RUSS AUGUST & KABAT
Marc A. Fenster, State Bar No. 181067
Benjamin T. Wang, State Bar No. 228712
Adam S. Hoffman, State Bar No. 218740
Fredricka Ung, State Bar No. 253794
12424 Wilshire Boulevard, 12th Floor
Los Angeles, California 90025
Tel: 310.826.7474
Fax: 310.826.6991
e-mail: mfenster@raklaw.com;
e-mail: bwang@raklaw.com;
e-mail: ahoffman@raklaw.com; and
e-mail: fung@raklaw.com

Attorneys for Plaintiff
TRAMONTANE IP, LLC

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA – WESTERN DIVISION

TRAMONTANE IP, LLC,

Plaintiff,

vs.

PIONEER ELECTRONICS (USA) INC.,

Defendant.

Case No. CV 12 1696 GW (PJWx)

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Tramontane IP, LLC ("Tramontane") alleges as follows:

PARTIES

1. Tramontane is a Virginia limited liability company with a principal place of business at 2331 Mill Road, Suite 100, Alexandria, VA 22314.

2. On information and belief, Pioneer Electronics (USA) Inc. ("Pioneer") is a Delaware corporation with a principal place of business at 1925 East Dominguez Street, Long Beach, CA 90810.

JURISDICTION AND VENUE

3. This is an action for patent infringement arising under the patent laws of the United States of America, 35 U.S.C. § 1, *et seq.*, including § 271. This Court has subject matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a).

4. This Court has personal jurisdiction over defendant because, among other reasons, defendant resides in California and this District, has done business in California and this District, has committed and continues to commit acts of patent infringement in California and this District, and has harmed and continues to harm Tramontane in California and this District, by, among other things, using, selling, offering for sale, and importing infringing products or processes in California and this District.

5. Venue is proper in this district under 28 U.S.C. §§ 1391(b)-(c) and 1400(b) because, among other reasons, defendant is subject to personal jurisdiction in this District, has consented to this District, and has committed acts of patent infringement in this District. On information and belief, for example, defendants have used, sold, offered for sale, and imported infringing products or processes in this District.

COUNT I

(Infringement of U.S. Patent No. 6,526,268)

6. Tramontane is the owner by assignment of United States Patent No. 6,526,268 ("the '268 patent"), entitled "Mobile Weather Band Radio and Method." The '268 patent issued on February 25, 2003. A true and correct copy of the '268 patent is attached hereto as Exhibit A.

7. On information and belief, in violation of one or more provisions of 35 U.S.C. § 271, defendant has infringed one or more claims of the '268 patent by making, using, selling, offering to sell, or importing navigation systems that provide dynamic geographic updating to users by way of, for example, geographically encoded broadcast radio signals. Defendant's navigation systems,

including Avic Z130BT, and navigation systems that function similarly, receive geographically encoded messages with traffic and/or weather content from, for example, broadcast radio signals, through a radio receiver built into the navigation system housing or power cable, or similar receiving devices, and dynamically provide information to the user on traffic and/or weather conditions.

8. Defendant committed these acts of infringement without license or authorization.

9. As a result of defendant's infringement of the '268 patent, Tramontane has suffered monetary damages in an amount not yet determined, and will continue to suffer damages in the future unless defendant's infringing activities are enjoined by this Court.

10. Tramontane has suffered and will continue to suffer severe and irreparable harm unless this Court issues a permanent injunction prohibiting defendant, its agents, servants, employees, representatives, and all others acting in active concert therewith from infringing the '268 patent.

PRAYER FOR RELIEF

Tramontane prays for the following relief:

1. A judgment that defendant has directly infringed (either literally or under the doctrine of equivalents) one or more claims of the '268 patent;

2. A permanent injunction enjoining defendant and its officers, directors, agents, servants, affiliates, employees, divisions, branches, subsidiaries, parents, and all others acting in active concert or participation with them, from infringing each of the '268 patent;

3. An award of damages resulting from defendant's acts of infringement in accordance with 35 U.S.C. § 284;

4. A judgment and order finding that this is an exceptional case within the meaning of 35 U.S.C. § 285 and awarding to Tramontane its reasonable attorneys' fees against defendant;

5. A judgment and order requiring defendant to provide an accounting and to pay supplemental damages to Tramontane, including without limitation, pre-judgment and post-judgment interest; and

6. Any and all other relief to which Tramontane may show itself to be entitled.

DEMAND FOR JURY TRIAL

Tramontane demands a trial by jury on all issues so triable.

Dated: February 28, 2012

RUSS AUGUST & KABAT
MARC A. FENSTER
BENJAMIN T. WANG
ADAM S. HOFFMAN
FREDRICKA UNG

By: _____
Marc A. Fenster
Attorney for Plaintiffs

US006526268B1

(12) **United States Patent**
Marrah et al.

(10) **Patent No.: US 6,526,268 B1**
(45) **Date of Patent: Feb. 25, 2003**

(54) **MOBILE WEATHER BAND RADIO AND METHOD**

(75) Inventors: **Jeffrey Joseph Marrah**, Kokomo, IN (US); **Harry Diamond**, Tipton, IN (US)

(73) Assignee: **Delphi Technologies, Inc.**, Troy, MI (US)

(*) Notice: 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.: **09/390,794**

(22) Filed: **Sep. 7, 1999**

(51) **Int. Cl.**[7] **H04M 17/02**
(52) **U.S. Cl.** **455/186.1**; 455/456; 455/34.4
(58) **Field of Search** 455/344, 404, 455/179.1, 456, 414, 186.1, 161.3, 161.1, 457; 340/601, 286.02, 905, 7.54; 701/207, 117; 702/3

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National Weather Service, NOAA Weather Radio (NWR) Transmitters, NWR Specific Area Message Encoding NWR—Same, Update #4.42, Mar. 31, 1999.

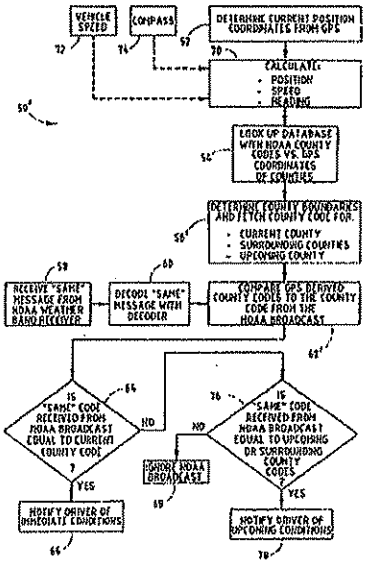
* cited by examiner

Primary Examiner—Thanh Cong Le
Assistant Examiner—C. Chow
(74) *Attorney, Agent, or Firm*—Jimmy L. Funke; Stefan V. Chmielewski

(57) **ABSTRACT**

A mobile weather band radio and method with dynamic geographic message updating. The radio has a weather band tuner for receiving weather band signals containing a message and a geographic identification code. A position indicative receiver is provided for receiving position indicative signals and determining a current position of the radio. Geographic identification codes and electronic map data are stored in memory for defining geographic regions corresponding to the geographic identification codes. A controller determines one of the geographic codes corresponding to the determined current position based on the position indicative signals, and further performs an operation, such as playing the message, when the determined geographic code corresponds to the received geographic code.

40 Claims, 6 Drawing Sheets



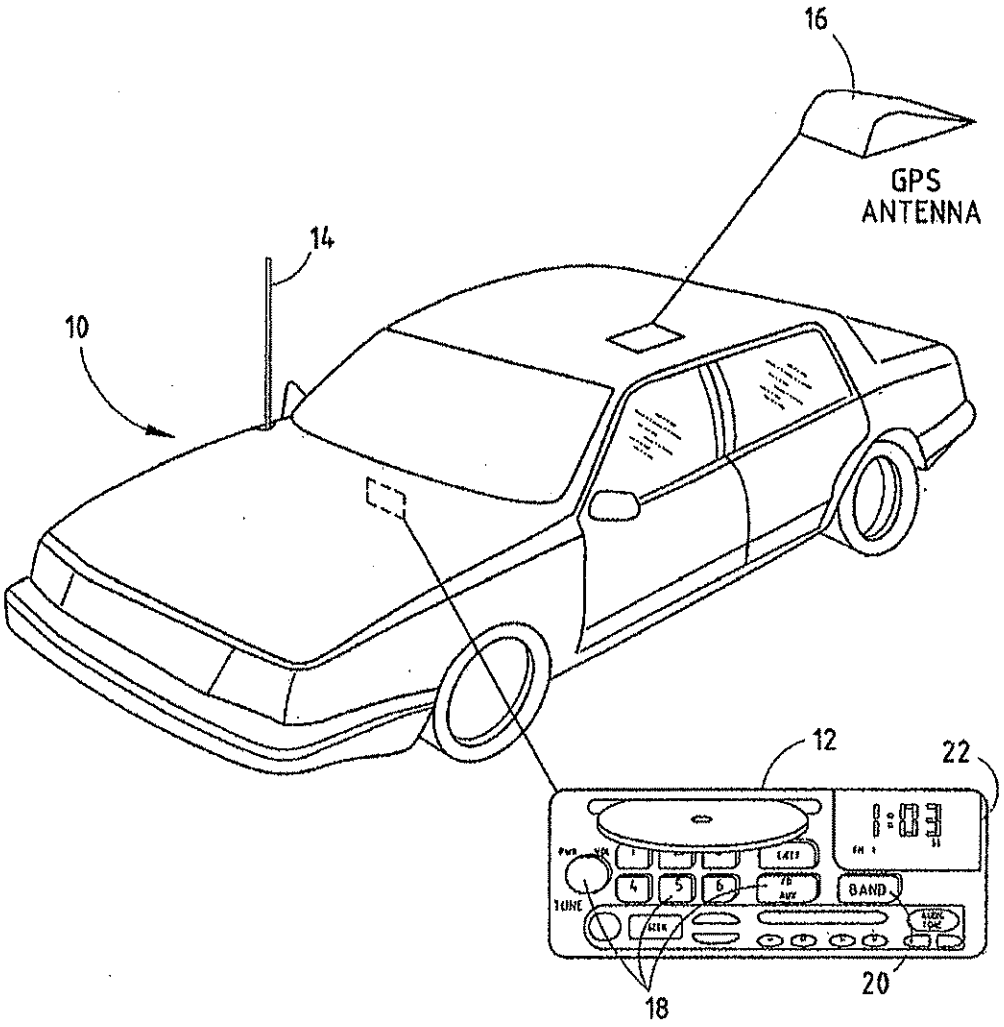


FIG. 1

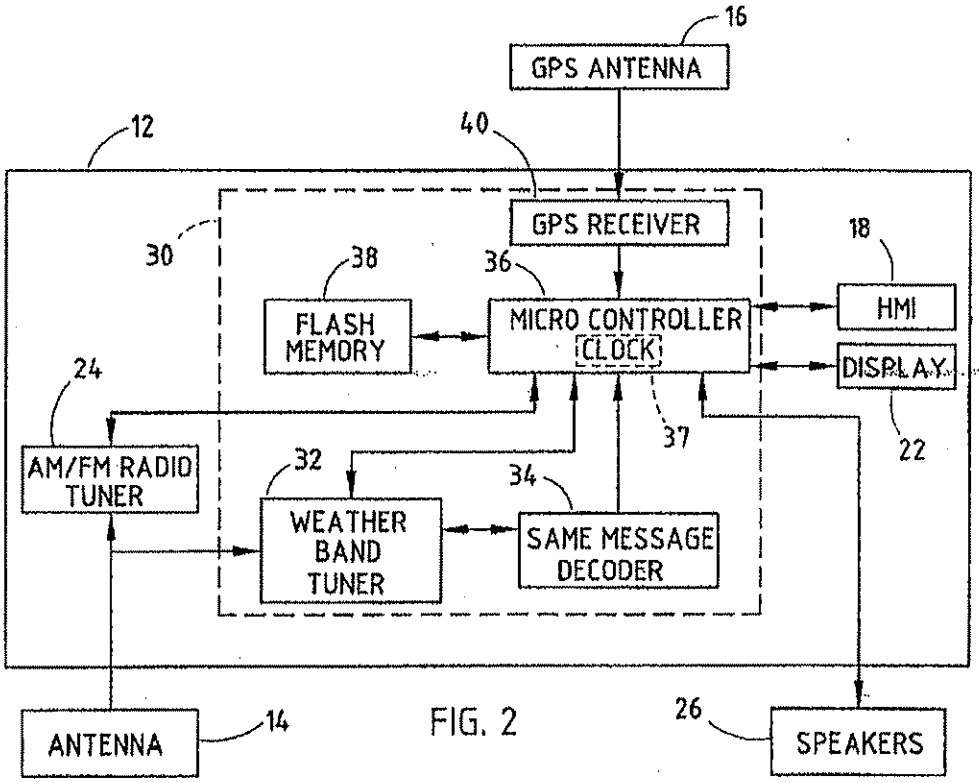

16
GPS ANTENNA
12
40
GPS RECEIVER
30
38
36
18
FLASH MEMORY
MICRO CONTROLLER
CLOCK
HMI
DISPLAY
24
37
22
AM/FM RADIO TUNER
32
34
WEATHER BAND TUNER
SAME MESSAGE DECODER
ANTENNA
14
26
SPEAKERS

FIG. 2

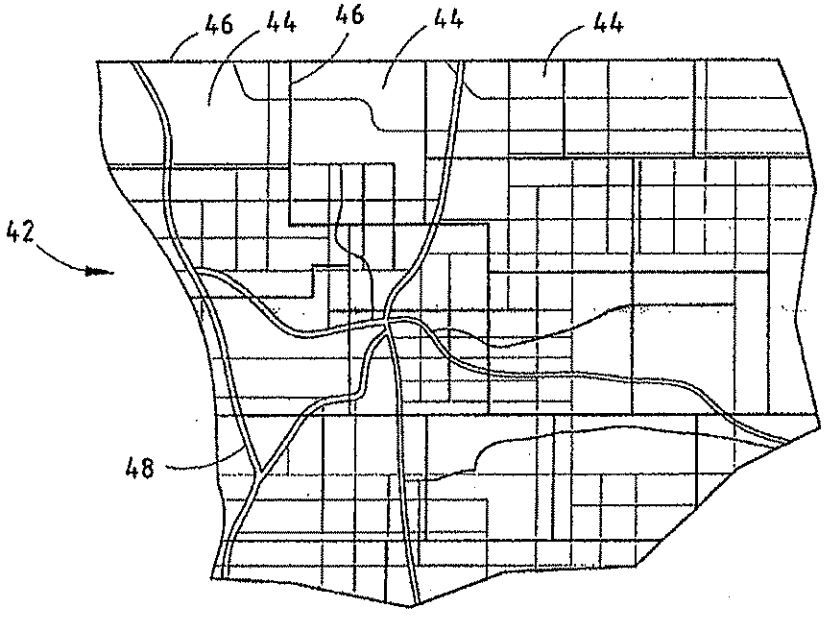

46
44
46
44
44
42
48

FIG. 3

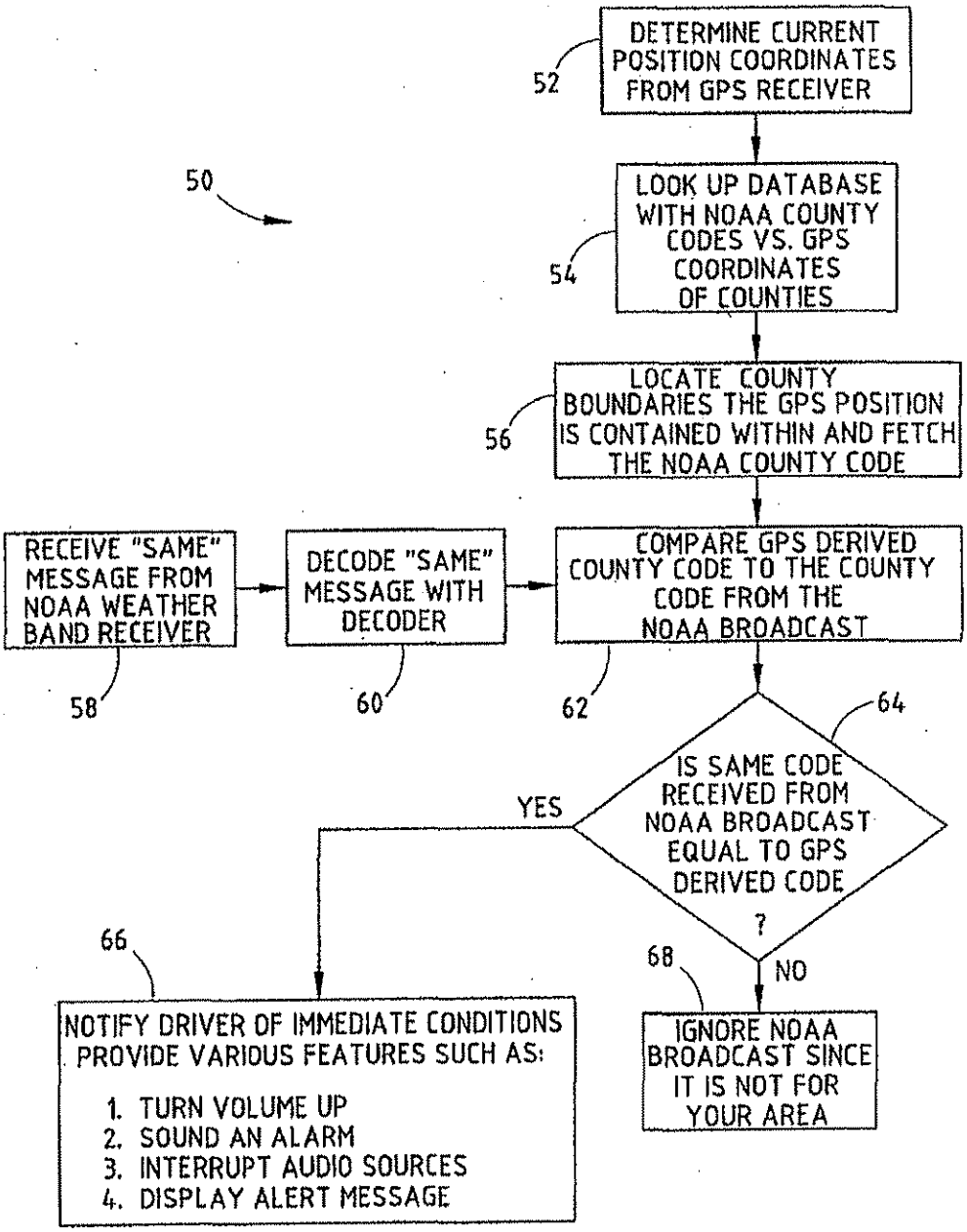

50
52
DETERMINE CURRENT POSITION COORDINATES FROM GPS RECEIVER
54
LOOK UP DATABASE WITH NOAA COUNTY CODES VS. GPS COORDINATES OF COUNTIES
56
LOCATE COUNTY BOUNDARIES THE GPS POSITION IS CONTAINED WITHIN AND FETCH THE NOAA COUNTY CODE
58
RECEIVE "SAME" MESSAGE FROM NOAA WEATHER BAND RECEIVER
60
DECODE "SAME" MESSAGE WITH DECODER
62
COMPARE GPS DERIVED COUNTY CODE TO THE COUNTY CODE FROM THE NOAA BROADCAST
64
IS SAME CODE RECEIVED FROM NOAA BROADCAST EQUAL TO GPS DERIVED CODE ?
YES
NO
66
NOTIFY DRIVER OF IMMEDIATE CONDITIONS PROVIDE VARIOUS FEATURES SUCH AS:
1. TURN VOLUME UP
2. SOUND AN ALARM
3. INTERRUPT AUDIO SOURCES
4. DISPLAY ALERT MESSAGE
68
IGNORE NOAA BROADCAST SINCE IT IS NOT FOR YOUR AREA

FIG. 4

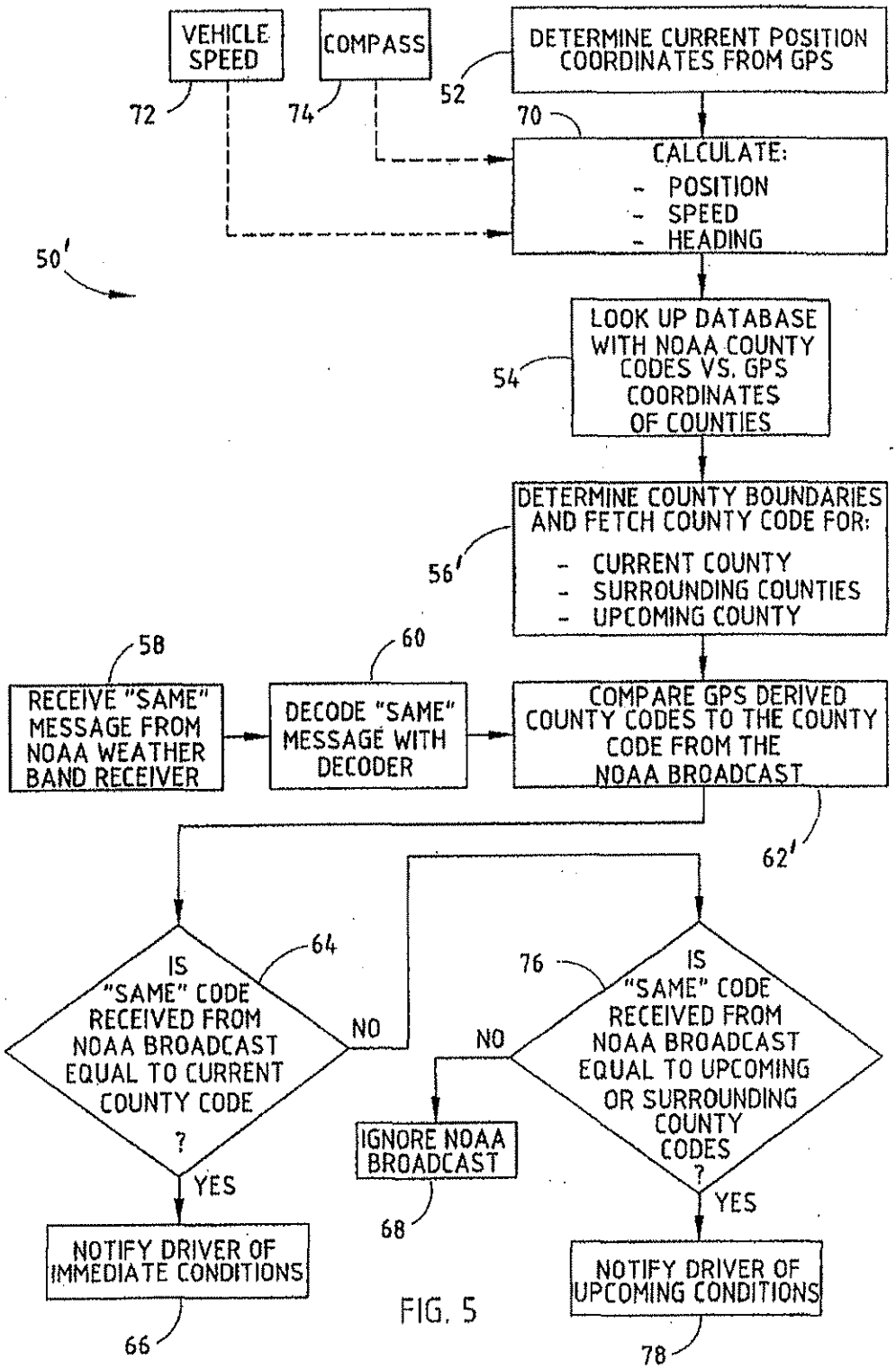
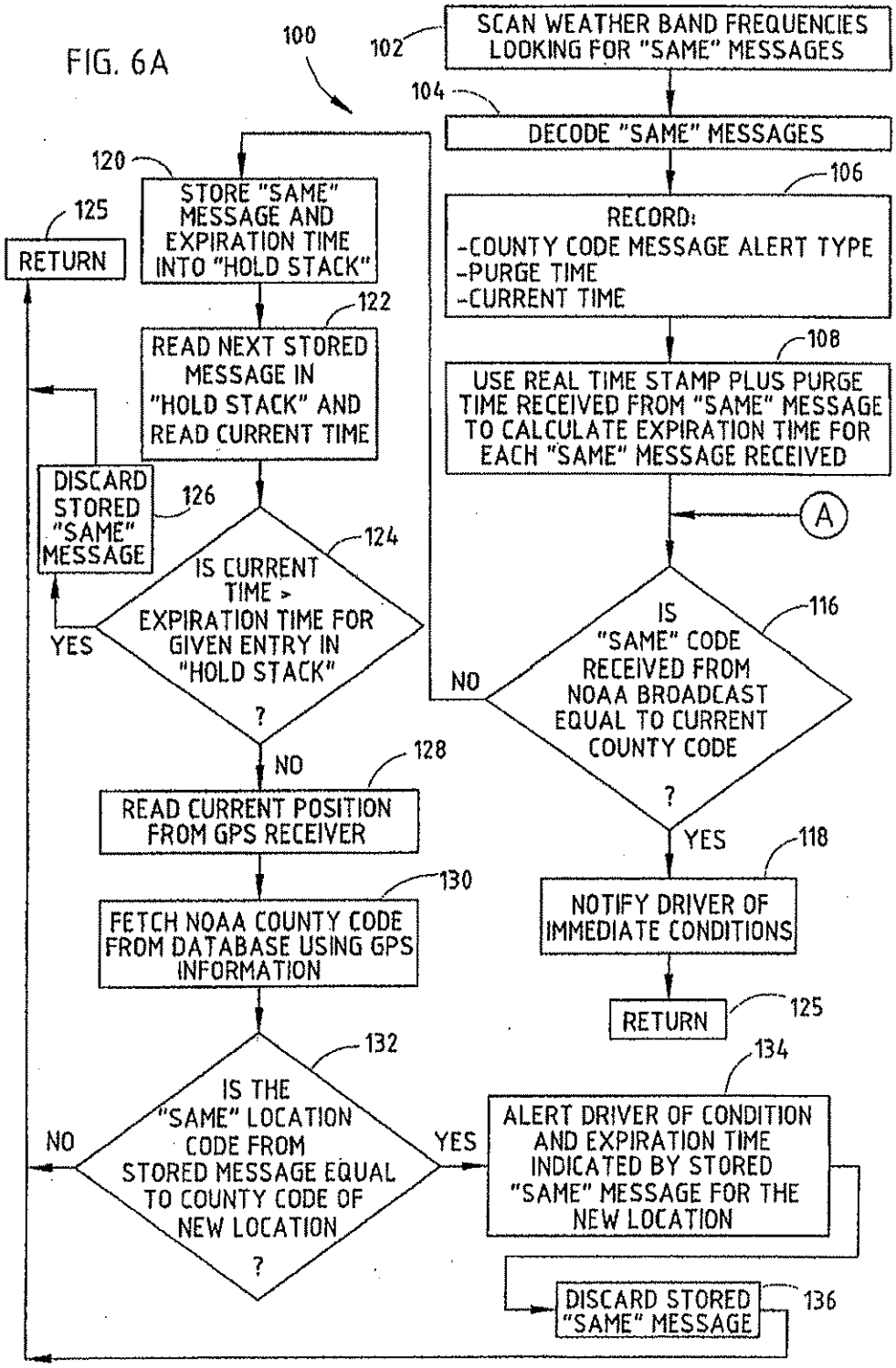

VEHICLE SPEED
COMPASS
DETERMINE CURRENT POSITION COORDINATES FROM GPS
72
74
52
70
CALCULATE:
- POSITION
- SPEED
- HEADING
50'
LOOK UP DATABASE WITH NOAA COUNTY CODES VS. GPS COORDINATES OF COUNTIES
54
DETERMINE COUNTY BOUNDARIES AND FETCH COUNTY CODE FOR:
- CURRENT COUNTY
- SURROUNDING COUNTIES
- UPCOMING COUNTY
56'
58
60
RECEIVE "SAME" MESSAGE FROM NOAA WEATHER BAND RECEIVER
DECODE "SAME" MESSAGE WITH DECODER
COMPARE GPS DERIVED COUNTY CODES TO THE COUNTY CODE FROM THE NOAA BROADCAST
62'
64
IS "SAME" CODE RECEIVED FROM NOAA BROADCAST EQUAL TO CURRENT COUNTY CODE ?
NO
YES
76
IS "SAME" CODE RECEIVED FROM NOAA BROADCAST EQUAL TO UPCOMING OR SURROUNDING COUNTY CODES ?
NO
YES
IGNORE NOAA BROADCAST
68
NOTIFY DRIVER OF IMMEDIATE CONDITIONS
66
NOTIFY DRIVER OF UPCOMING CONDITIONS
78

FIG. 5

FIG. 6A


100
102
SCAN WEATHER BAND FREQUENCIES LOOKING FOR "SAME" MESSAGES
104
DECODE "SAME" MESSAGES
106
RECORD:
-COUNTY CODE MESSAGE ALERT TYPE
-PURGE TIME
-CURRENT TIME
108
USE REAL TIME STAMP PLUS PURGE TIME RECEIVED FROM "SAME" MESSAGE TO CALCULATE EXPIRATION TIME FOR EACH "SAME" MESSAGE RECEIVED
A
116
IS "SAME" CODE RECEIVED FROM NOAA BROADCAST EQUAL TO CURRENT COUNTY CODE ?
NO
YES
118
NOTIFY DRIVER OF IMMEDIATE CONDITIONS
125
RETURN
120
STORE "SAME" MESSAGE AND EXPIRATION TIME INTO "HOLD STACK"
122
READ NEXT STORED MESSAGE IN "HOLD STACK" AND READ CURRENT TIME
124
IS CURRENT TIME > EXPIRATION TIME FOR GIVEN ENTRY IN "HOLD STACK" ?
YES
126
DISCARD STORED "SAME" MESSAGE
NO
128
READ CURRENT POSITION FROM GPS RECEIVER
130
FETCH NOAA COUNTY CODE FROM DATABASE USING GPS INFORMATION
132
IS THE "SAME" LOCATION CODE FROM STORED MESSAGE EQUAL TO COUNTY CODE OF NEW LOCATION ?
NO
YES
134
ALERT DRIVER OF CONDITION AND EXPIRATION TIME INDICATED BY STORED "SAME" MESSAGE FOR THE NEW LOCATION
136
DISCARD STORED "SAME" MESSAGE

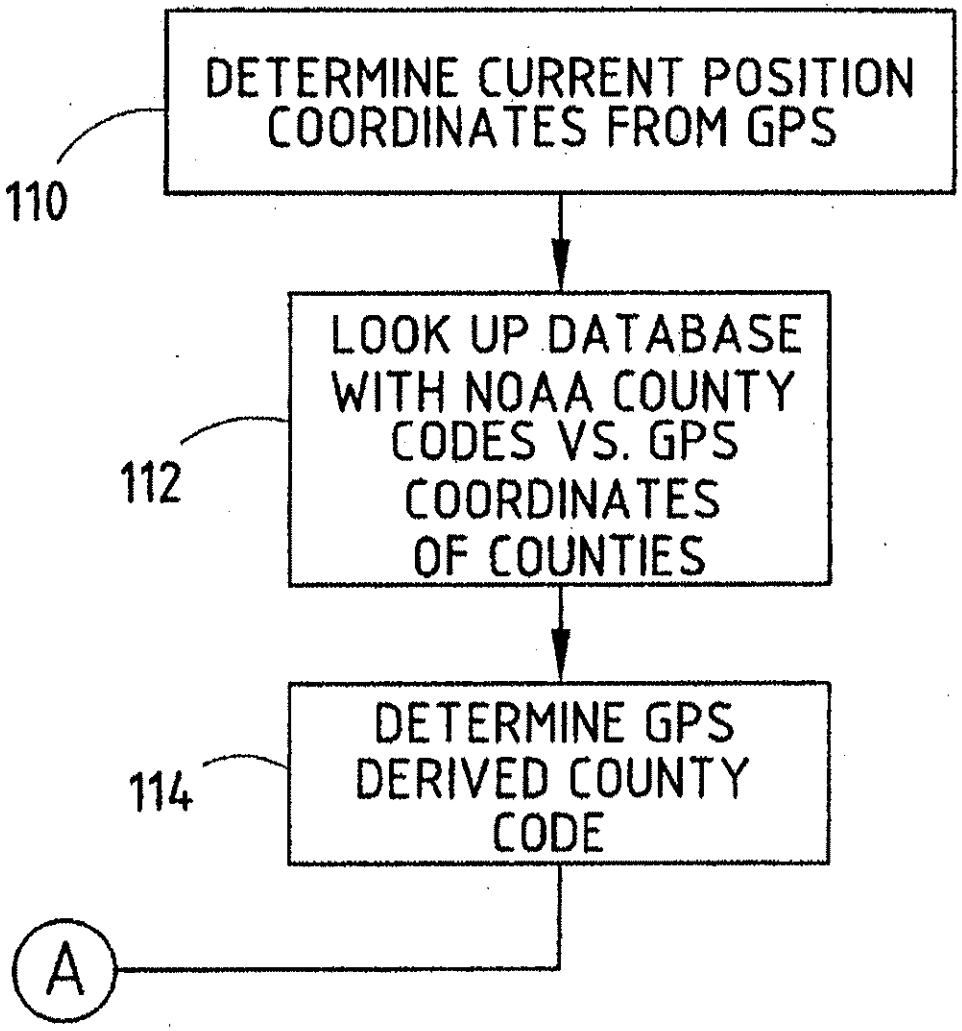

DETERMINE CURRENT POSITION COORDINATES FROM GPS
110
LOOK UP DATABASE WITH NOAA COUNTY CODES VS. GPS COORDINATES OF COUNTIES
112
DETERMINE GPS DERIVED COUNTY CODE
114
A

FIG. 6B

MOBILE WEATHER BAND RADIO AND METHOD

TECHNICAL FIELD

The present invention generally relates to electronic radios and, more particularly, to a mobile weather band radio for providing weather messages, emergency messages, and other information.

BACKGROUND OF THE INVENTION

The National Oceanic and Atmospheric Administration (NOAA) has been providing a weather band radio broadcast service in the United States for many years. The NOAA weather radio (NWR) service provides continuous weather and emergency related updates to local geographic regions. The NOAA weather radio service provides weather-related warnings and serves as a broadcast warning system for other emergency messages about events that may threaten life and/or property. To receive weather band broadcast service information, a specially designed receiver is generally required to tune to the weather band broadcast. Currently, the NOAA weather band broadcast transmissions include seven narrow band frequency modulated (FM) channels in the very high frequency (VHF) band ranging from 162.400 to 162.550 kHz, with a 25 kHz channel separation between adjacent channels. The seven channels are broadcast from transmitters located in various geographic regions and the signals for multiple channels often overlap. Accordingly, it is possible to tune a weather band radio to receive a plurality of weather band channels from one location.

Recently, NOAA has added digital voice synthesis which allows for faster distribution of emergency updates, in contrast to analog voice recordings. Moreover, NOAA has also added Specific Area Message Encoding (SAME) which provides digital information indicative of the geographic region covered by the accompanying message. Currently, the geographic regions are typically defined by counties. This allows for weather band receivers to filter out messages that do not pertain to a selected geographic region. In general, the NOAA weather radio transmitter devoted to a given geographic area may not provide the strongest signal with the best reception that is available at certain locations in its coverage area. As a consequence, by simply tuning to the station having the strongest signal, a radio user may miss those messages pertaining to the geographic region of interest.

The use of the SAME message generally allows for receipt of only those messages in a selected geographic area. The weather band radio must include decoding circuitry capable of decoding the SAME digital message. In addition, a geographic identification code generally is used to identify the county of interest, and the code must be manually input into the decoding circuitry to configure the radio for the geographic area of interest. Once configured, the weather band radio will respond only to those messages associated with the selected geographic identification code, and may ignore alert messages which do not pertain to the selected region of interest. For home-based weather band radios, the SAME message is satisfactory since the location of the radio is generally fixed. However, when the weather band radio is transported from one geographic coverage region to another geographic coverage region, the weather band radio generally must be reprogrammed by the user. This reprogramming drawback becomes particularly significant when a weather band radio is used in a mobile vehicle, such as an automobile, which frequently travels amongst various geographic counties. Accordingly, it is therefore desirable to provide for a weather band radio which offers dynamic updating to adjust for geographic location.

SUMMARY OF THE INVENTION

In accordance with the teachings of the present invention, a radio and method of providing radio messages with geographic based messaging is provided. The radio includes a receiver for receiving broadcast radio signals containing a message and a corresponding geographic identifier. The radio includes a device for determining a current position of the radio. Also included are geographic identifiers and electronic map data, preferably stored in memory, for defining geographic regions corresponding to the geographic identifiers. A controller determines which one of the geographic identifiers corresponds to the determined current position, and further performs an operation when the determined geographic identifier corresponds to the received geographic identifier.

According to the preferred embodiment, the radio is particularly well suited for use as a weather band radio for providing weather and emergency messages and emergency alert signals. The present invention advantageously allows for receipt of those messages that are intended to cover the location of the radio, while ignoring messages not of interest. According to other embodiments, the radio may further provide messages for an upcoming and/or surrounding geographic regions, and may track the message's expiration time.

These and other features, advantages and objects of the present invention will be further understood and appreciated by those skilled in the art by reference to the following specification, claims and appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. **1** is a perspective view of an automotive vehicle equipped with a weather band radio;

FIG. **2** is a block diagram of the weather band radio integrated into the car radio according to the present invention;

FIG. **3** is a map illustrating one example of geographic county regions which are electronically stored for use in the weather band radio;

FIG. **4** is a flow diagram illustrating a method of providing geographic based messages with the weather band radio according to one embodiment of the present invention;

FIG. **5** is a flow diagram illustrating a method of providing geographic based messages with the weather band radio according to another embodiment of the present invention; and

FIGS. **6A–6B** is a flow diagram illustrating a method of providing geographic based messages with expiration time tracking according to a further embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, an automotive vehicle **10** is shown equipped with an AM/FM audio car radio **12** which includes a weather band radio integrated with the audio car radio **12**.

According to the preferred embodiment, the weather band radio is integrated into the automotive vehicle's AM/FM audio car radio **12** to provide for receipt of weather band signals that are broadcast within a geographic region of interest. While the weather band radio described herein is integrated in an audio car radio **12**, it should be appreciated that the weather band radio may be employed as a separate stand alone electronic device, such as a portable hand held device, and may be used in other various applications, without departing from the teachings of the present invention.

The audio car radio **12** may be easily mounted in the dash of the vehicle **10** according to a conventional car radio installation. The car radio **12** shown is an AM/FM radio equipped with an audio tape and a CD player, and includes a human-machine interface (HMI) key matrix with a plurality of manually operable controls **18** which extend from its face plate. Included in the controls **18** is a "BAND" pushbutton switch **20** for selecting amongst the available broadcast bands which include the amplitude modulation (AM) band, the frequency modulation (FM) band, and the weather band. The controls **18** and display **22** are easily accessible by the driver or a passenger in the vehicle **10**. In addition, the vehicle **10** further includes an AM/FM/weather band antenna **14** for receiving broadcast signals. Antenna **14** is capable of receiving the weather band frequency range, as well as the AM and/or FM broadcast signals. Further, a global positioning system (GPS) antenna **16** is preferably mounted on the roof of the vehicle **10**, and is exposed to GPS radio wave signals.

Referring to FIG. **2**, the audio car radio **12** is shown connected to antennas **14** and **16**, and is further connected to audio speakers **26**. Audio car radio **12** contains a conventional AM/FM radio tuner **24** coupled to antenna **14** for tuning to selected radio frequencies. Integrated within the audio radio **12** is a weather band radio **30** which is generally shown by dash lines. The weather band radio **30** is commonly packaged and integrated with the audio car radio **12** such that certain electronics may be shared with the AM/FM radio electronics. The weather band radio **30**, according to the present invention, may include a stand alone weather band radio, or may be integrated in the audio car radio **12** as shown.

Included in weather band radio **30** is a weather band tuner **32** which is coupled to antenna **14** for receiving signals received on antenna **14**. Coupled to the tuner **32** is a SAME message decoder **34** which receives and decodes the Specific Area Message Encoding (SAME) weather band signals provided by weather band tuner **32**. The weather band radio **30** also includes a microcontroller **36**, preferably containing a microprocessor, and non-volatile memory, such as flash memory **38**. Microcontroller **36** includes a time clock **37**. In addition, the weather band radio **30** further includes a global positioning system (GPS) receiver **40** which is coupled to the GPS antenna **16** for receiving current position indicating signals.

The weather band tuner **32** is automatically adjustable via the microcontroller **36** to tune to one of a plurality of available weather band channels for receiving broadcast weather band signals which may contain weather, emergency or other messages. Weather band tuners are commercially available and are well-known in the art for receiving broadcast narrow band FM signals provided throughout the United States by the National Oceanic and Atmospheric Administration (NOAA) weather radio (NWR) service. Currently, the NOAA weather radio service transmits seven weather band channels in the very high frequency range of 162.400 to 162.550 kHz, having a 25 kHz channel spacing between adjacent channels. The weather band tuner **32** is adjustable in that it can be adjusted to tune to any one of the channels that are made available.

The NOAA weather radio service currently transmits weather and emergency related message information on the weather band, and provides an emergency alert system in which weather and emergency messages are broadcast, along with other information, as part of the specific area message encoding (SAME) message. The SAME message further includes one or more geographic identifiers, generally in the form of alphanumeric codes, which define the geographical counties to which the weather or emergency information pertains. Currently, each geographic identification code corresponds to a unique county, however, other geographical boundaries may be defined and assigned a unique code. A description of the current specific area message encoding provided by the NOAA weather radio service is disclosed in the published report entitled "NATIONAL WEATHER SERVICE, NOAA WEATHER RADIO (NWR) TRANSMITTERS, NWR SPECIFIC AREA MESSAGE ENCODING," Update #4.42, dated Mar. 31, 1999, which is hereby incorporated by reference.

The SAME message decoder **34** receives and decodes the SAME message received by the weather band tuner **32**, and provides the decoded message to the microcontroller **36**. It should be appreciated that the SAME message decoding could, alternatively, be performed by the microcontroller **36**. The microcontroller **36** processes the SAME message, along with GPS received position indication information and, in accordance with the programmed software stored in flash memory **38** or other memory, actuates the appropriate response for the geographical region(s) of interest. According to one embodiment, the weather and/or emergency message information is made available for the county where the weather band radio **30** is currently located. According to another embodiment, the predicted upcoming county and/or surrounding counties are included.

According to well-known GPS operations, the GPS receiver **40** receives GPS radio wave signals via the GPS receiving antenna **16**. The GPS radio wave signals are emitted from existing GPS satellites. A constellation of multiple high altitude GPS satellites currently exist in earth orbit and are available to provide continuous worldwide position fixes in all types of weather conditions. The GPS receiver **40** has a built-in processing unit and memory for processing the GPS radio wave signals to determine the latitude and longitude position coordinates of the current position, as well as determining the current direction of travel and speed of the vehicle.

More specifically, the GPS receiver **40** continuously receives radio wave signals from the GPS antenna **16** and determines accurate position coordinates which identify the location of the received signals. This determination includes calculating the distance from various satellites to determine a position relative thereto. By measuring the current signals sent by the GPS satellites and knowing orbital parameters of the satellites, the GPS receiver **40** is able to determine the position thereof and generate longitude and latitude position coordinates which identify the position of the received signals. Given the received GPS signals, the latitude and longitude position coordinates of the GPS receiver **40** are determined by computing distance from each of several GPS satellites currently visible to the receiver **40** by direct-line-of-sight. Distance is determined by precise computation of the time required for radio signals to travel from the GPS satellite to the GPS receiver. Combined with precise infor-

mation about the satellites' positions relative to the earth, precise latitude and longitude position coordinates are computed. GPS is widely known and should be understood to those skilled in the art as a means for providing accurate position information. It should also be understood that enhanced accuracy may be obtained with GPS now and in the future. For example, a differential receiver can also be employed to provide the availability of differential GPS which provides enhanced position determining accuracy. Further, it should be appreciated that other forms of position determining devices, other than GPS, could be employed now and in the future to provide updated position information.

Geographic regions are electronically mapped and stored in memory along with geographic identification codes that identify each of the regions. An example of a geographic territory and the boundaries defining each county as the geographic regions is shown in FIG. **3**. The solid lines **46** represent the geographic boundaries defining each of a plurality of counties **44**. As a mobile vehicle travels on a road **48**, the vehicle may cross geographic boundaries **46** to travel from one county to another county. Each of the counties **44** has an assigned geographic identification code stored in memory. The longitude and latitude position coordinates of the boundaries may be stored in memory and compared to the GPS derived current position to determine the geographic region of interest.

According to one embodiment of the present invention, the weather band radio **30** determines which geographic county the vehicle is currently located in, and provides messages which pertain to that geographic county only. According to another embodiment of the present invention, the weather band radio **30** further determines one or more upcoming geographic counties and/or surrounding counties, and provides messages relevant to those counties. It should be appreciated that other geographically defined regions may be employed, such as defining boundaries based on rectilinear coordinates or based on distance from a certain location such as a county seat, without departing from the teachings of the present invention.

Referring to FIG. **4**, a methodology **50** for providing weather band radio service in a mobile vehicle is illustrated therein according to one embodiment of the present invention. Methodology **50** determines the current position coordinates from the GPS receiver in step **52**. In step **54**, methodology **50** performs a lookup in the database which contains the NOAA county codes versus GPS position coordinates of counties. The county boundaries for which the determined GPS position is contained within are located, and the corresponding NOAA county code for that county is fetched from memory in step **56**. Accordingly, the NOAA county code, which identifies the geographic region that includes the current position coordinates, is determined.

At the same time, methodology **50** receives the SAME message from the NOAA weather band receiver in step **58**, and decodes the SAME message with the decoder in step **60**. The radio preferably scans weather band frequencies looking for all broadcast SAME messages. The decoded message may include weather, emergency, or other information. Additionally, the decoded message includes one or more county code identifiers which identify the county, portions of a county, a plurality of counties for which the associated weather, emergency, or other message information pertains. In step **62**, methodology **50** compares the GPS derived county code to the county code(s) from the SAME message of the NOAA broadcast. Decision block **64** then compares the SAME county code received from the NOAA broadcast with the GPS derived county code, and determines if the county codes match. If the SAME county code does not match the GPS derived code, the NOAA broadcast message is ignored in step **68**, since the message does not pertain to the geographic region in which the radio is located. If the SAME county code matches the GPS derived county code, methodology **50** proceeds to step **66** to notify the driver of the vehicle of immediate conditions or other designated messages. The warning of immediate conditions may include providing various features such as turning the volume up on the audio radio, sounding an alarm, interrupting audio sources such as playback devices and AM/FM broadcasts, displaying an alert message, as well as providing other various features. The alert messages could include the warning of a severe weather condition, such as a tornado watch or a tornado warning, and/or a statement of a condition or emergency regarding non-weather related information. Following each of steps **66** and **68**, methodology **50** returns to repeat the steps.

With particular reference to FIG. **5**, an alternate methodology **50'** is shown for providing weather band related information according to another embodiment of the present invention. Methodology **50'** includes step **52** of determining the current GPS position coordinates, step **54** of looking up the database with the NOAA county codes versus GPS coordinates of counties, step **58** of receiving the SAME message from the NOAA weather band receiver, and step **60** of decoding the SAME message with a decoder. In addition, methodology **50'** calculates the position of the vehicle, the speed of the vehicle, and the heading direction of the vehicle in step **70**. The speed and heading information may be computed from the signals received by the GPS receiver or, alternately, may include separate inputs such as a vehicle speed signal **72** and a compass signal **74**. In step **56**, methodology **50'** determines the current county boundaries for the GPS determined position and fetches the county code for the current county, the surrounding counties, and/or the upcoming county. This may include determining the counties of interest as a function of the current detected position, speed, and heading direction of the vehicle. In step **62'**, methodology **50'** compares the GPS derived county codes to the county code received from the NOAA broadcast message.

Methodology **50'** proceeds to decision block **64** to determine if the SAME county code received from the NOAA broadcast is equal to the current county code and, if so, notifies the driver of immediate conditions in step **66**, as is described above. If the SAME county code is not equal to the current county code, methodology **50'** proceeds to decision block **76** to check if the SAME county code received from the NOAA broadcast is equal to the upcoming or surrounding county codes. If the same code is equal to the upcoming or surrounding county codes, the driver of the vehicle is notified of the upcoming conditions for the upcoming or surrounding counties in step **78**. Otherwise, methodology **50'** ignores the NOAA broadcast, since the message does not pertain to the current county, the surrounding counties of interest, or the upcoming county. Following each of steps **66**, **68**, and **78**, methodology **50'** returns to repeat the steps.

Referring to FIGS. **6A–6B**, a methodology **100** is shown for providing weather band related information based on the message's expiration time according to yet another embodiment. Methodology **100** scans the weather band frequencies looking for the SAME messages in step **102** and proceeds to step **104** to decode the SAME messages as is discussed above. In step **106**, the county code message alert type,

expiration purge time, and current time are recorded. The expiration purge time is determined from the SAME message and provides a period of time over which the message alert is valid. For example, a tornado warning may be accompanied by an expiration purge time period for which the warning is in effect. At the same time, the current time, as taken from the time clock **37**, is recorded. In step **108**, methodology **100** uses the real time stamp plus the purge time received from the SAME message to calculate an expiration time for each SAME message received. At the same time, methodology **100** determines the current position coordinates from the GPS receiver in step **110**, looks up the database with the NOAA county codes versus GPS coordinates of counties in step **112**, and determines the GPS derived county code, as is explained above.

In step **116**, the SAME county code received from the NOAA broadcast is compared to the current county code. If the SAME county code received from the NOAA broadcast is equal to the current county code, the driver of the vehicle is notified of the immediate conditions provided in the message, as set forth in step **118**. Following step **118**, methodology **100** returns to the beginning in step **125** to repeat the routine. If the SAME county code received from the NOAA broadcast does not equal the current county code, methodology **100** proceeds to step **120** to store the SAME message and expiration time into a hold stack. The hold stack may include an internally generated shift register for storing each message and its corresponding expiration time in sequentially readable memory locations.

In step **122**, the next stored message in the hold stack is read, and the current time is read from the time clock **37**. In decision block **124**, the current time is compared to the message's expiration time. If the current time is greater than the expiration time for the given message entry in the hold stack, the expiration time has timed out and the alert message is no longer in effect, so methodology **100** proceeds to step **126** to discard the corresponding stored SAME message, and then returns in step **125** to the beginning to repeat the routine. If the current time does not exceed the expiration time for a given message entry in the hold stack, methodology **100** proceeds to step **128** to read the current position from the GPS receiver, and fetches the NOAA county code from the database using the GPS information in step **130**. Decision block **132** compares the SAME location code from the stored message with the county code of the new location. If the SAME location code from the stored message does not equal the county code of the new location, methodology **100** proceeds to step **125** to return to the beginning of the routine. If the SAME location code from the stored message is equal to the county code of the new location, the vehicle has entered a county where the message is in effect, and therefore proceeds to step **134** to alert the driver of the alert condition and the expiration time indicated by the stored SAME message for the new location.

Following step **134**, methodology **100** proceeds to discard the stored SAME message in step **136** and returns to the beginning of the routine in step **125**. Accordingly, methodology **100** may track the expiration time associated with a given alert message and may provide the message when a vehicle enters the geographic region of interest, provided that the expiration time is still in effect for the corresponding message.

Accordingly, the weather band radio **30** of the present invention advantageously provides for weather band messaging to provide those messages that pertain to the geographic region of interest. In particular, the weather band radio **30** advantageously allows for the receipt of weather and emergency messages that pertain to the current geographical position of the weather band radio **30**, and may ignore messages that do not pertain to the current geographic position. In addition, the weather band radio may further provide message information pertaining to an upcoming geographic region and/or surrounding geographic regions of interest. Further, the weather band radio may track an expiration time associated with an alert message, and may provide the alert message once the radio enters the geographic region of interest, provided the expiration time has not yet expired.

It will be understood by those who practice the invention and those skilled in the art, that various modifications and improvements may be made to the invention without departing from the spirit of the disclosed concept. The scope of protection afforded is to be determined by the claims and by the breadth of interpretation allowed by law.

What is claimed is:

1. A radio with dynamic geographic message updating, said radio comprising:

a radio receiver for receiving broadcast radio signals containing a message and a corresponding geographic identifier;

a device for determining a current position of the radio;

geographic identifiers and electronic map data defining geographic regions corresponding to said geographic identifiers; and

a controller processing the determined current position to determine one of said geographic identifiers corresponding to the determined current position, said controller further performing an operation in response to said message when said received geographic identifier corresponds to said determined geographic identifier.

2. The radio as defined in claim **1**, wherein said radio comprises a weather band radio for tuning to weather band stations.

3. The radio as defined in claim **1**, wherein said controller ignores said message when said determined geographic identifier does not correspond to said received geographic identifier.

4. The radio as defined in claim **1**, wherein said operation comprises communicating said message to a radio listener.

5. The radio as defined in claim **1**, wherein said radio is located in a mobile vehicle.

6. The radio as defined in claim **5**, wherein said radio is integrated in a car radio.

7. The radio as defined in claim **1**, wherein said radio is a portable hand held radio.

8. The radio as defined in claim **1**, wherein said device for determining a current position comprises a position indicative receiver for receiving position indicative signals.

9. The radio as defined in claim **8**, wherein said position indicative receiver comprises a global positioning system receiver for receiving global positioning system signals.

10. The radio as defined in claim **1**, wherein said geographic identifiers comprise unique alphanumeric codes corresponding to each of a plurality of counties.

11. The radio as defined in claim **1**, wherein said geographic identifiers and electronic map data are stored in memory.

12. The radio as defined in claim **1**, wherein said controller further determines a direction of travel of said radio and determines an expected upcoming geographic region based on said direction of travel, said controller further performing an operation when said expected upcoming geographic region corresponds to said received geographic identifier.

13. The radio as defined in claim 1, wherein said controller further determines one or more surrounding geographic regions and performs an operation when said one or more surrounding geographic regions corresponds to said received geographic identifier.

14. The radio as defined in claim 1, wherein said message comprises an emergency message.

15. The radio as defined in claim 1, wherein said controller further determines an expiration time for said message and compares said expiration time to a current time reading, said controller performing said operation only if said expiration time has not expired.

16. The radio as defined in claim 15, wherein said controller stores said messages and corresponding expiration time and performs said operation when the geographic identifier corresponds to the determined geographic identifier.

17. The radio as defined in claim 1, wherein said receiver includes a tuner.

18. A mobile weather band radio with dynamic geographic message updating, said radio comprising:

a radio receiver for receiving weather band signals containing a message and geographic identifier;

a position indicative receiver for receiving position indicative signals and determining a current position of said radio;

memory storing geographic identifiers and electronic map data defining geographic regions corresponding to said stored geographic identifiers; and

a controller processing the determined current position to determine one of said geographic identifiers corresponding to the determined current position, said controller generating an alert signal in response to said message when the determined geographic identifier corresponds to said received geographic identifier.

19. The radio as defined in claim 18, wherein said controller ignores said message when said determined geographic identifier does not correspond to said received geographic identifier.

20. The radio as defined in claim 18, wherein said radio is integrated in a car radio.

21. The radio as defined in claim 18, wherein said radio is a portable hand held radio.

22. The radio as defined in claim 18, wherein said position indicative receiver comprises a global positioning system receiver for receiving global positioning system signals.

23. The radio as defined in claim 18, wherein said controller further determines a direction of travel and determines an expected upcoming geographic region based on said direction of travel, said controller generating said alert signal when said expected upcoming geographic region corresponds to said received geographic identifier.

24. The radio as defined in claim 18, wherein said geographic identifiers comprise unique alphanumeric codes corresponding to each of a plurality of counties.

25. The radio as defined in claim 18, wherein said controller further determines one or more surrounding geographic regions and performs an operation when said one or more surrounding geographic regions corresponds to said received geographic identifier.

26. The radio as defined in claim 18, wherein said controller further determines an expiration time for said message and compares said expiration time to a current time reading, said controller performing said operation only if said expiration time has not expired.

27. The radio as defined in claim 26, wherein said controller stores said messages and corresponding expiration time and performs said operation when the geographic identifier corresponds to the determined geographic identifier.

28. A method for providing radio messages with dynamic geographic updating, said method comprising the steps of:

determining a current position;

comparing said current position with electronically stored map data and determining which one of a plurality of geographic regions said current position is located within;

receiving a radio wave signal containing a message and a geographic identifier;

comparing the determined geographic identifier defined by said position indicative signal with said received geographic identifier and determining whether said determined geographic identifier corresponds to said received geographic identifier; and

performing an operation if said determined geographic identifier corresponds to said received geographic identifier.

29. The method as defined in claim 28, wherein said step of performing an operation includes communicating said message to a radio user.

30. The method as defined in claim 29, wherein said step of performing an operation includes producing an audio sound signal in response to said message.

31. The method as defined in claim 28 further comprising the step of ignoring said radio wave signal if said determined geographic identifier does not correspond to said received geographic identifier.

32. The method as defined in claim 28 further comprising the step of storing a plurality of geographic identifiers in memory along with electronic map data with defined geographic regions corresponding to each of said identifiers.

33. The method as defined in claim 28, wherein said radio wave signals comprise weather band radio signals.

34. The method as defined in claim 28, wherein said step of determining a current position comprises receiving position indicative signals with a receiver and determining a current position thereof.

35. The method as defined in claim 28, wherein said radio is located in a mobile vehicle.

36. The method as defined in claim 35 further comprising the step of determining a direction of travel of said vehicle and determining an expected upcoming geographic region based on said direction of travel, and further performing an operation when said expected upcoming geographic region corresponds to said received geographic identifier.

37. The method as defined in claim 28, wherein said radio is a portable hand held radio.

38. The method as defined in claim 28 further comprising the step of determining one or more surrounding geographic regions and performing an operation when said one or more surrounding geographic regions corresponds to said received geographic identifier.

39. The method as defined in claim 28 further comprising the step of determining an expiration time for said message and comparing said expiration time to a current time reading, said method further performing said operation only if said expiration time has not expired.

40. The method as defined in claim 39 further comprising the step of performing said operation when the geographic identifier corresponds to the determined geographic identifier.

* * * * *

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Adamski et al.

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(45) **Date of Patent: Nov. 7, 2006**

(54) **PREVIEWING POINTS OF INTEREST IN NAVIGATION SYSTEM**

(75) Inventors: **Mark D. Adamski**, Westfield, IN (US); **Jeffrey H. Burch**, Kokomo, IN (US)

(73) Assignee: **Delphi Technologies, Inc.**, Troy, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 266 days.

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G08G 1/0969 (2006.01)

(52) **U.S. Cl.** **701/211**; 701/207; 701/209; 701/210; 340/995.17; 340/995.24

(58) **Field of Classification Search** 701/211, 701/207, 201, 208, 209, 212; 340/995.14, 340/995.15, 995.17, 995.2, 995.24
See application file for complete search history.

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Primary Examiner—Tan Q. Nguyen
(74) *Attorney, Agent, or Firm*—Jimmy L. Funke

(57) **ABSTRACT**

A vehicle navigation system provides information relating to a list of intersections or other points of interest located ahead of a vehicle relative to a heading vector of the vehicle. The vehicle navigation system uses information about the current location of the vehicle and the heading vector in connection with a navigation database to identify a list of the intersections or other points of interest along the current street. The vehicle navigation system presents this information to an occupant of the vehicle. As the vehicle progresses and makes turn maneuvers, the navigation system updates the list of intersections or other points of interest that the vehicle is approaching. The occupant can receive information regarding points of interest without needing to enter a planned destination beforehand. In addition, the occupant can determine the location of the vehicle relative to the surrounding area without the clutter of irrelevant map details.

30 Claims, 2 Drawing Sheets

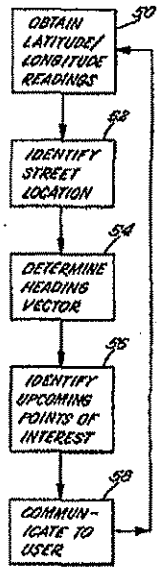

EXHIBIT
B

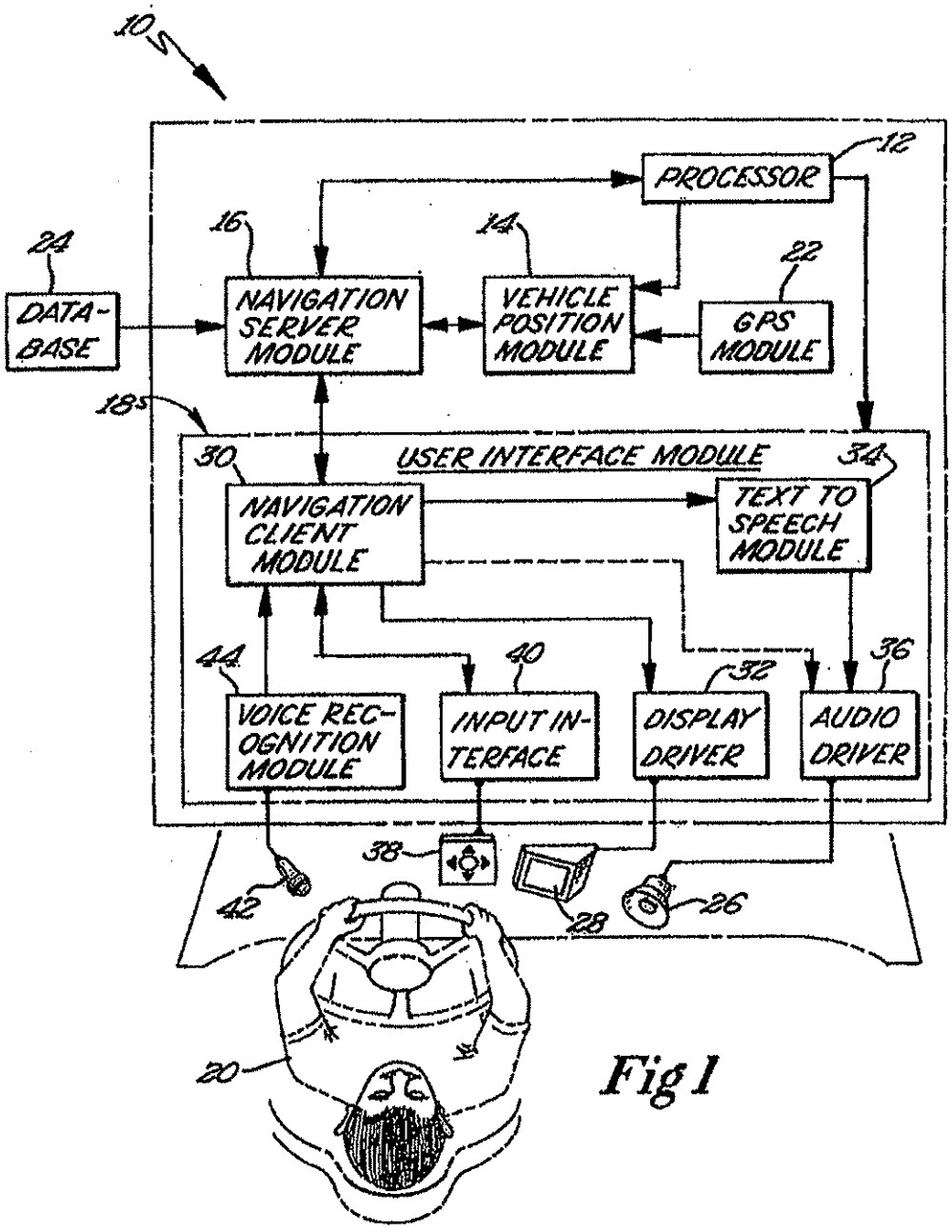
10
12
PROCESSOR
16
14
22
24
DATA-BASE
NAVIGATION SERVER MODULE
VEHICLE POSITION MODULE
GPS MODULE
18
30
USER INTERFACE MODULE
34
NAVIGATION CLIENT MODULE
TEXT TO SPEECH MODULE
44
40
32
36
VOICE REC-OGNITION MODULE
INPUT IN-TERFACE
DISPLAY DRIVER
AUDIO DRIVER
38
42
28
26
20

Fig 1

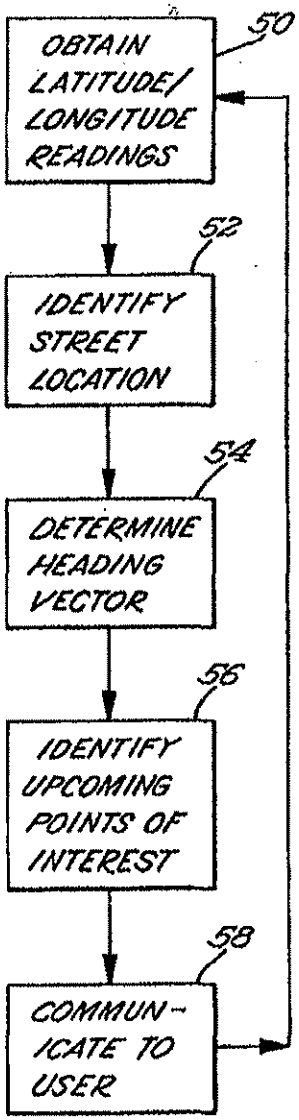

Fig 2

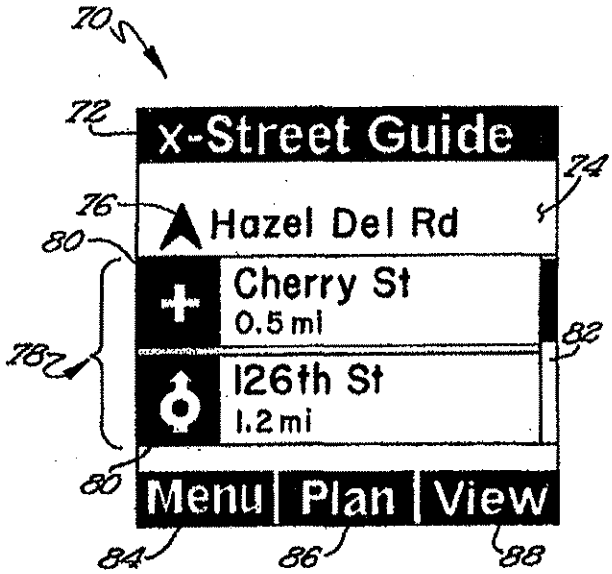

Fig 3 LIST

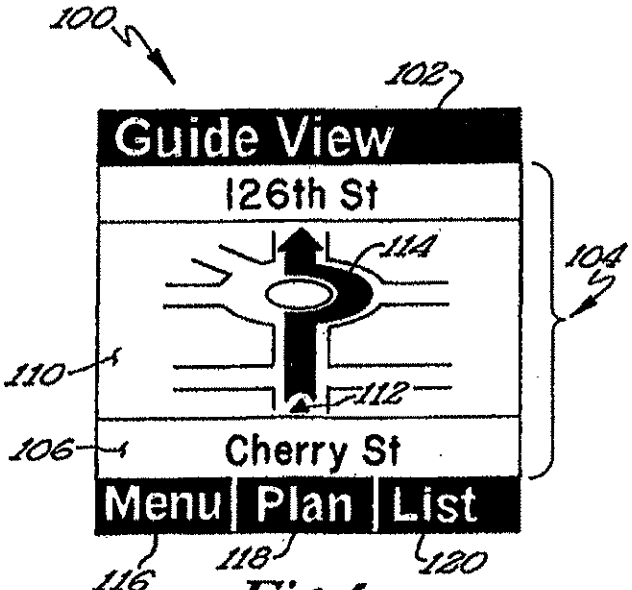

Fig 4 VIEW

PREVIEWING POINTS OF INTEREST IN NAVIGATION SYSTEM

TECHNICAL FIELD

The disclosure relates generally to vehicle navigation systems. More particularly, the disclosure relates to graphic user interfaces for use in connection with vehicle navigation systems.

BACKGROUND

An increasing number of vehicles are equipped with on-board navigation systems that display the position of the vehicle and surrounding streets, intersections, and other points of interest. Some navigation systems allow the driver to input or program a route. The navigation system then displays the position of the vehicle along the route.

In addition to displaying the vehicle position along a route, a navigation system can typically also display the vehicle location even when no route is programmed. In this case, the navigation system does not have a route that provides a context for the display. Some navigation systems that incorporate relatively large color display screens can display the vehicle location in the context of a detailed map reference of the surrounding area when no route is programmed.

Other navigation systems, however, incorporate smaller display screens. Rendering the vehicle location is difficult because the display screen is too small to display a map reference that is both sufficiently detailed and sufficiently free of clutter to be useful. For example, the map reference may be rendered at a sufficient level of detail, but contain so much clutter as to be unreadable from the position of the driver. Even with a relatively large display screen, some users may find a detailed map reference too cluttered to be useful. On the other hand, the map reference may be sufficiently free of clutter to allow the driver to locate the visual representation of the car, but lack detailed information as to surrounding streets. In either case, the driver does not significantly benefit from the map reference.

SUMMARY OF THE DISCLOSURE

According to various example implementations, a vehicle navigation system provides an occupant of a vehicle with information relating to a list of intersections or other points of interest located ahead of the vehicle relative to the current direction of travel of the vehicle. The vehicle navigation system uses information about the current location of the vehicle and a heading vector that indicates the current direction of travel in connection with a navigation database to identify a list of the intersections or other points of interest along the current street. The vehicle navigation system presents this information to the occupant. As the vehicle progresses and makes turn maneuvers, the navigation system updates the list of intersections or other points of interest that the vehicle is approaching.

In one implementation, information relating to a location of a vehicle is communicated to an occupant of the vehicle in the absence of predetermined route information by determining the location of the vehicle and a heading vector associated with the vehicle. A point of interest is identified as a function of the location of the vehicle and the heading vector associated with the vehicle. This point of interest is then communicated to the occupant of the vehicle.

Another implementation is directed to a navigation system for use in a vehicle. A global positioning system (GPS) receiver is configured to determine a location of the vehicle. A data retrieval device is configured to retrieve, from a data storage medium, navigation data representing a plurality of points of interest. A processor-based subsystem is operatively coupled to the GPS receiver and to the data retrieval device. The processor-based system is configured to determine a heading vector associated with the vehicle and to receive the navigation data from the data retrieval device. The processor-based system is further configured to select a point of interest from the plurality of points of interest as a function of the location of the vehicle and the heading vector associated with the vehicle and to communicate the point of interest to an occupant of the vehicle.

In still another embodiment, a processor-readable medium contains processor-executable instructions. When executed by a processor-based system in a vehicle, the processor-executable instructions cause the processor-based system to determine a location of the vehicle and a heading vector associated with the vehicle. The processor-based system then identifies a point of interest as a function of the location of the vehicle and the heading vector associated with the vehicle and communicates the point of interest to the occupant of the vehicle.

Various implementations may provide certain advantages. The navigation system communicates information regarding upcoming intersections and points of interest based on the current location and heading vector of the vehicle. As a result, the occupant can receive information regarding points of interest without needing to enter a planned destination beforehand. Even when a destination is entered, the occupant can benefit from being able to determine the location of the vehicle relative to the surrounding area without the clutter of irrelevant map details.

Additional advantages and features will become apparent from the following description and the claims that follow, considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram depicting a vehicle navigation system according to an embodiment.

FIG. 2 is a flow diagram illustrating a method of communicating information relating to a location of a vehicle according to another embodiment.

FIG. 3 illustrates an example graphic user interface (GUI) that may be presented to the user.

FIG. 4 depicts another example GUI that may be presented to the user.

DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS

A vehicle navigation system provides an occupant of a vehicle with information relating to a list of intersections or other points of interest located ahead of the vehicle relative to the current direction of travel of the vehicle. Using a global positioning system (GPS), for example, the vehicle navigation system obtains information about the current location of the vehicle and a heading vector that indicates the current direction of travel. The vehicle navigation system uses this information in connection with a navigation database to identify a list of the intersections or other points of interest along the current street. Based on the current location of the vehicle and the heading vector, the vehicle

navigation system determines which intersections or other points of interest the vehicle is approaching and presents this information to the occupant.

As the vehicle progresses along the street and makes turn maneuvers, the navigation system updates the list of intersections or other points of interest that the vehicle is approaching. Because the navigation system presents information to the occupant based on the current location and heading vector of the vehicle rather than on pre-programmed route information, the occupant can receive information regarding points of interest without needing to enter a planned destination beforehand. Communication of information to the occupant is enhanced, particularly in relatively inexpensive vehicle navigation systems having small display screens. Such systems are better able to provide the occupant with enough information to discern nearby points of interest without cluttering the screen with so much information that the display becomes unusable by the occupant. Navigation systems having larger screens can also benefit from reduced clutter.

Various embodiments are described as displaying information without reference to a predetermined route. It will be appreciated by those of skill in the art, however, that the methods and apparatuses described herein can also be used to display information when a destination is entered. When a destination is entered, the occupant can determine the location of the vehicle relative to the surrounding area without the clutter of irrelevant map details.

The following description of various embodiments implemented in a vehicle navigation system is to be construed by way of illustration rather than limitation. This description is not intended to limit the invention or its applications or uses. For example, while various embodiments are described as being implemented in a vehicle navigation system, it will be appreciated that the principles described herein may be applicable to navigation systems operable in other environments.

In the following description, numerous specific details are set forth in order to provide a thorough understanding of various embodiments. It will be apparent to one skilled in the art that the present invention may be practiced without some or all of these specific details. In other instances, well known components and process steps have not been described in detail in order to avoid unnecessarily obscuring the present invention.

Various embodiments may be described in the general context of processor-executable instructions, such as program modules, being executed by a processor. Generally, program modules include routines, programs, objects, components, data structures, etc., that perform particular tasks or implement particular abstract data types. In addition, some embodiments may also be practiced in distributed processing environments in which tasks are performed by remote processing devices that are linked through a communications network or other data transmission medium. In a distributed processing environment, program modules and other data may be located in both local and remote storage media, including memory storage devices.

Referring now to the drawings, FIG. **1** illustrates a vehicle navigation system **10**. The vehicle navigation system **10** includes a processor-based system comprising a processor **12** configured to execute a number of software modules, including a vehicle position module **14**, a navigation server module **16**, and a user interface module **18**. As described below, the processor **12** may interface with a user **20** via one or more input and output devices controlled by the user interface module **18**. The user **20** can be the driver of the vehicle or, alternatively, a passenger.

The processor **12** is typically configured to operate with one or more types of processor readable media. Processor readable media can be any available media that can be accessed by the processor **12** and includes both volatile and nonvolatile media, removable and non-removable media. By way of example, and not limitation, processor readable media may include storage media and communication media. Storage media includes both volatile and nonvolatile, removable and nonremovable media implemented in any method or technology for storage of information such as processor-readable instructions, data structures, program modules, or other data. Storage media includes, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile discs (DVDs) or other optical disc storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to store the desired information and that can be accessed by the processor **12**. Communication media typically embodies processor-readable instructions, data structures, program modules or other data in a modulated data signal such as a carrier wave or other transport mechanism and includes any information delivery media. The term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media includes wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared, and other wireless media. Combinations of any of the above are also intended to be included within the scope of processor-readable media.

The vehicle position module **14** determines the location of the vehicle, for example, by obtaining data from a GPS module **22**. Alternatively, the vehicle position module **14** may determine the location of the vehicle in another way, such as by measuring the distance and direction traveled from a known reference point. In addition to the location of the vehicle, the vehicle position module **14** determines a heading vector, or direction of travel, of the vehicle. The vehicle position module **14** may determine the heading vector using any of a variety of conventional techniques.

The vehicle position module **14** provides the location and heading vector information to the navigation server module **16**. The navigation server module **16** uses this information in combination with information relating to points of interest, such as intersections, to identify one or more points of interest that the vehicle is approaching. This information may be contained in a database **24**. The database **24** may be stored in any of a variety of processor-readable media, including, for example, optical discs including CD-ROMs and DVD-ROMs, memory cards, and the like.

When the navigation server module **16** has identified one or more points of interest that the vehicle is approaching, the navigation server module **16** provides this information to the user **20** using one or more output devices, such as a speaker **26** or a display screen **28**, controlled via the user interface module **18**. The speaker **26** may be part of a vehicle audio system or a standalone speaker. The display screen **28** is typically part of a vehicle information system, but may be implemented as a standalone display screen.

In the embodiment shown in FIG. **1**, the navigation server module **16** provides the information regarding points of interest that the vehicle is approaching to a navigation client module **30**. The navigation client module **30** in turn generates graphic output, audio output, or both. A display driver

32 processes the graphic output and renders the graphic output on the display screen 28. The audio output may include speech, sound effects, or both. Speech output may be generated, for example, as a synthesized rendering of a name of an intersection or other point of interest by a text-to-speech module 34. Sound effects may include, for example, chimes or other sounds to alert the user 20 of certain types of points of interest, such as intersections or restaurants. Both speech and sound effects are processed by an audio driver 36, which renders the audio output using the speaker 26.

In addition to providing output to the user 20, the user interface module 18 can also receive input from the user 20. For example, the user 20 may advance through the list of upcoming points of interest using a keypad 38 or other input device. An input interface 40 provides the input to the navigation client module 30, which makes appropriate changes to the display or audio output according to the input. Further, in some embodiments, the user 20 may interact with the vehicle navigation system 10 by voice commands spoken into a microphone 42. A voice recognition module 44 converts the voice commands to text or another format that can be processed by the vehicle navigation system 10.

FIG. 2 is a flow diagram illustrating an example method executed by the processor 12 of FIG. 1 to communicate to the user 20 information relating to intersections or other points of interest that the vehicle is approaching. The processor 12 may communicate this information when the user 20 has not entered a destination or other route information. Further, the processor 12 may also communicate this information when the user 20 has entered a destination or other route information.

The vehicle position module 14 obtains from the GPS module 22 information relating to the position of the vehicle, including, for example, latitude and longitude readings (50). Based on the latitude and longitude readings and information received in the navigation server module 16 from the database 24, the processor 12 determines the street on which the vehicle is currently located (52). In addition to the location of the vehicle, the vehicle position module 14 determines a heading vector (54) that indicates the direction in which the vehicle is traveling. The vehicle position module 14 may determine the heading vector using any of a variety of conventional techniques.

Based on the location and heading vector of the vehicle, the processor 12 identifies one or more intersections or other points of interest that the vehicle is approaching (56). In some implementations, for example, the intersections or other points of interest are associated in the database 24 with location information, e.g., longitude and latitude coordinates or street identifiers. For instance, the database 24 may contain a list of street names, each of which is associated with a list of intersections located on the corresponding street.

The navigation server module 16 executing on the processor 12 compares the location information associated with the intersections or other points of interest with the location and heading vector of the vehicle. In this way, the navigation server module 16 determines which intersections or other points of interest are located in the vicinity of the vehicle and in the current direction of travel of the vehicle. The navigation server module 16 optionally also identifies which intersections or other points of interest are located in the vicinity of and behind the vehicle, i.e., points of interest that the vehicle has passed.

The user interface module 18 then communicates the information (58) relating to nearby intersections or other points of interest to the user 20 via one or more output devices, including, but not limited to, the speaker 26, the display screen 28, or both. For example, the user interface module 18 may display graphic representations of the point of interest and of the vehicle using the display screen 28. These graphic representations may include a detailed view of an upcoming intersection. The user interface module 18 may display text in addition to or instead of the graphic representations. The text may include, for example, names of and distances to intersecting streets. Further, the user interface module 18 may generate an audible indicator of the point of interest using the speaker 26, either instead of or in addition to providing a visual indicator. This audible indicator may include speech, sound effects, or both.

If the street on which the vehicle is located contains multiple intersections or other points of interest, the user interface module 18 may communicate some or all of these points of interest to the user 20. For example, the user interface module 18 may inform the user 20 of all upcoming intersections, but omit information relating to other types of points of interest. The user interface module 18 may communicate multiple points of interest as a sequence of successive points of interest. In some implementations, the user interface module 18 advances through the sequence in response to input received from the user 20 via an input device, such as the keypad 38 or the microphone 42. The user interface module 18 may also advance through the sequence in response to movement of the vehicle, for example, as a function of the distance of the vehicle from a point of interest or as a function of the speed of the vehicle.

To ensure that the information communicated to the user 20 relates to the current position of the vehicle, the processor 12 periodically obtains updated information relating to the location and heading vector of the vehicle (50). In this way, as the vehicle progresses and makes turn maneuvers, the vehicle navigation system 10 looks ahead to update upcoming intersection information to the user 20. As a result, the user 20 can look ahead in the direction of travel without entering a planned destination and gain a sense of the vehicle location relative to intersections and other points of interest.

FIG. 3 illustrates an example graphic user interface (GUI) 70 that the user interface module 18 may present to the user 20. A title bar 72 identifies the GUI 70 as a street guide. Immediately below the title bar 72, a text bar 74 identifies the street on which the vehicle is currently located. An icon 76, such as an arrowhead, may indicate the direction of travel of the vehicle using a conventional north-up representation. Below the text bar 74, a dynamic intersection list 78 conveys information relating to upcoming intersections or other points of interest. The dynamic intersection list 78 includes the names of upcoming intersections and the distances to those intersections. Icons 80 may indicate the type of intersection or other point of interest. As depicted in FIG. 3, for example, Cherry St. is a typical intersection, and 126th St. is a traffic circle. A scroll bar 82 indicates the position of the currently displayed points of interest relative to a sequence of points of interest. The dynamic intersection list 78 is automatically updated as the vehicle progresses. In addition, the user 20 can scroll through the dynamic intersection list 78 using the keypad 38, the microphone 42, or another suitable input device.

Below the dynamic intersection list 78, soft key indicators facilitate activation of various features. For example, a "menu" soft key indicator 84 may allow the user 20 to access a menu of configuration and other options. A "plan" soft key indicator 86 may allow the user 20 to access a menu for planning a route, e.g., by selecting from a list of recent

destinations or favorite destinations. A "view" soft key indicator **88** may allow the user **20** to toggle the display to show a detailed intersection view as depicted in FIG. **4**. In some implementations, the soft key indicators **84**, **86**, and **88** are visually and logically associated with keys on the keypad **38** of FIG. **1**. Other implementations may incorporate a touch-sensitive display screen. In such implementations, the soft key indicators **84**, **86**, and **88** may be rendered on areas of the display screen that, when touched, invoke the associated features.

FIG. **4** depicts another example GUI **100** that the user interface module **18** may present to the user **20**. A title bar **102** identifies the GUI **100** as a guide view. Immediately below the title bar **102**, a detailed intersection view **104** depicts upcoming intersections or other points of interest. For example, text bars **106** and **108** identify upcoming intersections as Cherry St. and 126th St., respectively. A map area **110** depicts the vehicle as an icon **112**, such as an arrowhead pointing along the current heading vector. An arrow **114** represents the current path of the vehicle, assuming the vehicle does not make any turns or similar maneuvers. The map area **110** may be depicted using a north-up representation or using a forward-up representation and is automatically updated as the vehicle progresses. In addition, the user **20** can scroll through the map area **110** using the keypad **38**, the microphone **42**, or another suitable input device.

Below the detailed intersection view **104**, soft key indicators facilitate activation of various features. For example, a "menu" soft key indicator **116** may allow the user **20** to access a menu of configuration and other options. A "plan" soft key indicator **118** may allow the user **20** to access a menu for planning a route, e.g., by selecting from a list of recent destinations or favorite destinations. A "list" soft key indicator **120** may allow the user **20** to toggle the display to show the dynamic intersection list **78** as depicted in FIG. **3**. In some implementations, the soft key indicators **116**, **118**, and **120** are visually and logically associated with keys on the keypad **38** of FIG. **1**. Other implementations may incorporate a touch-sensitive display screen. In such implementations, the soft key indicators **1116**, **118**, and **120** may be rendered on areas of the display screen that, when touched, invoke the associated features.

As demonstrated by the foregoing discussion, various implementations may provide certain advantages. Because the navigation system presents information to the user **20** based on the current location and heading vector of the vehicle rather than on pre-programmed route information, the user **20** can receive information regarding points of interest without entering a planned destination. The readability and usability of the information conveyed to the user **20** is enhanced, particularly in relatively inexpensive vehicle navigation systems having small display screens. Such systems are better able to provide the user **20** with enough information to discern nearby points of interest without cluttering the screen with so much information that the display becomes unusable. Navigation systems having larger screens can also benefit from reduced clutter.

It will be understood by those who practice the invention and those skilled in the art that various modifications and improvements may be made without departing from the spirit and scope of the disclosed embodiments. The scope of protection afforded is to be determined solely by the claims and by the breadth of interpretation allowed by law.

What is claimed is:

1. A method to communicate to an occupant of a vehicle information relating to a location of the vehicle in the absence of predetermined destination or route information, the method comprising:

determining the location of the vehicle;

determining a heading vector associated with the vehicle;

identifying a point of interest as a function of the location of the vehicle and the heading vector associated with the vehicle without reference to any predetermined destination; and

communicating the point of interest to the occupant of the vehicle without reference to any predetermined destination.

2. The method of claim **1**, wherein communicating the point of interest to the occupant of the vehicle comprises displaying a graphic representation of the point of interest and a graphic representation of the vehicle using a display device.

3. The method of claim **1**, wherein communicating the point of interest to the occupant of the vehicle comprises generating an audible indicator of the point of interest using an audio device.

4. The method of claim **1**, wherein determining the location of the vehicle comprises identifying a street on which the vehicle is located.

5. The method of claim **4**, wherein the point of interest is an intersection, and further comprising identifying the intersection as a function of the location of the vehicle, the heading vector associated with the vehicle, and a list of intersections along the street.

6. The method of claim **1**, further comprising:

identifying a plurality of points of interest as a function of the location of the vehicle and the heading vector associated with the vehicle; and

communicating at least one of the points of interest to the occupant of the vehicle.

7. The method of claim **6**, further comprising communicating the at least one of the points of interest to the occupant of the vehicle as a sequence of successive points of interest.

8. The method of claim **7**, further comprising communicating the successive points of interest in response to input received from the occupant of the vehicle.

9. The method of claim **7**, further comprising communicating the successive points of interest in response to movement of the vehicle.

10. A point of interest display system for use in a vehicle, the point of interest display system comprising:

a global positioning system (GPS) receiver configured to determine a location of the vehicle;

a data retrieval device configured to retrieve, from a data storage medium, navigation data representing a plurality of points of interest; and

a processor-based subsystem operatively coupled to the GPS receiver and to the data retrieval device and configured to

determine a heading vector associated with the vehicle,

receive the navigation data from the data retrieval device,

select a point of interest from the plurality of points of interest as a function of the location of the vehicle and the heading vector associated with the vehicle without reference to any predetermined destination, and

communicate the point of interest to an occupant of the vehicle without reference to any predetermined destination.

11. The point of interest display system of claim 10, further comprising a display device operatively coupled to the processor-based subsystem, wherein the processor-based subsystem is configured to cause the display device to display a graphic representation of the point of interest and a graphic representation of the vehicle.

12. The point of interest display system of claim 10, further comprising an audio output device operatively coupled to the processor-based system, wherein the processor-based subsystem is configured to cause the audio output device to generate an audible indicator of the point of interest.

13. The point of interest display system of claim 12, further comprising a speech module operatively coupled to the processor-based system and to the audio output device and configured to generate a speech indicator of the point of interest.

14. The point of interest display system of claim 10, wherein the processor-based system is further configured to determine the location of the vehicle comprises identifying a street on which the vehicle is located.

15. The point of interest display system of claim 14, wherein the point of interest is an intersection, and wherein the processor-based system is further configured to identify the intersection as a function of the location of the vehicle, the heading vector associated with the vehicle, and a list of intersections along the street.

16. The point of interest display system of claim 10, wherein the processor-based system is further configured to:

identify a plurality of points of interest as a function of the location of the vehicle and the heading vector associated with the vehicle; and

communicate at least one of the points of interest to the occupant of the vehicle.

17. The point of interest display system of claim 16, wherein the processor-based system is further configured to communicate the at least one of the points of interest to the occupant of the vehicle as a sequence of successive points of interest.

18. The point of interest display system of claim 17, further comprising an input device operatively coupled to the processor-based system and configured to receive input from the occupant, wherein the processor-based system is further configured to communicate the successive points of interest in response to input received from the occupant of the vehicle.

19. The point of interest display system of claim 18, wherein the input device comprises at least one of a keypad and an audio input device.

20. The point of interest display system of claim 17, wherein the processor-based system is further configured to communicate the successive points of interest in response to movement of the vehicle.

21. The point of interest display system of claim 10, wherein the data retrieval device comprises at least one of a memory device, an optical retrieval device, and a magnetic retrieval device.

22. A processor-readable medium containing processor-executable instructions that, when executed by a processor-based system in a vehicle, cause the processor-based system to:

determine a location of the vehicle and a heading vector associated with the vehicle;

identify a point of interest as a function of the location of the vehicle and the heading vector associated with the vehicle without reference to any predetermined destination; and

communicate the point of interest to the occupant of the vehicle without reference to any predetermined destination.

23. The processor-readable medium of claim 22, wherein the processor-executable instructions cause the processor-based system to display a graphic representation of the point of interest and a graphic representation of the vehicle using a display device without reference to any predetermined destination.

24. The processor-readable medium of claim 22, wherein the processor-executable instructions cause the processor-based system to generate an audible indicator of the point of interest using an audio device.

25. The processor-readable medium of claim 22, wherein the processor-executable instructions cause the processor-based system to identify a street on which the vehicle is located.

26. The processor-readable medium of claim 25, wherein the point of interest is an intersection, and wherein the processor-executable instructions cause the processor-based system to identify the intersection as a function of the location of the vehicle, the heading vector associated with the vehicle, and a list of intersections along the street.

27. The processor-readable medium of claim 22, wherein the processor-executable instructions cause the processor-based system to:

identify a plurality of points of interest as a function of the location of the vehicle and the heading vector associated with the vehicle; and

communicate at least one of the points of interest to the occupant of the vehicle.

28. The processor-readable medium of claim 27, wherein the processor-executable instructions cause the processor-based system to communicate the at least one of the points of interest to the occupant of the vehicle as a sequence of successive points of interest.

29. The processor-readable medium of claim 28, wherein the processor-executable instructions cause the processor-based system to communicate the successive points of interest in response to input received from the occupant of the vehicle.

30. The processor-readable medium of claim 28, wherein the processor-executable instructions cause the processor-based system to communicate the successive points of interest in response to movement of the vehicle.

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