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3:04-CV-00614 AMERICAN CALCAR INC V. BMW OF NORTH AMERICA

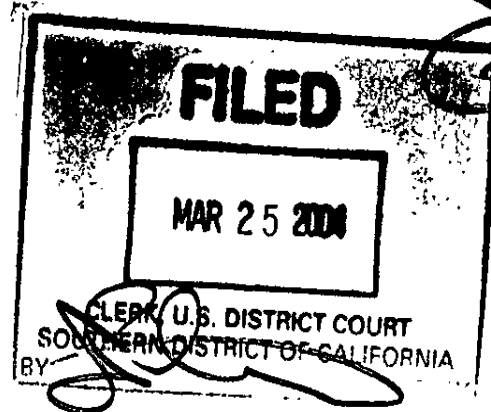
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Attorneys for Plaintiff
 AMERICAN CALCAR, INC.



IN THE UNITED STATES DISTRICT COURT
 FOR THE SOUTHERN DISTRICT OF CALIFORNIA

AMERICAN CALCAR INC.,
 a Delaware corporation,

Plaintiff,

v.

BMW OF NORTH AMERICA, LLC,
 a New Jersey limited liability company,

Defendant.

Civil Action No.

'04 CV 00614 DMS (LSP)

**COMPLAINT FOR INFRINGEMENT
 OF U.S. PATENT NOS. 6,009,355;**

6,148,261; 6,275,231; 6,282,464;

6,330,497; 6,438,465; 6,459,961;

6,529,824; 6,542,795; 6,587,758;

6,587,759; 6,703,944

DEMAND FOR JURY TRIAL

Plaintiff AMERICAN CALCAR INC. hereby complains of Defendant BMW OF
 NORTH AMERICA, LLC, and alleges as follows:

JURISDICTION AND VENUE

1. This action for patent infringement arises under the patent laws of the United
 States, Title 35, United States Code, more particularly, 35 U.S.C. §§ 271 and 281.

2. This Court has subject matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a).

3. Venue is proper in this judicial district under 28 U.S.C. §§ 1391(c) and 1400(b).

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THE PARTIES

4. Plaintiff AMERICAN CALCAR INC. (hereinafter, "ACI") is a Delaware corporation with its principal place of business at 1001 Avenida Pico C139, San Clemente, California.

5. ACI is informed and believes, and on that basis alleges, that Defendant BMW OF NORTH AMERICA, LLC (hereinafter, "BMW" or "Defendant") is a New Jersey limited liability company with its principal place of business at 300 Chestnut Ridge Road, Woodcliff Lake, New Jersey.

6. ACI is informed and believes, and on that basis alleges, that BMW does business in this judicial district and has committed acts of infringement in this judicial district.

7. ACI is the owner by assignment of United States Patent No. 6,009,355 ("the '355 patent"), duly and lawfully issued on December 28, 1999. A copy of the '355 patent is attached hereto as Exhibit A.

8. ACI is the owner by assignment of United States Patent No. 6,148,261 ("the '261 patent"), duly and lawfully issued on November 14, 2000. A copy of the '261 patent is attached hereto as Exhibit B.

9. ACI is the owner by assignment of United States Patent No. 6,275,231 ("the '231 patent"), duly and lawfully issued on August 14, 2001. A copy of the '231 patent is attached hereto as Exhibit C.

10. ACI is the owner by assignment of United States Patent No. 6,282,464 ("the '464 patent"), duly and lawfully issued on August 28, 2001. A copy of the '464 patent is attached hereto as Exhibit D.

11. ACI is the owner by assignment of United States Patent No. 6,330,497 ("the '497 patent"), duly and lawfully issued on December 11, 2001. A copy of the '497 patent is attached hereto as Exhibit E.

12. ACI is the owner by assignment of United States Patent No. 6,438,465 ("the '465 patent"), duly and lawfully issued on August 20, 2002. A copy of the '465 patent is attached hereto as Exhibit F.

13. ACI is the owner by assignment of United States Patent No. 6,459,961 (“the ‘961 patent”), duly and lawfully issued on October 1, 2002. A copy of the ‘961 patent is attached hereto as Exhibit G.

14. ACI is the owner by assignment of United States Patent No. 6,529,824 (“the ‘824 patent”), duly and lawfully issued on March 4, 2003. A copy of the ‘824 patent is attached hereto as Exhibit H.

15. ACI is the owner by assignment of United States Patent No. 6,542,795 (“the ‘795 patent”), duly and lawfully issued on April 1, 2003. A copy of the ‘795 patent is attached hereto as Exhibit I.

16. ACI is the owner by assignment of United States Patent No. 6,587,758 (“the ‘758 patent”), duly and lawfully issued on July 1, 2003. A copy of the ‘758 patent is attached hereto as Exhibit J.

17. ACI is the owner by assignment of United States Patent No. 6,587,759 (“the ‘759 patent”), duly and lawfully issued on July 1, 2003. A copy of the ‘759 patent is attached hereto as Exhibit K.

18. ACI is the owner by assignment of United States Patent No. 6,703,944 (“the ‘944 patent”), duly and lawfully issued on March 9, 2004. A copy of the ‘944 patent is attached hereto as Exhibit L.

CLAIMS FOR RELIEF

I. INFRINGEMENT OF THE '355 PATENT

19. ACI hereby incorporates by reference paragraphs 1-18 as if restated herein.

20. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

21. ACI is informed and believes, and on that basis alleges, that the Defendant has been and still is infringing the '355 patent under § 271(a) by importing into the United States and/or making, selling, or offering to sell within the United States the systems for use in a vehicle claimed in the '355 patent, and by performing the methods for use in a system in a vehicle claimed in the '355 patent. ACI is further informed and believes, and on that basis

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1 alleges, that the Defendant's infringement of the '355 patent under § 271(a) will continue unless
2 enjoined by this Court.

3 22. ACI is informed and believes, and on that basis alleges, that the Defendant has
4 been and still is knowingly and intentionally inducing others to directly infringe the '355 patent
5 under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the
6 iDrive system, and sufficient instructions to others thereby inducing infringement of the '355
7 patent under § 271(b). ACI is further informed and believes, and on that basis alleges, that the
8 Defendant's inducement of others to infringe the '355 patent will continue unless enjoined by
9 this Court.

10 23. ACI is informed and believes, and on that basis alleges, that the Defendant is
11 willfully infringing the '355 patent in a manner described above in paragraphs 21 and 22, and
12 will continue to do so unless enjoined by this Court.

13 24. ACI is informed and believes, and on that basis alleges, that the Defendant has
14 derived, received, and will continue to derive and receive from the aforesaid acts of
15 infringement, as described above in paragraphs 21 through 23, gains, profits, and advantages,
16 tangible and intangible, the extent of which are believed to be substantial, but the exact amounts
17 of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI
18 has been, and will continue to be, greatly and irreparably damaged.

19 **II. INFRINGEMENT OF THE '261 PATENT**

20 25. ACI hereby incorporates by reference paragraphs 1-24 as if restated herein.

21 26. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

22 27. ACI is informed and believes, and on that basis alleges, that the Defendant has
23 been and still is infringing the '261 patent under § 271(a) by importing into the United States
24 and/or making, selling, or offering to sell within the United States the systems for use in a
25 vehicle claimed in the '261 patent, and by performing the methods for use in a system in a
26 vehicle claimed in the '261 patent. ACI is further informed and believes, and on that basis
27 alleges, that the Defendant's infringement of the '261 patent under § 271(a) will continue unless
28 enjoined by this Court.

28. ACI is informed and believes, and on that basis alleges, that the Defendant has been and still is knowingly and intentionally inducing others to directly infringe the '261 patent under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the iDrive system and/or the navigation system, and sufficient instructions to others thereby inducing infringement of the '261 patent under § 271(b). ACI is further informed and believes, and on that basis alleges, that the Defendant's inducement of others to infringe the '261 patent will continue unless enjoined by this Court.

29. ACI is informed and believes, and on that basis alleges, that the Defendant is willfully infringing the '261 patent in a manner described above in paragraphs 27 and 28, and will continue to do so unless enjoined by this Court.

30. ACI is informed and believes, and on that basis alleges, that the Defendant has derived, received, and will continue to derive and receive from the aforesaid acts of infringement, as described above in paragraphs 27 through 29, gains, profits, and advantages, tangible and intangible, the extent of which are believed to be substantial, but the exact amounts of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI has been, and will continue to be, greatly and irreparably damaged.

III. INFRINGEMENT OF THE '231 PATENT

31. ACI hereby incorporates by reference paragraphs 1-30 as if restated herein.

32. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

33. ACI is informed and believes, and on that basis alleges, that the Defendant has been and still is infringing the '231 patent under § 271(a) by importing into the United States and/or making, selling, or offering to sell within the United States the systems for use in a vehicle claimed in the '231 patent, and by performing the methods for use in a system in a vehicle claimed in the '231 patent. ACI is further informed and believes, and on that basis alleges, that the Defendant's infringement of the '231 patent under § 271(a) will continue unless enjoined by this Court.

34. ACI is informed and believes, and on that basis alleges, that the Defendant has been and still is knowingly and intentionally inducing others to directly infringe the '231 patent

1 under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the
2 iDrive system, and sufficient instructions to others thereby inducing infringement of the '231
3 patent under § 271(b). ACI is further informed and believes, and on that basis alleges, that the
4 Defendant's inducement of others to infringe the '231 patent will continue unless enjoined by
5 this Court.

6 35. ACI is informed and believes, and on that basis alleges, that the Defendant is
7 willfully infringing the '231 patent in a manner described above in paragraphs 33 and 34, and
8 will continue to do so unless enjoined by this Court.

9 36. ACI is informed and believes, and on that basis alleges, that the Defendant has
10 derived, received, and will continue to derive and receive from the aforesaid acts of
11 infringement, as described above in paragraphs 33 through 35, gains, profits, and advantages,
12 tangible and intangible, the extent of which are believed to be substantial, but the exact amounts
13 of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI
14 has been, and will continue to be, greatly and irreparably damaged.

15 **IV. INFRINGEMENT OF THE '464 PATENT**

16 37. ACI hereby incorporates by reference paragraphs 1-36 as if restated herein.

17 38. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

18 39. ACI is informed and believes, and on that basis alleges, that the Defendant has
19 been and still is infringing the '464 patent under § 271(a) by importing into the United States
20 and/or making, selling, or offering to sell within the United States the systems for providing
21 messages in a vehicle claimed in the '464 patent, and by performing the methods for use in a
22 system for providing messages in a vehicle claimed in the '464 patent. ACI is further informed
23 and believes, and on that basis alleges, that the Defendant's infringement of the '464 patent
24 under § 271(a) will continue unless enjoined by this Court.

25 40. ACI is informed and believes, and on that basis alleges, that the Defendant has
26 been and still is knowingly and intentionally inducing others to directly infringe the '464 patent
27 under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the
28 iDrive system and/or the parking distance control, and sufficient instructions to others thereby

1 inducing infringement of the '464 patent under § 271(b). ACI is further informed and believes,
 2 and on that basis alleges, that the Defendant's inducement of others to infringe the '464 patent
 3 will continue unless enjoined by this Court.

4 41. ACI is informed and believes, and on that basis alleges, that the Defendant is
 5 willfully infringing the '464 patent in a manner described above in paragraphs 39 and 40, and
 6 will continue to do so unless enjoined by this Court.

7 42. ACI is informed and believes, and on that basis alleges, that the Defendant has
 8 derived, received, and will continue to derive and receive from the aforesaid acts of
 9 infringement, as described above in paragraphs 39 through 41, gains, profits, and advantages,
 10 tangible and intangible, the extent of which are believed to be substantial, but the exact amounts
 11 of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI
 12 has been, and will continue to be, greatly and irreparably damaged.

13 **V. INFRINGEMENT OF THE '497 PATENT**

14 43. ACI hereby incorporates by reference paragraphs 1-42 as if restated herein.

15 44. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

16 45. ACI is informed and believes, and on that basis alleges, that the Defendant has
 17 been and still is infringing the '497 patent under § 271(a) by importing into the United States
 18 and/or making, selling, or offering to sell within the United States the systems for operating a
 19 device to perform a function in a vehicle claimed in the '497 patent, and by performing the
 20 methods for operating a device to perform a function in a vehicle claimed in the '497 patent.
 21 ACI is further informed and believes, and on that basis alleges, that the Defendant's
 22 infringement of the '497 patent under § 271(a) will continue unless enjoined by this Court.

23 46. ACI is informed and believes, and on that basis alleges, that the Defendant has
 24 been and still is knowingly and intentionally inducing others to directly infringe the '497 patent
 25 under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the
 26 iDrive system, and sufficient instructions to others thereby inducing infringement of the '497
 27 patent under § 271(b). ACI is further informed and believes, and on that basis alleges, that the

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1 Defendant's inducement of others to infringe the '497 patent will continue unless enjoined by
2 this Court.

3 47. ACI is informed and believes, and on that basis alleges, that the Defendant is
4 willfully infringing the '497 patent in a manner described above in paragraphs 45 and 46, and
5 will continue to do so unless enjoined by this Court.

6 48. ACI is informed and believes, and on that basis alleges, that the Defendant has
7 derived, received, and will continue to derive and receive from the aforesaid acts of
8 infringement, as described above in paragraphs 45 through 47, gains, profits, and advantages,
9 tangible and intangible, the extent of which are believed to be substantial, but the exact amounts
10 of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI
11 has been, and will continue to be, greatly and irreparably damaged.

12 VI. INFRINGEMENT OF THE '465 PATENT

13 49. ACI hereby incorporates by reference paragraphs 1-48 as if restated herein.

14 50. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

15 51. ACI is informed and believes, and on that basis alleges, that the Defendant has
16 been and still is infringing the '465 patent under § 271(a) by importing into the United States
17 and/or making, selling, or offering to sell within the United States the systems for use in a
18 vehicle claimed in the '465 patent, and by performing the methods for use in a system in a
19 vehicle claimed in the '465 patent. ACI is further informed and believes, and on that basis
20 alleges, that the Defendant's infringement of the '465 patent under § 271(a) will continue unless
21 enjoined by this Court.

22 52. ACI is informed and believes, and on that basis alleges, that the Defendant has
23 been and still is knowingly and intentionally inducing others to directly infringe the '465 patent
24 under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the
25 iDrive system, and sufficient instructions to others thereby inducing infringement of the '465
26 patent under § 271(b). ACI is further informed and believes, and on that basis alleges, that the
27 Defendant's inducement of others to infringe the '465 patent will continue unless enjoined by
28 this Court.

1 53. ACI is informed and believes, and on that basis alleges, that the Defendant is
2 willfully infringing the '465 patent in a manner described above in paragraphs 51 and 52, and
3 will continue to do so unless enjoined by this Court.

4 54. ACI is informed and believes, and on that basis alleges, that the Defendant has
5 derived, received, and will continue to derive and receive from the aforesaid acts of
6 infringement, as described above in paragraphs 51 through 53, gains, profits, and advantages,
7 tangible and intangible, the extent of which are believed to be substantial, but the exact amounts
8 of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI
9 has been, and will continue to be, greatly and irreparably damaged.

10 **VII. INFRINGEMENT OF THE '961 PATENT**

11 55. ACI hereby incorporates by reference paragraphs 1-54 as if restated herein.

12 56. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

13 57. ACI is informed and believes, and on that basis alleges, that the Defendant has
14 been and still is infringing the '961 patent under § 271(a) by importing into the United States
15 and/or making, selling, or offering to sell within the United States the systems for use in a
16 vehicle claimed in the '961 patent, and by performing the methods for use in a system in a
17 vehicle claimed in the '961 patent. ACI is further informed and believes, and on that basis
18 alleges, that the Defendant's infringement of the '961 patent under § 271(a) will continue unless
19 enjoined by this Court.

20 58. ACI is informed and believes, and on that basis alleges, that the Defendant has
21 been and still is knowingly and intentionally inducing others to directly infringe the '961 patent
22 under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the
23 iDrive system and/or the navigation system, and sufficient instructions to others thereby
24 inducing infringement of the '961 patent under § 271(b). ACI is further informed and believes,
25 and on that basis alleges, that the Defendant's inducement of others to infringe the '961 patent
26 will continue unless enjoined by this Court.

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1 59. ACI is informed and believes, and on that basis alleges, that the Defendant is
2 willfully infringing the '961 patent in a manner described above in paragraphs 57 and 58, and
3 will continue to do so unless enjoined by this Court.

4 60. ACI is informed and believes, and on that basis alleges, that the Defendant has
5 derived, received, and will continue to derive and receive from the aforesaid acts of
6 infringement, as described above in paragraphs 57 through 59, gains, profits, and advantages,
7 tangible and intangible, the extent of which are believed to be substantial, but the exact amounts
8 of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI
9 has been, and will continue to be, greatly and irreparably damaged.

10 **VIII. INFRINGEMENT OF THE '824 PATENT**

11 61. ACI hereby incorporates by reference paragraphs 1-60 as if restated herein.

12 62. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

13 63. ACI is informed and believes, and on that basis alleges, that the Defendant has
14 been and still is infringing the '824 patent under § 271(a) by importing into the United States
15 and/or making, selling, or offering to sell within the United States the systems for use in a
16 vehicle claimed in the '824 patent, and by performing the methods for use in a system in a
17 vehicle claimed in the '824 patent. ACI is further informed and believes, and on that basis
18 alleges, that the Defendant's infringement of the '824 patent under § 271(a) will continue unless
19 enjoined by this Court.

20 64. ACI is informed and believes, and on that basis alleges, that the Defendant has
21 been and still is knowingly and intentionally inducing others to directly infringe the '824 patent
22 under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the
23 iDrive system and/or the navigation system, and sufficient instructions to others thereby
24 inducing infringement of the '824 patent under § 271(b). ACI is further informed and believes,
25 and on that basis alleges, that the Defendant's inducement of others to infringe the '824 patent
26 will continue unless enjoined by this Court.

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1 65. ACI is informed and believes, and on that basis alleges, that the Defendant is
2 willfully infringing the '824 patent in a manner described above in paragraphs 63 and 64, and
3 will continue to do so unless enjoined by this Court.

4 66. ACI is informed and believes, and on that basis alleges, that the Defendant has
5 derived, received, and will continue to derive and receive from the aforesaid acts of
6 infringement, as described above in paragraphs 63 through 65, gains, profits, and advantages,
7 tangible and intangible, the extent of which are believed to be substantial, but the exact amounts
8 of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI
9 has been, and will continue to be, greatly and irreparably damaged.

10 **IX. INFRINGEMENT OF THE '795 PATENT**

11 67. ACI hereby incorporates by reference paragraphs 1-66 as if restated herein.

12 68. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

13 69. ACI is informed and believes, and on that basis alleges, that the Defendant has
14 been and still is infringing the '795 patent under § 271(a) by importing into the United States
15 and/or making, selling, or offering to sell within the United States the systems for use in a
16 vehicle claimed in the '795 patent and the software for performing a process claimed in the '795
17 patent, and by performing the methods for use in a system in a vehicle claimed in the '795
18 patent. ACI is further informed and believes, and on that basis alleges, that the Defendant's
19 infringement of the '795 patent under § 271(a) will continue unless enjoined by this Court.

20 70. ACI is informed and believes, and on that basis alleges, that the Defendant has
21 been and still is knowingly and intentionally inducing others to directly infringe the '795 patent
22 under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the
23 iDrive system, and sufficient instructions to others thereby inducing infringement of the '795
24 patent under § 271(b). ACI is further informed and believes, and on that basis alleges, that the
25 Defendant's inducement of others to infringe the '795 patent will continue unless enjoined by
26 this Court.

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1 71. ACI is informed and believes, and on that basis alleges, that the Defendant is
2 willfully infringing the '795 patent in a manner described above in paragraphs 69 and 70, and
3 will continue to do so unless enjoined by this Court.

4 72. ACI is informed and believes, and on that basis alleges, that the Defendant has
5 derived, received, and will continue to derive and receive from the aforesaid acts of
6 infringement, as described above in paragraphs 69 through 71, gains, profits, and advantages,
7 tangible and intangible, the extent of which are believed to be substantial, but the exact amounts
8 of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI
9 has been, and will continue to be, greatly and irreparably damaged.

10 **X. INFRINGEMENT OF THE '758 PATENT**

11 73. ACI hereby incorporates by reference paragraphs 1-72 as if restated herein.

12 74. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

13 75. ACI is informed and believes, and on that basis alleges, that the Defendant has
14 been and still is infringing the '758 patent under § 271(a) by importing into the United States
15 and/or making, selling, or offering to sell within the United States the systems for adjusting a
16 function in a vehicle claimed in the '758 patent, and by performing the methods for use in a
17 system for adjusting a function in a vehicle claimed in the '758 patent. ACI is further informed
18 and believes, and on that basis alleges, that the Defendant's infringement of the '758 patent
19 under § 271(a) will continue unless enjoined by this Court.

20 76. ACI is informed and believes, and on that basis alleges, that the Defendant has
21 been and still is knowingly and intentionally inducing others to directly infringe the '758 patent
22 under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the
23 iDrive system, and sufficient instructions to others thereby inducing infringement of the '758
24 patent under § 271(b). ACI is further informed and believes, and on that basis alleges, that the
25 Defendant's inducement of others to infringe the '758 patent will continue unless enjoined by
26 this Court.

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1 77. ACI is informed and believes, and on that basis alleges, that the Defendant is
2 willfully infringing the '758 patent in a manner described above in paragraphs 75 and 76, and
3 will continue to do so unless enjoined by this Court.

4 78. ACI is informed and believes, and on that basis alleges, that the Defendant has
5 derived, received, and will continue to derive and receive from the aforesaid acts of
6 infringement, as described above in paragraphs 75 through 77, gains, profits, and advantages,
7 tangible and intangible, the extent of which are believed to be substantial, but the exact amounts
8 of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI
9 has been, and will continue to be, greatly and irreparably damaged.

10 **XI. INFRINGEMENT OF THE '759 PATENT**

11 79. ACI hereby incorporates by reference paragraphs 1-78 as if restated herein.

12 80. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

13 81. ACI is informed and believes, and on that basis alleges, that the Defendant has
14 been and still is infringing the '759 patent under § 271(a) by importing into the United States
15 and/or making, selling, or offering to sell within the United States the systems for adjusting a
16 function in a vehicle claimed in the '759 patent, and by performing the methods for use in a
17 system for adjusting a function in a vehicle claimed in the '759 patent. ACI is further informed
18 and believes, and on that basis alleges, that the Defendant's infringement of the '759 patent
19 under § 271(a) will continue unless enjoined by this Court.

20 82. ACI is informed and believes, and on that basis alleges, that the Defendant has
21 been and still is knowingly and intentionally inducing others to directly infringe the '759 patent
22 under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the
23 iDrive system, and sufficient instructions to others thereby inducing infringement of the '759
24 patent under § 271(b). ACI is further informed and believes, and on that basis alleges, that the
25 Defendant's inducement of others to infringe the '759 patent will continue unless enjoined by
26 this Court.

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1 83. ACI is informed and believes, and on that basis alleges, that the Defendant is
2 willfully infringing the '759 patent in a manner described above in paragraphs 81 and 82, and
3 will continue to do so unless enjoined by this Court.

4 84. ACI is informed and believes, and on that basis alleges, that the Defendant has
5 derived, received, and will continue to derive and receive from the aforesaid acts of
6 infringement, as described above in paragraphs 81 through 83, gains, profits, and advantages,
7 tangible and intangible, the extent of which are believed to be substantial, but the exact amounts
8 of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI
9 has been, and will continue to be, greatly and irreparably damaged.

10 **XII. INFRINGEMENT OF THE '944 PATENT**

11 85. ACI hereby incorporates by reference paragraphs 1-84 as if restated herein.

12 86. This is a claim for patent infringement under 35 U.S.C. §§ 271 and 281.

13 87. ACI is informed and believes, and on that basis alleges, that the Defendant has
14 been and still is infringing the '944 patent under § 271(a) by importing into the United States
15 and/or making, selling, or offering to sell within the United States the systems for use in a
16 vehicle claimed in the '944 patent, and by performing the methods for use in a system in a
17 vehicle claimed in the '944 patent. ACI is further informed and believes, and on that basis
18 alleges, that the Defendant's infringement of the '944 patent under § 271(a) will continue unless
19 enjoined by this Court.

20 88. ACI is informed and believes, and on that basis alleges, that the Defendant has
21 been and still is knowingly and intentionally inducing others to directly infringe the '944 patent
22 under § 271(a), by providing vehicles, including but not limited to BMW vehicles with the
23 iDrive system and/or the active cruise control, and sufficient instructions to others thereby
24 inducing infringement of the '944 patent under § 271(b). ACI is further informed and believes,
25 and on that basis alleges, that the Defendant's inducement of others to infringe the '944 patent
26 will continue unless enjoined by this Court.

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89. ACI is informed and believes, and on that basis alleges, that the Defendant is willfully infringing the '944 patent in a manner described above in paragraphs 87 and 88, and will continue to do so unless enjoined by this Court.

90. ACI is informed and believes, and on that basis alleges, that the Defendant has derived, received, and will continue to derive and receive from the aforesaid acts of infringement, as described above in paragraphs 87 through 89, gains, profits, and advantages, tangible and intangible, the extent of which are believed to be substantial, but the exact amounts of which are presently not known to ACI. By reason of the aforesaid acts of infringement, ACI has been, and will continue to be, greatly and irreparably damaged.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff ACI prays for relief as follows:

A. That the Defendant be adjudged to have infringed the '355, '261, '231, '464, '497, '465, '961, '824, '795, '758, '759 and '944 patents under 35 U.S.C. § 271(a) and (b);

B. That the Defendant be adjudged to have willfully infringed the '355, '261, '231, '464, '497, '465, '961, '824, '795, '758, '759 and '944 patents under 35 U.S.C. § 271(a) and (b);

C. That the Defendant, as well as its respective officers, agents, servants, employees and attorneys, and those persons in active concert or participation with them be preliminarily and permanently restrained and enjoined under 35 U.S.C. § 283 from directly or indirectly infringing the '355, '261, '231, '464, '497, '465, '961, '824, '795, '758, '759 and '944 patents;

D. That the Court award damages to compensate ACI for the Defendant's infringement of the '355, '261, '231, '464, '497, '465, '961, '824, '795, '758, '759 and '944 patents, as well as enhanced damages, pursuant to 35 U.S.C. § 284;

E. That the Court award ACI its attorneys' fees pursuant to 35 U.S.C. § 285;

F. That the Court assess pre-judgment and post-judgment interests and costs of suit against the Defendant, and award such interests and costs to ACI; and

G. That ACI have such other and further relief as this Court may deem just and proper.

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Dated: March 25, 2004

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

By: 
Frederick S. Berretta
David K. Wiggins
John G. Rickenbrode

Attorneys for Plaintiff
AMERICAN CALCAR INC.

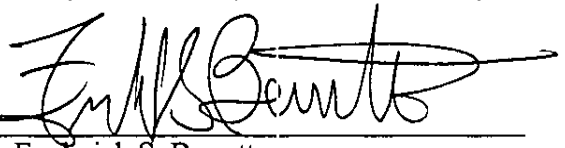
DEMAND FOR JURY TRIAL

Plaintiff AMERICAN CALCAR INC. hereby demands a trial by jury as to all issues triable by jury, specifically including, but not limited to, the infringement of United States Patent Nos. 6,009,355; 6,148,261; 6,275,231; 6,282,464; 6,330,497; 6,438,465; 6,459,961; 6,529,824; 6,542,795; 6,587,758; 6,587,759; and 6,703,944.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: March 25, 2004

By: 

Frederick S. Berretta
David K. Wiggins
John G. Rickenbrode

Attorneys for Plaintiff
AMERICAN CALCAR INC.

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US006009355A

United States Patent [19][11] **Patent Number:** 6,009,355**Obradovich et al.**[45] **Date of Patent:** *Dec. 28, 1999[54] **MULTIMEDIA INFORMATION AND CONTROL SYSTEM FOR AUTOMOBILES**[75] **Inventors:** Michael L. Obradovich, San Clemente; Michael L. Kent, Garden Grove; John G. Dinkel, Irvine, all of Calif.[73] **Assignee:** American Calcar Inc., Wilmington, Del.[*] **Notice:** This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

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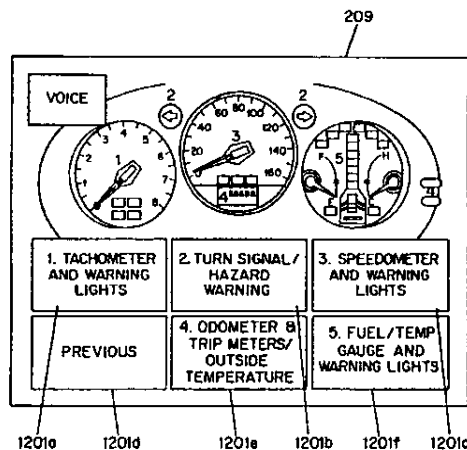
[58] **Field of Search** 701/29, 30, 31,
 701/32, 33, 36, 102, 101, 100, 99; 73/117.1,
 117.3, 118.2, 118.3, 116; 123/634; 340/825.06,
 825.36, 436, 438, 439, 825.25, 825.24,
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In a multimedia information and control system for use in an automobile, at least one interface is employed which enables a user to access information concerning the automobile and control vehicle functions in an efficient manner. The user may select one of a plurality of displayed options on a screen of such an interface. Through audio, video and/or text media, the user is provided with information concerning the selected option and the vehicle function corresponding thereto. Having been so informed, the user may activate the selected option to control the corresponding vehicle function.

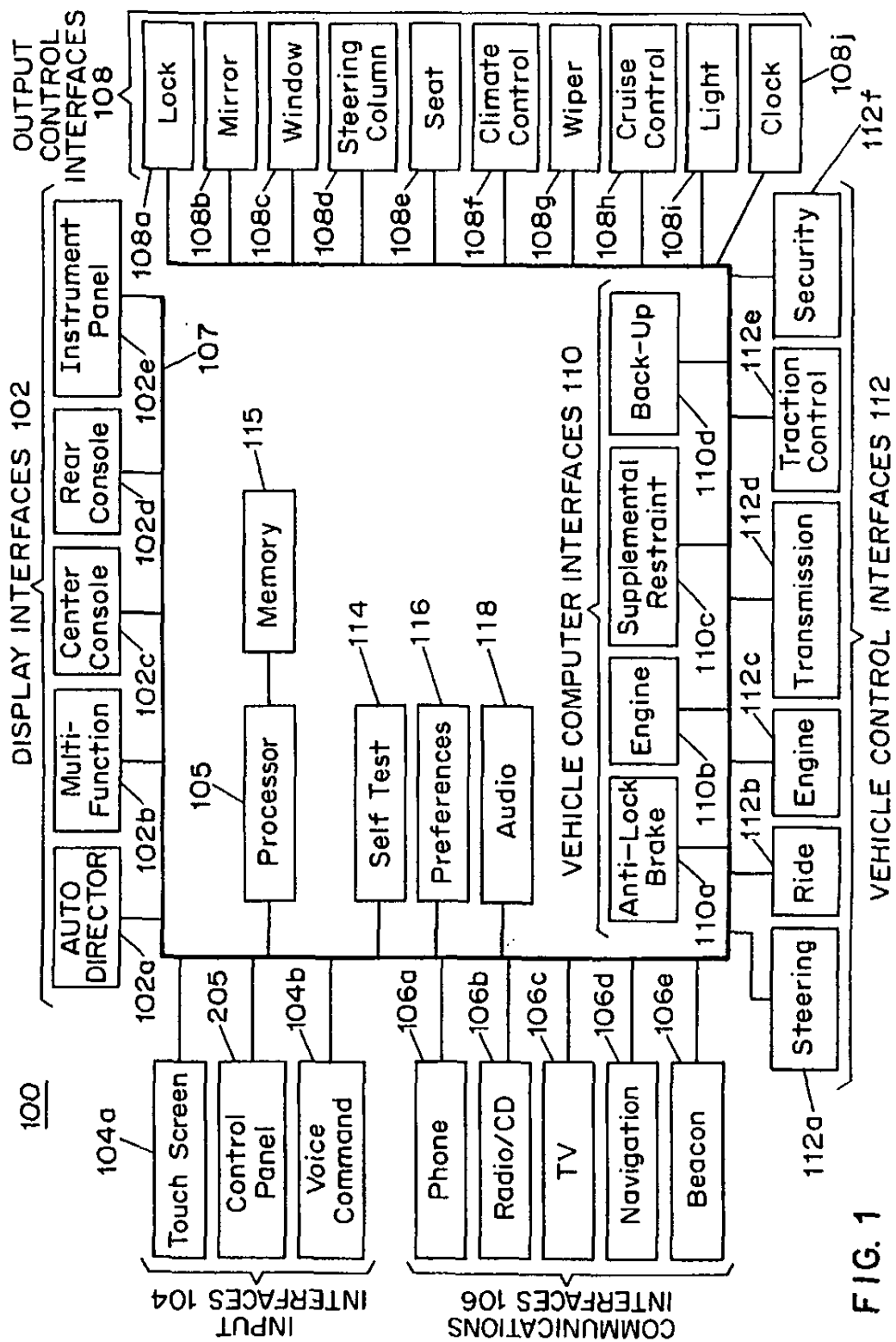
99 Claims, 15 Drawing Sheets

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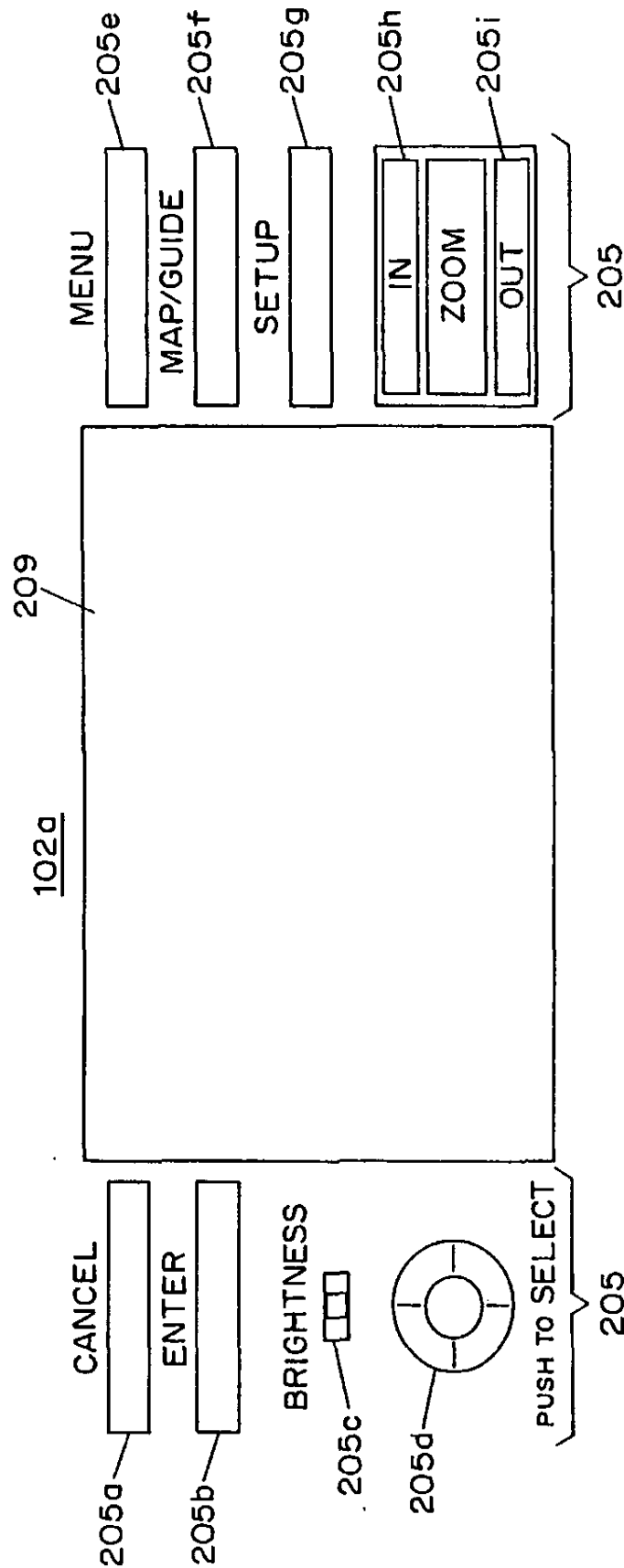


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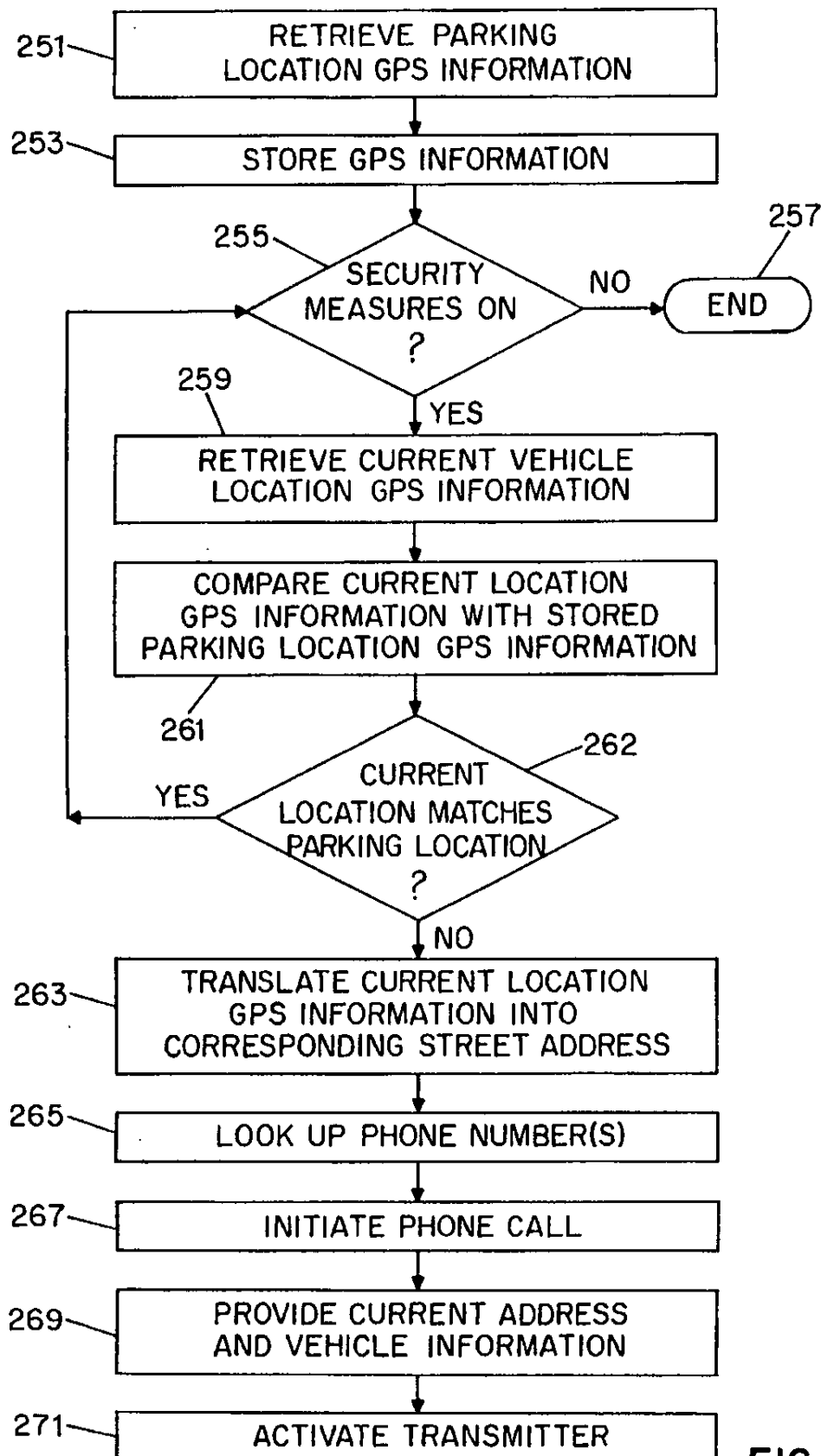


FIG. 3A

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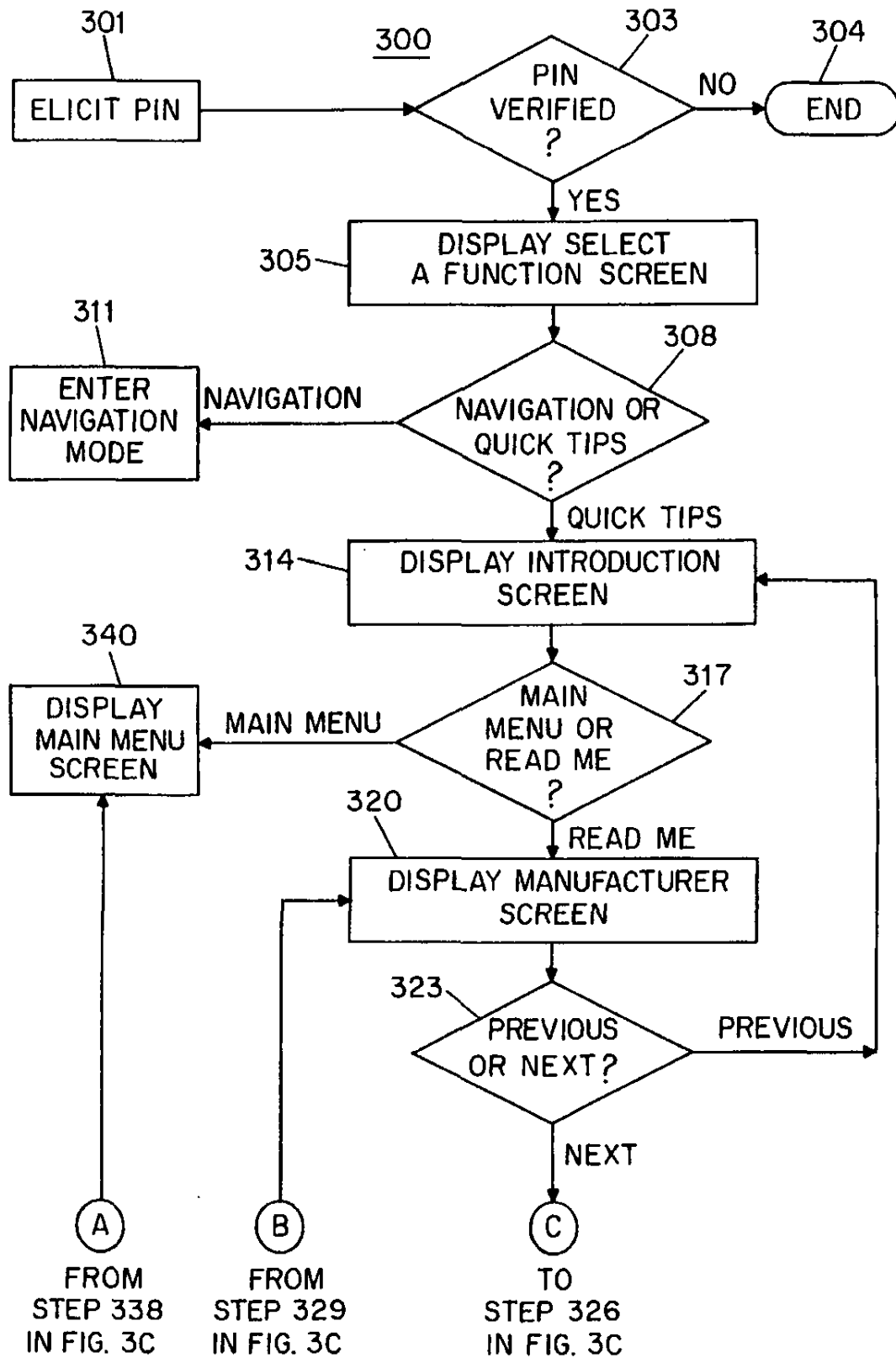


FIG. 3B

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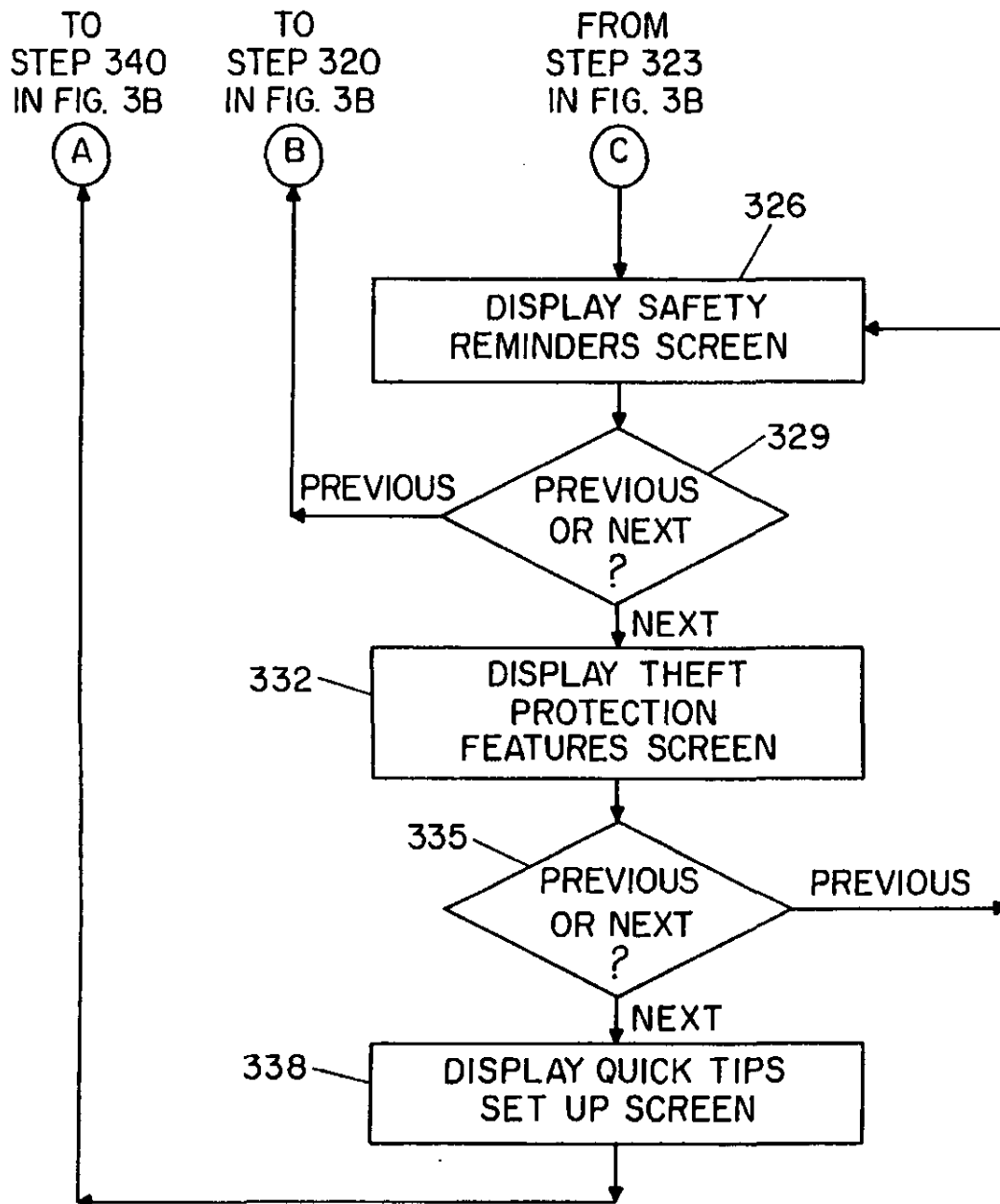


FIG. 3C

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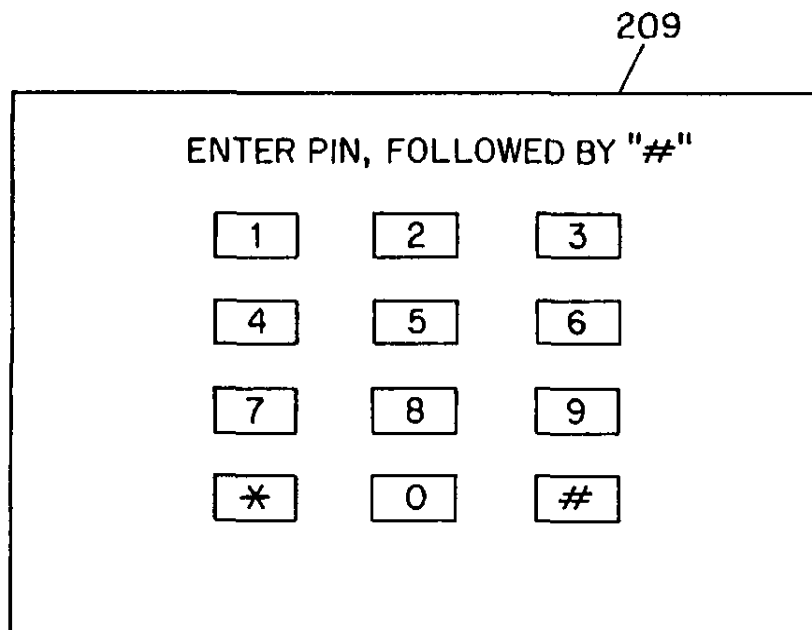


FIG. 4A

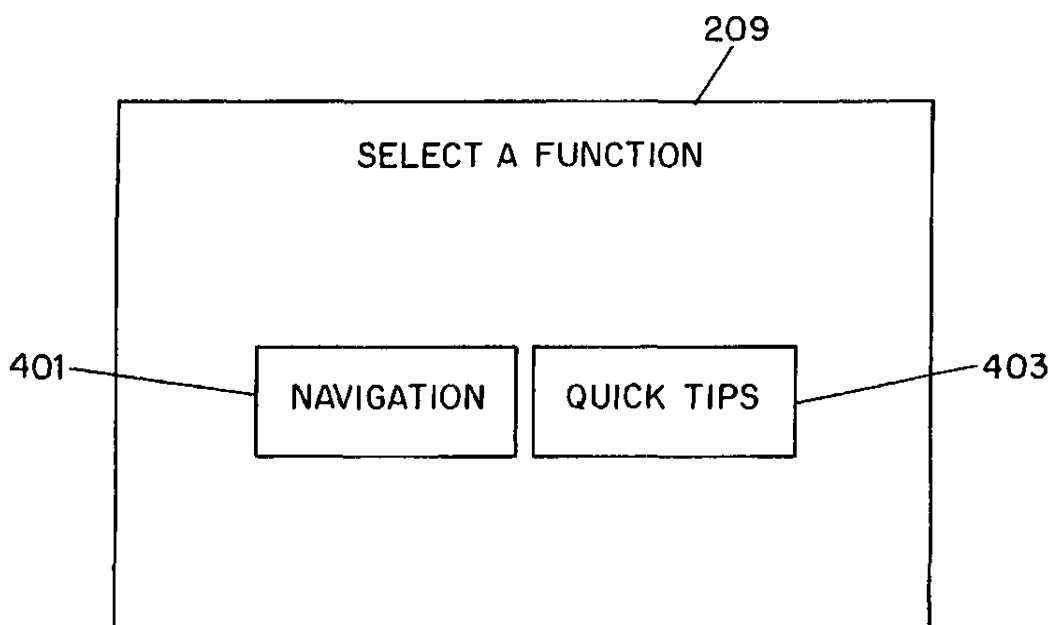


FIG. 4B

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FIG. 5

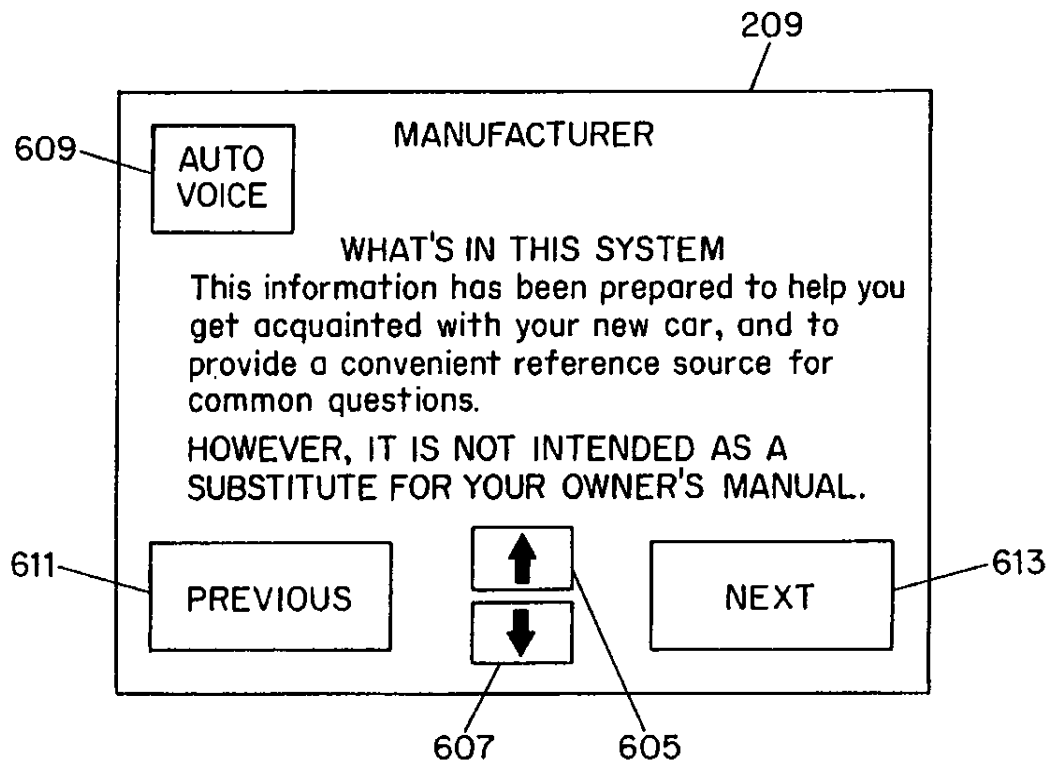


FIG. 6

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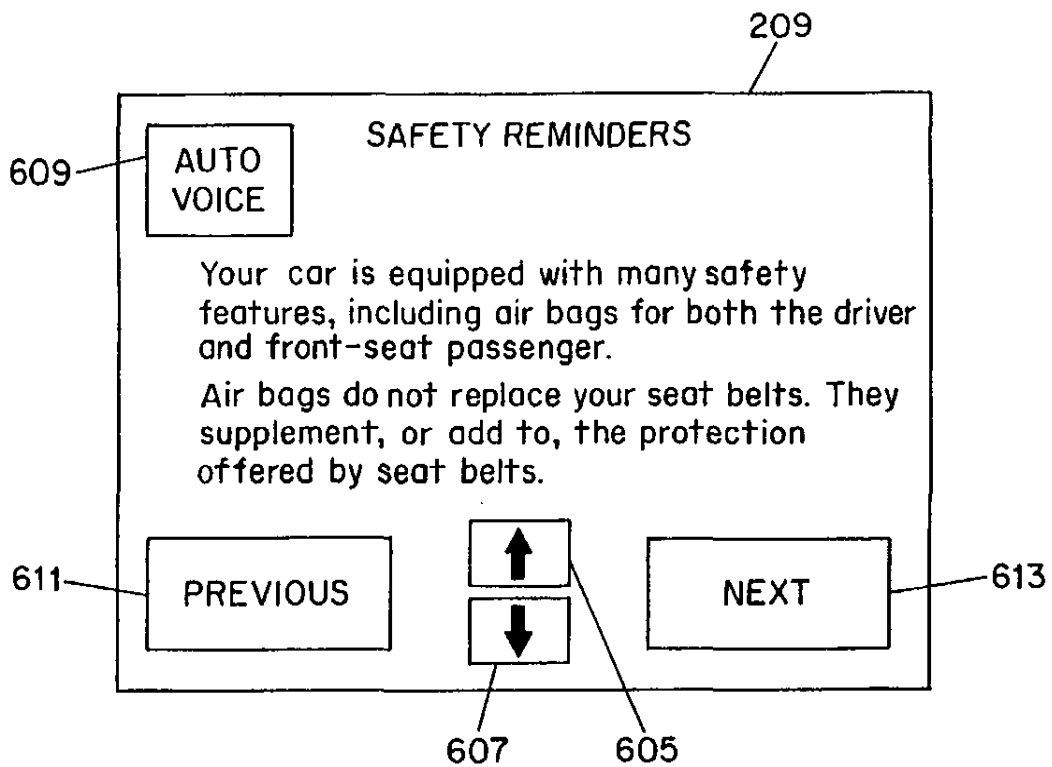


FIG. 7

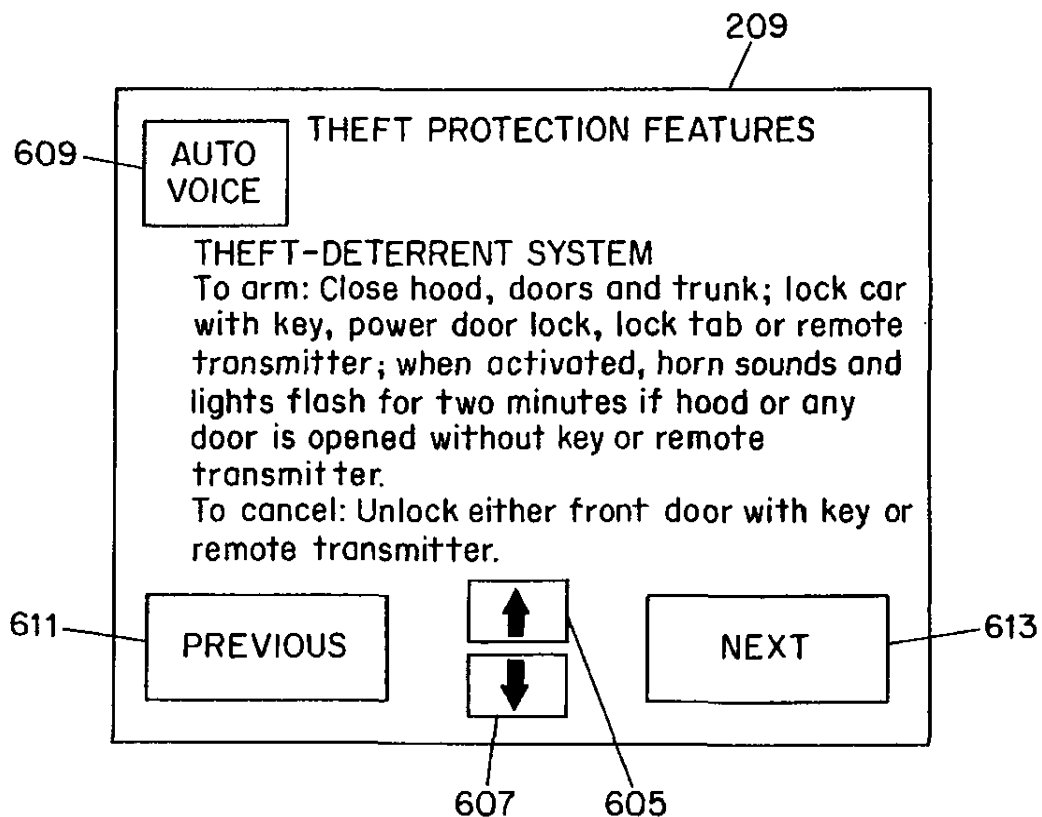


FIG. 8

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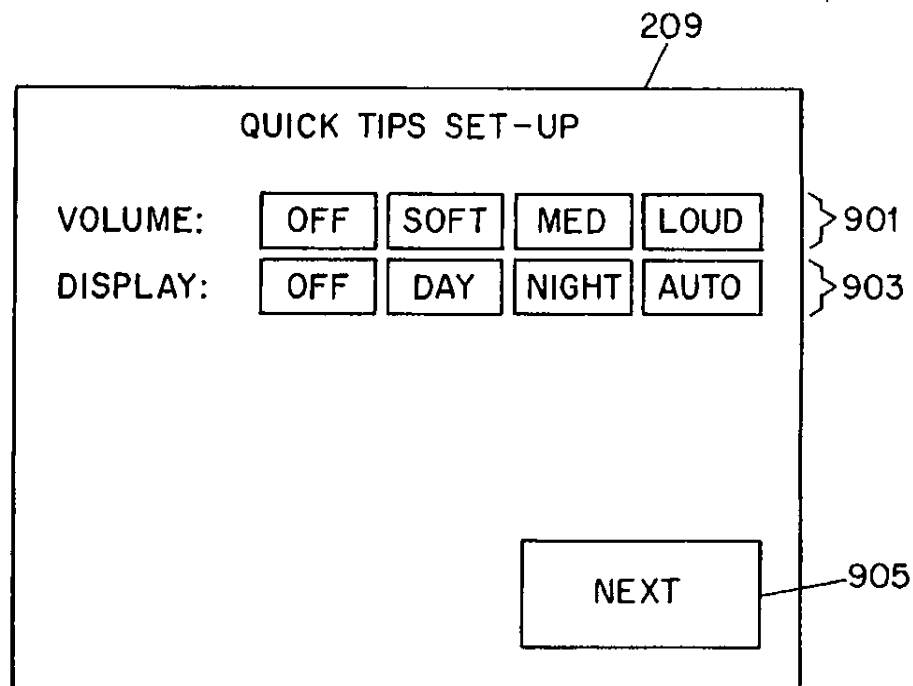


FIG. 9

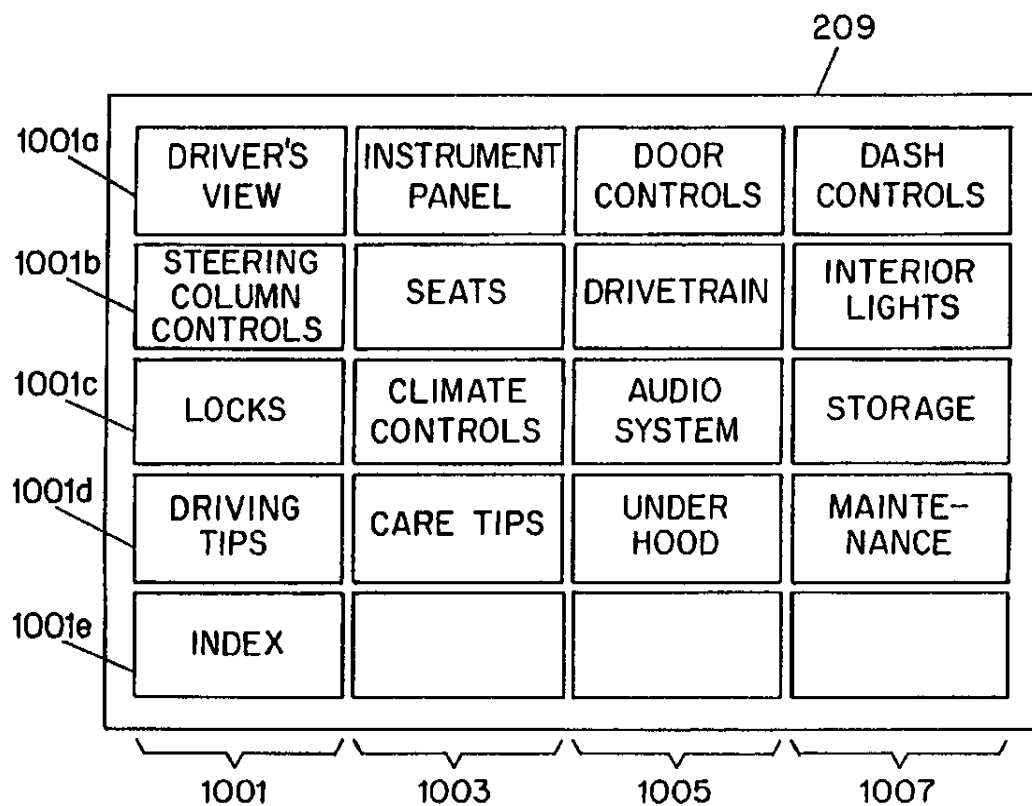


FIG. 10

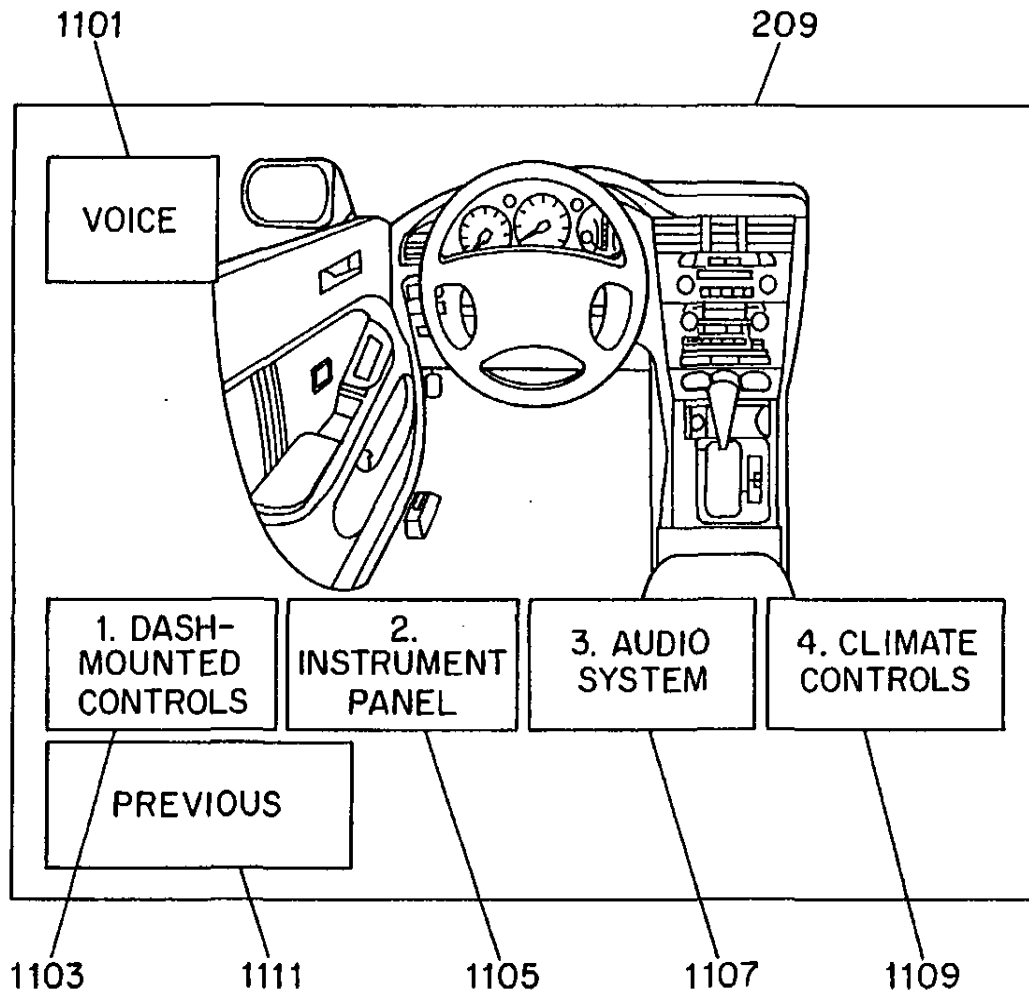


FIG. 11

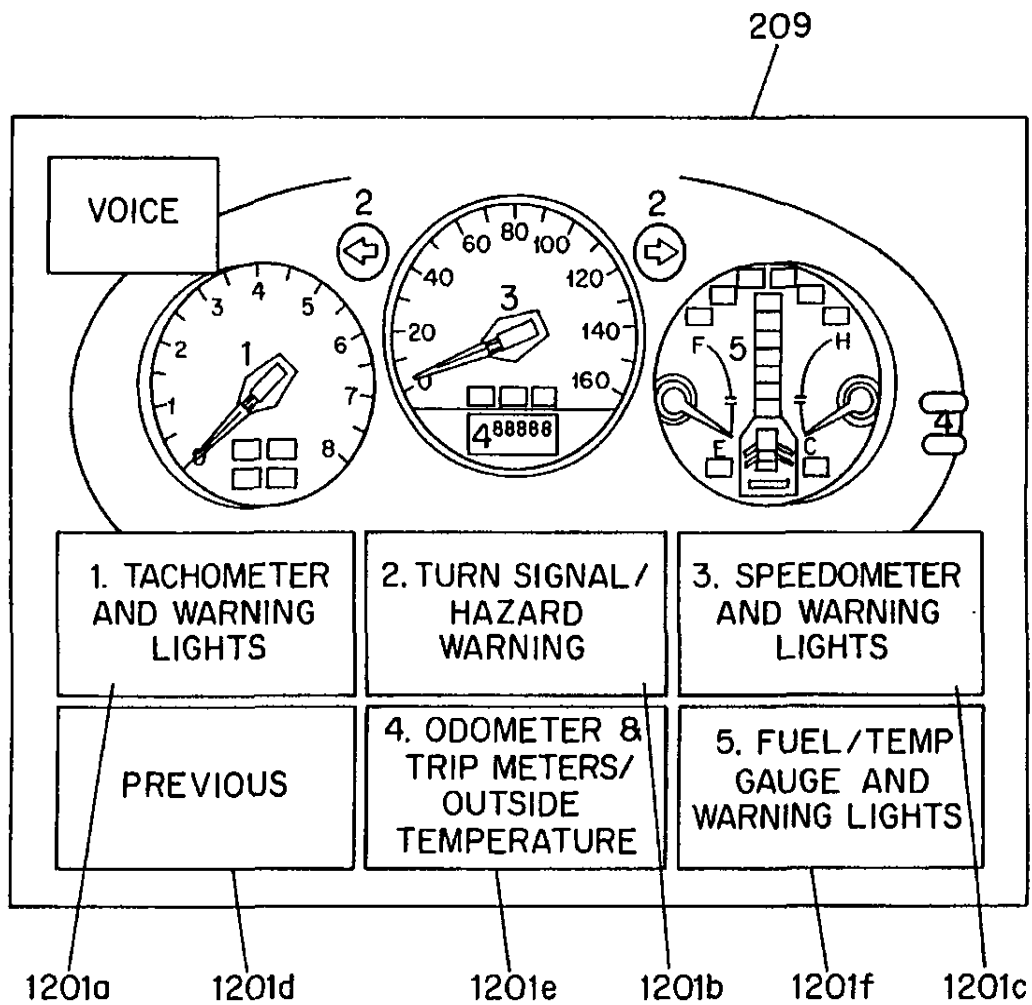


FIG. 12

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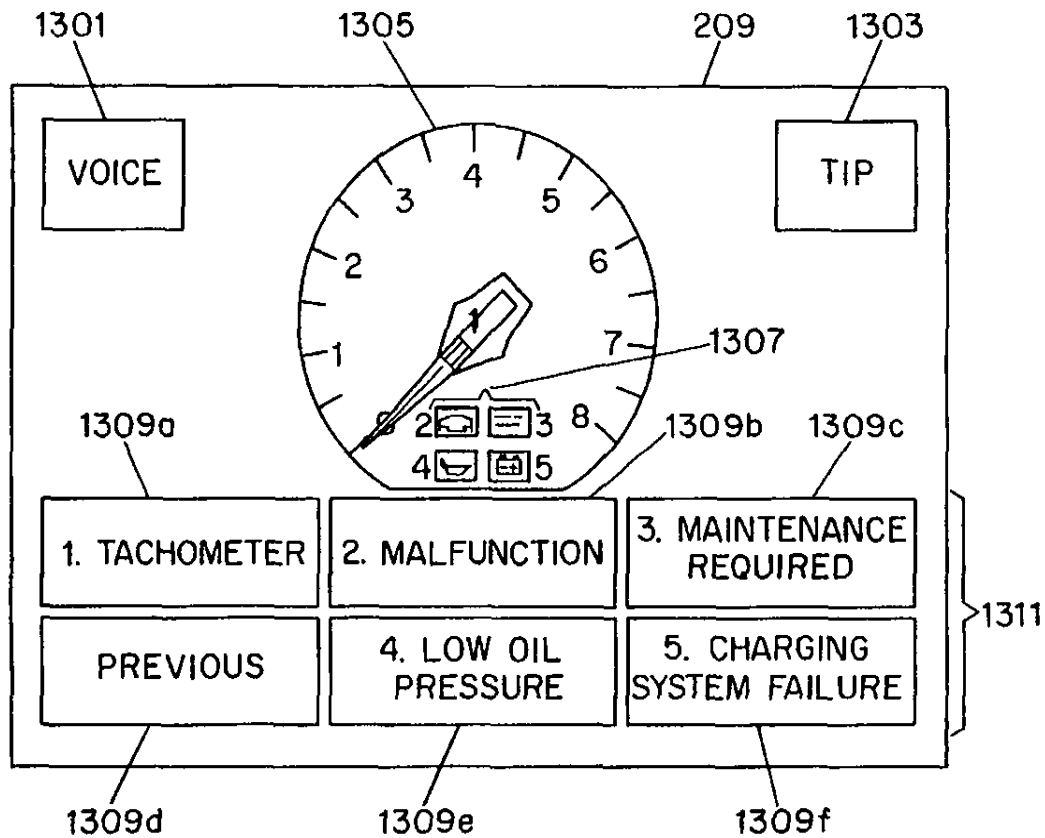


FIG. 13

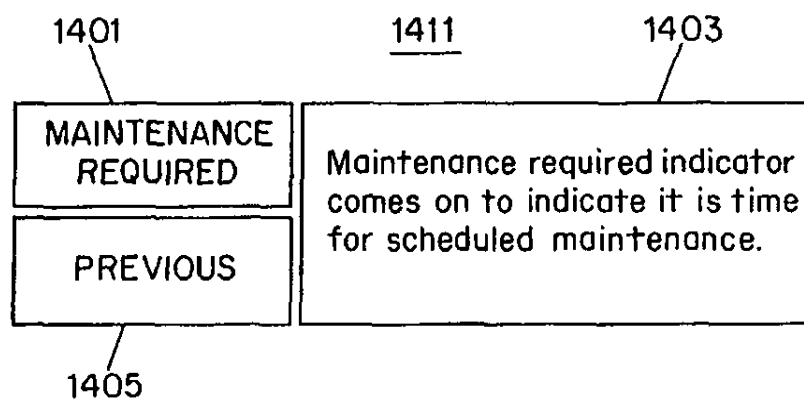


FIG. 14

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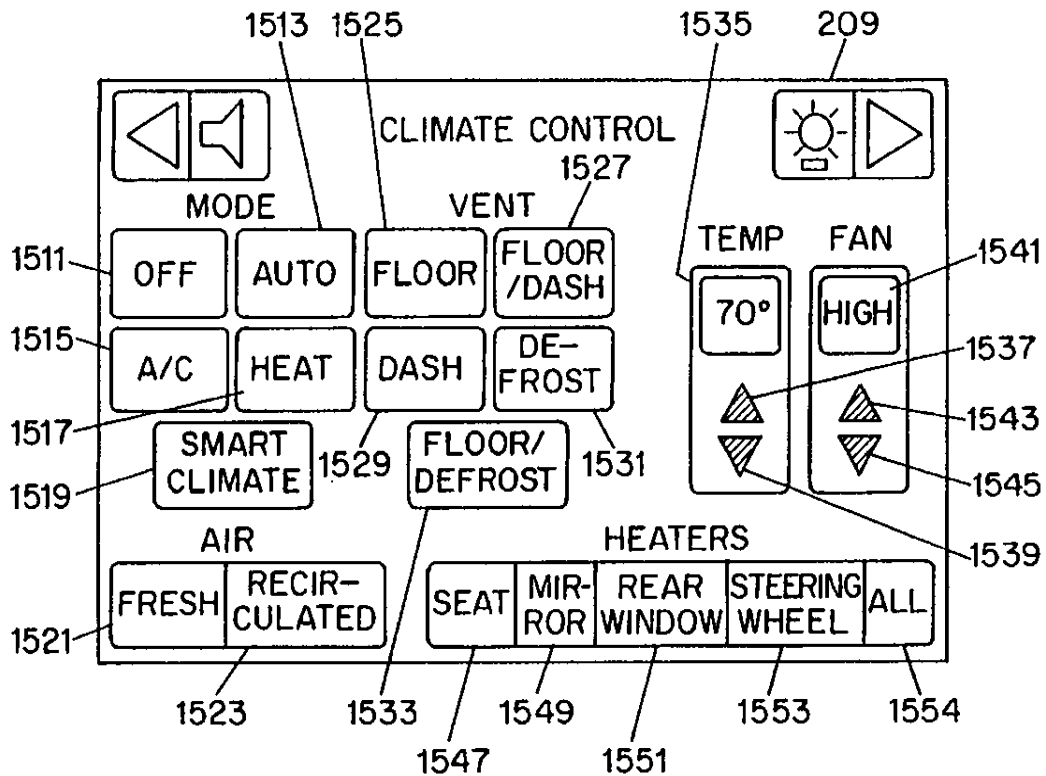


FIG. 15

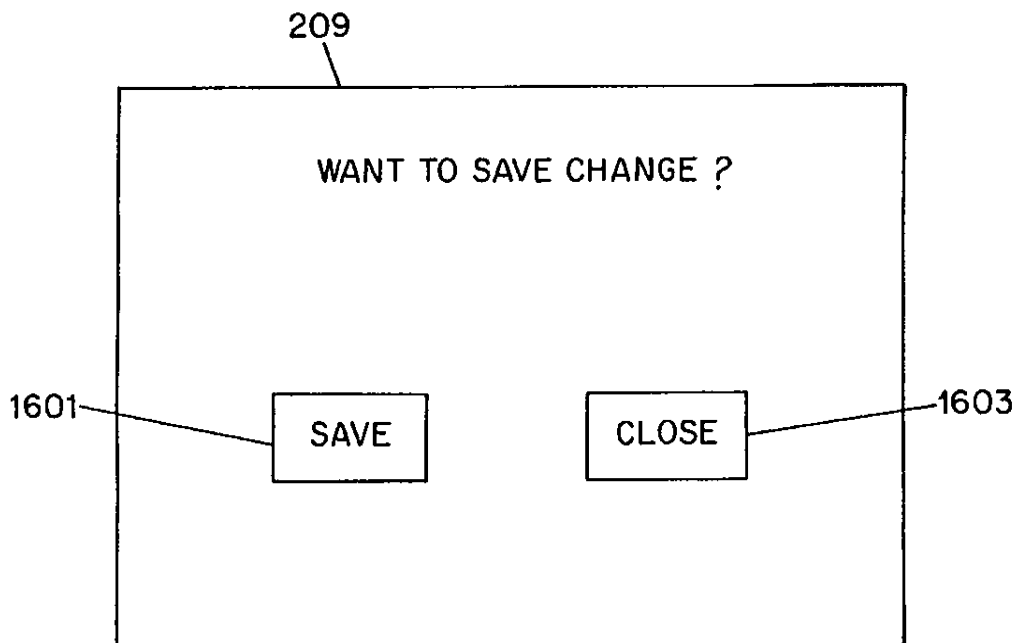


FIG. 16

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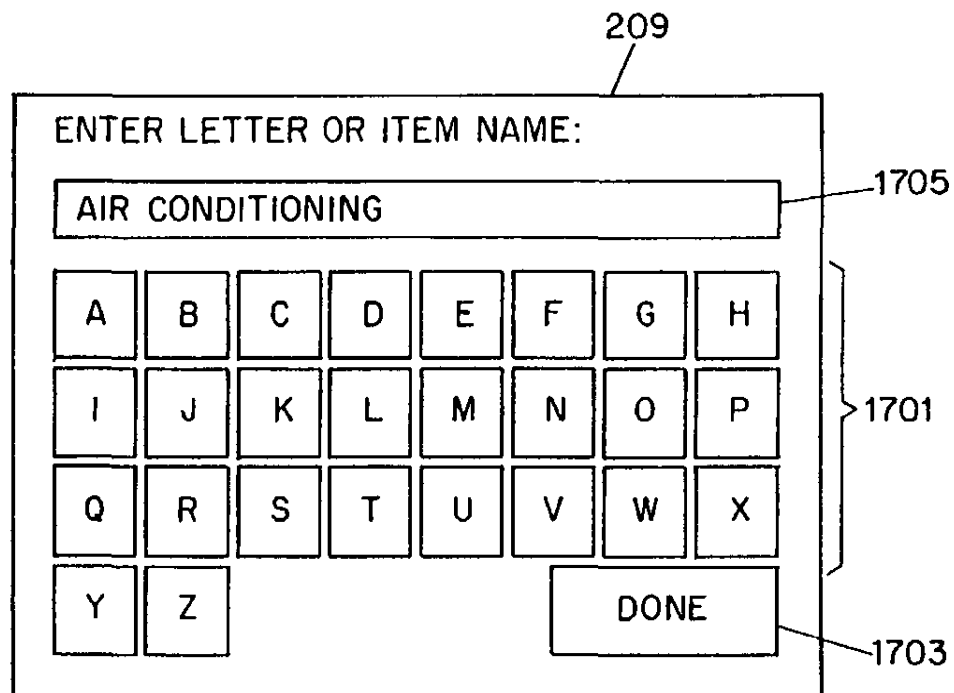


FIG. 17

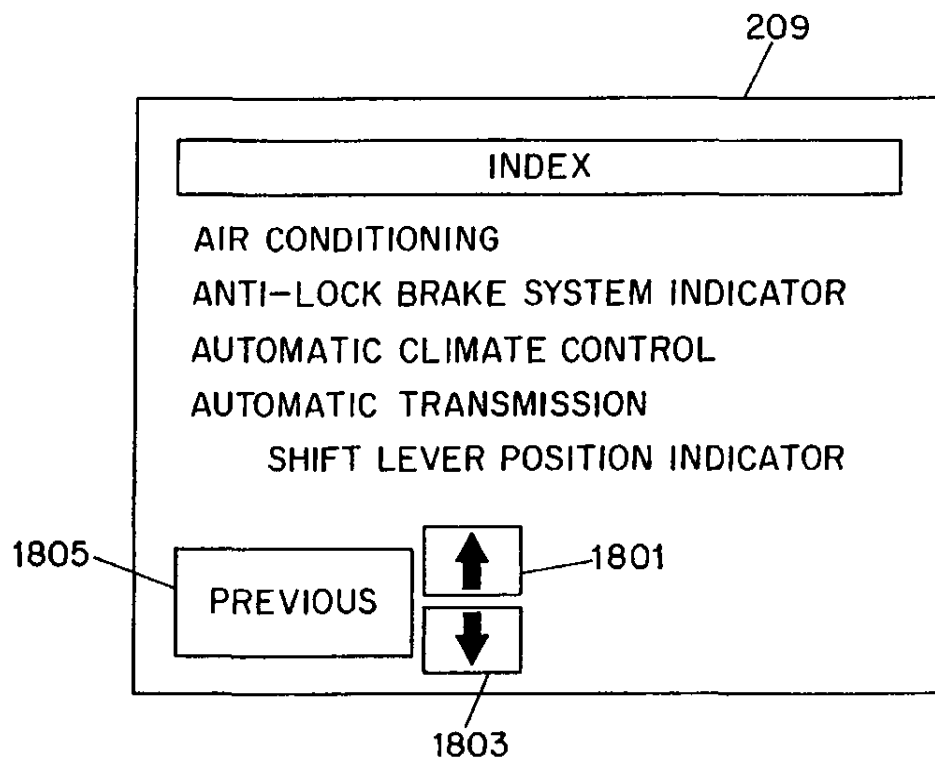


FIG. 18

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1901		1903	
1905	AIR CONDITIONING	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
	ANTI-LOCK BRAKE SYSTEM INDICATOR	LINK TO WARNING LIGHT OPTION #4 ON FUEL/TEMP SCREEN (NOT SHOWN)	
	AUTOMATIC CLIMATE CONTROL	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
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	•	•	•
	•		
	CHARGING SYSTEM FAILURE INDICATOR	LINK TO CHARGING SYSTEM FAILURE OPTION 1309f (FIG. 13)	
	CLIMATE CONTROL SYSTEM	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
	COOLING	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
	CRUISE CONTROL INDICATOR	LINK TO WARNING LIGHT OPTION #2 ON SPEEDOMETER SCREEN (NOT SHOWN)	
	DEFOG/DEFROST	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
	DOOR AJAR INDICATOR	LINK TO WARNING LIGHT OPTION #7 ON FUEL/TEMP SCREEN (NOT SHOWN)	
	DIRECTIONAL SIGNALS INDICATOR	LINK TO TURN SIGNAL/HAZARD WARNING OPTION 1201b (FIG. 12)	
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FIG. 19

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MULTIMEDIA INFORMATION AND CONTROL SYSTEM FOR AUTOMOBILES

FIELD OF THE INVENTION

The invention relates generally to information and control systems and, more particularly, to a system for use in an automobile which facilitates a user's retrieval and/or dissemination of information, and control of vehicle functions.

BACKGROUND OF THE INVENTION

Information is vital to day-to-day activities. With no access to information, people cannot function efficiently in this society, and their lives and financial well-being are put in jeopardy. People want to be well-informed, so much so that when they are travelling in automobiles, they tune into local radio stations to listen to news, weather forecasts and traffic conditions. For that matter, some automobiles are equipped with audiovisual systems including television (TV) receivers. One such system is disclosed in U.S. Pat. No. 5,404,443 issued to Hirata. The Hirata system provides audiovisual information in a number of modes including a TV mode, which may be selected by control switches disposed on the periphery of a display.

Automobile users like to be continually updated with information affecting their travel plans such as weather and traffic conditions because of its fast changing nature. Automobile users who are traveling also like to continually keep in touch with their homes and offices, and to confirm appointments and hotel reservations so that they can adjust their itineraries accordingly. To that end, cellular mobile telephones were introduced to enable automobile users to conduct business and contact their families while they are traveling.

In addition, local map information is important to automobile travelers moving from one locale to another. As such, navigation systems were developed to help reach their destinations in an unfamiliar milieu. One such vehicle navigation system is disclosed in U.S. Pat. No. 5,274,560 issued to LaRue. The disclosed system is based on artificial intelligence and provides a driver with directions via a voice interface. The system is built upon an optical disk player which can be used for entertainment as well. Digitized maps, compressed voice records and computer programs are stored on an optical disk compatible with the disk player. After a destination point is identified, the disclosed system finds the best route from the digitized maps and guides the driver therethrough via the voice interface, taking into account the latest traffic conditions received by an FM receiver to avoid congestion.

Recently, navigation systems based on military global positioning system (GPS) technology have emerged. One such navigation system is commercially available as an option for the latest model of the ACURA 3.5 RL automobile. This ACURA navigation system receives signals from a constellation of satellites which is part of the GPS. In response to these signals, the navigation system pinpoints the automobile's location (in latitude and longitude). It also detects the automobile's speed and direction. With geographic information stored on a hard disk in an onboard computer, the navigation system is capable of verbally and visually communicating to the user instructions for reaching the destination.

In addition to the above techniques for communications with automobile users, a technique for disseminating information regarding the automobiles themselves is disclosed in U.S. Pat. No. 5,442,553 issued to Parillo. The disclosed

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system is a vehicle diagnostic and software upgrade system. In this system, sensors are provided in the vehicle to generate dynamic data relating to various mechanical controls and the engine of the vehicle, including engine R.P.M., fuel/air mixture, emissions and pollution content information. A microprocessor in the vehicle has access to selectable program parameters affecting the functioning of the mechanical controls. The microprocessor collects and transmits the dynamic data to a remote diagnostic station periodically or upon its request. In response, the remote station sends, to the vehicle, signals indicative of any changes in its software and/or program parameters. The microprocessor accordingly causes the changes to be made in the vehicle based on the received signals.

Besides the communication capabilities described above, an automobile has many accessories and user control elements such as lights, wipers, a clock, temperature control, cruise control, seat adjustment control, mirror adjustment control, and an anti-theft system. A technique for centralizing the command of the individual control elements is disclosed in U.S. Pat. No. 5,555,502 issued to Opel. The disclosed system includes a centralized control panel on a steering wheel which, together with a display, is utilized to control the electronic components of the automobile. The display is positioned in the area of the driver's sun visor. After the driver presses one of the buttons on the control panel corresponding to a desired electronic component, a menu is displayed so that the driver is able to select items from the menu to program the component. The selection is accomplished by pressing specified buttons on the panel.

In addition, a technique for controlling vehicle accessories via voice command is disclosed in U.S. Pat. No. 4,827,520 issued to Zeinstra. In accordance with this technique, control functions of each accessory are formatted in a summary page for display on a screen, which is scanned by infrared light to sense any touching thereon. By uttering any of the displayed functions on the summary page, preceded by either a specified keyword or an actuation of a push-to-talk switch on a steering wheel, a more detailed subpage of the selected function is displayed for further selection by voice. As an alternative to the voice command, the selection can also be accomplished by touching the displayed function on the screen.

Voice command and touch screen techniques are frequently mentioned in prior art references in controlling car accessories. In particular, U.S. Pat. No. 5,214,707 issued to Fujimoto et al. discloses a system for voice-controlling equipment inside a vehicle, including microphones capable of discriminating voice commands as to whether they are generated at the driver side or at the assistant side of the vehicle in a noisy environment.

SUMMARY OF THE INVENTION

It is celebratory that technology advances at lightning speed. However, many people are left behind the technological frontier, and to some extent develop "technophobia". Some of them have even given up this technological race, which is confirmed by the blinking "12:00" display on the clocks of many video cassette recorders (VCRs) being used.

Similarly, it is fantastic that automobiles nowadays include many advanced accessories such as audiovisual systems, anti-theft systems, anti-lock brake systems, climate control, and cruise control which embrace the latest technologies. However, of all these accessories, many automobile users only know how to operate the headlights and windshield wipers, and regard the rest as nuisance. That is,

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the users pay for numerous accessories which they do not use, resulting in much consumer waste. We have recognized that such non-use is principally attributed to an inefficient distribution of operating knowledge of the automobile and, in particular, its accessories.

Specifically, when automobile users presently want to learn about certain aspects of an automobile, they need to consult an owner's manual which could have been lost or misplaced when they need it the most. In addition, the manual is unpopular because many users simply want to avoid reading any written material, and find it intimidating as it oftentimes is filled with incomprehensible technical jargon.

We have further recognized that even with the operating knowledge, many users are overwhelmed and confused with the large number of knobs, switches and buttons used to control the individual vehicle parts and accessories.

Accordingly, it is an object of the invention to design an information and control system for use inside an automobile with the user in mind. The user is afforded a centralized control which may be used in lieu of the knobs, switches and buttons to operate the vehicle parts and accessories. In accordance with the invention, the centralized control is intimately tied to an information system such that the user is able to efficiently access information about the functions and operations of such parts and accessories, and in a synergistic manner apply that information to operate same, using the centralized control.

It is another object of the invention that the access to the information is intuitive and direct so that the user can obtain the relevant information in a few self-explanatory steps. To that end, the invention embraces a multimedia approach where audio and video media are added to the traditional text media to convey information. The additional media increases the dimensions of both the user's comprehension of the information and the user's interaction with the automobile. Moreover, the information access is driven by a multilevel menu based on an intuitive model of taxonomy where information is organized in a minimal number of levels of subject matter from general to specific. The above integration of the multimedia approach with the multilevel menu approach presents an effective way of retrieving information in the automobile. Advantageously, with the invention, the user would not be distracted or overburdened by irrelevant information in the course of an information retrieval, which is conducive to a safe driving environment.

In the preferred embodiment, when the user wants to access information about a given part or accessory of the automobile, the user is presented with options on a display screen. Each option is associated with a respective one of different parts or accessories of the automobile. The user is able to select through the interface one of the options, associated with the given automobile part or accessory. The option, when selected, is highlighted in a first color, for example, yellow. A voice is then generated by the inventive system to explain the purpose or the content of the selected option before the user commits to it. Having been so informed, the user may then activate the selected option in retrieving the information of interest. The activated option is highlighted in a second color, e.g., blue, to indicate its active status. The retrieved information is presented to the user both in text and in voice.

BRIEF DESCRIPTION OF THE DRAWING

Further objects, features and advantages of the invention will become apparent from the following detailed descrip-

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tion taken in conjunction with the accompanying drawing showing an illustrative embodiment of the invention, in which:

FIG. 1 is a block diagram of an automobile information and control system in accordance with the invention;

FIG. 2 illustrates a control panel and a display interface for a user to interact with the system of FIG. 1;

FIG. 3A illustrates a flow chart depicting the steps of an anti-car-theft routine used in the system of FIG. 1;

FIGS. 3B and 3C jointly illustrate a flow chart depicting the steps of a routine for presenting various screens to the user in the system interaction;

FIG. 4A illustrates a screen for eliciting a personal identification number (PIN) from the system user;

FIG. 4B illustrates a SELECT A FUNCTION screen including features thereof in accordance with the invention;

FIG. 5 illustrates an introduction screen including features thereof in accordance with the invention;

FIG. 6 illustrates a MANUFACTURER screen including features thereof in accordance with the invention;

FIG. 7 illustrates a SAFETY REMINDERS screen including features thereof in accordance with the invention;

FIG. 8 illustrates a THEFT PROTECTION FEATURES screen including features thereof in accordance with the invention;

FIG. 9 illustrates a QUICK TIP SET-UP screen including features thereof in accordance with the invention;

FIG. 10 illustrates a MAIN MENU screen including features thereof in accordance with invention;

FIG. 11 illustrates a DRIVER'S VIEW screen including features thereof in accordance with the invention;

FIG. 12 illustrates an INSTRUMENT PANEL screen including features thereof in accordance with the invention;

FIG. 13 illustrates a TACHOMETER AND WARNING LIGHTS screen including features thereof in accordance with the invention;

FIG. 14 illustrates a segment of the screen of FIG. 13 providing the user with information regarding a particular function of the automobile;

FIG. 15 illustrates a CLIMATE CONTROL screen including features thereof in accordance with the invention;

FIG. 16 illustrates a SAVE screen for saving the user's preferences in accordance with the invention;

FIG. 17 illustrates a DATA ENTRY screen in accordance with the invention for looking up information regarding a specific item in the automobile;

FIG. 18 illustrates an INDEX screen with listed items for which information is available; and

FIG. 19 is a look-up table listing searchable items and the corresponding instructions for a processor in the system of FIG. 1 to provide information regarding such items.

Throughout this disclosure, unless otherwise stated, like elements, components and sections in the figures are denoted by the same numerals.

DETAILED DESCRIPTION

FIG. 1 illustrates information and control system 100 embodying the principles of the invention for use in an automobile. System 100 is referred to as the "AUTO DIRECTOR" system. It is user-friendly and designed with the automobile user in mind. For example, with AUTO DIRECTOR display interface 102a to be described, information about the automobile is readily available literally at

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the fingertips of the user. This information includes operational instructions, maintenance procedures, safety measures, and information about virtually every capability of the automobile. In accordance with the invention, the user is able to efficiently access such information using multimedia means involving audio, text and video media. Also with interface 102a, or multifunction display interface 102b as described, the user is afforded a centralized control whereby he/she can program or adjust different vehicle parts and accessories using the information thus obtained.

As shown in FIG. 1, central to system 100 is processor 105 connected to memory 115. Data bus 107 connects processor 105 to display interfaces 102, input interfaces 104, communications interfaces 106, output control interfaces 108, vehicle computer interfaces 110, vehicle control interfaces 112, self-test interface 114, preferences interface 116, and audio interface 118.

Display interfaces 102 include, inter alia, AUTO DIRECTOR display interface 102a, which is illustrated in FIG. 2, together with control panel 205 in FIG. 1. By way of example, but not limitation, the hardware of interface 102a and control panel 205 are derived from a prior art navigation system of the type of the ACURA navigation system. In fact, illustrative embodiment to realize not only AUTO DIRECTOR functions to be described, but also the well-known navigation function.

Interface 102a includes a conventional liquid crystal display screen 209, and LCD driver (not shown) for processor 105 to control the display on screen 209. Interface 102a also incorporates well-known touch-screen circuitry (not shown) connected to touch screen interface 104a in FIG. 1. With this circuitry, the user can interact with processor 105 by, say, touching a displayed option on screen 209. Through interface 104a, processor 105 receives from the touch screen circuitry a signal identifying the location on screen 209 where it has been touched. If such a location matches the predetermined location of one of the displayed options, processor 105 determines that that option has been selected. With such touch-screen and displayed option selection capabilities, through AUTO DIRECTOR interface 102a, the user is able to obtain information on and control selectable functions of the automobile such as the instrument panel, navigation function, mobile phone, radio/CD player, locks, mirrors, windows, driver's seat adjustment control, climate control, windshield wipers, cruise control, lights, security function, steering, ride control, engine and transmission.

Control panel 205 comprises CANCEL switch 205a, ENTER switch 205b, BRIGHTNESS switch 205c, PUSH TO SELECT knob 205d, MENU switch 205e, MAP/GUIDE switch 205f, SETUP switch 205g, ZOOM IN switch 205h and ZOOM OUT switch 205i. BRIGHTNESS switch 205c comprises a standard variable resistor such that when it is pushed one way, operating circuitry 121 responsively causes the display intensity to increase, and the other way to decrease. ZOOM IN switch 205h when pressed enables the automobile user to enlarge a particular visual area of interest on screen 209, affording better details. On the other hand, ZOOM OUT switch 205i when pressed performs the inverse function to switch 205h. As an alternative to the touch-screen capability, switch 205d similar to a standard joystick is provided for the user to move from one displayed option to another on screen 209 in the same direction (e.g., up, down, left or right) as the switch is operated. A desired option may be selected by pressing ENTER switch 205b. The functions of the other switches are described hereinbelow.

low as they are called out in the operation of system 100. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and control panel 205 are mounted close to the center of the dashboard of the automobile next to the steering wheel.

Referring back to FIG. 1, display interfaces 102 also include multifunction display interface 102b, center console display interface 102c, rear console display interface 102d, and instrument panel display interface 102e.

Specifically, multifunction display interface 102b is installed on the dashboard close to interface 102a on the driver side. Like interface 102a, interface 102b provides the user with graphic display and control of selected functions using well-known touch screen technology. In fact, interface 102b duplicates certain control functions (e.g., navigation, phone, radio and climate control) of interface 102a so that the user can use interface 102b to control a selected function while interface 102a is engaged in another ongoing function. For example, while the user is relying on AUTO DIRECTOR interface 102a to provide navigation information to reach a given destination, the user may want to adjust the climate control of the automobile. It is inconvenient for the user to terminate the ongoing navigation mode of interface 102a, albeit temporarily, to access the climate control function through the interface, adjust the climate control and then resume the navigation mode. Thus, it is preferable to leave the navigation mode of interface 102a alone and use interface 102b to administer the climate control.

Center console interface 102c is installed close to interface 102a on the passenger side. Similar to interface 102b, interface 102c provides the front seat passenger with graphic display and control of functions which include: the front passenger seat adjustment, door lock, window, climate and TV controls. If enabled by the driver, control is also available for the radio/CD player and phone.

Rear console display interface 102d is installed on the back of a front seat. Similar to interface 102c, interface 102d provides rear seat passengers with graphic display and control of certain functions if enabled by driver or front seat passenger. These functions include: the rear seat climate, windows, door locks, radio/CD player and TV controls.

Instrument panel display interface 102e is installed on the dashboard in front of the driver seat. This interface provides the driver with graphic display of the vehicle speed, engine RPM, outside and inside temperatures, oil pressure, fuel level, time, odometer reading, trip odometer reading and warning light indicators. Through AUTO DIRECTOR interface 102a, the system user may select the display of the information in either an analog or a digital form.

Input interfaces 104 comprise standard touch screen interface 104a and control panel 205 described before, and voice command interface 104b (not shown) for processing voice commands by the user through the microphone to control or modify selected functions of system 100.

Communications interfaces 106 include phone interface 106a, radio/CD interface 106b, television (TV) interface 106c, navigation interface 106d, and beacon interface 106e. Processor 105 interacts with and controls standard phone equipment connected to phone interface 106a. Through processor 105, the user may operate the phone equipment via voice command, thereby realizing hands-free operation of the equipment. Alternatively, the user may operate the phone equipment using the touch screen capability provided by AUTO DIRECTOR display interface 102a or multifunc-

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tion display interface 102b. The user may also operate the phone equipment via remote switches.

Similarly, processor 105 interacts with and controls one or more radio receivers and CD players in the automobile connected to radio/CD interface 106b. Through processor 105, the user may operate the radio receivers via voice command, remote switch and/or touch screen capability.

Processor 105 further interacts with and controls one or more TV receivers in the automobile connected to TV interface 106c. Again, the user may operate the TV receivers via voice command, remote switches and/or touch screen capability.

As further described hereinbelow, navigation interface 106d is connected to a standard inertial guidance system (not shown) capable of providing gyros information, and deriving the vehicle location based on GPS information. With the map information stored in memory 115, the inertial guidance system is capable of providing the user with navigational instructions via interface 102a or 102b. Besides the locational information, local and national emergency information may be derived from the GPS information using additional standard decoding circuitry in interface 106d.

Beacon interface 106e is used for connection to a standard beacon device for detecting a predetermined beacon radio signal to provide additional locational information.

Output control interfaces 108 include lock interface 108a, mirror interface 108b, window interface 108c, steering column interface 108d, seat interface 108e, climate control interface 108f, wiper interface 108g, cruise control interface 108h, light interface 108i and clock interface 108j.

Specifically, lock interface 108a comprises output control logic controllable by processor 105 to lock or unlock the car doors, glove box, console storage, trunk (or liftgate), fuel filler door, brakes and transmission, and enable or disable the child-proof door locks, fuel pump and ignition.

Mirror interface 108b comprises output control logic controllable by processor 105 to maneuver the positions of the outside mirrors and inside rear view mirror, and to fold or unfold the outside mirrors.

Window interface 108c comprises output control logic controllable by processor 105 to incrementally or completely open or close all windows, and to open, close or tilt any sunroof.

Steering column interface 108d comprises output control logic controllable by processor 105 to move the steering column in or out and up or down.

Seat interface 108e comprises output control logic controllable by processor 105 to (1) adjust the positions of the front seats forward or aft, and up or down; (2) tilt the front or rear of the seat cushion up or down; (3) adjust the seat back lumbar, width and angle forward or aft; (4) increase or decrease the cushion size and stiffness; (5) raise or lower the head restraint; and (6) raise or lower the seat belt height.

Climate control interface 108f comprises output control logic controllable by processor 105 to (1) turn the climate control system on or off; (2) select an air flow mode; (3) set fan speeds; (4) enable or disable seat heaters; (5) select fresh or recirculated air (for driver only); and (6) enable or disable front and rear defrosters, mirrors and steering wheel heaters (for driver only).

Windshield wiper interface 108g comprises output control logic controllable by processor 105 to (1) select a high, low, intermittent, single wipe or off mode; (2) set an intermittent delay; and (3) enable or disable front or rear washers. Interface 108g also includes control logic for controlling

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rain- and speed-sensitive wipers, and for activating an automatic wash in a single wide mode when the windshield is at a certain level of opacity.

Cruise control interface 108h comprises output control logic controllable by processor 105 to (1) turn the cruise control on or off, (2) set the vehicle speed, and (3) cancel or resume the set speed.

Light interface 108i comprises output control logic controllable by processor 105 to select an automatic on mode or off mode for parking lights, headlights and fog lights; and to turn on or off map or courtesy lights.

Clock interface 108j comprises output control logic controllable by processor 105 to set an initial date and time on a conventional clock (not shown) connected to interface 108j. System 100 relies on the current date and time kept by the clock to provide a time reference for the system functions.

Vehicle computer interfaces 110 include anti-lock brake computer interface 110a, engine computer interface 110b and supplemental restraint computer interface 110c for processor 105 to communicate with the computers controlling the anti-lock brakes, engine and supplemental restraints (e.g., back-up airbag deployers and seat belt tensioners), respectively. Interfaces 110 also include back-up interface 110d through which processor 105 receives and analyzes signals from the engine, anti-lock brake and supplemental restraint computers. These signals would indicate to processor 105 any failures of the computers. In response to a computer failure, processor 105 causes a corresponding back-up computer connected to interface 110d to provide a back-up function.

Vehicle control interfaces 112 include steering interface 112a, ride interface 112b, engine interface 112c, transmission interface 112d, traction control interface 112e, and security interface 112f.

Specifically, steering interface 112a comprises input monitoring and output control logic for processor 105 to lighten or tighten the steering effort ratio in response to changing road conditions. Through interface 102a, the user may opt for manual or automatic steering effort ratio control. Interface 112a is capable of adapting and storing data according to the driver's inputs. It also allows for steering of front and/or rear wheels for sporty or increased stability.

Ride interface 112b comprises input monitoring and output control logic for processor 105 to lighten or stiffen the ride control to front and/or rear of vehicle in response to changing road conditions. Through interface 102a, the user may also opt for manual or automatic ride control.

Engine interface 112c comprises input monitoring and output control logic allowing for shutting off a specified number of cylinders, and varying valve and cam timing to increase performance or fuel economy. This interface also allows for manual or automatic control of the engine components, and includes the capability of adapting and storing data according to the driver's inputs.

Transmission interface 112d comprises input monitoring and output control logic for selecting manual or automatic shifting of the transmission. In an automatic shifting mode, interface 112d is capable of adapting and storing data according to the driver's inputs. Interface 112d also allows for control of a variable differential ratio for fast acceleration and high economy cruise.

Traction control interface 112e comprises input monitoring and output control logic providing information on whether power is delivered to front and/or rear wheels of the

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vehicle and what proportion of the power is delivered to each wheel. This interface also allows for manual or automatic control, and such functions as yaw control in cooperation with the anti-lock brakes and an engine cylinder shutoff.

Security interface 112f comprises control logic for setting a security level, and enabling or disabling a number of security related functions such as the fuel supply cut-off, motion detector, brake locking, etc. Interface 112f also allows entry of a new or alteration of an existing personal identification number (PIN) for personalization of the vehicle functions, i.e., saving the vehicle functional preferences.

In accordance with an aspect of the invention, system 100 incorporates an anti-car-theft technique involving security interface 112f. In accordance with this inventive technique, security interface 112f further comprises a sensor for detection of a predetermined condition to trigger an anti-theft routine. It will be appreciated that a person skilled in the art will come up with many different triggering events causing the sensor to invoke the routine. For example, a passive way of triggering the anti-theft routine would be after the sensor detects that the engine is off and the user has opened, closed and locked the driver's door.

In any event, as soon as processor 105 receives from the sensor a signal requesting an invocation of the anti-theft routine, processor 105 retrieves from navigation interface 106d GPS information identifying the parking location of the automobile, as indicated at step 251 in FIG. 3A. Processor 105 then stores at step 253 the parking location GPS information in memory 115. At step 255, processor 105 determines whether the security measures remain on. By way of example, but not limitation, such determination is based on information from lock interface 108a indicating whether the driver's door is properly unlocked. If that door is properly unlocked, processor 105 determines that the security measures are called off, and the anti-theft routine comes to an end, as indicated at step 257.

Otherwise if processor 105 determines that the security measures remain on, processor 105 at step 259 retrieves from navigation interface 106d GPS information identifying the current location of the automobile. Processor 105 then compares at step 261 the current location GPS information with the parking location GPS information previously stored. If processor 105 at step 262 determines that the current location matches the parking location based on the comparison, the anti-theft routine returns to step 255 after a predetermined period. Otherwise if processor 105 determines that the current location does not match the parking location, processor 105 assumes that the automobile has been removed without authorization, i.e., stolen. At this point, if a conventional alarm system is connected to security interface 112f, processor 105 would cause an alarm to come on, gas to be cut off, etc.

In this example, a conventional transmitter (not shown) is connected to security interface 112f and transmits a predetermined sequence of signals receivable by a law enforcement agency or a suitable alarm monitor company when it is activated. Continuing the example, processor 105 translates the GPS information identifying the current vehicle location into the corresponding street address based on the map information stored in memory 115, as indicated at step 263. Processor 105 at step 265 looks up one or more phone numbers pre-stored in memory 115 for reporting to the law enforcement agency (or the alarm monitor company) about the stolen status. Alternatively, a list of phone numbers

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associated with law enforcement agencies (or branches of the alarm monitor company) in many different geographic locations is pre-stored, along with the GPS information identifying the locations of the respective law enforcement agencies (or alarm monitor company branches). This being so, processor 105 locates the closest law enforcement agency (or alarm monitor company branch) and its associated phone number(s) by comparing the current vehicle location GPS information with the respective agency (or branch) location GPS information.

In any event, processor 105 at step 267 initiates a call to a law enforcement agency (or an alarm monitor company branch) through phone interface 106a using the phone number just located. After the phone connection is established, processor 105 provides through the connection information about the current address of the vehicle using conventional voice synthesizer circuitry (not shown) in audio interface 118, and the pre-recorded information about the vehicle itself such as its vehicle identification number (VIN), model, year, color, license number, etc., as indicated at step 269. Through the same phone connection, processor 105 may also provide information about the vehicle's owner such as his/her name and contact number so that the law enforcement agency (or alarm monitor company branch) can notify the owner of the incident. Processor 105 at step 271 activates the aforementioned transmitter connected to security interface 112f to generate the predetermined sequence of signals in case the stolen vehicle is in transit. For that matter, processor 105 can also repeatedly check on the latest vehicle location and report any new address different from the one previously reported. Thus, by tracking the signals in the vicinity of the latest reported vehicle location, the law enforcement agency (or alarm monitor company) would recover the vehicle in an efficient manner.

Referring back to FIG. 1, self-test interface 114 comprises input/output (I/O) control logic for performing an active self-test of system 100 on power up or at the user's request. Specifically, interface 114 polls every other interface in system 100 for a self-test result. Each interface, when polled, performs an active self-test and reports the test results to interface 114, where such test results are gathered and caused to be displayed on interface 102a.

Preferences interface 116 monitors changes made by the user in selected functions after the user logs on system 100, and prompts the user to save such preferences. These preferences are stored in memory 115 in association with the user's PIN. Functions affording the user choices include auto locks, an easy entry, auto lamps, the seat position, steering column position, mirror position, radio, steering, ride, transmission shift, engine performance, climate, and security level.

Audio interface 118 comprises I/O control logic for receiving audio signals from a radio/CD, TV, compact disk (CD) player, or phone interface, processing the received audio signals, providing proper amplifications thereto, and routing the resulting sound to appropriate speakers and headphones (not shown) connected to interface 118. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and multifunction display interface 102b share the same speakers. Interface 118 also provides center and rear console display interfaces 102c and 102d with separate audio channels, speakers and headphone outputs. The front and rear speakers may be muted by the user as a preference.

Interface 118 also processes requests from other interfaces for pre-recorded digital sounds stored in a SOUNDSGOOD library in memory 115 and routes the requested sounds to the

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appropriate interfaces. In addition, interface 118 comprises the conventional voice synthesizer circuitry for providing voice messages to the appropriate interfaces.

FIGS. 3B and 3C jointly illustrate routine 300 for accessing, through AUTO DIRECTOR display interface 102a, a main menu to obtain operational instructions, maintenance procedures, safety measures, and other information about the automobile, collectively referred to as "Quick Tips". Routine 300 is stored in memory 115 and initiated when SETUP switch 205g in FIG. 2 is pressed. Instructed by routine 300, processor 105 at step 301 elicits a PIN from the user by displaying a screen of FIG. 4A through interface 102a. As shown in FIG. 4A, a video key-pad comprising numeral keys "1" through "9", and "*" and "#" keys are displayed on screen 209. In response, the user enters a sequence of numerals by touching the corresponding displayed keys, followed by the "#" key.

It should be pointed out that in accordance with another aspect of the invention, when a displayed key or option is touched on the screen of AUTO DIRECTOR display interface 102a or multifunction display interface 102b, a tone pre-selected by the user from the SOUNDSGOOD library is generated through audio interface 118, indicating that the key or option has been touched on the screen. Advantageously, relying on the audio tone confirmation, as opposed to a visual confirmation, the user while driving can continually watch the road.

The user may alternatively enter the above numeral sequence using control panel 205 in a manner to be described. In any event, processor 105 then verifies at step 303 the PIN entry by comparing it with the user's pre-selected PIN. The latter is stored in memory 115, along with the user's preferences. In a standard way, the user is given a few chances to enter a correct PIN. Verification of the PIN entry identifies the user as a legitimate user. Thus, if the PIN entry is not valid, routine 300 comes to an end, as indicated at step 304.

Otherwise if the PIN entry is valid, processor 105 at step 305 causes interface 102a to display on screen 209 a "SELECT A FUNCTION" screen, which is illustrated in FIG. 4B. As shown in FIG. 4B, two options, namely, "NAVIGATION" and "QUICK TIPS", are displayed on screen 209. By default, NAVIGATION option 401 is highlighted yellow when the screen of FIG. 4B appears.

It should be pointed out that in this illustrative embodiment, a yellow highlight on an option indicates that the option is selected but not yet activated. Once a yellow highlighted option is activated, the option is highlighted blue. System 100 then performs according to the activated option.

Thus, in this instance, the user may activate the yellow highlighted NAVIGATION option by touching the option on screen 209 or by pressing ENTER switch 205b.

However, if QUICK TIPS option 403 is desired, the user may touch that option on screen 209, which would then be highlighted yellow. A second touch on the same option will change the highlight to blue, indicating the active status. As an alternative, the user may utilize knob 205d of FIG. 2 to select QUICK TIPS option 403 by first pushing the knob to the right. In response, processor 105 causes the yellow highlight to move from default NAVIGATION option 401 to QUICK TIPS option 403. The user can then select the QUICK TIPS option by pressing ENTER switch 205b. Upon selection, the yellow highlighted option will again turn blue.

Processor 105 at step 308 detects an activation of either NAVIGATION option 401 or QUICK TIPS option 403. If

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NAVIGATION option 401 is activated, processor 105 at step 311 causes system 100 to enter into a navigation mode. In this mode, processor 105 causes navigational instructions to be displayed on screen 209 in a conventional manner. In providing the navigation instructions, the standard inertial guidance system connected to navigation interface 106d receives signals from a constellation of GPS satellites maintained and controlled by the U.S. Department of Defense. In response to these signals, the inertial guidance system identifies the location (in longitude and latitude) of the automobile. The system also detects the vehicle speed, and the direction in which the vehicle is headed. By accessing the map information stored in memory 115, the system is capable of visually and verbally providing the user with directions to a given destination through AUTO DIRECTOR display interface 102a and audio interface 118, respectively.

Otherwise if activation of QUICK TIPS option 403 is detected at step 308, processor 105 causes interface 102a to display an introduction screen on screen 209, as indicated at step 314. This introduction screen is illustrated in FIG. 5.

As shown in FIG. 5, system source identification, warning and instructional information appear on the introduction screen, along with two options, "MAIN MENU" and "READ ME". The default option in this instance is READ ME option 501 which is highlighted yellow. Processor 105 detects at step 317 whether MAIN MENU option 503 or READ ME option 501 is activated. If MAIN MENU option 503 is activated, routine 300 proceeds to step 340 to be described. Otherwise if READ ME option 501 is activated, routine 300 proceeds to step 320 where processor 105 causes a series of three screens to be displayed. The first screen of the series is a "MANUFACTURER" screen, which is illustrated in FIG. 6.

As shown in FIG. 6, a description of the QUICK TIPS system appears on the MANUFACTURER screen. If the text to be displayed exceeds one screen, which is the case here, scrolling options comprising scroll-up option 605 and scroll-down option 607 are provided. When option 605 is touched and activated on screen 209, additional text scrolls up one paragraph at a time. Option 607 performs an inverse function to option 605. Again, as an alternative, the user may maneuver PUSH TO SELECT knob 205d until the desired scroll option (or direction arrow) is highlighted yellow. The activation of the highlighted option is achieved by pressing ENTER switch 205b.

By default, displayed option 609 has the "AUTO VOICE" wording thereon and is highlighted blue as the MANUFACTURER screen comes on. Accordingly, a pre-recorded voice is activated by processor 105 through audio interface 118 to read the entire text associated with this screen without interruption, including the text which is not presently shown on screen 209 but otherwise shown upon scrolling. To alter the AUTO VOICE function, the user may touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "AUTO VOICE" wording on option 609 changes to "MANUAL VOICE", which is highlighted blue, indicating its active status.

In accordance with the MANUAL VOICE function, a pre-recorded voice reads the displayed text only, and stops reading until additional text is scrolled onto the screen. To silence the voice, the user may again touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "MANUAL VOICE" wording on option 609 changes to "VOICE OFF", and the voice is deactivated, with the option now highlighted yellow. The cycle of the AUTO VOICE, MANUAL VOICE and VOICE OFF functions can be repeated by successively touching option 609 or pressing switch 205b.

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Other displayed options on the screen of FIG. 6 include PREVIOUS option 611 and NEXT option 613. As indicated at step 323, option 611 when selected causes routine 300 to return to step 314, where the introduction screen of FIG. 5 is again displayed. Otherwise, if option 613 is selected, routine 300 proceeds to step 326 in FIG. 3C where processor 105 causes a "SAFETY REMINDERS" screen to be displayed on screen 209. FIG. 7 illustrates such a screen.

As shown in FIG. 7, like the MANUFACTURER screen, the SAFETY REMINDERS screen includes option 609 displayed with the default wording "AUTO VOICE" thereon, PREVIOUS option 611, NEXT option 613, scroll-up option 605 and scroll-down option 607. This screen reminds the user of the safety features of the vehicle including, for example, air bags and seat belts. As indicated at step 329, option 611 when selected causes routine 300 to return to step 320 of FIG. 3B. Otherwise if option 613 is selected, routine 300 proceeds to step 332 where processor 105 causes a "THEFT PROTECTION FEATURES" screen to be displayed on LCD screen 209. FIG. 8 illustrates such a screen.

As shown in FIG. 8, the THEFT PROTECTION FEATURES screen similarly has thereon displayed options 605, 607, 609, 611 and 613. This screen describes to the user a theft-deterrent system including the anti-theft routine of FIG. 3A equipped in the vehicle. As indicated at step 335, option 611 when selected causes routine 300 to return to step 326. Otherwise if option 613 is selected, routine 300 proceeds to step 338 where processor 105 causes a "QUICK TIPS SET-UP" screen to be displayed on LCD screen 209. FIG. 9 illustrates such a screen.

As shown in FIG. 9, the QUICK TIPS SET-UP screen comprises two arrays of displayed options, denoted 901 and 903, respectively. Array 901 concerns the volume of the audio part of system 100. In this illustrative embodiment, the user may select the options in array 901 to respectively turn the volume off, to a "SOFT" level, to a medium level, and to a "LOUD" level. Array 903 concerns the display of LCD 119 of system 100. In this illustrative embodiment, the user may select the options in array 903 to respectively turn the display off, adjust it to a "DAY" setting, adjust it to a "NIGHT" setting, and have it automatically adjusted. When the QUICK TIPS SETUP screen comes on, by default, the volume is set to a medium level (i.e., the "MED" option in array 901 highlighted blue), and the display is set to be automatically adjusted (i.e., the "AUTO" option in array 903 highlighted blue).

Also shown in FIG. 9 is NEXT option 905. By selecting this option, routine 300 returns to step 340 of FIG. 3B where a "MAIN MENU" screen is displayed on LCD screen 209. After routine 300 is performed, the screen of FIG. 9 can be invoked at any time by pressing SETUP switch 205g to re-adjust the volume and the intensity of the LCD of system 100.

FIG. 10 illustrates the MAIN MENU screen. This screen comprises displayed options disposed in columns 1001, 1003, 1005, and 1007. For example, column 1001 includes DRIVER'S VIEW option 1001a, STEERING COLUMN CONTROLS option 1001b, LOCK option 1001c, DRIVING TIPS option 1001d, and INDEX option 1001e. It should also be noted that this screen can be invoked at any time by pressing MENU switch 205e.

When the MAIN MENU screen comes on, by default, DRIVER'S VIEW option 1001a is highlighted yellow, indicating that it is selected. However, the user may touch any other displayed option on screen 209 for re-selection. A

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further touch on the yellow highlighted option changes its color to blue and activates same. Again, the user may alternatively maneuver PUSH TO SELECT knob 205d to re-select any other displayed option, followed by a depression of ENTER switch 205b to activate the selected option. Since LCD screen 209 is compact, the display area for each option on the MAIN MENU screen is generally small. As a result, selection and activation of an option by touching the option on the screen is susceptible to errors, especially when the vehicle is in motion. Thus, in this situation it may be preferable to achieve the same result using knob 205d and switch 205b, instead.

In addition, because of the small display area allocated to each option on the MAIN MENU screen, the wording on the option is brief and thus tends to be cryptic. In accordance with a feature of the invention, after a predetermined time (e.g., a few seconds) has elapsed from the option's being highlighted yellow, processor 105 causes a voice to be generated on speakers 127 to explain the purpose of the option before the user activates it. For example, after a predetermined delay from DRIVER'S VIEW option 1001a's being highlighted yellow, a voice is activated, stating the option name, followed by an explanation of the purpose of the option such as "To provide location of dash mounted components." Thus, this inventive feature affords a preview of the option before the user commits to it, thereby avoiding unnecessary backtracking.

Continuing the example, after hearing the preview of option 1001a, the user decides to select that option. In response, processor 105 causes a "DRIVER'S VIEW" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 11. When the DRIVER'S VIEW screen appears, VOICE option 1101 is highlighted blue, indicating that voice announcements are active. To disable the voice announcements, the user may touch VOICE option 1101 on screen 209, or alternatively press ENTER switch 205b. VOICE option 1101 would be highlighted yellow when disabled.

As also shown in FIG. 11, a view of the interior of the automobile from the driver's perspective is provided. Underneath that view, DASH-MOUNTED CONTROLS option 1103, INSTRUMENT PANEL option 1105, AUDIO SYSTEM option 1107, CLIMATE CONTROLS option 1109 and PREVIOUS option 1111 are displayed. By default, DASH-MOUNTED CONTROLS option is highlighted yellow. However, the user in this example decides to select INSTRUMENT PANEL option 1105, instead. By touching option 1105 on screen 209, the option is highlighted yellow. If VOICE option is not disabled, after a predetermined delay, an announcement such as "To provide information on gauges, meters and warning lights" comes on to preview the purpose or content of option 1105. Options 1103, 1107, and 1109 are similarly programmed. In this instance, selecting PREVIOUS option 1111 enables the user to return to the MAIN MENU screen of FIG. 10.

Continuing the example, assuming that the user activates option 1105 after hearing the preview, in response processor 105 causes an "INSTRUMENT PANEL" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 12. As shown in FIG. 12, the previous screen format is generally maintained in that it provides a view of the object (the instrument panel of the automobile in this instance) pertinent to the option which has been selected, along with displayed options for further selection thereunder. Based on the disclosure heretofore, the design and operation of these screens by now are apparent to a person skilled in the art, and become self-explanatory.

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In accordance with another feature of the invention, individual elements on the instrument panel shown in FIG. 12 are labeled with numerals "1", "2", "3", "4" and "5" which correspond to option 1201a designated "1. TACHOMETER AND WARNING LIGHTS", option 1201b designated "2. TURN SIGNAL/HAZARD WARNING", option 1201c designated "3. SPEEDOMETER AND WARNING LIGHTS", option 1201e designated "4. ODOMETER & TRIP METERS/OUTSIDE TEMPERATURE", and option 1201f designated "5. FUEL/TEMP GAUGE AND WARNING LIGHTS", respectively. As such, the function of the displayed options is two-fold. First, the wording on each displayed option informs the user of what the corresponding element(s) represents. Second, each displayed option is also for selection to obtain more information about the corresponding element(s). In addition, with the above voice preview feature, the user is further apprised of the purpose or content of the option before he/she commits to it. For example, TACHOMETER AND WARNING LIGHTS option 1201a corresponds to a voice preview such as "To provide information on tachometer, malfunction, maintenance required, low oil pressure and charging system failure indicators."

Assuming that the user in this instance activates option 1201a, in response processor 105 causes a "TACHOMETER AND WARNING LIGHTS" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 13.

FIG. 13 shows VOICE option 1301 similar to option 1101 described before, TIP option 1303, a tachometer of the automobile denoted 1305, warning lights collectively denoted 1307, and options 1309a through 1309f in display segment 1311.

When TIP option 1303 appears on screen 209, it indicates that helpful hints or reminders are available upon selection thereof. In accordance with another feature of the invention, the appearance of TIP option 1303 is accompanied by the playing of a sound segment associated therewith. This sound segment may be pre-selected by the user from the SOUNDSGOOD library. After an adaptation period, the user would be able to rely on the familiar sound segment, without looking at the screen, to alert him/her of the availability of the TIP option.

Similarly, the user may pre-select another sound segment associated with warnings. Such a sound segment should connote urgency or even emergency as such warnings include, for example, engine overheating, an extremely low fuel level caution, GPS emergency information from navigation interface 106d, etc. Under control of processor 115, audio interface 118 preempts any on-going announcement and momentarily substitute therefor any such warning as soon as it occurs, which is preceded by the associated sound segment.

In any event, if option 1303 is selected in this instance, a voice comes on and utters a tip regarding tachometer 1305 such as "To prevent engine damage, do not drive with needle in red zone." This tip is also momentarily displayed on segment 1311 in lieu of options 1309a through 1309f.

Similar to the elements on the INSTRUMENT PANEL screen, tachometer 1305 and warning lights 1307 on this screen are individually labeled and correspond to options 1309a, 1309b, 1309c, 1309e and 1309f, respectively. Assuming in this example that MAINTENANCE REQUIRED option 1309c is activated, display segment 1311 would be replaced by new display segment 1411 illustrated in FIG. 14. As shown in FIG. 14, item 1401 indicates the subject selected, i.e., "MAINTENANCE

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REQUIRED". Item 1403 explains what the MAINTENANCE REQUIRED warning light, when on, indicates. In this instance it states, "Maintenance required warning light comes on to indicate it is time for scheduled maintenance." PREVIOUS option 1405 enables the user to reactivate segment 1311 of FIG. 13.

Assuming further that at this point the user wants to learn about and also to program the air conditioning of the automobile, the user may access a "CLIMATE CONTROL" screen by successively pressing the PREVIOUS option to backtrack to the DRIVER'S VIEW screen of FIG. 11, where CLIMATE CONTROLS option 1109 is available. As a second alternative, the user may press MENU switch 205e to invoke the MAIN MENU screen of FIG. 10, where a "CLIMATE CONTROLS" option within column 1003 is available. A third alternative is provided in the event that the user cannot immediately relate "air conditioning" to the CLIMATE CONTROLS option. At the MAIN MENU screen of FIG. 10, the user may select Index option 1001e to be described. It suffices to know for now that this option allows the user to access the "CLIMATE CONTROL" screen using the term "air conditioning".

FIG. 15 illustrates the "CLIMATE CONTROL" screen. With the voice enabled, a first touch on any displayed option on screen 209 causes it to be highlighted yellow, indicating its selected status. A second touch causes it to be highlighted blue, indicating its active status. With the voice disabled, only one touch on any displayed option activates it.

As shown in FIG. 15, the MODE options include OFF option 1511, AUTO option 1513, A/C option 1515, HEAT option 1517, and SMART CLIMATE option 1519. It should be noted that only one of the MODE options can be active at a time. In this example, assuming that the voice is enabled, when OFF option 1151 is selected by a first touch, a voice explaining the option comes on, uttering "To disable climate control." A second touch on the same option would then shut the climate control off through climate control interface 108f.

When AUTO option 1153 is selected by a first touch, a voice comes on to explain the option, uttering "System automatically determines air-flow distribution and volume for optimum efficiency." A second touch on the same option enables the automatic control, followed by a voice utterance, "Set desired temperature." Temperature display 1535 then flashes with the current temperature setting, prompting the user to set a desired temperature in a manner to be described.

If the user neglects to set a temperature after a predetermined time, in accordance with another aspect of the invention, a temperature range is automatically maintained by processor 105 in response to the date and time information from clock interface 108j, and the GPS information from navigation interface 106d. Based on the date and time information, processor 105 knows what the current season (e.g., mid-winter versus mid-summer) and time of the day (e.g., night verse noon) are. Based on the GPS information, processor 105 knows the region (e.g., New England versus Southern California) where the vehicle is. Processor 105 looks up a table stored in memory 115 containing predetermined temperature ranges corresponding to different combinations of the temporal and geographic parameters. It then prescribes an appropriate temperature range according to the table. This temperature range is updated by processor 105 periodically to reflect changes in the time of the day and the geographic location of the vehicle.

Similarly, A/C option 1515 and HEAT option 1517 respectively enable the user to activate air conditioning and heaters at a desired temperature or a default temperature range.

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SMART CLIMATE option 1519 is designed to allow the user to program the climate control for the next ride before he/she leaves the vehicle. When SMART CLIMATE option 1519 is selected by a first touch, a voice comes on to explain the option, uttering "To enable pre-heating or pre-cooling of vehicle." A second touch on the option activates the function, followed by a voice utterance, "Set desired temperature. Set desired time using fan speed arrows." Temperature display 1535 then flashes the current temperature setting, prompting the user to set a desired temperature. Similarly, fan speed display 1541 then flashes the current date, followed by current time, prompting the user to set the date and time that the user plans to reenter the vehicle. Through climate control interface 108f, processor 105 determines whether the current level of power from the car battery and any back-up power sources is sufficient. If it is insufficient, a message such as "Fail to pre-condition vehicle temperature" is issued through audio interface 118 to notify the user of the noncompliance. Otherwise, when it is close to the re-entry time, processor 105 determines the start-up time to effect the preconditioning, depending on the temperature difference between the inside and outside of the vehicle at that time. Processor 105 would then cause a combination of heaters and/or heat pumps (not shown) connected to interface 108f to pre-condition the vehicle temperature. In order to avoid substantially draining the power, in this illustrative embodiment, the requested temperature would be maintained up to an hour after the set re-entry time.

The Air options in FIG. 15 include FRESH option 1521 and RECIRCULATED option 1523. Only one of these two options can be active at a time. When FRESH option 1521 is selected by a first touch on the option, a voice comes on to explain the selected option, uttering "To select outside air to circulate in vehicle." A second touch on the option activates the selection to ventilate the vehicle with outside air. Similarly, RECIRCULATED option 1523 allows the user to select the inside air for recirculation in the vehicle.

The VENT options in FIG. 15 include FLOOR option 1525, FLOOR/DASH option 1527, DASH option 1529, DEFROST option 1531 and FLOOR/DEFROST option 1533. Only one of these five options can be active at a time. When FLOOR option 1525 is selected by a first touch on the option, a voice comes on explaining the option, uttering "Main air distribution to floor." A second touch on the option directs an air flow toward the vehicle floor.

Similarly, FLOOR/DASH option 1527 enables the user to bifurcate the air flow between the floor and the dashboard. DASH option 1529 enables the user to direct the air flow from the dashboard. DEFROST option 1531 enables the user to direct the air flow toward the windshield and select fresh air if not selected. FLOOR/DEFROST option 1533 enables the user to bifurcate the air flow between the floor and windshield.

Temperature display 1535 displays the temperature selected by the user. Touching on up-arrow 1537 increases the selected temperature while touching on down-arrow 1539 decreases same. Continued touching on either up-arrow 1537 or down-arrow 1539 causes the temperature setting to change rapidly.

Similarly, fan speed display 1541 displays the fan speed (high, medium or low) selected by the user. Touching on up-arrow 1543 increases the selected fan speed while touching down-arrow 1539 decreases same.

The HEATERS options in FIG. 15 include SEAT option 1547, MIRROR option 1549, REAR WINDOW option

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1551, STEERING WHEEL option 1553, and ALL option 1554. One or more of these options can be active at the same time. When SEAT option 1547 is selected by a first touch on the option, a voice comes on to explain the option, uttering "To enable seat heaters." A second touch on the option activates the seat heaters connected to climate control interface 108f.

Similarly, MIRROR option 1549 enables the user to activate outside mirror heaters. REAR WINDOW option 1551 enables the user to activate a rear window defroster. STEERING WHEEL option 1553 enables the user to activate a steering wheel heater. Finally, ALL option 1554 enables the user to activate all of the heaters simultaneously.

In personalizing the vehicle, preference interface 116 monitors any user adjustments to certain vehicle functions by comparing their current settings with the corresponding stored preferences in memory 115. Thus, for example, if the user changes any of the settings relating to the climate control such as the mode, vent, air, temperature, fan speed, etc. from its previous preferred setting, preference interface 116 causes a SAVE screen to appear on screen 209. This SAVE screen is illustrated in FIG. 16. As shown in FIG. 16, the user is prompted to save the change in the setting that he/she has just made. The user at this point may activate SAVE option 1601 to change the previous preferred setting. The SAVE screen thereafter disappears in favor of the previous screen. Otherwise, he/she may activate CLOSE option 1603 to close the SAVE screen, without storing the latest setting, which is then treated as a temporary setting. In the latter case, for example, a restart of the automobile will obliterate such a temporary setting, and reinstate the stored preferred setting.

Climate control screens can similarly be invoked by the front passenger and rear passengers on display interfaces 102c and 102d, respectively. Such screens provide similar MODE options including OFF, AUTO, A/C and HEAT options; and VENT options including LOWER VENT, UPPER VENT and LOWER/UPPER vent options. They also provide for temperature and fan speed adjustments for the respective localized areas. However, no save screen is provided.

Using INDEX option 1001e of FIG. 10 to look up information on and/or to control various items in the automobile will now be described. After option 1001e is activated, a DATA ENTRY screen illustrated in FIG. 17 is exhibited on screen 209. As shown in FIG. 17, a message "Enter Letter Or Item Name" appears to prompt the user for an entry of the name of the item of interest or its beginning letter. For this purpose, entry options for letters A through Z arranged in a grid format are provided in section 1701 for selection. In addition, DONE option 1703, when activated, indicates to system 100 that the entry is completed. Subdisplay 1705 is used to echo the user's entry to ensure its correctness.

In this illustration, the user enters "AIR CONDITIONING" as exhibited on subdisplay 1705. In response, an INDEX screen shown in FIG. 18 appears on display screen 209, with the search item name "AIR CONDITIONING" highlighted yellow. It should be noted that other item names such as "Anti-lock Brake System Indicator" are also shown, and they are in alphabetical order following "AIR CONDITIONING". This stems from the design of system 100 whereby the user may conveniently enter the beginning letter of the search item name only. In that case, a list of item names in alphabetical order with the first item name having the same beginning letter highlighted yellow. For instance,

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if the user had only entered "A" for "AIR CONDITIONING", a list of item names starting with "A" in alphabetical order would appear on screen 209 (although in this instance it would be the same list as shown in FIG. 18 as "AIR CONDITIONING" is the first item with a letter "A" in system 100). If the user cannot locate the name of the item of interest in the list, he/she may scroll the screen using scroll-up option 1801 or scroll-down option 1803 to review additional item names after or before the listed item names. Alternatively, the user may select PREVIOUS option 1805 to return to the screen of FIG. 17 to enter the complete item name.

In any event, after the user locates the item name on the INDEX screen, the user may then touch the item name to access information on that item. To that end, a look-up table is stored in memory 115. FIG. 19 illustrates such a look-up table, wherein left column 1901 lists each item name in alphabetical order in the index, and right column 1903 lists the corresponding instruction for processor 105 to carry out to access information on that item. For example, according to row 1905 of the table, the selection and activation of the item name "AIR CONDITIONING" causes processor 105 to connect the user to the CLIMATE CONTROL screen of FIG. 15 previously described.

The foregoing merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise numerous other systems which embody the principles of the invention and are thus within its spirit and scope.

For example, based on the disclosure heretofore, it is apparent that through system 100, the user can run diagnostics on selected parts of the automobile by voice command or touch-screen control.

In addition, in the disclosed embodiment, through system 100, the user is able to program the climate control for the next ride before he/she leaves the vehicle. It will be appreciated that the user will be able to achieve same remotely ahead of time via telecommunication means. For example, processor 105 may be programmed to accept climate control commands through phone interface 106a. In that instance, the user can call from anywhere to establish a phone connection with phone interface 106a using a predetermined phone number, through which the user communicates the commands to climate control interface 108f to program the climate control. Through the phone connection, the user may be provided with climate control options described above in a synthesized voice. The user may activate one or more of such options by pressing a predetermined touch-tone key on the telephone keypad corresponding to a "yes" or "no" response. Similarly, the user may achieve the relevant temperature and/or time settings by pressing the touch-tone keys corresponding to the numerals indicative thereof. Of course, telecommunication means other than the telephone including a radio frequency (RF) transmitter may also be used to communicate the climate control commands from a remote area.

In addition, in the disclosed embodiment, the user may access different screens provided by AUTO DIRECTOR display interface 102a to learn about and control certain vehicle functions. It will be appreciated that a person skilled in the art will develop a demonstration program wherein a series of such screens will be automatically presented to a user in a predetermined sequence. The presentation may include commentaries, and highlights on selected options displayed on each screen. Furthermore, the presentation may be coupled with the showing of actual vehicle functions. For

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example, in demonstrating the climate control screen of FIG. 15, while the function of a highlighted VENT option (e.g., Floor, Floor/Dash, Dash, Defrost or Floor/Defrost) is explained, it is activated so that the user in the automobile can feel an actual air flow from the corresponding direction. The above demonstration program may be invoked using a PIN provided by the automobile manufacturer. The program may run continually while the automobile is shown in a showroom, or may be invoked by the user occasionally to obtain relevant information.

Further, in the disclosed embodiment, the MAINTENANCE REQUIRED warning light comes on when it is time for scheduled maintenance. In accordance with another aspect of the invention, the maintenance is scheduled by system 100 according to the cumulative time of the tachometer reading above a predetermined RPM value. Such cumulative time reflects the extent of the engine wear, and if it exceeds a predetermined length of time without maintenance, the engine performance would degrade substantially. In measuring the cumulative time in question, a conventional comparator (not shown) is employed in system 100 to compare the instantaneous tachometer reading (provided by engine control interface 112c) with the predetermined RPM value. Each time when the tachometer reading exceeds the predetermined value, processor 105 is interrupted to register the length of such an occurrence. The latter is added to a running sum to update the cumulative time in question. This cumulative time may be displayed on instrument panel display interface 102e, along with the tachometer reading and the MAINTENANCE REQUIRED warning indicator. A second conventional comparator (not shown) is employed in system 100 to compare the cumulative time with the above predetermined time length. As soon as the cumulative time exceeds the predetermined length, processor 105 is interrupted and causes the MAINTENANCE REQUIRED warning light to come on, indicating that it is time for maintenance.

Still further, system 100 as described is highly adaptable in adjusting to new system requirements, and capable of "learning" new automobile features to be introduced into the system. Such learning may involve a modification or an upgrade in the system software stored in memory 115.

Moreover, other features of system 100 may include capabilities of communications with a third party remote from the vehicle. For example, system 100 may be programmed to transmit signals representing data on the current speed of the vehicle and its VIN receivable by a radar system, thus enabling the third party to monitor its speed. Furthermore, system 100 may be programmed by the third party to disable and subsequently enable the vehicle upon successful verification of a PIN pre-assigned to the third party. To that end, system 100 is capable of receiving remote transmission of the PIN, followed by the disable or enable code. The transmission may be encrypted for security reasons. Furthermore, more than one PIN may be used for different purposes. For example, a PIN may be assigned to a law enforcement agency to disable the vehicle because of a suspension of a license, or to temporarily disable the vehicle when the driver is intoxicated. Another PIN may be assigned to an environmental protection agency to disable the vehicle for failing to meet the emission requirements. Yet another PIN may be assigned to the vehicle owner to disable the vehicle when parked, thereby reducing the risk of a car theft. The disabling of the vehicle involves cutting off its gas, putting on its anti-lock brakes, etc.

Further, system 100 is capable of receiving a low-frequency, low-power broadcast covering an area of a lim-

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ited radius, referred to as a "Cell". The broadcast may provide electronic GPS map and Yellow Page type information pertaining to the cell. This information, when received, may be downloaded onto AUTO DIRECTOR display interface 102a or multifunction display interface 102b. Such information includes a local directory indicating locations of nearby gas stations, restaurants and other facilities on the GPS map, with respect to the current location of the automobile. The local directory may be formatted in the form of "web pages" featuring the local businesses, and include additional information such as business hours, telephone numbers, and information on products and services provided by such businesses.

The above broadcast may also provide local weather information sponsored by a civic group or commercial entity. In the case of civic group sponsorship, the local civic events may be posted alongside the weather information, and in the case of commercial sponsorship, advertisements may be posted instead. Of course, as the automobile moves from cell to cell, the contents of the broadcast change accordingly.

In addition, while the radio in the automobile is tuned to a particular radio station, system 100 is also capable of receiving any electronic files broadcast from that radio station, along with the radio program. These electronic files, which may be in the form of web pages, can be downloaded onto the system. The system user may then scroll the pages to learn such information as program listings and coming events sponsored by the radio station.

Moreover, in the disclosed embodiment, system 100 is illustratively used in an automobile. It will be appreciated that a person skilled in the art may also employ the inventive system in another type of vehicle such as a boat, an airplane, etc.

Finally, although information and control system 100, as disclosed, is embodied in the form of various discrete functional blocks, the system could equally well be embodied in an arrangement in which the functions of any one or more of those blocks or indeed, all of the functions thereof, are realized, for example, by one or more appropriately programmed processors or devices.

We claim:

1. A system in a vehicle for accessing information about a given aspect of said vehicle comprising:

a display element for displaying at least one option which is associated with said given aspect of said vehicle, the at least one option indicating a first status;

a first interface for selecting the at least one option, the selected at least one option indicating a second status; an output device for providing the content of said selected at least one option; and

a second interface for activating said selected at least one option to access said information, the activated option indicating a third status.

2. The system of claim 1 wherein the information includes instructions for operating the given aspect of said vehicle.

3. The system of claim 2 wherein said output device includes at least one audio element for communicating the instructions via audio media.

4. The system of claim 1 wherein said display element comprises a liquid crystal display (LCD).

5. The system of claim 1 wherein at least one of the first interface and the second interface includes a touch-screen capability.

6. The system of claim 1 wherein said second status is indicated by a highlight on said selected option in a first color.

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7. The system of claim 6 wherein said third status is indicated by a highlight on the activated option in a second color.

8. The system of claim 1 wherein said output device includes at least one audio element for communicating said information via audio media.

9. The system of claim 1 wherein the first interface is the same as the second interface.

10. The system of claim 1 wherein the content of said selected at least one option is provided via audio media.

11. The system of claim 1 wherein the information is visually communicated.

12. The system of claim 1 wherein said output device is capable of providing special information.

13. The system of claim 12 wherein the special information concerns the current condition of the vehicle.

14. The system of claim 1 further comprising a navigator processor for providing navigational information.

15. The system of claim 14 wherein the navigational information is provided based on global positioning system (GPS) data.

16. The system of claim 1 wherein at least one of the first interface and the second interface includes a voice command capability.

17. The system of claim 1 further comprising a processor for verifying a personal identification number (PIN).

18. The system of claim 1 wherein the at least one option includes a plurality of options, which are presented in a menu format.

19. The system of claim 1 further comprising a device for receiving an input, wherein the at least one option is displayed in response to the input, which describes at least part of the given aspect of the vehicle.

20. The system of claim 19 wherein the input includes textual entry.

21. A method for use in a system in a vehicle for accessing information about a given aspect of said vehicle comprising:

displaying at least one option which is associated with said given aspect of said vehicle, the at least one option indicating a first status;

selecting the at least one option, the selected at least one option indicating a second status;

providing the content of said selected at least one option; and

activating said selected at least one option to access said information, the activated option indicating a third status.

22. The method of claim 21 wherein the selected at least one option is selected using a touch-screen technique.

23. The method of claim 21 wherein said second status is indicated by a highlight on said selected option in a first color.

24. The method of claim 23 wherein said third status is indicated by a highlight on the activated option in a second color.

25. The method of claim 21 further comprising communicating said information via audio media.

26. The method of claim 21 wherein the content of said selected at least one option is provided via audio media.

27. The method of claim 21 wherein the information includes instructions for operating the given aspect of the vehicle.

28. The method of claim 27 further comprising communicating the instructions via audio media.

29. The method of claim 21 wherein at least one of the first and second statuses is indicated by a pre-selected audio signal.

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30. The method of claim 21 wherein said vehicle is an automobile.

31. The method of claim 21 further comprising providing special information.

32. The method of claim 31 wherein the special information concerns the current condition of the vehicle.

33. The method of claim 21 further comprising providing navigational information.

34. The method of claim 33 wherein the navigational information is provided based on GPS data.

35. The method of claim 21 wherein the selected at least one option is selected via voice command.

36. The method of claim 21 further comprising verifying a PIN.

37. The method of claim 21 wherein the at least one option includes a plurality of option, the method further comprising presenting the plurality of options in a menu format.

38. The method of claim 21 further comprising receiving an input, wherein the at least one option is displayed in response to the input, which describes at least part of the given aspect of the vehicle.

39. The method of claim 38 wherein the input includes a textual entry.

40. A system for use in a vehicle comprising:

a display element for showing a sequence of displays;

a control element for populating a plurality of options on at least first and second ones of the displays, the options on the first display being selectable to access information concerning a plurality of aspects of the vehicle, the options on the second display being selectable to access information concerning a subset of the aspects of the vehicle;

a first interface for selecting one of the options on the first display, the selected option being associated with the subset of the aspects of the vehicle;

an output device responsive to the selected option for vocally identifying different vehicle aspects in the subset whose information is accessible by selecting the options on the second display before the second display is shown; and

a second interface for activating the selected option to cause the second display to be shown.

41. The system of claim 40 wherein at least one of the first and second interfaces includes a touch-screen capability.

42. The system of claim 40 wherein the information concerning the subset of the aspects of the vehicle includes instructions for operating at least one of the aspects of the vehicle in the subset.

43. The system of claim 40 wherein the selected option indicates a first status, and the activated option indicates a second status.

44. The system of claim 43 wherein at least one of the first and second statuses is indicated by a pre-selected audio signal.

45. The system of claim 43 wherein said first status is indicated by a first color, and said second status is indicated by a second color.

46. The system of claim 40 wherein said vehicle is an automobile.

47. The system of claim 40 wherein the options on the first display are populated thereon in response to an entry of data to the system.

48. The system of claim 40 wherein the plurality of aspects of the vehicle include different functions provided by the vehicle.

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49. The system of claim 48 wherein the different functions relate to climate control of the vehicle.

50. The system of claim 40 wherein the display element also displays a tip option for providing instructions concerning operation of at least one of the plurality of aspects of the vehicle, a display of the tip option being accompanied by a selected audio signal.

51. The system of claim 40 wherein at least one of the first and second interfaces includes a device for receiving a voice command.

52. A method for use in a system in a vehicle comprising: showing a sequence of displays;

populating a plurality of options on at least first and second ones of the displays, the options on the first display being selectable to access information concerning a plurality of aspects of the vehicle, the options on the second display being selectable to access information concerning a subset of the aspects of the vehicle; selecting one of the options on the first display, the selected option being associated with the subset of the aspects of the vehicle;

in response to the selected option, vocally identifying different vehicle aspects in the subset whose information is accessible by selecting the options on the second display before the second display is shown; and activating the selected option to cause the second display to be shown.

53. The method of claim 52 wherein the information concerning the subset of the aspects of the vehicle includes instructions for operating at least one of the aspects of the vehicle in the subset.

54. The method of claim 52 wherein the selected option indicates a first status, and the activated option indicates a second status.

55. The method of claim 54 wherein said first status is indicated by a first color, and said second status is indicated by a second color.

56. The method of claim 52 wherein the options on the first display are populated thereon in response to an entry of data to the system.

57. The method of claim 52 wherein the plurality of aspects of the vehicle include different functions provided by the vehicle.

58. The method of claim 57 wherein the different functions relate to climate control of the vehicle.

59. The method of claim 52 further comprising displaying a tip option for providing instructions concerning operation of at least one of the plurality of aspects of the vehicle, a display of the tip option being accompanied by a selected audio signal.

60. The method of claim 52 wherein the selected option is selected via voice command.

61. A system for use in a vehicle comprising:

a processor for issuing at least one option which is selectable to access information concerning an aspect of the vehicle;

an interface for showing said at least one option and said aspect of the vehicle before said at least one option is selected, said at least one option including thereon a description of said aspect of the vehicle; and

an indicator for providing an indication on the at least one option for associating said at least one option with the aspect of the vehicle shown, the indication being different from the description.

62. The system of claim 61 wherein the indication includes a numeral.

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63. The system of claim 61 wherein said interface includes a display element.

64. The system of claim 63 wherein said display element includes an LCD.

65. The system of claim 61 further comprising an input for activating the option.

66. The system of claim 65 wherein an activation of the option is indicated by a selected audio signal.

67. The system of claim 65 wherein the option is activated to control the aspect of the vehicle.

68. The system of claim 61 wherein the information is provided via audio media.

69. The system of claim 61 wherein the information is visually provided.

70. The system of claim 61 wherein said vehicle is an automobile.

71. The system of claim 61 wherein the option is issued in response to an entry of information to the system.

72. The system of claim 61 wherein the aspect of the vehicle includes a function provided by the vehicle.

73. The system of claim 72 wherein said function relates to climate control of the vehicle.

74. The system of claim 61 further comprising a provider for providing special information.

75. The system of claim 74 wherein said special information when provided is preceded by a selected audio signal.

76. The system of claim 74 wherein the special information concerns the current condition of the vehicle.

77. The system of claim 61 further comprising a navigator processor for providing navigational information.

78. The system of claim 77 wherein the navigational information is provided based on GPS data.

79. A method for use in a system in a vehicle comprising: issuing at least one option which is selectable to access information concerning an aspect of the vehicle;

showing said at least one option and said aspect of the vehicle before said at least one option is selected, said at least one option including thereon a description of said aspect of the vehicle; and

associating said at least one option with the aspect of the vehicle shown using an indication on said at least one option, the indication being different from the description.

80. The method of claim 79 wherein said indicator includes a numeral.

81. The method of claim 79 further comprising the step of activating the option.

82. The method of claim 81 wherein an activation of the option is indicated by a selected audio signal.

83. The method of claim 81 wherein the option is activated to control the aspect of the vehicle.

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84. The system of claim 79 wherein the information is provided via audio media.

85. The system of claim 79 wherein the information is visually provided.

86. The method of claim 79 wherein said vehicle is an automobile.

87. The method of claim 79 wherein the option is issued in response to an entry of information to the system.

88. The method of claim 79 wherein the aspect of the vehicle includes a function provided by the vehicle.

89. The method of claim 88 wherein said function relates to climate control of the vehicle.

90. The method of claim 79 further comprising the step of providing special information.

91. The method of claim 90 wherein said special information when provided is preceded by a selected audio signal.

92. The method of claim 90 wherein the special information concerns the current condition of the vehicle.

93. The method of claim 79 further comprising the step of providing navigational information.

94. The method of claim 93 wherein the navigational information is provided based on GPS data.

95. A method for providing information concerning maintenance of an engine in a vehicle comprising the steps of: measuring a rate at which the engine runs;

detecting whether the rate of the engine exceeds a predetermined rate;

recording a period during which the rate of the engine is detected exceeding the predetermined rate;

adding said period to a cumulative period; and

emitting an alert when said cumulative period exceeds a predetermined period.

96. The method of claim 95 wherein the rate is a function of an RPM value.

97. The method of claim 96 wherein the vehicle is an automobile.

98. Apparatus for providing information concerning maintenance of an engine in a vehicle, the apparatus comprising:

a comparator for determining whether a rate at which the engine runs exceeds a predetermined rate;

a processor for accumulating periods during which the rate of the engine exceeds the predetermined rate; and

an indicator for emitting an alert when a sum of the periods exceeds a predetermined period.

99. The apparatus of claim 98 wherein the rate is a function of an RPM value.

* * * * *



US006148261A

United States Patent [19][11] **Patent Number:** 6,148,261**Obradovich et al.**[45] **Date of Patent:** *Nov. 14, 2000

[54] **PERSONAL COMMUNICATION SYSTEM TO SEND AND RECEIVE VOICE DATA POSITIONING INFORMATION**

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[75] **Inventors:** Michael L. Obradovich, San Clemente; John Dinkel, Irvine; Michael Kent, Garden Grove, all of Calif.

[73] **Assignee:** American Calcar, Inc., Wilmington, Del.

[*] **Notice:** This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] **Appl. No.:** 08/879,955

[22] **Filed:** Jun. 20, 1997

[51] **Int. Cl.⁷** G01C 15/00

[52] **U.S. Cl.** 701/208; 340/286.01; 340/988; 340/995; 701/213; 701/300

[58] **Field of Search** 340/944, 945, 340/961, 971, 979, 988, 989, 990, 995, 286.01, 286.06; 342/352, 357, 457; 701/207, 208, 209, 300, 213, 301; 455/456, 457, 433, 437, 438, 439, 440, 459, 461

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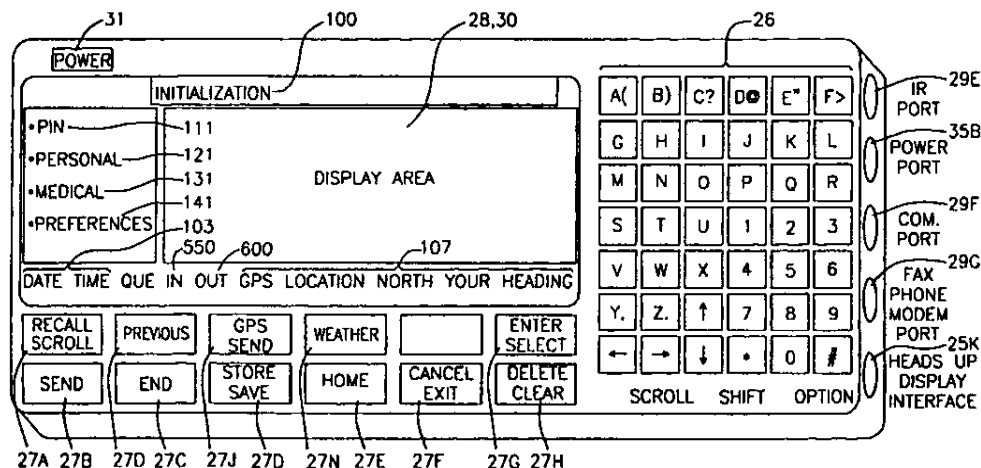
Assistant Examiner—Ed Pipala

Attorney, Agent, or Firm—Christie, Parker & Hale, LLP

[57]

ABSTRACT

A location tagged data provision and display system. A personal communication device (PCD) with electromagnetic communication capability has a GPS receiver and a display. The PCD requests maps and location tagged data from data providers and other for display on the PCD. The data providers respond to requests by using searching and sorting schemes to interrogate data bases and then automatically transmitting data responsive to the requests to the requesting PCD.

42 Claims, 31 Drawing Sheets

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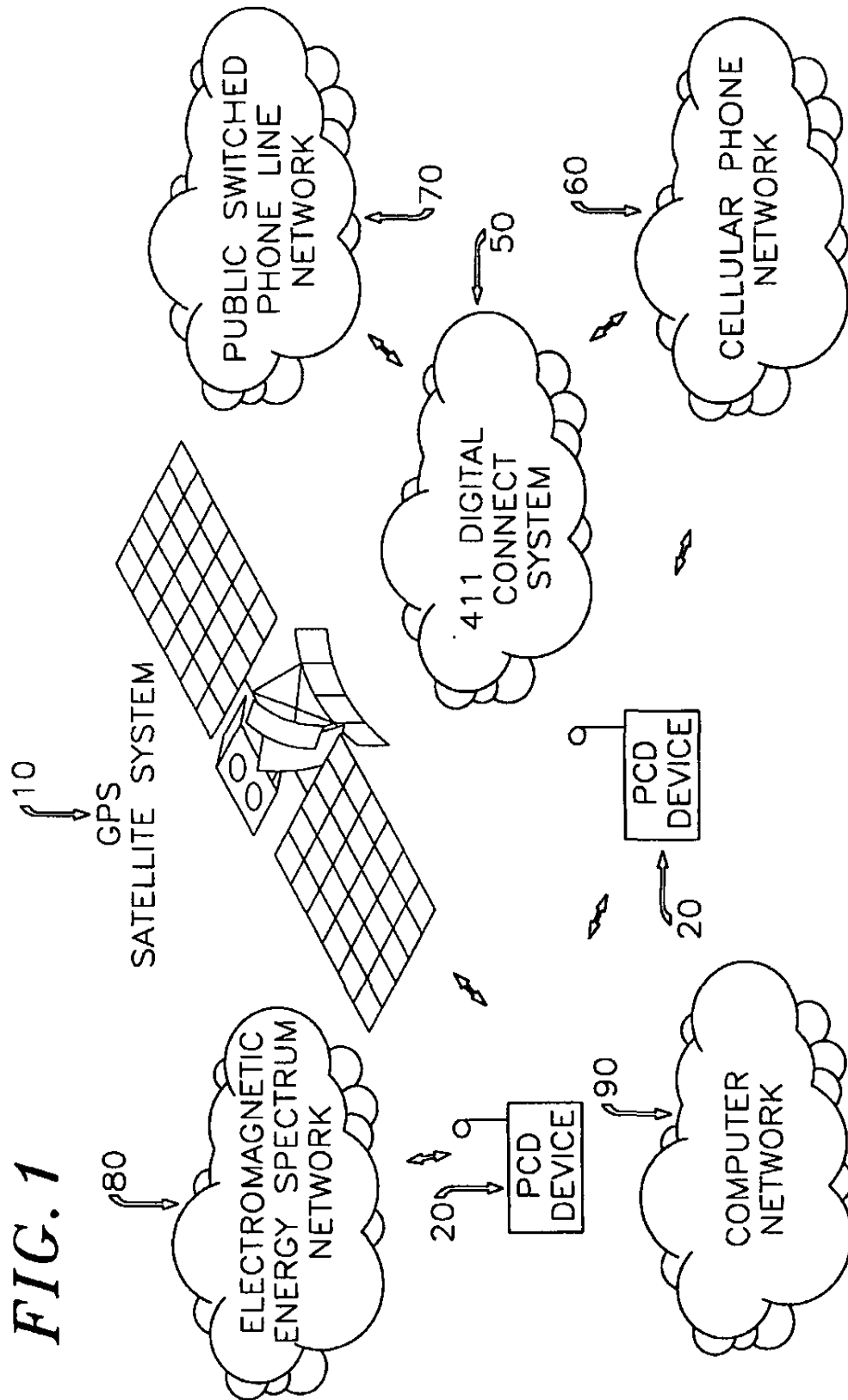
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FIG. 2

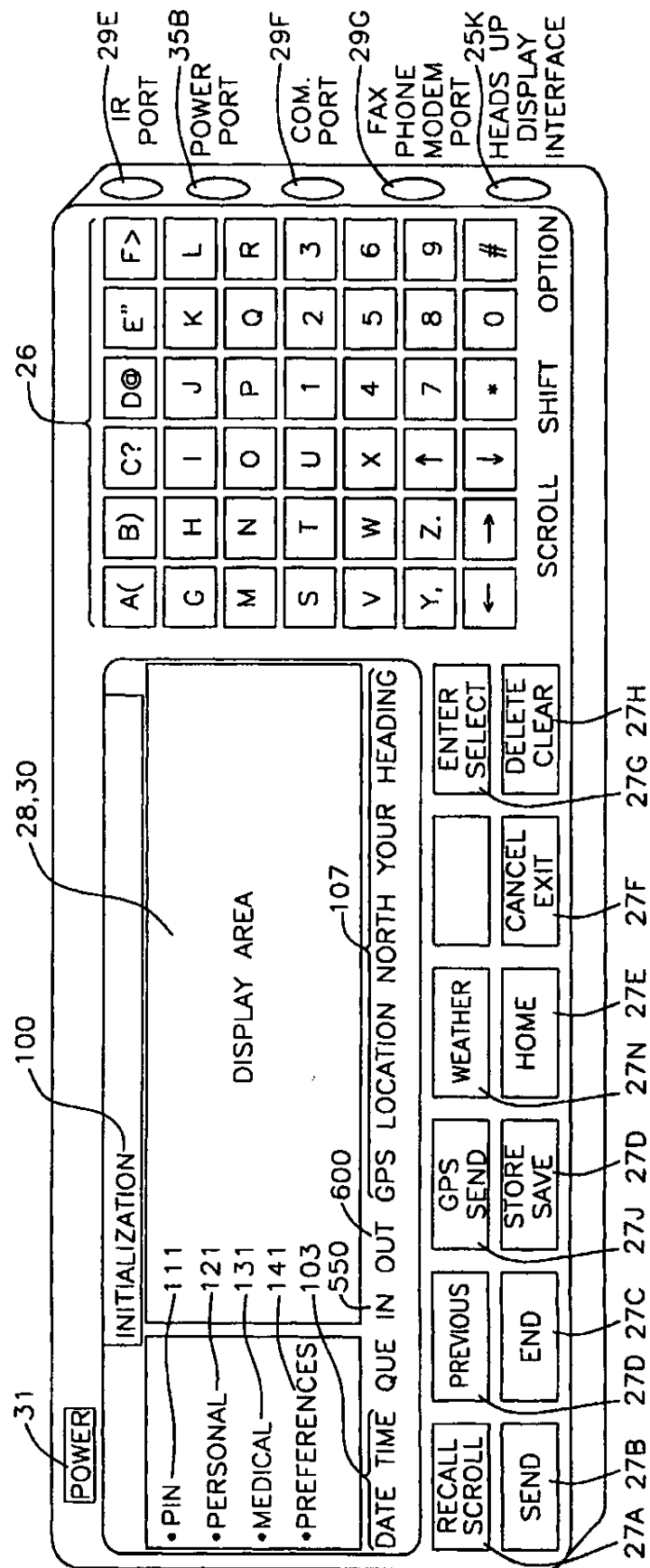
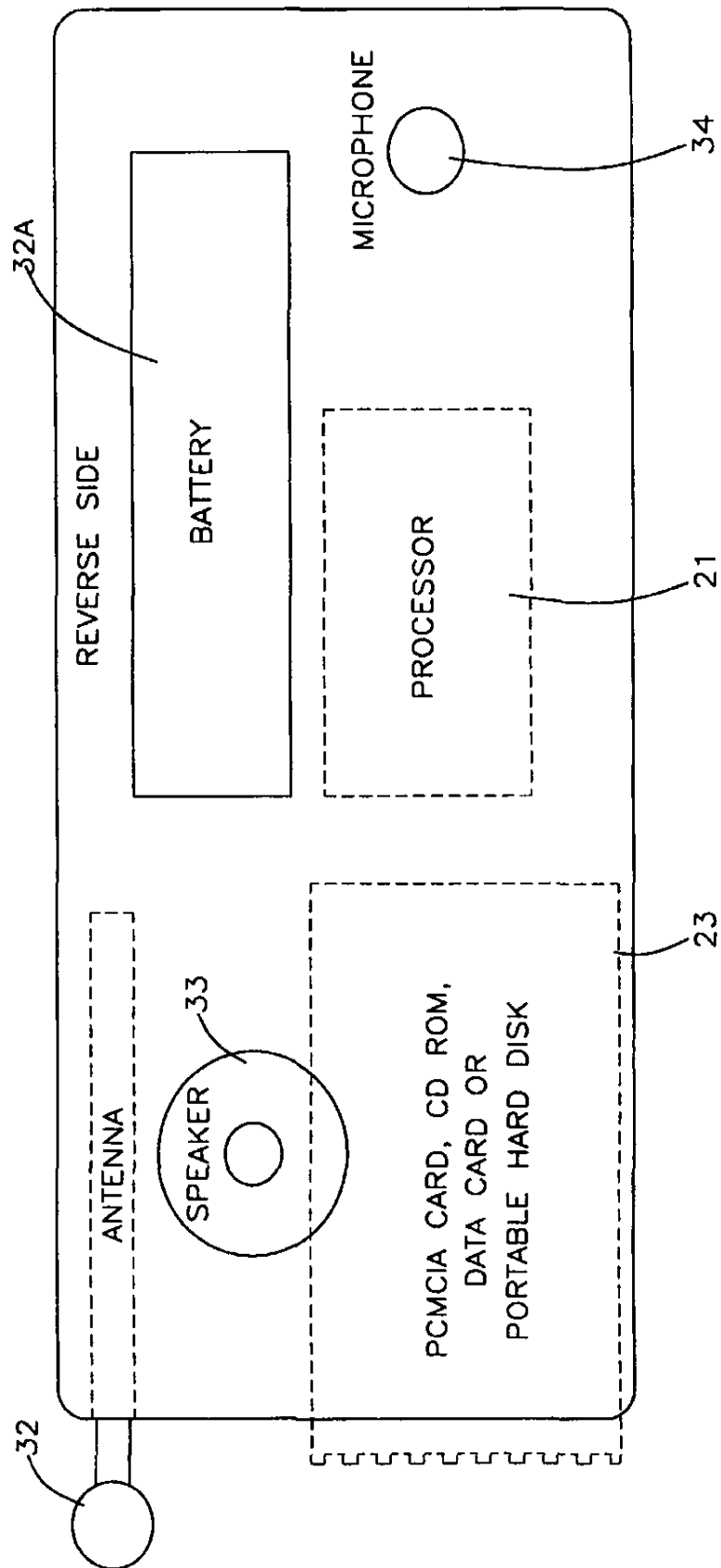


FIG. 3



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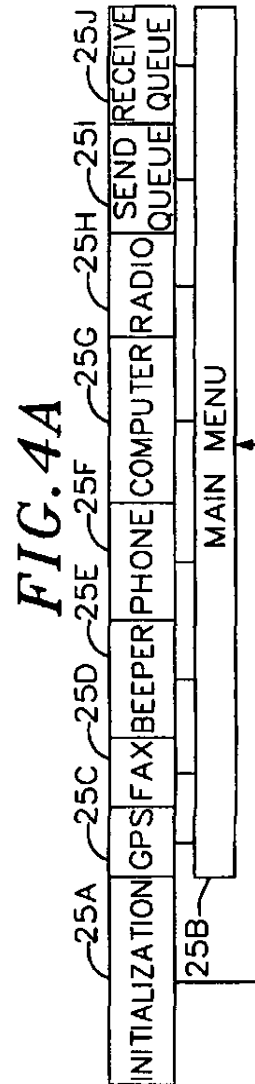
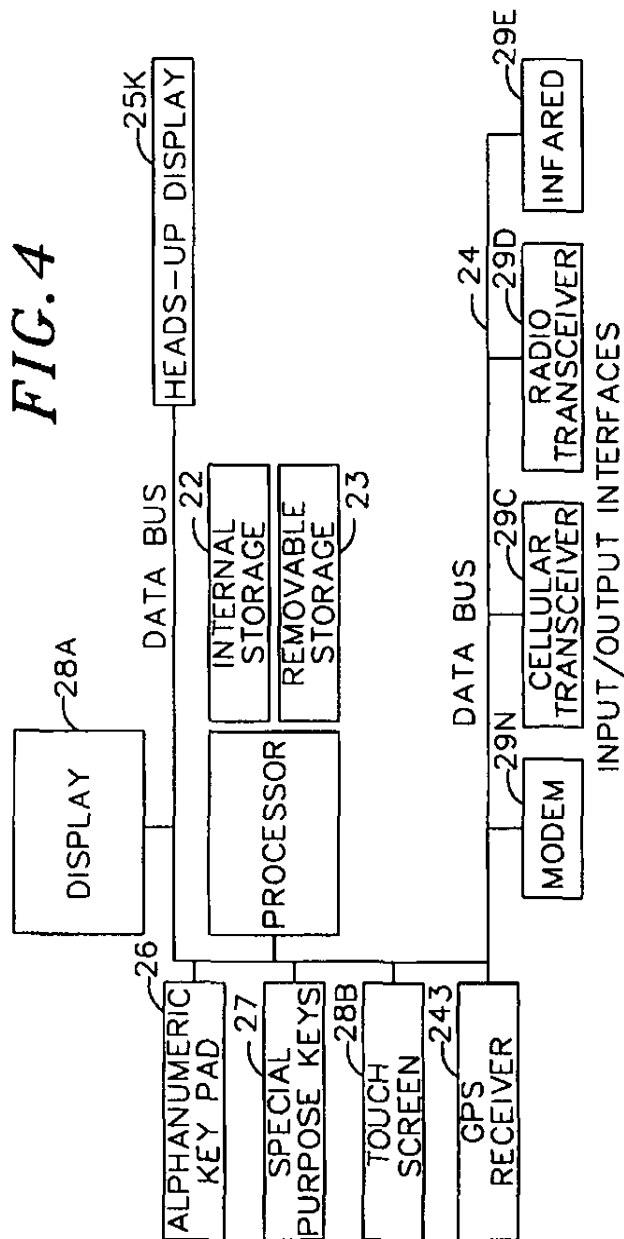
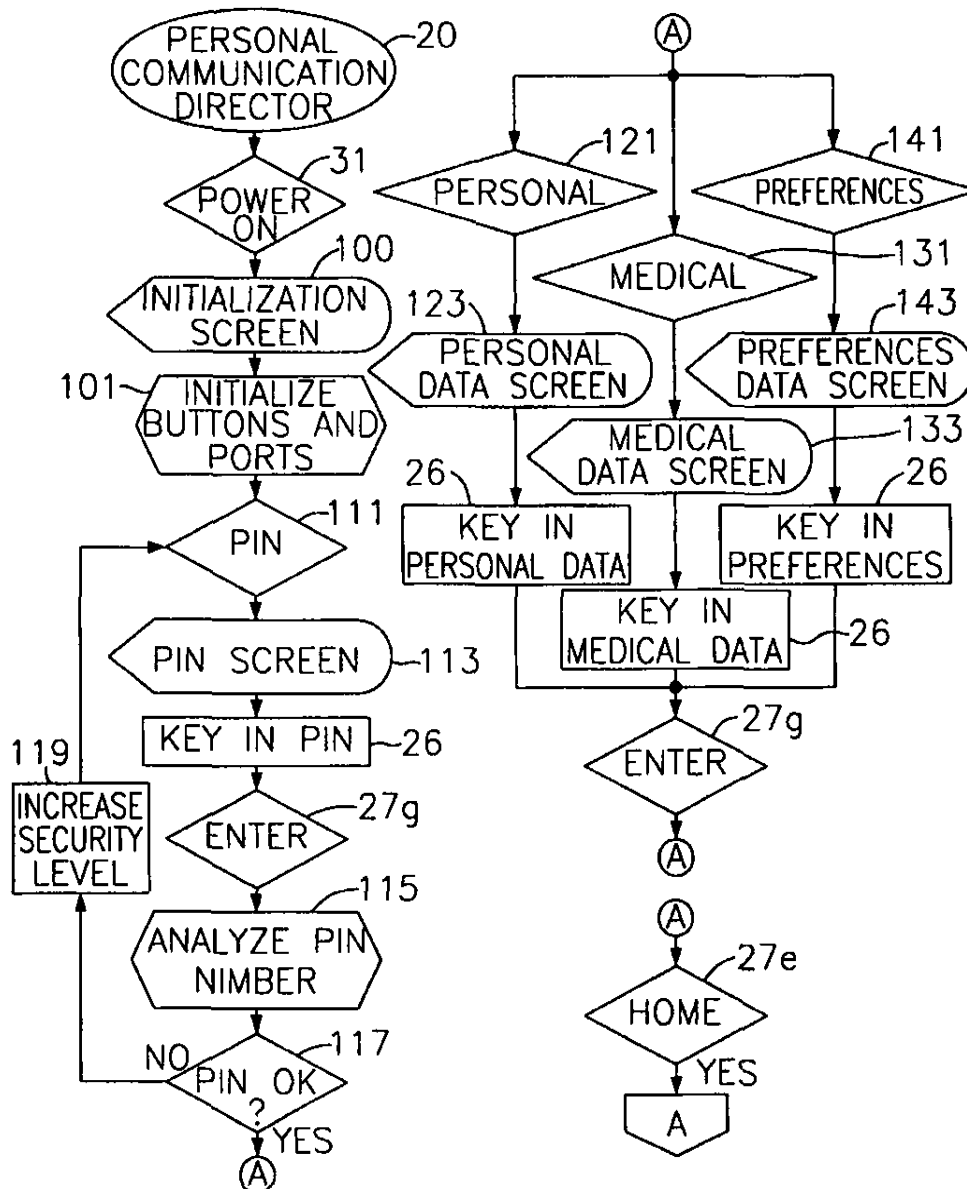


FIG. 5A

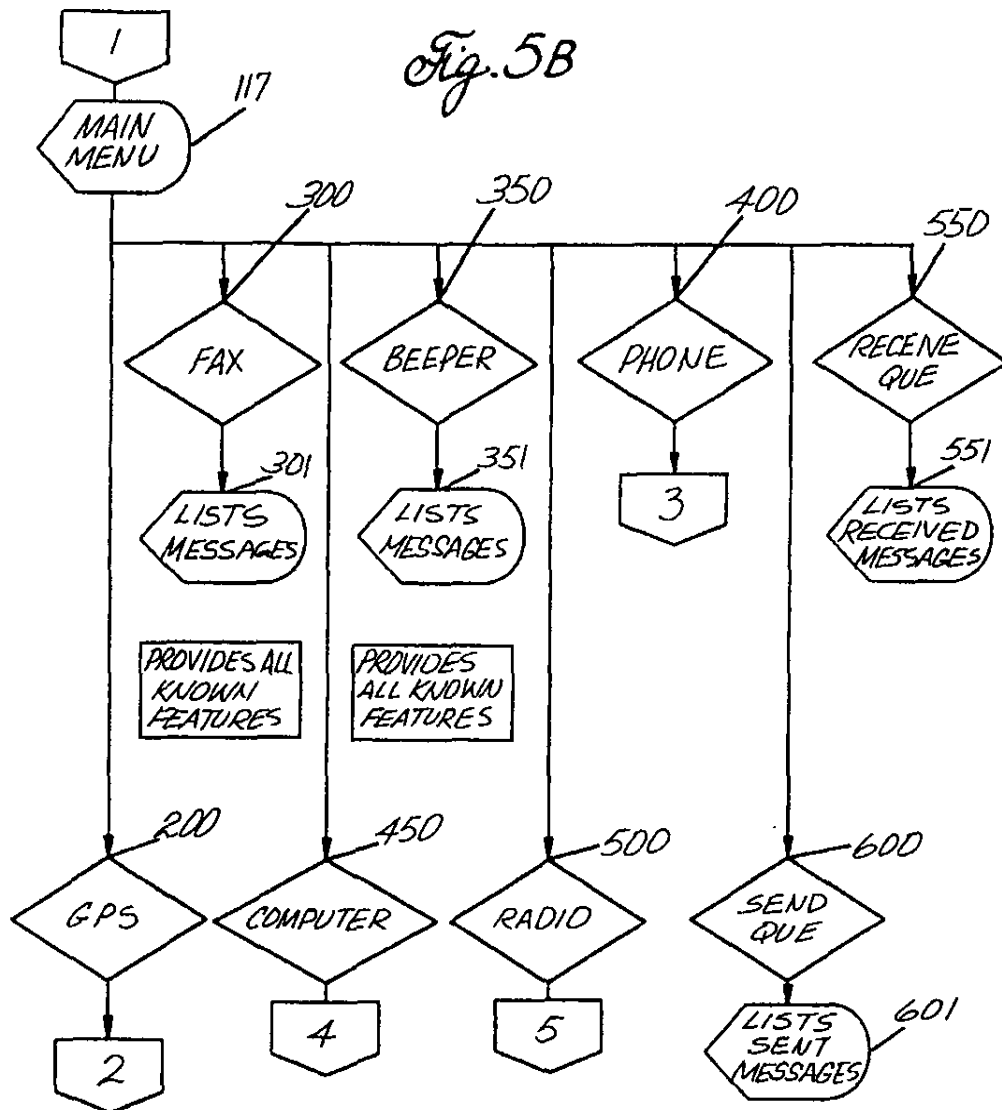


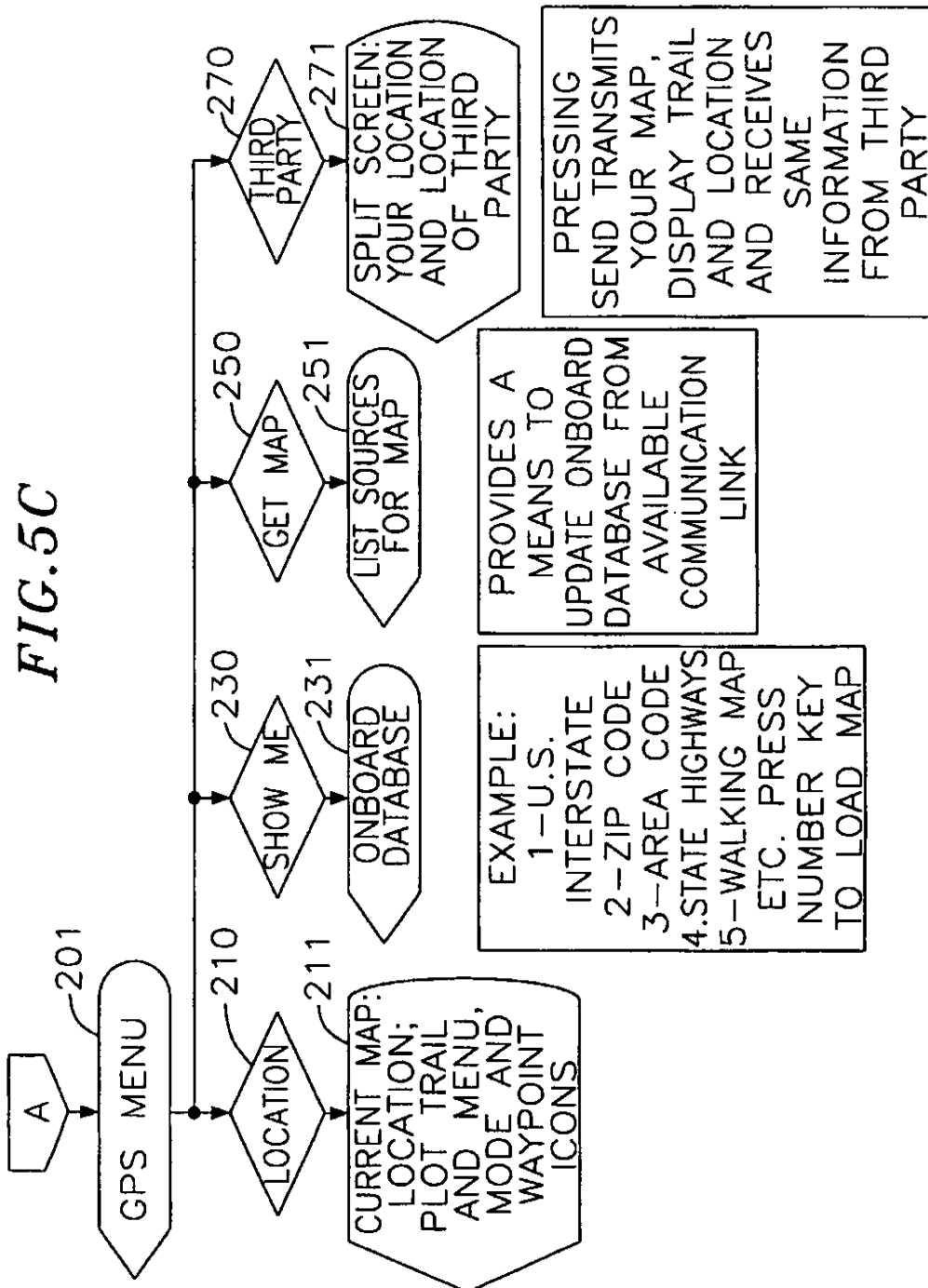
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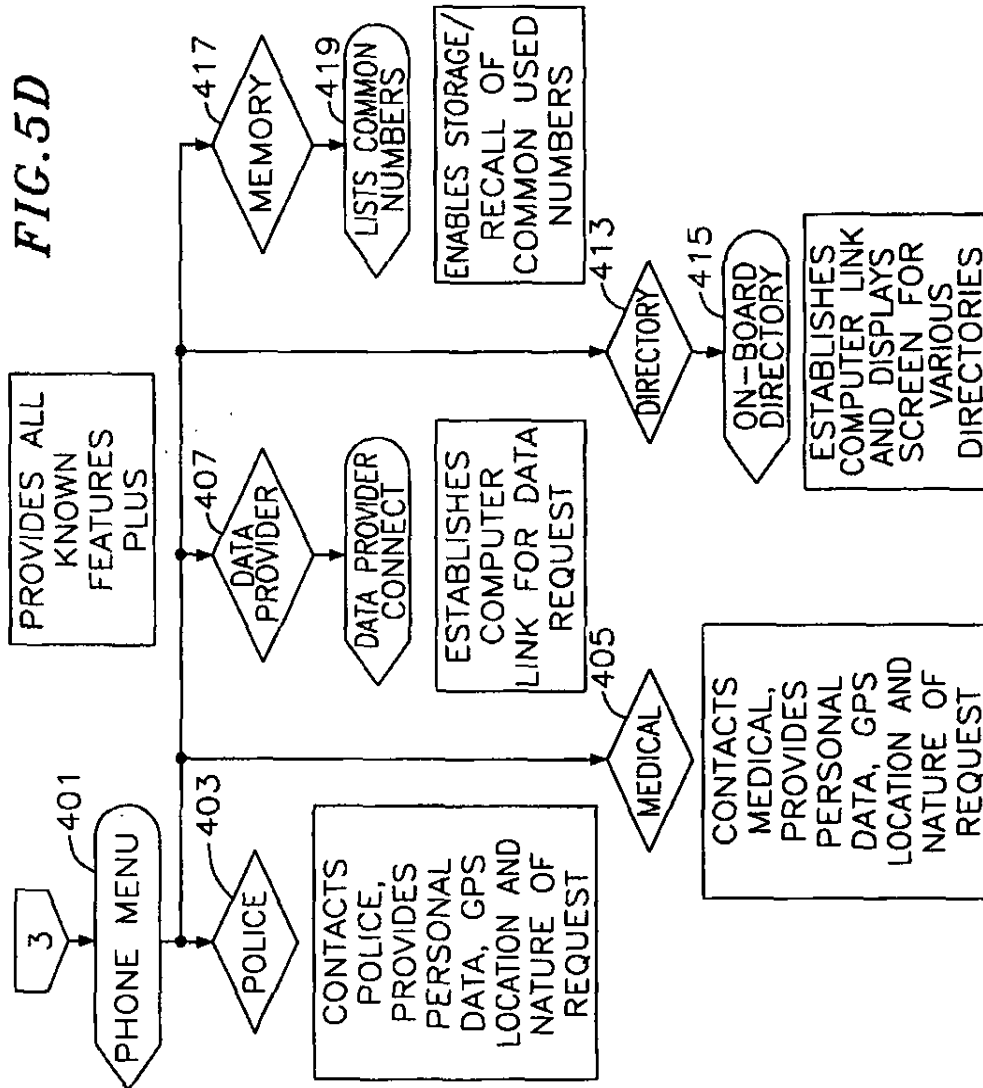
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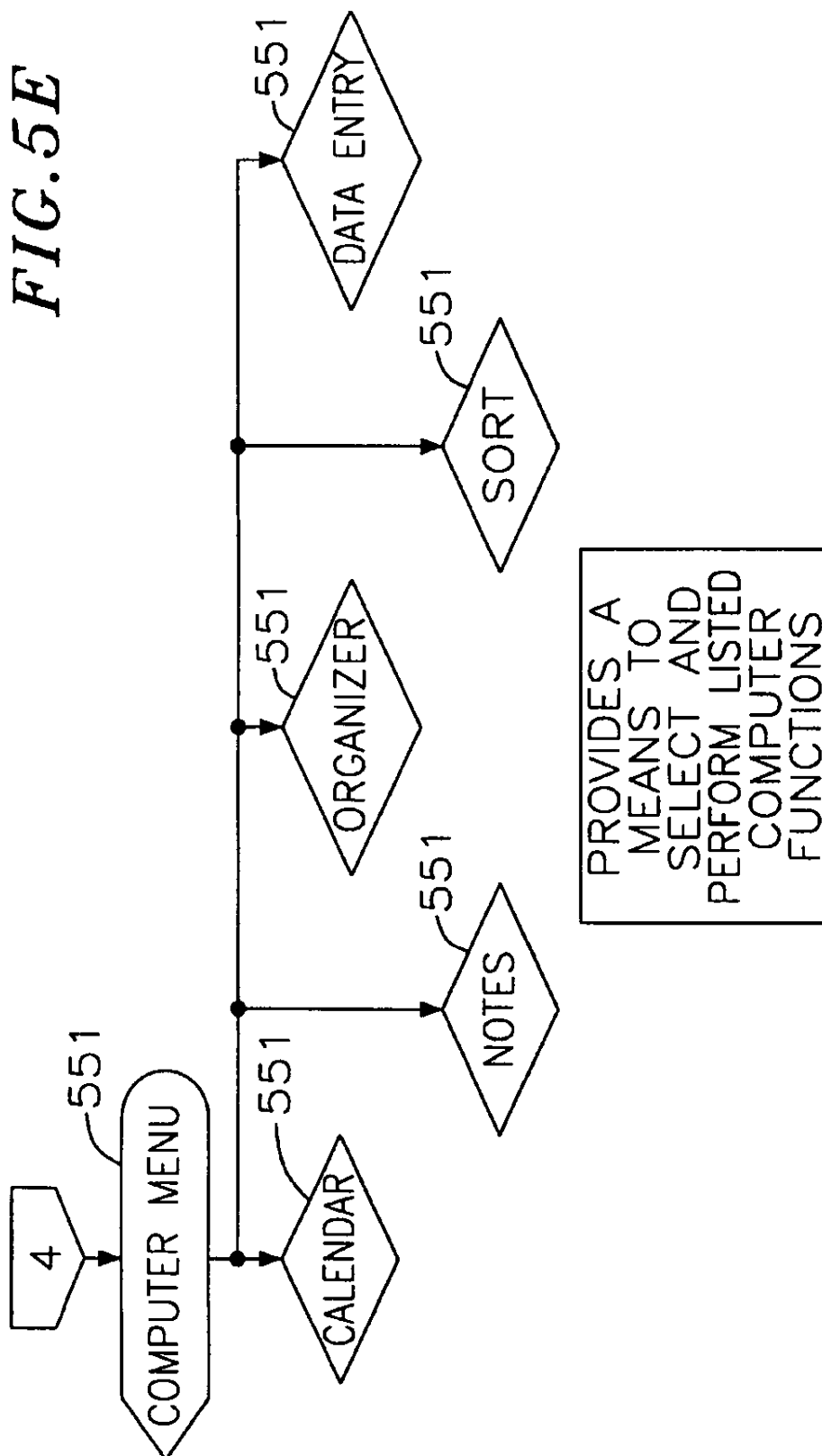
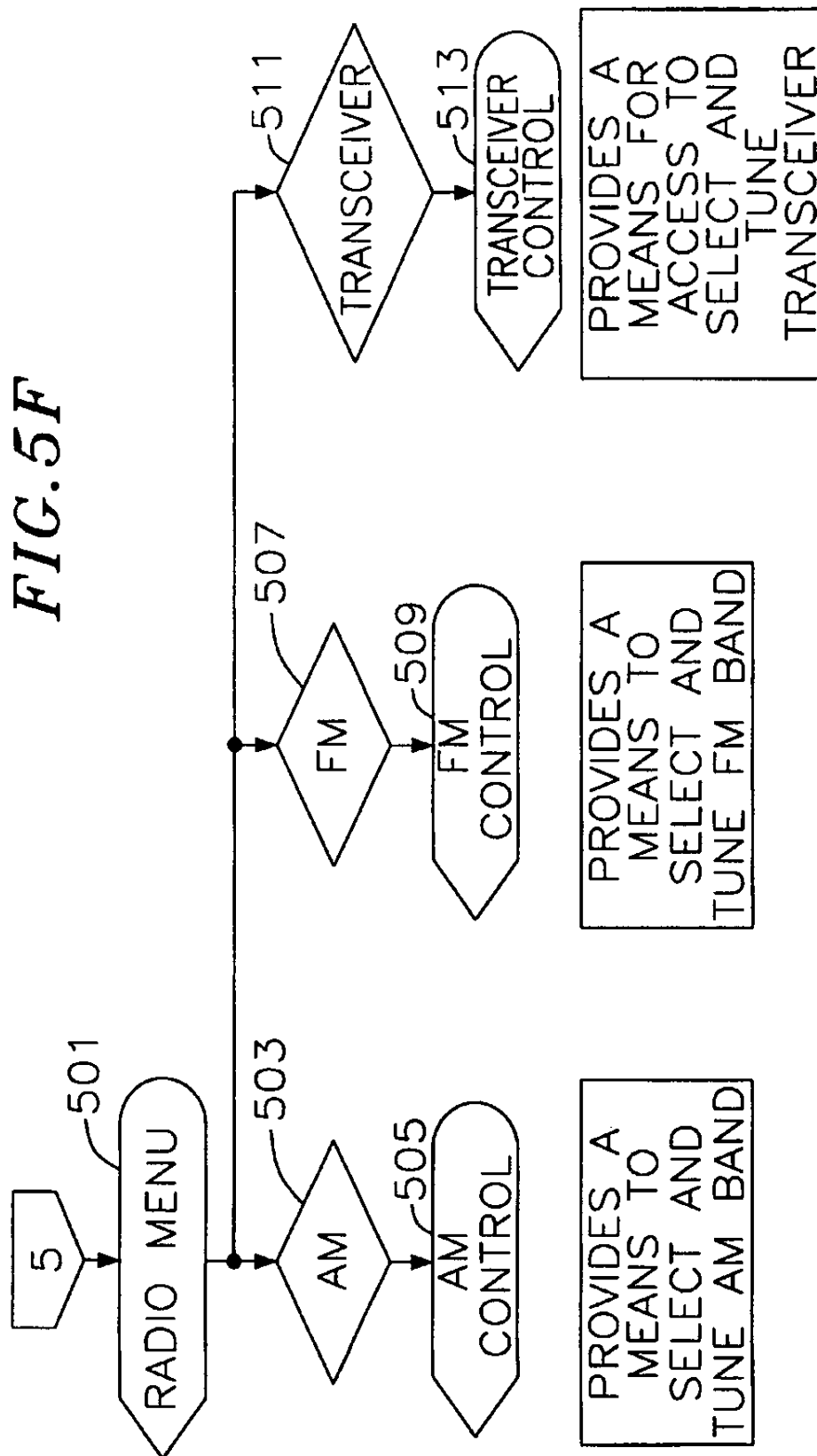


FIG. 5F

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FIG. 6

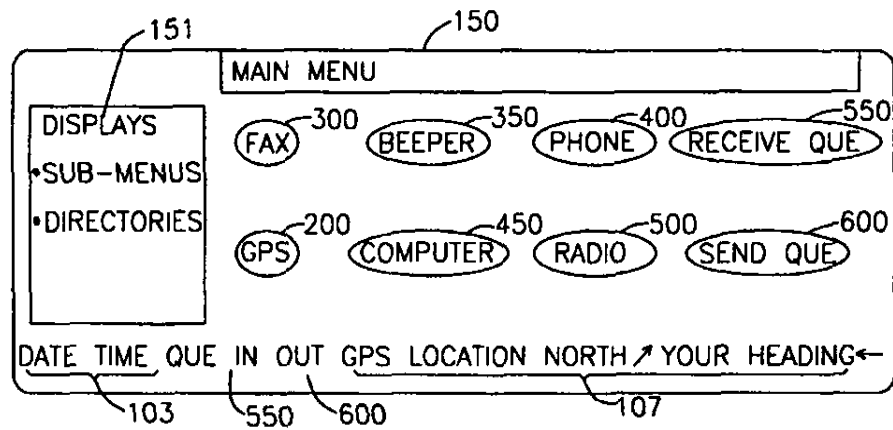
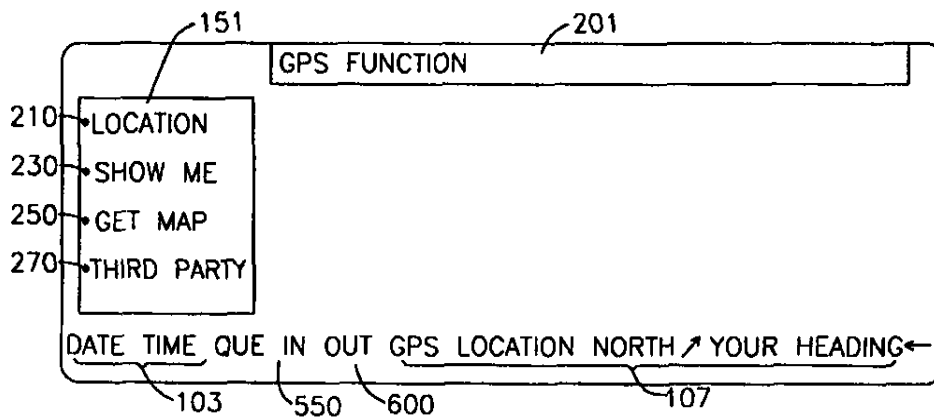


FIG. 7



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FIG. 8

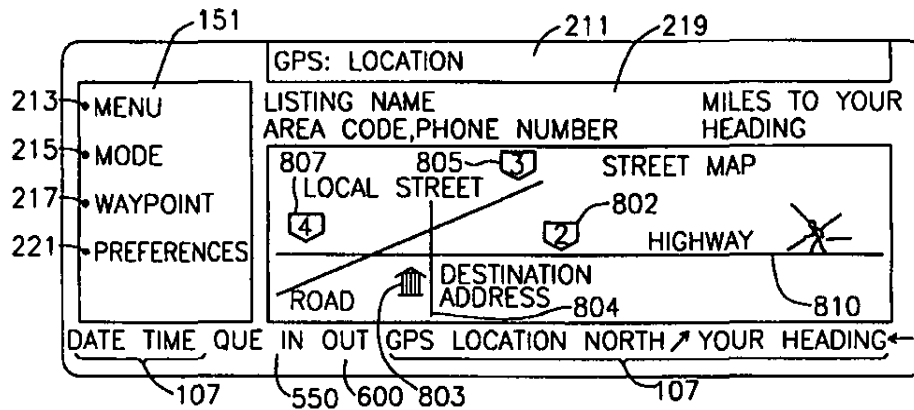
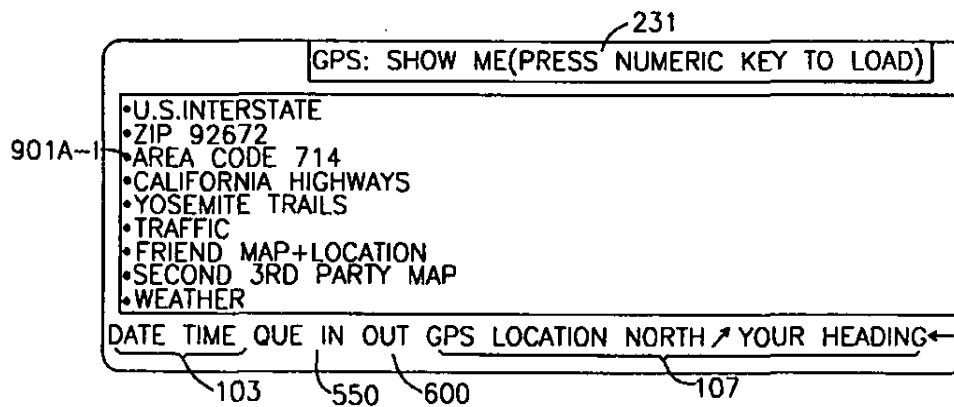


FIG. 9



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FIG. 10

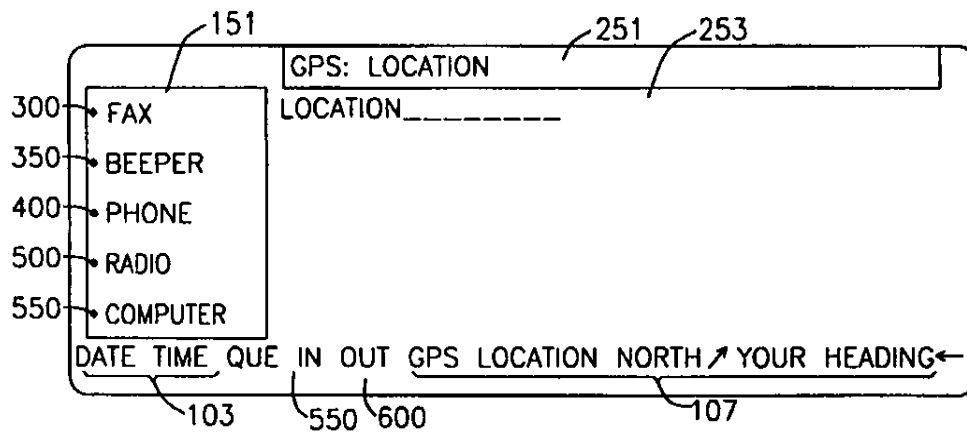
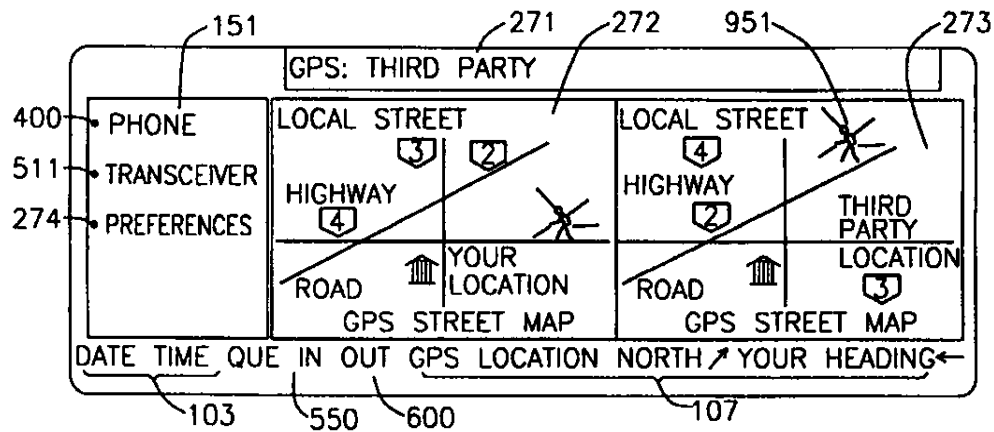


FIG. 11



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FIG. 12

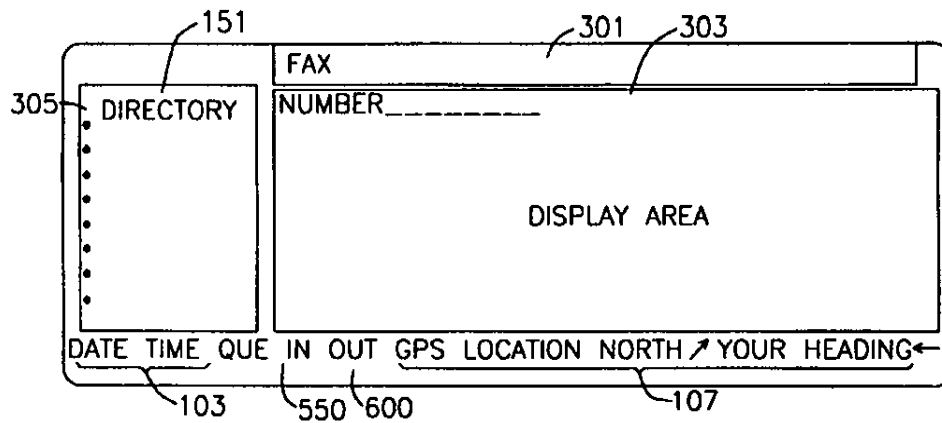
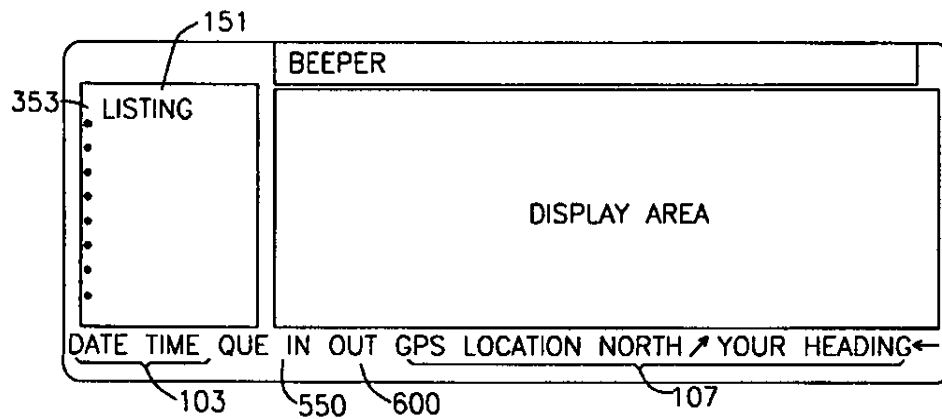


FIG. 13



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FIG. 14

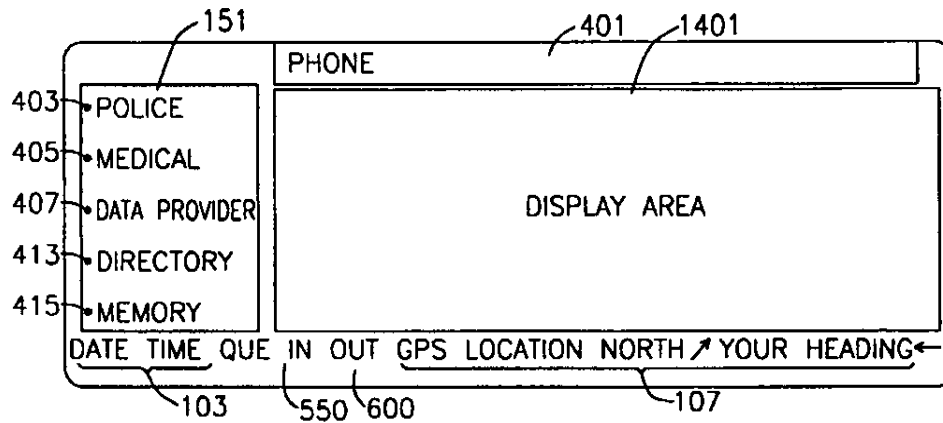
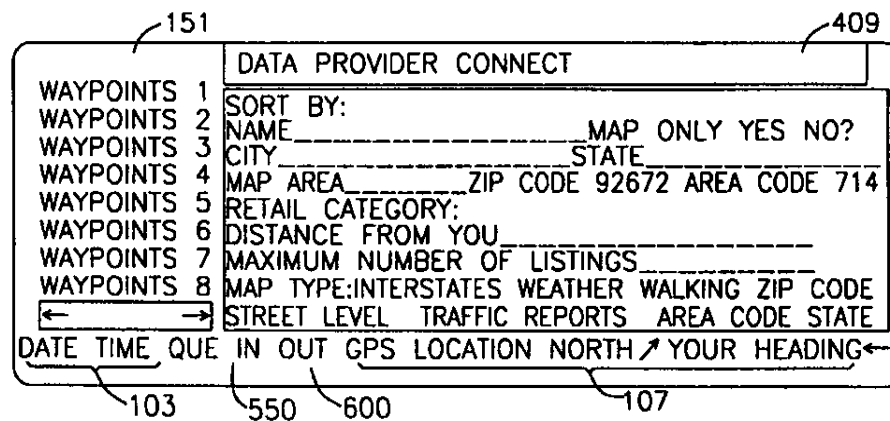


FIG. 15



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FIG. 16

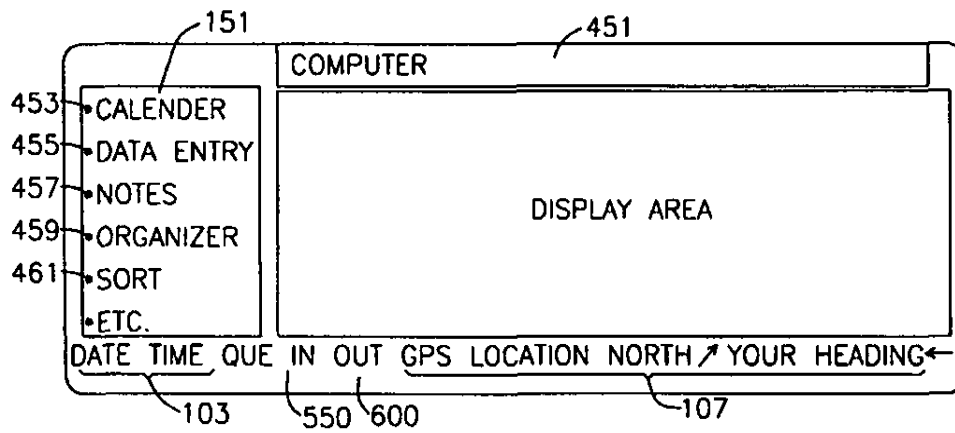
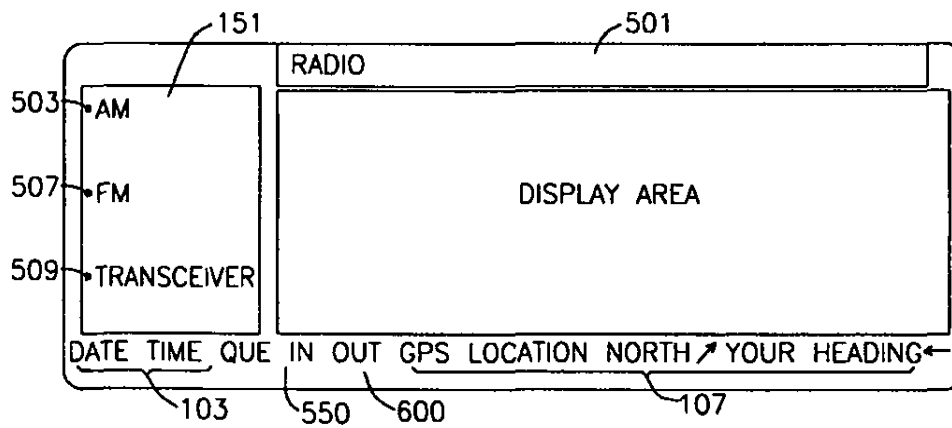


FIG. 17



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FIG. 18

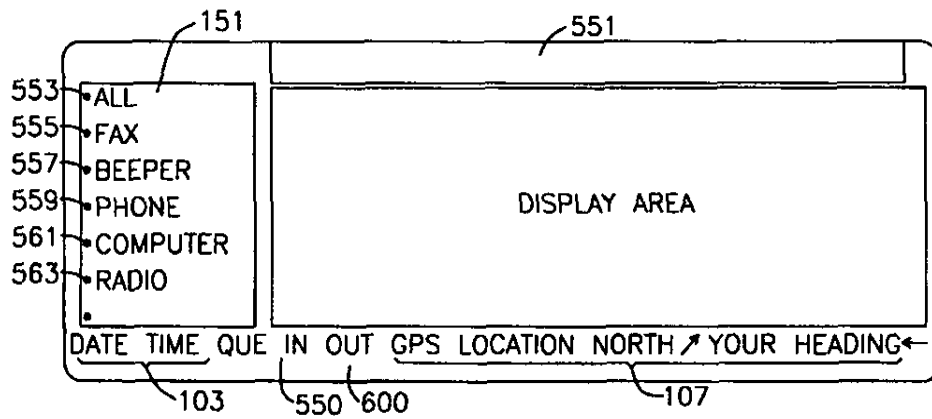
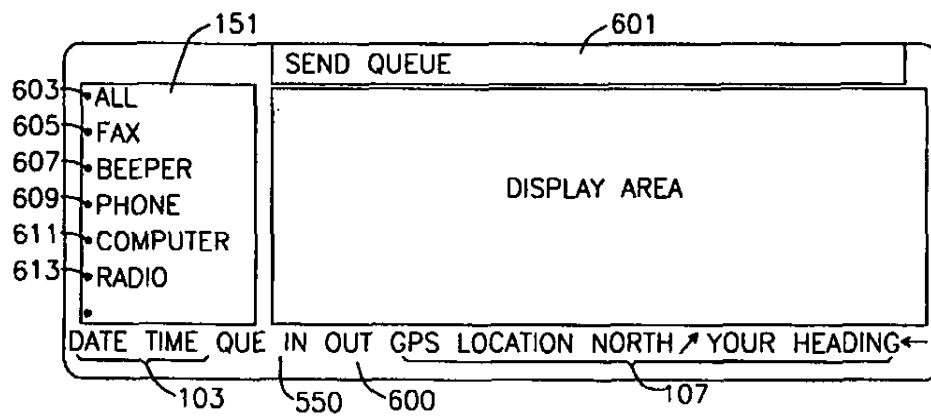


FIG. 19



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FIG. 20

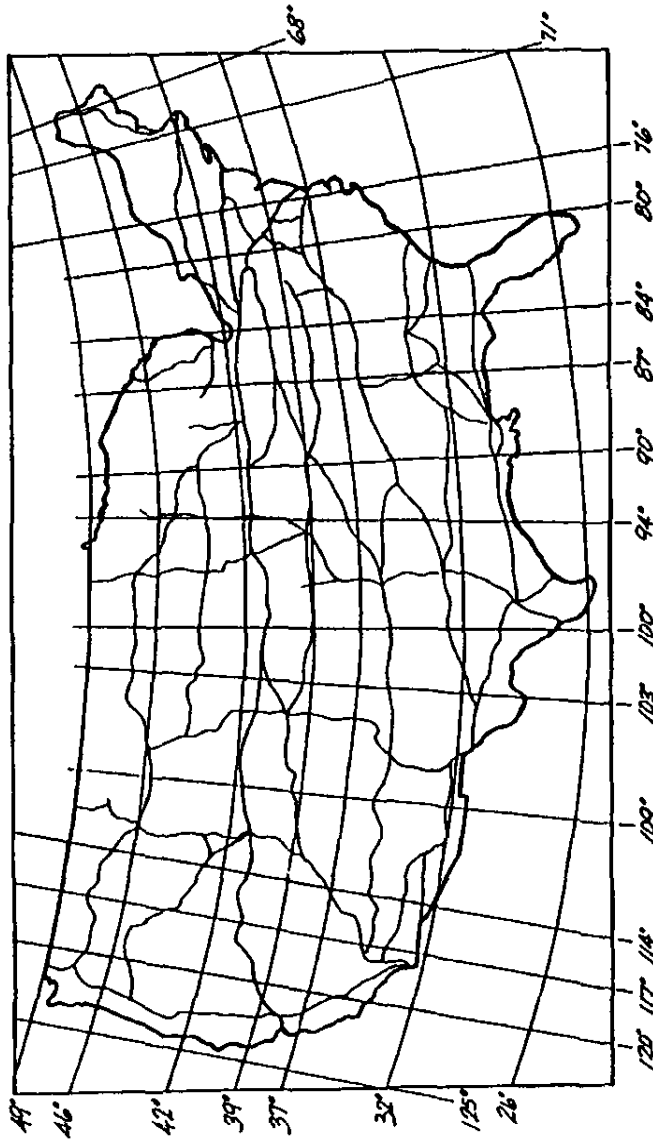
LISTING / NAME / WAYPOINT	ADDRESS	CITY	STATE/PHONE NO	CPS LOCATION NORTH	CPS WEST	WAYPOINT
ALEX'S GERMAN-AMERICAN RESTAURANT	2801 S. EL CAMINO REAL	SAN CLEMENTE	CA 714-492-8986	33°24.60	117°36.25	1
ANTOINE'S CAFE	218 S. EL CAMINO REAL	SAN CLEMENTE	CA 714-492-1763	33°25.40	117°37.38	2
BAKERS'S SQUARE RESTAURANT & PIES	610 CAMINO DE LOS MARES	SAN CLEMENTE	CA 714-661-3100	33°27.80	117°39.60	3
BEACH GARDEN CAFE	618 1/2 AVENIDA VICTORIA	SAN CLEMENTE	CA 714-498-8145	33°25.35	117°37.36	4
BOOTLEGGERS GRILL & SPEAKEASY	111 AVE. PALIZADA	SAN CLEMENTE	CA 714-361-8658	33°25.65	117°37.85	5
BURBON STREET SANDWICHERY	430 N. EL CAMINO REAL	SAN CLEMENTE	CA 714-492-7827	33°25.58	117°37.76	6
BURGER STOP	524 AVENIDA PICO	SAN CLEMENTE	CA 714-492-2350	33°25.92	117°37.12	7
BURRITO BASKET, THE	2017 S. EL CAMINO REAL	SAN CLEMENTE	CA 714-498-5002	33°25.10	117°36.34	8
CAFE CALYPSO	114 AVENIDA DEL MAR	SAN CLEMENTE	CA 714-366-9346	33°25.42	117°37.42	9
CAFE EXPRESSO	641 CAMINO DE LOS MARES	SAN CLEMENTE	CA 714-240-3467	33°25.81	117°37.31	10
CAPTAIN CULVER COUNTERCULTURE NATURAL FOODS	149 AVENIDA DEL MAR	SAN CLEMENTE	CA 714-498-8098	33°25.39	117°37.40	11
CARL'S JR. RESTAURANT	638 CAMINO DE LOS MARES	SAN CLEMENTE	CA 714-493-0189	33°27.65	117°39.45	12
CARL'S JR. RESTAURANT	3929 S. EL CAMINO REAL	SAN CLEMENTE	CA 714-498-5641	33°24.50	117°35.95	13
CARROWS RESTAURANT	620 AVENIDA PICO	SAN CLEMENTE	CA 714-492-4290	33°25.85	117°37.10	14
CHINA BEACH CANTEN	2369 S. EL CAMINO REAL	SAN CLEMENTE	CA 714-492-6228	33°27.80	117°37.15	15
CHINA WELL RESTAURANT	620 CAMINO DE LOS MARES	SAN CLEMENTE	CA 714-661-6813	33°27.61	117°39.42	16
COCO'S FAMILY RESTAURANT	2350 S. EL CAMINO REAL	SAN CLEMENTE	CA 714-498-1542	33°24.90	117°36.18	17
CORKY'S CAFE	2727 VIA CASCADITA	SAN CLEMENTE	CA 714-492-1135	33°25.10	117°37.48	18
COURTSIDE RESTAURANT	111 AVE. VISTA MONTANA	SAN CLEMENTE	CA 714-361-2211	33°25.10	117°36.10	19
DAVE'S MEXICAN RESTAURANT	1701 N. EL CAMINO REAL	SAN CLEMENTE	CA 714-492-7887	33°25.50	117°38.90	20
DEL TACO	109 CALLE DE INDUSTRIAS	SAN CLEMENTE	CA 714-492-5311	33°25.51	117°36.50	21
DENNY'S RESTAURANT	529 AVENIDA PICO	SAN CLEMENTE	CA 714-492-2382	33°25.48	117°36.15	22
DOMINOES PIZZA	1502 N. EL CAMINO REAL	SAN CLEMENTE	CA 714-498-9002	33°25.25	117°37.50	23
EASTERN WINDS	201 N. EL CAMINO REAL	SAN CLEMENTE	CA 714-492-3008	33°25.01	117°37.05	24
EL CAMINO TACOS	420 S. EL CAMINO REAL	SAN CLEMENTE	CA 714-366-8358	33°25.10	117°37.25	25
EL JEFE CAFE	106 E. ESCALONES	SAN CLEMENTE	CA 714-492-4010	33°25.25	117°37.03	26
EL MIRADOR	301 N. EL CAMINO REAL	SAN CLEMENTE	CA 714-366-0855	33°25.08	117°37.10	27

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115 *Fig. 21*

LONGITUDE AND LATITUDE COORDINATES.

- AREA CODE BOUNDARIES.
- ZIP CODE BOUNDARIES.
- NATIONAL PARK BOUNDARIES.
- METRO TRAFFIC ZONES.
- INTERSTATE BOUNDARIES.
- US HIGHWAY BOUNDARIES.
- STATE ROUTE BOUNDARIES.
- CITY, COUNTY, STATE, PROVINCE BOUNDARIES.
- POLITICAL BOUNDARIES.
- ECONOMIC, RETAIL, BUSINESS ZONE BOUNDARIES.

GPS ENCODED EMBODIMENTS ARE NOT LIMITED TO THE ABOVE EXAMPLES AND MAY INCLUDE MANY OTHER SYSTEMS USING VARIOUS RECORDING TECHNIQUES.

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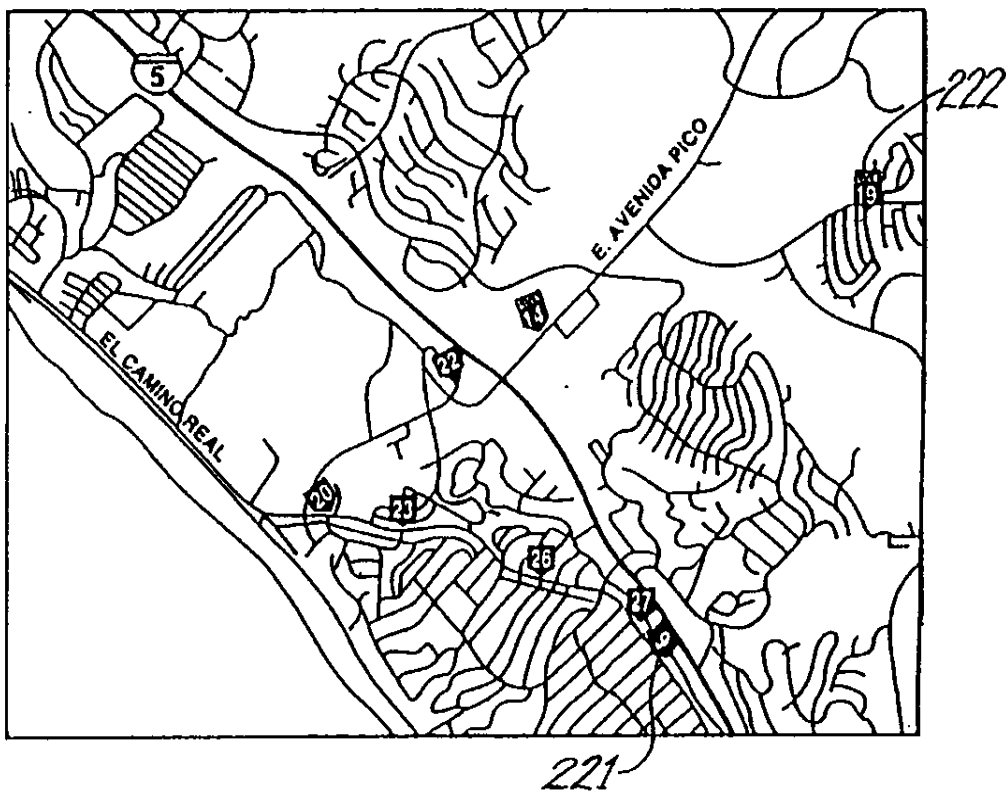


Fig. 22

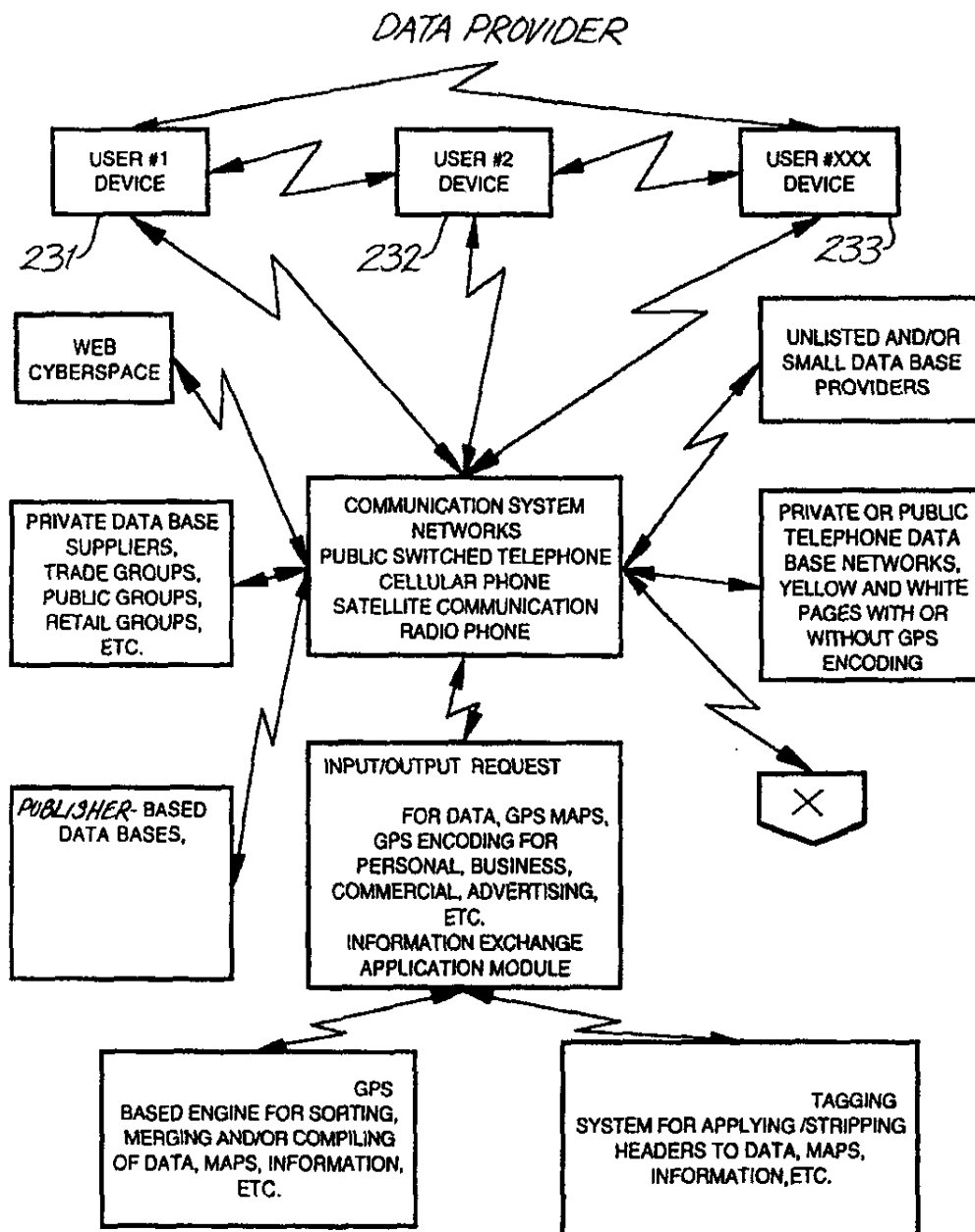


Fig. 23A

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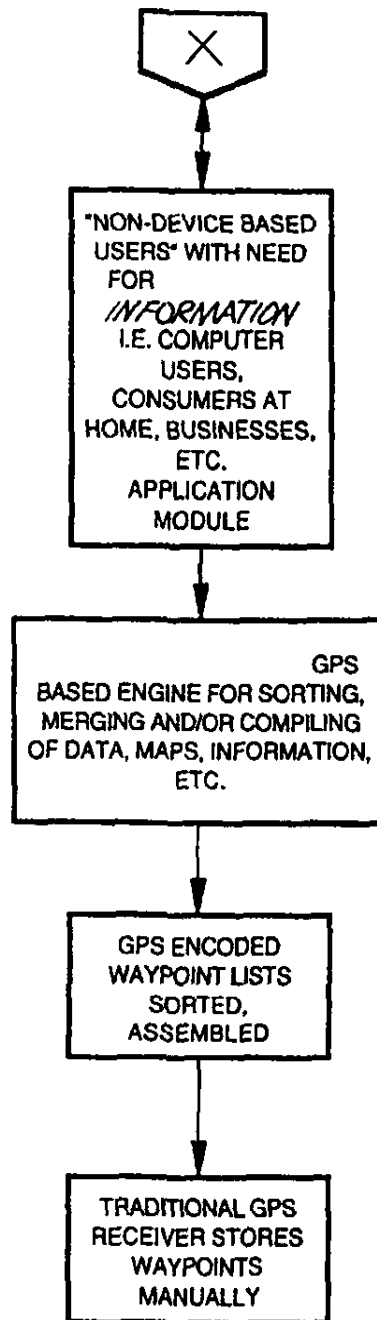


Fig. 23B

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REQUESTER

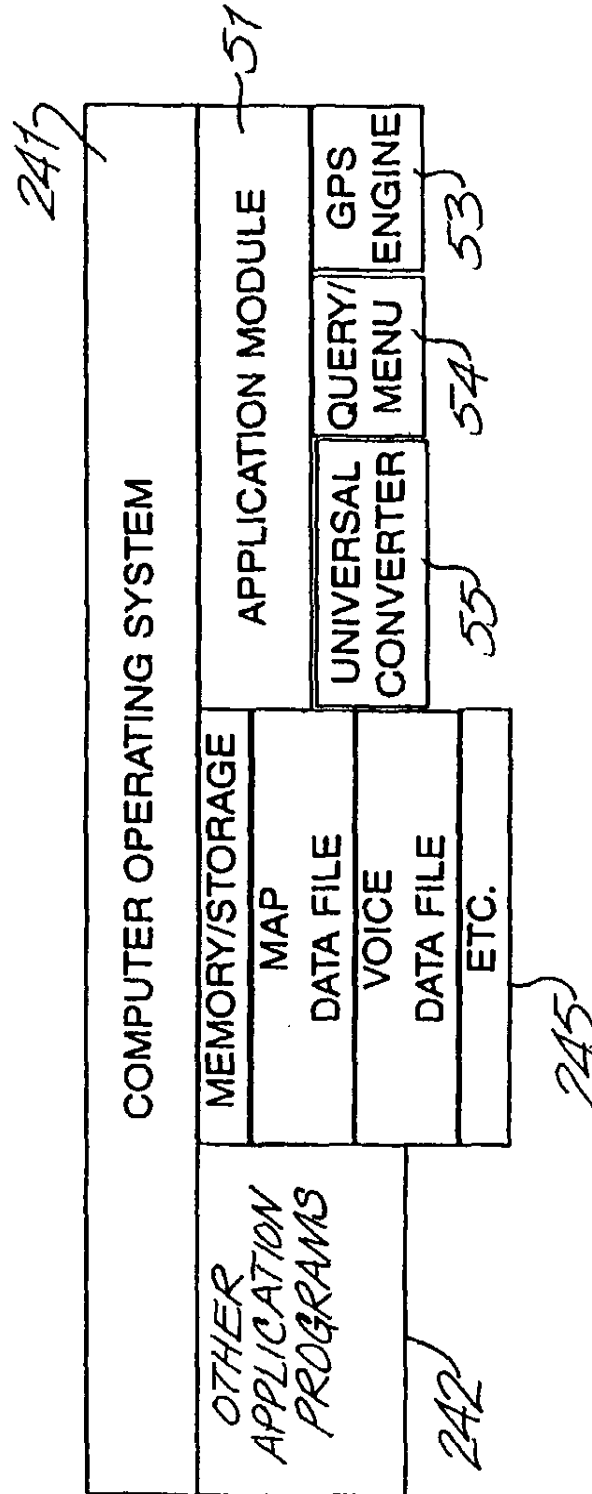


Fig. 24

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PROVIDER

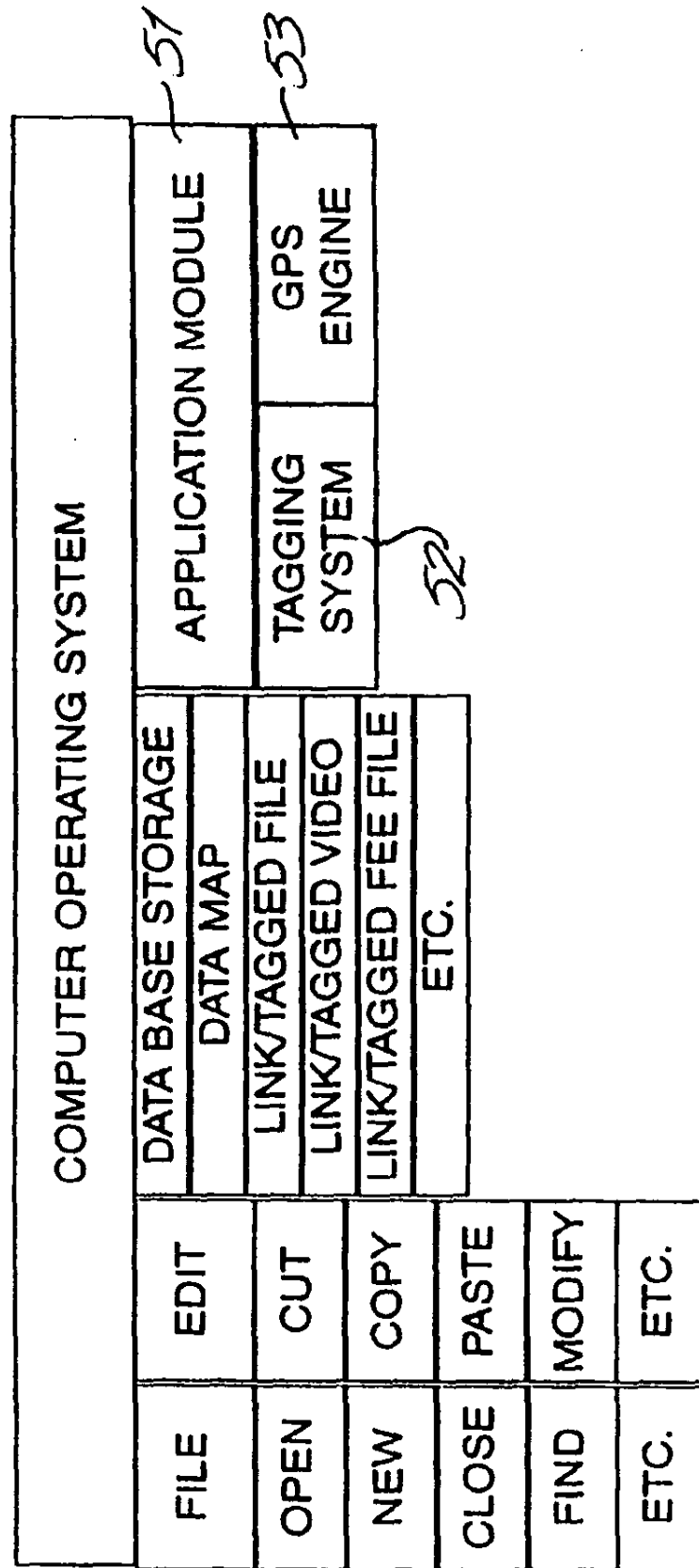


Fig. 25

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APPLICATION MODULE

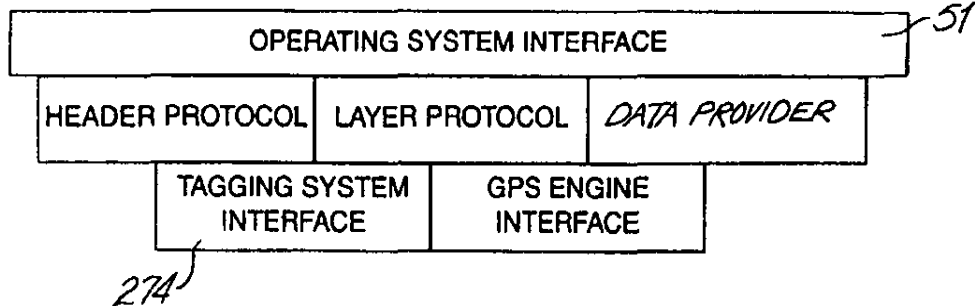


Fig. 26

TAGGING SYSTEM

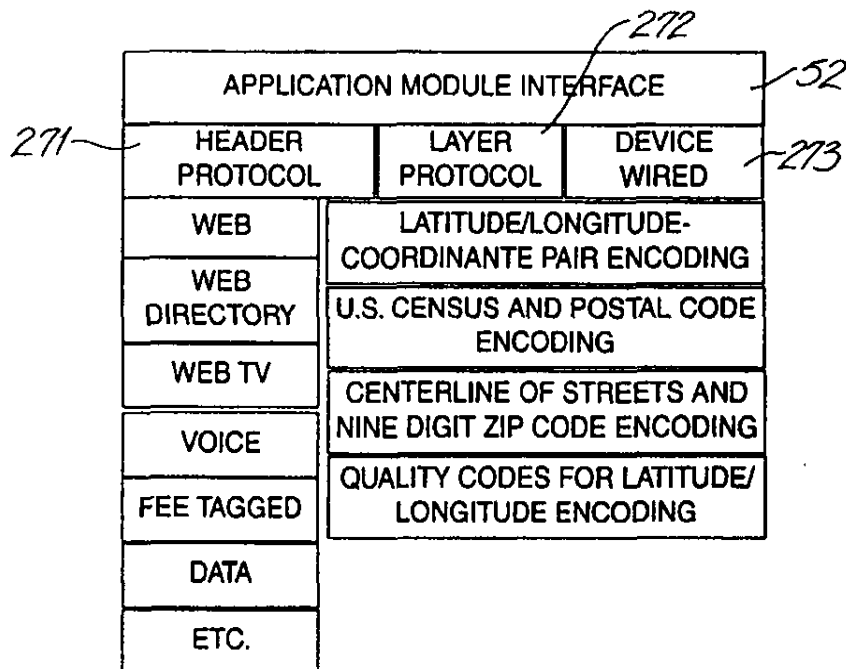


Fig. 27

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GPS ENGINE

53

APPLICATION MODULE INTERFACE			
HEADER PROTOCOL	LAYER SYSTEM	ACCESS LATITUDE/LONGITUDE QUALITY CODES FOR BEST DISPLAY SCALES	
TAG TYPE	LAYER PROTOCOL	USE SPATIAL QUERY FUNCTIONS	
LATITUDE/ LONGITUDE	ROUTE PLANNING	USE CENTROID INTERPOLATION FUNCTIONS	
RADIUS		USE MATCH-RATE COMPARISON FUNCTIONS	
MAP			
WAYPOINT LINKS			
ETC.			

Fig. 28

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UNIVERSAL TRANSLATOR

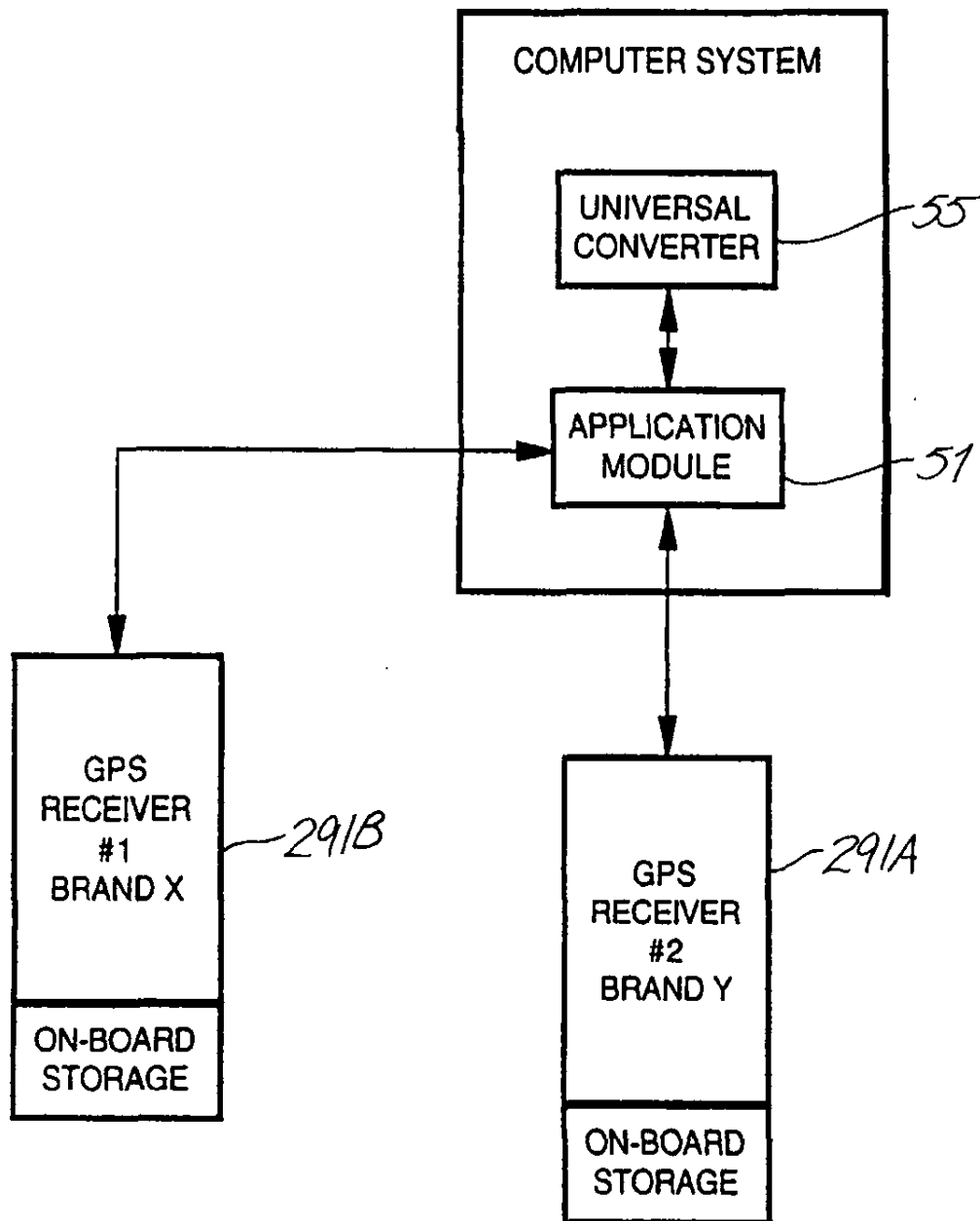


Fig. 29

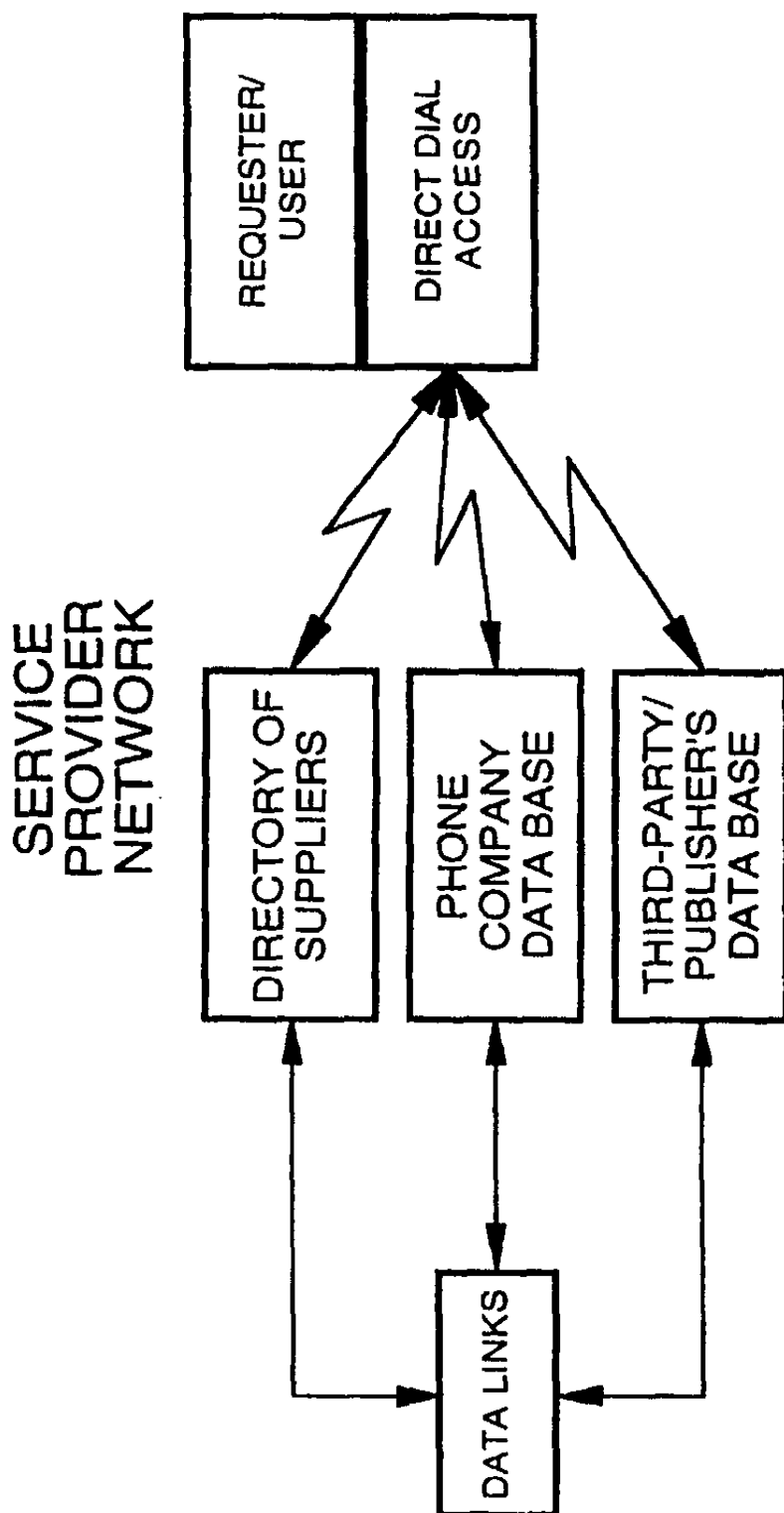


Fig. 30

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DIGITAL WEB TV

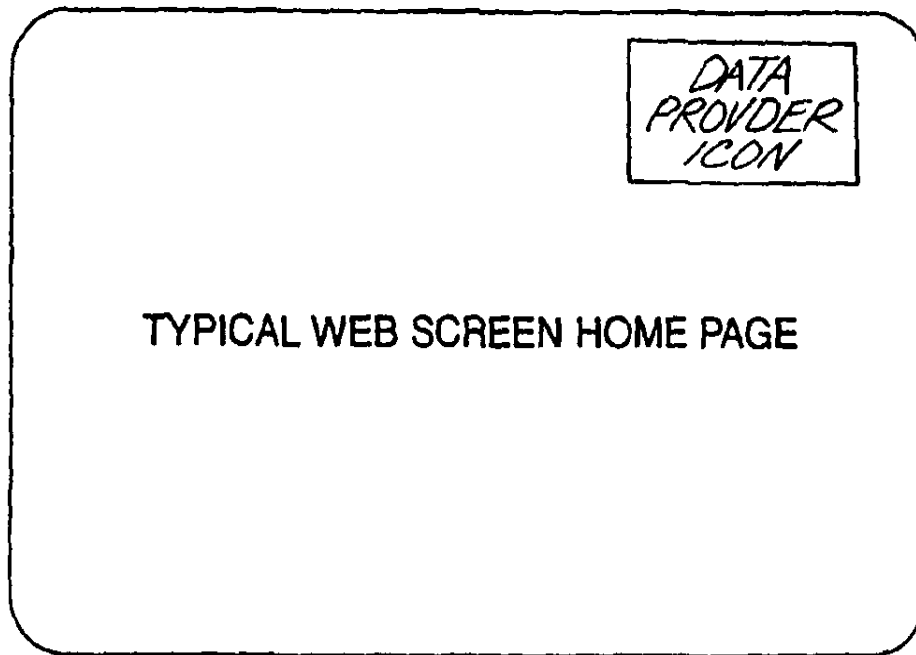


Fig. 31

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FIG. 32

321A-M

US SATELLITE	WEATHER MAP PROVIDER (PRESS TO UPDATE)
RADAR CURRENT	CENTER MAP BY:
DELTA RADAR	CITY _____ STATE _____
LOCAL RADAR	LAYER MAPS _____ ZIP CODE _____
SURFACE MAPS	AREA CODE _____
WIND CHILL	DISTANCE FROM YOU _____ MILES/KILOMETERS
CURRENT TEMPS.	DISTANCE FROM _____ MILES
JET STREAM	MAP TYPE:
TRAVEL HAZARDS	(PRESS TO SELECT FROM LIST)
FORECASTS	UPDATE MAP LIST @ _____ HOUR
SURFACE WINDS	UPDATE EVERY _____ HOUR, PROMPT Y/N?
FARM	ANIMATE MAPS Y/N PLAY NAVIGATE MAP Y/N
SHORT RANGE	
← →	
DATE TIME QUE IN OUT GPS LOCATION NORTH ↗ YOUR HEADING ←	

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U.S. Patent

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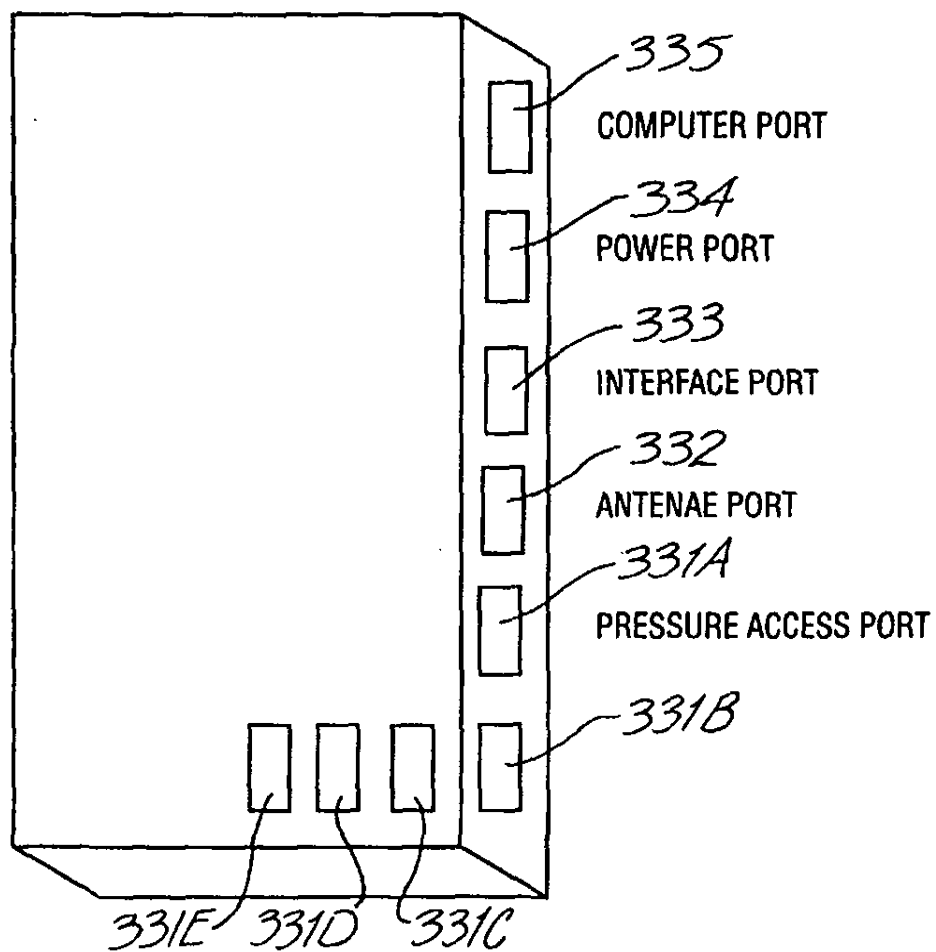


FIGURE 33

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PERSONAL COMMUNICATION SYSTEM TO SEND AND RECEIVE VOICE DATA POSITIONING INFORMATION

FIELD OF THE INVENTION

The invention relates generally to a system for communicating data including global-positioning-encoded information. In particular, the present invention relates specifically to a device and system for communicating and retrieving position and position related data.

BACKGROUND OF THE INVENTION

Availability of up-to-date information is more important today than ever before and this will continue to be true for the foreseeable future. People want to be well informed, so much so that they travel with cellular phones, beepers, and even portable hand-held Global Positioning System (GPS) satellite receivers.

GPS capable devices generally have a GPS receiver for receiving satellite signals from the GPS satellite network that allow for determination of the device's position. Such devices allow for precisely locating the device in terms of latitude and longitude using the GPS receiver. Some devices have map data stored in memory and a display for showing the device position with reference to the map data. Other devices have no underlying map data base for reference. Rather, they show only the geographic coordinates of the device's location. These coordinates may be referred to as waypoints. Most GPS receiver devices can store many waypoints. Some GPS receiver devices can plot and display a trail of waypoints and store this trail for future retrieval. Sophisticated devices may compute the device's heading, speed, and other information based on comparisons with previous GPS determined positions.

GPS receiver devices with map display capability may store the map information on computer diskettes, CD-ROM's, or other computer memory storage devices. The device location may then be displayed on a display terminal with reference to a map stored in the computer memory storage device. The available quantity of map data, however, can overwhelm the memory capability of easily portable computer devices. This problem is exacerbated when additional information is included and linked with the map data. In addition, information is more valuable when it is up to date and available at the time of consumption, and such devices do not incorporate a means for updating the stored information. By way of example, a CD ROM could never maintain an up-to-date list of every 5-star restaurant.

Some GPS receiver devices have the ability to communicate over a telecommunications network. These devices do not provide for automatic or semi-automatic dynamic exchange of on-line position dependent or related information. In addition, these devices cannot communicate with third parties in the absence of a uniform data format standard. For example, a cellular-phone-based system comprising GPS location information working in conjunction with proprietary Public Safety Answering Point (PSAP) telephone equipment is known. The device provides personal and medical information on an emergency basis to the proper authorities. Such a device does not allow third parties to communicate, tag, interrogate, limit, designate, modify or share this information amongst themselves for any other use.

To that end, the ability to receive digital data structures with GPS encoding, and storing this information for eventual use or broadcast to third parties, would be valuable. Today, the U.S. and several other countries have indepen-

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dent publishers busily GPS mapping everything down to the most minute detail. Most of these data bases are available on CD ROM storage. The problem is that no one data base can contain enough information to fulfill the unique requests of every particular and picky consumer. The costs associated with providing and maintaining such a large data base would be overwhelming and over-burdening. Additionally, most consumers do not like reading or compiling vast data bases.

SUMMARY OF THE INVENTION

The system of the present invention comprises Personal Communications Devices (PCDs), and traditional computer systems with GPS engines, routers, and other application programs to request, process, and transmit tagged GPS encoded information. The system, with related applications, can be accessed by device users, traditional computer users, web-site users (cyberspace), data publishers, public or private enterprises or individuals, by means of application programs. The tagged GPS encoded data files can be stored or sent via communication links using AM, FM, spread spectrum, microwave, laser or light beam in free or fiber optic, line-of-sight, reflected, satellite, secure or non-secure, or any type of communications between multiple points that the application or the state-of-the-art may allow. The system is a waypoint tag and interrogation system using various protocols to answer requests and provide GPS-encoded information. The applications use GPS devices, engines, routing and encoding for access to specific requester-designated data retrieval requests. The applications access fax machines, beepers, telephones and other communication linked devices. The system accesses computer and storage systems with various applications in order to provide this information from a plurality of providers. The system thereby eliminates or reduces the need for large storage devices and interchangeable storage modules.

One embodiment of the present invention includes a requesting device, a data provider (hardware and software), a user, tagger applications or GPS engine and router system with protocols for encoding, tagging, modifying, interrogating, arranging, limiting, displaying, sorting, mapping, segregating, sending, receiving and updating waypoint and the waypoints connected data structures with digital or graphic maps, digital voice files, linked digital web files properly encoded and tagged by way of specific devices, or by traditional computer and storage systems.

The application programs contain protocols for users, providers, taggers, list maintenance organizations, and others, and will use a dynamic identification system from applications containing GPS search engines, route planners, compilers, designators, publishers, and others to permit communication of information.

The PCD is a cellular-phone-sized electronic device, combining the capabilities of a GPS receiver, transceiver, digital beeper, cell phone and projection system into one compact unit. The PCD is capable of uploading emergency information (medical, police alert, etc.) via a one-push button that phones 911 or a security monitoring center similar to those used for house alarms. The alert continues to be broadcast until a response is made.

The PCD is also capable of downloading information via a request to a data provider, similar to a request for directory information from a phone company or other service. In this mode the PCD acts similar to calling a phone operator for information. However, in this instance, no human contact is required. The caller requests specific information (location of gas stations, names of restaurants, local banks, etc.) via a

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voice command ("Download e.g., Wells Fargo Banks") or via digital commands using a keypad or other input device and the requested information is automatically downloaded to and stored in the memory of the user's PCD. This information can be accessed off-line via the screen on the PCD. It is all done digitally, eliminating having to write down information such as name, address, location map, GPS latitude and longitude encoding, direction and distance to location, hours of operation, or other items of information. The PCD can be plugged into an automobile input port or similar device, if available, and provide distances and directions to locations of interest. Similar information of a condensed nature can also be provided to the user via the screen of the PCD. The user is not required to be a subscriber to some proprietary system, instead the PCD can use any means to access any data base from any potential provider, whether GPS encoded or not.

In some areas the information would be sent and received by way of a Local Area Broadcast via radio frequency signals to each home, car or PCD within a reception area. In such an embodiment, users are able to access companies listed on the broadcast network from data providers of properly tagged, yellow page-type information or are provided with GPS encoded information and maps similar to web page listings. This would be advantageous to small towns with little information available for travelers, but which have an interest in providing up-to-date traffic, weather and travel advisories to benefit the local community and businesses. Such a system does not require a master, home or base unit. The providers of data base or advertising information could be a single data provider and could also be individual users with application programs that allow provision of such data. The application programs provide a means for sending and receiving data, GPS encoded data and graphics encoded data. The application programs can also act as a universal coder/decoder to other proprietary GPS data bases.

The present invention allows users to request detailed information relating to their present location as well as information related to distant locales. Some of the advantages provided by the invention include:

1. Information can be received digitally by a PCD user from any system.
2. Multiple requests can be retained, stored or resent.
3. In-depth dynamic data retrievals are possible and could be viewed later.
4. GPS tagging and encoding with latitude and longitude information along with encoded maps for navigation.
5. Small non-contiguous map segments are possible.
6. On-line storage of data personal and other information, along with GPS encoded maps on some data files.
7. Display menus, interfaces and applications can be viewed on heads-up display systems in automobiles, homes, businesses and various commercial applications.
8. Allows for portable Internet access.
9. Provides a means for an Internet based telephone directory access tagged and linked to the originating area code and phone numbers.

Remote and distant third parties could communicate with each other and, by sending and receiving GPS encoded data, can meet or find each other in remote locations. Maps and other digital data may be transmitted/received by fax, beeper (receive only), computer, phone and radio.

One embodiment of this invention would include a system of non-subscribers communicating to each other in a similar

fashion, without the use of base stations. In addition, the non-subscribers could send personal data bases with maps included, GPS information, and other information of non-related data or graphics from publishers of any such data base. In this embodiment the device would act as a transceiver, sending and receiving dynamic moving waypoint information in digital formats, including maps of various sizes and embodiments.

The PCD can display a singular or a plurality of images and displays, project an image on to a screen or viewing surface, store or communicate data (depicted as a line, graphic, icon, etc.) to and/or receive latitude and longitude data from third parties. Additionally, the device can send/receive latitude- and longitude-encoded maps and other data to/from a third party, send/receive standard or non-standard phone and fax communications (AM, FM, spread spectrum, microwave, laser or light beam in free or fiber optic, line of sight, reflected, satellite, secure or non-secure, or any type of communications between two points that the application or state-of-the-art may allow), perform computer functions from existing application software and operating systems, receive standard or non-standard beeper messages, interface with a conventional computer and provide an interface to a heads-up display, an external viewing device or any projection system.

An embodiment of this invention incorporates a GPS transceiver with a designated application used with a communication system or network. Several users of this invention can communicate and send data, maps and graphic files with or without GPS encoding. By example, a user could request from another party a map of walking trails of Yosemite Valley with latitude and longitude designations properly GPS encoded. This map may not be in the requester's data base or in a large number of subscriber's or non-subscriber's data bases. This highly stylized map and encoded information, of a possible non-uniform nature, could be on just one user's PCD device or external source. The requesting user could contact the specialized source for specific information, and be sent via a communication link, the specific data, this data could then be modified by the user and sent back to the original provider.

The preferred embodiment of the PCD and system provides a means for requesting and receiving data files which can be tagged, modified and interrogated. This data can be comprised of many different formats and applications with potentially unique compilations from potentially unrelated, (non)-subscribers or (non)-linked users. These users can communicate with commercial, business and personal computer systems and devices having the capability of running an application (or applications) and having the ability to request and provide waypoint information which can be tagged, modified and interrogated.

Another preferred embodiment of this invention provides a means for decoding tagged, modifiable and interrogatable maps and data files furnished by third parties for display on the user's PCD or traditional computer devices.

In one embodiment of the device and tagging system the GPS information is communicated from locations, homes, businesses, commercial designations, government resources, public and private areas, cyberspace and other communication systems. Various designated locations, or a plurality and multiplicity of locations, or data structures, are assigned as waypoints. These waypoints could be tagged, or interrogated from an application program which describes, encodes, reports, modifies and communicates this encoded information and data from any location. In addition, the transmitting device may report a plurality and multiplicity of

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locations or events unrelated to either the location of either the transmitting or receiving device. Indeed, the device could communicate to many unlinked, unreported or unconnected waypoints and send active dynamic information to the requester. Cyberspace providers may enter the network web system, use applications for device communications and participate in the exchange of information using designated GPS engines and applications. By way of example, the invention can provide a requester with dynamic advertisements encoded with maps, location information, or other data to a location anywhere in the U.S. Indeed, tagged files which are linked can be sent from a third-party publisher located in another state.

The system is similar to the world wide web, except the web does not use GPS engines, applications, tagging systems, etc. By way of example, one difference is that the invention uses GPS devices, engines, applications and encoding for access to specific requester designated data retrieval techniques. The invention provides a means to locate specific individuals or places using standard GPS search techniques.

The system includes the concept of storing data, including voice messages. The system encodes files for use in a location tagged data format system. Users can request and compile information and store the information on remote computer systems. Certain protocols for compilation, encoding and tagging data files may be desirable in order to create files for system usage.

An embodiment of the invention uses fax, beepers, telephones, and/or computer and storage systems with application programs to properly GPS encode, tag, modify and interrogate requests and provide same from a plurality of providers. An embodiment of the invention includes applications or GPS engine systems for encoding, tagging, modifying, interrogating, arranging, limiting, displaying, sorting, mapping, segregating, sending, receiving and updating waypoints and its connected data structures with maps, or by any other means by way of specific devices, or by traditional computer and storage systems.

Another advantage the invention provides is a means to display this type of information and a means to store data unrelated to any interrogation by the PCD device. Methods of display include multiple of displays including, by example, overhead displays, heads-up displays, projection systems, LCD displays, computer displays or any past or future designed displays whether connected directly or by some electromagnetic means. The preferred embodiment of the device could include any means of display or combinations thereof. In addition, the device could include many control devices such as remote control, remote mouse type devices and any combination of keyboards.

Further objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings showing an illustrative embodiment of the invention in which like parts are designated by like reference numerals throughout.

DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a GPS transceiver system and communication links incorporating the present invention;

FIG. 2 is a front perspective view of a PCD of the present invention showing a layout of controls and an initialization screen;

FIG. 3 is a rear view of the PCD of FIG. 2;

FIG. 4 is a block diagram of the PCD of FIG. 2;

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FIG. 4A shows a screen menu hierarchy of the PCD of FIG. 2;

FIG. 5A illustrates a flow chart depicting the program sequence for the entry of a personal identification number (PIN) and personal data into the PCD of FIG. 2

FIG. 5B illustrates a flow chart depicting the program sequence for the user to select a mode of operation using the PCD of FIG. 2;

FIG. 5C illustrates a flow chart depicting the program sequence for the user to control the GPS mode of the PCD of FIG. 2;

FIG. 5D illustrates a flow chart depicting the program sequence for the user to control the phone mode of the PCD of FIG. 2;

FIG. 5E illustrates a flow chart depicting the program sequence for the user to control the computer mode of the PCD of FIG. 2;

FIG. 5F illustrates a flow chart depicting the program sequence for the user to control the radio mode of the PCD of FIG. 2;

FIG. 6 illustrates the Main Menu page of the PCD of FIG. 2;

FIG. 7 illustrates the select GPS Function page of the PCD of FIG. 2;

FIG. 8 illustrates the GPS: Location page of the PCD of FIG. 2;

FIG. 9 illustrates the GPS: Show Me page of the PCD of FIG. 2;

FIG. 10 illustrates the GPS: Get Map page of the PCD of FIG. 2;

FIG. 11 illustrates the GPS: Third Party page of the PCD of FIG. 2;

FIG. 12 illustrates the FAX page of the PCD of FIG. 2;

FIG. 13 illustrates the Beeper page of the PCD of FIG. 2;

FIG. 14 illustrates the Phone page of the PCD of FIG. 2;

FIG. 15 illustrates an Information Request page of the PCD of FIG. 2;

FIG. 16 illustrates the Computer page of the PCD of FIG. 2;

FIG. 17 illustrates the Radio page of the PCD of FIG. 2;

FIG. 18 illustrates the Receive Queue page of the PCD of FIG. 2;

FIG. 19 illustrates the Send Queue page of the PCD of FIG. 2;

FIG. 20 illustrates a typical listing downloaded from a data provider;

FIG. 21 illustrates a typical GPS encoded map downloaded from a data provider;

FIG. 22 illustrates atypical GPS encoded map with waypoints locating restaurants within a specified radius;

FIG. 23A illustrates an exemplary data provider;

FIG. 23B illustrates an exemplary configuration of a non-PCD computer utilizing a modified application module;

FIG. 24 illustrates a software module configuration of a requester;

FIG. 25 illustrates a software module configuration of a provider;

FIG. 26 illustrates a software module configuration of the application module;

FIG. 27 illustrates a software module configuration of the tagging system;

FIG. 28 illustrates a software module configuration of the GPS engine;

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FIG. 29 illustrates a software module configuration of the universal translator;

FIG. 30 illustrates a typical configuration of the service provider;

FIG. 31 illustrates a possible configuration of the digital web TV;

FIG. 32 illustrates the Weather Map Request page of the PCD of FIG. 2; and

FIG. 33 illustrates a weather reporting device.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a system capable of communicating using the electromagnetic energy spectrum, traditional computer networks, cellular phone networks, public telephone networks, and satellite system networks. The major components of the system comprises personal communication devices (PCDs) 20 and one or more of the following: a cellular phone network 60, a standard phone line network 70, an electromagnetic energy spectrum network 80 and/or a computer network 90. The PCD receives signals from a GPS satellite system 10.

FIG. 2 illustrates a PCD of the present invention. The PCD has a display 28a. The display may be of a LCD type or other types known in the art. Incorporated with the display is a touch screen input device 28b, which are known in the art. The PCD also has an alphanumeric key pad 26, which includes many of the standard keys generally found on computer keyboards. The location of the keys, and the selection of the characters used on a single key, may be varied as desired. The PCD also has specialized keys 27a-g, n related to GPS, telecommunications, and other functions. Located on one side of the PCD are a number of input and output ports. In the embodiment shown, these ports include a modem output port 29g, a generalized communication port 29f, a power port 35b, an infrared port 29e, and a heads-up display interface port 25k. The location of these ports are shown for descriptive purposes only, the specific location of these ports on the PCD is not critical. The power port allows the PCD to be operated from an external power source (not shown). The communication port allows the PCD to be connected to printers, local computer networks, and the like.

FIG. 3 shows a rear view of the PCD of FIG. 2. The rear of the PCD contains a microphone 34 towards one edge of the rear of the PCD and a speaker 33 towards the opposing edge. The layout of the microphone and the speaker is similar to that found in portable cellular telephones. An antenna 32 extends from the edge near the speaker to allow for communication in a cellular telephone network or via other electromagnetic spectrum means. The PCD contains a battery 38a. The battery allows for mobile operation of the PCD and is the selected power source if an external power source is not available through the power port. The PCD's operation is governed by a processor 21. A variety of microprocessors may be used, with the selection of such determined by processing power, power utilization, and other factors and requirements. The PCD has a slot 23 for a PCMCIA card, CD-ROM, or other computer accessory. The PCD is powered on when the power button 31 (shown in FIG. 2) is depressed. In the embodiment shown, at initial device power on, the processor causes the PCD to display the initialization screen 100 (shown in FIG. 2).

FIG. 4 shows a block diagram of the PCD. Control and logic functions are performed by the processor 21. Internal data storage 22, which is provided by conventional memory such as RAM or ROM or variations thereof, may be

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accessed by the processor. The processor may also access removable data storage devices 23 such as a hard disk installed via the PCMCIA slot, a CD-ROM type device or other similar removable data storage devices. The processor is connected by a data bus 24 to a number of devices. These include the alphanumeric key pad and other special purpose keys, the touch screen, and other hard wired input devices. The heads-up display output port and the display screen are also connected via the data bus to the processor, it being recognized that a number of display related devices such as VGA cards, chips, and the like are also required to implement the display device functions and the other previously mentioned functions. The microprocessor may also access or control communications with telephone networks, either hardwired or cellular, radio transmissions, infra-red transmissions, or communications with other computer devices.

All known verbal commands from GPS systems can be implemented and attachment or inclusion of voice activation for map instructions relative to location, GPS and street designations, including heading descriptions, distance, and arrival time estimates can be included.

FIG. 24 illustrates a block diagram of the PCD's software components. An application module or program 51 interfaces with the PCD's operating system 241. The operating system may be DOS, UNIX, Windows 95, Windows NT, O/S2 Apple McIntosh, Next Computer, or other operating systems, including operating systems well suited to devices with constrained memory or other limitations due to the small physical size of the PCD. The operating system additionally interfaces with other application programs 242 that provide standard file edit and other functions typically found in personal computers. The operating system, or other application programs interfacing with the operating system, provide for maintenance of data bases 245 used by the PCD. The application module includes a GPS engine 53 providing GPS functions, including interfacing with the GPS receiver 243 (shown in FIG. 4). A query menu program 54 of the application module controls the graphical user interface and related functions for the device. Included in the application module is a universal converter 55.

As illustrated in FIG. 29, the universal converter enables the PCD to read in data provided by third parties 291a,b and convert or filter such data to a format useable by the PCD. The universal converter first inspects the received data to determine if the data is in a known format which can be converted to the format used by the PCD. If the format is not known by the device, the universal converter attempts to extract any ASCII data or format the data as a bit map as appropriate.

As illustrated in FIG. 26, the application module further includes programs to implement data formatting and communication protocols using header protocols 271, layer protocols 272, and data provider protocols 273. The application module also includes a tagging system interface program 274. The elements of the tagging system are illustrated in FIG. 27. The purpose of the tagging system is to provide a common universal data structure for requests and responding to requests. Various techniques common in the GEO coding industry, using U.S. Census bureau data and tiger files with certain modifications, can establish parameters for software suppliers to use latitude and longitude encoding as coordinate pairs, postal code encoding and street centering encoding, all for the benefit of accuracy in designating certain files as "tagged". The tagging system provides the ability to apply and strip header and layer information to and from data files.

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FIG. 4A shows the top level page menu display hierarchy of the PCD. At initial power on the initialization page 25a (shown in FIG. 2) is displayed. The initialization page allows for the entry of a personal identification number and other data. Depressing the home button 27e (shown in FIG. 2) displays the Main Menu page 25b. A number of additional pages are available from the Main Menu page. These include the GPS 25c, Fax 25d, Beeper 25e, Phone 25f, Computer 25g, Radio 25h, Send Queue 25i, and Receive Queue 25j pages.

FIG. 5A lists a sequence for the operator of the PCD to answer certain questions, provide information for future access regarding handling of emergency events and handling of same by civil authorities or private individuals empowered to act on behalf of the operator. Access is denied or provided based upon user codes. The entry of a user code may allow for limited to full access of the data stored in the device and usage of same with different codes providing different levels of access and usage. Similar information and sequencing is provided by the application modules and operating system for medical and other information in the event of emergencies. In one embodiment of the preferences screen (not shown) information can be displayed in a specified manner, events recorded and equipment options listed. Specific usage of the device and furnished software would be recalled by each user having access and user codes to operate the PCD, each user having unique individual screens and setups based on that user's preferences. The initial setup of screen preferences and other user configuration details are well known in the art.

Selecting PIN 111 from the Main Menu page displays a screen 113 prompting the user to input a personal identification number. Using an alphanumeric key pad 26, the user inputs a personal identification number and presses ENTER 27g. The processor analyzes the entered personal identification number and determines if the number is valid 115 FIG. If the entered personal identification number is valid the processor enables PERSONAL 121, MEDICAL 131, PREFERENCES 141 touch points on the display screen. These touchpoints, and touchpoints later referred to, are selectable either by pressing the display screen at the touchpoint location or by selecting the underlying display item with the cursor. If the PCD already contains personal, medical and preference data, the HOME button 27e is enabled. If the personal identification number is not valid, the processor 21 will increase the device security level 119. This may include, but is not limited to, disabling the PCD operation for a specified time. Selecting PERSONAL 121, MEDICAL 131 or PREFERENCES 141 touchpoints displays the corresponding pages 123, 133, or 143. These pages request specific data, and allow the user to input data using alphanumeric key pad 26. Completion of data entry is indicated by pressing the ENTER button 27g.

In addition, the Initialization page 100 FIG. 2, as well as all other pages, displays the time and the date 103, touch points for QUE IN 550 and OUT 600 (described later in this document) and limited GPS information 107. The limited GPS information comprises of the user's location (latitude and longitude), an arrow pointing to north and an arrow indicating direction of device travel.

When enabled, pressing the HOME button 27e (FIG. 2) signals the processor to display the Main Menu page 150 FIG. 5B. As shown in FIG. 6, the Main Menu page allows the operator to use the touch screen to select the GPS 200, FAX 300, BEEPER 350, PHONE 400, COMPUTER 450, RADIO 500, RECEIVE QUE 550 and SEND QUE 600 touchpoints. The heading and directional information are

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displayed in real time and are dynamic. Pressing the FAX touchpoint causes the processor to display a Fax page (shown in FIG. 12) which lists received facsimile messages 301. The Fax page includes display interfaces appropriate for the sending and receiving of facsimile communications through the FAX Phone Modem port 29g, and such displays and functions are well known in the art. Pressing the BEEPER touchpoint causes the processor to display a Beeper page (shown in FIG. 13). The Beeper page displays received beeper messages 351 and allows for the deletion of such messages from the display and internal memory storage. Also, a sub-menu portion of the display 151 is reserved for sub-menus and directories.

Pressing GPS 200 causes the processor 21 to display a GPS Function page 201, which is illustrated in FIG. 7. The GPS page provides for selection of a GPS mode through touch points in the sub-menu portion of the display. The available modes are location 210, show me 230, get map 250 and third party 270 modes. The display returns to the GPS Function page when the PREVIOUS button 27i (shown in FIG. 2) is pressed. The display hierarchy for the GPS functions is illustrated in FIG. 5C. The Location, Show Me, Get Map, and Third Party pages descend from the GPS Menu page. The Location page comprises the current map, the location on the map of the device, and a plot of the trail of the device on the map. The sub-menu portion of the display provides for additional selection of still further pages. These pages include a Menu page, a Mode page, a Waypoint page, and a Preferences page.

The Location page is illustrated in FIG. 8. The Location page includes a GPS map 219 (latitude and longitude encoded coordinate pairs). The sample page shown is an encoded map showing the device position, plot trail and the encoded map location of the selected waypoint. The map displayed could be from on-board memory or sent by other third parties by way of communication links to the PCD. When map data files are encoded with location information, the location information can be referred to as waypoints. These tagged waypoints, with links to other data structures, can then be sent to users via an application to various communication systems. Closed-loop or proprietary GPS receivers can send/receive data to/from other third parties (Brand X, Brand Y) via their own proprietary format using an application system as a universal converter. The location information is dynamic and updated periodically by the PCD's communication system via link-up with GPS-based satellites. The Location page indicates the PCD position 801, indicated by a walking person, as being located on a highway 810. A waypoint 802 is along the highway en route to the desired destination address 803 located on a local street 804 which intersects the highway. A first point of interest 807 is also displayed as being along the highway, as is a second point of interest 805 along a second local road intersecting the highway. The limited GPS information, providing location, heading and north, is also displayed. The illustrated Location page display shows only one possible combination of a map layout. Other display sequences such as North up, course up, user at top of screen, user in middle, and other display sequences are possible. The dynamic nature of the PCD allows the PCD to display GPS encoded maps as the PCD progresses dynamically with relation to the maps.

Using interpolation techniques, performing spatial query analysis, and establishing layers for best display scale for any given map record allows the device to provide the user extended capability not possessed by traditional GPS devices. Applying various protocols and interpolation tech-

niques allow files to be arranged geographically by distance from a designated point (usually the requester's latitude and longitude as the starting point, but other locations may also be used). The maps are also arranged in layers, menus, limited, listed, showed, displayed, and sorted.

The Location mode provides typical GPS system functions. The touch points MENU 213, MODE 215 and WAY-POINT 217 and PREFERENCES 221 provide access to the Menu, Mode, Waypoint, and Preferences pages. These pages, along with various buttons on the alphanumeric key pad 26 FIGS. 2 and 4 and special function buttons 27, are used to configure the display to the user's preference. The preferences page 221 enables selection of such features as voice, maps, scroll, off screen maps away from cursor and other features. The listing name 219 portion of the Location page displays information pertaining to a waypoint selected through the use of the cursor.

FIG. 9 illustrates the Show Me page accessed from the GPS page. The Show Me page shows a list of available maps 901a-i stored on-board, which includes maps retrieved from the receive queue area of the PCD memory. The user can load a map into the location or third party pages by pressing the corresponding number key on alphanumeric key pad 26 (shown in FIG. 2) or by scrolling through the list to highlight the appropriate map and then pressing ENTER button 27g. Maps may also be removed from on-board storage using the DELETE button 27h.

FIG. 10 illustrates the Get Map page accessed from the GPS Menu page. The user of the PCD can request the map by location from PCD memory or an external source. The user may enter a desired map location. If a map location is entered, the PCD will only search PCD memory for a map for the entered location. Maps from an external source are downloaded via any of the communication links such as the FAX, BEEPER, PHONE or RADIO touchpoints provided in the sub-menu portion of the display 151. Depending on the user's requirements, several maps could exist showing similar map areas with different layers for viewing. By way of example, airport maps with air space requirements, coastal waterway, maps, and interstate maps, and even hand drawn maps scanned into a computer system all show different resources within a given geographic area. These maps, when presented on the PCD, could over-saturate the display map detail for any given map area. Therefore, it is preferred that the actual map displayed be selectable. Maps are retrieved by pressing QUE IN 550, scrolling to highlight the desired map, and pressing ENTER 27g FIG. 2.

FIG. 11 illustrates the Third Party page accessed from the GPS menu page. The Third Party page provides an interface to communications with a third party through touch points in the sub-menu display 151. In the display shown, a user can receive a third party's data and GPS encoded map for viewing on the device or save it for future usage. The user can also dynamically track the third party by periodically having the third party send updates via normal communication links. The third party location can be displayed on-board (furnished at some earlier date), or on maps sent by the third party. The PCD plots and interpolates the GPS data and latitude coordinate pair on the displayed map using spatial query analysis techniques performed by an application module. The information received from the third party may be other than maps or GPS encoded information, but may be information of any type. The data is received from the third party using phone 400 and radio communication links 500. A PREFERENCES touch point 274 enables entry

of items such as phone numbers for automatic call back and time interval for automatic transmission of information. If the radio, a satellite phone, or other frequency based communications link is utilized, the PREFERENCES touch point allows entry of frequencies for use for automatic transmission of information. A split screen displays the user's location on a map on the left side of display 272 and, after contact with a third party via a communication link, the third party's map and location on the right side of display 273. If the third party's location is sufficiently close to the user's location, or if the user's displayed map covers a sufficiently large area, both the user's and third party's location can be shown on the same map without resort to a split screen display.

FIG. 32 illustrates a Weather Map Request page. The Weather Map Request page is accessed by pressing the Weather button 27n (shown in FIG. 2) on the PCD. The Weather Map Request page allows the PCD user to specify the map location and scale, the map type, whether the selected map should be automatically updated at specified intervals, and whether a set of maps should be displayed in a sequential fashion. The PCD displays a number of different types of weather maps, including satellite images, radar maps, temperature maps, wind chill maps, and any other type of weather map available. Some weather information is more perfectly provided by showing a sequence of displays indicating the change in weather over time. Therefore, the PCD allows the operator to sequentially display a set of maps, thus providing an animated map display.

FIG. 33 illustrates a weather reporting device. The weather reporting device has a power port 334 to provide electrical power to the weather reporting device. As with the PCD, the weather reporting device may also be powered by a battery (not shown). The weather reporting device also has a computer port 335, an interface port 333, an antenna port 332, a pressure access port 331a, and a number of auxiliary ports 331b-e. The computer port provides a communications interface to a standard personal computer or the PCD. The interface port provides an interface to systems with weather detection features, such as aircraft with weather radars or lightning strike finders. The antenna port allows an external antenna to be connected to the weather reporting device, thereby providing remote operation capability. The pressure access port provides external access for an internal pressure sensitive device (not shown) for the determination of barometric pressure. A plurality of auxiliary input ports 441b-e provide an interface for connecting the weather reporting device to external weather detection sensors such as temperature sensors, wind sensors, and other weather sensing devices.

The Fax page is accessed by pressing the FAX touchpoint on the Main Menu page. FIG. 12 illustrates the Fax page. The sub-menu portion of the display is available for listing previously stored phone numbers. These phone numbers are selectable as a facsimile destination. In addition, the user can directly enter the phone number to indicate the facsimile destination. As with other pages, the PCD continues to dynamically display the limited GPS information of location, north and heading. The PCD facsimile function is performed by application software executed by the processor. Multiple fax locations, time set, send after certain time, and other traditional functions of fax machines and their implementation are well known in the art. The Fax page provides for display of a message (not shown) entered via the alphanumeric key pad 26 (shown in FIG. 2) or through selection of messages stored in the send queue area of device memory. Messages stored in the queue area of PCD memory

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can be selected by scrolling through a directory 305 of all fax messages stored. To view a stored message the user uses the SCROLL button 27a (shown in FIG. 2) to highlight an entry, and then press ENTER button 27g. Pressing the SEND button 27b transmits the selected or entered facsimile. The user may also view received faxes using this mode by pressing QUE IN 350 FIG. 12, using the SCROLL button 27a to highlight the desired message, and pressing the ENTER button 27g.

The Beeper page is accessed from the Main Menu page. Pressing the BEEPER touch point on the Main Menu page causes the processor to display the Beeper page. The device contains capabilities consistent with common practices of beepers, also known as pagers, such as sending and receiving messages. These functions and their implementation are well known in the art. The PCD is also satellite communications capable. Beeper messages can be received by the PCD without interference to the other device capabilities. Therefore, the user could continue using the telephone or other features seemingly uninterrupted by the reception of digital beeper messages and display of those messages. The Beeper page provides a list of beeper messages (not shown) stored in the receive queue area. Messages stored in the receive queue can be selected by scrolling through listing 353 FIG. 13 of all beeper messages stored. To view a stored message, the user uses the SCROLL button to highlight a desired message and presses the ENTER button 27g. Messages are deleted when the DELETE button is pressed with at least one message selected.

The Phone page is illustrated in FIG. 14. The Phone page is accessed from the Main Menu page. Pressing the PHONE touchpoint on the Main Menu page causes the processor to display the Phone page. The Phone page is also accessed by pressing the PHONE touchpoint on the Get Map and Third Party pages. As with the other pages, the limited GPS data is continuously displayed showing PCD location, heading, and north. The PCD can access several areas of the display even while the PCD is being used as a telephone. Information provided in the display area 1401 will vary depending upon the page from which the phone page was accessed. The Phone page provides for selection of a function through touch points displayed in the sub-menu portion of the display. The selectable touchpoints are: POLICE 403, MEDICAL 405, DATA PROVIDER 407, DIRECTORY 413, and MEMORY 415.

When the POLICE touchpoint is pressed, the PCD places a call to emergency 911. The 911 telephone number is the default, another number could instead have been entered for any particular user through the preferences selection. Once the telephone call is answered, the PCD provides the information entered using the Preferences function and the device location. The user may also establish voice and data communications through the microphone 34 and speaker 33 (shown in FIG. 3).

The PCD performs equivalent functions when the MEDICAL touchpoint is pressed. As different phone numbers and information can be entered in the selection of user preferences, however, different phone numbers may be used and different information may be transmitted.

When the DATA PROVIDER touchpoint is pressed, the processor displays the Data Provider Connect page. The Data Provider Connect page provides a means to specify the type and amount of data to be downloaded from a specified data provider. The Data Provider Connect page has numerous data fields which are selected by use of the cursor. Once a field is selected, the user may enter data in that field using

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the alphanumeric keys. The data fields include data for name, city, state, map area, zip code, telephone area code, retail category, distance from device location, and maximum number of listings to be provided by the data supplier. Whether a map only is requested and what particular types of maps, such as interstate maps, walking area maps, zip code maps, street maps, area code maps, or state maps, are requested are also provided as options. Touch points for weather information and traffic reports are also provided. Once the appropriate data fields and/or type of data required is input or selected, pressing the send key transmits the data request to the data provider. Details regarding the method of transmission of the responsive data is automatically sent by the data provider to the data provider along with the data request.

The primary data providers may include the public telephone company networks but may also include other entities. The data providers maintain data, including maps, telephone yellow page entries, and other information such as traffic and weather reports. This information is maintained in a timely manner and is accessible through the use of data base methods well known in those in the art. Upon receiving a request for data, the data provider determines the nature of the data request, searches the appropriate data base or data bases, and transmits the requested information to the requesting device in the manner specified by the requesting device. The user, after the PCD receives the data as requested, disconnects, goes off line to review the information, deleting some, saving others, and storing other encoded information on the PCD. The user can now further edit the device's entire data base and decide a sequence for navigating to the locations listed in the various menus as waypoints. Thus users of the PCD can decide to navigate using the GPS features of the PCD and select certain waypoints and the order in which to proceed. By way of example, but not limited to same, users could select gas stations, banks, restaurants, shopping centers in unfamiliar areas, navigate today from one point of beginning and tomorrow continue navigating from another point of beginning, being assured that the device will always know how to get to various locations. Should the user require further locations to visit, the PCD is capable of obtaining new navigational data and adding to the already active route plan without having to completely start over.

Pressing the DIRECTORY touchpoint 413 displays an alphabetical listing (not shown) of phone numbers stored on-board. The user may scroll through the listing and select a desired phone number. Pressing MEMORY 415, displays an alphabetical listing (not shown) of frequently used phone numbers. The user may scroll through the listing and select a desired number. Pressing the SEND button causes the device to dial the selected phone number.

FIG. 16 illustrates the Computer page. The Computer page is accessed by pressing the COMPUTER touchpoint 450 (shown in FIG. 6) on the Main Menu page. The Computer page allows the user to operate the device as a standard personal computer utilizing application programs of the type normally present on personal computers. As examples, the display of FIG. 16 provides for touchpoints in the sub-menu portion of the display for calendar date entry, notes, and organizer application programs. As with the other pages, the limited GPS information is also displayed.

FIG. 17 illustrates the Radio page. The Radio page is accessed by pressing the RADIO touchpoint 500 on the Main Menu page. The radio mode provides the user with an interface for selecting the type of radio signal through touch points displayed in the sub-menu 151 area. The selectable

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types are: AM 503, FM 507 and TRANSCEIVER 511. Selecting any type will display a page (not shown) requesting frequency, volume, and other parameters relating to radio transmission and reception. The AM and FM are standard receivers. The device can thereby tune and listen to broadcasts that provide data links and receive data files using legal AM or FM radio bands (or any other radio band legal to access and provide radio station information). The device therefore allows users to communicate information amongst themselves without having to rely on telephone technology. This is especially valuable when telephone technology is not available.

The Receive Queue page displays stored received messages. The received messages may be displayed by reception type through selection of the transmission line type listed in the sub-menu portion of the display, the selectable types, through touch points displayed in the sub-menu 151 area, are: ALL 553, FAX 555, BEEPER 557, PHONE 559, COMPUTER 561 and RADIO 563. Selecting a type, will sort (by specified type) and display (by date and time) all messages received. By way of example, the radio queue contains GPS-encoded voice mail or digital files (containing information to various sites) provided by private third-party sources. The phone system queue contains previous calls with digital messages linked to web pages containing voice and video data. The computer which may be queued contains personal letters, calendars, notes and the like from more traditional sources or user created tagged files for storage. The fax queue contains traditional faxes which may illustrate maps with waypoints. The beeper mode queue contains received beeper messages (digital and voice).

The Send Queue page is accessed by pressing the SEND QUE touchpoint on the Main Menu page. The Send Queue page includes similar functions as the receive queue, except the Send Queue is a staging area for sending messages. The Send Queue page displays sent or to-be-sent data and an interface for selecting the specific type of queue. The selectable types, through touch points displayed in the sub-menu portion of the display 151, are: ALL 603, FAX 605, BEEPER 607, PHONE 609, COMPUTER 611 and RADIO 613. Selecting a type, will sort (by specified type) and display (by date and time) all messages sent or waiting to be sent.

FIGS. 23 A and B are a system block diagram including a block diagram of a data provider. A plurality of PCDs 231, 232, 233 communicate with each other using the aforementioned communication means. The PCDs also communicate with various data base information suppliers including private data base information suppliers, publisher data base information suppliers, telephone service data base information suppliers, and a data base provider. The data base provider receives digital requests for map information or other data regarding a geographic area. The data provider collects map data and other data and tags the other data to the map data and maintains the map and location tagged data in a data base. Human intervention is not required in responding to data requests.

As shown in FIG. 23B, the application module of the device is ported to a computer system not GPS capable, or merely not portable so as to have no need for a GPS receiver. The application module allows non-PCD based computer users to provide data to the data provider in the correct format, as well as receive data from devices or the data provider. This allows the non-device base computer user to track the location of devices and to collect information to be manually entered into a traditional GPS capable device as an aid in future trip planning.

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FIG. 20 illustrates a list of GPS encoded data for a restaurant listing of restaurants in a requested area. This list may have been furnished by third parties or a data provider. The PCD has stored this information in digital format and is displayed on a GEO coded map, GIFF map or any other map the PCD stored in memory or receives from a third party or data provider. The information can be arranged by the PCD using criteria enabling the user unlimited access to the data. If the user chooses to navigate to these locations singularly or as a group, the GPS engine performs these functions, allowing a user of the device to accurately travel to the desired restaurant. As shown in FIG. 21, the PCD can use any scale of map or combinations and other types of maps as shown. The user of the PCD selects certain maps for storage and recalls same when needed for navigation. By way of example, the user's device could have a local Los Angeles street map, an interstate map (as shown in FIG. 21), and a New York city map in device memory. The user could navigate to the airport using the GPS functions and stored Los Angeles map, fly to New Jersey, rent a car and navigate to New York using the interstate map and, finally, find a specific restaurant in New York City by using the third map stored in PCD memory.

As shown in FIG. 22, the PCD contains a map with various waypoint locations the user has selected. These waypoints are both standard waypoints 221 and linked waypoints 222. The waypoints are indicated by a marker on the display. Standard waypoints indicate identifiable locations of interest. Linked waypoints have additional data associated with the waypoint. The additional data may be text data, visual data such as a photographic image of the waypoint, or an audio data file. When the marker for the linked waypoint is selected using the touch screen or other input device, the processor determines if the additional data associated with the waypoint is available in the PCD memory. If the additional data is not available in the PCD memory, the PCD automatically requests the additional data from a data provider. Once the additional data is available, the PCD displays or otherwise makes use of the additional data.

Using the map of FIG. 22, the user could navigate to a school, restaurant, bank, gas station, government office using the PCD to interpolate using spatial query techniques to find the best routes to each location. The PCD can re-collate the list for the most efficient route using the application and GPS engine modules. Using software programming techniques and math formulas, persons skilled in the arts will utilize spatial analysis queries and functions to determine best routing and "closest to" scenarios. In addition, centroid interpolation functions and match-rate comparison functions used by the GEO coding community will further enhance this application's ability to universally communicate with other systems.

FIG. 30 further illustrates a system whereby the user uses a PCD to dial a direct access number similar to dialing 411, but all requests are requested and serviced automatically. Upon connection to the system, the user makes keyboard requests to the PCD or traditional computer system using the application program of the PCD. Upon requests being received by the data provider or similar information provider, the provider or supplier searches the data base for data responsive to the request. The provider or supplier can access further data through data links to other third party sources and continue to provide all data required by the requester. This system is consistent with the world wide web, linking data through hypertext connections and designations. This invention's system converts information

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requests to data requests, not verbal requests, as presently being practiced in directory assistance type services. This narrow usage of the application module allows convenient access to directory assistance that primarily provides data and chunks of information in a short period of time consistent with directory assistance today.

FIG. 31 shows a web page screen with a data provider icon displayed on the device. Pressing or otherwise selecting the icon will enable a menu for the requester to specify a data request. Download will be in the form of a compressed digital data file that may include video, sound, or other digitally encoded data.

While this invention has been described with reference to illustrative embodiments, this description is not intended to be construed in any limiting sense. Various other embodiments of the invention will be apparent to persons skilled in the art upon reference to this description. It is therefore contemplated that the appended claims will cover any such modifications of the embodiments as fall within the true scope and spirit of the invention.

We claim:

1. A locating and map downloading system comprising: a personal digital communicator comprising: a display for the display of map information and selectable waypoints, the selectable waypoints being displayed with respect to the map information; a receiver for receiving GPS signals; means for processing the GPS signals whereby location of the personal digital communicator may be determined; a first transceiver; a first modem coupled to the transceiver and to a first digital processor; a communicator input means for formatting a request for map information, and for selecting a waypoint, the communicator input means coupled to the first digital processor; the first digital processor being programmed to cause display of map information and selectable waypoints by the display, and to cause transmission via the first modem and the first transceiver of requests for map information and requests for additional data associated with a selected waypoint; and a map storage and transmitting device comprising a second transceiver, a second modem coupled to the second transceiver and a second digital processor, memory accessible by the second digital processor for storing map information, waypoints, and additional data associated with the waypoints, the second digital processor being programmed to determine which map information stored in the memory is responsive to the request for map information and to cause transmission via the second modem and the second transceiver of map information responsive to the request.
2. The locating and map downloading system of claim 1 wherein the first processor transmits via the first modem and the first transceiver a request for map information pertaining to the communicator location and receives via the first transceiver and the first modem map information responsive to the request.
3. The locating and map downloading system of claim 1 wherein the first processor transmits via the first modem and the first transceiver a request for map information pertaining to a location other than the communicator location.
4. The locating and map downloading system of claim 1 wherein the first digital processor is further programmed to cause transmission via the first modem and the first transceiver further data associated with a location to the map storage and transmitting device and the second processor stores the further data associated with the location in the map storage and transmitting device memory.
5. The locating and map downloading system of claim 1 wherein the first digital processor determines a heading of direction of the personal digital communicator.
6. The locating and map downloading system of claim 1 wherein the first digital processor is programmed to determine the direction of North.
7. The locating and map downloading system of claim 1 wherein the first and second transceivers are transceivers for communicating in a cellular phone network.
8. The locating and map downloading system of claim 1 wherein the first and second transceivers are transceivers for radio communications.
9. The locating and map downloading system of claim 1 wherein the first and second transceivers are transceivers for telephonic communications.
10. The locating and map downloading system of claim 1 wherein the first and second transceivers are transceivers for communicating in a satellite communications network.
11. The locating and map downloading system of claim 1 wherein the first digital processor stores communicator configuration information in the communicator memory and is programmed to configure the personal digital communicator according to the configuration information.
12. The locating and map downloading system of claim 11 wherein the communicator configuration information includes at least one personal identification number and the first digital processor is programmed to configure the personal digital communicator differently in response to different personal identification numbers.
13. The locating and map downloading system of claim 1 wherein the communicator input means for formatting requests for map information uses selection criteria.
14. The locating and map downloading system of claim 13 wherein the first digital processor is programmed to determine if the communicator memory contains map information for a geographic area within a selected radius of the first modem and the first transceiver a request for map information for a geographic area within a selected radius of the personal digital communicator if the communicator memory does not contain such map information.
15. The locating and map downloading system of claim 1 wherein the first digital processor is programmed to determine a route to a selected waypoint.
16. The locating and map downloading system of claim 15 wherein the first digital processor is programmed to determine a route to a number of sequentially selected waypoints.
17. The locating and map downloading system of claim 16 wherein the first digital processor is programmed to modify the route to a number of sequentially selected waypoints in response to the selection of a further waypoint.
18. The locating and map downloading system of claim 1 wherein the first digital processor is programmed to cause display of different waypoints on the display based on aspects of the additional data.
19. The locating and map downloading system of claim 18 wherein the first digital processor is programmed to cause the display to display the additional data associated with a selected waypoint when the waypoint is selected.
20. The locating and map downloading system of claim 19 wherein the additional data comprises a video data file.
21. The locating and map downloading system of claim 19 wherein the additional data comprises an audio data file.

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22. The locating and map downloading system of claim 1 wherein the Personal digital communicator further comprises communicator memory, operatively coupled to the first digital processor, for storing map information and additional data.

23. The locating and map downloading system of claim 22 wherein the map storage and transmitting device comprises a second personal digital communicator.

24. The locating and map downloading system of claim 22 further comprising a weather information gathering device for providing weather information to the first digital processor.

25. The locating and map downloading system of claim 24 wherein the first digital processor is programmed to automatically transmit via the first modem and first transceiver the weather information.

26. A personal digital communicator device comprising:
a GPS receiver for receiving GPS signals;

a processor to determine the device location based on the GPS signals, the processor being programmed to format requests for specified data regarding unspecified locations within a geographic area from a data provider and to process responsive data to the requests received by a communications means, the responsive data including geographic location data;

the communication means providing a means for requesting and receiving map information from digital map storage devices; and

a display for displaying external map information received from digital map storage devices and the device location.

27. The personal digital communicator device of claim 26 wherein the processor determines a heading of direction of the device.

28. The personal digital communicator device of claim 26 wherein the processor determines the direction of north.

29. The personal digital communicator device of claim 26 further comprising a weather information gathering device providing weather information to the processor.

30. The personal digital communicator device of claim 26 wherein the communication means provides a means for providing the personal digital communicator device location to other personal digital communicator devices and a means for receiving locations of the other personal digital communicators.

31. The personal digital communication device of claim 30 wherein the display displays the other device locations with respect to the external map information.

32. The personal digital communicator device of claim 26 wherein the display displays a symbol indicative of the geographic location of the responsive data with respect to the external map information.

33. The personal digital communicator device of claim 32 further comprising computer memory accessible by the processor.

34. The personal digital communicator device of claim 33 wherein the computer memory stores internal map information in the computer memory.

35. The personal digital communicator device of claim 34 wherein the display displays a symbol indicative of the geographical location of the responsive data with respect to the internal map information.

36. The personal digital communicator device of claim 35 further comprising a keyboard input means for providing data to the processor.

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37. The personal digital communicator device of claim 36 wherein the indicative symbol is selectable using the keyboard input means and the display displays the responsive data when the indicative symbol is selected.

38. The personal digital communicator device of claim 36 wherein the indicative symbol is selectable using the keyboard input means and the processor formats a request for data regarding the geographical location indicated by the indicative symbol when the indicative symbol is selected.

39. The personal digital communicator device of claim 36 wherein an entered personal identification number is entered using the keyboard means, at least one stored personal identification number is stored in the computer memory, the processor compares the entered personal identification number and the at least one stored personal identification number and disables device operation for a period of time if the compared personal identification numbers are not identical.

40. The personal digital communicator device of claim 39 wherein a plurality of personal identification numbers are stored in the computer memory and the displayed map information is displayed in different predefined formats when different personal identification numbers are entered.

41. A locating and map downloading system comprising:
a personal digital communicator comprising:

means for determining a location of the personal digital communicator;

means for requesting map information and additional data associated with specific locations within the map information from a map storage and transmission device;

means for receiving the map information and additional data associated with specific locations within the map information from the map storage and transmission device;

means for storing the map information and additional data associated with specific locations within the map information;

means for displaying the map information and markers indicating availability of additional data associated with specific locations within the map information and the location of the personal digital communicator with respect to the map information;

means for selecting a one of the markers;

means for determining if additional information associated with a specific location identified by a marker is stored by the means for storing the map information and the additional data; and

means for requesting further additional data associated with the specific location identified by the marker from the map storage and transmission device; and the map storage and transmission device comprising:

means for receiving the request for map information and additional data associated with specific locations within the map information and for receiving the request for further additional data; and

means for processing the request for map information and additional data associated with specific locations within the map information and for processing the request for further additional data; and

means for transmitting the map information and additional data associated with specific locations within the map information and for transmitting the further additional data.

42. A personal digital communicator comprising:

a processor;

a memory accessible by the processor;

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a display coupled to the processor, the display displaying map information and a position of the personal digital communicator with respect to the map information, the map information including waypoints, as commanded by the processor; 5

input means for formatting requests for map information and for selecting waypoints;

a GPS receiver coupled to the processor, the processor being programmed to process information received by the GPS receiver to determine therefrom the position of the personal digital communicator; 10

a transceiver coupled to the processor;

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the processor being programmed to request map information using the transceiver from a map storage and transmitting device, to process map information received from the map storage and transmitting device, to determine the availability of additional stored data for waypoints in the memory upon selection of a one of the waypoints by the input means, and to request additional stored data using the transceiver from the map storage and transmitting device upon selection of the one of the waypoints if the additional stored data is not available in the memory.

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(12) **United States Patent**
Obradovich

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(45) **Date of Patent:** **Aug. 14, 2001**

(54) **CENTRALIZED CONTROL AND MANAGEMENT SYSTEM FOR AUTOMOBILES**

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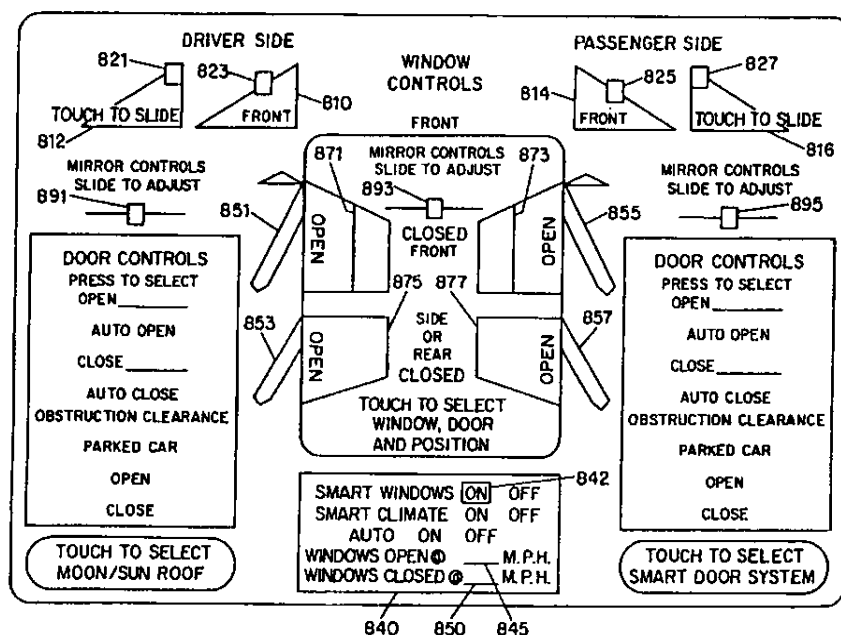
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(57) **ABSTRACT**

In a control and management system for automobiles, a central processor in the system connects traditionally unrelated vehicle subsystems together to realize synergistic functions such as smart driving, automatic parking, etc. A master interface having a display is employed in the system to help a user control and manage the vehicle functions.

45 Claims, 17 Drawing Sheets



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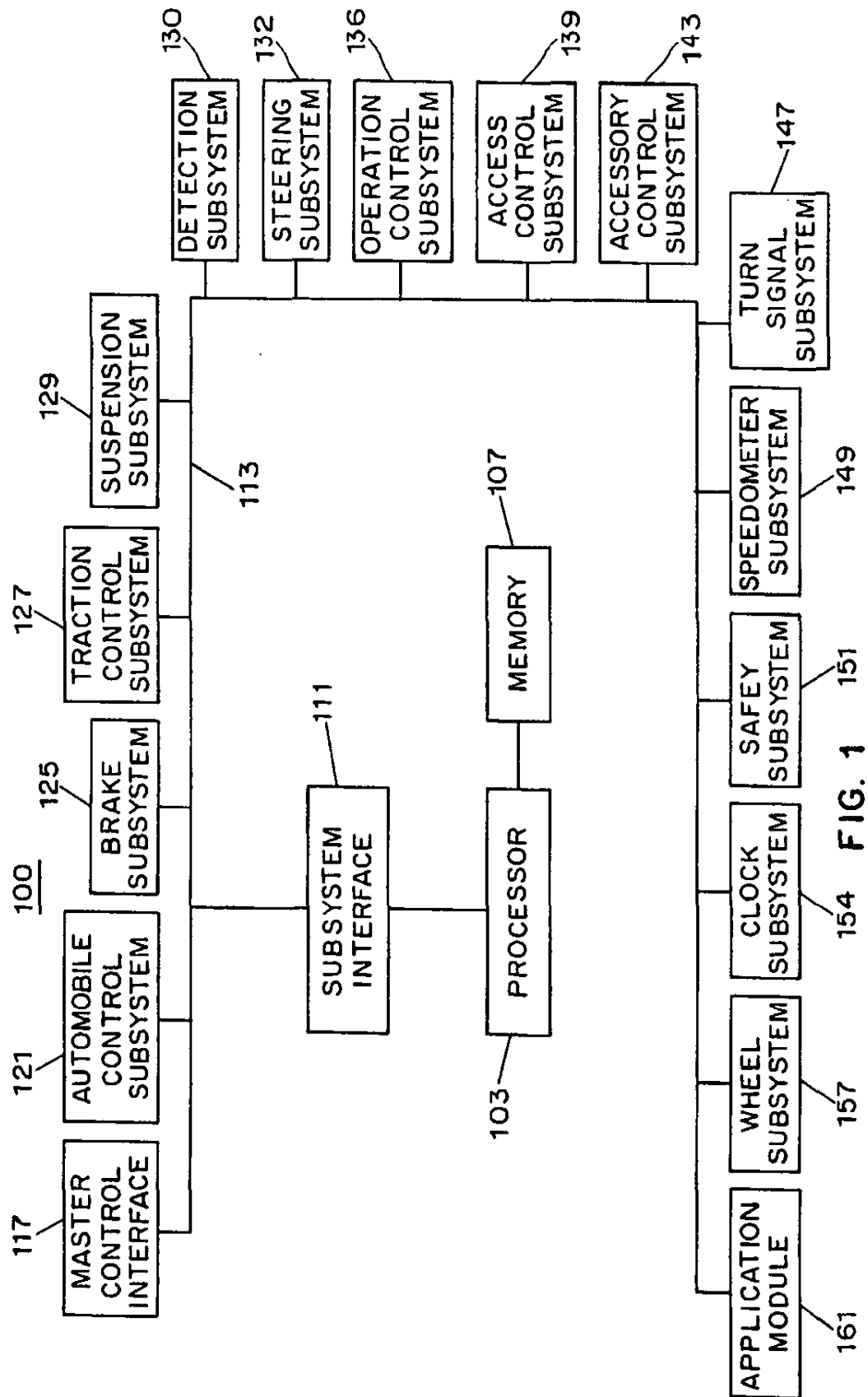
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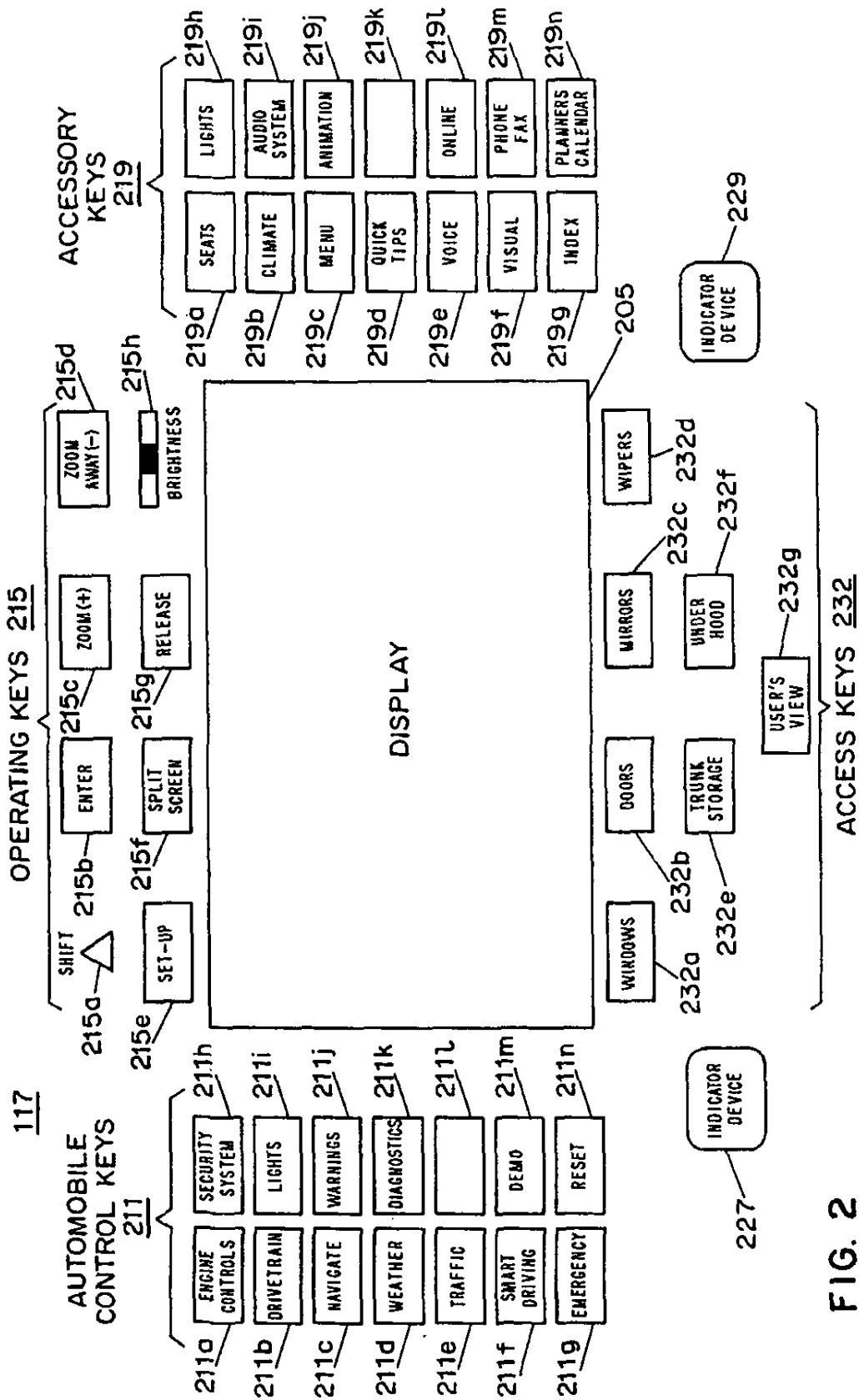


FIG. 2

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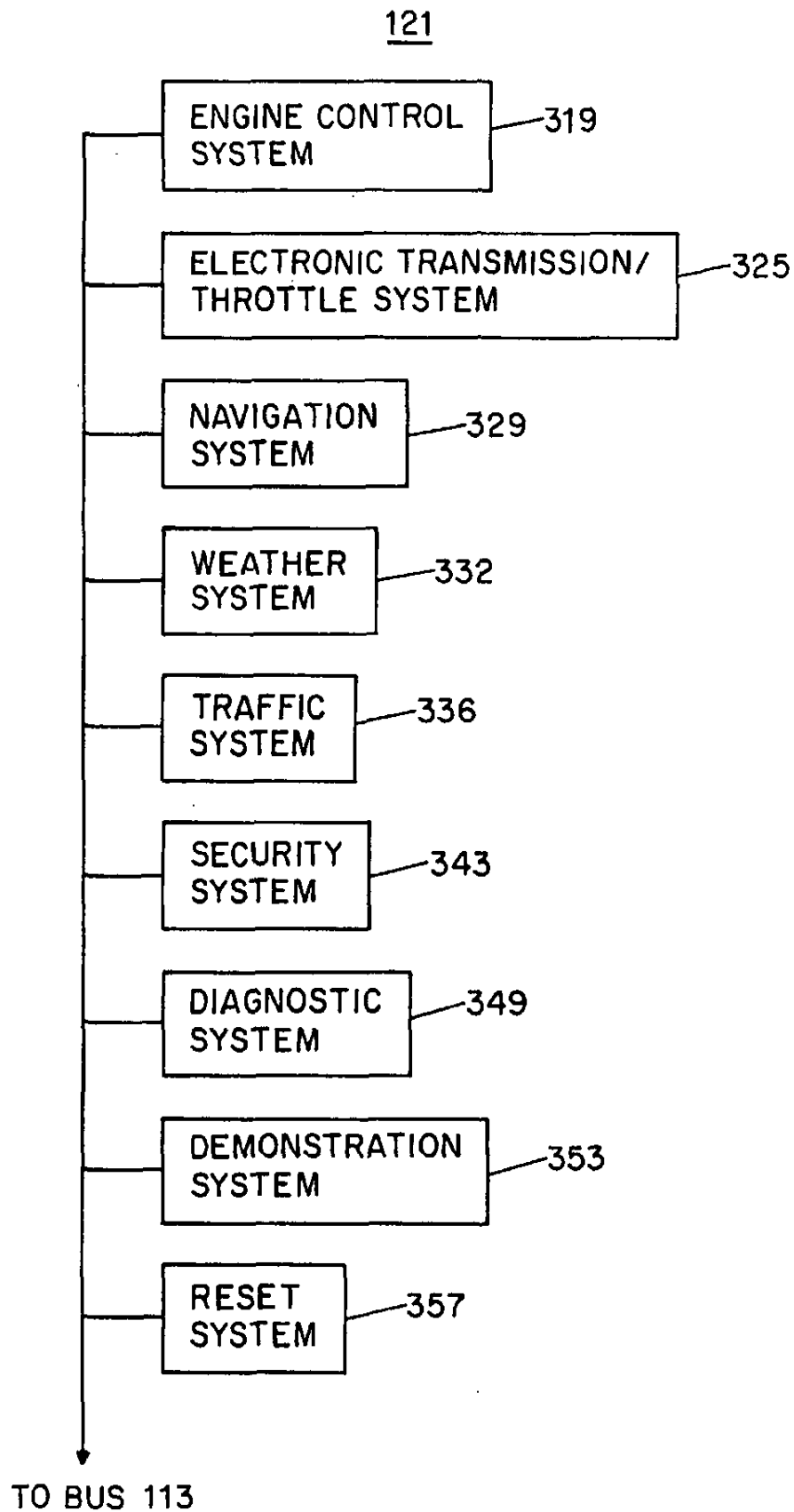


FIG. 3

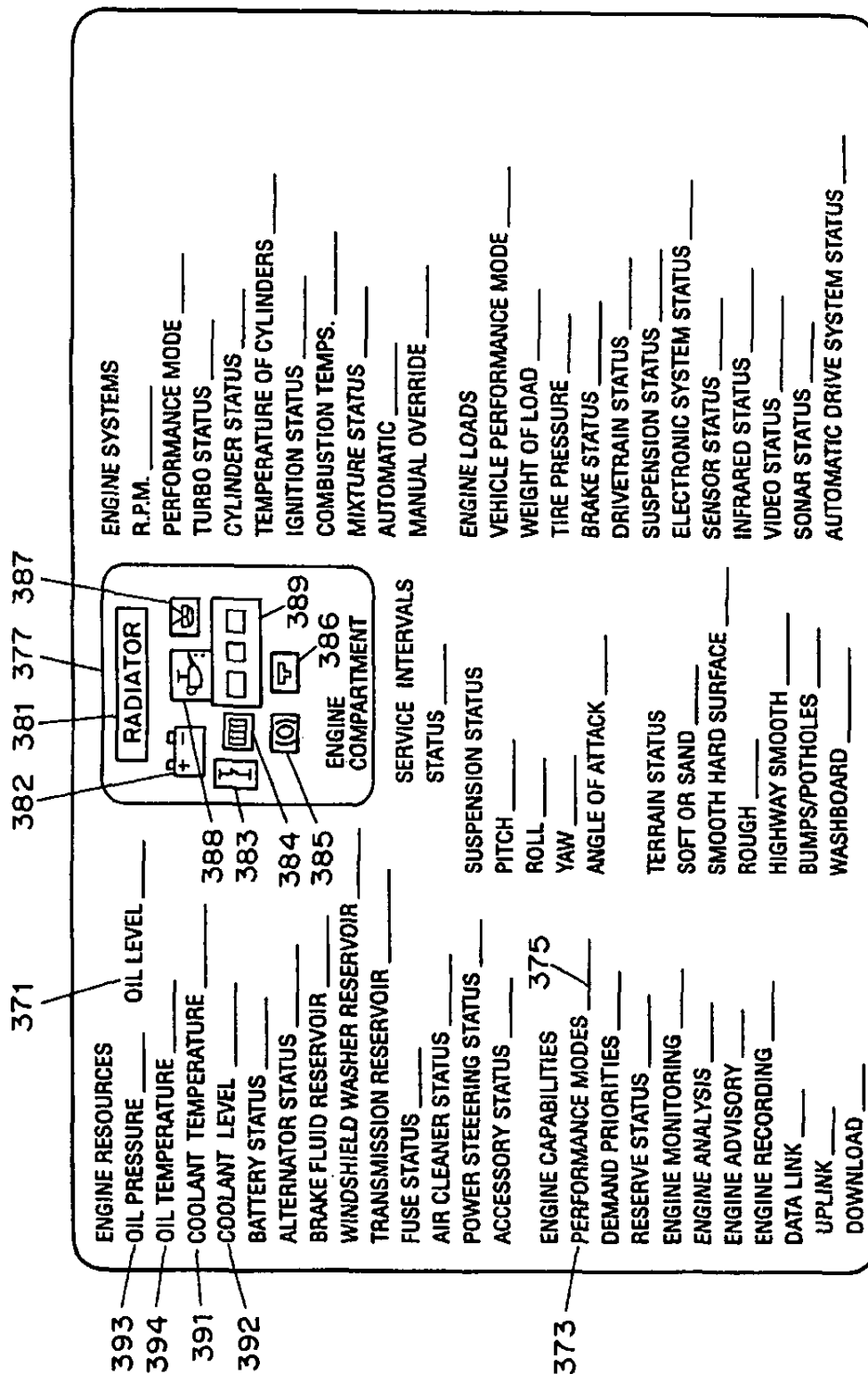


FIG. 4

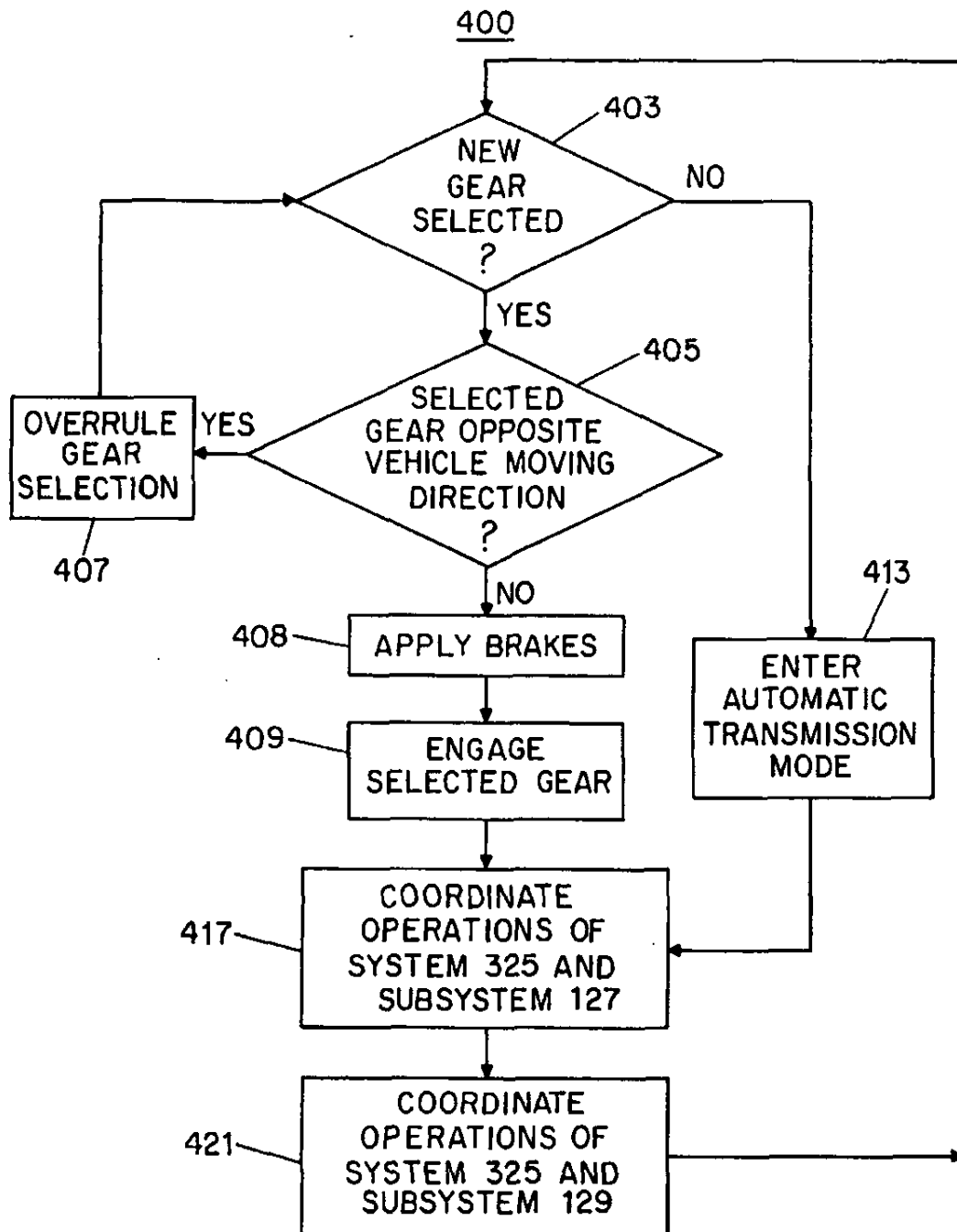


FIG. 5

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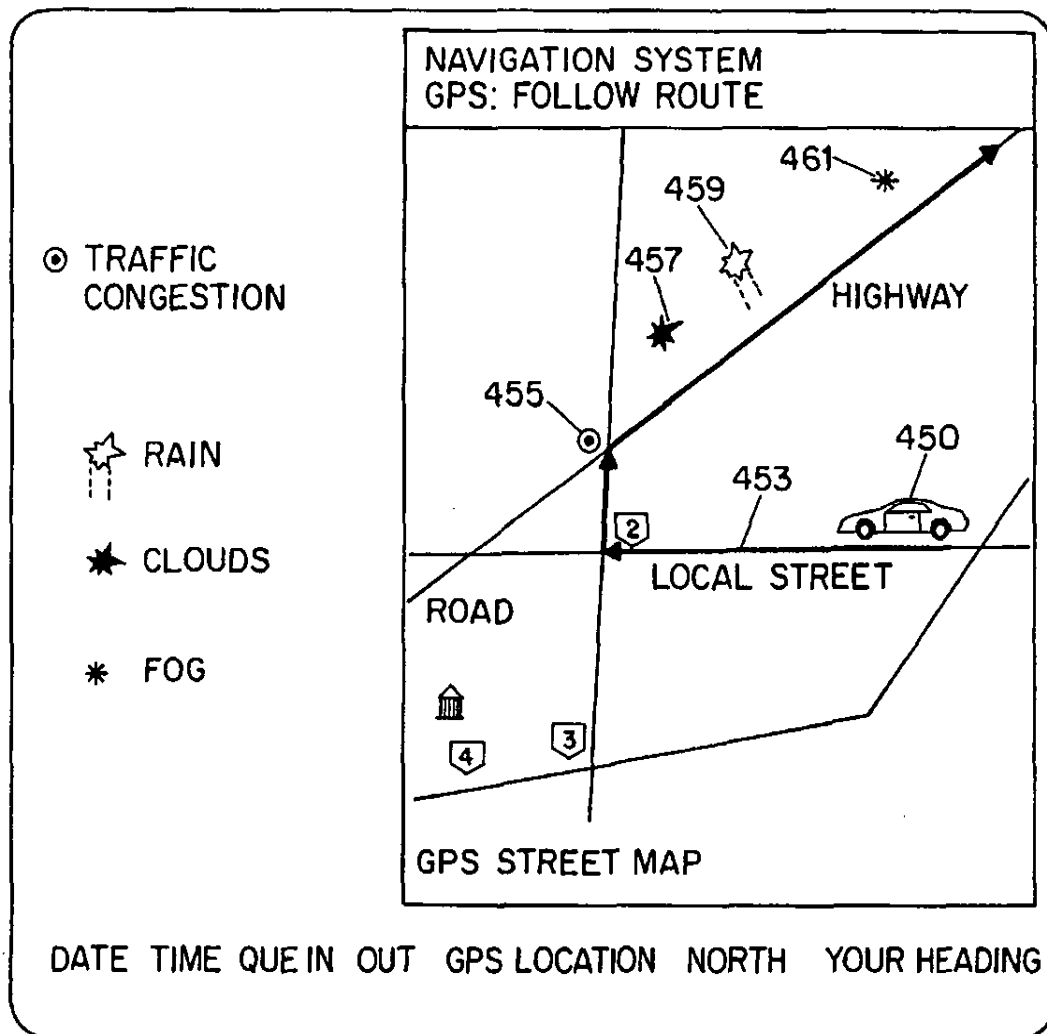
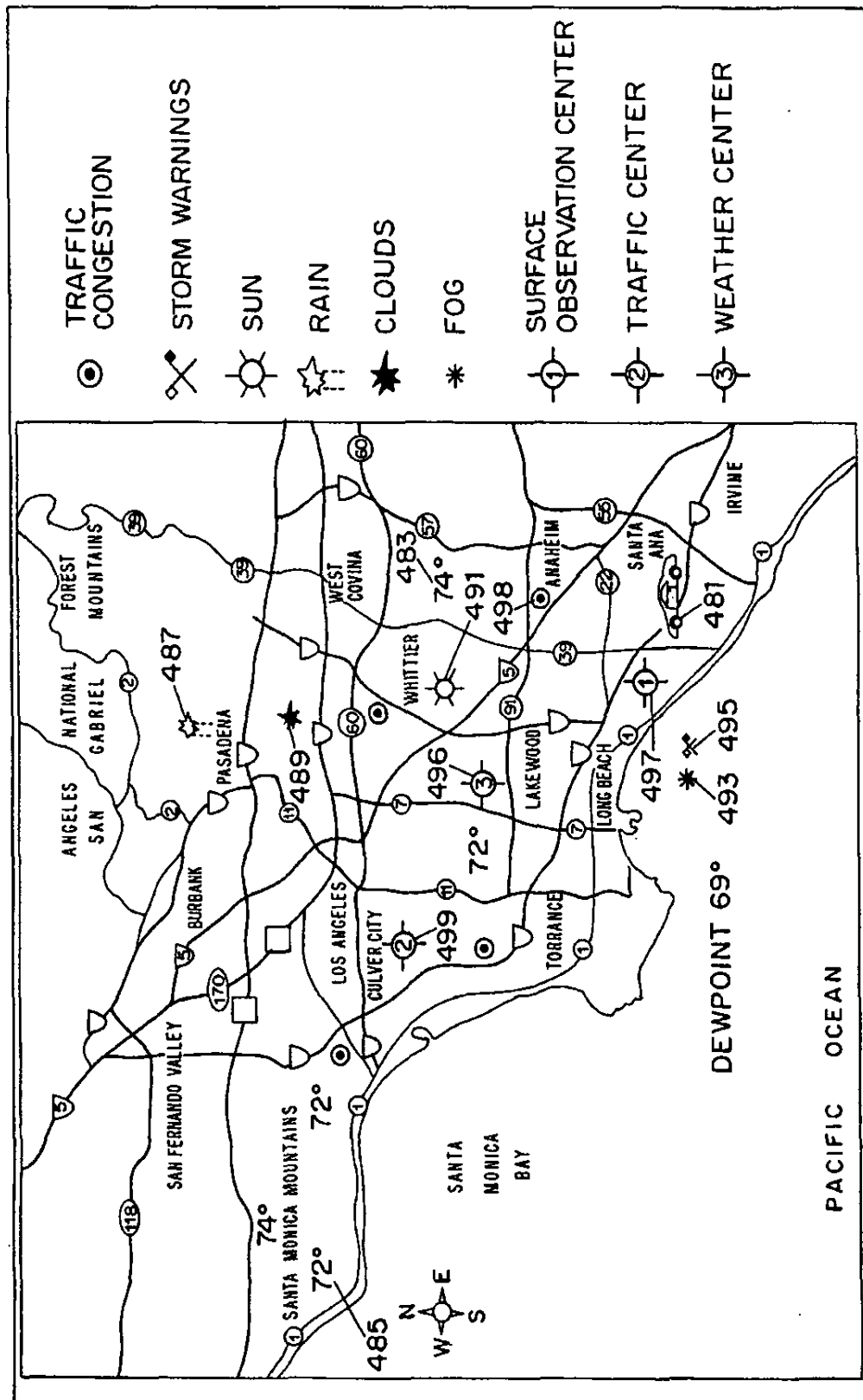


FIG. 6



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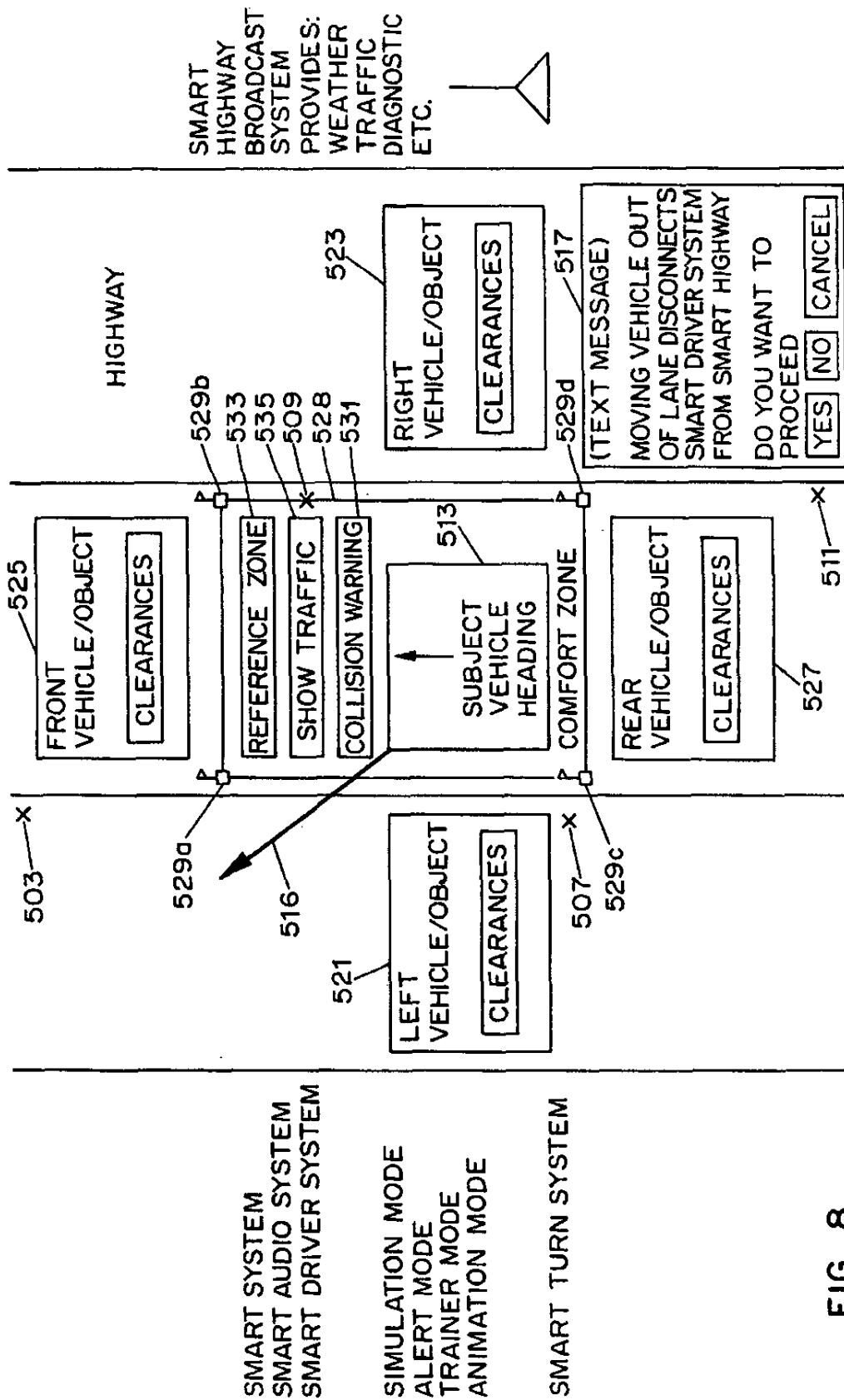


FIG. 8

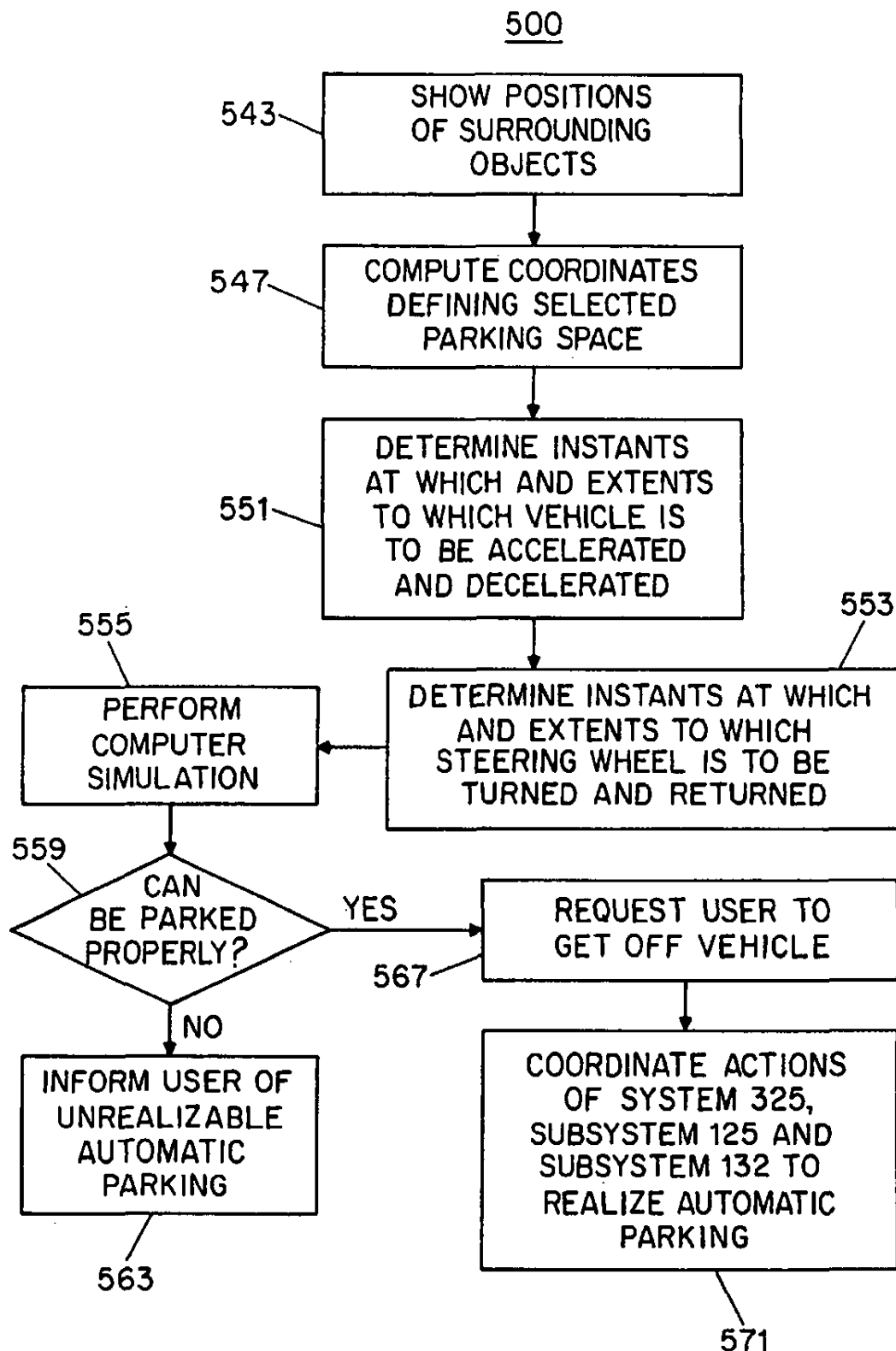


FIG. 9

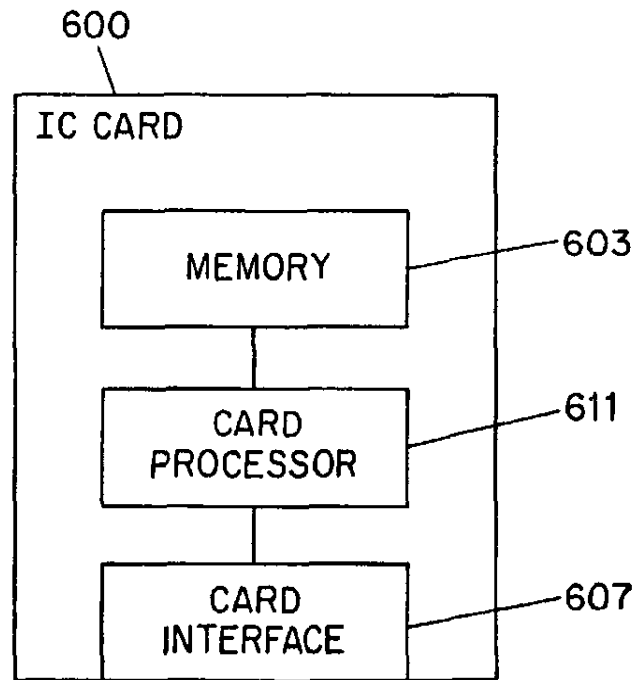


FIG. 10

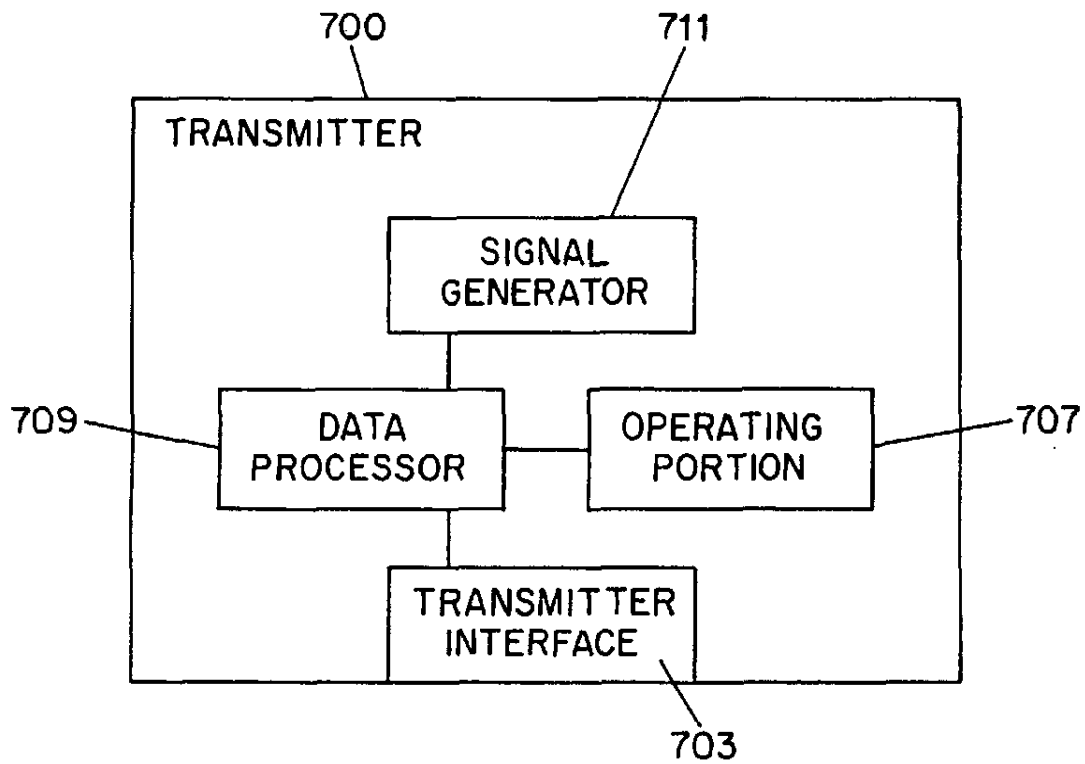


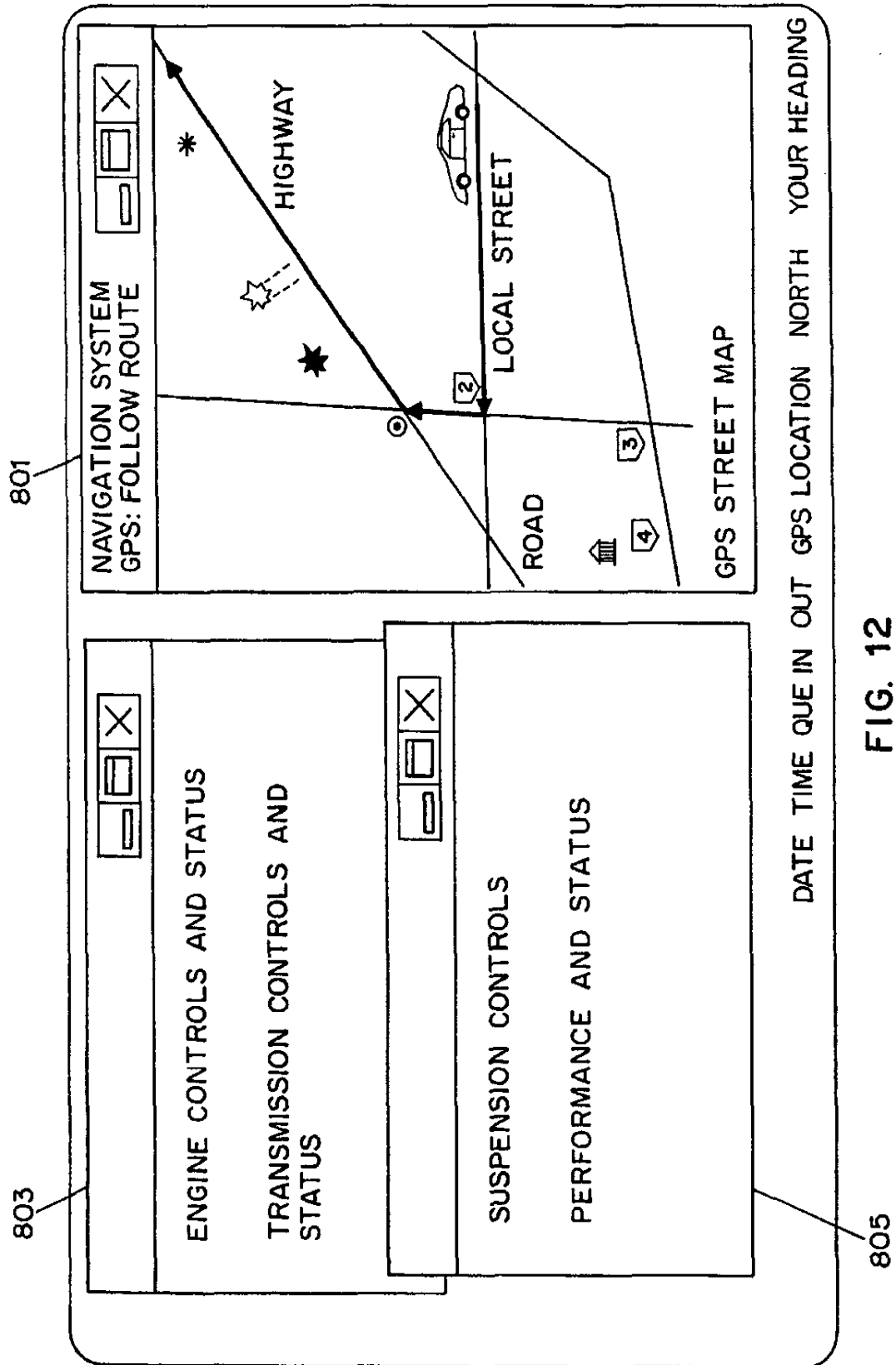
FIG. 11

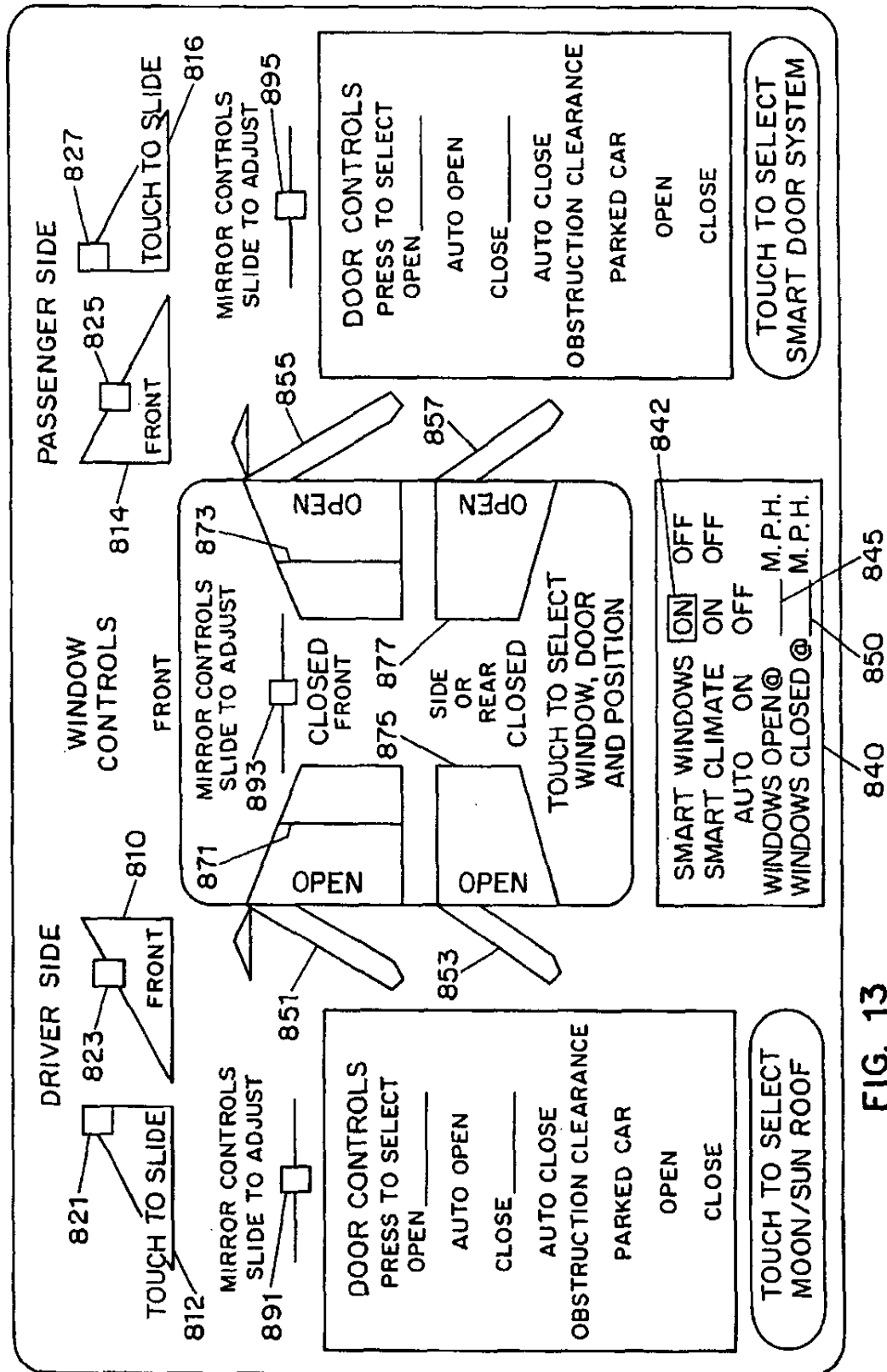
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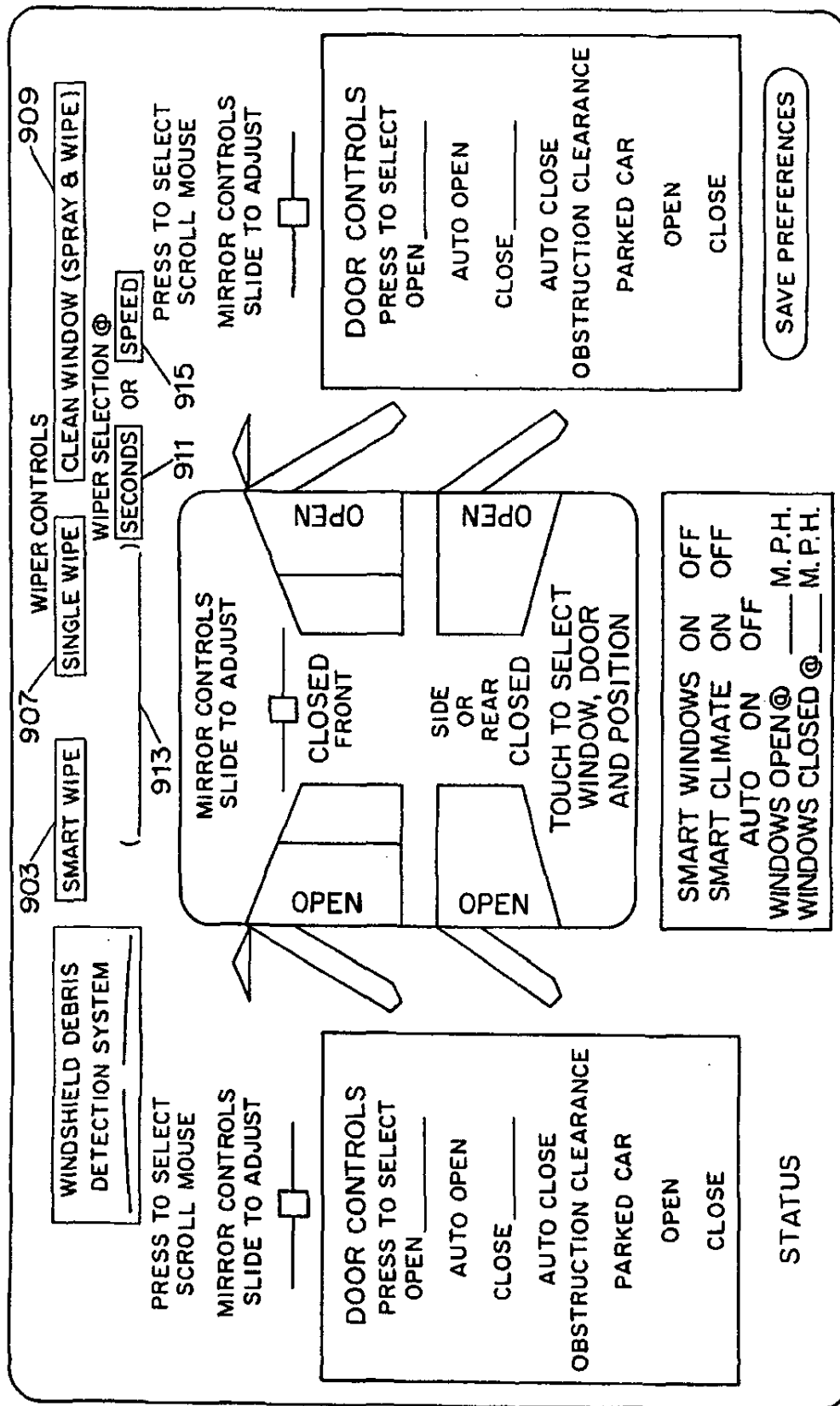


FIG. 14

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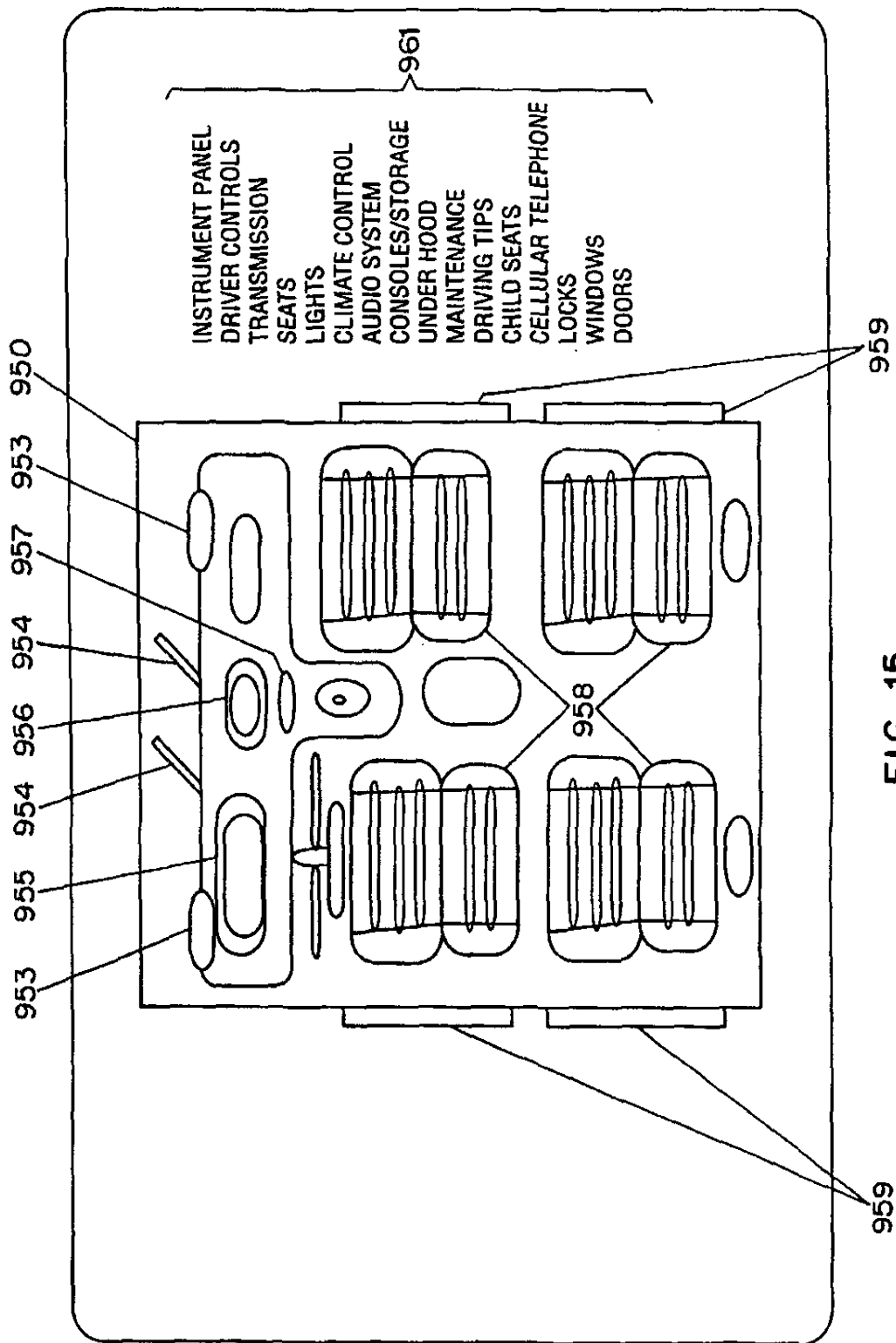
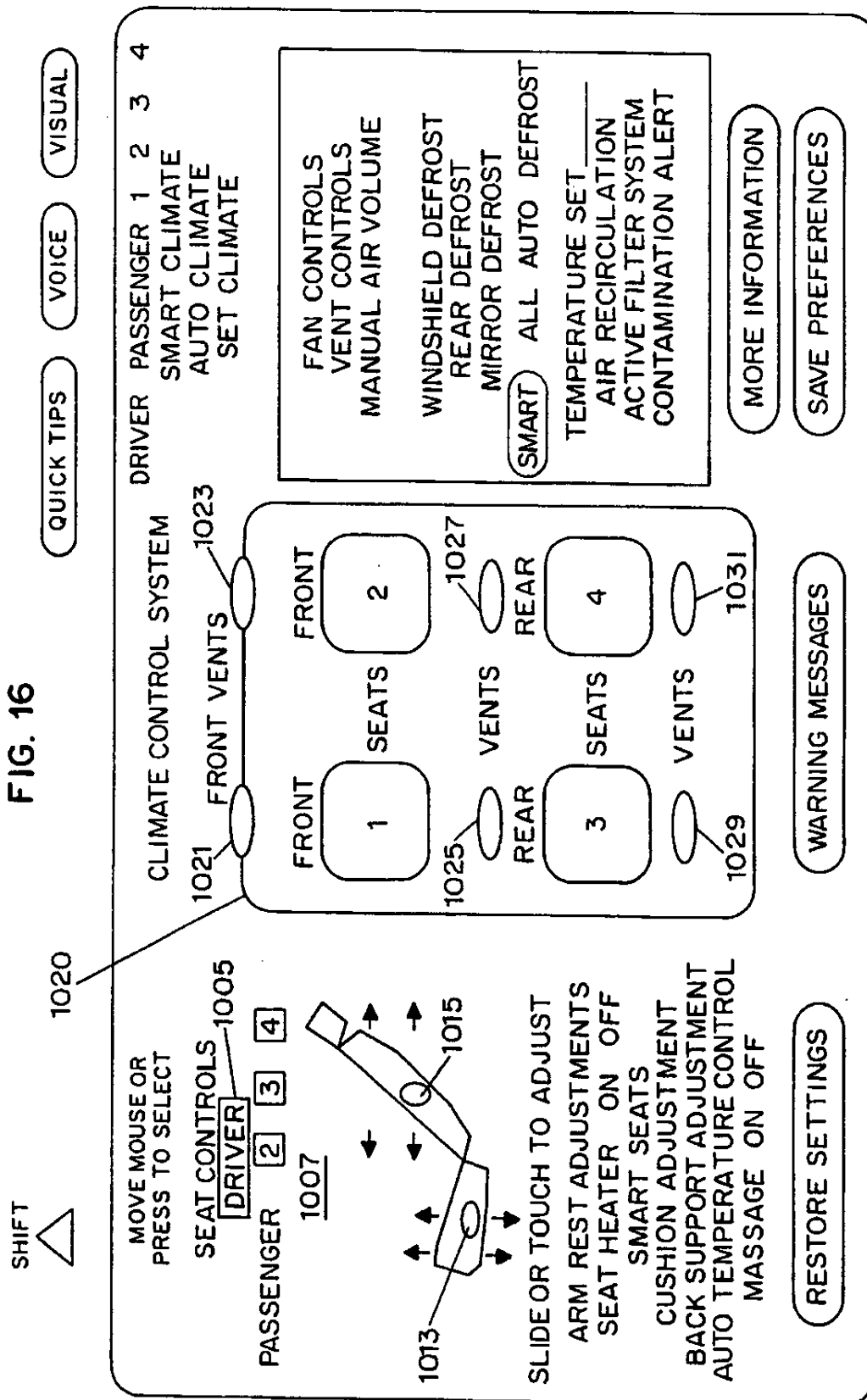


FIG. 15

FIG. 16



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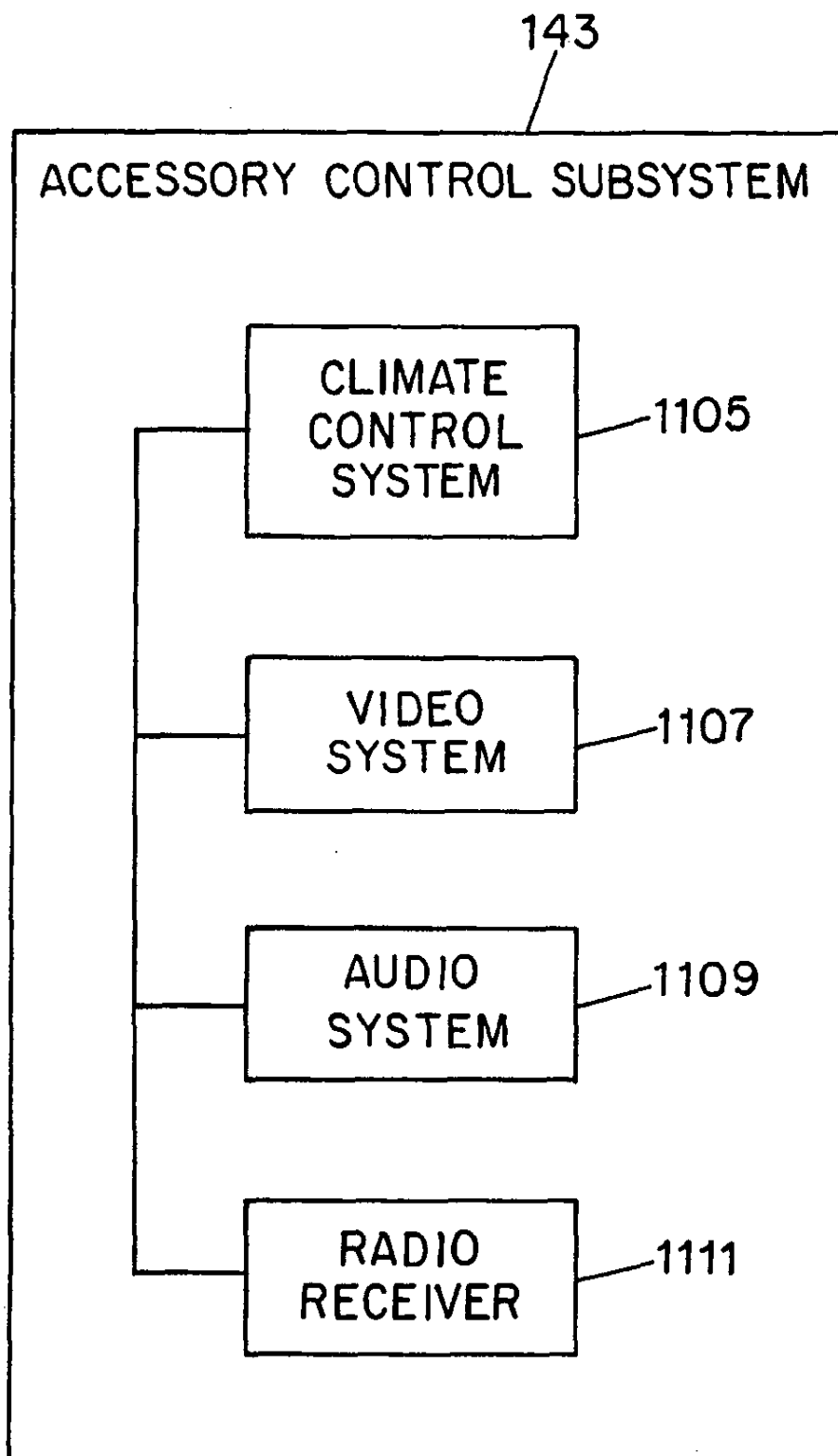


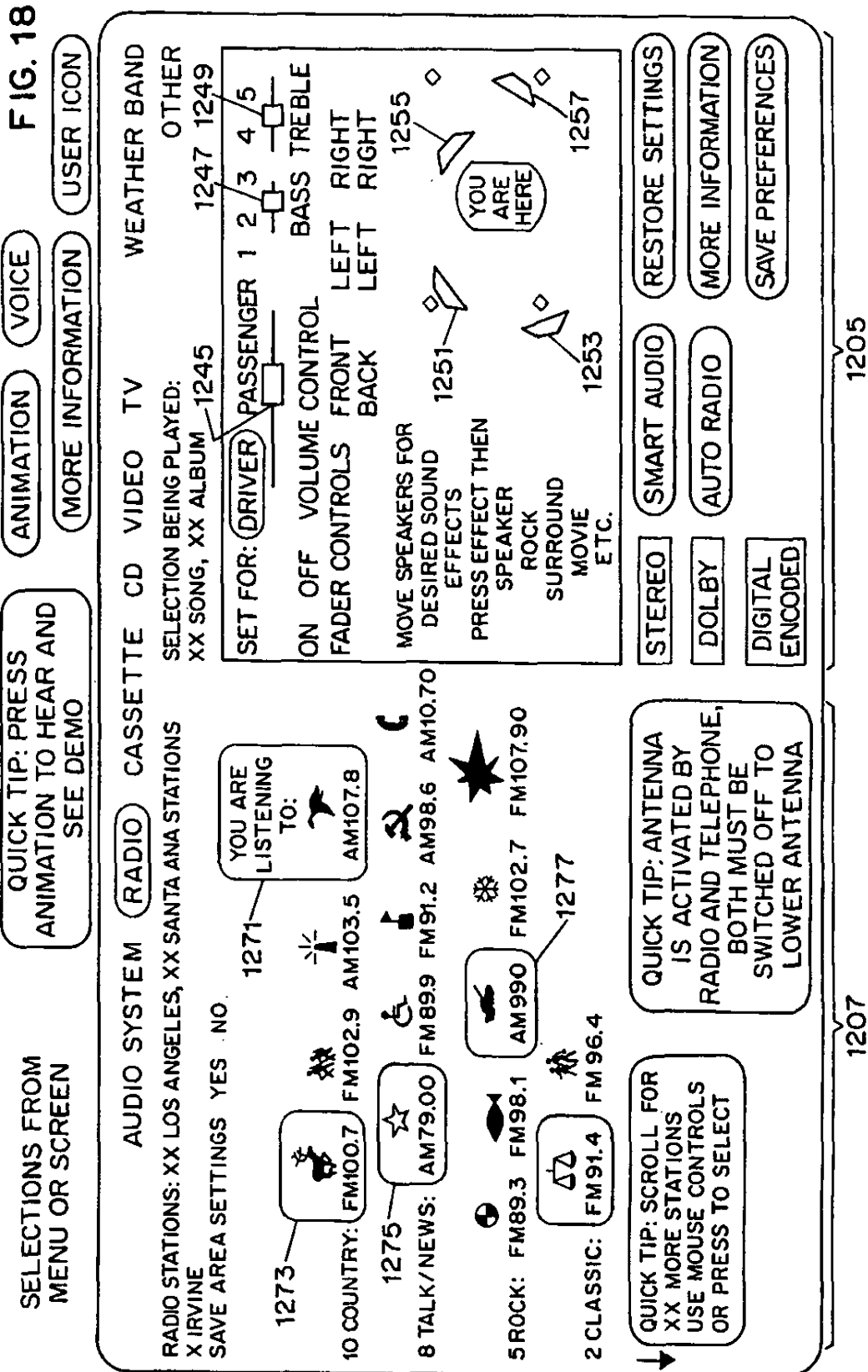
FIG. 17

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CENTRALIZED CONTROL AND MANAGEMENT SYSTEM FOR AUTOMOBILES

STATEMENT OF RELATED APPLICATIONS

The present application is related to copending, commonly assigned U.S. patent application Ser. No. 08/789,934, entitled "Multimedia Information and Control System for Automobiles."

FIELD OF THE INVENTION

The invention relates generally to control and management systems and, more particularly, to a system for use in an automobile which facilitates the user's control and management of various vehicle functions.

BACKGROUND OF THE INVENTION

The concept of an automated highway system (AHS) has been fervently pursued. Although the interpretation of the AHS concept varies from one person to another, people implementing the concept are incorporating more and more technology into an automobile to improve its operations, better its safety measures, and add conveniences to the vehicle user.

A prevalent interpretation of the AHS concept is hands-free driving. To that end, magnets have been buried along an experimental automated highway, and automobiles have been equipped with magnetometers to sense the magnets to guide the moving vehicles, thereby obviating manual steering. In another approach, an automobile is equipped with a video system in which cameras monitor different segments of the road ahead and feed images to on-board computers that control steering, acceleration and braking of the vehicle.

Although the above hands-free driving systems are at various stages of development and will be made available to the public in years to come, a less comprehensive system known as an "adaptive cruise control system" will soon be publicly available. This system is capable of adjusting a vehicle's speed to keep it moving with the flow of traffic. Specifically, it relies on radar or infrared sensors to measure the distance to the vehicle just ahead. If the vehicle ahead speeds up or slows down, an onboard computer adjusts the throttle or brakes to maintain a safe distance.

Although the ultimate AHS is in the works, it is believed that the building blocks therefor are in place. These building blocks include the well-known "drive-by-wire" system, TRAXXAR stability control system, global positioning satellite (GPS) navigation system, etc. The drive-by-wire system refers to a throttle system responsive to electrical control signals to adjust the speed of a vehicle, and plays a major role in the aforementioned adaptive cruise control system.

In the TRAXXAR system, sensors are used to measure the steering wheel position, yaw rate and lateral acceleration of the vehicle. These sensors work with an onboard computer to controllably apply brakes at selected wheels to avoid potential skids.

In a well-known manner, the GPS navigation system receives signals from a constellation of satellites. In response to such signals, the navigation system pinpoints the vehicle's location (in latitude and longitude). It also detects the vehicle's speed and direction. With geographic information stored on an onboard computer, the navigation system is capable of verbally and visually communicating to the user instructions for reaching the destination.

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SUMMARY OF THE INVENTION

Today's automobiles are commonly equipped with an anti-lock brake system (ABS), a cruise control system, a climate control system, a compact disk (CD) player, a radio receiver, an audiovisual system, a restraint system, an air bag system, a cellular communication system, a car alarm system, and so on and so forth. The users are overwhelmed and confused with a large number of knobs, switches and buttons used to control the discrete functions of the individual systems. We have recognized that as more and more systems are being incorporated into an automobile to implement the AHS concept, the management of the systems will be more unwieldy than ever.

The invention overcomes the prior art limitations by employing a master interface to manage system functions in a vehicle. In accordance with the invention, a plurality of items are exhibited on a display in the master interface. Each item represents a respective one of the systems in the vehicle. The exhibited items are arranged on the display in substantially the same relation to one another as the systems represented thereby in the vehicle. At least one of the items can be selected using an indicator device (e.g., a mouse). The system represented by the selected item can be operated to realize the functions associated therewith.

Accordingly, it is an object of the invention that the master interface for controlling the system functions is simple and well organized, as opposed to using the large number of knobs, switches and buttons to control same as in the prior art.

It is another object of the invention that the master interface centralizes the system functions so that the user can focus on a single interface while driving, rather than being distracted by the large number of knobs, switches and buttons used in the prior art, which are dispersed throughout the vehicle.

It is yet another object of the invention that the access to the system functions through the master interface is intuitive and direct so that a user who is not familiar with the vehicle can instantly learn to manage such functions.

The master interface is connected to a central processor in accordance with a system architecture wherein the central processor also connects traditionally unrelated vehicle systems together. With such an architecture, the central processor can coordinate the actions of the connected systems to realize synergistic functions such as smart driving, automatic parking, etc.

BRIEF DESCRIPTION OF THE DRAWING

Further objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing showing an illustrative embodiment of the invention, in which:

FIG. 1 is a block diagram of a control and management system for use in an automobile in accordance with the invention;

FIG. 2 illustrates a master control interface in the system of FIG. 1;

FIG. 3 illustrates an automobile control subsystem in the system of FIG. 1;

FIG. 4 illustrates a screen containing engine related options appearing on a display in the interface of FIG. 2;

FIG. 5 is a flow chart depicting the steps of a drivetrain routine in the system of FIG. 1;

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FIG. 6 illustrates a navigation screen on the display including weather and traffic indicators in accordance with the invention;

FIG. 7 illustrates another screen on the display including weather and traffic information in accordance with the invention;

FIG. 8 illustrates yet another screen on the display for automatic driving in accordance with the invention;

FIG. 9 is a flow chart depicting the steps of an automatic parking routine in accordance with the invention;

FIG. 10 is a block diagram of an integrated circuit (IC) card for gaining access to a vehicle in accordance with the invention;

FIG. 11 is a block diagram of a transmitter for coupling to the IC card of FIG. 10;

FIG. 12 illustrates multiple screens on the display when the interface of FIG. 2 is put in a split screen mode;

FIG. 13 is a display screen for adjusting windows and mirrors, and opening/closing doors of the vehicle in accordance with the invention;

FIG. 14 is a display screen for, among other things, adjusting wipers in the vehicle in accordance with the invention;

FIG. 15 is a display screen including a user's view of the vehicle for controlling and accessing information concerning different components in the vehicle in accordance with the invention;

FIG. 16 is a display screen for adjusting seats and vents in the vehicle in accordance with the invention;

FIG. 17 is a block diagram of an accessory control subsystem in the system of FIG. 1; and

FIG. 18 is a display screen for adjusting audio and radio facilities in the vehicle in accordance with the invention.

Throughout this disclosure, unless otherwise stated, like elements, components and sections in the figures are denoted by the same numerals.

DETAILED DESCRIPTION

The present invention is directed to a technique for effective management and control of vehicle functions in an automobile. Traditionally, an automobile incorporates a multiplicity of discrete systems such as a climate control system, an audio system, an anti-lock brake system (ABS), a cruise control system, etc. These systems are individually controlled and managed by their own user interfaces including knobs, switches, buttons, and displays. As the automobile industry is fervently pursuing the automated highway system (AHS) concept, more and more systems are being added to the automobile. As a result, the management of all these systems becomes more unwieldy than ever.

FIG. 1 illustrates control and management system 100 for use in an automobile, which embodies the principles of the invention. In accordance with the invention, system 100 places the previously unrelated automobile subsystems under centralized control, thereby coordinating their functions synergistically and allowing data sharing among the subsystems effectively. In addition, system 100 provides a user-friendly master control interface for the user to manage the subsystems in an efficient manner.

As shown in FIG. 1, central to system 100 is processor 103 of conventional design. Processor 103 is connected to non-volatile memory 107 and subsystem interface 111. The latter is an ensemble of standard inputs/outputs (I/O's) connecting processor 103 to the subsystems to be described.

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Processor 103 performs various tasks in system 100 according to certain routines stored in memory 107. For example, through interface 111, processor 103 collects information from the subsystems for analysis, and transmits data and control signals to the subsystems, thereby controlling the vehicle functions.

Interface 111 connects the aforementioned subsystems through common bus 113, which include master control interface 117, automobile control subsystem 121, brake subsystem 125, traction control subsystem 127, suspension subsystem 129, detection subsystem 130, steering subsystem 132, operation control subsystem 136, access control subsystem 139, accessory control subsystem 143, turn signal subsystem 147, speedometer subsystem 149, safety subsystem 151, clock subsystem 154, wheel subsystem 157 and application module 161.

Referring also to FIG. 2, master control interface 117 in accordance with the invention affords the user centralized control and management of the vehicle functions. interface 117 includes display 205, driver control keys 211, operating keys 215, accessory keys 219, access keys 232, and indicator devices 227 and 229. When a particular key or device is depressed or operated, the corresponding signal is generated by interface 117 and interrupts processor 103 to inform the latter the depression of the key or the operation of the device.

By way of example, display 205 is a liquid crystal display (LCD) located on a dashboard of the automobile. Display 205 includes a LCD driver (not shown) for processor 103 to control the display graphics. This driver is also responsive to signals generated by indicator devices 227 and 229 to perform certain tasks to be described. In this illustrative embodiment, both devices 227 and 229 are each a mouse device which may be wireless, and can be used to point and click at displayed options on display 205 and to scroll various menus or screens. However, it will be appreciated that devices 227 and 229 may be joysticks, light pens, trackballs, touchpad, or a combination thereof, instead.

Display 205 also incorporates well-known touch-screen circuitry (not shown). With this circuitry, the user can interact with processor 103 by, say, touching a displayed option on display 205. Through interface 117, processor 103 receives from the touch screen circuitry a signal identifying the location on display 205 where it has been touched. If such a location matches the predetermined location of one of the displayed options, processor 103 determines that the option has been selected. With such touch-screen and displayed option selection capabilities, the user is able to obtain information on and control selectable functions of the automobile.

Automobile control keys 211 relate to the functions provided by automobile control subsystem 121. Subsystem 121 monitors many aspects of the vehicle operation including the exhaust temperature, fuel flow, engine temperature, ignition timing, individual cylinder operations, heat exchange, etc.

When ENGINE CONTROLS key 211a is depressed, processor 103 is prompted to collect information from, among others, engine control system 319 (in FIG. 3) within subsystem 121. Processor 103 thereafter causes the screen of FIG. 4 to be displayed on display 205. FIG. 4 illustratively includes "ENGINE RESOURCES", "ENGINE CAPABILITIES", "ENGINE SYSTEMS", and "ENGINE LOADS" categories relating to the engine controls of the vehicle. Under each category, the user may use indicator device 227 or 229 to point and click at various engine related options to select same. Alternatively, utilizing the touch-

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5 screen capability, the user may touch the options on the screen with his/her finger to achieve the selection. The selected options are highlighted in a first color, and the readings and/or statuses corresponding thereto are shown in the respective blanks following the items.

For example, when OIL LEVEL option 371 is selected, the amount of oil in the engine is indicated, i.e., whether the current level of engine oil is high, medium or low. By selecting PERFORMANCE MODES option 373, the user learns whether the engine is in an aggressive mode or a fuel economy mode. The aggressive mode offers a high power output and should be used when sudden accelerations and decelerations (e.g., passing other vehicles) are anticipated. Otherwise, the fuel economy mode is recommended. When one of the two modes is indicated on line 375, the line is highlighted in a second color, indicating that another performance mode option is available for selection. In this instance, when the user points and clicks at line 375, the other performance mode option is displayed. The user may then point and click at such other option to change the performance mode.

In accordance with an aspect of the invention, subscreen 377 is used to graphically depict the engine compartment of the vehicle. By way of example, displayed items 381 through 389 in subscreen 377 depict the radiator, battery, fuse box, air cleaner, brake fluid reservoir, transmission fluid reservoir, windshield washer reservoir, oil compartment and engine block in the engine compartment, respectively. It should be pointed out that the relative positions of these displayed items correspond to those of the depicted components in the actual engine compartment. Knowing the relative positions of the components under the hood of the vehicle, the user can easily identify and point and click at selected items to quickly access information concerning the corresponding components. For example, when displayed item 381 depicting the radiator is selected, options 391 and 392 relating to the radiator are highlighted, and the readings of the current coolant temperature and coolant level are shown in the respective blanks. When displayed item 388 depicting the oil compartment is selected, options 393, 371 and 394 relating to the oil compartment are highlighted, and the readings of the current oil pressure, oil level and oil temperature are shown in the respective blanks.

As shown in FIG. 3, subsystem 121 also includes electronic transmission/throttle system 325, which operates under the control of processor 103 in accordance with certain drivetrain routines. The program instructions defining these routines are stored in memory 107 in this instance. Alternatively, they may be stored in a memory (not shown) in subsystem 121.

Instructed by one of the drivetrain routines, which is denoted 400 in FIG. 5, processor 103 detects whether the user has selected a transmission gear different from the currently engaged gear, as indicated at step 403. The gear selection is achieved by depressing DRIVETRAIN key 211b, followed by operating indicator device 227 or 229. For example, after depressing key 211b and moving device 227 forward (backward) causes processor 103 to initiate a signal to system 325 to select a forward (reverse) gear.

If the user has selected a different gear at step 403, routine 400 proceeds to step 405 where processor 103 determines whether the selected gear is opposite the automobile's moving direction. If the selected gear is a reverse (forward) gear, and the automobile is moving forward (backward), processor 103 overrules the user's selection, as indicated at step 407. Routine 400 then returns to step 403. Otherwise if

the selected gear and the moving automobile direction are both forward or reverse, routine 400 proceeds to step 408 where processor 103 causes brake subsystem 125 to apply the brakes of the vehicle, and thereafter to step 409 where it causes system 325 to engage the selected gear. Routine 400 proceeds from step 409 to step 417 to be described.

If at step 403 processor 103 does not detect any gear change by the user, it causes system 325 to enter an automatic transmission mode in which system 325 automatically shifts the gears in a well-known manner, as indicated at step 413. Routine 400 then proceeds to step 417 where processor 103 coordinates the operation of system 325 with that of traction control subsystem 127, which may be of the type of the TRAXXAR stability control system, to prevent skids. At step 421, processor 103 coordinates the operation of system 325 with that of suspension subsystem 129 including shock absorbers to afford a smooth, comfortable and safe ride. From step 421, routine 400 returns to step 403 described above.

Another drivetrain routine causes system 325 to perform gear shifting in cooperation with other subsystems such as detection subsystem 130 and brake subsystem 125 to handle certain road conditions. Detection subsystem 130 includes radar, sonar, infrared sensors, Doppler radar, magnetometers and/or other object finder mechanisms, and is used for, among other things, monitoring the road condition ahead. For example, when an upcoming curve is detected, system 325 handles the transmission accordingly while the brakes are controllably applied by brake subsystem 125 to avoid any skid.

It should be noted at this point that suspension subsystem 129 also includes a height actuator, whereby processor 103 can controllably adjust the height of the vehicle. Thus, continuing the above example, when detection system 130 detects the upcoming curve, processor 103 may also cause the vehicle height to be lowered to increase its stability. In another instance, when detection system 103 detects a raised road surface ahead, processor 103 causes the height of the vehicle to be increased to clear the elevation, thus avoiding scraping the bottom of the vehicle.

Navigation system 329 in FIG. 3 provides onboard and/or on-line navigation capability. In a well-known manner, system 329 receives signals from a constellation of satellites which is part of the global positioning system (GPS). In response to these signals, system 329 pinpoints the automobile's location in latitude and longitude. In addition, system 329 receives the vehicle directional and speed information from a compass subsystem (not shown) and an accelerometer (not shown), respectively.

Specifically, the user depresses NAVIGATE key 211c to request instructions for a given destination from navigation system 329. When the depression of key 211c is detected by processor 103, the user is elicited for information concerning the destination, any intermediate stops, etc. Such elicitation is realized by posing questions on display 205 and/or by uttering those questions using a synthesized voice through an audio output. The user then provides verbal responses thereto through an audio input. Relying on standard speech recognition circuitry in system 100, navigation system 329 recognizes and registers the responses. Using stored map information, system 329 then provides on display 205 a suggested route leading to the destination. Furthermore, based on the knowledge of the vehicle's instantaneous speeds and directions, system 329 is capable of verbally and visually directing the user to the destination. Because of the limited capacity of the storage for the map information or because the map information needs to be

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updated from time to time, it will be appreciated that system 329 would instead obtain the necessary, latest map information from an on-line service through a cellular or wireless connection.

In addition to directing the user to a given destination, system 329 through processor 103 cooperates with weather system 332 and traffic system 336 to be described. In accordance with an aspect of the invention, systems 332 and 336 jointly provides on display 205 updates regarding traffic congestion, weather conditions, hazards, highway warnings along the route suggested by system 329.

FIG. 6 illustrates one such navigation screen on display 205. On this screen, indicator 450 marks the current position of the vehicle. The suggested route (shown in boldface) by navigation system 329 is numerically denoted 453. Traffic indicator 455 is provided by system 336 to indicate where traffic congestion is on route 453. Similarly, weather indicators 457, 459 and 461 are provided by system 332 to indicate the cloudy, rainy and foggy conditions, respectively, at different points along route 453. It will be appreciated that these traffic and weather indicators may be colored and/or flashing to attract the user's attention.

Weather system 332 derives weather conditions from computer files obtained from an on-line service through a cellular or wireless connection. In an alternative embodiment, system 332 may include such well-known avionics as weather radar and lightning strike finders to detect weather conditions. By depressing WEATHER key 211d, the user is provided on display 205 with a map centered at a reference point indicative of the vehicle location. As to be described, system 100 runs a windows based operating system. With such an operating system, the user may operate indicator device 227 or 229 to point and click at a selected point on the map, and drag same to create a window surrounding a desired location, which may or may not include the vehicle location. Processor 103 causes system 332 to retrieve the relevant computer weather files, and derives therefrom the weather information regarding the area defined by the window.

FIG. 7 illustrates one such window which is created on display 205 and which surrounds the Los Angeles area. In this instance, the vehicle location is numerically denoted 481. As shown in FIG. 7, temperatures (denoted 483 and 485 for example) are indicated in parts of the subject area corresponding thereto. In addition, among others, weather indicators 487, 489, 491, 493 and 495 respectively indicate the rainy, cloudy, sunny and foggy conditions and storm warnings in the corresponding parts of the area. Moreover, weather center 496 and surface observation center 497 are indicated. The user may point and click at the respective centers to obtain the corresponding reports on weather and surface observation of the local area. These reports are generated on display 205 in text and/or read to the user through the audio output of system 100.

By default, system 332 provides the current weather information on display 205. Otherwise if the user specifies a time, system 332 provides the user with a weather forecast if the specified time is in the future, and weather history if it is in the past. With such future, current and/or past, short and/or long range weather information, the user can effectively plan his/her trip, and avoid unfavorable weather conditions.

Using the weather information from system 332, processor 103 issues on display 205 travel advisories such as requesting the user to check tire pressures after a drastic temperature change. In addition, processor 103 may cause a

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release of heat to warm the car battery to boost its starting power in cold weather, cause additional venting of engine heat in hot weather, and ensure closing of windows and doors in inclement weather.

It will be appreciated that weather system 332 may also be capable of obtaining weather information from such systems as the United States satellite systems, Delta radar, local area radar, etc. In addition, system 332 may be capable of gathering further information including United States current surface maps, wind chill maps, jet stream maps, winter travel hazards, forecast highs/lows, tropical weather, surface wind maps, grain and farm weather maps, etc.

Traffic system 336 will now be described. Similar to weather system 332, system 336 is capable of obtaining computerized traffic information from an on-line service through a cellular or wireless connection. In an alternative embodiment, system 336 may include such well-known electronics as a line-of-sight radar, forward infrared radar, and/or Doppler radar, each with terrain following capabilities, to sense surrounding traffic conditions.

By depressing TRAFFIC key 211e, the user is similarly provided on display 205 with a map centered at a reference point indicative of the vehicle location. The user may then operate indicator device 227 or 229 to point and click at a selected point on the map, and drag same to create a window surrounding a desired location, which may or may not include the vehicle location. In response, processor 103 causes traffic system 336 to obtain the relevant traffic information regarding the area defined by the window. In accordance with another aspect of the invention, the traffic information may be overlaid on an existing window (e.g., a window previously created for obtaining weather information) by pressing TRAFFIC key 211e.

Referring again to FIG. 7, the illustrative weather window includes overlaid traffic information in this instance. For example, traffic indicator 498 indicates traffic congestion near "Anaheim" inside the window. In addition, by pointing and clicking at traffic center 499, the user may obtain a traffic report in text and/or voice concerning the local traffic. After learning the traffic situations in the area of interest, the user can effectively plan his/her route to avoid potential traffic congestion or hazards.

In addition, traffic system 211e is capable of storing and recalling traffic maps and sending same to third parties using a cellular or wireless connection.

The aforementioned detection subsystem 130 also helps provide an adaptive cruise control capability. Specifically, subsystem 130 measures the distance to the vehicle just ahead. With electronic transmission/throttle system 325 and brake subsystem 125, processor 103 adjusts the vehicle's speed to keep it moving with the traffic flow. If the vehicle ahead speeds up or slows down, subsystem 130 signals processor 103 to accordingly adjust the throttle or brakes to maintain a safe distance.

When SMART DRIVING key 211f is depressed, processor 103 causes a menu to be displayed on display 205. This menu includes selectable items such as automatic driving and automatic parking. If automatic driving is selected, upon detecting by detection subsystem 130 an automated highway, processor 103 graphically depicts on display 205 the highway segment. Illustratively, processor 103 causes the screen of FIG. 8 to be displayed.

In FIG. 8, indicators 503, 507, 509 and 511 demarcate the highway lane incorporating AHS technology which the subject vehicle (denoted 513) is in. In this instance, these indicators mark the locations of magnets buried in the AHS

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highway lane, which are detected by the magnetometer in subsystem 130. Steering subsystem 132 relies on the detection of the magnets which are separated in predetermined intervals on both sides of the lane to properly steer subject vehicle 513, thereby realizing automatic driving. In accordance with an aspect of the invention, processor 103 keeps track of the occurrences of the magnets in the AHS highway lane. If for any reason the magnets are missing or undetected for a predetermined number of intervals in a row, which may adversely affect the proper steering of the vehicle, processor 103 causes a warning to come on the display. If the user in response to such a warning redirects arrow 516 which is aligned with the AHS lane to point toward, say, the left lane, which is a non-AHS lane, processor 103 is interrupted to terminate the automatic driving. A textual message 517 immediately comes on to confirm the termination of the automatic driving. With such a confirmation, processor 103, among other things, causes turn signal subsystem 147 to be described to activate the left turn signal. The user may then manually steer the vehicle into the left lane.

In accordance with another aspect of the invention, the user may define comfort zone 528 surrounding subject vehicle 513, in which any of left vehicle/object 521, right vehicle/object 523, front vehicle/object 525, and rear vehicle/object 527 is not allowed. Comfort zone 528 may be realized by using indicator device 227 or 229 to point at indicators 529a, 529b, 529c and 529d individually, and dragging same away from subject vehicle 513. Alternatively, the user may select CLEARANCE options appearing in the respective boxes representing the vehicles/objects to define the comfort zone. The selection of one such option is followed by a prompt for the desired minimum distance from the corresponding vehicle/object, if any.

Processor 103 is programmed to control the steering, throttle and brakes of the vehicle in an attempt to keep any surrounding vehicles/objects outside comfort zone 528. If any such vehicle/object unavoidably comes within zone 528, processor 103 would issue on display 205 a warning of the zone violation, provided that COMFORT ZONE warning option 531 has been selected. A reference zone is defined by the vehicle manufacturer to be the minimal space surrounding the subject vehicle to avoid collisions with a good confidence, taking into account the instantaneous speed of the subject vehicle relative to the surrounding vehicles/objects. By design, comfort zone 520 cannot be made smaller than the reference zone. Selection of REFERENCE ZONE option 533 enables the user to set comfort zone 520 to be the same as the reference zone. In any event, no matter how large comfort zone 520 is, any vehicle/object coming within the reference zone automatically causes issuance of a collision alarm. In response to such an alarm, the user takes emergency measures to avoid any collision.

Subsystem 130 in this instance detects not only the vehicle/object ahead as in the adaptive cruise control case, but also any other surrounding vehicles/objects. Subsystem 130 periodically communicates to processor 103 data concerning the speeds and the coordinates of any surrounding vehicles/objects, relative to the subject vehicle, to realize the above comfort zone and reference zone protections. If the user selects SHOW TRAFFIC option 535, processor 103 causes display 205 to show the current positions of any actual surrounding vehicles/objects, relative to the subject vehicle. With such visual information, the user is fully aware of his/her driving environment, thus improving the user's safety especially in night driving.

As mentioned before, the user can also select automatic parking of the vehicle from the above menu invoked by

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depression of SMART DRIVING key 211f. If the automatic parking option is selected, after the vehicle comes to a complete stop, automatic parking routine 500 stored in memory 107 is invoked. When instructed by this routine, which is depicted in FIG. 9, processor 103 causes display 205 to show thereon the positions of the surrounding objects relative to the subject vehicle, as indicated at step 543.

At this point, the user may touch the screen of display 205 to define a parking space into which the vehicle is to be parked. In order to carry out parallel parking effectively, this parking space needs to be reasonably suitable for the vehicle to be maneuvered into. Processor 103 at step 547 computes the coordinates defining the selected parking space. Knowing the respective coordinates of the subject vehicle, the surrounding objects and the parking space, processor 103 at step 551 determines the instants at which and extents to which the vehicle is to be accelerated and decelerated in the cause of the parking, and at step 553 the instants at which and extents to which the steering wheel is to be turned and returned. At step 555, processor 103 causes a computer simulation to be performed using the speed and steering parameters just determined to verify that the automatic parking is feasible, without running into any surrounding objects. At that point, the user may depress ANIMATION key 219j to view on display 205 the simulation in which the subject vehicle moves into the user defined parking space in an animated fashion. At step 559 processor 103 determines whether the vehicle can be properly parked under the above conditions. If processor 103 determines that the automatic parking is unrealizable, processor 103 informs the user of same, as indicated at step 563. In response, the user needs to select another parking space or may attempt to park the vehicle manually.

Otherwise if processor 103 determines that the automatic parking is realizable, processor 103 sends an audio and video message to request the user to get off the vehicle before the automatic parking is engaged, as indicated at step 567. In the preferred embodiment, the user is provided with a transmitter (e.g., transmitter 700 to be described) for remotely signaling to processor 103 to carry out the actual parking after the user leaves the vehicle. When it is so signaled, processor 103 at step 571 coordinates the actions of electronic transmission/throttle system 325, brake subsystem 125 and steering subsystem 132 to realize the automatic parking according to the devised scheme. During the automatic parking, for any reason, the user may also use the aforementioned transmitter to signal processor 103 to abort the parking. In addition, processor 103 may cause a predetermined audible signal to be emitted to alert surrounding people while the vehicle is being parked.

In addition, the automatic parking may also be achievable by training the vehicle. For example, let's say the user often parks his/her vehicle in a particular garage. In that case, processor 103 may be set in a training mode in which as the user maneuvers and moves the vehicle from a predetermined location outside the garage to a designated parking space in the garage, processor 103 registers the coordinated operations by the user of the systems involved. Thus, with the training, each time when the vehicle is placed at the predetermined location and put in an automatic parking mode, processor 103 repeats the system operations, as registered, and accordingly parks the vehicle in the designated parking space.

Conversely, processor 103 can be programmed to perform the inverse function to the above automatic parking, i.e., to direct the vehicle out of a parking space.

When emergency key 211g is depressed, processor 103 causes emergency options to be displayed on display 205.

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These options may include police-type emergencies, medical emergencies, mechanical problems, panic measures, etc. For example, upon selection of the police-type emergencies option, the user may be queried whether he/she is a victim. If the user responds affirmatively, processor 103 immediately establishes a phone or modem connection with a police authority to automatically furnish such preliminary information as the identity of the user, description of the vehicle and emergency contacts, which are pre-recorded, along with the current location of the vehicle identified by navigation system 329. If possible, the user may also add, in the communication, the nature of the emergency and current statuses of the user and any passengers. By automatically communicating at least the preliminary information to the proper authority in case of an emergency, the user can be instantly reached and helped.

System 100 also includes a panic alarm, audiovisual recording facilities to audio- and video-tape potential crime scenes for later review when the user selects the panic measures option. In addition, system 100 may include broadcasting capabilities to disseminate alarm signals (e.g., a car fire alarm) via citizen's band (CB) for example.

Security system 343 in FIG. 3 works closely with access control subsystem 139 to afford controlled access to the vehicle's doors, windows, trunk, hood, accessories, system software, etc. In this illustrative embodiment, the holder of a master key to security system 343, who is mostly likely the vehicle owner, is able to assign security levels and/or access codes to other authorized users to implement the controlled access. This master key may be in the form of a special code initially provided by the vehicle manufacturer.

For example, using system 343, the master key holder assigns to each authorized user a respective personal identification number (PIN), along with a clearance level. When a person attempts to, say, adjust an accessory, which is pre-assigned with a selected security level, processor 103 elicits from the user his/her PIN through display 205 or a similar interface. In response, the person may enter a PIN by touching the appropriate keys on a displayed keypad. Upon receiving the PIN entry, processor 103 checks with system 343 whether the PIN is valid. Verification of the PIN ensures that the person is an authorized user. If the PIN is valid, processor 103 then compares the clearance level associated with the PIN with the security level of the accessory in question. Only when the clearance level is higher than the security level, would the authorized user be allowed to adjust the accessory.

The above security measures may also be used to arm and disarm anti-theft capabilities in the vehicle, which may be based on infrared, sonar or other similar surveillance technology. In addition, selected individual items in the vehicle are digitally encoded so that they would not be functional if someone removes and attempts to re-install them without proper codes.

Moreover, in this illustrative embodiment, security system 343 includes a receiver for receiving an RF signal containing security and personal preference data. Before gaining access to the subject vehicle, a user needs to furnish at least the security data for verification. If the security data is valid, processor 103 causes system 343 to unlock the doors and disarm the anti-theft capabilities of the vehicle. To that end, each authorized user is provided with an access card (analogous to a driver's permit) in the form of a standard integrated circuit (IC) card (also known as a "Smart Card"). FIG. 10 illustrates one such IC card, denoted 600. Security data including a user PIN and control information

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is stored in memory 603 in card 600. This security data may be encrypted in accordance with a well-known encryption algorithm such as an RSA or a digital encryption standard (DES) algorithm.

The aforementioned control information includes an access code indicative of the extent to which a user is allowed to control the vehicle functions and/or access its hardware and software. Depending on the access code, the user may be accorded full operating privilege, or one of the more restricted operating privileges respectively designed for family members, mechanics, police officers, etc.

In addition to the aforementioned security data, personal preference data may also be stored in memory 603. The personal preference data contains information regarding the user preferred settings of the doors, locks, windows, engine, performance profiles, climate control, audio system and other vehicle functions.

FIG. 11 illustrates transmitter 700 into which card 600 can be inserted. Specifically, transmitter 700 includes transmitter interface 703 for receiving card interface 607. Interfaces 703 and 607 are electrically compatible with each other, and may be in accordance with the PCMCIA interface standard. Before entering the subject vehicle, the user needs to couple interface 607 to interface 703. To gain entry to the vehicle, the user needs to depress a START button in operating portion 707 of the transmitter to initiate an RF signal directed to the receiver of system 343. It should be noted at this point that a PARK button is also provided in portion 707 for initiating automatic parking described before.

Upon detecting a depression of the START button, data processor 709 communicates with card processor 611 to have a copy of the above-described security data and personal preference data in memory 603 transferred to transmitter 700. Data processor 709 formats the received data pursuant to a predetermined protocol, and causes signal generator 711 to transmit the RF signal, whose waveform is modulated by the formatted data.

After the receiver of system 343 receives the transmitted signal, it recovers therefrom the security data and personal preference data. Processor 103 then performs a security check based on the received security data. If it determines that the user is not an authorized user, he/she would be denied access to the vehicle. Otherwise, processor 103 causes the driver door of the vehicle to be unlocked, and accords the proper operating privilege. In addition, processor 103 stores the received personal preference data in memory 107. Based on such received data, processor 103 effects the preferred vehicle settings to personalize the vehicle functions.

It will be appreciated that, instead of an IC memory, the aforementioned security and personal preference data may be stored in a magnetic medium such as a standard magnetic stripe, or in the form of a one-dimensional or two dimensional bar-code on a card. In the case where the bar-code is used, security system 343 may incorporate a conventional bar-code scanner for reading the encoded data. In addition, the stored data need not be transmitted via an RF medium. It may well be transmitted via a laser, infrared or any other medium, or through a telephone network, a private network, a cellular network, the Internet or any other network, as long as the vehicle is equipped with the appropriate data receiver.

Depression of LIGHTS key 211i in FIG. 2 invokes on display 205 displayed options including, for example, all lights on/off, running lights on/off and flashers on/off. For each option, the user may further select the light operation durations, and set weather, hazardous, ambient light conditions under which the light would be automatically turned on.

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Depression of WARNINGS key 211j prompts processor 103 to display on display 205 predetermined advisories and cautions on operating the vehicle, such as the advisory "adjusting seat while driving could result in loss of vehicle control."

Upon a start-up of system 100, periodically or when each system therein for a self-test result. The system, when polled, performs an active self-test and reports the test results to diagnostic system 349. The latter analyzes the Processor 103 causes display 205 to display a clear status for those systems having no identifiable problem, and to graphically indicate the locations of identified irregularities for the other systems, along with messages describing the irregularities. Some irregularities may cause processor 103 to restrict certain vehicle operations until a corrective action therefor is taken.

The exception data received by processor 103 is stored in memory 107. Alternatively, they may be stored in a secure storage such as a "black box" which would survive an accident involving the subject vehicle. In the event of an accident, the exception data would be retrievable for determination of any mechanical cause for the accident.

Key 211i is currently unused. However, in accordance with an aspect of the invention, key 211i can be programmed to replace any function key in system 100 and its associated function. For that matter, as a provision for the user preferences, system 100 allows the user to re-program or re-designate each function key in system 100 to realize his/her preferred key arrangement. The re-designation is effected by the user's stepping through a menu-driven program, and registered by processor 103 as one of that user's preferences.

Depression of DEMO key 211m allows the user to access a self-guided demonstration provided by demonstration system 353. When the vehicle is in a showroom before its sale, the demonstration comprises a multimedia presentation on display 205, providing sales-type information including information on each feature and aspect of the vehicle, and functions afforded by master control interface 117. After the sale of the vehicle, the demonstration may include pre-recorded video programs for showing on display 205 operations of interface 117 to implement such functions as smart driving, obtaining weather and traffic information, etc. Thus, with this demonstration capability, a user who is not familiar with the subject vehicle can instantly learn to manage the various vehicle functions.

In accordance with another aspect of the invention, demonstration system 353 may be put in a rehearsal mode in which a prospective vehicle user can be trained and tested for his/her dexterity and familiarity with the vehicle functions. In such a rehearsal mode, traffic situations and vehicle conditions are simulated on display 205. At the same time, the prospective user is required to operate master control interface 117 to properly handle each given scenario. Only after satisfying the operating requirements, may the prospective user be granted the aforementioned access card (or "driver's permit") according to the appropriate operating privilege.

Depression of RESET key 211n allows the user to reset/restart selected systems in system 100 for reasons of malfunction or nonperformance. The reset is accomplished by reset system 357, and can also be selected by depressing

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MENU key 219c or INDEX key 219g to be described. When a system is reset, power to the system is temporarily cut off. After regaining power, the reset system runs a restarting routine, and either resumes normal operation or identifies any problems to processor 103. In the latter case, processor 103 posts necessary messages to alert the user of the reported problems.

Operating keys 215 relate to the functions provided by operation control subsystem 136. With SHIFT key 215a, each other key on interface 117 corresponds to two functions depending on whether the key is depressed together with SHIFT 215a.

Depression of ENTER key 215b allows the user to initiate an action. If no action is required, depression of key 215b causes generation of a warning tone.

Depression of ZOOM(+) key 215c allows the user to obtain information not presently displayed, thereby providing other related subjects such as owner's manual material, tips, warnings, cautions, etc.

Depression of ZOOM AWAY(-) 215d effects the inverse function to depression of key 215c. That is, it allows the user to leave a related subject to continue with the original subject.

Depression of SET-UP key 215e allows the user to set parameters in system 100, which affect the functions of master control interface 117, selected aspects of the vehicle, priority of menu selections, access by other users to the hardware and software of the vehicle, etc. To facilitate setting of new parameters, after key 215e is depressed, operation control subsystem 136 causes display 205 to show thereon information about installed features, accessories, options, original equipment, dealer installed equipment, after market installations/removals, etc. In addition, information about the vehicle's capabilities, safety features, legal requirements, equipment installers, repair facilities, maintenance records, software revisions and updates, etc., which is stored in subsystem 136, may be accessed and reviewed using the set-up function as well.

In this illustrative embodiment, a windows based operating system of the type of the MICROSOFT WINDOWS copy of the operating system software is stored in memory 107. Utilizing such an operating system, processor 103 can be programmed to control display 205 to provide organized data presentation through one or more windows.

By depressing SPLIT SCREEN key 215f, followed by clicking and dragging indicator device 227 or 229, multiple windows can be created on display 205. Advantageously, with multiple windows, certain actions can be effectively coordinated and cross-checked. For example, a vehicle function may be monitored in a first window while it is modified via menu selection in a second window. As a result, the modification can be immediately observed in the first window. Thus, with multiple windows, various menus and vehicle functions can be simultaneously accessed and monitored.

FIG. 12 illustrates multiple windows numerically denoted 801, 803 and 805, respectively, created on display 205 using the SPLIT SCREEN capability. As shown in FIG. 12, the user may utilize window 753 to realize the navigation function provided by navigation system 329. At the same time, windows 755 and 757 respectively provide first and second menus for the user's selection.

Depression of RELEASE key 215g at a particular screen effects the "enter" function, followed by an immediate return to a predetermined screen such as the main menu or "home"

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screen. Thus, unlike key 215d, depression of key 215g does not provide an incremental return to a previous screen, but an instant return to the home screen.

BRIGHTNESS key 215h comprises a standard variable resistor such that when it is pushed one way (the other way), the intensity of display 205 is increased (decreased). Utilizing the proper intensity, the user can readily view display 205 under different ambient light conditions (e.g., night time, excess glare, bright sun, etc.).

Access keys 232 relate to functions provided by access control subsystem 139 in FIG. 1. Depression of WINDOWS key 232a invokes the screen of FIG. 13 on display 205. As shown in FIG. 13, triangles 810, 812, 814 and 816 correspond to the driver side front window, driver side rear window, passenger side front window and passenger side rear window, respectively. Indicators 821, 823, 825 and 827 on the hypotenuses of the respective triangles indicate the extents to which the corresponding windows are open. The user may touch the indicator on the screen to raise (or lower) it along the hypotenuse. In response, processor 103 causes access control subsystem 139 to close (or open) the window accordingly. Alternatively, the user may operate indicator device 227 or 229 to point at one of the indicators and drag same along the hypotenuse to control the corresponding window opening.

In addition, a SMART WINDOWS function on sub-screen 840 may be selected by touching ON option 842 on the screen or pointing and clicking at same. With the SMART WINDOWS function selected, for example, subsystem 139 causes the windows to be completely closed upon a shut-off of the engine or an activation of air conditioning. When coupled with a SMART CLIMATE function to be described, the SMART WINDOWS function includes slightly opening selected windows to vent out excess heat prior to the user's arrival, thereby pre-conditioning the vehicle. In addition, when an AUTO function on sub-screen 840 is selected, the user can specify the vehicle speed at which the driver side front window is made completely open or closed. By touching on the screen, or pointing and clicking at blank 845 or blank 850, choices of speed are listed beneath the blank. For example, by selecting a zero speed for blank 845 ahead of a toll plaza, the window in question would be completely opened when the vehicle stops at a toll booth, thereby conveniently allowing the user to pay tolls.

The screen of FIG. 13 may also be invoked by depressing DOORS key 232b. Flaps 851, 853, 855 and 857 in FIG. 13 correspond to the driver side front door, driver side rear door, passenger side front door and passenger side rear door, respectively. By touching one of the flaps on the screen with a finger or pointing and clicking at the flap with indicator 227 or 229, subsystem 139 including a door actuator controllably closes the corresponding door if it is previously open, and vice versa.

Subsystem 139 also includes door sensors to detect any obstacle in the way of closing or opening each door. Upon detection of any such obstacle, subsystem 139 immediately suspends the door movement until the obstacle is removed. In this instance, both the front doors are not fully open because of detected obstacles. This fact is indicated by lines 871 and 873 marking the extents to which the respective doors are open and closed. On the other hand, both the rear doors in this instance are fully open as the corresponding lines 875 and 877 have moved all the way toward the center.

It should be apparent by now that the above door control may also be effectuated by voice command. For that matter,

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the locking of the individual doors after they are closed, or activation of the child lock system may also be realized by voice command.

Depression of MIRRORS key 232c again invokes the screen of FIG. 13. Indicators 891, 893 and 895 correspond to the left rear-view mirror, center rear-view mirror and right rear-view mirror, respectively. The user may operate indicator device 227 or 229 to point at one of the indicators and drag same (or utilize the touch-screen capability) to left or right to tilt the corresponding mirror toward left or right accordingly.

Subsystem 139 also includes mirror heaters, sensors and actuators. Based on the above personal preference data, subsystem 139 causes the mirror heaters to defrost the mirrors under certain specified temperature and weather conditions. Upon the sensors' detecting a tight parking space for example, subsystem 139 causes the actuators to fold back one or both external mirrors to avoid damages. In addition, processor 103 coordinates the action of electronic transmission/throttle system 325 with that of the mirror actuators such that when the gear is put in reverse, the actuators automatically adjust the mirrors to provide a good rear view while the vehicle is backing up.

It will be appreciated that subsystem 139 may also incorporate mirror enhancement techniques for self-dimming the mirrors or adjusting their clarity, density, opacity, reflectivity, color, zooming, etc. based on specified light conditions.

It should be noted at this point that as long as the screen of FIG. 13 is showing on display 205, the user can conveniently adjust the windows, doors and/or mirrors at the same time, without the need of depressing the corresponding access keys to invoke the screen repeatedly.

Depression of WIPERS key 232d invokes the screen of FIG. 14. Subsystem 139 further comprises wipers, wiper actuators and a windshield debris detection system. The latter includes sensors which are attached to the windshield of the vehicle to determine the intensity of a vibration of the windshield. They also determine the frequency of the vibration whose intensity is above a predetermined threshold. This threshold accounts for the intensity of the normal windshield vibration of a moving vehicle. When SMART WIPE option 903 on the screen of FIG. 14 is selected, processor 103 causes the wiper actuators to operate the wipers in response to a vibration of above-normal intensity caused by rain, snow, insects, hail, and such falling on the windshield. The detection of such a vibration is communicated by the windshield debris detection system to processor 103, along with the information concerning the frequency of the vibration. Accordingly, processor 103 varies the rate of windshield sweeping with the communicated frequency. Thus, for example, in the SMART WIPE mode, the windshield wiping rate is adjusted lower when the vehicle stops in the rain, versus the vehicle running against the rain (i.e., rain drops falling on the windshield at a higher frequency).

Other wiper controls are also available on the screen of FIG. 14. For example, selection of SINGLE WIPE option 907 causes the wipers to sweep once across the windshield. Selection of CLEAN WINDOW option 909 causes spraying of cleaning liquid onto the windshield, followed a predetermined number of wipes. In addition, the speed of the wipers can be specified by selecting SECONDS option 911. After option 911 is selected, the user can point and click at blank 913 to select one of the displayed numbers, thereby specifying the wiper speed in terms of once so many seconds. Thus, option 911 is convenient for the user to implement

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intermittent wiping. To specify the speed of continuous wiping, the user may select SPEED option 915. After such an option is selected, the user can point and click at blank 913 to select one of the displayed speed levels ranging from slow to fast.

Depression of TRUNK STORAGE key 232e provides controlled access to the trunk/storage of the subject vehicle. In addition, it allows the user to program climate control system 1105 to be described to controllably cool or heat the trunk/storage to properly preserve the cargo. Moreover, it enables the user to instruct processor 103 to open (close) the trunk/storage upon a shut-off (start-up) of the engine.

Depression of UNDER HOOD key 232f releases the hood of the subject vehicle. Through processor 103, various systems may communicate to the hood mechanism controlling the release of the hood. For example, when certain fluid levels are detected low or components under the hood need repair or replacement, upon the user's agreeing to take a certain remedial action, processor 103 causes the hood mechanism to release the hood in anticipation of such an action. In addition, each time when the engine is started and the vehicle is ready to move, processor 103 checks with the hood mechanism to ensure that the hood has not be accidentally released.

Depression of USER'S VIEW key 292g invokes the screen of FIG. 15. However, this screen is the default screen or "home" screen on display 205. That is, it automatically comes on after the vehicle is started, even without depression of key 292g. In accordance with the invention, the screen of FIG. 15 allows the user to control and manage certain basic vehicle functions based on an intuitive approach, without the need of depressing any keys. To that end, subscreen 950 is used to graphically depict the user's view of the vehicle. By way of example, displayed items 953 through 959 in subscreen 950 depict the vents, windshield wipers, instrument panel, audio system, rear-view mirror, seats and windows/doors in the vehicle, respectively. It should be pointed out that the relative positions of these displayed items correspond to those of the depicted components in the actual vehicle. Knowing the relative positions of the components in the vehicle, the user can easily identify and point and click at selected items to efficiently control the corresponding components, and/or access information concerning them.

Specifically, when one of items 953 depicting a vent is selected, processor 103 causes the screen of FIG. 16 (described below) to be displayed for the user to adjust the air condition. When one of items 954 depicting a windshield wiper is selected, processor 103 causes the screen of FIG. 14 (described before) to be displayed for the user to adjust the wiper function. When item 955 depicting the instrument panel is selected, processor 103 causes the readings of the speedometer, tachometer, odometer and engine coolant temperature to be displayed. When item 956 depicting the audio system is selected, processor 103 causes the screen of FIG. 18 (described below) to be displayed for the user to adjust the audio system. When item 957 depicting the rear-view mirror is selected, processor 103 causes the screen of FIG. 13 (described before) to be displayed for the user to adjust the rear-view mirror and other mirrors. When one of items 958 depicting a seat is selected, processor 103 causes the screen of FIG. 16 to be displayed for the user to adjust the seat. Finally, when one of items 959 depicting a window/door is selected, processor 103 causes the screen of FIG. 13 to be displayed for the user to control the window/door. In addition, menu 961 including vehicle components which are not depicted is provided in the screen of FIG. 15 for the

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user's selection. Any selected component from the menu is highlighted to indicate its selection.

Accessory keys 219 relate to the functions provided by accessory control subsystem 143. Depression of SEATS key 219a invokes the screen of FIG. 16. By pointing and clicking at DRIVER selection 1005, processor 103 causes display 205 to show the current configuration of the driver seat, denoted 1007. Similarly, by pointing and clicking at one of displayed numerals "2" through "4" next to the word "PASSENGER," processor 103 causes display 205 to show the current configuration of the corresponding passenger seat.

The default configurations of the seats are defined by the personal preference data initially provided by the user. Thus, upon a start-up of system 100, processor 103 effects the default configurations. However, by pointing at indicators 1013 and 1015 and dragging same using indicator device 217 or 219 (or using the touch-screen capability), the user may accordingly adjust the height of the cushion and the incline of the back support of the seat, respectively. Nevertheless, for safety reasons not all configurations of the driver seat are allowed. The arm rest, if any, can be similarly adjusted. The lumbar support and massage capabilities and seat temperature can be selected as well. All of the above seat adjustments may be saved in memory 107.

As shown in FIG. 17, subsystem 143 includes climate control system 1105 for effecting the climate control of the vehicle. System 1105 may utilize additional power resources such as solar or reserved batteries to provide the necessary cooling/heating. Climate control system 1105 includes capabilities of providing air-conditioning/heating local to the driver and passengers, and also to the overall interior and trunk/storage space. System 1105 also manages air flows in the vehicle, and cooperates with access control subsystem 139 to achieve window controls. In addition, system 1105 includes air sensors to detect presence of contaminated and stale air. When such air is detected, system 1105 automatically vents it out before its spreading. Furthermore, processor 103 communicates to the user, through display 205, alarms regarding presence of any hazardous gas or fume in the air, and to what extent it is consumed by the user. System 1105 may also include onboard filtration devices to purify contaminated air.

Depression of CLIMATE key 219b also invokes the screen of FIG. 16. Vent indicators 1021, 1023, 1025, 1027, 1029 and 1031 indicate the locations of respective vents in relation to the seats inside the vehicle, denoted 1020. By pointing and clicking at one of the vent indicators, the user may select the air temperature, and certain fan movement of the corresponding vent.

The individual vent settings are stored in memory 107. Thus upon a start-up of the vehicle, processor 103 receives and analyzes signals from various thermo-sensors in the vehicle. Based on such an analysis, processor 103 adjusts the temperatures and air movement of each vent according to the preferred settings.

Depression of MENU key 219c provides various menus on display 205 for selection. Such menus enable the user to access other features and capabilities of the vehicle which are not accessible by depressing any other keys on interface 117. This stems from the physical limit as to the number of keys used, without overwhelming the user. Thus, any items which are not shown may be accessed by a selection of an appropriate menu and/or further selections within the menu using the hot spot touch-screen capability, ENTER key 215b, or indicator device 227 or 229.

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In addition, user preference selections may be presented by icon selection bars, hot keys, or function keys, or may be realized using a set-up screen. Moreover, where further information related to a displayed option or item would be helpful, an icon or similar graphical means identified as tips, warnings, etc. for accessing such information is provided.

Depression of QUICK TIPS key 219d enables the user to obtain answers to frequently asked questions (FAQs) and multimedia (i.e., audio, text and video) information regarding different features (e.g., safety features) of the vehicle, and various systems and subsystems embodied therein. A similar QUICK TIPS arrangement is described in copending, commonly assigned U.S. patent application Ser. No. 08/789,934 ("the '934 application"), entitled "Multimedia Information and Control System for Automobiles," which is hereby incorporated by reference as if fully set forth herein.

In this illustrative embodiment, the QUICK TIPS text is written in well-known hypertext markup language (HTML), and provides hyperlinks to owner's manual information, pictures, videos, captions, tips and warnings relating to the subject being reviewed. In addition, VOICE key 219e to be described may be selected to have the text read to the user, along with its display. Moreover, the QUICK TIPS feature may be indicated on display screens in the form of a selectable icon or option. By selecting such an option, the user is provided with further information on the items appearing on the screen.

It should be noted at this point that the audio medium is an important medium for presenting information to the user especially when he/she is driving and needs to keep his/her eyes on the road. As such, VOICE key 219e is provided to afford an option for voice presentation of instructions, displayed options, and description of various systems and features of the vehicle.

It should also be noted that it is advantageous to have a sound library stored in memory 107, from which the user is able to select favorable tones and sound clips to enhance the user's comprehension while he/she is driving. For example, when a displayed option is touched by the user on screen 205, a pre-selected tone is generated through the audio output, indicating that the option has been selected. Relying on the audio tone confirmation, as opposed to a visual confirmation, the user while driving can continually watch the road.

Depression of VISUAL key 219f provides different system views, and visual information including warnings, cautions, hazards, advisories, etc. It also provides a selection of display systems such as head-up display, projection, three-dimensional display, holographic and virtual reality systems which may be provided in the vehicle in combination with or in lieu of display system 205.

When coupled with SHIFT key 215a, depression of visual key 219f however activates video system 1107, which enables the user to play on display 205 selected videos from a video library (e.g., a compact disk (CD) jukebox) connected to system 100, to receive TV programs, to record and playback of pictures and video clips from such sources as video and digital cameras, and to run video files on weather and traffic downloaded from an external information source such as the Internet.

In this illustrative embodiment, the user is provided with an alternative way of looking up information about the vehicle, which is arranged by topics in alphabetical order. Depression of INDEX key 219g enables the user to enter a keyword relating to the subject of inquiry. Such a keyword

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may be entered by pointing and clicking at the appropriate letter keys on a displayed keyboard. After matching the keyword entry with one of the available topics, processor 103 causes the information concerning the topic to be presented in audio, video and/or text. A similar INDEX arrangement is also described in the '934 application.

Depression of LIGHTS key 219h enables the user to program the intensity of individual interior lights depending on the ambient light condition, and the usage thereof such as the duration of the respective on-times. The preferred light settings are stored in memory 107.

Depression of AUDIO SYSTEM key 219i invokes the screen of FIG. 18 on display 205. In this instance, audio portion 1205 for controlling audio system 1109 shares the same screen with radio portion 1207 for controlling radio receiver 1111. With audio system 1109, the user is able to distribute selected audio signals to driver and passenger locations. These signals are communicated, through processor 103, to such subsystems as headsets, earphones, directional speakers, etc.

As shown in FIG. 18, portion 1205 enables the user to set for each driver and passenger sound preferences. With the word "DRIVER" clicked on and highlighted, the user may use indicator device 227 or 229 to point at indicator 1245 and move same to adjust the volume of the audio output, indicator 1247 to adjust the bass level, and indicator 1249 to adjust the treble level. In addition, the user may relocate speakers with respect to the user location to obtain the optimum sound effects. For example, each speaker is placed on a track and can be driven by an actuator along the track to reposition it. The relocation of the speakers can be achieved by pointing at indicators 1251, 1253, 1255 and 1257 corresponding to the respective speakers, and dragging same to the desired individual locations using indicator device 227 or 229. Accordingly, processor 103 causes the actuators to physically move the speakers along the respective tracks to realize the desired arrangement. Portion 1205 also provides other options such as fader control, graphic presentation of sound events, and saving of the preferred audio settings.

Portion 1207 shows a listing of radio stations for selection. In accordance with an aspect of the invention, the frequencies of the selected stations are stored based on geographic locations such as Los Angeles, Santa Ana and Irvine. As is well known, the geographic coverage of each station is limited. As a user travels beyond the coverage, the broadcast from that station becomes too weak to receive. As such, processor 103 continually causes a frequency scanner to update the listed stations which are within the receiving range. The user may save a subset of the listed stations as his/her favorite stations according to the current vehicle location.

Advantageously, by saving certain favorite stations according to the locations which the user visits often, when the user travels from one such location to another, he/she can instantly change the listing to contain the corresponding favorite stations. As a result, the otherwise, cumbersome programming of the stations back and forth between the locations is obviated.

In the preferred embodiment, the favorite radio station frequencies are actually stored according to the GPS coordinates of the locations shown on portion 1207. Navigation system 329 periodically communicates the GPS coordinates of the current vehicle location to processor 103. The latter compares the communicated GPS coordinates with those of the locations in question. As soon as processor 103 deter-

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mines that one such location is close to the current vehicle location within a predetermined range, processor 103 causes the listing of favorite stations associated with the new location to come on for selection.

In accordance with another aspect of the invention, for the user's convenience, the radio stations are categorized, and listed according to selected music types such as "country", "rock" and "classic", and selected program contents such as "talk/news". To that end, in each radio broadcast, the station transmits auxiliary data concerning its identity, e.g., an icon, signage and/or call number representing the station, and the type of program it airs, e.g., the type of music. In FM stereo broadcast for instance, the auxiliary data may be transmitted using subcarriers within a subsidiary communications authorization (SCA) band which lies above the 53 kHz portion of the station bandwidth allocated to the transmission of conventional stereo audio signals. A variety of prior art techniques may be used to modulate these subcarriers to transmit the auxiliary data. In addition, in accordance with the technique disclosed in U.S. Pat. No. 5,408,686 issued Apr. 18, 1995 to Mankovitz, the stereo audio portion of the station broadcast band, rather than the SCA band, may also be used for transmission of such auxiliary data.

The auxiliary data transmitted by each station is received by radio receiver 1111 in the form of a digital message signal. By decoding such a message signal, receiver 1111 recovers the aforementioned information concerning the station identity and the program type. Processor 103 screens the stations for the program types pre-selected by the user. The desired stations are then shown on display 205 according to the pre-selected program types. Illustratively, the stations are represented by the respective icons or signage, and frequencies. The user may point and click at (or touch on the screen) one of the icons representing the station which he/she wants to listen.

In this instance, the user has selected and is listening to one of the stations denoted 1271, whose icon is highlighted in a first color. In accordance with another aspect of the invention, the previously selected stations, such as stations 1273, 1275 and 1277 are highlighted in a second color. Advantageously, with the color highlighting, the user can readily back-track the previously selected stations and settle on one of them, or explore new, unheard stations.

It should be noted that from the screen of FIG. 18, the user may also access other entertainment systems such as cassette, CD, VCR and TV systems, and the weather band and other functions.

It should also be noted that the above selection of the displayed stations may be accomplished by voice command or depressing preset buttons. In addition, with the proper authorization, more than one user can save his/her preferred listing of stations, along with special notes about each station. In that case, when one wants to change the current listing of stations, he/she needs to enter a PIN before his/her preferred listing can be invoked. Moreover, the authorized user may also be privy to other users' preferred listings, and allowed to choose therefrom.

Depression of ANIMATION key 219j enables the user to view on display 205 animations relating to selected vehicle functions (e.g., automatic parking) which are being or to be performed. These animations are instructional, and help the user implement the functions in question and/or understand the effects thereof.

Like key 2111 previously described, key 219k is reserved for future use in this instance.

Depression of ONLINE key 219l enables the user to access on-line systems through such communication links as

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telephone, wireless, cellular, satellite, radio spectrum, infrared and sonar connections. For example, while the vehicle is being operated, the user may choose to access the vehicle manufacturer's computer to run extensive diagnostic tests on the vehicle on-line. To that end, processor 103 establishes a communication link with the manufacturer computer. After an initial handshake between processor 103 and the manufacturer computer, the latter runs diagnostic routines on the vehicle systems through processor 103, and elicits from processor 103 information such as relevant operational parameters. Test results are generated by the manufacturer computer and transmitted to processor 103 for display. In addition, the manufacturer computer can correct or adjust any operational parameter values during the tests to improve the vehicle's performance. Similarly, any software upgrade or downloading for the vehicle systems can be realized through the on-line connection. Notices of recalls can also be transmitted to processor 103 for the user's information.

Depression of PHONE/MODEM key 219m allows the user to obtain mobile phone, facsimile modem and data modem connections through cellular and wireless networks.

Depression of PLANNERS/CALENDAR key 219n invokes reminder routines for informing the user of past and upcoming events. For example, certain maintenance reminders may be communicated by the aforementioned manufacturer computer to processor 103 through an on-line connection. Instructed by one of the reminder routines, processor 103 accesses systems such as navigation system 329 to identify the closest mechanic when the scheduled maintenance is due.

Referring back to FIG. 1, turn signal subsystem 147 in accordance with the invention not only provides the traditional function of activating turn signals in response to the user's initiation, but also causes furnishing of intelligence information on an impending turn. Once processor 103 is interrupted by subsystem 147 and notified of the impending turn into a particular direction, processor 103 causes detection subsystem 130 to sense any obstacles or moving objects in the street into which the vehicle is turning. Processor 103 then causes display 205 to display such obstacles and moving objects which may be hidden from the user's view, along with verbal and visual warnings of any foreseeable hazards. Thus, with such an assisted turning feature, the risk of an accident occurring during a turn is substantially reduced. Furthermore, in automatic driving, processor 103 orchestrates the actions of steering subsystem 132, brake subsystem 125 and electronic transmission/throttle system 325 to make a calculated move around an obstacle, or simply stops the vehicle at the turn to avoid any collision.

Speedometer subsystem 149 includes an accelerometer for evaluating the instantaneous speed of the vehicle. The speed information is communicated by subsystem 149 to processor 103 for use in navigation, automatic driving, automatic parking, etc. The speed information may also be stored with time and GPS information, and recorded in memory 107 or the aforementioned "black box". The memory content may be remotely accessed by a police authority, via a dial-up connection, to determine any speed violation, along with the associated time, and geographic location based on the GPS information.

Safety subsystem 151 includes restraint devices and air-bags. In accordance with yet another aspect of the invention, subsystem 151 keeps track of the air-bag deployment and expiration dates. Advance air-bag expiration and recharge notifications are transmitted to processor 103. Also transmitted to processor 103 are data collected by subsystem 151

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23 concerning usage of safety devices, tire and brake wear, etc., and data on intervals of maintenance performed on and long term durability of those components. All such safety information received by processor 103 can be accessed and displayed at the user's request. In addition, tips and support for the user's safety in response to certain vehicle malfunctions, failures or eminent dangers are issued by safety subsystem 151 via display 205.

Through processor 103, subsystem 151 cooperates with other systems in system 100 in certain events. For example, in an accident, as soon as subsystem 151 informs processor 103 of a deployment of an air-bag, processor 103 signals engine control system 319 to halt the engine activity, brake subsystem 125 to apply emergency braking, and suspension subsystem 129 to stabilize the vehicle. Processor 103 may further request from navigation system 329 GPS coordinates identifying the accident scene, and cause the audiovisual recording facilities in the vehicle to audio- and video-tape the accident scene, and emergency data to be transmitted to the authority to obtain help as described before.

Clock subsystem 154 provides time and date information. Relying on such information, processor 103 duly synchronizes system activities and keeps track of events. For example, utilizing the temporal information, processor 103 issues the above-described reminders and notifications in a timely manner. Similarly, the abovedescribed planner functions such as scheduling maintenance are made possible with such information.

Suspension subsystem 129 provides, as mentioned before, wheel and stability control during the vehicle operation. In addition, subsystem 129 includes sensors for evaluating the current road condition, and adjusts the ride and comfort using yaw controls and dampers in response to the evaluated condition. It also provides processor 103 with continuous updates about the road condition. Utilizing such updates, processor 103 coordinates the actions of other systems such as steering and brake subsystems to handle the road in a manner prescribed by the user.

Wheel subsystem 157 includes sensors for reading tire pressures, detection of loss of tire traction or tread, etc. Relevant information is communicated by subsystem 157 to processor 103 to issue necessary alarms including abnormally low tire pressures. Processor 103 also incorporates the received information in a concerted effort to achieve ride stability and smoothness.

Application module 161 which may be located close to master control interface 117 includes a standard interface such as an RS232 serial interface. Through this interface, the user or service personnel may use a conventional computer to update system programs and personal preference data stored in memory 107, or run diagnostic routines thereon to identify any system problems.

In an alternative embodiment, the standard interface in module 161, similar to interface 703, accepts IC card 600 previously described. In addition to the aforementioned security data and personal preference data, space is allocated in card memory 603 for storing system programs, diagnostic routines and header information. Such header information includes instructions for processing of certain contents of memory 603.

Utilizing a conventional IC card writer connected to a standard computer which may be remote from the vehicle, the user or authorized service personnel can revise the security data and personal preference data in memory 603, and load new programs, program upgrades and/or diagnostic routines onto the IC card. It should be noted that any change

in the card memory content requires an initial entry of the aforementioned master key, or other authorized keys allowing limited access. The IC card may be inserted into the standard interface of application module 161 when system 100 is powered down. On power up, after system 100 is initialized, processor 103 checks the security data in memory 603. Upon verification of the security data, processor 103 reads the header information in memory 603, and accordingly causes a transfer of any new system programs from memory 603 to memory 107 and any upgrade to the existing programs. In addition, in the presence of any diagnostic routines in memory 603, processor 103 then reads routines directly off the IC card. Processor 103 then reads the personal preference data in memory 603 to effect the preferred settings of the vehicle functions.

The foregoing merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise numerous other systems which embody the principles of the invention and are thus within its spirit and scope.

For example, in the disclosed embodiment, control and management system 100 is illustratively used in an automobile. It will be appreciated that a person skilled in the art may also employ the inventive system in another type of vehicle such as a boat, an airplane, etc.

Finally, although control and management system 100, as disclosed, is embodied in the form of various discrete functional blocks, the system could equally well be embodied in an arrangement in which the functions of any one or more of those blocks or indeed, all of the functions thereof, are realized, for example, by one or more appropriately programmed processors or devices.

What is claimed is:

1. A system for use in a vehicle including an engine compartment, the engine compartment having a plurality of components therein, the system comprising:
 - a display for displaying a plurality of items and a plurality of information objects, the plurality of items each representing a respective one of the components in the engine compartment, the displayed items being arranged on the display in substantially the same relation to one another as the components represented thereby in the engine compartment, each component corresponding to one or more of the information objects;
 - an interface for selecting at least one of the items; and
 - a processor for activating the one or more of the information objects corresponding to the component represented by the selected item to provide information concerning the component.
2. The system of claim 1 wherein said vehicle comprises an automobile.
3. The system of claim 1 wherein said display comprises a liquid crystal display (LCD).
4. The system of claim 1 wherein said interface includes an indicator device for selecting the at least one of the items.
5. The system of claim 4 wherein said indicator device comprises a mouse device.
6. The system of claim 1 wherein said interface includes a touch-screen capability.
7. The system of claim 1 wherein said component includes a radiator.
8. The system of claim 7 wherein said information includes a reading of temperature of coolant in the radiator.
9. The system of claim 7 wherein said information includes a reading of a level of coolant in the radiator.

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10. The system of claim 1 wherein said component includes an oil compartment.

11. The system of claim 10 wherein said information includes a reading of a temperature of oil in the oil compartment.

12. The system of claim 10 wherein said information includes a reading of a level of oil in the oil compartment.

13. A system for use in a vehicle to adjust a position of an item in the vehicle comprising:

a display for showing thereon an indicator associated with the item, the item being separate from the display;

a track;

an actuator for moving the item in the vehicle along the track; and

an interface for moving the indicator on the display to cause the actuator to move the item along the track to adjust the position of the item, an extent to which the position the item is adjusted being a function of an extent to which the indicator is moved.

14. The system of claim 13 wherein the item includes a window.

15. The system of claim 13 wherein the item includes a mirror.

16. The system of claim 13 wherein the item includes a door.

17. The system of claim 13 wherein the item includes a seat.

18. The system of claim 13 wherein the item includes an audio output.

19. The system of claim 13 wherein the interface includes a device for directing the indicator.

20. The system of claim 13 wherein the interface includes a touch-screen capability.

21. A system for use in a vehicle comprising:

a receiver for receiving signals from a plurality of sources, the plurality of sources providing a plurality of entertainment programs, respectively, the entertainment programs being classified in a plurality of categories based on contents of the entertainment programs, the receiver deriving, from the received signals, information identifying at least respective categories of entertainment programs provided by the sources; and

an interface for presenting indicators representing respective ones of the plurality of sources, each indicator being selectable to receive entertainment programs from the source represented by the indicator, the indicators being arranged according to the respective categories of entertainment programs provided by the sources represented thereby.

22. The system of claim 21 wherein each of the sources includes a radio station.

23. The system of claim 21 wherein the categories include types of music.

24. The system of claim 21 wherein the information derived from the received signals also identifies the sources.

25. The system of claim 21 wherein at least one of the indicators indicates a status concerning whether the at least one indicator has been selected.

26. The system of claim 25 wherein the status is indicated by a first color if the at least one indicator has been selected, and by a second color if the at least one indicator has not been selected.

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27. A method for use in a system in a vehicle including an engine compartment, the engine compartment having a plurality of components therein, the system including a display, the method comprising:

displaying a plurality of items and a plurality of information objects, the plurality of items each representing a respective one of the components in the engine compartment, the displayed items being arranged on the display in substantially the same relation to one another as the components represented thereby in the engine compartment, each component corresponding to one or more of the information objects;

selecting at least one of the items; and

activating the one or more of the information objects corresponding to the component represented by the selected item to provide information concerning the component.

28. The method of claim 27 wherein the component includes a radiator.

29. The method of claim 28 wherein the information includes a reading of temperature of coolant in the radiator.

30. The method of claim 28 wherein the information includes a reading of a level of coolant in the radiator.

31. The method of claim 27 wherein the component includes an oil compartment.

32. The method of claim 31 wherein the information includes a reading of a temperature of oil in the oil compartment.

33. The method of claim 31 wherein the information includes a reading of a level of oil in the oil compartment.

34. A method for use in a system in a vehicle for adjusting a position of an item in the vehicle, the system including a display, a track and an actuator for moving the item in the vehicle along the track, the method comprising:

showing on the display an indicator associated with the item, the item being separate from the display; and

moving the indicator on the display to cause the actuator to move the item along the track to adjust the position of the item, an extent to which the position of the item is adjusted being a function of an extent to which the indicator is moved.

35. The method of claim 34 wherein the item includes a window.

36. The method of claim 34 wherein the item includes a mirror.

37. The method of claim 34 wherein the item includes a door.

38. The method of claim 34 wherein the item includes a seat.

39. The method of claim 34 wherein the item includes an audio output.

40. A method for use in a system in a vehicle comprising: receiving signals from a plurality of sources, the plurality of sources providing a plurality of entertainment programs, respectively, the entertainment programs being classified in a plurality of categories based on contents of the entertainment programs;

deriving, from the received signals, information identifying at least respective categories of entertainment programs provided by the sources; and

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presenting indicators representing respective ones of the plurality of sources, each indicator being selectable to receive entertainment programs from the source represented by the indicator, the indicators being arranged according to the respective categories of entertainment programs provided by the sources represented thereby.

41. The method of claim 40 wherein each of the sources includes a radio station.

42. The method of claim 40 wherein the categories include types of music.

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43. The method of claim 40 wherein the information derived from the received signals also identifies the sources.

44. The method of claim 40 wherein at least one of the indicators indicates a status concerning whether the at least one indicator has been selected.

45. The method of claim 44 wherein the status is indicated by a first color if the at least one indicator has been selected, and by a second color if the at least one indicator has not been selected.

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(12) **United States Patent**
Obradovich

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(54) **TECHNIQUE FOR EFFECTIVELY PROVIDING AUDIO INFORMATION IN A VEHICLE**

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(52) U.S. Cl. **701/1; 701/200; 701/211; 701/36; 340/988; 340/990**

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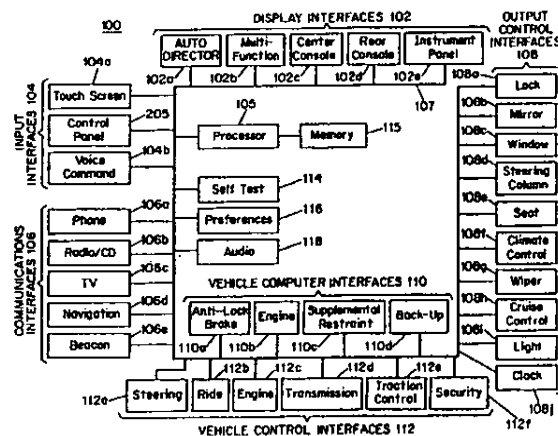
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(57) ABSTRACT

In a multimedia information and control system for use in an automobile, at least one interface is employed which enables a user to access information concerning the automobile and control vehicle functions in an efficient manner. The user may select one of a plurality of displayed options on a screen of such an interface. Through audio, video and/or text media, the user is provided with information concerning the selected option and the vehicle function corresponding thereto. Having been so informed, the user may activate the selected option to control the corresponding vehicle function.

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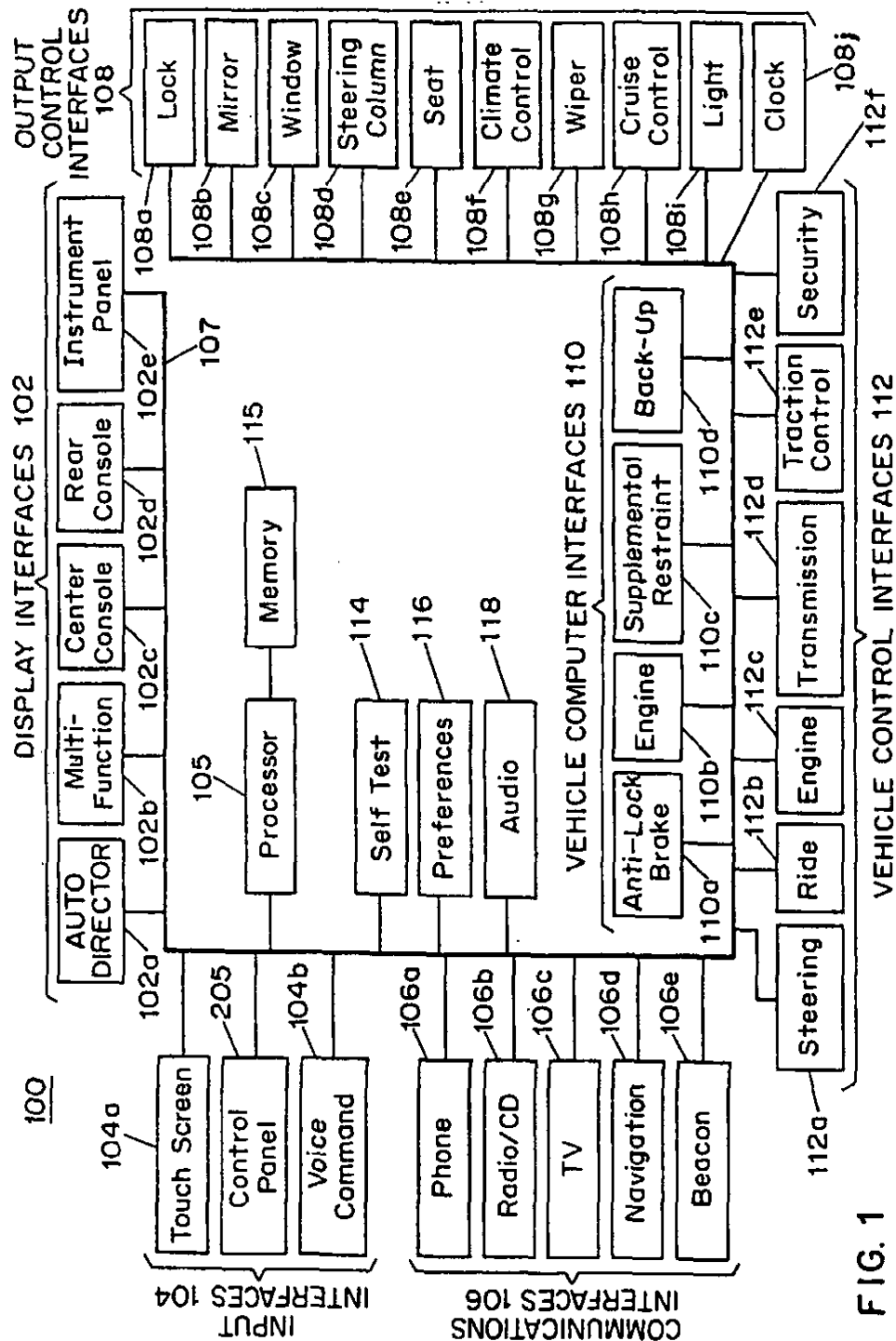


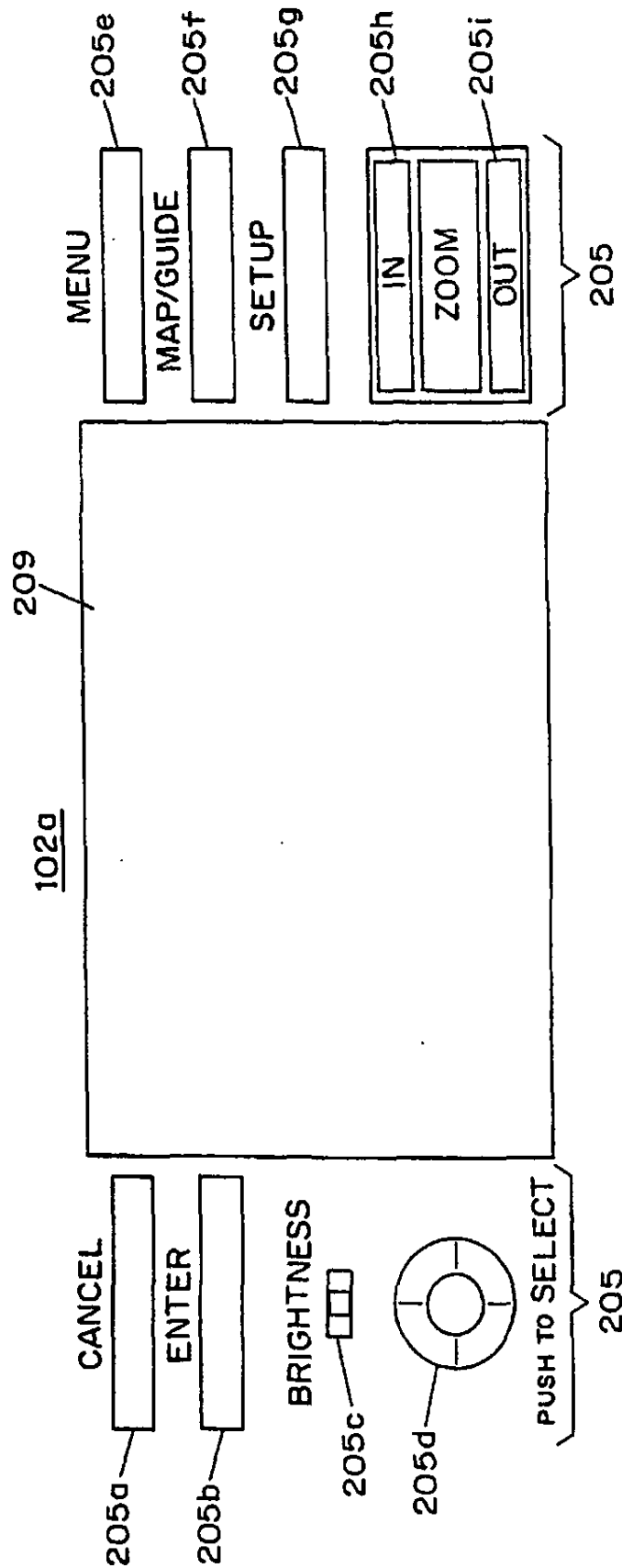
FIG. 1

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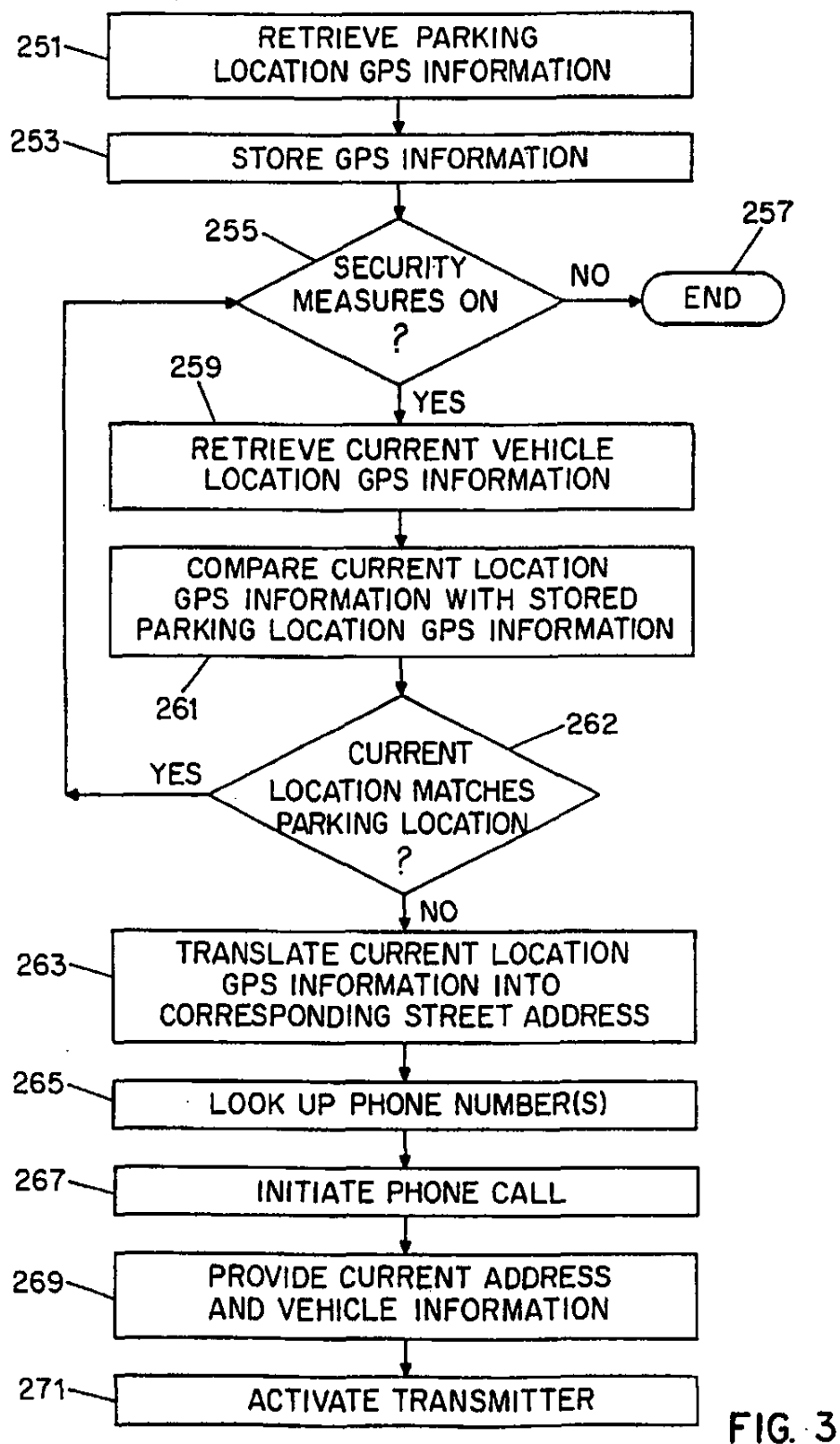


FIG. 3

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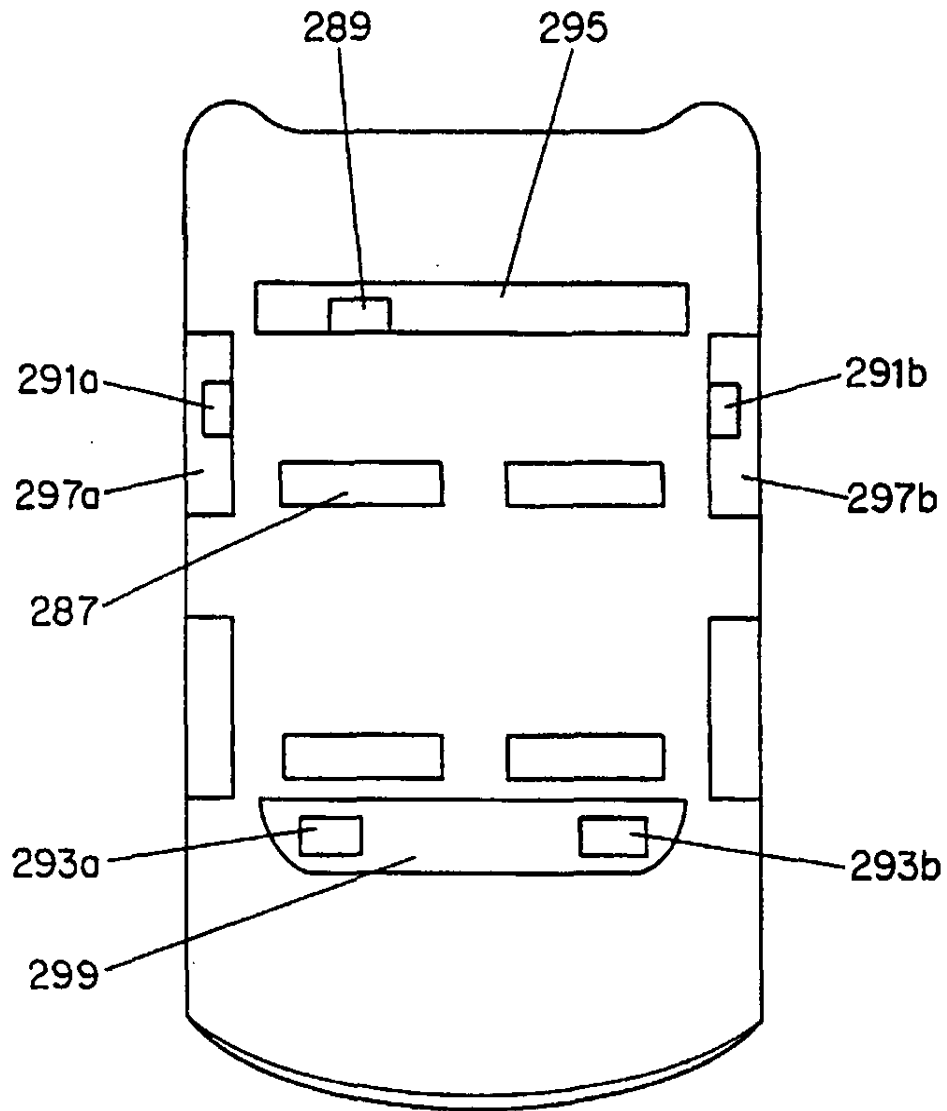


FIG. 4

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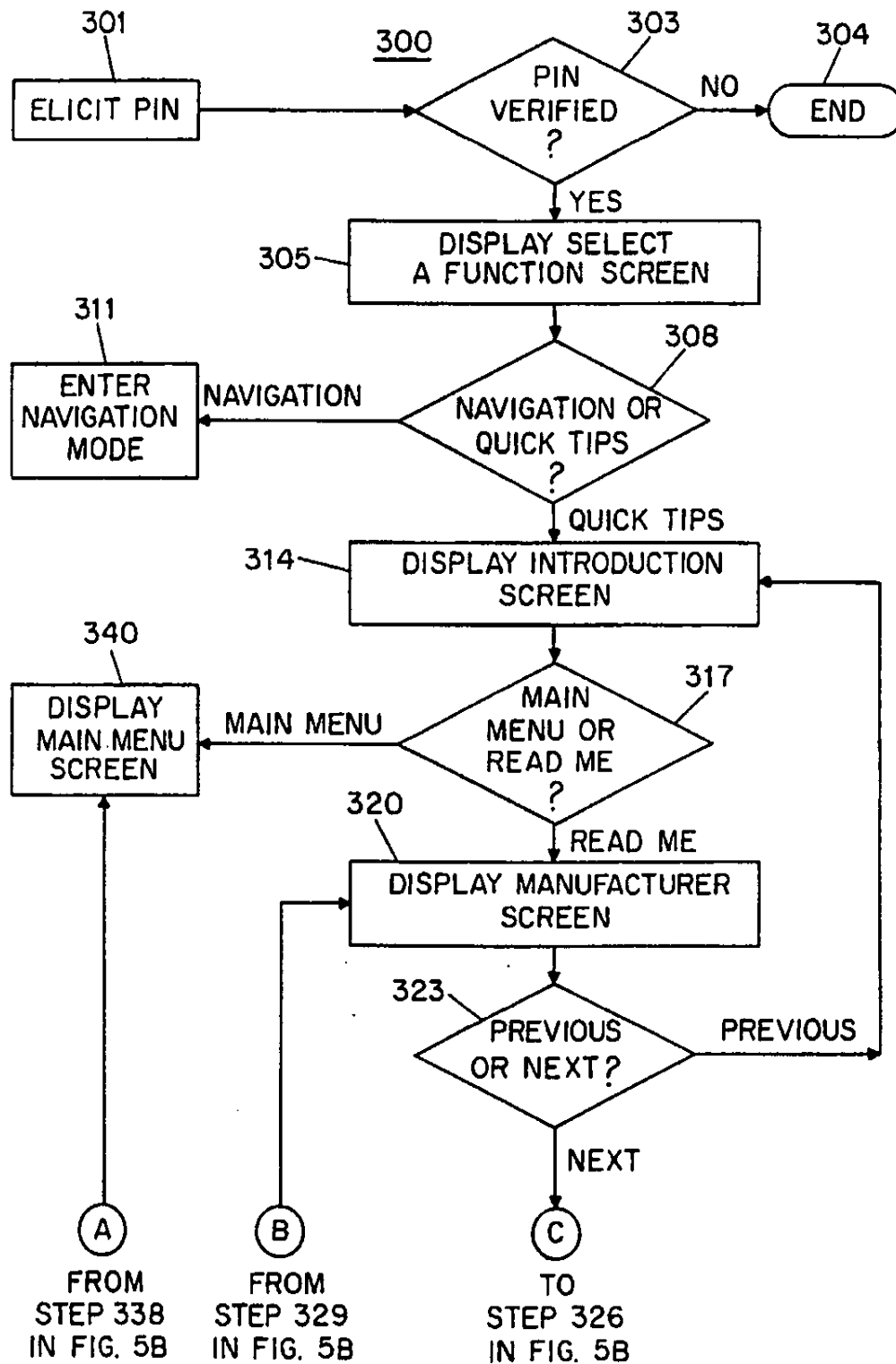


FIG. 5A

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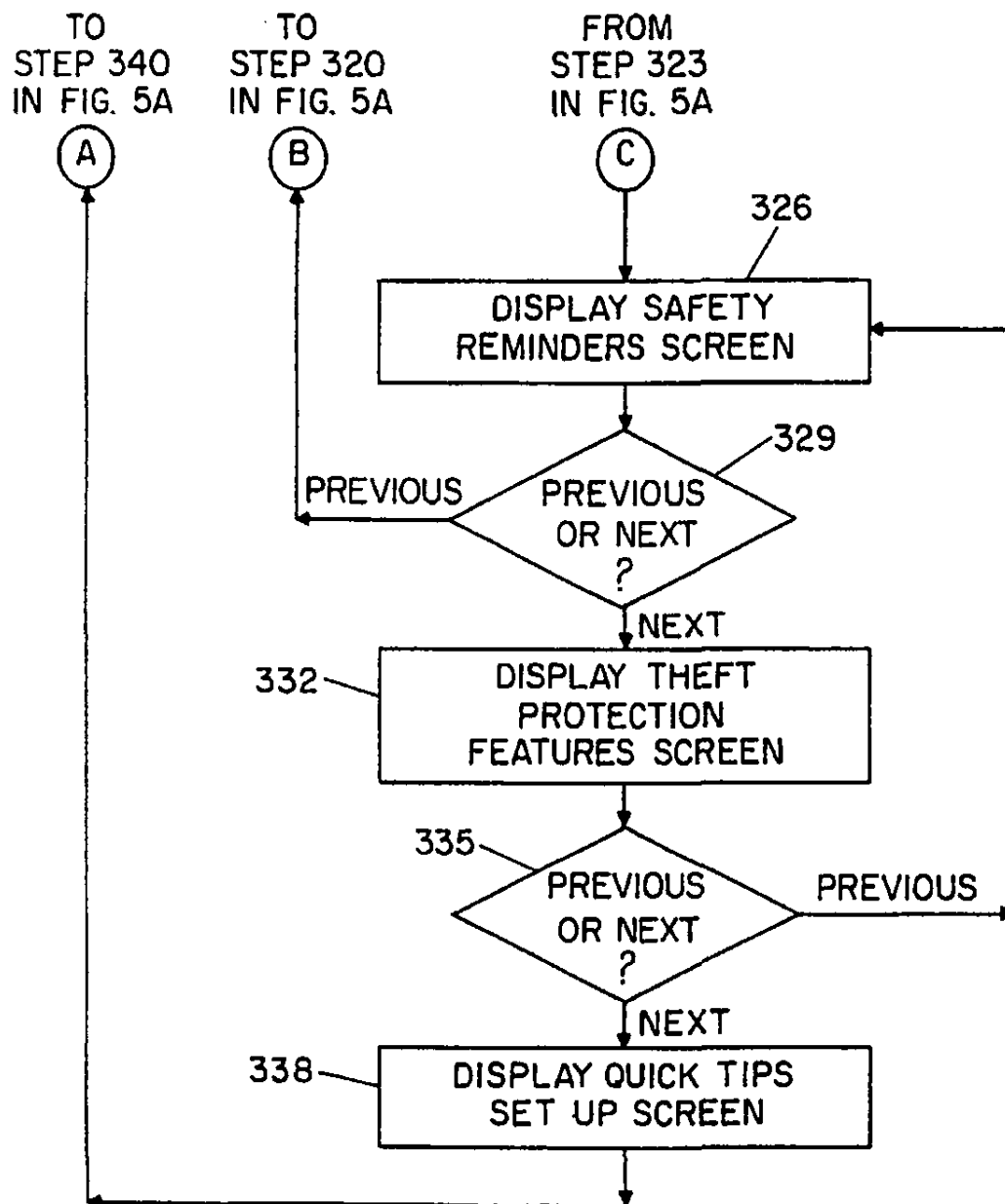


FIG. 5B

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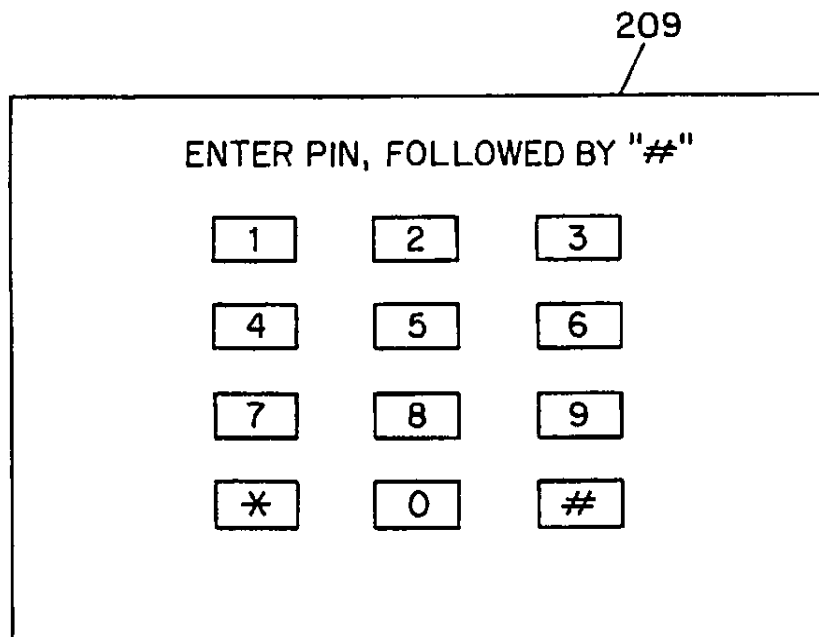


FIG. 6

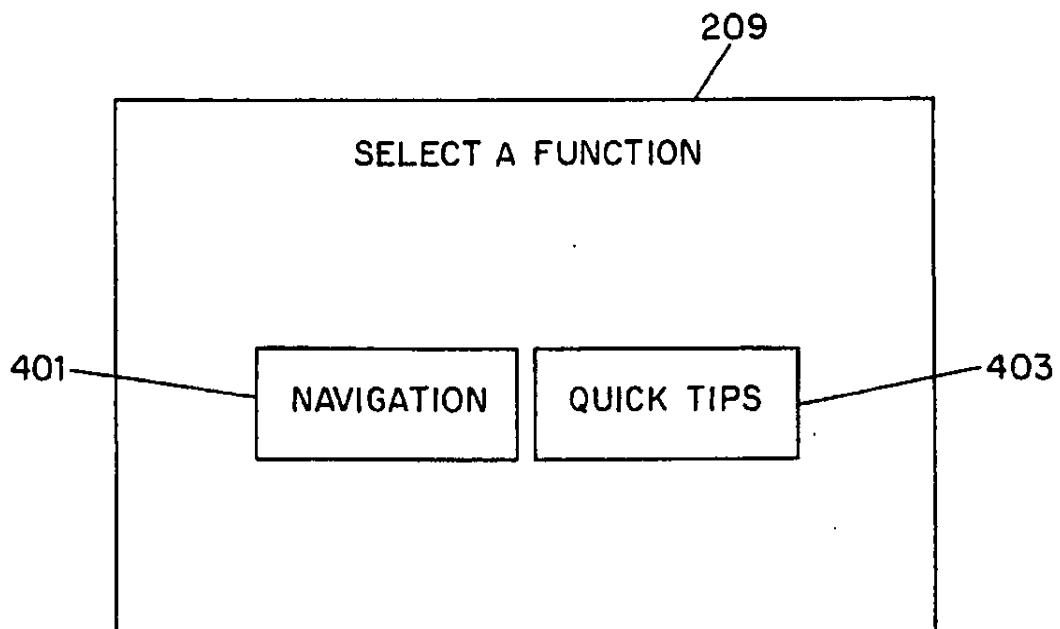


FIG. 7

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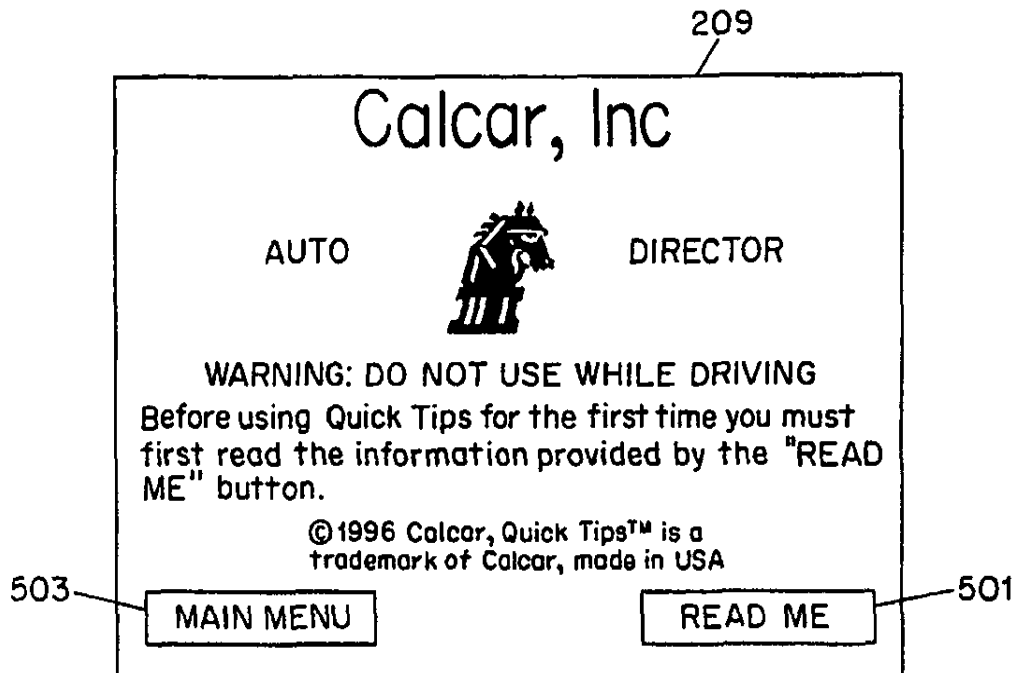


FIG. 8

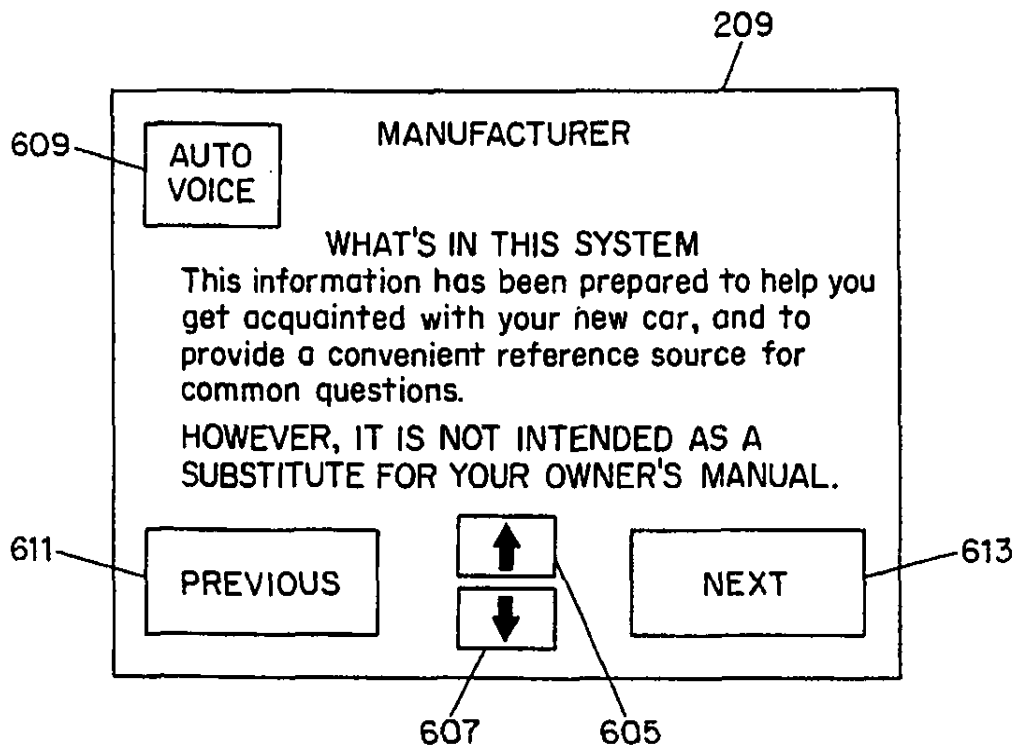


FIG. 9

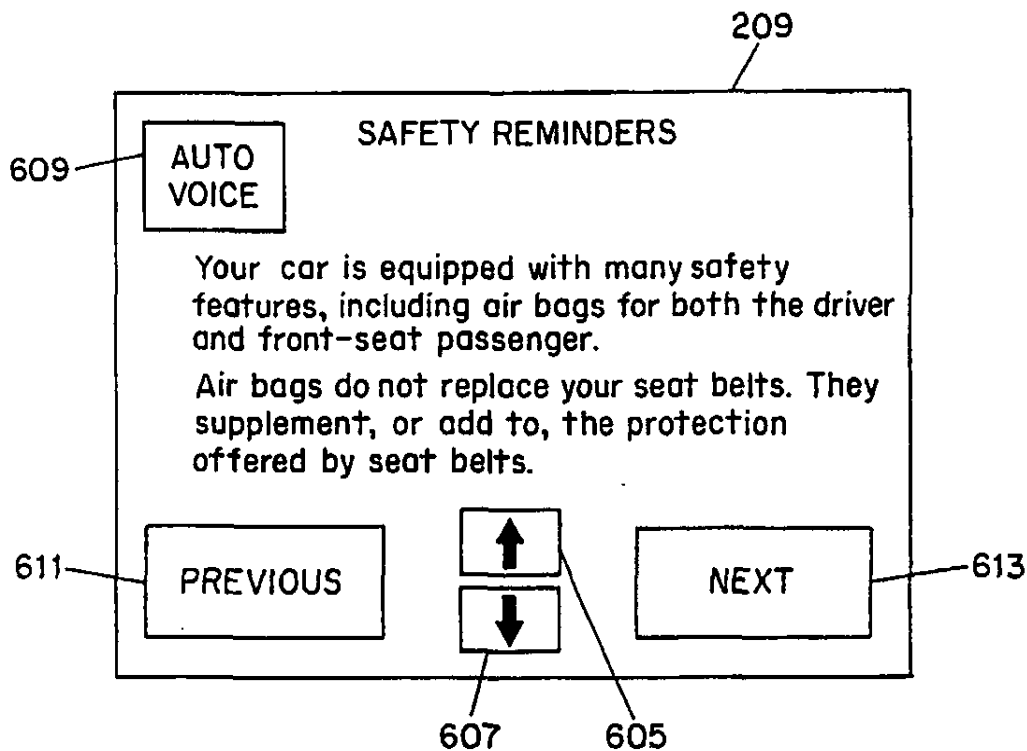


FIG. 10

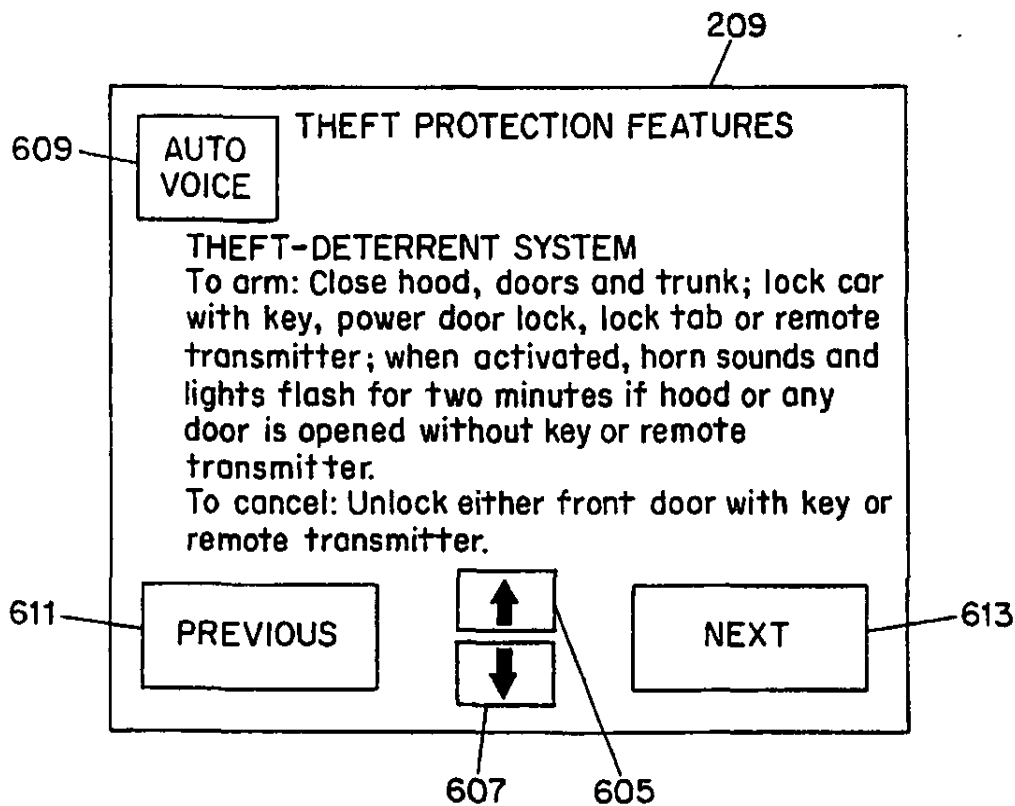


FIG. 11

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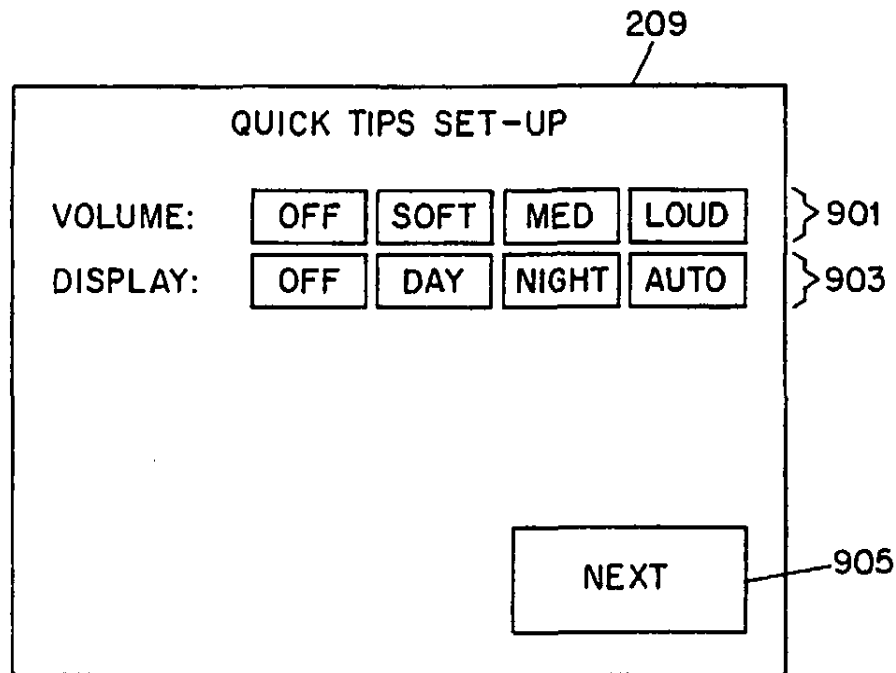


FIG. 12

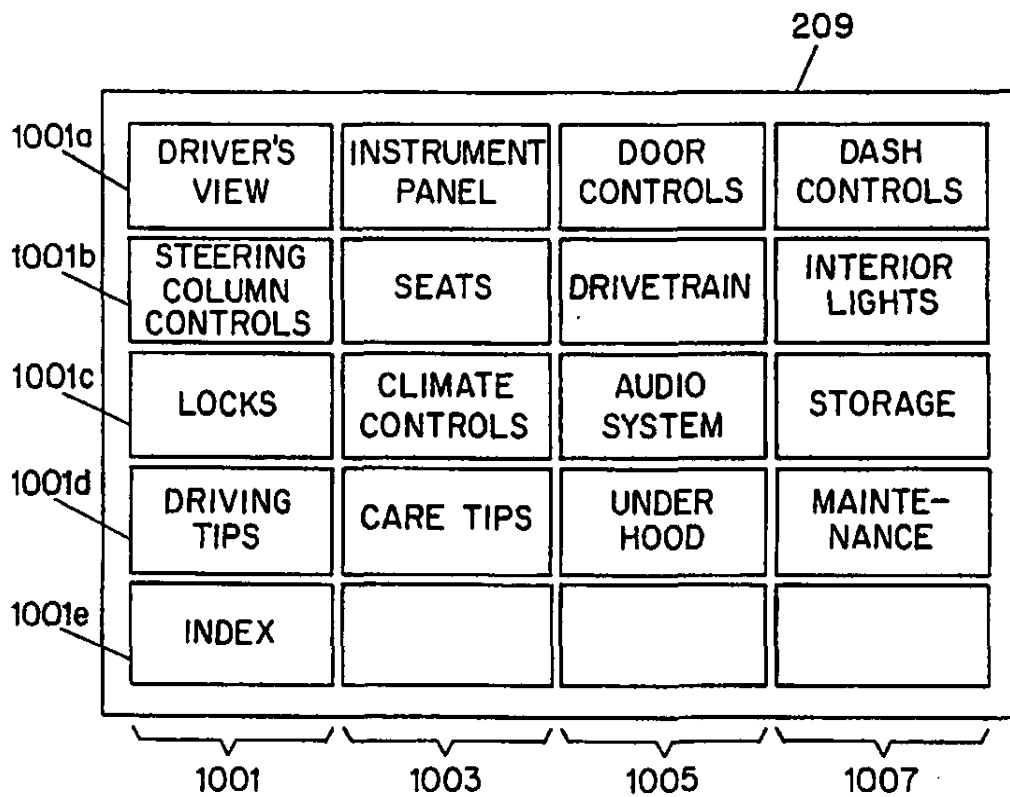


FIG. 13

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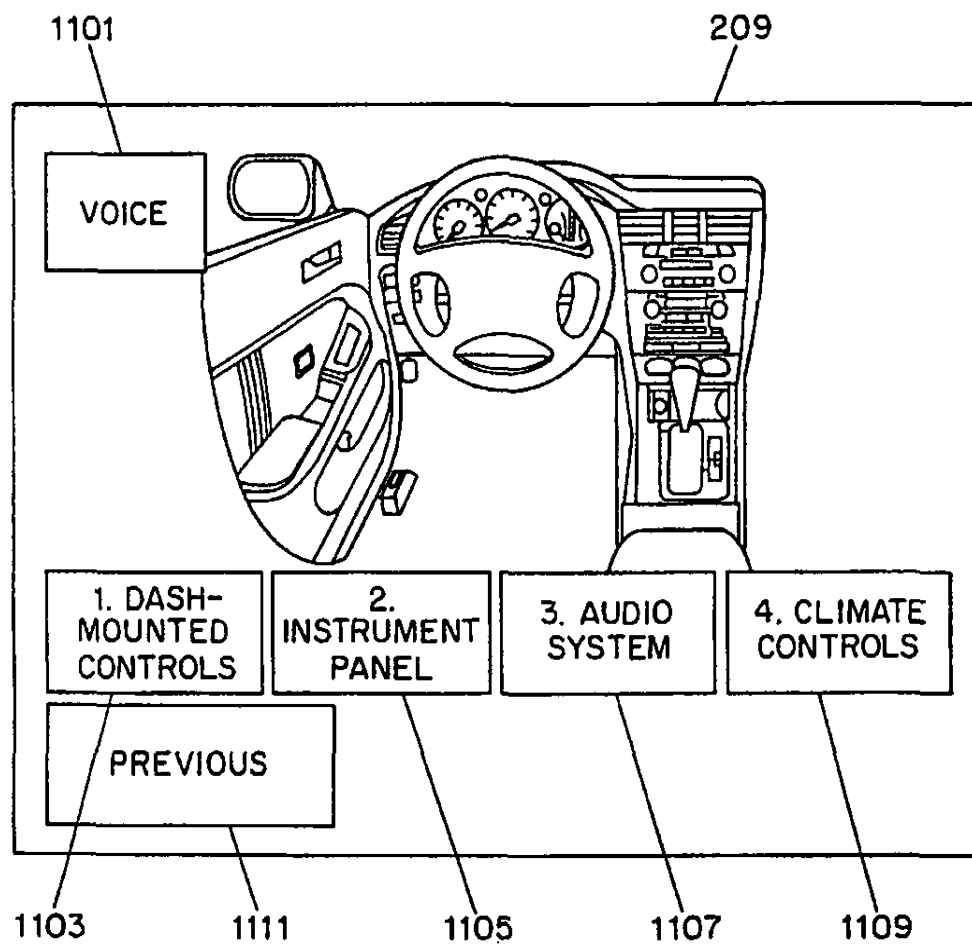


FIG. 14

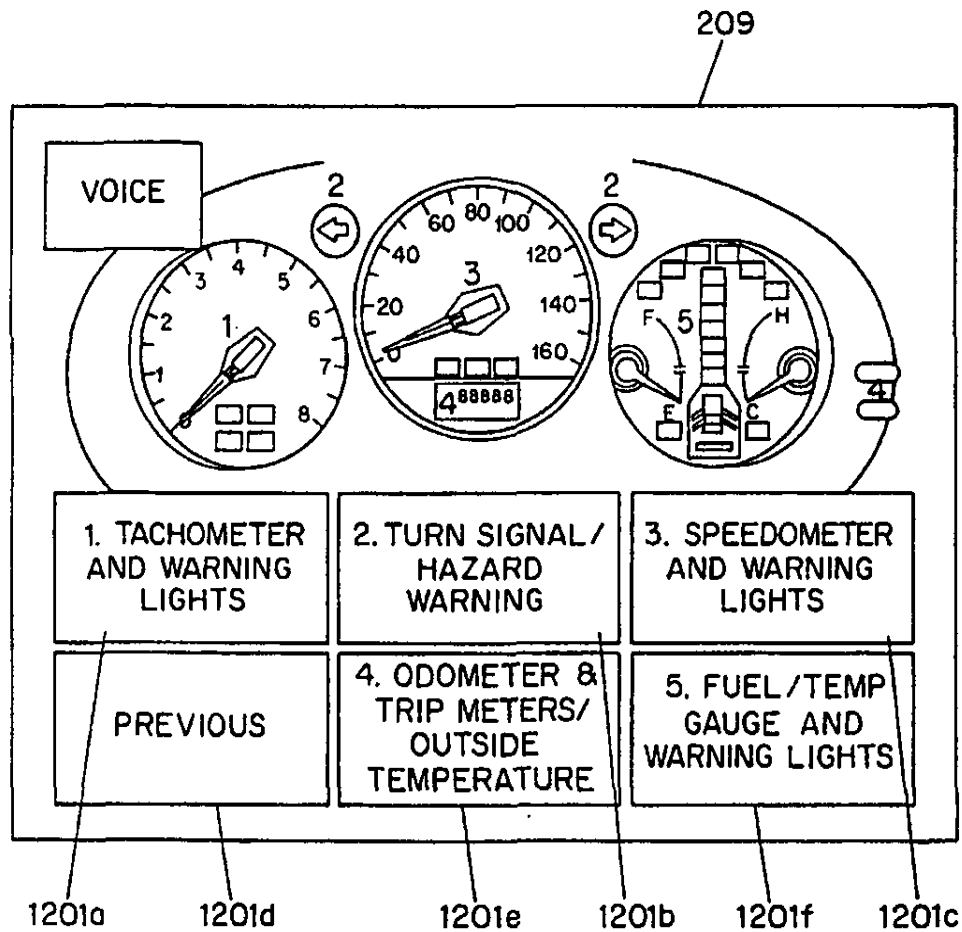


FIG. 15A

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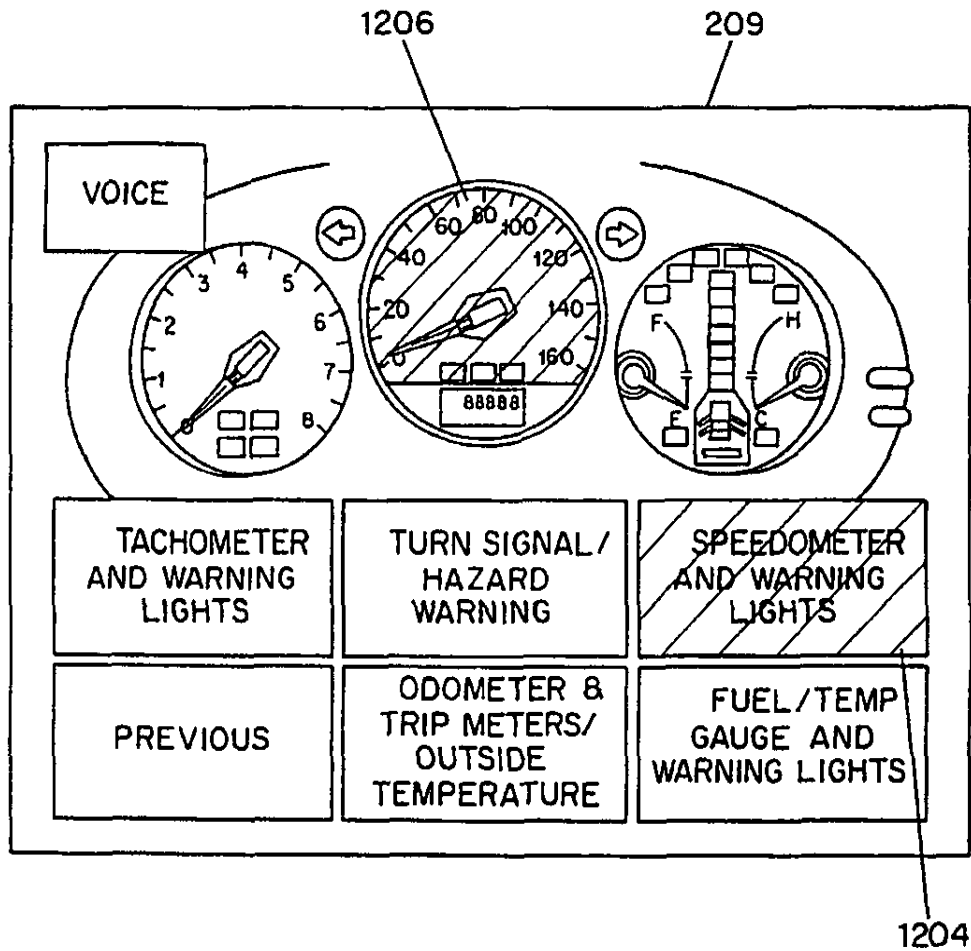


FIG. 15B

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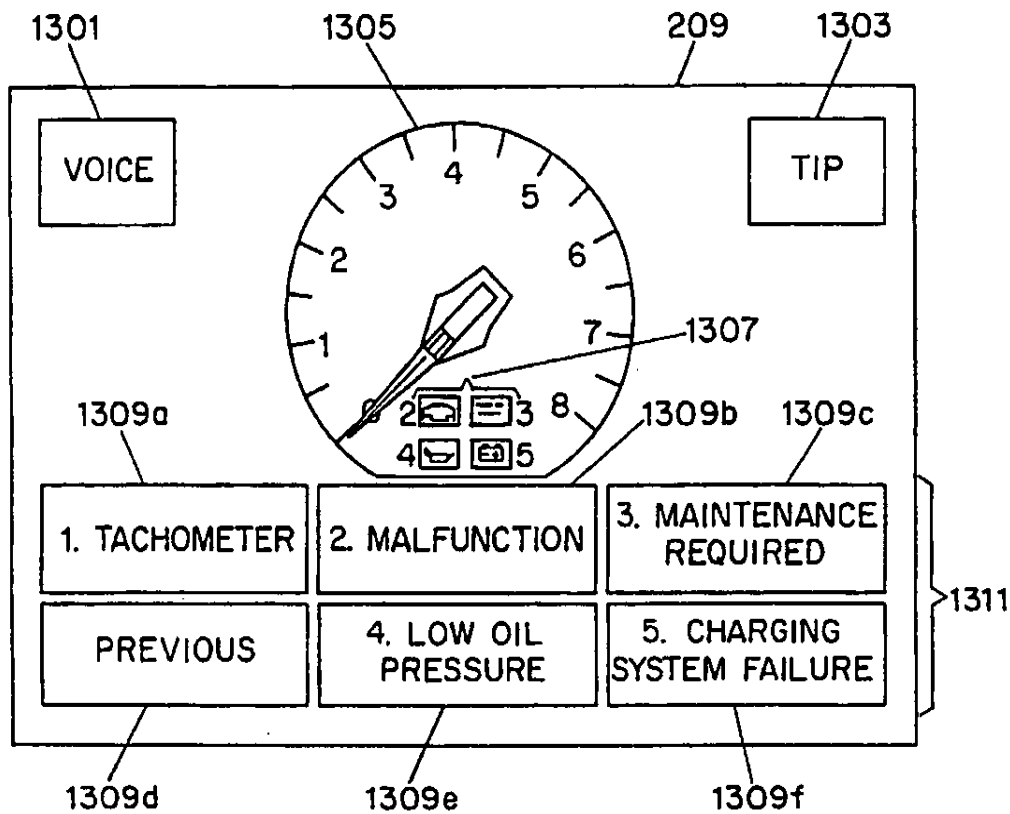


FIG. 16

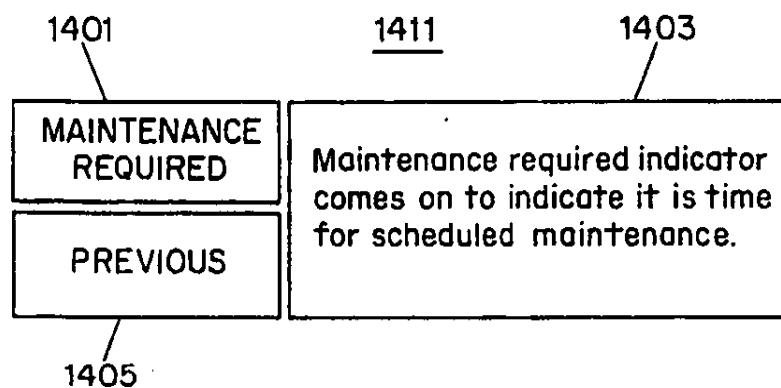


FIG. 17

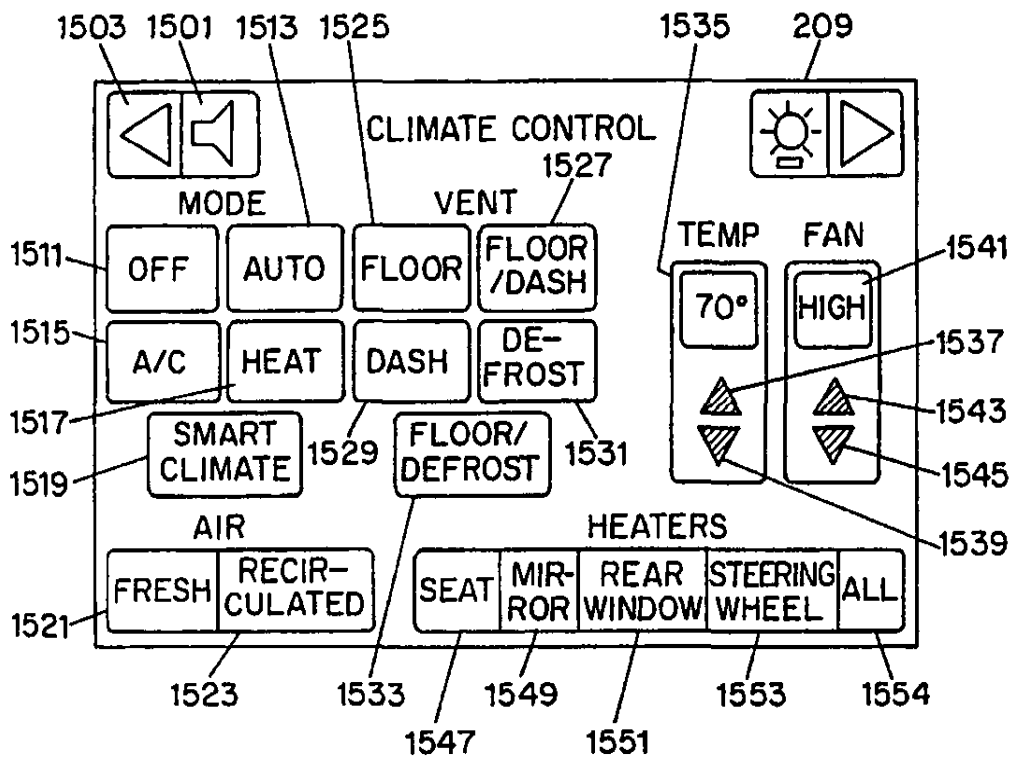


FIG. 18

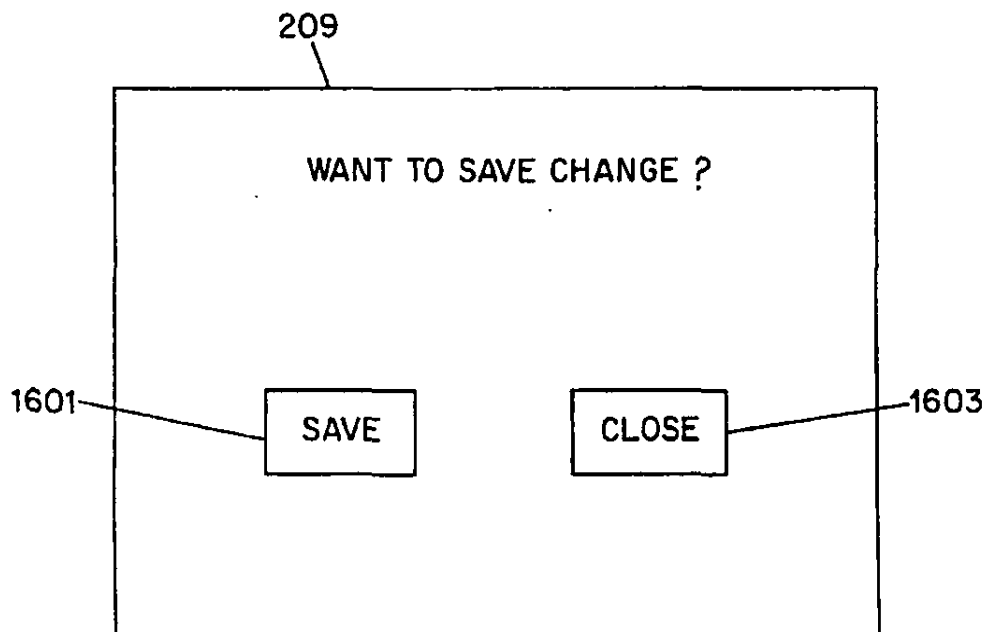


FIG. 19

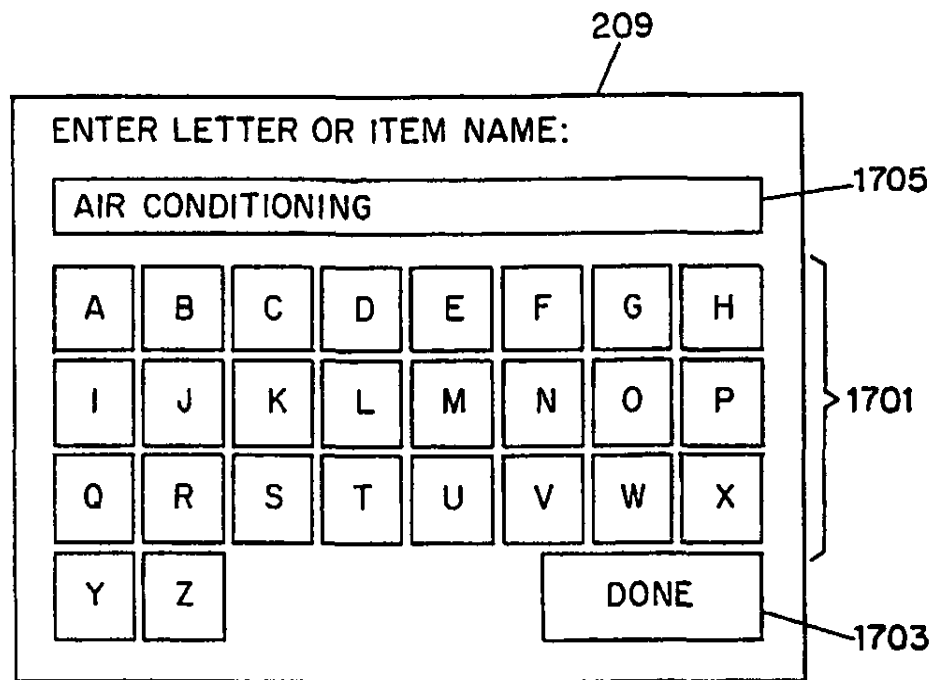


FIG. 20

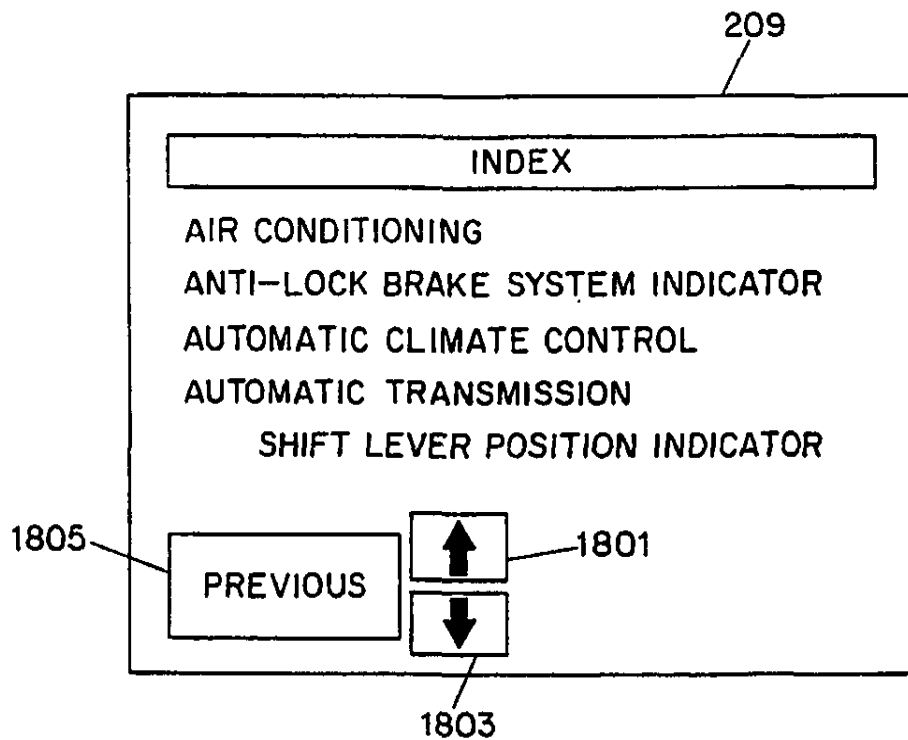


FIG. 21

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1905	1901	AIR CONDITIONING	1903	LINK TO CLIMATE CONTROL SCREEN OF FIG. 18	• • •
		ANTI-LOCK BRAKE SYSTEM INDICATOR		LINK TO WARNING LIGHT OPTION #4 ON FUEL/TEMP SCREEN (NOT SHOWN)	
		AUTOMATIC CLIMATE CONTROL		LINK TO CLIMATE CONTROL SCREEN OF FIG. 18	
		CHARGING SYSTEM FAILURE INDICATOR		LINK TO CHARGING SYSTEM FAILURE OPTION 1309f (FIG. 16)	• • •
		CLIMATE CONTROL SYSTEM		LINK TO CLIMATE CONTROL SCREEN OF FIG. 18	
		COOLING		LINK TO CLIMATE CONTROL SCREEN OF FIG. 18	
		CRUISE CONTROL INDICATOR		LINK TO WARNING LIGHT OPTION #2 ON SPEEDOMETER SCREEN (NOT SHOWN)	
		DEFOG/DEFROST		LINK TO CLIMATE CONTROL SCREEN OF FIG. 18	
		DOOR AJAR INDICATOR		LINK TO WARNING LIGHT OPTION #7 ON FUEL/TEMP SCREEN (NOT SHOWN)	
		DIRECTIONAL SIGNALS INDICATOR		LINK TO TURN SIGNAL/HAZARD WARNING OPTION 1201b (FIG. 15A)	

FIG. 22

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TECHNIQUE FOR EFFECTIVELY PROVIDING AUDIO INFORMATION IN A VEHICLE

This application is a continuation-in-part of application Ser. No. 08/789,934, filed on Jan. 28, 1997.

TECHNICAL FIELD

The invention relates generally to information and control systems and, more particularly, to a system for use in an automobile which facilitates a user's retrieval and/or dissemination of information, and control of vehicle functions.

BACKGROUND OF THE INVENTION

Information is vital to day-to-day activities. With no access to information, people cannot function efficiently in this society, and their lives and financial well-being are put in jeopardy. People want to be well-informed, so much so that when they are travelling in automobiles, they tune into local radio stations to listen to news, weather forecasts and traffic conditions. For that matter, some automobiles are equipped with audiovisual systems including television (TV) receivers. One such system is disclosed in U.S. Pat. No. 5,404,443 issued to Hirata. The Hirata system provides audiovisual information in a number of modes including a TV mode, which may be selected by control switches disposed on the periphery of a display.

Automobile users like to be continually updated with information affecting their travel plans such as weather and traffic conditions because of its fast changing nature. Automobile users who are traveling also like to continually keep in touch with their homes and offices, and to confirm appointments and hotel reservations so that they can adjust their itineraries accordingly. To that end, cellular mobile telephones were introduced to enable automobile users to conduct business and contact their families while they are traveling.

In addition, local map information is important to automobile travelers moving from one locale to another. As such, navigation systems were developed to help reach their destinations in an unfamiliar milieu. One such vehicle navigation system is disclosed in U.S. Pat. No. 5,274,560 issued to LaRue. The disclosed system is based on artificial intelligence and provides a driver with directions via a voice interface. The system is built upon an optical disk player which can be used for entertainment as well. Digitized maps, compressed voice records and computer programs are stored on an optical disk compatible with the disk player. After a destination point is identified, the disclosed system finds the best route from the digitized maps and guides the driver therethrough via the voice interface, taking into account the latest traffic conditions received by an FM receiver to avoid congestion.

Recently, navigation systems based on military global positioning system (GPS) technology have emerged. One such navigation system is commercially available as an option for the latest model of the ACURA 3.5 RL automobile. This ACURA navigation system receives signals from a constellation of satellites which is part of the GPS. In response to these signals, the navigation system pinpoints the automobile's location (in latitude and longitude). It also detects the automobile's speed and direction. With geographic information stored on a hard disk in an onboard computer, the navigation system is capable of verbally and visually communicating to the user instructions for reaching the destination.

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In addition to the above techniques for communications with automobile users, a technique for disseminating information regarding the automobiles themselves is disclosed in U.S. Pat. No. 5,442,553 issued to Parillo. The disclosed system is a vehicle diagnostic and software upgrade system. In this system, sensors are provided in the vehicle to generate dynamic data relating to various mechanical controls and the engine of the vehicle, including engine R.P.M., fuel/air mixture, emissions and pollution content information. A microprocessor in the vehicle has access to selectable program parameters affecting the functioning of the mechanical controls. The microprocessor collects and transmits the dynamic data to a remote diagnostic station periodically or upon its request. In response, the remote station sends, to the vehicle, signals indicative of any changes in its software and/or program parameters. The microprocessor accordingly causes the changes to be made in the vehicle based on the received signals.

Besides the communication capabilities described above, an automobile has many accessories and user control elements such as lights, wipers, a clock, temperature control, cruise control, seat adjustment control, mirror adjustment control, and an anti-theft system. A technique for centralizing the command of the individual control elements is disclosed in U.S. Pat. No. 5,555,502 issued to Opel. The disclosed system includes a centralized control panel on a steering wheel which, together with a display, is utilized to control the electronic components of the automobile. The display is positioned in the area of the driver's sun visor. After the driver presses one of the buttons on the control panel corresponding to a desired electronic component, a menu is displayed so that the driver is able to select items from the menu to program the component. The selection is accomplished by pressing specified buttons on the panel.

In addition, a technique for controlling vehicle accessories via voice command is disclosed in U.S. Pat. No. 4,827,520 issued to Zeinstra. In accordance with this technique, control functions of each accessory are formatted in a summary page for display on a screen, which is scanned by infrared light to sense any touching thereon. By uttering any of the displayed functions on the summary page, preceded by either a specified keyword or an actuation of a push-to-talk switch on a steering wheel, a more detailed subpage of the selected function is displayed for further selection by voice. As an alternative to the voice command, the selection can also be accomplished by touching the displayed function on the screen.

Voice command and touch screen techniques are frequently mentioned in prior art references in controlling car accessories. In particular, U.S. Pat. No. 5,214,707 issued to Fujimoto et al. discloses a system for voice-controlling equipment inside a vehicle, including microphones capable of discriminating voice commands as to whether they are generated at the driver side or at the assistant side of the vehicle in a noisy environment.

SUMMARY OF THE INVENTION

It is celebratory that technology advances at lightning speed. However, many people are left behind the technological frontier, and to some extent develop "technophobia". Some of them have even given up this technological race, which is confirmed by the blinking "12:00" display on the clocks of many video cassette recorders (VCRs) being used. Similarly, it is fantastic that automobiles nowadays include many advanced accessories such as audiovisual systems, anti-theft systems, anti-lock brake systems, climate

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control, and cruise control which embrace the latest technologies. However, of all these accessories, many automobile users only know how to operate the headlights and windshield wipers, and regard the rest as nuisance. That is, the users pay for numerous accessories which they do not use, resulting in much consumer waste. We have recognized that such non-use is principally attributed to an inefficient distribution of operating knowledge of the automobile and, in particular, its accessories.

Specifically, when automobile users presently want to learn about certain aspects of an automobile, they need to consult an owner's manual which could have been lost or misplaced when they need it the most. In addition, the manual is unpopular because many users simply want to avoid reading any written material, and find it intimidating as it oftentimes is filled with incomprehensible technical jargon.

We have further recognized that even with the operating knowledge, many users are overwhelmed and confused with the large number of knobs, switches and buttons used to control the individual vehicle parts and accessories.

Accordingly, it is an object of the invention to design an information and control system for use inside an automobile with the user in mind. The user is afforded a centralized control which may be used in lieu of the knobs, switches and buttons to operate the vehicle parts and accessories. In accordance with the invention, the centralized control is intimately tied to an information system such that the user is able to efficiently access information about the functions and operations of such parts and accessories, and in a synergistic manner apply that information to operate same, using the centralized control.

It is another object of the invention that the access to the information is intuitive and direct so that the user can obtain the relevant information in a few self-explanatory steps. To that end, the invention embraces a multimedia approach where audio and video media are added to the traditional text media to convey information. The additional media increases the dimensions of both the user's comprehension of the information and the user's interaction with the automobile. Moreover, the information access is driven by a multilevel menu based on an intuitive model of taxonomy where information is organized in a minimal number of levels of subject matter from general to specific. The above integration of the multimedia approach with the multilevel menu approach presents an effective way of retrieving information in the automobile. Advantageously, with the invention, the user would not be distracted or overburdened by irrelevant information in the course of an information retrieval, which is conducive to a safe driving environment.

In the preferred embodiment, when the user wants to access information about a given part or accessory of the automobile, the user is presented with options on a display screen. Each option is associated with a respective one of different parts or accessories of the automobile. The user is able to select through the interface one of the options, associated with the given automobile part or accessory. The option when selected is highlighted, for example, in yellow. A voice is then generated by the inventive system to explain the purpose or the content of the selected option before the user commits to it. Having been so informed, the user may then activate the selected option in retrieving the information of interest. The retrieved information is presented to the user in text, voice and/or graphics.

BRIEF DESCRIPTION OF THE DRAWING

Further objects, features and advantages of the invention will become apparent from the following detailed descrip-

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tion taken in conjunction with the accompanying drawing showing an illustrative embodiment of the invention, in which:

FIG. 1 is a block diagram of an automobile information and control system in accordance with the invention;

FIG. 2 illustrates a control panel and a display interface for a user to interact with the system of FIG. 1;

FIG. 3 illustrates a flow chart depicting the steps of an anti-car-theft routine used in the system of FIG. 1;

FIG. 4 illustrates an arrangement of speakers in an automobile in accordance with the invention;

FIGS. 5A and 5B jointly illustrate a flow chart depicting the steps of a routine for presenting various screens to the user in the system interaction;

FIG. 6 illustrates a screen for eliciting a personal identification number (PIN) from the system user;

FIG. 7 illustrates a SELECT A FUNCTION screen including features thereof in accordance with the invention;

FIG. 8 illustrates an introduction screen including features thereof in accordance with the invention;

FIG. 9 illustrates a MANUFACTURER screen including features thereof in accordance with the invention;

FIG. 10 illustrates a SAFETY REMINDERS screen including features thereof in accordance with the invention;

FIG. 11 illustrates a THEFT PROTECTION FEATURES screen including features thereof in accordance with the invention;

FIG. 12 illustrates a QUICK TIP SET-UP screen including features thereof in accordance with the invention;

FIG. 13 illustrates a MAIN MENU screen including features thereof in accordance with invention;

FIG. 14 illustrates a DRIVER'S VIEW screen including features thereof in accordance with the invention;

FIG. 15A illustrates an INSTRUMENT PANEL screen including features thereof in accordance with the invention;

FIG. 15E illustrates an association of an item with an option corresponding thereto on a second INSTRUMENT PANEL screen in accordance with the invention;

FIG. 16 illustrates a TACHOMETER AND WARNING LIGHTS screen including features thereof in accordance with the invention;

FIG. 17 illustrates a segment of the screen of FIG. 16 providing the user with information regarding a particular function of the automobile;

FIG. 18 illustrates a CLIMATE CONTROL screen including features thereof in accordance with the invention;

FIG. 19 illustrates a SAVE screen for saving the user's preferences in accordance with the invention;

FIG. 20 illustrates a DATA ENTRY screen in accordance with the invention for looking up information regarding a specific item in the automobile;

FIG. 21 illustrates an INDEX screen with listed items for which information is available; and

FIG. 22 is a look-up table listing searchable items and the corresponding instructions for a processor in the system of FIG. 1 to provide information regarding such items.

Throughout this disclosure, unless otherwise stated, like elements, components and sections in the figures are denoted by the same numerals.

DETAILED DESCRIPTION

FIG. 1 illustrates information and control system 100 embodying the principles of the invention for use in an

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automobile. System 100 is referred to as the "AUTO DIRECTOR" system. It is user-friendly and designed with the automobile user in mind. For example, with AUTO DIRECTOR display interface 102a to be described, information about the automobile is readily available literally at the fingertips of the user. This information includes operational instructions, maintenance procedures, safety measures, and information about virtually every capability of the automobile. In accordance with the invention, the user is able to efficiently access such information using multimedia means involving audio, text and video media. Also with interface 102a, or multifunction display interface 102b to be described, the user is afforded a centralized control whereby he/she can program or adjust different vehicle parts and accessories using the information thus obtained.

As shown in FIG. 1, central to system 100 is a processor 105 connected to memory 115. Data bus 107 connects processor 105 to display interfaces 102, input interfaces 104, communications interfaces 106, output control interfaces 108, vehicle computer interfaces 110, vehicle control interfaces 112, self-test interface 114, preferences interface 116, and audio interface 118.

Display interfaces 102 include, inter alia, AUTO DIRECTOR display interface 102a, which is illustrated in FIG. 2, together with control panel 205 in FIG. 1. By way of example, but not limitation, the hardware of interface 102a and control panel 205 are derived from a prior art navigation system of the type of the ACURA navigation system. In fact, interface 102a and control panel 205 are used in this illustrative embodiment to realize not only AUTO DIRECTOR functions to be described, but also the well-known navigation function.

Interface 102a includes a conventional liquid crystal display screen 209, and LCD driver (not shown) for processor 105 to control the display on screen 209. Interface 102a also incorporates well-known touch-screen circuitry (not shown) connected to touch screen interface 104a in FIG. 1. With this circuitry, the user can interact with processor 105 by, say, touching a displayed option on screen 209. Through interface 104a, processor 105 receives from the touch screen circuitry a signal identifying the location on screen 209 where it has been touched. If such a location matches the predetermined location of one of the displayed options, processor 105 determines that that option has been selected. With such touch-screen and displayed option selection capabilities, through AUTO DIRECTOR interface 102a, the user is able to obtain information on and control selectable functions of the automobile such as the instrument panel, navigation function, mobile phone, radio/CD player, locks, mirrors, windows, driver's seat adjustment control, climate control, windshield wipers, cruise control, lights, security function, steering, ride control, engine and transmission.

Control panel 205 comprises CANCEL switch 205a, ENTER switch 205b, BRIGHTNESS switch 205c, PUSH TO SELECT knob 205d, MENU switch 205e, MAP/GUIDE switch 205f, SETUP switch 205g, ZOOM IN switch 205h and ZOOM OUT switch 205i. BRIGHTNESS switch 205c comprises a standard variable resistor such that when it is pushed one way, operating circuitry 121 responsively causes the display intensity to increase, and the other way to decrease. ZOOM IN switch 205h when pressed enables the automobile user to enlarge a particular visual area of interest on screen 209, affording better details. On the other hand, ZOOM OUT switch 205i when pressed performs the inverse function to switch 205h. As an alternative to the touch-screen capability, switch 205d similar to a standard joystick

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is provided for the user to move from one displayed option to another on screen 209 in the same direction (e.g., up, down, left or right) as the switch is operated. A desired option may be selected by pressing ENTER switch 205b. The functions of the other switches are described hereinbelow as they are called out in the operation of system 100. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and control panel 205 are mounted close to the center of the dashboard of the automobile next to the steering wheel.

Referring back to FIG. 1, display interfaces 102 also include multifunction display interface 102b, center console display interface 102c, rear console display interface 102d, and instrument panel display interface 102e.

Specifically, multifunction display interface 102b is installed on the dashboard close to interface 102a on the driver side. Like interface 102a, interface 102b provides the user with graphic display and control of selected functions using well-known touch screen technology. In fact, interface 102b duplicates certain control functions (e.g., navigation, phone, radio and climate control) of interface 102a so that the user can use interface 102b to control a selected function while interface 102a is engaged in another ongoing function. For example, while the user is relying on AUTO DIRECTOR interface 102a to provide navigation information to reach a given destination, the user may want to adjust the climate control of the automobile. It is inconvenient for the user to terminate the ongoing navigation mode of interface 102a, albeit temporarily, to access the climate control function through the interface, adjust the climate control and then resume the navigation mode. Thus, it is preferable to leave the navigation mode of interface 102a alone and use interface 102b to administer the climate control.

Center console interface 102c is installed close to interface 102a on the passenger side. Similar to interface 102b, interface 102c provides the front seat passenger with graphic display and control of functions which include: the front passenger seat adjustment, door lock, window, climate and TV controls. If enabled by the driver, control is also available for the radio/CD player and phone.

Rear console display interface 102d is installed on the back of a front seat. Similar to interface 102c, interface 102d provides rear seat passengers with graphic display and control of certain functions if enabled by driver or front seat passenger. These functions include: the rear seat climate, windows, door locks, radio/CD player and TV controls.

Instrument panel display interface 102e is installed on the dashboard in front of the driver seat. This interface provides the driver with graphic display of the vehicle speed, engine RPM, outside and inside temperatures, oil pressure, fuel level, time, odometer reading, trip odometer reading and warning light indicators. Through AUTO DIRECTOR interface 102a, the system user may select the display of the information in either an analog or a digital form.

Input interfaces 104 comprise touch screen interface 104a and control panel 205 described before, and voice command interface 104b. The latter is connected to a microphone (not shown) and comprises standard voice command circuitry (not shown) for processing voice commands by the user through the microphone to control or modify selected functions of system 100.

Communications interfaces 106 include phone interface 106a, radio/CD interface 106b, television (TV) interface 106c, navigation interface 106d, and beacon interface 106e. Processor 105 interacts with and controls standard phone equipment connected to phone interface 106a. Through

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processor 105, the user may operate the phone equipment via voice command, thereby realizing hands-free operation of the equipment. Alternatively, the user may operate the phone equipment using the touch screen capability provided by AUTO DIRECTOR display interface 102a or multifunction display interface 102b. The user may also operate the phone equipment via remote switches.

Similarly, processor 105 interacts with and controls one or more radio receivers and CD players in the automobile connected to radio/CD interface 106b. Through processor 105, the user may operate the radio receivers via voice command, remote switch and/or touch screen capability.

Processor 105 further interacts with and controls one or more TV receivers in the automobile connected to TV interface 106c. Again, the user may operate the TV receivers via voice command, remote switches and/or touch screen capability. It should be noted at this point that it is apparent to a person skilled in the art that wherever the touch screen capability may be used to select or control various options or functions provided by system 100, the voice command is equally applicable. As such, without further repetition, the explicit mention of use of the voice command as an alternative to that of the touch screen capability in each instance is conveniently omitted in the ensuing discussion.

As further described hereinbelow, navigation interface 106d is connected to a standard inertial guidance system (not shown) capable of providing gyros information, and deriving the vehicle location based on GPS information. With the map information stored in memory 115, the inertial guidance system is capable of providing the user with navigational instructions via interface 102a or 102b. Besides the locational information, local and national emergency information may be derived from the GPS information using additional standard decoding circuitry in interface 106d.

Beacon interface 106e is used for connection to a standard beacon device for detecting a predetermined beacon radio signal to provide additional location information.

Output control interfaces 108 include lock interface 108a, mirror interface 108b, window interface 108c, steering column interface 108d, seat interface 108e, climate control interface 108f, wiper interface 108g, cruise control interface 108h, light interface 108i and clock interface 108j.

Specifically, lock interface 108a comprises output control logic controllable by processor 105 to lock or unlock the car doors, glove box, console storage, trunk (or liftgate), fuel filler door, brakes and transmission, and enable or disable the child-proof door locks, fuel pump and ignition.

Mirror interface 108b comprises output control logic controllable by processor 105 to maneuver the positions of the outside mirrors and inside rear view mirror, and to fold or unfold the outside mirrors.

Window interface 108c comprises output control logic controllable by processor 105 to incrementally or completely open or close all windows, and to open, close or tilt any sunroof.

Steering column interface 108d comprises output control logic controllable by processor 105 to move the steering column in or out and up or down.

Seat interface 108e comprises output control logic controllable by processor 105 to (1) adjust the positions of the front seats forward or aft, and up or down; (2) tilt the front or rear of the seat cushion up or down; (3) adjust the seat back lumbar, width and angle forward or aft; (4) increase or decrease the cushion size and stiffness; (5) raise or lower the head restraint; and (6) raise or lower the seat belt height.

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Climate control interface 108f comprises output control logic controllable by processor 105 to (1) turn the climate control system on or off; (2) select an air flow mode; (3) set fan speeds; (4) enable or disable seat heaters; (5) select fresh or recirculated air (for driver only); and (6) enable or disable front and rear defrosters, mirrors and steering wheel heaters (for driver only).

Windshield wiper interface 108g comprises output control logic controllable by processor 105 to (1) select a high, low, intermittent, single wipe or off mode; (2) set an intermittent delay; and (3) enable or disable front or rear washers. Interface 108g also includes control logic for controlling rain- and speed-sensitive wipers, and for activating an automatic wash in a single wide mode when the windshield is at a certain level of opacity.

Cruise control interface 108h comprises output control logic controllable by processor 105 to (1) turn the cruise control on or off, (2) set the vehicle speed, and (3) cancel or resume the set speed.

Light interface 108i comprises output control logic controllable by processor 105 to select an automatic on mode or off mode for parking lights, headlights and fog lights; and to turn on or off map or courtesy lights.

Clock interface 108j comprises output control logic controllable by processor 105 to set an initial date and time on a conventional clock (not shown) connected to interface 108j. System 100 relies on the current date and time kept by the clock to provide a time reference for the system functions.

Vehicle computer interfaces 110 include anti-lock brake computer interface 110a, engine computer interface 110b and supplemental restraint computer interface 110c for processor 105 to communicate with the computers controlling the anti-lock brakes, engine and supplemental restraints (e.g., back-up airbag deployers and seat belt tensioners), respectively. Interfaces 110 also include back-up interface 110d through which processor 105 receives and analyzes signals from the engine, anti-lock brake and supplemental restraint computers. These signals would indicate to processor 105 any failures of the computers. In response to a computer failure, processor 105 causes a corresponding back-up computer connected to interface 110d to provide a back-up function.

Vehicle control interfaces 112 include steering interface 112a, ride interface 112b, engine interface 112c, transmission interface 112d, traction control interface 112e, and security interface 112f.

Specifically, steering interface 112a comprises input monitoring and output control logic for processor 105 to lighten or tighten the steering effort ratio in response to changing road conditions. Through interface 102a, the user may opt for manual or automatic steering effort ratio control. Interface 112a is capable of adapting and storing data according to the driver's inputs. It also allows for steering of front and/or rear wheels for sporty or increased stability.

Ride interface 112b comprises input monitoring and output control logic for processor 105 to lighten or stiffen the ride control to front and/or rear of vehicle in response to changing road conditions. Through interface 102a, the user may also opt for manual or automatic ride control.

Engine interface 112c comprises input monitoring and output control logic allowing for shutting off a specified number of cylinders, and varying valve and cam timing to increase performance or fuel economy. This interface also allows for manual or automatic control of the engine components, and includes the capability of adapting and storing data according to the driver's inputs.

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Transmission interface 112d comprises input monitoring and output control logic for selecting manual or automatic shifting of the transmission. In an automatic shifting mode, interface 112d is capable of adapting and storing data according to the driver's inputs. Interface 112d also allows for control of a variable differential ratio for fast acceleration and high economy cruise.

Traction control interface 112e comprises input monitoring and output control logic providing information on whether power is delivered to front and/or rear wheels of the vehicle and what proportion of the power is delivered to each wheel. This interface also allows for manual or automatic control, and such functions as yaw control in cooperation with the anti-lock brakes and an engine cylinder shutoff.

Security interface 112f comprises control logic for setting a security level, and enabling or disabling a number of security related functions such as the fuel supply cut-off, motion detector, brake locking, etc. Interface 112f also allows entry of a new or alteration of an existing personal identification number (PIN) for personalization of the vehicle functions, i.e., saving the vehicle functional preferences.

In accordance with an aspect of the invention, system 100 incorporates an anti-car-theft technique involving security interface 112f. In accordance with this inventive technique, security interface 112f further comprises a sensor for detection of a predetermined condition to trigger an anti-theft routine. It will be appreciated that a person skilled in the art will come up with many different triggering events causing the sensor to invoke the routine. For example, a passive way of triggering the anti-theft routine would be after the sensor detects that the engine is off and the user has opened, closed and locked the driver's door.

In any event, as soon as processor 105 receives from the sensor a signal requesting an invocation of the anti-theft routine, processor 105 retrieves from navigation interface 106d GPS information identifying the parking location of the automobile, as indicated at step 251 in FIG. 3. Processor 105 then stores at step 253 the parking location GPS information in memory 115. At step 255, processor 105 determines whether the security measures remain on. By way of example, but not limitation, such determination is based on information from lock interface 108a indicating whether the driver's door is properly unlocked. If that door is properly unlocked, processor 105 determines that the security measures are called off, and the anti-theft routine comes to an end, as indicated at step 257.

Otherwise if processor 105 determines that the security measures remain on, processor 105 at step 259 retrieves from navigation interface 106d GPS information identifying the current location of the automobile. Processor 105 then compares at step 261 the current location GPS information with the parking location GPS information previously stored. If processor 105 at step 262 determines that the current location matches the parking location based on the comparison, the anti-theft routine returns to step 255 after a predetermined period. Otherwise if processor 105 determines that the current location does not match the parking location, processor 105 assumes that the automobile has been removed without authorization, i.e., stolen. At this point, if a conventional alarm system is connected to security interface 112f, processor 105 would cause an alarm to come on, gas to be cut off, etc.

In this example, a conventional transmitter (not shown) is connected to security interface 112f and transmits a prede-

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termined sequence of signals receivable by a law enforcement agency or a suitable alarm monitor company when it is activated. Continuing the example, processor 105 translates the GPS information identifying the current vehicle location into the corresponding street address based on the map information stored in memory 115, as indicated at step 263. Processor 105 at step 265 looks up one or more phone numbers pre-stored in memory 115 for reporting to the law enforcement agency (or the alarm monitor company) about the stolen status. Alternatively, a list of phone numbers associated with law enforcement agencies (or branches of the alarm monitor company) in many different geographic locations is pre-stored, along with the GPS information identifying the locations of the respective law enforcement agencies (or alarm monitor company branches). This being so, processor 105 locates the closest law enforcement agency (or alarm monitor company branch) and its associated phone number(s) by comparing the current vehicle location GPS information with the respective agency (or branch) location GPS information.

In any event, processor 105 at step 267 initiates a call to a law enforcement agency (or an alarm monitor company branch) through phone interface 106a using the phone number just located. After the phone connection is established, processor 105 provides through the connection information about the current address of the vehicle using conventional voice synthesizer circuitry (not shown) in audio interface 118, and the pre-recorded information about the vehicle itself such as its vehicle identification number (VIN), model, year, color, license number, etc., as indicated at step 269. Through the same phone connection, processor 105 may also provide information about the vehicle's owner such as his/her name and contact number so that the law enforcement agency (or alarm monitor company branch) can notify the owner of the incident. Processor 105 at step 271 activates the aforementioned transmitter connected to security interface 112f to generate the predetermined sequence of signals in case the stolen vehicle is in transit. For that matter, processor 105 can also repeatedly check on the latest vehicle location and report any new address different from the one previously reported. Thus, by tracking the signals in the vicinity of the latest reported vehicle location, the law enforcement agency (or alarm monitor company) would recover the vehicle in an efficient manner.

In accordance with another aspect of the invention, after processor 105 determines that the vehicle requires maintenance (e.g., based on cumulative RPM measures described below), relying on the GPS information concerning the current location of the vehicle and the GPS information identifying the locations of a predetermined list of service stations, processor 105 issues an alert to the user when it determines that the vehicle is currently within a predetermined distance from one of the service stations so that the user can conveniently drive to that nearby service station to have the vehicle serviced. To that end, the GPS information concerning the service station locations is stored in memory 115. After determining that the vehicle requires maintenance, processor 105 from time to time compares the GPS information concerning the current vehicle location with that concerning each service station in the list, thereby identifying the closest service station currently to the vehicle and the distance between them. If such a distance is within the predetermined distance, e.g., 5 miles, processor 105 causes a message to be displayed on AUTO DIRECTOR interface 102a and/or to be announced through audio interface 118 described below, informing the user about the closest service station. In addition, if interface 102a is put in

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a navigation mode, the GPS information concerning such a service station is used by the aforementioned inertial guidance system to direct the user there.

Referring back to FIG. 1, self-test interface 114 comprises input/output (I/O) control logic for performing an active self-test of system 100 on power up or at the user's request. Specifically, interface 114 polls every other interface in system 100 for a self-test result. Each interface, when polled, performs an active self-test and reports the test results to interface 114, where such test results are gathered and caused to be displayed on interface 102a.

Preferences interface 116 monitors changes made by the user in selected functions after the user logs on system 100, and prompts the user to save such preferences. These preferences are stored in memory 115 in association with the user's PIN. Functions affording the user choices include auto locks, an easy entry, auto lamps, the seat position, steering column position, mirror position, radio, steering, ride, transmission shift, engine performance, climate, and security level.

Audio interface 118 comprises I/O control logic for receiving audio signals from a radio/CD, TV, compact disk (CD) player, or phone interface, processing the received audio signals, providing proper amplifications thereto, and routing the resulting sound to appropriate speakers and headphones (not shown) connected to interface 118.

In this illustrative embodiment, AUTO DIRECTOR display interface 102a and multifunction display interface 102b share the same speakers. As illustrated in FIG. 4, these speakers are central speaker 289, front left speaker 291a, front right speaker 291b, rear left speaker 293a and rear right speaker 293b. Central speaker 289 is installed on dashboard 295 directly opposite driver seat 287 in the automobile. In addition, speakers 291a and 291b are installed on the inside of front left door 297a and the inside of front right door 297b, respectively. Speakers 293a and 293b are respectively installed in left and right corners of rear shelf 299 in the automobile.

Interface 118 also provides center and rear console display interfaces 102c and 102d with separate audio channels, speakers and headphone outputs. The front and rear speakers may be muted by the user as a preference.

Interface 118 also processes requests from other interfaces for pre-recorded digital sounds stored in a SOUNDSGOOD library in memory 115 and routes the requested sounds to the appropriate interfaces. In addition, interface 118 comprises the conventional voice synthesizer circuitry for providing voice messages to the appropriate interfaces. Moreover, in accordance with another aspect of the invention, the voice messages and any accompanying digital sounds are routed to selected ones of speakers 289, 291a, 291b, 293a and 293b to effectively deliver the messages to the user. For instance, if the messages are extremely important, e.g., messages requiring actions to be taken immediately, to capture the full attention of the user, such messages may be routed to central speaker 289 and thereby directed toward the face of the user. If the messages are less important, e.g., advisories requiring actions to be taken sometime but not immediately, such messages may be routed to front speakers 291a and 291b. If the messages are still less important, e.g., driving tips and other messages for information only, such messages may be routed to rear speakers 293a and 293b, rendering the effect of background information.

FIGS. 5A and 5B jointly illustrate routine 300 for accessing, through AUTO DIRECTOR display interface 102a, a main menu to obtain operational instructions, main-

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tenance procedures, safety measures, and other information about the automobile, collectively referred to as "Quick Tips". Routine 300 is stored in memory 115 and initiated when SETUP switch 205g in FIG. 2 is pressed. Instructed by routine 300, processor 105 at step 301 elicits a PIN from the user by displaying a screen of FIG. 6 through interface 102a. As shown in FIG. 6, a video key-pad comprising numeral keys "1" through "9", and "*" and "#" keys are displayed on screen 209. In response, the user enters a sequence of numerals by touching the corresponding displayed keys, followed by the "#" key.

It should be pointed out that in accordance with another aspect of the invention, when a displayed key or option is touched on the screen of AUTO DIRECTOR display interface 102a or multifunction display interface 102b, a tone pre-selected by the user from the SOUNDSGOOD library is generated through audio interface 118, indicating that the key or option has been touched on the screen. Advantageously, relying on the audio tone confirmation, as opposed to a visual confirmation, the user while driving can continually watch the road.

The user may alternatively enter the above numeral sequence using control panel 205 in a manner to be described. In any event, processor 105 then verifies at step 303 the PIN entry by comparing it with the user's pre-selected PIN. The latter is stored in memory 115, along with the user's preferences. In a standard way, the user is given a few chances to enter a correct PIN. Verification of the PIN entry identifies the user as a legitimate user. Thus, if the PIN entry is not valid, routine 300 comes to an end, as indicated at step 304.

Otherwise if the PIN entry is valid, processor 105 at step 305 causes interface 102a to display on screen 209 a "SELECT A FUNCTION" screen, which is illustrated in FIG. 7. As shown in FIG. 7, two options, namely, "NAVIGATION" and "QUICK TIPS", are displayed on screen 209. By default, NAVIGATION option 401 is highlighted yellow when the screen of FIG. 7 appears.

It should be pointed out that in this illustrative embodiment, a yellow highlight on an option indicates that the option is selected but not yet activated. Once a yellow highlighted option is activated, the option is highlighted blue momentarily. System 100 then performs according to the activated option.

Thus, in this instance, the user may activate the yellow highlighted NAVIGATION option by touching the option on screen 209 or by pressing ENTER switch 205b.

However, if QUICK TIPS option 403 is desired, the user may touch that option on screen 209, which would then be highlighted yellow. A second touch on the same option will change the highlight to blue, indicating the active status. As an alternative, the user may utilize knob 205d of FIG. 2 to select QUICK TIPS option 403 by first pushing the knob to the right. In response, processor 105 causes the yellow highlight to move from default NAVIGATION option 401 to QUICK TIPS option 403. The user can then select the QUICK TIPS option by pressing ENTER switch 205b. Upon selection, the yellow highlighted option will again turn blue.

Processor 105 at step 308 detects an activation of either NAVIGATION option 401 or QUICK TIPS option 403. If NAVIGATION option 401 is activated, processor 105 at step 311 causes system 100 to enter into a navigation mode. In this mode, processor 105 causes navigational instructions to be displayed on screen 209 in a conventional manner. In providing the navigation instructions, the standard inertial guidance system connected to navigation interface 106d

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receives signals from a constellation of GPS satellites maintained and controlled by the U.S. Department of Defense. In response to these signals, the inertial guidance system identifies the location (in longitude and latitude) of the automobile. The system also detects the vehicle speed, and the direction in which the vehicle is headed. By accessing the map information stored in memory 115, the system is capable of visually and verbally providing the user with directions to a given destination through AUTO DIRECTOR display interface 102a and audio interface 118, respectively.

Otherwise if activation of QUICK TIPS option 403 is detected at step 308, processor 105 causes interface 102a to display an introduction screen on screen 209, as indicated at step 314. This introduction screen is illustrated in FIG. 8.

As shown in FIG. 8, system source identification, warning and instructional information appear on the introduction screen, along with two options, "MAIN MENU" and "READ ME". The default option in this instance is READ ME option 501 which is highlighted yellow. Processor 105 detects at step 317 whether MAIN MENU option 503 or READ ME option 501 is activated. If MAIN MENU option 503 is activated, routine 300 proceeds to step 340 to be described. Otherwise if READ ME option 501 is activated, routine 300 proceeds to step 320 where processor 105 causes a series of three screens to be displayed. The first screen of the series is a "MANUFACTURER" screen, which is illustrated in FIG. 9.

As shown in FIG. 9, a description of the QUICK TIPS system appears on the MANUFACTURER screen. If the text to be displayed exceeds one screen, which is the case here, scrolling options comprising scroll-up option 605 and scroll-down option 607 are provided. When option 605 is touched and activated on screen 209, additional text scrolls up one paragraph at a time. Option 607 performs an inverse function to option 605. Again, as an alternative, the user may maneuver PUSH TO SELECT knob 205d until the desired scroll option (or direction arrow) is highlighted yellow. The activation of the highlighted option is achieved by pressing ENTER switch 205b.

By default, displayed option 609 has the "AUTO VOICE" wording thereon and is highlighted blue as the MANUFACTURER screen comes on. Accordingly, a pre-recorded voice is activated by processor 105 through audio interface 118 to read the entire text associated with this screen without interruption, including the text which is not presently shown on screen 209 but otherwise shown upon scrolling. To alter the AUTO VOICE function, the user may touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "AUTO VOICE" wording on option 609 changes to "MANUAL VOICE", which is highlighted blue, indicating its active status.

In accordance with the MANUAL VOICE function, a pre-recorded voice reads the displayed text only, and stops reading until additional text is scrolled onto the screen. To silence the voice, the user may again touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "MANUAL VOICE" wording on option 609 changes to "VOICE OFF", and the voice is deactivated, with the option now highlighted yellow. The cycle of the AUTO VOICE, MANUAL VOICE and VOICE OFF functions can be repeated by successively touching option 609 or pressing switch 205b.

Other displayed options on the screen of FIG. 9 include PREVIOUS option 611 and NEXT option 613. As indicated at step 323, option 611 when selected causes routine 300 to return to step 314, where the introduction screen of FIG. 8

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is again displayed. Otherwise, if option 613 is selected, routine 300 proceeds to step 326 in FIG. 5B where processor 105 causes a "SAFETY REMINDERS" screen to be displayed on screen 209. FIG. 10 illustrates such a screen.

As shown in FIG. 10, like the MANUFACTURER screen, the SAFETY REMINDERS screen includes option 609 displayed with the default wording "AUTO VOICE" thereon, PREVIOUS option 611, NEXT option 613, scroll-up option 605 and scroll-down option 607. This screen reminds the user of the safety features of the vehicle including, for example, air bags and seat belts. As indicated at step 329, option 611 when selected causes routine 300 to return to step 320 of FIG. 5A. Otherwise if option 613 is selected, routine 300 proceeds to step 332 where processor 105 causes a "THEFT PROTECTION FEATURES" screen to be displayed on LCD screen 209. FIG. 11 illustrates such a screen.

As shown in FIG. 11, the THEFT PROTECTION FEATURES screen similarly has thereon displayed options 605, 607, 609, 611 and 613. This screen describes to the user a theft-deterrent system including the anti-theft routine of FIG. 3 equipped in the vehicle. As indicated at step 335, option 611 when selected causes routine 300 to return to step 326. Otherwise if option 613 is selected, routine 300 proceeds to step 338 where processor 105 causes a "QUICK TIPS SET-UP" screen to be displayed on LCD screen 209. FIG. 12 illustrates such a screen.

As shown in FIG. 12, the QUICK TIPS SET-UP screen comprises two arrays of displayed options, denoted 901 and 903, respectively. Array 901 concerns the volume of the audio part of system 100. In this illustrative embodiment, the user may select the options in array 901 to respectively turn the volume off, to a "SOFT" level, to a medium level, and to a "LOUD" level. Array 903 concerns the display of LCD 119 of system 100. In this illustrative embodiment, the user may select the options in array 903 to respectively turn the display off, adjust it to a "DAY" setting, adjust it to a "NIGHT" setting, and have it automatically adjusted. When the QUICK TIPS SETUP screen comes on, by default, the volume is set to a medium level (i.e., the "MED" option in array 901 highlighted blue), and the display is set to be automatically adjusted (i.e., the "AUTO" option in array 903 highlighted blue).

Also shown in FIG. 12 is NEXT option 905. By selecting this option, routine 300 returns to step 340 of FIG. 5A where a "MAIN MENU" screen is displayed on LCD screen 209. After routine 300 is performed, the screen of FIG. 12 can be invoked at any time by pressing SETUP switch 205g to re-adjust the volume and the intensity of the LCD of system 100.

FIG. 13 illustrates the MAIN MENU screen. This screen comprises displayed options disposed in columns 1001, 1003, 1005, and 1007. For example, column 1001 includes DRIVER'S VIEW option 1001a, STEERING COLUMN CONTROLS option 1001b, LOCK option 1001c, DRIVING TIPS option 1001d, and INDEX option 1001e. It should also be noted that this screen can be invoked at any time by pressing MENU switch 205e.

When the MAIN MENU screen comes on, by default, DRIVER'S VIEW option 1001a is highlighted yellow, indicating that it is selected. However, the user may touch any other displayed option on screen 209 for re-selection. A further touch on the yellow highlighted option changes its color to blue and activates same. Again, the user may alternatively maneuver PUSH TO SELECT knob 205d to re-select any other displayed option, followed by a depress-

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sion of ENTER switch 205b to activate the selected option. Since LCD screen 209 is compact, the display area for each option on the MAIN MENU screen is generally small. As a result, selection and activation of an option by touching the option on the screen is susceptible to errors, especially when the vehicle is in motion. Thus, in this situation it may be preferable to achieve the same result using knob 205d and switch 205b, instead.

In addition, because of the small display area allocated to each option on the MAIN MENU screen, the wording on the option is brief and thus tends to be cryptic. In accordance with a feature of the invention, after a predetermined time (e.g., a few seconds) has elapsed from the option's being highlighted yellow, processor 105 causes a voice to be generated on speakers 127 to explain the purpose of the option before the user activates it. For example, after a predetermined delay from DRIVE'S VIEW option 1001a's being highlighted yellow, a voice is activated, stating the option name, followed by an explanation of the purpose of the option such as "To provide location of dash mounted components." Thus, this inventive feature affords a preview of the option before the user commits to it, thereby avoiding unnecessary backtracking.

Continuing the example, after hearing the preview of option 1001a, the user decides to select that option. In response, processor 105 causes a "DRIVER'S VIEW" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 14. When the DRIVER'S VIEW screen appears, VOICE option 1101 is highlighted blue, indicating that voice announcements are active. To disable the voice announcements, the user may touch VOICE option 1101 on screen 209, or alternatively press ENTER switch 205b. VOICE option 1101 would be highlighted yellow when disabled.

As also shown in FIG. 14, a view of the interior of the automobile from the driver's perspective is provided. Underneath that view, DASH-MOUNTED CONTROLS option 1103, INSTRUMENT PANEL option 1105, AUDIO SYSTEM option 1107, CLIMATE CONTROLS option 1109 and PREVIOUS option 1111 are displayed. By default, DASH-MOUNTED CONTROLS option is highlighted yellow. However, the user in this example decides to select INSTRUMENT PANEL option 1105, instead. By touching option 1105 on screen 209, the option is highlighted yellow. If VOICE option is not disabled, after a predetermined delay, an announcement such as "To provide information on gauges, meters and warning lights" comes on to preview the purpose or content of option 1105. Options 1103, 1107, and 1109 are similarly programmed. In this instance, selecting PREVIOUS option 1111 enables the user to return to the MAIN MENU screen of FIG. 13.

It should be noted at this point that if the user chooses to return to the MAIN MENU screen, DRIVER'S VIEW option 1001a previously activated on that screen is highlighted in another distinctive color, e.g., grey, indicating its previous activation status. Advantageously, when the user searches for particular information using the MAIN MENU screen, and the information is not found through certain options activated, these options are now highlighted grey. Knowing those options highlighted grey have been explored, which do not lead to the desired information, the user would not re-activate them by mistake, thereby performing the search effectively. For that matter, in this illustrative embodiment, each option previously activated is highlighted in the above distinctive color, i.e., grey in this instance, indicating its previous activation status.

Continuing the above example, assuming that the user activates option 1105 in FIG. 14 after hearing the aforemen-

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tioned preview, in response processor 105 causes an "INSTRUMENT PANEL" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 15A. As shown in FIG. 15A, the previous screen format is generally maintained in that it provides a view of the object (the instrument panel of the automobile in this instance) pertinent to the option which has been selected, along with displayed options for further selection thereunder. Based on the disclosure heretofore, the design and operation of these screens by now are apparent to a person skilled in the art, and become self-explanatory.

In accordance with another feature of the invention, individual elements on the instrument panel shown in FIG. 15A are labeled with numerals "1", "2", "3", "4" and "5" which correspond to option 1201a designated "1. TACHOMETER AND WARNING LIGHTS", option 1201b designated "2. TURN SIGNAL/HAZARD WARNING", option 1201c designated "3. SPEEDOMETER AND WARNING LIGHTS", option 1201e designated "4. ODOMETER & TRIP METERS/OUTSIDE TEMPERATURE", and option 1201f designated "5. FUEL/TEMP GAUGE AND WARNING LIGHTS", respectively. As such, the function of the displayed options is two-fold. First, the wording on each displayed option informs the user of what the corresponding element(s) represents. Second, each displayed option is also for selection to obtain more information about the corresponding element(s). In addition, with the above voice preview feature, the user is further apprised of the purpose or content of the option before he/she commits to it. For example, TACHOMETER AND WARNING LIGHTS option 1201a corresponds to a voice preview such as "To provide information on tachometer and malfunction, maintenance required, low oil pressure and charging system failure indicators."

It should be noted at this point that in an alternative embodiment, the association of the displayed options with the corresponding elements on the instrument panel shown in FIG. 15A is not realized using numeral references, i.e., "1", "2", "3", "4" and "5" described above. Rather, in accordance with yet another aspect of the invention, as soon as one of the displayed options is selected (e.g., by touching the displayed option) on screen 209 and thus highlighted yellow in this instance, the corresponding element on the instrument panel is highlighted in the same color, thereby accomplishing the desired association without using any numeral references. Conversely, knowing a particular element on the instrument panel for which information is sought, the user selects (e.g., by touching) that particular element shown on the INSTRUMENT PANEL screen. Accordingly, the selected element on the screen is highlighted yellow, and at the same time the corresponding option is highlighted in the same color. The activation of the highlighted option may be achieved by, e.g., touching the highlighted option or the corresponding highlighted element on screen 209.

FIG. 15B illustrates the INSTRUMENT PANEL screen in the alternative embodiment. For example, as soon as SPEEDOMETER AND WARNING LIGHTS option 1204 is selected and thus highlighted yellow (shown shaded), element 1206 depicting the corresponding speedometer and warning lights is also highlighted yellow (also shown shaded), and vice versa. In fact, the association using the same highlight in accordance with the invention applies throughout the screens, wherever appropriate, in the alternative embodiment, including the DRIVER'S VIEW screen described above.

Continuing the example in the present illustrative embodiment, assuming that the user in this instance acti-

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vates option 1201a in FIG. 15A, in response processor 105 causes a "TACHOMETER AND WARNING LIGHTS" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 16.

FIG. 16 shows VOICE option 1301 similar to option 1101 described before, TIP option 1303, a tachometer of the automobile denoted 1305, warning lights collectively denoted 1307, and options 1309a through 1309f in display segment 1311.

When TIP option 1303 appears on screen 209, it indicates that helpful hints or reminders are available upon selection thereof. In accordance with another feature of the invention, the appearance of TIP option 1303 is accompanied by the playing of a sound segment associated therewith. This sound segment may be preselected by the user from the SOUNDS-GOOD library. After an adaptation period, the user would be able to rely on the familiar sound segment, without looking at the screen, to alert him/her of the availability of the TIP option.

Similarly, the user may pre-select another sound segment associated with warnings. Such a sound segment should connote urgency or even emergency as such warnings include, for example, engine overheating, an extremely low fuel level caution, GPS emergency information from navigation interface 106d, etc. Under control of processor 115, audio interface 118 preempts any on-going announcement and momentarily substitute therefor any such warning as soon as it occurs, which is preceded by the associated sound segment. As mentioned before, such an emergency warning, along with the associated sound segment, is communicated to the user through central speaker 289 in FIG. 4, which is disposed directly across driver seat 295. As a result, the user is able to much appreciate the emergency of the warning due to both of the direction from which the warning is announced and the associated sound segment preceding it.

In any event, if option 1303 is selected in this instance, a voice comes on and utters a tip regarding tachometer 1305 such as "To prevent engine damage, do not drive with needle in red zone." This tip is also momentarily displayed on segment 1311 in lieu of options 1309a through 1309f.

Similar to the elements on the INSTRUMENT PANEL screen, tachometer 1305 and warning lights 1307 on this screen are individually labeled and correspond to options 1309a, 1309b, 1309c, 1309e and 1309f, respectively. Assuming in this example that MAINTENANCE REQUIRED option 1309c is activated, display segment 1311 would be replaced by new display segment 1411 illustrated in FIG. 17. As shown in FIG. 17, item 1401 indicates the subject selected, i.e., "MAINTENANCE REQUIRED". Item 1403 explains what the MAINTENANCE REQUIRED warning light, when on, indicates. In this instance it states, "Maintenance required warning light comes on to indicate it is time for scheduled maintenance." PREVIOUS option 1405 enables the user to reactivate segment 1311 of FIG. 16.

Assuming further that at this point the user wants to learn about and also to program the air conditioning of the automobile, the user may access a "CLIMATE CONTROL" screen by successively pressing the PREVIOUS option to backtrack to the DRIVER'S VIEW screen of FIG. 14, where CLIMATE CONTROLS option 1109 is available. As a second alternative, the user may press MENU switch 205e to invoke the MAIN MENU screen of FIG. 13, where a "CLIMATE CONTROLS" option within column 1003 is available. A third alternative is provided in the event that the user cannot immediately relate "air conditioning" to the

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CLIMATE CONTROLS option. At the MAIN MENU screen of FIG. 13, the user may select Index option 1001e to be described. It suffices to know for now that this option allows the user to access the "CLIMATE CONTROL" screen using the term "air conditioning".

FIG. 18 illustrates the "CLIMATE CONTROL" screen. As shown in FIG. 18, VOICE option 1501 whose function is similar to that of option 1101 or 1301 described before is indicated in this instance using a pre-selected icon, as opposed to the word "VOICE". With the voice enabled, a first touch on any displayed option on screen 209 causes it to be highlighted yellow, indicating its selected status. A second touch causes it to be highlighted blue, indicating its active status. With the voice disabled, only one touch on any displayed option activates it.

Likewise, PREVIOUS option 1503 whose function is similar to that of option 1111 or 1309d described before is indicated in this instance using a second pre-selected icon, as opposed to the word "PREVIOUS". Advantageously, relying on icons instead of text describing the options, the user is able to select a desired option efficiently, especially when he/she is not proficient in a particular language (e.g., English in this instance) used in system 100. It will be appreciated that system 100, however, may provide different language versions of presentation, from which a user may select a desired language version.

The MODE options in FIG. 18 include OFF option 1511, AUTO option 1513, A/C option 1515, HEAT option 1517, and SMART CLIMATE option 1519. It should be noted that only one of the MODE options can be active at a time. In this example, assuming that the voice is enabled, when OFF option 1151 is selected by a first touch, a voice explaining the option comes on, uttering "To disable climate control." A second touch on the same option would then shut the climate control off through climate control interface 108f.

When AUTO option 1153 is selected by a first touch, a voice comes on to explain the option, uttering "System automatically determines air-flow distribution and volume for optimum efficiency." A second touch on the same option enables the automatic control, followed by a voice utterance, "Set desired temperature." Temperature display 1535 then flashes with the current temperature setting, prompting the user to set a desired temperature in a manner to be described.

If the user neglects to set a temperature after a predetermined time, in accordance with another aspect of the invention, a temperature range is automatically maintained by processor 105 in response to the date and time information from clock interface 108j, and the GPS information from navigation interface 106d. Based on the date and time information, processor 105 knows what the current season (e.g., mid-winter versus mid-summer) and time of the day (e.g., night verse noon) are. Based on the GPS information, processor 105 knows the region (e.g., New England versus Southern California) where the vehicle is. Processor 105 looks up a table stored in memory 115 containing predetermined temperature ranges corresponding to different combinations of the temporal and geographic parameters. It then prescribes an appropriate temperature range according to the table. This temperature range is updated by processor 105 periodically to reflect changes in the time of the day and the geographic location of the vehicle.

It should be noted that the actual realization of the temperature range as prescribed may depend on specific situations. For example, where the current temperature inside the vehicle is below the prescribed temperature range and sunlight is detected inside same, to conserve energy,

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processor 105 causes heaters in the vehicle to heat the vehicle compartment at a low rate, taking into account the sunlight shining through the windows of the vehicle, which helps heat the compartment due to the well known "greenhouse" effect. To that end, conventional devices sensitive to solar energy may be used to detect the presence and intensity of the sunlight inside the vehicle. Depending on the detected intensity, processor 105 accordingly adjusts the heating rates of the heaters to efficiently achieve the prescribed temperature range. In general, the higher the intensity, the lower are the heating rates.

Similarly, A/C option 1515 and HEAT option 1517 respectively enable the user to activate air conditioning and heaters at a desired temperature or a default temperature range.

SMART CLIMATE option 1519 is designed to allow the user to program the climate control for the next ride before he/she leaves the vehicle. When SMART CLIMATE option 1519 is selected by a first touch, a voice comes on to explain the option, uttering "To enable pre-heating or pre-cooling of vehicle." A second touch on the option activates the function, followed by a voice utterance, "Set desired temperature. Set desired time using fan speed arrows." Temperature display 1535 then flashes the current temperature setting, prompting the user to set a desired temperature. Similarly, fan speed display 1541 then flashes the current date, followed by current time, prompting the user to set the date and time that the user plans to re-enter the vehicle. Through climate control interface 108f, processor 105 determines whether the current level of power from the car battery and any back-up power sources is sufficient. If it is insufficient, a message such as "Fail to pre-condition vehicle temperature" is issued through audio interface 118 to notify the user of the noncompliance. Otherwise, when it is close to the re-entry time, processor 105 determines the start-up time to effect the pre-conditioning, depending on the temperature difference between the inside and outside of the vehicle at that time. Processor 105 would then cause a combination of heaters and/or heat pumps (not shown) connected to interface 108f to pre-condition the vehicle temperature. In order to avoid substantially draining the power, in this illustrative embodiment, the requested temperature would be maintained up to an hour after the set re-entry time.

The Air options in FIG. 18 include FRESH option 1521 and RECIRCULATED option 1523. Only one of these two options can be active at a time. When FRESH option 1521 is selected by a first touch on the option, a voice comes on to explain the selected option, uttering "To select outside air to circulate in vehicle." A second touch on the option activates the selection to ventilate the vehicle with outside air. Similarly, RECIRCULATED option 1523 allows the user to select the inside air for recirculation in the vehicle.

The VENT options in FIG. 18 include FLOOR option 1525, FLOOR/DASH option 1527, DASH option 1529, DEFROST option 1531 and FLOOR/DEFROST option 1533. Only one of these five options can be active at a time. When FLOOR option 1525 is selected by a first touch on the option, a voice comes on explaining the option, uttering "Main air distribution to floor." A second touch on the option directs an air flow toward the vehicle floor.

Similarly, FLOOR/DASH option 1527 enables the user to bifurcate the air flow between the floor and the dashboard. DASH option 1529 enables the user to direct the air flow from the dashboard. DEFROST option 1531 enables the user to direct the air flow toward the windshield and select fresh

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air if not selected. FLOOR/DEFROST option 1533 enables the user to bifurcate the air flow between the floor and windshield.

Temperature display 1535 displays the temperature selected by the user. Touching on up-arrow 1537 increases the selected temperature while touching on down-arrow 1539 decreases same. Continued touching on either up-arrow 1537 or down-arrow 1539 causes the temperature setting to change rapidly.

Similarly, fan speed display 1541 displays the fan speed (high, medium or low) selected by the user. Touching on up-arrow 1543 increases the selected fan speed while touching down-arrow 1539 decreases same.

The HEATERS options in FIG. 18 include SEAT option 1547, MIRROR option 1549, REAR WINDOW option 1551, STEERING WHEEL option 1553, and ALL option 1554. One or more of these options can be active at the same time. When SEAT option 1547 is selected by a first touch on the option, a voice comes on to explain the option, uttering "To enable seat heaters." A second touch on the option activates the seat heaters connected to climate control interface 108f.

Similarly, MIRROR option 1549 enables the user to activate outside mirror heaters. REAR WINDOW option 1551 enables the user to activate a rear window defroster. STEERING WHEEL option 1553 enables the user to activate a steering wheel heater. Finally, ALL option 1554 enables the user to activate all of the heaters simultaneously.

In personalizing the vehicle, preference interface 116 monitors any user adjustments to certain vehicle functions by comparing their current settings with the corresponding stored preferences in memory 115. Thus, for example, if the user changes any of the settings relating to the climate control such as the mode, vent, air, temperature, fan speed, etc. from its previous preferred setting, preference interface 116 causes a SAVE screen to appear on screen 209. This SAVE screen is illustrated in FIG. 19. As shown in FIG. 19, the user is prompted to save the change in the setting that he/she has just made. The user at this point may activate SAVE option 1601 to change the previous preferred setting. The SAVE screen thereafter disappears in favor of the previous screen. Otherwise, he/she may activate CLOSE option 1603 to close the SAVE screen, without storing the latest setting, which is then treated as a temporary setting. In the latter case, for example, a restart of the automobile will obliterate such a temporary setting, and reinstate the stored preferred setting.

Climate control screens can similarly be invoked by the front passenger and rear passengers on display interfaces 102c and 102d, respectively. Such screens provide similar MODE options including OFF, AUTO, A/C and HEAT options; and VENT options including LOWER VENT, UPPER VENT and LOWER/UPPER vent options. They also provide for temperature and fan speed adjustments for the respective localized areas. However, no save screen is provided.

Using INDEX option 1001e of FIG. 13 to look up information on and/or to control various items in the automobile will now be described. After option 1001e is activated, a DATA ENTRY screen illustrated in FIG. 20 is exhibited on screen 209. As shown in FIG. 20, a message "Enter Letter Or Item Name" appears to prompt the user for an entry of the name of the item of interest or its beginning letter. For this purpose, entry options for letters A through Z arranged in a grid format are provided in section 1701 for selection. In addition, DONE option 1703, when activated,

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indicates to system 100 that the entry is completed. Subdisplay 1705 is used to echo the user's entry to ensure its correctness.

In this illustration, the user enters "AIR CONDITIONING" as exhibited on subdisplay 1705. In response, an INDEX screen shown in FIG. 21 appears on display screen 209, with the search item name "AIR CONDITIONING" highlighted yellow. It should be noted that other item names such as "Anti-lock Brake System Indicator" are also shown, and they are in alphabetical order following "AIR CONDITIONING". This stems from the design of system 100 whereby the user may conveniently enter the beginning letter of the search item name only. In that case, a list of item names in alphabetical order with the first item name having the same beginning letter highlighted yellow. For instance, if the user had only entered "A" for "AIR CONDITIONING", a list of item names starting with "A" in alphabetical order would appear on screen 209 (although in this instance it would be the same list as shown in FIG. 21 as "AIR CONDITIONING" is the first item with a letter "A" in system 100). If the user cannot locate the name of the item of interest in the list, he/she may scroll the screen using scroll-up option 1801 or scroll-down option 1803 to review additional item names after or before the listed item names. Alternatively, the user may select PREVIOUS option 1805 to return to the screen of FIG. 20 to enter the complete item name.

In any event, after the user locates the item name on the INDEX screen, the user may then touch the item name to access information on that item. To that end, a look-up table is stored in memory 115. FIG. 22 illustrates such a look-up table, wherein left column 1901 lists each item name in alphabetical order in the index, and right column 1903 lists the corresponding instruction for processor 105 to carry out to access information on that item. For example, according to row 1905 of the table, the selection and activation of the item name "AIR CONDITIONING" causes processor 105 to connect the user to the CLIMATE CONTROL screen of FIG. 18 previously described.

The foregoing merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise numerous other systems which embody the principles of the invention and are thus within its spirit and scope.

For example, based on the disclosure heretofore, it is apparent that through system 100, the user can run diagnostics on selected parts of the automobile by voice command or touch-screen control.

In addition, it will be appreciated that a windows based operating system of the type of the MICROSOFT WINDOWS operating system is installed on system 100. Specifically, a copy of the operating system software is stored in memory 115. Utilizing such an operating system, processor 105 can be programmed to control display interfaces 102 to present information through one or more windows on screen 209. Thus, in that case, the user may activate two or more options from the MAIN MENU screen of FIG. 13, e.g., the INSTRUMENT PANEL option and CLIMATE CONTROLS option, one after another. Accordingly, in a well-known manner, processor 105 causes the corresponding screens, e.g., the INSTRUMENT PANEL screen of FIG. 15A and the CLIMATE CONTROL screen of FIG. 18, to be displayed in respective windows on screen 209. Advantageously, with the multiple windows, the user may efficiently control and retrieve information from the multiple displayed screens.

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Moreover, with the above operating system, processor 105 is responsive to signals generated by an indicator device used to point at and click on a displayed option to select and activate same. For example, such an indicator device may be a mouse, joystick, stylus, trackball or touchpad which may be operable by hand or foot, and wired or wireless.

Further, in the disclosed embodiment, through system 100, the user is able to program the climate control for the next ride before he/she leaves the vehicle. It will be appreciated that the user will be able to achieve same remotely ahead of time via telecommunication means. For example, processor 105 may be programmed to accept climate control commands through phone interface 106a. In that instance, the user can call from anywhere to establish a phone connection with phone interface 106a using a predetermined phone number, through which the user communicates the commands to climate control interface 108f to program the climate control. Through the phone connection, the user may be provided with climate control options described above in a synthesized voice. The user may activate one or more of such options by pressing a predetermined touch-tone key on the telephone keypad corresponding to a "yes" or "no" response. Similarly, the user may achieve the relevant temperature and/or time settings by pressing the touch-tone keys corresponding to the numerals indicative thereof. Of course, telecommunication means other than the telephone including a radio frequency (RF) transmitter may also be used to communicate the climate control commands from a remote area.

In addition, in the disclosed embodiment, the user may access different screens provided by AUTO DIRECTOR display interface 102a to learn about and control certain vehicle functions. It will be appreciated that a person skilled in the art will develop a demonstration program wherein a series of such screens will be automatically presented to a user in a predetermined sequence. The presentation may include commentaries, and highlights on selected options displayed on each screen. Furthermore, the presentation may be coupled with the showing of actual vehicle functions. For example, in demonstrating the climate control screen of FIG. 18, while the function of a highlighted VENT option (e.g., Floor, Floor/Dash, Dash, Defrost or Floor/Defrost) is explained, it is activated so that the user in the automobile can feel an actual air flow from the corresponding direction. The above demonstration program may be invoked using a PIN provided by the automobile manufacturer. The program may run continually while the automobile is shown in a showroom, or may be invoked by the user occasionally to obtain relevant information.

Further, in the disclosed embodiment, the MAINTENANCE REQUIRED warning light comes on when it is time for scheduled maintenance. In accordance with another aspect of the invention, the maintenance is scheduled by system 100 according to the cumulative time of the tachometer reading above a predetermined RPM value. Such cumulative time reflects the extent of the engine wear, and if it exceeds a predetermined length of time without maintenance, the engine performance would degrade substantially. In measuring the cumulative time in question, a conventional comparator (not shown) is employed in system 100 to compare the instantaneous tachometer reading (provided by engine control interface 112c) with the predetermined RPM value. Each time when the tachometer reading exceeds the predetermined value, processor 105 is interrupted to register the length of such an occurrence. The latter is added to a running sum to update the cumulative time in question. This cumulative time may be displayed on

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instrument panel display interface 102e, along with the tachometer reading and the MAINTENANCE REQUIRED warning indicator. A second conventional comparator (not shown) is employed in system 100 to compare the cumulative time with the above predetermined time length. As soon as the cumulative time exceeds the predetermined length, processor 105 is interrupted and causes the MAINTENANCE REQUIRED warning light to come on, indicating that it is time for maintenance.

Still further, system 100 as described is highly adaptable in adjusting to new system requirements, and capable of "learning" new automobile features to be introduced into the system. Such learning may involve a modification or an upgrade in the system software stored in memory 115.

Moreover, other features of system 100 may include capabilities of communications with a third party remote from the vehicle. For example, system 100 may be programmed to transmit signals representing data on the current speed of the vehicle and its VIN receivable by a radar system, thus enabling the third party to monitor its speed. Furthermore, system 100 may be programmed by the third party to disable and subsequently enable the vehicle upon successful verification of a PIN pre-assigned to the third party. To that end, system 100 is capable of receiving remote transmission of the PIN, followed by the disable or enable code. The transmission may be encrypted for security reasons. Furthermore, more than one PIN may be used for different purposes. For example, a PIN may be assigned to a law enforcement agency to disable the vehicle because of a suspension of a license, or to temporarily disable the vehicle when the driver is intoxicated. Another PIN may be assigned to an environmental protection agency to disable the vehicle for failing to meet the emission requirements. Yet another PIN may be assigned to the vehicle owner to disable the vehicle when parked, thereby reducing the risk of a car theft. The disabling of the vehicle involves cutting off its gas, putting on its anti-lock brakes, etc.

Further, system 100 is capable of receiving a low-frequency, low-power broadcast covering an area of a limited radius, referred to as a "Cell". The broadcast may provide electronic GPS map and Yellow Page type information pertaining to the cell. This information, when received, may be downloaded onto AUTO DIRECTOR display interface 102a or multifunction display interface 102b. Such information includes a local directory indicating locations of nearby gas stations, restaurants and other facilities on the GPS map, with respect to the current location of the automobile. The local directory may be formatted in the form of "web pages" featuring the local businesses, and include additional information such as business hours, telephone numbers, and information on products and services provided by such businesses.

The above broadcast may also provide local weather information sponsored by a civic group or commercial entity. In the case of civic group sponsorship, the local civic events may be posted alongside the weather information, and in the case of commercial sponsorship, advertisements may be posted instead. Of course, as the automobile moves from cell to cell, the contents of the broadcast change accordingly.

In addition, while the radio in the automobile is tuned to a particular radio station, system 100 is also capable of receiving any electronic files broadcast from that radio station, along with the radio program. These electronic files, which may be in the form of web pages, can be downloaded onto the system. The system user may then scroll the pages

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to learn such information as program listings and coming events sponsored by the radio station.

Moreover, in the disclosed embodiment, system 100 is illustratively used in an automobile. It will be appreciated that a person skilled in the art may also employ the inventive system in another type of vehicle such as a boat, an airplane, etc.

Finally, although information and control system 100, as disclosed, is embodied in the form of various discrete functional blocks, the system could equally well be embodied in an arrangement in which the functions of any one or more of those blocks or indeed, all of the functions thereof, are realized, for example, by one or more appropriately programmed processors or devices.

What is claimed is:

1. A system for providing messages of varying importance levels in a vehicle comprising:

a plurality of audio output devices for providing the messages, the audio output devices being disposed in different areas in the vehicle; and

a processor for assigning the audio output devices to a plurality of groups, each group including one or more of the audio output devices, each group of audio output devices corresponding to a respective one of the importance levels of the messages, a message being provided by a group of audio output devices corresponding to an importance level of the message.

2. The system of claim 1 wherein each of the plurality of audio output devices includes a speaker.

3. The system claim 1 wherein the group of audio output devices includes at least one audio output device disposed opposite a seat in the vehicle such that the message is provided toward a front part of a person occupying the seat.

4. The system of claim 3 wherein the message requires immediate attention.

5. The system of claim 3 wherein a second group of audio output devices includes at least a second audio output device disposed behind the seat in the vehicle, the message being more important than a second message provided using the at least second audio output device.

6. The system of claim 3 wherein a second group of audio output devices includes at least a second audio output device disposed on a door in the vehicle, the message being more important than a second message provided using the at least second audio output device.

7. The system of claim 6 wherein the second message include an advisory.

8. A method for use in a system for providing messages of varying importance levels in a vehicle, the system including a plurality of audio output devices for providing the messages, the audio output devices being disposed in different areas in the vehicle, the method comprising:

assigning the audio output devices to a plurality of groups, each group including one or more of the audio output devices, each group of audio output devices corresponding to a respective one of the importance levels of the messages; and

providing a message using a group of audio output devices corresponding to an importance level of the message.

9. The method of claim 8 wherein the group of audio output devices includes at least one audio output device disposed opposite a seat in the vehicle such that the message is provided toward a front part of a person occupying the seat.

10. The method of claim 9 wherein the message requires immediate attention.

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11. The method of claim 9 wherein a second group of audio output devices includes at least a second audio output device disposed on a door in the vehicle, the message being more important than a second message provided using the at least second audio output device.

12. The method of claim 11 wherein the second message includes an advisory.

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13. The method of claim 9 wherein a second group of audio output devices includes at least a second audio output device disposed behind the seat in the vehicle, the message being more important than a second message provided using the at least second audio output device.

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(54) **MULTIMEDIA TECHNIQUE FOR
OPERATING DEVICES IN A VEHICLE**

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(*) **Notice:** This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(51) **Int. Cl.**⁷ G06F 7/70

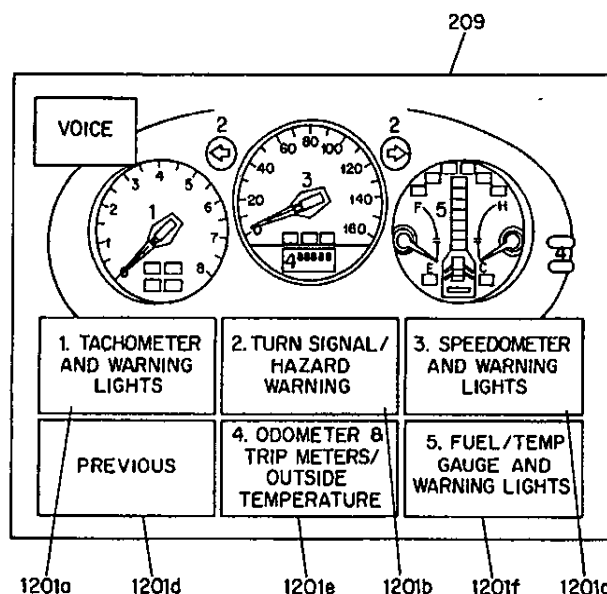
(52) **U.S. Cl.** 701/1; 701/29; 340/336;
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(57) **ABSTRACT**

In a multimedia information and control system for use in an automobile, at least one interface is employed which enables a user to access information concerning the automobile and control vehicle functions in an efficient manner. The user may select one of a plurality of displayed options on a screen of such an interface. Through audio, video and/or text media, the user is provided with information concerning the selected option and the vehicle function corresponding thereto. Having been so informed, the user may activate the selected option to control the corresponding vehicle function.

56 Claims, 15 Drawing Sheets



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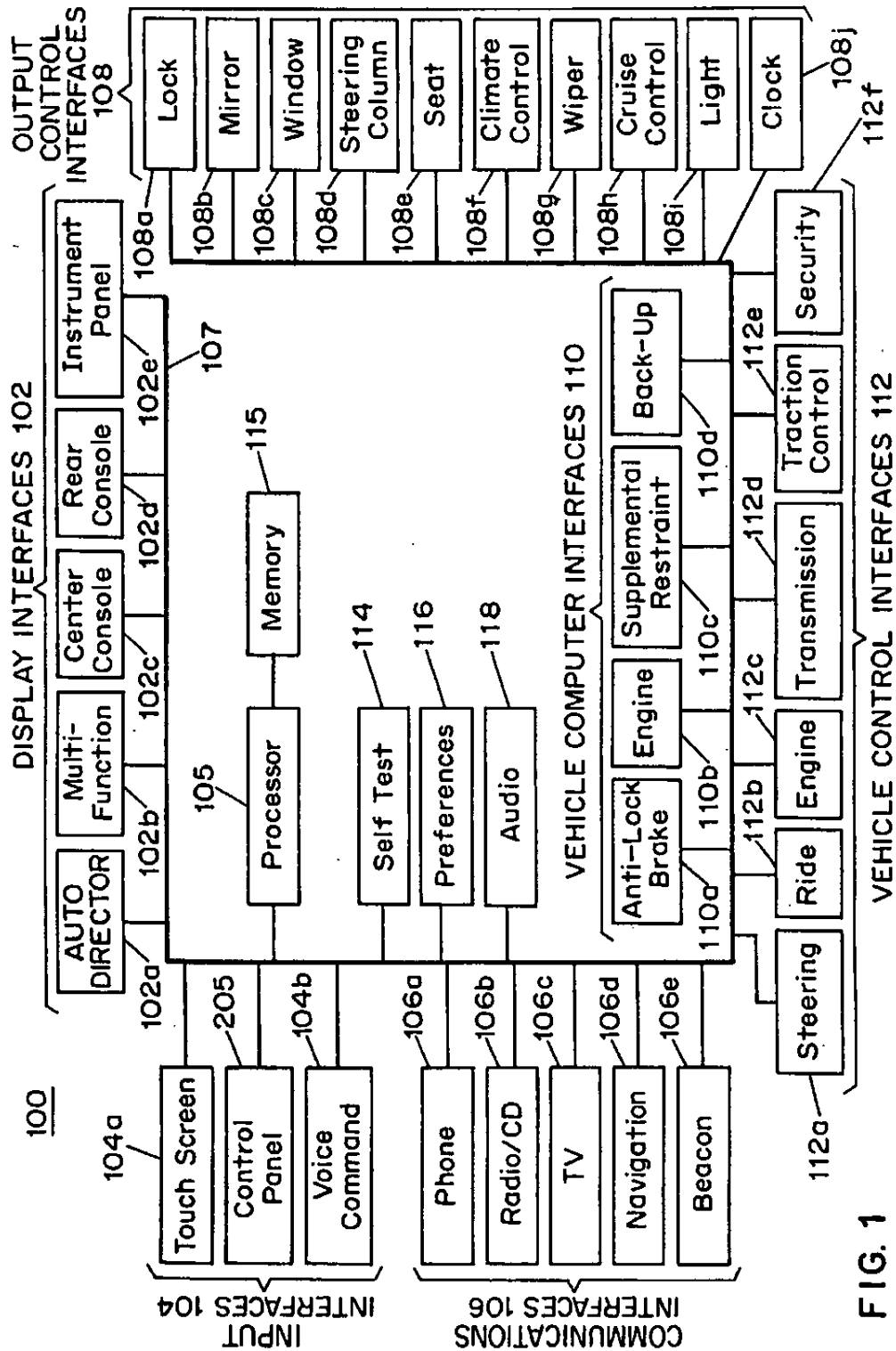


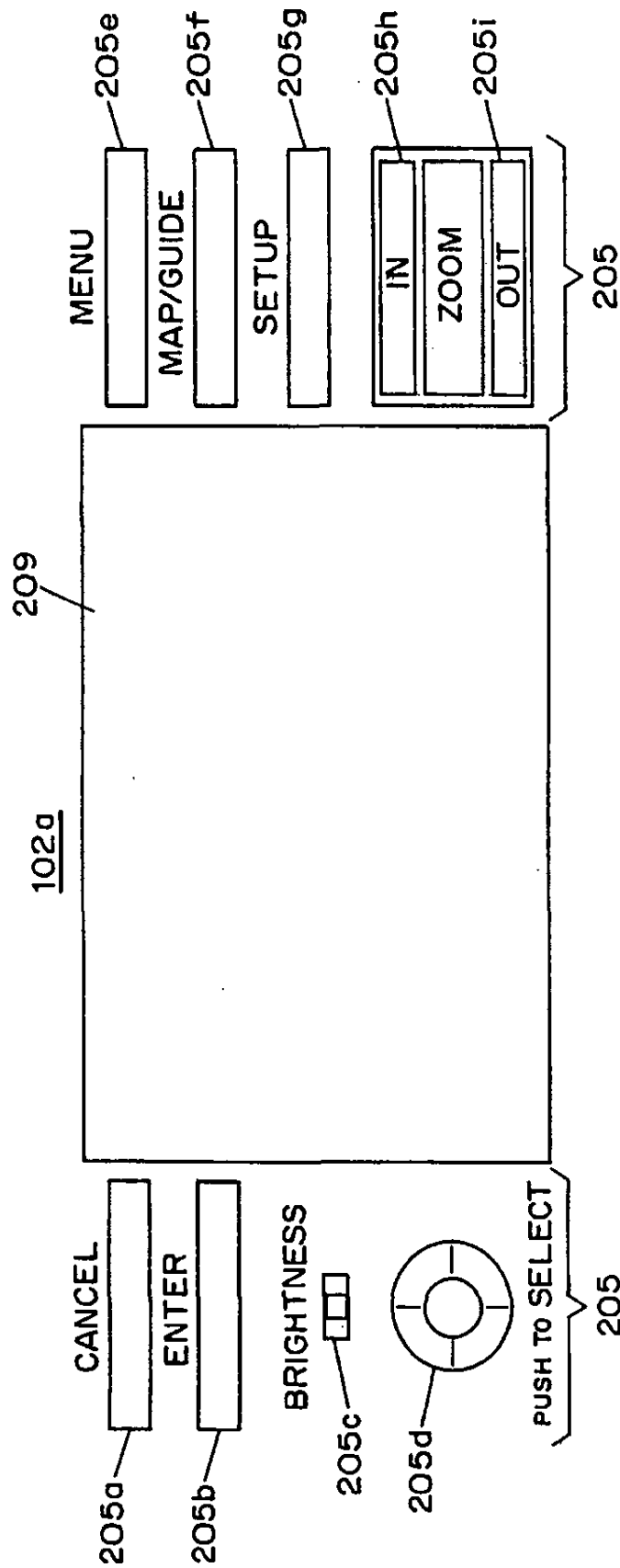
FIG. 1

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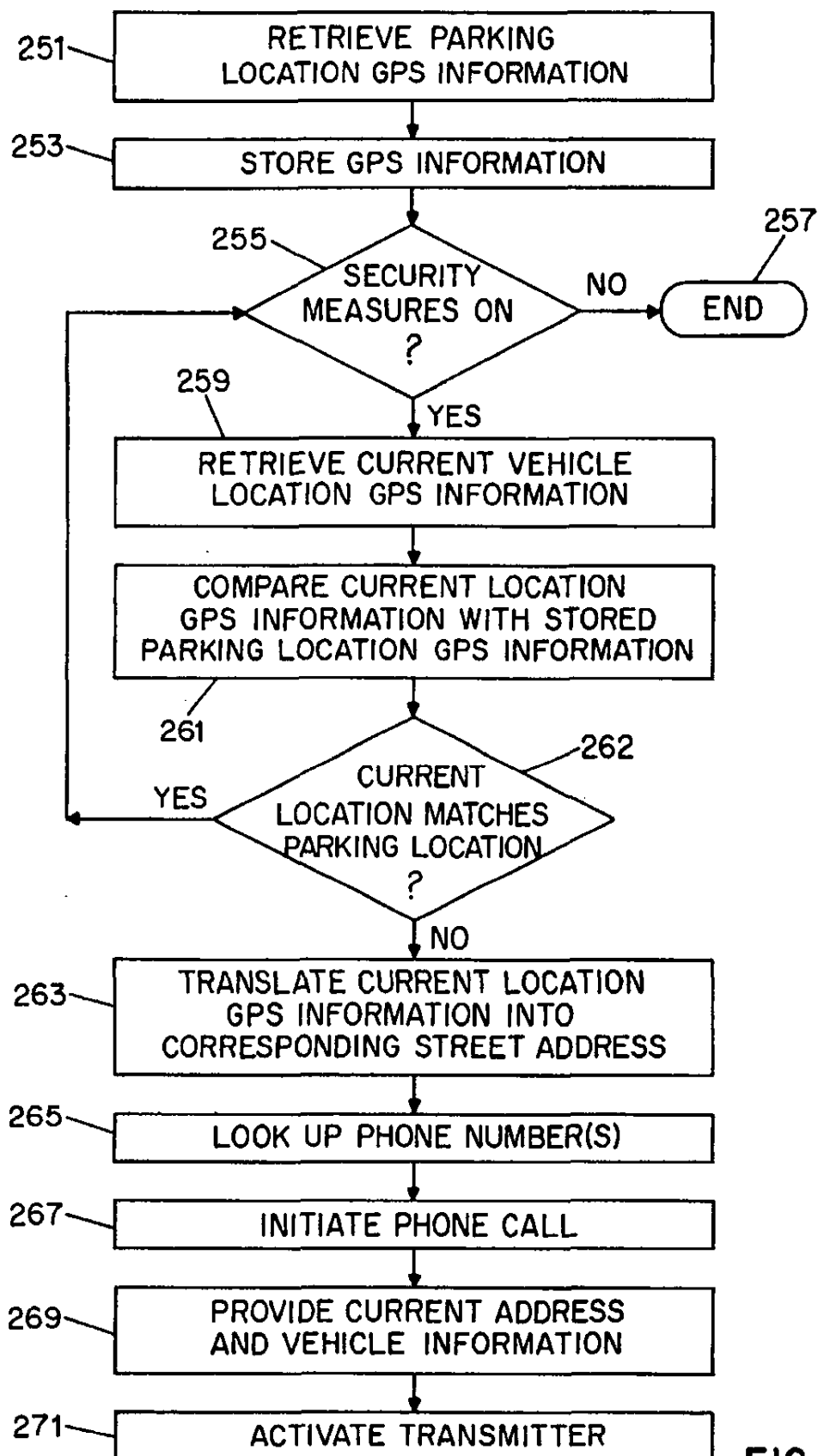


FIG. 3A

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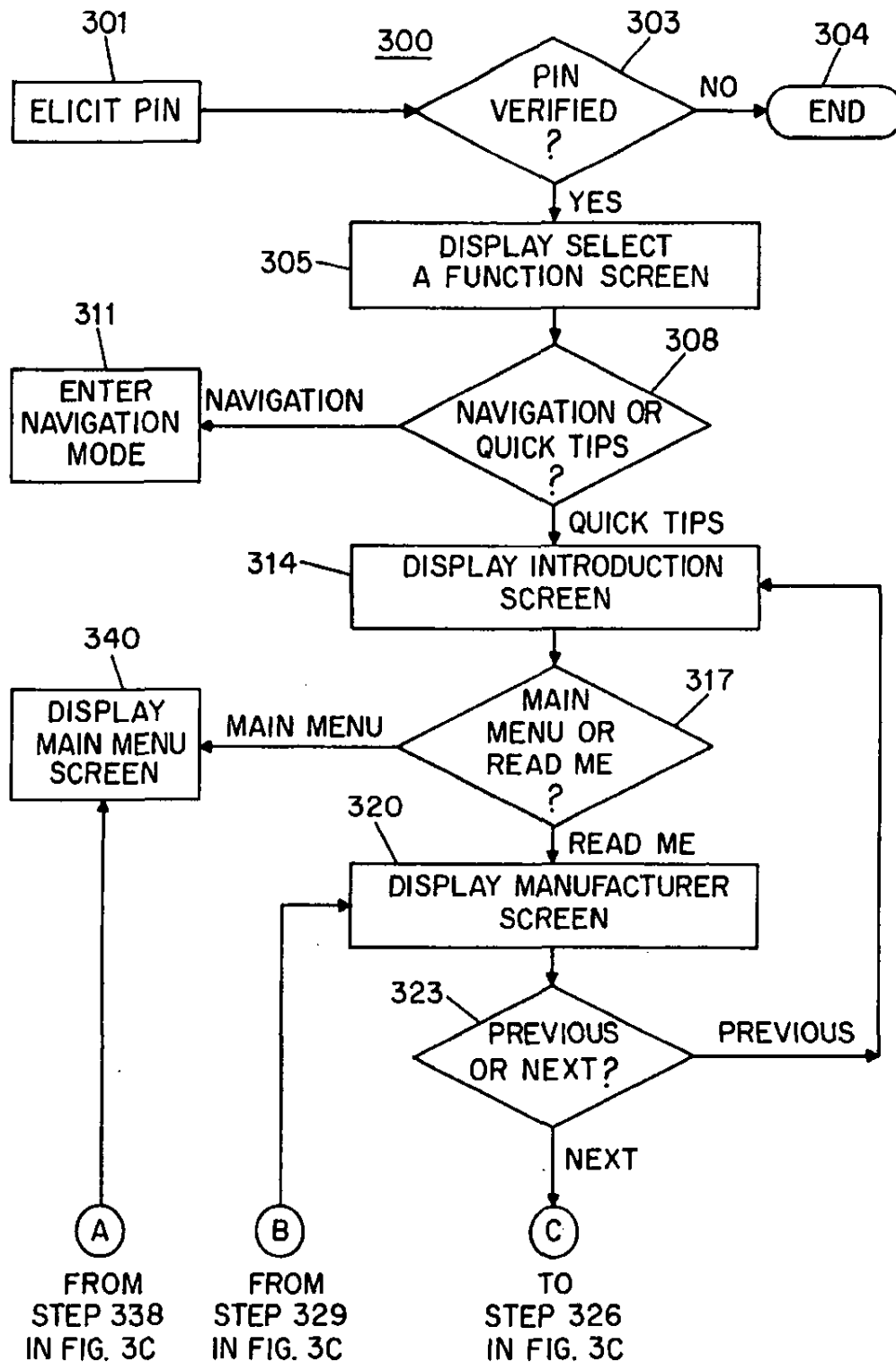


FIG. 3B

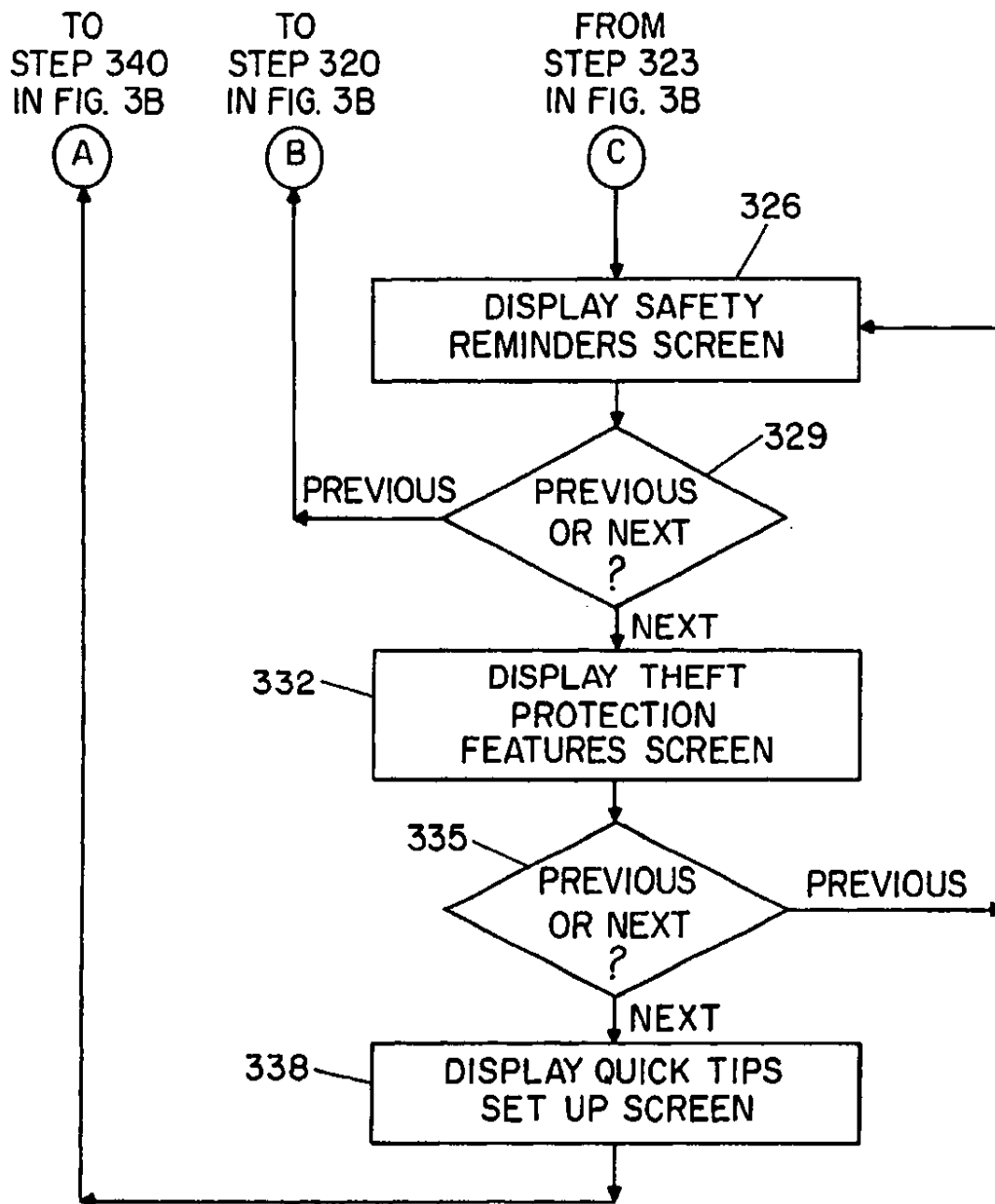


FIG. 3C

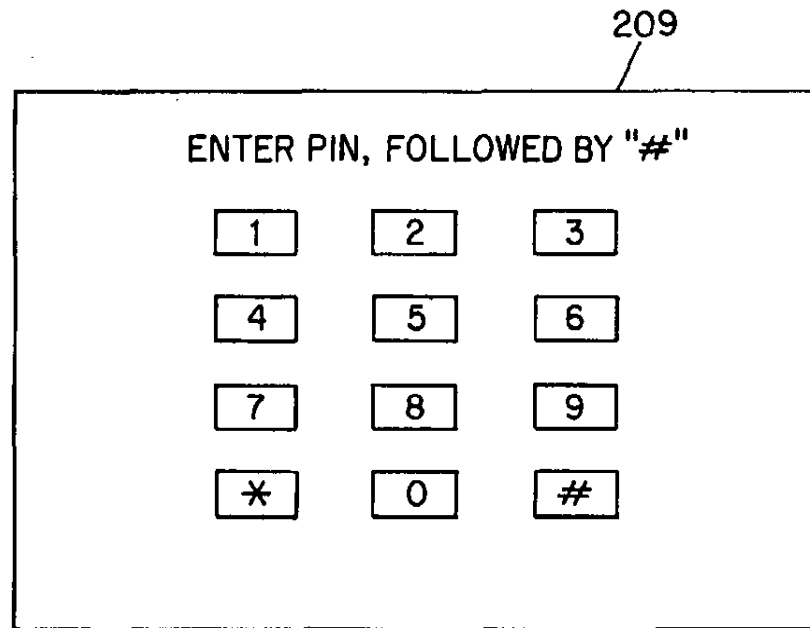


FIG. 4A

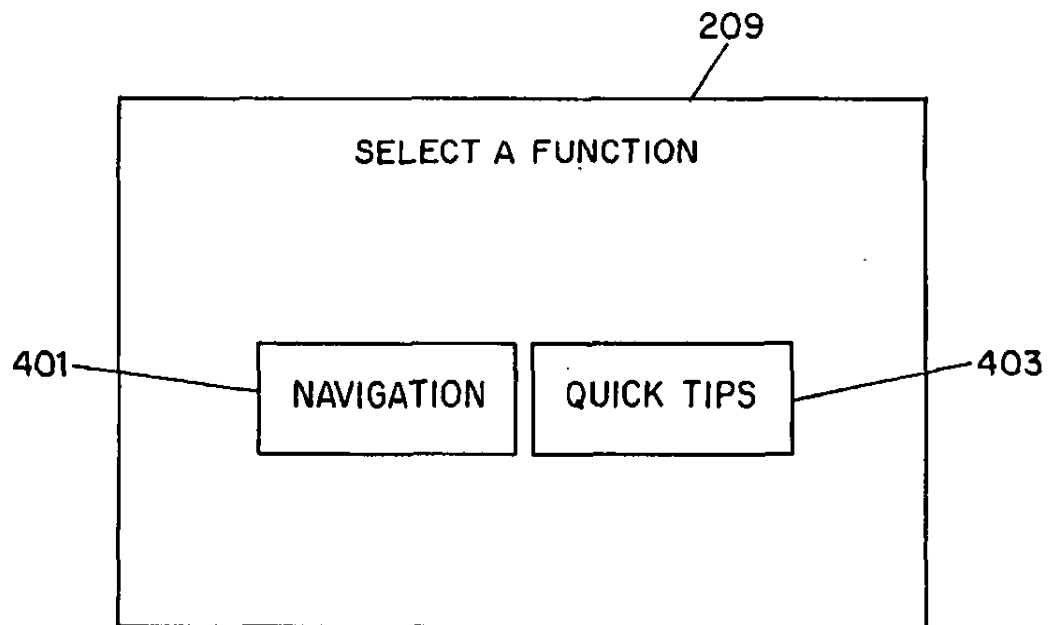


FIG. 4B

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FIG. 5

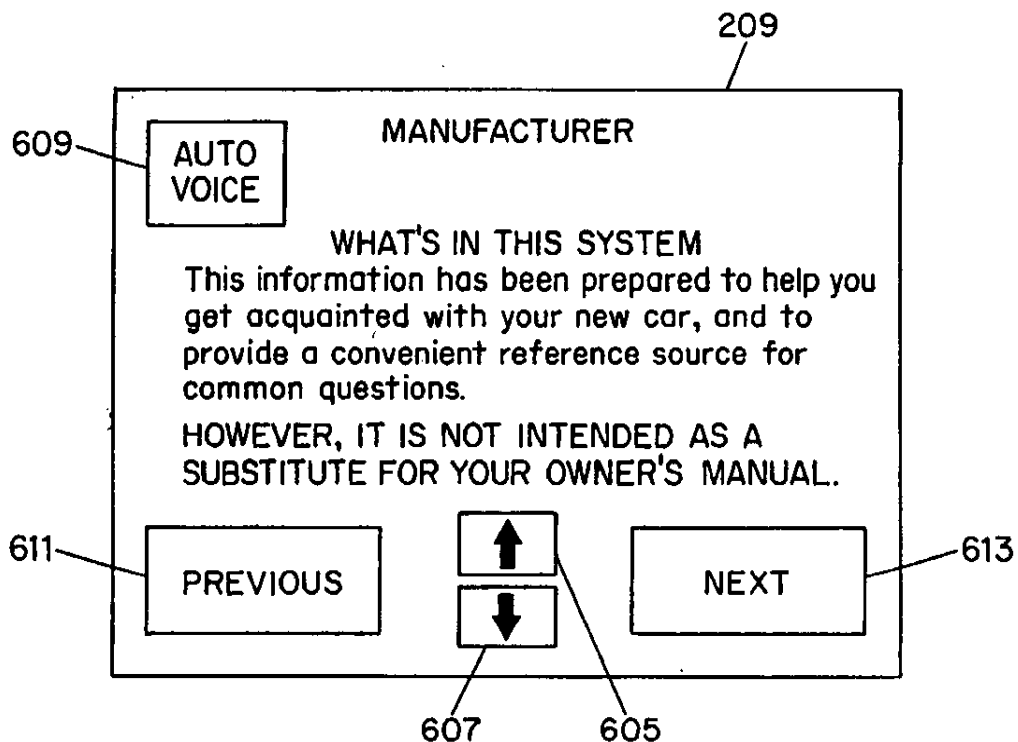


FIG. 6

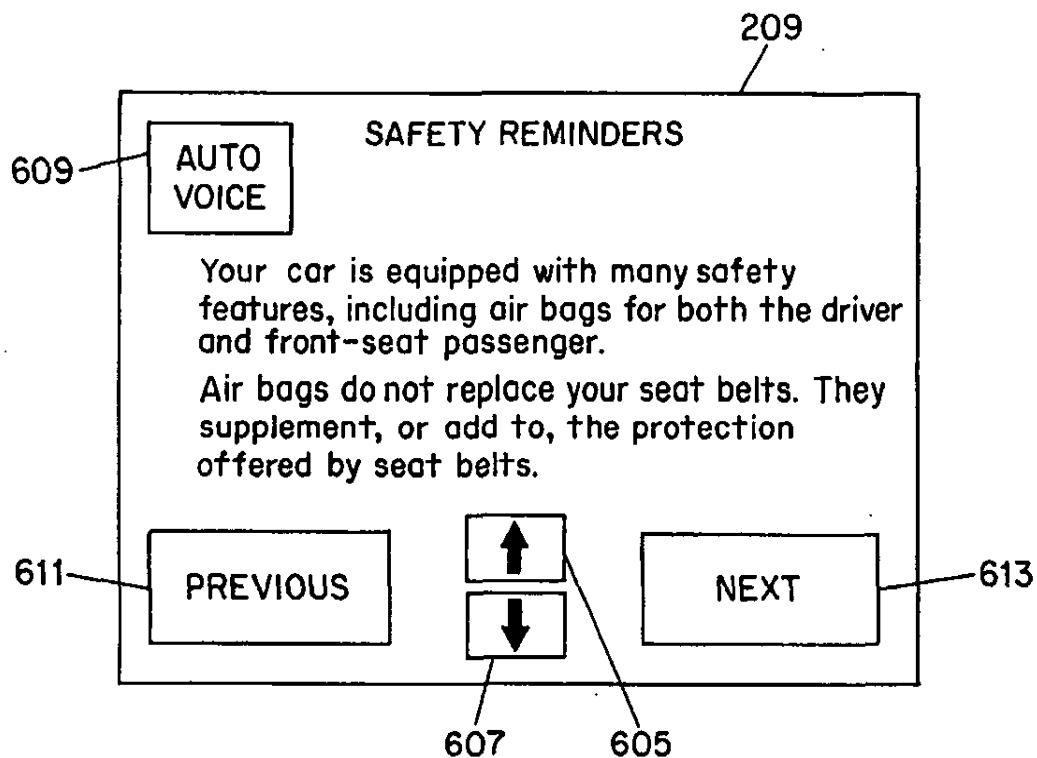


FIG. 7

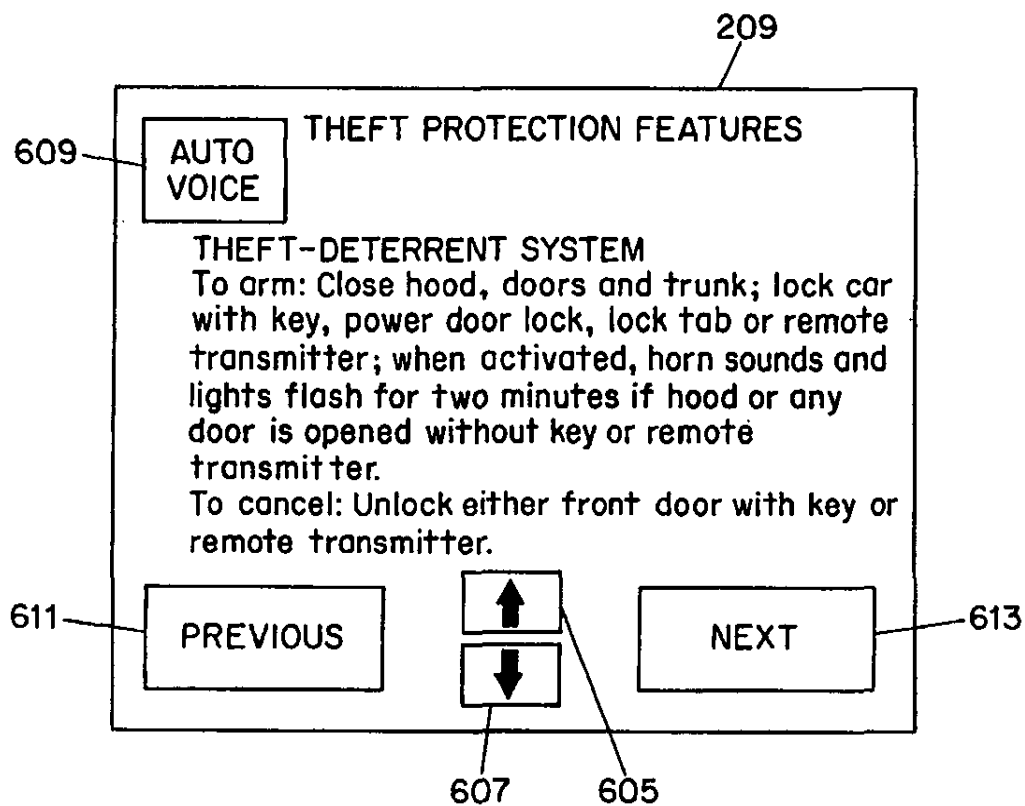


FIG. 8

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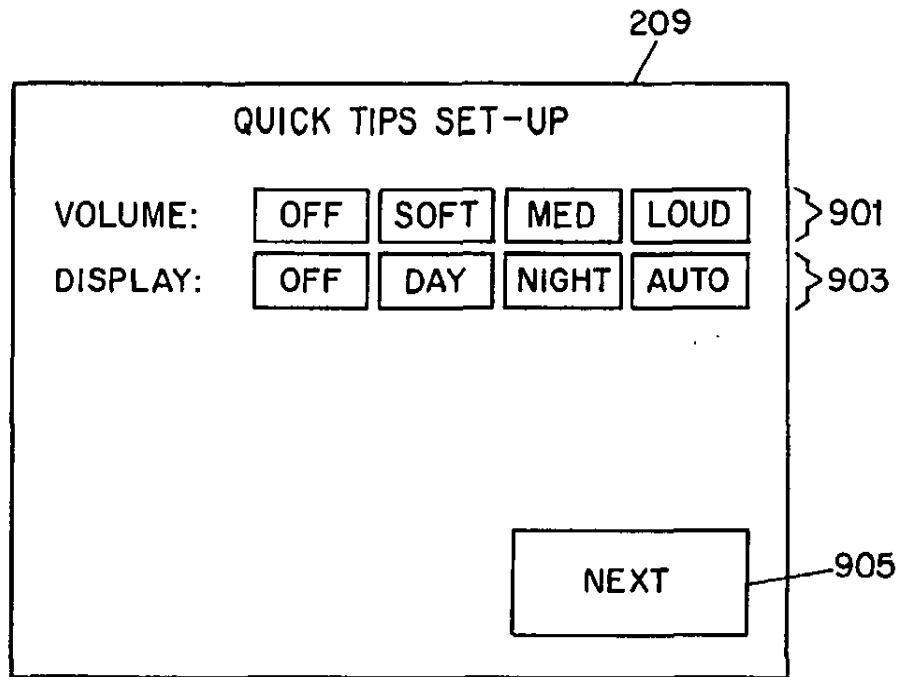


FIG. 9

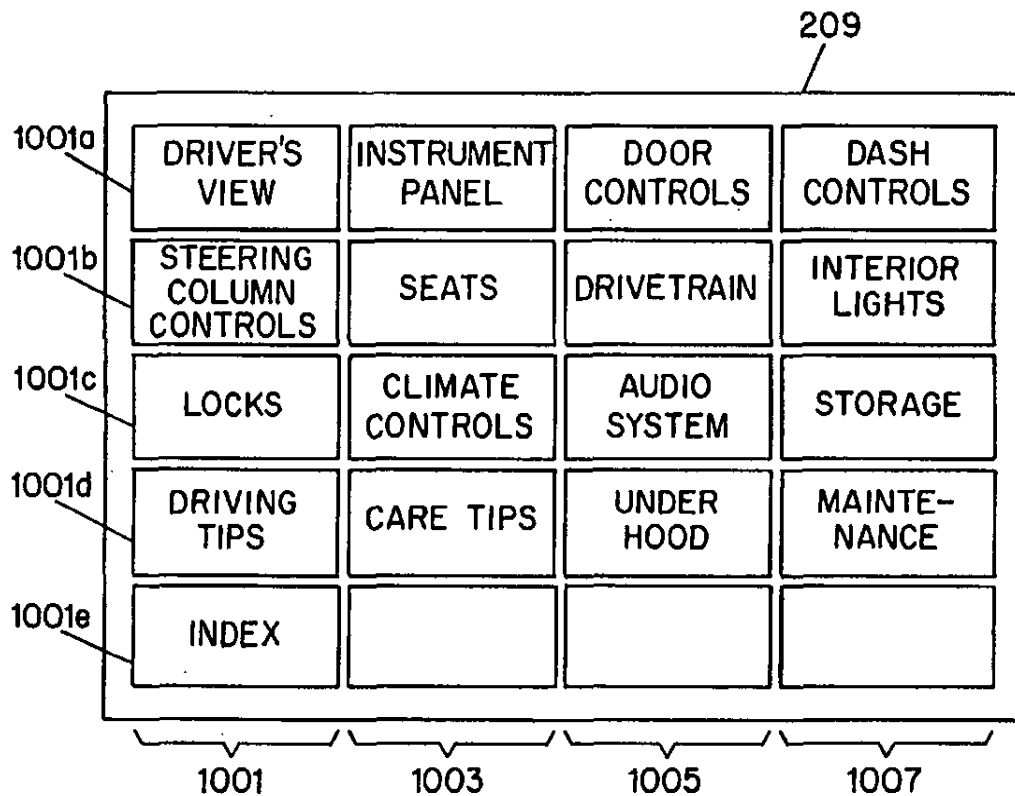


FIG. 10

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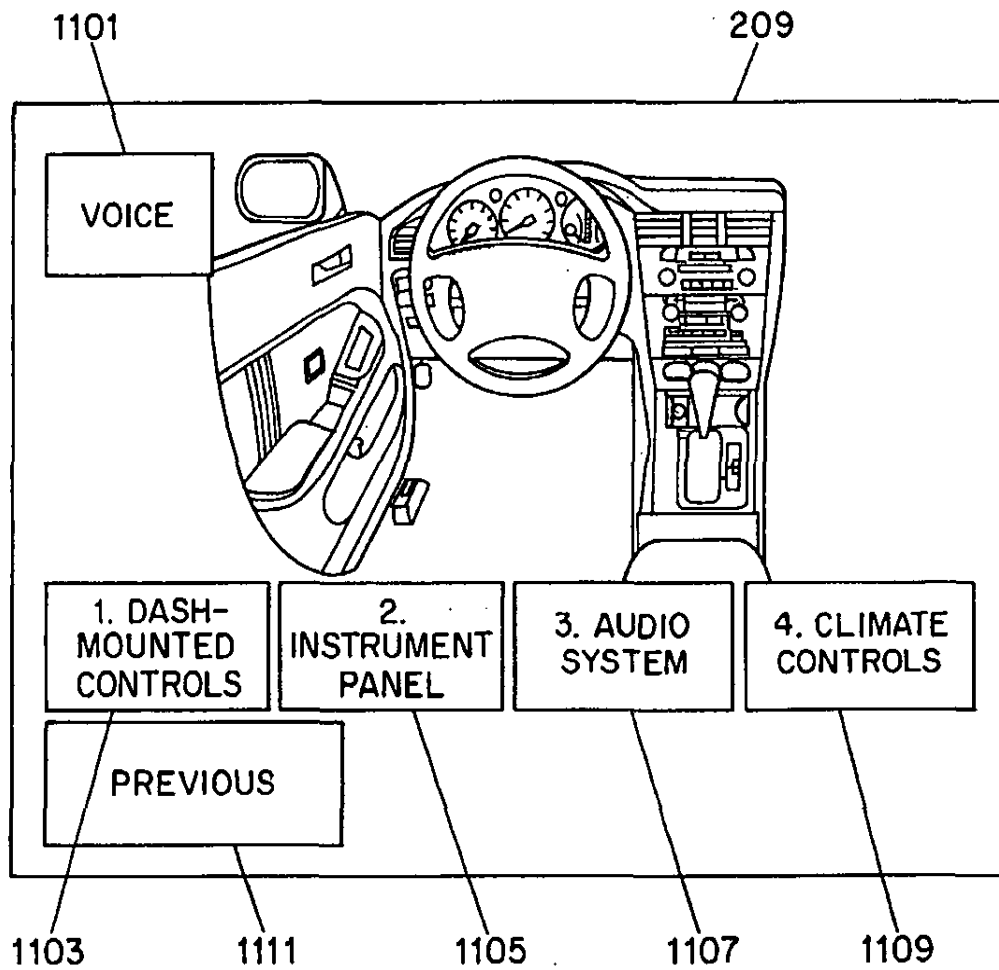


FIG. 11

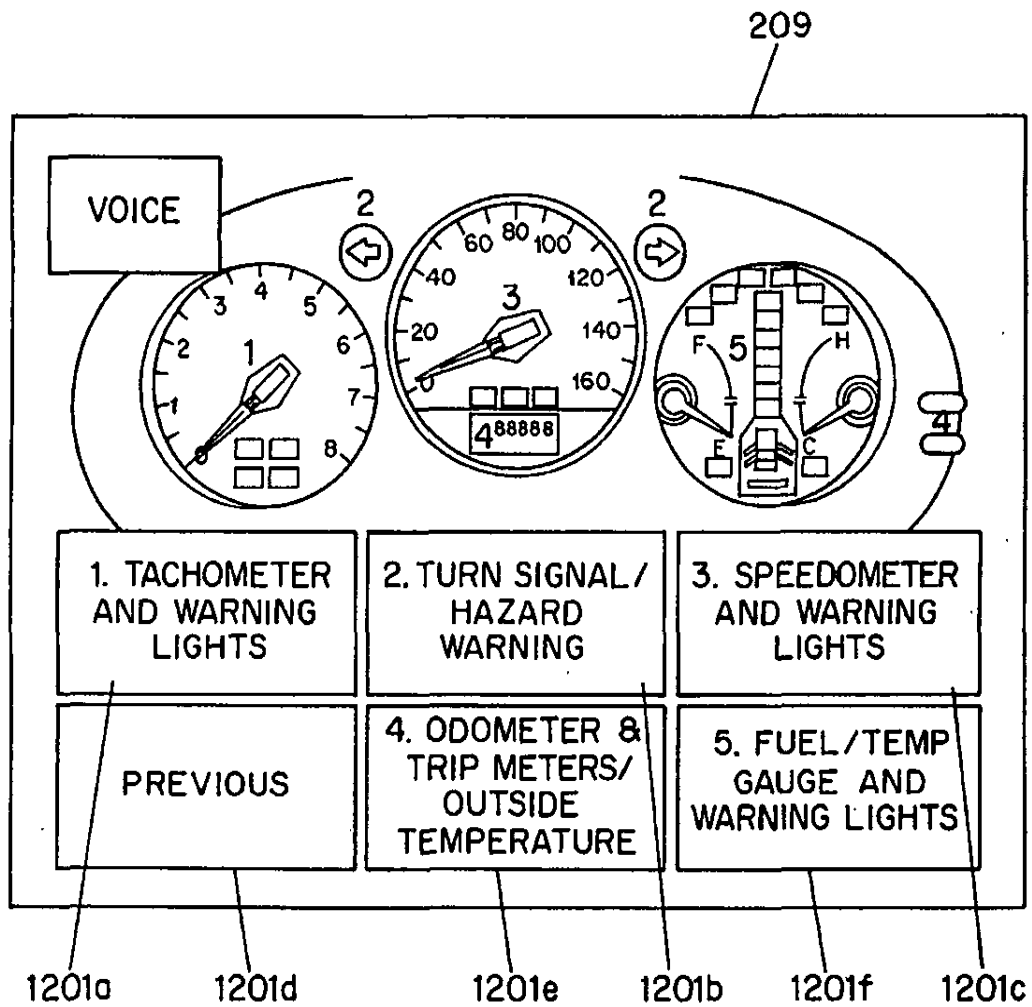


FIG. 12

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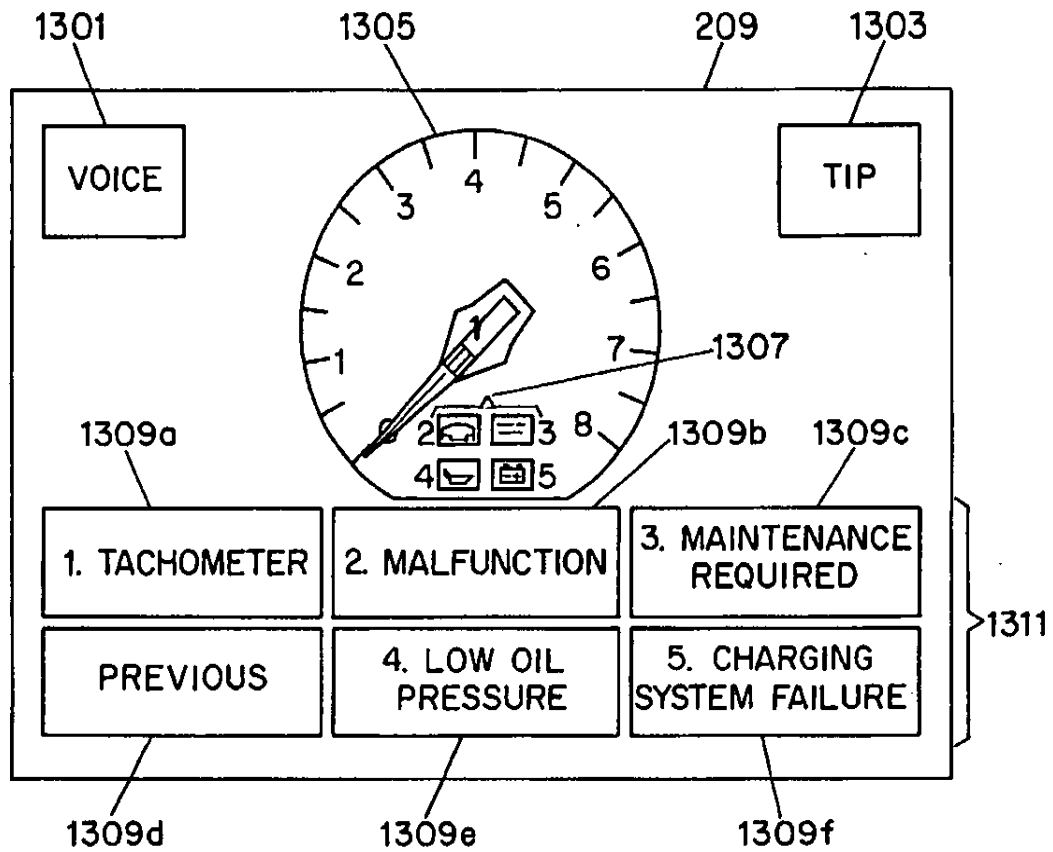


FIG. 13

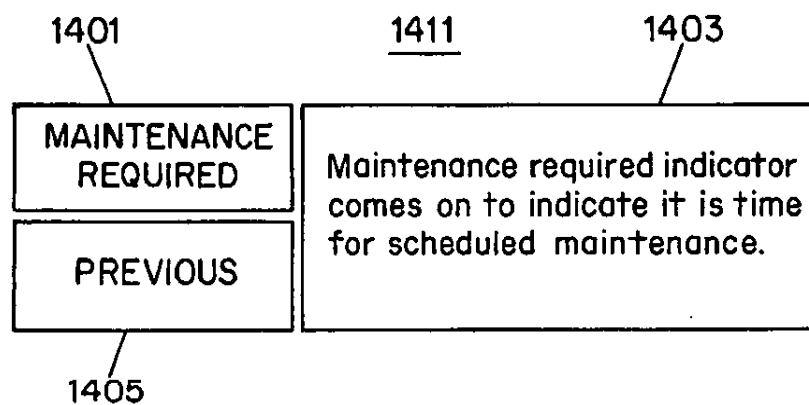


FIG. 14

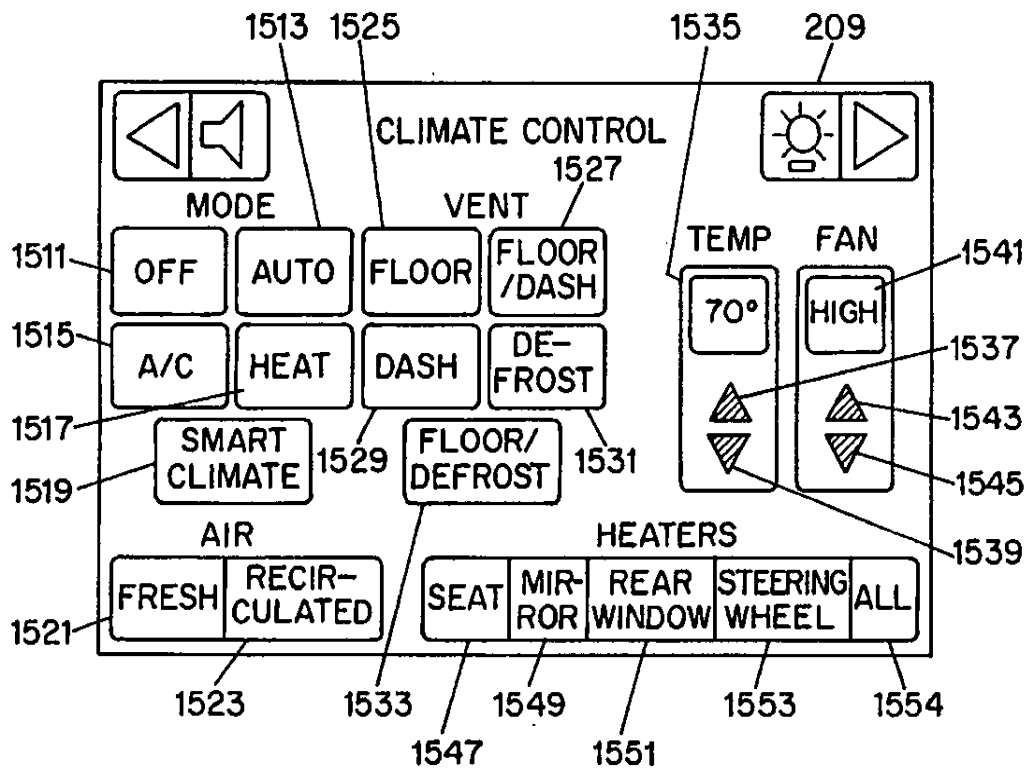


FIG. 15

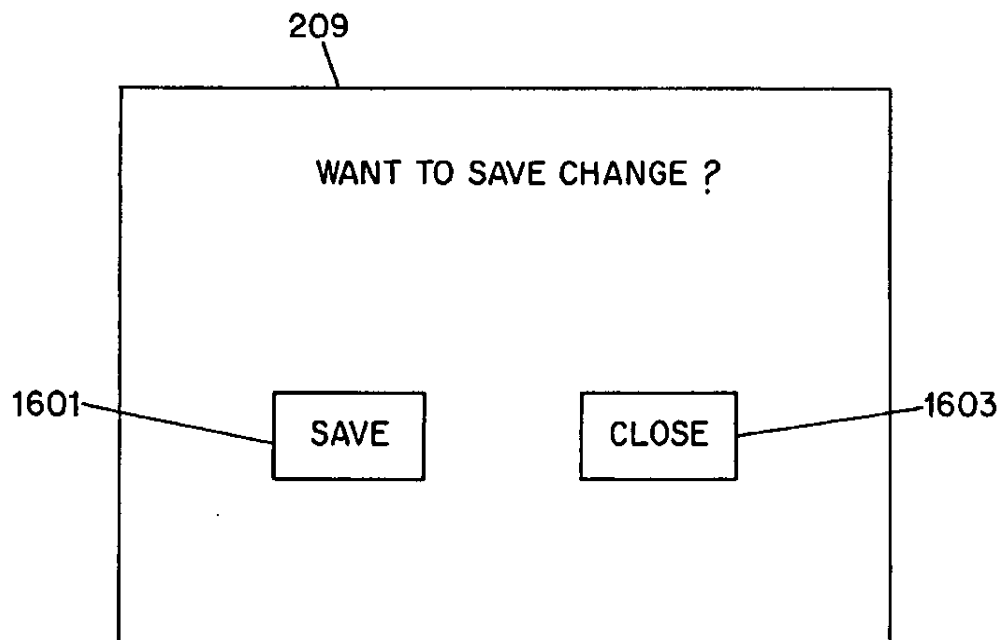


FIG. 16

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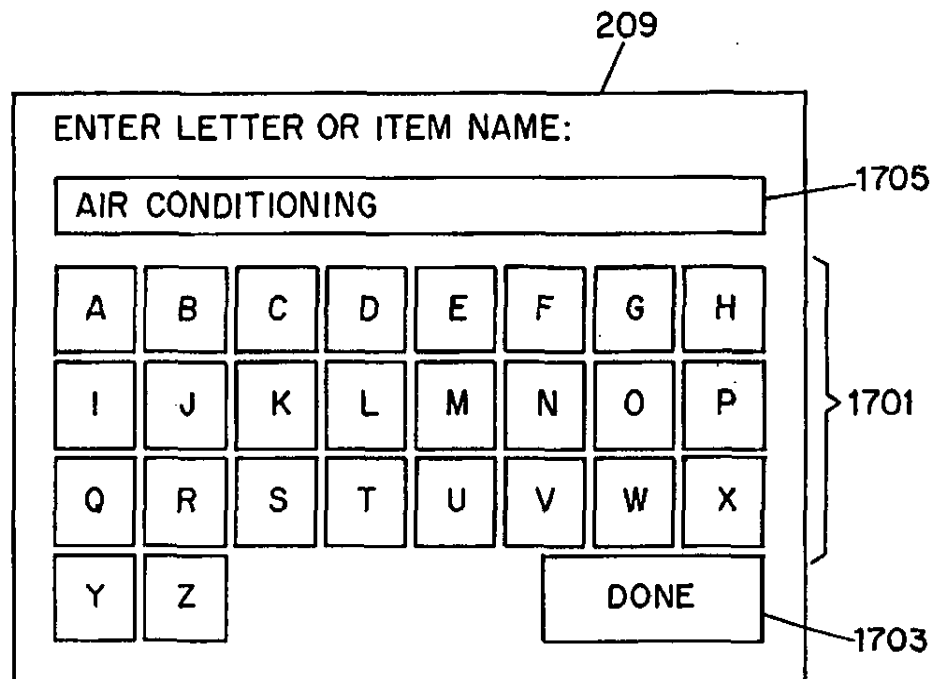


FIG. 17

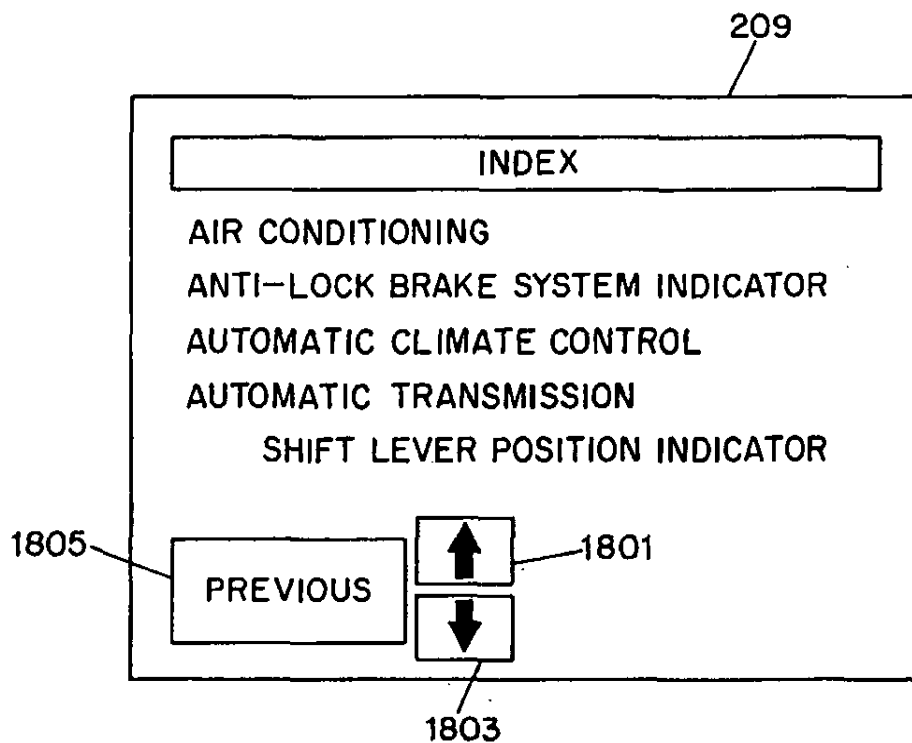


FIG. 18

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1901		1903	
1905	AIR CONDITIONING	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
	ANTI-LOCK BRAKE SYSTEM INDICATOR	LINK TO WARNING LIGHT OPTION #4 ON FUEL/TEMP SCREEN (NOT SHOWN)	
	AUTOMATIC CLIMATE CONTROL	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
	CHARGING SYSTEM FAILURE INDICATOR	LINK TO CHARGING SYSTEM FAILURE OPTION 1309f (FIG. 13)	
	CLIMATE CONTROL SYSTEM	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
	COOLING	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
	CRUISE CONTROL INDICATOR	LINK TO WARNING LIGHT OPTION #2 ON SPEEDOMETER SCREEN (NOT SHOWN)	
	DEFOG/DEFROST	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
	DOOR AJAR INDICATOR	LINK TO WARNING LIGHT OPTION #7 ON FUEL/TEMP SCREEN (NOT SHOWN)	
	DIRECTIONAL SIGNALS INDICATOR	LINK TO TURN SIGNAL/HAZARD WARNING OPTION 1201b (FIG. 12)	

FIG. 19

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MULTIMEDIA TECHNIQUE FOR OPERATING DEVICES IN A VEHICLE

This application is a continuation of application Ser. No. 09/401,039 filed on Sep. 21, 1999, now 6,178,782 which is a division of application Ser. No. 08/789,934 filed on Jan. 28, 1997, maturing into U.S. Pat. No. 6,009,355 issued on Dec. 28, 1999.

FIELD OF THE INVENTION

The invention relates generally to information and control systems and, more particularly, to a system for use in an automobile which facilitates a user's retrieval and/or dissemination of information, and control of vehicle functions.

BACKGROUND OF THE INVENTION

Information is vital to day-to-day activities. With no access to information, people cannot function efficiently in this society, and their lives and financial well-being are put in jeopardy. People want to be well-informed, so much so that when they are travelling in automobiles, they tune into local radio stations to listen to news, weather forecasts and traffic conditions. For that matter, some automobiles are equipped with audiovisual systems including television (TV) receivers. One such system is disclosed in U.S. Pat. No. 5,404,443 issued to Hirata. The Hirata system provides audiovisual information in a number of modes including a TV mode, which may be selected by control switches disposed on the periphery of a display.

Automobile users like to be continually updated with information affecting their travel plans such as weather and traffic conditions because of its fast changing nature. Automobile users who are traveling also like to continually keep in touch with their homes and offices, and to confirm appointments and hotel reservations so that they can adjust their itineraries accordingly. To that end, cellular mobile telephones were introduced to enable automobile users to conduct business and contact their families while they are traveling.

In addition, local map information is important to automobile travelers moving from one locale to another. As such, navigation systems were developed to help reach their destinations in an unfamiliar milieu. One such vehicle navigation system is disclosed in U.S. Pat. No. 5,274,560 issued to LaRue. The disclosed system is based on artificial intelligence and provides a driver with directions via a voice interface. The system is built upon an optical disk player which can be used for entertainment as well. Digitized maps, compressed voice records and computer programs are stored on an optical disk compatible with the disk player. After a destination point is identified, the disclosed system finds the best route from the digitized maps and guides the driver therethrough via the voice interface, taking into account the latest traffic conditions received by an FM receiver to avoid congestion.

Recently, navigation systems based on military global positioning system (GPS) technology have emerged. One such navigation system is commercially available as an option for the latest model of the ACURA 3.5 RL automobile. This ACURA navigation system receives signals from a constellation of satellites which is part of the GPS. In response to these signals, the navigation system pinpoints the automobile's location (in latitude and longitude). It also detects the automobile's speed and direction. With geographic information stored on a hard disk in an onboard computer, the navigation system is capable of verbally and

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visually communicating to the user instructions for reaching the destination.

In addition to the above techniques for communications with automobile users, a technique for disseminating information regarding the automobiles themselves is disclosed in U.S. Pat. No. 5,442,553 issued to Parillo. The disclosed system is a vehicle diagnostic and software upgrade system. In this system, sensors are provided in the vehicle to generate dynamic data relating to various mechanical controls and the engine of the vehicle, including engine R.P.M., fuel/air mixture, emissions and pollution content information. A microprocessor in the vehicle has access to selectable program parameters affecting the functioning of the mechanical controls. The microprocessor collects and transmits the dynamic data to a remote diagnostic station periodically or upon its request. In response, the remote station sends, to the vehicle, signals indicative of any changes in its software and/or program parameters. The microprocessor accordingly causes the changes to be made in the vehicle based on the received signals.

Besides the communication capabilities described above, an automobile has many accessories and user control elements such as lights, wipers, a clock, temperature control, cruise control, seat adjustment control, mirror adjustment control, and an anti-theft system. A technique for centralizing the command of the individual control elements is disclosed in U.S. Pat. No. 5,555,502 issued to Opel. The disclosed system includes a centralized control panel on a steering wheel which, together with a display, is utilized to control the electronic components of the automobile. The display is positioned in the area of the driver's sun visor. After the driver presses one of the buttons on the control panel corresponding to a desired electronic component, a menu is displayed so that the driver is able to select items from the menu to program the component. The selection is accomplished by pressing specified buttons on the panel.

In addition, a technique for controlling vehicle accessories via voice command is disclosed in U.S. Pat. No. 4,827,520 issued to Zeinstra. In accordance with this technique, control functions of each accessory are formatted in a summary page for display on a screen, which is scanned by infrared light to sense any touching thereon. By uttering any of the displayed functions on the summary page, preceded by either a specified keyword or an actuation of a push-to-talk switch on a steering wheel, a more detailed subpage of the selected function is displayed for further selection by voice. As an alternative to the voice command, the selection can also be accomplished by touching the displayed function on the screen.

Voice command and touch screen techniques are frequently mentioned in prior art references in controlling car accessories. In particular, U.S. Pat. No. 5,214,707 issued to Fujimoto et al. discloses a system for voice-controlling equipment inside a vehicle, including microphones capable of discriminating voice commands as to whether they are generated at the driver side or at the assistant side of the vehicle in a noisy environment.

SUMMARY OF THE INVENTION

It is celebratory that technology advances at lightning speed. However, many people are left behind the technological frontier, and to some extent develop "technophobia". Some of them have even given up this technological race, which is confirmed by the blinking "12:00" display on the clocks of many video cassette recorders (VCRs) being used.

Similarly, it is fantastic that automobiles nowadays include many advanced accessories such as audiovisual

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systems, anti-theft systems, anti-lock brake systems, climate control, and cruise control which embrace the latest technologies. However, of all these accessories, many automobile users only know how to operate the headlights and windshield wipers, and regard the rest as nuisance. That is, the users pay for numerous accessories which they do not use, resulting in much consumer waste. We have recognized that such non-use is principally attributed to an inefficient distribution of operating knowledge of the automobile and, in particular, its accessories.

Specifically, when automobile users presently want to learn about certain aspects of an automobile, they need to consult an owner's manual which could have been lost or misplaced when they need it the most. In addition, the manual is unpopular because many users simply want to avoid reading any written material, and find it intimidating as it oftentimes is filled with incomprehensible technical jargon.

We have further recognized that even with the operating knowledge, many users are overwhelmed and confused with the large number of knobs, switches and buttons used to control the individual vehicle parts and accessories.

Accordingly, it is an object of the invention to design an information and control system for use inside an automobile with the user in mind. The user is afforded a centralized control which may be used in lieu of the knobs, switches and buttons to operate the vehicle parts and accessories. In accordance with the invention, the centralized control is intimately tied to an information system such that the user is able to efficiently access information about the functions and operations of such parts and accessories, and in a synergistic manner apply that information to operate same, using the centralized control.

It is another object of the invention that the access to the information is intuitive and direct so that the user can obtain the relevant information in a few self-explanatory steps. To that end, the invention embraces a multimedia approach where audio and video media are added to the traditional text media to convey information. The additional media increases the dimensions of both the user's comprehension of the information and the user's interaction with the automobile. Moreover, the information access is driven by a multilevel menu based on an intuitive model of taxonomy where information is organized in a minimal number of levels of subject matter from general to specific. The above integration of the multimedia approach with the multilevel menu approach presents an effective way of retrieving information in the automobile. Advantageously, with the invention, the user would not be distracted or overburdened by irrelevant information in the course of an information retrieval, which is conducive to a safe driving environment.

In the preferred embodiment, when the user wants to access information about a given part or accessory of the automobile, the user is presented with options on a display screen. Each option is associated with a respective one of different parts or accessories of the automobile. The user is able to select through the interface one of the options, associated with the given automobile part or accessory. The option, when selected, is highlighted in a first color, for example, yellow. A voice is then generated by the inventive system to explain the purpose or the content of the selected option before the user commits to it. Having been so informed, the user may then activate the selected option is retrieving the information of interest. The activated option is highlighted in a second color, e.g., blue, to indicate its active status. The retrieved information is presented to the user both in text and in voice.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing showing an illustrative embodiment of the invention, in which:

FIG. 1 is a block diagram of an automobile information and control system in accordance with the invention;

FIG. 2 illustrates a control panel and a display interface for a user to interact with the system of FIG. 1;

FIG. 3A illustrates a flow chart depicting the steps of an anti-car-theft routine used in the system of FIG. 1;

FIGS. 3B and 3C jointly illustrate a flow chart depicting the steps of a routine for presenting various screens to the user in the system interaction;

FIG. 4A illustrates a screen for eliciting a personal identification number (PIN) from the system user;

FIG. 4B illustrates a SELECT A FUNCTION screen including features thereof in accordance with the invention;

FIG. 5 illustrates an introduction screen including features thereof in accordance with the invention;

FIG. 6 illustrates a MANUFACTURER screen including features thereof in accordance with the invention;

FIG. 7 illustrates a SAFETY REMINDERS screen including features thereof in accordance with the invention;

FIG. 8 illustrates a THEFT PROTECTION FEATURES screen including features thereof in accordance with the invention;

FIG. 9 illustrates a QUICK TIP SET-UP screen including features thereof in accordance with the invention;

FIG. 10 illustrates a MAIN MENU screen including features thereof in accordance with the invention;

FIG. 11 illustrates a DRIVER'S VIEW screen including features thereof in accordance with the invention;

FIG. 12 illustrates an INSTRUMENT PANEL screen including features thereof in accordance with the invention;

FIG. 13 illustrates a TACHOMETER AND WARNING LIGHTS screen including features thereof in accordance with the invention;

FIG. 14 illustrates a segment of the screen of FIG. 13 providing the user with information regarding a particular function of the automobile;

FIG. 15 illustrates a CLIMATE CONTROL screen including features thereof in accordance with the invention;

FIG. 16 illustrates a SAVE screen for saving the user's preferences in accordance with the invention;

FIG. 17 illustrates a DATA ENTRY screen in accordance with the invention for looking up information regarding a specific item in the automobile;

FIG. 18 illustrates an INDEX screen with listed items for which information is available; and

FIG. 19 is a look-up table listing searchable items and the corresponding instructions for a processor in the system of FIG. 1 to provide information regarding such items.

Throughout this disclosure, unless otherwise stated, like elements, components and sections in the figures are denoted by the same numerals.

DETAILED DESCRIPTION

FIG. 1 illustrates information and control system 100 embodying the principles of the invention for use in an automobile. System 100 is referred to as the "AUTO

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DIRECTOR" system. It is user-friendly and designed with the automobile user in mind. For example, with AUTO DIRECTOR display interface 102a to be described, information about the automobile is readily available literally at the fingertips of the user. This information includes operational instructions, maintenance procedures, safety measures, and information about virtually every capability of the automobile. In accordance with the invention, the user is able to efficiently access such information using multimedia means involving audio, text and video media. Also with interface 102a, or multifunction display interface 102b to be described, the user is afforded a centralized control whereby he/she can program or adjust different vehicle parts and accessories using the information thus obtained.

As shown in FIG. 1, central to system 100 is processor 105 connected to memory 115. Data bus 107 connects processor 105 to display interfaces 102, input interfaces 104, communications interfaces 106, output control interfaces 108, vehicle computer interfaces 110, vehicle control interfaces 112, self-test interface 114, preferences interface 116, and audio interface 118.

Display interfaces 102 include, inter alia, AUTO DIRECTOR display interface 102a, which is illustrated in FIG. 2, together with control panel 205 in FIG. 1. By way of example, but not limitation, the hardware of interface 102a and control panel 205 are derived from a prior art navigation system of the type of the ACURA navigation system. In fact, interface 102a and control panel 205 are used in this illustrative embodiment to realize not only AUTO DIRECTOR functions to be described, but also the well-known navigation function.

Interface 102a includes a conventional liquid crystal display screen 209, and LCD driver (not shown) for processor 105 to control the display on screen 209. Interface 102a also incorporates well-known touch-screen circuitry (not shown) connected to touch screen interface 104a in FIG. 1. With this circuitry, the user can interact with processor 105 by, say, touching a displayed option on screen 209. Through interface 104a, processor 105 receives from the touch screen circuitry a signal identifying the location on screen 209 where it has been touched. If such a location matches the predetermined location of one of the displayed options, processor 105 determines that that option has been selected. With such touch-screen and displayed option selection capabilities, through AUTO DIRECTOR interface 102a, the user is able to obtain information on and control selectable functions of the automobile such as the instrument panel, navigation function, mobile phone, radio/CD player, locks, mirrors, windows, driver's seat adjustment control, climate control, windshield wipers, cruise control, lights, security function, steering, ride control, engine and transmission.

Control panel 205 comprises CANCEL switch 205a, ENTER switch 205b, BRIGHTNESS switch 205c, PUSH TO SELECT knob 205d, MENU switch 205e, MAP/GUIDE switch 205f, SETUP switch 205g, ZOOM IN switch 205h and ZOOM OUT switch 205i. BRIGHTNESS switch 205c comprises a standard variable resistor such that when it is pushed one way, operating circuitry 121 responsively causes the display intensity to increase, and the other way to decrease. ZOOM IN switch 205h when pressed enables the automobile user to enlarge a particular visual area of interest on screen 209, affording better details. On the other hand, ZOOM OUT switch 205i when pressed performs the inverse function to switch 205h. As an alternative to the touch-screen capability, switch 205d similar to a standard joystick is provided for the user to move from one displayed option

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to another on screen 209 in the same direction (e.g., up, down, left or right) as the switch is operated. A desired option may be selected by pressing ENTER switch 205b. The functions of the other switches are described hereinbelow as they are called out in the operation of system 100. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and control panel 205 are mounted close to the center of the dashboard of the automobile next to the steering wheel.

Referring back to FIG. 1, display interfaces 102 also include multifunction display interface 102b, center console display interface 102c, rear console display interface 102d, and instrument panel display interface 102e.

Specifically, multifunction display interface 102b is installed on the dashboard close to interface 102a on the driver side. Like interface 102a, interface 102b provides the user with graphic display and control of selected functions using well-known touch screen technology. In fact, interface 102b duplicates certain control functions (e.g., navigation, phone, radio and climate control) of interface 102a so that the user can use interface 102b to control a selected function while interface 102a is engaged in another ongoing function. For example, while the user is relying on AUTO DIRECTOR interface 102a to provide navigation information to reach a given destination, the user may want to adjust the climate control of the automobile. It is inconvenient for the user to terminate the ongoing navigation mode of interface 102a, albeit temporarily, to access the climate control function through the interface, adjust the climate control and then resume the navigation mode. Thus, it is preferable to leave the navigation mode of interface 102a alone and use interface 102b to administer the climate control.

Center console interface 102c is installed close to interface 102a on the passenger side. Similar to interface 102b, interface 102c provides the front seat passenger with graphic display and control of functions which include: the front passenger seat adjustment, door lock, window, climate and TV controls. If enabled by the driver, control is also available for the radio/CD player and phone.

Rear console display interface 102d is installed on the back of a front seat. Similar to interface 102c, interface 102d provides rear seat passengers with graphic display and control of certain functions if enabled by driver or front seat passenger. These functions include: the rear seat climate, windows, door locks, radio/CD player and TV controls.

Instrument panel display interface 102e is installed on the dashboard in front of the driver seat. This interface provides the driver with graphic display of the vehicle speed, engine RPM, outside and inside temperatures, oil pressure, fuel level, time, odometer reading, trip odometer reading and warning light indicators. Through AUTO DIRECTOR interface 102a, the system user may select the display of the information in either an analog or a digital form.

Input interfaces 104 comprise touch screen interface 104a and control panel 205 described before, and voice command interface 104b. The latter is connected to a microphone (not shown) and comprises standard voice command circuitry (not shown) for processing voice commands by the user through the microphone to control or modify selected functions of system 100.

Communications interfaces 106 include phone interface 106a, radio/CD interface 106b, television (TV) interface 106c, navigation interface 106d, and beacon interface 106e. Processor 105 interacts with and controls standard phone equipment connected to phone interface 106a. Through processor 105, the user may operate the phone equipment

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via voice command, thereby realizing hands-free operation of the equipment. Alternatively, the user may operate the phone equipment using the touch screen capability provided by AUTO DIRECTOR display interface 102a or multifunction display interface 102b. The user may also operate the phone equipment via remote switches.

Similarly, processor 105 interacts with and controls one or more radio receivers and CD players in the automobile connected to radio/CD interface 106b. Through processor 105, the user may operate the radio receivers via voice command, remote switch and/or touch screen capability.

Processor 105 further interacts with and controls one or more TV receivers in the automobile connected to TV interface 106c. Again, the user may operate the TV receivers via voice command, remote switches and/or touch screen capability.

As further described hereinbelow, navigation interface 106d is connected to a standard inertial guidance system (not shown) capable of providing gyros information, and deriving the vehicle location based on GPS information. With the map information stored in memory 115, the inertial guidance system is capable of providing the user with navigational instructions via interface 102a or 102b. Besides the locational information, local and national emergency information may be derived from the GPS information using additional standard decoding circuitry in interface 106d.

Beacon interface 106e is used for connection to a standard beacon device for detecting a predetermined beacon radio signal to provide additional locational information.

Output control interfaces 108 include lock interface 108a, mirror interface 108b, window interface 108c, steering column interface 108d, seat interface 108e, climate control interface 108f, wiper interface 108g, cruise control interface 108h, light interface 108i and clock interface 108j.

Specifically, lock interface 108a comprises output control logic controllable by processor 105 to lock or unlock the car doors, glove box, console storage, trunk (or liftgate), fuel filler door, brakes and transmission, and enable or disable the child-proof door locks, fuel pump and ignition.

Mirror interface 108b comprises output control logic controllable by processor 105 to maneuver the positions of the outside mirrors and inside rear view mirror, and to fold or unfold the outside mirrors.

Window interface 108c comprises output control logic controllable by processor 105 to incrementally or completely open or close all windows, and to open, close or tilt any sunroof.

Steering column interface 108d comprises output control logic controllable by processor 105 to move the steering column in or out and up or down.

Seat interface 108e comprises output control logic controllable by processor 105 to (1) adjust the positions of the front seats forward or aft, and up or down; (2) tilt the front or rear of the seat cushion up or down; (3) adjust the seat back lumbar, width and angle forward or aft; (4) increase or decrease the cushion size and stiffness; (5) raise or lower the head restraint; and (6) raise or lower the seat belt height.

Climate control interface 108f comprises output control logic controllable by processor 105 to (1) turn the climate control system on or off; (2) select an air flow mode; (3) set fan speeds; (4) enable or disable seat heaters; (5) select fresh or recirculated air (for driver only); and (6) enable or disable front and rear defrosters, mirrors and steering wheel heaters (for driver only).

Windshield wiper interface 108g comprises output control logic controllable by processor 105 to (1) select a high, low,

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intermittent, single wipe or off mode; (2) set an intermittent delay; and (3) enable or disable front or rear washers. Interface 108g also includes control logic for controlling rain- and speed-sensitive wipers, and for activating an automatic wash in a single wide mode when the windshield is at a certain level of opacity.

Cruise control interface 108h comprises output control logic controllable by processor 105 to (1) turn the cruise control on or off, (2) set the vehicle speed, and (3) cancel or resume the set speed.

Light interface 108i comprises output control logic controllable by processor 105 to select an automatic on mode or off mode for parking lights, headlights and fog lights; and to turn on or off map or courtesy lights.

Clock interface 108j comprises output control logic controllable by processor 105 to set an initial date and time on a conventional clock (not shown) connected to interface 108j. System 100 relies on the current date and time kept by the clock to provide a time reference for the system functions.

Vehicle computer interfaces 110 include anti-lock brake computer interface 110a, engine computer interface 110b and supplemental restraint computer interface 110c for processor 105 to communicate with the computers controlling the anti-lock brakes, engine and supplemental restraints (e.g., back-up airbag deployers and seat belt tensioners), respectively. Interfaces 110 also include back-up interface 110d through which processor 105 receives and analyzes signals from the engine, anti-lock brake and supplemental restraint computers. These signals would indicate to processor 105 any failures of the computers. In response to a computer failure, processor 105 causes a corresponding back-up computer connected to interface 110d to provide a back-up function.

Vehicle control interfaces 112 include steering interface 112a, ride interface 112b, engine interface 112c, transmission interface 112d, traction control interface 112e, and security interface 112f.

Specifically, steering interface 112a comprises input monitoring and output control logic for processor 105 to lighten or tighten the steering effort ratio in response to changing road conditions. Through interface 102a, the user may opt for manual or automatic steering effort ratio control. Interface 112a is capable of adapting and storing data according to the driver's inputs. It also allows for steering of front and/or rear wheels for sporty or increased stability.

Ride interface 112b comprises input monitoring and output control logic for processor 105 to lighten or stiffen the ride control to front and/or rear of vehicle in response to changing road conditions. Through interface 102a, the user may also opt for manual or automatic ride control.

Engine interface 112c comprises input monitoring and output control logic allowing for shutting off a specified number of cylinders, and varying valve and cam timing to increase performance or fuel economy. This interface also allows for manual or automatic control of the engine components, and includes the capability of adapting and storing data according to the driver's inputs.

Transmission interface 112d comprises input monitoring and output control logic for selecting manual or automatic shifting of the transmission. In an automatic shifting mode, interface 112d is capable of adapting and storing data according to the driver's inputs. Interface 112d also allows for control of a variable differential ratio for fast acceleration and high economy cruise.

Traction control interface 112e comprises input monitoring and output control logic providing information on

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whether power is delivered to front and/or rear wheels of the vehicle and what proportion of the power is delivered to each wheel. This interface also allows for manual or automatic control, and such functions as yaw control in cooperation with the anti-lock brakes and an engine cylinder shutoff.

Security interface 112f comprises control logic for setting a security level, and enabling or disabling a number of security related functions such as the fuel supply cut-off, motion detector, brake locking, etc. Interface 112f also allows entry of a new or alteration of an existing personal identification number (PIN) for personalization of the vehicle functions, i.e., saving the vehicle functional preferences.

In accordance with an aspect of the invention, system 100 incorporates an anti-car-theft technique involving security interface 112f. In accordance with this inventive technique, security interface 112f further comprises a sensor for detection of a predetermined condition to trigger an anti-theft routine. It will be appreciated that a person skilled in the art will come up with many different triggering events causing the sensor to invoke the routine. For example, a passive way of triggering the anti-theft routine would be after the sensor detects that the engine is off and the user has opened, closed and locked the driver's door.

In any event, as soon as processor 105 receives from the sensor a signal requesting an invocation of the anti-theft routine, processor 105 retrieves from navigation interface 106d GPS information identifying the parking location of the automobile, as indicated at step 251 in FIG. 3A. Processor 105 then stores at step 253 the parking location GPS information in memory 115. At step 255, processor 105 determines whether the security measures remain on. By way of example, but not limitation, such determination is based on information from lock interface 108a indicating whether the driver's door is properly unlocked. If that door is properly unlocked, processor 105 determines that the security measures are called off, and the anti-theft routine comes to an end, as indicated at step 257.

Otherwise if processor 105 determines that the security measures remain on, processor 105 at step 259 retrieves from navigation interface 106d GPS information identifying the current location of the automobile. Processor 105 then compares at step 261 the current location GPS information with the parking location GPS information previously stored. If processor 105 at step 262 determines that the current location matches the parking location based on the comparison, the anti-theft routine returns to step 255 after a predetermined period. Otherwise if processor 105 determines that the current location does not match the parking location, processor 105 assumes that the automobile has been removed without authorization, i.e., stolen. At this point, if a conventional alarm system is connected to security interface 112f, processor 105 would cause an alarm to come on, gas to be cut off, etc.

In this example, a conventional transmitter (not shown) is connected to security interface 112f and transmits a predetermined sequence of signals receivable by a law enforcement agency or a suitable alarm monitor company when it is activated. Continuing the example, processor 105 translates the GPS information identifying the current vehicle location into the corresponding street address based on the map information stored in memory 115, as indicated at step 263. Processor 105 at step 265 looks up one or more phone numbers pre-stored in memory 115 for reporting to the law enforcement agency (or the alarm monitor company) about

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the stolen status. Alternatively, a list of phone numbers associated with law enforcement agencies (or branches of the alarm monitor company) in many different geographic locations is pre-stored, along with the GPS information identifying the locations of the respective law enforcement agencies (or alarm monitor company branches). This being so, processor 105 locates the closest law enforcement agency (or alarm monitor company branch) and its associated phone number(s) by comparing the current vehicle location GPS information with the respective agency (or branch) location GPS information.

In any event, processor 105 at step 267 initiates a call to a law enforcement agency (or an alarm monitor company branch) through phone interface 106a using the phone number just located. After the phone connection is established, processor 105 provides through the connection information about the current address of the vehicle using conventional voice synthesizer circuitry (not shown) in audio interface 118, and the pre-recorded information about the vehicle itself such as its vehicle identification number (VIN), model, year, color, license number, etc., as indicated at step 269. Through the same phone connection, processor 105 may also provide information about the vehicle's owner such as his/her name and contact number so that the law enforcement agency (or alarm monitor company branch) can notify the owner of the incident. Processor 105 at step 271 activates the aforementioned transmitter connected to security interface 112f to generate the predetermined sequence of signals in case the stolen vehicle is in transit. For that matter, processor 105 can also repeatedly check on the latest vehicle location and report any new address different from the one previously reported. Thus, by tracking the signals in the vicinity of the latest reported vehicle location, the law enforcement agency (or alarm monitor company) would recover the vehicle in an efficient manner.

Referring back to FIG. 1, self-test interface 114 comprises input/output (I/O) control logic for performing an active self-test of system 100 on power up or at the user's request. Specifically, interface 114 polls every other interface in system 100 for a self-test result. Each interface, when polled, performs an active self-test and reports the test results to interface 114, where such test results are gathered and caused to be displayed on interface 102a.

Preferences interface 116 monitors changes made by the user in selected functions after the user logs on system 100, and prompts the user to save such preferences. These preferences are stored in memory 115 in association with the user's PIN. Functions affording the user choices include auto locks, an easy entry, auto lamps, the seat position, steering column position, mirror position, radio, steering, ride, transmission shift, engine performance, climate, and security level.

Audio interface 118 comprises I/O control logic for receiving audio signals from a radio/CD, TV, compact disk (CD) player, or phone interface, processing the received audio signals, providing proper amplifications thereto, and routing the resulting sound to appropriate speakers and headphones (not shown) connected to interface 118. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and multifunction display interface 102b share the same speakers. Interface 118 also provides center and rear console display interfaces 102c and 102d with separate audio channels, speakers and headphone outputs. The front and rear speakers may be muted by the user as a preference.

Interface 118 also processes requests from other interfaces for pre-recorded digital sounds stored in a SOUNDSGOOD

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library in memory 115 and routes the requested sounds to the appropriate interfaces. In addition, interface 118 comprises the conventional voice synthesizer circuitry for providing voice messages to the appropriate interfaces.

FIGS. 3B and 3C jointly illustrate routine 300 for accessing, through AUTO DIRECTOR display interface 102a, a main menu to obtain operational instructions, maintenance procedures, safety measures, and other information about the automobile, collectively referred to as "Quick Tips". Routine 300 is stored in memory 115 and initiated when SETUP switch 205g in FIG. 2 is pressed. Instructed by routine 300, processor 105 at step 301 elicits a PIN from the user by displaying a screen of FIG. 4A through interface 102a. As shown in FIG. 4A, a video key-pad comprising numeral keys "1" through "9", and "*" and "#" keys are displayed on screen 209. In response, the user enters a sequence of numerals by touching the corresponding displayed keys, followed by the "#" key.

It should be pointed out that in accordance with another aspect of the invention, when a displayed key or option is touched on the screen of AUTO DIRECTOR display interface 102a or multifunction display interface 102b, a tone pre-selected by the user from the SOUNDSGOOD library is generated through audio interface 118, indicating that the key or option has been touched on the screen. Advantageously, relying on the audio tone confirmation, as opposed to a visual confirmation, the user while driving can continually watch the road.

The user may alternatively enter the above numeral sequence using control panel 205 in a manner to be described. In any event, processor 105 then verifies at step 303 the PIN entry by comparing it with the user's pre-selected PIN. The latter is stored in memory 115, along with the user's preferences. In a standard way, the user is given a few chances to enter a correct PIN. Verification of the PIN entry identifies the user as a legitimate user. Thus, if the PIN entry is not valid, routine 300 comes to an end, as indicated at step 304.

Otherwise if the PIN entry is valid, processor 105 at step 305 causes interface 102a to display on screen 209 a "SELECT A FUNCTION" screen, which is illustrated in FIG. 4B. As shown in FIG. 4B, two options, namely, "NAVIGATION" and "QUICK TIPS", are displayed on screen 209. By default, NAVIGATION option 401 is highlighted yellow when the screen of FIG. 4B appears.

It should be pointed out that in this illustrative embodiment, a yellow highlight on an option indicates that the option is selected but not yet activated. Once a yellow highlighted option is activated, the option is highlighted blue. System 100 then performs according to the activated option.

Thus, in this instance, the user may activate the yellow highlighted NAVIGATION option by touching the option on screen 209 or by pressing ENTER switch 205b.

However, if QUICK TIPS option 403 is desired, the user may touch that option on screen 209, which would then be highlighted yellow. A second touch on the same option will change the highlight to blue, indicating the active status. As an alternative, the user may utilize knob 205d of FIG. 2 to select QUICK TIPS option 403 by first pushing the knob to the right. In response, processor 105 causes the yellow highlight to move from default NAVIGATION option 401 to QUICK TIPS option 403. The user can then select the QUICK TIPS option by pressing ENTER switch 205b. Upon selection, the yellow highlighted option will again turn blue.

Processor 105 at step 308 detects an activation of either NAVIGATION option 401 or QUICK TIPS option 403. If

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NAVIGATION option 401 is activated, processor 105 at step 311 causes system 100 to enter into a navigation mode. In this mode, processor 105 causes navigational instructions to be displayed on screen 209 in a conventional manner. In providing the navigation instructions, the standard inertial guidance system connected to navigation interface 106d receives signals from a constellation of GPS satellites maintained and controlled by the U.S. Department of Defense. In response to these signals, the inertial guidance system identifies the location (in longitude and latitude) of the automobile. The system also detects the vehicle speed, and the direction in which the vehicle is headed. By accessing the map information stored in memory 115, the system is capable of visually and verbally providing the user with directions to a given destination through AUTO DIRECTOR display interface 102a and audio interface 118, respectively.

Otherwise if activation of QUICK TIPS option 403 is detected at step 308, processor 105 causes interface 102a to display an introduction screen on screen 209, as indicated at step 314. This introduction screen is illustrated in FIG. 5.

As shown in FIG. 5, system source identification, warning and instructional information appear on the introduction screen, along with two options, "MAIN MENU" and "READ ME". The default option in this instance is READ ME option 501 which is highlighted yellow. Processor 105 detects at step 317 whether MAIN MENU option 503 or READ ME option 501 is activated. If MAIN MENU option 503 is activated, routine 300 proceeds to step 340 to be described. Otherwise if READ ME option 501 is activated, routine 300 proceeds to step 320 where processor 105 causes a series of three screens to be displayed. The first screen of the series is a "MANUFACTURER" screen, which is illustrated in FIG. 6.

As shown in FIG. 6, a description of the QUICK TIPS system appears on the MANUFACTURER screen. If the text to be displayed exceeds one screen, which is the case here, scrolling options comprising scroll-up option 605 and scroll-down option 607 are provided. When option 605 is touched and activated on screen 209, additional text scrolls up one paragraph at a time. Option 607 performs an inverse function to option 605. Again, as an alternative, the user may maneuver PUSH TO SELECT knob 205d until the desired scroll option (or direction arrow) is highlighted yellow. The activation of the highlighted option is achieved by pressing ENTER switch 205b.

By default, displayed option 609 has the "AUTO VOICE" wording thereon and is highlighted blue as the MANUFACTURER screen comes on. Accordingly, a pre-recorded voice is activated by processor 105 through audio interface 118 to read the entire text associated with this screen without interruption, including the text which is not presently shown on screen 209 but otherwise shown upon scrolling. To alter the AUTO VOICE function, the user may touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "AUTO VOICE" wording on option 609 changes to "MANUAL VOICE", which is highlighted blue, indicating its active status.

In accordance with the MANUAL VOICE function, a pre-recorded voice reads the displayed text only, and stops reading until additional text is scrolled onto the screen. To silence the voice, the user may again touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "MANUAL VOICE" wording on option 609 changes to "VOICE OFF", and the voice is deactivated, with the option now highlighted yellow. The cycle of the AUTO VOICE, MANUAL VOICE and VOICE OFF functions can be repeated by successively touching option 609 or pressing switch 205b.

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Other displayed options on the screen of FIG. 6 include PREVIOUS option 611 and NEXT option 613. As indicated at step 323, option 611 when selected causes routine 300 to return to step 314, where the introduction screen of FIG. 5 is again displayed. Otherwise, if option 613 is selected, routine 300 proceeds to step 326 in FIG. 3C where processor 105 causes a "SAFETY REMINDERS" screen to be displayed on screen 209. FIG. 7 illustrates such a screen.

As shown in FIG. 7, like the MANUFACTURER screen, the SAFETY REMINDERS screen includes option 609 displayed with the default wording "AUTO VOICE" thereon, PREVIOUS option 611, NEXT option 613, scroll-up option 605 and scroll-down option 607. This screen reminds the user of the safety features of the vehicle including, for example, air bags and seat belts. As indicated at step 329, option 611 when selected causes routine 300 to return to step 320 of FIG. 3B. Otherwise if option 613 is selected, routine 300 proceeds to step 332 where processor 105 causes a "THEFT PROTECTION FEATURES" screen to be displayed on LCD screen 209. FIG. 8 illustrates such a screen.

As shown in FIG. 8, the THEFT PROTECTION FEATURES screen similarly has thereon displayed options 605, 607, 609, 611 and 613. This screen describes to the user a theft-deterrent system including the anti-theft routine of FIG. 3A equipped in the vehicle. As indicated at step 335, option 611 when selected causes routine 300 to return to step 326. Otherwise if option 613 is selected, routine 300 proceeds to step 338 where processor 105 causes a "QUICK TIPS SET-UP" screen to be displayed on LCD screen 209. FIG. 9 illustrates such a screen.

As shown in FIG. 9, the QUICK TIPS SET-UP screen comprises two arrays of displayed options, denoted 901 and 903, respectively. Array 901 concerns the volume of the audio part of system 100. In this illustrative embodiment, the user may select the options in array 901 to respectively turn the volume off, to a "SOFT" level, to a medium level, and to a "LOUD" level. Array 903 concerns the display of LCD 119 of system 100. In this illustrative embodiment, the user may select the options in array 903 to respectively turn the display off, adjust it to a "DAY" setting, adjust it to a "NIGHT" setting, and have it automatically adjusted. When the QUICK TIPS SETUP screen comes on, by default, the volume is set to a medium level (i.e., the "MED" option in array 901 highlighted blue), and the display is set to be automatically adjusted (i.e., the "AUTO" option in array 903 highlighted blue).

Also shown in FIG. 9 is NEXT option 905. By selecting this option, routine 300 returns to step 340 of FIG. 3B where a "MAIN MENU" screen is displayed on LCD screen 209. After routine 300 is performed, the screen of FIG. 9 can be invoked at any time by pressing SETUP switch 205g to re-adjust the volume and the intensity of the LCD of system 100.

FIG. 10 illustrates the MAIN MENU screen. This screen comprises displayed options disposed in columns 1001, 1003, 1005, and 1007. For example, column 1001 includes DRIVER'S VIEW option 1001a, STEERING COLUMN CONTROLS option 1001b, LOCK option 1001c, DRIVING TIPS option 1001d, and INDEX option 1001e. It should also be noted that this screen can be invoked at any time by pressing MENU switch 205e.

When the MAIN MENU screen comes on, by default, DRIVER'S VIEW option 1001a is highlighted yellow, indicating that it is selected. However, the user may touch any other displayed option on screen 209 for re-selection. A

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further touch on the yellow highlighted option changes its color to blue and activates same. Again, the user may alternatively maneuver PUSH TO SELECT knob 205d to re-select any other displayed option, followed by a depression of ENTER switch 205b to activate the selected option. Since LCD screen 209 is compact, the display area for each option on the MAIN MENU screen is generally small. As a result, selection and activation of an option by touching the option on the screen is susceptible to errors, especially when the vehicle is in motion. Thus, in this situation it may be preferable to achieve the same result using knob 205d and switch 205b, instead.

In addition, because of the small display area allocated to each option on the MAIN MENU screen, the wording on the option is brief and thus tends to be cryptic. In accordance with a feature of the invention, after a predetermined time (e.g., a few seconds) has elapsed from the option's being highlighted yellow, processor 105 causes a voice to be generated on speakers 127 to explain the purpose of the option before the user activates it. For example, after a predetermined delay from DRIVER'S VIEW option 1001a's being highlighted yellow, a voice is activated, stating the option name, followed by an explanation of the purpose of the option such as "To provide location of dash mounted components." Thus, this inventive feature affords a preview of the option before the user commits to it, thereby avoiding unnecessary backtracking.

Continuing the example, after hearing the preview of option 1001a, the user decides to select that option. In response, processor 105 causes a "DRIVER'S VIEW" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 11. When the DRIVER'S VIEW screen appears, VOICE option 1101 is highlighted blue, indicating that voice announcements are active. To disable the voice announcements, the user may touch VOICE option 1101 on screen 209, or alternatively press ENTER switch 205b. VOICE option 1101 would be highlighted yellow when disabled.

As also shown in FIG. 11, a view of the interior of the automobile from the driver's perspective is provided. Underneath that view, DASH-MOUNTED CONTROLS option 1103, INSTRUMENT PANEL option 1105, AUDIO SYSTEM option 1107, CLIMATE CONTROLS option 1109 and PREVIOUS option 1111 are displayed. By default, DASH-MOUNTED CONTROLS option is highlighted yellow. However, the user in this example decides to select INSTRUMENT PANEL option 1105, instead. By touching option 1105 on screen 209, the option is highlighted yellow. If VOICE option is not disabled, after a predetermined delay, an announcement such as "To provide information on gauges, meters and warning lights" comes on to preview the purpose or content of option 1105. Options 1103, 1107, and 1109 are similarly programmed. In this instance, selecting PREVIOUS option 1111 enables the user to return to the MAIN MENU screen of FIG. 10.

Continuing the example, assuming that the user activates option 1105 after hearing the preview, in response processor 105 causes an "INSTRUMENT PANEL" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 12. As shown in FIG. 12, the previous screen format is generally maintained in that it provides a view of the object (the instrument panel of the automobile in this instance) pertinent to the option which has been selected, along with displayed options for further selection thereunder. Based on the disclosure heretofore, the design and operation of these screens by now are apparent to a person skilled in the art, and become self-explanatory.

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In accordance with another feature of the invention, individual elements on the instrument panel shown in FIG. 12 are labeled with numerals "1", "2", "3", "4" and "5" which correspond to option 1201a designated "1. TACHOMETER AND WARNING LIGHTS", option 1201b designated "2. TURN SIGNAL/HAZARD WARNING", option 1201c designated "3. SPEEDOMETER AND WARNING LIGHTS", option 1201e designated "4. ODOMETER & TRIP METERS/OUTSIDE TEMPERATURE", and option 1201f designated "5. FUEL/TEMP GAUGE AND WARNING LIGHTS", respectively. As such, the function of the displayed options is two-fold. First, the wording on each displayed option informs the user of what the corresponding element(s) represents. Second, each displayed option is also for selection to obtain more information about the corresponding element(s). In addition, with the above voice preview feature, the user is further apprised of the purpose or content of the option before he/she commits to it. For example, TACHOMETER AND WARNING LIGHTS option 1201a corresponds to a voice preview such as "To provide information on tachometer, malfunction, maintenance required, low oil pressure and charging system failure indicators."

Assuming that the user in this instance activates option 1201a, in response processor 105 causes a "TACHOMETER AND WARNING LIGHTS" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 13.

FIG. 13 shows VOICE option 1301 similar to option 1101 described before, TIP option 1303, a tachometer of the automobile denoted 1305, warning lights collectively denoted 1307, and options 1309a through 1309f in display segment 1311.

When TIP option 1303 appears on screen 209, it indicates that helpful hints or reminders are available upon selection thereof. In accordance with another feature of the invention, the appearance of TIP option 1303 is accompanied by the playing of a sound segment associated therewith. This sound segment may be pre-selected by the user from the SOUNDSGOOD library. After an adaptation period, the user would be able to rely on the familiar sound segment, without looking at the screen, to alert him/her of the availability of the TIP option.

Similarly, the user may pre-select another sound segment associated with warnings. Such a sound segment should connote urgency or even emergency as such warnings include, for example, engine overheating, an extremely low fuel level caution, GPS emergency information from navigation interface 106d, etc. Under control of processor 115, audio interface 118 preempts any on-going announcement and momentarily substitute therefor any such warning as soon as it occurs, which is preceded by the associated sound segment.

In any event, if option 1303 is selected in this instance, a voice comes on and utters a tip regarding tachometer 1305 such as "To prevent engine damage, do not drive with needle in red zone." This tip is also momentarily displayed on segment 1311 in lieu of options 1309a through 1309f.

Similar to the elements on the INSTRUMENT PANEL screen, tachometer 1305 and warning lights 1307 on this screen are individually labeled and correspond to options 1309a, 1309b, 1309c, 1309e and 1309f, respectively. Assuming in this example that MAINTENANCE REQUIRED option 1309c is activated, display segment 1311 would be replaced by new display segment 1411 illustrated in FIG. 14. As shown in FIG. 14, item 1401 indicates the subject selected, i.e., "MAINTENANCE

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REQUIRED". Item 1403 explains what the MAINTENANCE REQUIRED warning light, when on, indicates. In this instance it states, "Maintenance required warning light comes on to indicate it is time for scheduled maintenance." PREVIOUS option 1405 enables the user to reactivate segment 1311 of FIG. 13.

Assuming further that at this point the user wants to learn about and also to program the air conditioning of the automobile, the user may access a "CLIMATE CONTROL" screen by successively pressing the PREVIOUS option to backtrack to the DRIVER'S VIEW screen of FIG. 11, where CLIMATE CONTROLS option 1109 is available. As a second alternative, the user may press MENU switch 205e to invoke the MAIN MENU screen of FIG. 10, where a "CLIMATE CONTROLS" option within column 1003 is available. A third alternative is provided in the event that the user cannot immediately relate "air conditioning" to the CLIMATE CONTROLS option. At the MAIN MENU screen of FIG. 10, the user may select Index option 1001e to be described. It suffices to know for now that this option allows the user to access the "CLIMATE CONTROL" screen using the term "air conditioning".

FIG. 15 illustrates the "CLIMATE CONTROL" screen. With the voice enabled, a first touch on any displayed option on screen 209 causes it to be highlighted yellow, indicating its selected status. A second touch causes it to be highlighted blue, indicating its active status. With the voice disabled, only one touch on any displayed option activates it.

As shown in FIG. 15, the MODE options include OFF option 1511, AUTO option 1513, A/C option 1515, HEAT option 1517, and SMART CLIMATE option 1519. It should be noted that only one of the MODE options can be active at a time. In this example, assuming that the voice is enabled, when OFF option 1511 is selected by a first touch, a voice explaining the option comes on, uttering "To disable climate control." A second touch on the same option would then shut the climate control off through climate control interface 108f.

When AUTO option 1513 is selected by a first touch, a voice comes on to explain the option, uttering "System automatically determines air-flow distribution and volume for optimum efficiency." A second touch on the same option enables the automatic control, followed by a voice utterance, "Set desired temperature." Temperature display 1535 then flashes with the current temperature setting, prompting the user to set a desired temperature in a manner to be described.

If the user neglects to set a temperature after a predetermined time, in accordance with another aspect of the invention, a temperature range is automatically maintained by processor 105 in response to the date and time information from clock interface 108j, and the GPS information from navigation interface 106d. Based on the date and time information, processor 105 knows what the current season (e.g., mid-winter versus mid-summer) and time of the day (e.g., night verse noon) are. Based on the GPS information, processor 105 knows the region (e.g., New England versus Southern California) where the vehicle is. Processor 105 looks up a table stored in memory 115 containing predetermined temperature ranges corresponding to different combinations of the temporal and geographic parameters. It then prescribes an appropriate temperature range according to the table. This temperature range is updated by processor 105 periodically to reflect changes in the time of the day and the geographic location of the vehicle.

Similarly, A/C option 1515 and HEAT option 1517 respectively enable the user to activate air conditioning and heaters at a desired temperature or a default temperature range.

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SMART CLIMATE option 1519 is designed to allow the user to program the climate control for the next ride before he/she leaves the vehicle. When SMART CLIMATE option 1519 is selected by a first touch, a voice comes on to explain the option, uttering "To enable pre-heating or pre-cooling of vehicle." A second touch on the option activates the function, followed by a voice utterance, "Set desired temperature. Set desired time using fan speed arrows." Temperature display 1535 then flashes the current temperature setting, prompting the user to set a desired temperature. Similarly, fan speed display 1541 then flashes the current date, followed by current time, prompting the user to set the date and time that the user plans to re-enter the vehicle. Through climate control interface 108f, processor 105 determines whether the current level of power from the car battery and any back-up power sources is sufficient. If it is insufficient, a message such as "Fail to pre-condition vehicle temperature" is issued through audio interface 118 to notify the user of the noncompliance. Otherwise, when it is close to the re-entry time, processor 105 determines the start-up time to effect the pre-conditioning, depending on the temperature difference between the inside and outside of the vehicle at that time. Processor 105 would then cause a combination of heaters and/or heat pumps (not shown) connected to interface 108f to pre-condition the vehicle temperature. In order to avoid substantially draining the power, in this illustrative embodiment, the requested temperature would be maintained up to an hour after the set re-entry time.

The Air options in FIG. 15 include FRESH option 1521 and RECIRCULATED option 1523. Only one of these two options can be active at a time. When FRESH option 1521 is selected by a first touch on the option, a voice comes on to explain the selected option, uttering "To select outside air to circulate in vehicle." A second touch on the option activates the selection to ventilate the vehicle with outside air. Similarly, RECIRCULATED option 1523 allows the user to select the inside air for recirculation in the vehicle.

The VENT options in FIG. 15 include FLOOR option 1525, FLOOR/DASH option 1527, DASH option 1529, DEFROST option 1531 and FLOOR/DEFROST option 1533. Only one of these five options can be active at a time. When FLOOR option 1525 is selected by a first touch on the option, a voice comes on explaining the option, uttering "Main air distribution to floor." A second touch on the option directs an air flow toward the vehicle floor.

Similarly, FLOOR/DASH option 1527 enables the user to bifurcate the air flow between the floor and the dashboard. DASH option 1529 enables the user to direct the air flow from the dashboard. DEFROST option 1531 enables the user to direct the air flow toward the windshield and select fresh air if not selected. FLOOR/DEFROST option 1533 enables the user to bifurcate the air flow between the floor and windshield.

Temperature display 1535 displays the temperature selected by the user. Touching on up-arrow 1537 increases the selected temperature while touching on down-arrow 1539 decreases same. Continued touching on either up-arrow 1537 or down-arrow 1539 causes the temperature setting to change rapidly.

Similarly, fan speed display 1541 displays the fan speed (high, medium or low) selected by the user. Touching on up-arrow 1543 increases the selected fan speed while touching down-arrow 1539 decreases same.

The HEATERS options in FIG. 15 include SEAT option 1547, MIRROR option 1549, REAR WINDOW option

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1551, STEERING WHEEL option 1553, and ALL option 1554. One or more of these options can be active at the same time. When SEAT option 1547 is selected by a first touch on the option, a voice comes on to explain the option, uttering "To enable seat heaters." A second touch on the option activates the seat heaters connected to climate control interface 108f.

Similarly, MIRROR option 1549 enables the user to activate outside mirror heaters. REAR WINDOW option 1551 enables the user to activate a rear window defroster. STEERING WHEEL option 1553 enables the user to activate a steering wheel heater. Finally, ALL option 1554 enables the user to activate all of the heaters simultaneously.

In personalizing the vehicle, preference interface 116 monitors any user adjustments to certain vehicle functions by comparing their current settings with the corresponding stored preferences in memory 115. Thus, for example, if the user changes any of the settings relating to the climate control such as the mode, vent, air, temperature, fan speed, etc. from its previous preferred setting, preference interface 116 causes a SAVE screen to appear on screen 209. This SAVE screen is illustrated in FIG. 16. As shown in FIG. 16, the user is prompted to save the change in the setting that he/she has just made. The user at this point may activate SAVE option 1601 to change the previous preferred setting. The SAVE screen thereafter disappears in favor of the previous screen. Otherwise, he/she may activate CLOSE option 1603 to close the SAVE screen, without storing the latest setting, which is then treated as a temporary setting. In the latter case, for example, a restart of the automobile will obliterate such a temporary setting, and reinstate the stored preferred setting.

Climate control screens can similarly be invoked by the front passenger and rear passengers on display interfaces 102c and 102d, respectively. Such screens provide similar MODE options including OFF, AUTO, A/C and HEAT options; and VENT options including LOWER VENT, UPPER VENT and LOWER/UPPER vent options. They also provide for temperature and fan speed adjustments for the respective localized areas. However, no save screen is provided.

Using INDEX option 1001e of FIG. 10 to look up information on and/or to control various items in the automobile will now be described. After option 1001e is activated, a DATA ENTRY screen illustrated in FIG. 17 is exhibited on screen 209. As shown in FIG. 17, a message "Enter Letter Or Item Name" appears to prompt the user for an entry of the name of the item of interest or its beginning letter. For this purpose, entry options for letters A through Z arranged in a grid format are provided in section 1701 for selection. In addition, DONE option 1703, when activated, indicates to system 100 that the entry is completed. Subdisplay 1705 is used to echo the user's entry to ensure its correctness.

In this illustration, the user enters "AIR CONDITIONING" as exhibited on subdisplay 1705. In response, an INDEX screen shown in FIG. 18 appears on display screen 209, with the search item name "AIR CONDITIONING" highlighted yellow. It should be noted that other item names such as "Anti-lock Brake System Indicator" are also shown, and they are in alphabetical order following "AIR CONDITIONING". This stems from the design of system 100 whereby the user may conveniently enter the beginning letter of the search item name only. In that case, a list of item names in alphabetical order with the first item name having the same beginning letter highlighted yellow. For instance,

if the user had only entered "A" for "AIR CONDITIONING", a list of item names starting with "A" in alphabetical order would appear on screen 209 (although in this instance it would be the same list as shown in FIG. 18 as "AIR CONDITIONING" is the first item with a letter "A" in system 100). If the user cannot locate the name of the item of interest in the list, he/she may scroll the screen using scroll-up option 1801 or scroll-down option 1803 to review additional item names after or before the listed item names. Alternatively, the user may select PREVIOUS option 1805 to return to the screen of FIG. 17 to enter the complete item name.

In any event, after the user locates the item name on the INDEX screen, the user may then touch the item name to access information on that item. To that end, a look-up table is stored in memory 115. FIG. 19 illustrates such a look-up table, wherein left column 1901 lists each item name in alphabetical order in the index, and right column 1903 lists the corresponding instruction for processor 105 to carry out to access information on that item. For example, according to row 1905 of the table, the selection and activation of the item name "AIR CONDITIONING" causes processor 105 to connect the user to the CLIMATE CONTROL screen of FIG. 15 previously described.

The foregoing merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise numerous other systems which embody the principles of the invention and are thus within its spirit and scope.

For example, based on the disclosure heretofore, it is apparent that through system 100, the user can run diagnostics on selected parts of the automobile by voice command or touch-screen control.

In addition, in the disclosed embodiment, through system 100, the user is able to program the climate control for the next ride before he/she leaves the vehicle. It will be appreciated that the user will be able to achieve same remotely ahead of time via telecommunication means. For example, processor 105 may be programmed to accept climate control commands through phone interface 106a. In that instance, the user can call from anywhere to establish a predetermined connection with phone interface 106a using a predetermined phone number, through which the user communicates the commands to climate control interface 108f to program the climate control. Through the phone connection, the user may be provided with climate control options described above in a synthesized voice. The user may activate one or more of such options by pressing a predetermined touch-tone key on the telephone keypad corresponding to a "yes" or "no" response. Similarly, the user may achieve the relevant temperature and/or time settings by pressing the touch-tone keys corresponding to the numerals indicative thereof. Of course, telecommunication means other than the telephone including a radio frequency (RF) transmitter may also be used to communicate the climate control commands from a remote area.

In addition, in the disclosed embodiment, the user may access different screens provided by AUTO DIRECTOR display interface 102a to learn about and control certain vehicle functions. It will be appreciated that a person skilled in the art will develop a demonstration program wherein a series of such screens will be automatically presented to a user in a predetermined sequence. The presentation may include commentaries, and highlights on selected options displayed on each screen. Furthermore, the presentation may be coupled with the showing of actual vehicle functions. For

example, in demonstrating the climate control screen of FIG. 15, while the function of a highlighted VENT option (e.g., Floor, Floor/Dash, Dash, Defrost or Floor/Defrost) is explained, it is activated so that the user in the automobile can feel an actual air flow from the corresponding direction. The above demonstration program may be invoked using a PIN provided by the automobile manufacturer. The program may run continually while the automobile is shown in a showroom, or may be invoked by the user occasionally to obtain relevant information.

Further, in the disclosed embodiment, the MAINTENANCE REQUIRED warning light comes on when it is time for scheduled maintenance. In accordance with another aspect of the invention, the maintenance is scheduled by system 100 according to the cumulative time of the tachometer reading above a predetermined RPM value. Such cumulative time reflects the extent of the engine wear, and if it exceeds a predetermined length of time without maintenance, the engine performance would degrade substantially. In measuring the cumulative time in question, a conventional comparator (not shown) is employed in system 100 to compare the instantaneous tachometer reading (provided by engine control interface 112c) with the predetermined RPM value. Each time when the tachometer reading exceeds the predetermined value, processor 105 is interrupted to register the length of such an occurrence. The time in question. This cumulative time may be displayed on instrument panel display interface 102a, along with the tachometer reading and the MAINTENANCE REQUIRED warning indicator. A second conventional comparator (not shown) is employed in system 100 to compare the cumulative time with the above predetermined time length. As soon as the cumulative time exceeds the predetermined length, processor 105 is interrupted and causes the MAINTENANCE REQUIRED warning light to come on, indicating that it is time for maintenance.

Still further, system 100 as described is highly adaptable in adjusting to new system requirements, and capable of "learning" new automobile features to be introduced into the system. Such learning may involve a modification or an upgrade in the system software stored in memory 115.

Moreover, other features of system 100 may include capabilities of communications with a third party remote from the vehicle. For example, system 100 may be programmed to transmit signals representing data on the current speed of the vehicle and its VIN receivable by a radar system, thus enabling the third party to monitor its speed. Furthermore, system 100 may be programmed by the third party to disable and subsequently enable the vehicle upon successful verification of a PIN pre-assigned to the third party. To that end, system 100 is capable of receiving remote transmission of the PIN, followed by the disable or enable code. The transmission may be encrypted for security reasons. Furthermore, more than one PIN may be used for different purposes. For example, a PIN may be assigned to a law enforcement agency to disable the vehicle because of a suspension of a license, or to temporarily disable the vehicle when the driver is intoxicated. Another PIN may be assigned to an environmental protection agency to disable the vehicle for failing to meet the emission requirements. Yet another PIN may be assigned to the vehicle owner to disable the vehicle when parked, thereby reducing the risk of a car theft. The disabling of the vehicle involves cutting off its gas, putting on its anti-lock brakes, etc.

Further, system 100 is capable of receiving a low-frequency, low-power broadcast covering an area of a lim-

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ited radius, referred to as a "Cell". The broadcast may provide electronic GPS map and Yellow Page type information pertaining to the cell. This information, when received, may be downloaded onto AUTO DIRECTOR display interface 102a or multifunction display interface 102b. Such information includes a local directory indicating locations of nearby gas stations, restaurants and other facilities on the GPS map, with respect to the current location of the automobile. The local directory may be formatted in the form of "web pages" featuring the local businesses, and include additional information such as business hours, telephone numbers, and information on products and services provided by such businesses.

The above broadcast may also provide local weather information sponsored by a civic group or commercial entity. In the case of civic group sponsorship, the local civic events may be posted alongside the weather information, and in the case of commercial sponsorship, advertisements may be posted instead. Of course, as the automobile moves from cell to cell, the contents of the broadcast change accordingly.

In addition, while the radio in the automobile is tuned to a particular radio station, system 100 is also capable of receiving any electronic files broadcast from that radio station, along with the radio program. These electronic files, which may be in the form of web pages, can be downloaded onto the system. The system user may then scroll the pages to learn such information as program listings and coming events sponsored by the radio station.

Moreover, in the disclosed embodiment, system 100 is illustratively used in an automobile. It will be appreciated that a person skilled in the art may also employ the inventive system in another type of vehicle such as a boat, an airplane, etc.

Finally, although information and control system 100, as disclosed, is embodied in the form of various discrete functional blocks, the system could equally well be embodied in an arrangement in which the functions of any one or more of those blocks or indeed, all of the functions thereof, are realized, for example, by one or more appropriately programmed processors or devices.

We claim:

1. A system for operating a device to perform a function in a vehicle comprising:

- a display element for displaying at least one option which is associated with the function of the vehicle, the at least one option indicating a first status;
- a first interface for selecting the at least one option, the selected at least one option indicating a second status;
- an output element for providing information concerning the selected at least one option;
- a second interface for activating the selected at least one option, the activated option indicating a third status; and
- a processor for causing the device to perform the function after the selected at least one option is activated.

2. The system of claim 1 wherein the function includes climate control.

3. The system of claim 1 wherein the first interface is the same as the second interface.

4. The system of claim 1 wherein the display element includes a liquid crystal display (LCD).

5. The system of claim 1 wherein the second status is indicated by a highlight on the selected at least one option in a first color.

6. The system of claim 5 wherein the third status is indicated by a highlight on the activated option in a second color.

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7. The system of claim 1 wherein the selected at least one option is selected using a touch-screen technique.

8. The system of claim 1 wherein the information is provided via audio media.

9. The system of claim 1 wherein the information is provided textually.

10. The system of claim 1 wherein at least one of the first interface and the second interface includes a device for indicating the at least one option.

11. The system of claim 1 wherein at least one of the first interface and the second interface includes a control button.

12. The system of claim 1 wherein at least one of the first interface and the second interface includes a voice command capability.

13. The system of claim 1 wherein the function includes a radio function.

14. The system of claim 1 wherein the function includes a television function.

15. The system of claim 1 wherein the function includes a CD playing function.

16. The system of claim 1 wherein the function includes a navigation function.

17. The system of claim 1 wherein the function includes a telephonic function.

18. The system of claim 1 wherein the function includes a lock function.

19. The system of claim 1 wherein the function includes a mirror adjustment function.

20. The system of claim 1 wherein the function includes a window adjustment function.

21. The system of claim 1 wherein the function includes a seat adjustment function.

22. The system of claim 1 wherein the function includes a windshield wiper control function.

23. The system of claim 1 wherein the function includes a cruise control function.

24. The system of claim 1 wherein the function includes a light control function.

25. The system of claim 1 wherein the function includes a security function.

26. The system of claim 1 wherein the function includes a steering control function.

27. The system of claim 1 wherein the function includes a ride control function.

28. The system of claim 1 wherein the function includes an engine function.

29. The system of claim 1 wherein the function includes a transmission function.

30. A method for operating a device to perform a function in a vehicle comprising:

displaying at least one option which is associated with the function of the vehicle, the at least one option indicating a first status;

selecting the at least one option, the selected at least one option indicating a second status;

providing information concerning the selected at least one option;

activating the selected at least one option, the activated option indicating a third status; and

causing the device to perform the function after the selected at least one option is activated.

31. The method of claim 20 wherein the function includes climate control.

32. The method of claim 20 wherein the second status is indicated by a highlight on the selected at least one option in a first color.

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33. The method of claim 32 wherein the third status is indicated by a highlight on the activated option in a second color.

34. The method of claim 20 wherein the selected at least one option is selected using a touch-screen technique.

35. The method of claim 10 wherein the content is provided via audio media.

36. The method of claim 10 wherein the content is provided textually.

37. The method of claim 30 wherein the at least one option is selected using an indicator device.

38. The method of claim 30 wherein the at least one option is selected using a control button.

39. The method of claim 30 wherein the at least one option is selected via voice command.

40. The method of claim 30 wherein the function includes a radio function.

41. The method of claim 30 wherein the function includes a television function.

42. The method of claim 30 wherein the function includes a CD playing function.

43. The method of claim 30 wherein the function includes a navigation function.

44. The method of claim 30 wherein the function includes a telephonic function.

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45. The method of claim 30 wherein the function includes a lock function.

46. The method of claim 30 wherein the function includes a mirror adjustment function.

47. The method of claim 30 wherein the function includes a window adjustment function.

48. The method of claim 30 wherein the function includes a seat adjustment function.

49. The method of claim 30 wherein the function includes a windshield wiper control function.

50. The method of claim 30 wherein the function includes a cruise control function.

51. The method of claim 30 wherein the function includes a light control function.

52. The method of claim 30 wherein the function includes a security function.

53. The method of claim 30 wherein the function includes a steering control function.

54. The method of claim 30 wherein the function includes a ride control function.

55. The method of claim 30 wherein the function includes an engine function.

56. The method of claim 30 wherein the function includes a transmission function.

* * * * *



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(12) **United States Patent**
Obradovich et al.

(10) Patent No.: **US 6,438,465 B2**
(45) Date of Patent: ***Aug. 20, 2002**

(54) **TECHNIQUE FOR EFFECTIVELY
SEARCHING FOR INFORMATION IN A
VEHICLE**

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(52) U.S. Cl. **701/1; 701/36**
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168, 685, 802, 700, 705, 714, 737, 745;
340/436, 459, 521, 417; 73/117.2**

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Primary Examiner—Jacques H. Louis-Jacques

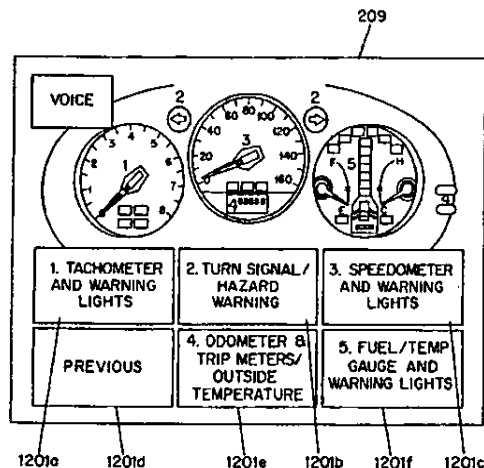
(74) Attorney, Agent, or Firm—Kaye Scholer LLP

(57)

ABSTRACT

In a multimedia information and control system for use in an automobile, at least one interface is employed which enables a user to access information concerning the automobile and control vehicle functions in an efficient manner. The user may select one of a plurality of displayed options on a screen of such an interface. Through audio, video and/or text media, the user is provided with information concerning the selected option and the vehicle function corresponding thereto. Having been so informed, the user may activate the selected option to control the corresponding vehicle function.

16 Claims, 15 Drawing Sheets



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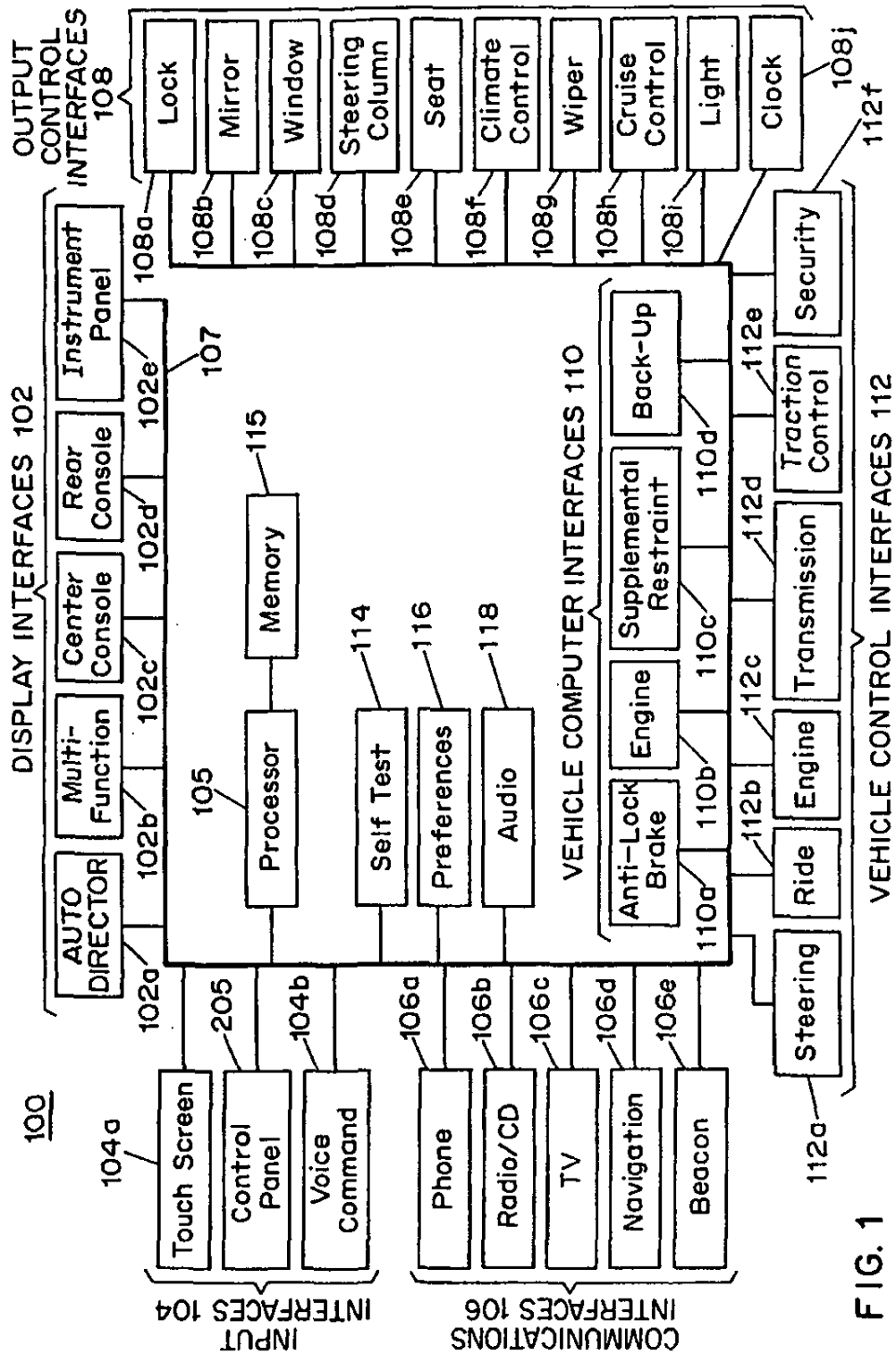


FIG. 1

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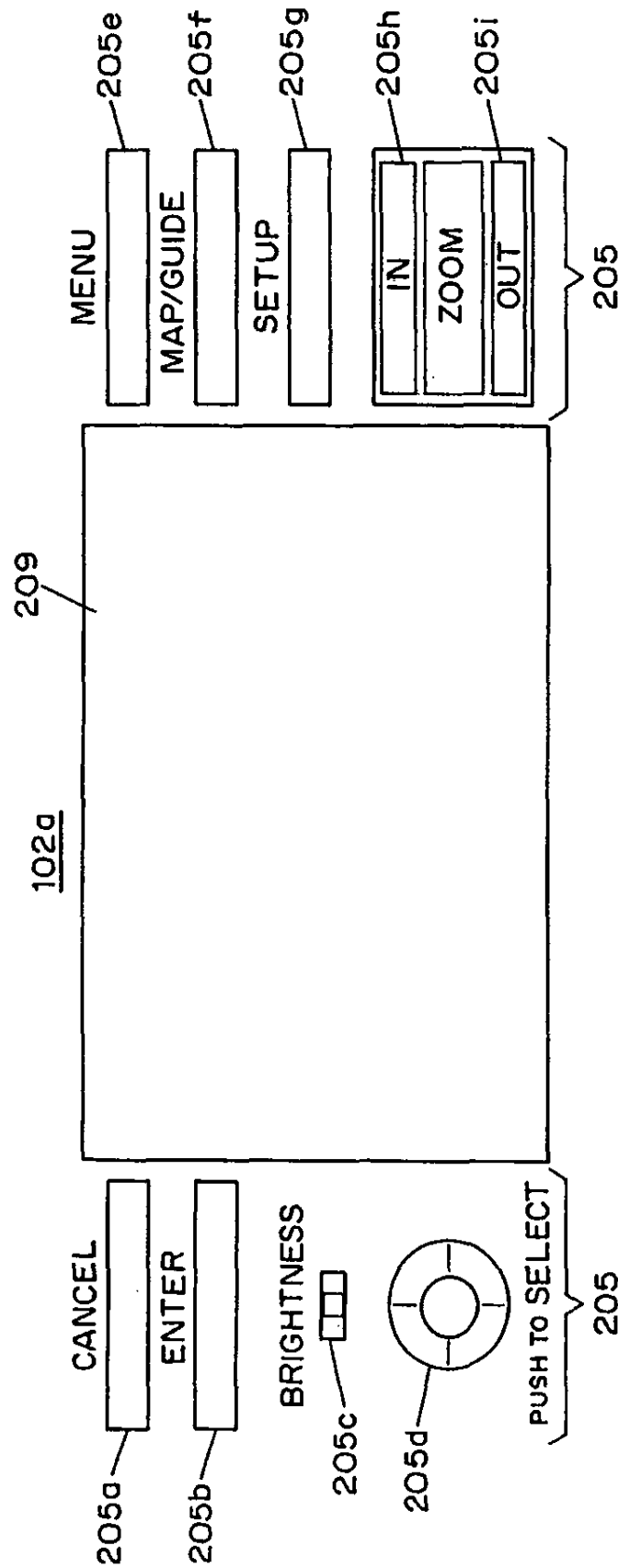


FIG. 2

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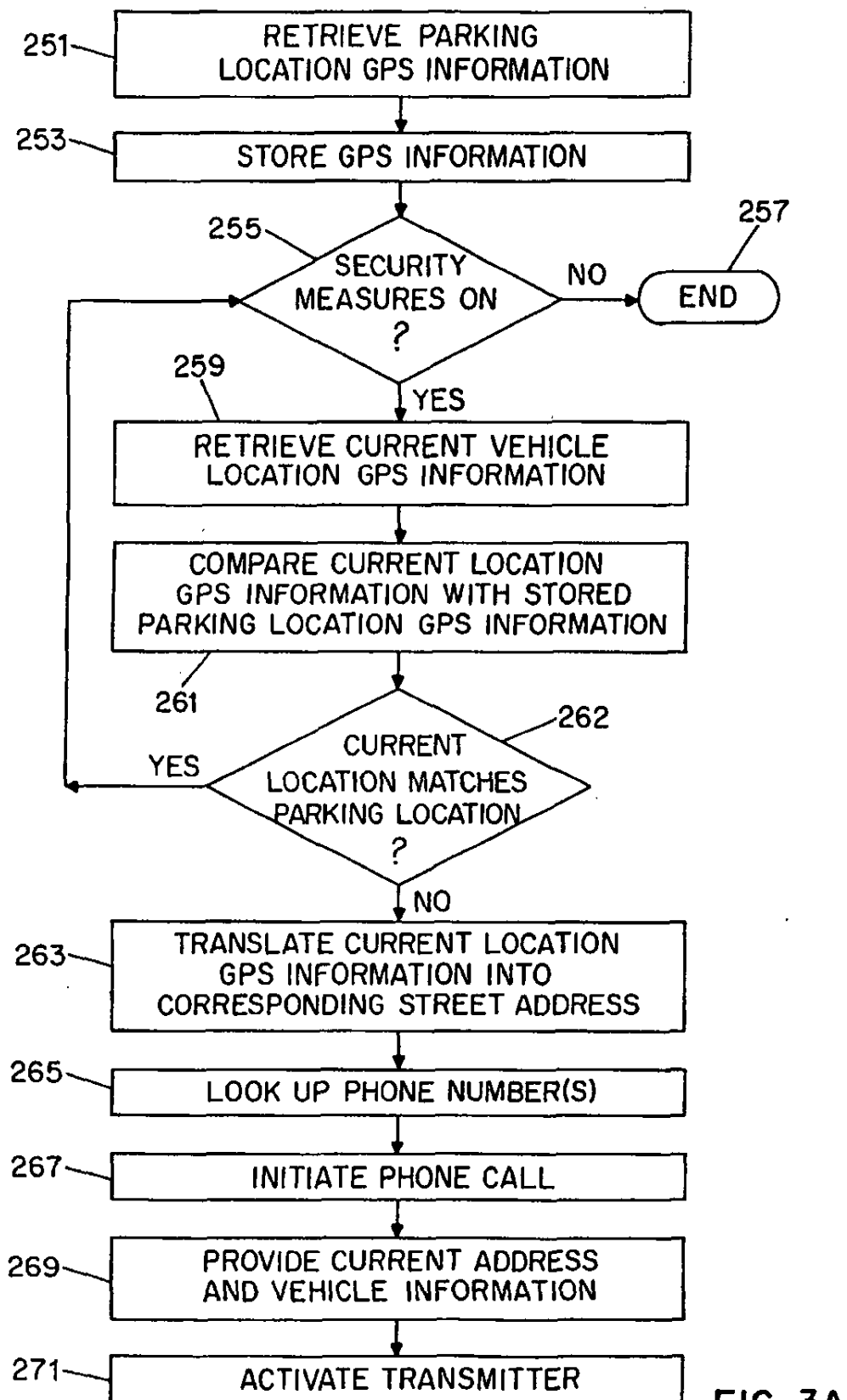


FIG. 3A

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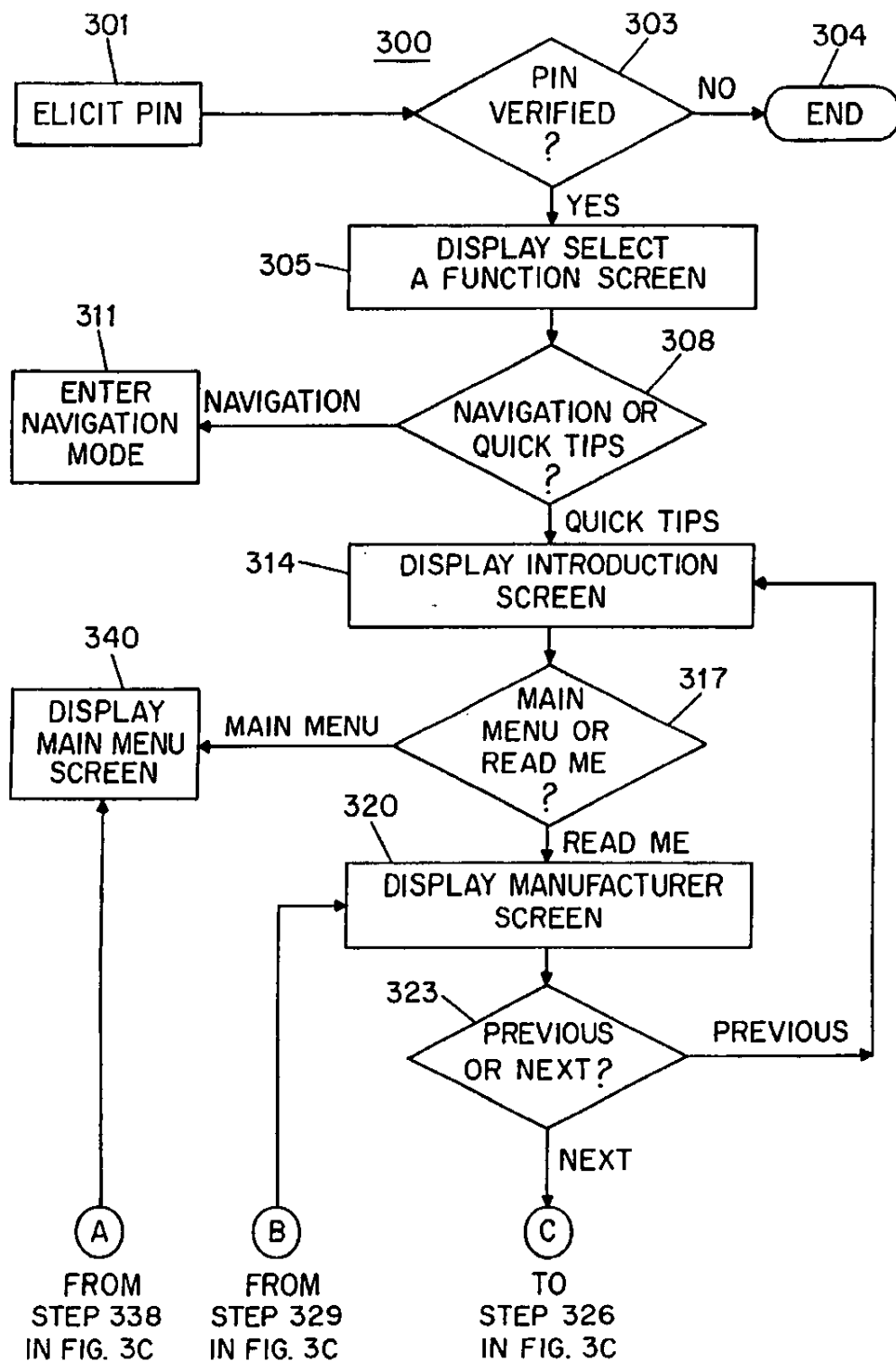


FIG. 3B

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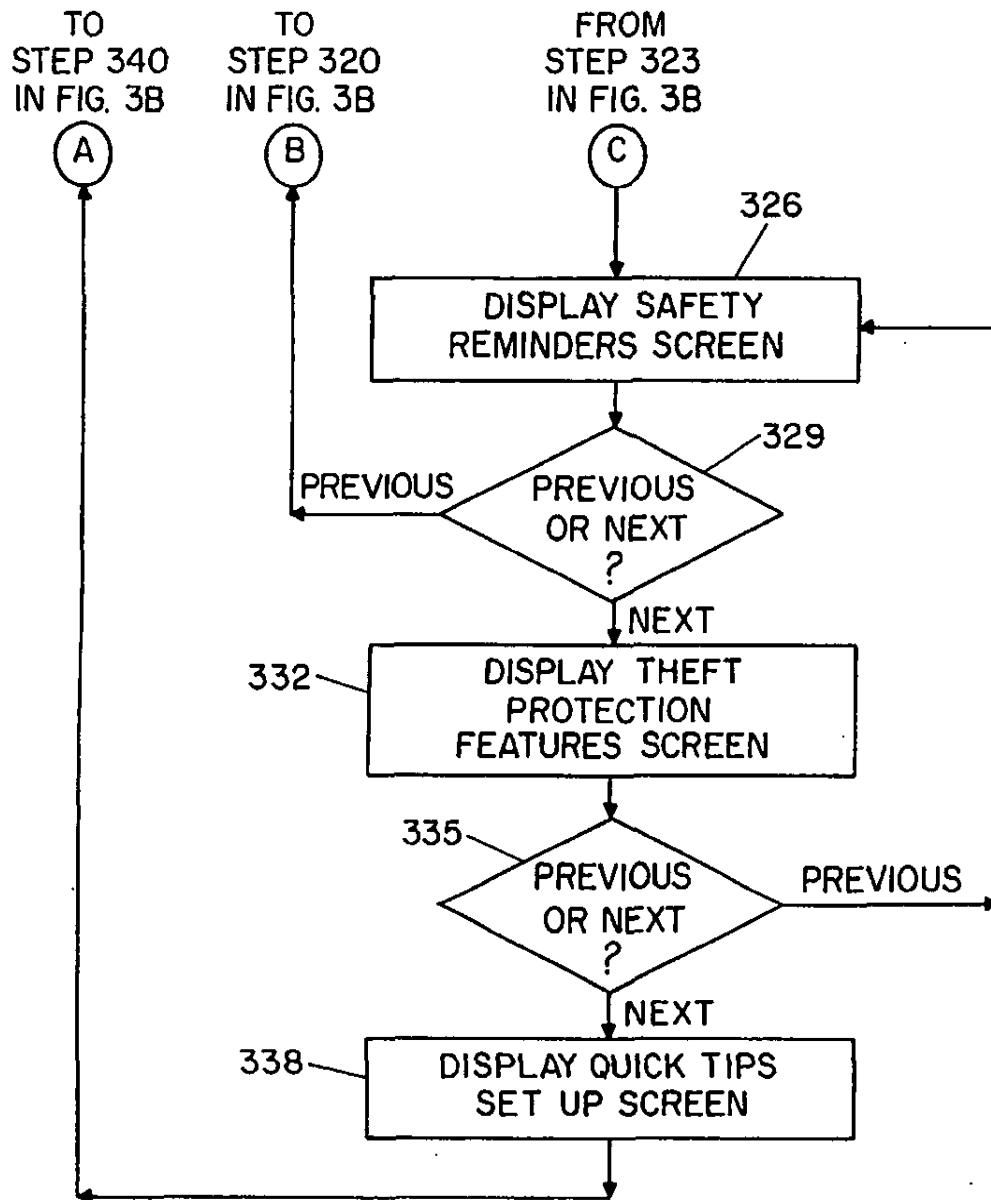


FIG. 3C

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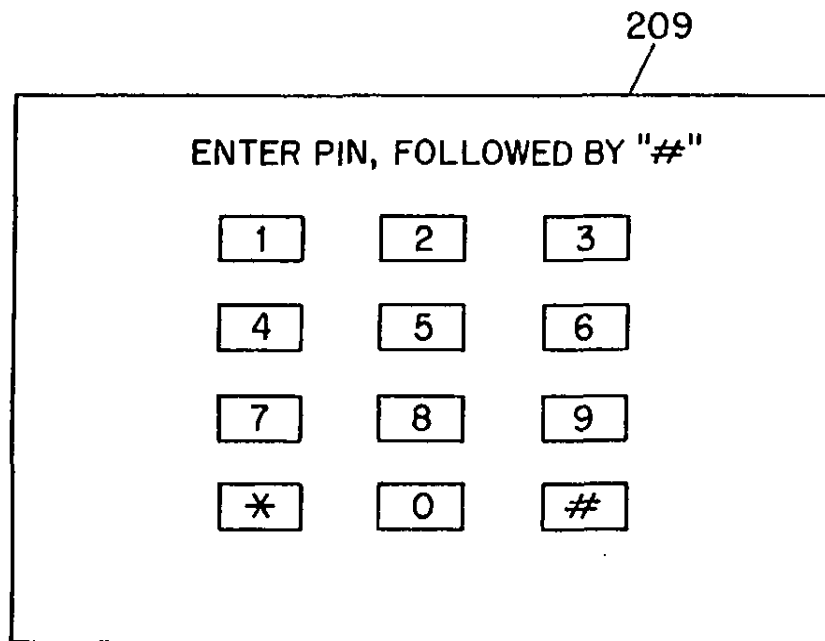


FIG. 4A

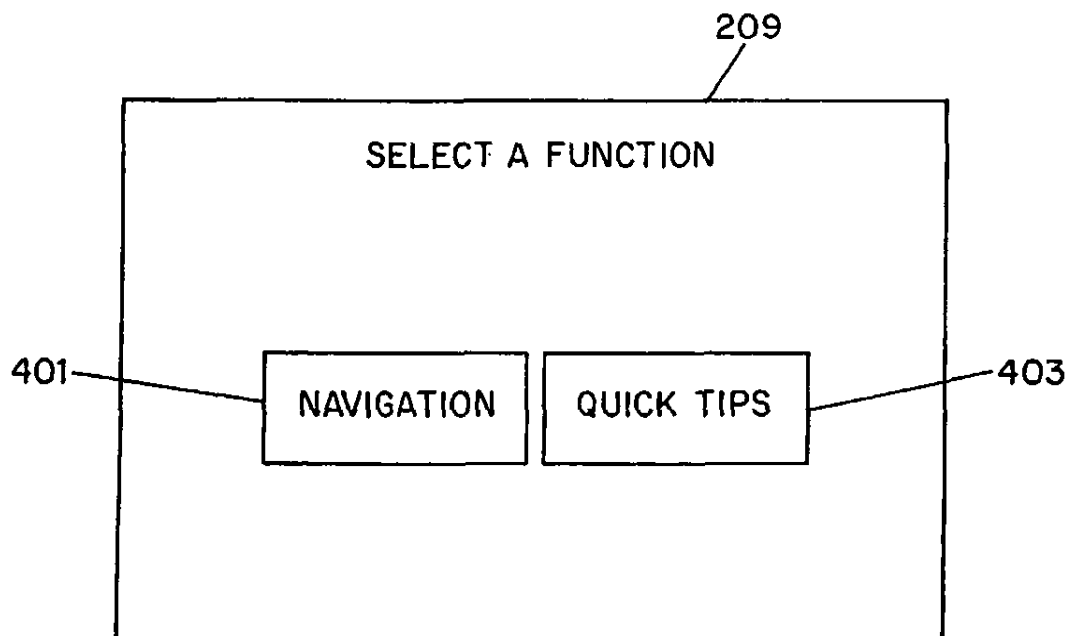


FIG. 4B

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FIG. 5

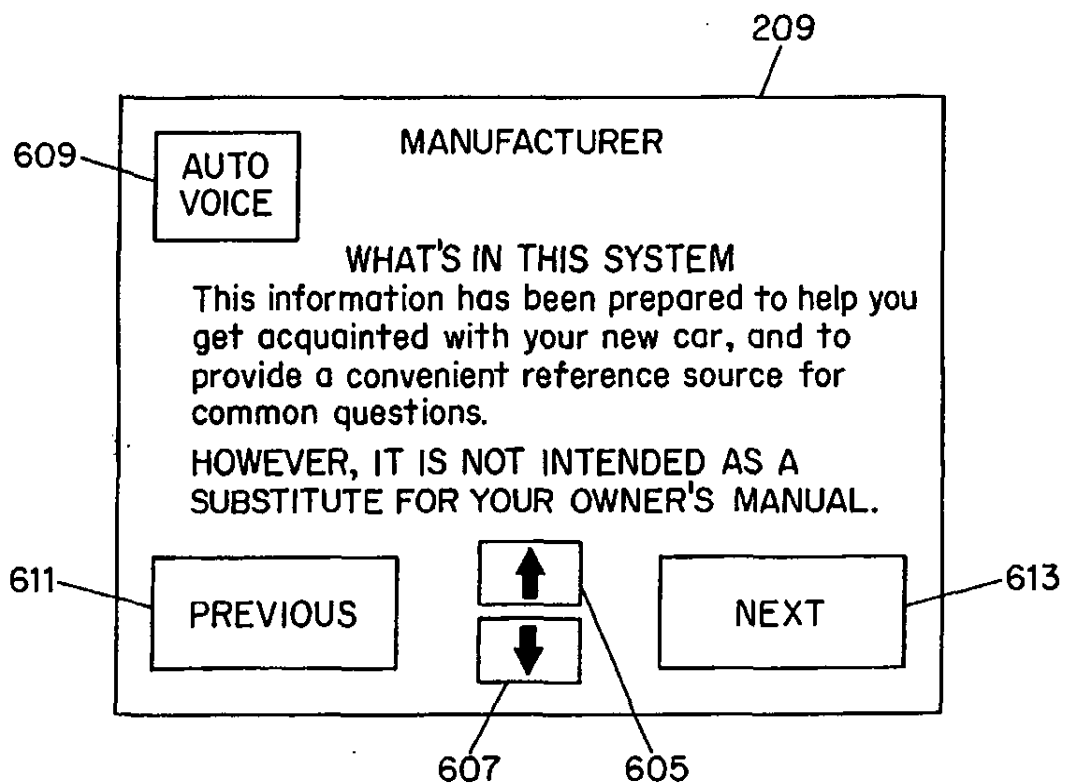


FIG. 6

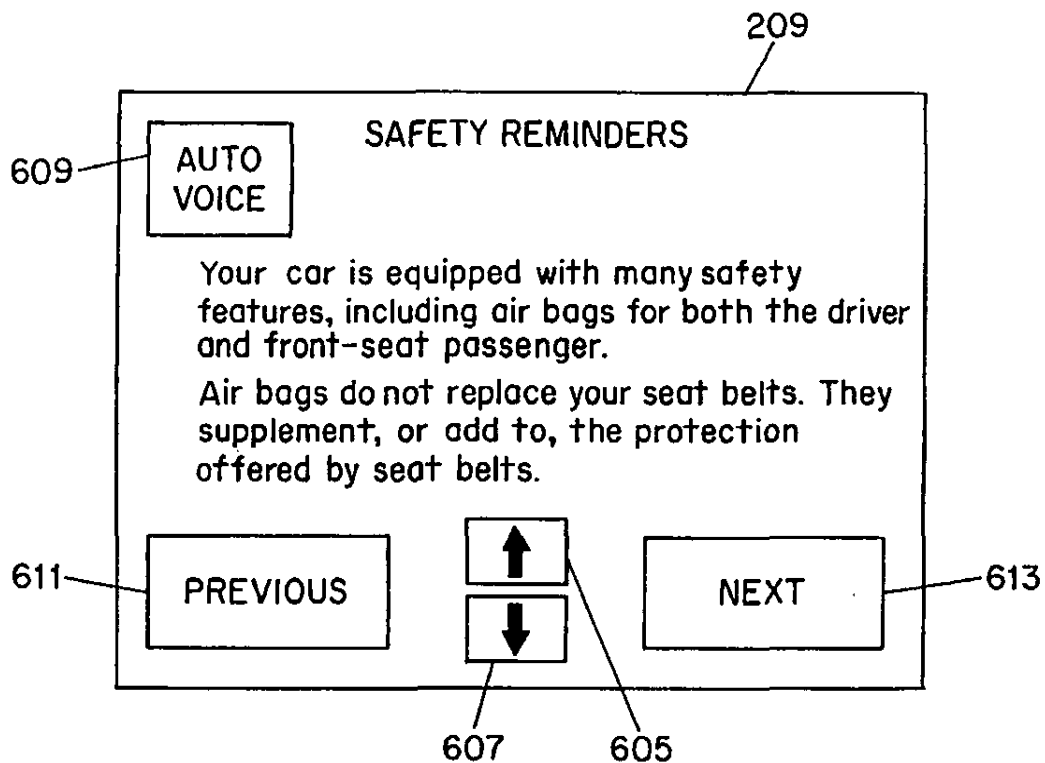


FIG. 7

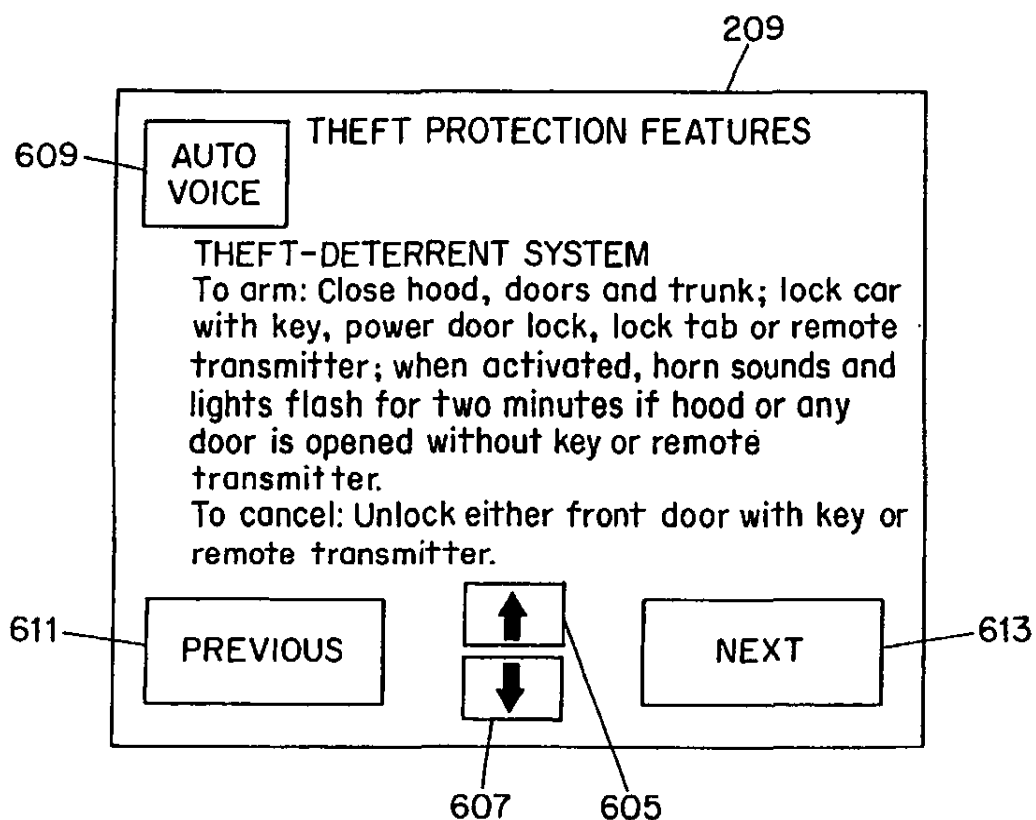


FIG. 8

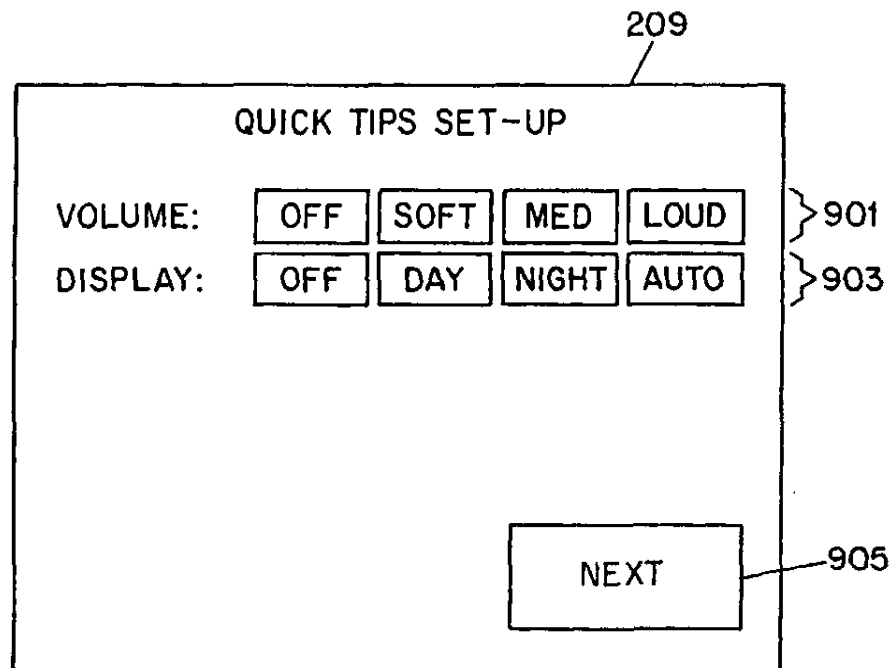


FIG. 9

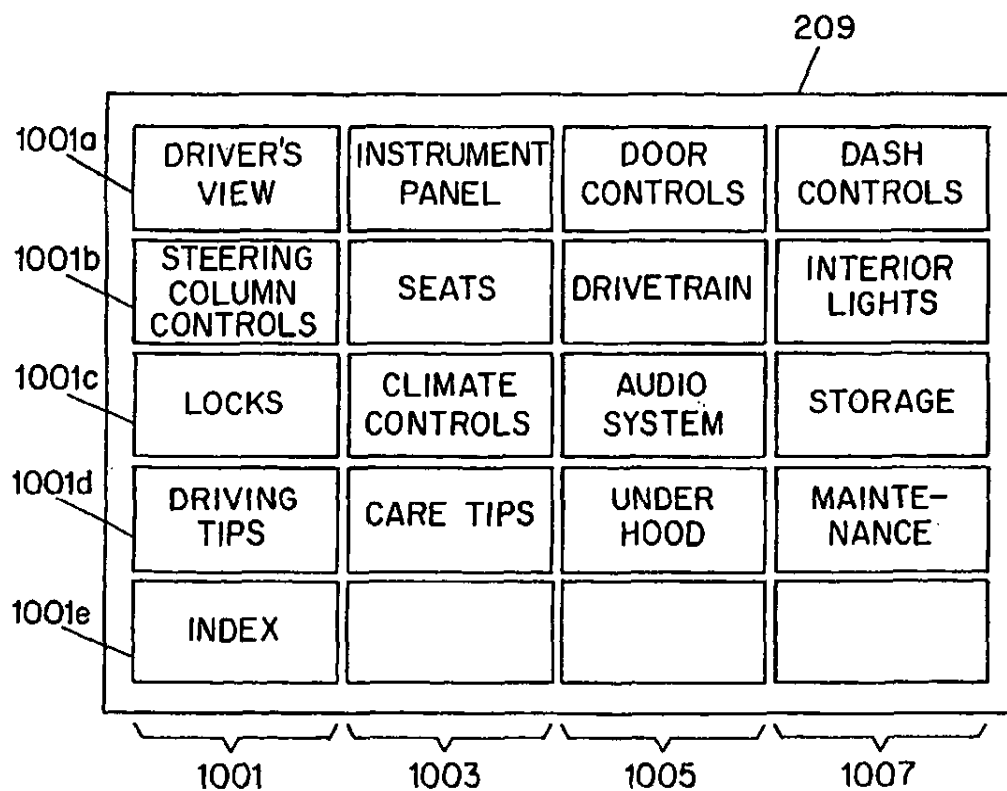


FIG. 10

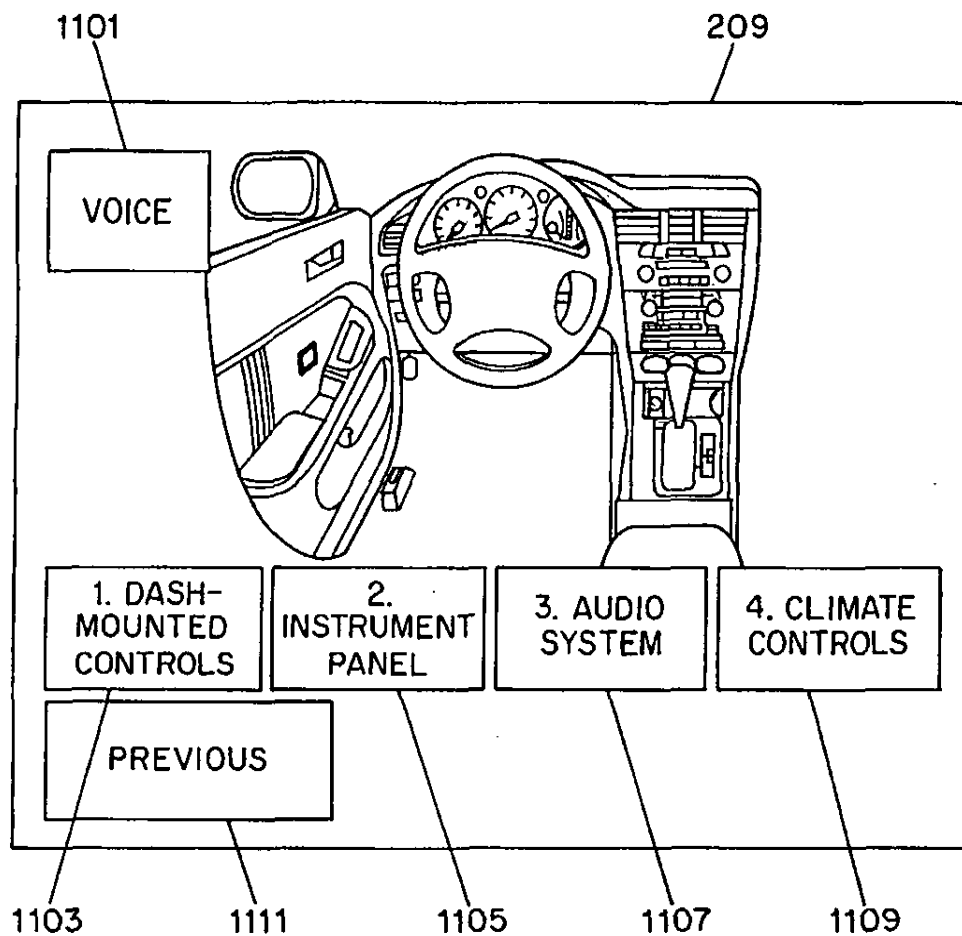


FIG. 11

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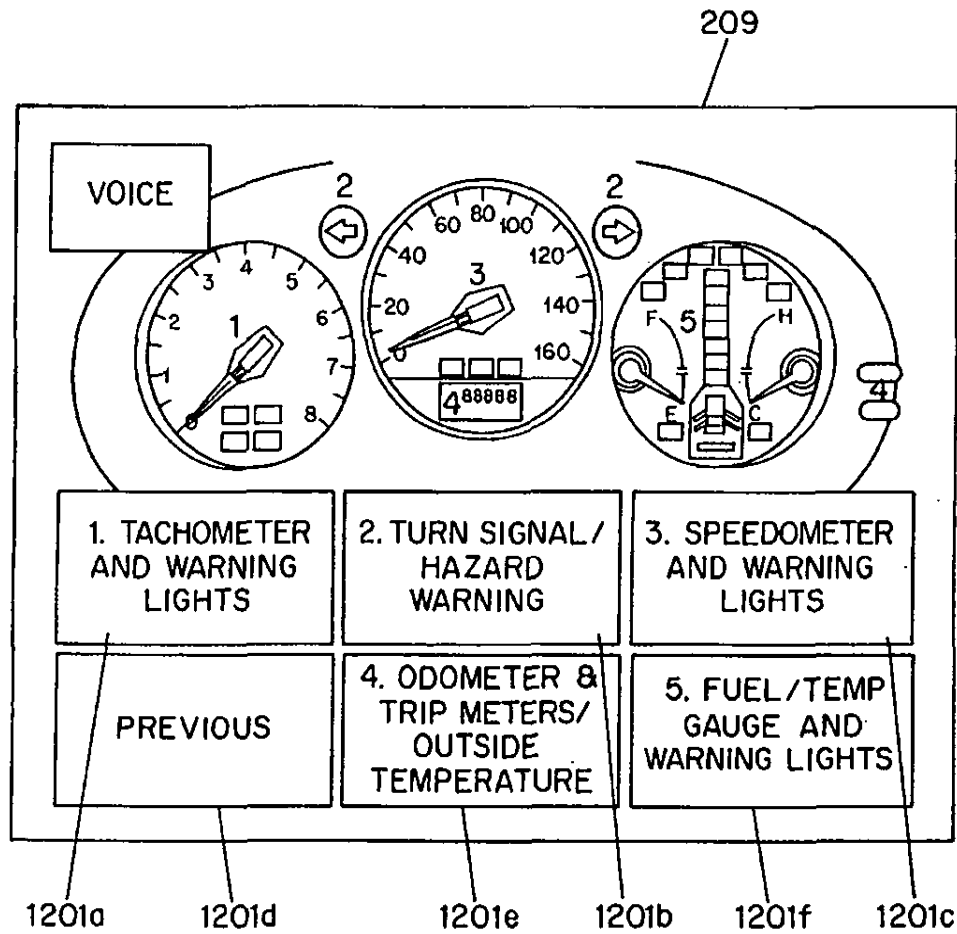


FIG. 12

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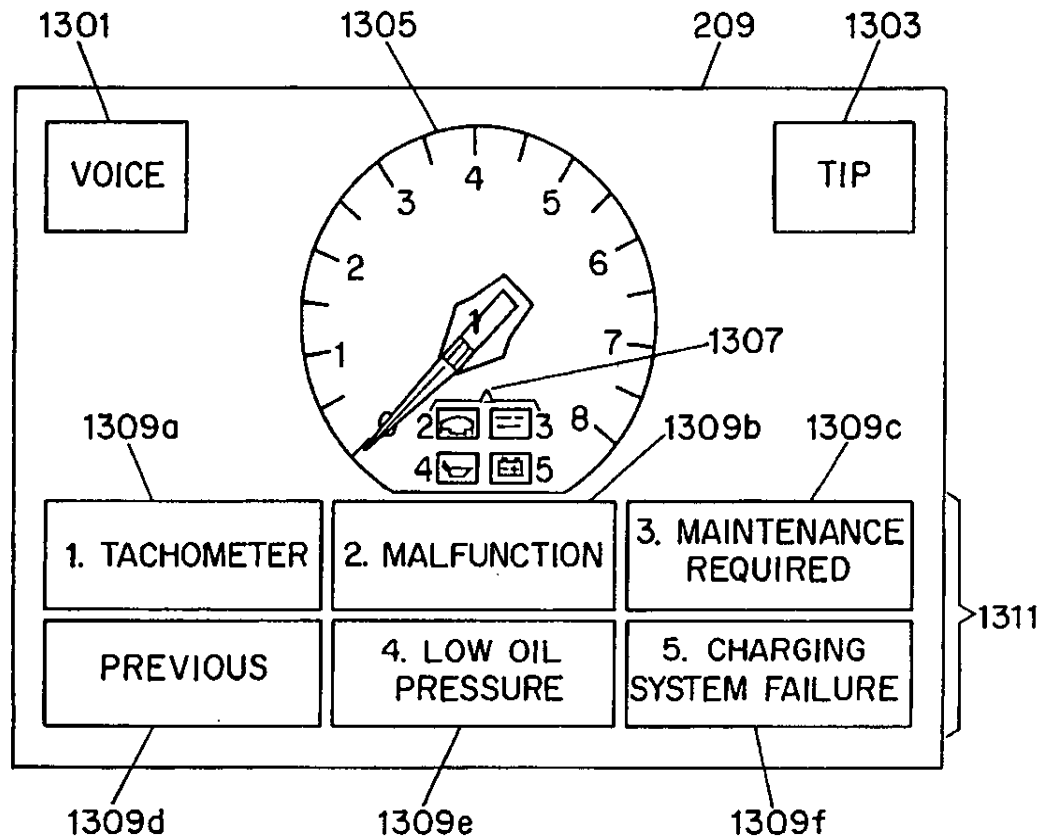


FIG. 13

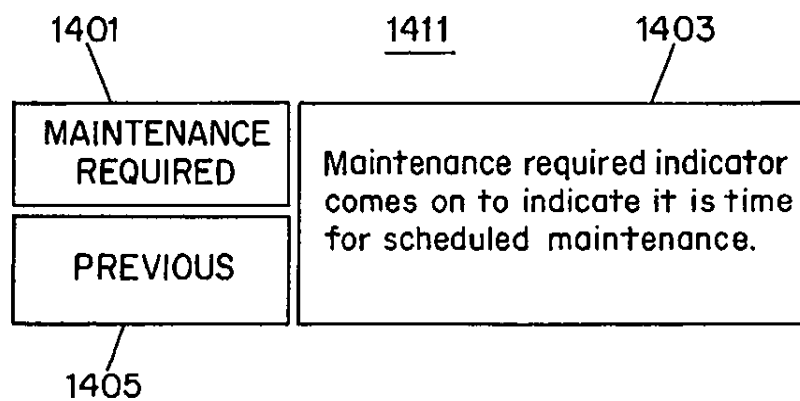


FIG. 14

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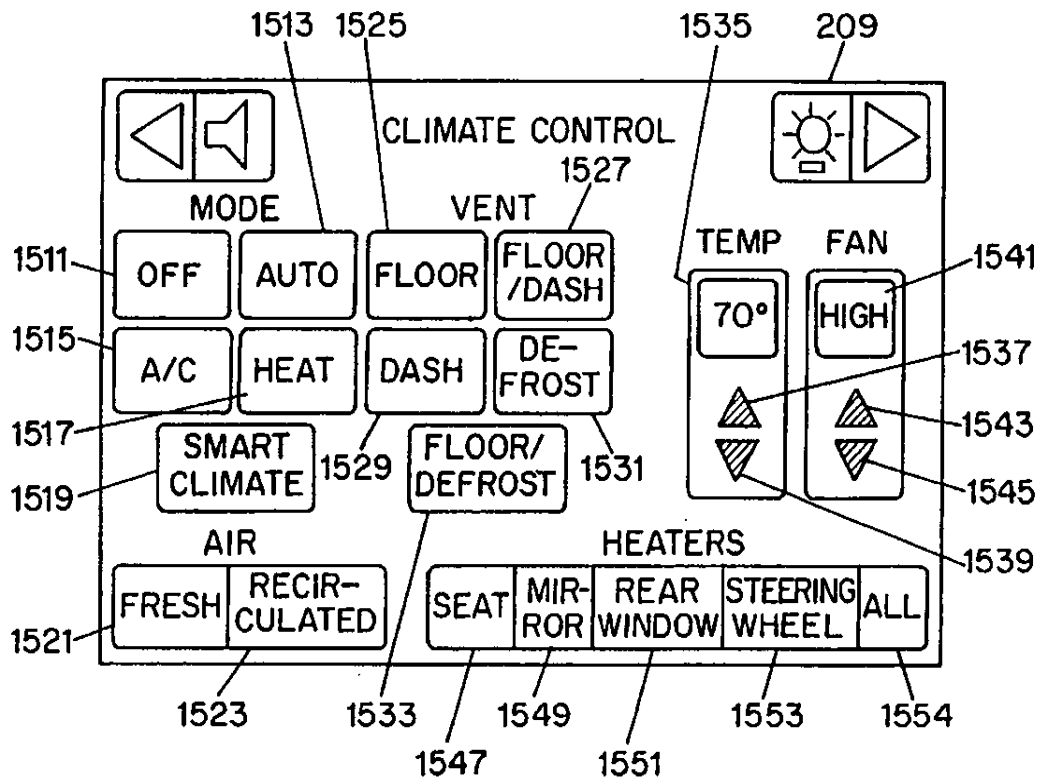


FIG. 15

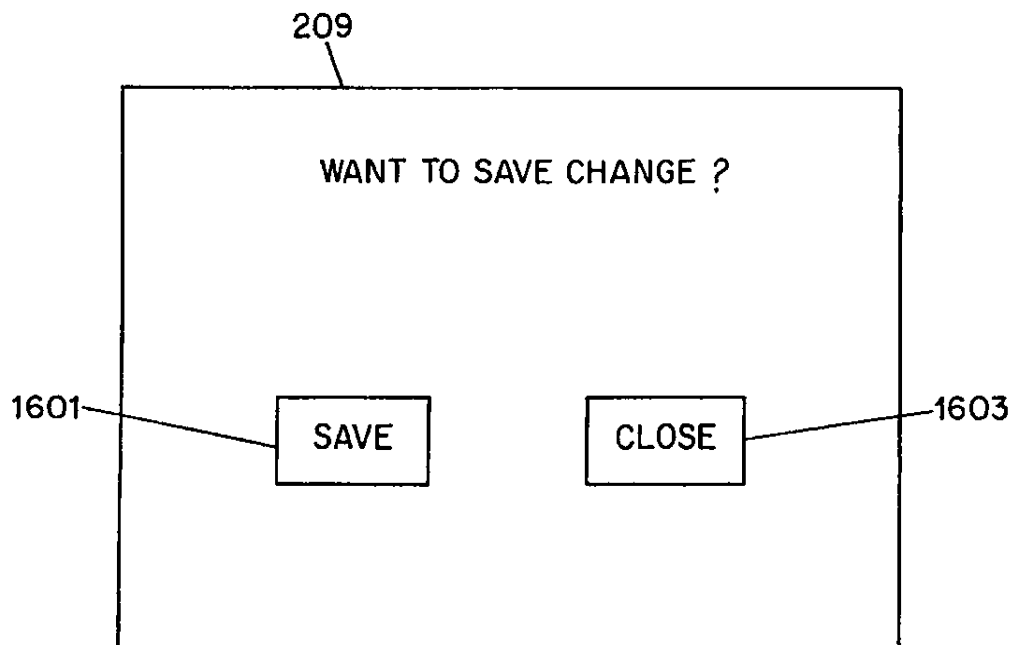


FIG. 16

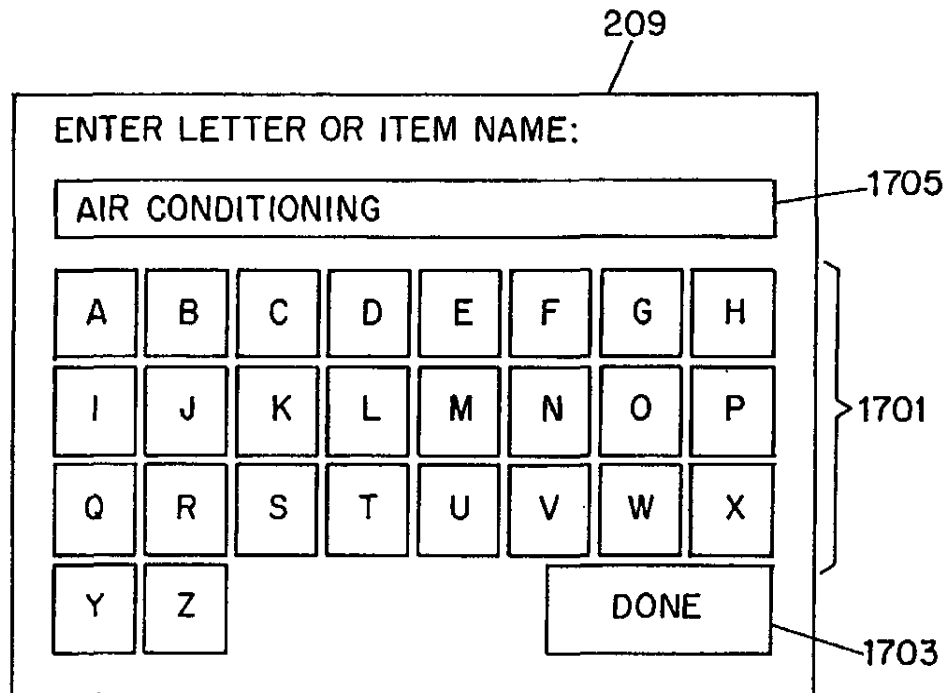


FIG. 17

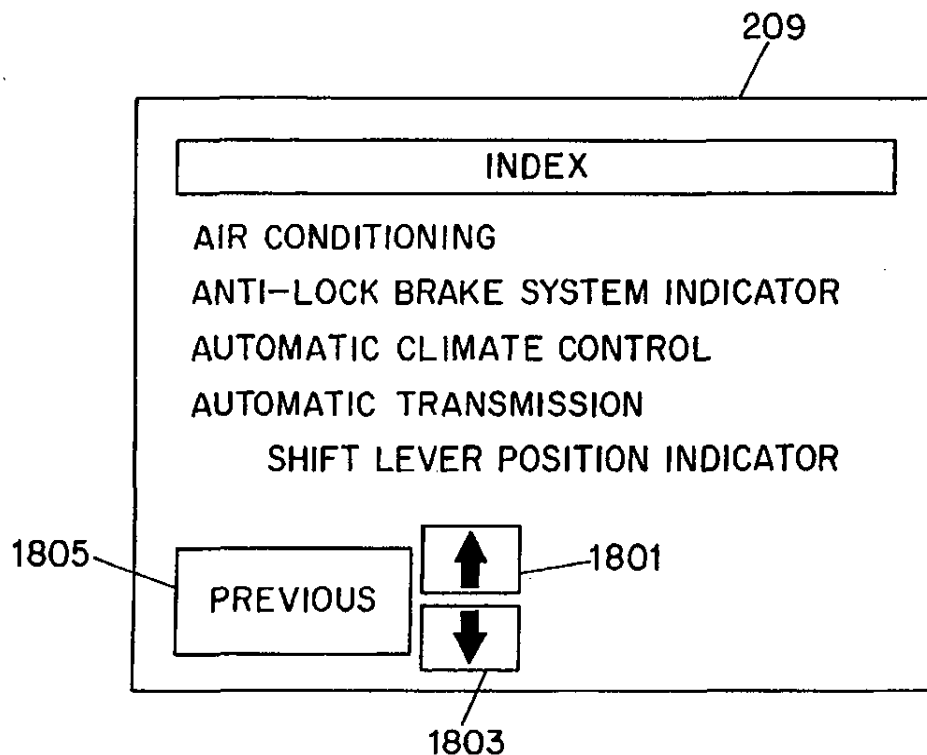


FIG. 18

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1901		1903	
1905	AIR CONDITIONING	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
	ANTI-LOCK BRAKE SYSTEM INDICATOR	LINK TO WARNING LIGHT OPTION #4 ON FUEL/TEMP SCREEN (NOT SHOWN)	
	AUTOMATIC CLIMATE CONTROL	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
•	•	•	•
•	•	•	•
CHARGING SYSTEM FAILURE INDICATOR		LINK TO CHARGING SYSTEM FAILURE OPTION 1309f (FIG. 13)	
CLIMATE CONTROL SYSTEM		LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
COOLING		LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
CRUISE CONTROL INDICATOR		LINK TO WARNING LIGHT OPTION #2 ON SPEEDOMETER SCREEN (NOT SHOWN)	
DEFOG/DEFROST		LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	
DOOR AJAR INDICATOR		LINK TO WARNING LIGHT OPTION #7 ON FUEL/TEMP SCREEN (NOT SHOWN)	
DIRECTIONAL SIGNALS INDICATOR		LINK TO TURN SIGNAL/HAZARD WARNING OPTION 1201b (FIG. 12)	
•	•	•	•
•	•	•	•

FIG. 19

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TECHNIQUE FOR EFFECTIVELY SEARCHING FOR INFORMATION IN A VEHICLE

This application is a continuation of application Ser. No. 09/401,038 filed on Sep. 21, 1999 now U.S. Pat. No. 6,233,506, which is a division of application Ser. No. 08/789,934 filed on Jan. 28, 1997, maturing into U.S. Pat. No. 6,009,355 issued on Dec. 28, 1999.

FIELD OF THE INVENTION

The invention relates generally to information and control systems and, more particularly, to a system for use in an automobile which facilitates a user's retrieval and/or dissemination of information, and control of vehicle functions.

BACKGROUND OF THE INVENTION

Information is vital to day-to-day activities. With no access to information, people cannot function efficiently in this society, and their lives and financial well-being are put in jeopardy. People want to be well-informed, so much so that when they are travelling in automobiles, they tune into local radio stations to listen to news, weather forecasts and traffic conditions. For that matter, some automobiles are equipped with audiovisual systems including television (TV) receivers. One such system is disclosed in U.S. Pat. No. 5,404,443 issued to Hirata. The Hirata system provides audiovisual information in a number of modes including a TV mode, which may be selected by control switches disposed on the periphery of a display.

Automobile users like to be continually updated with information affecting their travel plans such as weather and traffic conditions because of its fast changing nature. Automobile users who are traveling also like to continually keep in touch with their homes and offices, and to confirm appointments and hotel reservations so that they can adjust their itineraries accordingly. To that end, cellular mobile telephones were introduced to enable automobile users to conduct business and contact their families while they are traveling.

In addition, local map information is important to automobile travelers moving from one locale to another. As such, navigation systems were developed to help reach their destinations in an unfamiliar milieu. One such vehicle navigation system is disclosed in U.S. Pat. No. 5,274,560 issued to LaRue. The disclosed system is based on artificial intelligence and provides a driver with directions via a voice interface. The system is built upon an optical disk player which can be used for entertainment as well. Digitized maps, compressed voice records and computer programs are stored on an optical disk compatible with the disk player. After a destination point is identified, the disclosed system finds the best route from the digitized maps and guides the driver therethrough via the voice interface, taking into account the latest traffic conditions received by an FM receiver to avoid congestion.

Recently, navigation systems based on military global positioning system (GPS) technology have emerged. One such navigation system is commercially available as an option for the latest model of the ACURA 3.5 RL automobile. This ACURA navigation system receives signals from a constellation of satellites which is part of the GPS. In response to these signals, the navigation system pinpoints the automobile's location (in latitude and longitude). It also detects the automobile's speed and direction. With geographic information stored on a hard disk in an onboard

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computer, the navigation system is capable of verbally and visually communicating to the user instructions for reaching the destination.

In addition to the above techniques for communications with automobile users, a technique for disseminating information regarding the automobiles themselves is disclosed in U.S. Pat. No. 5,442,553 issued to Parillo. The disclosed system is a vehicle diagnostic and software upgrade system. In this system, sensors are provided in the vehicle to generate dynamic data relating to various mechanical controls and the engine of the vehicle, including engine R.P.M., fuel/air mixture, emissions and pollution content information. A microprocessor in the vehicle has access to selectable program parameters affecting the functioning of the mechanical controls. The microprocessor collects and transmits the dynamic data to a remote diagnostic station periodically or upon its request. In response, the remote station sends, to the vehicle, signals indicative of any changes in its software and/or program parameters. The microprocessor accordingly causes the changes to be made in the vehicle based on the received signals.

Besides the communication capabilities described above, an automobile has many accessories and user control elements such as lights, wipers, a clock, temperature control, cruise control, seat adjustment control, mirror adjustment control, and an anti-theft system. A technique for centralizing the command of the individual control elements is disclosed in U.S. Pat. No. 5,555,502 issued to Opel. The disclosed system includes a centralized control panel on a steering wheel which, together with a display, is utilized to control the electronic components of the automobile. The display is positioned in the area of the driver's sun visor. After the driver presses one of the buttons on the control panel corresponding to a desired electronic component, a menu is displayed so that the driver is able to select items from the menu to program the component. The selection is accomplished by pressing specified buttons on the panel.

In addition, a technique for controlling vehicle accessories via voice command is disclosed in U.S. Pat. No. 4,827,520 issued to Zeinstra. In accordance with this technique, control functions of each accessory are formatted in a summary page for display on a screen, which is scanned by infrared light to sense any touching thereon. By uttering any of the displayed functions on the summary page, preceded by either a specified keyword or an actuation of a push-to-talk switch on a steering wheel, a more detailed subpage of the selected function is displayed for further selection by voice. As an alternative to the voice command, the selection can also be accomplished by touching the displayed function on the screen.

Voice command and touch screen techniques are frequently mentioned in prior art references in controlling car accessories. In particular, U.S. Pat. No. 5,214,707 issued to Fujimoto et al. discloses a system for voice-controlling equipment inside a vehicle, including microphones capable of discriminating voice commands as to whether they are generated at the driver side or at the assistant side of the vehicle in a noisy environment.

SUMMARY OF THE INVENTION

It is celebratory that technology advances at lightning speed. However, many people are left behind the technological frontier, and to some extent develop "technophobia". Some of them have even given up this technological race, which is confirmed by the blinking "12:00" display on the clocks of many video cassette recorders (VCRs) being used.

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Similarly, it is fantastic that automobiles nowadays include many advanced accessories such as audiovisual systems, anti-theft systems, anti-lock brake systems, climate control, and cruise control which embrace the latest technologies. However, of all these accessories, many automobile users only know how to operate the headlights and windshield wipers, and regard the rest as nuisance. That is, the users pay for numerous accessories which they do not use, resulting in much consumer waste. We have recognized that such non-use is principally attributed to an inefficient distribution of operating knowledge of the automobile and, in particular, its accessories.

Specifically, when automobile users presently want to learn about certain aspects of an automobile, they need to consult an owner's manual which could have been lost or misplaced when they need it the most. In addition, the manual is unpopular because many users simply want to avoid reading any written material, and find it intimidating as it oftentimes is filled with incomprehensible technical jargon.

We have further recognized that even with the operating knowledge, many users are overwhelmed and confused with the large number of knobs, switches and buttons used to control the individual vehicle parts and accessories.

Accordingly, it is an object of the invention to design an information and control system for use inside an automobile with the user in mind. The user is afforded a centralized control which may be used in lieu of the knobs, switches and buttons to operate the vehicle parts and accessories. In accordance with the invention, the centralized control is intimately tied to an information system such that the user is able to efficiently access information about the functions and operations of such parts and accessories, and in a synergistic manner apply that information to operate same, using the centralized control.

It is another object of the invention that the access to the information is intuitive and direct so that the user can obtain the relevant information in a few self-explanatory steps. To that end, the invention embraces a multimedia approach where audio and video media are added to the traditional text media to convey information. The additional media increases the dimensions of both the user's comprehension of the information and the user's interaction with the automobile. Moreover, the information access is driven by a multilevel menu based on an intuitive model of taxonomy where information is organized in a minimal number of levels of subject matter from general to specific. The above integration of the multimedia approach with the multilevel menu approach presents an effective way of retrieving information in the automobile. Advantageously, with the invention, the user would not be distracted or overburdened by irrelevant information in the course of an information retrieval, which is conducive to a safe driving environment.

In the preferred embodiment, when the user wants to access information about a given part or accessory of the automobile, the user is presented with options on a display screen. Each option is associated with a respective one of different parts or accessories of the automobile. The user is able to select through the interface one of the options, associated with the given automobile part or accessory. The option, when selected, is highlighted in a first color, for example, yellow. A voice is then generated by the inventive system to explain the purpose or the content of the selected option before the user commits to it. Having been so informed, the user may then activate the selected option in retrieving the information of interest. The activated option is

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highlighted in a second color, e.g., blue, to indicate its active status. The retrieved information is presented to the user both in text and i[008e] voice.

BRIEF DESCRIPTION OF THE DRAWING

Further objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying draw in g showing an illustrative embodiment of the invention, in which:

FIG. 1 is a block diagram of an automobile information and control system in accordance with the invention;

FIG. 2 illustrates a control panel and a display interface for a user to interact with the system of FIG. 1;

FIG. 3A illustrates a flow chart depicting the steps of an anti-car-theft routine used in the system of FIG. 1;

FIGS. 3B and 3C jointly illustrate a flow chart depicting the steps of a routine for presenting various screens to the user in the system interaction;

FIG. 4A illustrates a screen for eliciting a personal identification number (PIN) from the system user;

FIG. 4B illustrates a SELECT A FUNCTION screen including features thereof in accordance with the invention;

FIG. 5 illustrates an introduction screen including features thereof in accordance with the invention;

FIG. 6 illustrates a MANUFACTURER screen including features thereof in accordance with the invention;

FIG. 7 illustrates a SAFETY REMINDERS screen including features thereof in accordance with the invention;

FIG. 8 illustrates a THEFT PROTECTION FEATURES screen including features thereof in accordance with the invention;

FIG. 9 illustrates a QUICK TIP SET-UP screen including features thereof in accordance with the invention;

FIG. 10 illustrates a MAIN MENU screen including features thereof in accordance with invention;

FIG. 11 illustrates a DRIVER'S VIEW screen including features thereof in accordance with the invention;

FIG. 12 illustrates an INSTRUMENT PANEL screen including features thereof in accordance with the invention;

FIG. 13 illustrates a TACHOMETER AND WARNING LIGHTS screen including features thereof in accordance with the invention;

FIG. 14 illustrates a segment of the screen of FIG. 13 providing the user with information regarding a particular function of the automobile;

FIG. 15 illustrates a CLIMATE CONTROL screen including features thereof in accordance with the invention;

FIG. 16 illustrates a SAVE screen for saving the user's preferences in accordance with the invention;

FIG. 17 illustrates a DATA ENTRY screen in accordance with the invention for looking up information regarding a specific item in the automobile;

FIG. 18 illustrates an INDEX screen with listed items for which information is available; and

FIG. 19 is a look-up table listing searchable items and the corresponding instructions for a processor in the system of FIG. 1 to provide information regarding such items.

Throughout this disclosure, unless otherwise stated, like elements, components and sections in the figures are denoted by the same numerals.

DETAILED DESCRIPTION

FIG. 1 illustrates information and control system 100 embodying the principles of the invention for use in an

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automobile. System 100 is referred to as the "AUTO DIRECTOR" system. It is user-friendly and designed with the automobile user in mind. For example, with AUTO DIRECTOR display interface 102a to be described, information about the automobile is readily available literally at the fingertips of the user. This information includes operational instructions, maintenance procedures, safety measures, and information about virtually every capability of the automobile. In accordance with the invention, the user is able to efficiently access such information using multimedia means involving audio, text and video media. Also with interface 102a, or multifunction display interface 102b to be described, the user is afforded a centralized control whereby he/she can program or adjust different vehicle parts and accessories using the information thus obtained.

As shown in FIG. 1, central to system 100 is processor 105 connected to memory 115. Data bus 107 connects processor 105 to display interfaces 102, input interfaces 104, communications interfaces 106, output control interfaces 108, vehicle computer interfaces 110, vehicle control interfaces 112, self-test interface 114, preferences interface 116, and audio interface 118.

Display interfaces 102 include, inter alia, AUTO DIRECTOR display interface 102a, which is illustrated in FIG. 2, together with control panel 205 in FIG. 1. By way of example, but not limitation, the hardware of interface 102a and control panel 205 are derived from a prior art navigation system of the type of the ACURA navigation system. In fact, interface 102a and control panel 205 are used in this illustrative embodiment to realize not only AUTO DIRECTOR functions to be described, but also the well-known navigation function.

Interface 102a includes a conventional liquid crystal display screen 209, and LCD driver (not shown) for processor 105 to control the display on screen 209. Interface 102a also incorporates well-known touch-screen circuitry (not shown) connected to touch screen interface 104a in FIG. 1. With this circuitry, the user can interact with processor 105 by, say, touching a displayed option on screen 209. Through interface 104a, processor 105 receives from the touch screen circuitry a signal identifying the location on screen 209 where it has been touched. If such a location matches the predetermined location of one of the displayed options, processor 105 determines that that option has been selected. With such touch-screen and displayed option selection capabilities, through AUTO DIRECTOR interface 102a, the user is able to obtain information on and control selectable functions of the automobile such as the instrument panel, navigation function, mobile phone, radio/CD player, locks, mirrors, windows, driver's seat adjustment control, climate control, windshield wipers, cruise control, lights, security function, steering, ride control, engine and transmission.

Control panel 205 comprises CANCEL switch 205a, ENTER switch 205b, BRIGHTNESS switch 205c, PUSH TO SELECT knob 205d, MENU switch 205e, MAP/GUIDE switch 205f, SETUP switch 205g, ZOOM IN switch 205h and ZOOM OUT switch 205i. BRIGHTNESS switch 205c comprises a standard variable resistor such that when it is pushed one way, operating circuitry 121 responsively causes the display intensity to increase, and the other way to decrease. ZOOM IN switch 205h when pressed enables the automobile user to enlarge a particular visual area of interest on screen 209, affording better details. On the other hand, ZOOM OUT switch 205i, when pressed performs the inverse function to switch 205h. As an alternative to the touch-screen capability, switch 205d, similar to a standard

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joystick is provided for the user to move from one displayed option to another on screen 209 in the same direction (e.g., up, down, left or right) as the switch is operated. A desired option may be selected by pressing ENTER switch 205b. The functions of the other switches are described hereinbelow as they are called out in the operation of system 100. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and control panel 205 are mounted close to the center of the dashboard of the automobile next to the steering wheel.

Referring back to FIG. 1, display interfaces 102 also include multifunction display interface 102b, center console display interface 102c, rear console display interface 102d, and instrument panel display interface 102e.

Specifically, multifunction display interface 102b is installed on the dashboard close to interface 102a on the driver side. Like interface 102a, interface 102b provides the user with graphic display and control of selected functions using well-known touch screen technology. In fact, interface 102b duplicates certain control functions (e.g., navigation, phone, radio and climate control) of interface 102a so that the user can use interface 102b to control a selected function while interface 102a is engaged in another ongoing function. For example, while the user is relying on AUTO DIRECTOR interface 102a to provide navigation information to reach a given destination, the user may want to adjust the climate control of the automobile. It is inconvenient for the user to terminate the ongoing navigation mode of interface 102a, albeit temporarily, to access the climate control function through the interface, adjust the climate control and then resume the navigation mode. Thus, it is preferable to leave the navigation mode of interface 102a alone and use interface 102b to administer the climate control.

Center console interface 102c is installed close to interface 102a on the passenger side. Similar to interface 102b, interface 102c provides the front seat passenger with graphic display and control of functions which include: the front passenger seat adjustment, door lock, window, climate and TV controls. If enabled by the driver, control is also available for the radio/CD player and phone.

Rear console display interface 102d is installed on the back of a front seat. Similar to interface 102c, interface 102d provides rear seat passengers with graphic display and control of certain functions if enabled by driver or front seat passenger. These functions include: the rear seat climate, windows, door locks, radio/CD player and TV controls.

Instrument panel display interface 102e is installed on the dashboard in front of the driver seat.

This interface provides the driver with graphic display of the vehicle speed, engine RPM, outside and inside temperatures, oil pressure, fuel level, time, odometer reading, trip odometer reading and warning light indicators. Through AUTO DIRECTOR interface 102a, the system user may select the display of the information in either an analog or a digital form.

Input interfaces 104 comprise touch screen interface 104a and control panel 205 described before, and voice command interface 104d. The latter is connected to a microphone (not shown) and comprises standard voice command circuitry (not shown) for processing voice commands by the user (through the microphone) to control or modify selected functions of system 100.

Communications interfaces 106 include phone interface 106a, radio/CD interface 106b, television (TV) interface 106c, navigation interface 106d, and beacon interface 106e. Processor 105 interacts with and controls standard phone

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equipment connected to phone interface 106a. Through processor 105, the user may operate the phone equipment via voice command, thereby realizing hands-free operation of the equipment. Alternatively, the user may operate the phone equipment using the touch screen capability provided by AUTO DIRECTOR display interface 102a or multifunction display interface 102b. The user may also operate the phone equipment via remote switches.

Similarly, processor 105 interacts with and controls one or more radio receivers and CD players in the automobile connected to radio/CD interface 106b. Through processor 105, the user may operate the radio receivers via voice command, remote switch and/or touch screen capability.

Processor 105 further interacts with and controls one or more TV receivers in the automobile connected to TV interface 106c. Again, the user may operate the TV receivers via voice command, remote switches and/or touch screen capability.

As further described hereinbelow, navigation interface 106d is connected to a standard inertial guidance system (not shown) capable of providing gyros information, and deriving the vehicle location based on GPS information. With the map information stored in memory 115, the inertial guidance system is capable of providing the user with navigational instructions via interface 102a or 102b. Besides the locational information, local and national emergency information may be derived from the GPS information using additional standard decoding circuitry in interface 106d.

Beacon interface 106e is used for connection to a standard beacon device for detecting a predetermined beacon radio signal to provide additional locational information.

Output control interfaces 108 include lock interface 108a, mirror interface 108b, window interface 108c, steering column interface 108d, seat interface 108e, climate control interface 108f, wiper interface 108g, cruise control interface 108h, light interface 108i and clock interface 108j.

Specifically, lock interface 108a comprises output control logic controllable by processor 105 to lock or unlock the car doors, glove box, console storage, trunk (or liftgate), fuel filler door, brakes and transmission, and enable or disable the child-proof door locks, fuel pump and ignition.

Mirror interface 108b comprises output control logic controllable by processor 105 to maneuver the positions of the outside mirrors and inside rear view mirror, and to fold or unfold the outside mirrors.

Window interface 108c comprises output control logic controllable by processor 105 to incrementally or completely open or close all windows, and to open, close or tilt any sunroof.

Steering column interface 108d comprises output control logic controllable by processor 105 to move the steering column in or out and up or down.

Seat interface 108e comprises output control logic controllable by processor 105 to (1) adjust the positions of the front seats forward or aft, and up or down; (2) tilt the front or rear of the seat cushion up or down; (3) adjust the seat back lumbar, width and angle forward or aft; (4) increase or decrease the cushion size and stiffness; (5) raise or lower the head restraint; and (6) raise or lower the seat belt height.

Climate control interface 108f comprises output control logic controllable by processor 105 to (1) turn the climate control system on or off; (2) select an air flow mode; (3) set fan speeds; (4) enable or disable seat heaters; (5) select fresh or recirculated air (for driver only); and (6) enable or disable front and rear defrosters, mirrors and steering wheel heaters (for driver only).

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Windshield wiper interface 108g comprises output control logic controllable by processor 105 to (1) select a high, low, intermittent, single wipe or off mode; (2) set an intermittent delay; and (3) enable or disable front or rear washers. Interface 108g also includes control logic for controlling rain- and speed-sensitive wipers, and for activating an automatic wash in a single wide mode when the windshield is at a certain level of opacity.

Cruise control interface 108h comprises output control logic controllable by processor 105 to (1) turn the cruise control on or off, (2) set the vehicle speed, and (3) cancel or resume the set speed.

Light interface 108i comprises output control logic controllable by processor 105 to select an automatic on mode or off mode for parking lights, headlights and fog lights; and to turn on or off map or courtesy lights.

Clock interface 108j comprises output control logic controllable by processor 105 to set an initial date and time on a conventional clock (not shown) connected to interface 108j. System 100 relies on the current date and time kept by the clock to provide a time reference for the system functions.

Vehicle computer interfaces 110 include anti-lock brake computer interface 110a, engine computer interface 110b and supplemental restraint computer interface 110c for processor 105 to communicate with the computers controlling the anti-lock brakes, engine and supplemental restraints (e.g., back-up airbag deployers and seat belt tensioners), respectively. Interfaces 110 also include back-up interface 110d through which processor 105 receives and analyzes signals from the engine, anti-lock brake and supplemental restraint computers. These signals would indicate to processor 105 any failures of the computers. In response to a computer failure, processor 105 causes a corresponding back-up computer connected to interface 110d to provide a back-up function.

Vehicle control interfaces 112 include steering interface 112a, ride interface 112b, engine interface 112c, transmission interface 112d, traction control interface 112e, and security interface 112f.

Specifically, steering interface 112a comprises input monitoring and output control logic for processor 105 to lighten or tighten the steering effort ratio in response to changing road conditions. Through interface 102a, the user may opt for manual or automatic steering effort ratio control. Interface 112a is capable of adapting and storing data according to the driver's inputs. It also allows for steering of front and/or rear wheels for sporty or increased stability.

Ride interface 112b comprises input monitoring and output control logic for processor 105 to lighten or stiffen the ride control to front and/or rear of vehicle in response to changing road conditions. Through interface 102a, the user may also opt for manual or automatic ride control.

Engine interface 112c comprises input monitoring and output control logic allowing for shutting off a specified number of cylinders, and varying valve and cam timing to increase performance or fuel economy. This interface also allows for manual or automatic control of the engine components, and includes the capability of adapting and storing data according to the driver's inputs.

Transmission interface 112d comprises input monitoring and output control logic for selecting manual or automatic shifting of the transmission. In an automatic shifting mode, interface 112d is capable of adapting and storing data according to the driver's inputs. Interface 112d also allows for control of a variable differential ratio for fast acceleration and high economy cruise.

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Traction control interface 112e comprises input monitoring and output control logic providing information on whether power is delivered to front and/or rear wheels of the vehicle and what proportion of the power is delivered to each wheel. This interface also allows for manual or automatic control, and such functions as yaw control in cooperation with the anti-lock brakes and an engine cylinder shutoff.

Security interface 112f comprises control logic for setting a security level, and enabling or disabling a number of security related functions such as the fuel supply cut-off, motion detector, brake locking, etc. Interface 112f also allows entry of a new or alteration of an existing personal identification number (PIN) for personalization of the vehicle functions, i.e., saving the vehicle functional preferences.

In accordance with an aspect of the invention, system 100 incorporates an anti-car-theft technique involving security interface 112f. In accordance with this inventive technique, security interface 112f further comprises a sensor for detection of a predetermined condition to trigger an anti-theft routine. It will be appreciated that a person skilled in the art will come up with many different triggering events causing the sensor to invoke the routine. For example, a passive way of triggering the anti-theft routine would be after the sensor detects that the engine is off and the user has opened, closed and locked the driver's door.

In any event, as soon as processor 105 receives from the sensor a signal requesting an invocation of the anti-theft routine, processor 105 retrieves from navigation interface 106d GPS information identifying the parking location of the automobile, as indicated at step 251 in FIG. 3A. Processor 105 then stores at step 253 the parking location GPS information in memory 115. At step 255, processor 105 determines whether the security measures remain on. By way of example, but not limitation, such determination is based on information from lock interface 108a indicating whether the driver's door is properly unlocked. If that door is properly unlocked, processor 105 determines that the security measures are called off, and the anti-theft routine comes to an end, as indicated at step 257.

Otherwise if processor 105 determines that the security measures remain on, processor 105 at step 259 retrieves from navigation interface 106d GPS information identifying the current location of the automobile.

Processor 105 then compares at step 261 the current location GPS information with the parking location GPS information previously stored. If processor 105 at step 262 determines that the current location matches the parking location based on the comparison, the anti-theft routine returns to step 255 after a predetermined period. Otherwise if processor 105 determines that the current location does not match the parking location, processor 105 assumes that the automobile has been removed without authorization, i.e., stolen. At this point, if a conventional alarm system is connected to security interface 112f, processor 105 would cause an alarm to come on, gas to be cut off, etc.

In this example, a conventional transmitter (not shown) is connected to security interface 112f and transmits a predetermined sequence of signals receivable by a law enforcement agency or a suitable alarm monitor company when it is activated. Continuing the example, processor 105 translates the GPS information identifying the current vehicle location into the corresponding street address based on the map information stored in memory 115, as indicated at step 263. Processor 105 at step 265 looks up one or more phone

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numbers pre-stored in memory 115 for reporting to the law enforcement agency (or the alarm monitor company) about the stolen status. Alternatively, a list of phone numbers associated with law enforcement agencies (or branches of the alarm monitor company) in many different geographic locations is pre-stored, along with the GPS information identifying the locations of the respective law enforcement agencies (or alarm monitor company branches). This being so, processor 105 locates the closest law enforcement agency (or alarm monitor company branch) and its associated phone number(s) by comparing the current vehicle location GPS information with the respective agency (or branch) location GPS information.

In any event, processor 105 at step 267 initiates a call to a law enforcement agency (or an alarm monitor company branch) through phone interface 106a using the phone number just located. After the phone connection is established, processor 105 provides through the connection information about the current address of the vehicle using conventional voice synthesizer circuitry (not shown) in audio interface 118, and the pre-recorded information about the vehicle itself such as its vehicle identification number (VIN), model, year, color, license number, etc., as indicated at step 269. Through the same phone connection, processor 105 may also provide information about the vehicle's owner such as his/her name and contact number so that the law enforcement agency (or alarm monitor company branch) can notify the owner of the incident. Processor 105 at step 271 activates the aforementioned transmitter connected to security interface 112f to generate the predetermined sequence of signals in case the stolen vehicle is in transit. For that matter, processor 105 can also repeatedly check on the latest vehicle location and report any new address different from the one previously reported. Thus, by tracking the signals in the vicinity of the latest reported vehicle location, the law enforcement agency (or alarm monitor company) would recover the vehicle in an efficient manner.

Referring back to FIG. 1, self-test interface 114 comprises input/output (I/O) control logic for performing an active self-test of system 100 on power up or at the user's request. Specifically, interface 114 polls every other interface in system 100 for a self-test result. Each interface, when polled, performs an active self-test and reports the test results to interface 114, where such test results are gathered and caused to be displayed on interface 102a.

Preferences interface 116 monitors changes made by the user in selected functions after the user logs on system 100, and prompts the user to save such preferences. These preferences are stored in memory 115 in association with the user's PIN. Functions affording the user choices include auto locks, an easy entry, auto lamps, the seat position, steering column position, mirror position, radio, steering, ride, transmission shift, engine performance, climate, and security level.

Audio interface 118 comprises I/O control logic for receiving audio signals from a radio/CD, TV, compact disk (CD) player, or phone interface, processing the received audio signals, providing proper amplifications thereto, and routing the resulting sound to appropriate speakers and headphones (not shown) connected to interface 118. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and multifunction display interface 102b share the same speakers. Interface 118 also provides center and rear console display interfaces 102c and 102d with separate audio channels, speakers and headphone outputs. The front and rear speakers may be muted by the user as a preference.

Interface 118 also processes requests from other interfaces for pre-recorded digital sounds stored in a SOUNDSGOOD

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library in memory 115 and routes the requested sounds to the appropriate interfaces. In addition, interface 118 comprises the conventional voice synthesizer circuitry for providing voice messages to the appropriate interfaces.

FIGS. 3B and 3C jointly illustrate routine 300 for accessing, through AUTO DIRECTOR display interface 102a, a main menu to obtain operational instructions, maintenance procedures, safety measures, and other information about the automobile, collectively referred to as "Quick Tips". Routine 300 is stored in memory 115 and initiated when SETUP switch 205g in FIG. 2 is pressed. Instructed by routine 300, processor 105 at step 301 elicits a PIN from the user by displaying a screen of FIG. 4A through interface 102a. As shown in FIG. 4A, a video key-pad comprising numeral keys "1" through "9", and "*" and "#" keys are displayed on screen 209. In response, the user enters a sequence of numerals by touching the corresponding displayed keys, followed by the "#" key.

It should be pointed out that in accordance with another aspect of the invention, when a displayed key or option is touched on the screen of AUTO DIRECTOR display interface 102a or multifunction display interface 102b, a tone pre-selected by the user from the SOUNDSGOOD library is generated through audio interface 118, indicating that the key or option has been touched on the screen. Advantageously, relying on the audio tone confirmation, as opposed to a visual confirmation, the user while driving can continually watch the road.

The user may alternatively enter the above numeral sequence using control panel 205 in a manner to be described. In any event, processor 105 then verifies at step 303 the PIN entry by comparing it with the user's pre-selected PIN. The latter is stored in memory 115, along with the user's preferences. In a standard way, the user is given a few chances to enter a correct PIN. Verification of the PIN entry identifies the user as a legitimate user. Thus, if the PIN entry is not valid, routine 300 comes to an end, as indicated at step 304.

Otherwise if the PIN entry is valid, processor 105 at step 305 causes interface 102a to display on screen 209 a "SELECT A FUNCTION" screen, which is illustrated in FIG. 4B. As shown in FIG. 4B, two options, namely, "NAVIGATION" and "QUICK TIPS", are displayed on screen 209. By default, NAVIGATION option 401 is highlighted yellow when the screen of FIG. 4B appears.

It should be pointed out that in this illustrative embodiment, a yellow highlight on an option indicates that the option is selected but not yet activated. Once a yellow highlighted option is activated, the option is highlighted blue. System 100 then performs according to the activated option.

Thus, in this instance, the user may activate the yellow highlighted NAVIGATION option by touching the option on screen 209 or by pressing ENTER switch 205b.

However, if QUICK TIPS option 403 is desired, the user may touch that option on screen 209, which would then be highlighted yellow. A second touch on the same option will change the highlight to blue, indicating the active status. As an alternative, the user may utilize knob 205d of FIG. 2 to select QUICK TIPS option 403 by first pushing the knob to the right. In response, processor 105 causes the yellow highlight to move from default NAVIGATION option 401 to QUICK TIPS option 403. The user can then select the QUICK TIPS option by pressing ENTER switch 205b. Upon selection, the yellow highlighted option will again turn blue.

Processor 105 at step 308 detects an activation of either NAVIGATION option 401 or QUICK TIPS option 403. If

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NAVIGATION option 401 is activated, processor 105 at step 311 causes system 100 to enter into a navigation mode. In this mode, processor 105 causes navigational instructions to be displayed on screen 209 in a conventional manner. In providing the navigation instructions, the standard inertial guidance system connected to navigation interface 106d receives signals from a constellation of GPS satellites maintained and controlled by the U.S. Department of Defense. In response to these signals, the inertial guidance system identifies the location (in longitude and latitude) of the automobile. The system also detects the vehicle speed, and the direction in which the vehicle is headed. By accessing the map information stored in memory 115, the system is capable of visually and verbally providing the user with directions to a given destination through AUTO DIRECTOR display interface 102a and audio interface 118, respectively.

Otherwise if activation of QUICK TIPS option 403 is detected at step 308, processor 105 causes interface 102a to display an introduction screen on screen 209, as indicated at step 314. This introduction screen is illustrated in FIG. 5.

As shown in FIG. 5, system source identification, warning and instructional information appear on the introduction screen, along with two options, "MAIN MENU" and "READ ME". The default option in this instance is READ ME option 501 which is highlighted yellow. Processor 105 detects at step 317 whether MAIN MENU option 503 or READ ME option 501 is activated. If MAIN MENU option 503 is activated, routine 300 proceeds to step 340 to be described. Otherwise if READ ME option 501 is activated, routine 300 proceeds to step 320 where processor 105 causes a series of three screens to be displayed. The first screen of the series is a "MANUFACTURER" screen, which is illustrated in FIG. 6.

As shown in FIG. 6, a description of the QUICK TIPS system appears on the MANUFACTURER screen. If the text to be displayed exceeds one screen, which is the case here, scrolling options comprising scroll-up option 605 and scroll-down option 607 are provided. When option 605 is touched and activated on screen 209, additional text scrolls up one paragraph at a time. Option 607 performs an inverse function to option 605. Again, as an alternative, the user may maneuver PUSH TO SELECT knob 205d until the desired scroll option (or direction arrow) is highlighted yellow. The activation of the highlighted option is achieved by pressing ENTER switch 205b.

By default, displayed option 609 has the "AUTO VOICE" wording thereon and is highlighted blue as the MANUFACTURER screen comes on. Accordingly, a pre-recorded voice is activated by processor 105 through audio interface 118 to read the entire text associated with this screen without interruption, including the text which is not presently shown on screen 209 but otherwise shown upon scrolling. To allow the AUTO VOICE function, the user may touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "AUTO VOICE" wording on option 609 changes to "MANUAL VOICE", which is highlighted blue, indicating its active status.

In accordance with the MANUAL VOICE function, a pre-recorded voice reads the displayed text only, and stops reading until additional text is scrolled onto the screen. To silence the voice, the user may again touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "MANUAL VOICE" wording on option 609 changes to "VOICE OFF", and the voice is deactivated, with the option now highlighted yellow. The cycle of the AUTO VOICE, MANUAL VOICE and VOICE OFF functions can be repeated by successively touching option 609 or pressing switch 205b.

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Other displayed options on the screen of FIG. 6 include PREVIOUS option 611 and NEXT option 613. As indicated at step 323, option 611 when selected causes routine 300 to return to step 314, where the introduction screen of FIG. 5 is again displayed. Otherwise, if option 613 is selected, routine 300 proceeds to step 326 in FIG. 3C where processor 105 causes a "SAFETY REMINDERS" screen to be displayed on screen 209. FIG. 7 illustrates such a screen.

As shown in FIG. 7, like the MANUFACTURER screen, the SAFETY REMINDERS screen includes option 609 displayed with the default wording "AUTO VOICE" thereon, PREVIOUS option 611, NEXT option 613, scroll-up option 605 and scroll-down option 607. This screen reminds the user of the safety features of the vehicle including, for example, air bags and seat belts. As indicated at step 329, option 611 when selected causes routine 300 to return to step 320 of FIG. 3B. Otherwise if option 613 is selected, routine 300 proceeds to step 332 where processor 105 causes a "THEFT PROTECTION FEATURES" screen to be displayed on LCD screen 209. FIG. 8 illustrates such a screen.

As shown in FIG. 8, the THEFT PROTECTION FEATURES screen similarly has thereon displayed options 605, 607, 609, 611 and 613. This screen describes to the user a theft-deterrent system including the anti-theft routine of FIG. 3A equipped in the vehicle. As indicated at step 335, option 611 when selected causes routine 300 to return to step 326. Otherwise if option 613 is selected, routine 300 proceeds to step 338 where processor 105 causes a "QUICK TIPS SET-UP" screen to be displayed on LCD screen 209. FIG. 9 illustrates such a screen.

As shown in FIG. 9, the QUICK TIPS SET-UP screen comprises two arrays of displayed options, denoted 901 and 903, respectively. Array 901 concerns the volume of the audio part of system 100. In this illustrative embodiment, the user may select the options in array 901 to respectively turn the volume off, to a "SOFT" level, to a medium level, and to a "LOUD" level. Array 903 concerns the display of LCD 119 of system 100. In this illustrative embodiment, the user may select the options in array 903 to respectively turn the display off, adjust it to a "DAY" setting, adjust it to a "NIGHT" setting, and have it automatically adjusted. When the QUICK TIPS SETUP screen comes on, by default, the volume is set to a medium level (i.e., the "MED" option in array 901 highlighted blue), and the display is set to be automatically adjusted (i.e., the "AUTO" option in array 903 highlighted blue).

Also shown in FIG. 9 is NEXT option 905. By selecting this option, routine 300 returns to step 340 of FIG. 3B where a "MAIN MENU" screen is displayed on LCD screen 209. After routine 300 is performed, the screen of FIG. 9 can be invoked at any time by pressing SETUP switch 205g to re-adjust the volume and the intensity of the LCD of system 100.

FIG. 10 illustrates the MAIN MENU screen. This screen comprises displayed options disposed in columns 1001, 1003, 1005, and 1007. For example, column 1001 includes DRIVER'S VIEW option 1001a, STEERING COLUMN CONTROLS option 1001b, LOCK option 1001c, DRIVING TIPS option 1001d, and INDEX option 1001e. It should also be noted that this screen can be invoked at any time by pressing MENU switch 205e.

When the MAIN MENU screen comes on, by default, DRIVER'S VIEW option 1001a is highlighted yellow, indicating that it is selected. However, the user may touch any other displayed option on screen 209 for re-selection. A

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further touch on the yellow highlighted option changes its color to blue and activates same. Again, the user may alternatively maneuver PUSH TO SELECT knob 205d to re-select any other displayed option, followed by a depression of ENTER switch 205b to activate the selected option. Since LCD screen 209 is compact, the display area for each option on the MAIN MENU screen is generally small. As a result, selection and activation of an option by touching the option on the screen is susceptible to errors, especially when the vehicle is in motion. Thus, in this situation it may be preferable to achieve the same result using knob 205d and switch 205b, instead.

In addition, because of the small display area allocated to each option on the MAIN MENU screen, the wording on the option is brief and thus tends to be cryptic.

In accordance with a feature of the invention, after a predetermined time (e.g., a few seconds) has elapsed from the option's being highlighted yellow, processor 105 causes a voice to be generated on speakers 127 to explain the purpose of the option before the user activates it. For example, after a predetermined delay from DRIVER'S VIEW option 1001a's being highlighted yellow, a voice is activated, stating the option name, followed by an explanation of the purpose of the option such as "To provide location of dash mounted components." Thus, this inventive feature affords a preview of the option before the user commits to it, thereby avoiding unnecessary backtracking.

Continuing the example, after hearing the preview of option 1001a, the user decides to select that option. In response, processor 105 causes a "DRIVER'S VIEW" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 11. When the DRIVER'S VIEW screen appears, VOICE option 1101 is highlighted blue, indicating that voice announcements are active. To disable the voice announcements, the user may touch VOICE option 1101 on screen 209, or alternatively press ENTER switch 205b. VOICE option 1101 would be highlighted yellow when disabled.

As also shown in FIG. 11, a view of the interior of the automobile from the driver's perspective is provided. Underneath that view, DASH-MOUNTED CONTROLS option 1103, INSTRUMENT PANEL option 1105, AUDIO SYSTEM option 1107, CLIMATE CONTROLS option 1109 and PREVIOUS option 1111 are displayed. By default, DASH-MOUNTED CONTROLS option is highlighted yellow. However, the user in this example decides to select INSTRUMENT PANEL option 1105, instead. By touching option 1105 on screen 209, the option is highlighted yellow. If VOICE option is not disabled, after a predetermined delay, an announcement such as "To provide information on gauges, meters and warning lights" comes on to preview the purpose or content of option 1105. Options 1103, 1107, and 1109 are similarly programmed. In this instance, selecting PREVIOUS option 1111 enables the user to return to the MAIN MENU screen of FIG. 10.

Continuing the example, assuming that the user activates option 1105 after hearing the preview, in response processor 105 causes an "INSTRUMENT PANEL" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 12. As shown in FIG. 12, the previous screen format is generally maintained in that it provides a view of the object (the instrument panel of the automobile in this instance) pertinent to the option which has been selected, along with displayed options for further selection thereunder. Based on the disclosure heretofore, the design and operation of these screens by now are apparent to a person skilled in the art, and become self-explanatory.

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In accordance with another feature of the invention, individual elements on the instrument panel shown in FIG. 12 are labeled with numerals "1", "2", "3", "4" and "5" which correspond to option 1201a designated "1. TACHOMETER AND WARNING LIGHTS", option 1201b designated "2. TURN SIGNAL/HAZARD WARNING", option 1201c designated "3. SPEEDOMETER AND WARNING LIGHTS", option 1201e designated "4. ODOMETER & TRIP METERS/OUTSIDE TEMPERATURE", and option 1201f designated "5. FUEL/TEMP GAUGE AND WARNING LIGHTS", respectively. As such, the function of the displayed options is two-fold. First, the wording on each displayed option informs the user of what the corresponding element(s) represents. Second, each displayed option is also for selection to obtain more information about the corresponding element(s). In addition, with the above voice preview feature, the user is further apprised of the purpose or content of the option before he/she commits to it. For example, TACHOMETER AND WARNING LIGHTS option 1201a corresponds to a voice preview such as "To provide information on tachometer, malfunction, maintenance required, low oil pressure and charging system failure indicators."

Assuming that the user in this instance activates option 1201a, in response processor 105 causes a "TACHOMETER AND WARNING LIGHTS" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 13.

FIG. 13 shows VOICE option 1301 similar to option 1101 described before, TIP option 1303, a tachometer of the automobile denoted 1305, warning lights collectively denoted 1307, and options 1309a through 1309f in display segment 1311.

When TIP option 1303 appears on screen 209, it indicates that helpful hints or reminders are available upon selection thereof. In accordance with another feature of the invention, the appearance of TIP option 1303 is accompanied by the playing of a sound segment associated therewith. This sound segment may be pre-selected by the user from the SOUNDSGOOD library. After an adaptation period, the user would be able to rely on the familiar sound segment, without looking at the screen, to alert him/her of the availability of the TIP option.

Similarly, the user may pre-select another sound segment associated with warnings. Such a sound segment should connote urgency or even emergency as such warnings include, for example, engine overheating, an extremely low fuel level caution, GPS emergency information from navigation interface 106d, etc. Under control of processor 115, audio interface 118 preempts any on-going announcement and momentarily substitute therefor any such warning as soon as it occurs, which is preceded by the associated sound segment.

In any event, if option 1303 is selected in this instance, a voice comes on and utters a tip regarding tachometer 1305 such as "To prevent engine damage, do not drive with needle in red zone." This tip is also momentarily displayed on segment 1311 in lieu of options 1309a through 1309f.

Similar to the elements on the INSTRUMENT PANEL screen, tachometer 1305 and warning lights 1307 on this screen are individually labeled and correspond to options 1309a, 1309b, 1309c, 1309e and 1309f, respectively. Assuming in this example that MAINTENANCE REQUIRED option 1309c is activated, display segment 1311 would be replaced by new display segment 1411 illustrated in FIG. 14. As shown in FIG. 14, item 1401 indicates the subject selected, i.e., "MAINTENANCE

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REQUIRED". Item 1403 explains what the MAINTENANCE REQUIRED warning light, when on, indicates. In this instance it states, "Maintenance required warning light comes on to indicate it is time for scheduled maintenance." PREVIOUS option 1405 enables the user to reactivate segment 1311 of FIG. 13.

Assuming further that at this point the user wants to learn about and also to program the air conditioning of the automobile, the user may access a "CLIMATE CONTROL" screen by successively pressing the PREVIOUS option to backtrack to the DRIVER'S VIEW screen of FIG. 11, where CLIMATE CONTROLS option 1109 is available. As a second alternative, the user may press MENU switch 205e to invoke the MAIN MENU screen of FIG. 10, where a "CLIMATE CONTROLS" option within column 1003 is available. A third alternative is provided in the event that the user cannot immediately relate "air conditioning" to the CLIMATE CONTROLS option. At the MAIN MENU screen of FIG. 10, the user may select Index option 1001e to be described. It suffices to know for now that this option allows the user to access the "CLIMATE CONTROL" screen using the term "air conditioning".

FIG. 15 illustrates the "CLIMATE CONTROL" screen. With the voice enabled, a first touch on any displayed option on screen 209 causes it to be highlighted yellow, indicating its selected status. A second touch causes it to be highlighted blue, indicating its active status. With the voice disabled, only one touch on any displayed option activates it.

As shown in FIG. 15, the MODE options include OFF option 1511, AUTO option 1513, A/C option 1515, HEAT option 1517, and SMART CLIMATE option 1519. It should be noted that only one of the MODE options can be active at a time. In this example, assuming that the voice is enabled, when OFF option 1151 is selected by a first touch, a voice explaining the option comes on, uttering "To disable climate control." A second touch on the same option would then shut the climate control off through climate control interface 108f.

When AUTO option 1513 is selected by a first touch, a voice comes on to explain the option, uttering "System automatically determines air-flow distribution and volume for optimum efficiency." A second touch on the same option enables the automatic control, followed by a voice utterance, "Set desired temperature." Temperature display 1535 then flashes with the current temperature setting, prompting the user to set a desired temperature in a manner to be described.

If the user neglects to set a temperature after a predetermined time, in accordance with another aspect of the invention, a temperature range is automatically maintained by processor 105 in response to the date and time information from clock interface 108j, and the GPS information from navigation interface 106d. Based on the date and time information, processor 105 knows what the current season (e.g., mid-winter versus mid-summer) and time of the day (e.g., night verse noon) are. Based on the GPS information, processor 105 knows the region (e.g., New England versus Southern California) where the vehicle is. Processor 105 looks up a table stored in memory 115 containing predetermined temperature ranges corresponding to different combinations of the temporal and geographic parameters. It then prescribes an appropriate temperature range according to the table. This temperature range is updated by processor 105 periodically to reflect changes in the time of the day and the geographic location of the vehicle.

Similarly, A/C option 1515 and HEAT option 1517 respectively enable the user to activate air conditioning and heaters at a desired temperature or a default temperature range.

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SMART CLIMATE option 1519 is designed to allow the user to program the climate control for the next ride before he/she leaves the vehicle. When SMART CLIMATE option 1519 is selected by a first touch, a voice comes on to explain the option, uttering "To enable pre-heating or pre-cooling of vehicle." A second touch on the option activates the function, followed by a voice utterance, "Set desired temperature. Set desired time using fan speed arrows." Temperature display 1535 then flashes the current temperature setting, prompting the user to set a desired temperature. Similarly, fan speed display 1541 then flashes the current date, followed by current time, prompting the user to set the date and time that the user plans to re-enter the vehicle. Through climate control interface 108f, processor 105 determines whether the current level of power from the car battery and any back-up power sources is sufficient. If it is insufficient, a message such as "Fail to pre-condition vehicle temperature" is issued through audio interface 118 to notify the user of the noncompliance. Otherwise, when it is close to the re-entry time, processor 105 determines the start-up time to effect the pre-conditioning, depending on the temperature difference between the inside and outside of the vehicle at that time. Processor 105 would then cause a combination of heaters and/or heat pumps (not shown) connected to interface 108f to pre-condition the vehicle temperature. In order to avoid substantially draining the power, in this illustrative embodiment, the requested temperature would be maintained up to an hour after the set re-entry time.

The Air options in FIG. 15 include FRESH option 1521 and RECIRCULATED option 1523. Only one of these two options can be active at a time. When FRESH option 1521 is selected by a first touch on the option, a voice comes on to explain the selected option, uttering "To select outside air to circulate in vehicle." A second touch on the option activates the selection to ventilate the vehicle with outside air. Similarly, RECIRCULATED option 1523 allows the user to select the inside air for recirculation in the vehicle.

The VENT options in FIG. 15 include FLOOR option 1525, FLOOR/DASH option 1527, DASH option 1529, DEFROST option 1531 and FLOOR/DEFROST option 1533. Only one of these five options can be active at a time. When FLOOR option 1525 is selected by a first touch on the option, a voice comes on explaining the option, uttering "Main air distribution to floor." A second touch on the option directs an air flow toward the vehicle floor.

Similarly, FLOOR/DASH option 1527 enables the user to bifurcate the air flow between the floor and the dashboard. DASH option 1529 enables the user to direct the air flow from the dashboard. DEFROST option 1531 enables the user to direct the air flow toward the windshield and select fresh air if not selected. FLOOR/DEFROST option 1533 enables the user to bifurcate the air flow between the floor and windshield.

Temperature display 1535 displays the temperature selected by the user. Touching on up-arrow 1537 increases the selected temperature while touching on down-arrow 1539 decreases same. Continued touching on either up-arrow 1537 or down-arrow 1539 causes the temperature setting to change rapidly.

Similarly, fan speed display 1541 displays the fan speed (high, medium or low) selected by the user. Touching on up-arrow 1543 increases the selected fan speed while touching down-arrow 1539 decreases same.

The HEATERS options in FIG. 15 include SEAT option 1547, MIRROR option 1549, REAR WINDOW option

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1551, STEERING WHEEL option 1553, and ALL option 1554. One or more of these options can be active at the same time. When SEAT option 1547 is selected by a first touch on the option, a voice comes on to explain the option, uttering "To enable seat heaters." A second touch on the option activates the seat heaters connected to climate control interface 108f.

Similarly, MIRROR option 1549 enables the user to activate outside mirror heaters. REAR WINDOW option 1551 enables the user to activate a rear window defroster. STEERING WHEEL option 1553 enables the user to activate a steering wheel heater. Finally, ALL option 1554 enables the user to activate all of the heaters simultaneously.

In personalizing the vehicle, preference interface 116 monitors any user adjustments to certain vehicle functions by comparing their current settings with the corresponding stored preferences in memory 115. Thus, for example, if the user changes any of the settings relating to the climate control such as the mode, vent, air, temperature, fan speed, etc. from its previous preferred setting, preference interface 116 causes a SAVE screen to appear on screen 209. This SAVE screen is illustrated in FIG. 16. As shown in FIG. 16, the user is prompted to save the change in the setting that he/she has just made. The user at this point may activate SAVE option 1601 to change the previous preferred setting. The SAVE screen thereafter disappears in favor of the previous screen. Otherwise, he/she may activate CLOSE option 1603 to close the SAVE screen, without storing the latest setting, which is then treated as a temporary setting. In the latter case, for example, a restart of the automobile will obliterate such a temporary setting, and reinstate the stored preferred setting.

Climate control screens can similarly be invoked by the front passenger and rear passengers on display interfaces 102c and 102d, respectively. Such screens provide similar MODE options including OFF, AUTO, A/C and HEAT options; and VENT options including LOWER VENT, UPPER VENT and LOWER/UPPER vent options. They also provide for temperature and fan speed adjustments for the respective localized areas. However, no save screen is provided.

Using INDEX option 1001e of FIG. 10 to look up information on and/or to control various items in the automobile will now be described. After option 1001e is activated, a DATA ENTRY screen illustrated in FIG. 17 is exhibited on screen 209. As shown in FIG. 17, a message "Enter Letter Or Item Name" appears to prompt the user for an entry of the name of the item of interest or its beginning letter. For this purpose, entry options for letters A through Z arranged in a grid format are provided in section 1701 for selection. In addition, DONE option 1703, when activated, indicates to system 100 that the entry is completed. Subdisplay 1705 is used to echo the user's entry to ensure its correctness.

In this illustration, the user enters "AIR CONDITIONING" as exhibited on subdisplay 1705. In response, an INDEX screen shown in FIG. 18 appears on display screen 209, with the search item name "AIR CONDITIONING" highlighted yellow. It should be noted that other item names such as "Anti-lock Brake System Indicator" are also shown, and they are in alphabetical order following "AIR CONDITIONING". This stems from the design of system 100 whereby the user may conveniently enter the beginning letter of the search item name only. In that case, a list of item names in alphabetical order with the first item name having the same beginning letter highlighted yellow. For instance,

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if the user had only entered "A" for "AIR CONDITIONING", a list of item names starting with "A" in alphabetical order would appear on screen 209 (although in this instance it would be the same list as shown in FIG. 18 as "AIR CONDITIONING" is the first item with a letter "A" in system 100). If the user cannot locate the name of the item of interest in the list, he/she may scroll the screen using scroll-up option 1801 or scroll-down option 1803 to review additional item names after or before the listed item names. Alternatively, the user may select PREVIOUS option 1805 to return to the screen of FIG. 17 to enter the complete item name.

In any event, after the user locates the item name on the INDEX screen, the user may then touch the item name to access information on that item. To that end, a look-up table is stored in memory 115. FIG. 19 illustrates such a look-up table, wherein left column 1901 lists each item name in alphabetical order in the index, and right column 1903 lists the corresponding instruction for processor 105 to carry out to access information on that item. For example, according to row 1905 of the table, the selection and activation of the item name "AIR CONDITIONING" causes processor 105 to connect the user to the CLIMATE CONTROL screen of FIG. 15 previously described.

The foregoing merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise numerous other systems which embody the principles of the invention and are thus within its spirit and scope.

For example, based on the disclosure heretofore, it is apparent that through system 100, the user can run diagnostics on selected parts of the automobile by voice command or touch-screen control.

In addition, in the disclosed embodiment, through system 100, the user is able to program the climate control for the next ride before he/she leaves the vehicle. It will be appreciated that the user will be able to achieve same remotely ahead of time via telecommunication means. For example, processor 105 may be programmed to accept climate control commands through phone interface 106a. In that instance, the user can call from anywhere to establish a phone connection with phone interface 106a using a predetermined phone number, through which the user communicates the commands to climate control interface 108f to program the climate control. Through the phone connection, the user may be provided with climate control options described above in a synthesized voice. The user may activate one or more of such options by pressing a predetermined touch-tone key on the telephone keypad corresponding to a "yes" or "no" response. Similarly, the user may achieve the relevant temperature and/or time settings by pressing the touch-tone keys corresponding to the numerals indicative thereof. Of course, telecommunication means other than the telephone including a radio frequency (RF) transmitter may also be used to communicate the climate control commands from a remote area.

In addition, in the disclosed embodiment, the user may access different screens provided by AUTO DIRECTOR display interface 102a to learn about and control certain vehicle functions. It will be appreciated that a person skilled in the art will develop a demonstration program wherein a series of such screens will be automatically presented to a user in a predetermined sequence. The presentation may include commentaries, and highlights on selected options displayed on each screen. Furthermore, the presentation may be coupled with the showing of actual vehicle functions. For

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example, in demonstrating the climate control screen of FIG. 15, while the function of a highlighted VENT option (e.g., Floor, Floor/Dash, Dash, Defrost or Floor/Defrost) is explained, it is activated so that the user in the automobile can feel an actual air flow from the corresponding direction. The above demonstration program may be invoked using a PIN provided by the automobile manufacturer. The program may run continually while the automobile is shown in a showroom, or may be invoked by the user occasionally to obtain relevant information.

Further, in the disclosed embodiment, the MAINTENANCE REQUIRED warning light comes on when it is time for scheduled maintenance. In accordance with another aspect of the invention, the maintenance is scheduled by system 100 according to the cumulative time of the tachometer reading above a predetermined RPM value. Such cumulative time reflects the extent of the engine wear, and if it exceeds a predetermined length of time without maintenance, the engine performance would degrade substantially. In measuring the cumulative time in question, a conventional comparator (not shown) is employed in system 100 to compare the instantaneous tachometer reading (provided by engine control interface 112c) with the predetermined RPM value. Each time when the tachometer reading exceeds the predetermined value, processor 105 is interrupted to register the length of such an occurrence. The latter is added to a running sum to update the cumulative time in question. This cumulative time may be displayed on instrument panel display interface 102e, along with the tachometer reading and the MAINTENANCE REQUIRED warning indicator. A second conventional comparator (not shown) is employed in system 100 to compare the cumulative time with the above predetermined time length. As soon as the cumulative time exceeds the predetermined length, processor 105 is interrupted and causes the MAINTENANCE REQUIRED warning light to come on, indicating that it is time for maintenance.

Still further, system 100 as described is highly adaptable in adjusting to new system requirements, and capable of "learning" new automobile features to be introduced into the system. Such learning may involve a modification or an upgrade in the system software stored in memory 115.

Moreover, other features of system 100 may include capabilities of communications with a third party remote from the vehicle. For example, system 100 may be programmed to transmit signals representing data on the current speed of the vehicle and its VIN receivable by a radar system, thus enabling the third party to monitor its speed. Furthermore, system 100 may be programmed by the third party to disable and subsequently enable the vehicle upon successful verification of a PIN pre-assigned to the third party. To that end, system 100 is capable of receiving remote transmission of the PIN, followed by the disable or enable code. The transmission may be encrypted for security reasons. Furthermore, more than one PIN may be used for different purposes. For example, a PIN may be assigned to a law enforcement agency to disable the vehicle because of a suspension of a license, or to temporarily disable the vehicle when the driver is intoxicated. Another PIN may be assigned to an environmental protection agency to disable the vehicle for failing to meet the emission requirements. Yet another PIN may be assigned to the vehicle owner to disable the vehicle when parked, thereby reducing the risk of a car theft. The disabling of the vehicle involves cutting off its gas, putting on its anti-lock brakes, etc.

Further, system 100 is capable of receiving a low-frequency, low-power broadcast covering an area of a lim-

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ited radius, referred to as a "Cell". The broadcast may provide electronic GPS map and Yellow Page type information pertaining to the cell. This information, when received, may be downloaded onto AUTO DIRECTOR display interface 102a or multifunction display interface 102b. Such information includes a local directory indicating locations of nearby gas stations, restaurants and other facilities on the GPS map, with respect to the current location of the automobile. The local directory may be formatted in the form of "web pages" featuring the local businesses, and include additional information such as business hours, telephone numbers, and information on products and services provided by such businesses.

The above broadcast may also provide local weather information sponsored by a civic group or commercial entity. In the case of civic group sponsorship, the local civic events may be posted alongside the weather information, and in the case of commercial sponsorship, advertisements may be posted instead. Of course, as the automobile moves from cell to cell, the contents of the broadcast change accordingly.

In addition, while the radio in the automobile is tuned to a particular radio station, system 100 is also capable of receiving any electronic files broadcast from that radio station, along with the radio program. These electronic files, which may be in the form of web pages, can be downloaded onto the system. The system user may then scroll the pages to learn such information as program listings and coming events sponsored by the radio station.

Moreover, in the disclosed embodiment, system 100 is illustratively used in an automobile. It will be appreciated that a person skilled in the art may also employ the inventive system in another type of vehicle such as a boat, an airplane, etc.

Finally, although information and control system 100, as disclosed, is embodied in the form of various discrete functional blocks, the system could equally well be embodied in an arrangement in which the functions of any one or more of those blocks or indeed, all of the functions thereof, are realized, for example, by one or more appropriately programmed processors or devices.

We claim:

1. A system for use in a vehicle comprising:
 - a memory for storing a plurality of displays having predetermined contents, the plurality of displays being associated with a plurality of aspects of the vehicle;
 - an interface for entering a query to conduct a search concerning an aspect of the vehicle;
 - an input device for selecting a result of the search;
 - a processor responsive to the selected result for identifying at least one of the plurality of displays which is associated with the aspect of the vehicle; and

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a display element for showing thereon the at least one display.

2. The system of claim 1 wherein the result is selected from a list of search results satisfying the query.

3. The system of claim 1 wherein an association of the plurality of displays with the plurality of aspects of the vehicle is established in a table format.

4. The system of claim 1 wherein the query includes a term at least identifying partially the aspect of the vehicle.

5. The system of claim 1 wherein the input device includes a touch-screen capability.

6. The system of claim 1 wherein the at least one display includes an option selectable to access information concerning the aspect of the vehicle.

7. The system of claim 1 wherein the at least one display includes an option selectable to control the aspect of the vehicle.

8. The system of claim 7 wherein the aspect of the vehicle includes a climate control of the vehicle.

9. The system of claim 1 wherein the interface includes the input device.

10. A method for use in a system in a vehicle comprising: storing in a memory a plurality of displays having predetermined contents, the plurality of displays being associated with a plurality of aspects of the vehicle; receiving an entry of a query to conduct a search concerning an aspect of the vehicle;

receiving from an input device a selection of a result of the search;

in response to the selected result, identifying at least one of the plurality of displays which is associated with the aspect of the vehicle; and

showing the at least one display.

11. The method of claim 10 wherein the result is selected from a list of search results satisfying the query.

12. The method of claim 10 wherein an association of the plurality of displays with the plurality of aspects of the vehicle is established in a table format.

13. The method of claim 10 wherein the query includes a term at least identifying partially the aspect of the vehicle.

14. The method of claim 10 wherein the at least one display includes an option selectable to access information concerning the aspect of the vehicle.

15. The method of claim 10 wherein the at least one display includes an option selectable to control the aspect of the vehicle.

16. The method of claim 15 wherein the aspect of the vehicle includes a climate control of the vehicle.

* * * * *



US006459961B1

(12) **United States Patent**
Obradovich et al.

(10) Patent No.: **US 6,459,961 B1**
(45) Date of Patent: ***Oct. 1, 2002**

(54) **TECHNIQUE FOR PROVIDING
INFORMATION UPON A NOTABLE
CONDITION IN A VEHICLE**

FOREIGN PATENT DOCUMENTS

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Michael L. Kent, Garden Grove; **John
G. Dinkel**, Irvine, all of CA (US)

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(73) Assignee: **American Calcar, Inc.**, Wilmington,
DE (US)

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(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **09/717,943**

(22) Filed: **Nov. 21, 2000**

Related U.S. Application Data

(60) Continuation of application No. 09/401,039, filed on Sep. 21, 1999, now Pat. No. 6,175,782, which is a division of application No. 08/789,934, filed on Jan. 28, 1997, now Pat. No. 6,009,355.

Primary Examiner—Jacques H. Louis-Jacques

(74) *Attorney, Agent, or Firm*—Kaye Scholer LLP

(51) Int. Cl.⁷ **G06F 7/00**
(52) U.S. Cl. **701/1; 701/29; 701/30;
340/438; 340/459; 340/461**
(58) Field of Search **701/1, 36, 48,
701/49, 29, 34; 340/461, 459, 527, 521,
438, 439, 457, 457.4, 462; 345/522, 835,
967**

(57) **ABSTRACT**

In a multimedia information and control system for use in an automobile, at least one interface is employed which enables a user to access information concerning the automobile and control vehicle functions in an efficient manner. The user may select one of a plurality of displayed options on a screen of such an interface. Through audio, video and/or text media, the user is provided with information concerning the selected option and the vehicle function corresponding thereto. Having been so informed, the user may activate the selected option to control the corresponding vehicle function.

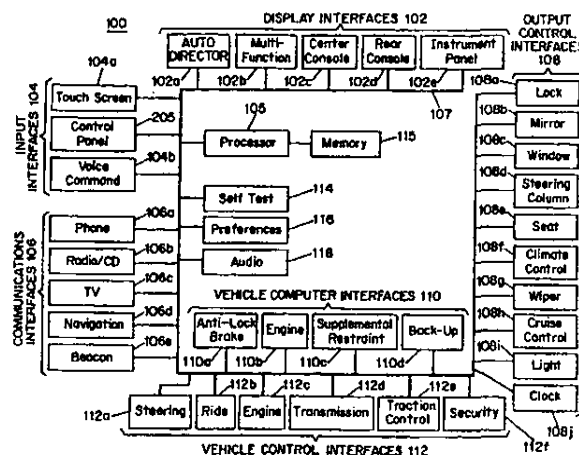
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23 Claims, 15 Drawing Sheets



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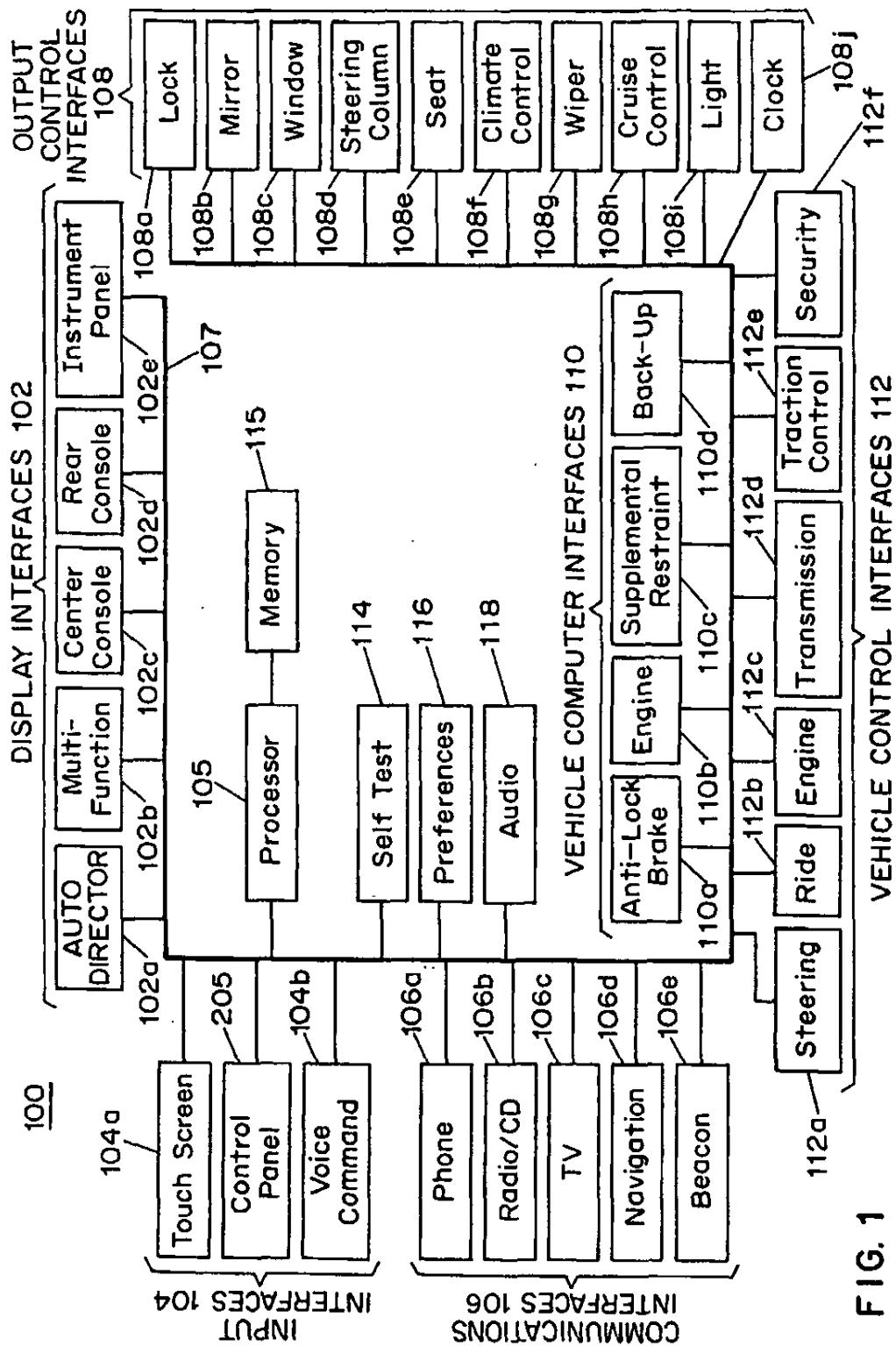


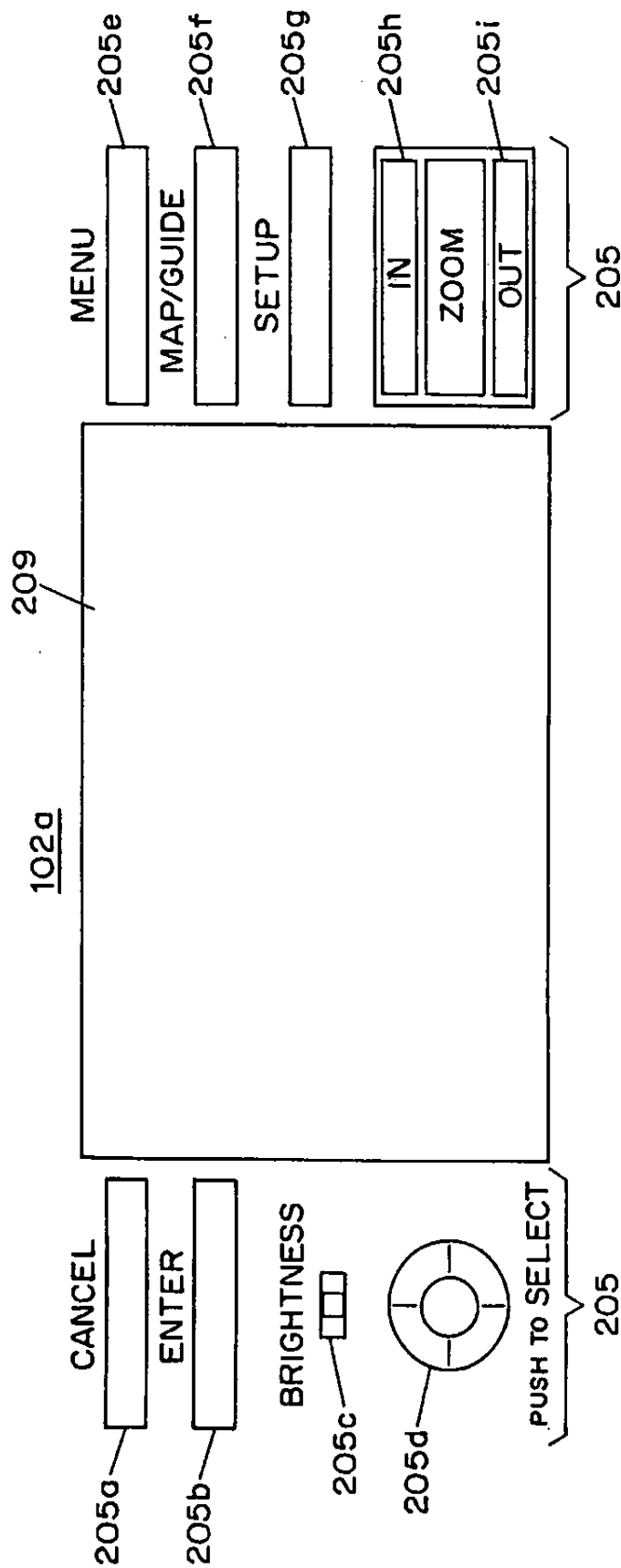
FIG. 1

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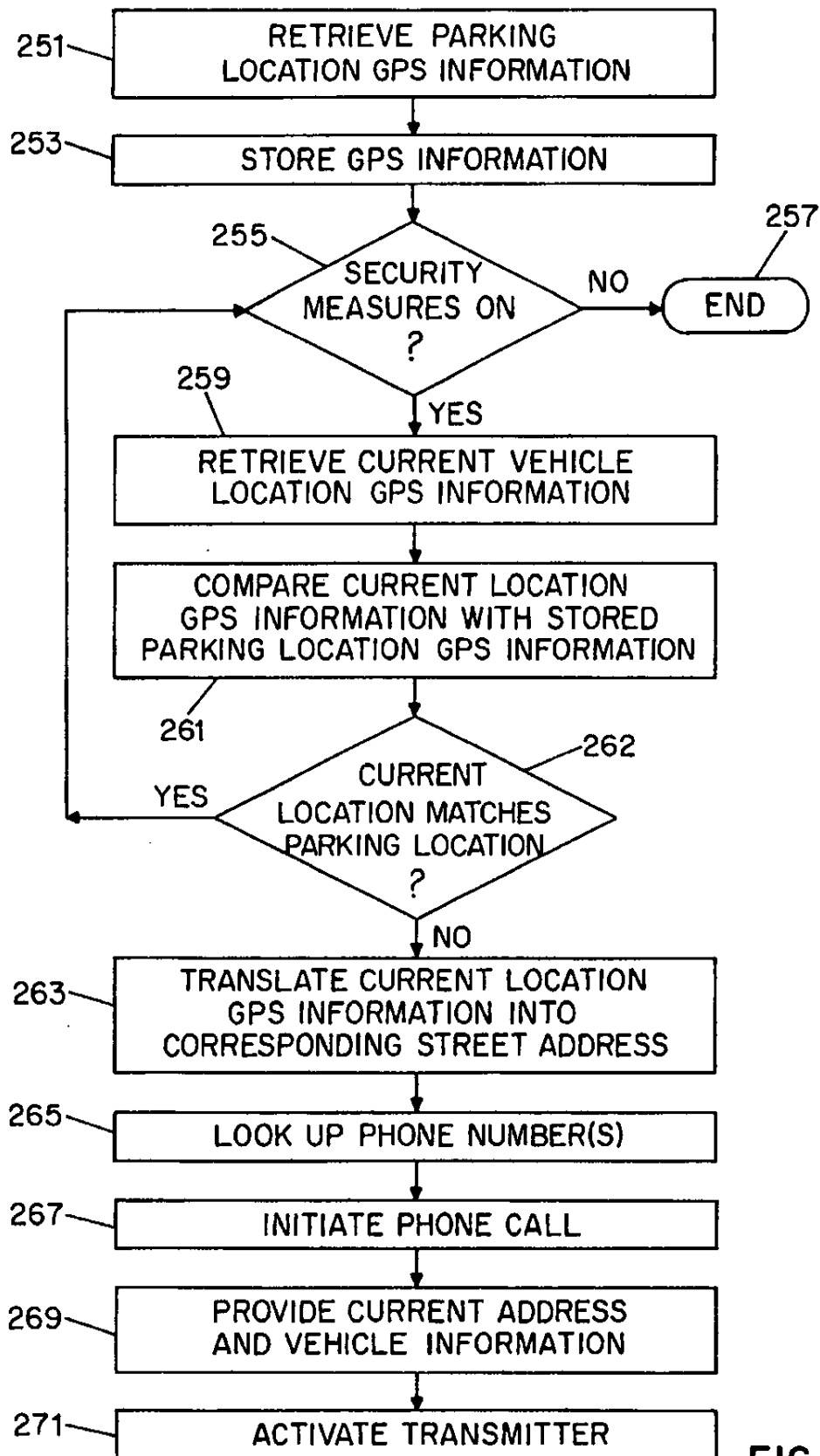


FIG. 3A

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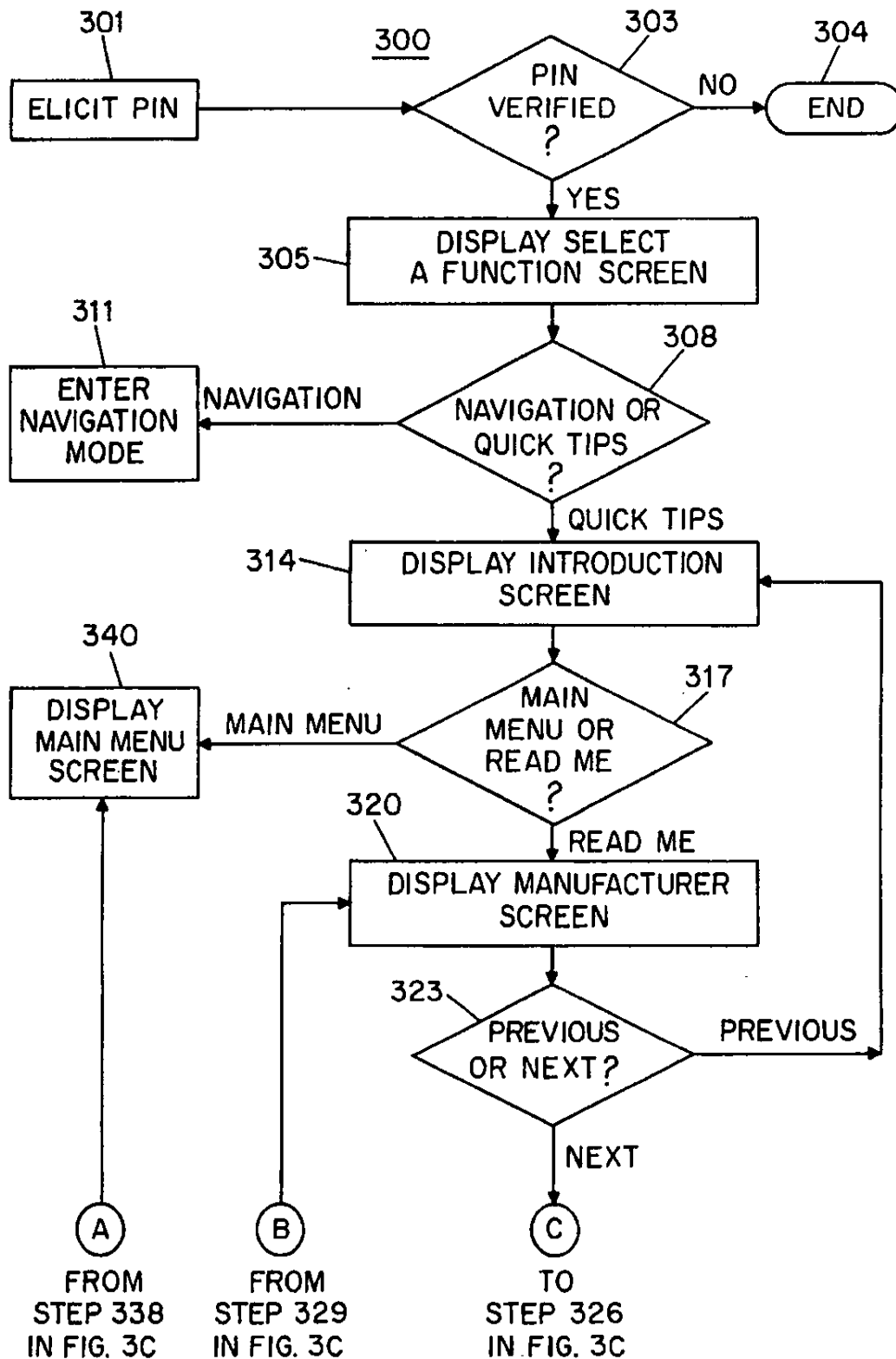


FIG. 3B

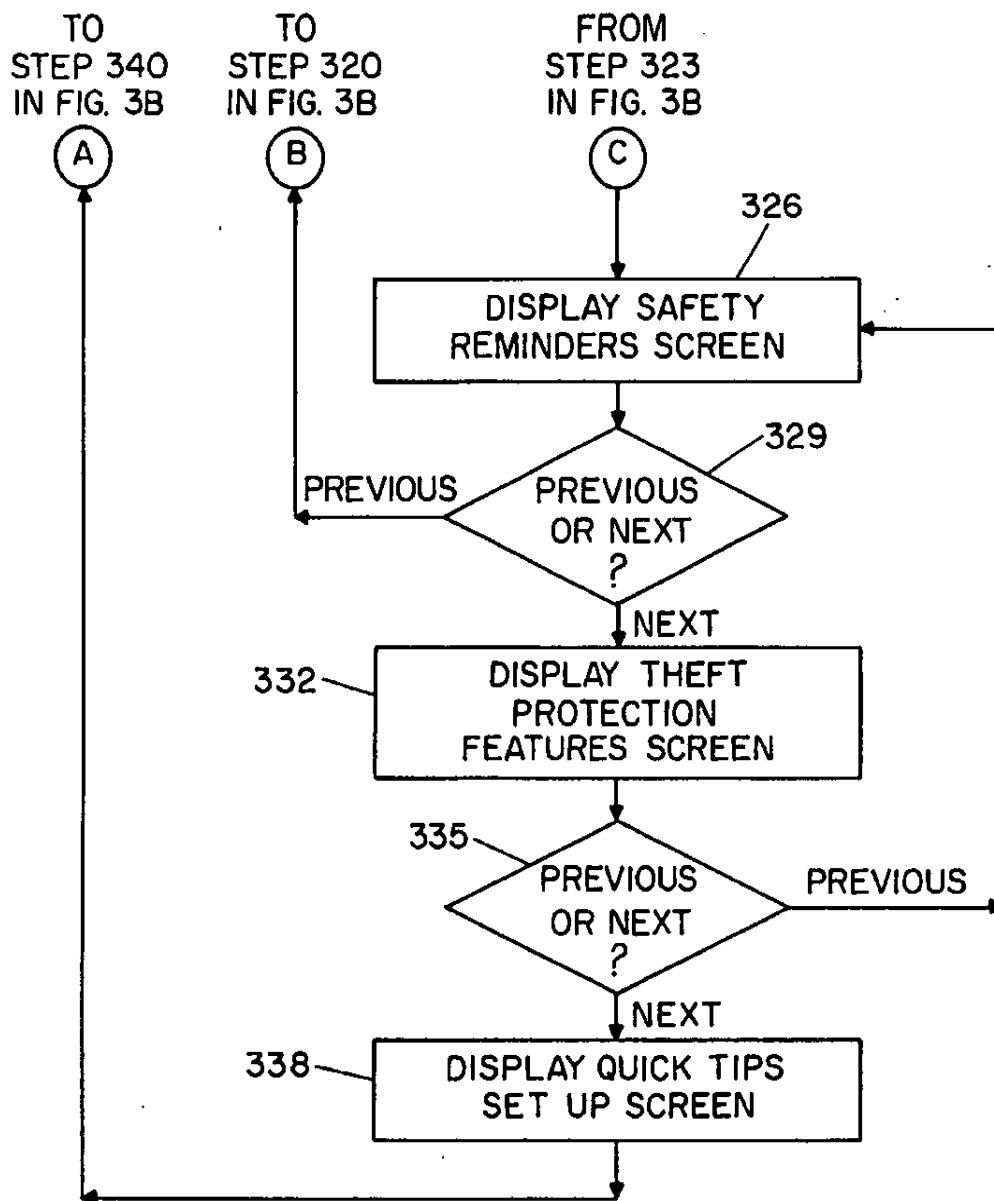


FIG. 3C

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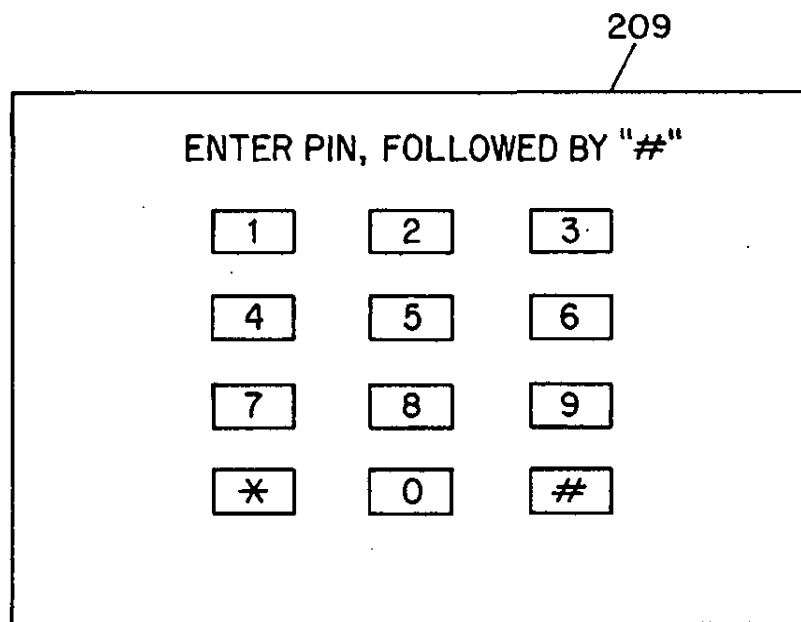


FIG. 4A

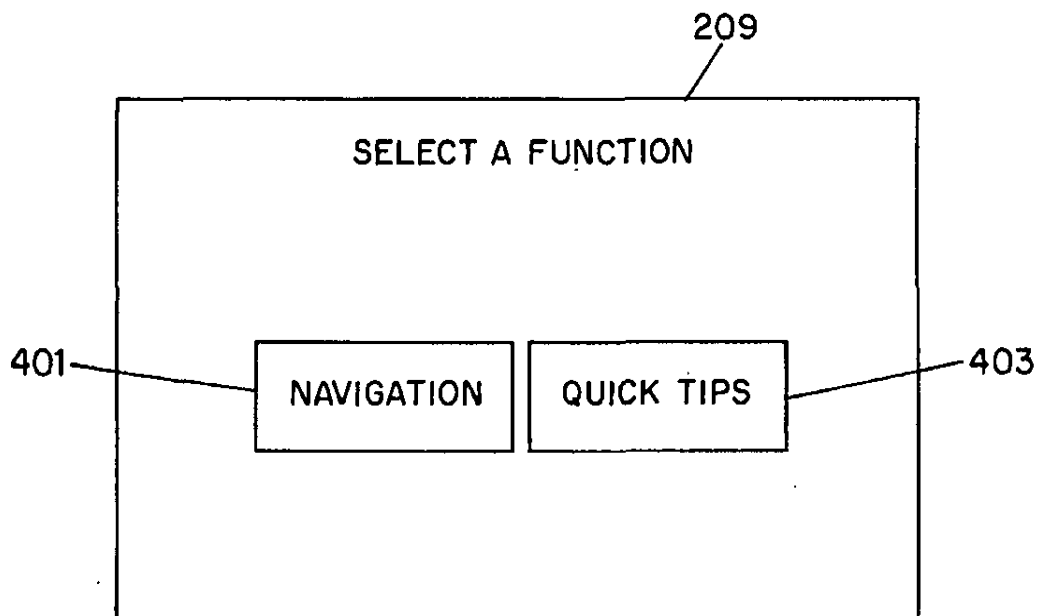


FIG. 4B

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FIG. 5

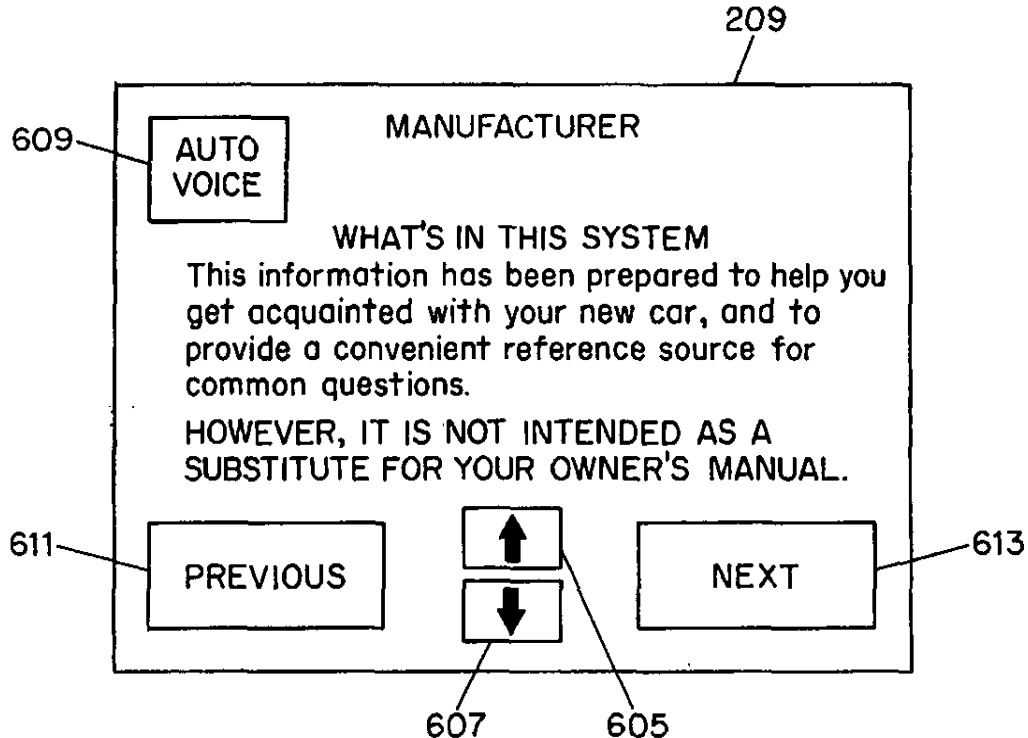


FIG. 6

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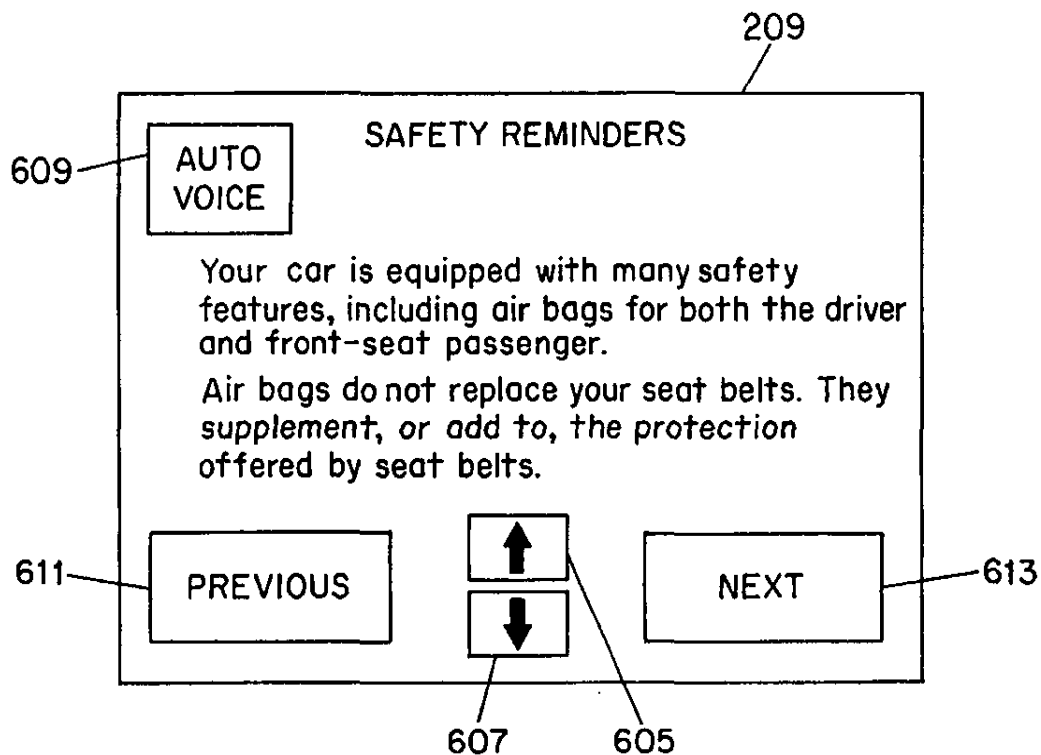


FIG. 7

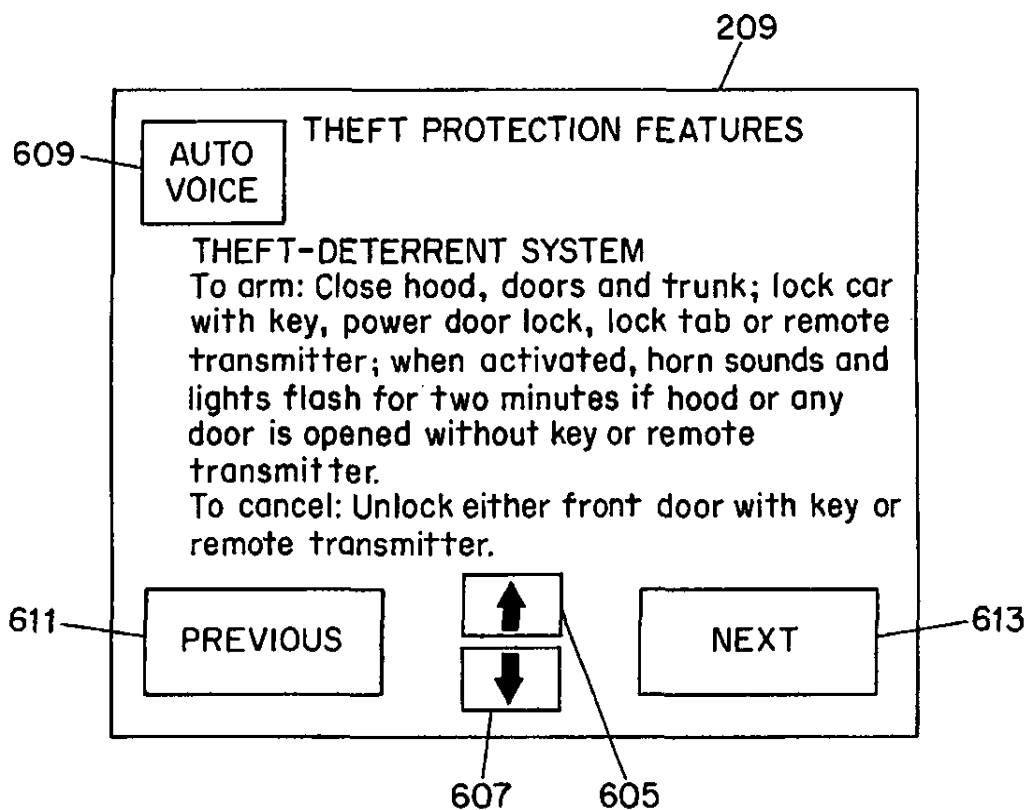


FIG. 8

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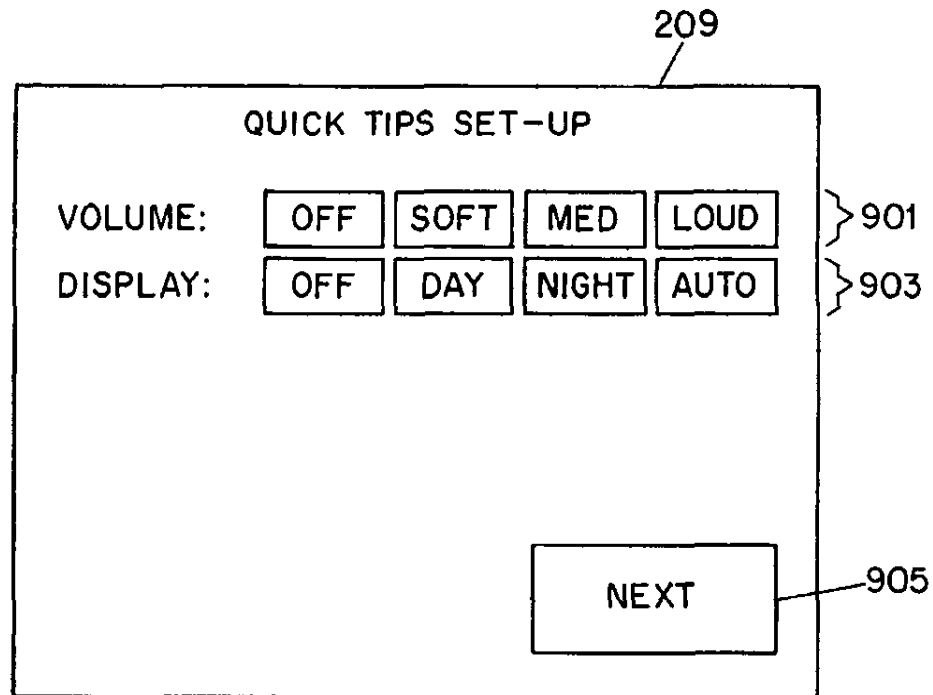


FIG. 9

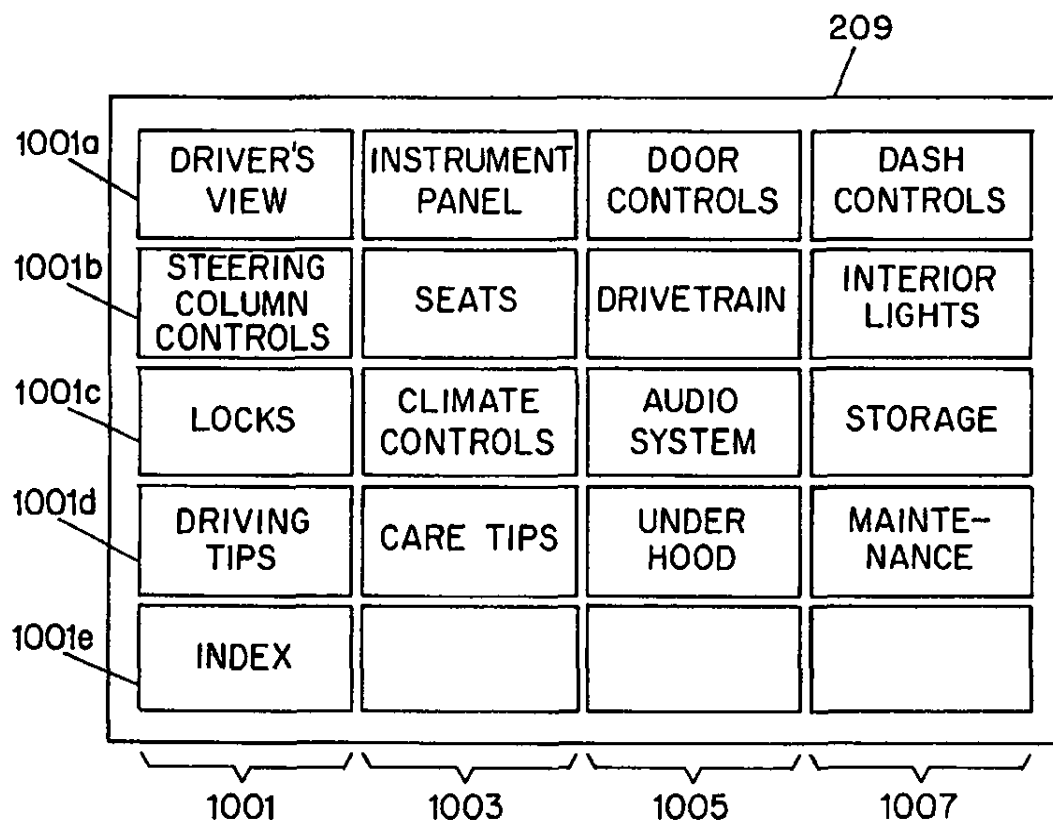


FIG. 10

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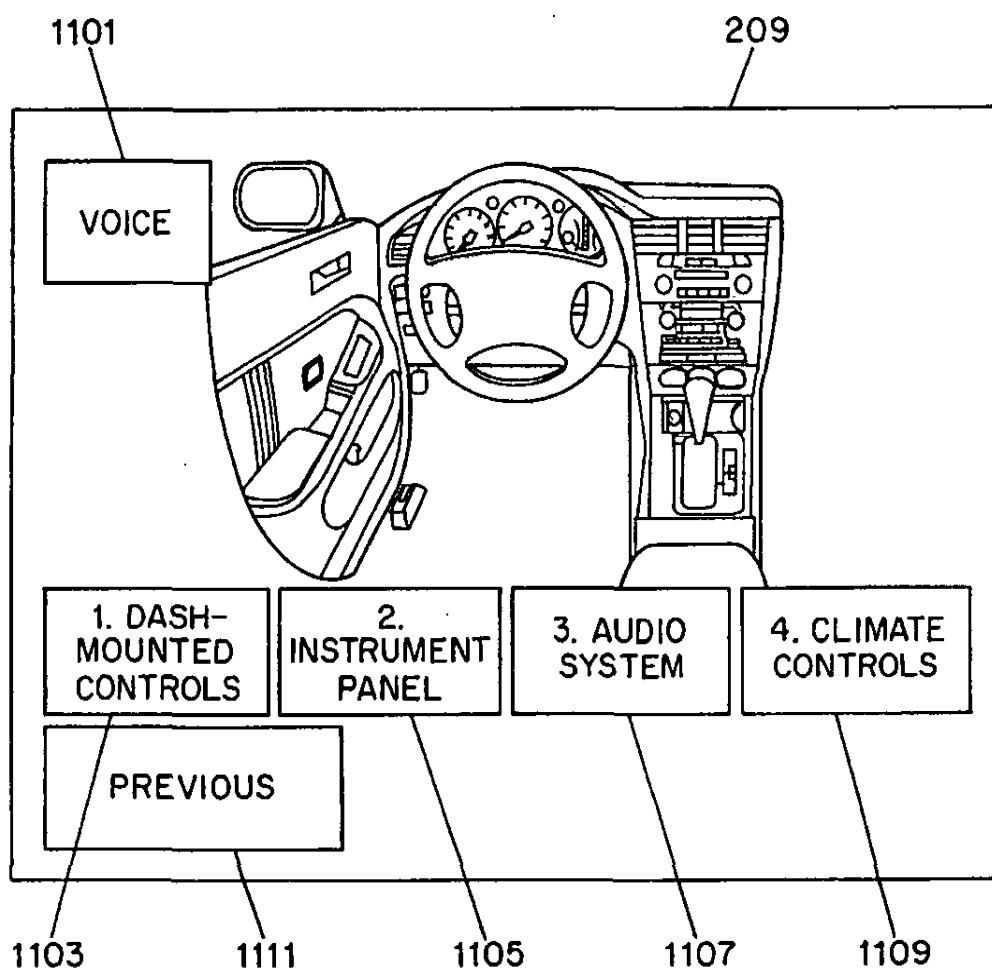


FIG. 11

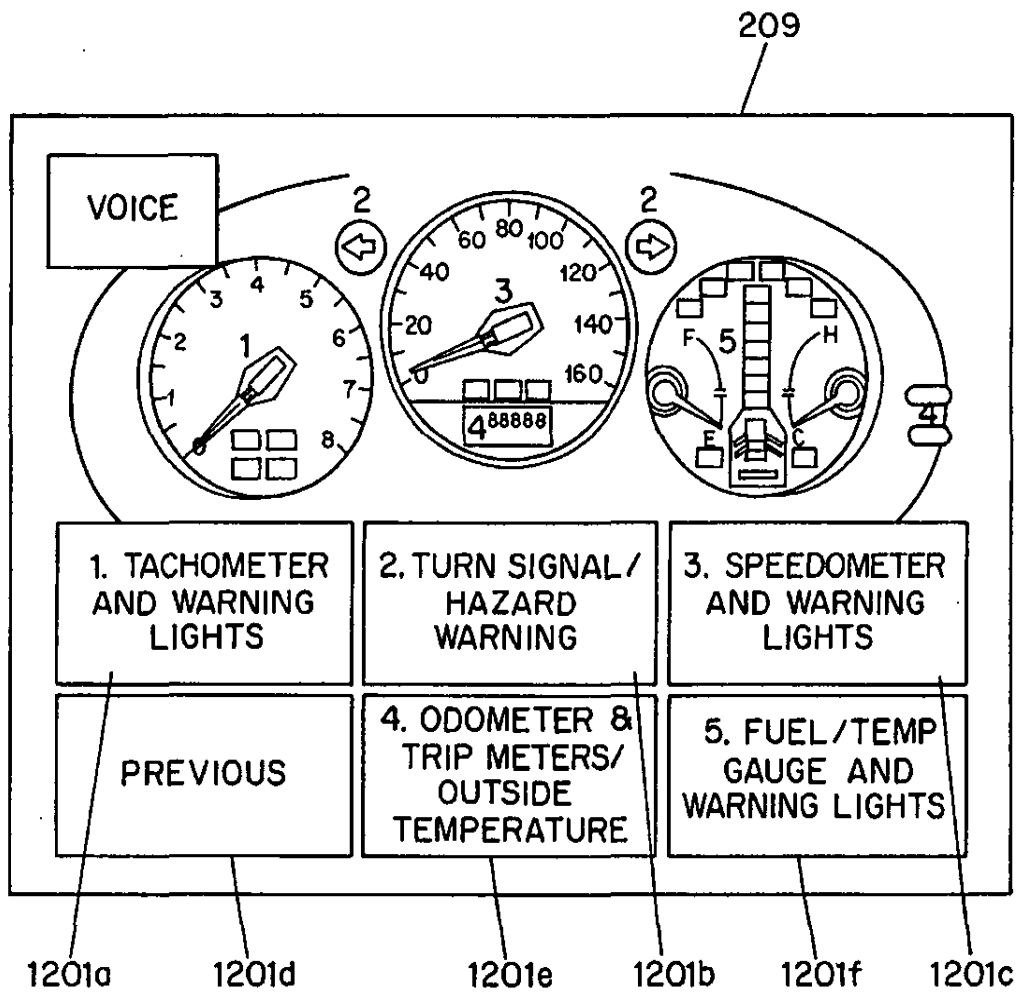


FIG. 12

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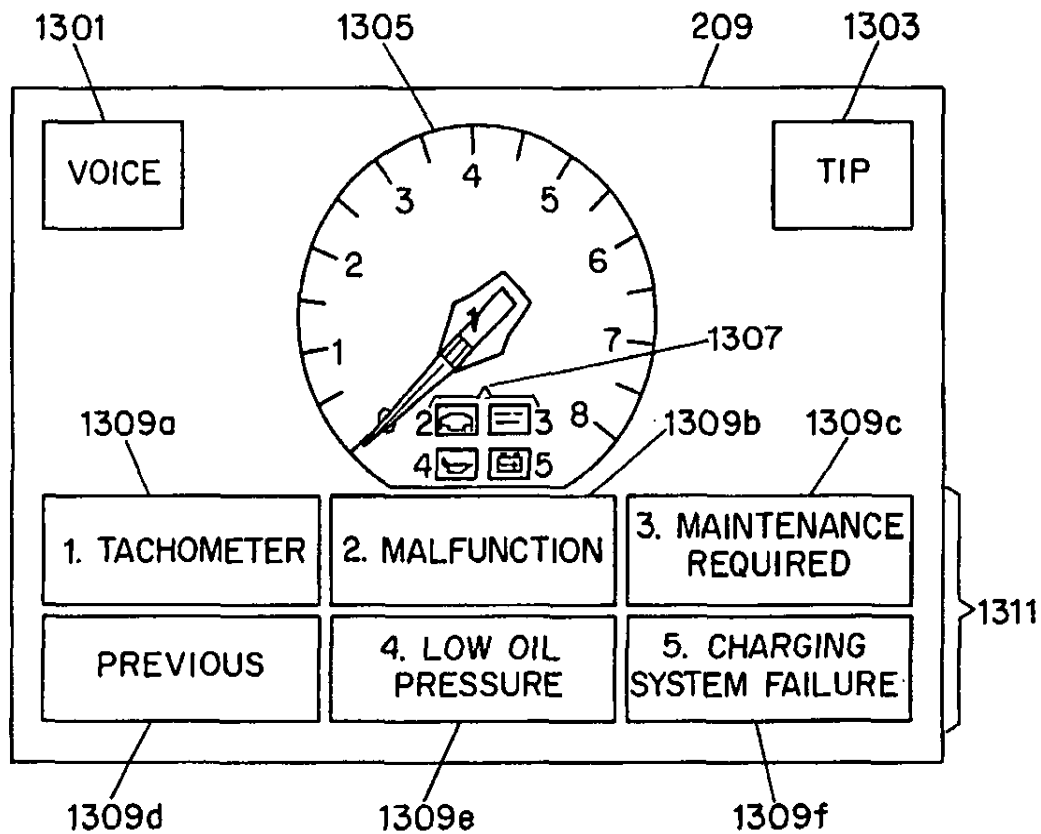


FIG. 13

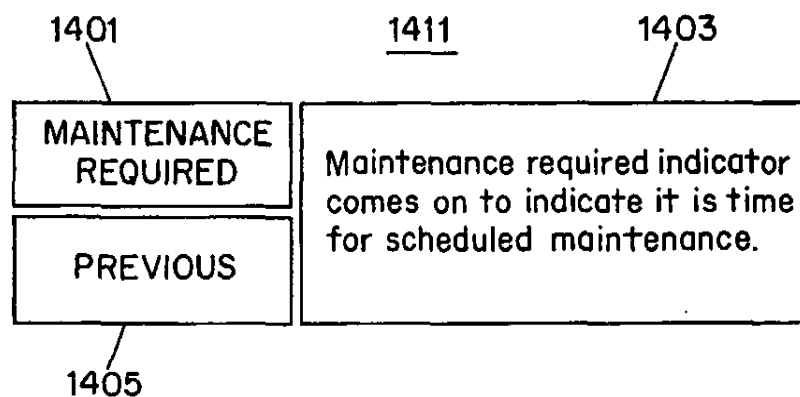


FIG. 14

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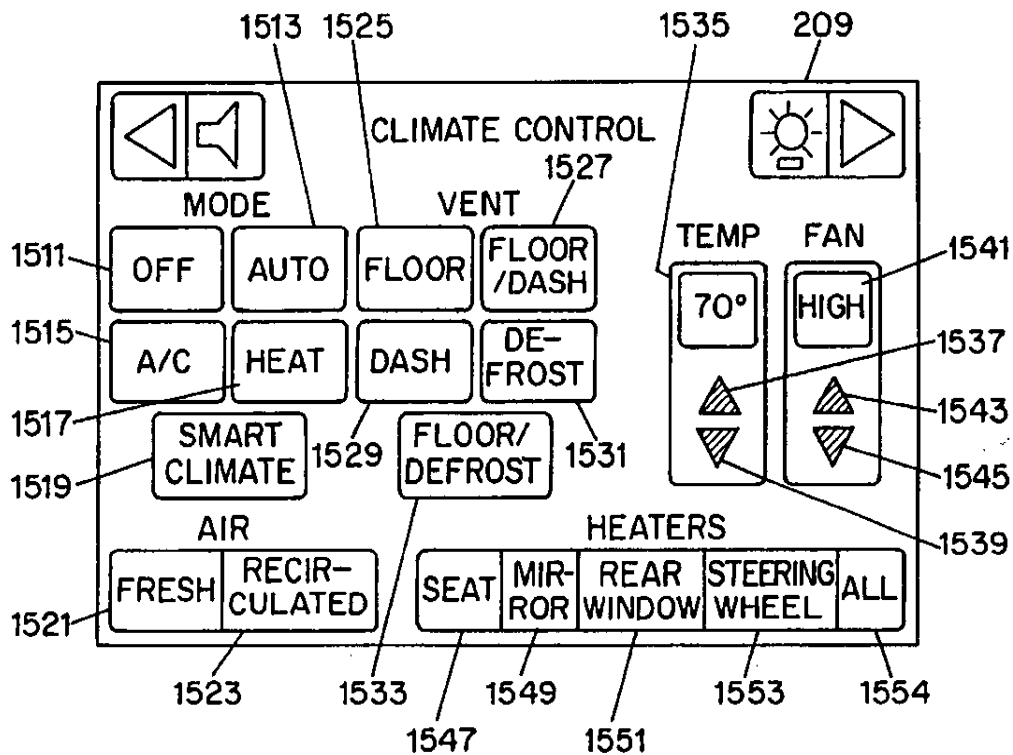


FIG. 15

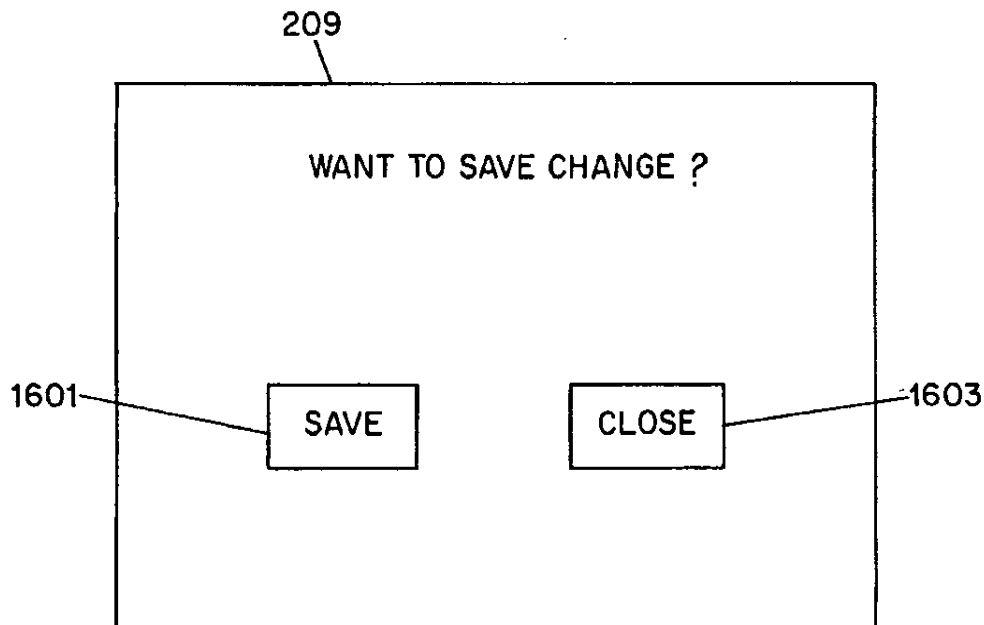


FIG. 16

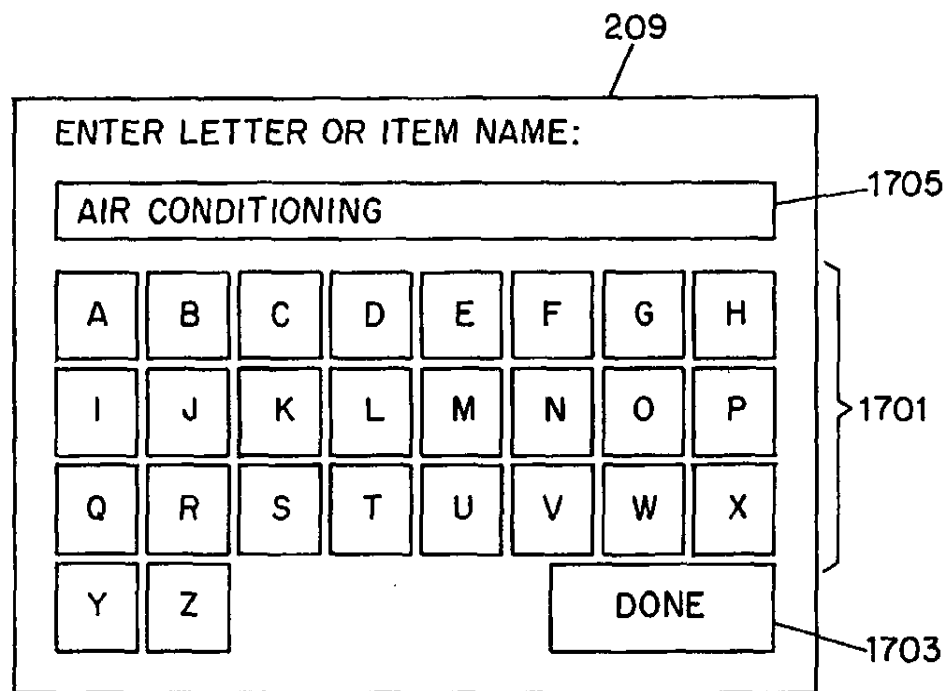


FIG. 17

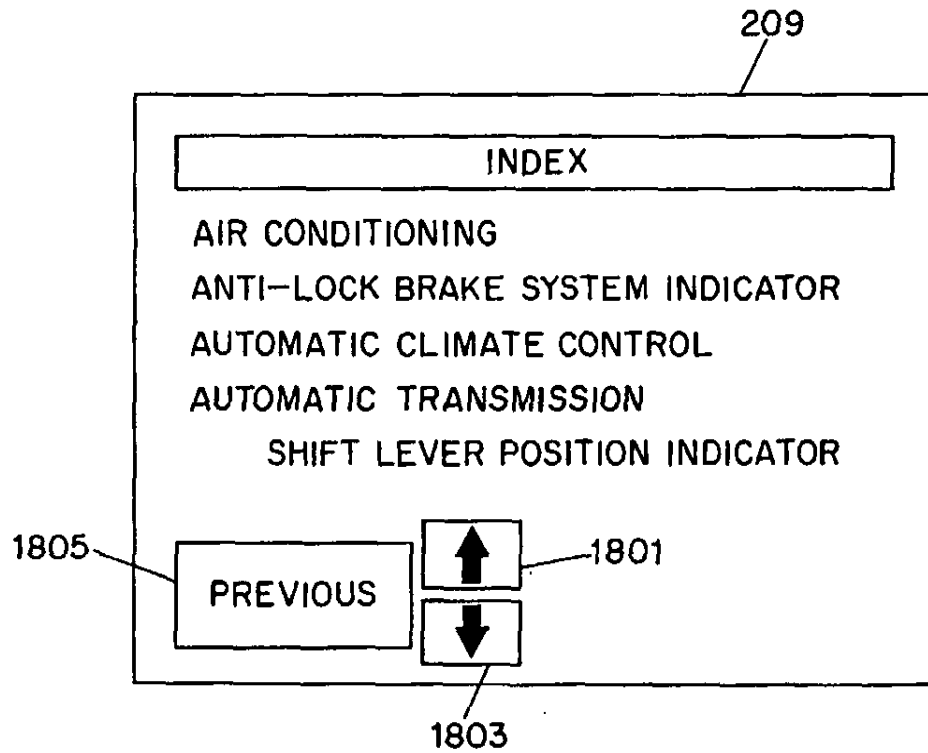


FIG. 18

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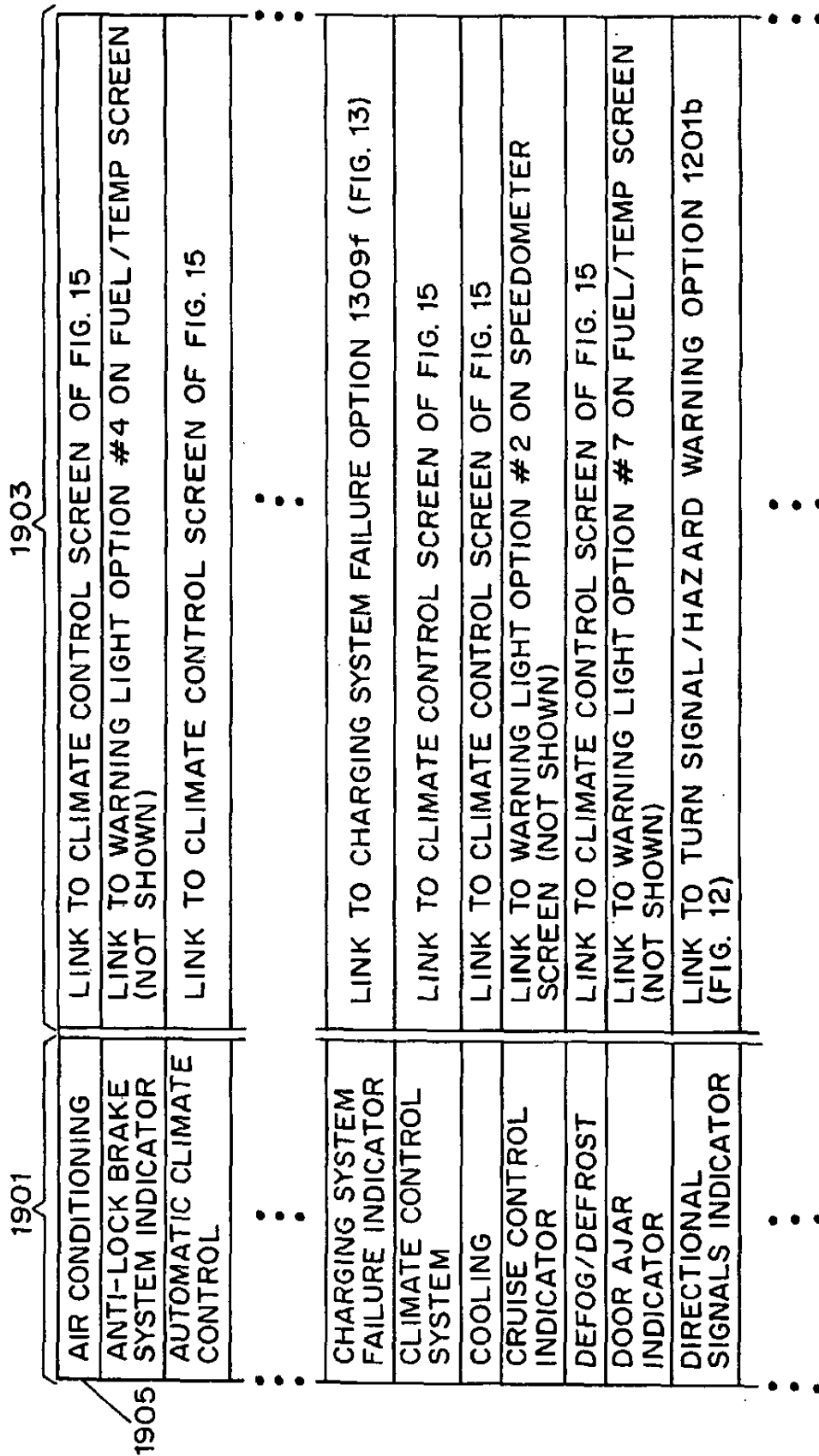


FIG. 19

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TECHNIQUE FOR PROVIDING INFORMATION UPON A NOTABLE CONDITION IN A VEHICLE

This application is a continuation of application Ser. No. 09/401,039 filed on Sep. 21, 1999, now U.S. Pat. No. 6,175,782 which is a division of application Ser. No. 08/789,934 filed on Jan. 28, 1997, maturing into U.S. Pat. No. 6,009,355 issued on Dec. 28, 1999.

FIELD OF THE INVENTION

The invention relates generally to *information and control systems* and, more particularly, to a system for use in an automobile which facilitates a user's retrieval and/or dissemination of information, and control of vehicle functions.

BACKGROUND OF THE INVENTION

Information is vital to day-to-day activities. With no access to information, people cannot function efficiently in this society, and their lives and financial well-being are put in jeopardy. People want to be well-informed, so much so that when they are travelling in automobiles, they tune into local radio stations to listen to news, weather forecasts and traffic conditions. For that matter, some automobiles are equipped with audiovisual systems including television (TV) receivers. One such system is disclosed in U.S. Pat. No. 5,404,443 issued to Hirata. The Hirata system provides audiovisual information in a number of modes including a TV mode, which may be selected by control switches disposed on the periphery of a display.

Automobile users like to be continually updated with information affecting their travel plans such as weather and traffic conditions because of its fast changing nature. Automobile users who are traveling also like to continually keep in touch with their homes and offices, and to confirm appointments and hotel reservations so that they can adjust their itineraries accordingly. To that end, cellular mobile telephones were introduced to enable automobile users to conduct business and contact their families while they are traveling.

In addition, local map information is important to automobile travelers moving from one locale to another. As such, navigation systems were developed to help reach their destinations in an unfamiliar milieu. One such vehicle navigation system is disclosed in U.S. Pat. No. 5,274,560 issued to LaRue. The disclosed system is based on artificial intelligence and provides a driver with directions via a voice interface. The system is built upon an optical disk player which can be used for entertainment as well. Digitized maps, compressed voice records and computer programs are stored on an optical disk compatible with the disk player. After a destination point is identified, the disclosed system finds the best route from the digitized maps and guides the driver therethrough via the voice interface, taking into account the latest traffic conditions received by an FM receiver to avoid congestion.

Recently, navigation systems based on military global positioning system (GPS) technology have emerged. One such navigation system is commercially available as an option for the latest model of the ACURA 3.5 RL automobile. This ACURA navigation system receives signals from a constellation of satellites which is part of the GPS. In response to these signals, the navigation system pinpoints the automobile's location (in latitude and longitude). It also detects the automobile's speed and direction. With geographic information stored on a hard disk in an onboard

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computer, the navigation system is capable of verbally and visually communicating to the user instructions for reaching the destination.

In addition to the above techniques for communications with automobile users, a technique for disseminating information regarding the automobiles themselves is disclosed in U.S. Pat. No. 5,442,553 issued to Parillo. The disclosed system is a vehicle diagnostic and software upgrade system. In this system, sensors are provided in the vehicle to generate dynamic data relating to various mechanical controls and the engine of the vehicle, including engine R.P.M., fuel/air mixture, emissions and pollution content information. A microprocessor in the vehicle has access to selectable program parameters affecting the functioning of the mechanical controls. The microprocessor collects and transmits the dynamic data to a remote diagnostic station periodically or upon its request. In response, the remote station sends, to the vehicle, signals indicative of any changes in its software and/or program parameters. The microprocessor accordingly causes the changes to be made in the vehicle based on the received signals.

Besides the communication capabilities described above, an automobile has many accessories and user control elements such as lights, wipers, a clock, temperature control, cruise control, seat adjustment control, mirror adjustment control, and an anti-theft system. A technique for centralizing the command of the individual control elements is disclosed in U.S. Pat. No. 5,555,502 issued to Opel. The disclosed system includes a centralized control panel on a steering wheel which, together with a display, is utilized to control the electronic components of the automobile. The display is positioned in the area of the driver's sun visor. After the driver presses one of the buttons on the control panel corresponding to a desired electronic component, a menu is displayed so that the driver is able to select items from the menu to program the component. The selection is accomplished by pressing specified buttons on the panel.

In addition, a technique for controlling vehicle accessories via voice command is disclosed in U.S. Pat. No. 4,827,520 issued to Zeinstra. In accordance with this technique, control functions of each accessory are formatted in a summary page for display on a screen, which is scanned by infrared light to sense any touching thereon. By uttering any of the displayed functions on the summary page, preceded by either a specified keyword or an actuation of a push-to-talk switch on a steering wheel, a more detailed subpage of the selected function is displayed for further selection by voice. As an alternative to the voice command, the selection can also be accomplished by touching the displayed function on the screen.

Voice command and touch screen techniques are frequently mentioned in prior art references in controlling car accessories. In particular, U.S. Pat. No. 5,214,707 issued to Fujimoto et al. discloses a system for voice-controlling equipment inside a vehicle, including microphones capable of discriminating voice commands as to whether they are generated at the driver side or at the assistant side of the vehicle in a noisy environment.

SUMMARY OF THE INVENTION

It is celebratory that technology advances at lightning speed. However, many people are left behind the technological frontier, and to some extent develop "technophobia". Some of them have even given up this technological race, which is confirmed by the blinking "12:00" display on the clocks of many video cassette recorders (VCRs) being used.

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Similarly, it is fantastic that automobiles nowadays include many advanced accessories such as audiovisual systems, anti-theft systems, anti-lock brake systems, climate control, and cruise control which embrace the latest technologies. However, of all these accessories, many automobile users only know how to operate the headlights and windshield wipers, and regard the rest as nuisance. That is, the users pay for numerous accessories which they do not use, resulting in much consumer waste. We have recognized that such non-use is principally attributed to an inefficient distribution of operating knowledge of the automobile and, in particular, its accessories.

Specifically, when automobile users presently want to learn about certain aspects of an automobile, they need to consult an owner's manual which could have been lost or misplaced when they need it the most. In addition, the manual is unpopular because many users simply want to avoid reading any written material, and find it intimidating as it oftentimes is filled with incomprehensible technical jargon.

We have further recognized that even with the operating knowledge, many users are overwhelmed and confused with the large number of knobs, switches and buttons used to control the individual vehicle parts and accessories.

Accordingly, it is an object of the invention to design an information and control system for use inside an automobile with the user in mind. The user is afforded a centralized control which may be used in lieu of the knobs, switches and buttons to operate the vehicle parts and accessories. In accordance with the invention, the centralized control is intimately tied to an information system such that the user is able to efficiently access information about the functions and operations of such parts and accessories, and in a synergistic manner apply that information to operate same, using the centralized control.

It is another object of the invention that the access to the information is intuitive and direct so that the user can obtain the relevant information in a few self-explanatory steps. To that end, the invention embraces a multimedia approach where audio and video media are added to the traditional text media to convey information. The additional media increases the dimensions of both the user's comprehension of the information and the user's interaction with the automobile. Moreover, the information access is driven by a multilevel menu based on an intuitive model of taxonomy where information is organized in a minimal number of levels of subject matter from general to specific. The above integration of the multimedia approach with the multilevel menu approach presents an effective way of retrieving information in the automobile. Advantageously, with the invention, the user would not be distracted or overburdened by irrelevant information in the course of an information retrieval, which is conducive to a safe driving environment.

In the preferred embodiment, when the user wants to access information about a given part or accessory of the automobile, the user is presented with options on a display screen. Each option is associated with a respective one of different parts or accessories of the automobile. The user is able to select through the interface one of the options, associated with the given automobile part or accessory. The option, when selected, is highlighted in a first color, for example, yellow. A voice is then generated by the inventive system to explain the purpose or the content of the selected option before the user commits to it. Having been so informed, the user may then activate the selected option in retrieving the information of interest. The activated option is

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highlighted in a second color, e.g., blue, to indicate its active status. The retrieved information is presented to the user both in text and in voice.

BRIEF DESCRIPTION OF THE DRAWING

Further objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing showing an illustrative embodiment of the invention, in which:

FIG. 1 is a block diagram of an automobile information and control system in accordance with the invention;

FIG. 2 illustrates a control panel and a display interface for a user to interact with the system of FIG. 1;

FIG. 3A illustrates a flow chart depicting the steps of an anti-car-theft routine used in the system of FIG. 1;

FIGS. 3B and 3C jointly illustrate a flow chart depicting the steps of a routine for presenting various screens to the user in the system interaction;

FIG. 4A illustrates a screen for eliciting a personal identification number (PIN) from the system user;

FIG. 4B illustrates a SELECT A FUNCTION screen including features thereof in accordance with the invention;

FIG. 5 illustrates an introduction screen including features thereof in accordance with the invention;

FIG. 6 illustrates a MANUFACTURER screen including features thereof in accordance with the invention;

FIG. 7 illustrates a SAFETY REMINDERS screen including features thereof in accordance with the invention;

FIG. 8 illustrates a THEFT PROTECTION FEATURES screen including features thereof in accordance with the invention;

FIG. 9 illustrates a QUICK TIP SET-UP screen including features thereof in accordance with the invention;

FIG. 10 illustrates a MAIN MENU screen including features thereof in accordance with the invention;

FIG. 11 illustrates a DRIVER'S VIEW screen including features thereof in accordance with the invention;

FIG. 12 illustrates an INSTRUMENT PANEL screen including features thereof in accordance with the invention;

FIG. 13 illustrates a TACHOMETER AND WARNING LIGHTS screen including features thereof in accordance with the invention;

FIG. 14 illustrates a segment of the screen of FIG. 13 providing the user with information regarding a particular function of the automobile;

FIG. 15 illustrates a CLIMATE CONTROL screen including features thereof in accordance with the invention;

FIG. 16 illustrates a SAVE screen for saving the user's preferences in accordance with the invention;

FIG. 17 illustrates a DATA ENTRY screen in accordance with the invention for looking up information regarding a specific item in the automobile;

FIG. 18 illustrates an INDEX screen with listed items for which information is available; and

FIG. 19 is a look-up table listing searchable items and the corresponding instructions for a processor in the system of FIG. 1 to provide information regarding such items.

Throughout this disclosure, unless otherwise stated, like elements, components and sections in the figures are denoted by the same numerals.

DETAILED DESCRIPTION

FIG. 1 illustrates information and control system 100 embodying the principles of the invention for use in an

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automobile. System 100 is referred to as the "AUTO DIRECTOR" system. It is user-friendly and designed with the automobile user in mind. For example, with AUTO DIRECTOR display interface 102a to be described, information about the automobile is readily available literally at the fingertips of the user. This information includes operational instructions, maintenance procedures, safety measures, and information about virtually every capability of the automobile. In accordance with the invention, the user is able to efficiently access such information using multimedia means involving audio, text and video media. Also with interface 102a, or multifunction display interface 102b to be described, the user is afforded a centralized control whereby he/she can program or adjust different vehicle parts and accessories using the information thus obtained.

As shown in FIG. 1, central to system 100 is processor 105 connected to memory 115. Data bus 107 connects processor 105 to display interfaces 102, input interfaces 104, communications interfaces 106, output control interfaces 108, vehicle computer interfaces 110, vehicle control interfaces 112, self-test interface 114, preferences interface 116, and audio interface 118.

Display interfaces 102 include, inter alia, AUTO DIRECTOR display interface 102a, which is illustrated in FIG. 2, together with control panel 205 in FIG. 1. By way of example, but not limitation, the hardware of interface 102a and control panel 205 are derived from a prior art navigation system of the type of the ACURA navigation system. In fact, interface 102a and control panel 205 are used in this illustrative embodiment to realize not only AUTO DIRECTOR functions to be described, but also the well-known navigation function.

Interface 102a includes a conventional liquid crystal display screen 209, and LCD driver (not shown) for processor 105 to control the display on screen 209. Interface 102a also incorporates well-known touch-screen circuitry (not shown) connected to touch screen interface 104a in FIG. 1. With this circuitry, the user can interact with processor 105 by, say, touching a displayed option on screen 209. Through interface 104a, processor 105 receives from the touch screen circuitry a signal identifying the location on screen 209 where it has been touched. If such a location matches the predetermined location of one of the displayed options, processor 105 determines that option has been selected. With such touch-screen and displayed option selection capabilities, through AUTO DIRECTOR interface 102a, the user is able to obtain information on and control selectable functions of the automobile such as the instrument panel, navigation function, mobile phone, radio/CD player, locks, mirrors, windows, driver's seat adjustment control, climate control, windshield wipers, cruise control, lights, security function, steering, ride control, engine and transmission.

Control panel 205 comprises CANCEL switch 205a, ENTER switch 205b, BRIGHTNESS switch 205c, PUSH TO SELECT knob 205d, MENU switch 205e, MAP/GUIDE switch 205f, SETUP switch 205g, ZOOM IN switch 205h and ZOOM OUT switch 205i. BRIGHTNESS switch 205c comprises a standard variable resistor such that when it is pushed one way, operating circuitry 121 responsively causes the display intensity to increase, and the other way to decrease. ZOOM IN switch 205h when pressed enables the automobile user to enlarge a particular visual area of interest on screen 209, affording better details. On the other hand, ZOOM OUT switch 205i when pressed performs the inverse function to switch 205h. As an alternative to the touch-screen capability, switch 205d similar to a standard joystick

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is provided for the user to move from one displayed option to another on screen 209 in the same direction (e.g., up, down, left or right) as the switch is operated. A desired option may be selected by pressing ENTER switch 205b. The functions of the other switches are described hereinbelow as they are called out in the operation of system 100. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and control panel 205 are mounted close to the center of the dashboard of the automobile next to the steering wheel.

Referring back to FIG. 1, display interfaces 102 also include multifunction display interface 102b, center console display interface 102c, rear console display interface 102d, and instrument panel display interface 102e.

Specifically, multifunction display interface 102b is installed on the dashboard close to interface 102a on the driver side. Like interface 102a, interface 102b provides the user with graphic display and control of selected functions using well-known touch screen technology. In fact, interface 102b duplicates certain control functions (e.g., navigation, phone, radio and climate control) of interface 102a so that the user can use interface 102b to control a selected function while interface 102a is engaged in another ongoing function. For example, while the user is relying on AUTO DIRECTOR interface 102a to provide navigation information to reach a given destination, the user may want to adjust the climate control of the automobile. It is inconvenient for the user to terminate the ongoing navigation mode of interface 102a, albeit temporarily, to access the climate control function through the interface, adjust the climate control and then resume the navigation mode. Thus, it is preferable to leave the navigation mode of interface 102a alone and use interface 102b to administer the climate control.

Center console interface 102c is installed close to interface 102a on the passenger side. Similar to interface 102b, interface 102c provides the front seat passenger with graphic display and control of functions which include: the front passenger seat adjustment, door lock, window, climate and TV controls. If enabled by the driver, control is also available for the radio/CD player and phone.

Rear console display interface 102d is installed on the back of a front seat. Similar to interface 102c, interface 102d provides rear seat passengers with graphic display and control of certain functions if enabled by driver or front seat passenger. These functions include: the rear seat climate, windows, door locks, radio/CD player and TV controls.

Instrument panel display interface 102e is installed on the dashboard in front of the driver seat. This interface provides the driver with graphic display of the vehicle speed, engine RPM, outside and inside temperatures, oil pressure, fuel level, time, odometer reading, trip odometer reading and warning light indicators. Through AUTO DIRECTOR interface 102a, the system user may select the display of the information in either an analog or a digital form.

Input interfaces 104 comprise touch screen interface 104a and control panel 205 described before, and voice command interface 104b. The latter is connected to a microphone (not shown) and comprises standard voice command circuitry (not shown) for processing voice commands by the user through the microphone to control or modify selected functions of system 100.

Communications interfaces 106 include phone interface 106a, radio/CD interface 106b, television (TV) interface 106c, navigation interface 106d, and beacon interface 106e. Processor 105 interacts with and controls standard phone equipment connected to phone interface 106a. Through

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processor 105, the user may operate the phone equipment via voice command, thereby realizing hands-free operation of the equipment. Alternatively, the user may operate the phone equipment using the touch screen capability provided by AUTO DIRECTOR display interface 102a or multifunction display interface 102b. The user may also operate the phone equipment via remote switches.

Similarly, processor 105 interacts with and controls one or more radio receivers and CD players in the automobile connected to radio/CD interface 106b. Through processor 105, the user may operate the radio receivers via voice command, remote switch and/or touch screen capability.

Processor 105 further interacts with and controls one or more TV receivers in the automobile connected to TV interface 106c. Again, the user may operate the TV receivers via voice command, remote switches and/or touch screen capability.

As further described hereinbelow, navigation interface 106d is connected to a standard inertial guidance system (not shown) capable of providing gyros information, and deriving the vehicle location based on GPS information. With the map information stored in memory 115, the inertial guidance system is capable of providing the user with navigational instructions via interface 102a or 102b. Besides the locational information, local and national emergency information may be derived from the GPS information using additional standard decoding circuitry in interface 106d.

Beacon interface 106e is used for connection to a standard beacon device for detecting a predetermined beacon radio signal to provide additional locational information.

Output control interfaces 108 include lock interface 108a, mirror interface 108b, window interface 108c, steering column interface 108d, seat interface 108e, climate control interface 108f, wiper interface 108g, cruise control interface 108h, light interface 108i and clock interface 108j.

Specifically, lock interface 108a comprises output control logic controllable by processor 105 to lock or unlock the car doors, glove box, console storage, trunk (or liftgate), fuel filler door, brakes and transmission, and enable or disable the child-proof door locks, fuel pump and ignition.

Mirror interface 108b comprises output control logic controllable by processor 105 to maneuver the positions of the outside mirrors and inside rear view mirror, and to fold or unfold the outside mirrors.

Window interface 108c comprises output control logic controllable by processor 105 to incrementally or completely open or close all windows, and to open, close or tilt any sunroof.

Steering column interface 108d comprises output control logic controllable by processor 105 to move the steering column in or out and up or down.

Seat interface 108e comprises output control logic controllable by processor 105 to (1) adjust the positions of the front seats forward or aft, and up or down; (2) tilt the front or rear of the seat cushion up or down; (3) adjust the seat back lumbar, width and angle forward or aft; (4) increase or decrease the cushion size and stiffness; (5) raise or lower the head restraint; and (6) raise or lower the seat belt height.

Climate control interface 108f comprises output control logic controllable by processor 105 to (1) turn the climate control system on or off; (2) select an air flow mode; (3) set fan speeds; (4) enable or disable seat heaters; (5) select fresh or recirculated air (for driver only); and (6) enable or disable front and rear defrosters, mirrors and steering wheel heaters (for driver only).

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Windshield wiper interface 108g comprises output control logic controllable by processor 105 to (1) select a high, low, intermittent, single wipe or off mode; (2) set an intermittent delay; and (3) enable or disable front or rear washers. Interface 108g also includes control logic for controlling rain- and speed-sensitive wipers, and for activating an automatic wash in a single wide mode when the windshield is at a certain level of opacity.

Cruise control interface 108h comprises output control logic controllable by processor 105 to (1) turn the cruise control on or off, (2) set the vehicle speed, and (3) cancel or resume the set speed.

Light interface 108i comprises output control logic controllable by processor 105 to select an automatic on mode or off mode for parking lights, headlights and fog lights; and to turn on or off map or courtesy lights.

Clock interface 108j comprises output control logic controllable by processor 105 to set an initial date and time on a conventional clock (not shown) connected to interface 108j. System 100 relies on the current date and time kept by the clock to provide a time reference for the system functions.

Vehicle computer interfaces 110 include anti-lock brake computer interface 110a, engine computer interface 110b and supplemental restraint computer interface 110c for processor 105 to communicate with the computers controlling the anti-lock brakes, engine and supplemental restraints (e.g., back-up airbag deployers and seat belt tensioners), respectively. Interfaces 110 also include back-up interface 110d through which processor 105 receives and analyzes signals from the engine, anti-lock brake and supplemental restraint computers. These signals would indicate to processor 105 any failures of the computers. In response to a computer failure, processor 105 causes a corresponding back-up computer connected to interface 110d to provide a back-up function.

Vehicle control interfaces 112 include steering interface 112a, ride interface 112b, engine interface 112c, transmission interface 112d, traction control interface 112e, and security interface 112f.

Specifically, steering interface 112a comprises input monitoring and output control logic for processor 105 to lighten or tighten the steering effort ratio in response to changing road conditions. Through interface 102a, the user may opt for manual or automatic steering effort ratio control. Interface 112a is capable of adapting and storing data according to the driver's inputs. It also allows for steering of front and/or rear wheels for sporty or increased stability.

Ride interface 112b comprises input monitoring and output control logic for processor 105 to lighten or stiffen the ride control to front and/or rear of vehicle in response to changing road conditions. Through interface 102a, the user may also opt for manual or automatic ride control.

Engine interface 112c comprises input monitoring and output control logic allowing for shutting off a specified number of cylinders, and varying valve and cam timing to increase performance or fuel economy. This interface also allows for manual or automatic control of the engine components, and includes the capability of adapting and storing data according to the driver's inputs.

Transmission interface 112d comprises input monitoring and output control logic for selecting manual or automatic shifting of the transmission. In an automatic shifting mode, interface 112d is capable of adapting and storing data according to the driver's inputs. Interface 112d also allows for control of a variable differential ratio for fast acceleration and high economy cruise.

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Traction control interface 112e comprises input monitoring and output control logic providing information on whether power is delivered to front and/or rear wheels of the vehicle and what proportion of the power is delivered to each wheel. This interface also allows for manual or automatic control, and such functions as yaw control in cooperation with the anti-lock brakes and an engine cylinder shutoff.

Security interface 112f comprises control logic for setting a security level, and enabling or disabling a number of security related functions such as the fuel supply cut-off, motion detector, brake locking, etc. Interface 112f also allows entry of a new or alteration of an existing personal identification number (PIN) for personalization of the vehicle functions, i.e., saving the vehicle functional preferences.

In accordance with an aspect of the invention, system 100 incorporates an anti-car-theft technique involving security interface 112f. In accordance with this inventive technique, security interface 112f further comprises a sensor for detection of a predetermined condition to trigger an anti-theft routine. It will be appreciated that a person skilled in the art will come up with many different triggering events causing the sensor to invoke the routine. For example, a passive way of triggering the anti-theft routine would be after the sensor detects that the engine is off and the user has opened, closed and locked the driver's door.

In any event, as soon as processor 105 receives from the sensor a signal requesting an invocation of the anti-theft routine, processor 105 retrieves from navigation interface 106d GPS information identifying the parking location of the automobile, as indicated at step 251 in FIG. 3A. Processor 105 then stores at step 253 the parking location GPS information in memory 115. At step 255, processor 105 determines whether the security measures remain on. By way of example, but not limitation, such determination is based on information from lock interface 108a indicating whether the driver's door is properly unlocked. If that door is properly unlocked, processor 105 determines that the security measures are called off, and the anti-theft routine comes to an end, as indicated at step 257.

Otherwise if processor 105 determines that the security measures remain on, processor 105 at step 259 retrieves from navigation interface 106d GPS information identifying the current location of the automobile. Processor 105 then compares at step 261 the current location GPS information with the parking location GPS information previously stored. If processor 105 at step 262 determines that the current location matches the parking location based on the comparison, the anti-theft routine returns to step 255 after a predetermined period. Otherwise if processor 105 determines that the current location does not match the parking location, processor 105 assumes that the automobile has been removed without authorization, i.e., stolen. At this point, if a conventional alarm system is connected to security interface 112f, processor 105 would cause an alarm to come on, gas to be cut off, etc.

In this example, a conventional transmitter (not shown) is connected to security interface 112f and transmits a predetermined sequence of signals receivable by a law enforcement agency or a suitable alarm monitor company when it is activated. Continuing the example, processor 105 translates the GPS information identifying the current vehicle location into the corresponding street address based on the map information stored in memory 115, as indicated at step 263. Processor 105 at step 265 looks up one or more phone

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numbers pre-stored in memory 115 for reporting to the law enforcement agency (or the alarm monitor company) about the stolen status. Alternatively, a list of phone numbers associated with law enforcement agencies (or branches of the alarm monitor company) in many different geographic locations is pre-stored, along with the GPS information identifying the locations of the respective law enforcement agencies (or alarm monitor company branches). This being so, processor 105 locates the closest law enforcement agency (or alarm monitor company branch) and its associated phone number(s) by comparing the current vehicle location GPS information with the respective agency (or branch) location GPS information.

In any event, processor 105 at step 267 initiates a call to a law enforcement agency (or an alarm monitor company branch) through phone interface 106a using the phone number just located. After the phone connection is established, processor 105 provides through the connection information about the current address of the vehicle using conventional voice synthesizer circuitry (not shown) in audio interface 118, and the pre-recorded information about the vehicle itself such as its vehicle identification number (VIN), model, year, color, license number, etc., as indicated at step 269. Through the same phone connection, processor 105 may also provide information about the vehicle's owner such as his/her name and contact number so that the law enforcement agency (or alarm monitor company branch) can notify the owner of the incident. Processor 105 at step 271 activates the aforementioned transmitter connected to security interface 112f to generate the predetermined sequence of signals in case the stolen vehicle is in transit. For that matter, processor 105 can also repeatedly check on the latest vehicle location and report any new address different from the one previously reported. Thus, by tracking the signals in the vicinity of the latest reported vehicle location, the law enforcement agency (or alarm monitor company) would recover the vehicle in an efficient manner.

Referring back to FIG. 1, self-test interface 114 comprises input/output (I/O) control logic for performing an active self-test of system 100 on power up or at the user's request. Specifically, interface 114 polls every other interface in system 100 for a self-test result. Each interface, when polled, performs an active self-test and reports the test results to interface 114, where such test results are gathered and caused to be displayed on interface 102a.

Preferences interface 116 monitors changes made by the user in selected functions after the user logs on system 100, and prompts the user to save such preferences. These preferences are stored in memory 115 in association with the user's PIN. Functions affording the user choices include auto locks, an easy entry, auto lamps, the seat position, steering column position, mirror position, radio, steering, ride, transmission shift, engine performance, climate, and security level.

Audio interface 118 comprises I/O control logic for receiving audio signals from a radio/CD, TV, compact disk (CD) player, or phone interface, processing the received audio signals, providing proper amplifications thereto, and routing the resulting sound to appropriate speakers and headphones (not shown) connected to interface 118. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and multifunction display interface 102b share the same speakers. Interface 118 also provides center and rear console display interfaces 102c and 102d with separate audio channels, speakers and headphone outputs. The front and rear speakers may be muted by the user as a preference.

Interface 118 also processes requests from other interfaces for pre-recorded digital sounds stored in a SOUNDSGOOD

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library in memory 115 and routes the requested sounds to the appropriate interfaces. In addition, interface 118 comprises the conventional voice synthesizer circuitry for providing voice messages to the appropriate interfaces.

FIGS. 3B and 3C jointly illustrate routine 300 for accessing, through AUTO DIRECTOR display interface 102a, a main menu to obtain operational instructions, maintenance procedures, safety measures, and other information about the automobile, collectively referred to as "Quick Tips". Routine 300 is stored in memory 115 and initiated when SETUP switch 205g in FIG. 2 is pressed. Instructed by routine 300, processor 105 at step 301 elicits a PIN from the user by displaying a screen of FIG. 4A through interface 102a. As shown in FIG. 4A, a video key-pad comprising numeral keys "1" through "9", and "*" and "#" keys are displayed on screen 209. In response, the user enters a sequence of numerals by touching the corresponding displayed keys, followed by the "#" key.

It should be pointed out that in accordance with another aspect of the invention, when a displayed key or option is touched on the screen of AUTO DIRECTOR display interface 102a or multifunction display interface 102b, a tone pre-selected by the user from the SOUNDGOOD library is generated through audio interface 118, indicating that the key or option has been touched on the screen. Advantageously, relying on the audio tone confirmation, as opposed to a visual confirmation, the user while driving can continually watch the road.

The user may alternatively enter the above numeral sequence using control panel 205 in a manner to be described. In any event, processor 105 then verifies at step 303 the PIN entry by comparing it with the user's pre-selected PIN. The latter is stored in memory 115, along with the user's preferences. In a standard way, the user is given a few chances to enter a correct PIN. Verification of the PIN entry identifies the user as a legitimate user. Thus, if the PIN entry is not valid, routine 300 comes to an end, as indicated at step 304.

Otherwise if the PIN entry is valid, processor 105 at step 305 causes interface 102a to display on screen 209 a "SELECT A FUNCTION" screen, which is illustrated in FIG. 4B. As shown in FIG. 4B, two options, namely, "NAVIGATION" and "QUICK TIPS", are displayed on screen 209. By default, NAVIGATION option 401 is highlighted yellow when the screen of FIG. 4B appears.

It should be pointed out that in this illustrative embodiment, a yellow highlight on an option indicates that the option is selected but not yet activated. Once a yellow highlighted option is activated, the option is highlighted blue. System 100 then performs according to the activated option.

Thus, in this instance, the user may activate the yellow highlighted NAVIGATION option by touching the option on screen 209 or by pressing ENTER switch 205b.

However, if QUICK TIPS option 403 is desired, the user may touch that option on screen 209, which would then be highlighted yellow. A second touch on the same option will change the highlight to blue, indicating the active status. As an alternative, the user may utilize knob 205d of FIG. 2 to select QUICK TIPS option 403 by first pushing the knob to the right. In response, processor 105 causes the yellow highlight to move from default NAVIGATION option 401 to QUICK TIPS option 403. The user can then select the QUICK TIPS option by pressing ENTER switch 205b. Upon selection, the yellow highlighted option will again turn blue.

Processor 105 at step 308 detects an activation of either NAVIGATION option 401 or QUICK TIPS option 403. If

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NAVIGATION option 401 is activated, processor 105 at step 311 causes system 100 to enter into a navigation mode. In this mode, processor 105 causes navigational instructions to be displayed on screen 209 in a conventional manner. In providing the navigation instructions, the standard inertial guidance system connected to navigation interface 106d receives signals from a constellation of GPS satellites maintained and controlled by the U.S. Department of Defense. In response to these signals, the inertial guidance system identifies the location (in longitude and latitude) of the automobile. The system also detects the vehicle speed, and the direction in which the vehicle is headed. By accessing the map information stored in memory 115, the system is capable of visually and verbally providing the user with directions to a given destination through AUTO DIRECTOR display interface 102a and audio interface 118, respectively.

Otherwise if activation of QUICK TIPS option 403 is detected at step 308, processor 105 causes interface 102a to display an introduction screen on screen 209, as indicated at step 314. This introduction screen is illustrated in FIG. 5.

As shown in FIG. 5, system source identification, warning and instructional information appear on the introduction screen, along with two options, "MAIN MENU" and "READ ME". The default option in this instance is READ ME option 501 which is highlighted yellow. Processor 105 detects at step 317 whether MAIN MENU option 503 or READ ME option 501 is activated. If MAIN MENU option 503 is activated, routine 300 proceeds to step 340 to be described. Otherwise if READ ME option 501 is activated, routine 300 proceeds to step 320 where processor 105 causes a series of three screens to be displayed. The first screen of the series is a "MANUFACTURER" screen, which is illustrated in FIG. 6.

As shown in FIG. 6, a description of the QUICK TIPS system appears on the MANUFACTURER screen. If the text to be displayed exceeds one screen, which is the case here, scrolling options comprising scroll-up option 605 and scroll-down option 607 are provided. When option 605 is touched and activated on screen 209, additional text scrolls up one paragraph at a time. Option 607 performs an inverse function to option 605. Again, as an alternative, the user may maneuver PUSH TO SELECT knob 205d until the desired scroll option (or direction arrow) is highlighted yellow. The activation of the highlighted option is achieved by pressing ENTER switch 205b.

By default, displayed option 609 has the "AUTO VOICE" wording thereon and is highlighted blue as the MANUFACTURER screen comes on. Accordingly, a pre-recorded voice is activated by processor 105 through audio interface 118 to read the entire text associated with this screen without interruption, including the text which is not presently shown on screen 209 but otherwise shown upon scrolling. To alter the AUTO VOICE function, the user may touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "AUTO VOICE" wording on option 609 changes to "MANUAL VOICE", which is highlighted blue, indicating its active status.

In accordance with the MANUAL VOICE function, a pre-recorded voice reads the displayed text only, and stops reading until additional text is scrolled onto the screen. To silence the voice, the user may again touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "MANUAL VOICE" wording on option 609 changes to "VOICE OFF", and the voice is deactivated, with the option now highlighted yellow. The cycle of the AUTO VOICE, MANUAL VOICE and VOICE OFF functions can be repeated by successively touching option 609 or pressing switch 205b.

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Other displayed options on the screen of FIG. 6 include PREVIOUS option 611 and NEXT option 613. As indicated at step 323, option 611 when selected causes routine 300 to return to step 314, where the introduction screen of FIG. 5 is again displayed. Otherwise, if option 613 is selected, routine 300 proceeds to step 326 in FIG. 3C where processor 105 causes a "SAFETY REMINDERS" screen to be displayed on screen 209. FIG. 7 illustrates such a screen.

As shown in FIG. 7, like the MANUFACTURER screen, the SAFETY REMINDERS screen includes option 609 displayed with the default wording "AUTO VOICE" thereon, PREVIOUS option 611, NEXT option 613, scroll-up option 605 and scroll-down option 607. This screen reminds the user of the safety features of the vehicle including, for example, air bags and seat belts. As indicated at step 329, option 611 when selected causes routine 300 to return to step 320 of FIG. 3B. Otherwise if option 613 is selected, routine 300 proceeds to step 332 where processor 105 causes a "THEFT PROTECTION FEATURES" screen to be displayed on LCD screen 209. FIG. 8 illustrates such a screen.

As shown in FIG. 8, the THEFT PROTECTION FEATURES screen similarly has thereon displayed options 605, 607, 609, 611 and 613. This screen describes to the user a theft-deterrent system including the anti-theft routine of FIG. 3A equipped in the vehicle. As indicated at step 335, option 611 when selected causes routine 300 to return to step 326. Otherwise if option 613 is selected, routine 300 proceeds to step 338 where processor 105 causes a "QUICK TIPS SET-UP" screen to be displayed on LCD screen 209. FIG. 9 illustrates such a screen.

As shown in FIG. 9, the QUICK TIPS SET-UP screen comprises two arrays of displayed options, denoted 901 and 903, respectively. Array 901 concerns the volume of the audio part of system 100. In this illustrative embodiment, the user may select the options in array 901 to respectively turn the volume off, to a "SOFT" level, to a medium level, and to a "LOUD" level. Array 903 concerns the display of LCD 119 of system 100. In this illustrative embodiment, the user may select the options in array 903 to respectively turn the display off, adjust it to a "DAY" setting, adjust it to a "NIGHT" setting, and have it automatically adjusted. When the QUICK TIPS SETUP screen comes on, by default, the volume is set to a medium level (i.e., the "MED" option in array 901 highlighted blue), and the display is set to be automatically adjusted (i.e., the "AUTO" option in array 903 highlighted blue).

Also shown in FIG. 9 is NEXT option 905. By selecting this option, routine 300 returns to step 340 of FIG. 3B where a "MAIN MENU" screen is displayed on LCD screen 209. After routine 300 is performed, the screen of FIG. 9 can be invoked at any time by pressing SETUP switch 205g to re-adjust the volume and the intensity of the LCD of system 100.

FIG. 10 illustrates the MAIN MENU screen. This screen comprises displayed options disposed in columns 1001, 1003, 1005, and 1007. For example, column 1001 includes DRIVER'S VIEW option 1001a, STEERING COLUMN CONTROLS option 1001b, LOCK option 1001c, DRIVING TIPS option 1001d, and INDEX option 1001e. It should also be noted that this screen can be invoked at any time by pressing MENU switch 205e.

When the MAIN MENU screen comes on, by default, DRIVER'S VIEW option 1001a is highlighted yellow, indicating that it is selected. However, the user may touch any other displayed option on screen 209 for re-selection. A

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further touch on the yellow highlighted option changes its color to blue and activates same. Again, the user may alternatively maneuver PUSH TO SELECT knob 205d to re-select any other displayed option, followed by a depression of ENTER switch 205b to activate the selected option. Since LCD screen 209 is compact, the display area for each option on the MAIN MENU screen is generally small. As a result, selection and activation of an option by touching the option on the screen is susceptible to errors, especially when the vehicle is in motion. Thus, in this situation it may be preferable to achieve the same result using knob 205d and switch 205b, instead.

In addition, because of the small display area allocated to each option on the MAIN MENU screen, the wording on the option is brief and thus tends to be cryptic. In accordance with a feature of the invention, after a predetermined time (e.g., a few seconds) has elapsed from the option's being highlighted yellow, processor 105 causes a voice to be generated on speakers 127 to explain the purpose of the option before the user activates it. For example, after a predetermined delay from DRIVER'S VIEW option 1001a's being highlighted yellow, a voice is activated, stating the option name, followed by an explanation of the purpose of the option such as "To provide location of dash mounted components." Thus, this inventive feature affords a preview of the option before the user commits to it, thereby avoiding unnecessary backtracking.

Continuing the example, after hearing the preview of option 1001a, the user decides to select that option. In response, processor 105 causes a "DRIVER'S VIEW" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 11. When the DRIVER'S VIEW screen appears, VOICE option 1101 is highlighted blue, indicating that voice announcements are active. To disable the voice announcements, the user may touch VOICE option 1101 on screen 209, or alternatively press ENTER switch 205b. VOICE option 1101 would be highlighted yellow when disabled.

As also shown in FIG. 11, a view of the interior of the automobile from the driver's perspective is provided. Underneath that view, DASH-MOUNTED CONTROLS option 1103, INSTRUMENT PANEL option 1105, AUDIO SYSTEM option 1107, CLIMATE CONTROLS option 1109 and PREVIOUS option 1111 are displayed. By default, DASH-MOUNTED CONTROLS option is highlighted yellow. However, the user in this example decides to select INSTRUMENT PANEL option 1105, instead. By touching option 1105 on screen 209, the option is highlighted yellow. If VOICE option is not disabled, after a predetermined delay, an announcement such as "To provide information on gauges, meters and warning lights" comes on to preview the purpose or content of option 1105. Options 1103, 1107, and 1109 are similarly programmed. In this instance, selecting PREVIOUS option 1111 enables the user to return to the MAIN MENU screen of FIG. 10.

Continuing the example, assuming that the user activates option 1105 after hearing the preview, in response processor 105 causes an "INSTRUMENT PANEL" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 12. As shown in FIG. 12, the previous screen format is generally maintained in that it provides a view of the object (the instrument panel of the automobile in this instance) pertinent to the option which has been selected, along with displayed options for further selection thereunder. Based on the disclosure heretofore, the design and operation of these screens by now are apparent to a person skilled in the art, and become self-explanatory.

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In accordance with another feature of the invention, individual elements on the instrument panel shown in FIG. 12 are labeled with numerals "1", "2", "3", "4" and "5" which correspond to option 1201a designated "1. TACHOMETER AND WARNING LIGHTS", option 1201b designated "2. TURN SIGNAL/HAZARD WARNING", option 1201c designated "3. SPEEDOMETER AND WARNING LIGHTS", option 1201e designated "4. ODOMETER & TRIP METERS/OUTSIDE TEMPERATURE", and option 1201f designated "5. FUEL/TEMP GAUGE AND WARNING LIGHTS", respectively. First, the wording of the displayed options is two-fold. Each displayed option is also for selection to obtain more information about the corresponding element(s). In addition, with the above voice preview feature, the user is further apprised of the purpose or content of the option before he/she commits to it. For example, TACHOMETER AND WARNING LIGHTS option 1201a corresponds to a voice preview such as "To provide information on tachometer, malfunction, maintenance required, low oil pressure and charging system failure indicators."

Assuming that the user in this instance activates option 1201a, in response processor 105 causes a "TACHOMETER AND WARNING LIGHTS" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 13.

FIG. 13 shows VOICE option 1301 similar to option 1101 described before, TIP option 1303, a tachometer of the automobile denoted 1305, warning lights collectively denoted 1307, and options 1309a through 1309f in display segment 1311.

When TIP option 1303 appears on screen 209, it indicates that helpful hints or reminders are available upon selection thereof. In accordance with another feature of the invention, the appearance of TIP option 1303 is accompanied by the playing of a sound segment associated therewith. This sound segment may be pre-selected by the user from the SOUNDSGOOD library. After an adaptation period, the user would be able to rely on the familiar sound segment, without looking at the screen, to alert him/her of the availability of the TIP option.

Similarly, the user may pre-select another sound segment associated with warnings. Such a sound segment should connote urgency or even emergency as such warnings include, for example, engine overheating, an extremely low fuel level caution, GPS emergency information from navigation interface 106d, etc. Under control of processor 115, audio interface 118 preempts any on-going announcement and momentarily substitute therefor any such warning as soon as it occurs, which is preceded by the associated sound segment.

In any event, if option 1303 is selected in this instance, a voice comes on and utters a tip regarding tachometer 1305 such as "To prevent engine damage, do not drive with needle in red zone." This tip is also momentarily displayed on segment 1311 in lieu of options 1309a through 1309f.

Similar to the elements on the INSTRUMENT PANEL screen, tachometer 1305 and warning lights 1307 on this screen are individually labeled and correspond to options 1309a, 1309b, 1309c, 1309e and 1309f, respectively.

Assuming in this example that MAINTENANCE REQUIRED option 1309c is activated, display segment 1411 would be replaced by new display segment 1401 illustrated in FIG. 14. As shown in FIG. 14, item 1401 indicates the subject selected, i.e., "MAINTENANCE

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REQUIRED". Item 1403 explains what the MAINTENANCE REQUIRED warning light, when on, indicates. In this instance it states, "Maintenance required warning light comes on to indicate it is time for scheduled maintenance." PREVIOUS option 1405 enables the user to reactivate segment 1311 of FIG. 13.

Assuming further that at this point the user wants to learn about and also to program the air conditioning of the automobile, the user may access a "CLIMATE CONTROL" screen by successively pressing the PREVIOUS option to backtrack to the DRIVER'S VIEW screen of FIG. 11, where CLIMATE CONTROLS option 1109 is available. As a second alternative, the user may press MENU switch 205e to invoke the MAIN MENU screen of FIG. 10, where a "CLIMATE CONTROLS" option within column 1003 is available. A third alternative is provided in the event that the user cannot immediately relate "air conditioning" to the CLIMATE CONTROLS option. At the MAIN MENU screen of FIG. 10, the user may select index option 1001e to be described. It suffices to know for now that this option allows the user to access the "CLIMATE CONTROL" screen using the term "air conditioning".

FIG. 15 illustrates the "CLIMATE CONTROL" screen. With the voice enabled, a first touch on any displayed option on screen 209 causes it to be highlighted yellow, indicating its selected status. A second touch causes it to be highlighted blue, indicating its active status. With the voice disabled, only one touch on any displayed option activates it.

As shown in FIG. 15, the MODE options include OFF option 1511, AUTO option 1513, A/C option 1515, HEAT option 1517, and SMART CLIMATE option 1519. It should be noted that only one of the MODE options can be active at a time. In this example, assuming that the voice is enabled, when OFF option 1151 is selected by a first touch, a voice explaining the option comes on, uttering "To disable climate control." A second touch on the same option would then shut the climate control off through climate control interface 108f.

When AUTO option 1153 is selected by a first touch, a voice comes on to explain the option, uttering "System automatically determines air-flow distribution and volume for optimum efficiency." A second touch on the same option enables the automatic control, followed by a voice utterance, "Set desired temperature." Temperature display 1535 then flashes with the current temperature setting, prompting the user to set a desired temperature in a manner to be described.

If the user neglects to set a temperature after a predetermined time, in accordance with another aspect of the invention, a temperature range is automatically maintained by processor 105 in response to the date and time information from clock interface 106d. Based on the date and time from navigation interface 106d, processor 105 knows what the current season (e.g., mid-winter versus mid-summer) and time of the day (e.g., night versus noon) are. Based on the GPS information, processor 105 knows the region (e.g., New England versus Southern California) where the vehicle is. Processor 105 looks up a table stored in memory 115 containing predetermined temperature ranges corresponding to different combinations of the temporal and geographic parameters. It then prescribes an appropriate temperature range according to the table. This temperature range is updated by processor 105 periodically to reflect changes in the time of the day and the geographic location of the vehicle.

Similarly, A/C option 1515 and HEAT option 1517 respectively enable the user to activate air conditioning and heaters at a desired temperature or a default temperature range.

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SMART CLIMATE option 1519 is designed to allow the user to program the climate control for the next ride before he/she leaves the vehicle. When SMART CLIMATE option 1519 is selected by a first touch, a voice comes on to explain the option, uttering "To enable pre-heating or pre-cooling of vehicle." A second touch on the option activates the function, followed by a voice utterance, "Set desired temperature. Set desired time using fan speed arrows." Temperature display 1535 then flashes the current temperature setting, prompting the user to set a desired temperature. Similarly, fan speed display 1541 then flashes the current date, followed by current time, prompting the user to set the date and time that the user plans to re-enter the vehicle. Through climate control interface 108f, processor 105 determines whether the current level of power from the car battery and any back-up power sources is sufficient. If it is insufficient, a message such as "Fail to pre-condition vehicle temperature" is issued through audio interface 118 to notify the user of the noncompliance. Otherwise, when it is close to the re-entry time, processor 105 determines the start-up time to effect the pre-conditioning, depending on the temperature difference between the inside and outside of the vehicle at that time. Processor 105 would then cause a combination of heaters and/or heat pumps (not shown) connected to interface 108f to pre-condition the vehicle temperature. In order to avoid substantially draining the power, in this illustrative embodiment, the requested temperature would be maintained up to an hour after the set re-entry time.

The Air options in FIG. 15 include FRESH option 1521 and RECIRCULATED option 1523. Only one of these two options can be active at a time. When FRESH option 1521 is selected by a first touch on the option, a voice comes on to explain the selected option, uttering "To select outside air to circulate in vehicle." A second touch on the option activates the selection to ventilate the vehicle with outside air. Similarly, RECIRCULATED option 1523 allows the user to select the inside air for recirculation in the vehicle.

The VENT options in FIG. 15 include FLOOR option 1525, FLOOR/DASH option 1527, DASH option 1529, DEFROST option 1531 and FLOOR/DEFROST option 1533. Only one of these five options can be active at a time. When FLOOR option 1525 is selected by a first touch on the option, a voice comes on explaining the option, uttering "Main air distribution to floor." A second touch on the option directs an air flow toward the vehicle floor.

Similarly, FLOOR/DASH option 1527 enables the user to bifurcate the air flow between the floor and the dashboard. DASH option 1529 enables the user to direct the air flow from the dashboard. DEFROST option 1531 enables the user to direct the air flow toward the windshield and select fresh air if not selected. FLOOR/DEFROST option 1533 enables the user to bifurcate the air flow between the floor and windshield.

Temperature display 1535 displays the temperature selected by the user. Touching on up-arrow 1537 increases the selected temperature while touching on down-arrow 1539 decreases same. Continued touching on either up-arrow 1537 or down-arrow 1539 causes the temperature setting to change rapidly.

Similarly, fan speed display 1541 displays the fan speed (high, medium or low) selected by the user. Touching on up-arrow 1543 increases the selected fan speed while touching on down-arrow 1539 decreases same.

The HEATERS options in FIG. 15 include SEAT option 1547, MIRROR option 1549, REAR WINDOW option

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1551, STEERING WHEEL option 1553, and ALL option 1554. One or more of these options can be active at the same time. When SEAT option 1547 is selected by a first touch on the option, a voice comes on to explain the option, uttering "To enable seat heaters." A second touch on the option activates the seat heaters connected to climate control interface 108f.

Similarly, MIRROR option 1549 enables the user to activate outside mirror heaters. REAR WINDOW option 1551 enables the user to activate a rear window defroster. STEERING WHEEL option 1553 enables the user to activate a steering wheel heater. Finally, ALL option 1554 enables the user to activate all of the heaters simultaneously.

In personalizing the vehicle, preference interface 116 monitors any user adjustments to certain vehicle functions by comparing their current settings with the corresponding stored preferences in memory 115. Thus, for example, if the user changes any of the settings relating to the climate control such as the mode, vent, air, temperature, fan speed, etc. from its previous preferred setting, preference interface 116 causes a SAVE screen to appear on screen 209. This SAVE screen is illustrated in FIG. 16. As shown in FIG. 16, the user is prompted to save the change in the setting that he/she has just made. The user at this point may activate SAVE option 1601 to change the previous preferred setting. The SAVE screen thereafter disappears in favor of the previous screen. otherwise, he/she may activate CLOSE option 1603 to close the SAVE screen, without storing the latest setting, which is then treated as a temporary setting. In the latter case, for example, a restart of the automobile will obliterate such a temporary setting, and reinstate the stored preferred setting.

Climate control screens can similarly be invoked by the front passenger and rear passengers on display interfaces 102c and 102d, respectively. Such screens provide similar MODE options including OFF, AUTO, A/C and HEAT options; and VENT options including LOWER VENT, UPPER VENT and LOWER/UPPER vent options. They also provide for temperature and fan speed adjustments for the respective localized areas. However, no save screen is provided.

Using INDEX option 1001e of FIG. 10 to look up information on and/or to control various items in the automobile will now be described. After option 1001e is activated, a DATA ENTRY screen illustrated in FIG. 17 is exhibited on screen 209. As shown in FIG. 17, a message "Enter Letter Or Item Name" appears to prompt the user for an entry of the name of the item of interest or its beginning letter. For this purpose, entry options for letters A through Z arranged in a grid format are provided in section 1701 for selection. In addition, DONE option 1703, when activated, indicates to system 100 that the entry is completed. Subdisplay 1705 is used to echo the user's entry to ensure its correctness.

In this illustration, the user enters "AIR CONDITIONING" as exhibited on subdisplay 1705. In response, an INDEX screen shown in FIG. 18 appears on display screen 209, with the search item name "AIR CONDITIONING" highlighted yellow. It should be noted that other item names such as "Anti-lock Brake System Indicator" are also shown, and they are in alphabetical order following "AIR CONDITIONING". This stems from the design of system 100 whereby the user may conveniently enter the beginning letter of the search item name only. In that case, a list of item names in alphabetical order with the first item name having the same beginning letter highlighted yellow. For instance,

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if the user had only entered "A" for "AIR CONDITIONING", a list of item names starting with "A" in alphabetical order would appear on screen 209 (although in this instance it would be the same list as shown in FIG. 18 as "AIR CONDITIONING" is the first item with a letter "A" in system 100). If the user cannot locate the name of the item of interest in the list, he/she may scroll the screen using scroll-up option 1801 or scroll-down option 1803 to review additional item names after or before the listed item names. Alternatively, the user may select PREVIOUS option 1805 to return to the screen of FIG. 17 to enter the complete item name.

In any event, after the user locates the item name on the INDEX screen, the user may then touch the item name to access information on that item. To that end, a look-up table is stored in memory 115. FIG. 19 illustrates such a look-up table, wherein left column 1901 lists each item name in alphabetical order in the index, and right column 1903 lists the corresponding instruction for processor 105 to carry out to access information on that item. For example, according to row 1905 of the table, the selection and activation of the item name "AIR CONDITIONING" causes processor 105 to connect the user to the CLIMATE CONTROL screen of FIG. 15 previously described.

The foregoing merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise numerous other systems which embody the principles of the invention and are thus within its spirit and scope.

For example, based on the disclosure heretofore, it is apparent that through system 100, the user can run diagnostics on selected parts of the automobile by voice command or touch-screen control.

In addition, in the disclosed embodiment, through system 100, the user is able to program the climate control for the next ride before he/she leaves the vehicle. It will be appreciated that the user will be able to achieve same remotely ahead of time via telecommunication means. For example, processor 105 may be programmed to accept climate control commands through phone interface 106a. In that instance, the user can call from anywhere to establish a phone connection with phone interface 106a using a predetermined phone number, through which the user communicates the commands to climate control interface 108f to program the climate control. Through the phone connection, the user may be provided with climate control options described above in a synthesized voice. The user may activate one or more of such options by pressing a predetermined touch-tone key on the telephone keypad corresponding to a "yes" or "no" response. Similarly, the user may achieve the relevant temperature and/or time settings by pressing the touch-tone keys corresponding to the numerals indicative thereof. Of course, telecommunication means other than the telephone including a radio frequency (RF) transmitter may also be used to communicate the climate control commands from a remote area.

In addition, in the disclosed embodiment, the user may access different screens provided by AUTO DIRECTOR display interface 102a to learn about and control certain vehicle functions. It will be appreciated that a person skilled in the art will develop a demonstration program wherein a series of such screens will be automatically presented to a user in a predetermined sequence. The presentation may include commentaries, and highlights on selected options displayed on each screen. Furthermore, the presentation may be coupled with the showing of actual vehicle functions. For

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example, in demonstrating the climate control screen of FIG. 15, while the function of a highlighted VENT option (e.g., Floor, Floor/Dash, Dash, Defrost or Floor/Defrost) is explained, it is activated so that the user in the automobile can feel an actual air flow from the corresponding direction. The above demonstration program may be invoked using a PIN provided by the automobile manufacturer. The program may run continually while the automobile is shown in a showroom, or may be invoked by the user occasionally to obtain relevant information.

Further, in the disclosed embodiment, the MAINTENANCE REQUIRED warning light comes on when it is time for scheduled maintenance. In accordance with another aspect of the invention, the maintenance is scheduled by system 100 according to the cumulative time of the tachometer reading above a predetermined RPM value. Such cumulative time reflects the extent of the engine wear, and if it exceeds a predetermined length of time without maintenance, the engine performance would degrade substantially. In measuring the cumulative time in question, a conventional comparator (not shown) is employed in system 100 to compare the instantaneous tachometer reading (provided by engine control interface 112c) with the predetermined RPM value. Each time when the tachometer reading exceeds the predetermined value, processor 105 is interrupted to register the length of such an occurrence. The latter is added to a running sum to update the cumulative time in question. This cumulative time may be displayed on instrument panel display interface 102e, along with the tachometer reading and the MAINTENANCE REQUIRED warning indicator. A second conventional comparator (not shown) is employed in system 100 to compare the cumulative time with the above predetermined time length. As soon as the cumulative time exceeds the predetermined length, processor 105 is interrupted and causes the MAINTENANCE REQUIRED warning light to come on, indicating that it is time for maintenance.

Still further, system 100 as described is highly adaptable in adjusting to new system requirements, and capable of "learning" new automobile features to be introduced into the system. Such learning may involve a modification or an upgrade in the system software stored in memory 115.

Moreover, other features of system 100 may include capabilities of communications with a third party remote from the vehicle. For example, system 100 may be programmed to transmit signals representing data on the current speed of the vehicle and its VIN receivable by a radar system, thus enabling the third party to monitor its speed. Furthermore, system 100 may be programmed by the third party to disable and subsequently enable the vehicle upon successful verification of a PIN pre-assigned to the third party. To that end, system 100 is capable of receiving remote transmission of the PIN, followed by the disable or enable code. The transmission may be encrypted for security reasons. Furthermore, more than one PIN may be used for different purposes. For example, a PIN may be assigned to a law enforcement agency to disable the vehicle because of a suspension of a license, or to temporarily disable the vehicle when the driver is intoxicated. Another PIN may be assigned to an environmental protection agency to disable the vehicle for failing to meet the emission requirements. Yet another PIN may be assigned to the vehicle owner to disable the vehicle when parked, thereby reducing the risk of a car theft. The disabling of the vehicle involves cutting off its gas, putting on its anti-lock brakes, etc.

Further, system 100 is capable of receiving a low-frequency, low-power broadcast covering an area of a lim-

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ited radius, referred to as a "Cell". The broadcast may provide electronic GPS map and Yellow Page type information pertaining to the cell. This information, when received, may be downloaded onto AUTO DIRECTOR display interface 102a or multifunction display interface 102b. Such information includes a local directory indicating locations of nearby gas stations, restaurants and other facilities on the GPS map, with respect to the current location of the automobile. The local directory may be formatted in the form of "web pages" featuring the local businesses, and include additional information such as business hours, telephone numbers, and information on products and services provided by such businesses.

The above broadcast may also provide local weather information sponsored by a civic group or commercial entity. In the case of civic group sponsorship, the local civic events may be posted alongside the weather information, and in the case of commercial sponsorship, advertisements may be posted instead. Of course, as the automobile moves from cell to cell, the contents of the broadcast change accordingly.

In addition, while the radio in the automobile is tuned to a particular radio station, system 100 is also capable of receiving any electronic files broadcast from that radio station, along with the radio program. These electronic files, which may be in the form of web pages, can be downloaded onto the system. The system user may then scroll the pages to learn such information as program listings and coming events sponsored by the radio station.

Moreover, in the disclosed embodiment, system 100 is illustratively used in an automobile. It will be appreciated that a person skilled in the art may also employ the inventive system in another type of vehicle such as a boat, an airplane, etc.

Finally, although information and control system 100, as disclosed, is embodied in the form of various discrete functional blocks, the system could equally well be embodied in an arrangement in which the functions of any one or more of those blocks or indeed, all of the functions thereof, are realized, for example, by one or more appropriately programmed processors or devices.

We claim:

1. A system for use in a vehicle, the system being responsive to a notable condition and comprising:

a display element;

an output subsystem for providing information concerning at least one device in the vehicle;

a processor responsive to the notable condition for interrupting a provision of the information concerning the at least one device with a provision of information concerning the notable condition, an option for selection being provided on the display element in response to the notable condition, thereby prompting a user to select the option; and

an interface for receiving a selection of the option, selected information for coping with the notable condition being provided in response to the selection of the option.

2. The system claim 1 wherein the at least one device includes a fuel gauge.

3. The system of claim 1 wherein the at least one device includes a speedometer.

4. The system of claim 1 wherein the at least one device includes an odometer.

5. The system of claim 1 wherein the at least one device includes a tachometer.

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6. The system of claim 1 wherein the at least one device includes a temperature gauge.

7. The system of claim 1 wherein the at least one device includes a climate control.

8. The system of claim 1 wherein the notable condition concerns engine overheating in the vehicle.

9. The system of claim 1 wherein the notable condition concerns a low fuel level in the vehicle.

10. The system of claim 1 wherein the selected information is provided via voice media.

11. The system of claim 1 wherein the selected information is provided textually.

12. A method for use in a system in a vehicle, the system being responsive to a notable condition, the system including a display element, the method comprising:

providing information concerning at least one device in the vehicle;

in response to the notable condition, interrupting a provision of the information concerning the at least one device with a provision of information concerning the notable condition, and providing an option for selection on the display element, thereby prompting a user to select the option;

receiving a selection of the option; and

in response to the selection of the option, providing selected information for coping with the notable condition.

13. The method claim 12 wherein the at least one device includes a fuel gauge.

14. The method of claim 12 wherein the at least one device includes a speedometer.

15. The method of claim 12 wherein the at least one device includes an odometer.

16. The method of claim 12 wherein the at least one device includes a tachometer.

17. The method of claim 12 wherein the at least one device includes a temperature gauge.

18. The method of claim 12 wherein the at least one device includes a climate control.

19. The method of claim 12 wherein the notable condition concerns engine overheating in the vehicle.

20. The method of claim 12 wherein the notable condition concerns a low fuel level in the vehicle.

21. The method of claim 12 wherein the selected information is provided via voice media.

22. The method of claim 12 wherein the selected information is provided textually.

23. Software including machine readable instructions stored in a tangible medium for performing a process, the process comprising:

providing information concerning at least one device in the vehicle;

in response to a notable condition, interrupting a provision of the information concerning the at least one device with a provision of information concerning the notable condition, and providing an option for selection on a display element, thereby prompting a user to select the option;

receiving a selection of the option; and

in response to the selection of the option, providing selected information for coping with the notable condition.

* * * * *



US006529824B1

(12) **United States Patent**
Obradovich et al.

(10) Patent No.: **US 6,529,824 B1**
(45) Date of Patent: ***Mar. 4, 2003**

(54) **PERSONAL COMMUNICATION SYSTEM
FOR COMMUNICATING VOICE DATA
POSITIONING INFORMATION**

(75) Inventors: **Michael L. Obradovich, San Clemente;
John Dinkel, Irvine; Michael Kent,
Garden Grove, all of CA (US)**

(73) Assignee: **American Calcar, Inc., Wilmington,
DE (US)**

(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/669,527**

(22) Filed: **Sep. 25, 2000**

Related U.S. Application Data

(62) Division of application No. 08/879,955, filed on Jun. 20, 1997, now Pat. No. 6,148,261.

(51) Int. Cl.⁷ **G06F 7/00**

(52) U.S. Cl. **701/208; 340/995; 342/357.1;
342/457; 455/456; 455/461**

(58) Field of Search **701/207, 208,
701/209, 213, 300; 340/944, 945, 961,
971, 979, 988, 989, 990, 995, 286.01, 286.06;
342/352, 357.1, 457; 455/433, 437, 438,
439, 440, 459, 461, 456, 457**

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Primary Examiner—William A. Cuchlinski, Jr.

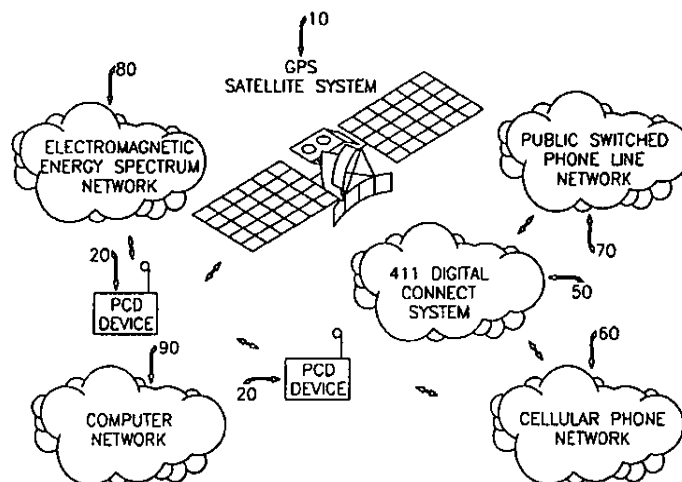
Assistant Examiner—Ed Pipala

(74) *Attorney, Agent, or Firm*—Christie, Parker & Hale, LLP

(57) **ABSTRACT**

A location tagged data provision and display system. A personal communication device (PCD) with electromagnetic communication capability has a GPS receiver and a display. The PCD requests maps and location tagged data from data providers and other for display on the PCD. The data providers respond to requests by using searching and sorting schemes to interrogate data bases and then automatically transmitting data responsive to the requests to the requesting PCD.

15 Claims, 31 Drawing Sheets



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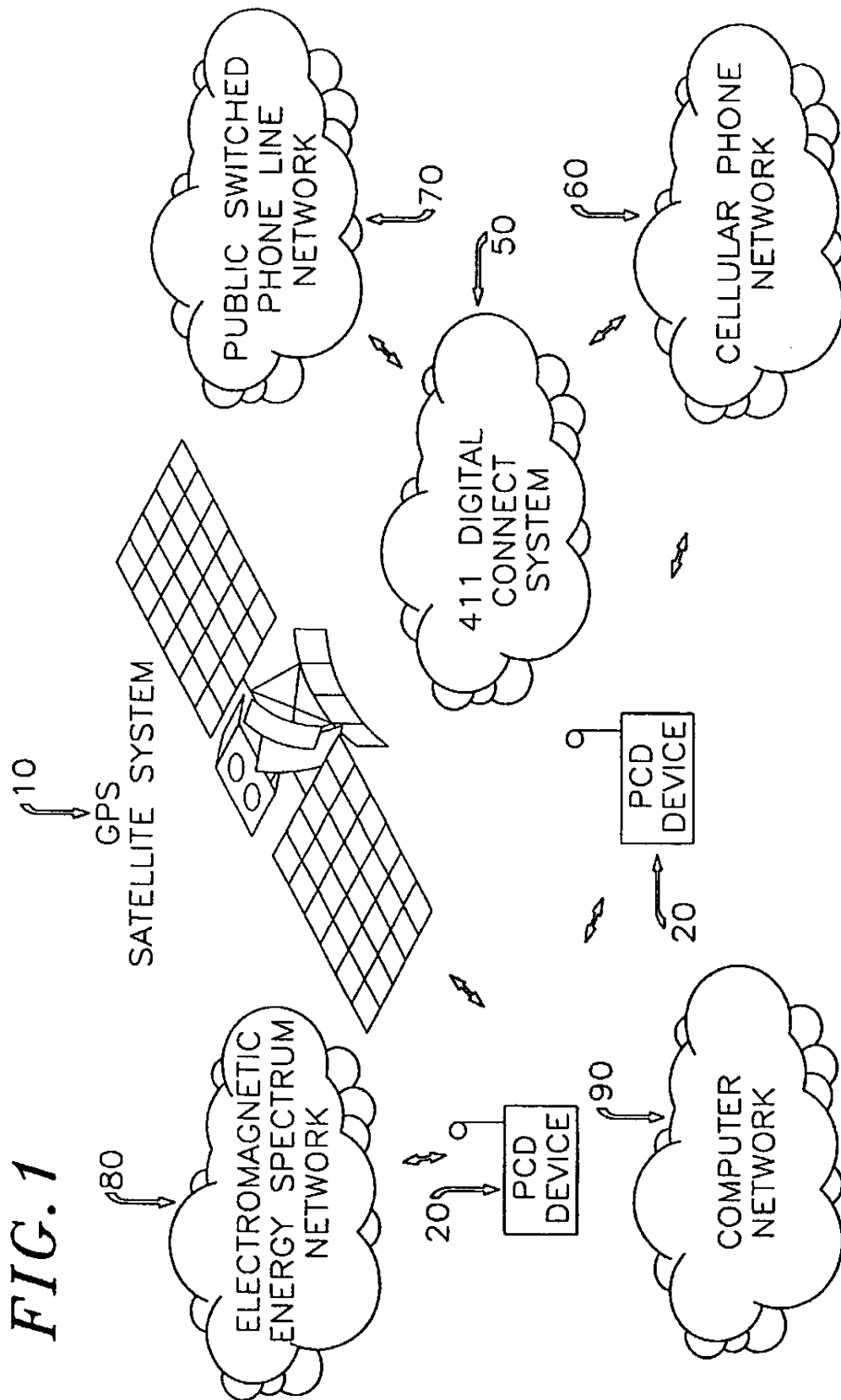
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FIG. 2

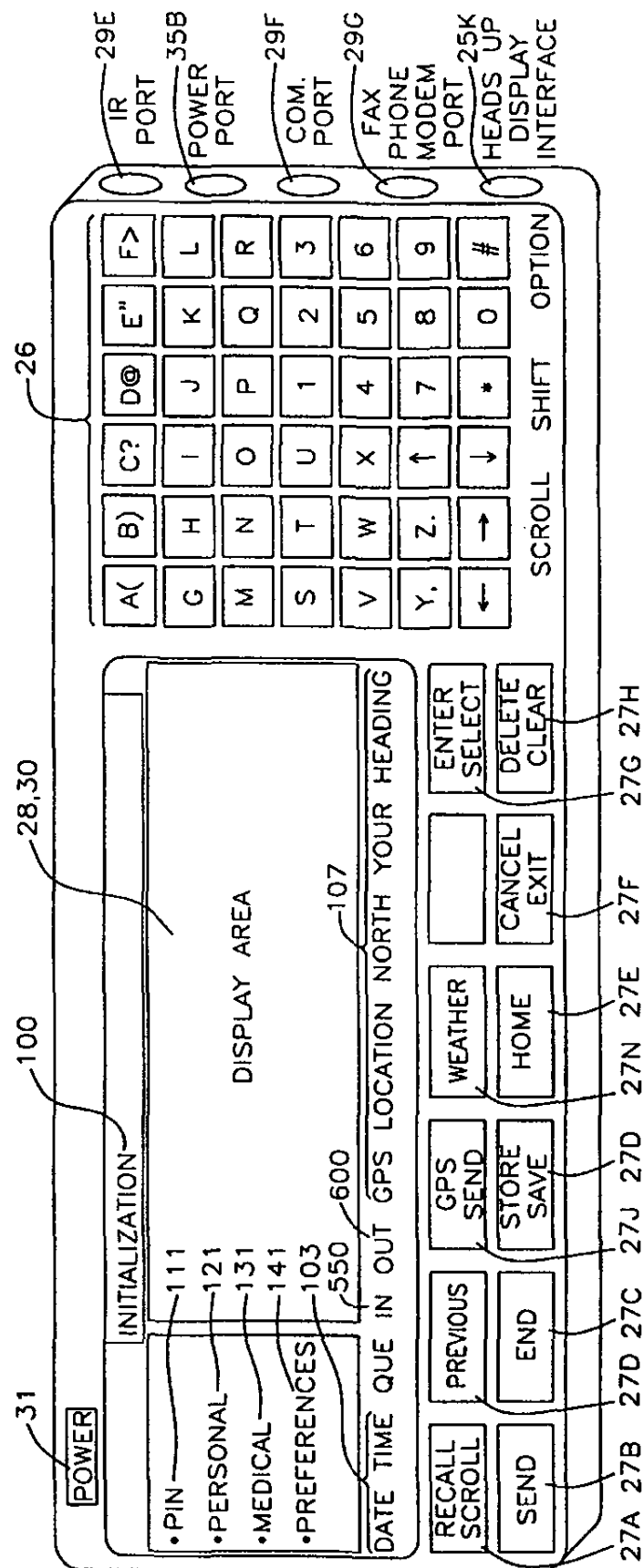
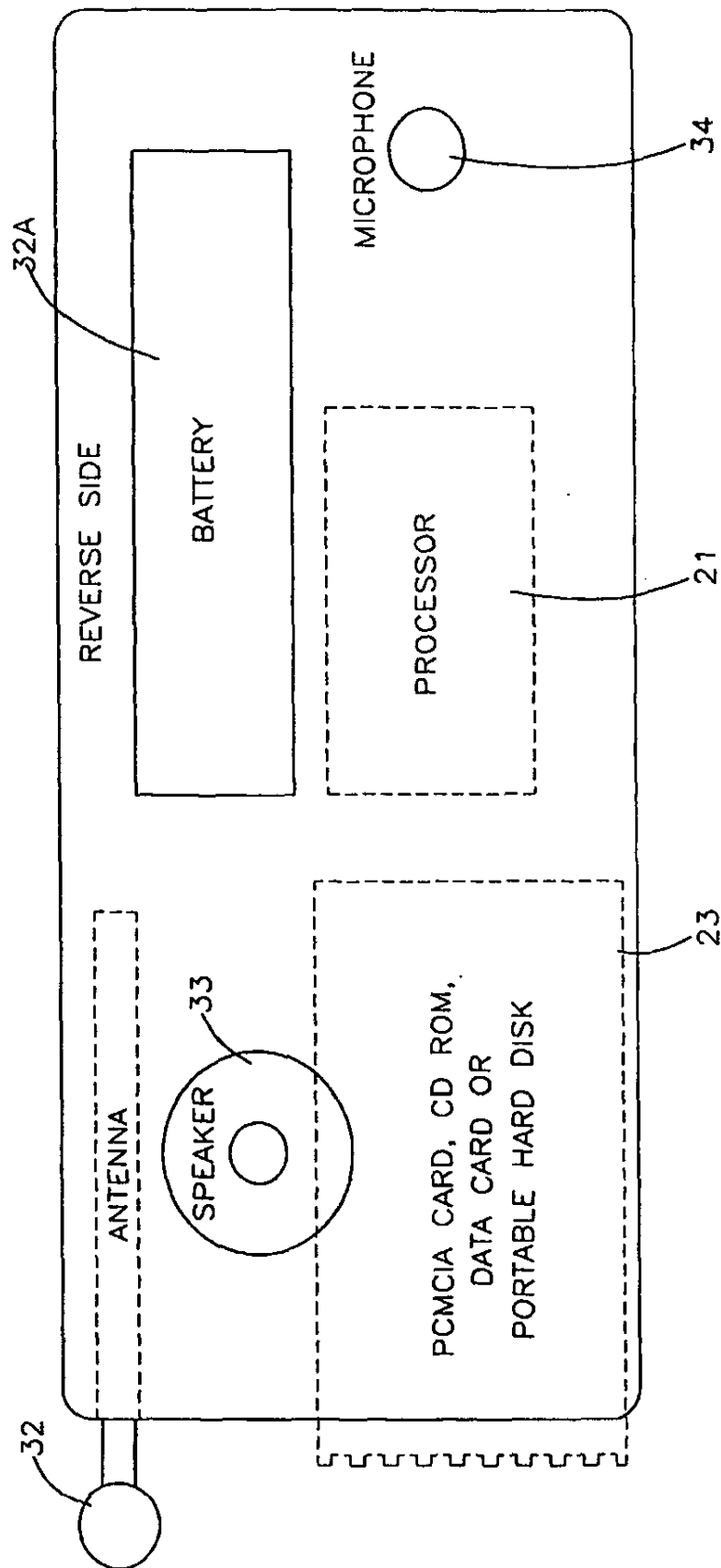


FIG. 3



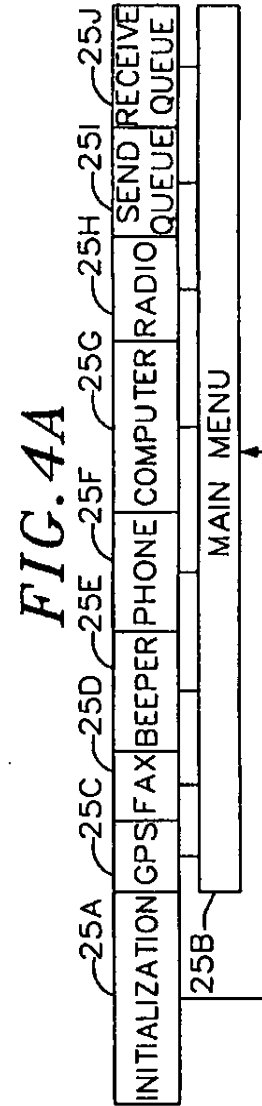
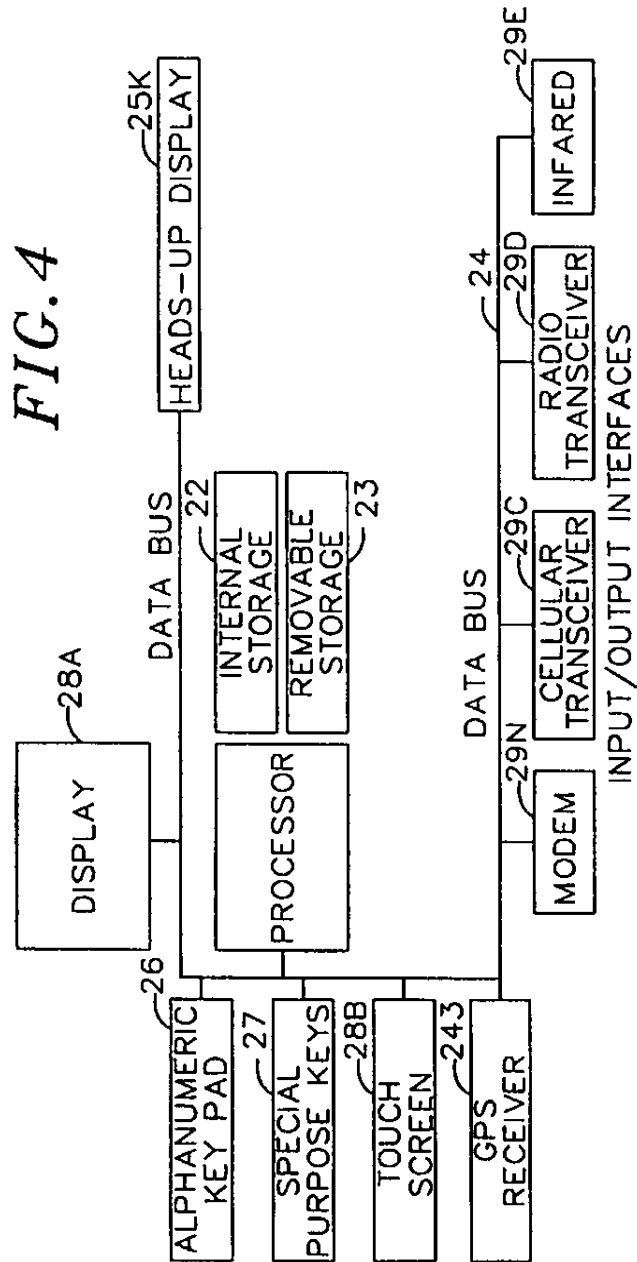
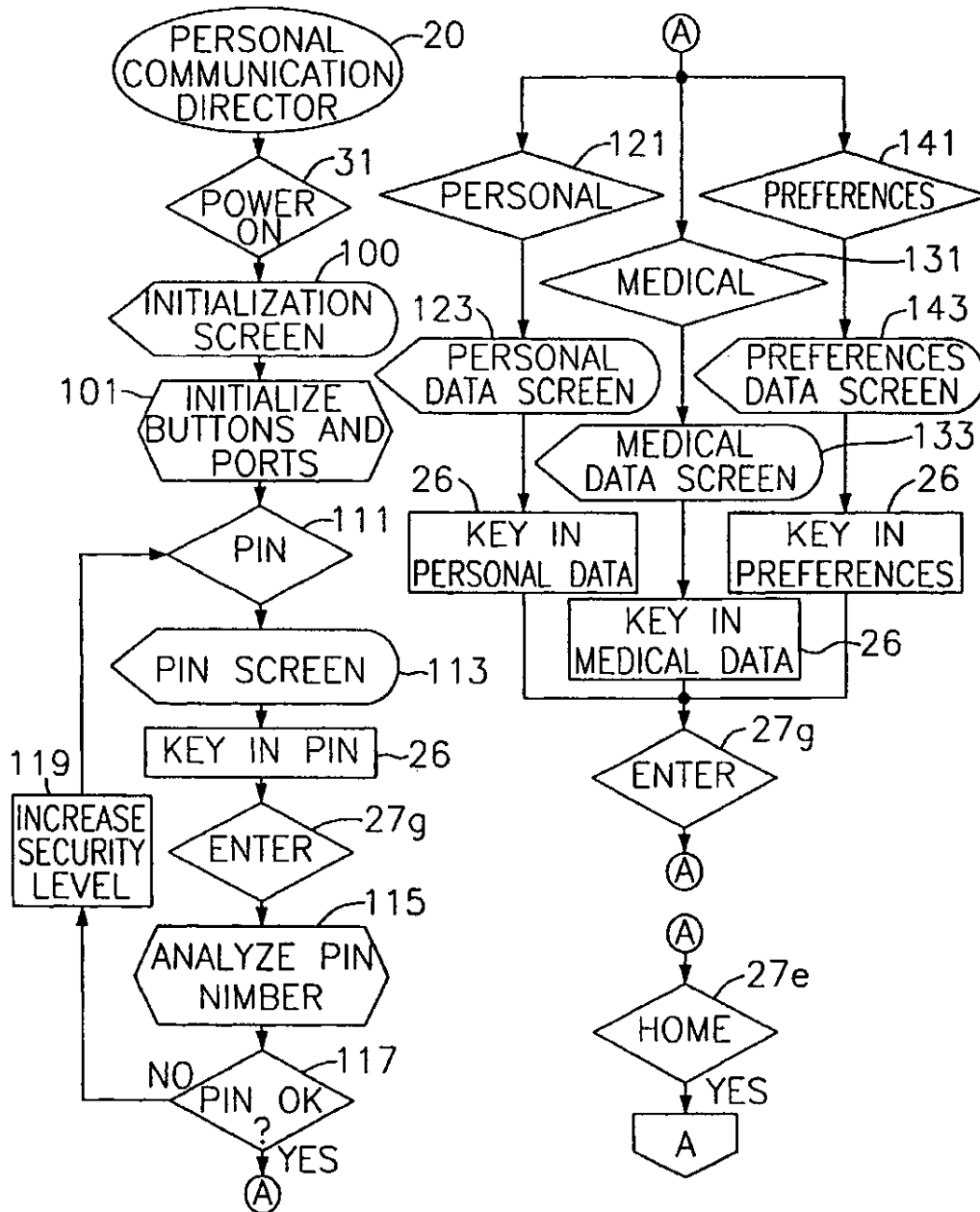
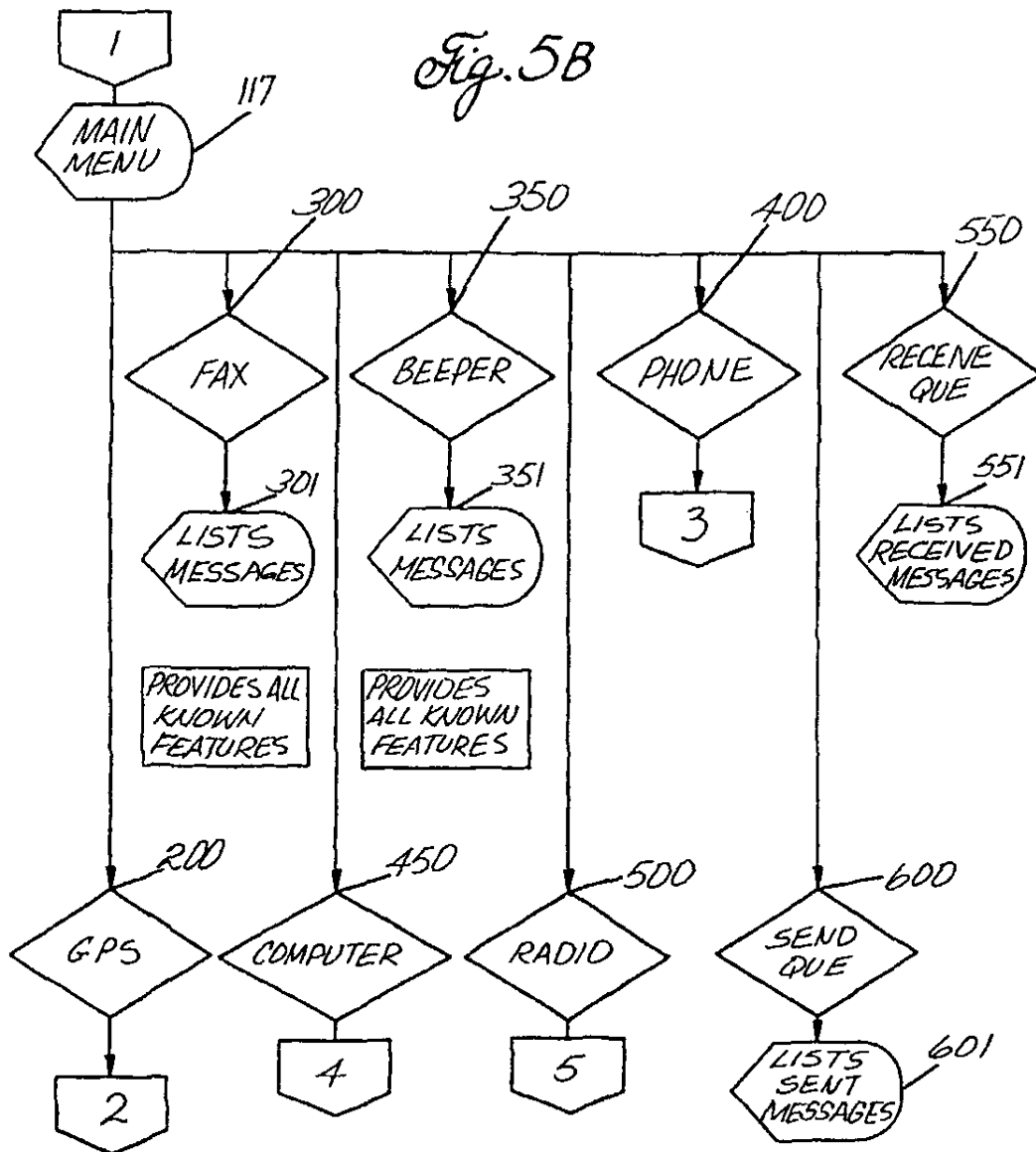
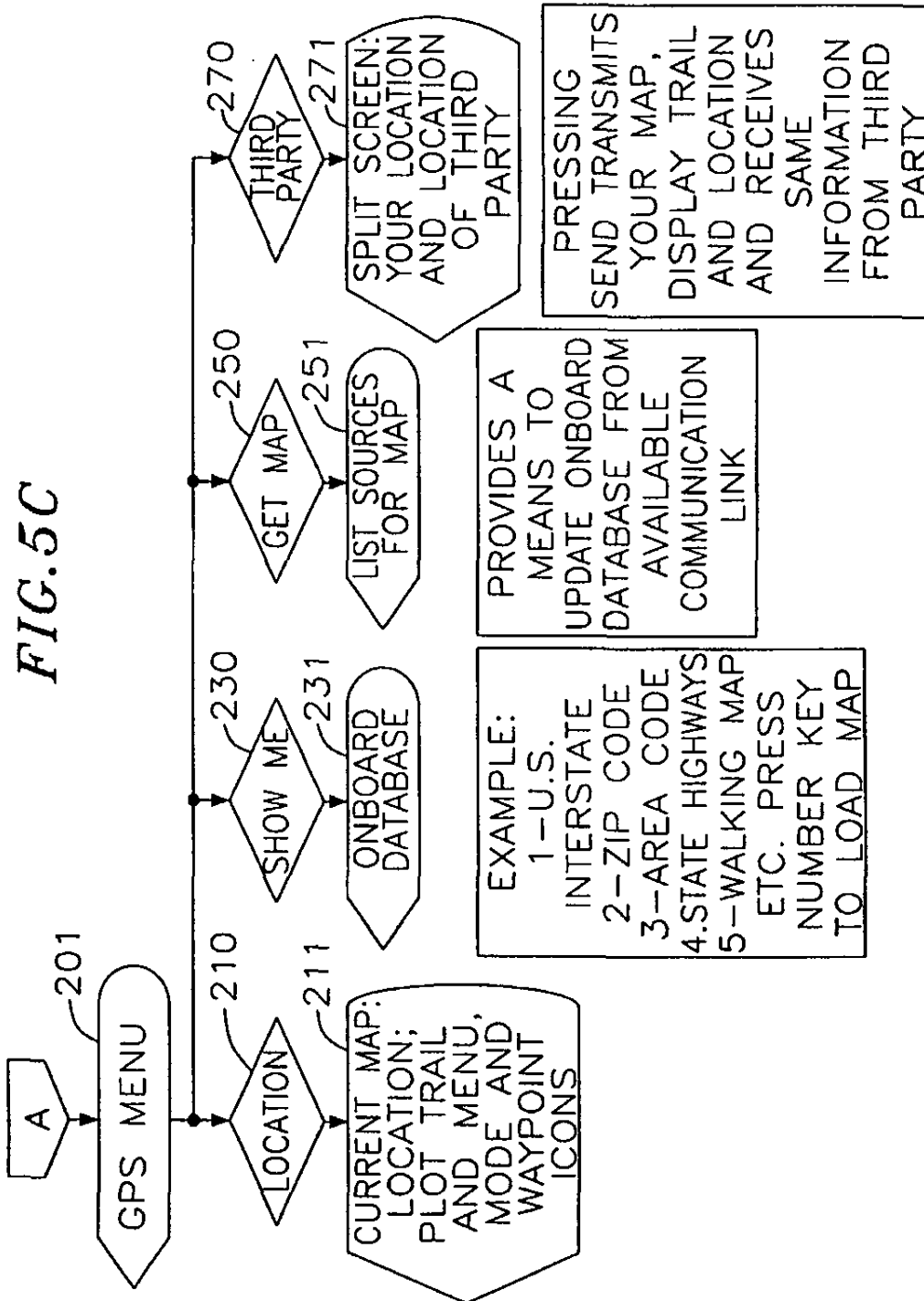


FIG. 5A







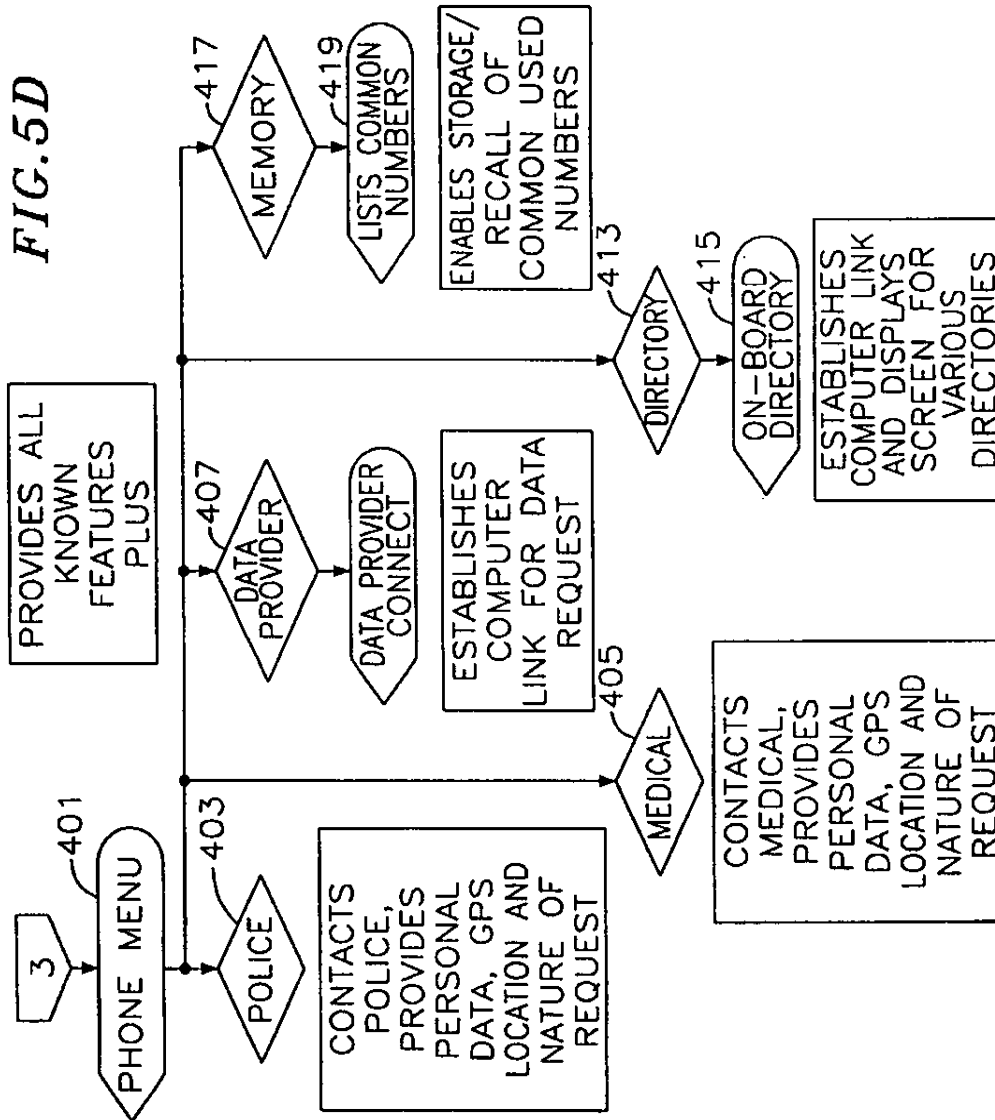


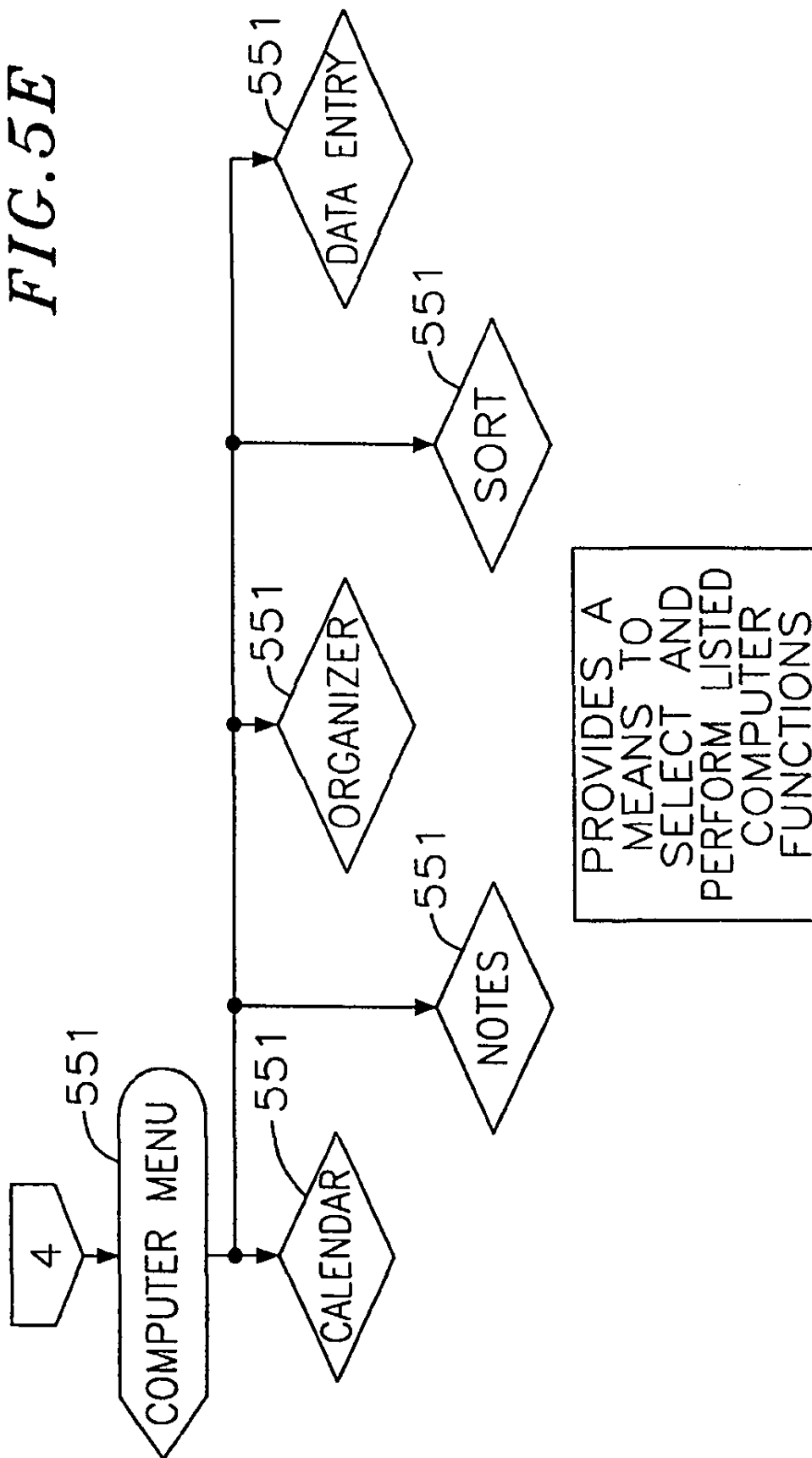
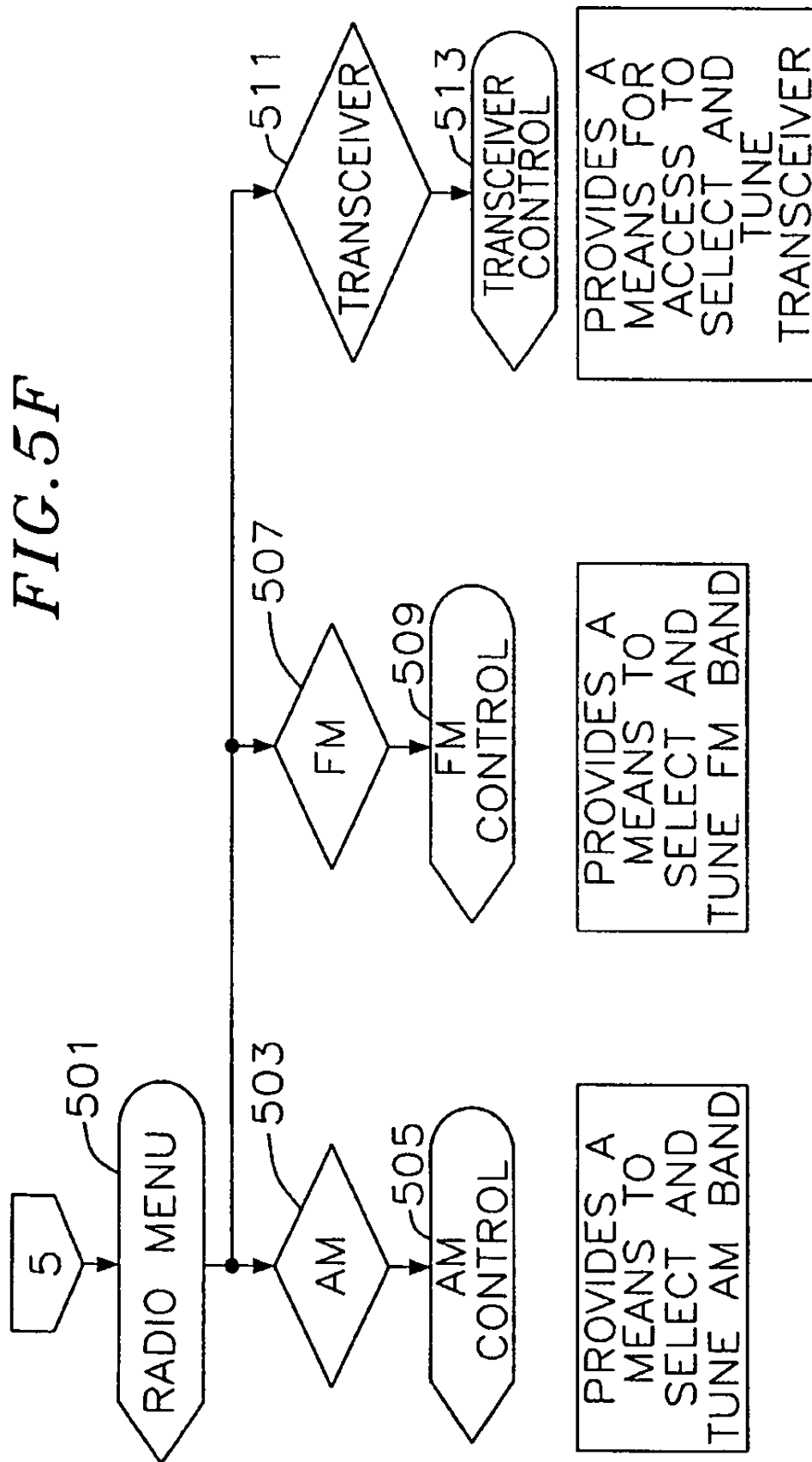
FIG. 5E

FIG. 5F

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FIG. 6

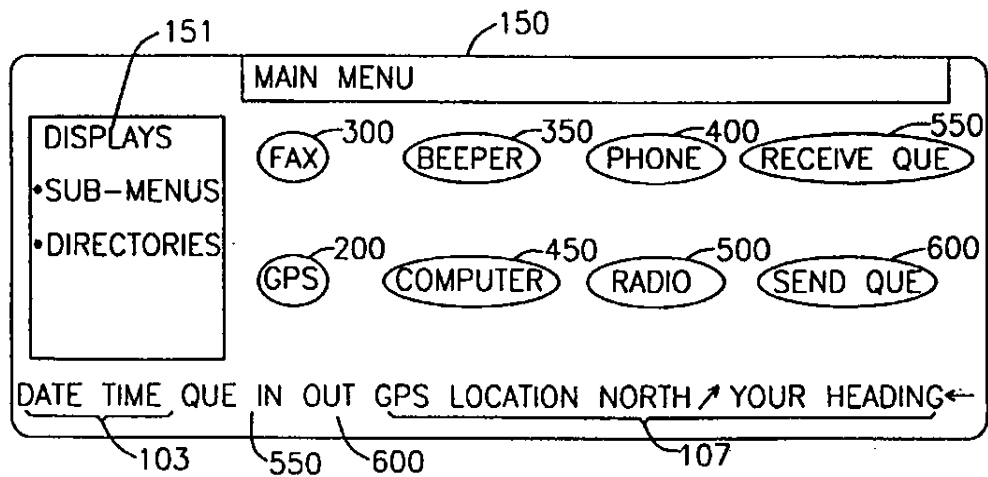
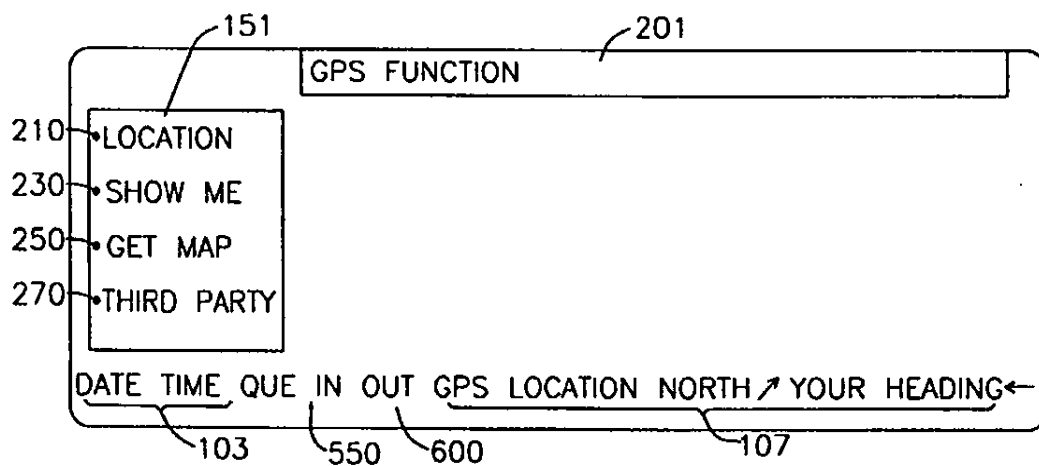


FIG. 7



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FIG. 8

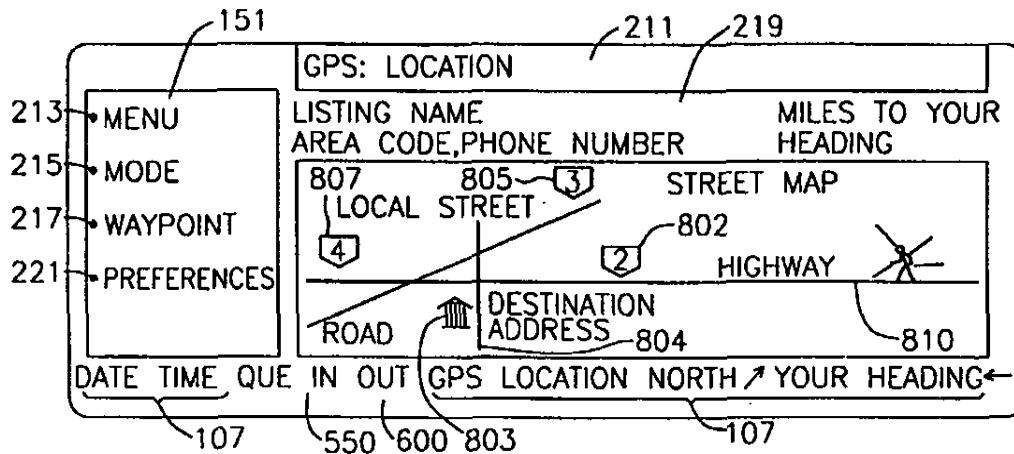
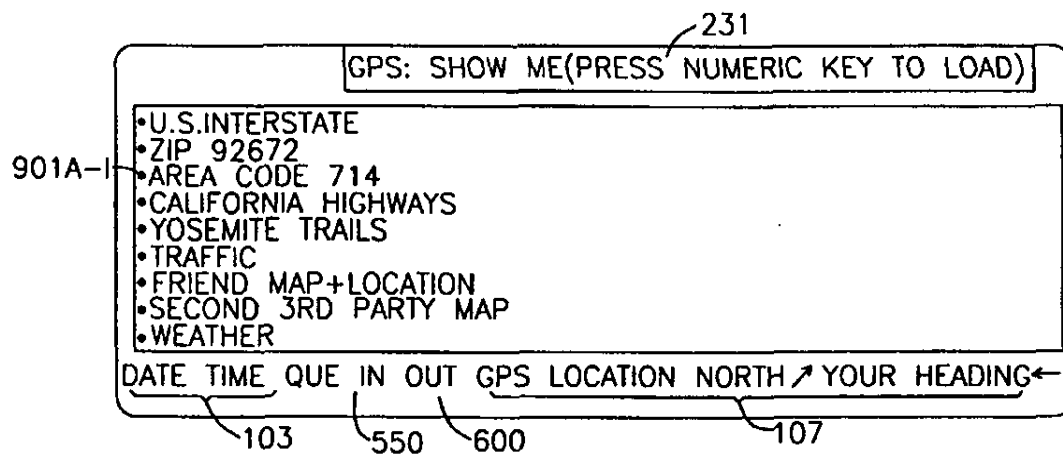


FIG. 9



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FIG. 10

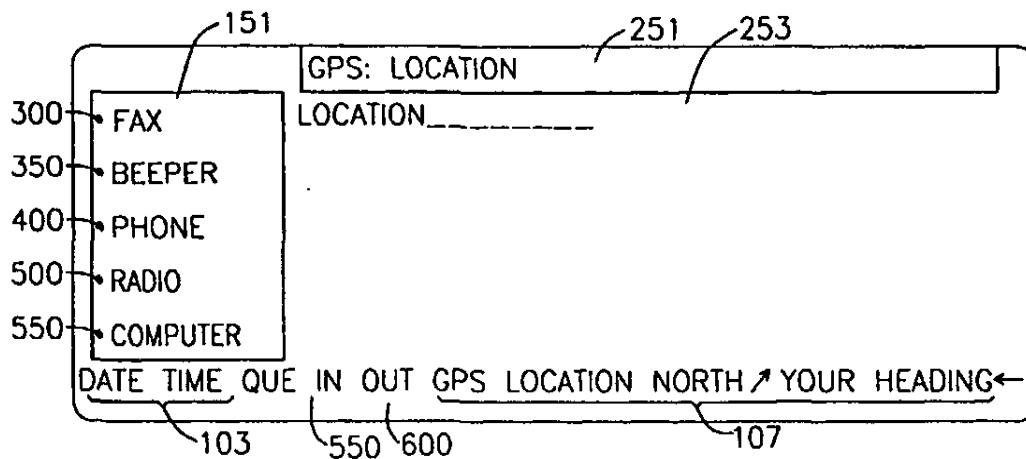
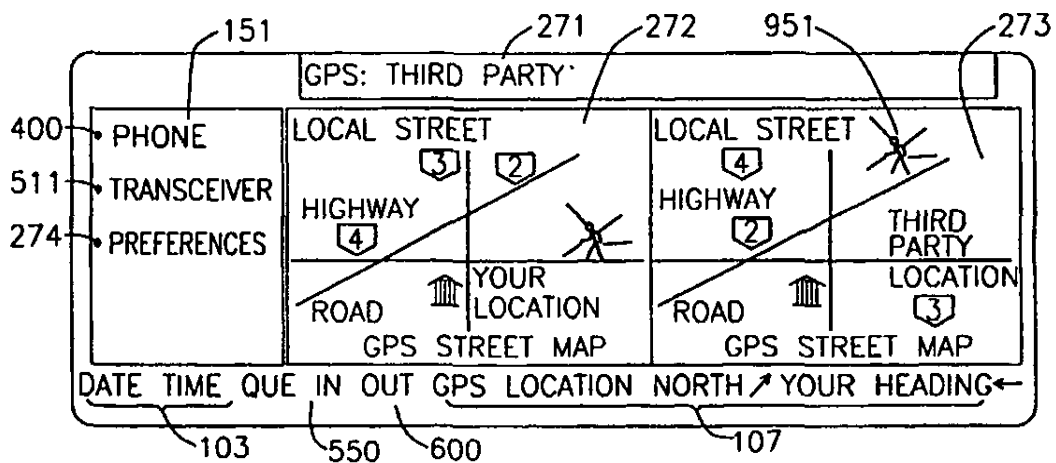


FIG. 11



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FIG. 12

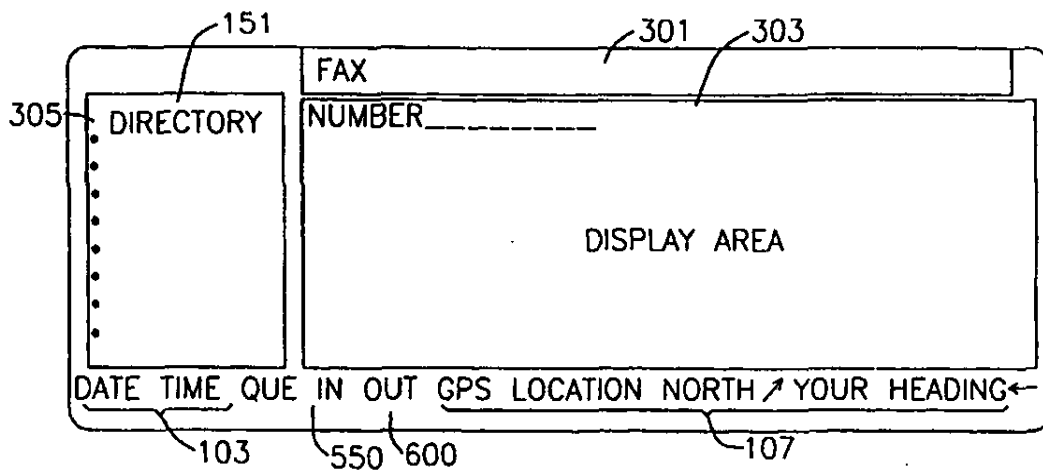
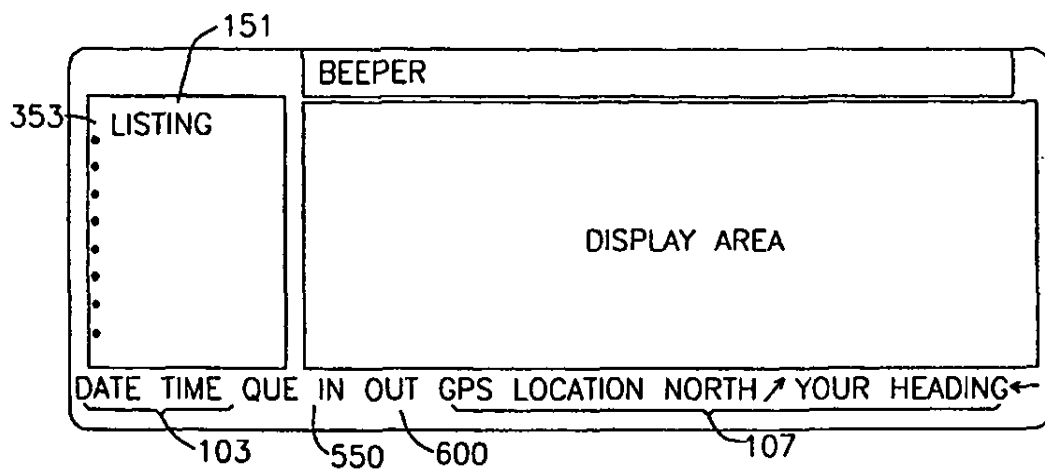


FIG. 13



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FIG. 14

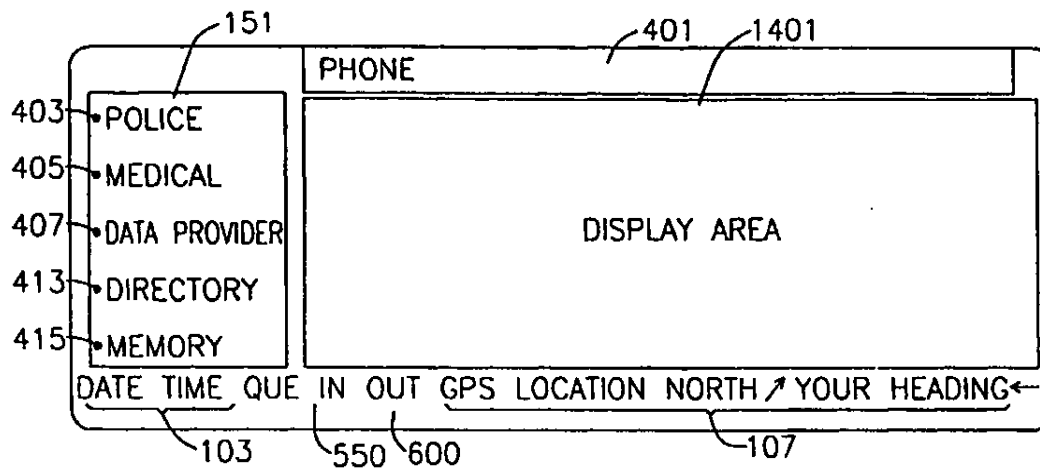
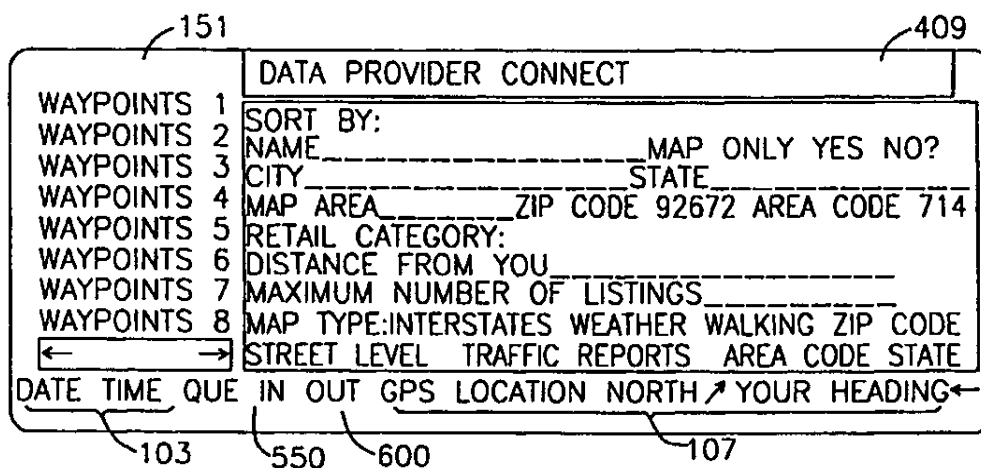


FIG. 15



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FIG. 16

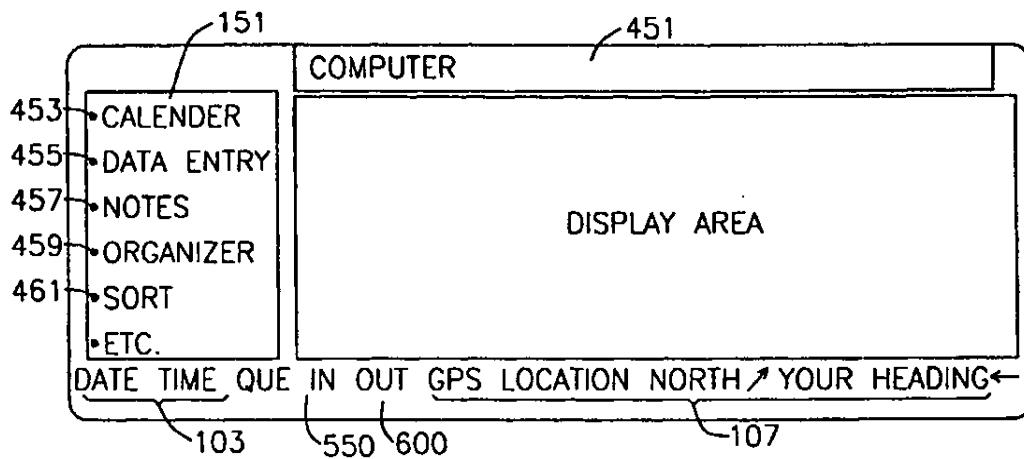
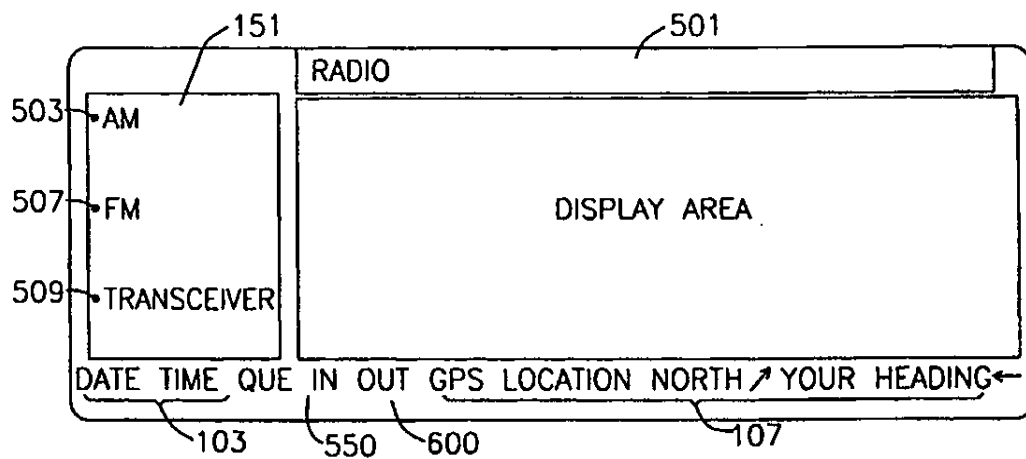


FIG. 17



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FIG. 18

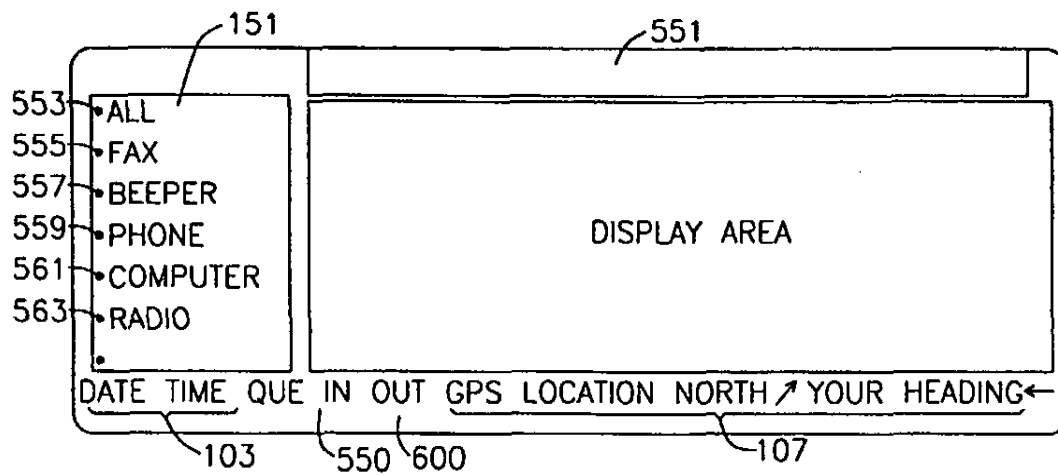
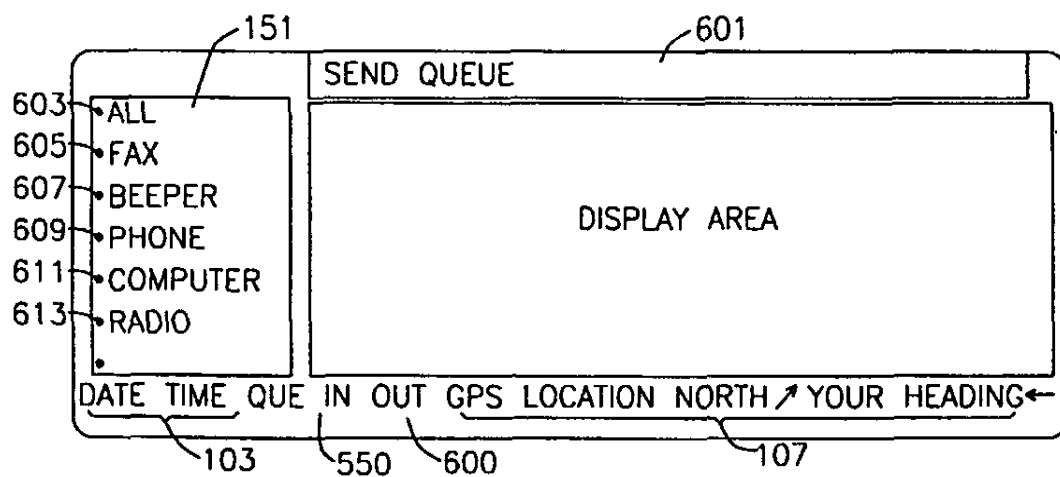


FIG. 19



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FIG. 20

LISTING / NAME / WAYPOINT	ADDRESS	CITY	STATE	PHONE NO	GPS LOCATION NORTH	GPS WEST	WAYPOINT
ALEX'S GERMAN-AMERICAN RESTAURANT	2801 S. EL CAMINO REAL	SAN CLEMENTE	CA	714-492-8986	33°24.60	117°36.25	1
ANTOINE'S CAFE	218 S. EL CAMINO REAL	SAN CLEMENTE	CA	714-492-1763	33°25.40	117°37.38	2
BAKERS'S SQUARE RESTAURANT & PIES	610 CAMINO DE LOS MARES	SAN CLEMENTE	CA	714-661-3100	33°27.80	117°39.60	3
BEACH GARDEN CAFE	618 1/2 AVENIDA VICTORIA	SAN CLEMENTE	CA	714-498-8145	33°25.35	117°37.36	4
BOOTLEGGERS GRILL & SPEAKEASY	111 AVE. PALIZADA	SAN CLEMENTE	CA	714-361-8658	33°25.65	117°37.85	5
BURBON STREET SANDWICHERY	430 N. EL CAMINO REAL	SAN CLEMENTE	CA	714-492-7827	33°25.58	117°37.76	6
BURGER STOP	524 AVENIDA PICO	SAN CLEMENTE	CA	714-492-2350	33°25.92	117°37.12	7
BURRITO BASKET, THE	2017 S. EL CAMINO REAL	SAN CLEMENTE	CA	714-498-5002	33°25.10	117°36.34	8
CAFE CALYPSO	114 AVENIDA DEL MAR	SAN CLEMENTE	CA	714-366-9346	33°25.42	117°37.42	9
CAFE EXPRESSO	641 CAMINO DE LOS MARES	SAN CLEMENTE	CA	714-240-3467	33°25.81	117°37.31	10
CAPTAIN CULVER COUNTERCULTURE NATURAL FOODS	149 AVENIDA DEL MAR	SAN CLEMENTE	CA	714-498-8098	33°25.39	117°37.40	11
CARL'S JR. RESTAURANT	638 CAMINO DE LOS MARES	SAN CLEMENTE	CA	714-493-0189	33°27.65	117°39.45	12
CARL'S JR. RESTAURANT	3929 S. EL CAMINO REAL	SAN CLEMENTE	CA	714-498-5641	33°24.50	117°35.95	13
CARROWS RESTAURANT	620 AVENIDA PICO	SAN CLEMENTE	CA	714-492-4290	33°25.85	117°37.10	14
CHINA BEACH CANTEEN	2369 S. EL CAMINO REAL	SAN CLEMENTE	CA	714-492-6228	33°27.80	117°37.15	15
CHINA WELL RESTAURANT	620 CAMINO DE LOS MARES	SAN CLEMENTE	CA	714-661-6813	33°27.61	117°39.42	16
COCO'S FAMILY RESTAURANT	2350 S. EL CAMINO REAL	SAN CLEMENTE	CA	714-498-1542	33°24.90	117°36.18	17
CORKY'S CAFE	2727 VIA CASCADITA	SAN CLEMENTE	CA	714-492-1135	33°25.10	117°37.48	18
COURTSIDE RESTAURANT	111 AVE. VISTA MONTANA	SAN CLEMENTE	CA	714-361-2211	33°25.10	117°36.10	19
DAVE'S MEXICAN RESTAURANT	1701 N. EL CAMINO REAL	SAN CLEMENTE	CA	714-492-7867	33°25.50	117°38.90	20
DEL TACO	109 CALLE DE INDUSTRIAS	SAN CLEMENTE	CA	714-492-5311	33°25.51	117°36.50	21
DENNY'S RESTAURANT	529 AVENIDA PICO	SAN CLEMENTE	CA	714-492-2382	33°25.48	117°36.15	22
DOMINOES PIZZA	1502 N. EL CAMINO REAL	SAN CLEMENTE	CA	714-498-9002	33°25.25	117°37.50	23
EASTERN WINDS	201 N. EL CAMINO REAL	SAN CLEMENTE	CA	714-492-3008	33°25.01	117°37.05	24
EL CAMINO TACOS	420 S. EL CAMINO REAL	SAN CLEMENTE	CA	714-366-8358	33°25.10	117°37.25	25
EL JEFE CAFE	106 E. ESCALONES	SAN CLEMENTE	CA	714-492-4010	33°25.25	117°37.03	26
EL MIRADOR	301 N. EL CAMINO REAL	SAN CLEMENTE	CA	714-366-0855	33°25.08	117°37.10	27

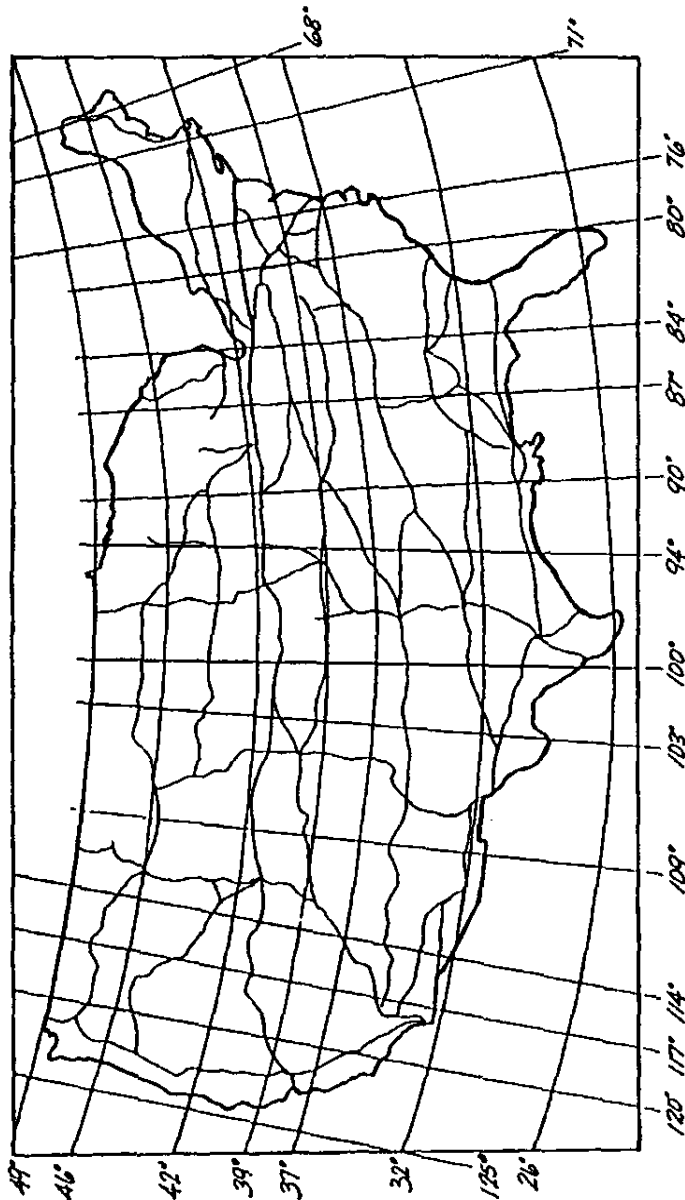


Fig. 21

- LONGITUDE AND LATITUDE COORDINATES.
- AREA CODE BOUNDARIES.
- ZIP CODE BOUNDARIES.
- NATIONAL PARK BOUNDARIES.
- METRO TRAFFIC ZONES.
- INTERSTATE BOUNDARIES.
- U.S. HIGHWAY BOUNDARIES.
- STATE ROUTE BOUNDARIES.
- CITY, COUNTY, STATE, PROVINCE BOUNDARIES.
- POLITICAL BOUNDARIES.
- ECONOMIC, RETAIL, BUSINESS IDUE BOUNDARIES.

GPS ENCODED EMBODIMENTS ARE NOT LIMITED TO THE ABOVE EXAMPLES AND MAY INCLUDE MANY OTHER SYSTEMS USING VARIOUS RECORDING TECHNIQUES.

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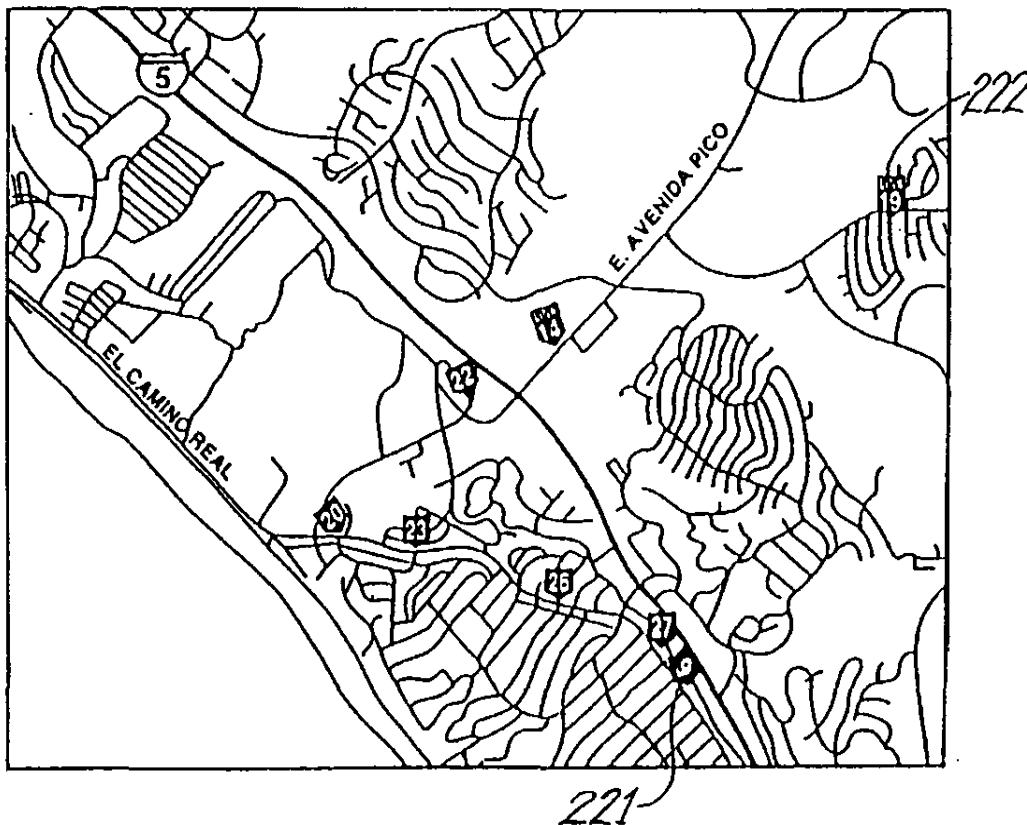


Fig. 22

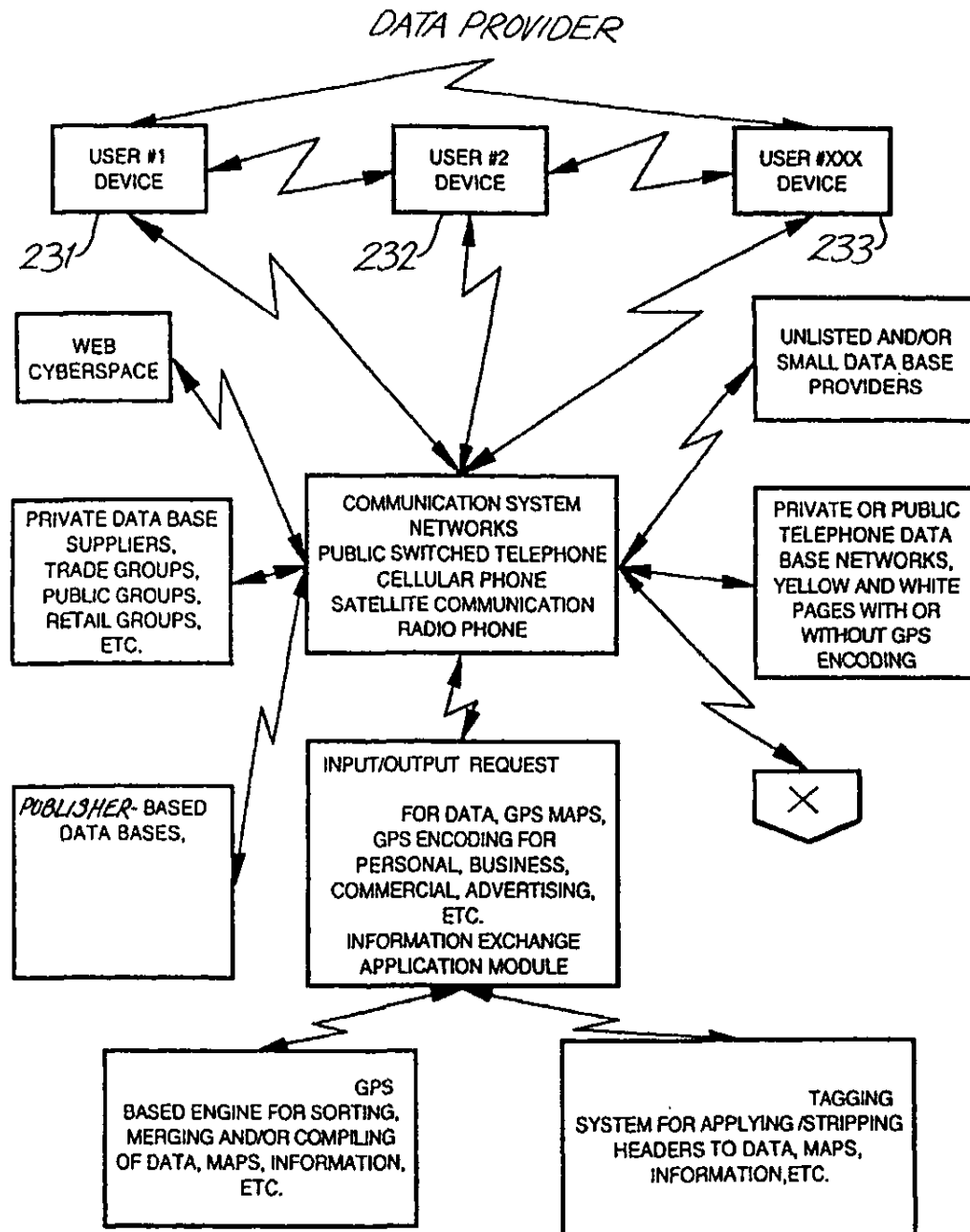


Fig. 23A

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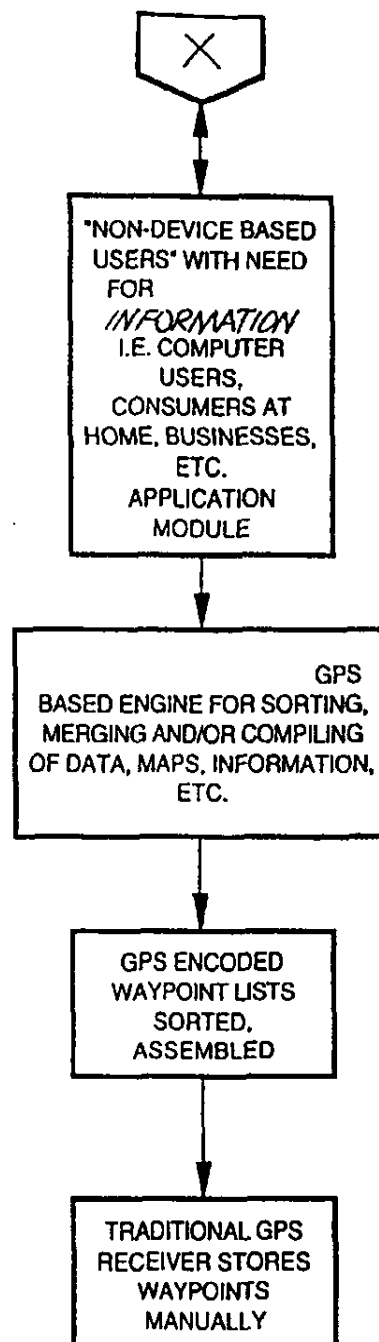


Fig. 23B

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REQUESTER

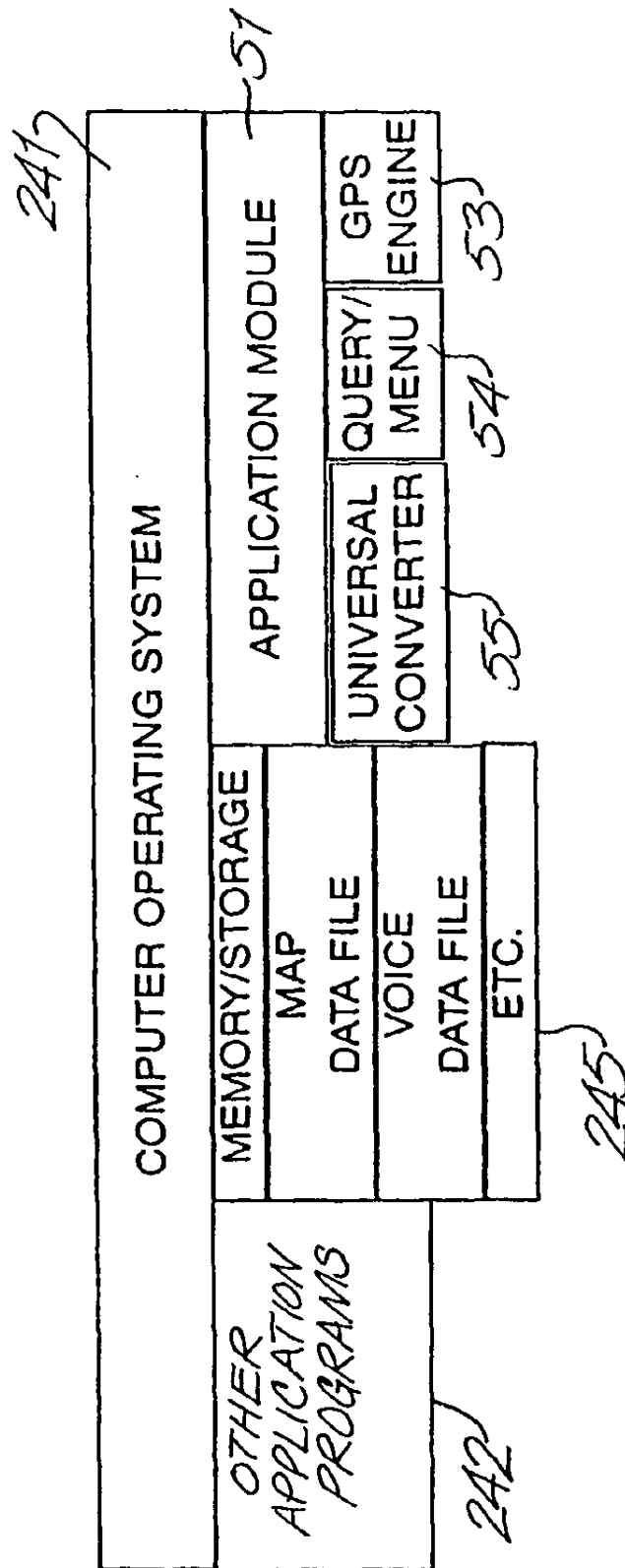


Fig. 24

PROVIDER

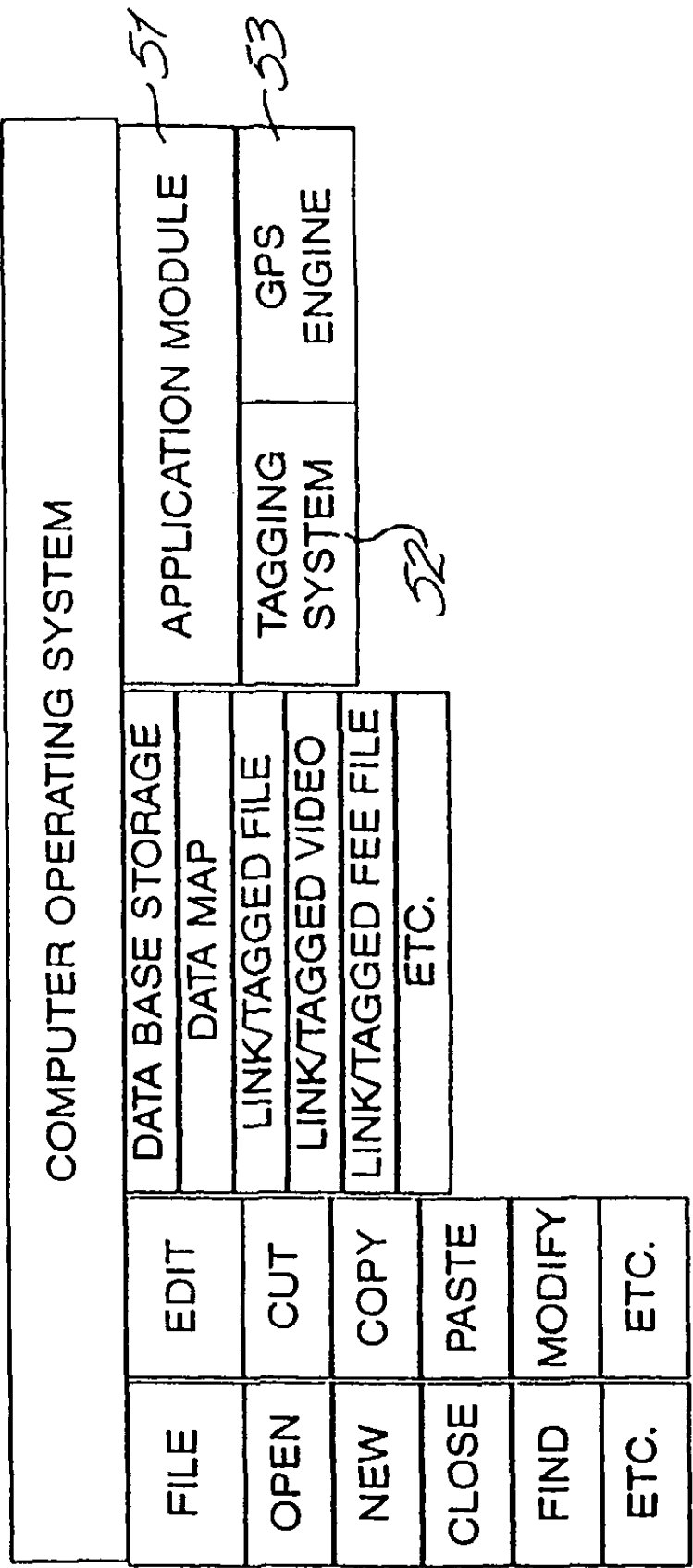


Fig. 25

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APPLICATION MODULE

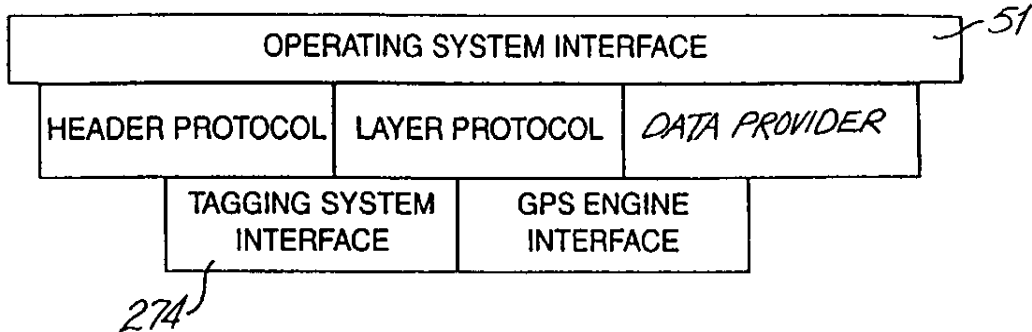


Fig. 26

TAGGING SYSTEM

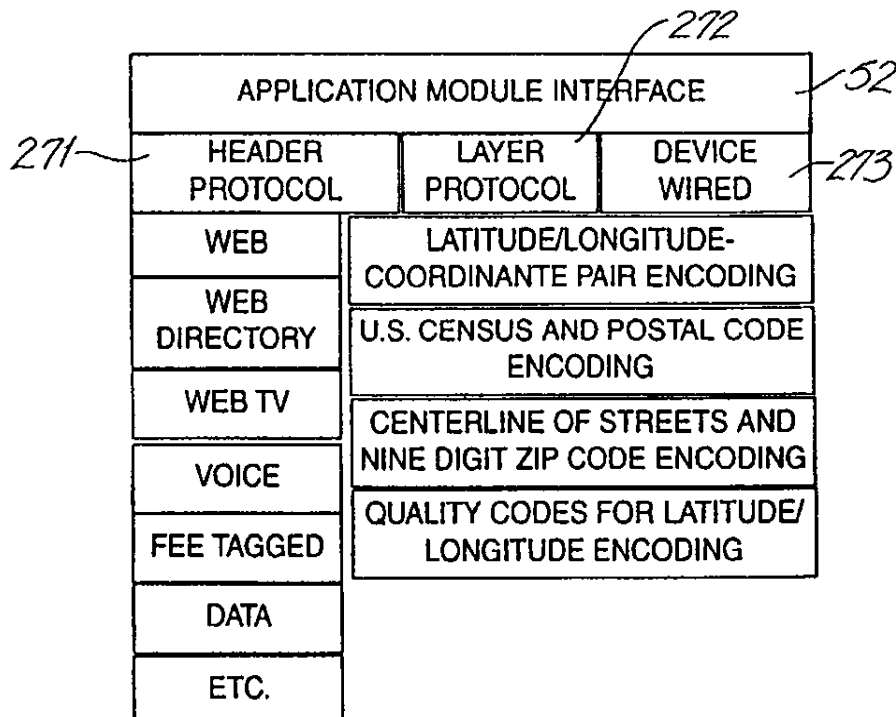


Fig. 27

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GPS ENGINE

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APPLICATION MODULE INTERFACE			
HEADER PROTOCOL	LAYER SYSTEM	ACCESS LATITUDE/LONGITUDE QUALITY CODES FOR BEST DISPLAY SCALES	
TAG TYPE	LAYER PROTOCOL	USE SPATIAL QUERY FUNCTIONS	
LATITUDE/ LONGITUDE	ROUTE PLANNING	USE CENTROID INTERPOLATION FUNCTIONS	
RADIUS		USE MATCH-RATE COMPARISON FUNCTIONS	
MAP			
WAYPOINT LINKS			
ETC.			

Fig. 28

UNIVERSAL TRANSLATOR

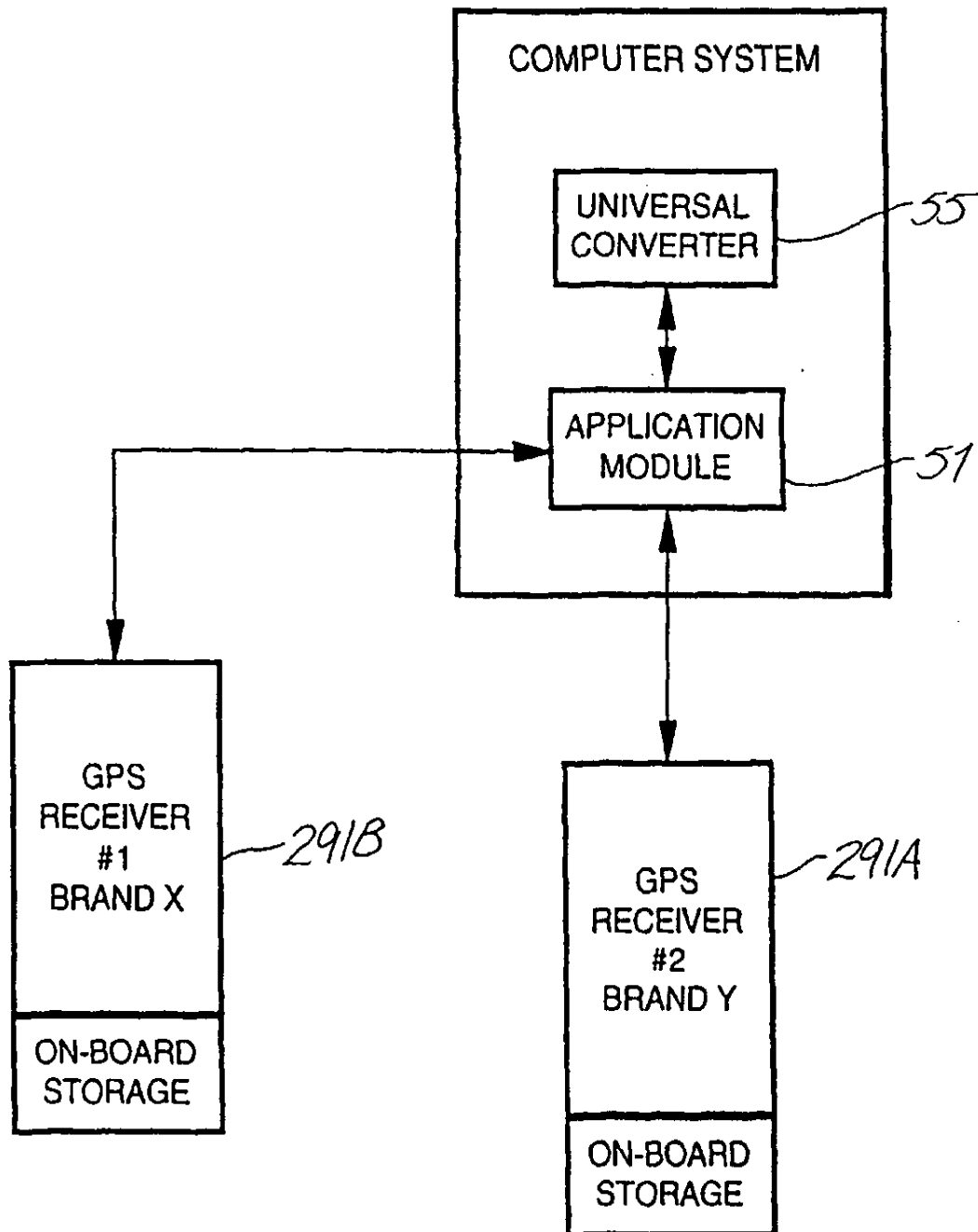


Fig. 29

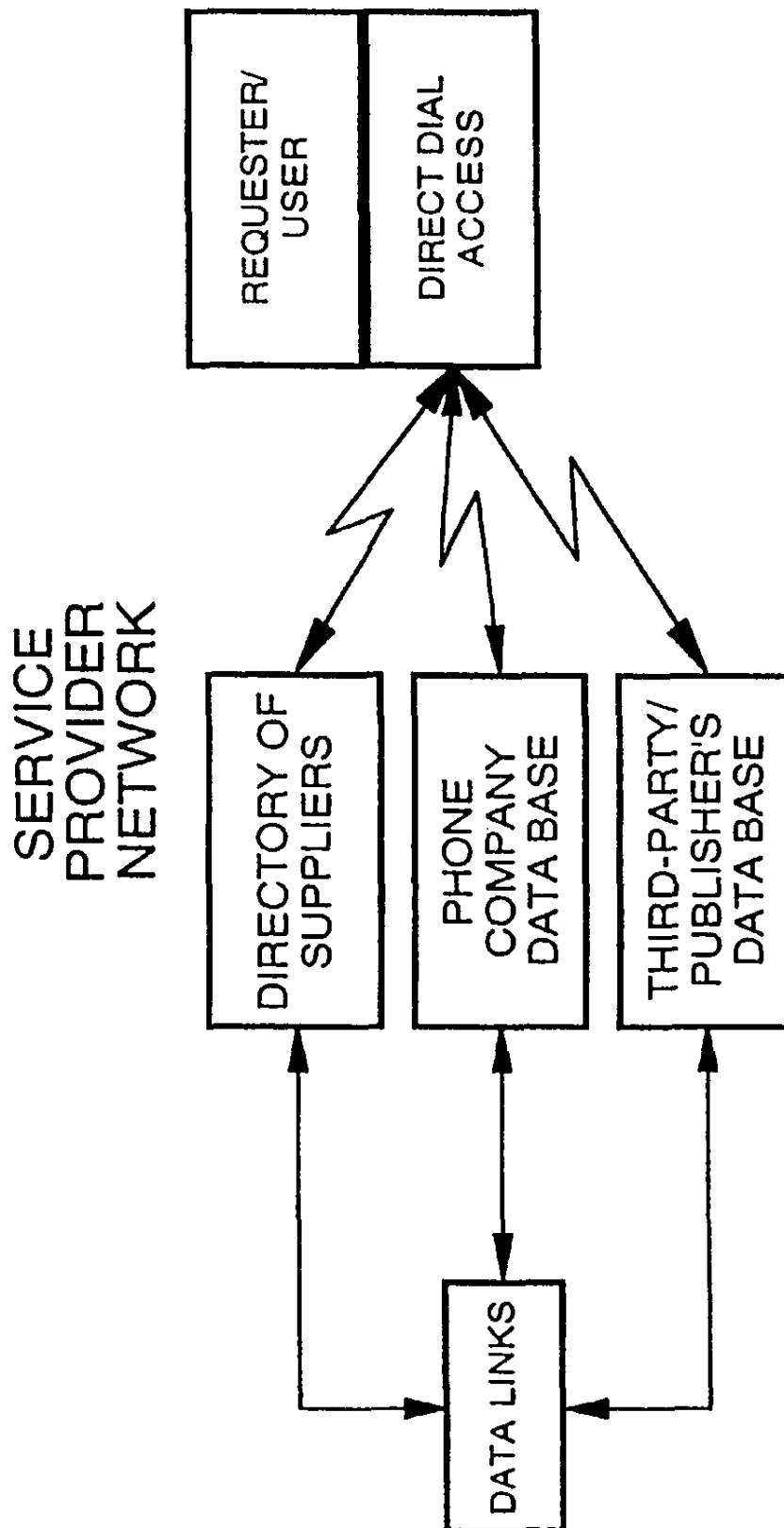


Fig. 30

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DIGITAL WEB TV

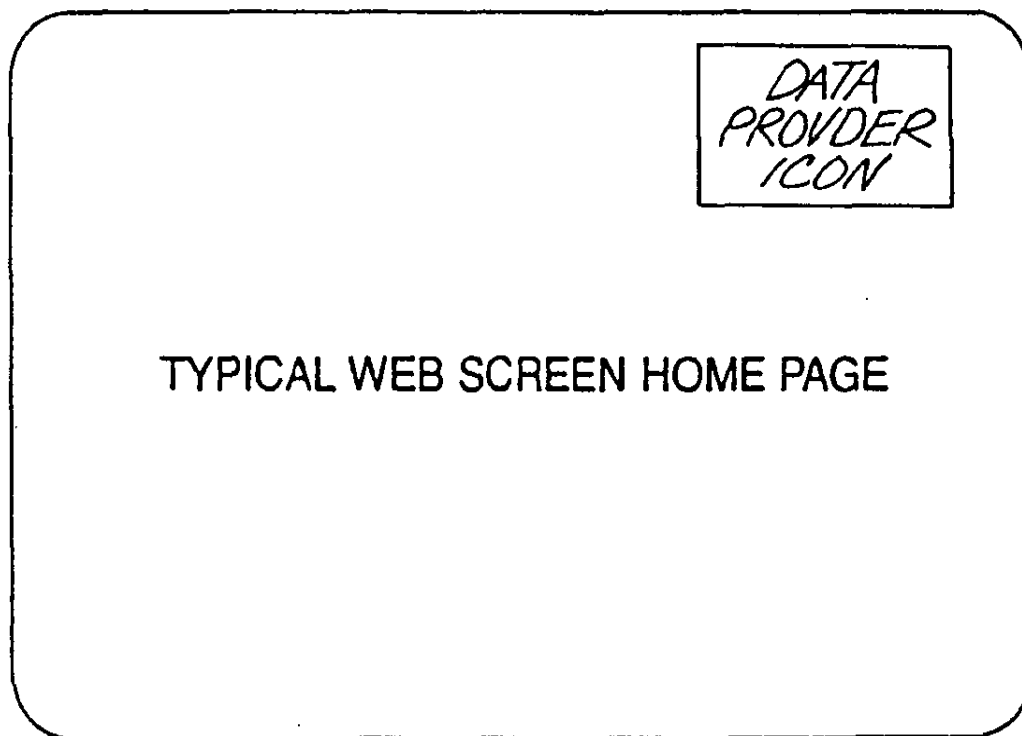


Fig. 31

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WEATHER: MAP PROVIDER (PRESS TO UPDATE)

CENTER MAP BY:

CITY _____ STATE _____

LAYER MAPS _____ ZIP CODE _____

AREA CODE _____

DISTANCE FROM YOU _____ MILES/KILOMETERS

DISTANCE FROM _____ MILES

MAP TYPE:

(PRESS TO SELECT FROM LIST)

UPDATE MAP LIST @ _____ HOUR

UPDATE EVERY _____ HOUR, PROMPT Y/N ?

ANIMATE MAPS Y/N PLAY NAVIGATE MAP Y/N

US SATELLITE

RADAR CURRENT

DELTA RADAR

LOCAL RADAR

SURFACE MAPS

WIND CHILL

CURRENT TEMPS.

JET STREAM

TRAVEL HAZARDS

FORECASTS

SURFACE WINDS

FARM

SHORT RANGE

DATE TIME **QUE IN** **OUT** GPS LOCATION NORTH **↗** YOUR HEADING **←**

321A-M

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FIGURE 32

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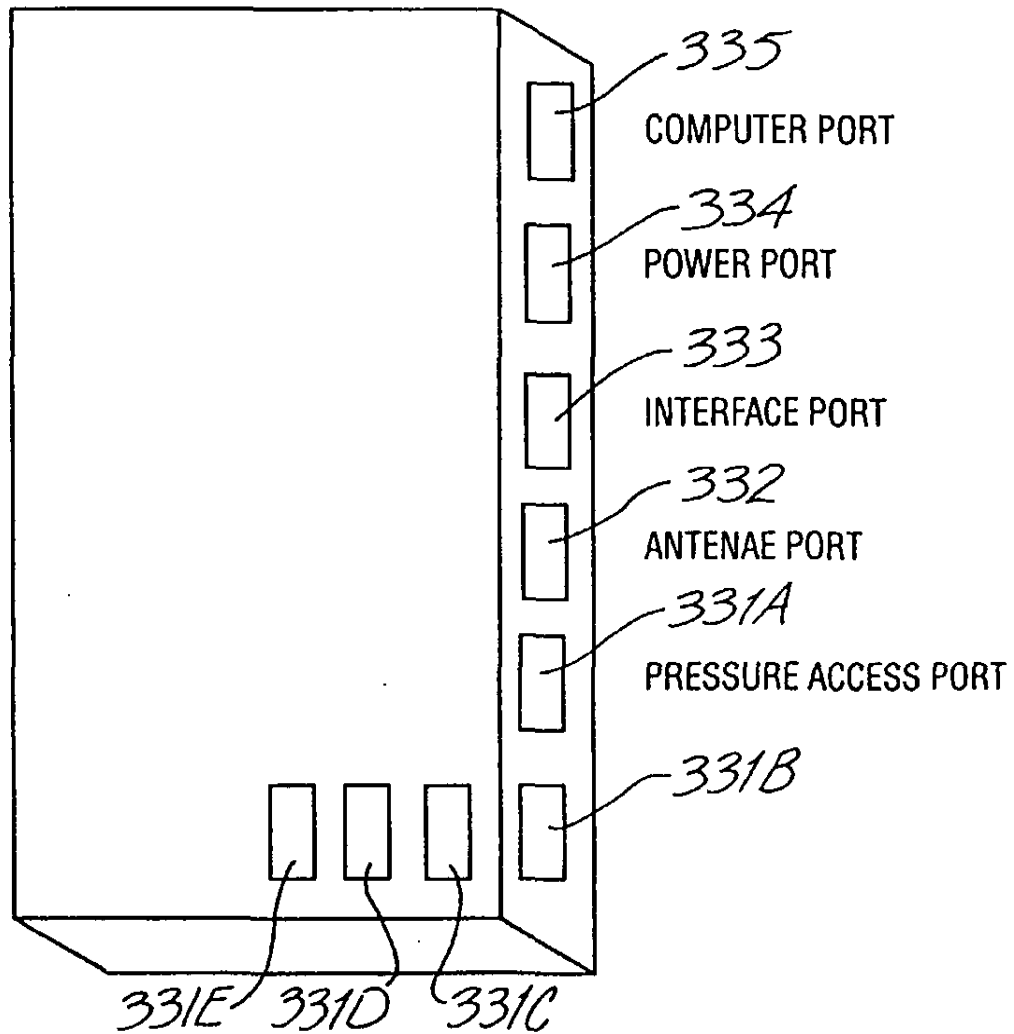


FIGURE 33

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PERSONAL COMMUNICATION SYSTEM FOR COMMUNICATING VOICE DATA POSITIONING INFORMATION

CROSS-REFERENCE TO RELATED APPLICATIONS

This patent application is a divisional application of U.S. patent application Ser. No. 08/879,955, filed on Jun. 20, 1997 now U.S. Pat. No. 6,148,261 the disclosure of which is incorporated by reference.

FIELD OF THE INVENTION

The invention relates generally to a system for communicating data including global-positioning-encoded information. In particular, the present invention relates specifically to a device and system for communicating and retrieving position and position related data.

BACKGROUND OF THE INVENTION

Availability of up-to-date information is more important today than ever before and this will continue to be true for the foreseeable future. People want to be well informed, so much so that they travel with cellular phones, beepers, and even portable hand-held Global Positioning System (GPS) satellite receivers.

GPS capable devices generally have a GPS receiver for receiving satellite signals from the GPS satellite network that allow for determination of the device's position. Such devices allow for precisely locating the device in terms of latitude and longitude using the GPS receiver. Some devices have map data stored in memory and a display for showing the device position with reference to the map data. Other devices have no underlying map data base for reference. Rather, they show only the geographic coordinates of the device's location. These coordinates may be referred to as waypoints. Most GPS receiver devices can store many waypoints. Some GPS receiver devices can plot and display a trail of waypoints and store this trail for future retrieval. Sophisticated devices may compute the device's heading, speed, and other information based on comparisons with previous GPS determined positions.

GPS receiver devices with map display capability may store the map information on computer diskettes, CD-ROMs, or other computer memory storage devices. The device location may then be displayed on a display terminal with reference to a map stored in the computer memory storage device. The available quantity of map data, however, can overwhelm the memory capability of easily portable computer devices. This problem is exacerbated when additional information is included and linked with the map data. In addition, information is more valuable when it is up to date and available at the time of consumption, and such devices do not incorporate a means for updating the stored information. By way of example, a CD ROM could never maintain an up-to-date list of every 5-star restaurant.

Some GPS receiver devices have the ability to communicate over a telecommunications network. These devices do not provide for automatic or semi-automatic dynamic exchange of on-line position dependent or related information. In addition, these devices cannot communicate with third parties in the absence of a uniform data format standard. For example, a cellular-phone-based system comprising GPS location information working in conjunction with proprietary Public Safety Answering Point (PSAP) telephone equipment is known. The device provides personal

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and medical information on an emergency basis to the proper authorities. Such a device does not allow third parties to communicate, tag, interrogate, limit, designate, modify or share this information amongst themselves for any other use.

To that end, the ability to receive digital data structures with GPS encoding, and storing this information for eventual use or broadcast to third parties, would be valuable. Today, the U.S. and several other countries have independent publishers busily GPS mapping everything down to the most minute detail. Most of these data bases are available on CD ROM storage. The problem is that no one data base can contain enough information to fulfill the unique requests of every particular and picky consumer. The costs associated with providing and maintaining such a large data base would be overwhelming and over-burdening. Additionally, most consumers do not like reading or compiling vast data bases.

SUMMARY OF THE INVENTION

The system of the present invention comprises Personal Communications Devices (PCDs), and traditional computer systems with GPS engines, routers, and other application programs to request, process, and transmit tagged GPS encoded information. The system, with related applications, can be accessed by device users, traditional computer users, web-site users (cyberspace), data publishers, public or private enterprises or individuals, by means of application programs. The tagged GPS encoded data files can be stored or sent via communication links using AM, FM, spread spectrum, microwave, laser or light beam in free or fiber optic, line-of-sight, reflected, satellite, secure or non-secure, or any type of communications between multiple points that the application or the state-of-the-art may allow. The system is a waypoint tag and interrogation system using various protocols to answer requests and provide GPS-encoded information. The applications use GPS devices, engines, routing and encoding for access to specific requester-designated data retrieval requests. The applications access fax machines, beepers, telephones and other communication linked devices. The system accesses computer and storage systems with various applications in order to provide this information from a plurality of providers. The system thereby eliminates or reduces the need for large storage devices and interchangeable storage modules.

One embodiment of the present invention includes a requesting device, a data provider (hardware and software), a user, tagger applications or GPS engine and router system with protocols for encoding, tagging, modifying, interrogating, arranging, limiting, displaying, sorting, mapping, segregating, sending, receiving and updating waypoint and the waypoints connected data structures with digital or graphic maps, digital voice files, linked digital web files properly encoded and tagged by way of specific devices, or by traditional computer and storage systems.

The application programs contain protocols for users, providers, taggers, list maintenance organizations, and others, and will use a dynamic identification system from applications containing GPS search engines, route planners, compilers, designators, publishers, and others is to permit communication of information.

The PCD is a cellular-phone-sized electronic device, combining the capabilities of a GPS receiver, transceiver, digital beeper, cell phone and projection system into one compact unit. The PCD is capable of uploading emergency information (medical, police alert, etc.) via a one-push button that phones 911 or a security monitoring center similar to those used for house alarms. The alert continues to be broadcast until a response is made.

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The PCD is also capable of downloading information via a request to a data provider, similar to a request for directory information from a phone company or other service. In this mode the PCD acts similar to calling a phone operator for information. However, in this instance, no human contact is required. The caller requests specific information (location of gas stations, names of restaurants, local banks, etc.) via a voice command ("Download e.g., Wells Fargo Banks") or via digital commands using a keypad or other input device and the requested information is automatically downloaded to and stored in the memory of the user's PCD. This information can be accessed off-line via the screen on the PCD. It is all done digitally, eliminating having to write down information such as name, address, location map, GPS latitude and longitude encoding, direction and distance to location, hours of operation, or other items of information. The PCD can be plugged into an automobile input port or similar device, if available, and provide distances and directions to locations of interest. Similar information of a condensed nature can also be provided to the user via the screen of the PCD. The user is not required to be a subscriber to some proprietary system, instead the PCD can use any means to access any data base from any potential provider, whether GPS encoded or not.

In some areas the information would be sent and received by way of a Local Area Broadcast via radio frequency signals to each home, car or PCD within a reception area. In such an embodiment, users are able to access companies listed on the broadcast network from data providers of properly tagged, yellow page-type information or are provided with GPS encoded information and maps similar to web page listings. This would be advantageous to small towns with little information available for travelers, but which have an interest in providing up-to-date traffic, weather and travel advisories to benefit the local community and businesses. Such a system does not require a master, home or base unit. The providers of data base or advertising information could be a single data provider and could also be individual users with application programs that allow provision of such data. The application programs provide a means for sending and receiving data, GPS encoded data and graphics encoded data. The application programs can also act as a universal coder/decoder to other proprietary GPS data bases.

The present invention allows users to request detailed information relating to their present location as well as information related to distant locales. Some of the advantages provided by the invention include:

1. Information can be received digitally by a PCD user from any system.
2. Multiple requests can be retained, stored or resent.
3. In-depth dynamic data retrievals are possible and could be viewed later.
4. GPS tagging and encoding with latitude and longitude information along with encoded maps for navigation.
5. Small non-contiguous map segments are possible.
6. On-line storage of data personal and other information, along with GPS encoded maps on some data files.
7. Display menus, interfaces and applications can be viewed on heads-up display systems in automobiles, homes, businesses and various commercial applications.
8. Allows for portable Internet access.
9. Provides a means for an Internet based telephone directory access tagged and linked to the originating area code and phone numbers.

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Remote and distant third parties could communicate with each other and, by sending and receiving GPS encoded data, can meet or find each other in remote locations. Maps and other digital data may be transmitted/received by fax, beeper (receive only), computer, phone and radio.

One embodiment of this invention would include a system of non-subscribers communicating to each other in a similar fashion, without the use of base stations. In addition, the non-subscribers could send personal data bases with maps included, GPS information, and other information of non-related data or graphics from publishers of any such data base. In this embodiment the device would act as a transceiver, sending and receiving dynamic moving waypoint information in digital formats, including maps of various sizes and embodiments.

The PCD can display a singular or a plurality of images and displays, project an image on to a screen or viewing surface, store or communicate data (depicted as a line, graphic, icon, etc.) to and/or receive latitude and longitude data from third parties. Additionally, the device can send/receive latitude- and longitude-encoded maps and other data to/from a third party, send/receive standard or non-standard phone and fax communications (AM, FM, spread spectrum, microwave, laser or light beam in free or fiber optic, line of sight, reflected, satellite, secure or non-secure, or any type of communications between two points that the application or state-of-the-art may allow), perform computer functions from existing application software and operating systems, receive standard or non-standard beeper messages, interface with a conventional computer and provide an interface to a heads-up display, an external viewing device or any projection system.

An embodiment of this invention incorporates a GPS transceiver with a designated application used with a communication system or network. Several users of this invention can communicate and send data, maps and graphic files with or without GPS encoding. By example, a user could request from another party a map of walking trails of Yosemite Valley with latitude and longitude designations properly GPS encoded. This map may not be in the requesting user's data base or in a large number of subscriber's or non-subscriber's data bases. This highly stylized map and encoded information, of a possible non-uniform nature, could be on just one user's PCD device or external source. The requesting user could contact the specialized source for specific information, and be sent via a communication link, the specific data, this data could then be modified by the user and sent back to the original provider.

The preferred embodiment of the PCD and system provides a means for requesting and receiving data files which can be tagged, modified and interrogated. This data can be comprised of many different formats and applications with potentially unique compilations from potentially unrelated, (non)-subscribers or (non)-linked users. These users can communicate with commercial, business and personal computer systems and devices having the capability of running an application (or applications) and having the ability to request and provide waypoint information which can be tagged, modified and interrogated.

Another preferred embodiment of this invention provides a means for decoding tagged, modifiable and interrogatable maps and data files furnished by third parties for display on the user's PCD or traditional computer devices.

In one embodiment of the device and tagging system the GPS information is communicated from locations, homes, businesses, commercial designations, government resources, public and private areas, cyberspace and other

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communication systems. Various designated locations, or a plurality and multiplicity of locations, or data structures, are assigned as waypoints. These waypoints could be tagged, or interrogated from an application program which describes, encodes, reports, modifies and communicates this encoded information and data from any location. In addition, the transmitting device may report a plurality and multiplicity of locations or events unrelated to either the location of either the transmitting or receiving device. Indeed, the device could communicate to many unlinked, unreported or unconnected waypoints and send active dynamic information to the requester. Cyberspace providers may enter the network web system, use applications for device communications and participate in the exchange of information using designated GPS engines and applications. By way of example, the invention can provide a requester with dynamic advertisements encoded with maps, location information, or other data to a location anywhere in the U.S. Indeed, tagged files which are linked can be sent from a third-party publisher located in another state.

The system is similar to the world wide web, except the web does not use GPS engines, applications, tagging systems, etc. By way of example, one difference is that the invention uses GPS devices, engines, applications and encoding for access to specific requester designated data retrieval techniques. The invention provides a means to locate specific individuals or places using standard GPS search techniques.

The system includes the concept of storing data, including voice messages. The system encodes files for use in a location tagged data format system. Users can request and compile information and store the information on remote computer systems. Certain protocols for compilation, encoding and tagging data files may be desirable in order to create files for system usage.

An embodiment of the invention uses fax, beepers, telephones, and/or computer and storage systems with application programs to properly GPS encode, tag, modify and interrogate requests and provide same from a plurality of providers. An embodiment of the invention includes applications or GPS engine systems for encoding, tagging, modifying, interrogating, arranging, limiting, displaying, sorting, mapping, segregating, sending, receiving and updating waypoints and its connected data structures with maps, or by any other means by way of specific devices, or by traditional computer and storage systems.

Another advantage the invention provides is a means to display this type of information and a means to store data unrelated to any interrogation by the PCD device. Methods of display include multiple of displays including, by example, overhead displays, heads-up displays, projection systems, LCD displays, computer displays or any past or future designed displays whether connected directly or by some electromagnetic means. The preferred embodiment of the device could include any means of display or combinations thereof. In addition, the device could include many control devices such as remote control, remote mouse type devices and any combination of keyboards.

Further objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings showing an illustrative embodiment of the invention in which like parts are designated by like reference numerals throughout.

DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a GPS transceiver system and communication links incorporating the present invention;

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FIG. 2 is a front perspective view of a PCD of the present invention showing a layout of controls and an initialization screen;

FIG. 3 is a rear view of the PCD of FIG. 2;

FIG. 4 is a block diagram of the PCD of FIG. 2;

FIG. 4A shows a screen menu hierarchy of the PCD of FIG. 2;

FIG. 5A illustrates a flow chart depicting the program sequence for the entry of a personal identification number (PIN) and personal data into the PCD of FIG. 2

FIG. 5B illustrates a flow chart depicting the program sequence for the user to select a mode of operation using the PCD of FIG. 2;

FIG. 5C illustrates a flow chart depicting the program sequence for the user to control the GPS mode of the PCD of FIG. 2;

FIG. 5D illustrates a flow chart depicting the program sequence for the user to control the phone mode of the PCD of FIG. 2;

FIG. 5E illustrates a flow chart depicting the program sequence for the user to control the computer mode of the PCD of FIG. 2;

FIG. 5F illustrates a flow chart depicting the program sequence for the user to control the radio mode of the PCD of FIG. 2;

FIG. 6 illustrates the Main Menu page of the PCD of FIG. 2;

FIG. 7 illustrates the select GPS Function page of the PCD of FIG. 2;

FIG. 8 illustrates the GPS: Location page of the PCD of FIG. 2;

FIG. 9 illustrates the GPS: Show Me page of the PCD of FIG. 2;

FIG. 10 illustrates the GPS: Get Map page of the PCD of FIG. 2;

FIG. 11 illustrates the GPS: Third Party page of the PCD of FIG. 2;

FIG. 12 illustrates the FAX page of the PCD of FIG. 2;

FIG. 13 illustrates the Beeper page of the PCD of FIG. 2;

FIG. 14 illustrates the Phone page of the PCD of FIG. 2;

FIG. 15 illustrates an Information Request page of the PCD of FIG. 2;

FIG. 16 illustrates the Computer page of the PCD of FIG. 2;

FIG. 17 illustrates the Radio page of the PCD of FIG. 2;

FIG. 18 illustrates the Receive Queue page of the PCD of FIG. 2;

FIG. 19 illustrates the Send Queue page of the PCD of FIG. 2;

FIG. 20 illustrates a typical listing downloaded from a data provider;

FIG. 21 illustrates a typical GPS encoded map downloaded from a data provider;

FIG. 22 illustrates atypical GPS encoded map with waypoints locating restaurants within a specified radius;

FIG. 23A illustrates an exemplary data provider;

FIG. 23B illustrates an exemplary configuration of a non-PCD computer utilizing a modified application module;

FIG. 24 illustrates a software module configuration of a requester;

FIG. 25 illustrates a software module configuration of a provider;

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FIG. 26 illustrates a software module configuration of the application module;

FIG. 27 illustrates a software module configuration of the tagging system;

FIG. 28 illustrates a software module configuration of the GPS engine;

FIG. 29 illustrates a software module configuration of the universal translator;

FIG. 30 illustrates a typical configuration of the service provider;

FIG. 31 illustrates a possible configuration of the digital web TV;

FIG. 32 illustrates the Weather Map Request page of the PCD of FIG. 2; and

FIG. 33 illustrates a weather reporting device.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a system capable of communicating using the electromagnetic energy spectrum, traditional computer networks, cellular phone networks, public telephone networks, and satellite system networks. The major components of the system comprises personal communication devices (PCDs) 20 and one or more of the following: a cellular phone network 60, a standard phone line network 70, an electromagnetic energy spectrum network 80 and/or a computer network 90. The PCD receives signals from a GPS satellite system 10.

FIG. 2 illustrates a PCD of the present invention. The PCD has a display 28a. The display may be of a LCD type or other types known in the art. Incorporated with the display is a touch screen input device 28b, which are known in the art. The PCD also has a alphanumeric key pad 26, which includes many of the standard keys generally found on computer keyboards. The location of the keys, and the selection of the characters used on a single key, may be varied as desired. The PCD also has specialized keys 27a-g, n related to GPS, telecommunications, and other functions. Located on one side of the PCD are a number of input and output ports. In the embodiment shown, these ports include a modem output port 29g, a generalized communication port 29f, a power port 35b, an infrared port 29e, and a heads-up display interface port 25k. The location of these ports are shown for descriptive purposes only, the specific location of these ports on the PCD is not critical. The power port allows the PCD to be operated from an external power source (not shown). The communication port allows the PCD to be connected to printers, local computer networks, and the like.

FIG. 3 shows a rear view of the PCD of FIG. 2. The rear of the PCD contains a microphone 34 towards one edge of the rear of the PCD and a speaker 33 towards the opposing edge. The layout of the microphone and the speaker is similar to that found in portable cellular telephones. An antenna 32 extends from the edge near the speaker to allow for communication in a cellular telephone network or via other electromagnetic spectrum means. The PCD contains a battery 32a. The battery allows for mobile operation of the PCD and is the selected power source if an external power source is not available through the power port. The PCD's operation is governed by a processor 21. A variety of microprocessors may be used, with the selection of such determined by processing power, power utilization, and other factors and requirements. The PCD has a slot 23 for a PCMCIA card, CD-ROM, or other computer accessory. The PCD is powered on when the power button 31 (shown in

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FIG. 2) is depressed. In the embodiment shown, at initial device power on, the processor causes the PCD to display the initialization screen 100 (shown in FIG. 2).

FIG. 4 shows a block diagram of the PCD. Control and logic functions are performed by the processor 21. Internal data storage 22, which is provided by conventional memory such as RAM or ROM or variations thereof, may be accessed by the processor. The processor may also access removable data storage devices 23 such as a hard disk installed via the PCMCIA slot, a CD-ROM type device or other similar removable data storage devices. The processor is connected by a data bus 24 to a number of devices. These include the alphanumeric key pad and other special purpose keys, the touch screen, and other hard wired input devices. The heads-up display output port and the display screen are also connected via the data bus to the processor, it being recognized that a number of display related devices such as VGA cards, chips, and the like are also required to implement the display device functions and the other previously mentioned functions. The microprocessor may also access or control communications with telephone networks, either hardwired or cellular, radio transmissions, infra-red transmissions, or communications with other computer devices.

All known verbal commands from GPS systems can be implemented and attachment or inclusion of voice activation for map instructions relative to location, GPS and street designations, including heading descriptions, distance, and arrival time estimates can be included.

FIG. 24 illustrates a block diagram of the PCD's software components. An application module or program 51 interfaces with the PCD's operating system 241. The operating system may be DOS, UNIX, Windows 95, Windows NT, O/S2 Apple McIntosh, Next Computer, or other operating systems, including operating systems well suited to devices with constrained memory or other limitations due to the small physical size of the PCD. The operating system additionally interfaces with other application programs 242 that provide standard file edit and other functions typically found in personal computers. The operating system, or other application programs interfacing with the operating system, provide for maintenance of data bases 245 used by the PCD. The application module includes a GPS engine 53 providing GPS functions, including interfacing with the GPS receiver 243 (shown in FIG. 4). A query menu program 54 of the application module controls the graphical user interface and related functions for the device. Included in the application module is a universal converter 55.

As illustrated in FIG. 29, the universal converter enables the PCD to read in data provided by third parties 291a, b and convert or filter such data to a format useable by the PCD. The universal converter first inspects the received data to determine if the data is in a known format which can be converted to the format used by the PCD. If the format is not known by the device, the universal converter attempts to extract any ASCII data or format the data as a bit map as appropriate.

As illustrated in FIG. 26, the application module further includes programs to implement data formatting and communication protocols using header protocols 271, layer protocols 272, and data provider protocols 273. The application module also includes a tagging system interface program 274. The elements of the tagging system are illustrated in FIG. 27. The purpose of the tagging system is to provide a common universal data structure for requests and responding to requests. Various techniques common in

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the GEO coding industry, using U.S. Census bureau data and tiger files with certain modifications, can establish parameters for software suppliers to use latitude and longitude encoding as coordinate pairs, postal code encoding and street centering encoding, all for the benefit of accuracy in designating certain files as "tagged". The tagging system provides the ability to apply and strip header and layer information to and from data files.

FIG. 4A shows the top level page menu display hierarchy of the PCD. At initial power on the initialization page 25a (shown in FIG. 2) is displayed. The initialization page allows for the entry of a personal identification number and other data. Depressing the home button 27e (shown in FIG. 2) displays the Main Menu page 25b. A number of additional pages are available from the Main Menu page. These include the GPS 25c, Fax 25d, Beeper 25e, Phone 25f, Computer 25g, Radio 25h, Send Queue 25i, and Receive Queue 25j pages.

FIG. 5A lists a sequence for the operator of the PCD to answer certain questions, provide information for future access regarding handling of emergency events and handling of same by civil authorities or private individuals empowered to act on behalf of the operator. Access is denied or provided based upon user codes. The entry of a user code may allow for limited to full access of the data stored in the device and usage of same with different codes providing different levels of access and usage. Similar information and sequencing is provided by the application modules and operating system for medical and other information in the event of emergencies. In one embodiment of the preferences screen (not shown) information can be displayed in a specified manner, events recorded and equipment options listed. Specific usage of the device and furnished software would be recalled by each user having access and user codes to operate the PCD, each user having unique individual screens and setups based on that user's preferences. The initial setup of screen preferences and other user configuration details are well known in the art.

Selecting PIN 111 from the Main Menu page displays a screen 113 prompting the user to input a personal identification number. Using an alphanumeric key pad 26, the user inputs a personal identification number and presses ENTER 27g. The processor analyzes the entered personal identification number and determines if the number is valid 115 FIG. If the entered personal identification number is valid the processor enables PERSONAL 121, MEDICAL 131, PREFERENCES 141 touch points on the display screen. These touchpoints, and touchpoints later referred to, are selectable either by pressing the display screen at the touchpoint location or by selecting the underlying display item with the cursor. If the PCD already contains personal, medical and preference data, the HOME button 27e is enabled. If the personal identification number is not valid, the processor 21 will increase the device security level 119. This may include, but is not limited to, disabling the PCD operation for a specified time. Selecting PERSONAL 121, MEDICAL 131 or PREFERENCES 141 touchpoints displays the corresponding pages 123, 133, or 143. These pages request specific data, and allow the user to input data using alphanumeric key pad 26. Completion of data entry is indicated by pressing the ENTER button 27g.

In addition, the Initialization page 100 FIG. 2, as well as all other pages, displays the time and the date 103, touch points for QUE IN 550 and OUT 600 (described later in this document) and limited GPS information 107. The limited GPS information comprises of the user's location (latitude and longitude), an arrow pointing to north and an arrow indicating direction of device travel.

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When enabled, pressing the HOME button 27e (FIG. 2) signals the processor to display the Main Menu page 150 FIG. 5B. As shown in FIG. 6, the Main Menu page allows the operator to use the touch screen to select the GPS 200, FAX 300, BEEPER 350, PHONE 400, COMPUTER 450, RADIO 500, RECEIVE QUE 550 and SEND QUE 600 touchpoints. The heading and directional information are displayed in real time and are dynamic. Pressing the FAX touchpoint causes the processor to display a Fax page (shown in FIG. 12) which lists received facsimile messages 301. The Fax page includes display interfaces appropriate for the sending and receiving of facsimile communications through the FAX Phone Modem port 29g, and such displays and functions are well known in the art. Pressing the BEEPER touchpoint causes the processor to display a Beeper page (shown in FIG. 13). The Beeper page displays received beeper messages 351 and allows for the deletion of such messages from the display and internal memory storage. Also, a sub-menu portion of the display 151 is reserved for sub-menus and directories.

Pressing GPS 200 causes the processor 21 to display a GPS Function page 201, which is illustrated in FIG. 7. The GPS page provides for selection of a GPS mode through touch points in the sub-menu portion of the display. The available modes are location 210, show me 230, get map 250 and third party 270 modes. The display returns to the GPS Function page when the PREVIOUS button 27i (shown in FIG. 2) is pressed. The display hierarchy for the GPS functions is illustrated in FIG. 5C. The Location, Show Me, Get Map, and Third Party pages descend from the GPS Menu page. The Location page comprises the current map, the location on the map of the device, and a plot of the trail of the device on the map. The sub-menu portion of the display provides for additional selection of still further pages. These pages include a Menu page, a Mode page, a Waypoint page, and a Preferences page.

The Location page is illustrated in FIG. 8. The Location page includes a GPS map 219 (latitude and longitude encoded coordinate pairs). The sample page shown is an encoded map showing the device position, plot trail and the encoded map location of the selected waypoint. The map displayed could be from on-board memory or sent by other third parties by way of communication links to the PCD. When map data files are encoded with location information, the location information can be referred to as waypoints. These tagged waypoints, with links to other data structures, can then be sent to users via an application to various communication systems. Closed-loop or proprietary GPS receivers can send/receive data to/from other third parties (Brand X, Brand Y) via their own proprietary format using an application system as a universal converter. The location information is dynamic and updated periodically by the PCD's communication system via link-up with GPS-based satellites. The Location page indicates the PCD position 801, indicated by a walking person, as being located on a highway 810. A waypoint 802 is along the highway en route to the desired destination address 803 located on a local street 804 which intersects the highway. A first point of interest 807 is also displayed as being along the highway, as is a second point of interest 805 along a second local road intersecting the highway. The limited GPS information, providing location, heading and north, is also displayed. The illustrated Location page display shows only one possible combination of a map layout. Other display sequences such as North up, course up, user at top of screen, user in middle, and other display sequences are possible. The dynamic nature of the PCD allows the PCD to display GPS encoded maps as the PCD progresses dynamically with relation to the maps.

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Using interpolation techniques, performing spatial query analysis, and establishing layers for best display scale for any given map record allows the device to provide the user extended capability not possessed by traditional GPS devices. Applying various protocols and interpolation techniques allow files to be arranged geographically by distance from a designated point (usually the requester's latitude and longitude as the starting point, but other locations may also be used). The maps are also arranged in layers, menus, limited, listed, showed, displayed, and sorted.

The Location mode provides typical GPS system functions. The touch points MENU 213, MODE 215 and WAY-POINT 217 and PREFERENCES 221 provide access to the Menu, Mode, Waypoint, and Preferences pages. These pages, along with various buttons on the alphanumeric key pad 26 FIGS. 2 and 4 and special function buttons 27, are used to configure the display to the user's preference. The preferences page 221 enables selection of such features as voice, maps, scroll, off screen maps away from cursor and other features. The listing name 219 portion of the Location page displays information pertaining to a waypoint selected through the use of the cursor.

FIG. 9 illustrates the Show Me page accessed from the GPS page. The Show Me page shows a list of available maps 901a-i stored on-board, which includes maps retrieved from the receive queue area of the PCD memory. The user can load a map into the location or third party pages by pressing the corresponding number key on alphanumeric key pad 26 (shown in FIG. 2) or by scrolling through the list to highlight the appropriate map and then pressing ENTER button 27g. Maps may also be removed from on-board storage using the DELETE button 27h.

FIG. 10 illustrates the Get Map page accessed from the GPS Menu page. The user of the PCD can request the map by location from PCD memory or an external source. The user may enter a desired map location. If a map location is entered, the PCD will only search PCD memory for a map for the entered location. Maps from an external source are downloaded via any of the communication links such as the FAX, BEEPER, PHONE or RADIO touchpoints provided in the sub-menu portion of the display 151. Depending on the users requirements, several maps could exist showing similar map areas with different layers for viewing. By way of example, airport maps with air space requirements, coastal waterway, maps, and interstate maps, and even hand drawn maps scanned into a computer system all show different resources within a given geographic area. These maps, when presented on the PCD, could over-saturate the display map detail for any given map area. Therefore, it is preferred that the actual map displayed be selectable. Maps are retrieved by pressing QUE IN 550, scrolling to highlight the desired map, and pressing ENTER 27g FIG. 2.

FIG. 11 illustrates the Third Party page accessed from the GPS menu page. The Third Party page provides an interface to communications with a third party through touch points in the sub-menu display 151. In the display shown, a user can receive a third party's data and GPS encoded map for viewing on the device or save it for future usage. The user can also dynamically track the third party by periodically having the third party send updates via normal communication links. The third party location can be displayed on maps dynamically sent by map publishers, maps already on-board (furnished at some earlier date), or on maps sent by the third party. The PCD plots and interpolates the GPS data sent by the third party and places an icon 951 (GPS latitude and longitude coordinate pair) on the displayed map using spatial query analysis techniques performed by an applica-

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tion module. The information received from the third party may be other than maps or GPS encoded information, but may be information of any type. The data is received from the third party using phone 400 and radio communication links 500. A PREFERENCES touch point 274 enables entry of items such as phone numbers for automatic call back and time interval for automatic transmission of information. If the radio, a satellite phone, or other frequency based communications link is utilized, the PREFERENCES touch point allows entry of frequencies for use for automatic transmission of information. A split screen displays the user's location on a map on the left side of display 272 and, after contact with a third party via a communication link, the third party's map and location on the right side of display 273. If the third party's location is sufficiently close to the user's location, or if the user's displayed map covers a sufficiently large area, both the user's and third party's location can be shown on the same map without resort to a split screen display.

FIG. 32 illustrates a Weather Map Request page. The Weather Map Request page is accessed by pressing the Weather button 27n (shown in FIG. 2) on the PCD. The Weather Map Request page allows the PCD user to specify the map location and scale, the map type, whether the selected map should be automatically updated at specified intervals, and whether a set of maps should be displayed in a sequential fashion. The PCD displays a number of different types of weather maps, including satellite images, radar maps, temperature maps, wind chill maps, and any other type of weather map available. Some weather information is more perfectly provided by showing a sequence of displays indicating the change in weather over time. Therefore, the PCD allows the operator to sequentially display a set of maps, thus providing an animated map display.

FIG. 33 illustrates a weather reporting device. The weather reporting device has a power port 334 to provide electrical power to the weather reporting device. As with the PCD, the weather reporting device may also be powered by a battery (not shown). The weather reporting device also has a computer port 335, an interface port 333, an antenna port 332, a pressure access port 331a, and a number of auxiliary ports 331b-e. The computer port provides a communications interface to a standard personal computer or the PCD. The interface port provides an interface to systems with weather detection features, such as aircraft with weather radars or lightning strike finders. The antenna port allows an external antenna to be connected to the weather reporting device, thereby providing remote operation capability. The pressure access port provides external access for an internal pressure sensitive device (not shown) for the determination of barometric pressure. A plurality of auxiliary input ports 331b-e provide an interface for connecting the weather reporting device to external weather detection sensors such as temperature sensors, wind sensors, and other weather sensing devices.

The Fax page is accessed by pressing the FAX touchpoint on the Main Menu page. FIG. 12 illustrates the Fax page. The sub-menu portion of the display is available for listing previously stored phone numbers. These phone numbers are selectable as a facsimile destination. In addition, the user can directly enter the phone number to indicate the facsimile destination. As with other pages, the PCD continues to dynamically display the limited GPS information of location, north and heading. The PCD facsimile function is performed by application software executed by the processor. Multiple fax locations, time set, send after certain time, and other traditional functions of fax machines and their

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implementation are well known in the art. The Fax page provides for display of a message (not shown) entered via the alphanumeric key pad 26 (shown in FIG. 2) or through selection of messages stored in the send queue area of device memory. Messages stored in the queue area of PCD memory can be selected by scrolling through a directory 305 of all fax messages stored. To view a stored message the user uses the SCROLL button 27a (shown in FIG. 2) to highlight an entry, and then press ENTER button 27g. Pressing the SEND button 27b transmits the selected or entered facsimile. The user may also view received faxes using this mode by pressing QUE IN 550 FIG. 12, using the SCROLL button 27a to highlight the desired message, and pressing the ENTER button 27g.

The Beeper page is accessed from the Main Menu page. Pressing the BEEPER touch point on the Main Menu page causes the processor to display the Beeper page. The device contains capabilities consistent with common practices of beepers, also known as pagers, such as sending and receiving messages. These functions and their implementation are well known in the art. The PCD is also satellite communications capable. Beeper messages can be received by the PCD without interference to the other device capabilities. Therefore, the user could continue using the telephone or other features seemingly uninterrupted by the reception of digital beeper messages and display of those messages. The Beeper page provides a list of beeper messages (not shown) stored in the receive queue area. Messages stored in the receive queue can be selected by scrolling through listing 353 FIG. 13 of all beeper messages stored. To view a stored message, the user uses the SCROLL button to highlight a desired message and presses the ENTER button 27g. Messages are deleted when the DELETE button is pressed with at least one message selected.

The Phone page is illustrated in FIG. 14. The Phone page is accessed from the Main Menu page. Pressing the PHONE touchpoint on the Main Menu page causes the processor to display the Phone page. The Phone page is also accessed by pressing the PHONE touchpoint on the Get Map and Third Party pages. As with the other pages, the limited GPS data is continuously displayed showing PCD location, heading, and north. The PCD can access several areas of the display even while the PCD is being used as a telephone. Information provided in the display area 1401 will vary depending upon the page from which the phone page was accessed. The Phone page provides for selection of a function through touch points displayed in the sub-menu portion of the display. The selectable touchpoints are: POLICE 403, MEDICAL 405, DATA PROVIDER 407, DIRECTORY 413, and MEMORY 415.

When the POLICE touchpoint is pressed, the PCD places a call to emergency 911. The 911 telephone number is the default, another number could instead have been entered for any particular user through the preferences selection. Once the telephone call is answered, the PCD provides the information entered using the Preferences function and the device location. The user may also establish voice and data communications through the microphone 34 and speaker 33 (shown in FIG. 3).

The PCD performs equivalent functions when the MEDICAL touchpoint is pressed. As different phone numbers and information can be entered in the selection of user preferences, however, different phone numbers may be used and different information may be transmitted.

When the DATA PROVIDER touchpoint is pressed, the processor displays the Data Provider Connect page. The

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Data Provider Connect page provides a means to specify the type and amount of data to be downloaded from a specified data provider. The Data Provider Connect page has numerous data fields which are selected by use of the cursor. Once a field is selected, the user may enter data in that field using the alphanumeric keys. The data fields include data for name, city, state, map area, zip code, telephone area code, retail category, distance from device location, and maximum number of listings to be provided by the data supplier. Whether a map only is requested and what particular types of maps, such as interstate maps, walking area maps, zip code maps, street maps, area code maps, or state maps, are requested are also provided as options. Touch points for weather information and traffic reports are also provided. Once the appropriate data fields and/or type of data required is input or selected, pressing the send key transmits the data request to the data provider. Details regarding the method of transmission of the responsive data is automatically sent by the data provider to the data provider along with the data request.

The primary data providers may include the public telephone company networks but may also include other entities. The data providers maintain data, including maps, telephone yellow page entries, and other information such as traffic and weather reports. This information is maintained in a timely manner and is accessible through the use of data base methods well known in those in the art. Upon receiving a request for data, the data provider determines the nature of the data request, searches the appropriate data base or data bases, and transmits the requested information to the requesting device in the manner specified by the requesting device. The user, after the PCD receives the data as requested, disconnects, goes off line to review the information, deleting some, saving others, and storing other encoded information on the PCD. The user can now further edit the device's entire data base and decide a sequence for navigating to the locations listed in the various menus as waypoints. Thus users of the PCD can decide to navigate using the GPS features of the PCD and select certain waypoints and the order in which to proceed. By way of example, but not limited to same, users could select gas stations, banks, restaurants, shopping centers in unfamiliar areas, navigate today from one point of beginning and tomorrow continue navigating from another point of beginning, being assured that the device will always know how to get to various locations. Should the user require further locations to visit, the PCD is capable of obtaining new navigational data and adding to the already active route plan without having to completely start over.

Pressing the DIRECTORY touchpoint 413 displays an alphabetical listing (not shown) of phone numbers stored on-board. The user may scroll through the listing and select a desired phone number. Pressing MEMORY 415, displays an alphabetical listing (not shown) of frequently used phone numbers. The user may scroll through the listing and select a desired number. Pressing the SEND button causes the device to dial the selected phone number.

FIG. 16 illustrates the Computer page. The Computer page is accessed by pressing the COMPUTER touchpoint 450 (shown in FIG. 6) on the Main Menu page. The Computer page allows the user to operate the device as a standard personal computer utilizing application programs of the type normally present on personal computers. As examples, the display of FIG. 16 provides for touchpoints in the sub-menu portion of the display for calendar date entry, notes, and organizer application programs. As with the other pages, the limited GPS information is also displayed.

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FIG. 17 illustrates the Radio page. The Radio page is accessed by pressing the RADIO touchpoint 500 on the Main Menu page. The radio mode provides the user with an interface for selecting the type of radio signal through touch points displayed in the sub-menu 151 area. The selectable types are: AM 503, FM 507 and TRANSCEIVER 511. Selecting any type will display a page (not shown) requesting frequency, volume, and other parameters relating to radio transmission and reception. The AM and FM are standard receivers. The device can thereby tune and listen to broadcasts that provide data links and receive data files using legal AM or FM radio bands (or any other radio band legal to access and provide radio station information). The device therefore allows users to communicate information amongst themselves without having to rely on telephone technology. This is especially valuable when telephone technology is not available.

The Receive Queue page displays stored received messages. The received messages may be displayed by reception type through selection of the transmission line type listed in the sub-menu portion of the display, the selectable types, through touch points displayed in the sub-menu 151 area, are: ALL 553, FAX 555, BEEPER 557, PHONE 559, COMPUTER 561 and RADIO 563. Selecting a type, will sort (by specified type) and display (by date and time) all messages received. By way of example, the radio queue contains GPS-encoded voice mail or digital files (containing information to various sites) provided by private third-party sources. The phone system queue contains previous calls with digital messages linked to web pages containing voice and video data. The computer which may be queued contains personal letters, calendars, notes and the like from more traditional sources or user created tagged files for storage. The fax queue contains traditional faxes which may illustrate maps with waypoints. The beeper mode queue contains received beeper messages (digital and voice).

The Send Queue page is accessed by pressing the SEND QUE touchpoint on the Main Menu page. The Send Queue page includes similar functions as the receive queue, except the Send Queue is a staging area for sending messages. The Send Queue page displays sent or to-be-sent data and an interface for selecting the specific type of queue. The selectable types, through touch points displayed in the sub-menu portion of the display 151, are: ALL 603, FAX 605, BEEPER 607, PHONE 609, COMPUTER 611 and RADIO 613. Selecting a type, will sort (by specified type) and display (by date and time) all messages sent or waiting to be sent.

FIGS. 23A and B are a system block diagram including a block diagram of a data provider. A plurality of PCDs 231, 232, 233 communicate with each other using the aforementioned communication means. The PCDs also communicate with various data base information suppliers including private data base information suppliers, publisher data base information suppliers, telephone service data base information suppliers, and a data base provider. The data base provider receives digital requests for map information or other data regarding a geographic area. The data provider collects map data and other data and tags the other data to the map data and maintains the map and location tagged data in a data base. Human intervention is not required in responding to data requests.

As shown in FIG. 23B, the application module of the device is ported to a computer system not GPS capable, or merely not portable so as to have no need for a GPS receiver. The application module allows non-PCD based computer users to provide data to the data provider in the correct

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format, as well as receive data from devices or the data provider. This allows the non-device base computer user to track the location of devices and to collect information to be manually entered into a traditional GPS capable device as an aid in future trip planning.

FIG. 20 illustrates a list of GPS encoded data for a restaurant listing of restaurants in a requested area. This list may have been furnished by third parties or a data provider. The PCD has stored this information in digital format and is displayed on a GEO coded map, GIFF map or any other map the PCD stored in memory or receives from a third party or data provider. The information can be arranged by the PCD using criteria enabling the user unlimited access to the data. If the user chooses to navigate to these locations singularly or as a group, the GPS engine performs these functions, allowing a user of the device to accurately travel to the desired restaurant. As shown in FIG. 21, the PCD can use any scale of map or combinations and other types of maps as shown. The user of the PCD selects certain maps for storage and recalls same when needed for navigation. By way of example, the user's device could have a local Los Angeles street map, an interstate map (as shown in FIG. 21), and a New York city map in device memory. The user could navigate to the airport using the GPS functions and stored Los Angeles map, fly to New Jersey, rent a car and navigate to New York using the interstate map and, finally, find a specific restaurant in New York City by using the third map stored in PCD memory.

As shown in FIG. 22, the PCD contains a map with various waypoint locations the user has selected. These waypoints are both standard waypoints 221 and linked waypoints 222. The waypoints are indicated by a marker on the display. Standard waypoints indicate identifiable locations of interest. Linked waypoints have additional data associated with the waypoint. The additional data may be text data, visual data such as a photographic image of the waypoint, or an audio data file. When the marker for the linked waypoint is selected using the touch screen or other input device, the processor determines if the additional data associated with the waypoint is available in the PCD memory. If the additional data is not available in the PCD memory, the PCD automatically requests the additional data from a data provider. Once the additional data is available, the PCD displays or otherwise makes use of the additional data.

Using the map of FIG. 22, the user could navigate to a school, restaurant, bank, gas station, government office using the PCD to interpolate using spatial query techniques to find the best routes to each location. The PCD can re-collate the list for the most efficient route using the application and GPS engine modules. Using software programming techniques and math formulas, persons skilled in the arts will utilize spatial analysis queries and functions to determine best routing and "closest to" scenarios. In addition, centroid interpolation functions and match-rate comparison functions used by the GEO coding community will further enhance this application's ability to universally communicate with other systems.

FIG. 30 further illustrates a system whereby the user uses a PCD to dial a direct access number similar to dialing 411, but all requests are requested and serviced automatically. Upon connection to the system, the user makes keyboard requests to the PCD or traditional computer system using the application program of the PCD. Upon requests being received by the data provider or similar information provider, the provider or supplier searches the data base for data responsive to the request. The provider or supplier can

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access further data through data links to other third party sources and continue to provide all data required by the requester. This system is consistent with the world wide web, linking data through hypertext connections and designations. This invention's system converts information requests to data requests, not verbal requests, as presently being practiced in directory assistance type services. This narrow usage of the application module allows convenient access to directory assistance that primarily provides data and chunks of information in a short period of time consistent with directory assistance today.

FIG. 31 shows a web page screen with a data provider icon displayed on the device. Pressing or otherwise selecting the icon will enable a menu for the requester to specify a data request. Download will be in the form of a compressed digital data file that may include video, sound, or other digitally encoded data.

While this invention has been described with reference to illustrative embodiments, this description is not intended to be construed in any limiting sense. Various other embodiments of the invention will be apparent to persons skilled in the art upon reference to this description. It is therefore contemplated that the appended claims will cover any such modifications of the embodiments as fall within the true scope and spirit of the invention.

What is claimed is:

1. A location tagged information storage and transceiver system comprising:

a transceiver, the transceiver receiving digital data from a personal digital communication device and transmitting digital data to the personal digital communication device;

a computer processor;

computer memory for storing map data for geographic areas and non-map data, with the non-map data in linked data fields concerning specific locations within the geographic areas for which map data is available, the non-map data tagged to the map data;

a sorting application module executed by the computer processor, the sorting application module responsive to requests from the personal digital communication device, the requests being for a specified maximum number of specified non-map data concerning specified geographic areas, the sorting application module searching the computer memory by data fields for the specified non-map data and providing the specified non-map data and map data linked to the specified non-map data to the transceiver for transmission to the personal digital communication device.

2. The location tagged information storage and transceiver system of claim 1 further comprising a linking and tagging module executed by the processor for linking data pertaining to a specific geographic location in linked data

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fields and tagging the linked data fields with a marker indicative of geographic location.

3. The location tagged information storage and transceiver system of claim 1 wherein the specified non-map data includes restaurant listings.

4. The location tagged information storage and transceiver system of claim 1 wherein the specified non-map data includes hours of operation.

5. The location tagged information storage and transceiver system of claim 1 wherein the specified non-map data includes traffic reports.

6. The location tagged information storage and transceiver system of claim 1 wherein the specified non-map data includes weather reports.

7. The location tagged information storage and transceiver system of claim 1 wherein the specified non-map data includes yellow page entries.

8. A method for storing and transmitting geo-relevant information comprising:

storing map data for geographic areas and non-map data, with the non-map data in linked data fields concerning specific locations within the geographic areas;

receiving a request from a user for a specified maximum number of listings of non-map data;

searching the map data and the non-map data to obtain specific map data and non-map data in response to the request; and

automatically transmitting the specific map data and up to the maximum number of listings of non-map data to the user.

9. The method for storing and transmitting geo-relevant information of claim 8 wherein the non-map data includes restaurant listings.

10. The method for storing and transmitting geo-relevant information of claim 8 wherein the non-map data includes hours of operation.

11. The method for storing and transmitting geo-relevant information of claim 8 wherein the non-map data includes traffic reports.

12. The method for storing and transmitting geo-relevant information of claim 8 wherein the non-map data includes weather reports.

13. The method for storing and transmitting geo-relevant information of claim 8 wherein the non-map data includes yellow page entries.

14. The method for storing and transmitting geo-relevant information of claim 8 wherein the map data includes latitude and longitude data.

15. The method for storing and transmitting geo-relevant information of claim 8 wherein the request includes information indicating a specified manner of transmission to the user of the specific map data and non-map data.

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(54) **TECHNIQUE FOR PROVIDING
INFORMATION AND CONTROL
RESPONSIVE TO A REQUEST IN A
VEHICLE**

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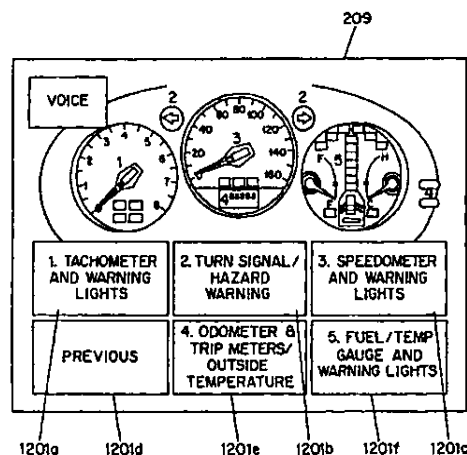
Primary Examiner—Jacques H. Louis-Jacques

(74) Attorney, Agent, or Firm—Kaye Scholer LLP

(57) **ABSTRACT**

In a multimedia information and control system for use in an
automobile, at least one interface is employed which enables
a user to access information concerning the automobile and
control vehicle functions in an efficient manner. The user
may select one of a plurality of displayed options on a screen
of such an interface. Through audio, video and/or text
media, the user is provided with information concerning the
selected option and the vehicle function corresponding
thereto. Having been so informed, the user may activate the
selected option to control the corresponding vehicle func-
tion.

20 Claims, 15 Drawing Sheets



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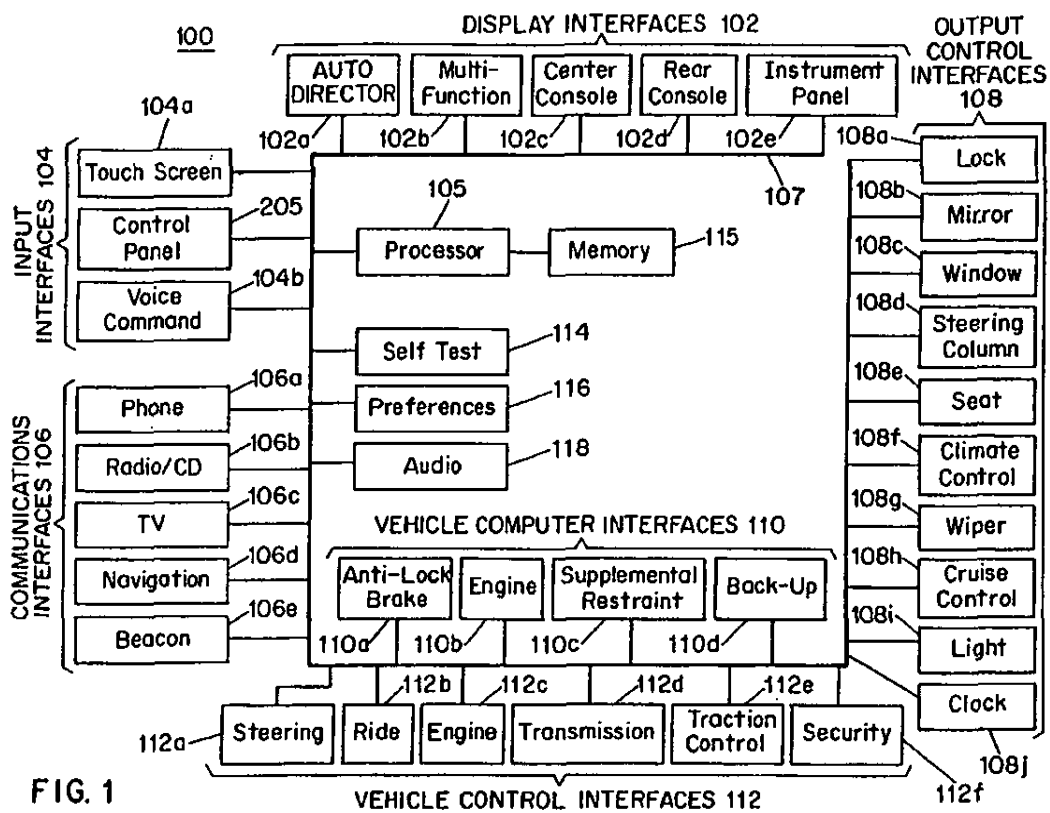
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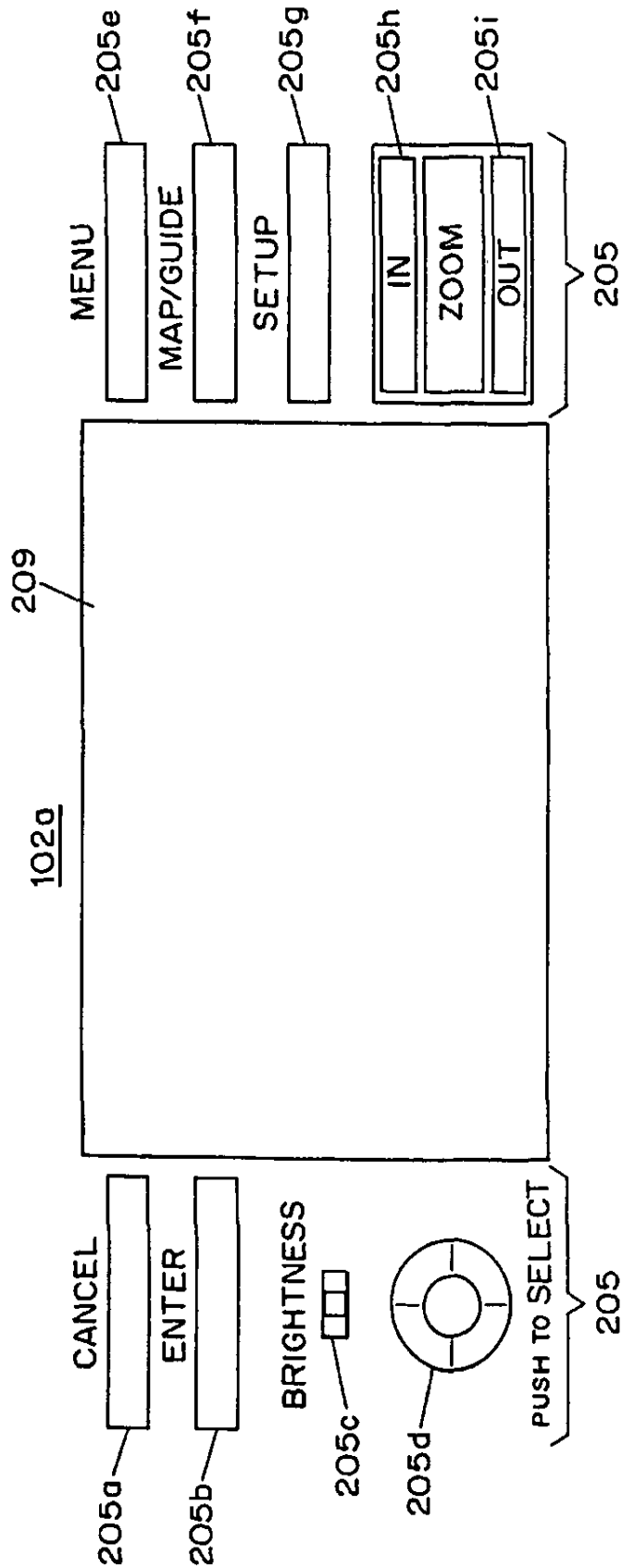


FIG. 2

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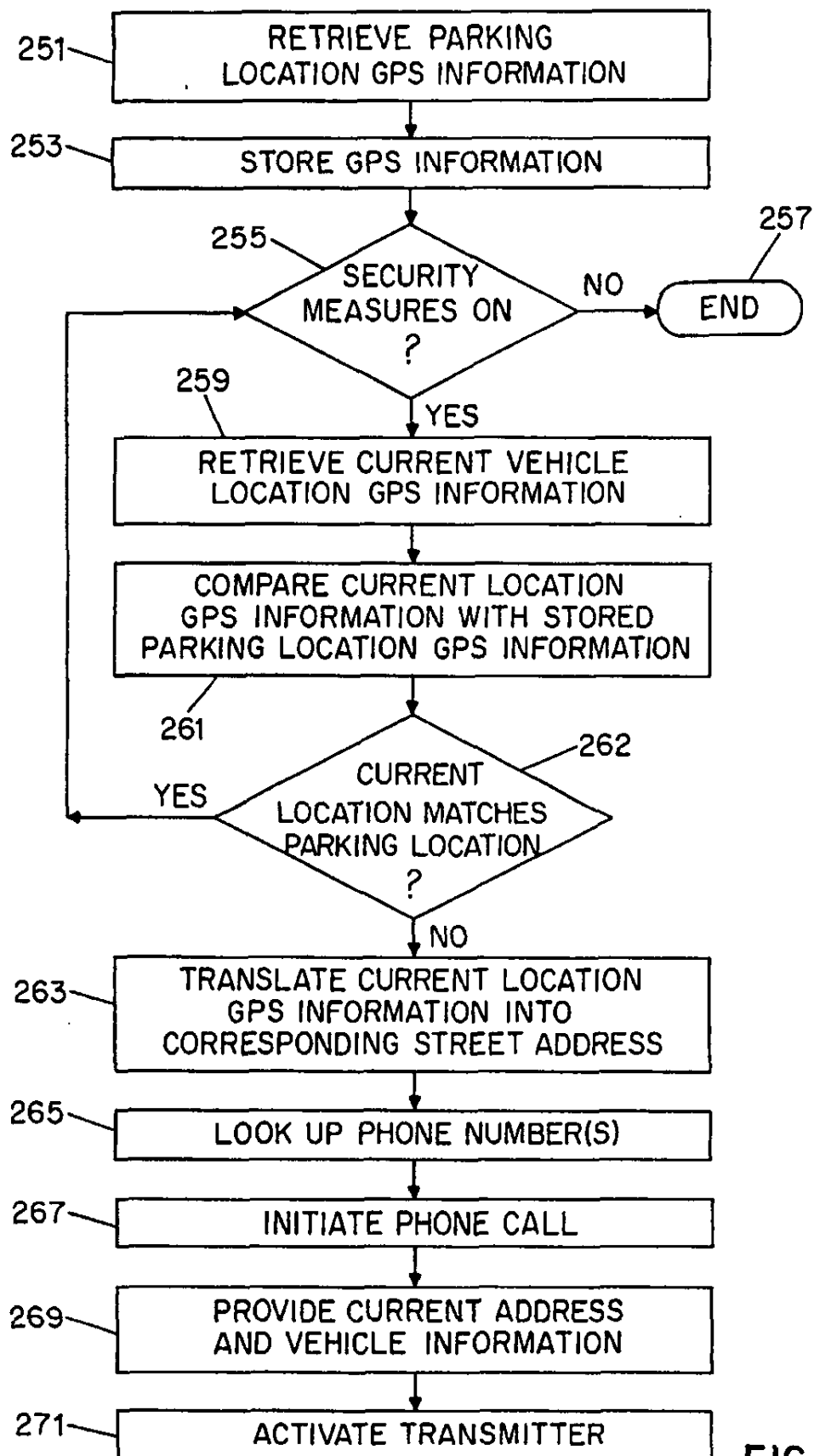


FIG. 3A

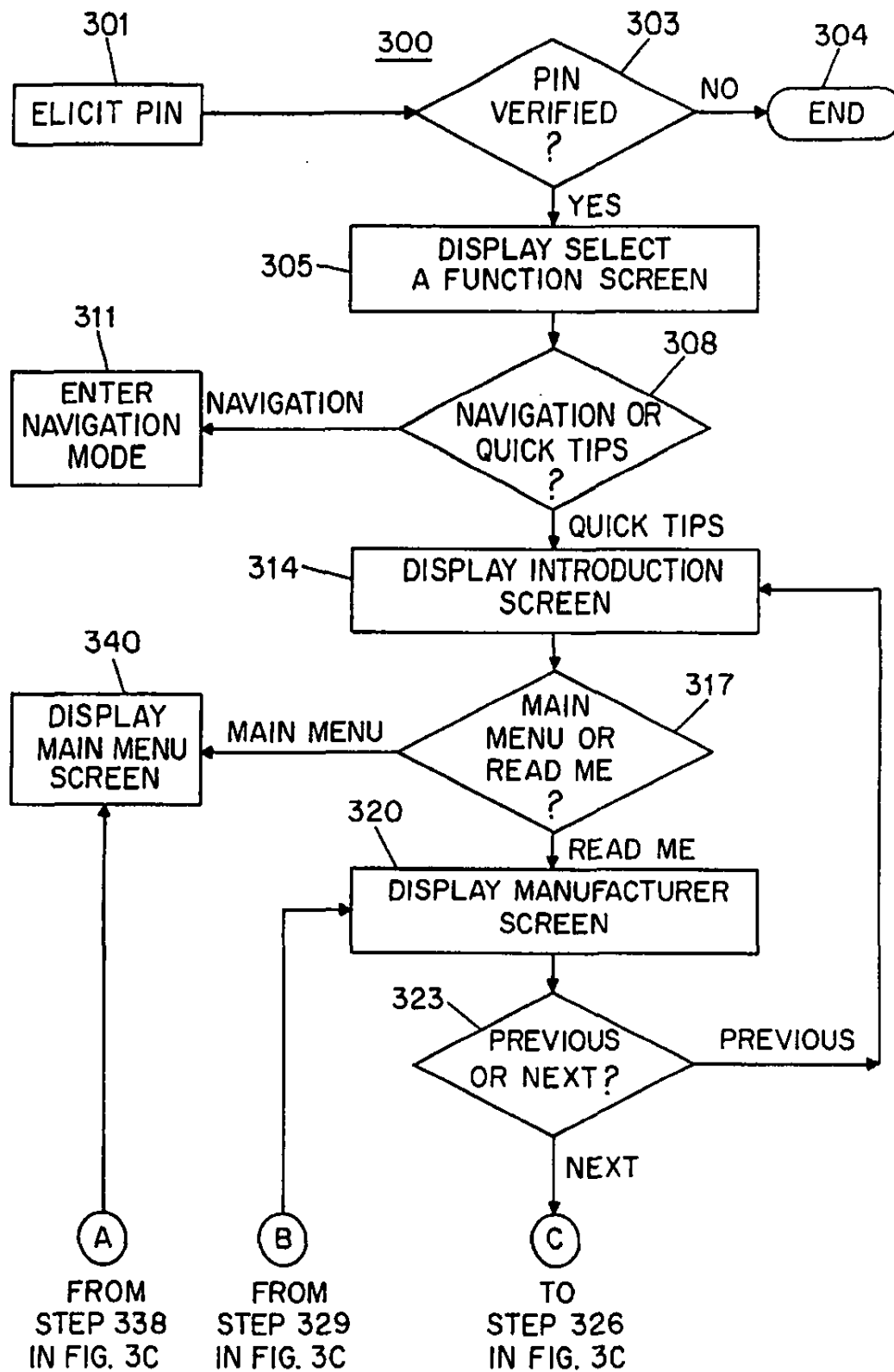


FIG. 3B

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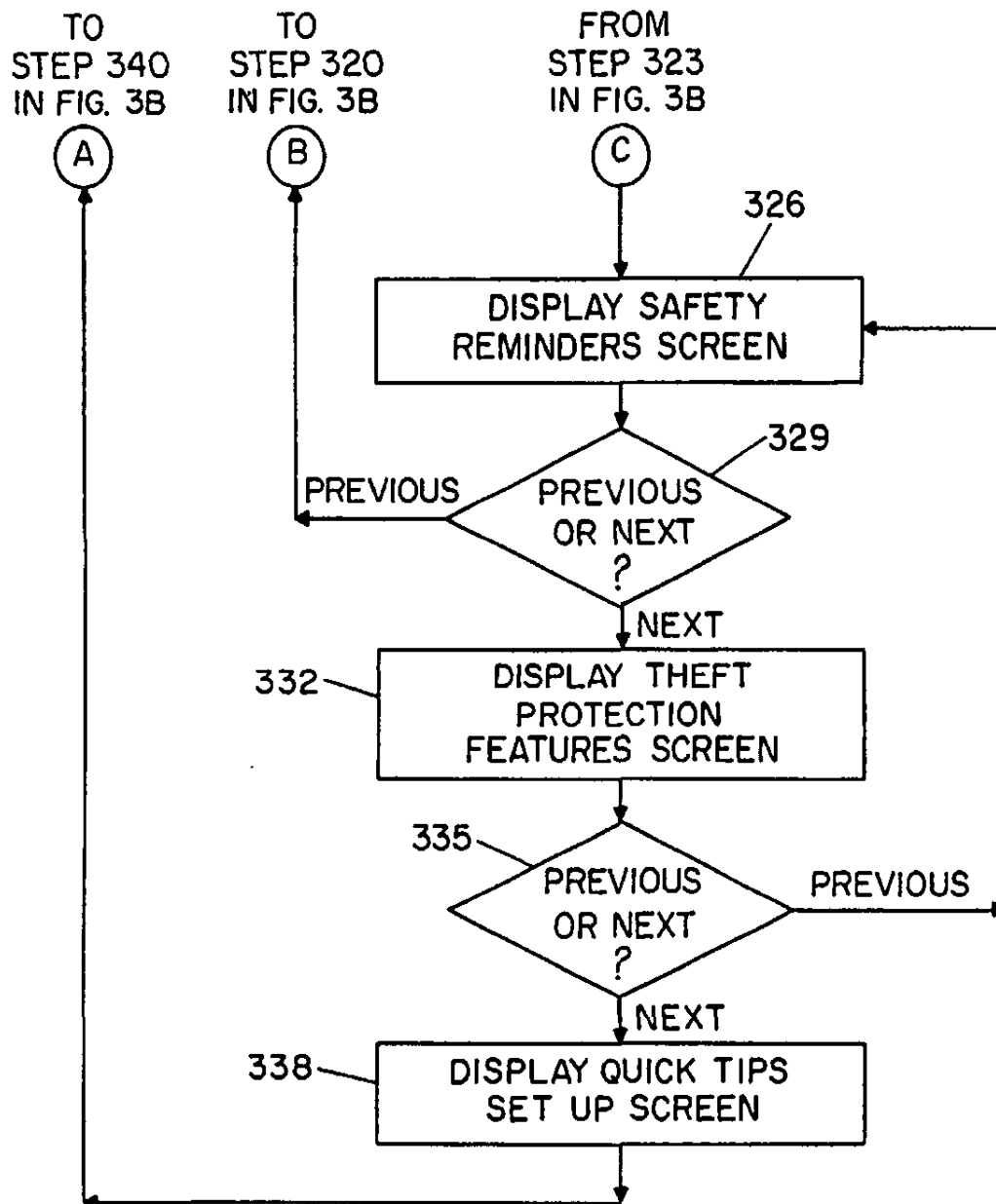


FIG. 3C

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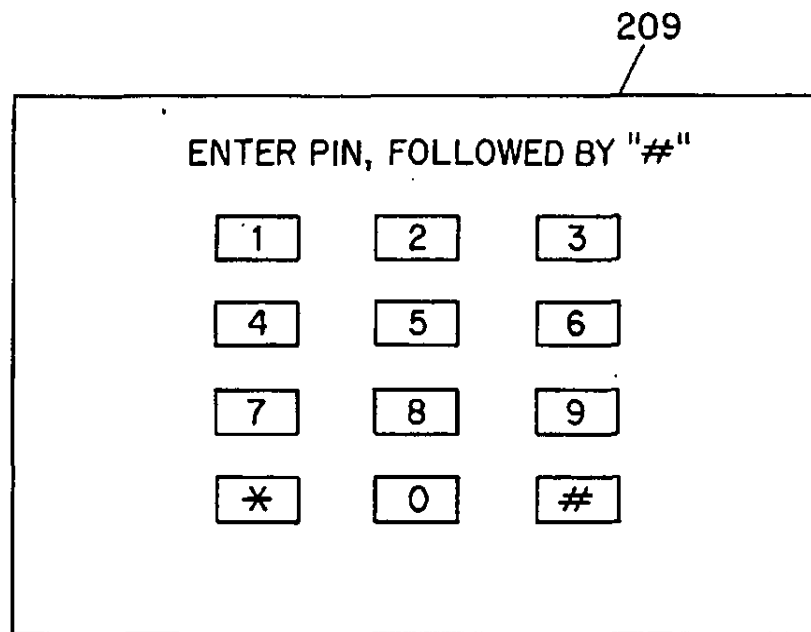


FIG. 4A

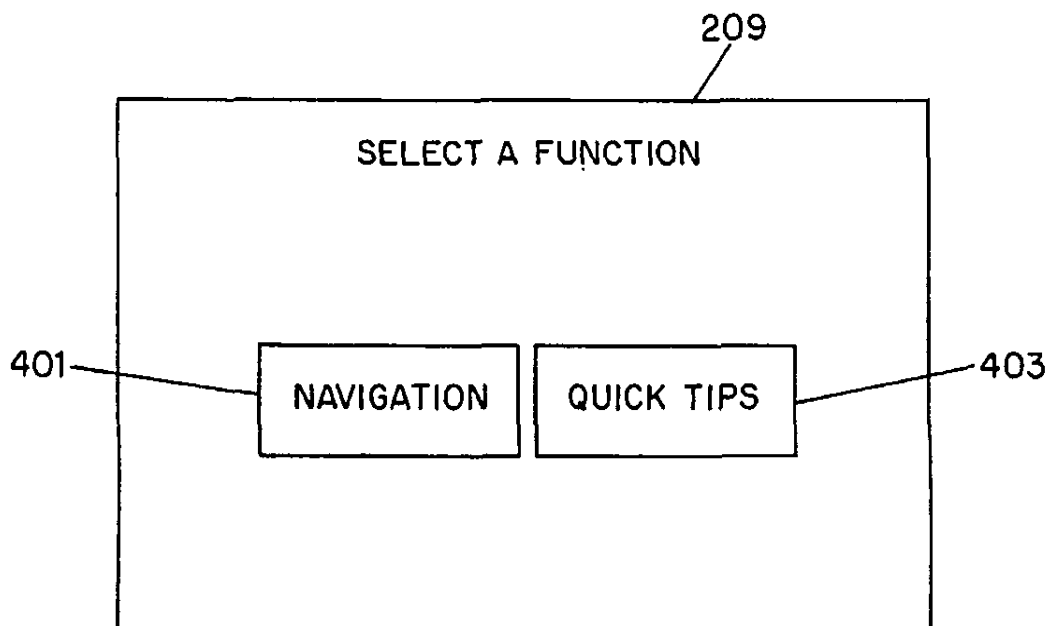


FIG. 4B

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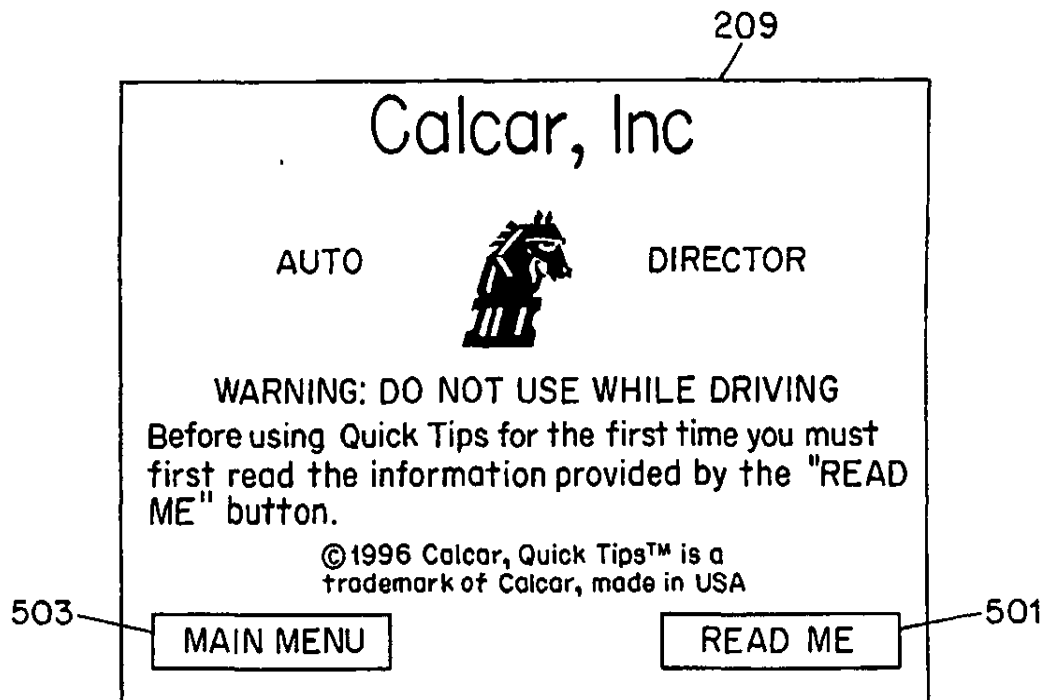


FIG. 5

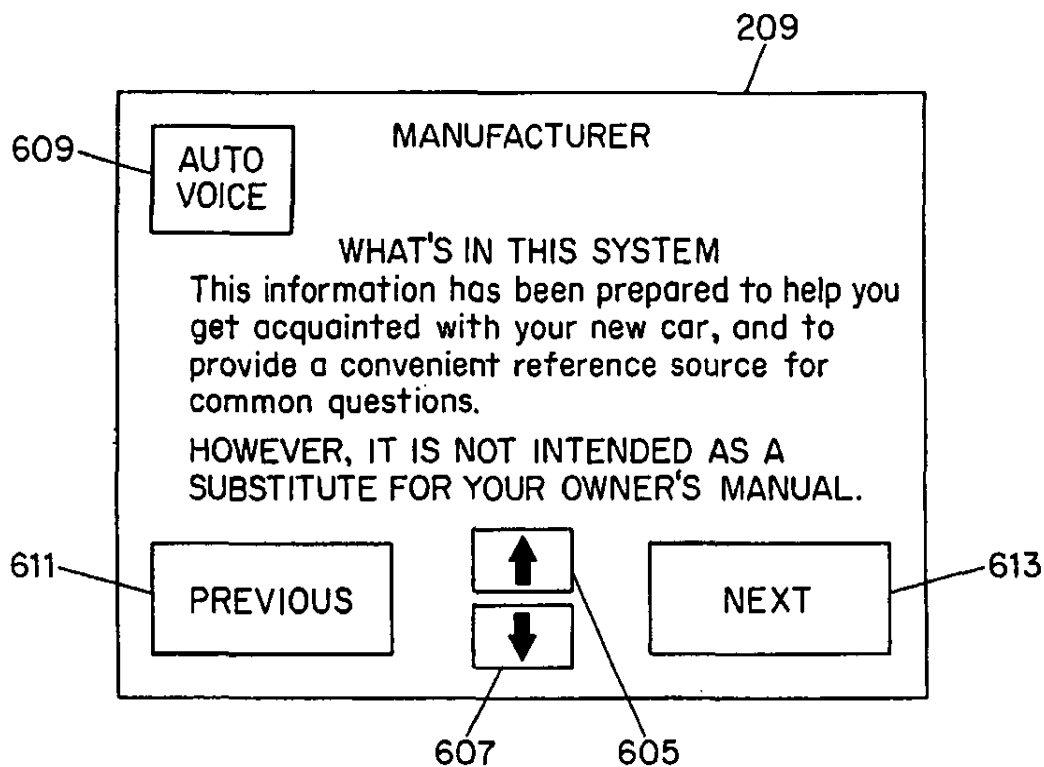


FIG. 6

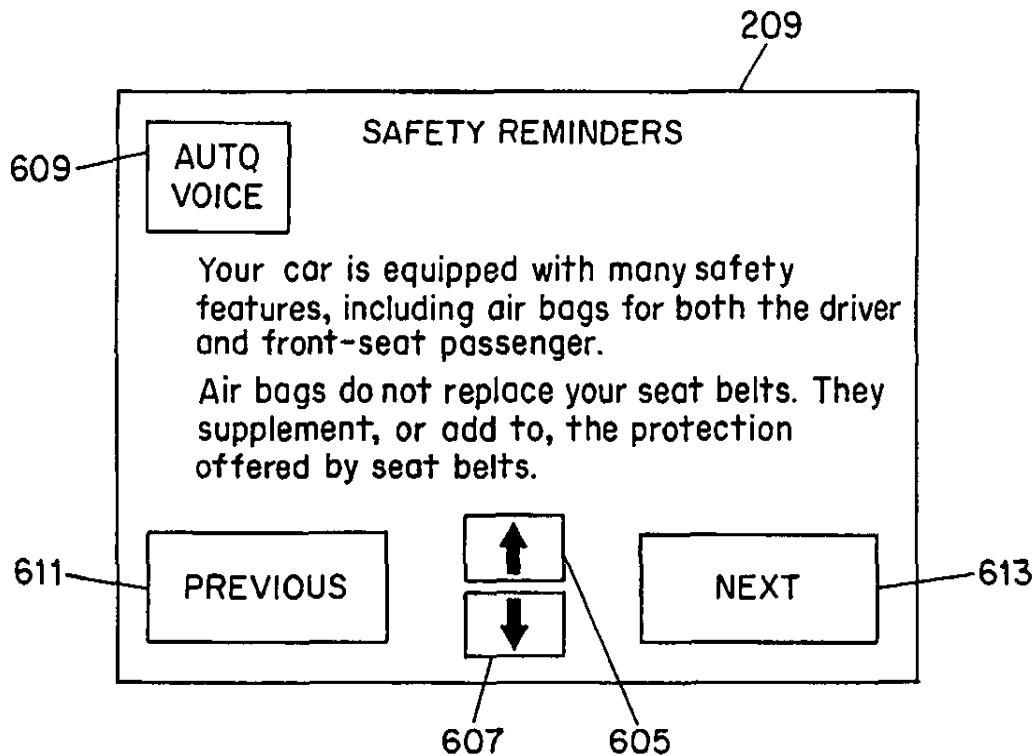


FIG. 7

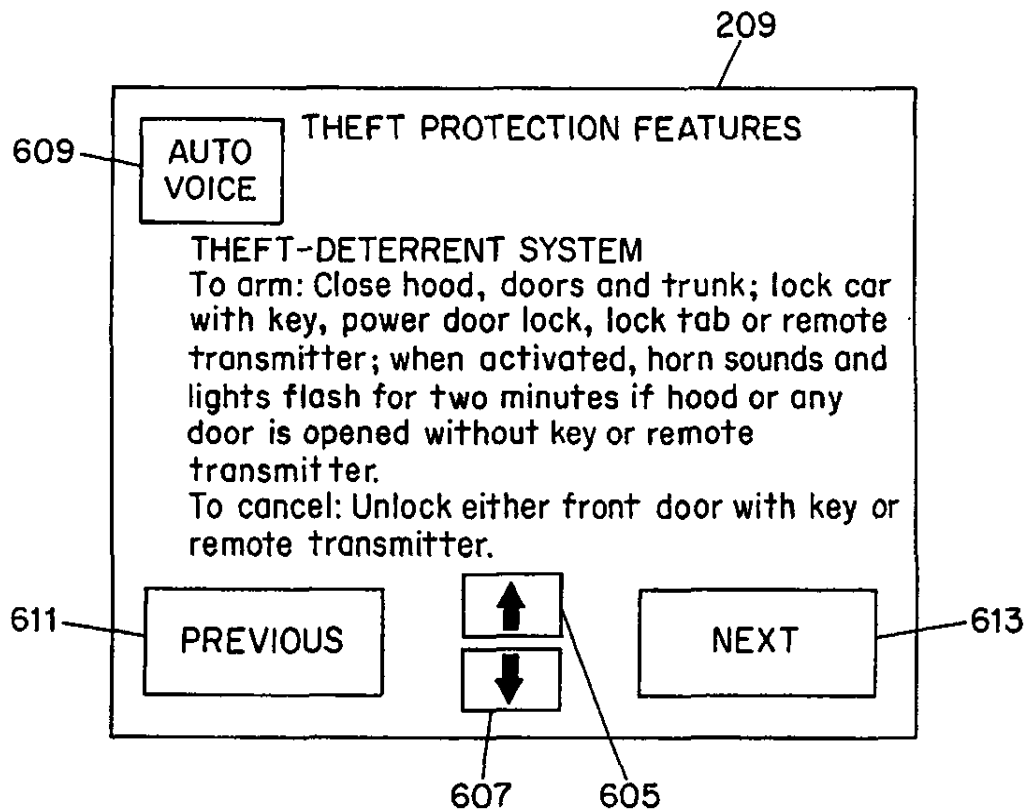


FIG. 8

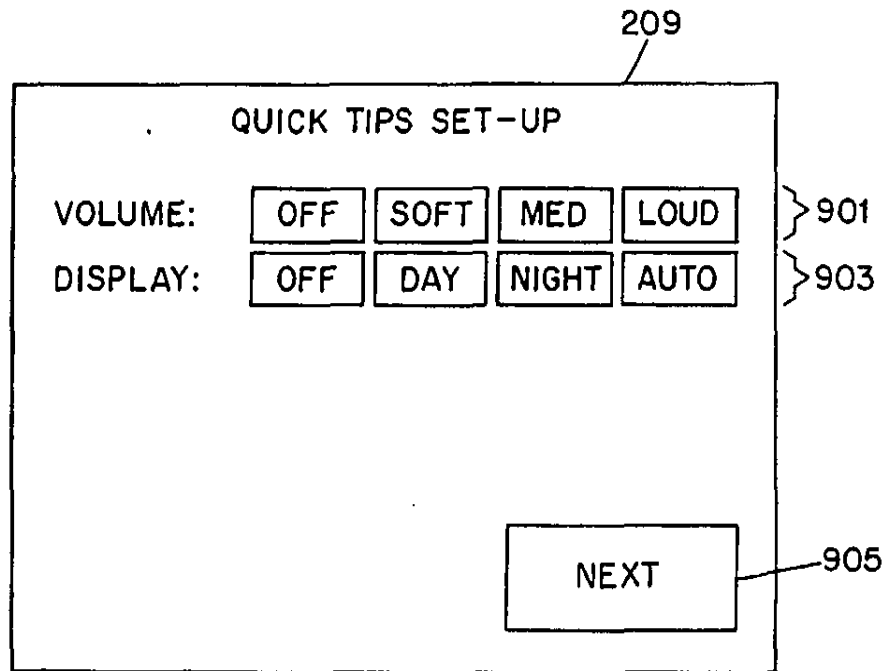


FIG. 9

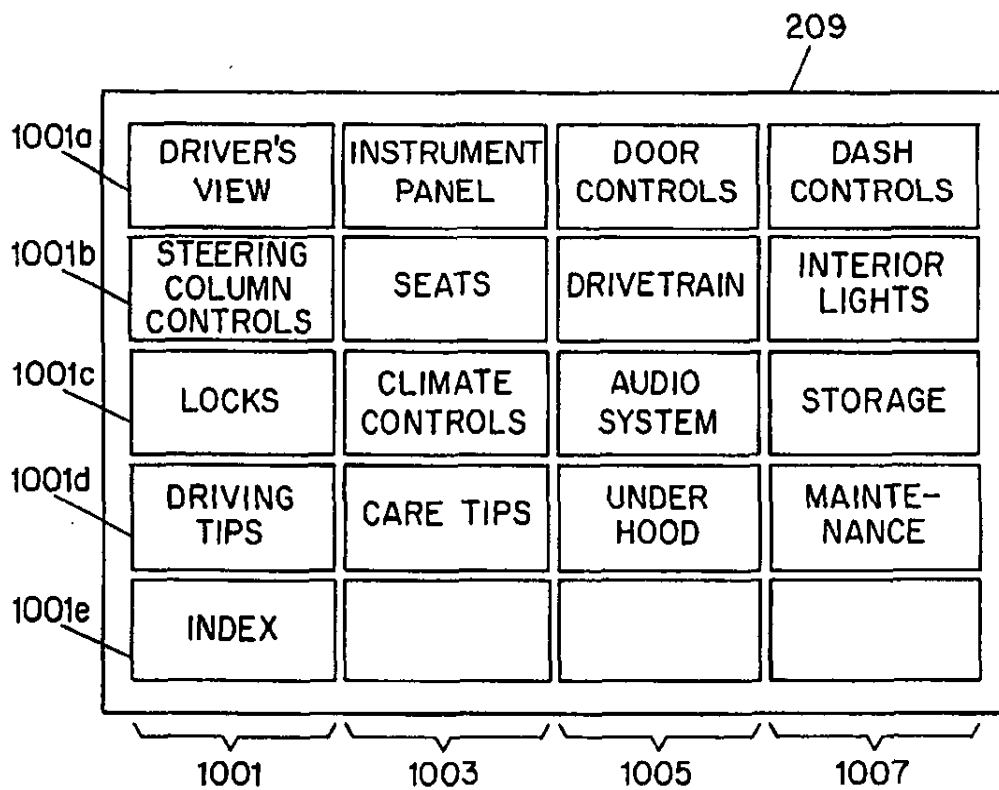


FIG. 10

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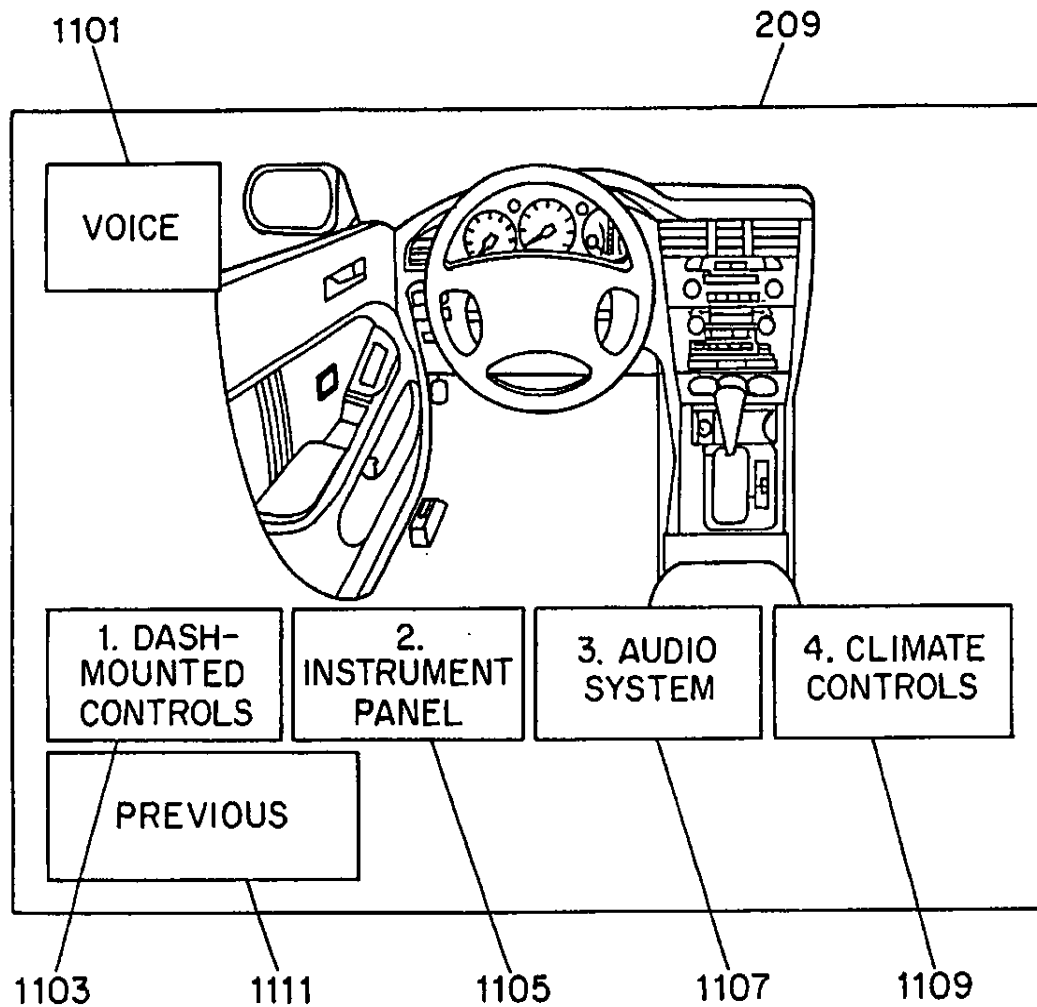


FIG. 11

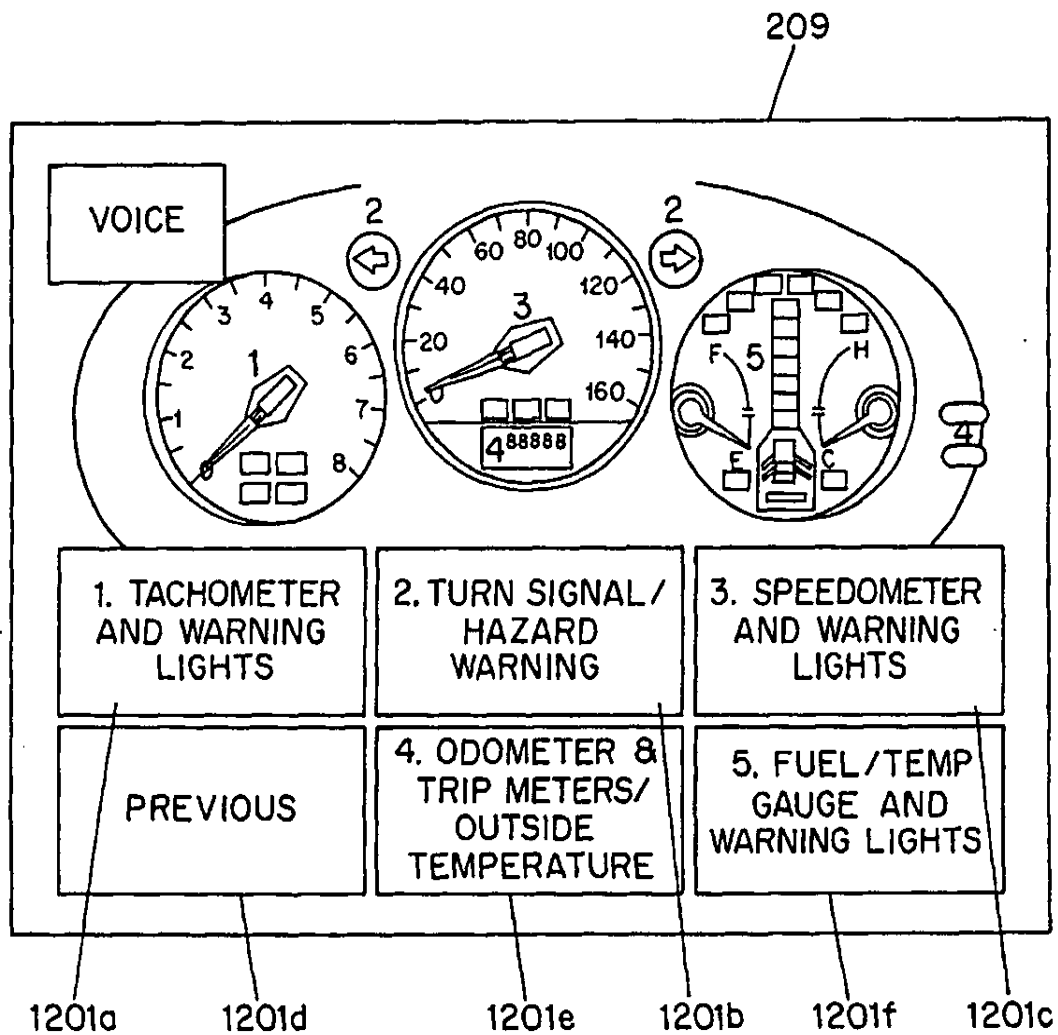


FIG. 12

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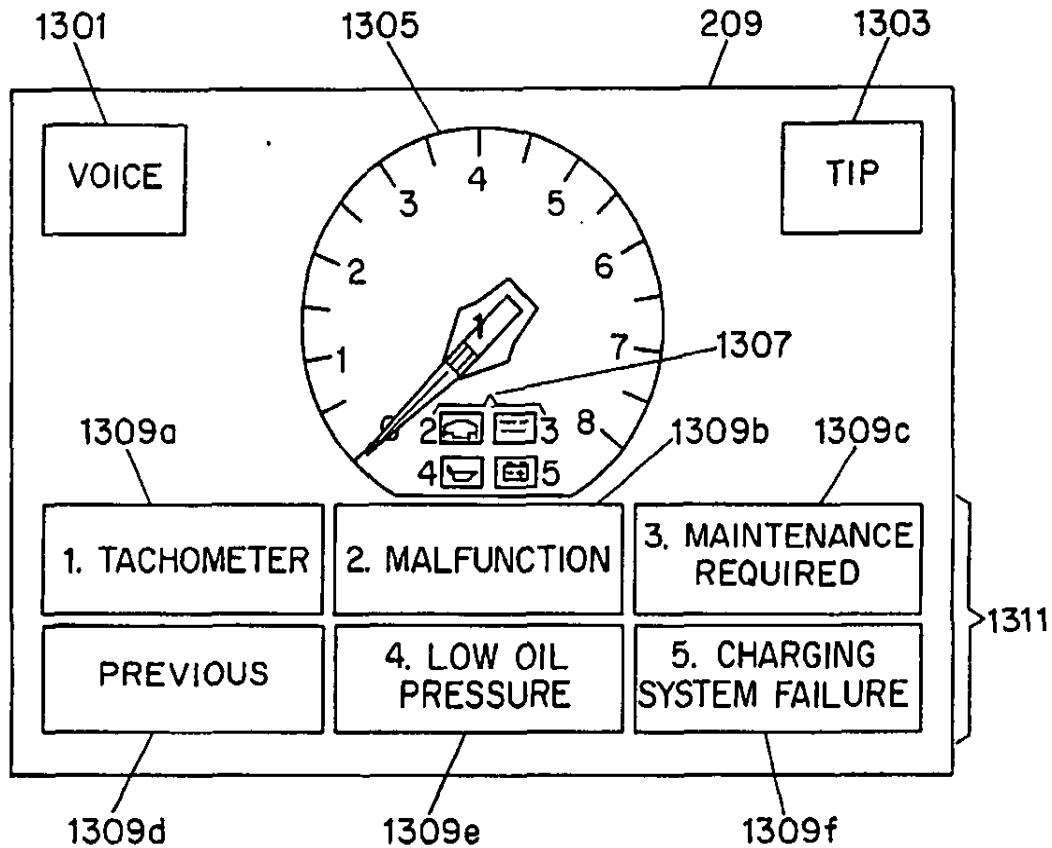


FIG. 13

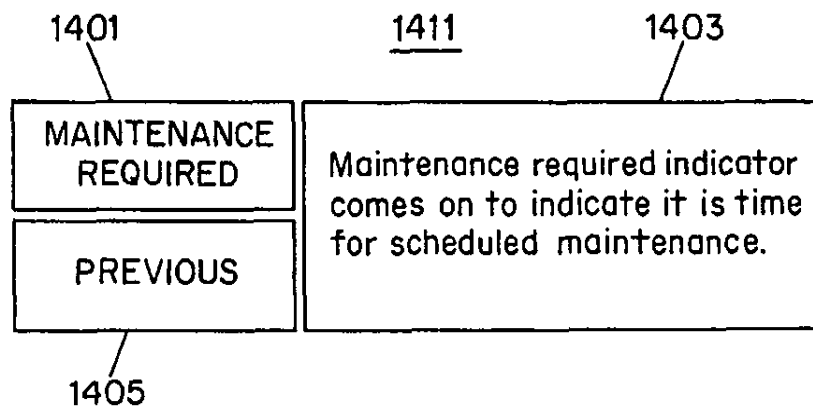


FIG. 14

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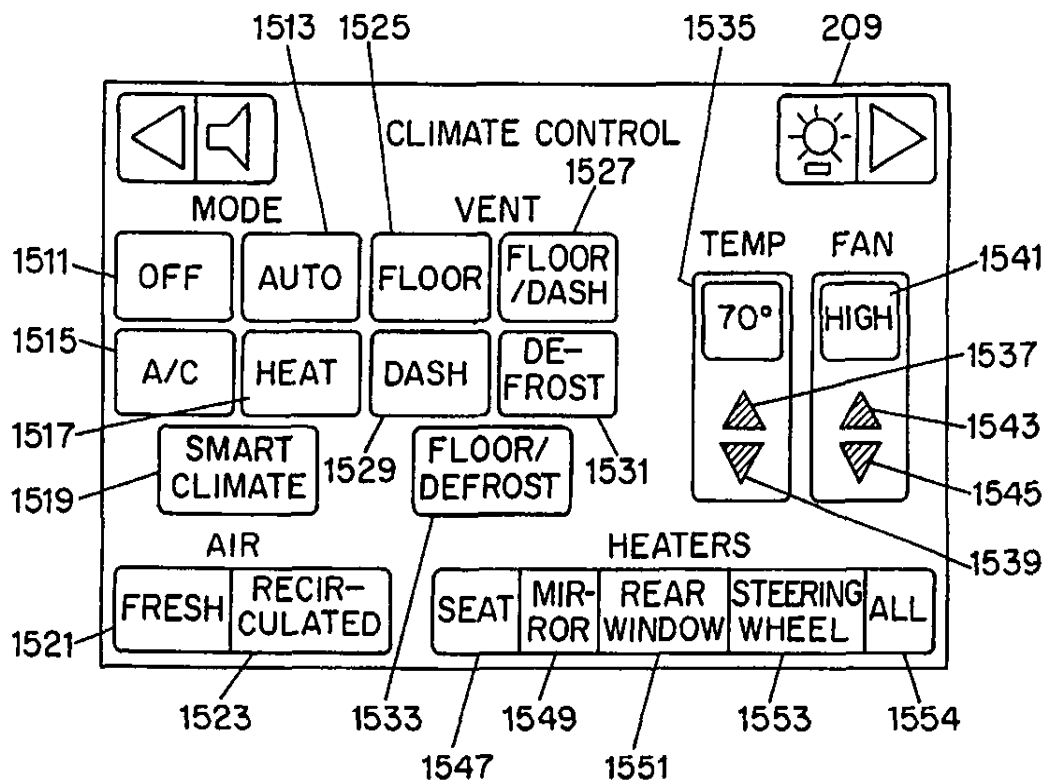


FIG. 15

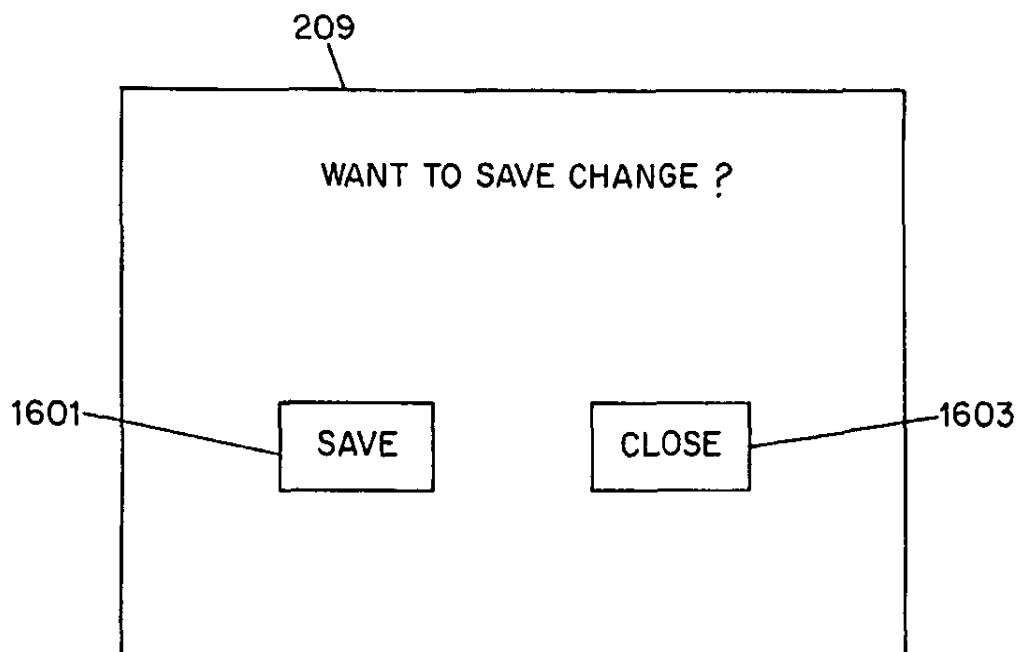


FIG. 16

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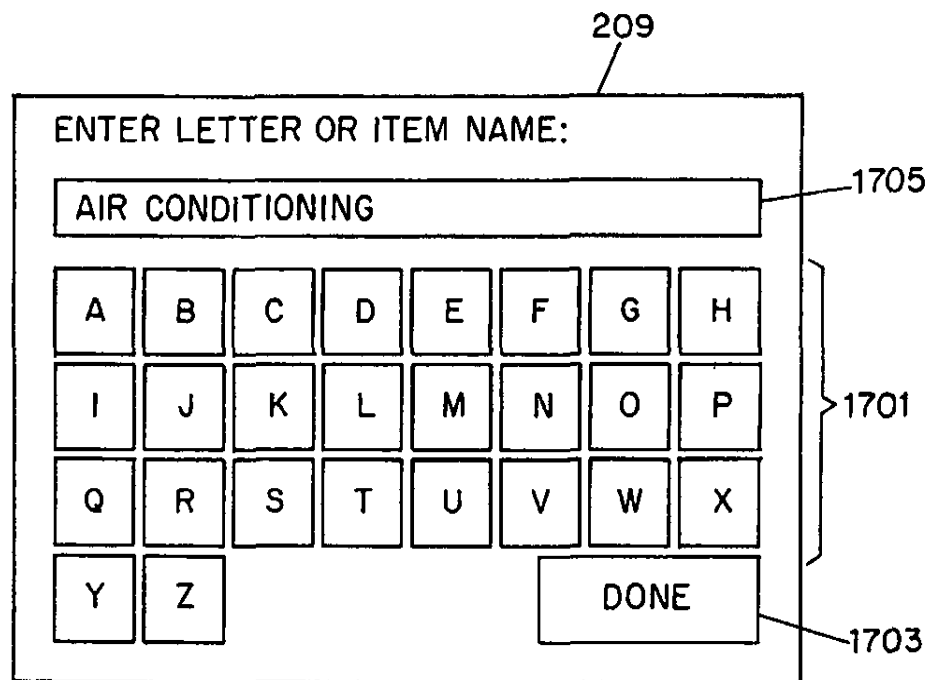


FIG. 17

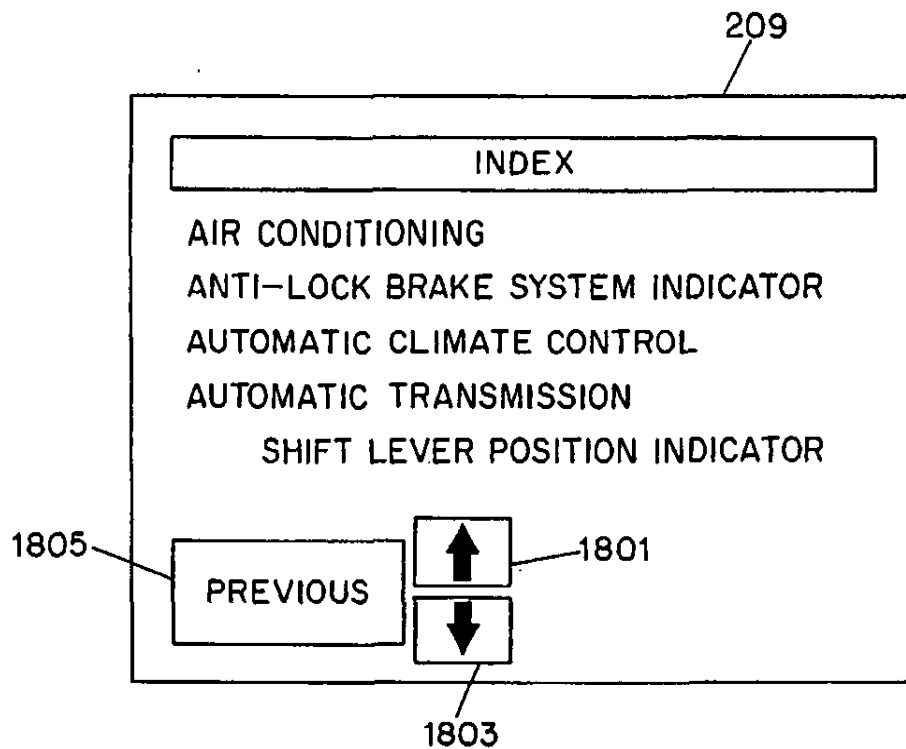


FIG. 18

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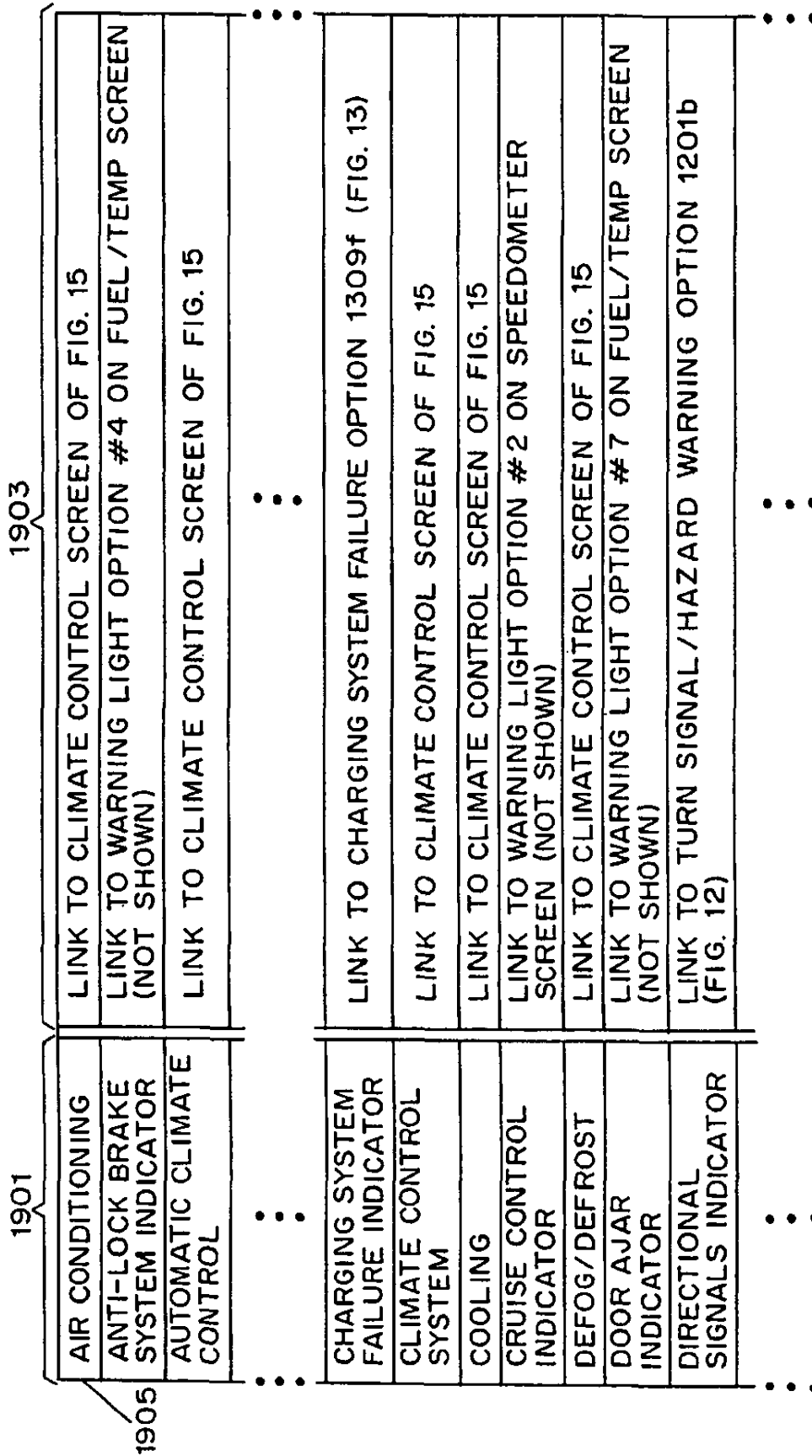


FIG. 19

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TECHNIQUE FOR PROVIDING INFORMATION AND CONTROL RESPONSIVE TO A REQUEST IN A VEHICLE

This application is a continuation of application Ser. No. 09/792,351 filed on Feb. 23, 2001, now U.S. Pat. No. 6,438,465, which is a continuation of application Ser. No. 09/401,038 filed on Sep. 21, 1999 now U.S. Pat. No. 6,233,506, which is a division of application Ser. No. 08/789,934 filed on Jan. 28, 1997, now U.S. Pat. No. 6,009,355.

FIELD OF THE INVENTION

The invention relates generally to information and control systems and, more particularly, to a system for use in an automobile which facilitates a user's retrieval and/or dissemination of information, and control of vehicle functions.

BACKGROUND OF THE INVENTION

Information is vital to day-to-day activities. With no access to information, people cannot function efficiently in this society, and their lives and financial well-being are put in jeopardy. People want to be well-informed, so much so that when they are travelling in automobiles, they tune into local radio stations to listen to news, weather forecasts and traffic conditions. For that matter, some automobiles are equipped with audiovisual systems including television (TV) receivers. One such system is disclosed in U.S. Pat. No. 5,404,443 issued to Hirata. The Hirata system provides audiovisual information in a number of modes including a TV mode, which may be selected by control switches disposed on the periphery of a display.

Automobile users like to be continually updated with information affecting their travel plans such as weather and traffic conditions because of its fast changing nature. Automobile users who are traveling also like to continually keep in touch with their homes and offices, and to confirm appointments and hotel reservations so that they can adjust their itineraries accordingly. To that end, cellular mobile telephones were introduced to enable automobile users to conduct business and contact their families while they are traveling.

In addition, local map information is important to automobile travelers moving from one locale to another. As such, navigation systems were developed to help reach their destinations in an unfamiliar milieu. One such vehicle navigation system is disclosed in U.S. Pat. No. 5,274,560 issued to LaRue. The disclosed system is based on artificial intelligence and provides a driver with directions via a voice interface. The system is built upon an optical disk player which can be used for entertainment as well. Digitized maps, compressed voice records and computer programs are stored on an optical disk compatible with the disk player. After a destination point is identified, the disclosed system finds the best route from the digitized maps and guides the driver therethrough via the voice interface, taking into account the latest traffic conditions received by an FM receiver to avoid congestion.

Recently, navigation systems based on military global positioning system (GPS) technology have emerged. One such navigation system is commercially available as an option for the latest model of the ACURA 3.5 RL automobile. This ACURA navigation system receives signals from a constellation of satellites which is part of the GPS. In response to these signals, the navigation system pinpoints

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the automobile's location (in latitude and longitude). It also detects the automobile's speed and direction. With geographic information stored on a hard disk in an onboard computer, the navigation system is capable of verbally and visually communicating to the user instructions for reaching the destination.

In addition to the above techniques for communications with automobile users, a technique for disseminating information regarding the automobiles themselves is disclosed in U.S. Pat. No. 5,442,553 issued to Parillo. The disclosed system is a vehicle diagnostic and software upgrade system. In this system, sensors are provided in the vehicle to generate dynamic data relating to various mechanical controls and the engine of the vehicle, including engine R.P.M., fuel/air mixture, emissions and pollution content information. A microprocessor in the vehicle has access to selectable program parameters affecting the functioning of the mechanical controls. The microprocessor collects and transmits the dynamic data to a remote diagnostic station periodically or upon its request. In response, the remote station sends, to the vehicle, signals indicative of any changes in its software and/or program parameters. The microprocessor accordingly causes the changes to be made in the vehicle based on the received signals.

Besides the communication capabilities described above, an automobile has many accessories and user control elements such as lights, wipers, a clock, temperature control, cruise control, seat adjustment control, mirror adjustment control, and an anti-theft system. A technique for centralizing the command of the individual control elements is disclosed in U.S. Pat. No. 5,555,502 issued to Opel. The disclosed system includes a centralized control panel on a steering wheel which, together with a display, is utilized to control the electronic components of the automobile. The display is positioned in the area of the driver's sun visor. After the driver presses one of the buttons on the control panel corresponding to a desired electronic component, a menu is displayed so that the driver is able to select items from the menu to program the component. The selection is accomplished by pressing specified buttons on the panel.

In addition, a technique for controlling vehicle accessories via voice command is disclosed in U.S. Pat. No. 4,827,520 issued to Zeinstra. In accordance with this technique, control functions of each accessory are formatted in a summary page for display on a screen, which is scanned by infrared light to sense any touching thereon. By uttering any of the displayed functions on the summary page, preceded by either a specified keyword or an actuation of a push-to-talk switch on a steering wheel, a more detailed subpage of the selected function is displayed for further selection by voice. As an alternative to the voice command, the selection can also be accomplished by touching the displayed function on the screen.

Voice command and touch screen techniques are frequently mentioned in prior art references in controlling car accessories. In particular, U.S. Pat. No. 5,214,707 issued to Fujimoto et al. discloses a system for voice-controlling equipment inside a vehicle, including microphones capable of discriminating voice commands as to whether they are generated at the driver side or at the assistant side of the vehicle in a noisy environment.

SUMMARY OF THE INVENTION

It is celebratory that technology advances at lightning speed. However, many people are left behind the technological frontier, and to some extent develop "technophobia".

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Some of them have even given up this technological race, which is confirmed by the blinking "12:00" display on the clocks of many video cassette recorders (VCRs) being used.

Similarly, it is fantastic that automobiles nowadays include many advanced accessories such as audiovisual systems, anti-theft systems, anti-lock brake systems, climate control, and cruise control which embrace the latest technologies. However, of all these accessories, many automobile users only know how to operate the headlights and windshield wipers, and regard the rest as nuisance. That is, the users pay for numerous accessories which they do not use, resulting in much consumer waste. We have recognized that such non-use is principally attributed to an inefficient distribution of operating knowledge of the automobile and, in particular, its accessories.

Specifically, when automobile users presently want to learn about certain aspects of an automobile, they need to consult an owner's manual which could have been lost or misplaced when they need it the most. In addition, the manual is unpopular because many users simply want to avoid reading any written material, and find it intimidating as it oftentimes is filled with incomprehensible technical jargon.

We have further recognized that even with the operating knowledge, many users are overwhelmed and confused with the large number of knobs, switches and buttons used to control the individual vehicle parts and accessories.

Accordingly, it is an object of the invention to design an information and control system for use inside an automobile with the user in mind. The user is afforded a centralized control which may be used in lieu of the knobs, switches and buttons to operate the vehicle parts and accessories. In accordance with the invention, the centralized control is intimately tied to an information system such that the user is able to efficiently access information about the functions and operations of such parts and accessories, and in a synergistic manner apply that information to operate same, using the centralized control.

It is another object of the invention that the access to the information is intuitive and direct so that the user can obtain the relevant information in a few self-explanatory steps. To that end, the invention embraces a multimedia approach where audio and video media are added to the traditional text media to convey information. The additional media increases the dimensions of both the user's comprehension of the information and the user's interaction with the automobile. Moreover, the information access is driven by a multilevel menu based on an intuitive model of taxonomy where information is organized in a minimal number of levels of subject matter from general to specific. The above integration of the multimedia approach with the multilevel menu approach presents an effective way of retrieving information in the automobile. Advantageously, with the invention, the user would not be distracted or overburdened by irrelevant information in the course of an information retrieval, which is conducive to a safe driving environment.

In the preferred embodiment, when the user wants to access information about a given part or accessory of the automobile, the user is presented with options on a display screen. Each option is associated with a respective one of different parts or accessories of the automobile. The user is able to select through the interface one of the options, associated with the given automobile part or accessory. The option, when selected, is highlighted in a first color, for example, yellow. A voice is then generated by the inventive system to explain the purpose or the content of the selected

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option before the user commits to it. Having been so informed, the user may then activate the selected option in retrieving the information of interest. The activated option is highlighted in a second color, e.g., blue, to indicate its active status. The retrieved information is presented to the user both in text and in voice.

BRIEF DESCRIPTION OF THE DRAWING

Further objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing showing an illustrative embodiment of the invention, in which:

FIG. 1 is a block diagram of an automobile information and control system in accordance with the invention;

FIG. 2 illustrates a control panel and a display interface for a user to interact with the system of FIG. 1;

FIG. 3A illustrates a flow chart depicting the steps of an anti-car-theft routine used in the system of FIG. 1;

FIGS. 3B and 3C jointly illustrate a flow chart depicting the steps of a routine for presenting various screens to the user in the system interaction;

FIG. 4A illustrates a screen for eliciting a personal identification number (PIN) from the system user;

FIG. 4B illustrates a SELECT A FUNCTION screen including features thereof in accordance with the invention;

FIG. 5 illustrates an introduction screen including features thereof in accordance with the invention;

FIG. 6 illustrates a MANUFACTURER screen including features thereof in accordance with the invention;

FIG. 7 illustrates a SAFETY REMINDERS screen including features thereof in accordance with the invention;

FIG. 8 illustrates a THEFT PROTECTION FEATURES screen including features thereof in accordance with the invention;

FIG. 9 illustrates a QUICK TIP SET-UP screen including features thereof in accordance with the invention;

FIG. 10 illustrates a MAIN MENU screen including features thereof in accordance with invention;

FIG. 11 illustrates a DRIVER'S VIEW screen including features thereof in accordance with the invention;

FIG. 12 illustrates an INSTRUMENT PANEL screen including features thereof in accordance with the invention;

FIG. 13 illustrates a TACHOMETER AND WARNING LIGHTS screen including features thereof in accordance with the invention;

FIG. 14 illustrates a segment of the screen of FIG. 13 providing the user with information regarding a particular function of the automobile;

FIG. 15 illustrates a CLIMATE CONTROL screen including features thereof in accordance with the invention;

FIG. 16 illustrates a SAVE screen for saving the user's preferences in accordance with the invention;

FIG. 17 illustrates a DATA ENTRY screen in accordance with the invention for looking up information regarding a specific item in the automobile;

FIG. 18 illustrates an INDEX screen with listed items for which information is available; and

FIG. 19 is a look-up table listing searchable items and the corresponding instructions for a processor in the system of FIG. 1 to provide information regarding such items.

Throughout this disclosure, unless otherwise stated, like elements, components and sections in the figures are denoted by the same numerals.

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DETAILED DESCRIPTION

FIG. 1 illustrates information and control system 100 embodying the principles of the invention for use in an automobile. System 100 is referred to as the "AUTO DIRECTOR" system. It is user-friendly and designed with the automobile user in mind. For example, with AUTO DIRECTOR display interface 102a to be described, information about the automobile is readily available literally at the fingertips of the user. This information includes operational instructions, maintenance procedures, safety measures, and information about virtually every capability of the automobile. In accordance with the invention, the user is able to efficiently access such information using multimedia means involving audio, text and video media. Also with interface 102a, or multifunction display interface 102b to be described, the user is afforded a centralized control whereby he/she can program or adjust different vehicle parts and accessories using the information thus obtained.

As shown in FIG. 1, central to system 100 is processor 105 connected to memory 115. Data bus 107 connects processor 105 to display interfaces 102, input interfaces 104, communications interfaces 106, output control interfaces 108, vehicle computer interfaces 110, vehicle control interfaces 112, self-test interface 114, preferences interface 116, and audio interface 118.

Display interfaces 102 include, inter alia, AUTO DIRECTOR display interface 102a, which is illustrated in FIG. 2, together with control panel 205 in FIG. 1. By way of example, but not limitation, the hardware of interface 102a and control panel 205 are derived from a prior art navigation system of the type of the ACURA navigation system. In fact, interface 102a and control panel 205 are used in this illustrative embodiment to realize not only AUTO DIRECTOR functions to be described, but also the well-known navigation function.

Interface 102a includes a conventional liquid crystal display screen 209, and LCD driver (not shown) for processor 105 to control the display on screen 209. Interface 102a also incorporates well-known touch-screen circuitry (not shown) connected to touch screen interface 104a in FIG. 1. With this circuitry, the user can interact with processor 105 by, say, touching a displayed option on screen 209. Through interface 104a, processor 105 receives from the touch screen circuitry a signal identifying the location on screen 209 where it has been touched. If such a location matches the predetermined location of one of the displayed options, processor 105 determines that that option has been selected. With such touch-screen and displayed option selection capabilities, through AUTO DIRECTOR interface 102a, the user is able to obtain information on and control selectable functions of the automobile such as the instrument panel, navigation function, mobile phone, radio/CD player, locks, mirrors, windows, driver's seat adjustment control, climate control, windshield wipers, cruise control, lights, security function, steering, ride control, engine and transmission.

Control panel 205 comprises CANCEL switch 205a, ENTER switch 205b, BRIGHTNESS switch 205c, PUSH TO SELECT knob 205d, MENU switch 205e, MAP/GUIDE switch 205f, SETUP switch 205g, ZOOM IN switch 205h and ZOOM OUT switch 205i. BRIGHTNESS switch 205c comprises a standard variable resistor such that when it is pushed one way, operating circuitry 121 responsively causes the display intensity to increase, and the other way to decrease. ZOOM IN switch 205h when pressed enables the automobile user to enlarge a particular visual area of interest

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on screen 209, affording better details. On the other hand, ZOOM OUT switch 205i when pressed performs the inverse function to switch 205h. As an alternative to the touch-screen capability, switch 205d similar to a standard joystick is provided for the user to move from one displayed option to another on screen 209 in the same direction (e.g., up, down, left or right) as the switch is operated. A desired option may be selected by pressing ENTER switch 205b. The functions of the other switches are described hereinbelow as they are called out in the operation of system 100. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and control panel 205 are mounted close to the center of the dashboard of the automobile next to the steering wheel.

Referring back to FIG. 1, display interfaces 102 also include multifunction display interface 102b, center console display interface 102c, rear console display interface 102d, and instrument panel display interface 102e.

Specifically, multifunction display interface 102b is installed on the dashboard close to interface 102a on the driver side. Like interface 102a, interface 102b provides the user with graphic display and control of selected functions using well-known touch screen technology. In fact, interface 102b duplicates certain control functions (e.g., navigation, phone, radio and climate control) of interface 102a so that the user can use interface 102b to control a selected function while interface 102a is engaged in another ongoing function. For example, while the user is relying on AUTO DIRECTOR interface 102a to provide navigation information to reach a given destination, the user may want to adjust the climate control of the automobile. It is inconvenient for the user to terminate the ongoing navigation mode of interface 102a, albeit temporarily, to access the climate control function through the interface, adjust the climate control and then resume the navigation mode. Thus, it is preferable to leave the navigation mode of interface 102a alone and use interface 102b to administer the climate control.

Center console interface 102c is installed close to interface 102a on the passenger side. Similar to interface 102b, interface 102c provides the front seat passenger with graphic display and control of functions which include: the front passenger seat adjustment, door lock, window, climate and TV controls. If enabled by the driver, control is also available for the radio/CD player and phone.

Rear console display interface 102d is installed on the back of a front seat. Similar to interface 102c, interface 102d provides rear seat passengers with graphic display and control of certain functions if enabled by driver or front seat passenger. These functions include: the rear seat climate, windows, door locks, radio/CD player and TV controls.

Instrument panel display interface 102e is installed on the dashboard in front of the driver seat. This interface provides the driver with graphic display of the vehicle speed, engine RPM, outside and inside temperatures, oil pressure, fuel level, time, odometer reading, trip odometer reading and warning light indicators. Through AUTO DIRECTOR interface 102a, the system user may select the display of the information in either an analog or a digital form.

Input interfaces 104 comprise touch screen interface 104a and control panel 205 described before, and voice command interface 104b. The latter is connected to a microphone (not shown) and comprises standard voice command circuitry (not shown) for processing voice commands by the user through the microphone to control or modify selected functions of system 100.

Communications interfaces 106 include phone interface 106a, radio/CD interface 106b, television (TV) interface

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106c, navigation interface 106d, and beacon interface 106e. Processor 105 interacts with and controls standard phone equipment connected to phone interface 106a. Through processor 105, the user may operate the phone equipment via voice command, thereby realizing hands-free operation of the equipment. Alternatively, the user may operate the phone equipment using the touch screen capability provided by AUTO DIRECTOR display interface 102a or multifunction display interface 102b. The user may also operate the phone equipment via remote switches.

Similarly, processor 105 interacts with and controls one or more radio receivers and CD players in the automobile connected to radio/CD interface 106b. Through processor 105, the user may operate the radio receivers via voice command, remote switch and/or touch screen capability.

Processor 105 further interacts with and controls one or more TV receivers in the automobile connected to TV interface 106c. Again, the user may operate the TV receivers via voice command, remote switches and/or touch screen capability.

As further described hereinbelow, navigation interface 106d is connected to a standard inertial guidance system (not shown) capable of providing gyros information, and deriving the vehicle location based on GPS information. With the map information stored in memory 115, the inertial guidance system is capable of providing the user with navigational instructions via interface 102a or 102b. Besides the locational information, local and national emergency information may be derived from the GPS information using additional standard decoding circuitry in interface 106d.

Beacon interface 106e is used for connection to a standard beacon device for detecting a predetermined beacon radio signal to provide additional locational information.

Output control interfaces 108 include lock interface 108a, mirror interface 108b, window interface 108c, steering column interface 108d, seat interface 108e, climate control interface 108f, wiper interface 108g, cruise control interface 108h, light interface 108i and clock interface 108j.

Specifically, lock interface 108a comprises output control logic controllable by processor 105 to lock or unlock the car doors, glove box, console storage, trunk (or liftgate), fuel filler door, brakes and transmission, and enable or disable the child-proof door locks, fuel pump and ignition.

Mirror interface 108b comprises output control logic controllable by processor 105 to maneuver the positions of the outside mirrors and inside rear view mirror, and to fold or unfold the outside mirrors.

Window interface 108c comprises output control logic controllable by processor 105 to incrementally or completely open or close all windows, and to open, close or tilt any sunroof.

Steering column interface 108d comprises output control logic controllable by processor 105 to move the steering column in or out and up or down.

Seat interface 108e comprises output control logic controllable by processor 105 to (1) adjust the positions of the front seats forward or aft, and up or down; (2) tilt the front or rear of the seat cushion up or down; (3) adjust the seat back lumbar, width and angle forward or aft; (4) increase or decrease the cushion size and stiffness; (5) raise or lower the head restraint; and (6) raise or lower the seat belt height.

Climate control interface 108f comprises output control logic controllable by processor 105 to (1) turn the climate control system on or off; (2) select an air flow mode; (3) set fan speeds; (4) enable or disable seat heaters; (5) select fresh

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or recirculated air (for driver only); and (6) enable or disable front and rear defrosters, mirrors and steering wheel heaters (for driver only).

Windshield wiper interface 108g comprises output control logic controllable by processor 105 to (1) select a high, low, intermittent, single wipe or off mode; (2) set an intermittent delay; and (3) enable or disable front or rear washers. Interface 108g also includes control logic for controlling rain- and speed-sensitive wipers, and for activating an automatic wash in a single wide mode when the windshield is at a certain level of opacity.

Cruise control interface 108h comprises output control logic controllable by processor 105 to (1) turn the cruise control on or off, (2) set the vehicle speed, and (3) cancel or resume the set speed.

Light interface 108i comprises output control logic controllable by processor 105 to select an automatic on mode or off mode for parking lights, headlights and fog lights; and to turn on or off map or courtesy lights.

Clock interface 108j comprises output control logic controllable by processor 105 to set an initial date and time on a conventional clock (not shown) connected to interface 108j. System 100 relies on the current date and time kept by the clock to provide a time reference for the system functions.

Vehicle computer interfaces 110 include anti-lock brake computer interface 110a, engine computer interface 110b and supplemental restraint computer interface 110c for processor 105 to communicate with the computers controlling the anti-lock brakes, engine and supplemental restraints (e.g., back-up airbag deployers and seat belt tensioners), respectively. Interfaces 110 also include back-up interface 110d through which processor 105 receives and analyzes signals from the engine, anti-lock brake and supplemental restraint computers. These signals would indicate to processor 105 any failures of the computers. In response to a computer failure, processor 105 causes a corresponding back-up computer connected to interface 110d to provide a back-up function.

Vehicle control interfaces 112 include steering interface 112a, ride interface 112b, engine interface 112c, transmission interface 112d, traction control interface 112e, and security interface 112f.

Specifically, steering interface 112a comprises input monitoring and output control logic for processor 105 to lighten or tighten the steering effort ratio in response to changing road conditions. Through interface 102a, the user may opt for manual or automatic steering effort ratio control. Interface 112a is capable of adapting and storing data according to the driver's inputs. It also allows for steering of front and/or rear wheels for sporty or increased stability.

Ride interface 112b comprises input monitoring and output control logic for processor 105 to lighten or stiffen the ride control to front and/or rear of vehicle in response to changing road conditions. Through interface 102a, the user may also opt for manual or automatic ride control.

Engine interface 112c comprises input monitoring and output control logic allowing for shutting off a specified number of cylinders, and varying valve and cam timing to increase performance or fuel economy. This interface also allows for manual or automatic control of the engine components, and includes the capability of adapting and storing data according to the driver's inputs.

Transmission interface 112d comprises input monitoring and output control logic for selecting manual or automatic

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shifting of the transmission. In an automatic shifting mode, interface 112d is capable of adapting and storing data according to the driver's inputs. Interface 112d also allows for control of a variable differential ratio for fast acceleration and high economy cruise.

Traction control interface 112e comprises input monitoring and output control logic providing information on whether power is delivered to front and/or rear wheels of the vehicle and what proportion of the power is delivered to each wheel. This interface also allows for manual or automatic control, and such functions as yaw control in cooperation with the anti-lock brakes and an engine cylinder shutoff.

Security interface 112f comprises control logic for setting a security level, and enabling or disabling a number of security related functions such as the fuel supply cut-off, motion detector, brake locking, etc. Interface 112f also allows entry of a new or alteration of an existing personal identification number (PIN) for personalization of the vehicle functions, i.e., saving the vehicle functional preferences.

In accordance with an aspect of the invention, system 100 incorporates an anti-car-theft technique involving security interface 112f. In accordance with this inventive technique, security interface 112f further comprises a sensor for detection of a predetermined condition to trigger an anti-theft routine. It will be appreciated that a person skilled in the art will come up with many different triggering events causing the sensor to invoke the routine. For example, a passive way of triggering the anti-theft routine would be after the sensor detects that the engine is off and the user has opened, closed and locked the driver's door.

In any event, as soon as processor 105 receives from the sensor a signal requesting an invocation of the anti-theft routine, processor 105 retrieves from navigation interface 106d GPS information identifying the parking location of the automobile, as indicated at step 251 in FIG. 3A. Processor 105 then stores at step 253 the parking location GPS information in memory 115. At step 255, processor 105 determines whether the security measures remain on. By way of example, but not limitation, such determination is based on information from lock interface 108a indicating whether the driver's door is properly unlocked. If that door is properly unlocked, processor 105 determines that the security measures are called off, and the anti-theft routine comes to an end, as indicated at step 257.

Otherwise if processor 105 determines that the security measures remain on, processor 105 at step 259 retrieves from navigation interface 106d GPS information identifying the current location of the automobile. Processor 105 then compares at step 261 the current location GPS information with the parking location GPS information previously stored. If processor 105 at step 262 determines that the current location matches the parking location based on the comparison, the anti-theft routine returns to step 255 after a predetermined period. Otherwise if processor 105 determines that the current location does not match the parking location, processor 105 assumes that the automobile has been removed without authorization, i.e., stolen. At this point, if a conventional alarm system is connected to security interface 112f, processor 105 would cause an alarm to come on, gas to be cut off, etc.

In this example, a conventional transmitter (not shown) is connected to security interface 112f and transmits a predetermined sequence of signals receivable by a law enforcement agency or a suitable alarm monitor company when it

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is activated. Continuing the example, processor 105 translates the GPS information identifying the current vehicle location into the corresponding street address based on the map information stored in memory 115, as indicated at step 263. Processor 105 at step 265 looks up one or more phone numbers pre-stored in memory 115 for reporting to the law enforcement agency (or the alarm monitor company) about the stolen status. Alternatively, a list of phone numbers associated with law enforcement agencies (or branches of the alarm monitor company) in many different geographic locations is pre-stored, along with the GPS information identifying the locations of the respective law enforcement agencies (or alarm monitor company branches). This being so, processor 105 locates the closest law enforcement agency (or alarm monitor company branch) and its associated phone number(s) by comparing the current vehicle location GPS information with the respective agency (or branch) location GPS information.

In any event, processor 105 at step 267 initiates a call to a law enforcement agency (or an alarm monitor company branch) through phone interface 106a using the phone number just located. After the phone connection is established, processor 105 provides through the connection information about the current address of the vehicle using conventional voice synthesizer circuitry (not shown) in audio interface 118, and the pre-recorded information about the vehicle itself such as its vehicle identification number (VIN), model, year, color, license number, etc., as indicated at step 269. Through the same phone connection, processor 105 may also provide information about the vehicle's owner such as his/her name and contact number so that the law enforcement agency (or alarm monitor company branch) can notify the owner of the incident. Processor 105 at step 271 activates the aforementioned transmitter connected to security interface 112f to generate the predetermined sequence of signals in case the stolen vehicle is in transit. For that matter, processor 105 can also repeatedly check on the latest vehicle location and report any new address different from the one previously reported. Thus, by tracking the signals in the vicinity of the latest reported vehicle location, the law enforcement agency (or alarm monitor company) would recover the vehicle in an efficient manner.

Referring back to FIG. 1, self-test interface 114 comprises input/output (I/O) control logic for performing an active self-test of system 100 on power up or at the user's request. Specifically, interface 114 polls every other interface in system 100 for a self-test result. Each interface, when polled, performs an active self-test and reports the test results to interface 114, where such test results are gathered and caused to be displayed on interface 102a.

Preferences interface 116 monitors changes made by the user in selected functions after the user logs on system 100, and prompts the user to save such preferences. These preferences are stored in memory 115 in association with the user's PIN. Functions affording the user choices include auto locks, an easy entry, auto lamps, the seat position, steering column position, mirror position, radio, steering, ride, transmission shift, engine performance, climate, and security level.

Audio interface 118 comprises I/O control logic for receiving audio signals from a radio/CD, TV, compact disk (CD) player, or phone interface, processing the received audio signals, providing proper amplifications thereto, and routing the resulting sound to appropriate speakers and headphones (not shown) connected to interface 118. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and multifunction display interface 102b share the

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same speakers. Interface 118 also provides center and rear console display interfaces 102c and 102d with separate audio channels, speakers and headphone outputs. The front and rear speakers may be muted by the user as a preference.

Interface 118 also processes requests from other interfaces for pre-recorded digital sounds stored in a SOUNDSGOOD library in memory 115 and routes the requested sounds to the appropriate interfaces. In addition, interface 118 comprises the conventional voice synthesizer circuitry for providing voice messages to the appropriate interfaces.

FIGS. 3B and 3C jointly illustrate routine 300 for accessing, through AUTO DIRECTOR display interface 102a, a main menu to obtain operational instructions, maintenance procedures, safety measures, and other information about the automobile, collectively referred to as "Quick Tips". Routine 300 is stored in memory 115 and initiated when SETUP switch 205g in FIG. 2 is pressed. Instructed by routine 300, processor 105 at step 301 elicits a PIN from the user by displaying a screen of FIG. 4A through interface 102a. As shown in FIG. 4A, a video key-pad comprising numeral keys "1" through "9", and "*" and "#" keys are displayed on screen 209. In response, the user enters a sequence of numerals by touching the corresponding displayed keys, followed by the "#" key.

It should be pointed out that in accordance with another aspect of the invention, when a displayed key or option is touched on the screen of AUTO DIRECTOR display interface 102a or multifunction display interface 102b, a tone pre-selected by the user from the SOUNDSGOOD library is generated through audio interface 118, indicating that the key or option has been touched on the screen. Advantageously, relying on the audio tone confirmation, as opposed to a visual confirmation, the user while driving can continually watch the road.

The user may alternatively enter the above numeral sequence using control panel 205 in a manner to be described. In any event, processor 105 then verifies at step 303 the PIN entry by comparing it with the user's pre-selected PIN. The latter is stored in memory 115, along with the user's preferences. In a standard way, the user is given a few chances to enter a correct PIN. Verification of the PIN entry identifies the user as a legitimate user. Thus, if the PIN entry is not valid, routine 300 comes to an end, as indicated at step 304.

Otherwise if the PIN entry is valid, processor 105 at step 305 causes interface 102a to display on screen 209 a "SELECT A FUNCTION" screen, which is illustrated in FIG. 4B. As shown in FIG. 4B, two options, namely, "NAVIGATION" and "QUICK TIPS", are displayed on screen 209. By default, NAVIGATION option 401 is highlighted yellow when the screen of FIG. 4B appears.

It should be pointed out that in this illustrative embodiment, a yellow highlight on an option indicates that the option is selected but not yet activated. Once a yellow highlighted option is activated, the option is highlighted blue. System 100 then performs according to the activated option.

Thus, in this instance, the user may activate the yellow highlighted NAVIGATION option by touching the option on screen 209 or by pressing ENTER switch 205b.

However, if QUICK TIPS option 403 is desired, the user may touch that option on screen 209, which would then be highlighted yellow. A second touch on the same option will change the highlight to blue, indicating the active status. As an alternative, the user may utilize knob 205d of FIG. 2 to select QUICK TIPS option 403 by first pushing the knob to

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the right. In response, processor 105 causes the yellow highlight to move from default NAVIGATION option 401 to QUICK TIPS option 403. The user can then select the QUICK TIPS option by pressing ENTER switch 205b. Upon selection, the yellow highlighted option will again turn blue.

Processor 105 at step 308 detects an activation of either NAVIGATION option 401 or QUICK TIPS option 403. If NAVIGATION option 401 is activated, processor 105 at step 311 causes system 100 to enter into a navigation mode. In this mode, processor 105 causes navigational instructions to be displayed on screen 209 in a conventional manner. In providing the navigation instructions, the standard inertial guidance system connected to navigation interface 106d receives signals from a constellation of GPS satellites maintained and controlled by the U.S. Department of Defense. In response to these signals, the inertial guidance system identifies the location (in longitude and latitude) of the automobile. The system also detects the vehicle speed, and the direction in which the vehicle is headed. By accessing the map information stored in memory 115, the system is capable of visually and verbally providing the user with directions to a given destination through AUTO DIRECTOR display interface 102a and audio interface 118, respectively.

Otherwise if activation of QUICK TIPS option 403 is detected at step 308, processor 105 causes interface 102a to display an introduction screen on screen 209, as indicated at step 314. This introduction screen is illustrated in FIG. 5.

As shown in FIG. 5, system source identification, warning and instructional information appear on the introduction screen, along with two options, "MAIN MENU" and "READ ME". The default option in this instance is READ ME option 501 which is highlighted yellow. Processor 105 detects at step 317 whether MAIN MENU option 503 or READ ME option 501 is activated. If MAIN MENU option 503 is activated, routine 300 proceeds to step 340 to be described. Otherwise if READ ME option 501 is activated, routine 300 proceeds to step 320 where processor 105 causes a series of three screens to be displayed. The first screen of the series is a "MANUFACTURER" screen, which is illustrated in FIG. 6.

As shown in FIG. 6, a description of the QUICK TIPS system appears on the MANUFACTURER screen. If the text to be displayed exceeds one screen, which is the case here, scrolling options comprising scroll-up option 605 and scroll-down option 607 are provided. When option 605 is touched and activated on screen 209, additional text scrolls up one paragraph at a time. Option 607 performs an inverse function to option 605. Again, as an alternative, the user may maneuver PUSH TO SELECT knob 205d until the desired scroll option (or direction arrow) is highlighted yellow. The activation of the highlighted option is achieved by pressing ENTER switch 205b.

By default, displayed option 609 has the "AUTO VOICE" wording thereon and is highlighted blue as the MANUFACTURER screen comes on. Accordingly, a pre-recorded voice is activated by processor 105 through audio interface 118 to read the entire text associated with this screen without interruption, including the text which is not presently shown on screen 209 but otherwise shown upon scrolling. To alter the AUTO VOICE function, the user may touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "AUTO VOICE" wording on option 609 changes to "MANUAL VOICE", which is highlighted blue, indicating its active status.

In accordance with the MANUAL VOICE function, a pre-recorded voice reads the displayed text only, and stops

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reading until additional text is scrolled onto the screen. To silence the voice, the user may again touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "MANUAL VOICE" wording on option 609 changes to "VOICE OFF", and the voice is deactivated, with the option now highlighted yellow. The cycle of the AUTO VOICE, MANUAL VOICE and VOICE OFF functions can be repeated by successively touching option 609 or pressing switch 205b.

Other displayed options on the screen of FIG. 6 include PREVIOUS option 611 and NEXT option 613. As indicated at step 323, option 611 when selected causes routine 300 to return to step 314, where the introduction screen of FIG. 5 is again displayed. Otherwise, if option 613 is selected, routine 300 proceeds to step 326 in FIG. 3C where processor 105 causes a "SAFETY REMINDERS" screen to be displayed on screen 209. FIG. 7 illustrates such a screen.

As shown in FIG. 7, like the MANUFACTURER screen, the SAFETY REMINDERS screen includes option 609 displayed with the default wording "AUTO VOICE" thereon, PREVIOUS option 611, NEXT option 613, scroll-up option 605 and scroll-down option 607. This screen reminds the user of the safety features of the vehicle including, for example, air bags and seat belts. As indicated at step 329, option 611 when selected causes routine 300 to return to step 320 of FIG. 3B. Otherwise if option 613 is selected, routine 300 proceeds to step 332 where processor 105 causes a "THEFT PROTECTION FEATURES" screen to be displayed on LCD screen 209. FIG. 8 illustrates such a screen.

As shown in FIG. 8, the THEFT PROTECTION FEATURES screen similarly has thereon displayed options 605, 607, 609, 611 and 613. This screen describes to the user a theft-deterrent system including the anti-theft routine of FIG. 3A equipped in the vehicle. As indicated at step 335, option 611 when selected causes routine 300 to return to step 326. Otherwise if option 613 is selected, routine 300 proceeds to step 338 where processor 105 causes a "QUICK TIPS SET-UP" screen to be displayed on LCD screen 209. FIG. 9 illustrates such a screen.

As shown in FIG. 9, the QUICK TIPS SET-UP screen comprises two arrays of displayed options, denoted 901 and 903, respectively. Array 901 concerns the volume of the audio part of system 100. In this illustrative embodiment, the user may select the options in array 901 to respectively turn the volume off, to a "SOFT" level, to a medium level, and to a "LOUD" level. Array 903 concerns the display of LCD 119 of system 100. In this illustrative embodiment, the user may select the options in array 903 to respectively turn the display off, adjust it to a "DAY" setting, adjust it to a "NIGHT" setting, and have it automatically adjusted. When the QUICK TIPS SETUP screen comes on, by default, the volume is set to a medium level (i.e., the "MED" option in array 901 highlighted blue), and the display is set to be automatically adjusted (i.e., the "AUTO" option in array 903 highlighted blue).

Also shown in FIG. 9 is NEXT option 905. By selecting this option, routine 300 returns to step 340 of FIG. 3B where a "MAIN MENU" screen is displayed on LCD screen 209. After routine 300 is performed, the screen of FIG. 9 can be invoked at any time by pressing SETUP switch 205g to re-adjust the volume and the intensity of the LCD of system 100.

FIG. 10 illustrates the MAIN MENU screen. This screen comprises displayed options disposed in columns 1001, 1003, 1005, and 1007. For example, column 1001 includes

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DRIVER'S VIEW option 1001a, STEERING COLUMN CONTROLS option 1001b, LOCK option 1001c, DRIVING TIPS option 1001d, and INDEX option 1001e. It should also be noted that this screen can be invoked at any time by pressing MENU switch 205e.

When the MAIN MENU screen comes on, by default, DRIVER'S VIEW option 1001a is highlighted yellow, indicating that it is selected. However, the user may touch any other displayed option on screen 209 for re-selection. A further touch on the yellow highlighted option changes its color to blue and activates same. Again, the user may alternatively maneuver PUSH TO SELECT knob 205d to re-select any other displayed option, followed by a depression of ENTER switch 205b to activate the selected option. Since LCD screen 209 is compact, the display area for each option on the MAIN MENU screen is generally small. As a result, selection and activation of an option by touching the option on the screen is susceptible to errors, especially when the vehicle is in motion. Thus, in this situation it may be preferable to achieve the same result using knob 205d and switch 205b, instead.

In addition, because of the small display area allocated to each option on the MAIN MENU screen, the wording on the option is brief and thus tends to be cryptic. In accordance with a feature of the invention, after a predetermined time (e.g., a few seconds) has elapsed from the option's being highlighted yellow, processor 105 causes a voice to be generated on speakers 127 to explain the purpose of the option before the user activates it. For example, after a predetermined delay from DRIVER'S VIEW option 1001a's being highlighted yellow, a voice is activated, stating the option name, followed by an explanation of the purpose of the option such as "To provide location of dash mounted components." Thus, this inventive feature affords a preview of the option before the user commits to it, thereby avoiding unnecessary backtracking.

Continuing the example, after hearing the preview of option 1001a, the user decides to select that option. In response, processor 105 causes a "DRIVER'S VIEW" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 11. When the DRIVER'S VIEW screen appears, VOICE option 1101 is highlighted blue, indicating that voice announcements are active. To disable the voice announcements, the user may touch VOICE option 1101 on screen 209, or alternatively press ENTER switch 205b. VOICE option 1101 would be highlighted yellow when disabled.

As also shown in FIG. 11, a view of the interior of the automobile from the driver's perspective is provided. Underneath that view, DASH-MOUNTED CONTROLS option 1103, INSTRUMENT PANEL option 1105, AUDIO SYSTEM option 1107, CLIMATE CONTROLS option 1109 and PREVIOUS option 1111 are displayed. By default, DASH-MOUNTED CONTROLS option is highlighted yellow. However, the user in this example decides to select INSTRUMENT PANEL option 1105, instead. By touching option 1105 on screen 209, the option is highlighted yellow. If VOICE option is not disabled, after a predetermined delay, an announcement such as "To provide information on gauges, meters and warning lights" comes on to preview the purpose or content of option 1105. Options 1103, 1107, and 1109 are similarly programmed. In this instance, selecting PREVIOUS option 1111 enables the user to return to the MAIN MENU screen of FIG. 10.

Continuing the example, assuming that the user activates option 1105 after hearing the preview, in response processor

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105 causes an "INSTRUMENT PANEL" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 12. As shown in FIG. 12, the previous screen format is generally maintained in that it provides a view of the object (the instrument panel of the automobile in this instance) pertinent to the option which has been selected, along with displayed options for further selection thereunder. Based on the disclosure heretofore, the design and operation of these screens by now are apparent to a person skilled in the art, and become self-explanatory.

In accordance with another feature of the invention, individual elements on the instrument panel shown in FIG. 12 are labeled with numerals "1", "2", "3", "4" and "5" which correspond to option 1201a designated "1. TACHOMETER AND WARNING LIGHTS", option 1201b designated "2. TURN SIGNAL/HAZARD WARNING", option 1201c designated "3. SPEEDOMETER AND WARNING LIGHTS", option 1201e designated "4. ODOMETER & TRIP METERS/OUTSIDE TEMPERATURE", and option 1201f designated "5. FUEL/TEMP GAUGE AND WARNING LIGHTS", respectively. As such, the function of the displayed options is two-fold. First, the wording on each displayed option informs the user of what the corresponding element(s) represents. Second, each displayed option is also for selection to obtain more information about the corresponding element(s). In addition, with the above voice preview feature, the user is further apprised of the purpose or content of the option before he/she commits to it. For example, TACHOMETER AND WARNING LIGHTS option 1201a corresponds to a voice preview such as "To provide information on tachometer and malfunction, maintenance required, low oil pressure and charging system failure indicators."

Assuming that the user in this instance activates option 1201a, in response processor 105 causes a "TACHOMETER AND WARNING LIGHTS" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 13.

FIG. 13 shows VOICE option 1301 similar to option 1101 described before, TIP option 1303, a tachometer of the automobile denoted 1305, warning lights collectively denoted 1307, and options 1309a through 1309f in display segment 1311.

When TIP option 1303 appears on screen 209, it indicates that helpful hints or reminders are available upon selection thereof. In accordance with another feature of the invention, the appearance of TIP option 1303 is accompanied by the playing of a sound segment associated therewith. This sound segment may be pre-selected by the user from the SOUNDSGOOD library. After an adaptation period, the user would be able to rely on the familiar sound segment, without looking at the screen, to alert him/her of the availability of the TIP option.

Similarly, the user may pre-select another sound segment associated with warnings. Such a sound segment should connote urgency or even emergency as such warnings include, for example, engine overheating, an extremely low fuel level caution, GPS emergency information from navigation interface 106d, etc. Under control of processor 115, audio interface 118 preempts any on-going announcement and momentarily substitute therefor any such warning as soon as it occurs, which is preceded by the associated sound segment.

In any event, if option 1303 is selected in this instance, a voice comes on and utters a tip regarding tachometer 1305 such as "To prevent engine damage, do not drive with needle in red zone." This tip is also momentarily displayed on segment 1311 in lieu of options 1309a through 1309f.

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Similar to the elements on the INSTRUMENT PANEL screen, tachometer 1305 and warning lights 1307 on this screen are individually labeled and correspond to options 1309a, 1309b, 1309c, 1309e and 1309f, respectively. Assuming in this example that MAINTENANCE REQUIRED option 1309c is activated, display segment 1311 would be replaced by new display segment 1411 illustrated in FIG. 14. As shown in FIG. 14, item 1401 indicates the subject selected, i.e., "MAINTENANCE REQUIRED". Item 1403 explains what the MAINTENANCE REQUIRED warning light, when on, indicates. In this instance it states, "Maintenance required warning light comes on to indicate it is time for scheduled maintenance." PREVIOUS option 1405 enables the user to reactivate segment 1311 of FIG. 13.

Assuming further that at this point the user wants to learn about and also to program the air conditioning of the automobile, the user may access a "CLIMATE CONTROL" screen by successively pressing the PREVIOUS option to backtrack to the DRIVER'S VIEW screen of FIG. 11, where CLIMATE CONTROLS option 1109 is available. As a second alternative, the user may press MENU switch 205e to invoke the MAIN MENU screen of FIG. 10, where a "CLIMATE CONTROLS" option within column 1003 is available. A third alternative is provided in the event that the user cannot immediately relate "air conditioning" to the CLIMATE CONTROLS option. At the MAIN MENU screen of FIG. 10, the user may select Index option 1001e to be described. It suffices to know for now that this option allows the user to access the "CLIMATE CONTROL" screen using the term "air conditioning".

FIG. 15 illustrates the "CLIMATE CONTROL" screen. With the voice enabled, a first touch on any displayed option on screen 209 causes it to be highlighted yellow, indicating its selected status. A second touch causes it to be highlighted blue, indicating its active status. With the voice disabled, only one touch on any displayed option activates it.

As shown in FIG. 15, the MODE options include OFF option 1511, AUTO option 1513, A/C option 1515, HEAT option 1517, and SMART CLIMATE option 1519. It should be noted that only one of the MODE options can be active at a time. In this example, assuming that the voice is enabled, when OFF option 1511 is selected by a first touch, a voice explaining the option comes on, uttering "To disable climate control." A second touch on the same option would then shut the climate control off through climate control interface 108f.

When AUTO option 1513 is selected by a first touch, a voice comes on to explain the option, uttering "System automatically determines air-flow distribution and volume for optimum efficiency." A second touch on the same option enables the automatic control, followed by a voice utterance, "Set desired temperature." Temperature display 1535 then flashes with the current temperature setting, prompting the user to set a desired temperature in a manner to be described.

If the user neglects to set a temperature after a predetermined time, in accordance with another aspect of the invention, a temperature range is automatically maintained by processor 105 in response to the date and time information from clock interface 108j, and the GPS information from navigation interface 106d. Based on the date and time information, processor 105 knows what the current season (e.g., mid-winter versus mid-summer) and time of the day (e.g., night verse noon) are. Based on the GPS information, processor 105 knows the region (e.g., New England versus Southern California) where the vehicle is. Processor 105

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looks up a table stored in memory 115 containing predetermined temperature ranges corresponding to different combinations of the temporal and geographic parameters. It then prescribes an appropriate temperature range according to the table. This temperature range is updated by processor 105 periodically to reflect changes in the time of the day and the geographic location of the vehicle.

Similarly, A/C option 1515 and HEAT option 1517 respectively enable the user to activate air conditioning and heaters at a desired temperature or a default temperature range.

SMART CLIMATE option 1519 is designed to allow the user to program the climate control for the next ride before he/she leaves the vehicle. When SMART CLIMATE option 1519 is selected by a first touch, a voice comes on to explain the option, uttering "To enable pre-heating or pre-cooling of vehicle." A second touch on the option activates the function, followed by a voice utterance, "Set desired temperature. Set desired time using fan speed arrows." Temperature display 1535 then flashes the current temperature setting, prompting the user to set a desired temperature. Similarly, fan speed display 1541 then flashes the current date, followed by current time, prompting the user to set the date and time that the user plans to reenter the vehicle. Through climate control interface 108f, processor 105 determines whether the current level of power from the car battery and any back-up power sources is sufficient. If it is insufficient, a message such as "Fail to pre-condition vehicle temperature" is issued through audio interface 118 to notify the user of the noncompliance. Otherwise, when it is close to the re-entry time, processor 105 determines the start-up time to effect the pre-conditioning, depending on the temperature difference between the inside and outside of the vehicle at that time. Processor 105 would then cause a combination of heaters and/or heat pumps (not shown) connected to interface 108f to pre-condition the vehicle temperature. In order to avoid substantially draining the power, in this illustrative embodiment, the requested temperature would be maintained up to an hour after the set re-entry time.

The Air options in FIG. 15 include FRESH option 1521 and RECIRCULATED option 1523. Only one of these two options can be active at a time. When FRESH option 1521 is selected by a first touch on the option, a voice comes on to explain the selected option, uttering "To select outside air to circulate in vehicle." A second touch on the option activates the selection to ventilate the vehicle with outside air. Similarly, RECIRCULATED option 1523 allows the user to select the inside air for recirculation in the vehicle.

The VENT options in FIG. 15 include FLOOR option 1525, FLOOR/DASH option 1527, DASH option 1529, DEFROST option 1531 and FLOOR/DEFROST option 1533. Only one of these five options can be active at a time. When FLOOR option 1525 is selected by a first touch on the option, a voice comes on explaining the option, uttering "Main air distribution to floor." A second touch on the option directs an air flow toward the vehicle floor.

Similarly, FLOOR/DASH option 1527 enables the user to bifurcate the air flow between the floor and the dashboard. DASH option 1529 enables the user to direct the air flow from the dashboard. DEFROST option 1531 enables the user to direct the air flow toward the windshield and select fresh air if not selected. FLOOR/DEFROST option 1533 enables the user to bifurcate the air flow between the floor and windshield.

Temperature display 1535 displays the temperature selected by the user. Touching on up-arrow 1537 increases

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the selected temperature while touching on down-arrow 1539 decreases same. Continued touching on either up-arrow 1537 or down-arrow 1539 causes the temperature setting to change rapidly.

Similarly, fan speed display 1541 displays the fan speed (high, medium or low) selected by the user. Touching on up-arrow 1543 increases the selected fan speed while touching down-arrow 1539 decreases same.

The HEATERS options in FIG. 15 include SEAT option 1547, MIRROR option 1549, REAR WINDOW option 1551, STEERING WHEEL option 1553, and ALL option 1554. One or more of these options can be active at the same time. When SEAT option 1547 is selected by a first touch on the option, a voice comes on to explain the option, uttering "To enable seat heaters." A second touch on the option activates the seat heaters connected to climate control interface 108f.

Similarly, MIRROR option 1549 enables the user to activate outside mirror heaters. REAR WINDOW option 1551 enables the user to activate a rear window defroster. STEERING WHEEL option 1553 enables the user to activate a steering wheel heater. Finally, ALL option 1554 enables the user to activate all of the heaters simultaneously.

In personalizing the vehicle, preference interface 116 monitors any user adjustments to certain vehicle functions by comparing their current settings with the corresponding stored preferences in memory 115. Thus, for example, if the user changes any of the settings relating to the climate control such as the mode, vent, air, temperature, fan speed, etc. from its previous preferred setting, preference interface 116 causes a SAVE screen to appear on screen 209. This SAVE screen is illustrated in FIG. 16. As shown in FIG. 16, the user is prompted to save the change in the setting that he/she has just made. The user at this point may activate SAVE option 1601 to change the previous preferred setting. The SAVE screen thereafter disappears in favor of the previous screen. Otherwise, he/she may activate CLOSE option 1603 to close the SAVE screen, without storing the latest setting, which is then treated as a temporary setting. In the latter case, for example, a restart of the automobile will obliterate such a temporary setting, and reinstate the stored preferred setting.

Climate control screens can similarly be invoked by the front passenger and rear passengers on display interfaces 102c and 102d, respectively. Such screens provide similar MODE options including OFF, AUTO, A/C and HEAT options; and VENT options including LOWER VENT, UPPER VENT and LOWER/UPPER vent options. They also provide for temperature and fan speed adjustments for the respective localized areas. However, no save screen is provided.

Using INDEX option 1001e of FIG. 10 to look up information on and/or to control various items in the automobile will now be described. After option 1001e is activated, a DATA ENTRY screen illustrated in FIG. 17 is exhibited on screen 209. As shown in FIG. 17, a message "Enter Letter Or Item Name" appears to prompt the user for an entry of the name of the item of interest or its beginning letter. For this purpose, entry options for letters A through Z arranged in a grid format are provided in section 1701 for selection. In addition, DONE option 1703, when activated, indicates to system 100 that the entry is completed. Subdisplay 1705 is used to echo the user's entry to ensure its correctness.

In this illustration, the user enters "AIR CONDITIONING" as exhibited on subdisplay 1705. In response, an

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INDEX screen shown in FIG. 18 appears on display screen 209, with the search item name "AIR CONDITIONING" highlighted yellow. It should be noted that other item names such as "Anti-lock Brake System Indicator" are also shown, and they are in alphabetical order following "AIR CONDITIONING". This stems from the design of system 100 whereby the user may conveniently enter the beginning letter of the search item name only. In that case, a list of item names in alphabetical order with the first item name having the same beginning letter highlighted yellow. For instance, if the user had only entered "A" for "AIR CONDITIONING", a list of item names starting with "A" in alphabetical order would appear on screen 209 (although in this instance it would be the same list as shown in FIG. 18 as "AIR CONDITIONING" is the first item with a letter "A" in system 100). If the user cannot locate the name of the item of interest in the list, he/she may scroll the screen using scroll-up option 1801 or scroll-down option 1803 to review additional item names after or before the listed item names. Alternatively, the user may select PREVIOUS option 1805 to return to the screen of FIG. 17 to enter the complete item name.

In any event, after the user locates the item name on the INDEX screen, the user may then touch the item name to access information on that item. To that end, a look-up table is stored in memory 115. FIG. 19 illustrates such a look-up table, wherein left column 1901 lists each item name in alphabetical order in the index, and right column 1903 lists the corresponding instruction for processor 105 to carry out to access information on that item. For example, according to row 1905 of the table, the selection and activation of the item name "AIR CONDITIONING" causes processor 105 to connect the user to the CLIMATE CONTROL screen of FIG. 15 previously described.

The foregoing merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise numerous other systems which embody the principles of the invention and are thus within its spirit and scope.

For example, based on the disclosure heretofore, it is apparent that through system 100, the user can run diagnostics on selected parts of the automobile by voice command or touch-screen control.

In addition, in the disclosed embodiment, through system 100, the user is able to program the climate control for the next ride before he/she leaves the vehicle. It will be appreciated that the user will be able to achieve same remotely ahead of time via telecommunication means. For example, processor 105 may be programmed to accept climate control commands through phone interface 106a. In that instance, the user can call from anywhere to establish a phone connection with phone interface 106a using a predetermined phone number, through which the user communicates the commands to climate control interface 108f to program the climate control. Through the phone connection, the user may be provided with climate control options described above in a synthesized voice. The user may activate one or more of such options by pressing a predetermined touch-tone key on the telephone keypad corresponding to a "yes" or "no" response. Similarly, the user may achieve the relevant temperature and/or time settings by pressing the touch-tone keys corresponding to the numerals indicative thereof. Of course, telecommunication means other than the telephone including a radio frequency (RF) transmitter may also be used to communicate the climate control commands from a remote area.

In addition, in the disclosed embodiment, the user may access different screens provided by AUTO DIRECTOR

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display interface 102a to learn about and control certain vehicle functions. It will be appreciated that a person skilled in the art will develop a demonstration program wherein a series of such screens will be automatically presented to a user in a predetermined sequence. The presentation may include commentaries, and highlights on selected options displayed on each screen. Furthermore, the presentation may be coupled with the showing of actual vehicle functions. For example, in demonstrating the climate control screen of FIG. 15, while the function of a highlighted VENT option (e.g., Floor, Floor/Dash, Dash, Defrost or Floor/Defrost) is explained, it is activated so that the user in the automobile can feel an actual air flow from the corresponding direction. The above demonstration program may be invoked using a PIN provided by the automobile manufacturer. The program may run continually while the automobile is shown in a showroom, or may be invoked by the user occasionally to obtain relevant information.

Further, in the disclosed embodiment, the MAINTENANCE REQUIRED warning light comes on when it is time for scheduled maintenance. In accordance with another aspect of the invention, the maintenance is scheduled by system 100 according to the cumulative time of the tachometer reading above a predetermined RPM value. Such cumulative time reflects the extent of the engine wear, and if it exceeds a predetermined length of time without maintenance, the engine performance would degrade substantially. In measuring the cumulative time in question, a conventional comparator (not shown) is employed in system 100 to compare the instantaneous tachometer reading (provided by engine control interface 112c) with the predetermined RPM value. Each time when the tachometer reading exceeds the predetermined value, processor 105 is interrupted to register the length of such an occurrence. The latter is added to a running sum to update the cumulative time in question. This cumulative time may be displayed on instrument panel display interface 102e, along with the tachometer reading and the MAINTENANCE REQUIRED warning indicator. A second conventional comparator (not shown) is employed in system 100 to compare the cumulative time with the above predetermined time length. As soon as the cumulative time exceeds the predetermined length, processor 105 is interrupted and causes the MAINTENANCE REQUIRED warning light to come on, indicating that it is time for maintenance.

Still further, system 100 as described is highly adaptable in adjusting to new system requirements, and capable of "learning" new automobile features to be introduced into the system. Such learning may involve a modification or an upgrade in the system software stored in memory 115.

Moreover, other features of system 100 may include capabilities of communications with a third party remote from the vehicle. For example, system 100 may be programmed to transmit signals representing data on the current speed of the vehicle and its VIN receivable by a radar system, thus enabling the third party to monitor its speed. Furthermore, system 100 may be programmed by the third party to disable and subsequently enable the vehicle upon successful verification of a PIN pre-assigned to the third party. To that end, system 100 is capable of receiving remote transmission of the PIN, followed by the disable or enable code. The transmission may be encrypted for security reasons. Furthermore, more than one PIN may be used for different purposes. For example, a PIN may be assigned to a law enforcement agency to disable the vehicle because of a suspension of a license, or to temporarily disable the vehicle when the driver is intoxicated. Another PIN may be

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assigned to an environmental protection agency to disable the vehicle for failing to meet the emission requirements. Yet another PIN may be assigned to the vehicle owner to disable the vehicle when parked, thereby reducing the risk of a car theft. The disabling of the vehicle involves cutting off its gas, putting on its anti-lock brakes, etc.

Further, system 100 is capable of receiving a low-frequency, low-power broadcast covering an area of a limited radius, referred to as a "Cell". The broadcast may provide electronic GPS map and Yellow Page type information pertaining to the cell. This information, when received, may be downloaded onto AUTO DIRECTOR display interface 102a or multifunction display interface 102b. Such information includes a local directory indicating locations of nearby gas stations, restaurants and other facilities on the GPS map, with respect to the current location of the automobile. The local directory may be formatted in the form of "web pages" featuring the local businesses, and include additional information such as business hours, telephone numbers, and information on products and services provided by such businesses.

The above broadcast may also provide local weather information sponsored by a civic group or commercial entity. In the case of civic group sponsorship, the local civic events may be posted alongside the weather information, and in the case of commercial sponsorship, advertisements may be posted instead. Of course, as the automobile moves from cell to cell, the contents of the broadcast change accordingly.

In addition, while the radio in the automobile is tuned to a particular radio station, system 100 is also capable of receiving any electronic files broadcast from that radio station, along with the radio program. These electronic files, which may be in the form of web pages, can be downloaded onto the system. The system user may then scroll the pages to learn such information as program listings and coming events sponsored by the radio station.

Moreover, in the disclosed embodiment, system 100 is illustratively used in an automobile. It will be appreciated that a person skilled in the art may also employ the inventive system in another type of vehicle such as a boat, an airplane, etc.

Finally, although information and control system 100, as disclosed, is embodied in the form of various discrete functional blocks, the system could equally well be embodied in an arrangement in which the functions of any one or more of those blocks or indeed, all of the functions thereof, are realized, for example, by one or more appropriately programmed processors or devices.

We claim:

1. A system for use in a vehicle comprising:

an interface for entering a request concerning an aspect of the vehicle, the request including a user description of the aspect of the vehicle;

a processor for selecting, based on the user description, a display which contains at least one option for selection, the at least one option pertaining to the aspect of the vehicle;

a display element for showing thereon the selected display; and

an input device for selecting the at least one option on the selected display.

2. The system of claim 1 wherein the user description includes a term at least identifying partially the aspect of the vehicle.

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3. The system of claim 2 wherein the term includes one or more words.

4. The system of claim 1 wherein the at least one option is selected to access information about the aspect of the vehicle.

5. The system of claim 1 wherein the at least one option is selected to control the aspect of the vehicle.

6. The system of claim 5 wherein the aspect of the vehicle includes a climate control of the vehicle.

7. The system of claim 1 wherein the interface includes a touch-screen capability.

8. The system of claim 1 wherein the interface includes a voice input.

9. The system of claim 1 wherein the interface includes the input device.

10. The system of claim 1 wherein the selected display includes a second option for selection which pertains to a second aspect of the vehicle having a description similar to the user description.

11. The system of claim 10 wherein the description of the second aspect of the vehicle is similar to the user description in spelling.

12. A method for use in a system in a vehicle comprising: receiving a request concerning an aspect of the vehicle, the request including a user description of the aspect of the vehicle;

selecting, based on the user description, a display which contains at least one option for selection, the at least one option pertaining to the aspect of the vehicle;

showing the selected display; and allowing a selection of the at least one option on the selected display.

13. The method of claim 12 wherein the user description includes a term at least identifying partially the aspect of the vehicle.

14. The method of claim 13 wherein the term includes one or more words.

15. The method of claim 12 wherein the at least one option is selected to access information about the aspect of the vehicle.

16. The method of claim 12 wherein the at least one option is selected to control the aspect of the vehicle.

17. The method of claim 16 wherein the aspect of the vehicle includes a climate control of the vehicle.

18. The method of claim 12 wherein the selected display includes a second option for selection which pertains to a second aspect of the vehicle having a description similar to the user description.

19. The method of claim 18 wherein the description of the second aspect of the vehicle is similar to the user description in spelling.

20. Software including machine readable instructions stored in a tangible medium for performing a process comprising:

receiving a request concerning an aspect of the vehicle, the request including a user description of the aspect of the vehicle;

selecting, based on the user description, a display which contains at least one option for selection, the at least one option pertaining to the aspect of the vehicle;

showing the selected display; and

allowing a selection of the at least one option on the selected display.

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(54) **TECHNIQUE FOR ADOPTING AN
 ADJUSTMENT OF A VEHICLE FUNCTION**

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 6,175,782, which is a division of application No. 08/789,
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 165/41, 254, 287, 247, 288, 289; 307/9.1,
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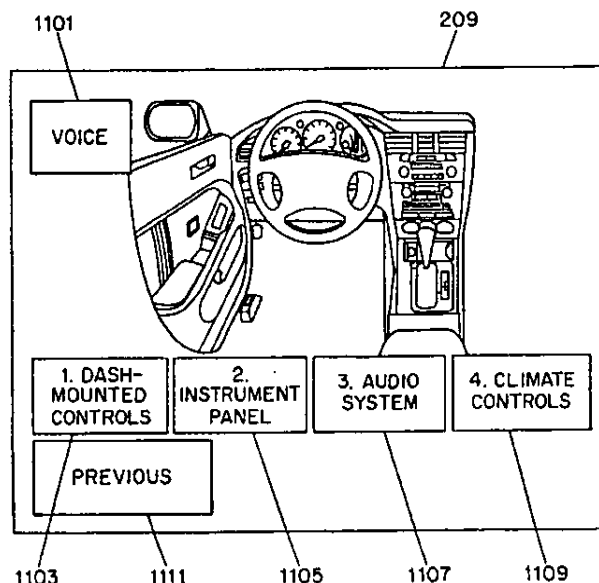
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(57) **ABSTRACT**

In a multimedia information and control system for use in an
 automobile, at least one interface is employed which enables
 a user to access information concerning the automobile and
 control vehicle functions in an efficient manner. The user
 may select one of a plurality of displayed options on a screen
 of such an interface. Through audio, video and/or text
 media, the user is provided with information concerning the
 selected option and the vehicle function corresponding
 thereto. Having been so informed, the user may activate the
 selected option to control the corresponding vehicle func-
 tion.

39 Claims, 15 Drawing Sheets



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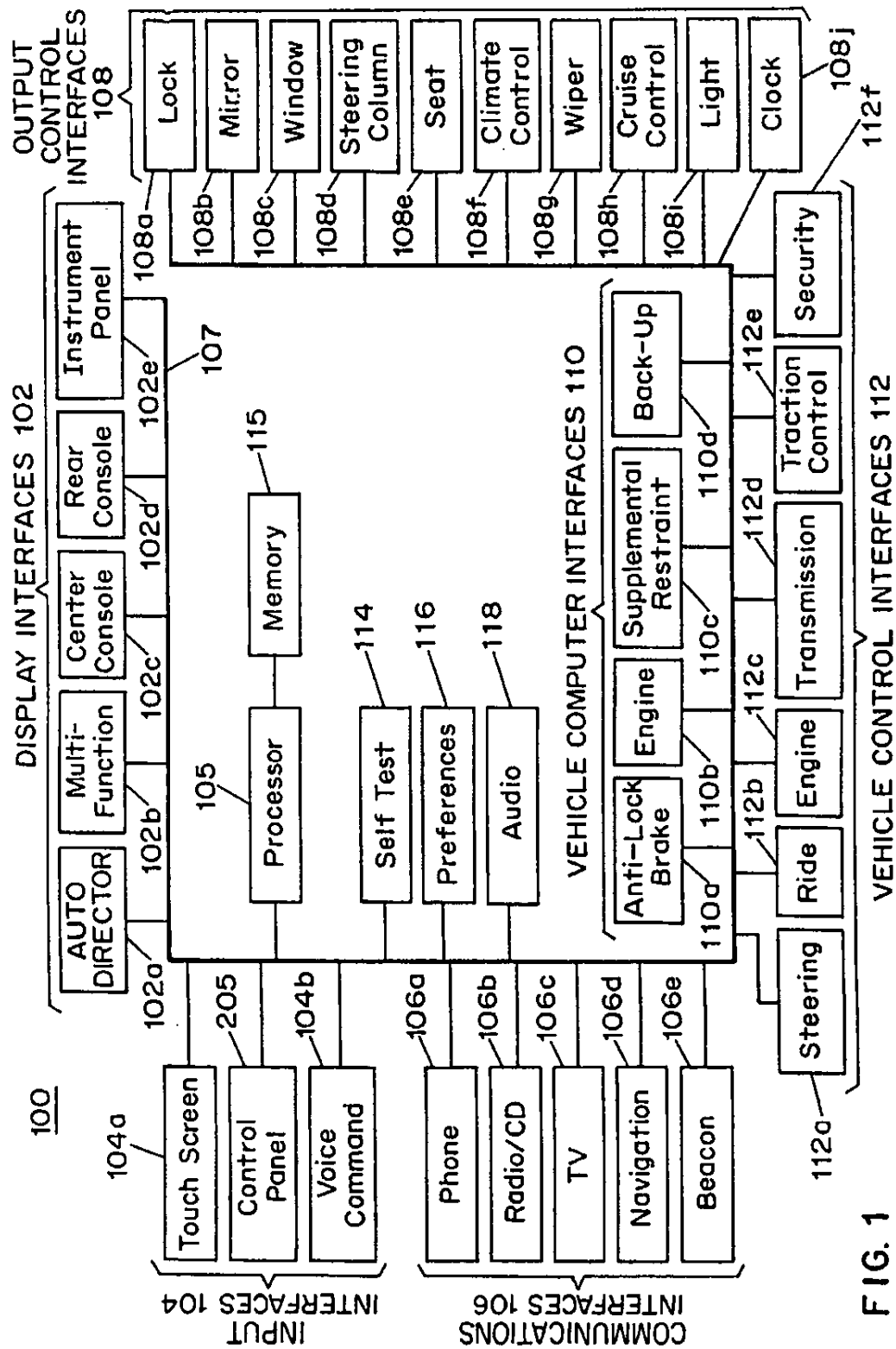


FIG. 1

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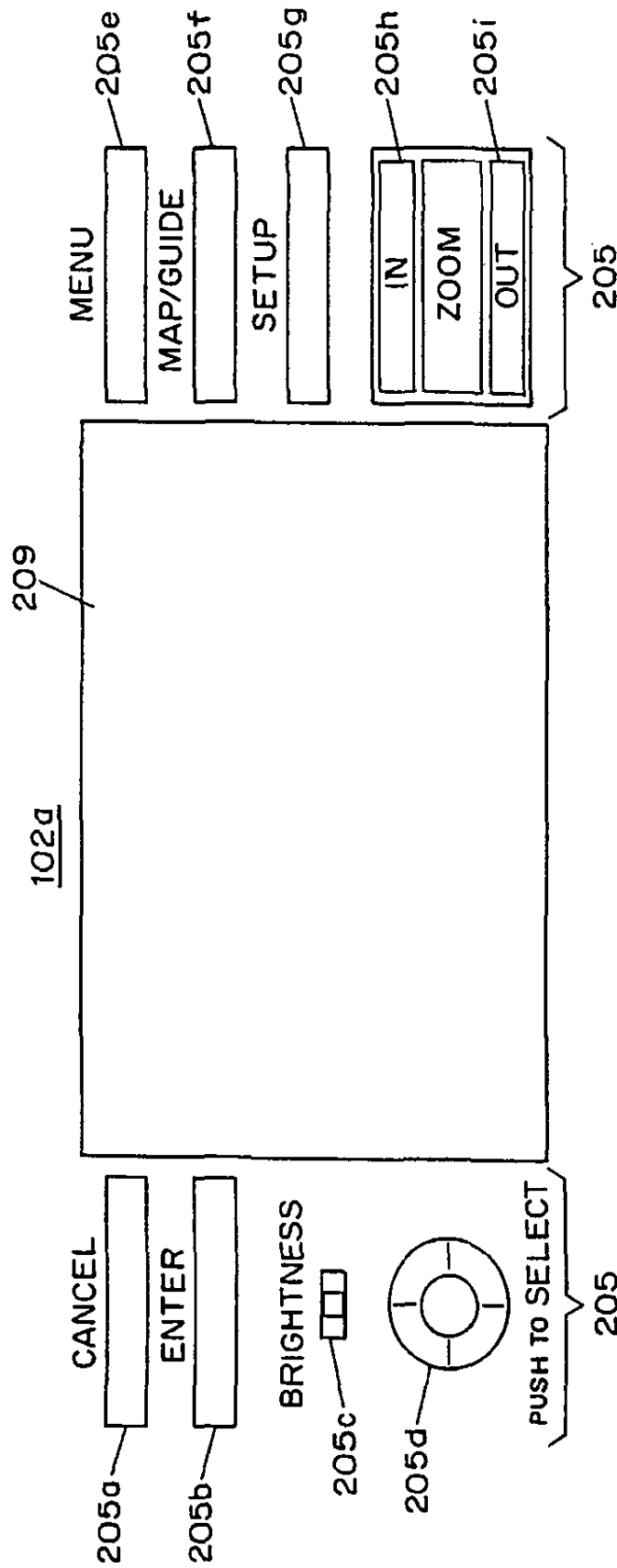


FIG. 2

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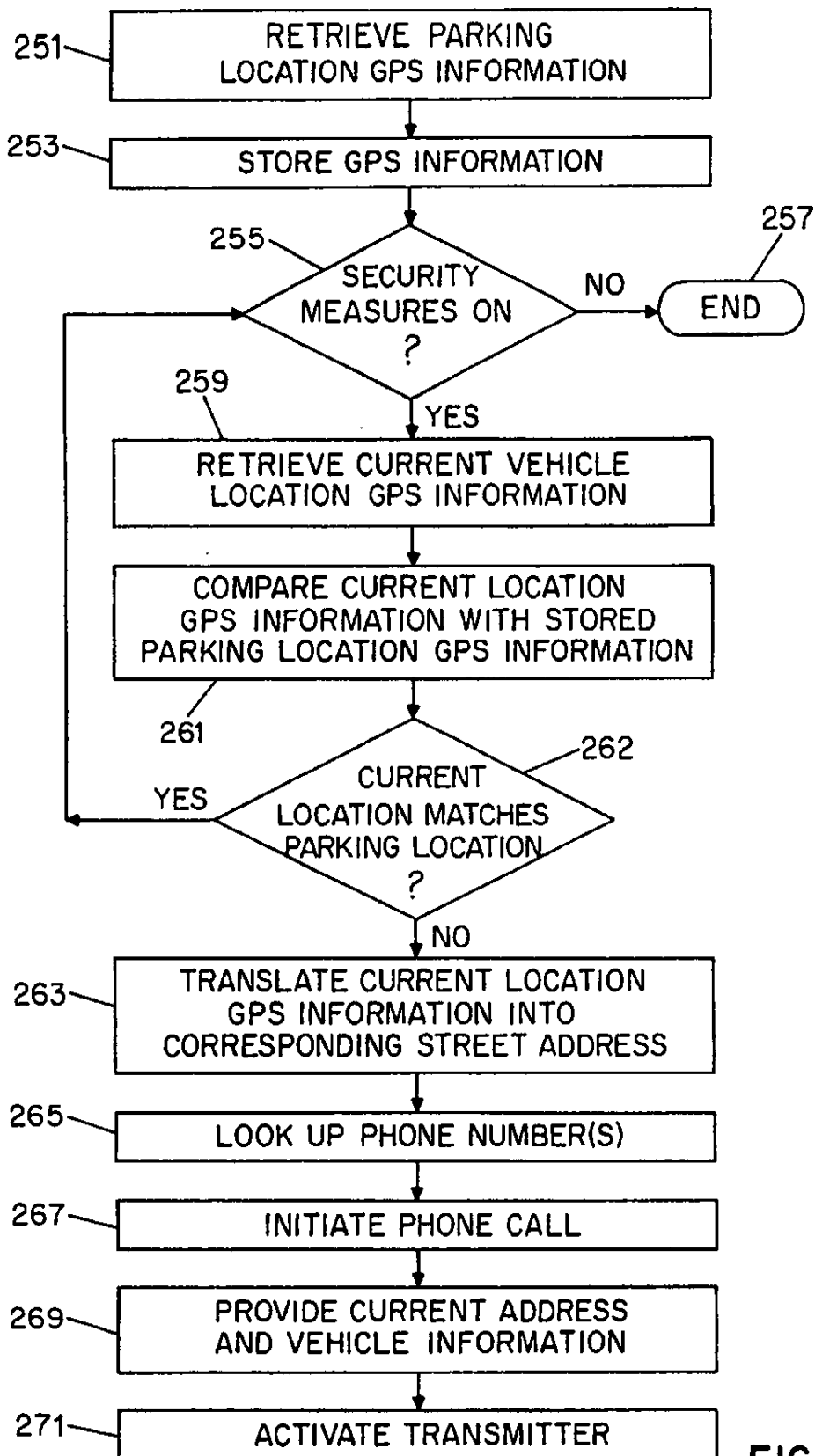


FIG. 3A

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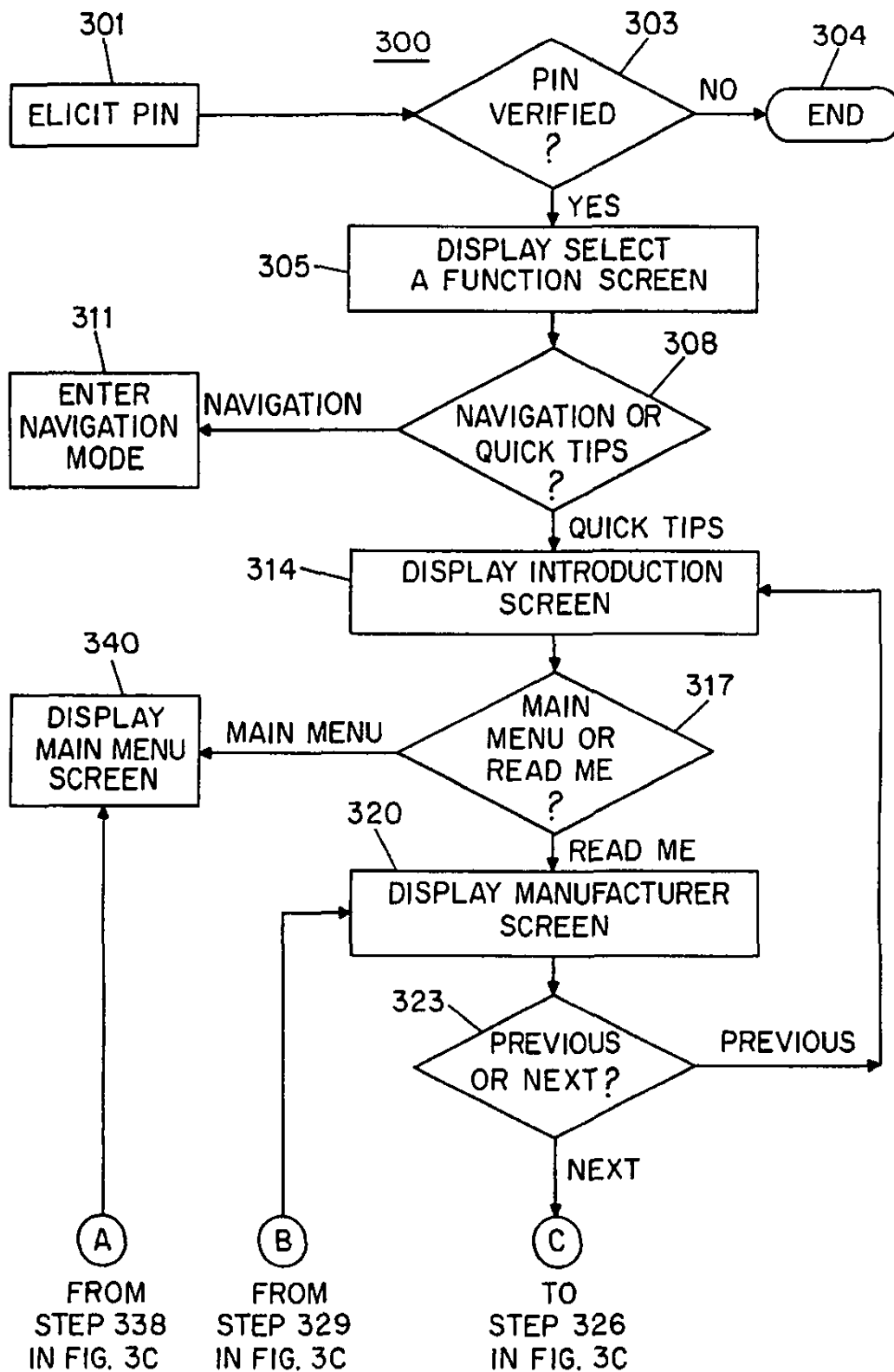


FIG. 3B

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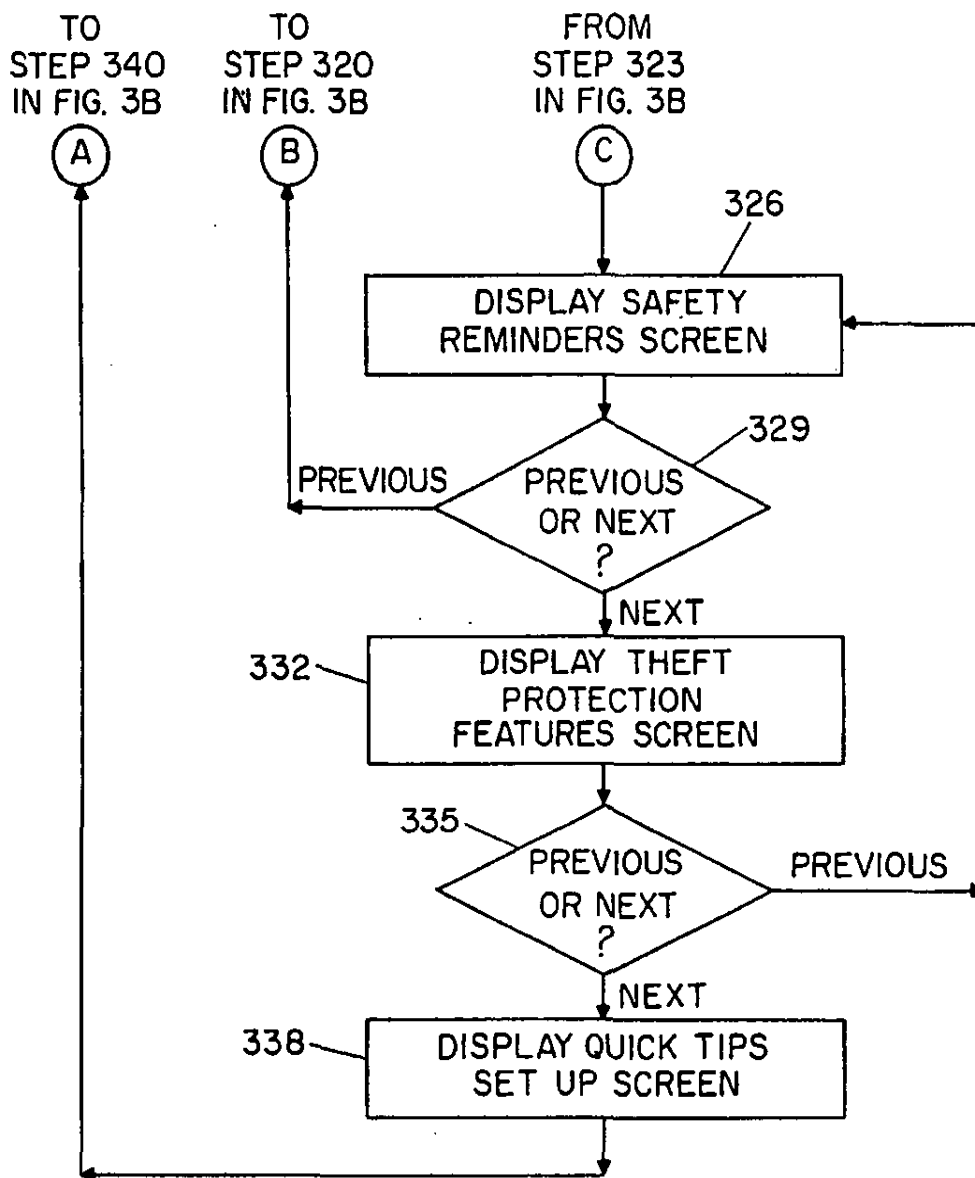


FIG. 3C

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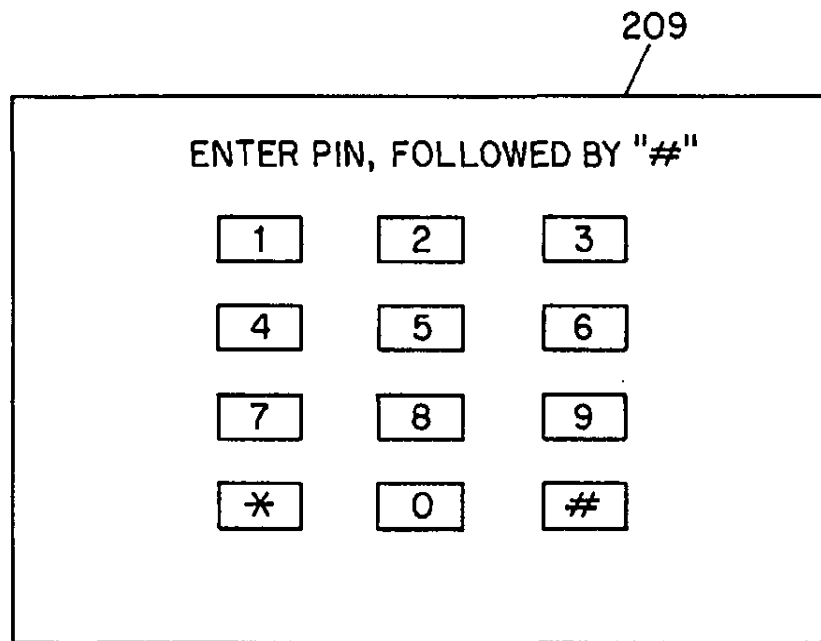


FIG. 4A

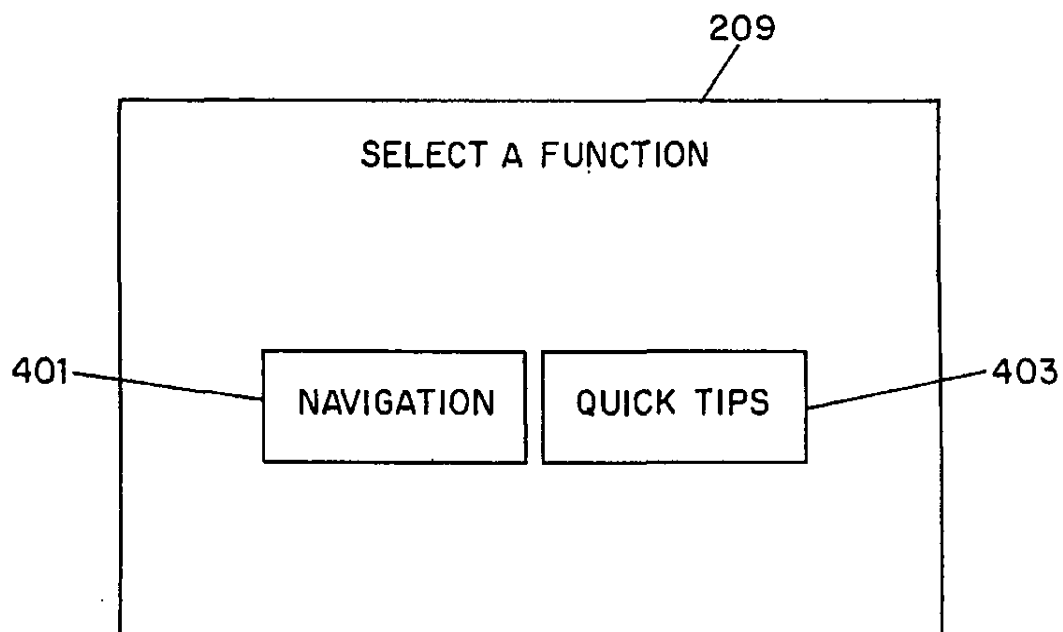


FIG. 4B

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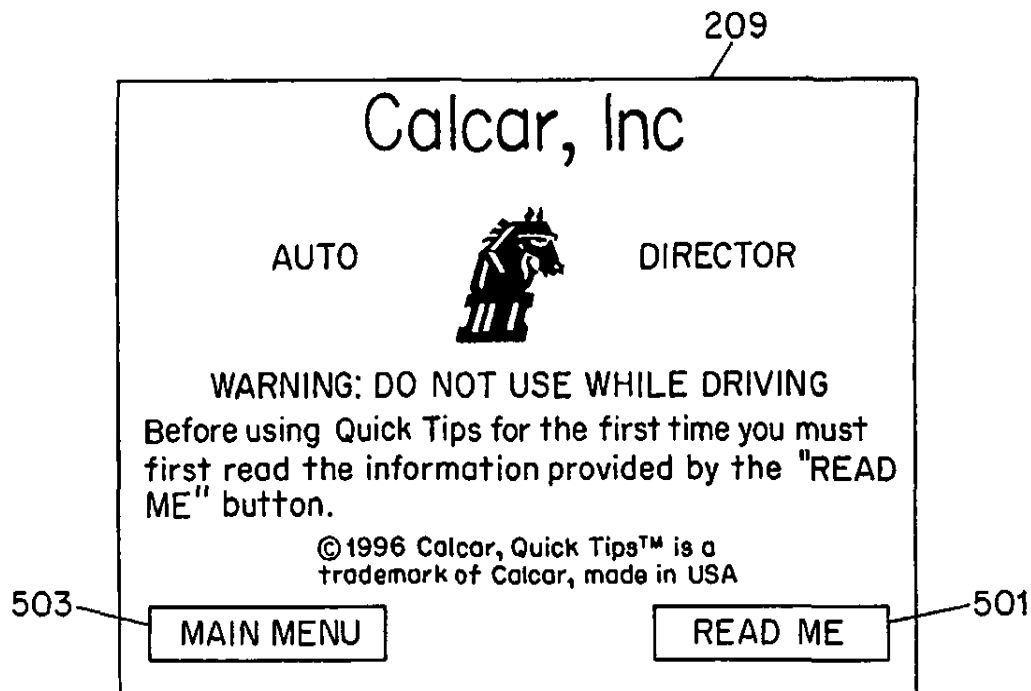


FIG. 5

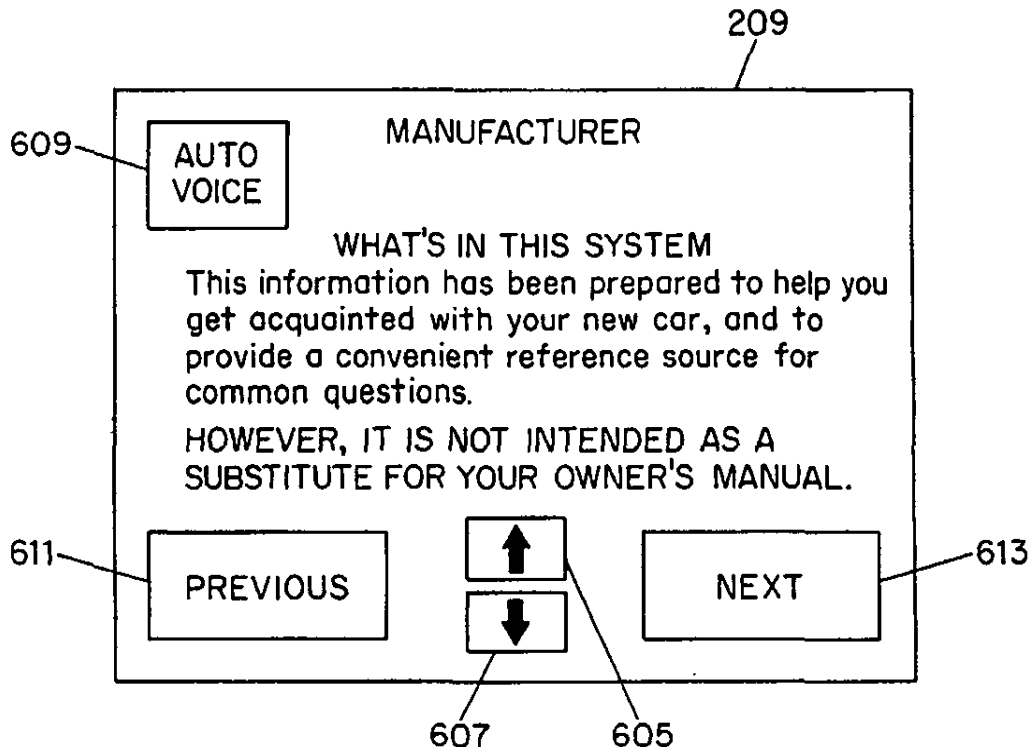


FIG. 6

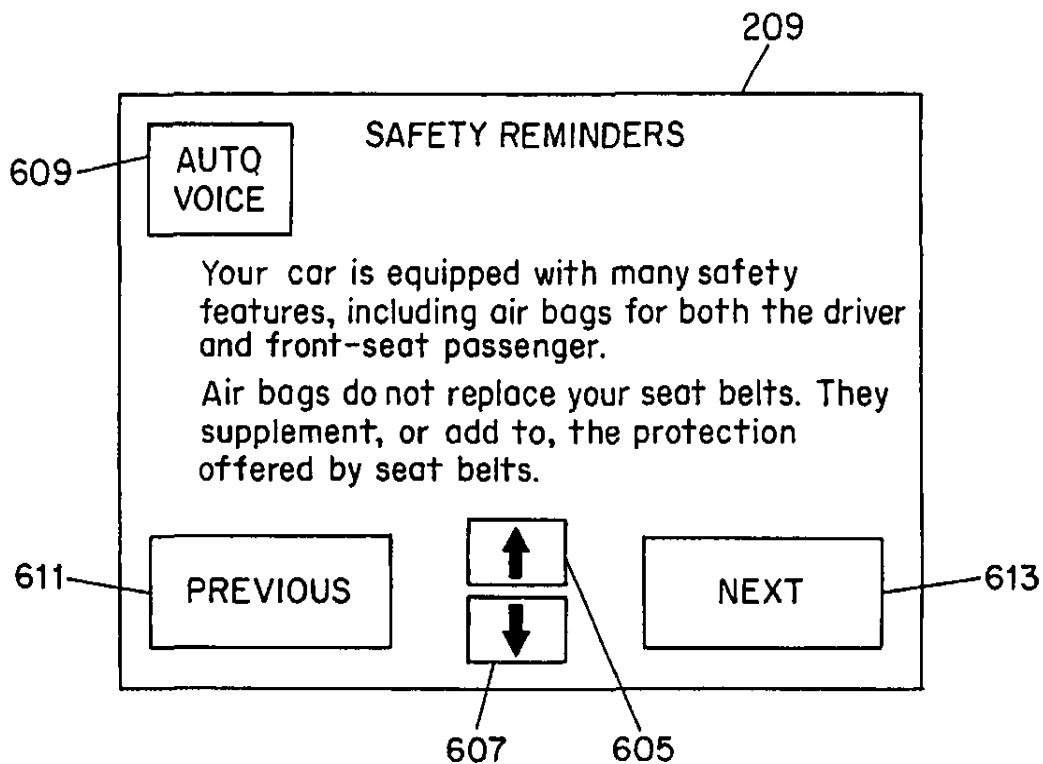


FIG. 7

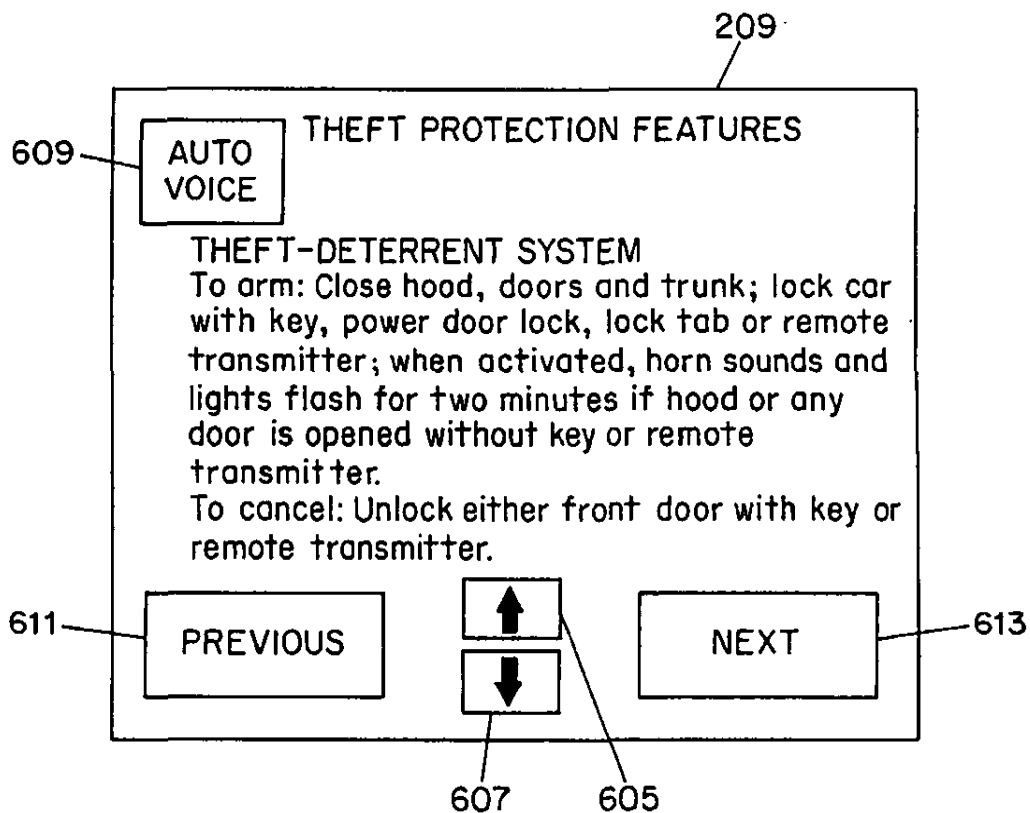


FIG. 8

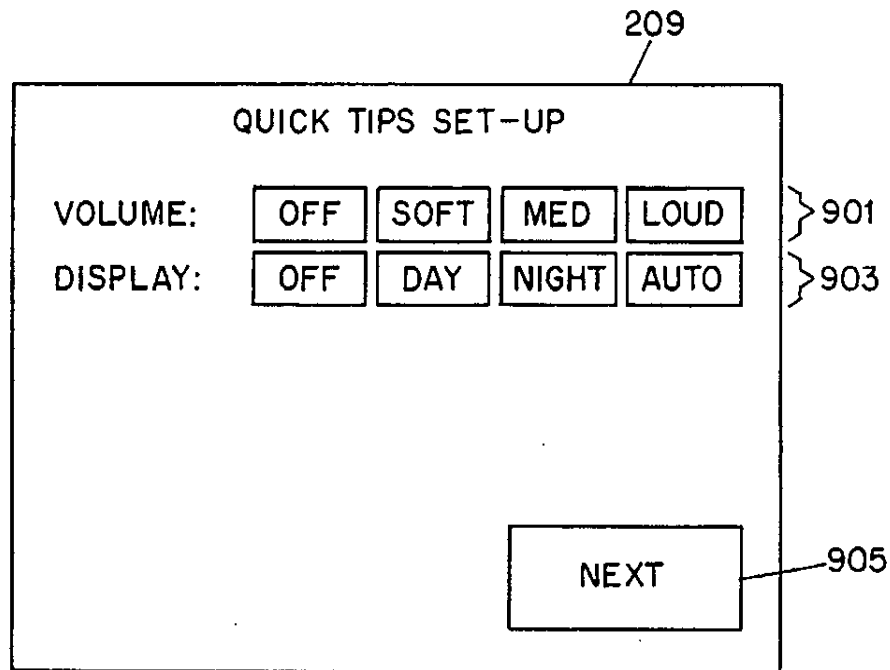


FIG. 9

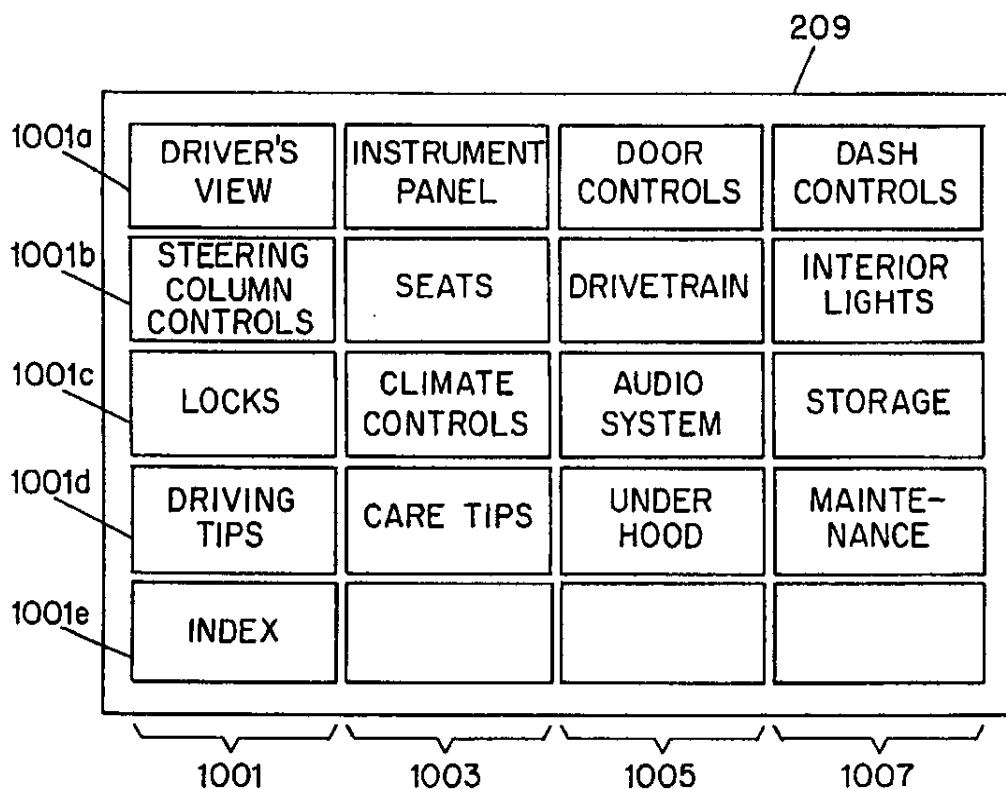


FIG. 10

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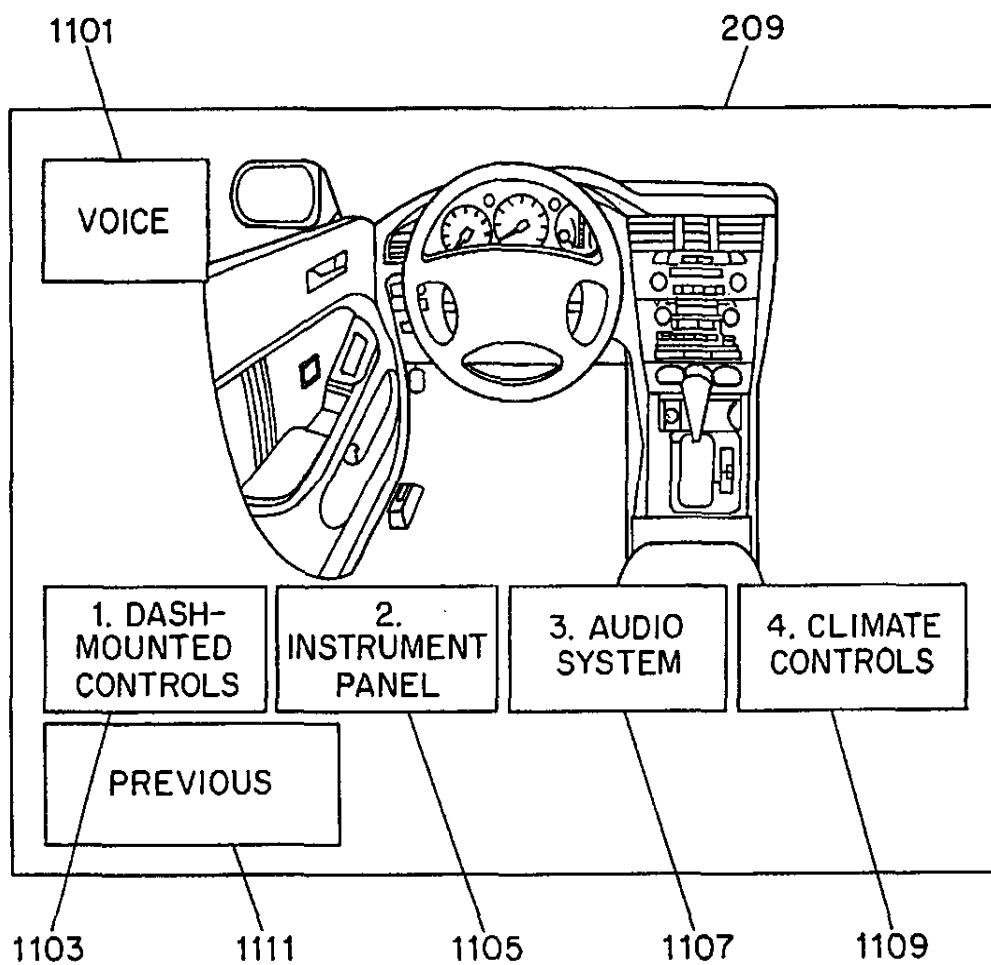


FIG. 11

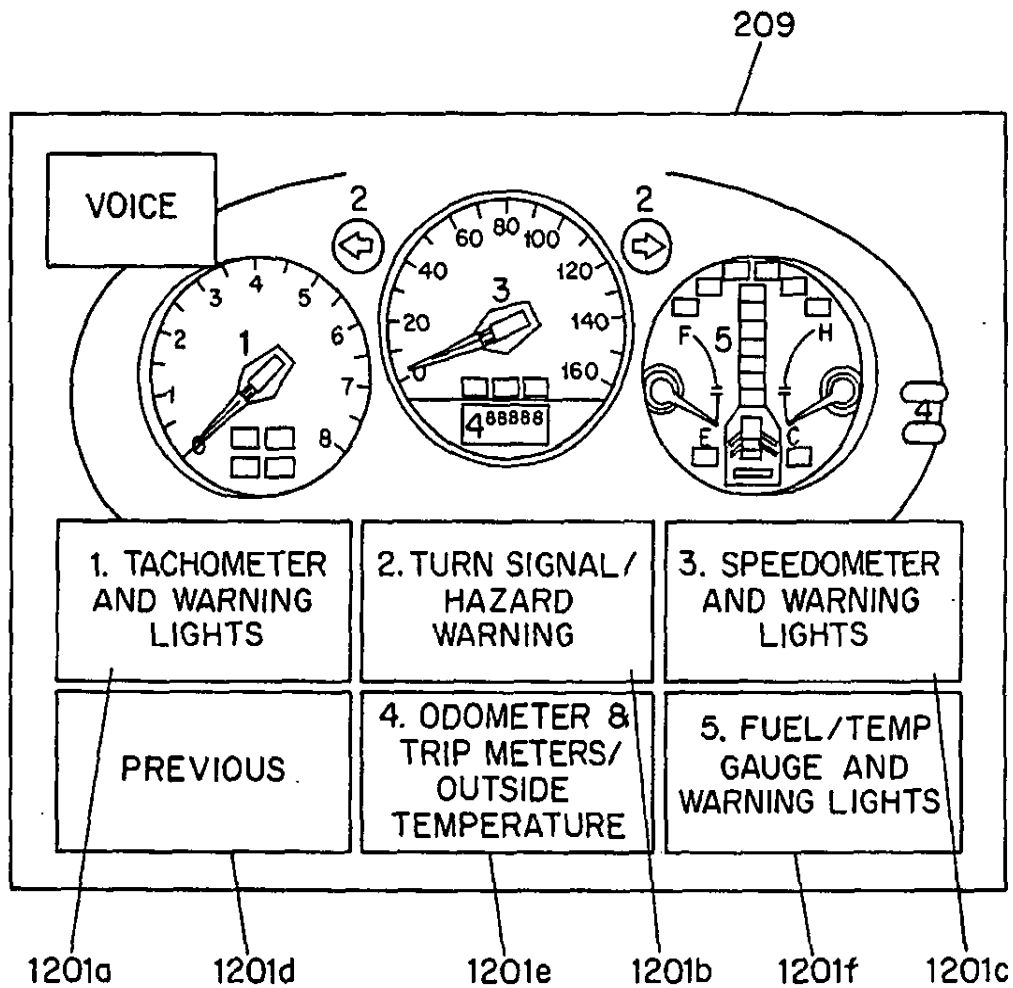


FIG. 12

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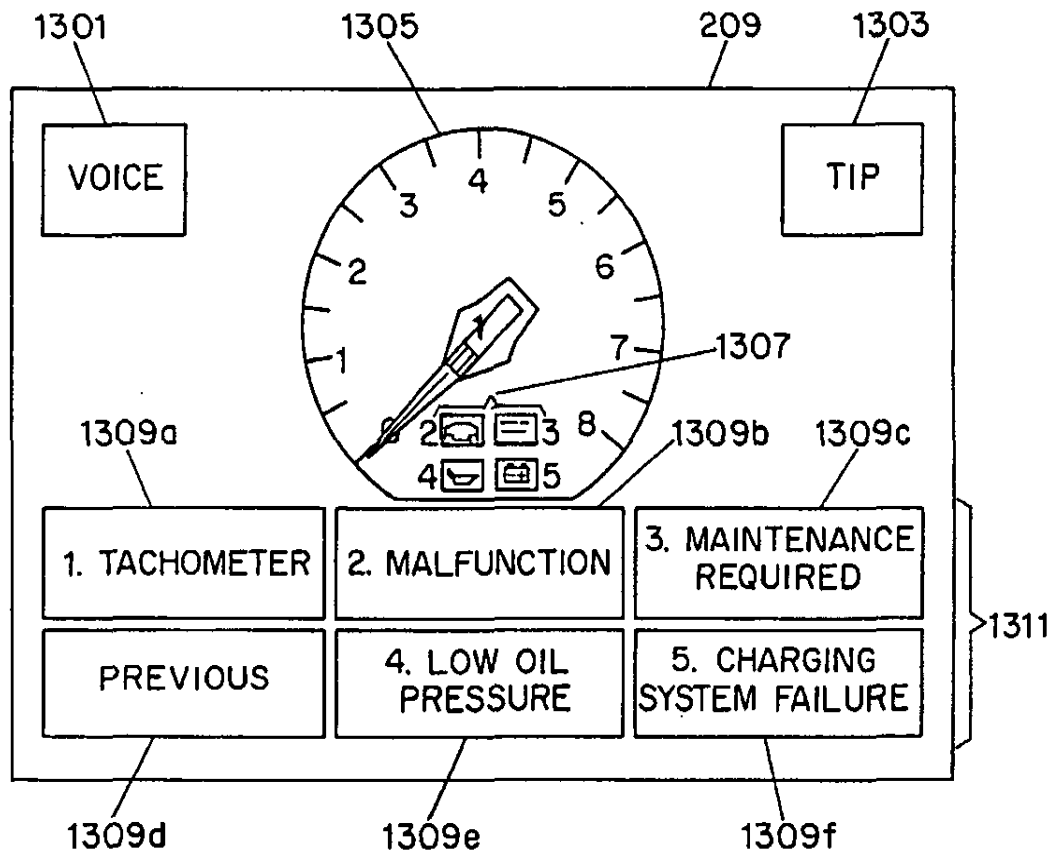


FIG. 13

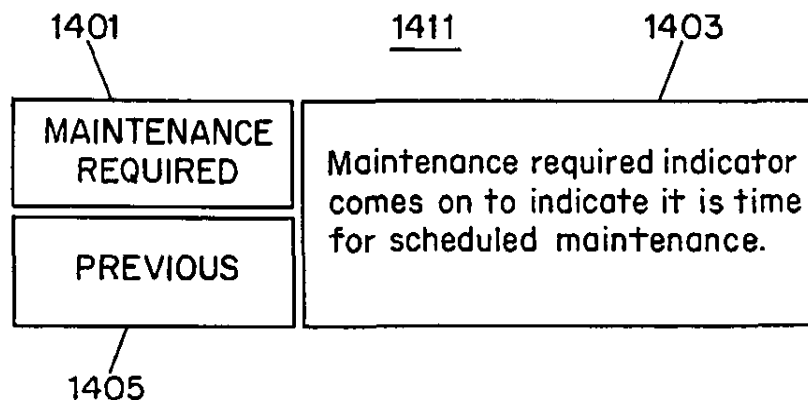


FIG. 14

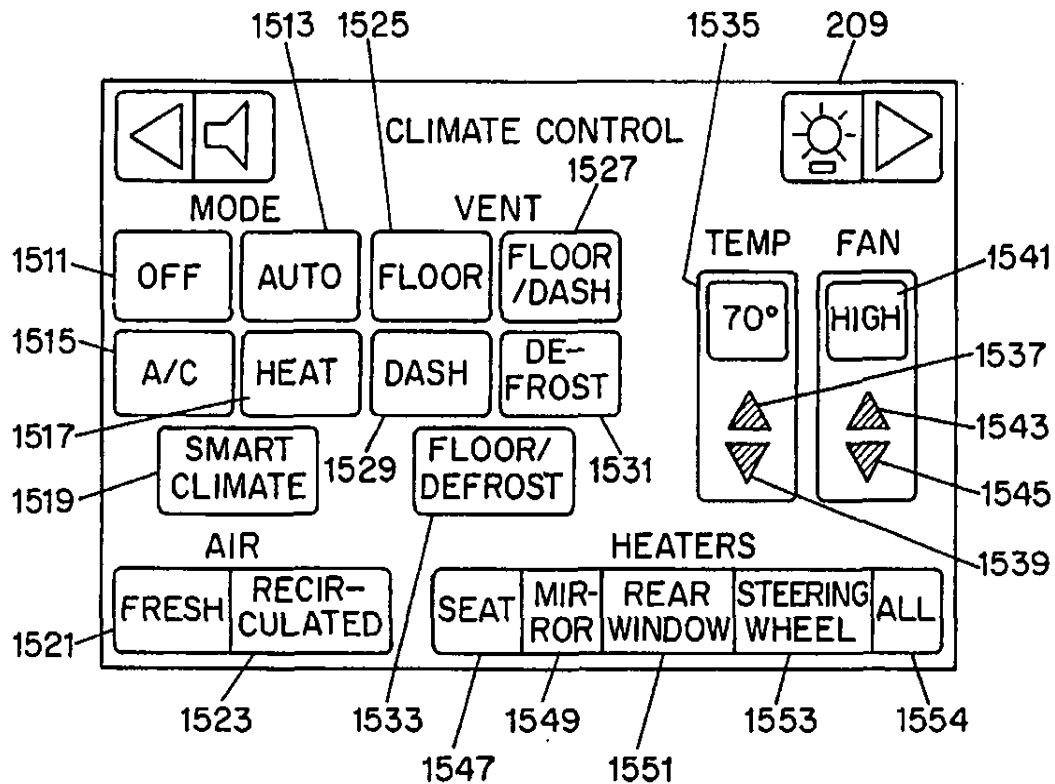


FIG. 15

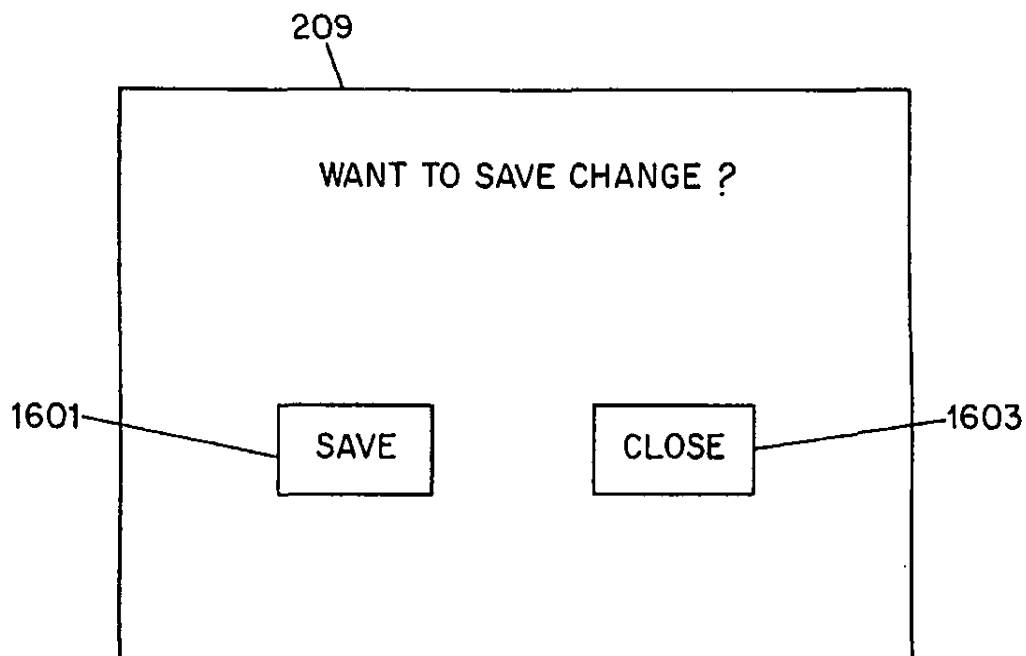


FIG. 16

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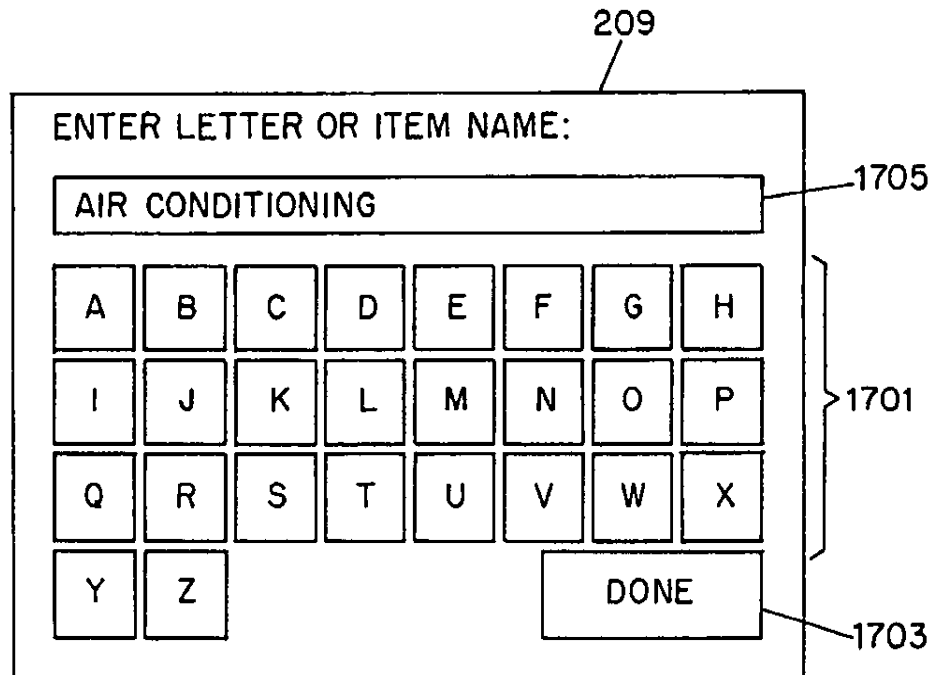


FIG. 17

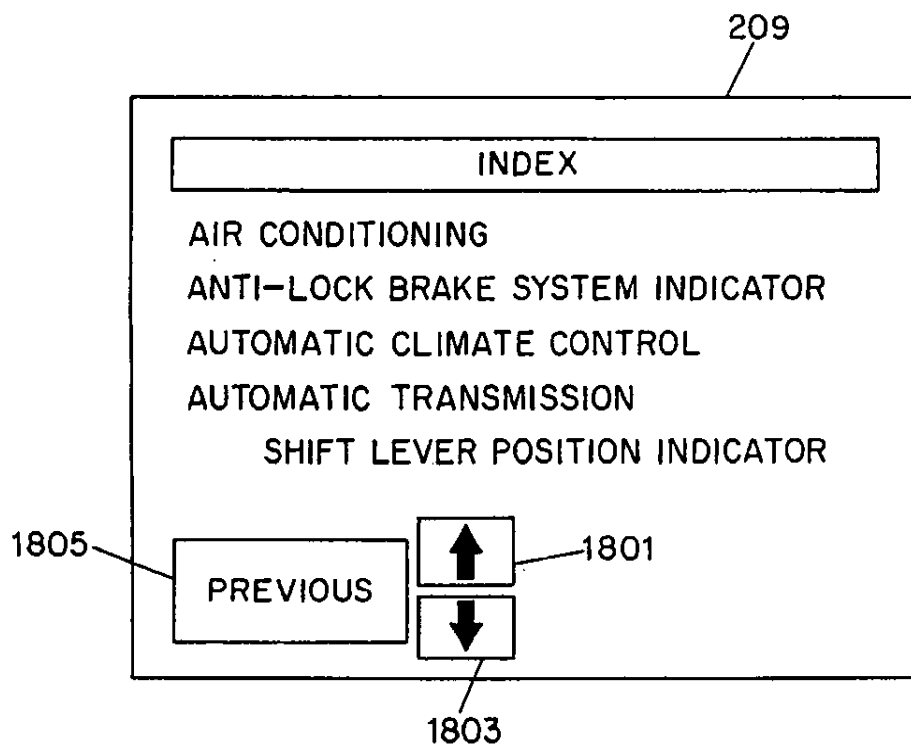


FIG. 18

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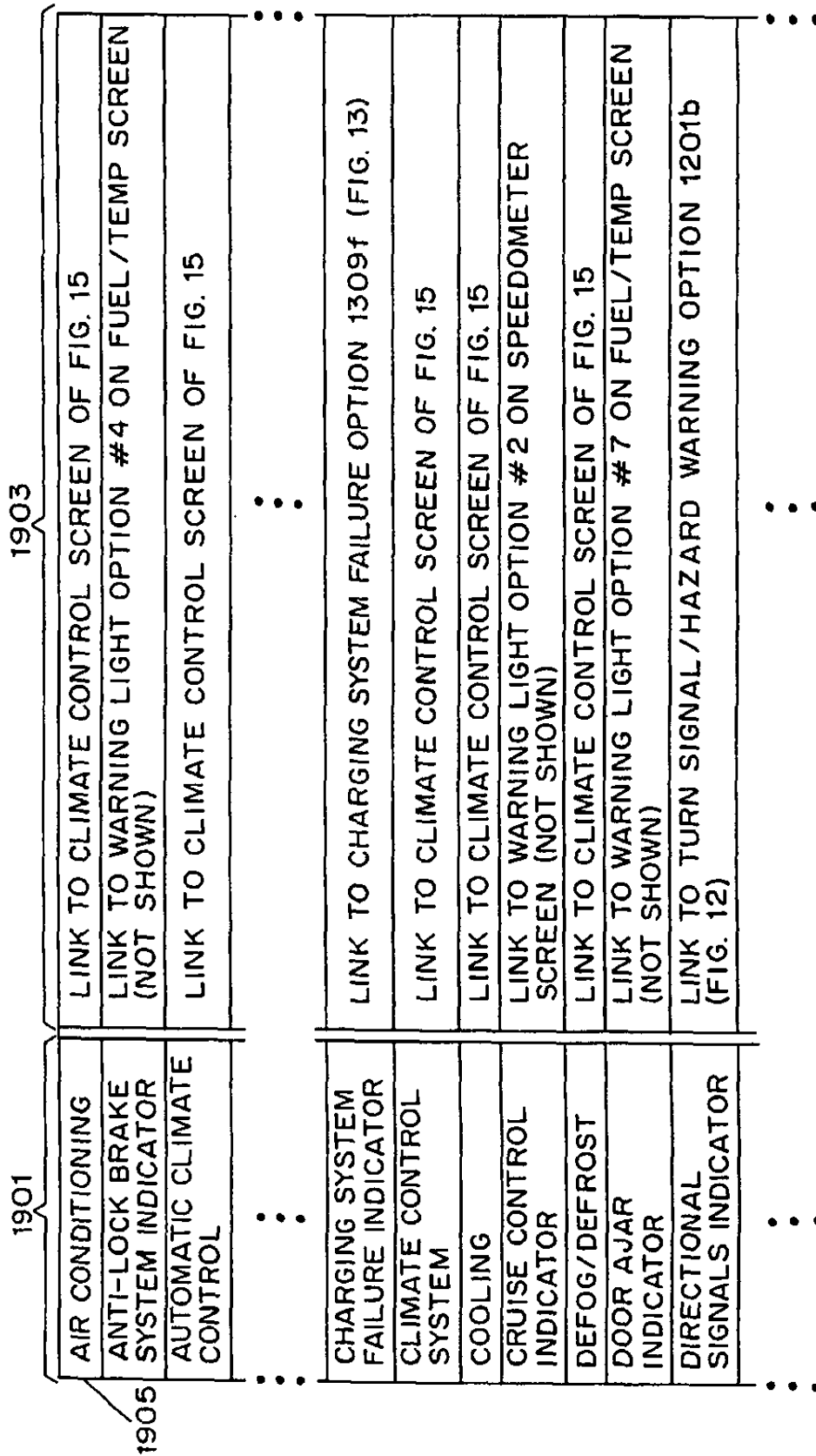


FIG. 19

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TECHNIQUE FOR ADOPTING AN ADJUSTMENT OF A VEHICLE FUNCTION

This application is a continuation of application Ser. No. 10/017,776 filed on Oct. 30, 2001, now U.S. Pat. No. 6,449,535, which is a continuation of application Ser. No. 09/717,943 filed on Nov. 21, 2000, now U.S. Pat. No. 6,459,961, which is a continuation of application Ser. No. 09/401,039 filed on Sep. 21, 1999, now U.S. Pat. No. 6,175,782, which is a division of application Ser. No. 08/789,934 filed on Jan. 28, 1997, now U.S. Pat. No. 6,009,355.

FIELD OF THE INVENTION

The invention relates generally to information and control systems and, more particularly, to a system for use in an automobile which facilitates a user's retrieval and/or dissemination of information, and control of vehicle functions.

BACKGROUND OF THE INVENTION

Information is vital to day-to-day activities. With no access to information, people cannot function efficiently in this society, and their lives and financial well-being are put in jeopardy. People want to be well-informed, so much so that when they are travelling in automobiles, they tune into local radio stations to listen to news, weather forecasts and traffic conditions. For that matter, some automobiles are equipped with audiovisual systems including television (TV) receivers. One such system is disclosed in U.S. Pat. No. 5,404,443 issued to Hirata. The Hirata system provides audiovisual information in a number of modes including a TV mode, which may be selected by control switches disposed on the periphery of a display.

Automobile users like to be continually updated with information affecting their travel plans such as weather and traffic conditions because of its fast changing nature. Automobile users who are traveling also like to continually keep in touch with their homes and offices, and to confirm appointments and hotel reservations so that they can adjust their itineraries accordingly. To that end, cellular mobile telephones were introduced to enable automobile users to conduct business and contact their families while they are traveling.

In addition, local map information is important to automobile travelers moving from one locale to another. As such, navigation systems were developed to help reach their destinations in an unfamiliar milieu. One such vehicle navigation system is disclosed in U.S. Pat. No. 5,274,560 issued to LaRue. The disclosed system is based on artificial intelligence and provides a driver with directions via a voice interface. The system is built upon an optical disk player which can be used for entertainment as well. Digitized maps, compressed voice records and computer programs are stored on an optical disk compatible with the disk player. After a destination point is identified, the disclosed system finds the best route from the digitized maps and guides the driver therethrough via the voice interface, taking into account the latest traffic conditions received by an FM receiver to avoid congestion.

Recently, navigation systems based on military global positioning system (GPS) technology have emerged. One such navigation system is commercially available as an option for the latest model of the ACURA 3.5 RL automobile. This ACURA navigation system receives signals from a constellation of satellites which is part of the GPS. In response to these signals, the navigation system pinpoints

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the automobile's location (in latitude and longitude). It also detects the automobile's speed and direction. With geographic information stored on a hard disk in an onboard computer, the navigation system is capable of verbally and visually communicating to the user instructions for reaching the destination.

In addition to the above techniques for communications with automobile users, a technique for disseminating information regarding the automobiles themselves is disclosed in U.S. Pat. No. 5,442,553 issued to Parillo. The disclosed system is a vehicle diagnostic and software upgrade system. In this system, sensors are provided in the vehicle to generate dynamic data relating to various mechanical controls and the engine of the vehicle, including engine R.P.M., fuel/air mixture, emissions and pollution content information. A microprocessor in the vehicle has access to selectable program parameters affecting the functioning of the mechanical controls. The microprocessor collects and transmits the dynamic data to a remote diagnostic station periodically or upon its request. In response, the remote station sends, to the vehicle, signals indicative of any changes in its software and/or program parameters. The microprocessor accordingly causes the changes to be made in the vehicle based on the received signals.

Besides the communication capabilities described above, an automobile has many accessories and user control elements such as lights, wipers, a clock, temperature control, cruise control, seat adjustment control, mirror adjustment control, and an anti-theft system. A technique for centralizing the command of the individual control elements is disclosed in U.S. Pat. No. 5,555,502 issued to Opel. The disclosed system includes a centralized control panel on a steering wheel which, together with a display, is utilized to control the electronic components of the automobile. The display is positioned in the area of the driver's sun visor. After the driver presses one of the buttons on the control panel corresponding to a desired electronic component, a menu is displayed so that the driver is able to select items from the menu to program the component. The selection is accomplished by pressing specified buttons on the panel.

In addition, a technique for controlling vehicle accessories via voice command is disclosed in U.S. Pat. No. 4,827,520 issued to Zeinstra. In accordance with this technique, control functions of each accessory are formatted in a summary page for display on a screen, which is scanned by infrared light to sense any touching thereon. By uttering any of the displayed functions on the summary page, preceded by either a specified keyword or an actuation of a push-to-talk switch on a steering wheel, a more detailed subpage of the selected function is displayed for further selection by voice. As an alternative to the voice command, the selection can also be accomplished by touching the displayed function on the screen.

Voice command and touch screen techniques are frequently mentioned in prior art references in controlling car accessories. In particular, U.S. Pat. No. 5,214,707 issued to Fujimoto et al. discloses a system for voice-controlling equipment inside a vehicle, including microphones capable of discriminating voice commands as to whether they are generated at the driver side or at the assistant side of the vehicle in a noisy environment.

SUMMARY OF THE INVENTION

It is celebratory that technology advances at lightning speed. However, many people are left behind the technological frontier, and to some extent develop "technophobia".

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Some of them have even given up this technological race, which is confirmed by the blinking "12:00" display on the clocks of many video cassette recorders (VCRs) being used.

Similarly, it is fantastic that automobiles nowadays include many advanced accessories such as audiovisual systems, anti-theft systems, anti-lock brake systems, climate control, and cruise control which embrace the latest technologies. However, of all these accessories, many automobile users only know how to operate the headlights and windshield wipers, and regard the rest as nuisance. That is, the users pay for numerous accessories which they do not use, resulting in much consumer waste. We have recognized that such non-use is principally attributed to an inefficient distribution of operating knowledge of the automobile and, in particular, its accessories.

Specifically, when automobile users presently want to learn about certain aspects of an automobile, they need to consult an owner's manual which could have been lost or misplaced when they need it the most. In addition, the manual is unpopular because many users simply want to avoid reading any written material, and find it intimidating as it oftentimes is filled with incomprehensible technical jargon.

We have further recognized that even with the operating knowledge, many users are overwhelmed and confused with the large number of knobs, switches and buttons used to control the individual vehicle parts and accessories.

Accordingly, it is an object of the invention to design an information and control system for use inside an automobile with the user in mind. The user is afforded a centralized control which may be used in lieu of the knobs, switches and buttons to operate the vehicle parts and accessories. In accordance with the invention, the centralized control is intimately tied to an information system such that the user is able to efficiently access information about the functions and operations of such parts and accessories, and in a synergistic manner apply that information to operate same, using the centralized control.

It is another object of the invention that the access to the information is intuitive and direct so that the user can obtain the relevant information in a few self-explanatory steps. To that end, the invention embraces a multimedia approach where audio and video media are added to the traditional text media to convey information. The additional media increases the dimensions of both the user's comprehension of the information and the user's interaction with the automobile. Moreover, the information access is driven by a multilevel menu based on an intuitive model of taxonomy where information is organized in a minimal number of levels of subject matter from general to specific. The above integration of the multimedia approach with the multilevel menu approach presents an effective way of retrieving information in the automobile. Advantageously, with the invention, the user would not be distracted or overburdened by irrelevant information in the course of an information retrieval, which is conducive to a safe driving environment.

In the preferred embodiment, when the user wants to access information about a given part or accessory of the automobile, the user is presented with options on a display screen. Each option is associated with a respective one of different parts or accessories of the automobile. The user is able to select through the interface one of the options, associated with the given automobile part or accessory. The option, when selected, is highlighted in a first color, for example, yellow. A voice is then generated by the inventive system to explain the purpose or the content of the selected

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option before the user commits to it. Having been so informed, the user may then activate the selected option in retrieving the information of interest. The activated option is highlighted in a second color, e.g., blue, to indicate its active status. The retrieved information is presented to the user both in text and in voice.

BRIEF DESCRIPTION OF THE DRAWING

Further objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing showing an illustrative embodiment of the invention, in which:

FIG. 1 is a block diagram of an automobile information and control system in accordance with the invention;

FIG. 2 illustrates a control panel and a display interface for a user to interact with the system of FIG. 1;

FIG. 3A illustrates a flow chart depicting the steps of an anti-car-theft routine used in the system of FIG. 1;

FIGS. 3B and 3C jointly illustrate a flow chart depicting the steps of a routine for presenting various screens to the user in the system interaction;

FIG. 4A illustrates a screen for eliciting a personal identification number (PIN) from the system user;

FIG. 4B illustrates a SELECT A FUNCTION screen including features thereof in accordance with the invention;

FIG. 5 illustrates an introduction screen including features thereof in accordance with the invention;

FIG. 6 illustrates a MANUFACTURER screen including features thereof in accordance with the invention;

FIG. 7 illustrates a SAFETY REMINDERS screen including features thereof in accordance with the invention;

FIG. 8 illustrates a THEFT PROTECTION FEATURES screen including features thereof in accordance with the invention;

FIG. 9 illustrates a QUICK TIP SET-UP screen including features thereof in accordance with the invention;

FIG. 10 illustrates a MAIN MENU screen including features thereof in accordance with the invention;

FIG. 11 illustrates a DRIVER'S VIEW screen including features thereof in accordance with the invention;

FIG. 12 illustrates an INSTRUMENT PANEL screen including features thereof in accordance with the invention;

FIG. 13 illustrates a TACHOMETER AND WARNING LIGHTS screen including features thereof in accordance with the invention;

FIG. 14 illustrates a segment of the screen of FIG. 13 providing the user with information regarding a particular function of the automobile;

FIG. 15 illustrates a CLIMATE CONTROL screen including features thereof in accordance with the invention;

FIG. 16 illustrates a SAVE screen for saving the user's preferences in accordance with the invention;

FIG. 17 illustrates a DATA ENTRY screen in accordance with the invention for looking up information regarding a specific item in the automobile;

FIG. 18 illustrates an INDEX screen with listed items for which information is available; and

FIG. 19 is a look-up table listing searchable items and the corresponding instructions for a processor in the system of FIG. 1 to provide information regarding such items.

Throughout this disclosure, unless otherwise stated, like elements, components and sections in the figures are denoted by the same numerals.

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DETAILED DESCRIPTION

FIG. 1 illustrates information and control system 100 embodying the principles of the invention for use in an automobile. System 100 is referred to as the "AUTO DIRECTOR" system. It is user-friendly and designed with the automobile user in mind. For example, with AUTO DIRECTOR display interface 102a to be described, information about the automobile is readily available literally at the fingertips of the user. This information includes operational instructions, maintenance procedures, safety measures, and information about virtually every capability of the automobile. In accordance with the invention, the user is able to efficiently access such information using multimedia means involving audio, text and video media. Also with interface 102a, or multifunction display interface 102b to be described, the user is afforded a centralized control whereby he/she can program or adjust different vehicle parts and accessories using the information thus obtained.

As shown in FIG. 1, central to system 100 is processor 105 connected to memory 115. Data bus 107 connects processor 105 to display interfaces 102, input interfaces 104, communications interfaces 106, output control interfaces 108, vehicle computer interfaces 110, vehicle control interfaces 112, self-test interface 114, preferences interface 116, and audio interface 118.

Display interfaces 102 include, inter alia, AUTO DIRECTOR display interface 102a, which is illustrated in FIG. 2, together with control panel 205 in FIG. 1. By way of example, but not limitation, the hardware of interface 102a and control panel 205 are derived from a prior art navigation system of the type of the ACURA navigation system. In fact, interface 102a and control panel 205 are used in this illustrative embodiment to realize not only AUTO DIRECTOR functions to be described, but also the well-known navigation function.

Interface 102a includes a conventional liquid crystal display screen 209, and LCD driver (not shown) for processor 105 to control the display on screen 209. Interface 102a also incorporates well-known touch-screen circuitry (not shown) connected to touch screen interface 104a in FIG. 1. With this circuitry, the user can interact with processor 105 by, say, touching a displayed option on screen 209. Through interface 104a, processor 105 receives from the touch screen circuitry a signal identifying the location on screen 209 where it has been touched. If such a location matches the predetermined location of one of the displayed options, processor 105 determines that that option has been selected. With such touch-screen and displayed option selection capabilities, through AUTO DIRECTOR interface 102a, the user is able to obtain information on and control selectable functions of the automobile such as the instrument panel, navigation function, mobile phone, radio/CD player, locks, mirrors, windows, driver's seat adjustment control, climate control, windshield wipers, cruise control, lights, security function, steering, ride control, engine and transmission.

Control panel 205 comprises CANCEL switch 205a, ENTER switch 205b, BRIGHTNESS switch 205c, PUSH TO SELECT knob 205d, MENU switch 205e, MAP/GUIDE switch 205f, SETUP switch 205g, ZOOM IN switch 205h and ZOOM OUT switch 205i. BRIGHTNESS switch 205c comprises a standard variable resistor such that when it is pushed one way, operating circuitry 121 responsively causes the display intensity to increase, and the other way to decrease. ZOOM IN switch 205h when pressed enables the automobile user to enlarge a particular visual area of interest

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on screen 209, affording better details. On the other hand, ZOOM OUT switch 205i when pressed performs the inverse function to switch 205h. As an alternative to the touch-screen capability, switch 205d similar to a standard joystick is provided for the user to move from one displayed option to another on screen 209 in the same direction (e.g., up, down, left or right) as the switch is operated. A desired option may be selected by pressing ENTER switch 205b. The functions of the other switches are described hereinbelow as they are called out in the operation of system 100. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and control panel 205 are mounted close to the center of the dashboard of the automobile next to the steering wheel.

Referring back to FIG. 1, display interfaces 102 also include multifunction display interface 102b, center console display interface 102c, rear console display interface 102d, and instrument panel display interface 102e.

Specifically, multifunction display interface 102b is installed on the dashboard close to interface 102a on the driver side. Like interface 102a, interface 102b provides the user with graphic display and control of selected functions using well-known touch screen technology. In fact, interface 102b duplicates certain control functions (e.g., navigation, phone, radio and climate control) of interface 102a so that the user can use interface 102b to control a selected function while interface 102a is engaged in another ongoing function. For example, while the user is relying on AUTO DIRECTOR interface 102a to provide navigation information to reach a given destination, the user may want to adjust the climate control of the automobile. It is inconvenient for the user to terminate the ongoing navigation mode of interface 102a, albeit temporarily, to access the climate control function through the interface, adjust the climate control and then resume the navigation mode. Thus, it is preferable to leave the navigation mode of interface 102a alone and use interface 102b to administer the climate control.

Center console interface 102c is installed close to interface 102a on the passenger side. Similar to interface 102b, interface 102c provides the front seat passenger with graphic display and control of functions which include: the front passenger seat adjustment, door lock, window, climate and TV controls. If enabled by the driver, control is also available for the radio/CD player and phone.

Rear console display interface 102d is installed on the back of a front seat. Similar to interface 102c, interface 102d provides rear seat passengers with graphic display and control of certain functions if enabled by driver or front seat passenger. These functions include: the rear seat climate, windows, door locks, radio/CD player and TV controls.

Instrument panel display interface 102e is installed on the dashboard in front of the driver seat. This interface provides the driver with graphic display of the vehicle speed, engine RPM, outside and inside temperatures, oil pressure, fuel level, time, odometer reading, trip odometer reading and warning light indicators. Through AUTO DIRECTOR interface 102a, the system user may select the display of the information in either an analog or a digital form.

Input interfaces 104 comprise touch screen interface 104a and control panel 205 described before, and voice command interface 104b. The latter is connected to a microphone (not shown) and comprises standard voice command circuitry (not shown) for processing voice commands by the user through the microphone to control or modify selected functions of system 100.

Communications interfaces 106 include phone interface 106a, radio/CD interface 106b, television (TV) interface

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106c, navigation interface 106d, and beacon interface 106e. Processor 105 interacts with and controls standard phone equipment connected to phone interface 106a. Through processor 105, the user may operate the phone equipment via voice command, thereby realizing hands-free operation of the equipment. Alternatively, the user may operate the phone equipment using the touch screen capability provided by AUTO DIRECTOR display interface 102a or multifunction display interface 102b. The user may also operate the phone equipment via remote switches.

Similarly, processor 105 interacts with and controls one or more radio receivers and CD players in the automobile connected to radio/CD interface 106b. Through processor 105, the user may operate the radio receivers via voice command, remote switch and/or touch screen capability. Processor 105 further interacts with and controls one or more TV receivers in the automobile connected to TV interface 106c. Again, the user may operate the TV receivers via voice command, remote switches and/or touch screen capability.

As further described hereinbelow, navigation interface 106d is connected to a standard inertial guidance system (not shown) capable of providing gyros information, and deriving the vehicle location based on GPS information. With the map information stored in memory 115, the inertial guidance system is capable of providing the user with navigational instructions via interface 102a or 102b. Besides the local information, local and national emergency information may be derived from the GPS information using additional standard decoding circuitry in interface 106d.

Beacon interface 106e is used for connection to a standard beacon device for detecting a predetermined beacon radio signal to provide additional locational information.

Output control interfaces 108 include lock interface 108a, mirror interface 108b, window interface 108c, steering column interface 108d, seat interface 108e, climate control interface 108f, wiper interface 108g, cruise control interface 108h, light interface 108i and clock interface 108j.

Specifically, lock interface 108a comprises output control logic controllable by processor 105 to lock or unlock the car doors, glove box, console storage, trunk (or liftgate), fuel filler door, brakes and transmission, and enable or disable the child-proof door locks, fuel pump and ignition.

Mirror interface 108b comprises output control logic controllable by processor 105 to maneuver the positions of the outside mirrors and inside rear view mirror, and to fold or unfold the outside mirrors.

Window interface 108c comprises output control logic controllable by processor 105 to incrementally or completely open or close all windows, and to open, close or tilt any sunroof.

Steering column interface 108d comprises output control logic controllable by processor 105 to move the steering column in or out and up or down.

Seat interface 108e comprises output control logic controllable by processor 105 to (1) adjust the positions of the front seats forward or aft, and up or down; (2) tilt the front or rear of the seat cushion up or down; (3) adjust the seat back lumbar, width and angle forward or aft; (4) increase or decrease the cushion size and stiffness; (5) raise or lower the head restraint; and (6) raise or lower the seat belt height.

Climate control interface 108f comprises output control logic controllable by processor 105 to (1) turn the climate control system on or off; (2) select an air flow mode; (3) set fan speeds; (4) enable or disable seat heaters; (5) select fresh

or recirculated air (for driver only); and (6) enable or disable front and rear defrosters, mirrors and steering wheel heaters (for driver only).

Windshield wiper interface 108g comprises output control logic controllable by processor 105 to (1) select a high, low, intermittent, single wipe or off mode; (2) set an intermittent delay; and (3) enable or disable front or rear washers. Interface 108g also includes control logic for controlling rain- and speed-sensitive wipers, and for activating an automatic wash in a single wide mode when the windshield is at a certain level of opacity.

Cruise control interface 108h comprises output control logic controllable by processor 105 to (1) turn the cruise control on or off; (2) set the vehicle speed, and (3) cancel or resume the set speed.

Light interface 108i comprises output control logic controllable by processor 105 to select an automatic on mode or off mode for parking lights, headlights and fog lights; and to turn on or off map or courtesy lights.

Clock interface 108j comprises output control logic controllable by processor 105 to set an initial date and time on a conventional clock (not shown) connected to interface 108j. System 100 relies on the current date and time kept by the clock to provide a time reference for the system functions.

Vehicle computer interfaces 110 include anti-lock brake computer interface 110a, engine computer interface 110b and supplemental restraint computer interface 110c for processor 105 to communicate with the computers controlling the anti-lock brakes, engine and supplemental restraints (e.g., back-up airbag deployers and seat belt tensioners), respectively. Interfaces 110 also include back-up interface 110d through which processor 105 receives and analyzes signals from the engine, anti-lock brake and supplemental restraint computers. These signals would indicate to processor 105 any failures of the computers. In response to a computer failure, processor 105 causes a corresponding back-up computer connected to interface 110d to provide a back-up function.

Vehicle control interfaces 112 include steering interface 112a, ride interface 112b, engine interface 112c, transmission interface 112d, traction control interface 112e, and security interface 112f.

Specifically, steering interface 112a comprises input monitoring and output control logic for processor 105 to lighten or tighten the steering effort ratio in response to changing road conditions. Through interface 102a, the user may opt for manual or automatic steering effort ratio control. Interface 112a is capable of adapting and storing data according to the driver's inputs. It also allows for steering of front and/or rear wheels for sporty or increased stability.

Ride interface 112b comprises input monitoring and output control logic for processor 105 to lighten or stiffen the ride control to front and/or rear of vehicle in response to changing road conditions. Through interface 102a, the user may also opt for manual or automatic ride control.

Engine interface 112c comprises input monitoring and output control logic allowing for shutting off a specified number of cylinders, and varying valve and cam timing to increase performance or fuel economy. This interface also allows for manual or automatic control of the engine components, and includes the capability of adapting and storing data according to the driver's inputs.

Transmission interface 112d comprises input monitoring and output control logic for selecting manual or automatic

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shifting of the transmission. In an automatic shifting mode, interface 112d is capable of adapting and storing data according to the driver's inputs. Interface 112d also allows for control of a variable differential ratio for fast acceleration and high economy cruise.

Traction control interface 112e comprises input monitoring and output control logic providing information on whether power is delivered to front and/or rear wheels of the vehicle and what proportion of the power is delivered to each wheel. This interface also allows for manual or automatic control, and such functions as yaw control in cooperation with the anti-lock brakes and an engine cylinder shutoff.

Security interface 112f comprises control logic for setting a security level, and enabling or disabling a number of security related functions such as the fuel supply cut-off, motion detector, brake locking, etc. Interface 112f also allows entry of a new or alteration of an existing personal identification number (PIN) for personalization of the vehicle functions, i.e., saving the vehicle functional preferences.

In accordance with an aspect of the invention, system 100 incorporates an anti-car-theft technique involving security interface 112f. In accordance with this inventive technique, security interface 112f further comprises a sensor for detection of a predetermined condition to trigger an anti-theft routine. It will be appreciated that a person skilled in the art will come up with many different triggering events causing the sensor to invoke the routine. For example, a passive way of triggering the anti-theft routine would be after the sensor detects that the engine is off and the user has opened, closed and locked the driver's door.

In any event, as soon as processor 105 receives from the sensor a signal requesting an invocation of the anti-theft routine, processor 105 retrieves from navigation interface 106d GPS information identifying the parking location of the automobile, as indicated at step 251 in FIG. 3A. Processor 105 then stores at step 253 the parking location GPS information in memory 115. At step 255, processor 105 determines whether the security measures remain on. By way of example, but not limitation, such determination is based on information from lock interface 108a indicating whether the driver's door is properly unlocked. If that door is properly unlocked, processor 105 determines that the security measures are called off, and the anti-theft routine comes to an end, as indicated at step 257.

Otherwise if processor 105 determines that the security measures remain on, processor 105 at step 259 retrieves from navigation interface 106d GPS information identifying the current location of the automobile. Processor 105 then compares at step 261 the current location GPS information with the parking location GPS information previously stored. If processor 105 at step 262 determines that the current location matches the parking location based on the comparison, the anti-theft routine returns to step 255 after a predetermined period. Otherwise if processor 105 determines that the current location does not match the parking location, processor 105 assumes that the automobile has been removed without authorization, i.e., stolen. At this point, if a conventional alarm system is connected to security interface 112f, processor 105 would cause an alarm to come on, gas to be cut off, etc.

In this example, a conventional transmitter (not shown) is connected to security interface 112f and transmits a predetermined sequence of signals receivable by a law enforcement agency or a suitable alarm monitor company when it

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is activated. Continuing the example, processor 105 translates the GPS information identifying the current vehicle location into the corresponding street address based on the map information stored in memory 115, as indicated at step 263. Processor 105 at step 265 looks up one or more phone numbers pre-stored in memory 115 for reporting to the law enforcement agency (or the alarm monitor company) about the stolen status. Alternatively, a list of phone numbers associated with law enforcement agencies (or branches of the alarm monitor company) in many different geographic locations is pre-stored, along with the GPS information identifying the locations of the respective law enforcement agencies (or alarm monitor company branches). This being so, processor 105 locates the closest law enforcement agency (or alarm monitor company branch) and its associated phone number(s) by comparing the current vehicle location GPS information with the respective agency (or branch) location GPS information.

In any event, processor 105 at step 267 initiates a call to a law enforcement agency (or an alarm monitor company branch) through phone interface 106a using the phone number just located. After the phone connection is established, processor 105 provides through the connection information about the current address of the vehicle using conventional voice synthesizer circuitry (not shown) in audio interface 118, and the pre-recorded information about the vehicle itself such as its vehicle identification number (VIN), model, year, color, license number, etc., as indicated at step 269. Through the same phone connection, processor 105 may also provide information about the vehicle's owner such as his/her name and contact number so that the law enforcement agency (or alarm monitor company branch) can notify the owner of the incident. Processor 105 at step 271 activates the aforementioned transmitter connected to security interface 112f to generate the predetermined sequence of signals in case the stolen vehicle is in transit. For that matter, processor 105 can also repeatedly check on the latest vehicle location and report any new address different from the one previously reported. Thus, by tracking the signals in the vicinity of the latest reported vehicle location, the law enforcement agency (or alarm monitor company) would recover the vehicle in an efficient manner.

Referring back to FIG. 1, self-test interface 114 comprises input/output (I/O) control logic for performing an active self-test of system 100 on power up or at the user's request. Specifically, interface 114 polls every other interface in system 100 for a self-test result. Each interface, when polled, performs an active self-test and reports the test results to interface 114, where such test results are gathered and caused to be displayed on interface 102a.

Preferences interface 116 monitors changes made by the user in selected functions after the user logs on system 100, and prompts the user to save such preferences. These preferences are stored in memory 115 in association with the user's PIN. Functions affording the user choices include auto locks, an easy entry, auto lamps, the seat position, steering column position, mirror position, radio, steering, ride, transmission shift, engine performance, climate, and security level.

Audio interface 118 comprises I/O control logic for receiving audio signals from a radio/CD, TV, compact disk (CD) player, or phone interface, processing the received audio signals, providing proper amplifications thereto, and routing the resulting sound to appropriate speakers and headphones (not shown) connected to interface 118. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and multifunction display interface 102b share the

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same speakers. Interface 118 also provides center and rear console display interfaces 102c and 102d with separate audio channels, speakers and headphone outputs. The front and rear speakers may be muted by the user as a preference.

Interface 118 also processes requests from other interfaces for pre-recorded digital sounds stored in a SOUNDSGOOD library in memory 115 and routes the requested sounds to the appropriate interfaces. In addition, interface 118 comprises the conventional voice synthesizer circuitry for providing voice messages to the appropriate interfaces.

FIGS. 3B and 3C jointly illustrate routine 300 for accessing, through AUTO DIRECTOR display interface 102a, a main menu to obtain operational instructions, maintenance procedures, safety measures, and other information about the automobile, collectively referred to as "Quick Tips". Routine 300 is stored in memory 115 and initiated when SETUP switch 205g in FIG. 2 is pressed. Instructed by routine 300, processor 105 at step 301 elicits a PIN from the user by displaying a screen of FIG. 4A through interface 102a. As shown in FIG. 4A, a video key-pad comprising numeral keys "1" through "9", and "*" and "#" keys are displayed on screen 209. In response, the user enters a sequence of numerals by touching the corresponding displayed keys, followed by the "#" key.

It should be pointed out that in accordance with another aspect of the invention, when a displayed key or option is touched on the screen of AUTO DIRECTOR display interface 102a or multifunction display interface 102b, a tone pre-selected by the user from the SOUNDSGOOD library is generated through audio interface 118, indicating that the key or option has been touched on the screen. Advantageously, relying on the audio tone confirmation, as opposed to a visual confirmation, the user while driving can continually watch the road.

The user may alternatively enter the above numeral sequence using control panel 205 in a manner to be described. In any event, processor 105 then verifies at step 303 the PIN entry by comparing it with the user's pre-selected PIN. The latter is stored in memory 115, along with the user's preferences. In a standard way, the user is given a few chances to enter a correct PIN. Verification of the PIN entry identifies the user as a legitimate user. Thus, if the PIN entry is not valid, routine 300 comes to an end, as indicated at step 304.

Otherwise if the PIN entry is valid, processor 105 at step 305 causes interface 102a to display on screen 209 a "SELECT A FUNCTION" screen, which is illustrated in FIG. 4B. As shown in FIG. 4B, two options, namely, "NAVIGATION" and "QUICK TIPS", are displayed on screen 209. By default, NAVIGATION option 401 is highlighted yellow when the screen of FIG. 4B appears.

It should be pointed out that in this illustrative embodiment, a yellow highlight on an option indicates that the option is selected but not yet activated. Once a yellow highlighted option is activated, the option is highlighted blue. System 100 then performs according to the activated option.

Thus, in this instance, the user may activate the yellow highlighted NAVIGATION option by touching the option on screen 209 or by pressing ENTER switch 205b.

However, if QUICK TIPS option 403 is desired, the user may touch that option on screen 209, which would then be highlighted yellow. A second touch on the same option will change the highlight to blue, indicating the active status. As an alternative, the user may utilize knob 205d of FIG. 2 to select QUICK TIPS option 403 by first pushing the knob to

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the right. In response, processor 105 causes the yellow highlight to move from default NAVIGATION option 401 to QUICK TIPS option 403. The user can then select the QUICK TIPS option by pressing ENTER switch 205b. Upon selection, the yellow highlighted option will again turn blue.

Processor 105 at step 308 detects an activation of either NAVIGATION option 401 or QUICK TIPS option 403. If NAVIGATION option 401 is activated, processor 105 at step 311 causes system 100 to enter into a navigation mode. In this mode, processor 105 causes navigational instructions to be displayed on screen 209 in a conventional manner. In providing the navigation instructions, the standard inertial guidance system connected to navigation interface 106d receives signals from a constellation of GPS satellites maintained and controlled by the U.S. Department of Defense. In response to these signals, the inertial guidance system identifies the location (in longitude and latitude) of the automobile. The system also detects the vehicle speed, and the direction in which the vehicle is headed. By accessing the map information stored in memory 115, the system is capable of visually and verbally providing the user with directions to a given destination through AUTO DIRECTOR display interface 102a and audio interface 118, respectively.

Otherwise if activation of QUICK TIPS option 403 is detected at step 308, processor 105 causes interface 102a to display an introduction screen on screen 209, as indicated at step 314. This introduction screen is illustrated in FIG. 5.

As shown in FIG. 5, system source identification, warning and instructional information appear on the introduction screen, along with two options, "MAIN MENU" and "READ ME". The default option in this instance is READ ME option 501 which is highlighted yellow. Processor 105 detects at step 317 whether MAIN MENU option 503 or READ ME option 501 is activated. If MAIN MENU option 503 is activated, routine 300 proceeds to step 340 to be described. Otherwise if READ ME option 501 is activated, routine 300 proceeds to step 320 where processor 105 causes a series of three screens to be displayed. The first screen of the series is a "MANUFACTURER" screen, which is illustrated in FIG. 6.

As shown in FIG. 6, a description of the QUICK TIPS system appears on the MANUFACTURER screen. If the text to be displayed exceeds one screen, which is the case here, scrolling options comprising scroll-up option 605 and scroll-down option 607 are provided. When option 605 is touched and activated on screen 209, additional text scrolls up one paragraph at a time. Option 607 performs an inverse function to option 605. Again, as an alternative, the user may maneuver PUSH TO SELECT knob 205d until the desired scroll option (or direction arrow) is highlighted yellow. The activation of the highlighted option is achieved by pressing ENTER switch 205b.

By default, displayed option 609 has the "AUTO VOICE" wording thereon and is highlighted blue as the MANUFACTURER screen comes on. Accordingly, a pre-recorded voice is activated by processor 105 through audio interface 118 to read the entire text associated with this screen without interruption, including the text which is not presently shown on screen 209 but otherwise shown upon scrolling. To alter the AUTO VOICE function, the user may touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "AUTO VOICE" wording on option 609 changes to "MANUAL VOICE", which is highlighted blue, indicating its active status.

In accordance with the MANUAL VOICE function, a pre-recorded voice reads the displayed text only, and stops

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reading until additional text is scrolled onto the screen. To silence the voice, the user may again touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "MANUAL VOICE" wording on option 609 changes to "VOICE OFF", and the voice is deactivated, with the option now highlighted yellow. The cycle of the AUTO VOICE, MANUAL VOICE and VOICE OFF functions can be repeated by successively touching option 609 or pressing switch 205b.

Other displayed options on the screen of FIG. 6 include PREVIOUS option 611 and NEXT option 613. As indicated at step 323, option 611 when selected causes routine 300 to return to step 314, where the introduction screen of FIG. 5 is again displayed. Otherwise, if option 613 is selected, routine 300 proceeds to step 326 in FIG. 3C where processor 105 causes a "SAFETY REMINDERS" screen to be displayed on screen 209. FIG. 7 illustrates such a screen.

As shown in FIG. 7, like the MANUFACTURER screen, the SAFETY REMINDERS screen includes option 609 displayed with the default wording "AUTO VOICE" thereon, PREVIOUS option 611, NEXT option 613, scroll-up option 605 and scroll-down option 607. This screen reminds the user of the safety features of the vehicle including, for example, air bags and seat belts. As indicated at step 329, option 611 when selected causes routine 300 to return to step 320 of FIG. 3B. Otherwise if option 613 is selected, routine 300 proceeds to step 332 where processor 105 causes a "THEFT PROTECTION FEATURES" screen to be displayed on LCD screen 209. FIG. 8 illustrates such a screen.

As shown in FIG. 8, the THEFT PROTECTION FEATURES screen similarly has thereon displayed options 605, 607, 609, 611 and 613. This screen describes to the user a theft-deterrent system including the anti-theft routine of FIG. 3A equipped in the vehicle. As indicated at step 335, option 611 when selected causes routine 300 to return to step 326. Otherwise if option 613 is selected, routine 300 proceeds to step 338 where processor 105 causes a "QUICK TIPS SET-UP" screen to be displayed on LCD screen 209. FIG. 9 illustrates such a screen.

As shown in FIG. 9, the QUICK TIPS SET-UP screen comprises two arrays of displayed options, denoted 901 and 903, respectively. Array 901 concerns the volume of the audio part of system 100. In this illustrative embodiment, the user may select the options in array 901 to respectively turn the volume off, to a "SOFT" level, to a medium level, and to a "LOUD" level. Array 903 concerns the display of LCD 119 of system 100. In this illustrative embodiment, the user may select the options in array 903 to respectively turn the display off, adjust it to a "DAY" setting, adjust it to a "NIGHT" setting, and have it automatically adjusted. When the QUICK TIPS SETUP screen comes on, by default, the volume is set to a medium level (i.e., the "MED" option in array 901 highlighted blue), and the display is set to be automatically adjusted (i.e., the "AUTO" option in array 903 highlighted blue).

Also shown in FIG. 9 is NEXT option 905. By selecting this option, routine 300 returns to step 340 of FIG. 3B where a "MAIN MENU" screen is displayed on LCD screen 209. After routine 300 is performed, the screen of FIG. 9 can be invoked at any time by pressing SETUP switch 205g to re-adjust the volume and the intensity of the LCD of system 100.

FIG. 10 illustrates the MAIN MENU screen. This screen comprises displayed options disposed in columns 1001, 1003, 1005, and 1007. For example, column 1001 includes

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DRIVER'S VIEW option 1001a, STEERING COLUMN CONTROLS option 1001b, LOCK option 1001c, DRIVING TIPS option 1001d, and INDEX option 1001e. It should also be noted that this screen can be invoked at any time by pressing MENU switch 205e.

When the MAIN MENU screen comes on, by default, DRIVER'S VIEW option 1001a is highlighted yellow, indicating that it is selected. However, the user may touch any other displayed option on screen 209 for re-selection. A further touch on the yellow highlighted option changes its color to blue and activates same. Again, the user may alternatively maneuver PUSH TO SELECT knob 205d to re-select any other displayed option, followed by a depression of ENTER switch 205b to activate the selected option. Since LCD screen 209 is compact, the display area for each option on the MAIN MENU screen is generally small. As a result, selection and activation of an option by touching the option on the screen is susceptible to errors, especially when the vehicle is in motion. Thus, in this situation it may be preferable to achieve the same result using knob 205d and switch 205b, instead.

In addition, because of the small display area allocated to each option on the MAIN MENU screen, the wording on the option is brief and thus tends to be cryptic. In accordance with a feature of the invention, after a predetermined time (e.g., a few seconds) has elapsed from the option's being highlighted yellow, processor 105 causes a voice to be generated on speakers 127 to explain the purpose of the option before the user activates it. For example, after a predetermined delay from DRIVER'S VIEW option 1001a's being highlighted yellow, a voice is activated, stating the option name, followed by an explanation of the purpose of the option such as "To provide location of dash mounted components." Thus, this inventive feature affords a preview of the option before the user commits to it, thereby avoiding unnecessary backtracking.

Continuing the example, after hearing the preview of option 1001a, the user decides to select that option. In response, processor 105 causes a "DRIVER'S VIEW" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 11. When the DRIVER'S VIEW screen appears, VOICE option 1101 is highlighted blue, indicating that voice announcements are active. To disable the voice announcements, the user may touch VOICE option 1101 on screen 209, or alternatively press ENTER switch 205b. VOICE option 1101 would be highlighted yellow when disabled.

As also shown in FIG. 11, a view of the interior of the automobile from the driver's perspective is provided. Underneath that view, DASH-MOUNTED CONTROLS option 1103, INSTRUMENT PANEL option 1105, AUDIO SYSTEM option 1107, CLIMATE CONTROLS option 1109 and PREVIOUS option 1111 are displayed. By default, DASH-MOUNTED CONTROLS option is highlighted yellow. However, the user in this example decides to select INSTRUMENT PANEL option 1105, instead. By touching option 1105 on screen 209, the option is highlighted yellow. If VOICE option is not disabled, after a predetermined delay, an announcement such as "To provide information on gauges, meters and warning lights" comes on to preview the purpose or content of option 1105. Options 1103, 1107, and 1109 are similarly programmed. In this instance, selecting PREVIOUS option 1111 enables the user to return to the MAIN MENU screen of FIG. 10.

Continuing the example, assuming that the user activates option 1105 after hearing the preview, in response processor

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105 causes an "INSTRUMENT PANEL" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 12. As shown in FIG. 12, the previous screen format is generally maintained in that it provides a view of the object (the instrument panel of the automobile in this instance) pertinent to the option which has been selected, along with displayed options for further selection thereunder. Based on the disclosure heretofore, the design and operation of these screens by now are apparent to a person skilled in the art, and become self-explanatory.

In accordance with another feature of the invention, individual elements on the instrument panel shown in FIG. 12 are labeled with numerals "1", "2", "3", "4" and "5" which correspond to option 1201a designated "1. TACHOMETER AND WARNING LIGHTS", option 1201b designated "2. TURN SIGNAL/HAZARD WARNING", option 1201c designated "3. SPEEDOMETER AND WARNING LIGHTS", option 1201e designated "4. ODOMETER & TRIP METERS/OUTSIDE TEMPERATURE", and option 1201f designated "5. FUEL/TEMP GAUGE AND WARNING LIGHTS", respectively. As such, the function of the displayed options is two-fold. First, the wording on each displayed option informs the user of what the corresponding element(s) represents. Second, each displayed option is also for selection to obtain more information about the corresponding element(s). In addition, with the above voice preview feature, the user is further apprised of the purpose or content of the option before he/she commits to it. For example, TACHOMETER AND WARNING LIGHTS option 1201a corresponds to a voice preview such as "To provide information on tachometer and malfunction, maintenance required, low oil pressure and charging system failure indicators."

Assuming that the user in this instance activates option 1201a, in response processor 105 causes a "TACHOMETER AND WARNING LIGHTS" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 13.

FIG. 13 shows VOICE option 1301 similar to option 1101 described before, TIP option 1303, a tachometer of the automobile denoted 1305, warning lights collectively denoted 1307, and options 1309a through 1309f in display segment 1311.

When TIP option 1303 appears on screen 209, it indicates that helpful hints or reminders are available upon selection thereof. In accordance with another feature of the invention, the appearance of TIP option 1303 is accompanied by the playing of a sound segment associated therewith. This sound segment may be pre-selected by the user from the SOUNDSGOOD library. After an adaptation period, the user would be able to rely on the familiar sound segment, without looking at the screen, to alert him/her of the availability of the TIP option.

Similarly, the user may pre-select another sound segment associated with warnings. Such a sound segment should connote urgency or even emergency as such warnings include, for example, engine overheating, an extremely low fuel level caution, GPS emergency information from navigation interface 106d, etc. Under control of processor 115, audio interface 118 preempts any on-going announcement and momentarily substitute therefor any such warning as soon as it occurs, which is preceded by the associated sound segment.

In any event, if option 1303 is selected in this instance, a voice comes on and utters a tip regarding tachometer 1305 such as "To prevent engine damage, do not drive with needle in red zone." This tip is also momentarily displayed on segment 1311 in lieu of options 1309a through 1309f.

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Similar to the elements on the INSTRUMENT PANEL screen, tachometer 1305 and warning lights 1307 on this screen are individually labeled and correspond to options 1309a, 1309b, 1309c, 1309e and 1309f, respectively. Assuming in this example that MAINTENANCE REQUIRED option 1309c is activated, display segment 1311 would be replaced by new display segment 1411 illustrated in FIG. 14. As shown in FIG. 14, item 1401 indicates the subject selected, i.e., "MAINTENANCE REQUIRED". Item 1403 explains what the MAINTENANCE REQUIRED warning light, when on, indicates. In this instance it states, "Maintenance required warning light comes on to indicate it is time for scheduled maintenance." PREVIOUS option 1405 enables the user to reactivate segment 1311 of FIG. 13.

Assuming further that at this point the user wants to learn about and also to program the air conditioning of the automobile, the user may access a "CLIMATE CONTROL" screen by successively pressing the PREVIOUS option to backtrack to the DRIVER'S VIEW screen of FIG. 11, where CLIMATE CONTROLS option 1109 is available. As a second alternative, the user may press MENU switch 205e to invoke the MAIN MENU screen of FIG. 10, where a "CLIMATE CONTROLS" option within column 1003 is available. A third alternative is provided in the event that the user cannot immediately relate "air conditioning" to the CLIMATE CONTROLS option. At the MAIN MENU screen of FIG. 10, the user may select Index option 1001e to be described. It suffices to know for now that this option allows the user to access the "CLIMATE CONTROL" screen using the term "air conditioning".

FIG. 15 illustrates the "CLIMATE CONTROL" screen. With the voice enabled, a first touch on any displayed option on screen 209 causes it to be highlighted yellow, indicating its selected status. A second touch causes it to be highlighted blue, indicating its active status. With the voice disabled, only one touch on any displayed option activates it.

As shown in FIG. 15, the MODE options include OFF option 1511, AUTO option 1513, A/C option 1515, HEAT option 1517, and SMART CLIMATE option 1519. It should be noted that only one of the MODE options can be active at a time. In this example, assuming that the voice is enabled, when OFF option 1151 is selected by a first touch, a voice explaining the option comes on, uttering "To disable climate control." A second touch on the same option would then shut the climate control off through climate control interface 108f.

When AUTO option 1513 is selected by a first touch, a voice comes on to explain the option, uttering "System automatically determines air-flow distribution and volume for optimum efficiency." A second touch on the same option enables the automatic control, followed by a voice utterance, "Set desired temperature." Temperature display 1535 then flashes with the current temperature setting, prompting the user to set a desired temperature in a manner to be described.

If the user neglects to set a temperature after a predetermined time, in accordance with another aspect of the invention, a temperature range is automatically maintained by processor 105 in response to the date and time information from clock interface 108j, and the GPS information from navigation interface 106d. Based on the date and time information, processor 105 knows what the current season (e.g., mid-winter versus mid-summer) and time of the day (e.g., night verse noon) are. Based on the GPS information, processor 105 knows the region (e.g., New England versus Southern California) where the vehicle is. Processor 105

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looks up a table stored in memory 115 containing predetermined temperature ranges corresponding to different combinations of the temporal and geographic parameters. It then prescribes an appropriate temperature range according to the table. This temperature range is updated by processor 105 periodically to reflect changes in the time of the day and the geographic location of the vehicle.

Similarly, A/C option 1515 and HEAT option 1517 respectively enable the user to activate air conditioning and heaters at a desired temperature or a default temperature range.

SMART CLIMATE option 1519 is designed to allow the user to program the climate control for the next ride before he/she leaves the vehicle. When SMART CLIMATE option 1519 is selected by a first touch, a voice comes on to explain the option, uttering "To enable pre-heating or pre-cooling of vehicle." A second touch on the option activates the function, followed by a voice utterance, "Set desired temperature. Set desired time using fan speed arrows." Temperature display 1535 then flashes the current temperature setting, prompting the user to set a desired temperature. Similarly, fan speed display 1541 then flashes the current date, followed by current time, prompting the user to set the date and time that the user plans to reenter the vehicle. Through climate control interface 108f, processor 105 determines whether the current level of power from the car battery and any back-up power sources is sufficient. If it is insufficient, a message such as "Fail to pre-condition vehicle temperature" is issued through audio interface 118 to notify the user of the noncompliance. Otherwise, when it is close to the re-entry time, processor 105 determines the start-up time to effect the pre-conditioning, depending on the temperature difference between the inside and outside of the vehicle at that time. Processor 105 would then cause a combination of heaters and/or heat pumps (not shown) connected to interface 108f to pre-condition the vehicle temperature. In order to avoid substantially draining the power, in this illustrative embodiment, the requested temperature would be maintained up to an hour after the set re-entry time.

The Air options in FIG. 15 include FRESH option 1521 and RECIRCULATED option 1523. Only one of these two options can be active at a time. When FRESH option 1521 is selected by a first touch on the option, a voice comes on to explain the selected option, uttering "To select outside air to circulate in vehicle." A second touch on the option activates the selection to ventilate the vehicle with outside air. Similarly, RECIRCULATED option 1523 allows the user to select the inside air for recirculation in the vehicle.

The VENT options in FIG. 15 include FLOOR option 1525, FLOOR/DASH option 1527, DASH option 1529, DEFROST option 1531 and FLOOR/DEFROST option 1533. Only one of these five options can be active at a time. When FLOOR option 1525 is selected by a first touch on the option, a voice comes on explaining the option, uttering "Main air distribution to floor." A second touch on the option directs an air flow toward the vehicle floor.

Similarly, FLOOR/DASH option 1527 enables the user to bifurcate the air flow between the floor and the dashboard. DASH option 1529 enables the user to direct the air flow from the dashboard. DEFROST option 1531 enables the user to direct the air flow toward the windshield and select fresh air if not selected. FLOOR/DEFROST option 1533 enables the user to bifurcate the air flow between the floor and windshield.

Temperature display 1535 displays the temperature selected by the user. Touching on up-arrow 1537 increases

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the selected temperature while touching on down-arrow 1539 decreases same. Continued touching on either up-arrow 1537 or down-arrow 1539 causes the temperature setting to change rapidly.

Similarly, fan speed display 1541 displays the fan speed (high, medium or low) selected by the user. Touching on up-arrow 1543 increases the selected fan speed while touching down-arrow 1539 decreases same.

The HEATERS options in FIG. 15 include SEAT option 1547, MIRROR option 1549, REAR WINDOW option 1551, STEERING WHEEL option 1553, and ALL option 1554. One or more of these options can be active at the same time. When SEAT option 1547 is selected by a first touch on the option, a voice comes on to explain the option, uttering "To enable seat heaters." A second touch on the option activates the seat heaters connected to climate control interface 108f.

Similarly, MIRROR option 1549 enables the user to activate outside mirror heaters. REAR WINDOW option 1551 enables the user to activate a rear window defroster. STEERING WHEEL option 1553 enables the user to activate a steering wheel heater. Finally, ALL option 1554 enables the user to activate all of the heaters simultaneously.

In personalizing the vehicle, preference interface 116 monitors any user adjustments to certain vehicle functions by comparing their current settings with the corresponding stored preferences in memory 115. Thus, for example, if the user changes any of the settings relating to the climate control such as the mode, vent, air, temperature, fan speed, etc. from its previous preferred setting, preference interface 116 causes a SAVE screen to appear on screen 209. This SAVE screen is illustrated in FIG. 16. As shown in FIG. 16, the user is prompted to save the change in the setting that he/she has just made. The user at this point may activate SAVE option 1601 to change the previous preferred setting. The SAVE screen thereafter disappears in favor of the previous screen. Otherwise, he/she may activate CLOSE option 1603 to close the SAVE screen, without storing the latest setting, which is then treated as a temporary setting. In the latter case, for example, a restart of the automobile will obliterate such a temporary setting, and reinstate the stored preferred setting.

Climate control screens can similarly be invoked by the front passenger and rear passengers on display interfaces 102c and 102d, respectively. Such screens provide similar MODE options including OFF, AUTO, A/C and HEAT options; and VENT options including LOWER VENT, UPPER VENT and LOWER/UPPER vent options. They also provide for temperature and fan speed adjustments for the respective localized areas. However, no save screen is provided.

Using INDEX option 1001e of FIG. 10 to look up information on and/or to control various items in the automobile will now be described. After option 1001e is activated, a DATA ENTRY screen illustrated in FIG. 17 is exhibited on screen 209. As shown in FIG. 17, a message "Enter Letter Or Item Name" appears to prompt the user for an entry of the name of the item of interest or its beginning letter. For this purpose, entry options for letters A through Z arranged in a grid format are provided in section 1701 for selection. In addition, DONE option 1703, when activated, indicates to system 100 that the entry is completed. Subdisplay 1705 is used to echo the user's entry to ensure its correctness.

In this illustration, the user enters "AIR CONDITIONING" as exhibited on subdisplay 1705. In response, an

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INDEX screen shown in FIG. 18 appears on display screen 209, with the search item name "AIR CONDITIONING" highlighted yellow. It should be noted that other item names such as "Anti-lock Brake System Indicator" are also shown, and they are in alphabetical order following "AIR CONDITIONING". This stems from the design of system 100 whereby the user may conveniently enter the beginning letter of the search item name only. In that case, a list of item names in alphabetical order with the first item name having the same beginning letter highlighted yellow. For instance, if the user had only entered "A" for "AIR CONDITIONING", a list of item names starting with "A" in alphabetical order would appear on screen 209 (although in this instance it would be the same list as shown in FIG. 18 as "AIR CONDITIONING" is the first item with a letter "A" in system 100). If the user cannot locate the name of the item of interest in the list, he/she may scroll the screen using scroll-up option 1801 or scroll-down option 1803 to review additional item names after or before the listed item names. Alternatively, the user may select PREVIOUS option 1805 to return to the screen of FIG. 17 to enter the complete item name.

In any event, after the user locates the item name on the INDEX screen, the user may then touch the item name to access information on that item. To that end, a look-up table is stored in memory 115. FIG. 19 illustrates such a look-up table, wherein left column 1901 lists each item name in alphabetical order in the index, and right column 1903 lists the corresponding instruction for processor 105 to carry out to access information on that item. For example, according to row 1905 of the table, the selection and activation of the item name "AIR CONDITIONING" causes processor 105 to connect the user to the CLIMATE CONTROL screen of FIG. 15 previously described.

The foregoing merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise numerous other systems which embody the principles of the invention and are thus within its spirit and scope.

For example, based on the disclosure heretofore, it is apparent that through system 100, the user can run diagnostics on selected parts of the automobile by voice command or touch-screen control.

In addition, in the disclosed embodiment, through system 100, the user is able to program the climate control for the next ride before he/she leaves the vehicle. It will be appreciated that the user will be able to achieve same remotely ahead of time via telecommunication means. For example, processor 105 may be programmed to accept climate control commands through phone interface 106a. In that instance, the user can call from anywhere to establish a phone connection with phone interface 106a using a predetermined phone number, through which the user communicates the commands to climate control interface 108f to program the climate control. Through the phone connection, the user may be provided with climate control options described above in a synthesized voice. The user may activate one or more of such options by pressing a predetermined touch-tone key on the telephone keypad corresponding to a "yes" or "no" response. Similarly, the user may achieve the relevant temperature and/or time settings by pressing the touch-tone keys corresponding to the numerals indicative thereof. Of course, telecommunication means other than the telephone including a radio frequency (RF) transmitter may also be used to communicate the climate control commands from a remote area.

In addition, in the disclosed embodiment, the user may access different screens provided by AUTO DIRECTOR

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display interface 102a to learn about and control certain vehicle functions. It will be appreciated that a person skilled in the art will develop a demonstration program wherein a series of such screens will be automatically presented to a user in a predetermined sequence. The presentation may include commentaries, and highlights on selected options displayed on each screen. Furthermore, the presentation may be coupled with the showing of actual vehicle functions. For example, in demonstrating the climate control screen of FIG. 15, while the function of a highlighted VENT option (e.g., Floor, Floor/Dash, Dash, Defrost or Floor/Defrost) is explained, it is activated so that the user in the automobile can feel an actual air flow from the corresponding direction. The above demonstration program may be invoked using a PIN provided by the automobile manufacturer. The program may run continually while the automobile is shown in a showroom, or may be invoked by the user occasionally to obtain relevant information.

Further, in the disclosed embodiment, the MAINTENANCE REQUIRED warning light comes on when it is time for scheduled maintenance. In accordance with another aspect of the invention, the maintenance is scheduled by system 100 according to the cumulative time of the tachometer reading above a predetermined RPM value. Such cumulative time reflects the extent of the engine wear, and if it exceeds a predetermined length of time without maintenance, the engine performance would degrade substantially. In measuring the cumulative time in question, a conventional comparator (not shown) is employed in system 100 to compare the instantaneous tachometer reading (provided by engine control interface 112c) with the predetermined RPM value. Each time when the tachometer reading exceeds the predetermined value, processor 105 is interrupted to register the length of such an occurrence. The latter is added to a running sum to update the cumulative time in question. This cumulative time may be displayed on instrument panel display interface 102e, along with the tachometer reading and the MAINTENANCE REQUIRED warning indicator. A second conventional comparator (not shown) is employed in system 100 to compare the cumulative time with the above predetermined time length. As soon as the cumulative time exceeds the predetermined length, processor 105 is interrupted and causes the MAINTENANCE REQUIRED warning light to come on, indicating that it is time for maintenance.

Still further, system 100 as described is highly adaptable in adjusting to new system requirements, and capable of "learning" new automobile features to be introduced into the system. Such learning may involve a modification or an upgrade in the system software stored in memory 115.

Moreover, other features of system 100 may include capabilities of communications with a third party remote from the vehicle. For example, system 100 may be programmed to transmit signals representing data on the current speed of the vehicle and its VIN receivable by a radar system, thus enabling the third party to monitor its speed. Furthermore, system 100 may be programmed by the third party to disable and subsequently enable the vehicle upon successful verification of a PIN pre-assigned to the third party. To that end, system 100 is capable of receiving remote transmission of the PIN, followed by the disable or enable code. The transmission may be encrypted for security reasons. Furthermore, more than one PIN may be used for different purposes. For example, a PIN may be assigned to a law enforcement agency to disable the vehicle because of a suspension of a license, or to temporarily disable the vehicle when the driver is intoxicated. Another PIN may be

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assigned to an environmental protection agency to disable the vehicle for failing to meet the emission requirements. Yet another PIN may be assigned to the vehicle owner to disable the vehicle when parked, thereby reducing the risk of a car theft. The disabling of the vehicle involves cutting off its gas, putting on its anti-lock brakes, etc.

Further, system 100 is capable of receiving a low-frequency, low-power broadcast covering an area of a limited radius, referred to as a "Cell". The broadcast may provide electronic GPS map and Yellow Page type information pertaining to the cell. This information, when received, may be downloaded onto AUTO DIRECTOR display interface 102a or multifunction display interface 102b. Such information includes a local directory indicating locations of nearby gas stations, restaurants and other facilities on the GPS map, with respect to the current location of the automobile. The local directory may be formatted in the form of "web pages" featuring the local businesses, and include additional information such as business hours, telephone numbers, and information on products and services provided by such businesses.

The above broadcast may also provide local weather information sponsored by a civic group or commercial entity. In the case of civic group sponsorship, the local civic events may be posted alongside the weather information, and in the case of commercial sponsorship, advertisements may be posted instead. Of course, as the automobile moves from cell to cell, the contents of the broadcast change accordingly.

In addition, while the radio in the automobile is tuned to a particular radio station, system 100 is also capable of receiving any electronic files broadcast from that radio station, along with the radio program. These electronic files, which may be in the form of web pages, can be downloaded onto the system. The system user may then scroll the pages to learn such information as program listings and coming events sponsored by the radio station.

Moreover, in the disclosed embodiment, system 100 is illustratively used in an automobile. It will be appreciated that a person skilled in the art may also employ the inventive system in another type of vehicle such as a boat, an airplane, etc.

Finally, although information and control system 100, as disclosed, is embodied in the form of various discrete functional blocks, the system could equally well be embodied in an arrangement in which the functions of any one or more of those blocks or indeed, all of the functions thereof, are realized, for example, by one or more appropriately programmed processors or devices.

We claim:

1. A method for use in a system for adjusting a function in a vehicle, the system including a display element, the function being operated based on a preferred setting thereof, the method comprising:

detecting an adjustment of the function based on a comparison of the preferred setting with a current setting of the function;

providing, on the display element, an option in response to a detection of the adjustment;

receiving a selection of the option;

in response to the selection of the option, adopting the current setting as a new preferred setting of the function; and

operating the function based on the current setting.

2. The method of claim 1 wherein the current setting is stored when the current setting is adopted.

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3. The method of claim 1 wherein the option includes a save option.

4. The method of claim 1 wherein the function includes a climate control.

5. The method of claim 1 wherein the function includes an entertainment function.

6. The method of claim 5 wherein the entertainment function includes an audio function.

7. The method of claim 6 wherein the audio function includes a radio.

8. The method of claim 6 wherein the audio function includes a compact disk (CD) player.

9. The method of claim 5 wherein the entertainment function includes a TV.

10. The method of claim 1 wherein the system includes an information system.

11. A method for use in a system for adjusting a function in a vehicle, the system including a display element, comprising:

receiving data concerning a setting affecting an operation of the function;

providing, on the display element, an option in response to the received data;

receiving a selection of the option;

adopting the setting in response to the selection of the option; and

operating the function based on the setting.

12. The method of claim 11 wherein the option includes a save option.

13. The method of claim 11 wherein the function includes a climate control.

14. The method of claim 11 wherein the function includes an entertainment function.

15. The method of claim 14 wherein the entertainment function includes an audio function.

16. The method of claim 15 wherein the audio function includes a radio.

17. The method of claim 15 wherein the audio function includes a CD player.

18. The method of claim 14 wherein the entertainment function includes a TV.

19. The method of claim 11 wherein the system includes an information system.

20. A system for adjusting a function in a vehicle, the function being operated based on a preferred setting thereof, the system comprising:

a processor for detecting an adjustment of the function based on a comparison of the preferred setting with a current setting of the function;

a display element for providing thereon an option in response to a detection of the adjustment;

an interface for receiving a selection of the option, the current setting being adopted as a new preferred setting of the function in response to the selection of the option; and

a mechanism for operating the function based on the current setting.

21. The system of claim 20 wherein the current setting is stored when the current setting is adopted.

22. The system of claim 20 wherein the option includes a save option.

23. The system of claim 20 wherein the function includes a climate control.

24. The system of claim 20 wherein the function includes an entertainment function.

25. The system of claim 24 wherein the entertainment function includes an audio function.

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26. The system of claim 25 wherein the audio function includes a radio.

27. The system of claim 25 wherein the audio function includes a CD player.

28. The system of claim 24 wherein the entertainment function includes a TV.

29. The system of claim 20 comprising an information system.

30. A system for adjusting a function in a vehicle comprising:

- a first interface for receiving data concerning a setting affecting an operation of the function;
- a display element for providing thereon an option in response to the received data;
- a second interface for receiving a selection of the option;
- a processor for adopting the setting in response to the selection of the option; and
- a mechanism for operating the function based on the setting.

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31. The system of claim 30 wherein the first interface includes the second interface.

32. The system of claim 30 wherein the option includes a save option.

33. The system of claim 30 wherein the function includes a climate control.

34. The system of claim 30 wherein the function includes an entertainment function.

35. The system of claim 34 wherein the entertainment function includes an audio function.

36. The system of claim 35 wherein the audio function includes a radio.

37. The system of claim 35 wherein the audio function includes a CD player.

38. The system of claim 34 wherein the entertainment function includes a TV.

39. The system of claim 30 comprising an information system.

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(12) **United States Patent**
Obradovich et al.

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(45) **Date of Patent:** *Jul. 1, 2003

(54) **TECHNIQUE FOR EFFECTIVELY PROVIDING INFORMATION RESPONSIVE TO A NOTABLE CONDITION IN A VEHICLE**

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(57) ABSTRACT

In a multimedia information and control system for use in an automobile, at least one interface is employed which enables a user to access information concerning the automobile and control vehicle functions in an efficient manner. The user may select one of a plurality of displayed options on a screen of such an interface. Through audio, video and/or text media, the user is provided with information concerning the selected option and the vehicle function corresponding thereto. Having been so informed, the user may activate the selected option to control the corresponding vehicle function.

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(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(52) **U.S. Cl.** 701/1; 701/29; 701/31; 340/438; 340/459; 340/461

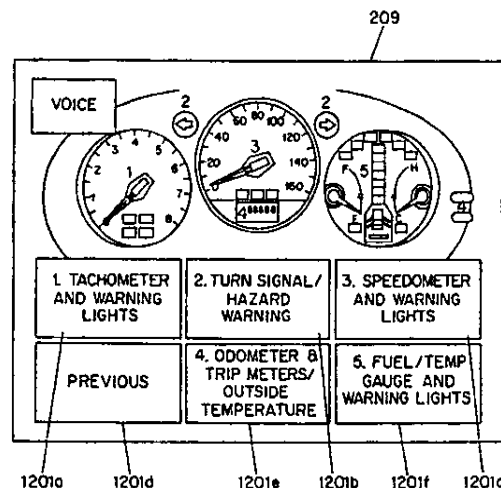
(58) **Field of Search** 701/1, 36, 48, 701/29, 30, 31, 33; 340/459, 460, 461, 436, 439, 438

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28 Claims, 15 Drawing Sheets



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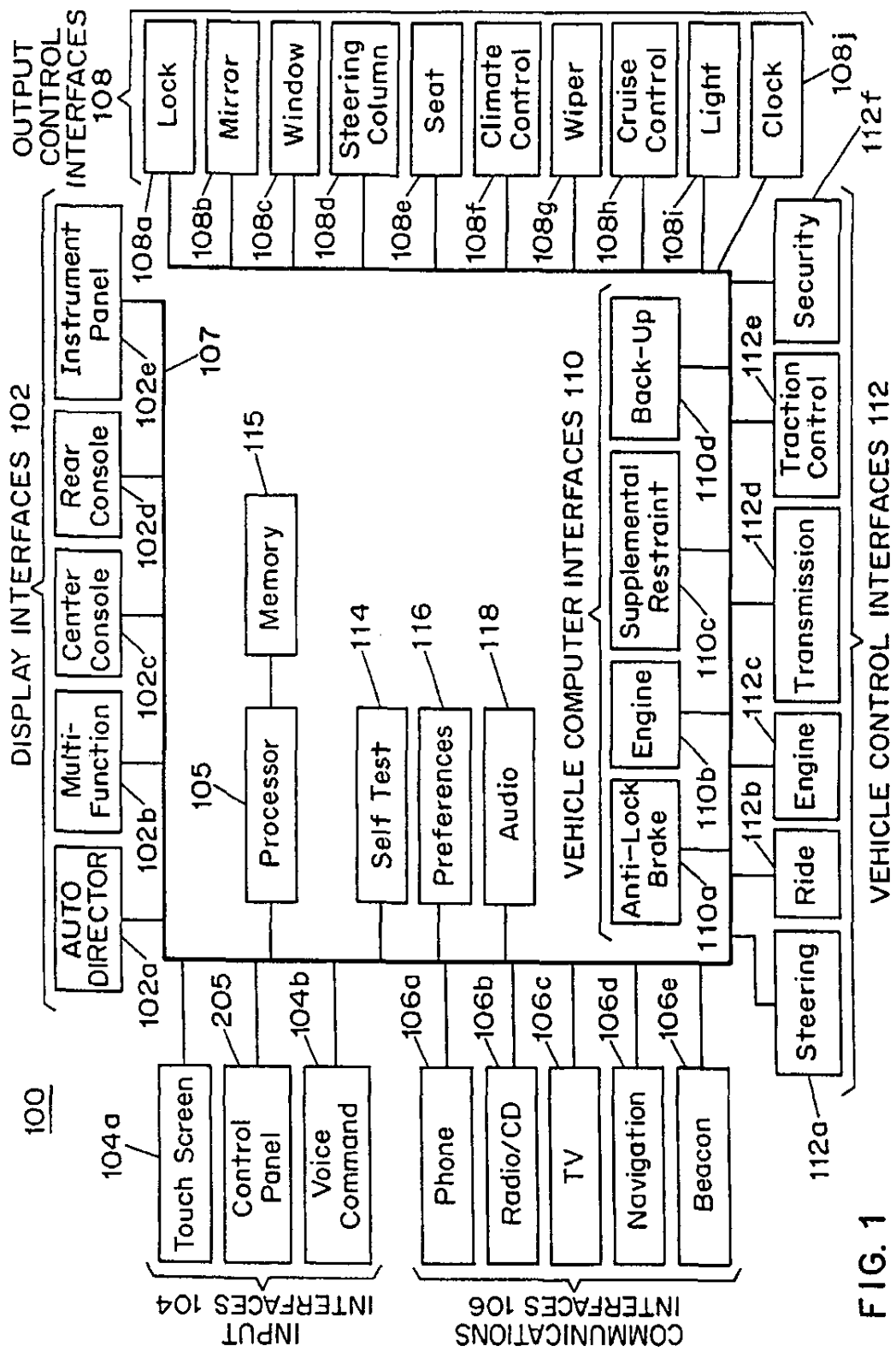


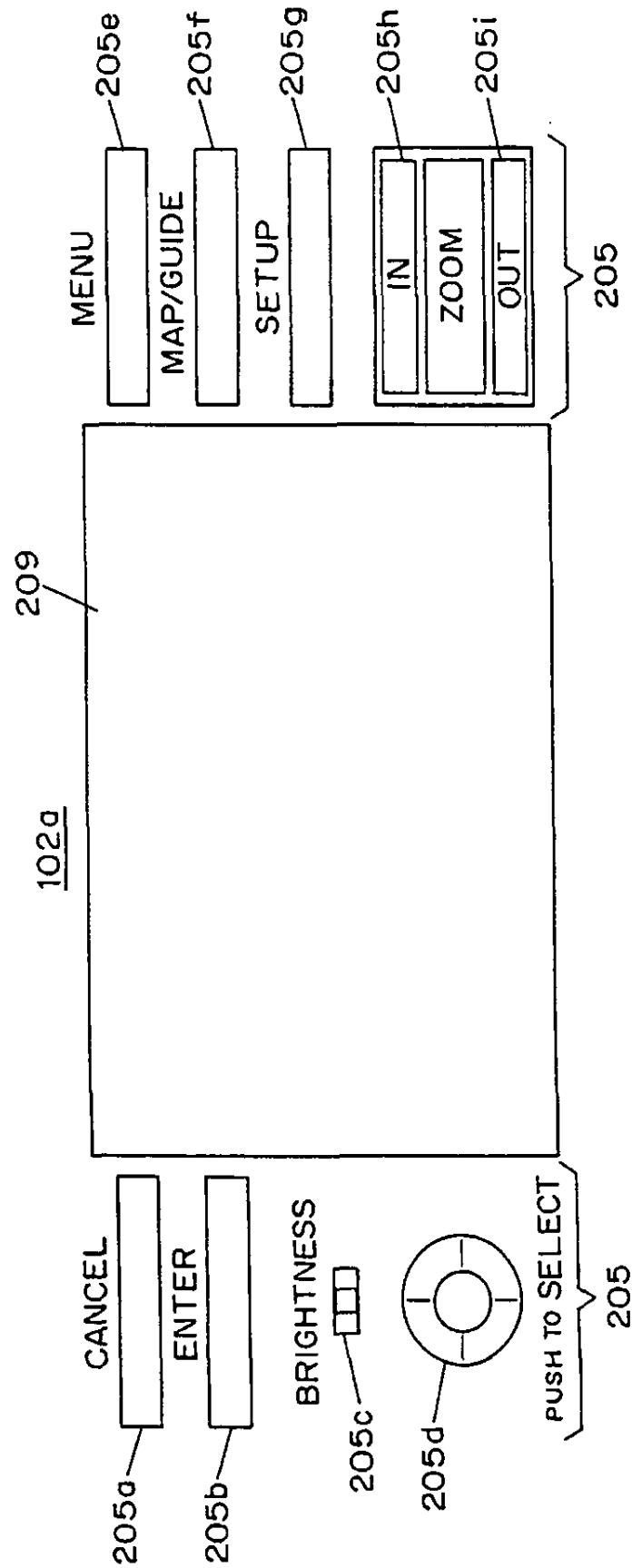
FIG. 1

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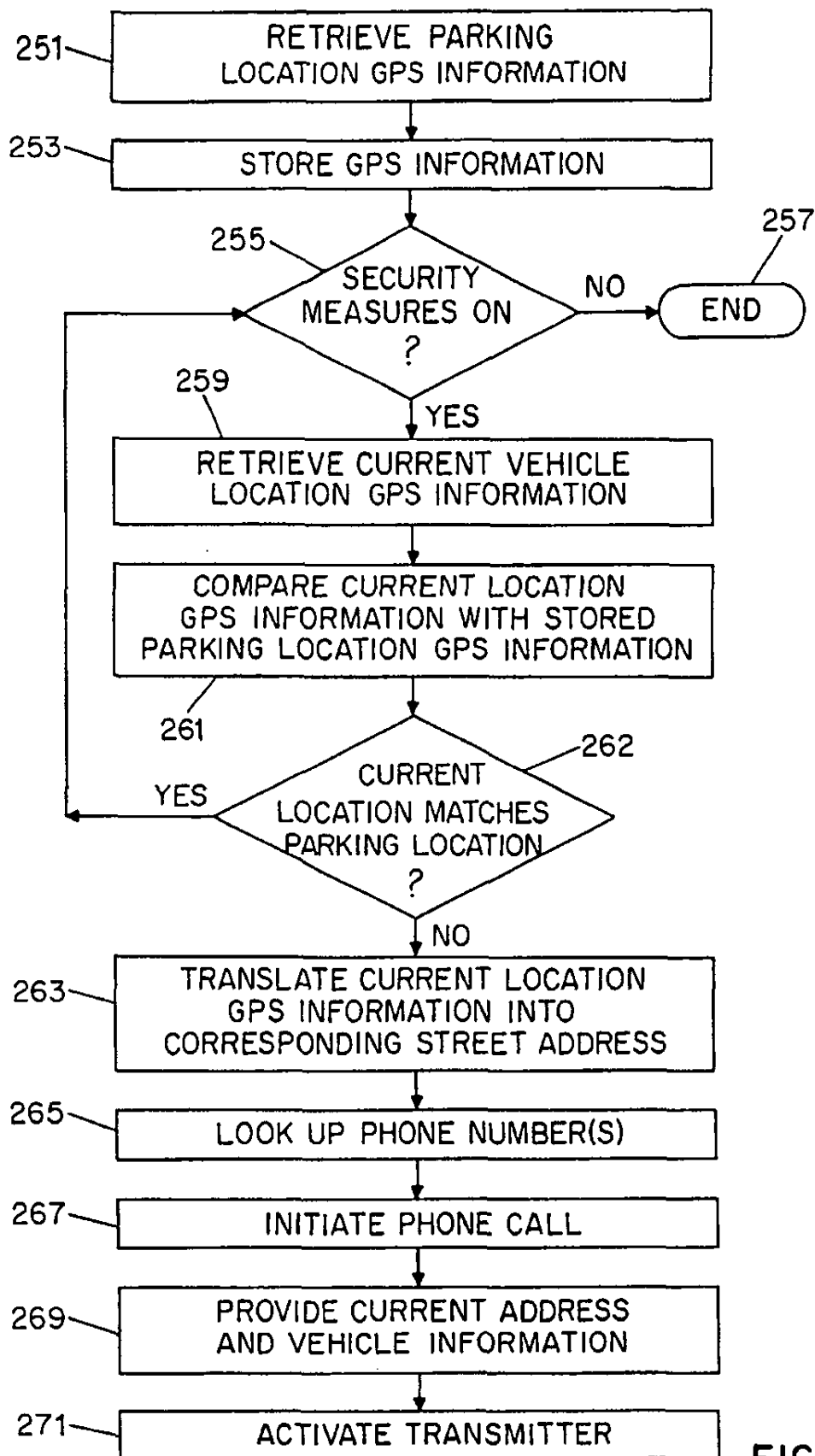


FIG. 3A

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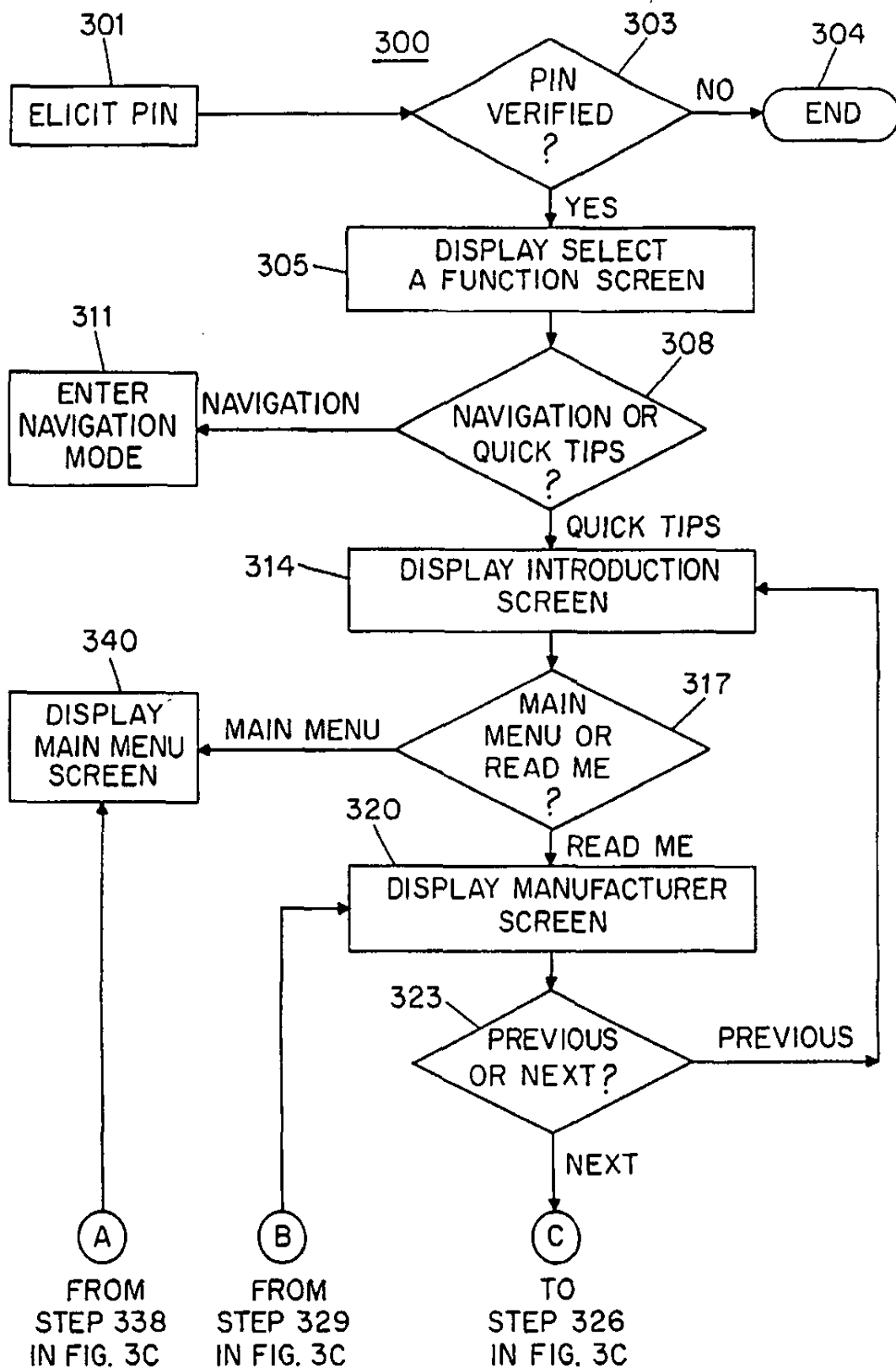


FIG. 3B

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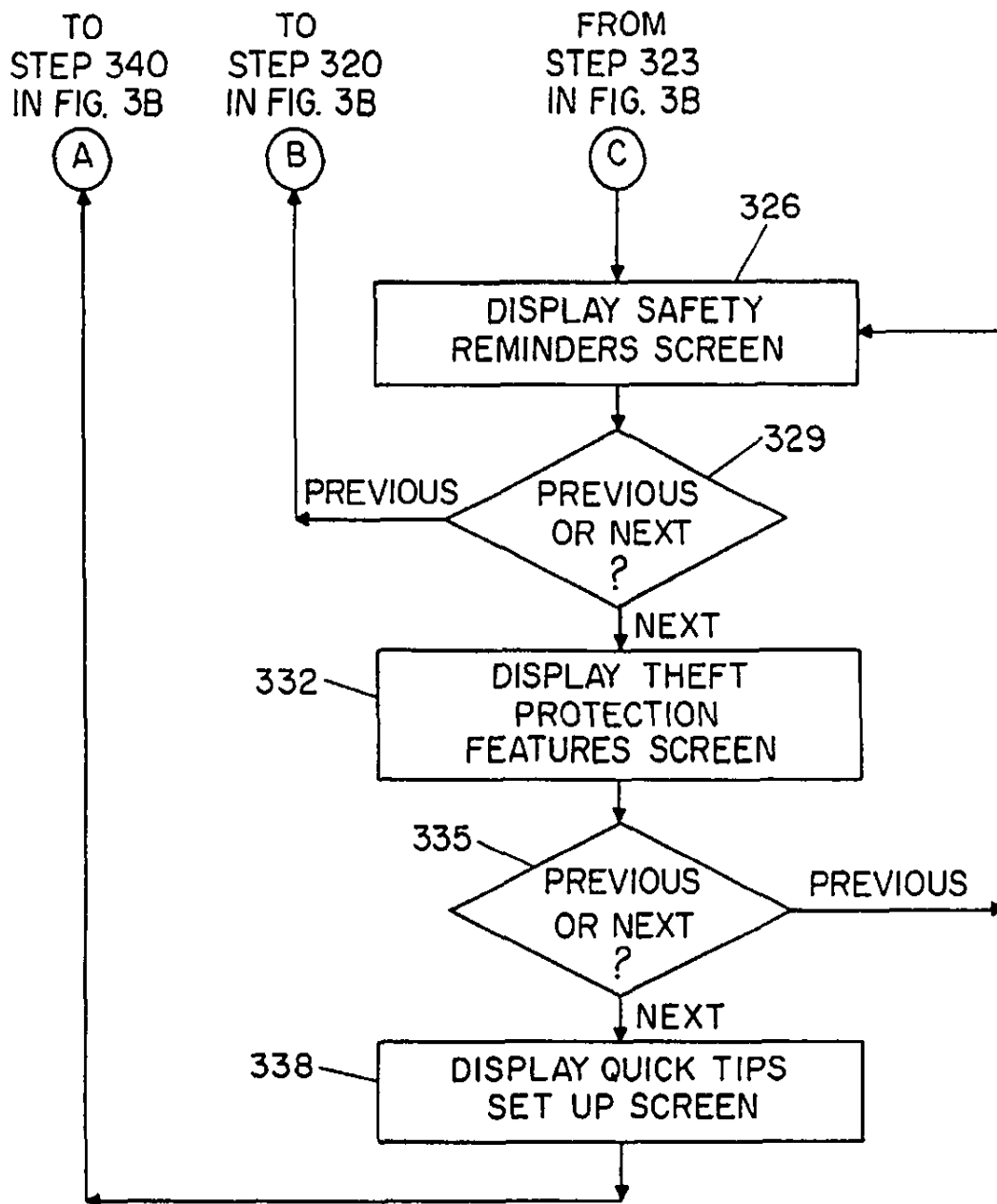


FIG. 3C

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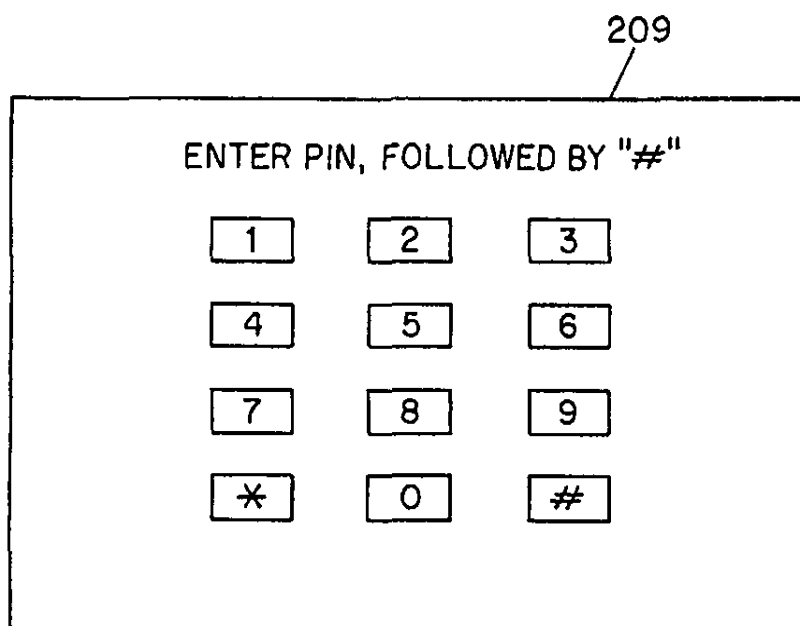


FIG. 4A

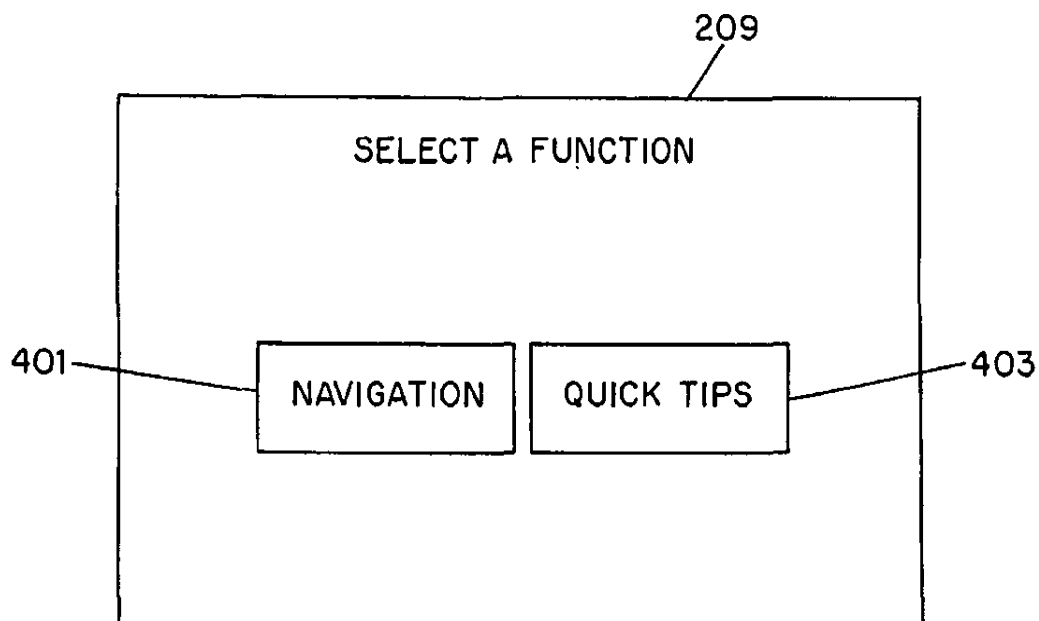


FIG. 4B

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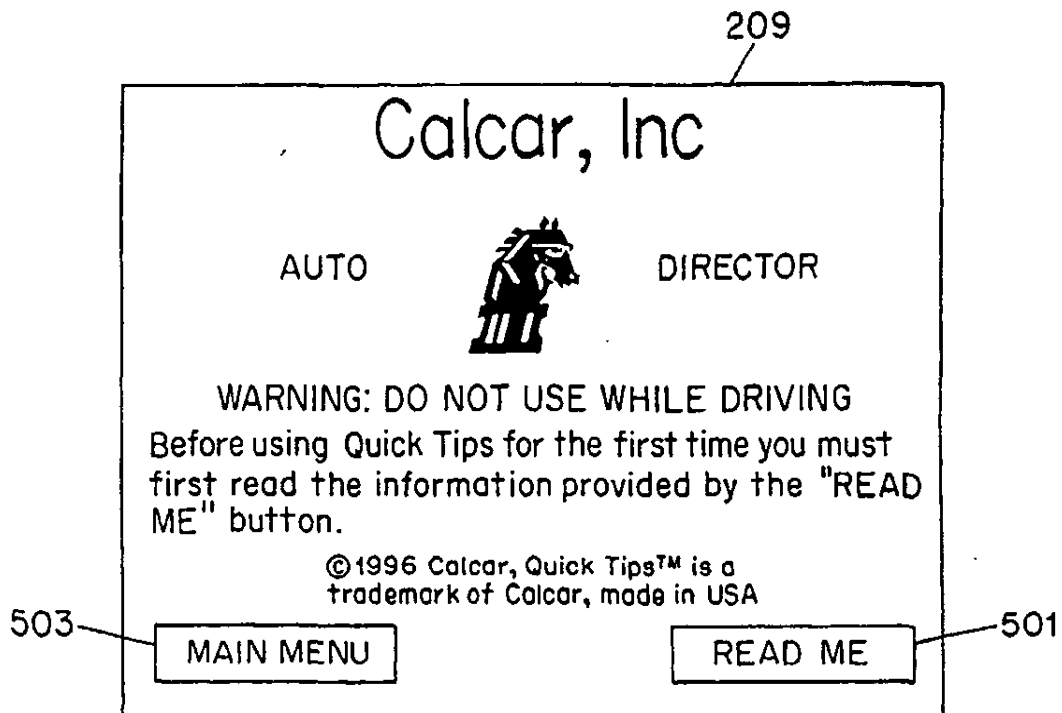


FIG. 5

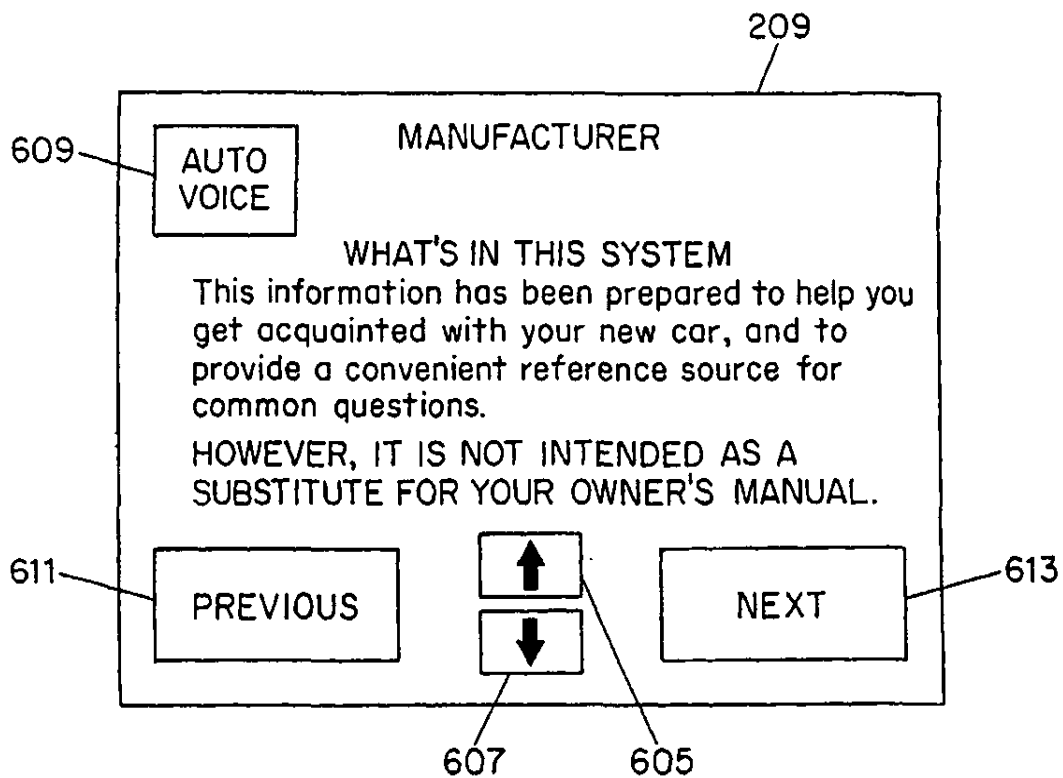


FIG. 6

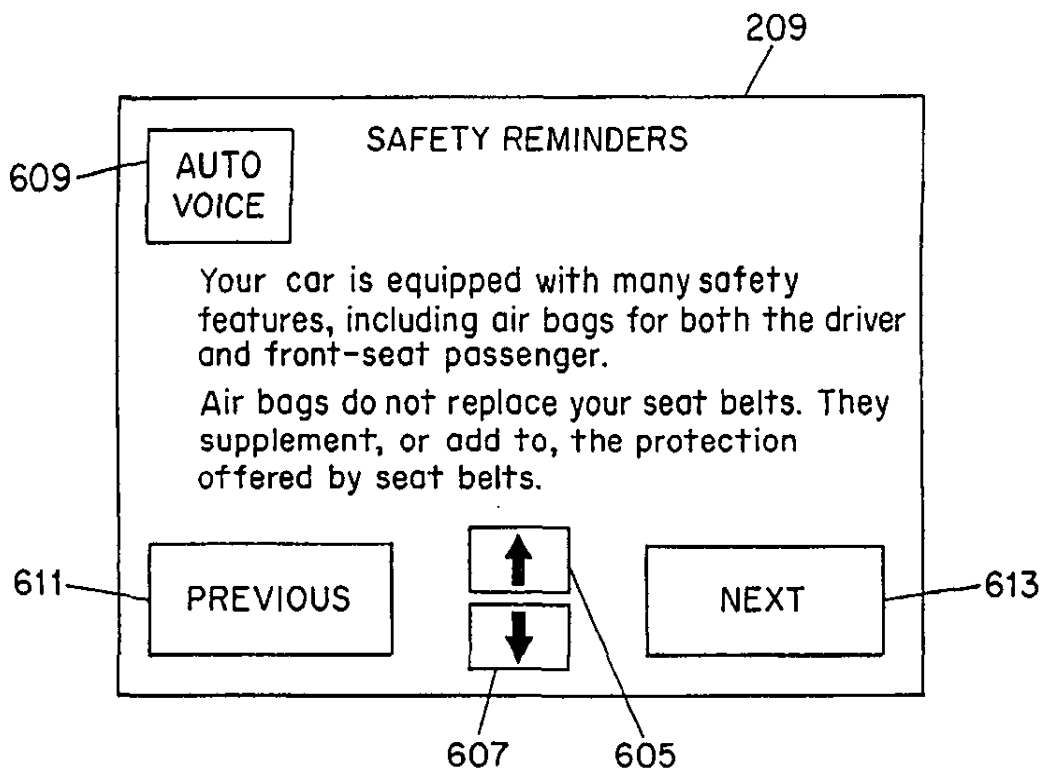


FIG. 7

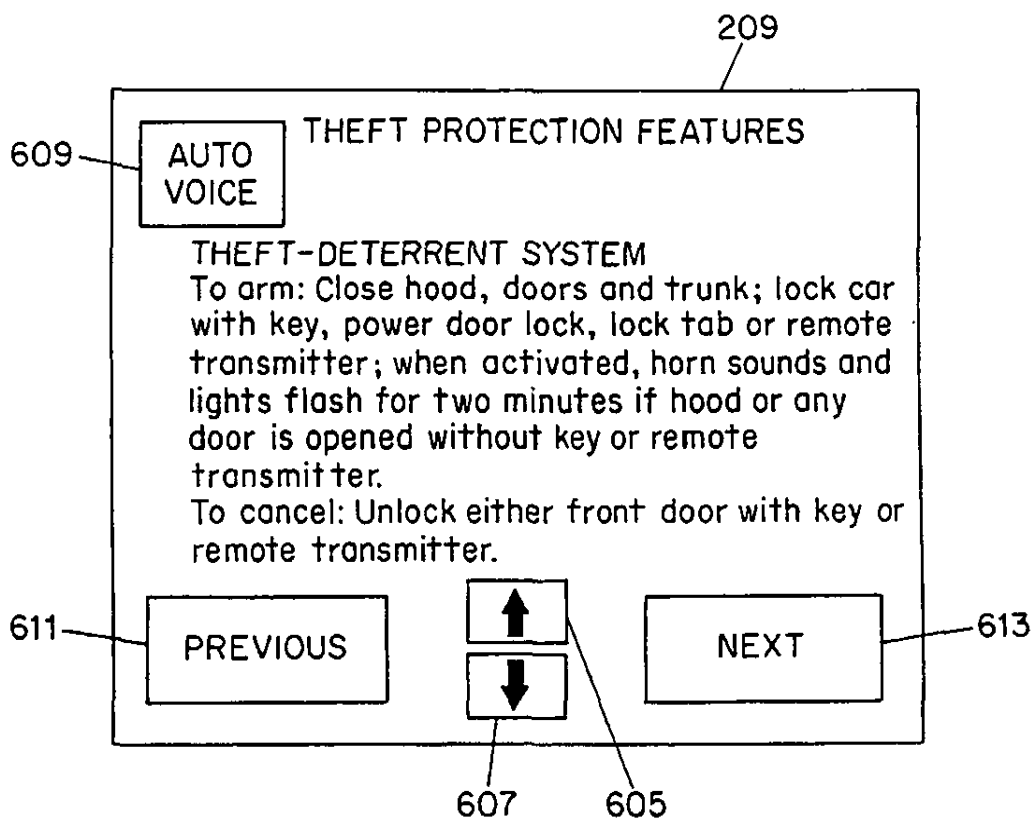


FIG. 8

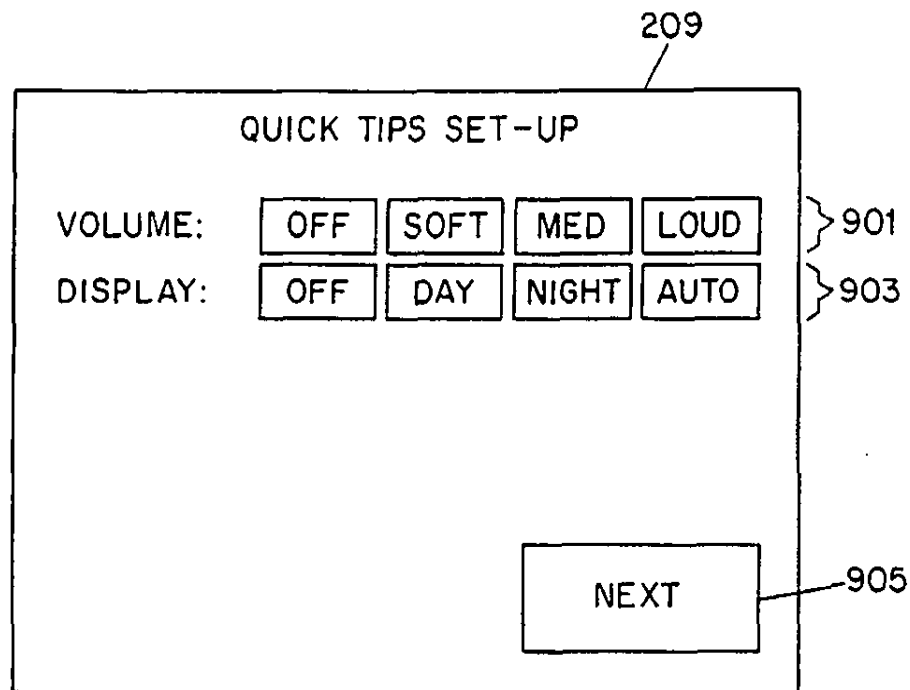


FIG. 9

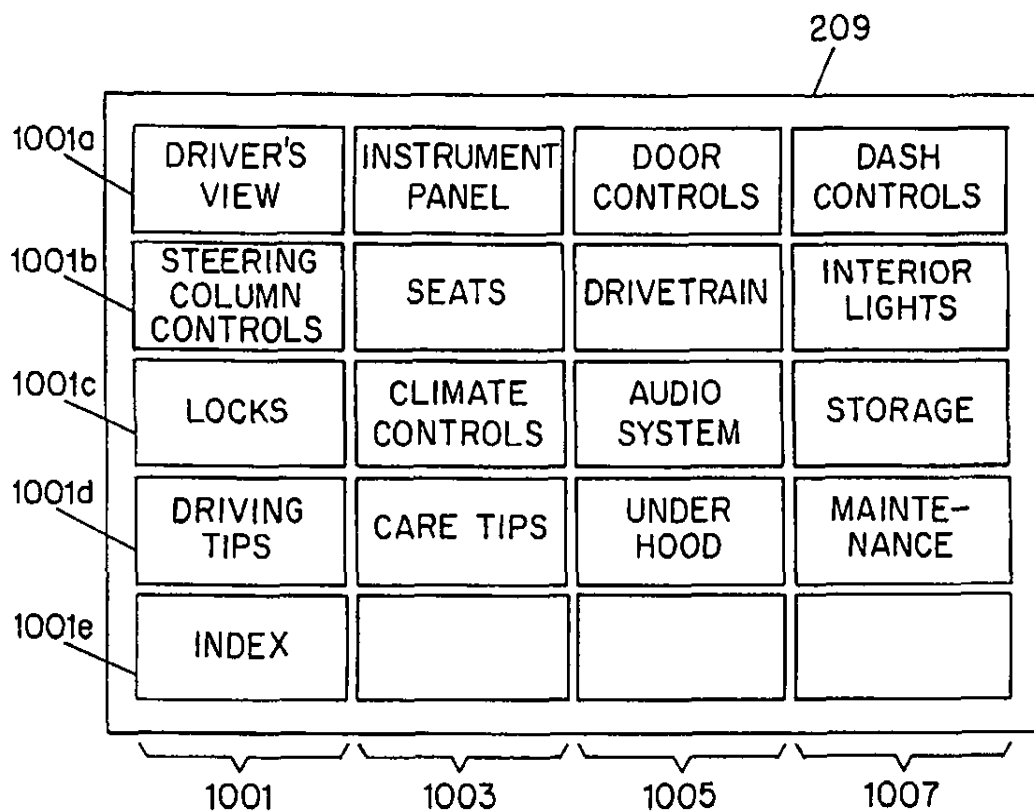


FIG. 10

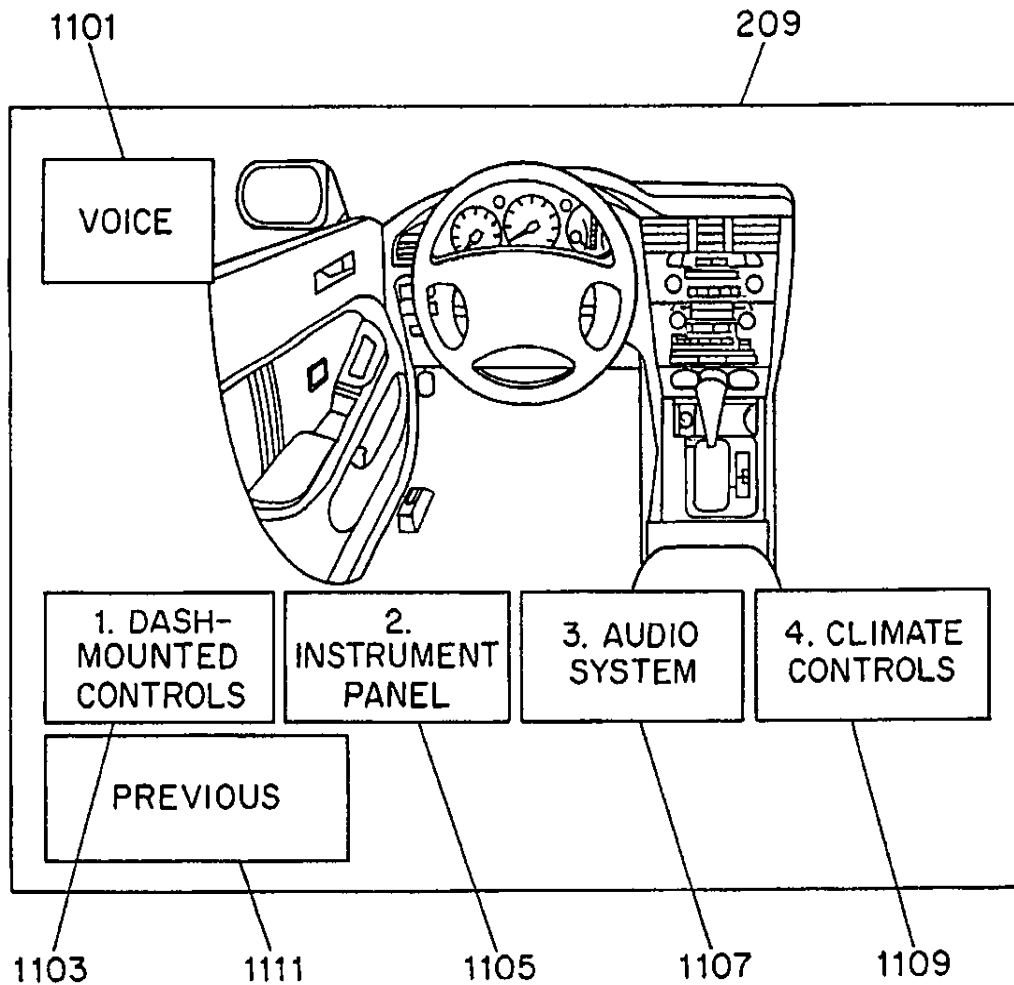


FIG. 11

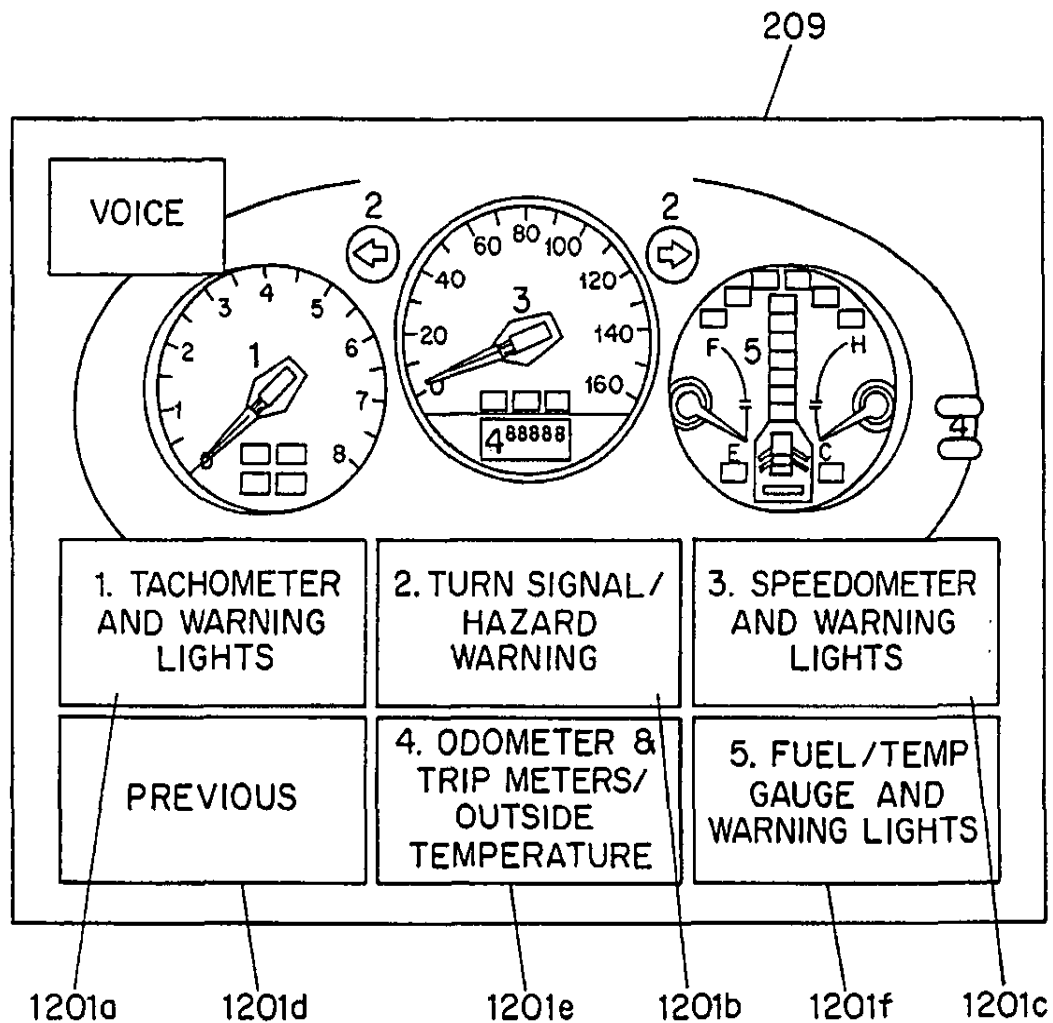


FIG. 12

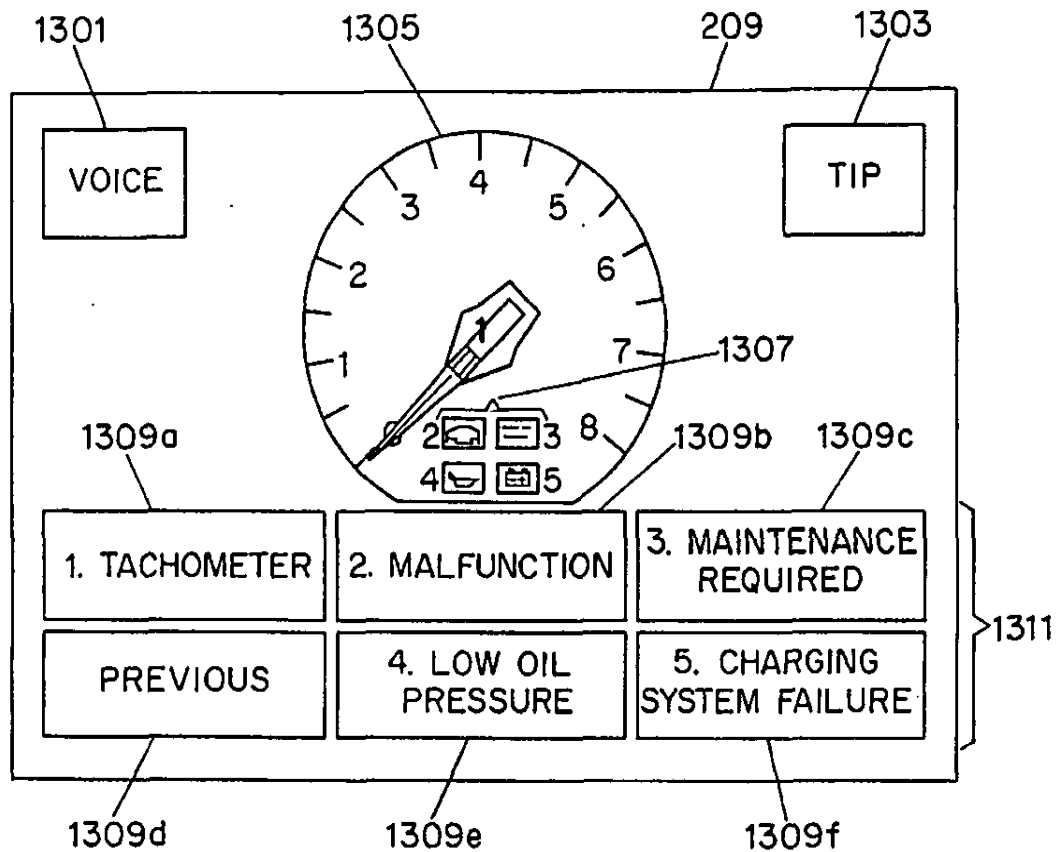


FIG. 13

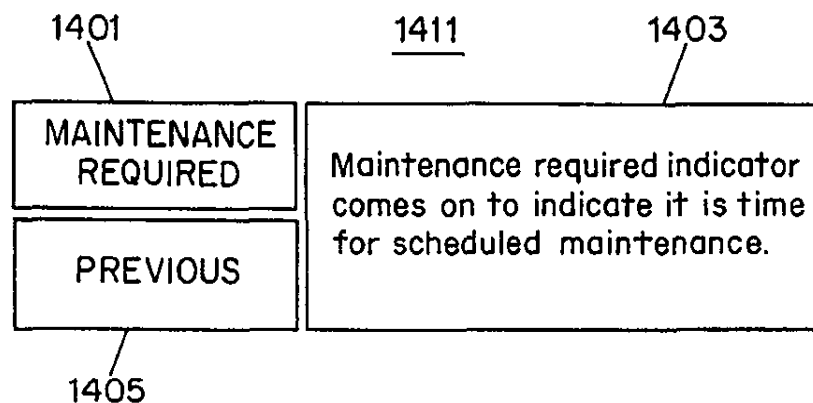


FIG. 14

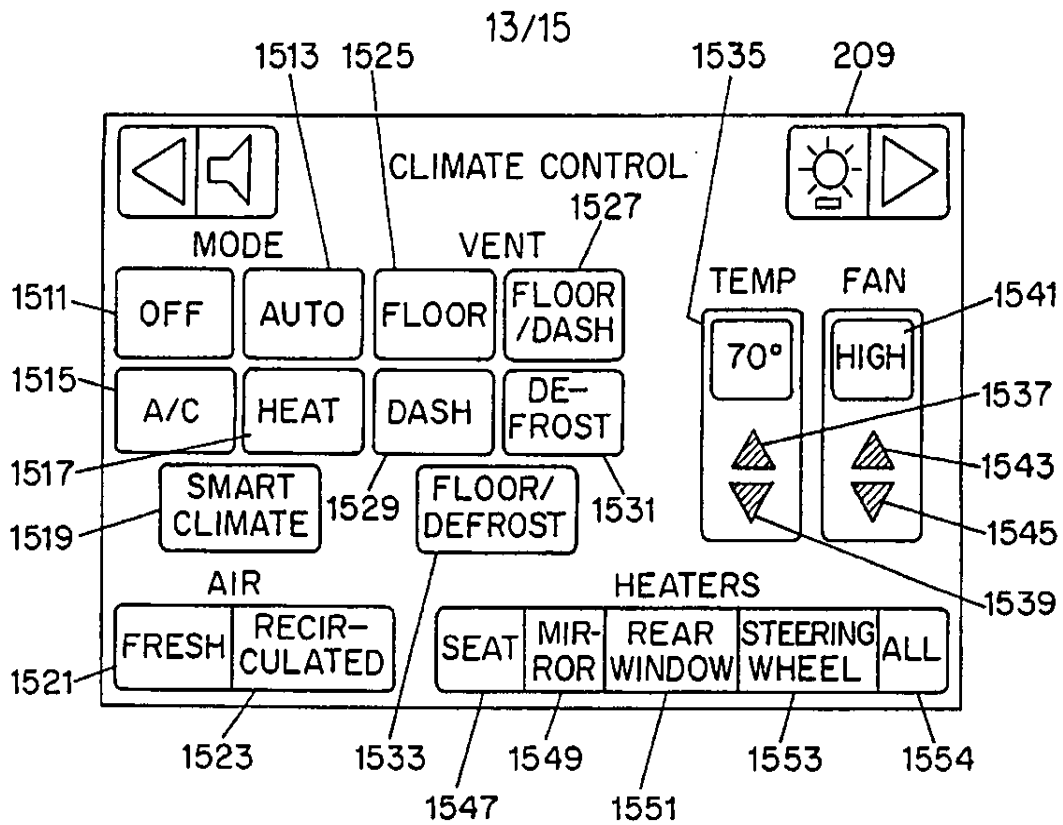


FIG. 15

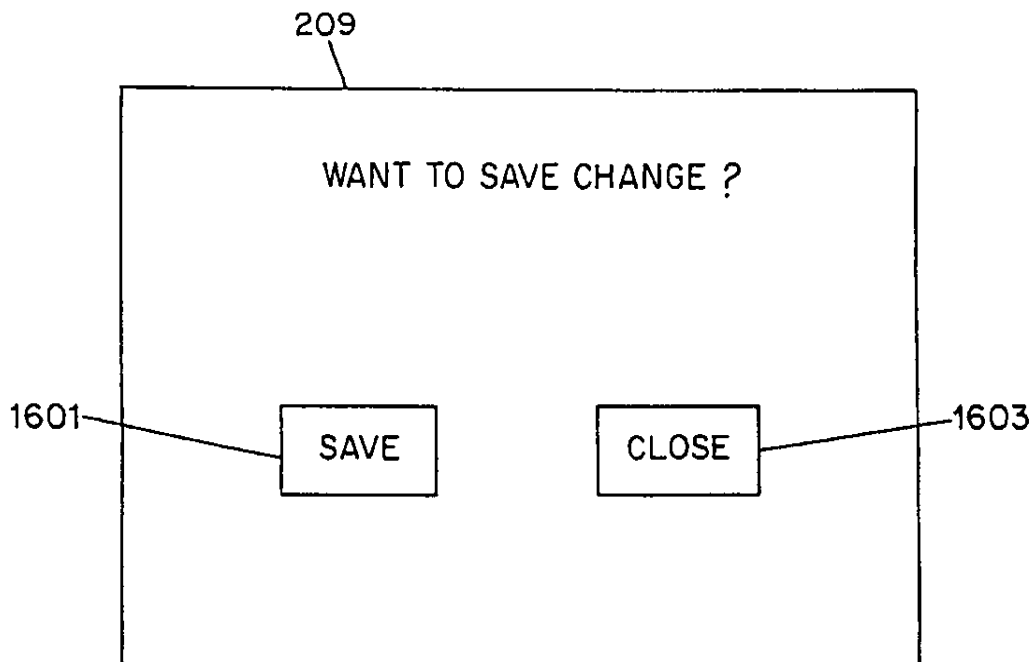


FIG. 16

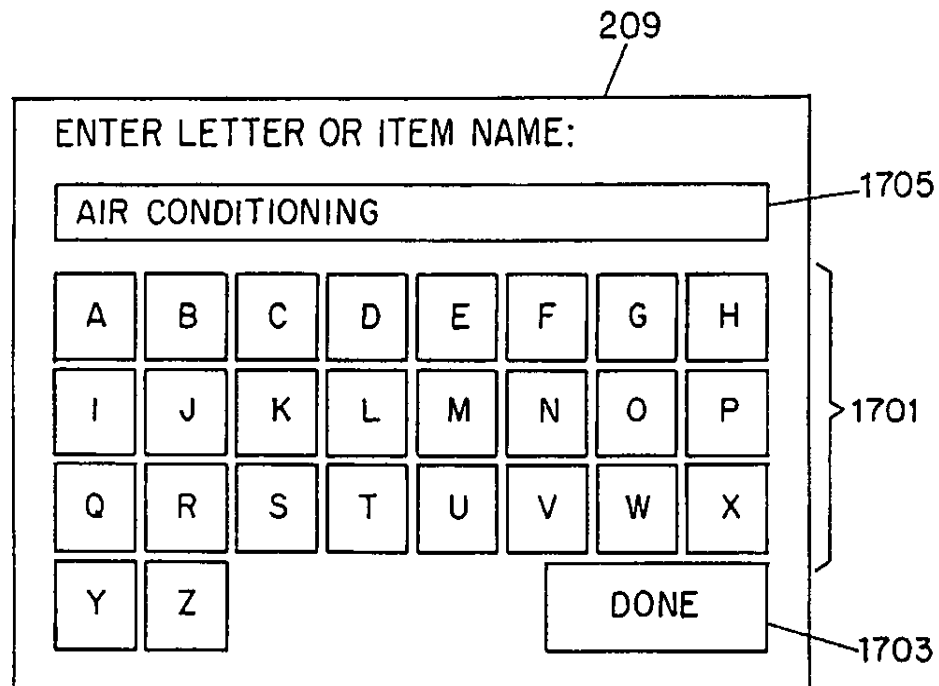


FIG. 17

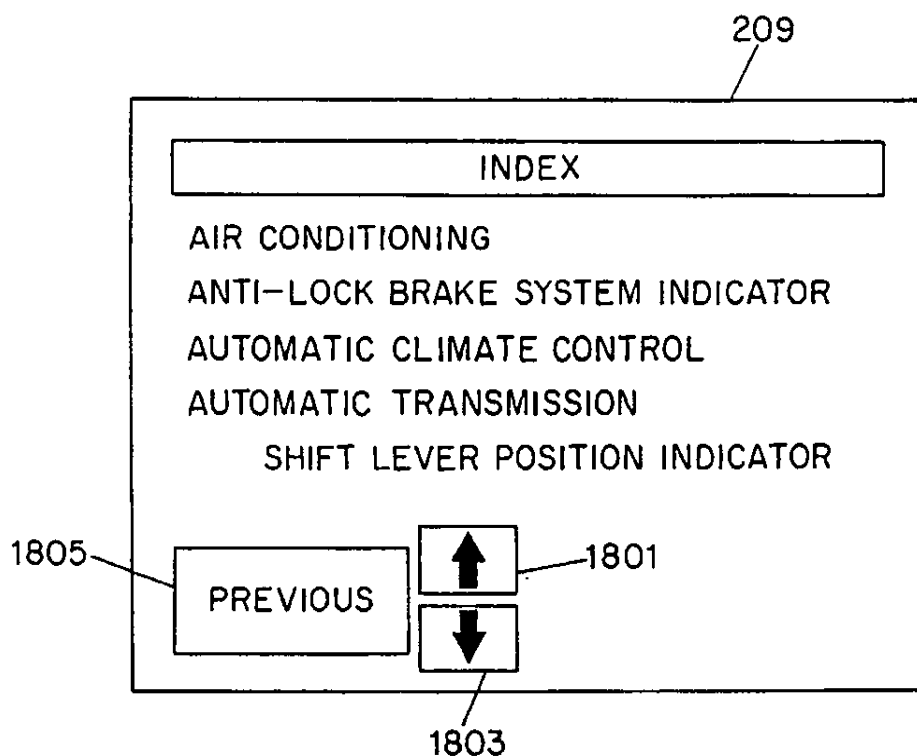


FIG. 18

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1901	AIR CONDITIONING ANTI-LOCK BRAKE SYSTEM INDICATOR AUTOMATIC CLIMATE CONTROL	• • •
1903	LINK TO CLIMATE CONTROL SCREEN OF FIG. 15 LINK TO WARNING LIGHT OPTION #4 ON FUEL/TEMP SCREEN (NOT SHOWN) LINK TO CLIMATE CONTROL SCREEN OF FIG. 15	• • •
1905	CHARGING SYSTEM FAILURE INDICATOR CLIMATE CONTROL SYSTEM COOLING CRUISE CONTROL INDICATOR DEFOG/DEFROST DOOR AJAR INDICATOR DIRECTIONAL SIGNALS INDICATOR	• • •
	LINK TO CHARGING SYSTEM FAILURE OPTION 1309f (FIG. 13) LINK TO CLIMATE CONTROL SCREEN OF FIG. 15 LINK TO CLIMATE CONTROL SCREEN OF FIG. 15 LINK TO WARNING LIGHT OPTION #2 ON SPEEDOMETER SCREEN (NOT SHOWN) LINK TO CLIMATE CONTROL SCREEN OF FIG. 15 LINK TO WARNING LIGHT OPTION #7 ON FUEL/TEMP SCREEN (NOT SHOWN) LINK TO TURN SIGNAL/HAZARD WARNING OPTION 1201b (FIG. 12)	• • •

FIG. 19

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TECHNIQUE FOR EFFECTIVELY PROVIDING INFORMATION RESPONSIVE TO A NOTABLE CONDITION IN A VEHICLE

This application is a continuation of application Ser. No. 09/717,943 filed on Nov. 21, 2000, which is a continuation of application Ser. No. 09/401,039 filed on Sep. 21, 1999, now U.S. Pat. No. 6,175,782, which is a division of application Ser. No. 08/789,934 filed on Jan. 28, 1997, now U.S. Pat. No. 6,009,355.

FIELD OF THE INVENTION

The invention relates generally to information and control systems and, more particularly, to a system for use in an automobile which facilitates a user's retrieval and/or dissemination of information, and control of vehicle functions.

BACKGROUND OF THE INVENTION

Information is vital to day-to-day activities. With no access to information, people cannot function efficiently in this society, and their lives and financial well-being are put in jeopardy. People want to be well-informed, so much so that when they are travelling in automobiles, they tune into local radio stations to listen to news, weather forecasts and traffic conditions. For that matter, some automobiles are equipped with audiovisual systems including television (TV) receivers. One such system is disclosed in U.S. Pat. No. 5,404,443 issued to Hirata. The Hirata system provides audiovisual information in a number of modes including a TV mode, which may be selected by control switches disposed on the periphery of a display.

Automobile users like to be continually updated with information affecting their travel plans such as weather and traffic conditions because of its fast changing nature. Automobile users who are traveling also like to continually keep in touch with their homes and offices, and to confirm appointments and hotel reservations so that they can adjust their itineraries accordingly. To that end, cellular mobile telephones were introduced to enable automobile users to conduct business and contact their families while they are traveling.

In addition, local map information is important to automobile travelers moving from one locale to another. As such, navigation systems were developed to help reach their destinations in an unfamiliar milieu. One such vehicle navigation system is disclosed in U.S. Pat. No. 5,274,560 issued to LaRue. The disclosed system is based on artificial intelligence and provides a driver with directions via a voice interface. The system is built upon an optical disk player which can be used for entertainment as well. Digitized maps, compressed voice records and computer programs are stored on an optical disk compatible with the disk player. After a destination point is identified, the disclosed system finds the best route from the digitized maps and guides the driver therethrough via the voice interface, taking into account the latest traffic conditions received by an FM receiver to avoid congestion.

Recently, navigation systems based on military global positioning system (GPS) technology have emerged. One such navigation system is commercially available as an option for the latest model of the ACURA 3.5 RL automobile. This ACURA navigation system receives signals from a constellation of satellites which is part of the GPS. In response to these signals, the navigation system pinpoints the automobile's location (in latitude and longitude). It also detects the automobile's speed and direction. With geo-

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graphic information stored on a hard disk in an onboard computer, the navigation system is capable of verbally and visually communicating to the user instructions for reaching the destination.

In addition to the above techniques for communications with automobile users, a technique for disseminating information regarding the automobiles themselves is disclosed in U.S. Pat. No. 5,442,553 issued to Parillo. The disclosed system is a vehicle diagnostic and software upgrade system. In this system, sensors are provided in the vehicle to generate dynamic data relating to various mechanical controls and the engine of the vehicle, including engine R.P.M., fuel/air mixture, emissions and pollution content information. A microprocessor in the vehicle has access to selectable program parameters affecting the functioning of the mechanical controls. The microprocessor collects and transmits the dynamic data to a remote diagnostic station periodically or upon its request. In response, the remote station sends, to the vehicle, signals indicative of any changes in its software and/or program parameters. The microprocessor accordingly causes the changes to be made in the vehicle based on the received signals.

Besides the communication capabilities described above, an automobile has many accessories and user control elements such as lights, wipers, a clock, temperature control, cruise control, seat adjustment control, mirror adjustment control, and an anti-theft system. A technique for centralizing the command of the individual control elements is disclosed in U.S. Pat. No. 5,555,502 issued to Opel. The disclosed system includes a centralized control panel on a steering wheel which, together with a display, is utilized to control the electronic components of the automobile. The display is positioned in the area of the driver's sun visor. After the driver presses one of the buttons on the control panel corresponding to a desired electronic component, a menu is displayed so that the driver is able to select items from the menu to program the component. The selection is accomplished by pressing specified buttons on the panel.

In addition, a technique for controlling vehicle accessories via voice command is disclosed in U.S. Pat. No. 4,827,520 issued to Zeinstra. In accordance with this technique, control functions of each accessory are formatted in a summary page for display on a screen, which is scanned by infrared light to sense any touching thereon. By uttering any of the displayed functions on the summary page, preceded by either a specified keyword or an actuation of a push-to-talk switch on a steering wheel, a more detailed subpage of the selected function is displayed for further selection by voice. As an alternative to the voice command, the selection can also be accomplished by touching the displayed function on the screen.

Voice command and touch screen techniques are frequently mentioned in prior art references in controlling car accessories. In particular, U.S. Pat. No. 5,214,707 issued to Fujimoto et al. discloses a system for voice-controlling equipment inside a vehicle, including microphones capable of discriminating voice commands as to whether they are generated at the driver side or at the assistant side of the vehicle in a noisy environment.

SUMMARY OF THE INVENTION

It is celebratory that technology advances at lightning speed. However, many people are left behind the technological frontier, and to some extent develop "technophobia". Some of them have even given up this technological race, which is confirmed by the blinking "12:00" display on the clocks of many video cassette recorders (VCRs) being used.

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Similarly, it is fantastic that automobiles nowadays include many advanced accessories such as audiovisual systems, anti-theft systems, anti-lock brake systems, climate control, and cruise control which embrace the latest technologies. However, of all these accessories, many automobile users only know how to operate the headlights and windshield wipers, and regard the rest as nuisance. That is, the users pay for numerous accessories which they do not use, resulting in much consumer waste. We have recognized that such non-use is principally attributed to an inefficient distribution of operating knowledge of the automobile and, in particular, its accessories.

Specifically, when automobile users presently want to learn about certain aspects of an automobile, they need to consult an owner's manual which could have been lost or misplaced when they need it the most. In addition, the manual is unpopular because many users simply want to avoid reading any written material, and find it intimidating as it oftentimes is filled with incomprehensible technical jargon.

We have further recognized that even with the operating knowledge, many users are overwhelmed and confused with the large number of knobs, switches and buttons used to control the individual vehicle parts and accessories.

Accordingly, it is an object of the invention to design an information and control system for use inside an automobile with the user in mind. The user is afforded a centralized control which may be used in lieu of the knobs, switches and buttons to operate the vehicle parts and accessories. In accordance with the invention, the centralized control is intimately tied to an information system such that the user is able to efficiently access information about the functions and operations of such parts and accessories, and in a synergistic manner apply that information to operate same, using the centralized control.

It is another object of the invention that the access to the information is intuitive and direct so that the user can obtain the relevant information in a few self-explanatory steps. To that end, the invention embraces a multimedia approach where audio and video media are added to the traditional text media to convey information. The additional media increases the dimensions of both the user's comprehension of the information and the user's interaction with the automobile. Moreover, the information access is driven by a multilevel menu based on an intuitive model of taxonomy where information is organized in a minimal number of levels of subject matter from general to specific. The above integration of the multimedia approach with the multilevel menu approach presents an effective way of retrieving information in the automobile. Advantageously, with the invention, the user would not be distracted or overburdened by irrelevant information in the course of an information retrieval, which is conducive to a safe driving environment.

In the preferred embodiment, when the user wants to access information about a given part or accessory of the automobile, the user is presented with options on a display screen. Each option is associated with a respective one of different parts or accessories of the automobile. The user is able to select through the interface one of the options, associated with the given automobile part or accessory. The option, when selected, is highlighted in a first color, for example, yellow. A voice is then generated by the inventive system to explain the purpose or the content of the selected option before the user commits to it. Having been so informed, the user may then activate the selected option in retrieving the information of interest. The activated option is

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highlighted in a second color, e.g., blue, to indicate its active status. The retrieved information is presented to the user both in text and in voice.

BRIEF DESCRIPTION OF THE DRAWING

Further objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing showing an illustrative embodiment of the invention, in which:

FIG. 1 is a block diagram of an automobile information and control system in accordance with the invention;

FIG. 2 illustrates a control panel and a display interface for a user to interact with the system of FIG. 1;

FIG. 3A illustrates a flow chart depicting the steps of an anti-car-theft routine used in the system of FIG. 1;

FIGS. 3B and 3C jointly illustrate a flow chart depicting the steps of a routine for presenting various screens to the user in the system interaction;

FIG. 4A illustrates a screen for eliciting a personal identification number (PIN) from the system user;

FIG. 4B illustrates a SELECT A FUNCTION screen including features thereof in accordance with the invention;

FIG. 5 illustrates an introduction screen including features thereof in accordance with the invention;

FIG. 6 illustrates a MANUFACTURER screen including features thereof in accordance with the invention;

FIG. 7 illustrates a SAFETY REMINDERS screen including features thereof in accordance with the invention;

FIG. 8 illustrates a THEFT PROTECTION FEATURES screen including features thereof in accordance with the invention;

FIG. 9 illustrates a QUICK TIP SET-UP screen including features thereof in accordance with the invention;

FIG. 10 illustrates a MAIN MENU screen including features thereof in accordance with invention;

FIG. 11 illustrates a DRIVER'S VIEW screen including features thereof in accordance with the invention;

FIG. 12 illustrates an INSTRUMENT PANEL screen including features thereof in accordance with the invention;

FIG. 13 illustrates a TACHOMETER AND WARNING LIGHTS screen including features thereof in accordance with the invention;

FIG. 14 illustrates a segment of the screen of FIG. 13 providing the user with information regarding a particular function of the automobile;

FIG. 15 illustrates a CLIMATE CONTROL screen including features thereof in accordance with the invention;

FIG. 16 illustrates a SAVE screen for saving the user's preferences in accordance with the invention;

FIG. 17 illustrates a DATA ENTRY screen in accordance with the invention for looking up information regarding a specific item in the automobile;

FIG. 18 illustrates an INDEX screen with listed items for which information is available; and

FIG. 19 is a look-up table listing searchable items and the corresponding instructions for a processor in the system of FIG. 1 to provide information regarding such items.

Throughout this disclosure, unless otherwise stated, like elements, components and sections in the figures are denoted by the same numerals.

DETAILED DESCRIPTION

FIG. 1 illustrates information and control system 100 embodying the principles of the invention for use in an

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automobile. System 100 is referred to as the "AUTO DIRECTOR" system. It is user-friendly and designed with the automobile user in mind. For example, with AUTO DIRECTOR display interface 102a to be described, information about the automobile is readily available literally at the fingertips of the user. This information includes operational instructions, maintenance procedures, safety measures, and information about virtually every capability of the automobile. In accordance with the invention, the user is able to efficiently access such information using multimedia means involving audio, text and video media. Also with interface 102a, or multifunction display interface 102b to be described, the user is afforded a centralized control whereby he/she can program or adjust different vehicle parts and accessories using the information thus obtained.

As shown in FIG. 1, central to system 100 is processor 105 connected to memory 115. Data bus 107 connects processor 105 to display interfaces 102, input interfaces 104, communications interfaces 106, output control interfaces 108, vehicle computer interfaces 110, vehicle control interfaces 112, self-test interface 114, preferences interface 116, and audio interface 118.

Display interfaces 102 include, inter alia, AUTO DIRECTOR display interface 102a, which is illustrated in FIG. 2, together with control panel 205 in FIG. 1. By way of example, but not limitation, the hardware of interface 102a and control panel 205 are derived from a prior art navigation system of the type of the ACURA navigation system. In fact, interface 102a and control panel 205 are used in this illustrative embodiment to realize not only AUTO DIRECTOR functions to be described, but also the well-known navigation function.

Interface 102a includes a conventional liquid crystal display screen 209, and LCD driver (not shown) for processor 105 to control the display on screen 209. Interface 102a also incorporates well-known touch-screen circuitry (not shown) connected to touch screen interface 104a in FIG. 1. With this circuitry, the user can interact with processor 105 by, say, touching a displayed option on screen 209. Through interface 104a, processor 105 receives from the touch screen circuitry a signal identifying the location on screen 209 where it has been touched. If such a location matches the predetermined location of one of the displayed options, processor 105 determines that that option has been selected. With such touch-screen and displayed option selection capabilities, through AUTO DIRECTOR interface 102a, the user is able to obtain information on and control selectable functions of the automobile such as the instrument panel, navigation function, mobile phone, radio/CD player, locks, mirrors, windows, driver's seat adjustment control, climate control, windshield wipers, cruise control, lights, security function, steering, ride control, engine and transmission.

Control panel 205 comprises CANCEL switch 205a, ENTER switch 205b, BRIGHTNESS switch 205c, PUSH TO SELECT knob 205d, MENU switch 205e, MAP/GUIDE switch 205f, SETUP switch 205g, ZOOM IN switch 205h and ZOOM OUT switch 205i. BRIGHTNESS switch 205c comprises a standard variable resistor such that when it is pushed one way, operating circuitry 121 responsively causes the display intensity to increase, and the other way to decrease. ZOOM IN switch 205h when pressed enables the automobile user to enlarge a particular visual area of interest on screen 209, affording better details. On the other hand, ZOOM OUT switch 205i when pressed performs the inverse function to switch 205h. As an alternative to the touch-screen capability, switch 205d similar to a standard joystick

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is provided for the user to move from one displayed option to another on screen 209 in the same direction (e.g., up, down, left or right) as the switch is operated. A desired option may be selected by pressing ENTER switch 205b. The functions of the other switches are described hereinbelow as they are called out in the operation of system 100. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and control panel 205 are mounted close to the center of the dashboard of the automobile next to the steering wheel.

Referring back to FIG. 1, display interfaces 102 also include multifunction display interface 102b, center console display interface 102c, rear console display interface 102d, and instrument panel display interface 102e.

Specifically, multifunction display interface 102b is installed on the dashboard close to interface 102a on the driver side. Like interface 102a, interface 102b provides the user with graphic display and control of selected functions using well-known touch screen technology. In fact, interface 102b duplicates certain control functions (e.g., navigation, phone, radio and climate control) of interface 102a so that the user can use interface 102b to control a selected function while interface 102a is engaged in another ongoing function. For example, while the user is relying on AUTO DIRECTOR interface 102a to provide navigation information to reach a given destination, the user may want to adjust the climate control of the automobile. It is inconvenient for the user to terminate the ongoing navigation mode of interface 102a, albeit temporarily, to access the climate control function through the interface, adjust the climate control and then resume the navigation mode. Thus, it is preferable to leave the navigation mode of interface 102a alone and use interface 102b to administer the climate control.

Center console interface 102c is installed close to interface 102a on the passenger side. Similar to interface 102b, interface 102c provides the front seat passenger with graphic display and control of functions which include: the front passenger seat adjustment, door lock, window, climate and TV controls. If enabled by the driver, control is also available for the radio/CD player and phone.

Rear console display interface 102d is installed on the back of a front seat. Similar to interface 102c, interface 102d provides rear seat passengers with graphic display and control of certain functions if enabled by driver or front seat passenger. These functions include: the rear seat climate, windows, door locks, radio/CD player and TV controls.

Instrument panel display interface 102e is installed on the dashboard in front of the driver seat. This interface provides the driver with graphic display of the vehicle speed, engine RPM, outside and inside temperatures, oil pressure, fuel level, time, odometer reading, trip odometer reading and warning light indicators. Through AUTO DIRECTOR interface 102a, the system user may select the display of the information in either an analog or a digital form.

Input interfaces 104 comprise touch screen interface 104a and control panel 205 described before, and voice command interface 104b. The latter is connected to a microphone (not shown) and comprises standard voice command circuitry (not shown) for processing voice commands by the user through the microphone to control or modify selected functions of system 100.

Communications interfaces 106 include phone interface 106a, radio/CD interface 106b, television (TV) interface 106c, navigation interface 106d, and beacon interface 106e. Processor 105 interacts with and controls standard phone equipment connected to phone interface 106a. Through

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processor 105, the user may operate the phone equipment via voice command, thereby realizing hands-free operation of the equipment. Alternatively, the user may operate the phone equipment using the touch screen capability provided by AUTO DIRECTOR display interface 102a or multifunction display interface 102b. The user may also operate the phone equipment via remote switches.

Similarly, processor 105 interacts with and controls one or more radio receivers and CD players in the automobile connected to radio/CD interface 106b. Through processor 105, the user may operate the radio receivers via voice command, remote switch and/or touch screen capability.

Processor 105 further interacts with and controls one or more TV receivers in the automobile connected to TV interface 106c. Again, the user may operate the TV receivers via voice command, remote switches and/or touch screen capability.

As further described hereinbelow, navigation interface 106d is connected to a standard inertial guidance system (not shown) capable of providing gyros information, and deriving the vehicle location based on GPS information. With the map information stored in memory 115, the inertial guidance system is capable of providing the user with navigational instructions via interface 102a or 102b. Besides the locational information, local and national emergency information may be derived from the GPS information using additional standard decoding circuitry in interface 106d.

Beacon interface 106e is used for connection to a standard beacon device for detecting a predetermined beacon radio signal to provide additional locational information.

Output control interfaces 108 include lock interface 108a, mirror interface 108b, window interface 108c, steering column interface 108d, seat interface 108e, climate control interface 108f, wiper interface 108g, cruise control interface 108h, light interface 108i and clock interface 108j.

Specifically, lock interface 108a comprises output control logic controllable by processor 105 to lock or unlock the car doors, glove box, console storage, trunk (or liftgate), fuel filler door, brakes and transmission, and enable or disable the child-proof door locks, fuel pump and ignition.

Mirror interface 108b comprises output control logic controllable by processor 105 to maneuver the positions of the outside mirrors and inside rear view mirror, and to fold or unfold the outside mirrors.

Window interface 108c comprises output control logic controllable by processor 105 to incrementally or completely open or close all windows, and to open, close or tilt any sunroof.

Steering column interface 108d comprises output control logic controllable by processor 105 to move the steering column in or out and up or down.

Seat interface 108e comprises output control logic controllable by processor 105 to (1) adjust the positions of the front seats forward or aft, and up or down; (2) tilt the front or rear of the seat cushion up or down; (3) adjust the seat back lumbar, width and angle forward or aft; (4) increase or decrease the cushion size and stiffness; (5) raise or lower the head restraint; and (6) raise or lower the seat belt height.

Climate control interface 108f comprises output control logic controllable by processor 105 to (1) turn the climate control system on or off; (2) select an air flow mode; (3) set fan speeds; (4) enable or disable seat heaters; (5) select fresh or recirculated air (for driver only); and (6) enable or disable front and rear defrosters, mirrors and steering wheel heaters (for driver only).

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Windshield wiper interface 108g comprises output control logic controllable by processor 105 to (1) select a high, low, intermittent, single wipe or off mode; (2) set an intermittent delay; and (3) enable or disable front or rear washers. Interface 108g also includes control logic for controlling rain- and speed-sensitive wipers, and for activating an automatic wash in a single wide mode when the windshield is at a certain level of opacity.

Cruise control interface 108h comprises output control logic controllable by processor 105 to (1) turn the cruise control on or off, (2) set the vehicle speed, and (3) cancel or resume the set speed. Light interface 108i comprises output control logic controllable by processor 105 to select an automatic on mode or off mode for parking lights, headlights and fog lights; and to turn on or off map or courtesy lights.

Clock interface 108j comprises output control logic controllable by processor 105 to set an initial date and time on a conventional clock (not shown) connected to interface 108j. System 100 relies on the current date and time kept by the clock to provide a time reference for the system functions.

Vehicle computer interfaces 110 include anti-lock brake computer interface 110a, engine computer interface 110b and supplemental restraint computer interface 110c for processor 105 to communicate with the computers controlling the anti-lock brakes, engine and supplemental restraints (e.g., back-up airbag deployers and seat belt tensioners), respectively. Interfaces 110 also include back-up interface 110d through which processor 105 receives and analyzes signals from the engine, anti-lock brake and supplemental restraint computers. These signals would indicate to processor 105 any failures of the computers. In response to a computer failure, processor 105 causes a corresponding back-up computer connected to interface 110d to provide a back-up function.

Vehicle control interfaces 112 include steering interface 112a, ride interface 112b, engine interface 112c, transmission interface 112d, traction control interface 112e, and security interface 112f.

Specifically, steering interface 112a comprises input monitoring and output control logic for processor 105 to lighten or tighten the steering effort ratio in response to changing road conditions. Through interface 102a, the user may opt for manual or automatic steering effort ratio control. Interface 112a is capable of adapting and storing data according to the driver's inputs. It also allows for steering of front and/or rear wheels for sporty or increased stability.

Ride interface 112b comprises input monitoring and output control logic for processor 105 to lighten or stiffen the ride control to front and/or rear of vehicle in response to changing road conditions. Through interface 102a, the user may also opt for manual or automatic ride control.

Engine interface 112c comprises input monitoring and output control logic allowing for shutting off a specified number of cylinders, and varying valve and cam timing to increase performance or fuel economy. This interface also allows for manual or automatic control of the engine components, and includes the capability of adapting and storing data according to the driver's inputs.

Transmission interface 112d comprises input monitoring and output control logic for selecting manual or automatic shifting of the transmission. In an automatic shifting mode, interface 112d is capable of adapting and storing data according to the driver's inputs. Interface 112d also allows for control of a variable differential ratio for fast acceleration and high economy cruise.

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Traction control interface 112e comprises input monitoring and output control logic providing information on whether power is delivered to front and/or rear wheels of the vehicle and what proportion of the power is delivered to each wheel. This interface also allows for manual or automatic control, and such functions as yaw control in cooperation with the anti-lock brakes and an engine cylinder shutoff.

Security interface 112f comprises control logic for setting a security level, and enabling or disabling a number of security related functions such as the fuel supply cut-off, motion detector, brake locking, etc. Interface 112f also allows entry of a new or alteration of an existing personal identification number (PIN) for personalization of the vehicle functions, i.e., saving the vehicle functional preferences.

In accordance with an aspect of the invention, system 100 incorporates an anti-car-theft technique involving security interface 112f. In accordance with this inventive technique, security interface 112f further comprises a sensor for detection of a predetermined condition to trigger an anti-theft routine. It will be appreciated that a person skilled in the art will come up with many different triggering events causing the sensor to invoke the routine. For example, a passive way of triggering the anti-theft routine would be after the sensor detects that the engine is off and the user has opened, closed and locked the driver's door.

In any event, as soon as processor 105 receives from the sensor a signal requesting an invocation of the anti-theft routine, processor 105 retrieves from navigation interface 106d GPS information identifying the parking location of the automobile, as indicated at step 251 in FIG. 3A. Processor 105 then stores at step 253 the parking location GPS information in memory 115. At step 255, processor 105 determines whether the security measures remain on. By way of example, but not limitation, such determination is based on information from lock interface 108a indicating whether the driver's door is properly unlocked. If that door is properly unlocked, processor 105 determines that the security measures are called off, and the anti-theft routine comes to an end, as indicated at step 257.

Otherwise if processor 105 determines that the security measures remain on, processor 105 at step 259 retrieves from navigation interface 106d GPS information identifying the current location of the automobile. Processor 105 then compares at step 261 the current location GPS information with the parking location GPS information previously stored. If processor 105 at step 262 determines that the current location matches the parking location based on the comparison, the anti-theft routine returns to step 255 after a predetermined period. Otherwise if processor 105 determines that the current location does not match the parking location, processor 105 assumes that the automobile has been removed without authorization, i.e., stolen. At this point, if a conventional alarm system is connected to security interface 112f, processor 105 would cause an alarm to come on, gas to be cut off, etc.

In this example, a conventional transmitter (not shown) is connected to security interface 112f and transmits a predetermined sequence of signals receivable by a law enforcement agency or a suitable alarm monitor company when it is activated. Continuing the example, processor 105 translates the GPS information identifying the current vehicle location into the corresponding street address based on the map information stored in memory 115, as indicated at step 263. Processor 105 at step 265 looks up one or more phone

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numbers pre-stored in memory 115 for reporting to the law enforcement agency (or the alarm monitor company) about the stolen status. Alternatively, a list of phone numbers associated with law enforcement agencies (or branches of the alarm monitor company) in many different geographic locations is pre-stored, along with the GPS information identifying the locations of the respective law enforcement agencies (or alarm monitor company branches). This being so, processor 105 locates the closest law enforcement agency (or alarm monitor company branch) and its associated phone number(s) by comparing the current vehicle location GPS information with the respective agency (or branch) location GPS information.

In any event, processor 105 at step 267 initiates a call to a law enforcement agency (or an alarm monitor company branch) through phone interface 106a using the phone number just located. After the phone connection is established, processor 105 provides through the connection information about the current address of the vehicle using conventional voice synthesizer circuitry (not shown) in audio interface 118, and the pre-recorded information about the vehicle itself such as its vehicle identification number (VIN), model, year, color, license number, etc., as indicated at step 269. Through the same phone connection, processor 105 may also provide information about the vehicle's owner such as his/her name and contact number so that the law enforcement agency (or alarm monitor company branch) can notify the owner of the incident. Processor 105 at step 271 activates the aforementioned transmitter connected to security interface 112f to generate the predetermined sequence of signals in case the stolen vehicle is in transit. For that matter, processor 105 can also repeatedly check on the latest vehicle location and report any new address different from the one previously reported. Thus, by tracking the signals in the vicinity of the latest reported vehicle location, the law enforcement agency (or alarm monitor company) would recover the vehicle in an efficient manner.

Referring back to FIG. 1, self-test interface 114 comprises input/output (I/O) control logic for performing an active self-test of system 100 on power up or at the user's request. Specifically, interface 114 polls every other interface in system 100 for a self-test result. Each interface, when polled, performs an active self-test and reports the test results to interface 114, where such test results are gathered and caused to be displayed on interface 102a.

Preferences interface 116 monitors changes made by the user in selected functions after the user logs on system 100, and prompts the user to save such preferences. These preferences are stored in memory 115 in association with the user's PIN. Functions affording the user choices include auto locks, an easy entry, auto lamps, the seat position, steering column position, mirror position, radio, steering, ride, transmission shift, engine performance, climate, and security level.

Audio interface 118 comprises I/O control logic for receiving audio signals from a radio/CD, TV, compact disk (CD) player, or phone interface, processing the received audio signals, providing proper amplifications thereto, and routing the resulting sound to appropriate speakers and headphones (not shown) connected to interface 118. In this illustrative embodiment, AUTO DIRECTOR display interface 102a and multifunction display interface 102b share the same speakers. Interface 118 also provides center and rear console display interfaces 102c and 102d with separate audio channels, speakers and headphone outputs. The front and rear speakers may be muted by the user as a preference.

Interface 118 also processes requests from other interfaces for pre-recorded digital sounds stored in a SOUNDSGOOD

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library in memory 115 and routes the requested sounds to the appropriate interfaces. In addition, interface 118 comprises the conventional voice synthesizer circuitry for providing the voice messages to the appropriate interfaces.

FIGS. 3B and 3C jointly illustrate routine 300 for accessing, through AUTO DIRECTOR display interface 102a, a main menu to obtain operational instructions, maintenance procedures, safety measures, and other information about the automobile, collectively referred to as "Quick Tips". Routine 300 is stored in memory 115 and initiated when SETUP switch 205g in FIG. 2 is pressed. Instructed by routine 300, processor 105 at step 301 elicits a PIN from the user by displaying a screen of FIG. 4A through interface 102a. As shown in FIG. 4A, a video key-pad comprising numeral keys "1" through "9", and "*" and "#" keys are displayed on screen 209. In response, the user enters a sequence of numerals by touching the corresponding displayed keys, followed by the "190" key.

It should be pointed out that in accordance with another aspect of the invention, when a displayed key or option is touched on the screen of AUTO DIRECTOR display interface 102a or multifunction display interface 102b, a tone pre-selected by the user from the SOUNDSGOOD library is generated through audio interface 118, indicating that the key or option has been touched on the screen. Advantageously, relying on the audio tone confirmation, as opposed to a visual confirmation, the user while driving can continually watch the road.

The user may alternatively enter the above numeral sequence using control panel 205 in a manner to be described. In any event, processor 105 then verifies at step 303 the PIN entry by comparing it with the user's pre-selected PIN. The latter is stored in memory 115, along with the user's preferences. In a standard way, the user is given a few chances to enter a correct PIN. Verification of the PIN entry identifies the user as a legitimate user. Thus, if the PIN entry is not valid, routine 300 comes to an end, as indicated at step 304.

Otherwise if the PIN entry is valid, processor 105 at step 305 causes interface 102a to display on screen 209 a "SELECT A FUNCTION" screen, which is illustrated in FIG. 4B. As shown in FIG. 4B, two options, namely, "NAVIGATION" and "QUICK TIPS", are displayed on screen 209. By default, NAVIGATION option 401 is highlighted yellow when the screen of FIG. 4B appears.

It should be pointed out that in this illustrative embodiment, a yellow highlight on an option indicates that the option is selected but not yet activated. Once a yellow highlighted option is activated, the option is highlighted blue. System 100 then performs according to the activated option.

Thus, in this instance, the user may activate the yellow highlighted NAVIGATION option by touching the option on screen 209 or by pressing ENTER switch 205b.

However, if QUICK TIPS option 403 is desired, the user may touch that option on screen 209, which would then be highlighted yellow. A second touch on the same option will change the highlight to blue, indicating the active status. As an alternative, the user may utilize knob 205d of FIG. 2 to select QUICK TIPS option 403 by first pushing the knob to the right. In response, processor 105 causes the yellow highlight to move from default NAVIGATION option 401 to QUICK TIPS option 403. The user can then select the QUICK TIPS option by pressing ENTER switch 205b. Upon selection, the yellow highlighted option will again turn blue. Processor 105 at step 308 detects an activation of either NAVIGATION option 401 or QUICK TIPS option 403. If

NAVIGATION option 401 is activated, processor 105 at step 311 causes system 100 to enter into a navigation mode. In this mode, processor 105 causes navigational instructions to be displayed on screen 209 in a conventional manner. In providing the navigation instructions, the standard inertial guidance system connected to navigation interface 106d receives signals from a constellation of GPS satellites maintained and controlled by the U.S. Department of Defense. In response to these signals, the inertial guidance system identifies the location (in longitude and latitude) of the automobile. The system also detects the vehicle speed, and the direction in which the vehicle is headed. By accessing the map information stored in memory 115, the system is capable of visually and verbally providing the user with directions to a given destination through AUTO DIRECTOR display interface 102a and audio interface 118, respectively. Otherwise if activation of QUICK TIPS option 403 is detected at step 308, processor 105 causes interface 403 to display an introduction screen on screen 209, as indicated at step 314. This introduction screen is illustrated in FIG. 5.

As shown in FIG. 5, system source identification, warning and instructional information appear on the introduction screen, along with two options, "MAIN MENU" and "READ ME". The default option in this instance is READ ME option 501 which is highlighted yellow. Processor 105 detects at step 317 whether MAIN MENU option 503 or READ ME option 501 is activated. If MAIN MENU option 503 is activated, routine 300 proceeds to step 340 to be described. Otherwise if READ ME option 501 is activated, routine 300 proceeds to step 320 where processor 105 causes a series of three screens to be displayed. The first screen of the series is a "MANUFACTURER" screen, which is illustrated in FIG. 6.

As shown in FIG. 6, a description of the QUICK TIPS system appears on the MANUFACTURER screen. If the text to be displayed exceeds one screen, which is the case here, scrolling options comprising scroll-up option 605 and scroll-down option 607 are provided. When option 605 is touched and activated on screen 209, additional text scrolls up one paragraph at a time. Option 607 performs an inverse function to option 605. Again, as an alternative, the user may maneuver PUSH TO SELECT knob 205d until the desired scroll option (or direction arrow) is highlighted yellow. The activation of the highlighted option is achieved by pressing ENTER switch 205b.

By default, displayed option 609 has the "AUTO VOICE" wording thereon and is highlighted blue as the MANUFACTURER screen comes on. Accordingly, a pre-recorded voice is activated by processor 105 through audio interface 118 to read the entire text associated with this screen without interruption, including the text which is not presently shown on screen 209 but otherwise shown upon scrolling. To alter the AUTO VOICE function, the user may touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "AUTO VOICE" wording on option 609 changes to "MANUAL VOICE", which is highlighted blue, indicating its active status.

In accordance with the MANUAL VOICE function, a pre-recorded voice reads the displayed text only, and stops reading until additional text is scrolled onto the screen. To silence the voice, the user may again touch option 609 on screen 209, or alternatively press ENTER switch 205b. By doing so, the "MANUAL VOICE" wording on option 609 changes to "VOICE OFF", and the voice is deactivated, with the option now highlighted yellow. The cycle of the AUTO VOICE, MANUAL VOICE and VOICE OFF functions can be repeated by successively touching option 609 or pressing switch 205b.

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Other displayed options on the screen of FIG. 6 include PREVIOUS option 611 and NEXT option 613. As indicated at step 323, option 611 when selected causes routine 300 to return to step 314, where the introduction screen of FIG. 5 is again displayed. Otherwise, if option 613 is selected, routine 300 proceeds to step 326 in FIG. 3C where processor 105 causes a "SAFETY REMINDERS" screen to be displayed on screen 209. FIG. 7 illustrates such a screen.

As shown in FIG. 7, like the MANUFACTURER screen, the SAFETY REMINDERS screen includes option 609 displayed with the default wording "AUTO VOICE" thereon, PREVIOUS option 611, NEXT option 613, scroll-up option 605 and scroll-down option 607. This screen reminds the user of the safety features of the vehicle including, for example, air bags and seat belts. As indicated at step 329, option 611 when selected causes routine 300 to return to step 320 of FIG. 3B. Otherwise if option 613 is selected, routine 300 proceeds to step 332 where processor 105 causes a "THEFT PROTECTION FEATURES" screen to be displayed on LCD screen 209. FIG. 8 illustrates such a screen.

As shown in FIG. 8, the THEFT PROTECTION FEATURES screen similarly has thereon displayed options 605, 607, 609, 611 and 613. This screen describes to the user a theft-deterrent system including the anti-theft routine of FIG. 3A equipped in the vehicle. As indicated at step 335, option 611 when selected causes routine 300 to return to step 326. Otherwise if option 613 is selected, routine 300 proceeds to step 338 where processor 105 causes a "QUICK TIPS SET-UP" screen to be displayed on LCD screen 209. FIG. 9 illustrates such a screen.

As shown in FIG. 9, the QUICK TIPS SET-UP screen comprises two arrays of displayed options, denoted 901 and 903, respectively. Array 901 concerns the volume of the audio part of system 100. In this illustrative embodiment, the user may select the options in array 901 to respectively turn the volume off, to a "SOFT" level, to a medium level, and to a "LOUD" level. Array 903 concerns the display of LCD 119 of system 100. In this illustrative embodiment, the user may select the options in array 903 to respectively turn the display off, adjust it to a "DAY" setting, adjust it to a "NIGHT" setting, and have it automatically adjusted. When the QUICK TIPS SETUP screen comes on, by default, the volume is set to a medium level (i.e., the "MED" option in array 901 highlighted blue), and the display is set to be automatically adjusted (i.e., the "AUTO" option in array 903 highlighted blue).

Also shown in FIG. 9 is NEXT option 905. By selecting this option, routine 300 returns to step 340 of FIG. 3B where a "MAIN MENU" screen is displayed on LCD screen 209. After routine 300 is performed, the screen of FIG. 9 can be invoked at any time by pressing SETUP switch 205g to re-adjust the volume and the intensity of the LCD of system 100.

FIG. 10 illustrates the MAIN MENU screen. This screen comprises displayed options disposed in columns 1001, 1003, 1005, and 1007. For example, column 1001 includes DRIVER'S VIEW option 1001a, STEERING COLUMN CONTROLS option 1001b, LOCK option 1001c, DRIVING TIPS option 1001d, and INDEX option 1001e. It should also be noted that this screen can be invoked at any time by pressing MENU switch 205e.

When the MAIN MENU screen comes on, by default, DRIVER'S VIEW option 1001a is highlighted yellow, indicating that it is selected. However, the user may touch any other displayed option on screen 209 for re-selection. A

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further touch on the yellow highlighted option changes its color to blue and activates same. Again, the user may alternatively maneuver PUSH TO SELECT knob 205d to re-select any other displayed option, followed by a depression of ENTER switch 205b to activate the selected option. Since LCD screen 209 is compact, the display area for each option on the MAIN MENU screen is generally small. As a result, selection and activation of an option by touching the option on the screen is susceptible to errors, especially when the vehicle is in motion. Thus, in this situation it may be preferable to achieve the same result using knob 205d and switch 205b, instead.

In addition, because of the small display area allocated to each option on the MAIN MENU screen, the wording on the option is brief and thus tends to be cryptic. In accordance with a feature of the invention, after a predetermined time (e.g., a few seconds) has elapsed from the option's being highlighted yellow, processor 105 causes a voice to be generated on speakers 127 to explain the purpose of the option before the user activates it. For example, after a predetermined delay from DRIVER'S VIEW option 1001a's being highlighted yellow, a voice is activated, stating the option name, followed by an explanation of the purpose of the option such as "To provide location of dash mounted components." Thus, this inventive feature affords a preview of the option before the user commits to it, thereby avoiding unnecessary backtracking.

Continuing the example, after hearing the preview of option 1001a, the user decides to select that option. In response, processor 105 causes a "DRIVER'S VIEW" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 11. When the DRIVER'S VIEW screen appears, VOICE option 1101 is highlighted blue, indicating that voice announcements are active. To disable the voice announcements, the user may touch VOICE option 1101 on screen 209, or alternatively press ENTER switch 205b. VOICE option 1101 would be highlighted yellow when disabled.

As also shown in FIG. 11, a view of the interior of the automobile from the driver's perspective is provided. Underneath that view, DASH-MOUNTED CONTROLS option 1103, INSTRUMENT PANEL option 1105, AUDIO SYSTEM option 1107, CLIMATE CONTROLS option 1109 and PREVIOUS option 1111 are displayed. By default, DASH-MOUNTED CONTROLS option is highlighted yellow. However, the user in this example decides to select INSTRUMENT PANEL option 1105, instead. By touching option 1105 on screen 209, the option is highlighted yellow. If VOICE option is not disabled, after a predetermined delay, an announcement such as "To provide information on gauges, meters and warning lights" comes on to preview the purpose or content of option 1105. Options 1103, 1107, and 1109 are similarly programmed. In this instance, selecting PREVIOUS option 1111 enables the user to return to the MAIN MENU screen of FIG. 10.

Continuing the example, assuming that the user activates option 1105 after hearing the preview, in response processor 105 causes an "INSTRUMENT PANEL" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 12. As shown in FIG. 12, the previous screen format is generally maintained in that it provides a view of the object (the instrument panel of the automobile in this instance) pertinent to the option which has been selected, along with displayed options for further selection thereunder. Based on the disclosure heretofore, the design and operation of these screens by now are apparent to a person skilled in the art, and become self-explanatory.

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In accordance with another feature of the invention, individual elements on the instrument panel shown in FIG. 12 are labeled with numerals "1", "2", "3", "4" and "5" which correspond to option 1201a designated "1. TACHOMETER AND WARNING LIGHTS", option 1201b designated "2. TURN SIGNAL/HAZARD WARNING", option 1201c designated "3. SPEEDOMETER AND WARNING LIGHTS", option 1201e designated "4. ODOMETER & TRIP METERS/OUTSIDE TEMPERATURE", and option 1201f designated "5. FUEL/TEMP GAUGE AND WARNING LIGHTS", respectively. As such, the function of the displayed options is two-fold. First, the wording on each displayed option informs the user of what the corresponding element(s) represents. Second, each displayed option is also for selection to obtain more information about the corresponding element(s). In addition, with the above voice preview feature, the user is further apprised of the purpose or content of the option before he/she commits to it. For example, TACHOMETER AND WARNING LIGHTS option 1201a corresponds to a voice preview such as "To provide information on tachometer and malfunction, maintenance required, low oil pressure and charging system failure indicators."

Assuming that the user in this instance activates option 1201a, in response processor 105 causes a "TACHOMETER AND WARNING LIGHTS" screen to be displayed on screen 209. Such a screen is illustrated in FIG. 13.

FIG. 13 shows VOICE option 1301 similar to option 1101 described before, TIP option 1303, a tachometer of the automobile denoted 1305, warning lights collectively denoted 1307, and options 1309a through 1309f in display segment 1311.

When TIP option 1303 appears on screen 209, it indicates that helpful hints or reminders are available upon selection thereof. In accordance with another feature of the invention, the appearance of TIP option 1303 is accompanied by the playing of a sound segment associated therewith. This sound segment may be pre-selected by the user from the SOUNDSGOOD library. After an adaptation period, the user would be able to rely on the familiar sound segment, without looking at the screen, to alert him/her of the availability of the TIP option.

Similarly, the user may pre-select another sound segment associated with warnings. Such a sound segment should connote urgency or even emergency as such warnings include, for example, engine overheating, an extremely low fuel level caution, GPS emergency information from navigation interface 106d, etc. Under control of processor 115, audio interface 118 preempts any on-going announcement and momentarily substitute therefor any such warning as soon as it occurs, which is preceded by the associated sound segment.

In any event, if option 1303 is selected in this instance, a voice comes on and utters a tip regarding tachometer 1305 such as "To prevent engine damage, do not drive with needle in red zone." This tip is also momentarily displayed on segment 1311 in lieu of options 1309a through 1309f.

Similar to the elements on the INSTRUMENT PANEL screen, tachometer 1305 and warning lights 1307 on this screen are individually labeled and correspond to options 1309a, 1309b, 1309c, 1309e and 1309f, respectively. Assuming in this example that MAINTENANCE REQUIRED option 1309c is activated, display segment 1311 would be replaced by new display segment 1411 illustrated in FIG. 14. As shown in FIG. 14, item 1401 indicates the subject selected, i.e., "MAINTENANCE

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REQUIRED". Item 1403 explains what the MAINTENANCE REQUIRED warning light, when on, indicates. In this instance it states, "Maintenance required warning light comes on to indicate it is time for scheduled maintenance." PREVIOUS option 1405 enables the user to reactivate segment 1311 of FIG. 13.

Assuming further that at this point the user wants to learn about and also to program the air conditioning of the automobile, the user may access a "CLIMATE CONTROL" screen by successively pressing the PREVIOUS option to backtrack to the DRIVER'S VIEW screen of FIG. 11, where CLIMATE CONTROLS option 1109 is available. As a second alternative, the user may press MENU switch 205e to invoke the MAIN MENU screen of FIG. 10, where a "CLIMATE CONTROLS" option within column 1003 is available. A third alternative is provided in the event that the user cannot immediately relate "air conditioning" to the CLIMATE CONTROLS option. At the MAIN MENU screen of FIG. 10, the user may select Index option 1001e to be described. It suffices to know for now that this option allows the user to access the "CLIMATE CONTROL" screen using the term "air conditioning".

FIG. 15 illustrates the "CLIMATE CONTROL" screen. With the voice enabled, a first touch on any displayed option on screen 209 causes it to be highlighted yellow, indicating its selected status. A second touch causes it to be highlighted blue, indicating its active status. With the voice disabled, only one touch on any displayed option activates it.

As shown in FIG. 15, the MODE options include OFF option 1511, AUTO option 1513, A/C option 1515, HEAT option 1517, and SMART CLIMATE option 1519. It should be noted that only one of the MODE options can be active at a time. In this example, assuming that the voice is enabled, when OFF option 1151 is selected by a first touch, a voice explaining the option comes on, uttering "To disable climate control." A second touch on the same option would then shut the climate control off through climate control interface 108f.

When AUTO option 1513 is selected by a first touch, a voice comes on to explain the option, uttering "System automatically determines air-flow distribution and volume for optimum efficiency." A second touch on the same option enables the automatic control, followed by a voice utterance, "Set desired temperature." Temperature display 1535 then flashes with the current temperature setting, prompting the user to set a desired temperature in a manner to be described.

If the user neglects to set a temperature after a predetermined time, in accordance with another aspect of the invention, a temperature range is automatically maintained by processor 105 in response to the date and time information from clock interface 108j, and the GPS information from navigation interface 106d. Based on the date and time information, processor 105 knows what the current season (e.g., mid-winter versus mid-summer) and time of the day (e.g., night verse noon) are. Based on the GPS information, processor 105 knows the region (e.g., New England versus Southern California) where the vehicle is. Processor 105 looks up a table stored in memory 115 containing predetermined temperature ranges corresponding to different combinations of the temporal and geographic parameters. It then prescribes an appropriate temperature range according to the table. This temperature range is updated by processor 105 periodically to reflect changes in the time of the day and the geographic location of the vehicle.

Similarly, A/C option 1515 and HEAT option 1517 respectively enable the user to activate air conditioning and heaters at a desired temperature or a default temperature range.

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SMART CLIMATE option 1519 is designed to allow the user to program the climate control for the next ride before he/she leaves the vehicle. When SMART CLIMATE option 1519 is selected by a first touch, a voice comes on to explain the option, uttering "To enable pre-heating or pre-cooling of the option, uttering "To enable pre-heating or pre-cooling of vehicle." A second touch on the option activates the function, followed by a voice utterance, "Set desired temperature. Set desired time using fan speed arrows." Temperature display 1535 then flashes the current temperature. Similarly, fan speed display 1541 then flashes the current setting, prompting the user to set a desired temperature. Similarly, fan speed display 1541 then flashes the current date, followed by current time, prompting the user to set the date, followed by the user plans to re-enter the vehicle. Through climate control interface 108f, processor 105 determines whether the current level of power from the car battery and any back-up power sources is sufficient. If it is insufficient, a message such as "Fail to pre-condition vehicle temperature" is issued through audio interface 118 to notify the user of the noncompliance. Otherwise, when it is close to the re-entry time, processor 105 determines the start-up time to effect the pre-conditioning, depending on the temperature difference between the inside and outside of the vehicle at that time. Processor 105 would then cause a combination of heaters and/or heat pumps (not shown) connected to interface 108f to pre-condition the vehicle temperature. In order to avoid substantially draining the power, in this illustrative embodiment, the requested temperature would be maintained up to an hour after the set re-entry time.

The Air options in FIG. 15 include FRESH option 1521 and RECIRCULATED option 1523. Only one of these two options can be active at a time. When FRESH option 1521 is selected by a first touch on the option, a voice comes on to explain the selected option, uttering "To select outside air to circulate in vehicle." A second touch on the option activates the selection to ventilate the vehicle with outside air. Similarly, RECIRCULATED option 1523 allows the user to select the inside air for recirculation in the vehicle.

The VENT options in FIG. 15 include FLOOR option 1525, FLOOR/DASH option 1527, DASH option 1529, DEFROST option 1531 and FLOOR/DEFROST option 1533. Only one of these five options can be active at a time. When FLOOR option 1525 is selected by a first touch on the option, a voice comes on explaining the option, uttering "Main air distribution to floor." A second touch on the option directs an air flow toward the vehicle floor.

Similarly, FLOOR/DASH option 1527 enables the user to bifurcate the air flow between the floor and the dashboard. DASH option 1529 enables the user to direct the air flow from the dashboard. DEFROST option 1531 enables the user to direct the air flow toward the windshield and select fresh air if not selected. FLOOR/DEFROST option 1533 enables the user to bifurcate the air flow between the floor and windshield.

Temperature display 1535 displays the temperature selected by the user. Touching on up-arrow 1537 increases the selected temperature while touching on down-arrow 1539 decreases same. Continued touching on either up-arrow 1537 or down-arrow 1539 causes the temperature setting to change rapidly.

Similarly, fan speed display 1541 displays the fan speed (high, medium or low) selected by the user. Touching on up-arrow 1543 increases the selected fan speed while touching down-arrow 1539 decreases same.

The HEATERS options in FIG. 15 include SEAT option 1547, MIRROR option 1549, REAR WINDOW option

1551, STEERING WHEEL option 1553, and ALL option 1554. One or more of these options can be active at the same time. When SEAT option 1547 is selected by a first touch on the option, a voice comes on to explain the option, uttering "To enable seat heaters." A second touch on the option activates the seat heaters connected to climate control interface 108f.

Similarly, MIRROR option 1549 enables the user to activate outside mirror heaters. REAR WINDOW option 1551 enables the user to activate a rear window defroster. STEERING WHEEL option 1553 enables the user to activate a steering wheel heater. Finally, ALL option 1554 enables the user to activate all of the heaters simultaneously.

In personalizing the vehicle, preference interface 116 monitors any user adjustments to certain vehicle functions by comparing their current settings with the corresponding stored preferences in memory 115. Thus, for example, if the user changes any of the settings relating to the climate control such as the mode, vent, air, temperature, fan speed, etc. from its previous preferred setting, preference interface 116 causes a SAVE screen to appear on screen 209. This SAVE screen is illustrated in FIG. 16. As shown in FIG. 16, the user is prompted to save the change in the setting that he/she has just made. The user at this point may activate the SAVE option 1601 to change the previous preferred setting. The SAVE screen thereafter disappears in favor of the previous screen. Otherwise, he/she may activate CLOSE option 1603 to close the SAVE screen, without storing the latest setting, which is then treated as a temporary setting. In the latter case, for example, a restart of the automobile will obliterate such a temporary setting, and reinstate the stored preferred setting.

Climate control screens can similarly be invoked by the front passenger and rear passengers on display interfaces 102c and 102d, respectively. Such screens provide similar MODE options including OFF, AUTO, A/C and HEAT options; and VENT options including LOWER VENT, UPPER VENT and LOWER/UPPER vent options. They also provide for temperature and fan speed adjustments for the respective localized areas. However, no save screen is provided.

Using INDEX option 1001e of FIG. 10 to look up information on and/or to control various items in the automobile will now be described. After option 1001e is activated, a DATA ENTRY screen illustrated in FIG. 17 is exhibited on screen 209. As shown in FIG. 17, a message "Enter Letter Or Item Name" appears to prompt the user for an entry of the name of the item of interest or its beginning letter. For this purpose, entry options for letters A through Z arranged in a grid format are provided in section 1701 for selection. In addition, DONE option 1703, when activated, indicates to system 100 that the entry is completed. Subdisplay 1705 is used to echo the user's entry to ensure its correctness.

In this illustration, the user enters "AIR CONDITIONING" as exhibited on subdisplay 1705. In response, an INDEX screen shown in FIG. 18 appears on display screen 209, with the search item name "AIR CONDITIONING" highlighted yellow. It should be noted that other item names such as "Anti-lock Brake System Indicator" are also shown, and they are in alphabetical order following "AIR CONDITIONING". This stems from the design of system 100 whereby the user may conveniently enter the beginning letter of the search item name only. In that case, a list of item names in alphabetical order with the first item name having the same beginning letter highlighted yellow. For instance,

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if the user had only entered "A" for "AIR CONDITIONING", a list of item names starting with "A" in alphabetical order would appear on screen 209 (although in this instance it would be the same list as shown in FIG. 18 as "AIR CONDITIONING" is the first item with a letter "A" in system 100). If the user cannot locate the name of the item of interest in the list, he/she may scroll the screen using scroll-up option 1801 or scroll-down option 1803 to review additional item names after or before the listed item names. Alternatively, the user may select PREVIOUS option 1805 to return to the screen of FIG. 17 to enter the complete item name.

In any event, after the user locates the item name on the INDEX screen, the user may then touch the item name to access information on that item. To that end, a look-up table is stored in memory 115. FIG. 19 illustrates such a look-up table, wherein left column 1901 lists each item name in alphabetical order in the index, and right column 1903 lists the corresponding instruction for processor 105 to carry out to access information on that item. For example, according to row 1905 of the table, the selection and activation of the item name "AIR CONDITIONING" causes processor 105 to connect the user to the CLIMATE CONTROL screen of FIG. 15 previously described.

The foregoing merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise numerous other systems which embody the principles of the invention and are thus within its spirit and scope.

For example, based on the disclosure heretofore, it is apparent that through system 100, the user can run diagnostics on selected parts of the automobile by voice command or touch-screen control.

In addition, in the disclosed embodiment, through system 100, the user is able to program the climate control for the next ride before he/she leaves the vehicle. It will be appreciated that the user will be able to achieve same remotely ahead of time via telecommunication means. For example, processor 105 may be programmed to accept climate control commands through phone interface 106a. In that instance, the user can call from anywhere to establish a phone connection with phone interface 106a using a predetermined phone number, through which the user communicates the commands to climate control interface 108f to program the climate control. Through the phone connection, the user may be provided with climate control options described above in a synthesized voice. The user may activate one or more of such options by pressing a predetermined touch-tone key on the telephone keypad corresponding to a "yes" or "no" response. Similarly, the user may achieve the relevant temperature and/or time settings by pressing the touch-tone keys corresponding to the numerals indicative thereof. Of course, telecommunication means other than the telephone including a radio frequency (RF) transmitter may also be used to communicate the climate control commands from a remote area.

In addition, in the disclosed embodiment, the user may access different screens provided by AUTO DIRECTOR display interface 102a to learn about and control certain vehicle functions. It will be appreciated that a person skilled in the art will develop a demonstration program wherein a series of such screens will be automatically presented to a user in a predetermined sequence. The presentation may include commentaries, and highlights on selected options displayed on each screen. Furthermore, the presentation may be coupled with the showing of actual vehicle functions. For

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example, in demonstrating the climate control screen of FIG. 15, while the function of a highlighted VENT option (e.g., Floor, Floor/Dash, Dash, Defrost or Floor/Defrost) is explained, it is activated so that the user in the automobile can feel an actual air flow from the corresponding direction. The above demonstration program may be invoked using a PIN provided by the automobile manufacturer. The program may run continually while the automobile is shown in a showroom, or may be invoked by the user occasionally to obtain relevant information.

Further, in the disclosed embodiment, the MAINTENANCE REQUIRED warning light comes on when it is time for scheduled maintenance. In accordance with another aspect of the invention, the maintenance is scheduled by system 100 according to the cumulative time of the tachometer reading above a predetermined RPM value. Such cumulative time reflects the extent of the engine wear, and if it exceeds a predetermined length of time without maintenance, the engine performance would degrade substantially. In measuring the cumulative time in question, a conventional comparator (not shown) is employed in system 100 to compare the instantaneous tachometer reading (provided by engine control interface 112c) with the predetermined RPM value. Each time when the tachometer reading exceeds the predetermined value, processor 105 is interrupted to register the length of such an occurrence. The latter is added to a running sum to update the cumulative time in question. This cumulative time may be displayed on instrument panel display interface 102e, along with the tachometer reading and the MAINTENANCE REQUIRED warning indicator. A second conventional comparator (not shown) is employed in system 100 to compare the cumulative time with the above predetermined time length. As soon as the cumulative time exceeds the predetermined length, processor 105 is interrupted and causes the MAINTENANCE REQUIRED warning light to come on, indicating that it is time for maintenance.

Still further, system 100 as described is highly adaptable in adjusting to new system requirements, and capable of "learning" new automobile features to be introduced into the system. Such learning may involve a modification or an upgrade in the system software stored in memory 115.

Moreover, other features of system 100 may include capabilities of communications with a third party remote from the vehicle. For example, system 100 may be programmed to transmit signals representing data on the current speed of the vehicle and its VIN receivable by a radar system, thus enabling the third party to monitor its speed. Furthermore, system 100 may be programmed by the third party to disable and subsequently enable the vehicle upon successful verification of a PIN pre-assigned to the third party. To that end, system 100 is capable of receiving remote transmission of the PIN, followed by the disable or enable code. The transmission may be encrypted for security reasons. Furthermore, more than one PIN may be used for different purposes. For example, a PIN may be assigned to a law enforcement agency to disable the vehicle because of a suspension of a license, or to temporarily disable the vehicle when the driver is intoxicated. Another PIN may be assigned to an environmental protection agency to disable the vehicle for failing to meet the emission requirements. Yet another PIN may be assigned to the vehicle owner to disable the vehicle when parked, thereby reducing the risk of a car theft. The disabling of the vehicle involves cutting off its gas, putting on its anti-lock brakes, etc.

Further, system 100 is capable of receiving a low-frequency, low-power broadcast covering an area of a lim-

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ited radius, referred to as a "Cell". The broadcast may provide electronic GPS map and Yellow Page type information pertaining to the cell. This information, when received, may be downloaded onto AUTO DIRECTOR display interface 102a or multifunction display interface 102b. Such information includes a local directory indicating locations of nearby gas stations, restaurants and other facilities on the GPS map, with respect to the current location of the automobile. The local directory may be formatted in the form of "web pages" featuring the local businesses, and include additional information such as business hours, telephone numbers, and information on products and services provided by such businesses.

The above broadcast may also provide local weather information sponsored by a civic group or commercial entity. In the case of civic group sponsorship, the local civic events may be posted alongside the weather information, and in the case of commercial sponsorship, advertisements may be posted instead. Of course, as the automobile moves from cell to cell, the contents of the broadcast change accordingly.

In addition, while the radio in the automobile is tuned to a particular radio station, system 100 is also capable of receiving any electronic files broadcast from that radio station, along with the radio program. These electronic files, which may be in the form of web pages, can be downloaded onto the system. The system user may then scroll the pages to learn such information as program listings and coming events sponsored by the radio station.

Moreover, in the disclosed embodiment, system 100 is illustratively used in an automobile. It will be appreciated that a person skilled in the art may also employ the inventive system in another type of vehicle such as a boat, an airplane, etc.

Finally, although information and control system 100, as disclosed, is embodied in the form of various discrete functional blocks, the system could equally well be embodied in an arrangement in which the functions of any one or more of those blocks or indeed, all of the functions thereof, are realized, for example, by one or more appropriately programmed processors or devices.

We claim:

1. A system for use in a vehicle comprising:
 - a display element;
 - an output element for providing information concerning at least one device in the vehicle;
 - a processor for identifying a notable condition of the vehicle;
 - a mechanism for providing an alert indicating the notable condition, a provision of the information concerning the at least one device being interrupted by the alert; and
 - an interface for selecting an option, which is provided on the display element in response to the notable condition, thereby prompting a user to select the option to obtain selected information to cope with the notable condition.
2. The system claim 1 wherein the alert is provided via audio media.
3. The system of claim 2 wherein the alert comprises a preselected audio signal.
4. The system claim 1 wherein the at least one device includes a fuel gauge.
5. The system of claim 1 wherein the at least one device includes a speedometer.
6. The system of claim 1 wherein the at least one device includes an odometer.

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7. The system of claim 1 wherein the at least one device includes a tachometer.

8. The system of claim 1 wherein the at least one device includes a temperature gauge.

9. The system of claim 1 wherein the at least one device includes a climate control.

10. The system of claim 1 wherein the notable condition concerns engine overheating in the vehicle.

11. The system of claim 1 wherein the notable condition concerns a low fuel level in the vehicle.

12. The system of claim 1 wherein the selected information is provided to the user via audio media.

13. The system of claim 1 wherein the selected information is provided to the user textually.

14. The system of claim 1 wherein the output element includes the display element.

15. A method for use in a system in a vehicle, the system including a display element, the method comprising:

providing information concerning at least one device in the vehicle;

identifying a notable condition of the vehicle;

providing an alert indicating the notable condition, a provision of the information concerning the at least one device being interrupted by the alert; and

providing an option on the display element in response to the notable condition, thereby prompting a user to select the option to obtain information to cope with the notable condition.

16. The method claim 15 wherein the alert is provided via audio media.

17. The method of claim 16 wherein the alert comprises a preselected audio signal.

18. The method claim 15 wherein the at least one device includes a fuel gauge.

19. The method of claim 15 wherein the at least one device includes a speedometer.

20. The method of claim 15 wherein the at least one device includes an odometer.

21. The method of claim 15 wherein the at least one device includes a tachometer.

22. The method of claim 15 wherein the at least one device includes a temperature gauge.

23. The method of claim 15 wherein the at least one device includes a climate control.

24. The method of claim 15 wherein the notable condition concerns engine overheating in the vehicle.

25. The method of claim 15 wherein the notable condition concerns a low fuel level in vehicle.

26. The method of claim 15 wherein the selected information is provided to the user via audio media.

27. The method of claim 15 wherein the selected information is provided to the user textually.

28. Software including machine readable instructions stored in a tangible medium for performing a process, the process comprising:

providing information concerning at least one device in the vehicle;

identifying a notable condition of the vehicle;

providing an alert indicating the notable condition, a provision of the information concerning the at least one device being interrupted by the alert; and

providing an option on the display element in response to the notable condition, thereby prompting a user to select the option to obtain information to cope with the notable condition.

* * * * *



US006703944B1

(12) **United States Patent**
Obradovich

(10) Patent No.: **US 6,703,944 B1**
(45) Date of Patent: **Mar. 9, 2004**

(54) **TECHNIQUE FOR EFFECTIVELY
MAINTAINING A SAFE DISTANCE
BETWEEN A VEHICLE AND AN OBJECT**

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Related U.S. Application Data

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(51) Int. Cl.⁷ **G08G 1/16**

(52) U.S. Cl. **340/903; 340/435; 340/436;
367/101; 367/909; 345/349**

(58) Field of Search **340/903, 901,
340/435, 436; 367/101, 909, 94; 345/349**

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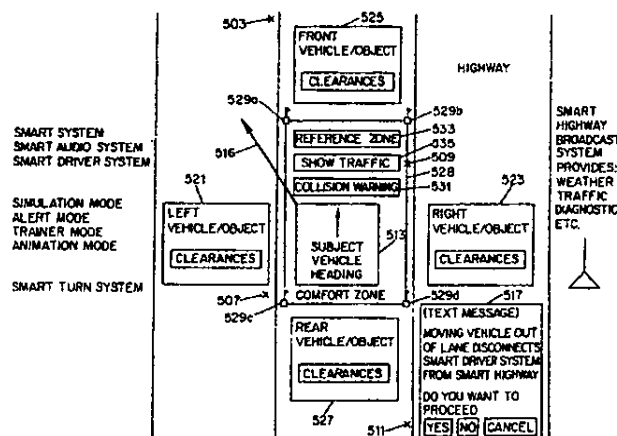
Primary Examiner—Nina Tong

(74) Attorney, Agent, or Firm—Kaye Scholer LLP

(57) **ABSTRACT**

In a control and management system for automobiles, a
central processor in the system connects traditionally unre-
lated vehicle subsystems together to realize synergistic
functions such as smart driving, automatic parking, etc. A
master interface having a display is employed in the system
to help a user control and manage the vehicle functions.

12 Claims, 17 Drawing Sheets



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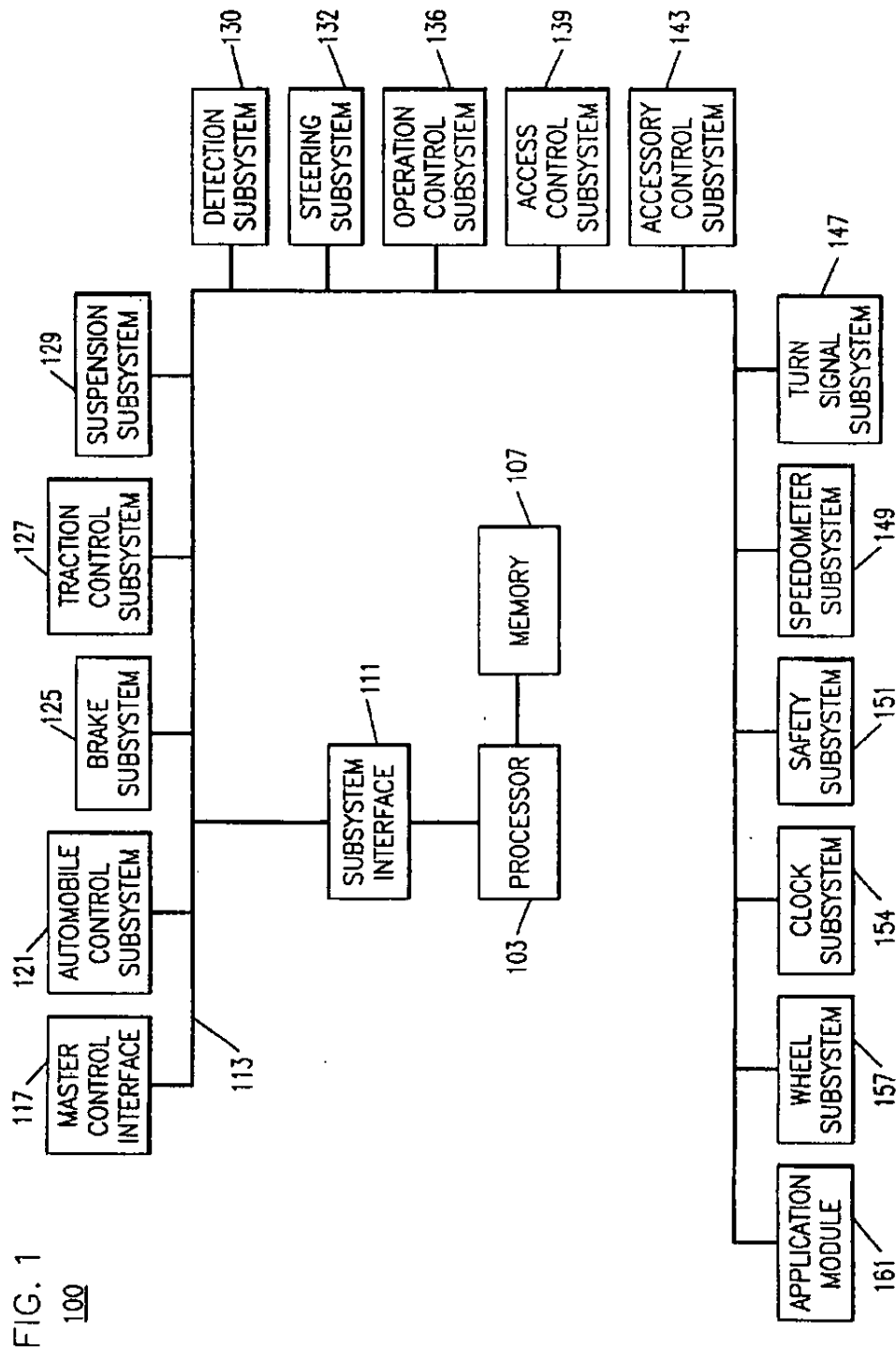
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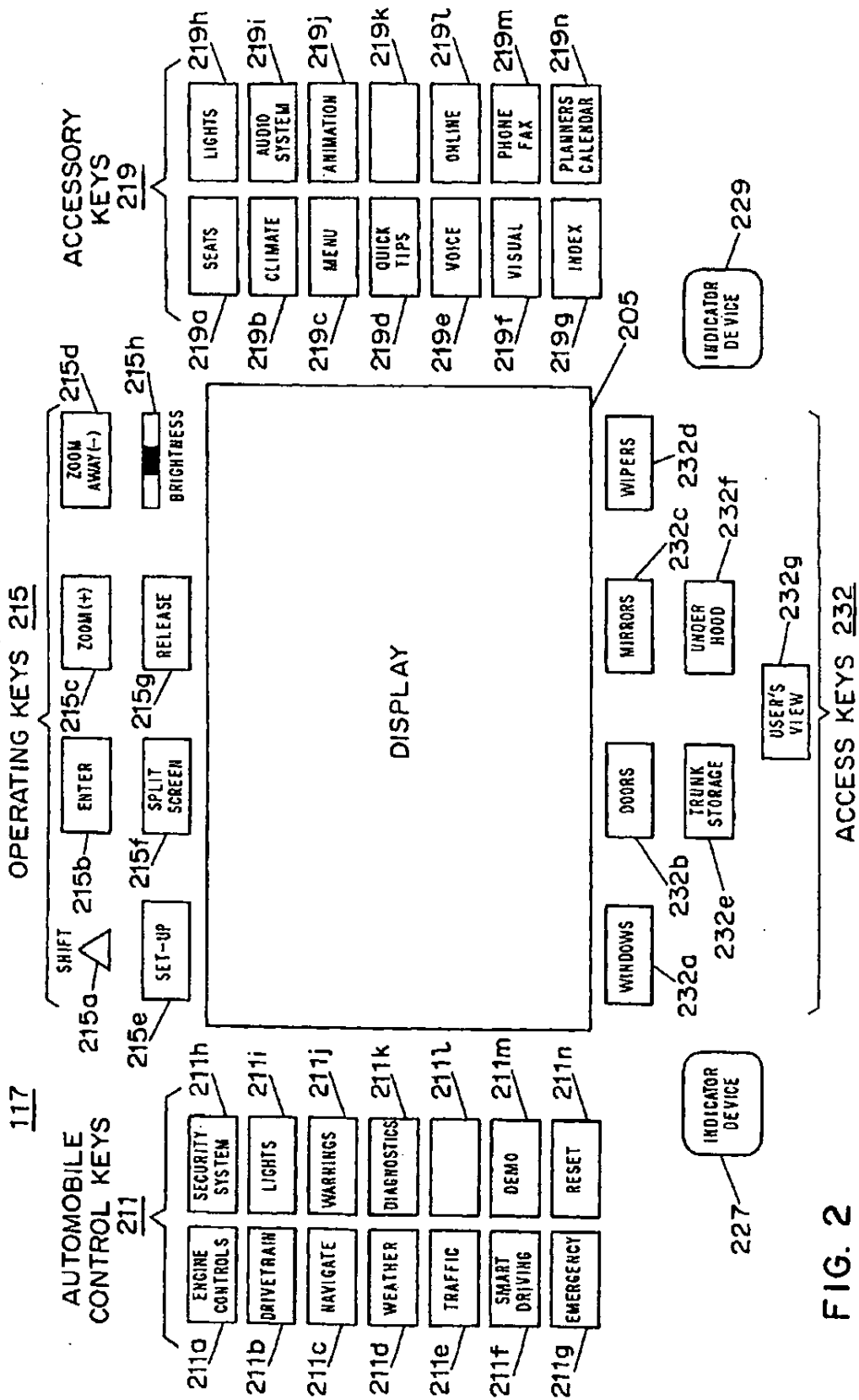


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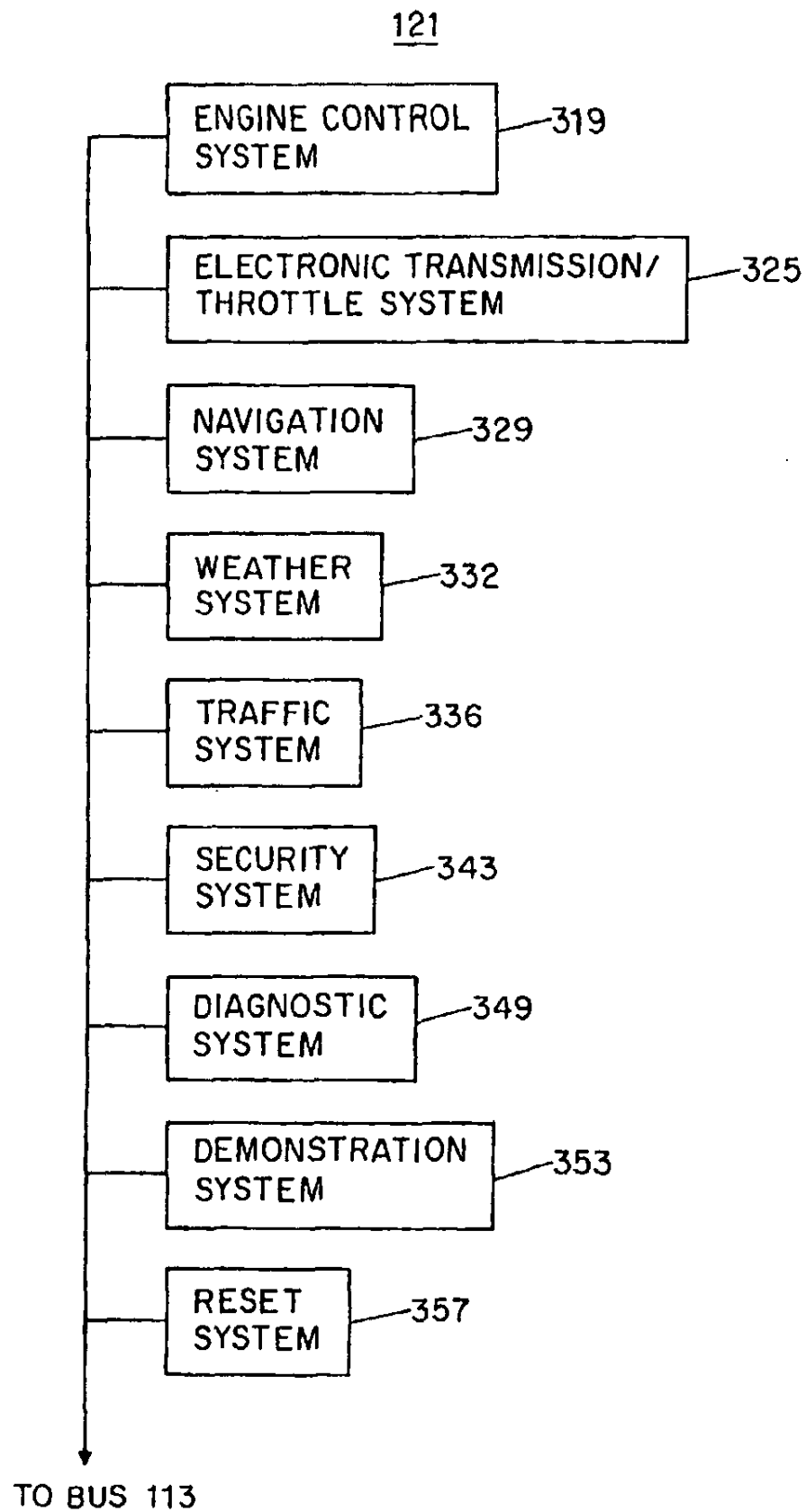


FIG. 3

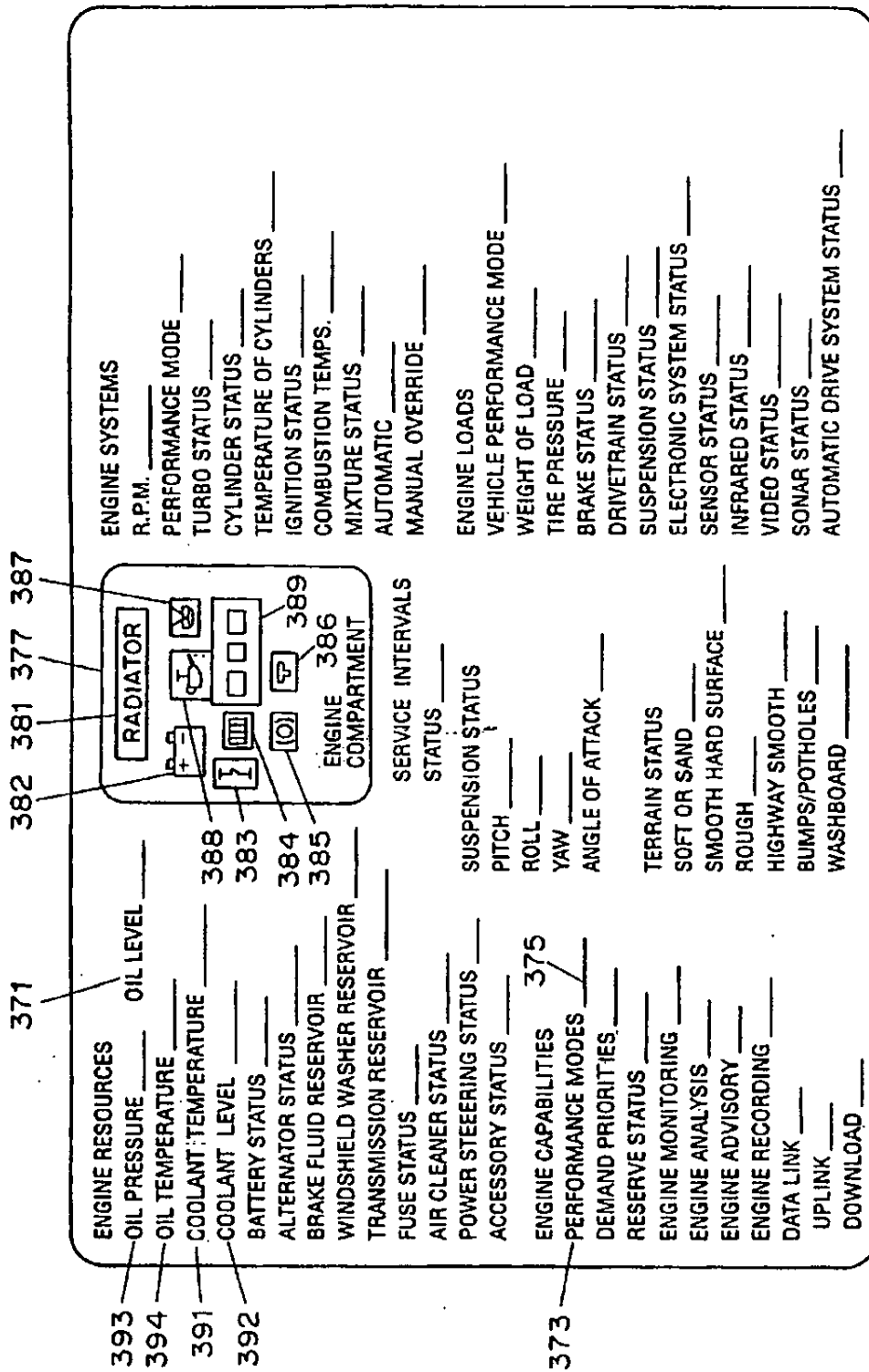


FIG. 4

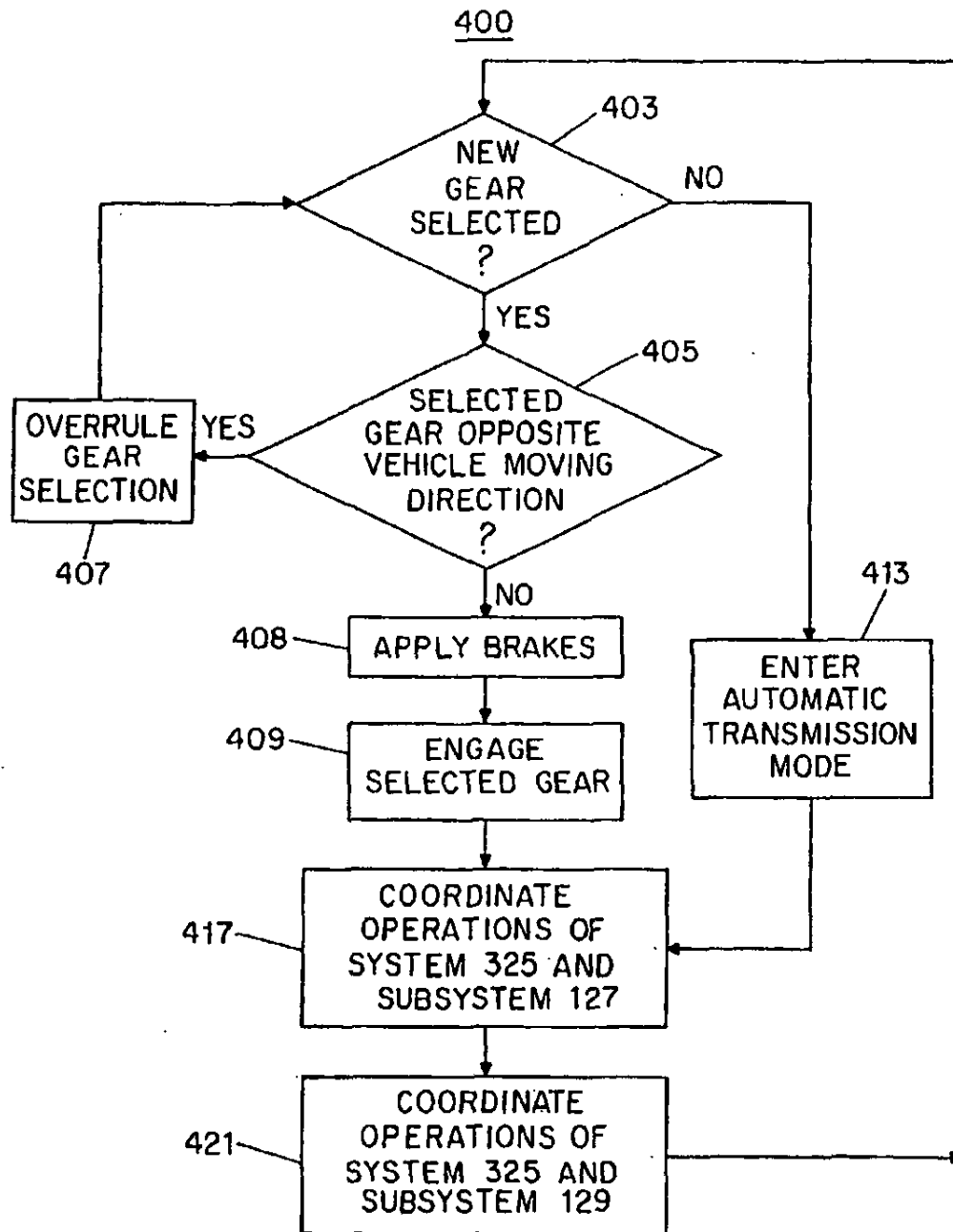


FIG. 5

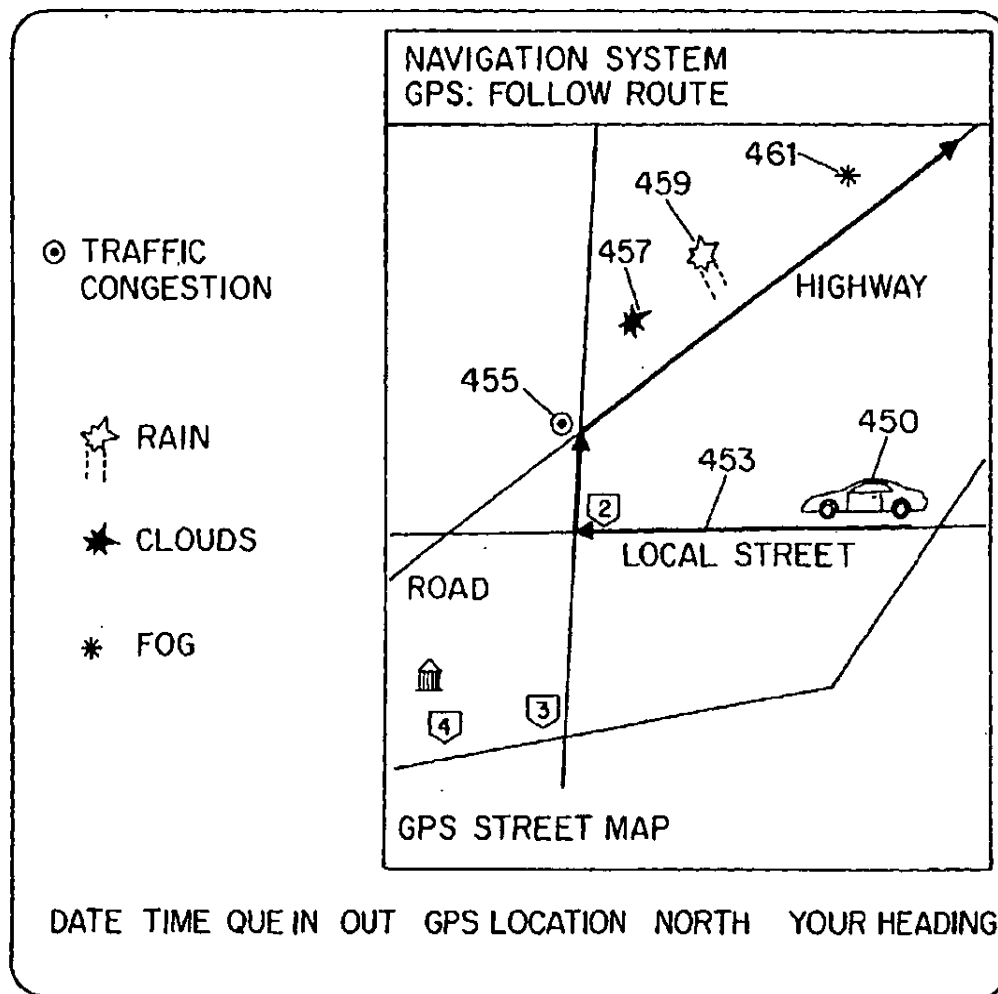


FIG. 6

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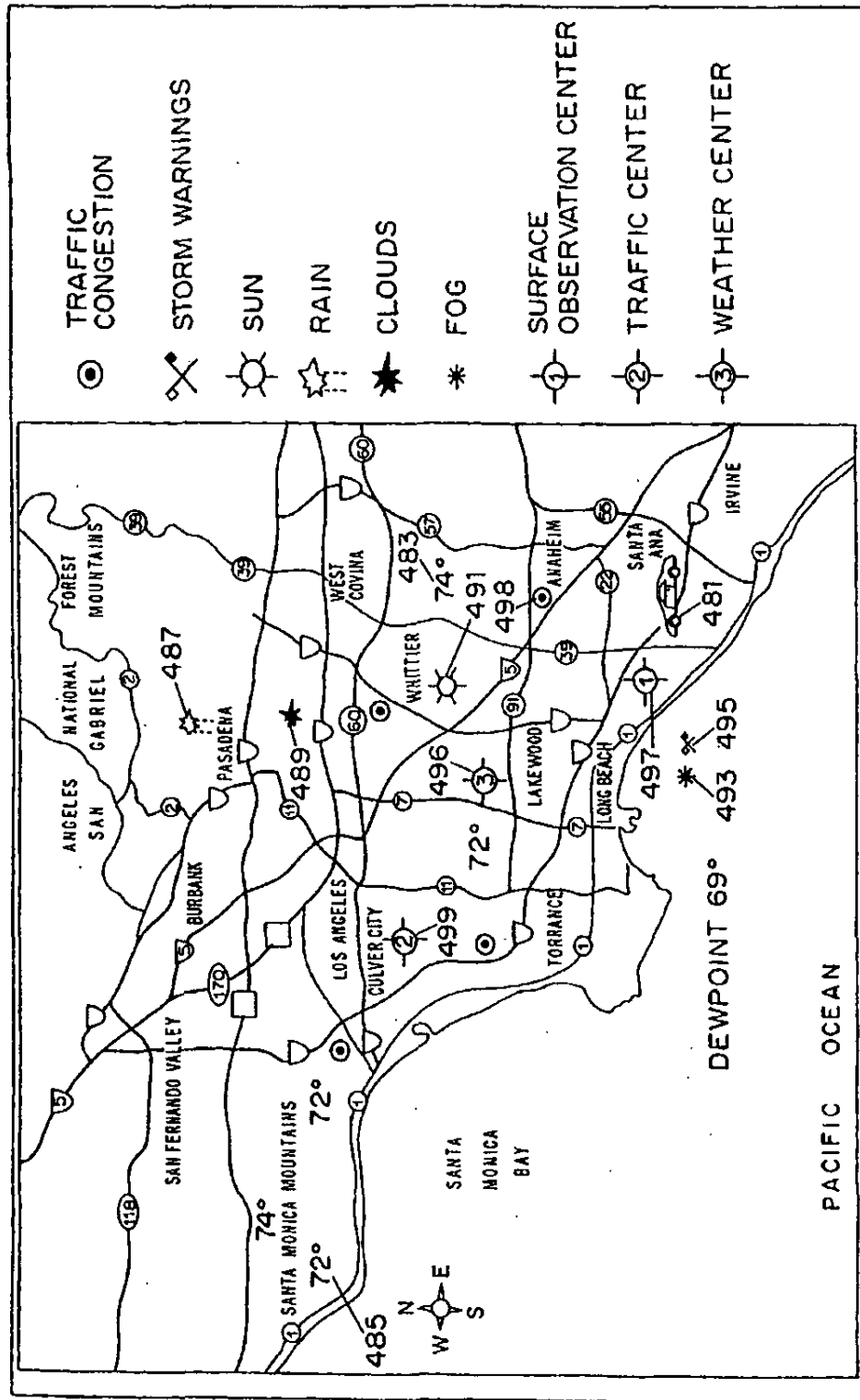
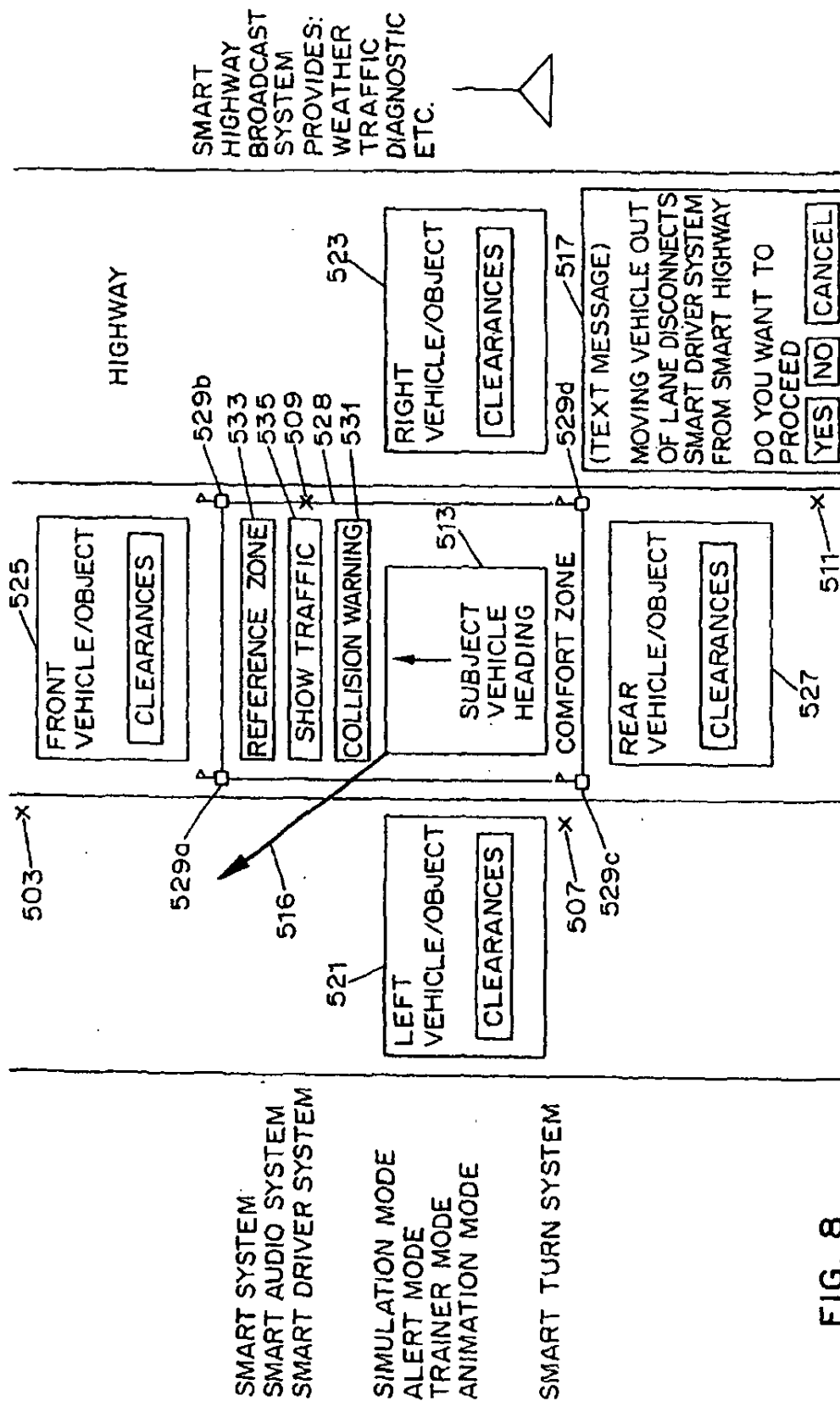


FIG. 7



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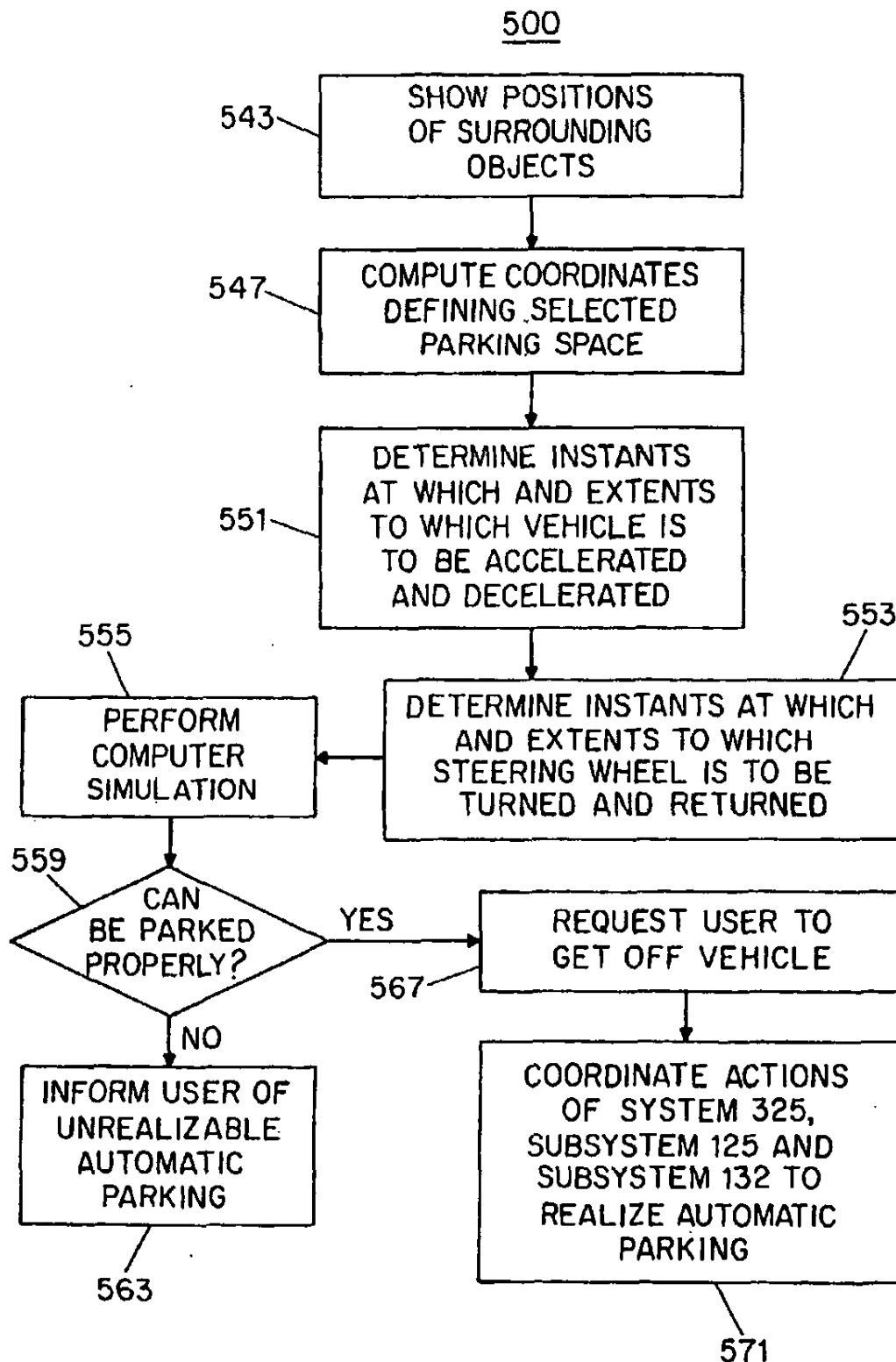


FIG. 9

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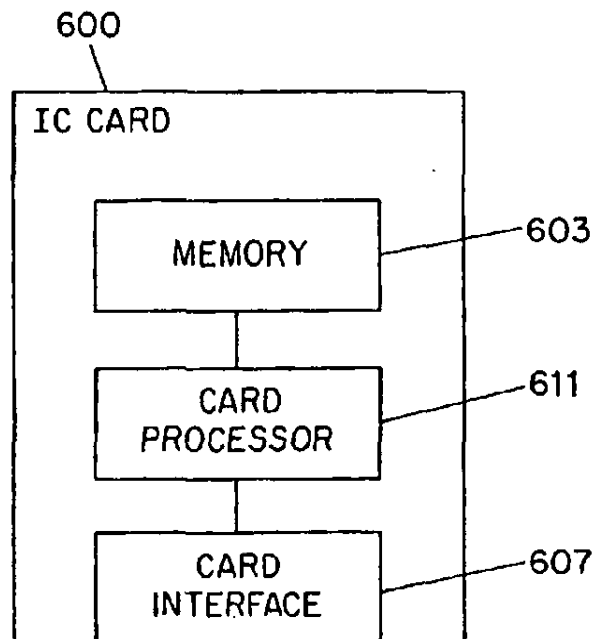


FIG. 10

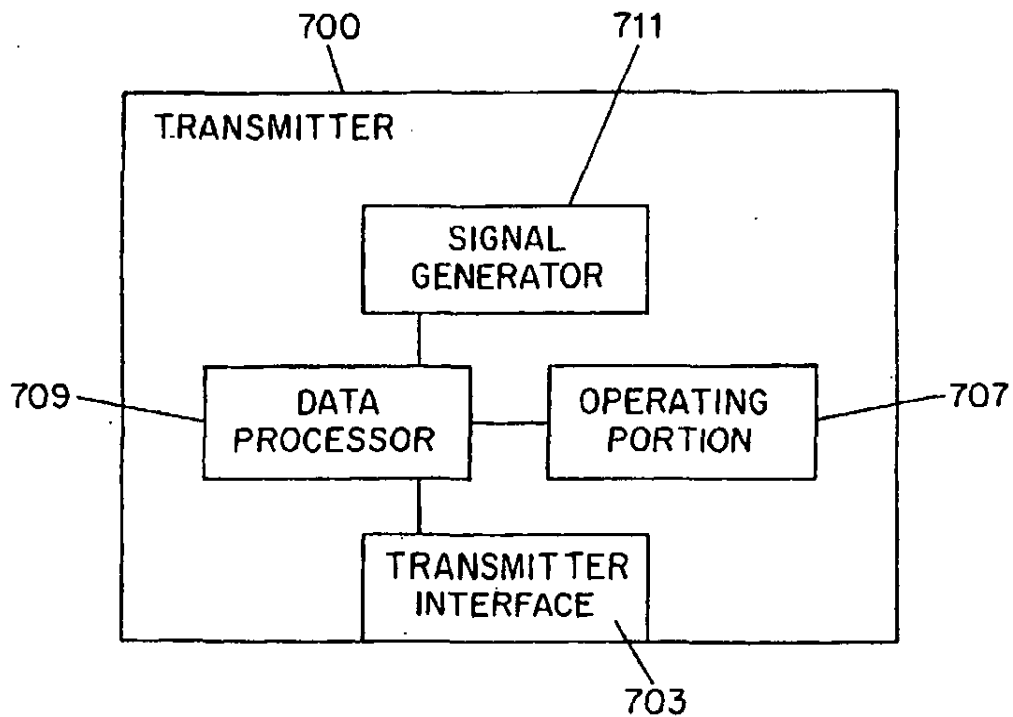


FIG. 11

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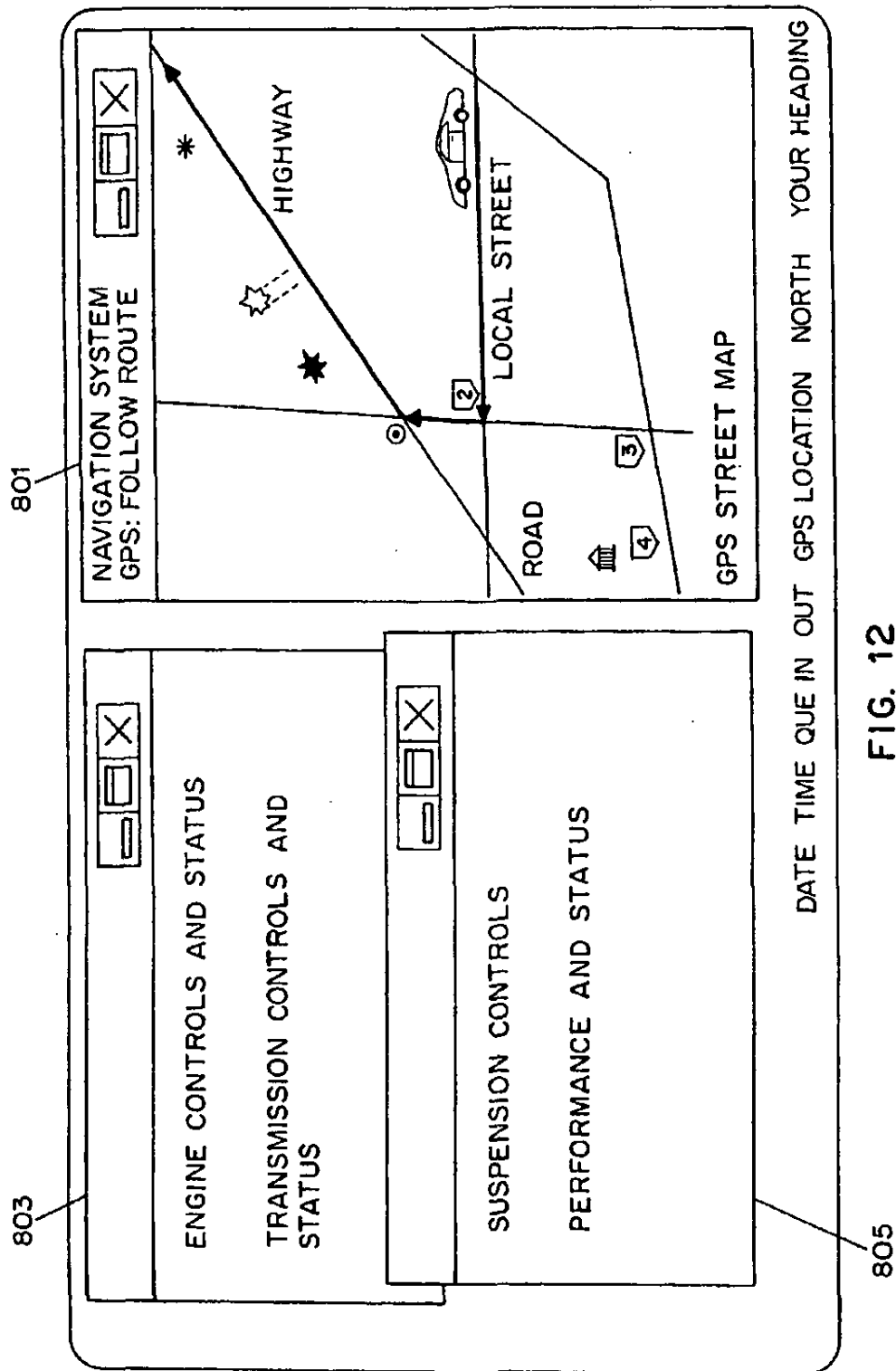
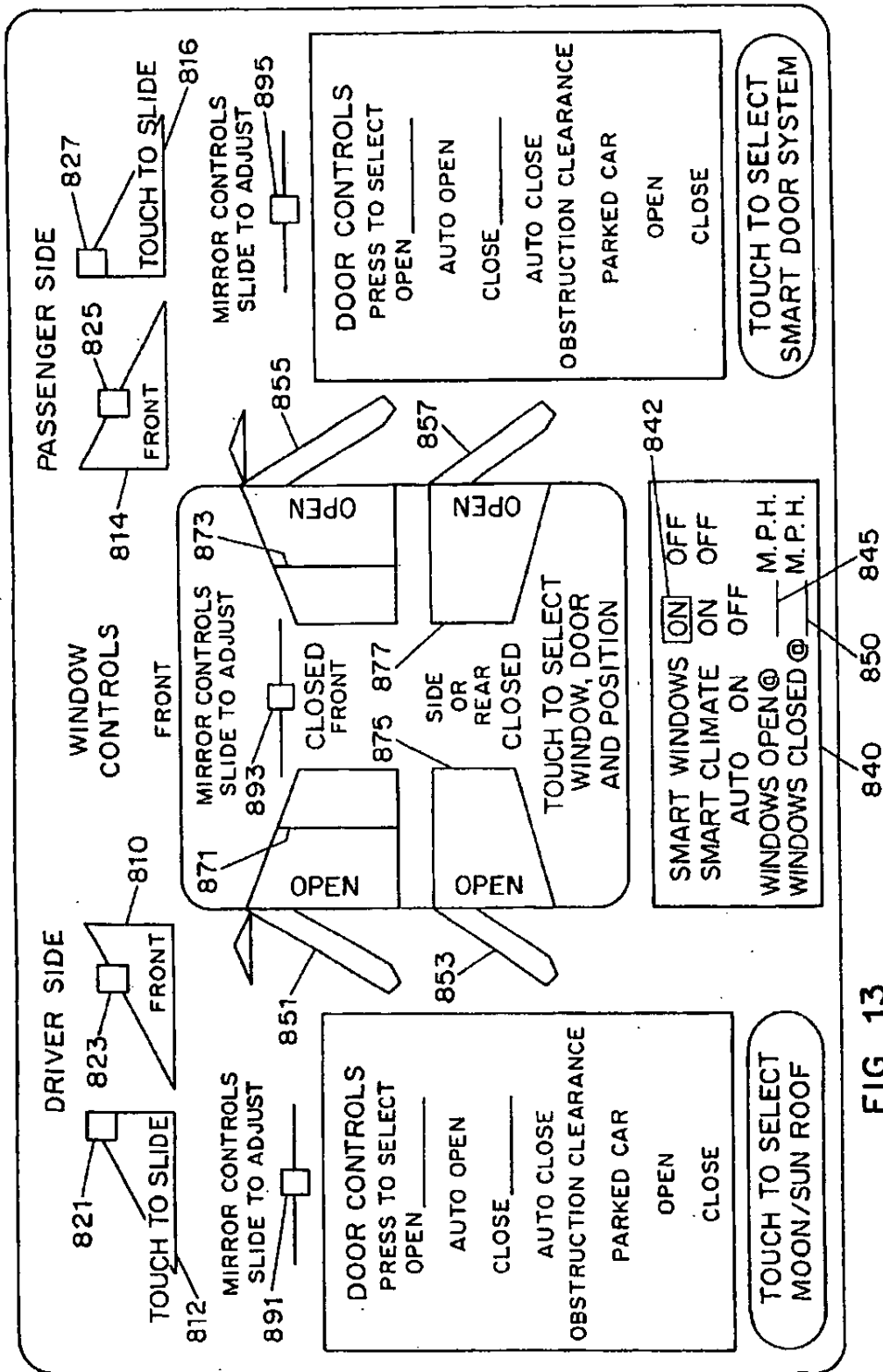


FIG. 12



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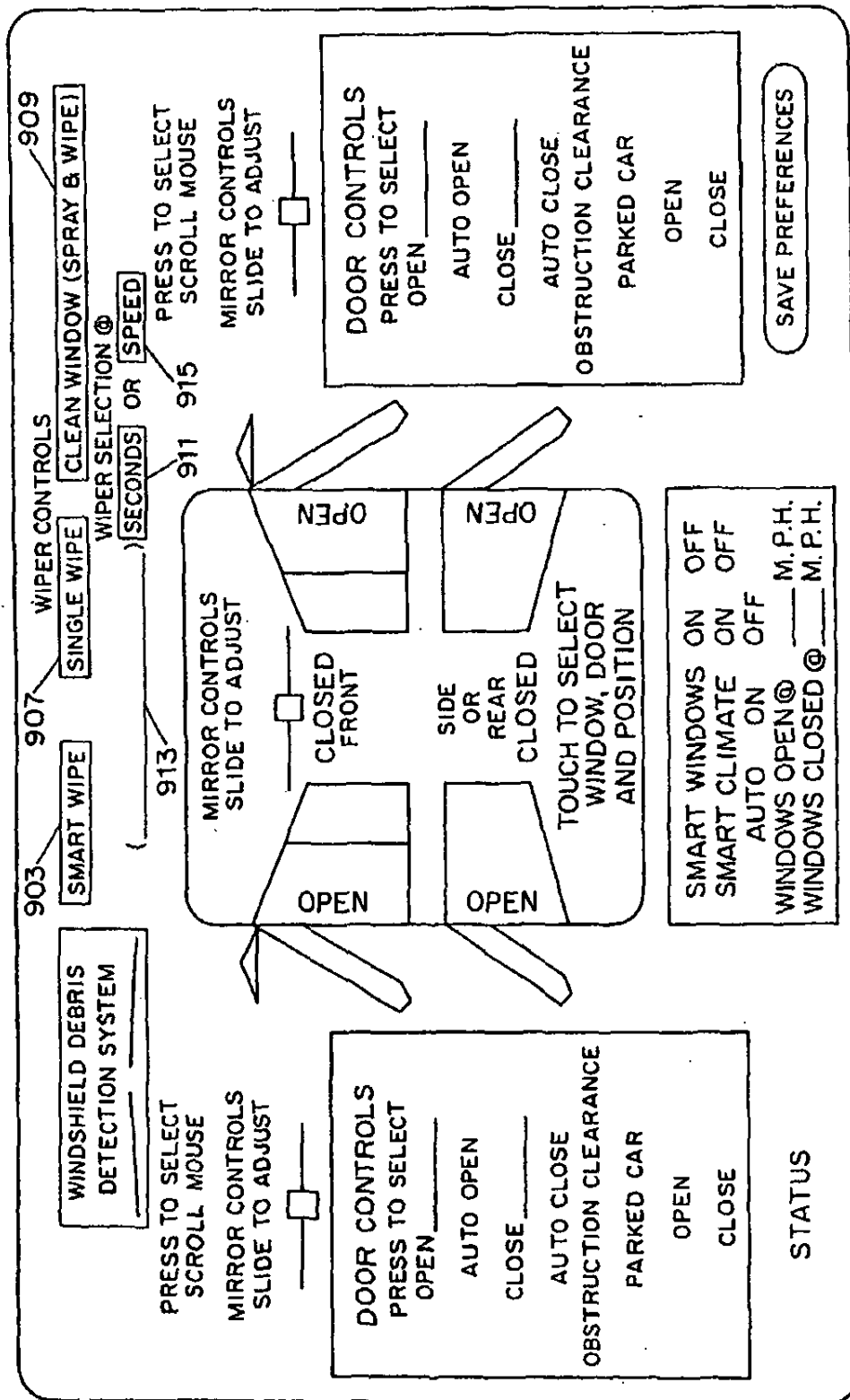


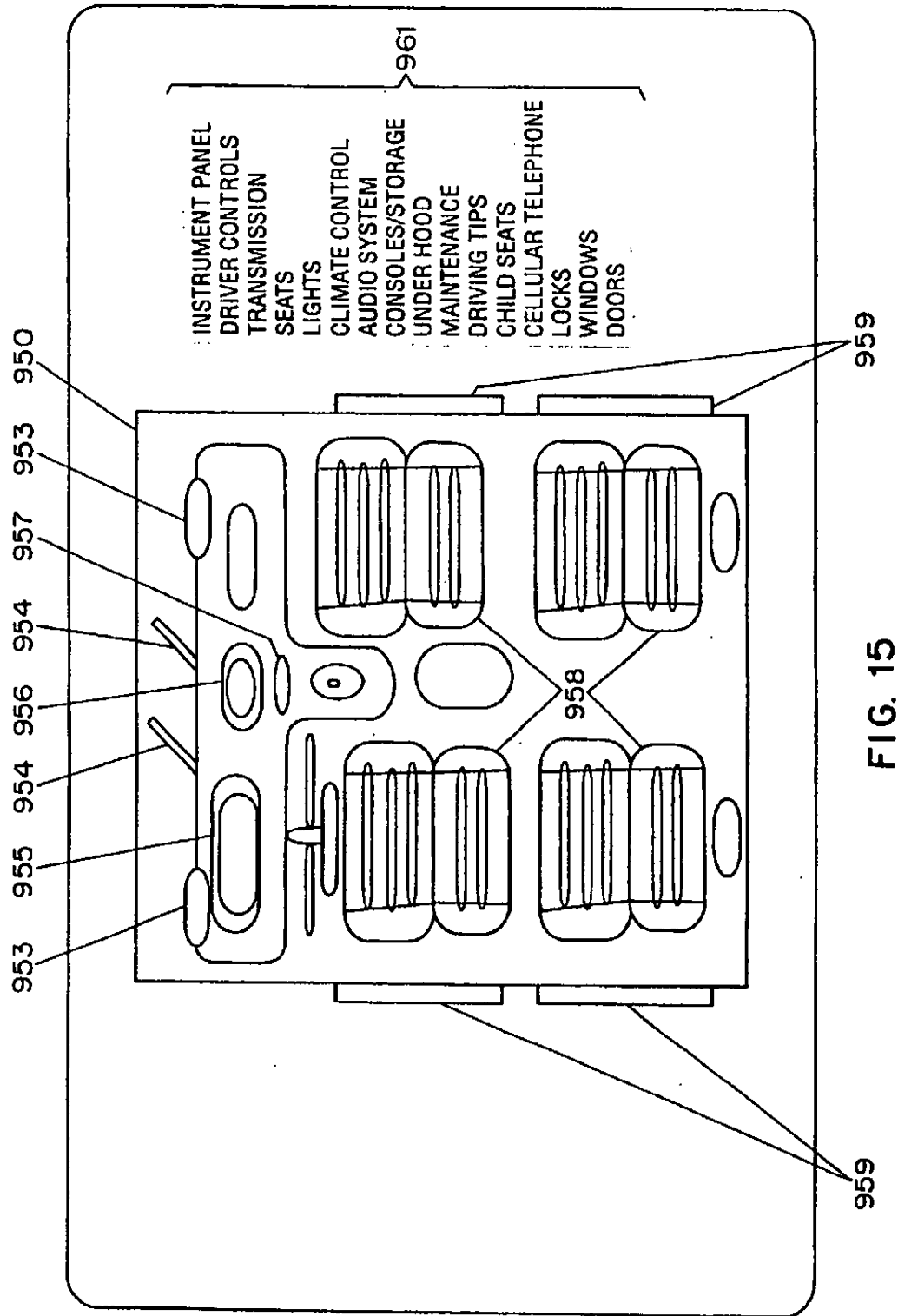
FIG. 14

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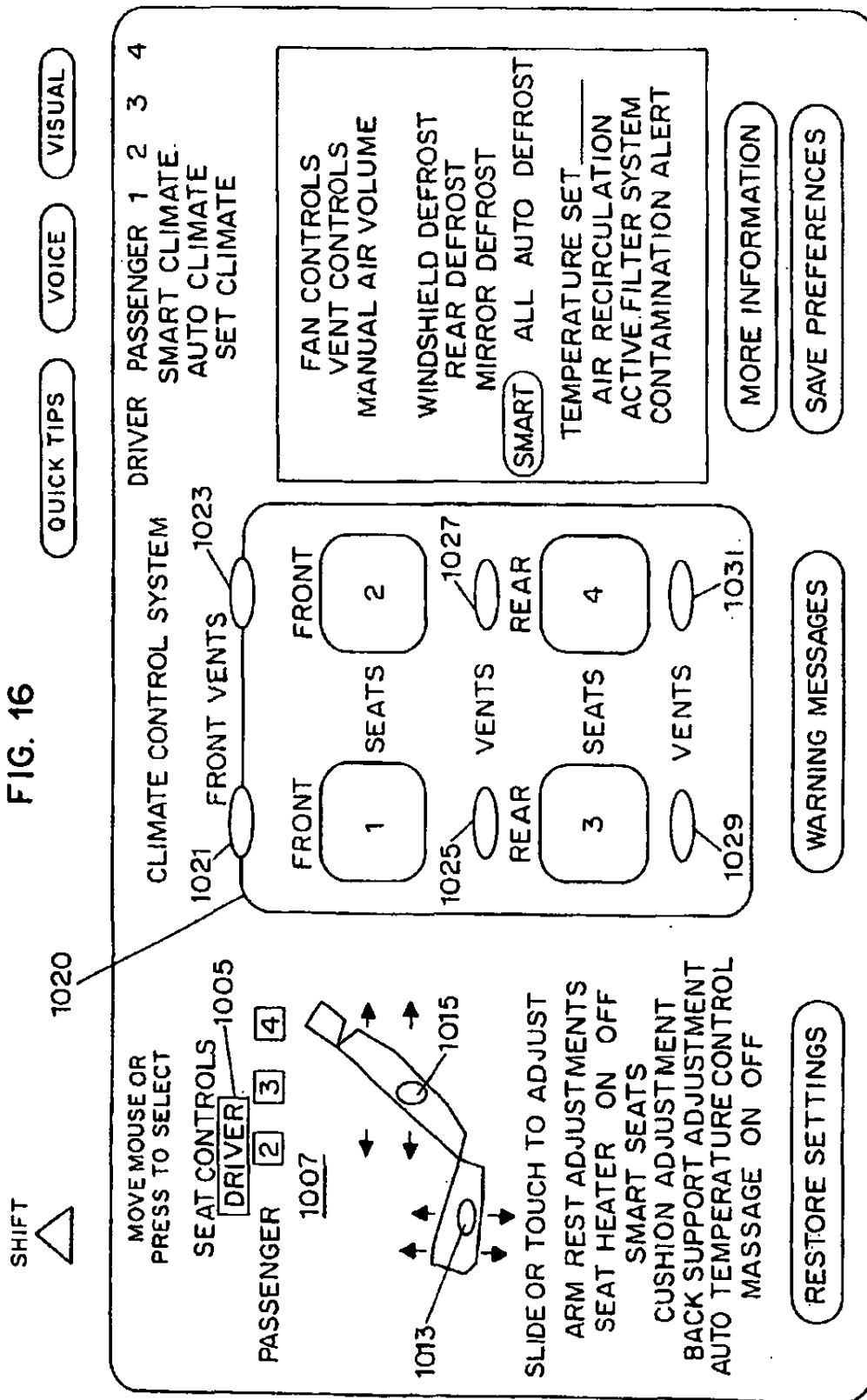
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FIG. 16



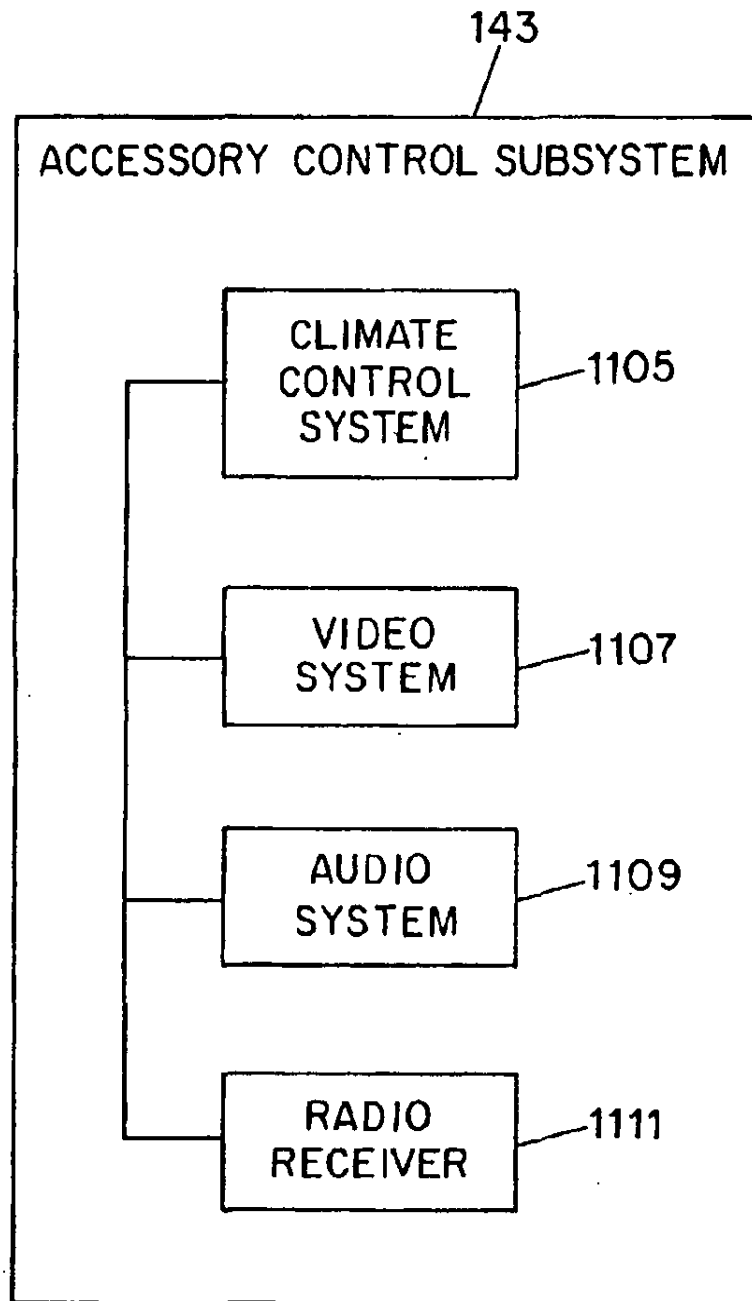


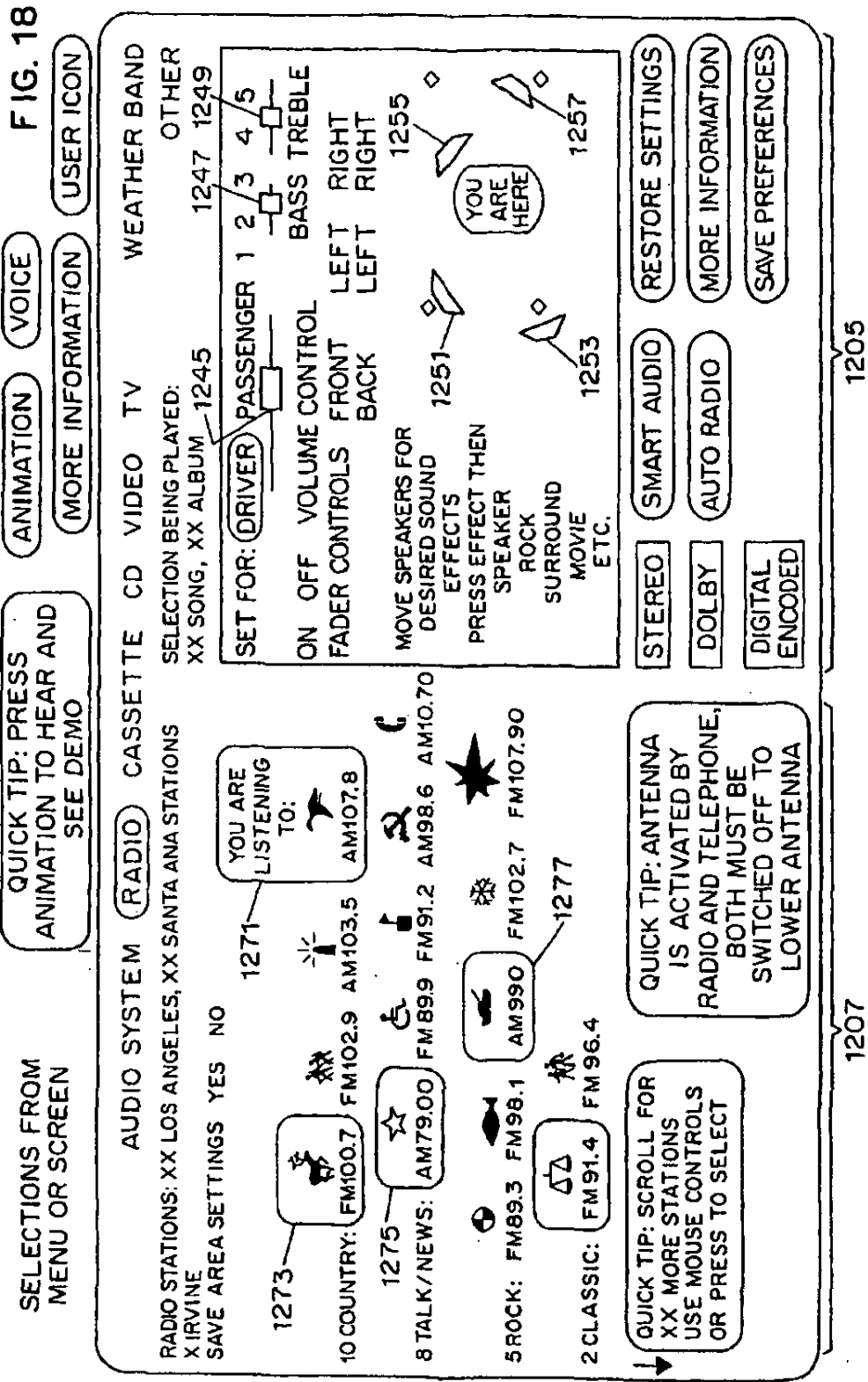
FIG. 17

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TECHNIQUE FOR EFFECTIVELY MAINTAINING A SAFE DISTANCE BETWEEN A VEHICLE AND AN OBJECT

This application is a division of application Ser. No. 08/904,855, filed on Aug. 1, 1997, now U.S. Pat. No. 6,275,231.

STATEMENT OF RELATED APPLICATIONS

The present application is related to copending, commonly assigned U.S. patent application Ser. No. 08/789,934, entitled "Multimedia Information and Control System for Automobiles."

FIELD OF THE INVENTION

The invention relates generally to control and management systems and, more particularly, to a system for use in an automobile which facilitates the user's control and management of various vehicle functions.

BACKGROUND OF THE INVENTION

The concept of an automated highway system (AHS) has been fervently pursued. Although the interpretation of the AHS concept varies from one person to another, people implementing the concept are incorporating more and more technology into an automobile to improve its operations, better its safety measures, and add conveniences to the vehicle user.

A prevalent interpretation of the AHS concept is hands-free driving. To that end, magnets have been buried along an experimental automated highway, and automobiles have been equipped with magnetometers to sense the magnets to guide the moving vehicles, thereby obviating manual steering. In another approach, an automobile is equipped with a video system in which cameras monitor different segments of the road ahead and feed images to on-board computers that control steering, acceleration and braking of the vehicle.

Although the above hands-free driving systems are at various stages of development and will be made available to the public in years to come, a less comprehensive system known as an "adaptive cruise control system" will soon be publicly available. This system is capable of adjusting a vehicle's speed to keep it moving with the flow of traffic. Specifically, it relies on radar or infrared sensors to measure the distance to the vehicle just ahead. If the vehicle ahead speeds up or slows down, an onboard computer adjusts the throttle or brakes to maintain a safe distance.

Although the ultimate AHS is in the works, it is believed that the building blocks therefor are in place. These building blocks include the well-known "drive-by-wire" system, TRAXXAR stability control system, global positioning satellite (GPS) navigation system, etc. The drive-by-wire system refers to a throttle system responsive to electrical control signals to adjust the speed of a vehicle, and plays a major role in the aforementioned adaptive cruise control system.

In the TRAXXAR system, sensors are used to measure the steering wheel position, yaw rate and lateral acceleration of the vehicle. These sensors work with an onboard computer to controllably apply brakes at selected wheels to avoid potential skids.

In a well-known manner, the GPS navigation system receives signals from a constellation of satellites. In response to such signals, the navigation system pinpoints the vehicle's location (in latitude and longitude). It also detects

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the vehicle's speed and direction. With geographic information stored on an onboard computer, the navigation system is capable of verbally and visually communicating to the user instructions for reaching the destination.

SUMMARY OF THE INVENTION

Today's automobiles are commonly equipped with an anti-lock brake system (ABS), a cruise control system, a climate control system, a compact disk (CD) player, a radio receiver, an audiovisual system, a restraint system, an air bag system, a cellular communication system, a car alarm system, and so on and so forth. The users are overwhelmed and confused with a large number of knobs, switches and buttons used to control the discrete functions of the individual systems. We have recognized that as more and more systems are being incorporated into an automobile to implement the AHS concept, the management of the systems will be more unwieldy than ever.

The invention overcomes the prior art limitations by employing a master interface to manage system functions in a vehicle. In accordance with the invention, a plurality of items are exhibited on a display in the master interface. Each item represents a respective one of the systems in the vehicle. The exhibited items are arranged on the display in substantially the same relation to one another as the systems represented thereby in the vehicle. At least one of the items can be selected using an indicator device (e.g., a mouse). The system represented by the selected item can be operated to realize the functions associated therewith.

Accordingly, it is an object of the invention that the master interface for controlling the system functions is simple and well organized, as opposed to using the large number of knobs, switches and buttons to control same as in the prior art.

It is another object of the invention that the master interface centralizes the system functions so that the user can focus on a single interface while driving, rather than being distracted by the large number of knobs, switches and buttons used in the prior art, which are dispersed throughout the vehicle.

It is yet another object of the invention that the access to the system functions through the master interface is intuitive and direct so that a user who is not familiar with the vehicle can instantly learn to manage such functions.

The master interface is connected to a central processor in accordance with a system architecture wherein the central processor also connects traditionally unrelated vehicle systems together. With such an architecture, the central processor can coordinate the actions of the connected systems to realize synergistic functions such as smart driving, automatic parking, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing showing an illustrative embodiment of the invention, in which:

FIG. 1 is a block diagram of a control and management system for use in an automobile in accordance with the invention;

FIG. 2 illustrates a master control interface in the system of FIG. 1;

FIG. 3 illustrates an automobile control subsystem in the system of FIG. 1;

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FIG. 4 illustrates a screen containing engine related options appearing on a display in the interface of FIG. 2;

FIG. 5 is a flow chart depicting the steps of a drivetrain routine in the system of FIG. 1;

FIG. 6 illustrates a navigation screen on the display including weather and traffic indicators in accordance with the invention;

FIG. 7 illustrates another screen on the display including weather and traffic information in accordance with the invention;

FIG. 8 illustrates yet another screen on the display for automatic driving in accordance with the invention;

FIG. 9 is a flow chart depicting the steps of an automatic parking routine in accordance with the invention;

FIG. 10 is a block diagram of an integrated circuit (IC) card for gaining access to a vehicle in accordance with the invention;

FIG. 11 is a block diagram of a transmitter for coupling to the IC card of FIG. 10;

FIG. 12 illustrates multiple screens on the display when the interface of FIG. 2 is put in a split screen mode;

FIG. 13 is a display screen for adjusting windows and mirrors, and opening/closing doors of the vehicle in accordance with the invention;

FIG. 14, is a display screen for, among other things, adjusting wipers in the vehicle in accordance with the invention;

FIG. 15 is a display screen including a user's view of the vehicle for controlling and accessing information concerning different components in the vehicle in accordance with the invention;

FIG. 16 is a display screen for adjusting seats and vents in the vehicle in accordance with the invention;

FIG. 17 is a block diagram of an accessory control subsystem in the system of FIG. 1; and

FIG. 18 is a display screen for adjusting audio and radio facilities in the vehicle in accordance with the invention.

Throughout this disclosure, unless otherwise stated, like elements, components and sections in the figures are denoted by the same numerals.

DETAILED DESCRIPTION

The present invention is directed to a technique for effective management and control of vehicle functions in an automobile. Traditionally, an automobile incorporates a multiplicity of discrete systems such as a climate control system, an audio system, an anti-lock brake system (ABS), a cruise control system, etc. These systems are individually controlled and managed by their own user interfaces including knobs, switches, buttons, and displays. As the automobile industry is fervently pursuing the automated highway system (AHS) concept, more and more systems are being added to the automobile. As a result, the management of all these systems becomes more unwieldy than ever.

FIG. 1 illustrates control and management system 100 for use in an automobile, which embodies the principles of the invention. In accordance with the invention, system 100 places the previously unrelated automobile subsystems under centralized control, thereby coordinating their functions synergistically and allowing data sharing among the subsystems effectively. In addition, system 100 provides a user-friendly master control interface for the user to manage the subsystems in an efficient manner. As shown in FIG. 1, central to system 100 is processor 103 of conventional

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design. Processor 103 is connected to non-volatile memory 107 and subsystem interface 111. The latter is an ensemble of standard inputs/outputs (I/O's) connecting processor 103 to the subsystems to be described. Processor 103 performs various tasks in system 100 according to certain routines stored in memory 107. For example, through interface 111, processor 103 collects information from the subsystems for analysis, and transmits data and control signals to the subsystems, thereby controlling the vehicle functions.

Interface 111 connects the aforementioned subsystems through common bus 113, which include master control interface 117, automobile control subsystem 121, brake subsystem 125, traction control subsystem 127, suspension subsystem 129, detection subsystem 130, steering subsystem 132, operation control subsystem 136, access control subsystem 139, accessory control subsystem 143, turn signal subsystem 147, speedometer subsystem 149, safety subsystem 151, clock subsystem 154, wheel subsystem 157 and application module 161.

Referring also to FIG. 2, master control interface 117 in accordance with the invention affords the user centralized control and management of the vehicle functions interface 117 includes display 205, driver control keys 211, operating keys 215, accessory keys 219, access keys 232, and indicator devices 227 and 229. When a particular key or device is depressed or operated, the corresponding signal is generated by interface 117 and interrupts processor 103 to inform the latter the depression of the key or the operation of the device.

By way of example, display 205 is a liquid crystal display (LCD) located on a dashboard of the automobile. Display 205 includes a LCD driver (not shown) for processor 103 to control the display graphics. This driver is also responsive to signals generated by indicator devices 227 and 229 to perform certain tasks to be described. In this illustrative embodiment, both devices 227 and 229 are each a mouse device which may be wireless, and can be used to point and click at displayed options on display 205 and to scroll various menus or screens. However, it will be appreciated that devices 227 and 229 may be joysticks, light pens, trackballs, touchpad, or a combination thereof, instead.

Display 205 also incorporates well-known touch-screen circuitry (not shown). With this circuitry, the user can interact with processor 103 by, say, touching a displayed option on display 205. Through interface 117, processor 103 receives from the touch screen circuitry a signal identifying the location on display 205 where it has been touched. If such a location matches the predetermined location of one of the displayed options, processor 103 determines that the option has been selected. With such touch-screen and displayed option selection capabilities, the user is able to obtain information on and control selectable functions of the automobile.

Automobile control keys 211 relate to the functions provided by automobile control subsystem 121. Subsystem 121 monitors many aspects of the vehicle operation including the exhaust temperature, fuel flow, engine temperature, ignition timing, individual cylinder operations, heat exchange, etc.

When ENGINE CONTROLS key 211a is depressed, processor 103 is prompted to collect information from, among others, engine control system 319 (in FIG. 3) within subsystem 121. Processor 103 thereafter causes the screen of FIG. 4 to be displayed on display 205. FIG. 4 illustratively includes "ENGINE RESOURCES", "ENGINE CAPABILITIES", "ENGINE SYSTEMS", and "ENGINE LOADS" categories relating to the engine controls of the

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vehicle. Under each category, the user may use indicator device 227 or 229 to point and click at various engine related options to select same. Alternatively, utilizing the touch-screen capability, the user may touch the options on the screen with his/her finger to achieve the selection. The selected options are highlighted in a first color, and the readings and/or statuses corresponding thereto are shown in the respective blanks following the items.

For example, when OIL LEVEL option 371 is selected, the amount of oil in the engine is indicated, i.e., whether the current level of engine oil is high, medium or low. By selecting PERFORMANCE MODES option 373, the user learns whether the engine is in an aggressive mode or a fuel economy mode. The aggressive mode offers a high power output and should be used when sudden accelerations and decelerations (e.g., passing other vehicles) are anticipated. Otherwise, the fuel economy mode is recommended. When one of the two modes is indicated on line 375, the line is highlighted in a second color, indicating that another performance mode option is available for selection. In this instance, when the user points and clicks at line 375, the other performance mode option is displayed. The user may then point and click at such other option to change the performance mode.

In accordance with an aspect of the invention, subscreen 377 is used to graphically depict the engine compartment of the vehicle. By way of example, displayed items 381 through 389 in subscreen 377 depict the radiator, battery, fuse box, air cleaner, brake fluid reservoir, transmission fluid reservoir, windshield washer reservoir, oil compartment and engine block in the engine compartment, respectively. It should be pointed out that the relative positions of these displayed items correspond to those of the depicted components in the actual engine compartment. Knowing the relative positions of the components under the hood of the vehicle, the user can easily identify and point and click at selected items to quickly access information concerning the corresponding components. For example, when displayed item 381 depicting the radiator is selected, options 391 and 392 relating to the radiator are highlighted, and the readings of the current coolant temperature and coolant level are shown in the respective blanks. When displayed item 388 depicting the oil compartment is selected, options 393, 371 and 394 relating to the oil compartment are highlighted, and the readings of the current oil pressure, oil level and oil temperature are shown in the respective blanks.

As shown in FIG. 3, subsystem 121 also includes electronic transmission/throttle system 325, which operates under the control of processor 103 in accordance with certain drivetrain routines. The program instructions defining these routines are stored in memory 107 in this instance. Alternatively, they may be stored in a memory, (not shown) in subsystem 121.

Instructed by one of the drivetrain routines, which is denoted 400 in FIG. 5, processor 103 detects whether the user has selected a transmission gear different from the currently engaged gear, as indicated at step 403. The gear selection is achieved by depressing DRIVETRAIN key 211b, followed by operating indicator device 227 or 229. For example, after depressing key 211b and moving device 227 forward (backward) causes processor 103 to initiate a signal to system 325 to select a forward (reverse) gear.

If the user has selected a different gear at step 403, routine 400 proceeds to step 405 where processor 103 determines whether the selected gear is opposite the automobile's moving direction. If the selected gear is a reverse (forward)

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gear, and the automobile is moving forward (backward), processor 103 overrules the user's selection, as indicated at step 407. Routine 400 then returns to step 403. Otherwise if the selected gear and the moving automobile direction are both forward or reverse, routine 400 proceeds to step 408 where processor 103 causes brake subsystem 125 to apply the brakes of the vehicle, and thereafter to step 409 where it causes system 325 to engage the selected gear. Routine 400 proceeds from step 409 to step 417 to be described.

If at step 403 processor 103 does not detect any gear change by the user, it causes system 325 to enter an automatic transmission mode in which system 325 automatically shifts the gears in a well-known manner, as indicated at step 413. Routine 400 then proceeds to step 417 where processor 103 coordinates the operation of system 325 with that of traction control subsystem 127, which may be of the type of the TRAXXAR stability control system, to prevent skids. At step 421, processor 103, coordinates the operation of system 325 with that of suspension subsystem 129 including shock absorbers to afford a smooth, comfortable and safe ride. From step 421, routine 400 returns to step 403 described above.

Another drivetrain routine causes system 325 to perform gear shifting in cooperation with other subsystems such as detection subsystem 130 and brake subsystem 125 to handle certain road conditions. Detection subsystem 130 includes radar, sonar, infrared sensors, Doppler radar, magnetometers and/or other object finder mechanisms, and is used for, among other things, monitoring the road condition ahead. For example, when an upcoming curve is detected, system 325 handles the transmission accordingly while the brakes are controllably applied by brake subsystem 125 to avoid any skid.

It should be noted at this point that suspension subsystem 129 also includes a height actuator, whereby processor 103 can controllably adjust the height of the vehicle. Thus, continuing the above example, when detection system 130 detects the upcoming curve, processor 103 may also cause the vehicle height to be lowered to increase its stability. In another instance, when detection system 103 detects a raised road surface ahead, processor 103 causes the height of the vehicle to be increased to clear the elevation, thus avoiding scraping the bottom of the vehicle.

Navigation system 329 in FIG. 3 provides onboard and/or on-line navigation capability. In a well-known manner, system 329 receives signals from a constellation of satellites which is part of the global positioning system (GPS). In response to these signals, system 329 pinpoints the automobile's location in latitude and longitude. In addition, system 329 receives the vehicle directional and speed information from a compass subsystem (not shown) and an accelerometer (not shown), respectively.

Specifically, the user depresses NAVIGATE key 211c to request instructions for a given destination from navigation system 329. When the depression of key 211c is detected by processor 103, the user is elicited for information concerning the destination, any intermediate stops, etc. Such elicitation is realized by posing questions on display 205 and/or by uttering those questions using a synthesized voice through an audio output. The user then provides verbal responses thereto through an audio input. Relying on standard speech recognition circuitry in system 100, navigation system 329 recognizes and registers the responses. Using stored map information, system 329 then provides on display 205 a suggested route leading to the destination. Furthermore, based on the knowledge of the vehicle's

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instantaneous speeds and directions, system 329 is capable of verbally and visually directing the user to the destination.

Because of the limited capacity of the storage for the map information or because the map information needs to be updated from time to time, it will be appreciated that system 329 would instead obtain the necessary, latest map information from an on-line service through a cellular or wireless connection.

In addition to directing the user to a given destination, system 329 through processor 103 cooperates with weather system 332 and traffic system 336 to be described. In accordance with an aspect of the invention, systems 332 and 336 jointly provide on display 205 updates regarding traffic congestion, weather conditions, hazards, highway warnings along the route suggested by system 329.

FIG. 6 illustrates one such navigation screen on display 205. On this screen, indicator 450 marks the current position of the vehicle. The suggested route (shown in boldface) by navigation system 329 is numerically denoted 453. Traffic indicator 455 is provided by system 336 to indicate where traffic congestion is on route 453. Similarly, weather indicators 457, 459 and 461 are provided by system 332 to indicate the cloudy, rainy and foggy conditions, respectively, at different points along route 453. It will be appreciated that these traffic and weather indicators may be colored and/or flashing to attract the user's attention.

Weather system 332 derives weather conditions from computer files obtained from an on-line service through a cellular or wireless connection. In an alternative embodiment, system 332 may include such well-known avionics as weather radar and lightning strike finders to detect weather conditions. By depressing WEATHER key 211d, the user is provided on display 205 with a map centered at a reference point indicative of the vehicle location. As to be described, system 100 runs a windows based operating system. With such an operating system, the user may operate indicator device 227 or 229 to point and click at a selected point on the map, and drag same to create a window surrounding a desired location, which may or may not include the vehicle location. Processor 103 causes system 332 to retrieve the relevant computer weather files, and derives therefrom the weather information regarding the area defined by the window.

FIG. 7 illustrates one such window which is created on display 205 and which surrounds the Los Angeles area. In this instance, the vehicle location is numerically denoted 481. As shown in FIG. 7, temperatures (denoted 483 and 485 for example) are indicated in parts of the subject area corresponding thereto. In addition, among others, weather indicators 487, 489, 491, 493 and 495 respectively indicate the rainy, cloudy, sunny and foggy conditions and storm warnings in the corresponding parts of the area. Moreover, weather center 496 and surface observation center 497 are indicated. The user may point and click at the respective centers to obtain the corresponding reports on weather and surface observation of the local area. These reports are generated on display 205 in text and/or read to the user through the audio output of system 100.

By default, system 332 provides the current weather information on display 205. Otherwise if the user specifies a time, system 332 provides the user with a weather forecast if the specified time is in the future, and weather history if it is in the past. With such future, current and/or past, short and/or long range weather information, the user can effectively plan his/her trip, and avoid unfavorable weather conditions.

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Using the weather information from system 332i processor 103 issues on display 205 travel advisories such as requesting the user to check tire pressures after a drastic temperature change. In addition, processor 103 may cause a release of heat to warm the car battery to boost its starting power in cold weather, cause additional venting of engine heat in hot weather, and ensure closing of windows and doors in inclement weather.

It will be appreciated that weather system 332 may also be capable of obtaining weather information from such systems as the United States satellite systems, Delta radar, local area radar, etc. In addition, system 332 may be capable of gathering further information including United States current surface maps, wind chill maps, jet stream maps, winter travel hazards, forecast highs/lows, tropical weather, surface wind maps, grain and farm weather maps, etc.

Traffic system 336 will now be described. Similar to weather system 332, system 336 is capable of obtaining computerized traffic information from an on-line service through a cellular or wireless connection. In an alternative embodiment, system 336 may include such well-known electronics as a line-of-sight radar, forward infrared radar, and/or Doppler radar, each with terrain following capabilities, to sense surrounding traffic conditions.

By depressing TRAFFIC key 211e, the user is similarly provided on display 205 with a map centered at a reference point indicative of the vehicle location. The user may then operate indicator device 227 or 229 to point and click at a selected point on the map, and drag same to create a window surrounding a desired location, which may or may not include the vehicle location. In response, processor 103 causes traffic system 336 to obtain the relevant traffic information regarding the area defined by the window. In accordance with another aspect of the invention, the traffic information may be overlaid on an existing window (e.g., a window previously created for obtaining weather information) by pressing TRAFFIC key 211e.

Referring again to FIG. 7, the illustrative weather window includes overlaid traffic information in this instance. For example, traffic indicator 498 indicates traffic congestion near "Anaheim" inside the window. In addition, by pointing and clicking at traffic center 499, the user may obtain a traffic report in text and/or voice concerning the local traffic. After learning the traffic situations in the area of interest, the user can effectively plan his/her route to avoid potential traffic congestion or hazards.

In addition, traffic system 211e is capable of storing and recalling traffic maps and sending same to third parties using a cellular or wireless connection.

The aforementioned detection subsystem 130 also helps provide an adaptive cruise control capability. Specifically, subsystem 130 measures the distance to the vehicle just ahead. With electronic transmission/throttle system 325 and brake subsystem 125, processor 103 adjusts the vehicle's speed to keep it moving with the traffic flow. If the vehicle ahead speeds up or slows down, subsystem 130 signals processor 103 to accordingly adjust the throttle or brakes to maintain a safe distance.

When SMART DRIVING key 211f is depressed, processor 103 causes a menu to be displayed on display 205. This menu includes selectable items such as automatic driving and automatic parking. If automatic driving is selected, upon detecting by detection subsystem 130 an automated highway, processor 103 graphically depicts on display 205 the highway segment. Illustratively, processor 103 causes the screen of FIG. 8 to be displayed.

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In FIG. 8, indicators 503, 507, 509 and 511 demarcate the highway lane incorporating AHS technology which the subject vehicle (denoted 513) is in. In this instance, these indicators mark the locations of magnets buried in the AHS highway lane, which are detected by the magnetometer in subsystem 130. Steering subsystem 132 relies on the detection of the magnets which are separated in predetermined intervals on both sides of the lane to properly steer subject vehicle 513, thereby realizing automatic driving. In accordance with an aspect of the invention, processor 103 keeps track of the occurrences of the magnets in the AHS highway lane. If for any reason the magnets are missing or undetected for a predetermined number of intervals in a row, which may adversely affect the proper steering of the vehicle, processor 103 causes a warning to come on the display. If the user in response to such a warning redirects arrow 516 which is aligned with the AHS lane to point toward, say, the left lane, which is a non-AHS lane, processor 103 is interrupted to terminate the automatic driving. A textual message 517 immediately comes on to confirm the termination of the automatic driving. With such a confirmation, processor 103, among other things, causes turn signal subsystem 147 to be described to activate the left turn signal. The user may then manually steer the vehicle into the left lane.

In accordance with another aspect of the invention, the user may define comfort zone 528 surrounding subject vehicle 513, in which any of left vehicle/object 521, right vehicle/object 523, front vehicle/object 525, and rear vehicle/object 527 is not allowed. Comfort zone 528 may be realized by using indicator device 227 or 229 to point at indicators 529a, 529b, 529c and 529d individually, and dragging same away from subject vehicle 513. Alternatively, the user may select CLEARANCE options appearing in the respective boxes representing the vehicles/objects to define the comfort zone. The selection of one such option is followed by a prompt for the desired minimum distance from the corresponding vehicle/object, if any.

Processor 103 is programmed to control the steering, throttle and brakes of the vehicle in an attempt to keep any surrounding vehicles/objects outside comfort zone 528. If any such vehicle/object unavoidably comes within zone 528, processor 103 would issue on display 205 a warning of the zone violation, provided that COMFORT ZONE warning option 531 has been selected. A reference zone is defined by the vehicle manufacturer to be the minimal space surrounding the subject vehicle to avoid collisions with a good confidence, taking into account the instantaneous speed of the subject vehicle relative to the surrounding vehicles/objects. By design, comfort zone 520 cannot be made smaller than the reference zone. Selection of REFERENCE ZONE option 533 enables the user to set comfort zone 520 to be the same as the reference zone. In any event, no matter how large comfort zone 520 is, any vehicle/object coming within the reference zone automatically causes issuance of a collision alarm. In response to such an alarm, the user takes emergency measures to avoid any collision.

Subsystem 130 in this instance detects not only the vehicle/object ahead as in the adaptive cruise control case, but also any other surrounding vehicles/objects. Subsystem 130 periodically communicates to processor 103 data concerning the speeds and the coordinates of any surrounding vehicles/objects, relative to the subject vehicle, to realize the above comfort zone and reference zone protections. If the user selects SHOW TRAFFIC option 535, processor 103 causes display 205 to show the current positions of any actual surrounding vehicles/objects, relative to the subject vehicle. With such visual information, the user is fully aware

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of his/her driving environment, thus improving the user's safety especially in night driving.

As mentioned before, the user can also select automatic parking of the vehicle from the above menu invoked by depression of SMART DRIVING key 211f. If the automatic parking option is selected, after the vehicle comes to a complete stop, automatic parking routine 500 stored in memory 107 is invoked. When instructed by this routine, which is depicted in FIG. 9, processor 103 causes display 205 to show thereon the positions of the surrounding objects relative to the subject vehicle, as indicated at step 543.

At this point, the user may touch the screen of display 205 to define a parking space into which the vehicle is to be parked. In order to carry out parallel parking effectively, this parking space needs to be reasonably suitable for the vehicle to be maneuvered into. Processor 103 at step 547 computes the coordinates defining the selected parking space. Knowing the respective coordinates of the subject vehicle, the surrounding objects and the parking space, processor 103 at step 551 determines the instant's at which and extents to which the vehicle is to be accelerated and decelerated in the course of the parking, and at step 553 the instants at which and extents to which the steering wheel is to be turned and returned. At step 555, processor 103 causes a computer simulation to be performed using the speed and steering parameters just determined to verify that the automatic parking is feasible, without running into any surrounding objects. At that point, the user may depress ANIMATION key 219j to view on display 205 the simulation in which the subject vehicle moves into the user defined parking space in an animated fashion. At step 559 processor 103 determines whether the vehicle can be properly parked under the above conditions. If processor 103 determines that the automatic parking is unrealizable, processor 103 informs the user of same, as indicated at step 563. In response, the user needs to select another parking space or may attempt to park the vehicle manually.

Otherwise if processor 103 determines that the automatic parking is realizable, processor 103 sends an audio and video message to request the user to get off the vehicle before the automatic parking is engaged, as indicated at step 567. In the preferred embodiment, the user is provided with a transmitter (e.g., transmitter 700 to be described) for remotely signaling to processor 103 to carry out the actual parking after the user leaves the vehicle. When it is so signaled, processor 103 at step 571 coordinates the actions of electronic transmission/throttle system 325, brake subsystem 125 and steering subsystem 132 to realize the automatic parking according to the devised scheme. During the automatic parking, for any reason, the user may also use the aforementioned transmitter to signal processor 103 to abort the parking. In addition, processor 103 may cause a predetermined audible signal to be emitted to alert surrounding people while the vehicle is being parked.

In addition, the automatic parking may also be achievable by training the vehicle. For example, let's say the user often parks his/her vehicle in a particular garage. In that case, processor 103 may be set in a training mode in which as the user maneuvers and moves the vehicle from a predetermined location outside the garage to a designated parking space in the garage, processor 103 registers the coordinated operations by the user of the systems involved. Thus, with the training, each time when the vehicle is placed at the predetermined location and put in an automatic parking mode, processor 103 repeats the system operations, as registered, and accordingly parks the vehicle in the designated parking space.

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Conversely, processor 103 can be programmed to perform the inverse function to the above automatic parking, i.e., to direct the vehicle out of a parking space.

When emergency key 211g is depressed, processor 103 causes emergency options to be displayed on display 205. These options may include police-type emergencies, medical emergencies, mechanical problems, panic measures, etc. For example, upon selection of the police-type emergencies option, the user may be queried whether he/she is a victim. If the user responds affirmatively, processor 103 immediately establishes a phone or modem connection with a police authority to automatically furnish such preliminary information as the identity of the user, description of the vehicle and emergency contacts, which are pre-recorded, along with the current location of the vehicle identified by navigation system 329. If possible, the user may also add, in the communication, the nature of the emergency and current statuses of the user and any passengers. By automatically communicating at least the preliminary information to the proper authority in case of an emergency, the user can be instantly reached and helped.

System 100 also includes a panic alarm, audiovisual recording facilities to audio- and video-tape potential crime scenes for later review when the user selects the panic measures option. In addition, system 100 may include broadcasting capabilities to disseminate alarm signals (e.g., a car fire alarm) via citizen's band (CB) for example.

Security system 343 in FIG. 3 works closely with access control subsystem 139 to afford controlled access to the vehicle's doors, windows, trunk, hood, accessories, system software, etc. In this illustrative embodiment, the holder of a master key to security system 343, who is mostly likely the vehicle owner, is able to assign security levels and/or access codes to other authorized users to implement the controlled access. This master key may be in the form of a special code initially provided by the vehicle manufacturer.

For example, using system 343, the master key holder assigns to each authorized user a respective personal identification number (PIN), along with a clearance level. When a person attempts to, say, adjust an accessory, which is pre-assigned with a selected security level, processor 103 elicits from the user his/her PIN through display 205 or a similar interface. In response, the person may enter a PIN by touching the appropriate keys on a displayed keypad. Upon receiving the PIN entry, processor 103 checks with system 343 whether the PIN is valid. Verification of the PIN ensures that the person is an authorized user. If the PIN is valid, processor 103 then compares the clearance level associated with the PIN with the security level of the accessory in question. Only when the clearance level is higher than the security level, would the authorized user be allowed to adjust the accessory.

The above security measures may also be used to arm and unarm anti-theft capabilities in the vehicle, which may be based on infrared, sonar or other similar surveillance technology. In addition, selected individual items in the vehicle are digitally encoded so that they would not be functional if someone removes and attempts to re-install them without proper codes.

Moreover, in this illustrative embodiment, security system 343 includes a receiver for receiving an RF signal containing security and personal preference data. Before gaining access to the subject vehicle, a user needs to furnish at least the security data for verification. If the security data is valid, processor 103 causes system 343 to unlock the doors and unarm the anti-theft capabilities of the vehicle. To

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that end, each authorized user is provided with an access card (analogous to a driver's permit) in the form of a standard integrated circuit (IC) card (also known as a "Smart Card"). FIG. 10 illustrates one such IC card, denoted 600. Security data including a user PIN and control information is stored in memory 603 in card 600. This security data may be encrypted in accordance with a well-known encryption algorithm such as an RSA or a digital encryption standard (DES) algorithm.

The aforementioned control information includes an access code indicative of the extent to which a user is allowed to control the vehicle functions and/or access its hardware and software. Depending on the access code, the user may be accorded full operating privilege, or one of the more restricted operating privileges respectively designed for family members, mechanics, police officers, etc.

In addition to the aforementioned security data, personal preference data may also be stored in memory 603. The personal preference data contains information regarding the user preferred settings of the doors, locks, windows, engine, performance profiles, climate control, audio system and other vehicle functions.

FIG. 11 illustrates transmitter 700 into which card 600 can be inserted. Specifically, transmitter 700 includes transmitter interface 703 for receiving card interface 607. Interfaces 703 and 607 are electrically compatible with each other, and may be in accordance with the PCMCIA interface standard. Before entering the subject vehicle, the user needs to couple interface 607 to interface 703. To gain entry to the vehicle, the user needs to depress a START button in operating portion 707 of the transmitter to initiate an RF signal directed to the receiver of system 343. It should be noted at this point that a PARK button is also provided in portion 707 for initiating automatic parking described before.

Upon detecting a depression of the START button, data processor 709 communicates with card processor 611 to have a copy of the above-described security data and personal preference data in memory 603 transferred to transmitter 700. Data processor 709 formats the received data pursuant to a predetermined protocol, and causes signal generator 711 to transmit the RF signal, whose waveform is modulated by the formatted data.

After the receiver of system 343 receives the transmitted signal, it recovers therefrom the security data and personal preference data. Processor 103 then performs a security check based on the received security data. If it determines that the user is not an authorized user, he/she would be denied access to the vehicle. Otherwise, processor 103 causes the driver door of the vehicle to be unlocked, and accords the proper operating privilege. In addition, processor 103 stores the received personal preference data in memory 107. Based on such received data, processor 103 effects the preferred vehicle settings to personalize the vehicle functions.

It will be appreciated that, instead of an IC memory, the aforementioned security and personal preference data may be stored in a magnetic medium such as a standard magnetic stripe, or in the form of a one-dimensional or two dimensional bar-code on a card. In the case where the barcode is used, security system 343 may incorporate a conventional bar-code scanner for reading the encoded data. In addition, the stored data need not be transmitted via an RF medium. It may well be transmitted via a laser, infrared or any other medium, or through a telephone network, a private network, a cellular network, the Internet or any other network, as long as the vehicle is equipped with the appropriate data receiver.

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Depression of LIGHTS key 211i in FIG. 2 invokes on display 205 displayed options including, for example, all lights on/off, running lights on/off and flashers on/off. For each option, the user may further select the light operation durations, and set weather, hazardous, ambient light conditions under which the light would be automatically turned on.

Depression of WARNINGS key 211j prompts processor 103 to display on display 205 predetermined advisories and cautions on operating the vehicle, such as the advisory "adjusting seat while driving could result in loss of vehicle control."

Upon a start-up of system 100, periodically or when DIAGNOSTICS key 211k is depressed, processor 103 polls each system therein for a self-test result. The system, when polled, performs an active self-test and reports the test results to diagnostic system 349. The latter analyzes the results, and communicates any exceptions to processor 103. Processor 103 causes display 205 to display a clear status for those systems having no identifiable problem, and to graphically indicate the locations of identified irregularities for the other systems, along with messages describing the irregularities. Some irregularities may cause processor 103 to restrict certain vehicle operations until a corrective action therefor is taken.

The exception data received by processor 103 is stored in memory 107. Alternatively, they may be stored in a secure storage such as a "black box" which would survive an accident involving the subject vehicle. In the event of an accident, the exception data would be retrievable for determination of any mechanical cause for the accident.

Key 211l is currently unused. However, in accordance with an aspect of the invention, key 211l can be programmed to replace any function key in system 100 and its associated function. For that matter, as a provision for the user preferences, system 100 allows the user to re-program or re-designate each function key in system 100 to realize his/her preferred key arrangement. The re-designation is effected by the user's stepping through a menu-driven program, and registered by processor 103 as one of that user's preferences.

Depression of DEMO key 211m allows the user to access a self-guided demonstration provided by demonstration system 353. When the vehicle is in a showroom before its sale, the demonstration comprises a multimedia presentation on display 205, providing sales-type information including information on each feature and aspect of the vehicle, and functions afforded by master control interface 117. After the sale of the vehicle, the demonstration may include pre-recorded video programs for showing on display 205 operating procedures to realize different vehicle functions. In particular, such video programs demonstrate step-by-step operations of interface 117 to implement such functions as smart driving, obtaining weather and traffic information, etc. Thus, with this demonstration capability, a user who is not familiar with the subject vehicle can instantly learn to manage the various vehicle functions.

In accordance with another aspect of the invention, demonstration system 353 may be put in a rehearsal mode in which a prospective vehicle user can be trained and tested for his/her dexterity and familiarity with the vehicle functions. In such a rehearsal mode, traffic situations and vehicle conditions are simulated on display 205. At the same time, the prospective user is required to operate master control interface 117 to properly handle each given scenario. Only after satisfying the operating requirements, may the pro-

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spective user be granted the aforementioned access card (or "driver's permit") according to the appropriate operating privilege.

Depression of RESET key 211n allows the user to reset/restart selected systems in system 100 for reasons of malfunction or nonperformance. The reset is accomplished by reset system 357, and can also be selected by depressing MENU key 219c or INDEX key 219g to be described. When a system is reset, power to the system is temporarily cut off. After regaining power, the reset system runs a restarting routine, and either resumes normal operation or identifies any problems to processor 103. In the latter case, processor 103 posts necessary messages to alert the user of the reported problems.

Operating keys 215 relate to the functions provided by operation control subsystem 136. With SHIFT key 215a, each other key on interface 117 corresponds to two functions depending on whether the key is depressed together with SHIFT 215a.

Depression of ENTER key 215b allows the user to initiate an action. If no action is required, depression of key 215b causes generation of a warning tone.

Depression of ZOOM(+) key 215c allows the user to obtain information not presently displayed, thereby providing other related subjects such as owner's manual material, tips, warnings, cautions, etc.

Depression of ZOOM AWAY(-) 215d effects the inverse function to depression of key 215c. That is, it allows the user to leave a related subject to continue with the original subject.

Depression of SET-UP key 215e allows the user to set parameters in system 100, which affect the functions of master control interface 117, selected aspects of the vehicle, priority of menu selections, access by other users to the hardware and software of the vehicle, etc. To facilitate setting of new parameters, after key 215e is depressed, operation control subsystem 136 causes display 205 to show thereon information about installed features, accessories, options, original equipment, dealer installed equipment, after market installations/removals, etc. In addition, information about the vehicle's capabilities, safety features, legal requirements, equipment installers, repair facilities, maintenance records, software revisions and updates, etc., which is stored in subsystem 136, may be accessed and reviewed using the set-up function as well.

In this illustrative embodiment, a windows based operating system of the type of the MICROSOFT WINDOWS operating system is installed on system 100. Specifically, a copy of the operating system software is stored in memory 107. Utilizing such an operating system, processor 103 can be programmed to control display 205 to provide organized data presentation through one or more windows.

By depressing SPLIT SCREEN key 215f, followed by clicking and dragging indicator device 227 or 229, multiple windows can be created on display 205. Advantageously, with multiple windows, certain actions can be effectively coordinated and cross-checked. For example, a vehicle function may be monitored in a first window while it is modified via menu selection in a second window. As a result, the modification can be immediately observed in the first window. Thus, with multiple windows, various menus and vehicle functions can be simultaneously accessed and monitored.

FIG. 12 illustrates multiple windows numerically denoted 801, 803 and 805, respectively, created on display 205 using the SPLIT SCREEN capability. As shown in FIG. 12, the

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user may utilize window 753 to realize the navigation function provided by navigation system 329. At the same time, windows 755 and 757 respectively provide first and second menus for the user's selection.

Depression of RELEASE key 215g at a particular screen effects the "enter" function, followed by an immediate return to a predetermined screen such as the main menu or "home" screen. Thus, unlike key 215d, depression of key 215g does not provide an incremental return to a previous screen, but an instant return to the home screen.

BRIGHTNESS key 215h comprises a standard variable resistor such that when it is pushed one way (the other way), the intensity of display 205 is increased (decreased). Utilizing the proper intensity, the user can readily view display 205 under different ambient light conditions (e.g., night time, excess glare, bright sun, etc.).

Access keys 232 relate to functions provided by access control subsystem 139 in FIG. 1. Depression of WINDOWS key 232a invokes the screen of FIG. 13 on display 205. As shown in FIG. 13, triangles 810, 812, 814 and 816 correspond to the driver side front window, driver side rear window, passenger side front window and passenger side rear window, respectively. Indicators 821, 823, 825 and 827 on the hypotenuses of the respective triangles indicate the extents to which the corresponding windows are open. The user may touch the indicator on the screen to raise (or lower) it along the hypotenuse. In response, processor 103 causes access control subsystem 139 to close (or open) the window accordingly. Alternatively, the user may operate indicator device 227 or 229 to point at one of the indicators and drag same along the hypotenuse to control the corresponding window opening.

In addition, a SMART WINDOWS function on sub-screen 840 may be selected by touching ON option 842 on the screen or pointing and clicking at same. With the SMART WINDOWS function selected, for example, subsystem 139 causes the windows to be completely-closed upon a shut-off of the engine or an activation of air conditioning. When coupled with a SMART CLIMATE function to be described, the SMART WINDOWS function includes slightly opening selected windows to vent out excess heat prior to the user's arrival, thereby pre-conditioning the vehicle. In addition, when an AUTO function on sub-screen 840 is selected, the user can specify the vehicle speed at which the driver side front window is made completely open or closed. By touching on the screen, or pointing and clicking at blank 845 or blank 850, choices of speed are listed beneath the blank. For example, by selecting a zero speed for blank 845 ahead of a toll plaza, the window in question would be completely opened when the vehicle stops at a toll booth, thereby conveniently allowing the user to pay tolls.

The screen of FIG. 13 may also be invoked by depressing DOORS key 232b. Flaps 851, 853, 855 and 857 in FIG. 13 correspond to the driver side front door, driver side rear door, passenger side front door and passenger side rear door, respectively. By touching one of the flaps on the screen with a finger or pointing and clicking at the flap with indicator 227 or 229, subsystem 139 including a door actuator controllably closes the corresponding door if it is previously open, and vice versa.

Subsystem 139 also includes door sensors to detect any obstacle in the way of closing or opening each door. Upon detection of any such obstacle, subsystem 139 immediately suspends the door movement until the obstacle is removed. In this instance, both the front doors are not fully open

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because of detected obstacles. This fact is indicated by lines 871 and 873 marking the extents to which the respective doors are open and closed. On the other hand, both the rear doors in this instance are fully open as the corresponding lines 875 and 877 have moved all the way toward the center.

It should be apparent by now that the above door control may also be effectuated by voice command. For that matter, the locking of the individual doors after they are closed, or activation of the child lock system may also be realized by voice command.

Depression of MIRRORS key 232c again invokes the screen of FIG. 13. Indicators 891, 893 and 895 correspond to the left rear-view mirror, center rear-view mirror and right rear-view mirror, respectively. The user may operate indicator device 227 or 229 to point at one of the indicators and drag same (or utilize the touch-screen capability) to left or right to tilt the corresponding mirror toward left or right accordingly.

Subsystem 139 also includes mirror heaters, sensors and actuators. Based on the above personal preference data, subsystem 139 causes the mirror heaters to defrost the mirrors under certain specified temperature and weather conditions. Upon the sensors' detecting a tight parking-space for example, subsystem 139 causes the actuators to fold back one or both external mirrors to avoid damages. In addition, processor 103 coordinates the action of electronic transmission/throttle system 325 with that of the mirror actuators such that when the gear is put in reverse, the actuators automatically adjust the mirrors to provide a good rear view while the vehicle is backing up.

It will be appreciated that subsystem 139 may also incorporate mirror enhancement techniques for self-dimming the mirrors or adjusting their clarity, density, opacity, reflectivity, color, zooming, etc. based on specified light conditions.

It should be noted at this point that as long as the screen of FIG. 13 is showing on display 205, the user can conveniently adjust the windows, doors and/or mirrors at the same time, without the need of depressing the corresponding access keys to invoke the screen repeatedly.

Depression of WIPERS key 232d invokes the screen of FIG. 14. Subsystem 139 further comprises wipers, wiper actuators and a windshield debris detection system. The latter includes sensors which are attached to the windshield of the vehicle to determine the intensity of a vibration of the windshield. They also determine the frequency of the vibration whose intensity is above a predetermined threshold. This threshold accounts for the intensity of the normal windshield vibration of a moving vehicle. When SMART WIPE option 903 on the screen of FIG. 14 is selected, processor 103 causes the wiper actuators to operate the wipers in response to a vibration of above-normal intensity caused by rain, snow, insects, hail, and such falling on the windshield. The detection of such a vibration is communicated by the windshield debris detection system to processor 103, along with the information concerning the frequency of the vibration. Accordingly, processor 103 varies the rate of windshield sweeping with the communicated frequency. Thus, for example, in the SMART WIPE mode, the windshield wiping rate is adjusted lower when the vehicle stops in the rain, versus the vehicle running against the rain (i.e., rain drops falling on the windshield at a higher frequency).

Other wiper controls are also available on the screen of FIG. 14. For example, selection of SINGLE WIPE option 907 causes the wipers to sweep once across the windshield. Selection of CLEAN WINDOW option 909 causes spraying

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of cleaning liquid onto the windshield, followed a predetermined number of wipes. In addition, the speed of the wipers can be specified by selecting SECONDS option 911. After option 911 is selected, the user can point and click at blank 913 to select one of the displayed numbers, thereby specifying the wiper speed in terms of once so many seconds. Thus, option 911 is convenient for the user to implement intermittent wiping. To specify the speed of continuous wiping, the user may select SPEED option 915. After such an option is selected, the user can point and click at blank 913 to select one of the displayed speed levels ranging from slow to fast.

Depression of TRUNK STORAGE key 232e provides controlled access to the trunk/storage of the subject vehicle. In addition, it allows the user to program climate control system 1105 to be described to controllably cool or heat the trunk/storage to properly preserve the cargo. Moreover, it enables the user to instruct processor 103 to open (close) the trunk/storage upon a shut-off (start-up) of the engine.

Depression of UNDER HOOD key 232f releases the hood of the subject vehicle. Through processor 103, various systems may communicate to the hood mechanism controlling the release of the hood. For example, when certain fluid levels are detected low or components under the hood need repair or replacement, upon the user's agreeing to take a certain remedial action, processor 103 causes the hood mechanism to release the hood in anticipation of such an action. In addition, each time when the engine is started and the vehicle is ready to move, processor 103 checks with the hood mechanism to ensure that the hood has not be accidentally released.

Depression of USER'S VIEW key 292g invokes the screen of FIG. 15. However, this screen is the default screen or "home" screen on display 205. That is, it automatically comes on after the vehicle is started, even without depression of key 292g. In accordance with the invention, the screen of FIG. 15 allows the user to control and manage certain basic vehicle functions based on an intuitive approach, without the need of depressing any keys. To that end, subscreen 950 is used to graphically depict the user's view of the vehicle. By way of example, displayed items 953 through 959 in subscreen 950 depict the vents, windshield wipers, instrument panel, audio system, rear-view mirror, seats and windows/doors in the vehicle, respectively. It should be pointed out that the relative positions of these displayed items correspond to those of the depicted components in the actual vehicle. Knowing the relative positions of the components in the vehicle, the user can easily identify and point and click at selected items to efficiently control the corresponding components, and/or access information concerning them.

Specifically, when one of items 953 depicting a vent is selected, processor 103 causes the screen of FIG. 16 (described below) to be displayed for the user to adjust the air condition. When one of items 954 depicting a windshield wiper is selected, processor 103 causes the screen of FIG. 14 (described before) to be displayed for the user to adjust the wiper function. When item 955 depicting the instrument panel is selected, processor 103 causes the readings of the speedometer, tachometer, odometer and engine coolant temperature to be displayed. When item 956 depicting the audio system is selected, processor 103 causes the screen of FIG. 18 (described below) to be displayed for the user to adjust the audio system. When item 957 depicting the rear-view mirror is selected, processor 103 causes the screen of FIG. 13 (described before) to be displayed for the user to adjust the rear-view mirror and other mirrors. When one of items

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958 depicting a seat is selected, processor 103 causes the screen of FIG. 16 to be displayed for the user to adjust the seat. Finally, when one of items 959 depicting a window/door is selected, processor 103 causes the screen of FIG. 13 to be displayed for the user to control the window/door. In addition, menu 961 including vehicle components which are not depicted is provided in the screen of FIG. 15 for the user's selection. Any selected component from the menu is highlighted to indicate its selection.

Accessory keys 219 relate to the functions provided by accessory control subsystem 143. Depression of SEATS key 219a invokes the screen of FIG. 16. By pointing and clicking at DRIVER selection 1005, processor 103 causes display 205 to show the current configuration of the driver seat, denoted 1007. Similarly, by pointing and clicking at one of displayed numerals "2" through "4" next to the word "PASSENGER," processor 103 causes display 205 to show the current configuration of the corresponding passenger seat.

The default configurations of the seats are defined by the personal preference data initially provided by the user. Thus, upon a start-up of system 100, processor 103 effects the default configurations. However, by pointing at indicators 1013 and 1015 and dragging same using indicator device 217 or 219 (or using the touch-screen capability), the user may accordingly adjust the height of the cushion and the incline of the back support of the seat, respectively. Nevertheless, for safety reasons not all configurations of the driver-seat are allowed. The arm rest, if any, can be similarly adjusted. The lumbar support and massage capabilities and seat temperature can be selected as well. All of the above seat adjustments may be saved in memory 107.

As shown in FIG. 17, subsystem 143 includes climate control system 1105 for effecting the climate control of the vehicle. System 1105 may utilize additional power resources such as solar or reserved batteries to provide the necessary cooling/heating. Climate control system 1105 includes capabilities of providing air-conditioning/heating local to the driver and passengers, and also to the overall interior and trunk/storage space. System 1105 also manages air flows in the vehicle, and cooperates with access control subsystem 139 to achieve window controls. In addition, system 1105 includes air sensors to detect presence of contaminated and stale air. When such air is detected, system 1105 automatically vents it out before its spreading. Furthermore, processor 103 communicates to the user, through display 205, alarms regarding presence of any hazardous gas or fume in the air, and to what extent it is consumed by the user. System 1105 may also include onboard filtration devices to purify contaminated air.

Depression of CLIMATE key 219b also invokes the screen of FIG. 16. Vent indicators 1021, 1023, 1025, 1027, 1029 and 1031 indicate the locations of respective vents in relation to the seats inside the vehicle, denoted 1020. By pointing and clicking at one of the vent indicators, the user may select the air temperature, and certain fan movement of the corresponding vent.

The individual vent settings are stored in memory 107. Thus upon a start-up of the vehicle, processor 103 receives and analyzes signals from various thermo-sensors in the vehicle. Based on such an analysis, processor 103 adjusts the temperatures and air movement of each vent according to the preferred settings.

Depression of MENU key 219c provides various menus on display 205 for selection. Such menus enable the user to access other features and capabilities of the vehicle which

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are not accessible by depressing any other keys on interface 117. This stems from the physical limit as to the number of keys used, without overwhelming the user. Thus, any items which are not shown may be accessed by a selection of an appropriate menu and/or further selections within the menu using the hot spot touch-screen capability, ENTER key 215b, or indicator device 227 or 229.

In addition, user preference selections may be presented by icon selection bars, hot keys, or function keys, or may be realized using a set-up screen. Moreover, where further information related to a displayed option or item would be helpful, an icon or similar graphical means identified as tips, warnings, etc. for accessing such information is provided.

Depression of QUICK TIPS key 219d enables the user to obtain answers to frequently asked questions (FAQs) and multimedia (i.e., audio, text and video) information regarding different features (e.g., safety features) of the vehicle, and various systems and subsystems embodied therein. A similar QUICK TIPS arrangement is described in copending, commonly assigned U.S. patent application Ser. No. 08/789,934 ("the '934 application"), entitled "Multimedia Information and Control System for Automobiles," which is hereby incorporated by reference as if fully set forth herein.

In this illustrative embodiment, the QUICK TIPS text is written in well-known hypertext markup language (HTML), and provides hyperlinks to owner's manual information, pictures, videos, captions, tips and warnings relating to the subject being reviewed. In addition, VOICE key 219e to be described may be selected to have the text read to the user, along with its display. Moreover, the QUICK TIPS feature may be indicated on display screens in the form of a selectable icon or option. By selecting such an option, the user is provided with further information on the items appearing on the screen.

It should be noted at this point that the audio medium is an important medium for presenting information to the user especially when he/she is driving and needs to keep his/her eyes on the road. As such, VOICE key 219e is provided to afford an option for voice presentation of instructions, displayed options, and description of various systems and features of the vehicle.

It should also be noted that it is advantageous to have a sound library stored in memory 107, from which the user is able to select favorable tones and sound clips to enhance the user's comprehension while he/she is driving. For example, when a displayed option is touched by the user on screen 205, a pre-selected tone is generated through the audio output, indicating that the option has been selected. Relying on the audio tone confirmation, as opposed to a visual confirmation, the user while driving can continually watch the road.

Depression of VISUAL key 219f provides different system views, and visual information including warnings, cautions, hazards, advisories, etc. It also provides a selection of display systems such as head-up display, projection, three-dimensional display, holographic and virtual reality systems which may be provided in the vehicle in combination with or in lieu of display system 205.

When coupled with SHIFT key 215a, depression of visual key 219f however activates video system 1107, which enables the user to play on display 205 selected videos from a video library (e.g., a compact disk (CD) jukebox) connected to system 100, to receive TV programs, to record and playback of pictures and video clips from such sources as video and digital cameras, and to run video files on weather

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and traffic downloaded from an external information source such as the Internet.

In this illustrative embodiment, the user is provided with an alternative way of looking up information about the vehicle, which is arranged by topics in alphabetical order. Depression of INDEX key 219g enables the user to enter a keyword relating to the subject of inquiry. Such a keyword may be entered by pointing and clicking at the appropriate letter keys on a displayed keyboard. After matching the keyword entry with one of the available topics, processor 103 causes the information concerning the topic to be presented in audio, video and/or text. A similar INDEX arrangement is also described in the '934 application.

Depression of LIGHTS key 219h enables the user to program the intensity of individual interior lights depending on the ambient light condition, and the usage thereof such as the duration of the respective on-times. The preferred light settings are stored in memory 107.

Depression of AUDIO SYSTEM key 219i invokes the screen of FIG. 18 on display 205. In this instance, audio portion 1205 for controlling audio system 1109 shares the same screen with radio portion 1207 for controlling radio receiver 1111. With audio system 1109, the user is able to distribute selected audio signals to driver and passenger locations. These signals are communicated, through processor 103, to such subsystems as headsets, earphones, directional speakers, etc.

As shown in FIG. 18, portion 1205 enables the user to set for each driver and passenger sound preferences. With the word "DRIVER" clicked on and highlighted, the user may use indicator device 227 or 229 to point at indicator 1245 and move same to adjust the volume of the audio output, indicator 1247 to adjust the bass level, and indicator 1249 to adjust the treble level. In addition, the user may relocate speakers with respect to the user location to obtain the optimum sound effects. For example, each speaker is placed on a track and can be driven by an actuator along the track to reposition it. The relocation of the speakers can be achieved by pointing at indicators 1251, 1253, 1255 and 1257 corresponding to the respective speakers, and dragging same to the desired individual locations using indicator device 227 or 229. Accordingly, processor 103 causes the actuators to physically move the speakers along the respective tracks to realize the desired arrangement. Portion 1205 also provides other options such as fader control, graphic presentation of sound events, and saving of the preferred audio settings.

Portion 1207 shows a listing of radio stations for selection. In accordance with an aspect of the invention, the frequencies of the selected stations are stored based on geographic locations such as Los Angeles, Santa Ana and Irvine. As is well known, the geographic coverage of each station is limited. As a user travels beyond the coverage, the broadcast from that station becomes too weak to receive. As such, processor 103 continually causes a frequency scanner to update the listed stations which are within the receiving range. The user may save a subset of the listed stations as his/her favorite stations according to the current vehicle location.

Advantageously, by saving certain favorite stations according to the locations which the user visits often, when the user travels from one such location to another, he/she can instantly change the listing to contain the corresponding favorite stations. As a result, the otherwise, cumbersome programming of the stations back and forth between the locations is obviated.

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In the preferred embodiment, the favorite radio station frequencies are actually stored according to the GPS coordinates of the locations shown on portion 1207. Navigation system 329 periodically communicates the GPS coordinates of the current vehicle location to processor 103. The latter compares the communicated GPS coordinates with those of the locations in question. As soon as processor 103 determines that one such location is close to the current vehicle location within a predetermined range, processor 103 causes the listing of favorite stations associated with the new location to come on for selection.

In accordance with another aspect of the invention, for the user's convenience, the radio stations are categorized, and listed according to selected music types such as "country", "rock" and "classic", and selected program contents such as "talk/news". To that end, in each radio broadcast, the station transmits auxiliary data concerning its identity, e.g., an icon, signage and/or call number representing the station, and the type of program it airs, e.g., the type of music. In FM stereo broadcast for instance, the auxiliary data may be transmitted using subcarriers within a subsidiary communications authorization (SCA) band which lies above the 53 kHz portion of the station bandwidth allocated to the transmission of conventional stereo audio signals. A variety of prior art techniques may be used to modulate these subcarriers to transmit the auxiliary data. In addition, in accordance with the technique disclosed in U.S. Pat. No. 5,408,686 issued Apr. 18, 1995 to Mankovitz, the stereo audio portion of the station broadcast band, rather than the SCA band, may also be used for transmission of such auxiliary data.

The auxiliary data transmitted by each station is received by radio receiver 1111 in the form of a digital message signal. By decoding such a message signal, receiver 1111 recovers the aforementioned information concerning the station identity and the program type. Processor 103 screens the stations for the program types pre-selected by the user. The desired stations are then shown on display 205 according to the pre-selected program types. Illustratively, the stations are represented by the respective icons or signage, and frequencies. The user may point and click at (or touch on the screen) one of the icons representing the station which he/she wants to listen.

In this instance, the user has selected and is listening to one of the stations denoted 1271, whose icon is highlighted in a first color. In accordance with another aspect of the invention, the previously selected stations, such as stations 1273, 1275 and 1277 are highlighted in a second color. Advantageously, with the color highlighting, the user can readily back-track the previously selected stations and settle on one of them, or explore new, unheard stations.

It should be noted that from the screen of FIG. 18, the user may also access other entertainment systems such as cassette, CD, VCR and TV systems, and the weather band and other functions.

It should also be noted that the above selection of the displayed stations may be accomplished by voice command or depressing preset buttons. In addition, with the proper authorization, more than one user can save his/her preferred listing of stations, along with special notes about each station. In that case, when one wants to change the current listing of stations, he/she needs to enter a PIN before his/her preferred listing can be invoked. Moreover, the authorized user may also be privy to other users' preferred listings, and allowed to choose therefrom.

Depression of ANIMATION key 219j enables the user to view on display 205 animations relating to selected vehicle

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functions (e.g., automatic parking) which are being or to be performed. These animations are instructional, and help the user implement the functions in question and/or understand the effects thereof.

Like key 211i previously described, key 219k is reserved for future use in this instance.

Depression of ONLINE key 219l enables the user to access on-line systems through such communication links as telephone, wireless, cellular, satellite, radio spectrum, infrared and sonar connections. For example, while the vehicle is being operated, the user may choose to access the vehicle manufacturer's computer to run extensive diagnostic tests on the vehicle on-line. To that end, processor 103 establishes a communication link with the manufacturer computer. After an initial handshake between processor 103 and the manufacturer computer, the latter runs diagnostic routines on the vehicle systems through processor 103, and elicits from processor 103 information such as relevant operational parameters. Test results are generated by the manufacturer computer and transmitted to processor 103 for display. In addition, the manufacturer computer can correct or adjust any operational parameter values during the tests to improve the vehicle's performance. Similarly, any software upgrade or downloading for the vehicle systems can be realized through the on-line connection. Notices of recalls can also be transmitted to processor 103 for the user's information.

Depression of PHONE/MODEM key 219m allows the user to obtain mobile phone, facsimile modem and data modem connections through cellular and wireless networks.

Depression of PLANNERS/CALENDAR key 219n invokes reminder routines for informing the user of past and upcoming events. For example, certain maintenance reminders may be communicated by the aforementioned manufacturer computer to processor 103 through an on-line connection. Instructed by one of the reminder routines, processor 103 accesses systems such as navigation system 329 to identify the closest mechanic when the scheduled maintenance is due.

Referring back to FIG. 1, turn signal subsystem 147 in accordance with the invention not only provides the traditional function of activating turn signals in response to the user's initiation, but also causes furnishing of intelligence information on an impending turn. Once processor 103 is interrupted by subsystem 147 and notified of the impending turn into a particular direction, processor 103 causes detection subsystem 130 to sense any obstacles or moving objects in the street to which the vehicle is turning. Processor 103 then causes display 205 to display such obstacles and moving objects which may be hidden from the user's view, along with verbal and visual warnings of any foreseeable hazards. Thus, with such an assisted turning feature, the risk of an accident occurring during a turn is substantially reduced. Furthermore, in automatic driving, processor 103 orchestrates the actions of steering subsystem 132, brake subsystem 125 and electronic transmission/throttle system 325 to make a calculated move around an obstacle, or simply stops the vehicle at the turn to avoid any collision.

Speedometer subsystem 149 includes an accelerometer for evaluating the instantaneous speed of the vehicle. The speed information is communicated by subsystem 149 to processor 103 for use in navigation, automatic driving, automatic parking, etc. The speed information may also be stored with time and GPS information, and recorded in memory 107 or the aforementioned "black box". The memory content may be remotely accessed by a police authority, via a dial-up connection, to determine any speed

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violation, along with the associated time, and geographic location based on the GPS information.

Safety subsystem 151 includes restraint devices and air-bags. In accordance with yet another aspect of the invention, subsystem 151 keeps track of the air-bag deployment and expiration dates. Advance air-bag expiration and recharge notifications are transmitted to processor 103. Also transmitted to processor 103 are data collected by subsystem 151 concerning usage of safety devices, tire and brake wear, etc., and data on intervals of maintenance performed on and long term durability of those components. All such safety information received by processor 103 can be accessed and displayed at the user's request. In addition, tips and support for the user's safety in response to certain vehicle malfunctions, failures or eminent dangers are issued by safety subsystem 151 via display 205.

Through processor 103, subsystem 151 cooperates with other systems in system 100 in certain events. For example, in an accident, as soon as subsystem 151 informs processor 103 of a deployment of an air-bag, processor 103 signals engine control system 319 to halt the engine activity, brake subsystem 125 to apply emergency braking, and suspension subsystem 129 to stabilize the vehicle. Processor 103 may further request from navigation system 329 GPS coordinates identifying the accident scene, and cause the audiovisual recording facilities in the vehicle to audio- and video-tape the accident scene, and emergency data to be transmitted to the authority to obtain help as described before.

Clock subsystem 154 provides time and date information. Relying on such information, processor 103 duly synchronizes system activities and keeps track of events. For example, utilizing the temporal information, processor 103 issues the above-described reminders and notifications in a timely manner. Similarly, the above-described planner functions such as scheduling maintenance are made possible with such information.

Suspension subsystem 129 provides, as mentioned before, wheel and stability control during the vehicle operation. In addition, subsystem 129 includes sensors for evaluating the current road condition, and adjusts the ride and comfort using yaw controls and dampeners in response to the evaluated condition. It also provides processor 103 with continuous updates about the road condition. Utilizing such updates, processor 103 coordinates the actions of other systems such as steering and brake subsystems to handle the road in a manner prescribed by the user.

Wheel subsystem 157 includes sensors for reading tire pressures, detection of loss of tire traction or tread, etc. Relevant information is communicated by subsystem 157 to processor 103 to issue necessary alarms including abnormally low tire pressures. Processor 103 also incorporates the received information in a concerted effort, to achieve ride stability and smoothness.

Application module 161 which may be located close to master control interface 117 includes a standard interface such as an RS232 serial interface. Through this interface, the user or service personnel may use a conventional computer to update system programs and personal preference data stored in memory 107, or run diagnostic routines thereon to identify any system problems.

In an alternative embodiment, the standard interface in module 161, similar to interface 703, accepts IC card 600 previously described. In addition to the aforementioned security data and personal preference data, space is allocated in card memory 603 for storing system programs, diagnostic routines and header information. Such header information includes instructions for processing of certain contents of memory 603.

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Utilizing a conventional IC card writer connected to a standard computer which may be remote from the vehicle, the user or authorized service personnel can revise the security data and personal preference data in memory 603, and load new programs, program upgrades and/or diagnostic routines onto the IC card. It should be noted that any change in the card memory content requires an initial entry of the aforementioned master key, or other authorized keys allowing limited access. The IC card may be inserted into the standard interface of application module 161 when system 100 is powered down. On power up, after system 100 is initialized, processor 103 checks the security data in memory 603. Upon verification of the security data, processor 103 reads the header information in memory 603, and accordingly causes a transfer of any new system programs from memory 603 to memory 107 and any upgrade to the existing programs. In addition, in the presence of any diagnostic routines in memory 603, processor 103 runs the routines directly off the IC card. Processor 103 then reads the personal preference data in memory 603 to effect the preferred settings of the vehicle functions.

The foregoing merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise numerous other systems which embody the principles of the invention and are thus within its spirit and scope.

For example, in the disclosed embodiment, control and management system 100 is illustratively used in an automobile. It will be appreciated that a person skilled in the art may also employ the inventive system in another type of vehicle such as a boat, an airplane, etc.

Finally, although control and management system 100, as disclosed, is embodied in the form of various discrete functional blocks, the system could equally well be embodied in an arrangement in which the functions of any one or more of those blocks or indeed, all of the functions thereof, are realized, for example, by one or more appropriately programmed processors or devices.

I claim:

1. A method for use in a system in a vehicle, the system including a display element, the method comprising:

providing at least one indicator on the display element; allowing a manipulation of the indicator on the display element to define a distance between the vehicle and a detectable object outside the vehicle, the defined distance being indicated on the display element, the manipulation of the indicator being restricted from defining the distance to be smaller than a reference distance, the reference distance being indicated on the display element and a function of a current speed of the vehicle relative to the detectable object;

determining whether a separation between the vehicle and a detectable object outside the vehicle is maintained at least the defined distance; and

providing an alert when it is determined that the separation of at least the defined distance is not maintained.

2. The method of claim 1 wherein the defined distance is measured from the front of the vehicle.

3. The method of claim 1 wherein the defined distance is measured from the back of the vehicle.

4. The method of claim 1 wherein the defined distance is measured from a side of the vehicle.

5. The method of claim 1 wherein the detectable object includes a second vehicle.

6. The method of claim 1 wherein the vehicle is in motion.

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7. A system for use in a vehicle comprising:
a display element, at least one indicator being provided on the display element;
an interface for manipulating the indicator on the display element to define a distance between the vehicle and a detectable object outside the vehicle, the defined distance being indicated on the display element, a manipulation of the indicator being restricted from defining the distance to be smaller than a reference distance, the reference distance being indicated on the display element and a function of a current speed of the vehicle relative to the detectable object;
a processor for determining whether a separation between the vehicle and a detectable object outside the vehicle is maintained at at least the defined distance; and

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an output device for providing an alert when it is determined that the separation of at least the defined distance is not maintained.

8. The system of claim 7 wherein the defined distance is measured from the front of the vehicle.

9. The system of claim 7 wherein the defined distance is measured from the back of the vehicle.

10. The system of claim 7 wherein the defined distance is measured from a side of the vehicle.

11. The system of claim 7 wherein the detectable object includes a second vehicle.

12. The system of claim 7 wherein the vehicle is in motion.

* * * * *

AO 120 (3/85)

TO: Commissioner of Patents and Trademarks Washington, D.C. 20231	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT

In compliance with the Act of July 19, 1952 (66 Stat. 814; 35 U.S.C. 290) you are hereby advised
that a court action has been filed on the following patent(s) in the U.S. District Court:

DOCKET NO. 04CV614 DMS(LSP)	DATE FILED 03-25-04	U.S. DISTRICT COURT United States District Court, Southern District of California
PLAINTIFF American Calcar Inc.		DEFENDANT BMW of North America, LLC.
PATENT NO.	DATE OF PATENT	PATENTEE
1 6,009,355	12-28-99	American Calcar Inc.
2 6,148,261	11-14-00	American Calcar Inc
3 6,275,231 B1	08-14-01	American Calcar Inc
4 6,282,464 B1	08-28-01	American Calcar Inc
5 6,330,497 B1	12-11-01	American Calcar Inc

In the above-entitled case, the following patent(s) have been included:

DATE INCLUDED	INCLUDED BY			
	☐ Amendment	☐ Answer	☐ Cross Bill	☐ Other Pleading
PATENT NO.	DATE OF PATENT	PATENTEE		
1				
2				
3				
4				
5				

In the above-entitled case, the following decision has been rendered or judgment issued:

DECISION/JUDGMENT		
CLERK	(BY) DEPUTY CLERK	DATE

Copy 1 - Upon initiation of action, mail this copy to Commissioner Copy 3 - Upon termination of action, mail this copy to Commissioner
Copy 2 - Upon filing document adding patent(s), mail this copy to Commissioner Copy 4 - Case file copy

6 6,438,465 B2	08-20-02	American Calcar, Inc.
7 6,459,961 B1	10-01-02	American Calcar, Inc
8 6,529,824 B1	03-04-03	American Calcar, Inc
9 6,542,795 B1	04-01-03	American Calcar, Inc
10 6,587,758 b2	07-01-03	American Calcar, Inc
11 6,587,759 b2	01-01-03	American Calcar, Inc
12 6,703,944 b1	04-09-04	American Calcar, Inc
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JS 44
(Rev. 07/89)

CIVIL COVER SHEET

The JS-44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON THE SECOND PAGE OF THIS FORM.)

I. (a) PLAINTIFFS

AMERICAN CALCAR, INC., a Delaware corporation

DEFENDANTS

BMW of NORTH AMERICA, LLC., a New Jersey limited liability company.

04 MAR 25 PM 2:17

(b) COUNTY OF RESIDENCE OF FIRST LISTED PLAINTIFF Orange County
(EXCEPT IN U.S. PLAINTIFF CASES)

CLERK, U.S. DISTRICT COURT
SOUTHERN DISTRICT OF CALIFORNIA
COUNTY OF RESIDENCE OF FIRST LISTED DEFENDANT Bergen County
(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE LOCATION OF THE TRACT OF LAND INVOLVED.

(c) ATTORNEYS (FIRM NAME, ADDRESS, AND TELEPHONE NUMBER)
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619-235-8550

ATTORNEYS (IF KNOWN)

04 CV 00614 DMS (LSP)

II. BASIS OF JURISDICTION (PLACE AN "X" IN ONE BOX ONLY)

- ☐ 1 U.S. Government Plaintiff
☒ 3 Federal Question (U.S. Government Not a Party)
☐ 2 U.S. Government Defendant
☐ 4 Diversity (Indicate Citizenship of Parties in Item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES (PLACE AN "X" IN ONE BOX FOR PLAINTIFF AND ONE BOX FOR DEFENDANT)

	PT	DEF		PT	DEF
Citizen of This State	☐ 1	☐ 1	Incorporated or Principal Place of Business in This State	☐ 4	☐ 4
Citizen of Another State	☐ 2	☐ 2	Incorporated and Principal Place of Business in Another State	☐ 5	☐ 5
Citizen or Subject of a Foreign Country	☐ 3	☐ 3	Foreign Nation	☐ 6	☐ 6

IV. CAUSE OF ACTION (CITE THE U.S. CIVIL STATUTE UNDER WHICH YOU ARE FILING AND WRITE A BRIEF STATEMENT OF CAUSE.

DO NOT CITE JURISDICTIONAL STATUTES UNLESS DIVERSITY.) Patent infringement arising under the patent laws of the United States Title 35, United States Code and 35 U.S.C. Sections 271 and 281

V. NATURE OF SUIT (PLACE AN "X" IN ONE BOX ONLY)

CONTRACT	TORTS	FORFEITURE/PENALTY	BANKRUPTCY	OTHER STATUTES
☐ 110 Insurance ☐ 120 Marine ☐ 130 Miller Act ☐ 140 Negotiable Instrument ☐ 150 Recovery of Overpayment & Enforcement of Judgment ☐ 151 Medicare Act ☐ 152 Recovery of Defaulted Student Loans (Excl. Veterans) ☐ 153 Recovery of Overpayment of Veteran's Benefits ☐ 160 Stockholders' Suits ☐ 190 Other Contract ☐ 195 Contract Product Liability	PERSONAL INJURY ☐ 310 Airplane ☐ 315 Airplane Product Liability ☐ 320 Assault, Libel & Slander ☐ 330 Federal Employers' Liability ☐ 340 Marine ☐ 345 Marine Product Liability ☐ 350 Motor Vehicle ☐ 355 Motor Vehicle Product Liability ☐ 360 Other Personal Injury PERSONAL INJURY ☐ 362 Personal Injury - Medical Malpractice ☐ 365 Personal Injury - Product Liability ☐ 368 Asbestos Personal Injury Product Liability PERSONAL PROPERTY ☐ 370 Other Fraud ☐ 371 Truth in Lending ☐ 380 Other Personal Property Damage ☐ 385 Property Damage Product Liability	☐ 610 Agriculture ☐ 620 Other Food & Drug ☐ 625 Drug Related Seizure of Property 21 USC 881 ☐ 630 Liquor Laws ☐ 640 R.R. & Truck ☐ 650 Airline Regs. ☐ 660 Occupational Safety/Health ☐ 690 Other LABOR ☐ 710 Fair Labor Standards Act ☐ 720 Labor/Mgmt. Relations ☐ 730 Labor/Mgmt. Reporting & Disclosure Act ☐ 740 Railway Labor Act ☐ 790 Other Labor Litigation ☐ 791 Empl. Ret. Inc. Security Act	☐ 422 Appeal 28 USC 158 ☐ 423 Withdrawal 28 USC 157 PROPERTY RIGHTS ☐ 820 Copyrights ☒ 830 Patent ☐ 840 Trademark SOCIAL SECURITY ☐ 861 HIA (13958) ☐ 862 Black Lung (923) ☐ 863 DIWC/DIWW (405(g)) ☐ 864 SSID Title XVI ☐ 865 RSI (405(g)) FEDERAL TAX SUITS ☐ 870 Taxes (U.S. Plaintiff or Defendant) ☐ 871 IRS - Third Party 26 USC 7609	☐ 400 State Reappointment ☐ 410 Antitrust ☐ 430 Banks and Banking ☐ 450 Commerce/ICC Rates/etc. ☐ 460 Deportation ☐ 470 Racketeer Influenced and Corrupt Organizations ☐ 810 Selective Service ☐ 850 Securities/Commodities/Exchange ☐ 875 Customer Challenge 12 USC 3410 ☐ 891 Agricultural Acts ☐ 892 Economic Stabilization Act ☐ 893 Environmental Matters ☐ 894 Energy Allocation Act ☐ 895 Freedom of Information Act ☐ 900 Appeal of Fee Determination Under Equal Access to Justice ☐ 950 Constitutionality of State Statutes ☐ 990 Other Statutory Actions
REAL PROPERTY ☐ 210 Land Condemnation ☐ 220 Foreclosure ☐ 230 Rent Lease & Ejectment ☐ 240 Torts to Land ☐ 245 Tort Product Liability ☐ 290 All Other Real Property	CIVIL RIGHTS ☐ 441 Voting ☐ 442 Employment ☐ 443 Housing/Accommodations ☐ 444 Welfare ☐ 440 Other Civil Rights	PRISONER PETITIONS ☐ 510 Motion to Vacate Sentence HABEAS CORPUS: ☐ 530 General ☐ 535 Death Penalty ☐ 540 Mandamus & Other ☐ 550 Civil Rights ☐ 555 Prison Conditions		

VI. ORIGIN

(PLACE AN "X" IN ONE BOX ONLY)

- ☒ 1 Original Proceeding
☐ 2 Removal from State Court
☐ 3 Remanded from Appellate Court
☐ 4 Reinstated or Reopened
☐ 5 Transferred from another district (specify)
☐ 6 Multidistrict Litigation
☐ 7 Appeal to District Judge from Magistrate Judgment

VII. REQUESTED IN COMPLAINT:

☐ CHECK IF THIS IS A CLASS ACTION DEMAND \$
UNDER F.R.C.P. 23

CHECK YES only if demanded in complaint:

JURY DEMAND: ☒ YES ☐ NO

VIII. RELATED CASE(S) (See instructions):

IF ANY

DATE March 25, 2004
 SIGNATURE OF ATTORNEY OF RECORD *Frederick S. Berretta*
 Docket Number

Frederick S. Berretta