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**UNITED STATES DISTRICT COURT**

**CENTRAL DISTRICT OF CALIFORNIA**

| | |
|---|---|
| Shipping & Transit LLC,<br><br>Plaintiff,<br><br>v.<br><br>DISH Network Corporation, a corporation; DISH Network L.L.C., a limited liability corporation,<br><br>Defendant. | Case No. 2:16-cv-06527<br><br>**COMPLAINT FOR PATENT INFRINGEMENT AND PERMANENT INJUNCTION**<br><br>**DEMAND FOR JURY TRIAL** |

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Plaintiff Shipping & Transit LLC, ("S&T"), by and through its undersigned counsel, for its Complaint against Defendant DISH Network Corporation and DISH Network L.L.C. (collectively, "DISH") makes the following allegations. These allegations are made upon information and belief.

## NATURE OF THE ACTION

1. This is an action to stop Defendant's infringement of United States Patent Nos. 6,317,060 ("the '060 Patent") and 6,415,207 ("the '207 Patent").

## THE PARTIES

2. Shipping & Transit LLC, formerly known as ArrivalStar S.A. and Melvino Technologies Limited, is a limited liability company organized under the laws of the State of Florida having an office and principal place of business at 711 SW 24th Ave., Boynton Beach, Florida 33435.

3. DISH Network Corporation is a Colorado corporation with a principal place of business at 9601 S. Meridian Boulevard, Englewood, CO 80112.

4. DISH Network L.L.C. is a Colorado limited liability company with a principal place of business at 9601 S. Meridian Boulevard, Englewood, CO 80112.

## JURISDICTION AND VENUE

5. This patent infringement action arises under the patent laws of the United States including 35 U.S.C. §§ 271, et seq.

6. This Court has subject-matter jurisdiction over this action pursuant to 28 U.S.C. § § 1331 and 1338(a) because it arises under United States Patent law.

7. This Court has personal jurisdiction over the Defendant because they (either directly or through their subsidiaries, divisions, groups or divisions) have sufficient minimum contacts with the forum as a result of business conducted within the State of California and this district; and/or specifically over the Defendant (either directly or through their subsidiaries, divisions, groups or distributors) because of their infringing conduct within or directed at the State of California and this district.

8. Venue is proper in this district pursuant to 28 U.S.C. §1391(b) and 1400(b).

**FACTS**

1. S&T is the owner, by assignment, of United States Patent No. 6,317,060 ("the '060 Patent"), entitled, "Base Station System and Method for Monitoring Travel of Mobile Vehicles and Communicating Notification Messages," which was duly and legally issued by the United States Patent and Trademark Office ("USPTO") on November 13, 2001. A true and correct copy of the '060 Patent is attached as **Exhibit A** to this complaint.

2. S&T is the owner, by assignment, of United States Patent No. 6,415,207 ("the '207 Patent"), entitled, "System and Method for Automatically Providing Vehicle Status Information," which was duly and legally issued by the USPTO on July 2, 2002. A true and correct copy of the '207 Patent is attached as **Exhibit B** to this complaint.

3. S&T is owner of all rights, titles and interests in and to the '060 Patent and the '207 Patent (collectively, "Patents-In-Suit") including the right to assert all causes of action arising from the infringement of the Patents-in-Suit and the right to all damages, past and present, for any infringement of the Patents-in-Suit.

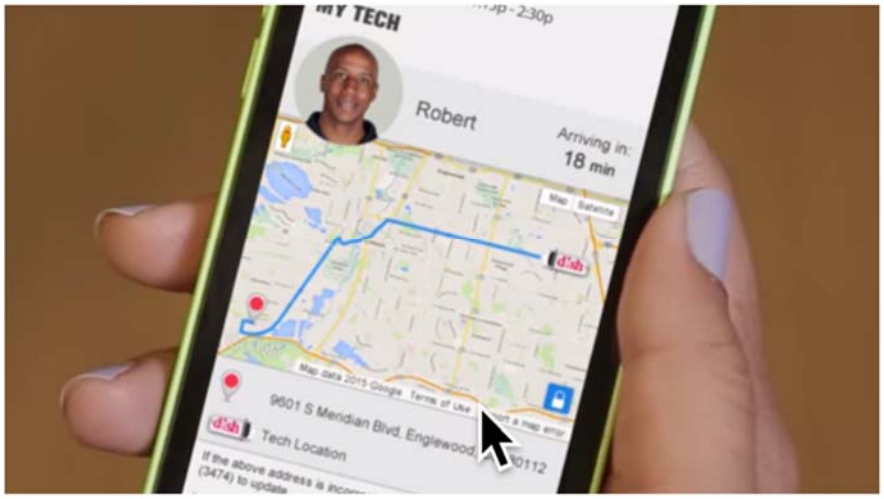
4. The claims of the Patents-In-Suit are valid and enforceable.

5. DISH's "My Tech" product uses driver/installer location information to provide tracking updates and messages to customers at arrival addresses. DISH "My Tech" is a computer based notification system for notifying users of impending arrivals of vehicles at particular locations; DISH sends an estimated time of arrival (ETA) 30 minutes before the estimated arrival, an automated message notifies the customer of the DISH technician's/installer's estimated time of arrival. As the technician/installer drives to the location of the appointment, the customer may watch a minute-by-minute count-down and the technician's location on a map. The DISH "My Tech" system stores all technicians locations at and when driving between service stops for its

vehicles; the DISH "My Tech" automated notification system selects and monitors portions of data to determine 30 minutes before the estimated time of arrival based on tracking, route, timing of route and arrival time in a countdown format; the DISH "My Tech" system determines when notifications should occur by subtracting 30 minutes from arrival time at location and sends notification messages to customers. See excerpt below from DISH's website.

**Dish Customers Can Now Track Repair Tech's Location, ETA**

By Chris Morran September 22, 2015




In an effort to add some accountability to install and repair appointments, Dish Network has launched "My Tech," a new feature of its MyDish.com that allows customers to see where their tech is, when they'll arrive, and what they look like.

6. DISH's "My Tech" system monitors vehicle locations to determine the arrival of technicians and reports the status by maintaining status and location information of vehicles; the system communicates with the user's device when the user logs in to the system. The user's device is a remote communication device. Customers using the system setup accounts, enter login information and or email addresses. The system utilizes the customer identification information to automatically log the customer into their own account and within these accounts automatically provide status information to the customer. Once the customer logs

into their account, the system automatically retrieves vehicle status information and transmits the retrieved vehicle status information to the customer.

7. Defendant DISH offers the DISH Accused Product, "My Tech", to its customers in the United States.

8. At a minimum, the DISH Accused Product have all the elements of at least claim 10 of the '207 Patent and claim 19 of the '060 Patent.

**COUNT I**

**CLAIM FOR PATENT INFRINGEMENT**

**UNDER 35 U.S.C. § 271 ('207 PATENT)**

9. S&T Technologies realleges and incorporates by reference the allegations of the preceding paragraphs of this Complaint as if fully set forth herein.

10. Without license or authorization and in violation of 35 U.S.C. §271(a), DISH has infringed and continues to infringe Claim 10 of '207 Patent by making, using, offering for sale and/or selling within this district and elsewhere in the United States the DISH Accused Products.

11. Unless enjoined by this Court, Defendant will continue to infringe the '207 Patent.

12. As a direct and proximate result of Defendant's infringement of the '207 Patent, S&T has been and will continue to be damaged in an amount yet to be determined, including but not limited to Plaintiff's lost profits and/or reasonable royalties.

**COUNT II**

**CLAIM FOR PATENT INFRINGEMENT**

**UNDER 35 U.S.C. § 271 ('060 PATENT)**

13. S&T Technologies realleges and incorporates by reference the allegations of the preceding paragraphs of this Complaint as if fully set forth herein.

14. Without license or authorization and in violation of 35 U.S.C. §271(a), DISH has infringed and continues to infringe Claim 19 of '060 Patent by making,

using, offering for sale and/or selling within this district and elsewhere in the United States the DISH Accused Products.

15. Unless enjoined by this Court, Defendant will continue to infringe the '060 Patent.

16. As a direct and proximate result of Defendant's infringement of the '060 Patent, S&T has been and will continue to be damaged in an amount yet to be determined, including but not limited to Plaintiff's lost profits and/or reasonable royalties.

**PRAYER FOR RELIEF**

WHEREFORE, Plaintiff prays for relief against Defendant as follows:

1. In favor of Plaintiff that Defendant has infringed each of the asserted claims of the '207 Patent and the '060 Patent;

2. Requiring Defendant to pay Plaintiff its damages, costs, expenses, and pre-judgment and post-judgment interest for Defendant's infringement each of the asserted claims of the '207 Patent and the '060 Patent as provided under 35 U.S.C § 284; but not less than a reasonable royalty; and

3. For such other and further relief as may be just and equitable.

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## DEMAND FOR TRIAL BY JURY

Pursuant to Rule 38 of the Federal Rules of Civil Procedure, Plaintiff hereby demands a jury trial on all issues and causes of action triable to a jury.

Respectfully submitted,

DATED: August 30, 2016

**COTMAN IP LAW GROUP, PLC**

*s/Rasheed M. McWilliams*

By:_____

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US006317060B1

(12) **United States Patent**
**Jones**

(10) **Patent No.: US 6,317,060 B1**
(45) **Date of Patent: *Nov. 13, 2001**

(54) **BASE STATION SYSTEM AND METHOD FOR MONITORING TRAVEL OF MOBILE VEHICLES AND COMMUNICATING NOTIFICATION MESSAGES**

(75) Inventor: **Martin Kelly Jones**, Vancouver (CA)

(73) Assignee: **Global Research Systems, Inc.**, Rome, GA (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.: **09/516,577**

(22) Filed: **Mar. 1, 2000**

**Related U.S. Application Data**

(60) Provisional application No. 60/122,482, filed on Mar. 1, 1999.

(51) **Int. Cl.**[7] ..... **G08G 1/123**

(52) **U.S. Cl.** ..... **340/994**; 340/989; 340/993; 701/204

(58) **Field of Search** ..... 340/994, 982, 340/989, 990, 991, 995, 906, 907, 539, 993; 701/204, 205, 206, 207, 208, 302

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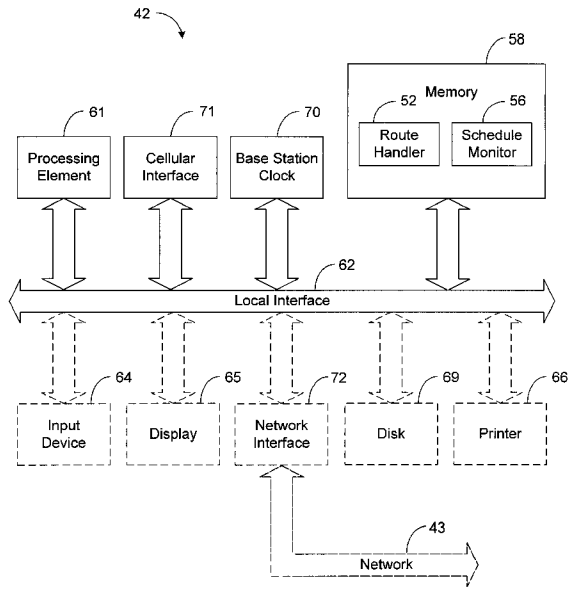
*Primary Examiner*—Benjamin C. Lee
(74) *Attorney, Agent, or Firm*—Thomas, Kayden, Horstemeyer & Risley, LLP

(57) **ABSTRACT**

A vehicle monitoring and notification system includes a route handler, a schedule monitor, and a communication handler. The schedule monitor determines when users should receive notification messages based on data that indicates when vehicles are expected to arrive at certain locations. The route handler communicates with vehicle control units on board vehicles to determine whether and how much any of the vehicles are off schedule. If any of the vehicles are off schedule, the route handler updates the data monitored by the schedule monitor to change when the schedule monitor determines that notification messages should be received by the users. Once the schedule monitor determines that a user should receive a notification message, the schedule monitor transmits a notification request to the communication handler. The communication handler then establishes communication with a communication device associated with the user and transmits a notification message to the user. Therefore, the user is warned of an impending arrival of a vehicle at a particular location.

**23 Claims, 11 Drawing Sheets**



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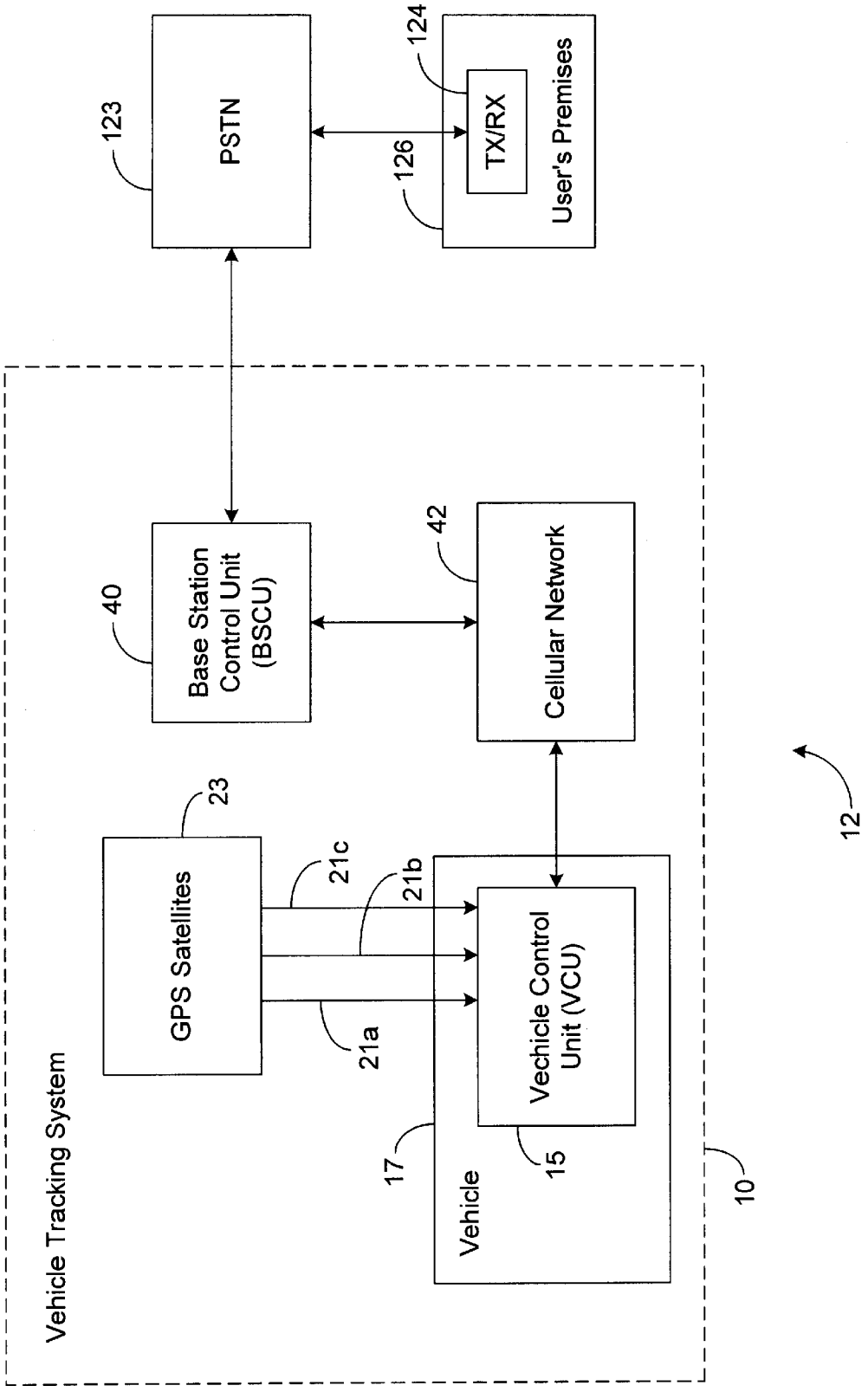
PSTN
123
124
TX/RX
126
User's Premises
Base Station Control Unit (BSCU)
40
42
Cellular Network
GPS Satellites
23
21c
21b
21a
Vechicle Control Unit (VCU)
17
15
Vehicle
10
12
Vehicle Tracking System

Fig. 1

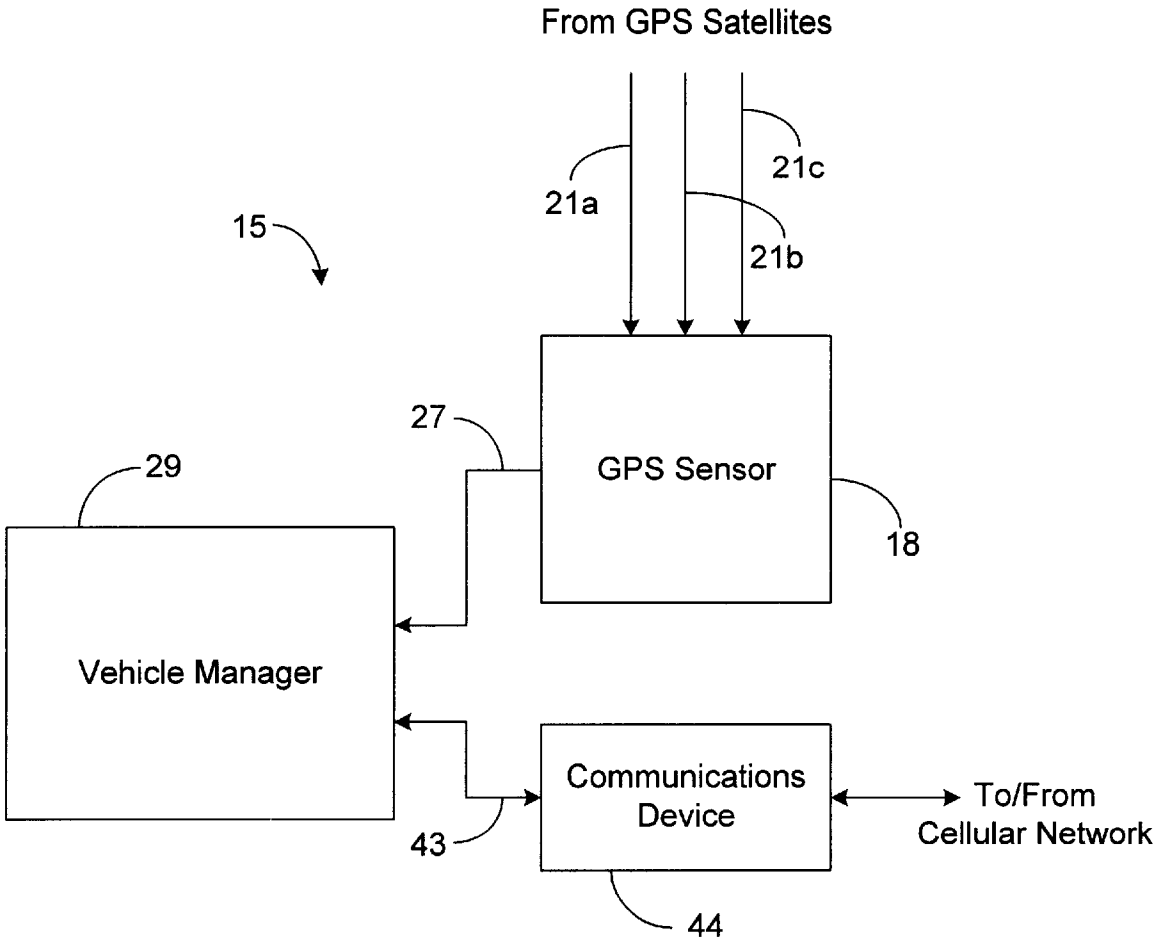
From GPS Satellites
21a
21c
21b
15
27
GPS Sensor
18
29
Vehicle Manager
Communications Device
To/From Cellular Network
43
44

Fig. 2

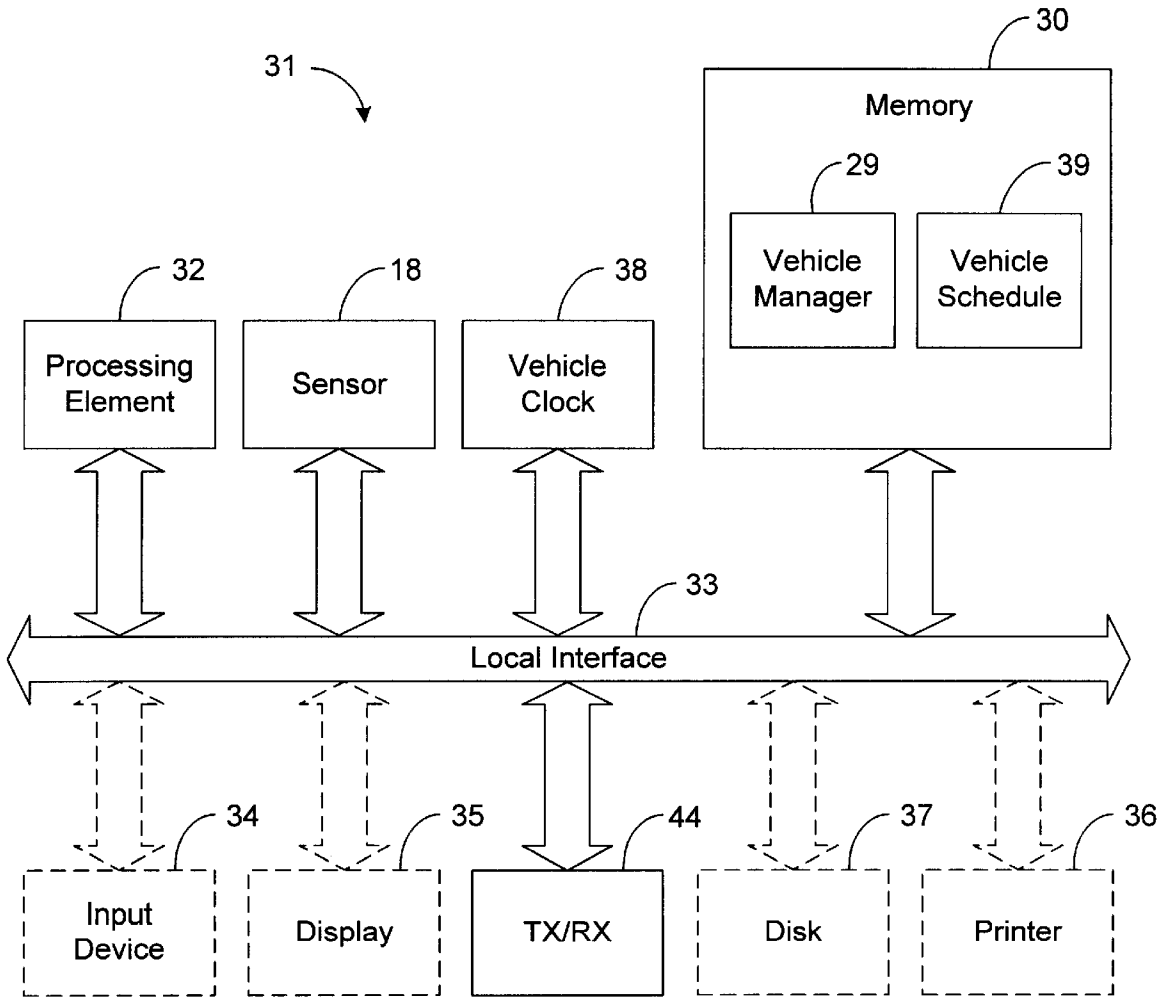
31
30
Memory
29
39
Vehicle Manager
Vehicle Schedule
32
18
38
Processing Element
Sensor
Vehicle Clock
33
Local Interface
34
35
44
37
36
Input Device
Display
TX/RX
Disk
Printer

Fig. 3

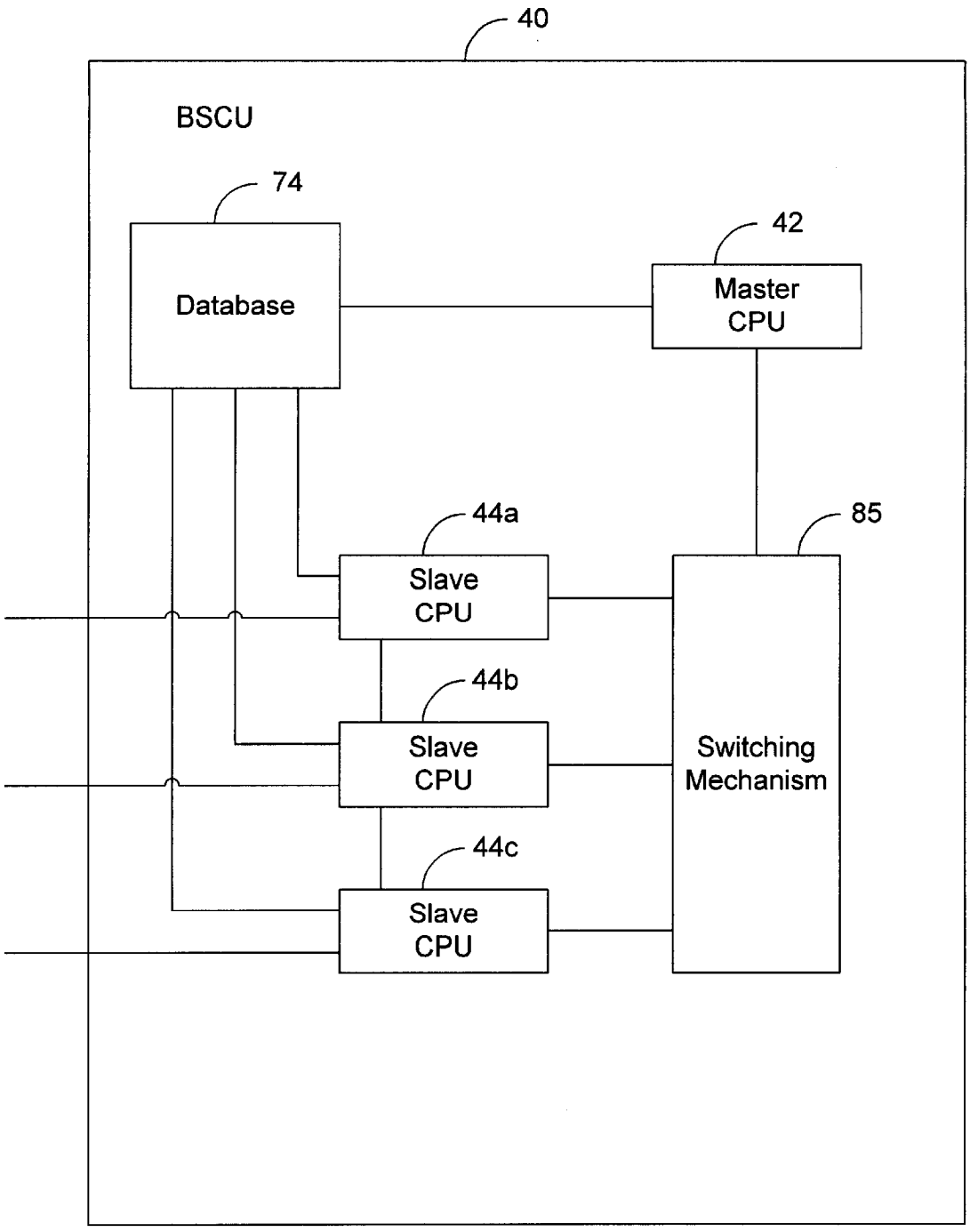
40
BSCU
74
Database
42
Master CPU
44a
Slave CPU
85
44b
Slave CPU
Switching Mechanism
44c
Slave CPU

FIG. 4

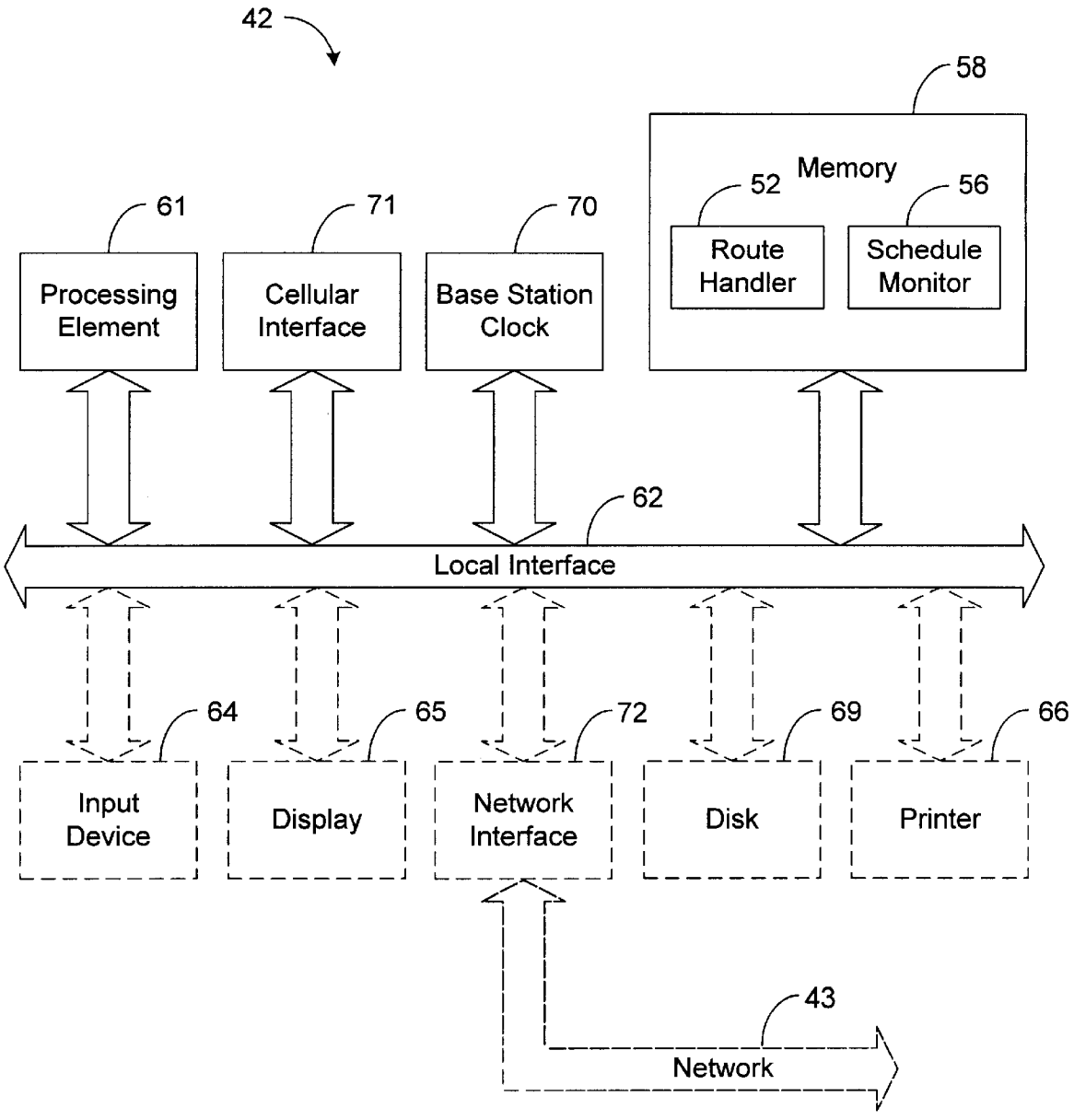
42
58
Memory
52
56
Route Handler
Schedule Monitor
61
71
70
Processing Element
Cellular Interface
Base Station Clock
62
Local Interface
64
65
72
69
66
Input Device
Display
Network Interface
Disk
Printer
43
Network

Fig. 5


| | TIME | Contact Information | Vechicle ID |
|---|---|---|---|
| Entry 1 | 6:30 | 1235670987 | 1112 |
| Entry 2 | 9:15 | 1235290945 | 2034 |
| Entry 3 | 12:45 | 1235467867 | 1390 |
| Entry 4 | 15:30 | 1234342313 | 0999 |

FIG. 6

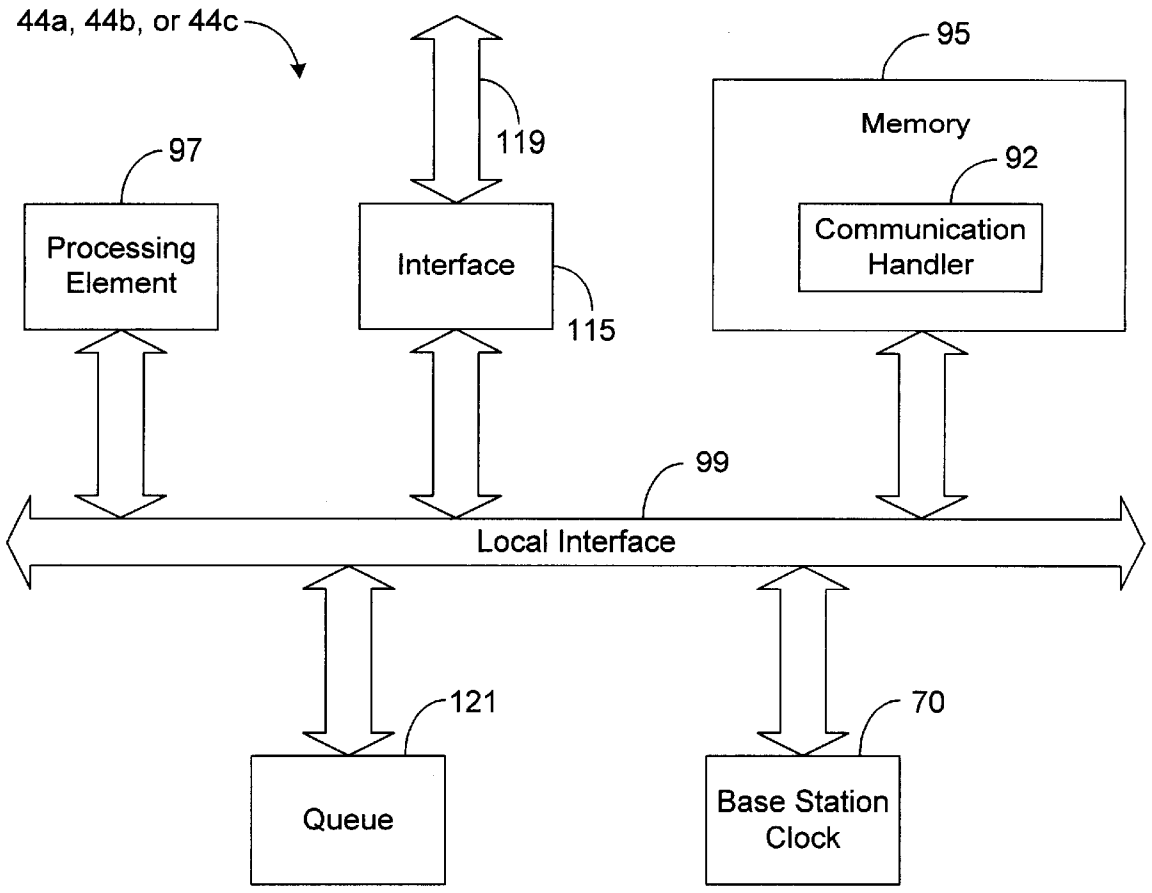
44a, 44b, or 44c
119
95
Memory
97
92
Processing Element
Interface
Communication Handler
115
99
Local Interface
121
70
Queue
Base Station Clock

FIG. 7

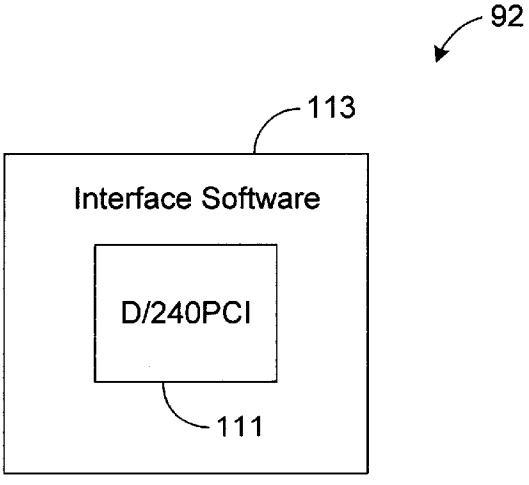
92
113
Interface Software
D/240PCI
111

FIG. 8

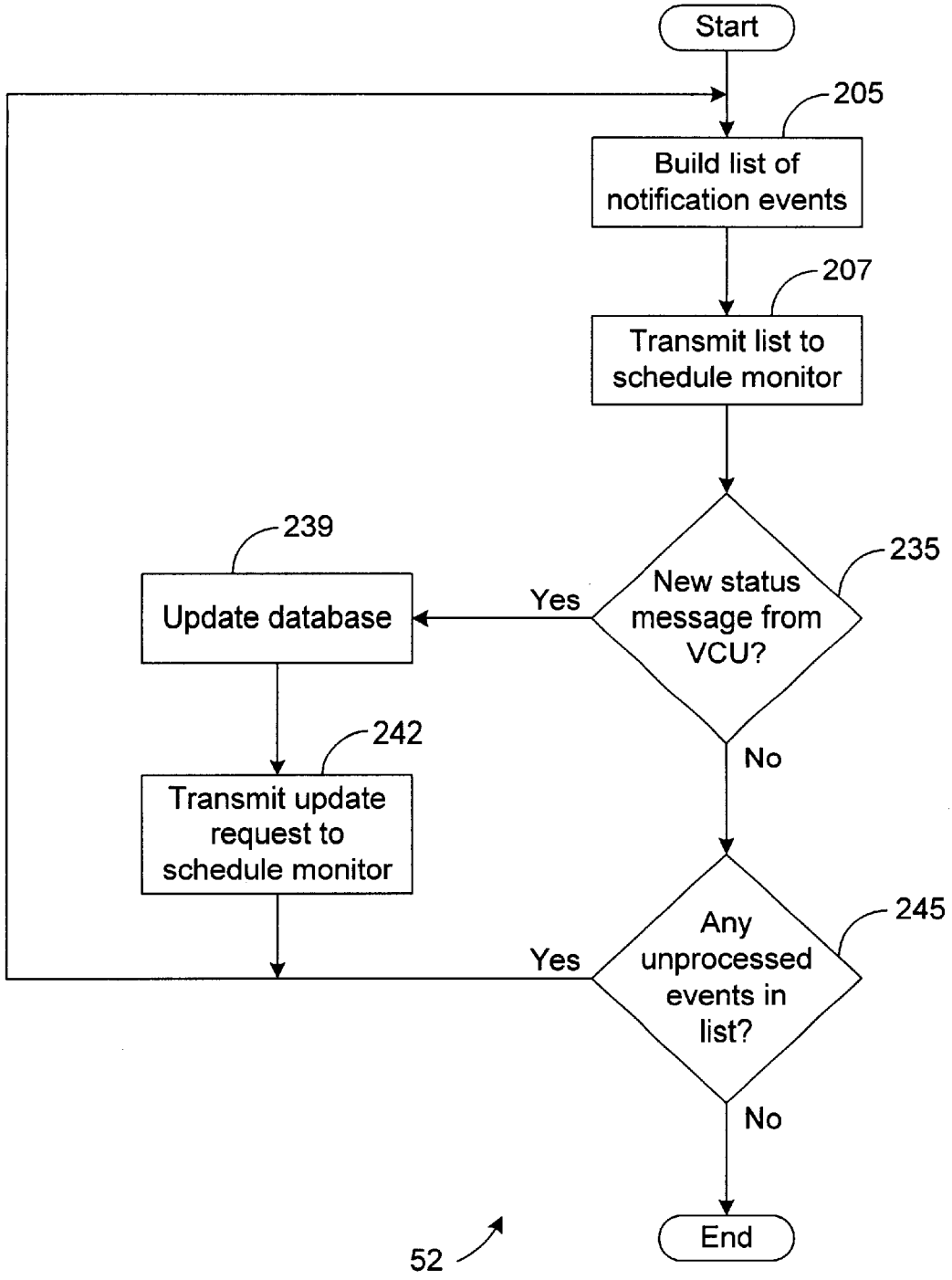
Start
205
Build list of notification events
207
Transmit list to schedule monitor
239
Update database
Yes
New status message from VCU?
235
242
Transmit update request to schedule monitor
No
Any unprocessed events in list?
245
Yes
No
End
52

FIG. 9

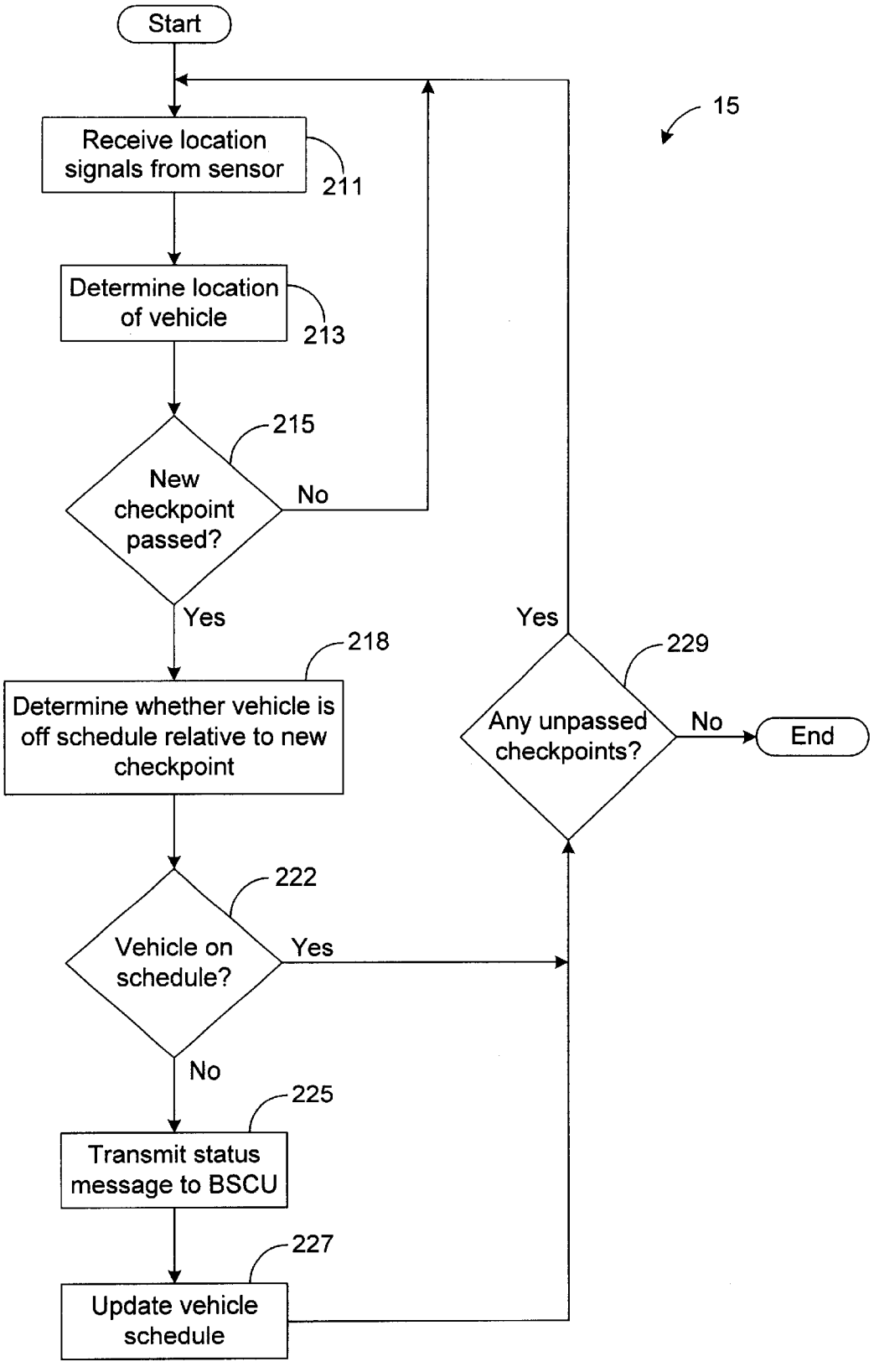
Start
15
Receive location signals from sensor
211
Determine location of vehicle
213
215
New checkpoint passed?
No
Yes
218
Determine whether vehicle is off schedule relative to new checkpoint
222
Vehicle on schedule?
Yes
No
225
Transmit status message to BSCU
227
Update vehicle schedule
Yes
229
Any unpassed checkpoints?
No
End

FIG. 10

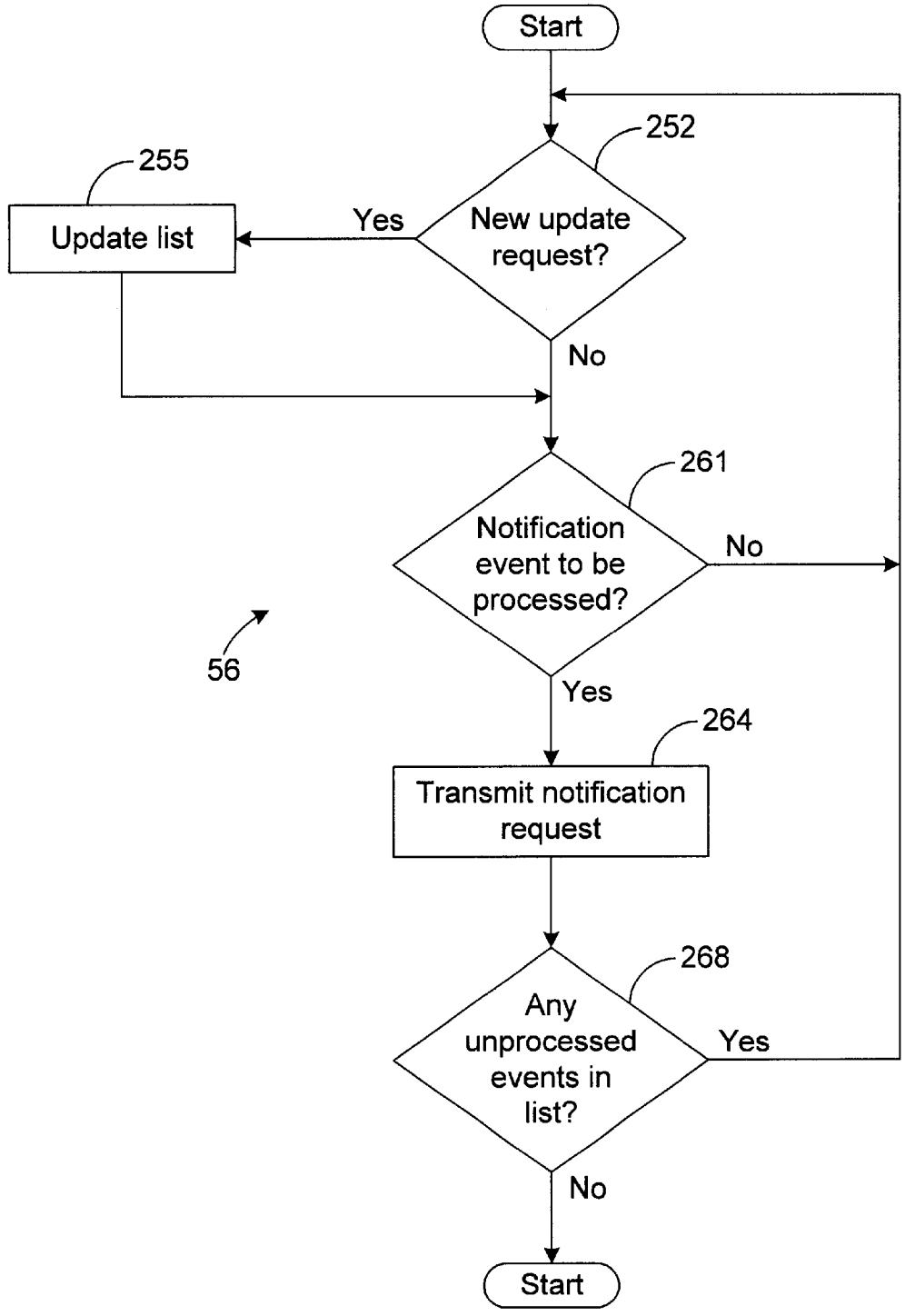
Start
252
New update request?
Yes
255
Update list
No
261
Notification event to be processed?
No
56
Yes
264
Transmit notification request
268
Any unprocessed events in list?
Yes
No
Start

FIG. 11

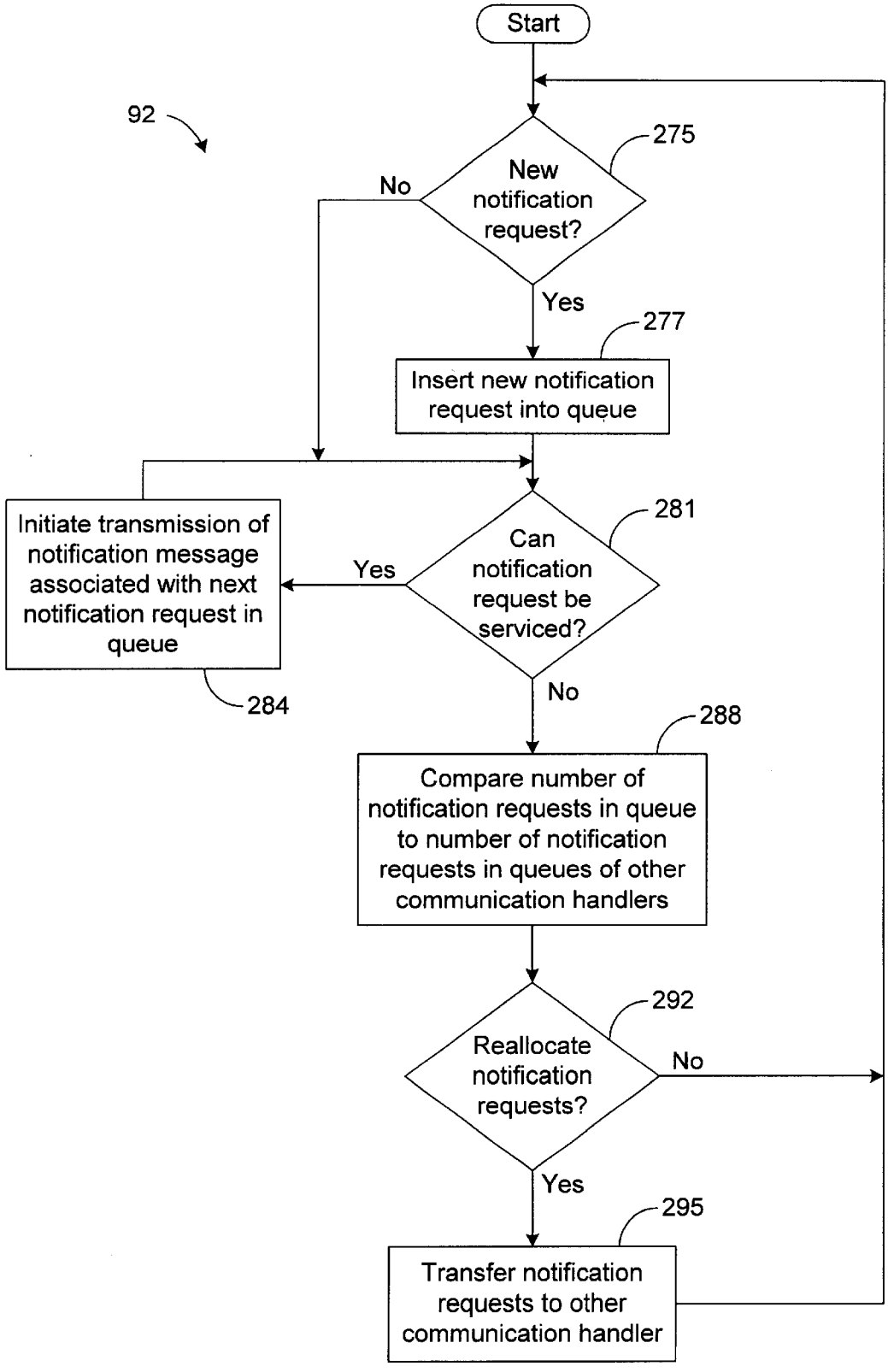
Start
92
275
New notification request?
No
Yes
277
Insert new notification request into queue
281
Can notification request be serviced?
Yes
Initiate transmission of notification message associated with next notification request in queue
284
No
288
Compare number of notification requests in queue to number of notification requests in queues of other communication handlers
292
Reallocate notification requests?
No
Yes
295
Transfer notification requests to other communication handler

FIG. 12

# BASE STATION SYSTEM AND METHOD FOR MONITORING TRAVEL OF MOBILE VEHICLES AND COMMUNICATING NOTIFICATION MESSAGES

## CLAIM OF PRIORITY AND CROSS REFERENCE TO RELATED APPLICATIONS

This document claims priority to U.S. provisional patent application entitled "BASE STATION APPARATUS AND METHOD FOR MONITORING TRAVEL OF MOBILE VEHICLE," assigned Ser. No. 60/122,482 and filed on Mar. 1, 1999, which is incorporated herein by reference.

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to vehicle monitoring and messaging systems and, in particular, to a vehicle monitoring system and method capable of communicating a plurality of notification messages to warn users of impending arrivals of vehicles.

2. Related Art

U.S. Pat. No. 5,400,020, entitled "Advance Notification System and Method," which is incorporated herein by reference, describes a system and method for communicating notification messages to users to warn the users of impending arrivals of vehicles. In this regard, each vehicle associated with the system is equipped with a tracking sensor, which is used to determine the location of the vehicle. Location signals indicating the location of the vehicle as the vehicle travels are transmitted to a base station control unit, which monitors the travel of the vehicle. When the vehicle is within a predefined time or distance of a particular location, the base station control unit transmits a notification message to a user. Therefore, the user is warned of the impending arrival of the vehicle at the particular location.

However, the base station control unit may be used to monitor the travel of a large number of vehicles or may be used to warn a large number of users of impending arrivals of a vehicle or vehicles. Furthermore, servicing a large number of vehicles and/or users may result in the need to simultaneously transmit a large number of notification messages. Accordingly, the ability to efficiently process data for a large number of vehicles and/or users and to efficiently transmit a large number of notification messages is critical in many applications.

Thus, a heretofore unaddressed need exists in the industry for better systems, apparatuses, and methods for accurately and efficiently tracking and/or reporting the status of mobile vehicles as the vehicles travel.

## SUMMARY OF THE INVENTION

The present invention overcomes many inadequacies and deficiencies of the prior art, as discussed hereinbefore. In general, the present invention provides an automated computer-based apparatus and method for monitoring travel of vehicles and for efficiently communicating notification messages to warn users of impending arrivals of the vehicles.

In a broad sense, the automated computer-based apparatus of the present invention includes a route handler, a schedule monitor, and a communication handler. The schedule monitor determines when users should receive notification messages based on data that indicates when vehicles are expected to arrive at certain locations. The route handler



communicates with vehicle control units on board the vehicles to determine how much any of the vehicles are off schedule. If any of the vehicles are off schedule, the route handler updates the data monitored by the schedule monitor to change when the schedule monitor determines that the notification messages should be received by the users.

Once the schedule monitor determines that a user should receive a notification message, the schedule monitor transmits a notification request to the communication handler. The communication handler then establishes communication with a communication device associated with the user and transmits a notification message to the user. Therefore, the user is warned of an impending arrival of a vehicle at a particular location.

In accordance with another feature of the present invention, the route handler selects portions of the data that are associated with notification events expected to occur during a particular time period. During the particular time period, the schedule monitor monitors the selected data to determine whether any notification messages should be received by users during the particular time period.

In accordance with another feature of the present invention, the communication handler stores the notification request and determines a number of notification requests stored by the communication handler. The communication handler then compares this number to a number of notification requests stored by another communication handler and transmits the notification request to the other communication handler if the difference in the two numbers exceeds a predefined threshold.

Other features and advantages of the present invention will become apparent to one skilled in the art upon examination of the following detailed description, when read in conjunction with the accompanying drawings. It is intended that all such features and advantages be included herein within the teachings of the present invention, as set forth herein and as sought to be protected by the claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be better understood with reference to the following drawings. The elements of the drawings are not necessarily to scale relative to each other, emphasis instead being placed upon clearly illustrating the principles of the invention. Furthermore, like reference numerals designate corresponding parts throughout the several views.

FIG. **1** is a block diagram illustrating a vehicle tracking system employed within the context of an advance notification system in accordance with the present invention.

FIG. **2** is a block diagram illustrating an implementation of the vehicle control unit of FIG. **1** in accordance with the present invention.

FIG. **3** is a block diagram illustrating a computer implementing the functionality of the vehicle control unit of FIG. **2** in accordance with the present invention.

FIG. **4** is a block diagram illustrating an implementation of the base station control unit of FIG. **1** in accordance with the present invention.

FIG. **5** is a block diagram illustrating a computer implementing the functionality of the master computer depicted in FIG. **4** in accordance with the present invention.

FIG. **6** is a schematic illustrating an exemplary list of notification events generated by the route handler of FIG. **5**.

FIG. **7** is a block diagram illustrating a computer implementing the functionality of the slave computers depicted in FIG. **4** in accordance with the present invention.

FIG. **8** is a block diagram illustrating a more detailed view of the communication handler depicted in FIG. **7**.

FIG. **9** is a flow chart illustrating the architecture, functionality, and operation of the route handler of FIG. **5**.

FIG. **10** is a flow chart illustrating the architecture, functionality, and operation of the vehicle control unit of FIG. **2** while the vehicle control unit is tracking the vehicle of FIG. **1**.

FIG. **11** is a flow chart illustrating the architecture, functionality, and operation of the communication handler of FIG. **5**.

FIG. **12** is a flow chart illustrating the architecture, functionality, and operation of the communication handler of FIG. **7**.

## DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** depicts an automated vehicle tracking system **10** illustrating the principles of the present invention. As shown by FIG. **1**, the vehicle tracking system **10** is preferably employed within the context of an automated advance notification system **12** that automatically provides advance notice of impending arrivals of vehicles at destinations or other locations.

As depicted in FIG. **1**, a vehicle control unit (VCU) **15** is disposed on a mobile vehicle **17**, which is capable of transporting the VCU **15** over various distances. U.S. patent application entitled "System and Method for an Advance Notification System for Monitoring and Reporting Proximity of a Vehicle," assigned Ser. No. 09/163,958, and filed on Sep. 30, 1998, which is incorporated herein by reference, describes an exemplary VCU **15** that may be used to implement the principles of the present invention.

Preferably, the vehicle **17** is a delivery vehicle for delivering items to a destination or for picking up items at a destination. Note that items can include many various types of packages or goods to be delivered or picked up. Furthermore, items can also include persons to be picked up or delivered, such as when a bus picks up and/or delivers passengers at different bus stops. Preferably, the vehicle **17** travels along a predetermined route in making its deliveries, and the vehicle **17** may make numerous stops along its route in order to deliver or pick up different items at different locations.

Vehicle Control Unit

A more detailed view of the VCU **15** is depicted in FIG. **2**. A sensor **18** within VCU **15** is configured to determine the location of the sensor **18** relative to a predetermined reference point. Preferably, sensor **18** is a global positioning system (GPS) sensor, although other types of positioning systems and/or sensors are also possible. For example, other types of sensors **18** that may be used to implement the principles of the present invention include, but are not limited to, an odometer or sensors associated with Glonass, Loran, Shoran, Decca, or Tacan. The GPS sensor **18** is configured to receive signals **21***a*–**21***c* from a plurality of GPS satellites **23**, and as known in the art, sensor **18** is designed to analyze signals **21***a*–**21***c* to determine the sensor's location or coordinate values relative to a predetermined reference point.

For example, in the foregoing embodiment where sensor **18** is a GPS sensor, the sensor **18** determines the sensor's location values relative to the Earth's zero degree latitude and zero degree longitude reference point, which is located at the intersection of the Equator and the Prime Meridian. U.S. Pat. No. 5,781,156 entitled "GPS Receiver and Method for Processing GPS Signals" and filed on Apr. 23, 1997 by Krasner, which is incorporated herein by reference, discusses the processing of GPS signals **21***a*–**21***c* received from GPS satellites **23** in order to determine the sensor's location values. Since the sensor **18** is located on or within the vehicle **17**, the location values determined by the sensor **18** are assumed to match the location values of the vehicle **17** and the VCU **15**.



It should be noted that the term "location value" shall be defined herein to mean any value or set of values that may be used to determine a location of a point on the Earth or within the Earth's atmosphere. This value may be a distance value, a coordinate value (i.e., grid value), polar value, vector value, or any other type of value or values known in the art for indicating locations of points.

Sensor **18** is designed to periodically transmit a signal **27** to vehicle manager **29** indicating the vehicle's current location values. Vehicle manager **29** is configured to receive signal **27** and to monitor the location of the vehicle **17** over time by processing multiple signals **27**. The vehicle manager **29** can be implemented in software, hardware, or a combination thereof. Preferably, as illustrated by way of example in FIG. **3**, the vehicle manager **29** of the present invention along with its associated methodology is implemented in software and stored in computer memory **30** of a computer system **31**.

Note that the vehicle manager **29** can be stored and transported on any computer-readable medium for use by or in connection with an instruction execution system, apparatus, or device, such as a computer-based system, processor-containing system, or other system that can fetch the instructions from the instruction execution system, apparatus, or device and execute the instructions. In the context of this document, a "computer-readable medium" can be any means that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device. The computer readable medium can be, for example but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, device, or propagation medium. More specific examples (a nonexhaustive list) of the computer-readable medium would include the following: an electrical connection (electronic) having one or more wires, a portable computer diskette (magnetic), a random access memory (RAM) (magnetic), a read-only memory (ROM) (magnetic), an erasable programmable read-only memory (EPROM or Flash memory) (magnetic), an optical fiber (optical), and a portable compact disc read-only memory (CDROM) (optical). Note that the computer-readable medium could even be paper or another suitable medium upon which the program is printed, as the program can be electronically captured, via for instance optical scanning of the paper or other medium, then compiled, interpreted or otherwise processed in a suitable manner if necessary, and then stored in a computer memory. As an example, the vehicle manager **29** may be magnetically stored and transported on a conventional portable computer diskette.

The preferred embodiment of the computer system **31** of FIG. **3** comprises one or more conventional processing elements **32**, such as a digital signal processor (DSP), that communicate to and drive the other elements within the system **31** via a local interface **33**, which can include one or more buses. Furthermore, an input device **34**, for example, a keyboard or a mouse, can be used to input data from a user of the system **31**, and screen display **35** or a printer **36** can be used to output data to the user. A disk storage mechanism

37 can be connected to the local interface 33 to transfer data to and from a nonvolatile disk (e.g., magnetic, optical, etc.). Furthermore, a vehicle clock 38 may be connected to the computer system 31 so that components of the system 31 may utilize data from the clock 38 to determine time through conventional techniques. It should be noted that input device 34, display 35, printer 36, and disk 37 are optional and are not necessarily a part of the preferred embodiment.

The vehicle manager 29 is preferably configured to maintain a predefined schedule 39, referred to herein as the "vehicle schedule 39," within memory 30. The predefined vehicle schedule 39 corresponds with a route of travel for the vehicle 17. In this regard, the predefined vehicle schedule 39 stored in memory 30 includes data defining locations or "checkpoints" along the vehicle's intended route of travel. Furthermore, each checkpoint is associated with a particular time value indicating when the vehicle 17 is expected to pass the associated checkpoint. Each checkpoint along with its associated time value may define an entry in the vehicle schedule 39.

Preferably, the time value associated with a checkpoint corresponds to a time of day that the vehicle 17 is expected to pass the checkpoint. For example, the time value associated with a checkpoint may define the hour and minute that the vehicle 17 is expected to pass the checkpoint. Consequently, when the vehicle 17 reaches the location defined by the checkpoint, the time of day, as defined by vehicle clock 38, can be compared with the time value in the schedule 39 associated with the checkpoint to determine whether the vehicle 17 is early, late, or on time. It should be noted that other data and other methodologies, such as the those disclosed in U.S. Pat. No. 5,400,020, for example, may be employed to determine whether or not the vehicle 17 is on schedule, without departing from the principles of the present invention.

As the vehicle 17 travels along its route, the vehicle manager 29 determines when the vehicle 17 passes a checkpoint by comparing the data received from sensor 18 with the checkpoint data stored in vehicle schedule 39. When the vehicle manager 29 determines that a checkpoint has been passed, the vehicle manager 29 is configured to determine a time value indicating the time of day by analyzing vehicle clock 38, and the vehicle manager 29 is configured to compare this time value with the time value in the schedule 39 associated with the checkpoint.

The vehicle 17 is considered to be off schedule if the value for the time of day from clock 38 differs from the time value in schedule 39 by a predetermined amount. Otherwise the vehicle 17 is considered to be on schedule. For example, assume that the vehicle 17 is to be considered off schedule if the vehicle 17 is early or late by more than two minutes and assume that the vehicle 17 is scheduled to pass a checkpoint at 6:30 a.m. If the vehicle 17 passes the checkpoint between 6:28 a.m. and 6:32 a.m., the vehicle 17 is on schedule. If the vehicle 17 passes the checkpoint before 6:28 a.m., the vehicle is off schedule and is early. If the vehicle 17 passes the checkpoint after 6:32 a.m., the vehicle 17 is off schedule and is late.

If the vehicle manager 29 determines that the vehicle 17 is off schedule, the vehicle manager 29 is configured to transmit a status message to a base station control unit (BSCU) 40 (FIG. 1) indicating how much the vehicle is off schedule, and the vehicle manager 29 is also configured to update the entries in the schedule 39. For example, assume that the vehicle 17 passes the aforementioned checkpoint at 6:25 a.m. In this example, the vehicle 17 is off schedule and five minutes early. Therefore, the vehicle manager 29 transmits a status message to BSCU 40 via cellular network 42 indicating that the vehicle 17 is five minutes early and decreases the expected times stored in the schedule 39 by five minutes. As a result, the schedule 39 is adjusted to account for the vehicle's earliness, and the vehicle 17 will not be deemed off schedule when the vehicle 17 passes the other checkpoints, provided that the rate of travel of the vehicle 17 continues as expected for the remainder of the route. Similarly, if the vehicle 17 passes the aforementioned checkpoint at 6:35 a.m., then the vehicle manager 29 is configured to transmit a status message indicating that the vehicle 17 is five minutes late and is configured to increase the times stored in the schedule 39 by five minutes.

It should be noted that updating the schedule 39 is not necessary in implementing the present invention. However, if the vehicle 17 is early or late at one checkpoint, the vehicle 17 will likely be respectively early or late at other checkpoints causing the vehicle manager 29 to make an off schedule determination and to transmit a status message at each of the remaining checkpoints in the route. By updating the times in schedule 39, the number of status messages transmitted to the BSCU 40 may be reduced in monitoring the travel of the vehicle 17.

It should be further noted that the status message transmitted by VCU 15 may be communicated via any suitable technique and that utilization of the cellular network 42 is not necessary. In this regard, other types of networks may be used to communicate the status message, or the status message may be communicated directly to the base station control unit 40 without the use of any type of communication network. For example, the status message may be communicated via short wave radio.

Base Station Control Unit

Referring to FIG. 4, the base station control unit (BSCU) 40 preferably comprises a master computer system 42 that controls one or more slave computer systems 44*a*, 44*b*, and 44*c*. Referring to FIG. 5, the master computer system 42 includes a route handler 52 and a schedule monitor 56. The route handler 52 and schedule monitor 56, which will be described in further detail hereafter, can be implemented in software, hardware, or a combination thereof. Preferably, as illustrated by way of example in FIG. 5, the route handler 52 and schedule monitor 56 of the present invention along with their associated methodology are implemented in software and stored in memory 58.

Further shown by FIG. 5, the computer system 42 may include one or more processing elements 61, such as a DSP, that communicate to and drive the other elements within the system 42 via a local interface 62, which may include one or more buses. Furthermore, an input device 64, for example, a keyboard or a mouse, can be used to input data from a user of the system 42, and screen display 65 or a printer 66 can be used to output data to the user. A disk storage mechanism 69 can be connected to the local interface 62 to transfer data to and from a nonvolatile disk (e.g., magnetic, optical, etc.). Furthermore, a base station clock 70 may be connected to the computer system 42 so that components of the system 42 may utilize data from the clock 70 to determine time through conventional techniques. The system 42 may also be connected to a cellular interface 71, or other type of suitable interface, for communicating with VCU 15. It may also be desirable for computer system 42 to include a network interface 72 that allows the system 42 to exchange data with a network 73. It should be noted that input device 64, display 65, printer 66, disk 69, network interface 72, and network 73 are optional and are not necessarily a part of the preferred embodiment.

Referring again to FIG. **4**, the database **74** shown by FIG. **4** preferably stores data defining the routes of one or more vehicles **17**. For example, the database **74** may include entries that are correlated with a vehicle **17** of the system **10**, wherein each entry includes sufficient data to define a checkpoint that may be used to monitor the travel of the vehicle **17**. The checkpoints defined in the database **74** for a particular vehicle **17** are preferably the same checkpoints defined in vehicle schedule **39** for the particular vehicle **17**. Furthermore, the entry may also include data to indicate the time of day that the vehicle **17** is expected to reach the checkpoint defined by the entry. Therefore, the database **74** includes sufficient data to define the checkpoints used to monitor the vehicles **17** associated with the system **10** and the times that the vehicles **17** should respectively pass the checkpoints.

Preferably, the database **74** also includes data indicating when different users are to be notified of an impending arrival of at least one of the vehicles **17** associated with the system **10**. For example, the database **74** may include data indicating that a user should be notified a certain amount of time before or after a particular vehicle **17** passes a particular checkpoint. Therefore, at any time, the database **74** can be queried to determine which checkpoints are to be passed by a particular vehicle **17** and when the particular vehicle **17** is expected to pass each of the checkpoints. The database **74** also can be queried to determine when users are to be notified of the particular vehicle's impending arrival. To facilitate querying of the database, the entries of the database **74** may be keyed by vehicle numbers used to identify the vehicles associated with the system **10**.

To illustrate the configuration and use of the database **74**, assume that a user would like to be notified when a particular vehicle **17** is two minutes from a particular location, such as the user's house or a scheduled vehicle stop. Assume further that the vehicle **17** is scheduled to pass a checkpoint every five minutes after starting its route and that the particular location is expected to be reached seventeen minutes after the vehicle **17** starts its route. In this scenario, the database **74** should include data that defines each of the checkpoints along the vehicle's route and that indicates the time that the vehicle **17** is expected to pass each of the checkpoints. The database **74** should also indicate that the individual is to be notified when the vehicle **17** passes the third checkpoint, since the vehicle **17** is expected to pass the third checkpoint fifteen minutes into the route (i.e., two minutes before the vehicle **17** is expected to reach the particular location).

The database **74** also preferably includes sufficient information to enable the individual to be automatically notified once a determination is made that the user should be notified. For example, the database **74** may include the individual's telephone number, pager number, e-mail address, or other type of contact information, depending on the methodology used to notify the individual.

The route handler **52** (FIG. **5**) is configured to query the database **74** to build a list of notification events that are expected to occur during a specified time period. A "notification event" is the generation of a notification message to be transmitted to a user to notify the user of an impending arrival of a vehicle **17** associated with the system **10**. For example, the route handler **52** may query the database **74** at the beginning of a day to determine each notification event that should occur during the course of the day, and the route handler **52** then builds a list of these events. The list should not only indicate what notification events are to occur but also should indicate at what time each notification event is expected to occur. The list may also include contact information (e.g., telephone numbers, pager numbers, e-mail addresses etc.) to facilitate the process of contacting the users associated with the notification events in the list.

FIG. **6** shows an exemplary list **81** that may be produced by the route handler **52**. The list **81** depicts four entries, although any number of entries may be included in the list **81**. Each entry of the list **81** is associated with a respective notification event and indicates: (1) the time at which the respective notification event is expected to occur, (2) the contact information (e.g., telephone number, pager number, e-mail address etc.) associated with the particular user, and (3) a vehicle number identifying the particular vehicle **17** associated with the notification event. For example, assume that "entry 1" is associated with a notification event for a user that would like to be notified when a particular vehicle (vehicle number "1112") is five minutes from a particular location. Based on the information stored in database **74**, assume that the route handler **52** determines that the notification event should occur at 6:30 a.m. (five minutes before the particular vehicle **17** is scheduled to arrive at the particular location). As a result, "entry 1" of the list **81** indicates that the notification event associated with the entry is to occur at 6:30 a.m. "Entry 1" also provides the user's contact information and the vehicle number ("1112") of the vehicle **17** that is to arrive at the particular location. Each of the other entries can be similarly configured based on the information associated with the notification events associated with the other entries. Once the route handler **52** has defined the list **81**, the route handler **52** transmits the list **81** to schedule monitor **56**.

When the BSCU **40** receives a status message from one of the VCUs **15** indicating that one of the vehicles **17** is early or late, the route handler **52** transmits an update request based on the received status message. In response to the update request, the schedule monitor **56** is designed to update the list **81**, if the list **81** includes an entry associated with a notification event pertaining to the one vehicle **17**.

For example, assume that the route handler **52** receives a status message indicating that the vehicle **17** associated with "entry 1" (i.e., vehicle number "1112") is seven minutes late. In response, the route handler **52** transmits an update request to schedule monitor **56**. The update request preferably includes information indicating which vehicle **17** is off schedule and how much the vehicle **17** is off schedule. Based on this update request, the schedule monitor **56** determines that the vehicle **17** associated with the update request (i.e., vehicle number "1112") is seven minutes late. The schedule monitor **56** is designed to traverse the list **81** to identify each entry associated with the vehicle number "1112" and is configured to increase the time values stored in the identified entries by seven minutes to account for the tardiness of vehicle number "1112." Therefore, in the list **81** depicted by FIG. **6**, the schedule monitor **56** changes the time value in "entry 1" from "6:30" to "6:37." As a result, the notification event associated with "entry 1" should not occur until 6:37 a.m.

Upon receiving a status message, the route handler **52** is also designed to update the database **74**. Therefore, in the example described hereinbefore, the route handler **52** is designed to input data into the database **74** indicating that vehicle number "1112" is seven minutes late. As a result, the database **74** can be consulted at any time to determine not only the scheduled route of any vehicle **17** but also to determine the status of the vehicle **17** as the vehicle **17** is traveling its route. In this regard, if the database **74** does not indicate that a particular vehicle **17** is early or late, then it can be assumed that the vehicle **17** should arrive at its future

checkpoints on schedule. However, if the database **74** indicates that the vehicle **17** is early or late, then it can be assumed that the vehicle **17** will arrive at its future checkpoints off schedule by the amount indicated by the database **74**.

The schedule monitor **56** is configured to periodically scan the list **81** to determine if a notification event should occur (i.e., if a notification message should be transmitted to a user). In this regard, when the time of the day, as determined from base station clock **70**, corresponds to (e.g., matches) the time indicated by one of the entries in the list **81**, the schedule monitor **56** determines that the notification event associated with the corresponding entry should occur. Therefore, to initiate the occurrence of the notification event, the schedule monitor **56** is designed to transmit a notification request to one of the slave computers **44***a*–**44***c*, which transmits a notification message in response to the notification request, as will be described in more detail hereinbelow.

As shown by FIG. **4**, a switching mechanism **85**, such as an etherswitch, for example, is used to route the notification request to the appropriate slave computer **44***a*–**44***c*. In an attempt to balance the workload of the slave computers **44***a*–**44***c*, the schedule monitor **56** preferably selects one of the slave mechanisms **44***a*–**44***c* to process the notification request based on the number of notification requests previously transmitted to each slave computer **44***a*–**44***c* within a specified time period. For example, the schedule monitor **56** could be configured to transmit the notification message to the slave computer **44***a*–**44***c* that has received the least number of notification requests in the last five minutes. As a result, the workload of the slave computers **44***a*–**44***c* is not likely to become disproportionately high for any one of the slave computers **44***a*–**44***c*.

As shown by FIG. **7**, each of the slave computers **44***a*–**44***c* includes a communication handler **92** configured to process each notification request received by the computer **44***a*–**44***c*. The communication handler **92** may be implemented in software, hardware, or a combination thereof. Preferably, as depicted by FIG. **7**, the communication handler **92** is implemented in software and stored in memory **95**.

Further shown by FIG. **7**, each slave computer system **44***a*–**44***c* may include one or more processing elements **97**, such as a DSP, that communicate to and drive the other elements within the system **44***a*–**44***c* via a local interface **99**, which may include one or more buses. Furthermore, the base station clock **70** may be connected to each computer system **44***a*–**44***c* so that components of the system **44***a*–**44***c* may utilize data from the clock **70** to determine time through conventional techniques. Each slave computer **44***a*–**44***c* preferably includes an interface **115**, such as a telephone interface, for example, coupled to a plurality of communication connections **119** that enables the communication handler **92** to transmit the notification messages across the connections **119**. As an example, the interface **115** may be coupled to a T1 trunk or a plurality of T1 trunks that, as known in the art, are capable of placing up to twenty-four telephone calls each.

The communication handler **92** is preferably capable of processing multiple notification requests and of simultaneously communicating multiple notification messages to users to warn the users of impending arrivals of vehicles **17**. For example, in one embodiment, the communication handler **92** is implemented by a D/240PCI card **111** manufactured by Dialogic Corp., as shown by FIG. **8**. Other software **113** may be implemented to interface the notification messages with the Dialogic card. This other software **113** may include Visual Voice software, which is a well known set of software commonly used to interface data with the Dialogic card **111**.

As shown by FIG. **1**, the notification messages may be routed to one or more users via a communication network, such as the publicly switched telephone network (PSTN) **123**. In this regard, the network **123** routes each notification message transmitted by a communication handler **92** to a communication device **124**, such as a telephone, for example, at a premises **126** of a user that is to receive the notification message. Upon receiving the notification message from network **123**, the communication device **124** communicates the notification message to the user. It should be noted that the notification messages do not necessarily have to be communicated via telephone calls and that the communications device **124** may be any device capable of communicating a notification message. For example, the communications device **124** may be pager in one embodiment. In another embodiment, the communication handler **92** transmits a notification message to the device **124** via the Internet. For example, the communication handler **92** may transmit an e-mail message to the device **124**, which in this example is a computer capable of reading the message and displaying the message to the user.

If a notification request cannot be immediately serviced by the communication handler **92**, then the communication handler **92** is designed to store the notification request into a queue **121**. The communication handler **92** then services the notification requests stored in the queue **121** on a first in, first out (FIFO) basis. Therefore, the communication handler **92** of each system **44***a*–**44***c* services the notification requests in the order in which they were received by the communication handler **92**.

As stated hereinbefore, each notification request is generated in response to a determination that a user should be warned of an impending arrival of a particular vehicle **17** at a particular location. Therefore, each notification request preferably includes contact information to enable the communication handler **92** to send a notification message to the particular user associated with the notification request or includes other information to enable the communication handler **92** to retrieve such contact information from the database **74**. As a result, the communication handler **92** is configured to utilize contact information included in the notification request or stored in the database **74** to transmit a notification request to the user associated with the notification request.

It should be noted that it is possible for the notification message to be user specific. For example, the message may include the phrase "Vehicle number 1112 is five minutes from your vehicle stop." To enable such a message, the vehicle number and the time from the user's stop may be included in the notification request. Therefore, each entry in the list **81** may include, in addition to the information shown in FIG. **6**, the amount of time that the vehicle **17** is from the user's selected destination when the notification event associated with the entry is expected to occur.

Furthermore, since there may be a delay between generating a notification request and in servicing the notification request, the communication handler **92** may be designed to query the database **74** to update the notification message before transmission. For example, if the notification request is generated when the vehicle **17** is five minutes from a user's selected destination and if the notification message is transmitted two minutes later, the communication handler **92** can be designed to query the database **74** based on the information provided in the notification request and determine that two minutes have elapsed since the notification request was generated. Therefore, the communication handler **92** may modify the message to include the phrase "Vehicle 1112 is three minutes from your vehicle stop."

It should be further noted that the list **81** is not a necessary feature of the present invention. In this regard, the database **74** can be repeatedly searched to determine when to generate notification requests. However, repeatedly searching the database **74** could result in the unnecessary processing of a vast amount of data, depending on the amount of data and entries stored in database **74**. Utilization of the list **81** enables a much smaller amount of data to be searched in identifying whether notification requests should be generated.

Furthermore, it is not necessary for the communication handlers **92** to be implemented by slave computers **44***a*–**44***c*. For example, it may be possible to implement the route handler **52**, the schedule monitor **56**, and the communication handlers **92** in a single computer system, such as system **42**. In addition, the present invention has been described as using three communication handlers **92** for the purposes of illustration only, and any number of communication handlers **92** (i.e., one or more) may be utilized by the system **10**.

In addition, it is possible to use the contents of the database **74** to create a web page indicating the status of the vehicles **17** associated with the system **10**. Therefore, users can access the web page via the Internet or some other suitable communication network to determine whether a particular vehicle **17** is on or off schedule and how much a particular vehicle may be off schedule.

Furthermore, as shown by FIG. **4**, the slave computers **44***a*–**44***c* can be connected to one another and can be configured to reallocate notification requests. For example, the communication handlers **92** in the slave computers **44***a*–**44***c* can be configured to communicate to one another how many notification requests are currently queued by each of the communication handlers **92**. If the difference in the number of notification requests queued by one communication handler **92** and the number of notification requests queued by another communication handler **92** exceeds a predetermined threshold, then the communication handler **92** having the higher number of queued notification requests preferably transmits one or more of the queued notification requests to the other communication handler **92**. Therefore, the occurrence of one communication handler **92** having a disproportionately high number of queued notification requests should be prevented.

It should be noted that there are many alternative embodiments that may be implemented to reallocate the notification requests without departing from the principles of the present invention. For example, in one embodiment, a first communication handler **92** may be designed to communicate a reallocation request to one or more of the other communication handlers **92** when the number of notification requests queued by the first communication handler falls below a predetermined threshold. In response to the reallocation request, at least one of the other communication handlers **92** transmits one or more of its queued notification requests to the first communication handler **92**, which services the notification request. Other variations for reallocating the notification requests are possible.

In other embodiments, it may be possible for the VCU **15** to transmit notification requests directly to the communication device **124** at the user's premises **126**. Such a system is fully described in U.S. Pat. No. 5,444,444 entitled "Apparatus and Method of Notifying a Recipient of an Unscheduled Delivery" and filed on Sep. 16, 1994, by Ross, which is incorporated herein by reference.

Alternative Embodiments

It should be noted that there are many alternative embodiments for implementing the vehicle tracking system **10**. For example, in one alternative embodiment, portions of the schedule monitor **56** are implemented in each of the slave computers **44***a*–**44***c*. When implemented in software, the schedule monitor **56** in each slave computer **44***a*–**44***c* may be stored in the memory **95** of the slave computer **44***a*–**44***c*.

In this example, a list **81** of notification events is created by the route handler **52** in the master computer **42**, as described hereinabove. However, portions (e.g., entries) of the list **81** are transmitted to each slave computer **44***a*–**44***c*, which monitors the received portion of the list **81**. For example, once the list **81** is created by the route handler **52**, the route handler **52** is designed to assign certain vehicles **17** to certain ones of the slave computers **44***a*–**44***c*. The route handler **52** is designed to then transmit each entry defining a notification event associated with a particular vehicle **17** to the slave computer **44***a*–**44***c* assigned to the particular vehicle **17**. The assignment of the vehicles **17** to the slave computers **44***a*–**44***c* is preferably controlled by the route handler **52** such that each slave computer **44***a*–**44***c* receives a similar number of notification events in an effort to prevent any one slave computer **44***a*–**44***c* from becoming overburdened.

The schedule monitor **56** in each slave computer **44***a*–**44***c* then builds a notification event list **81** including each of the entries received by the slave computer **44***a*–**44***c*. As a result, the functionality of monitoring the list **81** is divided across the slave computers **44***a*–**44***c*. Moreover, when a status message from a VCU **15** is received by cellular interface **71**, the route handler **52** in the master computer **42** is designed to determine which slave computer **44***a*–**44***c* is assigned to the vehicle **17** associated with the status message. Then, the route handler **52** of the slave computer **42** is designed to transmit the status message to the slave computer **44***a*–**44***c* assigned to the foregoing vehicle **17**. The schedule monitor **56** in the slave computer **44***a*–**44***a* receiving the status message then updates the list **81** maintained in the slave computer **44***a*–**44***c*, via techniques described hereinbefore.

The schedule monitor **56** in each slave computer **44***a*–**44***c* monitors the list **81** in the same slave computer **44***a*–**44***c* to determine when a notification event should occur. When a notification event occurs, the schedule monitor **56** transmits a notification request to the communication handler **92**, which processes the notification as described hereinbefore. Therefore, the operation of the foregoing embodiment is similar to the embodiment previously described, except that at least some of the functionality of the schedule monitor **56** is implemented in each of the slave computers **44***a*–**44***c*. Dividing the functionality of the schedule monitor **56** across multiple slave computers **44***a*–**44***c* is advantageous in applications utilizing a relatively large number of notification events, since monitoring of a large number of notification events by the master computer **42** may overload the master computer **42**.

Operation

The preferred use and operation of the system **10** and associated methodology are described hereafter.

Initially, a vehicle schedule **39** is respectively stored in the VCU **15** of each vehicle **17** associated with the system **10**. As set forth hereinbefore, the vehicle schedule **39** includes data defining a plurality of checkpoints along the vehicle's route or routes of travel and the expected time that the vehicle **17** is to pass each of the checkpoints. There are a variety of methodologies that may be employed to determine the information stored in the VCU **15**. In one embodiment, the data is accumulated from the sensor **18** and the vehicle clock **38**, as the vehicle **17** travels the route or routes. Such a methodology is described in more detail in U.S. patent application entitled "Apparatus and Method for Monitoring Travel of a Mobile Vehicle," assigned Ser. No. 09/395,497, and filed on Sep. 14, 1999, which is incorporated herein by reference.

The route data stored in vehicle schedule **39** is also stored in database **74** of BSCU **40**. Furthermore, contact information associated with each user that is to be notified of an impending arrival of one of the vehicles **17** is also stored in database **74** so that the users may be sent a notification message at appropriate times. Each user is allowed to select a vehicle **17** and a time when the user would like to be warned of an impending arrival of the selected vehicle **17**. The process of enabling a user to select a vehicle and a time is further described in U.S. patent application entitled "System and Method for Activation of an Advance Notification System for Monitoring and Reporting Status of Vehicle Travel," assigned Ser. No. 09/163,588, and filed on Sep. 30, 1998, which is incorporated herein by reference.

As shown by blocks **205** and **207** of FIG. **9**, the route handler **52** builds a list **81** of notification events that should occur during a specified time period and transmits this list **81** to schedule monitor **56**. For illustrative purposes, assume that the user selects to receive a notification message when a particular vehicle **17** is five minutes from a particular location. Further assume that the vehicle **17** is scheduled to arrive at the particular location at 6:35 a.m., which is within the aforementioned specified time period. As a result, the user should receive a notification message at 6:30 a.m., if the vehicle **17** is on schedule when traveling the route, and in performing block **205**, the route handler **52** defines an entry in the list **81** indicating that the user should be so notified at 6:30 a.m. "Entry 1" of the list **81** depicted by FIG. **6** is suitable for implementing the present invention in the context of the foregoing example.

At some point, the vehicle **17** begins to travel its route. Before or during travel of the route, the vehicle clock **38** should be synchronized with the BSCU clock **70**. As vehicle **17** travels its route, it passes checkpoints, and its VCU **15** monitors its progress. In this regard, based on the signals provided by sensor **18**, the VCU **15** determines when vehicle **17** passes each of its checkpoints, as shown by blocks **211**, **213**, and **215** of FIG. **10**. As depicted by blocks **218** and **222**, when vehicle **17** passes a checkpoint, the VCU **15** determines whether the vehicle **17** is on or off schedule by comparing the current time, as defined by vehicle clock **38**, with the time value associated with the passed checkpoint and stored in vehicle schedule **39**.

If vehicle **17** is determined to be off schedule, then the VCU **15** transmits a status message to BSCU **40** indicating how much the vehicle **17** is off schedule and updates the time values associated with the remaining checkpoints (i.e., the checkpoints that have yet to be passed by vehicle **17**), as shown by blocks **225** and **227**. As depicted by block **229**, the VCU **15** continues to monitor the progress of vehicle **17** until vehicle **17** passes the last checkpoint on the route.

Upon receiving a status message from the VCU **15**, the route handler **52** updates the database **74** to indicate that the vehicle **17** is off schedule by an amount indicated by the status message, as depicted by blocks **235** and **239** of FIG. **9**. Next, as shown by block **242**, the route handler **52** transmits an update request to the schedule monitor **56** indicating that the vehicle **17** associated with the status message is off schedule by a specified amount (e.g., a specified number of minutes early or late). As shown by block **245**, the route handler **52** continues to check for status messages until each notification event in the list **81** has occurred.

As shown by blocks **252** and **255** of FIG. **11**, the schedule monitor **56** updates the list **81** when the schedule monitor **56** receives an update request from route handler **52**. In this regard, when the schedule monitor **56** receives an update request indicating that a vehicle **17** is off schedule, the schedule monitor **56** changes the time values in the entries associated with the vehicle **17** by an amount that the vehicle **17** is off schedule.

As depicted by block **261**, the schedule monitor **56** periodically checks to determine whether any notification events should occur. In this regard, the schedule monitor **56** compares the current time, as determined by the BSCU clock **70**, with the time values in the list **81**. If the time value of an entry in the list **81** corresponds with the current time (e.g., matches the current time, in the preferred embodiment), then the schedule monitor **56** determines that a notification message should be transmitted to a user to warn the user of an impending arrival of the vehicle **17** associated with the entry. Therefore, in block **264**, the schedule monitor **56** transmits a notification request to one of the communication handlers **92** indicating that a user should be notified. The notification request preferably includes data identifying the user (such as the user's telephone number, pager number, e-mail address, or any other value unique to the user) and identifying the vehicle **17** associated with the notification event. As shown by block **268**, the schedule monitor **56** continues to monitor the entries in the list **81** until each notification event defined by the entries has occurred.

As shown by blocks **275** and **277** of FIG. **12**, each communication handler **92** places any new notification request received from schedule monitor **56** into a respective queue. As depicted by blocks **281** and **284**, each communication handler **92** determines whether a new call can be initiated via interface **115** and initiates transmission of a notification message if the interface **115** can handle a new call. In this regard, the communication handler **92** uses the information in the notification request to identify the user that should be notified by the notification message. The information in the notification request may either include the contact information needed to establish communication with the user or the communication handler **92** may look up the contact information in the database **74**.

Furthermore, the notification message may provide a status report for the vehicle **17** associated with the notifica-

tion request. For example, the notification message may indicate that the vehicle **17** is a certain number of minutes from a particular location. The communication handler **92** may retrieve information from the database **74** to form the notification message. By retrieving the information for the status report directly from the database **74**, the communication handler **92** utilizes the most recent information available in providing any status reports to the user.

If the interface **115** cannot handle a new call (e.g., the interface **115** is not operating properly or there are no available communication lines **119**) the communication handler **92** preferably checks to see if another communication handler **92** has a disproportionately less number of notification requests queued, as shown by block **288**. If the difference in the number of queued notification requests in the two communication handlers **92** being compared in block **288** exceeds a predetermined threshold, then the communication handler **92** reallocates the queued notification requests by transmitting one or more of its queued notification requests to the other communication handler **92** that has a smaller number of queued notification requests, as depicted by blocks **292** and **295**. Ultimately, a notification message is transmitted by one of the communication handlers for each notification request transmitted by the schedule monitor **56**.

It should be noted that the present invention has been described herein as determining when to initiate a notification message to a user based on a time value. However, other types of values may be used to monitor the travel of the vehicle **17**. For example, a notification message could be initiated when a particular vehicle comes within a certain distance of a particular location. U.S. patent application entitled "Base Station Apparatus and Method for Monitoring Travel of a Mobile Vehicle," assigned Ser. No. 09/395,501, and filed on Sep. 14, 1999, which is incorporated herein be reference, describes how distance values may be used to determine when to transmit notification messages.

It should be emphasized that the above-described embodiments of the present invention, particularly, any "preferred" embodiments, are merely possible examples of implementations, merely set forth for a clear understanding of the principles of the invention. Many variations and modifications may be made to the above-described embodiment(s) of the invention without departing substantially from the spirit and principles of the invention. All such modifications and variations are intended to be included herein within the scope of the present invention and protected by the claims.

Now, therefore, the following is claimed:

**1**. A system for notifying users of impending arrivals of vehicles at particular locations, comprising:

memory storing a first time value, said first time value indicating when a user should be notified of an impending arrival of a vehicle;

a clock configured to produce a second time value;

a route handler configured to receive a status message from said vehicle and to transmit an update request when said vehicle is off schedule based on said status message;

a schedule monitor configured to compare said first time value to said second time value and to produce and transmit a notification request based on a comparison of said time values, said schedule monitor further configured to update said first time value in response to said update request; and

a communication handler configured to receive said notification request and to transmit a notification message to said user in response to said notification request, said communication handler further configured to store said notification request and to determine a number of notification requests stored by said communication handler, said communication handler further configured to compare said number of notification requests to a threshold number and to cause reallocation of notification requests between said communication handler and at least one other communication handler based on a comparison of said number of notification requests to said threshold number.

**2**. The system of claim **1**, wherein said communication handler receives a notification request in response to said reallocation.

**3**. The system of claim **1**, wherein said communication handler transmits a notification request in response to said reallocation.

**4**. The system of claim **1**, wherein said threshold number is a number of notification requests stored in another communication handler.

**5**. The system of claim **1**, wherein said communication handler is configured to simultaneously transmit a plurality of notification messages across a plurality of communication lines.

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

a database storing route information associated with a plurality of vehicles, said route information including said first time value,

wherein said route handler is configured to determine whether said first time value is associated with a notification event that is expected to occur within a particular time period and to transmit said first time value to said schedule monitor in response to a determination that said notification event associated with said first time value is expected to occur within said particular time period.

**7**. The system of claim **1**, wherein said route handler is further configured to produce a list of notification events that are expected to occur within a particular time period, said route handler further configured to include said first time value in said list in response to a determination that said first time value is associated with a notification event that is expected to occur within said particular time period, said schedule monitor further configured to analyze said list to determine whether any notification requests should be transmitted to said communication handler.

**8**. The system of claim **1**, wherein said schedule monitor is implemented within a first computer system and said communication handler is implemented within a second computer system.

**9**. A system for notifying users of impending arrivals of vehicles at particular locations, comprising:

a database storing data associated with a plurality of vehicles;

a route handler configured to analyze said data and to select portions of said data that are associated with notification events expected to occur during a particular time period;

a schedule monitor configured to analyze said selected portions of said data during said particular time period and to disregard other portions of said data during said particular time period, said schedule monitor further configured to determine when at least one of said notification events should occur based on said selected portions of said data and to transmit a notification request in response to a determination by said schedule monitor that said at least one notification event should occur; and

a communication handler configured to receive said notification request and to transmit a notification message in response to said notification request.

**10**. The system of claim **9**, wherein said communication handler is configured to simultaneously transmit a plurality of notification messages across a plurality of communication lines.

**11**. The system of claim **9**, wherein said communication handler is configured to store said notification request and to determine a number of notification requests stored by said communication handler, said communication handler further configured to compare said number of notification requests to a threshold number and to cause reallocation of notification requests between said communication handler and at least one other communication handler based on a comparison of said number of notification requests to said threshold number.

**12**. The system of claim **9**, wherein said schedule monitor is implemented in a first computer system and said communication handler is implemented in a second computer system.

**13**. A system for notifying users of impending arrivals of vehicles at particular locations, comprising:

memory storing data indicating a proximity of at least one vehicle to at least one location;

a route handler configured to receive status messages and to update said data based on said status messages;

a schedule monitor configured to monitor said data and to transmit notification requests in response to determinations by said schedule monitor that said at least one vehicle is within a predefined proximity of at least one location; and

a plurality of communication handlers configured to respectively receive said notification requests and to transmit notification messages in response to said notification requests,

wherein said schedule monitor is further configured to determine a number of notification requests transmitted to one of said communication handlers within a first particular time period and to allocate said notification requests between said communication handlers based on said number.

**14**. The system of claim **13**, wherein at least one of said communication handlers is configured to store notification requests and to determine a number of notification requests stored by said at least one communication handler, said at least one communication handler further configured to compare said number of notification requests to a threshold number and to cause reallocation of notification requests between said communication handler and another of said communications handlers based on a comparison of said number of notification requests to said threshold number.

**15**. The system of claim **13**, wherein said route handler selects said data in response to a determination by said route handler that said data is associated with notification events that are expected to occur during a second particular time period.

**16**. A method for notifying users of impending arrivals of vehicles at particular locations, comprising the steps of:

storing a first time value, said first time value indicating when a user should be notified of an impending arrival of a vehicle;

receiving a second time value;

receiving a status message transmitted from said vehicle;

updating said first time value based on said status message;

comparing said first time value to said second time value;

transmitting a notification request to a communication handler based on said comparing said first time value step;

determining a number of notification requests stored by a communication handler;

comparing said number of notification requests to a threshold number;

reallocating said notification request between said communication handlers based on said comparing said number of notification requests step; and

transmitting a notification message to said user in response to said notification request.

**17**. The method of claim **16**, further comprising the steps of:

determining whether said first time value indicates a time within a particular time period, said particular time period including a time indicated by said second time value; and

performing said comparing said first time value step during said particular time period in response to a determination in said determining step that said first time value indicates a time within said particular time period.

**18**. The method of claim **16**, further comprising the steps of:

creating a list of notification events that are expected to occur within a particular time period;

including said first time value in said list in response to a determination that said first time value is associated with a notification event that is expected to occur within said particular time period; and

monitoring said list during said particular time period, said monitoring step including said comparing said first time value step.

**19**. A method for notifying users of impending arrivals of vehicles at particular locations, comprising the steps of:

storing data associated with a plurality of vehicles;

selecting portions of said data that are associated with notification events expected to occur during a particular time period;

analyzing said selected portions of said data during said particular time period;

disregarding other portions of said data during said particular time period;

determining when at least one of said notification events should occur based on said analyzing step; and

transmitting a notification message in response to said determining step.

**20**. A method for notifying users of impending arrivals of vehicles at particular locations, comprising the steps of:

storing data associated with at least one vehicle;

receiving at least one status message from said one vehicle;

updating said data based on said one status message;

analyzing said data;

determining when to notify a user of an impending arrival of said one vehicle at a particular location based on said analyzing step;

transmitting a notification request based on said determining step; and

allocating said notification request to a communication handler based on a number of notification requests transmitted to said communication handler during a first particular time period.

**21**. The method of claim **20**, further comprising the step of transmitting a notification message from said communication handler in response to said notification request, said notification message indicating said impending arrival of said one vehicle.

**22**. The method of claim **20**, further comprising the steps of:

storing said notification request in said communication handler;

determining a number of notification requests stored in said communication handler;

comparing said number of notification requests to a threshold number;

transmitting said notification request to another handler based on said comparing step; and

transmitting a notification message from said other communication handler in response to said notification request, said notification message indicating said impending arrival of said one vehicles.

**23**. The method of claim **20**, further comprising the step of selecting said data in response to a determination that said data is associated with notification events that are expected to occur during a second particular time period.

* * * * *

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(12) **United States Patent**
**Jones**

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(45) **Date of Patent: Jul. 2, 2002**

(54) **SYSTEM AND METHOD FOR AUTOMATICALLY PROVIDING VEHICLE STATUS INFORMATION**

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(73) Assignee: **Global Research Systems, Inc.**, Rome, GA (US)

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(21) Appl. No.: **09/516,476**

(22) Filed: **Mar. 1, 2000**

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(51) **Int. Cl.**[7] ..... **G05D 1/00**

(52) **U.S. Cl.** ..... **701/1**; 701/29; 701/35; 701/117; 342/357.06; 342/357.12

(58) **Field of Search** ..... 701/29, 35, 117, 701/1, 200, 204; 342/357.06, 357.12; 340/994

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*Assistant Examiner*—Marthe Y. Marc-Coleman
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(57) **ABSTRACT**

A system for monitoring and reporting vehicle status information includes a database, a communication interface, and a system manager. The database stores status information associated with a vehicle, and the communication interface is designed to communicate with communication devices remotely located from the system. The system manager receives a message transmitted from the vehicle and updates the status information stored in the database based on the received message. When a remote communication device establishes communication with the communication interface, the communication interface receives caller identification information automatically transmitted to the communication interface. The system manager analyzes this caller identification information and automatically retrieves status information from the database based on the caller identification information. The system manager then transmits, via the communication interface, the retrieved status information to the remote communication device.

**15 Claims, 3 Drawing Sheets**

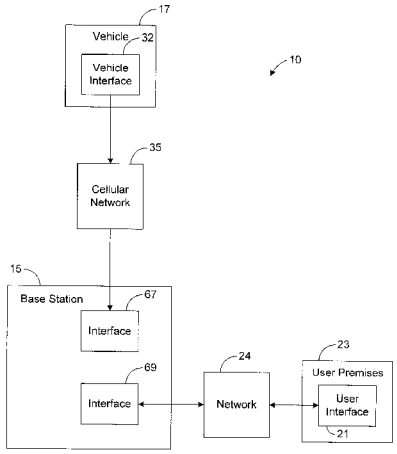


**EXHIBIT B**

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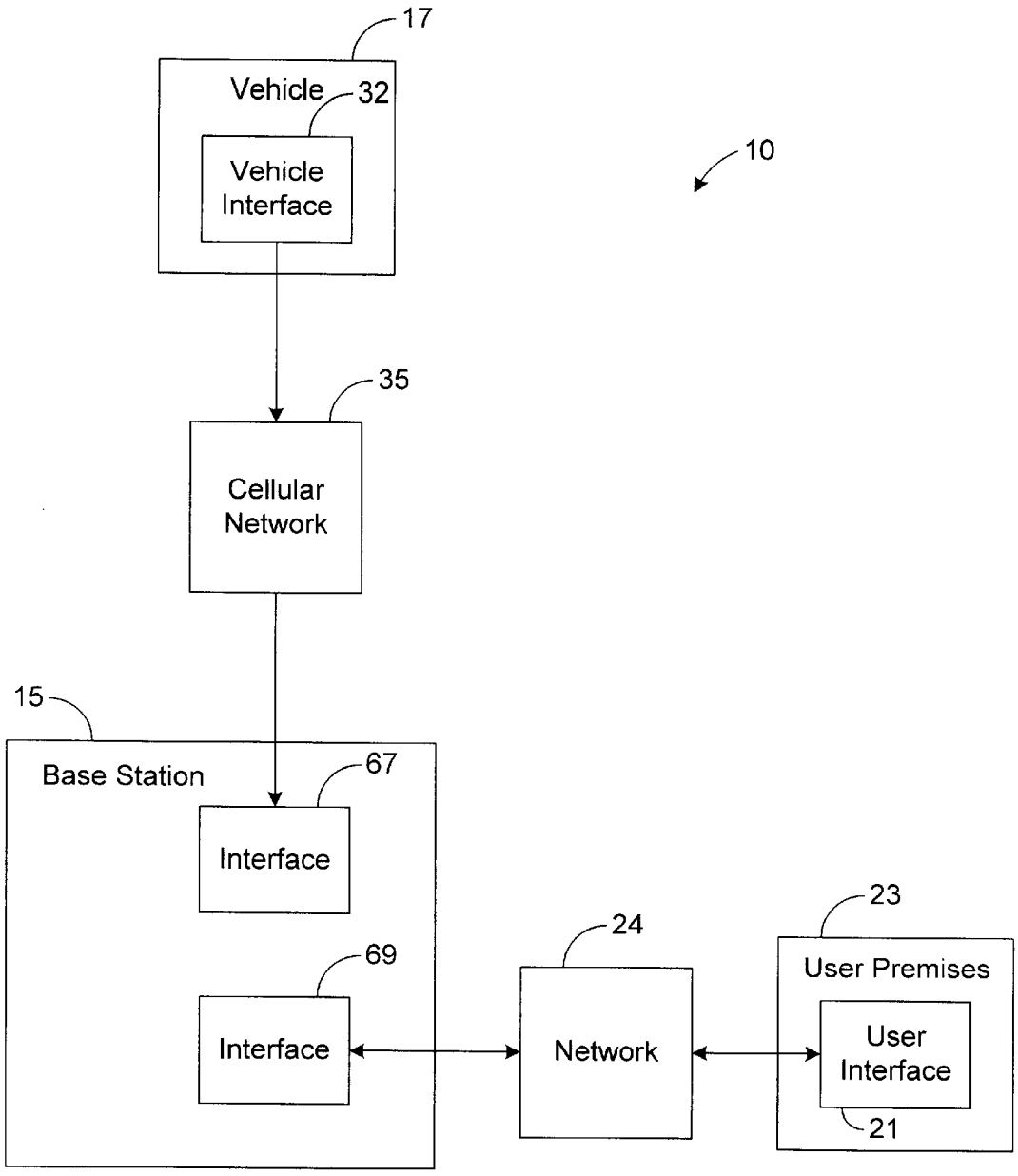
17
Vehicle
32
Vehicle Interface
10
35
Cellular Network
15
Base Station
67
Interface
69
Interface
24
Network
23
User Premises
User Interface
21

FIG. 1

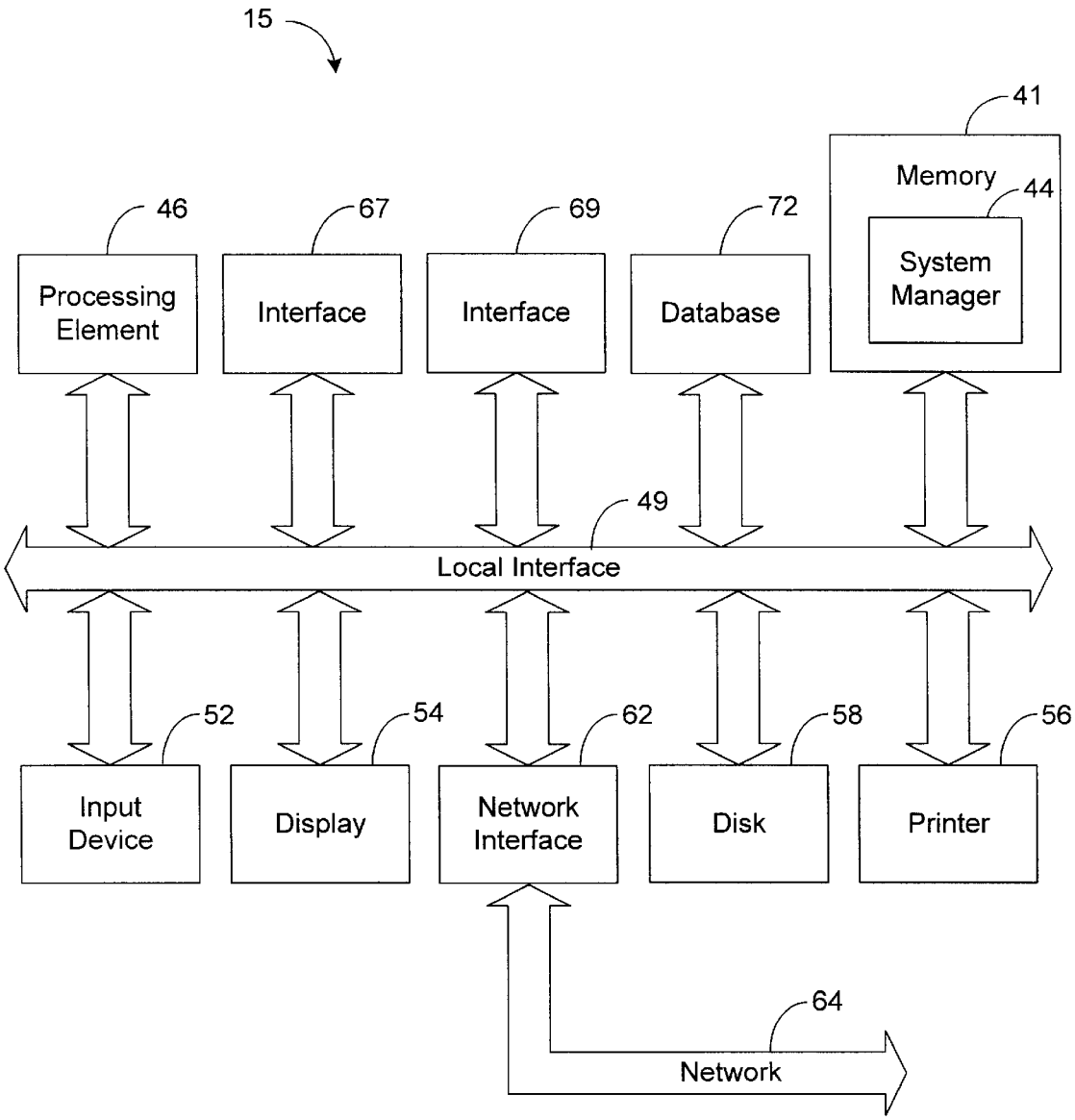
15
41
Memory
44
System Manager
46
Processing Element
67
Interface
69
Interface
72
Database
49
Local Interface
52
Input Device
54
Display
62
Network Interface
58
Disk
56
Printer
64
Network

FIG. 2

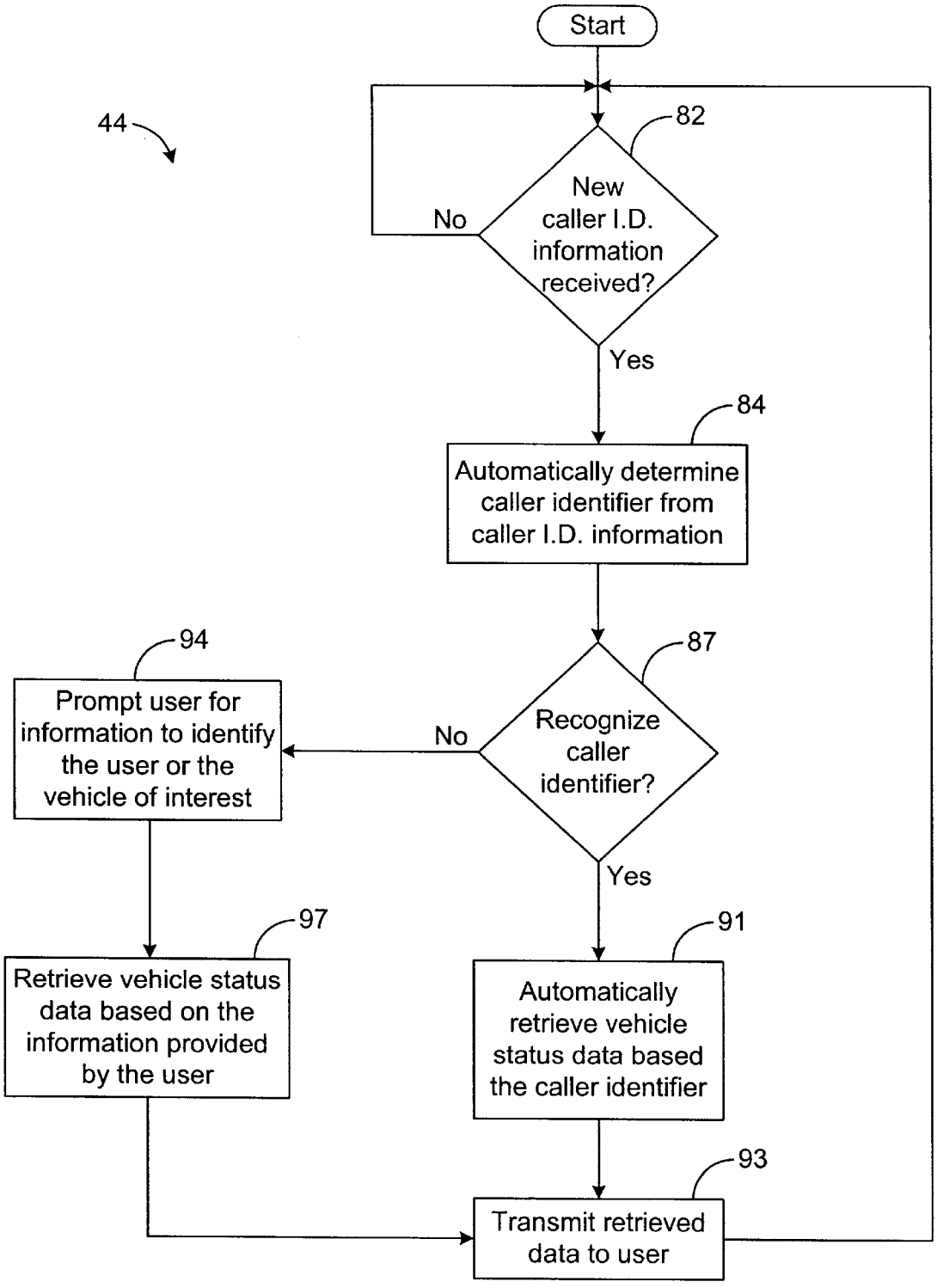
Start
44
82
New caller I.D. information received?
No
Yes
84
Automatically determine caller identifier from caller I.D. information
87
Recognize caller identifier?
No
Yes
94
Prompt user for information to identify the user or the vehicle of interest
97
Retrieve vehicle status data based on the information provided by the user
91
Automatically retrieve vehicle status data based the caller identifier
93
Transmit retrieved data to user

FIG. 3

# SYSTEM AND METHOD FOR AUTOMATICALLY PROVIDING VEHICLE STATUS INFORMATION

## CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to and the benefit of the filing date of U.S. Provisional Application Serial No. 60/122,482, filed on Mar. 1, 1999, and entitled "Base Station Apparatus and Method for Monitoring Travel of Mobile Vehicle."

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to vehicle information systems and, in particular, to a system and method for maintaining vehicle status information and of automatically and efficiently providing this information to users after communication is established with the users.

2. Related Art

Presently, it is possible for users to call a central processing station to obtain information on the status of a vehicle of interest. For example, it is possible for a user to call an airline or a bus depot and find out whether an airplane or bus is on or off schedule. In some situations a human operator at the processing station (e.g., the airline or bus depot) receives the call from the user who asks the operator for information regarding the status of a particular vehicle. The operator then looks up the status of the vehicle from a chart or database and provides the user with the requested information.

In other situations, the status information is automatically provided to the user after the user has submitted a status information request, thereby eliminating the need of human interaction at the processing station. For example, once communication with a communications device at the processing station is established, a computer at the processing station may prompt the user to identify which vehicle the user is interested in. The user may enter a vehicle identifier, such as an airplane number or bus number, for example, via touch-tone signaling or other suitable technique for interfacing information with computer systems. The computer then automatically retrieves information pertaining to the status of the vehicle identified by the user's inputs and provides this information to the user.

Having to provide either the operator or the computer with information identifying which vehicle is of interest to the user is timing consuming and burdensome. It would be desirable for the processing station to automatically provide the user with status information on a particular vehicle without the user having to provide a vehicle identifier.

Thus, a heretofore unaddressed need exists in the industry for providing a system and method of maintaining vehicle status information and of automatically and efficiently providing users with this information.

## SUMMARY OF THE INVENTION

The present invention overcomes the inadequacies and deficiencies of the prior art as discussed hereinbefore. Generally, the present invention provides a system and method for automatically providing a user with vehicle status information related to a particular vehicle or a particular set of vehicles.

In architecture, the system of the present invention utilizes a database, a communication interface, and a system manager. The database stores status information associated with a vehicle, and the communication interface is designed to communicate with communication devices remotely located from the system. The system manager receives a message transmitted from the vehicle and updates the status information stored in the database based on the received message. When a remote communication device establishes communication with the communication interface, the communication interface receives caller identification information automatically transmitted to the communication interface. The system manager analyzes this caller identification information and automatically retrieves status information from the database based on the caller identification information. The system manager then transmits, via the communication interface, the retrieved status information to the remote communication device.

The present invention can also be viewed as providing a method for monitoring and reporting status of vehicles. The method can be broadly conceptualized by the following steps: maintaining status information associated with a vehicle; communicating with a remote communication device; receiving caller identification information automatically transmitted in the communicating step; and automatically retrieving and transmitting the status information based on the caller identification information.

Other features and advantages of the present invention will become apparent to one skilled in the art upon examination of the following detailed description, when read in conjunction with the accompanying drawings. It is intended that all such features and advantages be included herein within the scope of the present invention and protected by the claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be better understood with reference to the following drawings. The elements of the drawings are not necessarily to scale relative to each other, emphasis instead being placed upon clearly illustrating the principles of the invention. Furthermore, like reference numerals designate corresponding parts throughout the several views.

FIG. **1** is a block diagram illustrating a system for monitoring and reporting status of vehicles in accordance with the present invention.

FIG. **2** is a block diagram illustrating a computer system implementing a base station depicted in FIG. **1**.

FIG. **3** is a flow chart illustrating the architecture and functionality of a system manager depicted in FIG. **2**.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** depicts a vehicle tracking system **10** in accordance with the preferred embodiment of the present invention. The system **10** includes a base station **15** configured to store information regarding the status of at least one vehicle **17**. For example, the base station **15** may store a value indicating the time that the vehicle **17** is expected to arrive at a particular location.

The base station **15** is configured to communicate with a user interface **21** at a user's premises **23** via a communications network **24**, such as the publicly switched telephone network (PSTN), for example. In this regard, the base station **15** may be configured to determine when the vehicle **17** is within a predetermined proximity (e.g., time or distance) from a particular location and to transmit a notification message to the user interface **21** to warn a user at the

premises **23** of an impending arrival of the vehicle **17** at the particular location. A base station **15** capable of tracking vehicle **17** and of transmitting such a notification message is fully described in U.S. Patent Application entitled "Base Station Apparatus and Method for Monitoring Travel of a Mobile Vehicle," assigned Ser. No. 09/395,501, and filed on Sep. 14, 1999, which is incorporated herein by reference.

The notification message can be transmitted via a telephone call, a page, an e-mail message, or any other suitable technique for communicating data. The user interface **21** is preferably any communication device or devices capable of communicating with base station **15** and, therefore, of receiving and processing the notification message. For example, the user interface **21** may be a telephone, a pager, a modem, or other suitable communication device.

In the preferred embodiment, the user interface **21** may be configured to establish communication with the base station **15** to discover the status of a particular vehicle **17**. Once communication with the base station **15** is established, the base station **15** is configured to automatically identify the user associated with the user interface **21** without prompting the user for inputs.

For example, in conventional telephony systems, caller identification (caller I.D.) information, such as the caller's telephone number, name, address, etc., is often automatically transmitted to the party receiving the call so that the party receiving the call can identify the caller before answering. U.S. Pat. No. 4,924,496, entitled "Automatic Incoming Telephone Call Originating Number and Party Display System" and issued on May 8, 1990, which is incorporated herein by reference, describes a process of automatically transmitting caller I.D. information without prompting the caller for inputs. The base station **15** is designed to utilize this caller I.D. information to identify the user at premises **23** that established communication with base station **15**.

Furthermore, the base station **15** is preferably aware of which users are associated with which vehicles **17**. Accordingly, after identifying the user who established communication with the base station **15**, the base station **15** is configured to automatically retrieve status information pertaining to the vehicle or vehicles **17** associated with the user and to transmit this information to the user interface **21**, which interfaces this information with the user at premises **23**. Therefore, the user is able to receive status information pertaining to a vehicle **17** associated with the user without having to manually provide inputs to the base station **15** to identify the associated vehicle **17**.

To ensure that the information provided to the user is accurate, the base station **15** is designed to update the status information stored in the base station **15**, when the vehicle **17** is unexpectedly late or early. In this regard, the vehicle **17** includes a vehicle interface **32** capable of communicating with the base station **15** via wireless signals. For example, in the preferred embodiment, the vehicle interface **32** may comprise a cellular telephone capable of transmitting wireless signals to base station **15** via a cellular network **35**. However, in other embodiments, the vehicle interface **32** may be comprised of another device or devices capable of communicating with the base station **15** either directly or through another type of network.

When the vehicle **17** is off schedule or when another event pertaining to the status of the vehicle **17** occurs, a status message is transmitted to the base station **15** to notify the base station **15** of the event. The status message may be manually interfaced with vehicle interface **32** via buttons or switches, for example, or may be automatically generated by



the vehicle interface **32**. U.S. Patent Application entitled "Apparatus and Method for Monitoring Travel of a Mobile Vehicle," assigned Ser. No. 09/395,497, and filed on Sep. 14, 1999, which is incorporated herein by reference, describes a system in which a status message is automatically transmitted when the vehicle **17** is off schedule.

The base station **15** is configured to receive the status message and to update the status information stored in the base station **15** in response to the status message. Therefore, the status information stored in the base station **15** should be accurate and up to date.

FIG. **2** depicts a more detailed view of the base station **15**. In the embodiment shown by FIG. **2** the base station **15** is implemented as a computer having memory **41**. The base station **15** preferably includes a system manager **44** that controls the operation of the base station **15**. The system manager **44** can be implemented in software, hardware, or a combination thereof. In the preferred embodiment, as illustrated by way of example in FIG. **2**, the system manager **44** of the present invention along with its associated methodology is implemented in software and stored in memory **41**.

Note that the system manager **44**, when implemented in software, can be stored and transported on any computer-readable medium for use by or in connection with an instruction execution system, apparatus, or device, such as a computer-based system, processor-containing system, or other system that can fetch the instructions from the instruction execution system, apparatus, or device and execute the instructions. In the context of this document, a "computer-readable medium" can be any means that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device. The computer readable medium can be, for example but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, device, or propagation medium. More specific examples (a nonexhaustive list) of the computer-readable medium would include the following: an electrical connection (electronic) having one or more wires, a portable computer diskette (magnetic), a random access memory (RAM) (magnetic), a read-only memory (ROM) (magnetic), an erasable programmable read-only memory (EPROM or Flash memory) (magnetic), an optical fiber (optical), and a portable compact disc read-only memory (CDROM) (optical). Note that the computer-readable medium could even be paper or another suitable medium upon which the program is printed, as the program can be electronically captured, via for instance optical scanning of the paper or other medium, then compiled, interpreted or otherwise processed in a suitable manner if necessary, and then stored in a computer memory. As an example, the system manager **44** may be magnetically stored and transported on a conventional portable computer diskette.

The preferred embodiment of the base station **15** of FIG. **2** also comprises one or more conventional processing elements **46**, such as a digital signal processor (DSP), that communicate to and drive the other elements within the base station **15** via a local interface **49**, which can include one or more buses. Furthermore, an input device **52**, for example, a keyboard or a mouse, can be used to input data, and screen display **54** or a printer **56** can be used to output data to the user. A disk storage mechanism **58** can be connected to the local interface **49** to transfer data to and from a nonvolatile disk (e.g., magnetic, optical, etc.). The base station **15** can be connected to a network interface **62** that allows the base station **15** to exchange data with a network **64**.

The base station **15** also includes an interface **67** for communicating with vehicle interface **32** (FIG. **1**) and an

interface **69** for communicating with user interface **21**. Interfaces **67** and **69** may be implemented by the same device or devices or may be implemented by a separate device or devices.

The base station **15** preferably stores status information in a database **72**. In this regard, the database **72** preferably includes a plurality of entries, in which each entry includes status information associated with a particular vehicle **17**. For example, an entry may include a data value indicating when a vehicle **17** is expected to arrive at a particular location or indicating whether the vehicle is on schedule. The status information stored in the entry may also define the aforementioned particular location or may include data identifying the packages or passengers, if any, on board the vehicle. Other types of information pertaining to the status of the vehicle **17** may be stored in the entry.

Each entry is preferably correlated with a vehicle identifier that identifies the vehicle **17** described by the status information stored within the entry. Furthermore, the status message may include the vehicle identifier of the vehicle **17** that transmitted the message. Therefore, when a status message is received by the base station **15**, the system manager **44** may identify which entries in the database **72** include information that potentially should be updated based on the status message.

Each entry is also correlated with at least one user identifier identifying a user associated with the vehicle **17** described by the information stored in the entry. For example, assume that a user is a passenger scheduled to ride on a particular vehicle **17**. At least one of the entries in the database **72** should include information pertaining to the status of the particular vehicle **17** (e.g., indicating whether the particular vehicle **17** is on or off schedule). This entry should be correlated with a user identifier that identifies the foregoing user. Accordingly, when the system manager **44** determines that this user has established communication with the base station **15**, the system manager **44** is configured to automatically identify, based on the user identifiers correlated with the entries, each entry associated with the user. Therefore, when the user establishes communication with the interface **69** in the foregoing example, the system manager **44** is configured to automatically identify the aforementioned entry having status information pertaining to the particular vehicle **17** that the user is to ride.

After identifying the entry or entries associated with the user, the system manager **44** is configured to retrieve the status information from the identified entry or entries and to transmit this information to the user. As a result, the user does not need to manually provide inputs to identify which information the system manager **44** should retrieve and transmit to the user.

It should be noted that other methodologies for storing status information and of associating the status information with the appropriate vehicles **17** and users may be employed without departing from the principles of the present invention.

## Operation

The preferred use and operation of the system **10** and associated methodology are described hereafter.

Assume for illustrative purposes that a user wishes to ride a vehicle **17** associated with the system **10**. Assume further that an entry in the database **72** is associated with this vehicle **17**. For example, assume that the entry indicates when the vehicle **17** is expected to arrive at a location, such as the location where the user is to meet the vehicle **17**, for example.

At some point, a user identifier identifying the user is correlated with entry. For example, during a registration period, the user may provide his or her telephone number, which is stored in the database **72** and correlated with the entry in the database **72** associated with the vehicle **17**. However, it should be noted that other types of user identifiers may be used. For example, the user identifier may be the user's name, the user's home or business address, the user's e-mail address, or other types of values that identify the user.

If the vehicle **17** is early or late, then it may be desirable for the user to change the time at which he or she leaves to meet the vehicle **17**. Therefore, before the user travels to the aforementioned location to meet the vehicle **17**, it may be desirable for the user to check the status of the vehicle **17** to find out if the vehicle **17** is off schedule. To check the status of the vehicle **17**, the user establishes communication with the base station **15** via user interface **21**. For example, in the preferred embodiment, the user utilizes interface **21** to establish a telephone call with the interface **69** at the base station **15**. In this example, both interfaces **21** and **69** are conventional telephone devices.

The interface **69** is designed to receive caller I.D. information that is automatically transmitted to the interface **69** when communication with the interface **69** is being established. In telephony systems the caller I.D. information is usually transmitted between the ringing signals transmitted to the interface **69**, and the caller I.D. information usually includes the telephone number associated with the user interface **21**.

Once the interface **69** has received the caller I.D. information, the system manager **44** automatically searches the caller I.D. information for a caller identifier (e.g., the telephone number provided in the caller I.D. information), as shown by blocks **82** and **84** of FIG. **3**. The caller identifier is information in the caller identification information used by the base station **15** to identify a caller. In the preferred embodiment where the user identifier stored in database **72** is the user's telephone number, the system manager **44** searches the caller I.D. information in block **84** for the telephone number defined by the caller I.D. information. This telephone number should be the telephone number associated with interface **21**.

After determining the caller identifier from the caller I.D. information, the system manager **44** then searches the database **72** to determine whether the caller identifier corresponds with one of the user identifiers already stored in the database **72**, as shown by block **87**. For example, in the preferred embodiment, the system manager **44** compares the telephone number included in the caller identification information to the user identifiers stored in the database **72**. As long as the user is calling from an interface **21** associated with the same telephone number provided during registration (i.e., the telephone number used by the base station **15** as the user identifier to identify the user), then the telephone number included in the caller I.D. information should correspond to (e.g., match) the user identifier associated with the user.

If a correspondence with a user identifier is determined in block **87**, then the system manager **44** automatically retrieves the entry correlated with the user identifier, as shown by block **91**. This entry should be the entry having status information pertaining to the vehicle **17** of interest to the user (e.g., the vehicle **17** that the user is planning to ride). The system manager **44** then transmits at least a portion of the retrieved status information to the user via interfaces **21** and **69**, as depicted by block **93**.

The status information transmitted to user interface **21** preferably indicates whether the aforementioned vehicle **17** is on or off schedule, although other types of information may be indicated by the status information. Note that this status information is provided to the user without the user having to provide any inputs once communication with the interface **69** is established. In this regard, the user merely dials the telephone number associated with the interface **69** in the preferred embodiment, and based on the caller I.D. information automatically provided to the interface **69**, the system manager **44** retrieves and transmits the aforementioned status information to the user interface **21**. Based on the status information transmitted to the user interface, the user should be able to determine whether the vehicle **17** is on or off schedule.

It should be noted that the base station manger **44** may fail to find a corresponding user identifier in the database **72** in some circumstances. For example, the user may call from an interface **21** associated with a telephone number other than the one provided during registration and, therefore, other than the one used by the base station **15** as a user identifier for the user. In such a situation, the system manager **44** should prompt the user to enter sufficient information so that the system manager **44** can either identify the user or the vehicle **17** of interest, as shown by block **94**. For example, the system manager **44** could prompt the user to enter, via touch tone signaling, the user's telephone number or the vehicle number of the vehicle **17** of interest to the user. In this situation, the system manager **44** retrieves the status information from the database **72** based on the inputs provided by the user instead of the caller identifier included in the caller I.D. information, as shown by block **97**.

Although the foregoing example has been described herein as utilizing a telephone call to establish communication with the interface **69**, the present invention should not be so limited. Any device capable of establishing communication with the interface **69** and of automatically transmitting caller I.D. information to the interface **69** should be suitable for implementing the user interface **21** of the present invention. For example, it is possible for the user interface **21** to establish communication with interface **69** over the Internet. In this example, the user identifier identifying the user could be the user's e-mail or source address. Therefore, upon receiving an e-mail message from interface **21**, the system manager **44** in block **84** searches for the sender's e-mail address. This e-mail address is compared with the user identifiers in the database **72** in block **87** to identify the status information that should be transmitted to the user in a return e-mail message. There are various other devices and techniques that may be employed for communicating between interfaces **69** and **23** without departing from the principles of the present invention.

It should be emphasized that the above-described embodiments of the present invention, particularly, any "preferred" embodiments, are merely possible examples of implementations, merely set forth for a clear understanding of the principles of the invention. Many variations and modifications may be made to the above-described embodiment(s) of the invention without departing substantially from the spirit and principles of the invention. All such modifications and variations are intended to be included herein within the scope of the present invention and protected by the claims.

What is claimed is:

**1**. A system for monitoring and reporting status of vehicles, comprising:

a database storing status information associated with a vehicle, said status information indicative of a current proximity of said identified vehicle;

a communication interface configured to communicate with communication devices remotely located from said system; and

a system manager configured to receive a message transmitted from said vehicle and to update said status information based on said message, said system manager further configured to analyze caller identification information automatically transmitted to said communication interface when a remote communication device establishes communication with said communication interface, said system manager further configured to automatically search for and locate a set of said status information based on said caller identification information, said system manager further configured to retrieve said set of status information and to transmit said retrieved set of status information to said remote communication device.

**2**. The system of claim **1**, wherein said caller identification information is a telephone number associated with said remote communication device.

**3**. The system of claim **1**, wherein said caller identification information is included within a message transmitted over the internet and received by said communication interface, and wherein said caller identification information is a source address automatically inserted into said message by said remote communication device, said source address identifying an address of said remote communication device.

**4**. The system of claim **1**, wherein said system manager is configured to transmit said retrieved set of status information to said remote communication device in response to said caller identification information.

**5**. A system for monitoring and reporting status of vehicles, comprising:

means for maintaining status information associated with a vehicle, said status information indicative of a current proximity of said identified vehicle;

means for communicating with a remote communication device, said means for communicating including a means for receiving caller identification information automatically transmitted to said communicating means;

means for utilizing said caller identification information to automatically search for and locate a set of said status information; and

means for automatically retrieving and transmitting said set of said status information.

**6**. The system of claim **5**, wherein said caller identification information is a telephone number.

**7**. The system of claim **5**, wherein said caller identification information is an e-mail address.

**8**. The system of claim **5**, further comprising:

means for receiving a status message transmitted from said vehicle; and

means for updating said status information based on said status message.

**9**. The system of claim **5**, wherein said status information indicates a proximity of said vehicle from a particular location.

**10**. A method for monitoring and reporting status of vehicles, comprising the steps of:

maintaining status information associated with a vehicle, said status information indicative of a current proximity of said vehicle;

communicating with a remote communication device;

receiving caller identification information automatically transmitted in said communicating step;

utilizing said caller identification information to automatically search for and locate a set of said status information;

automatically retrieving said set of status information based on said searching for and locating step; and

transmitting said retrieved set of status information to said remote communication device.

**11**. The method of claim **10**, wherein said caller identification information is a telephone number.

**12**. The method of claim **10**, wherein said caller identification information is an e-mail address.

**13**. The method of claim **10**, further comprising the steps of:



receiving a status message transmitted from said vehicle; and

updating said status information based on said status message.

**14**. The method of claim **10**, further comprising the step of indicating a proximity of said vehicle from a particular location via said status information.

**15**. The method of claim **10**, wherein said utilizing, retrieving, and transmitting steps are performed in response to said receiving step.

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