(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
16 August 2001 (16.08.2001)

PCT

(10) International Publication Number
WO 01/59601 A1

(51) International Patent Classification[7]: G06F 17/00

(21) International Application Number: PCT/US01/04428

(22) International Filing Date: 9 February 2001 (09.02.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/181,887 11 February 2000 (11.02.2000) US

(71) Applicants and
(72) Inventors: **GROUNDS, Thomas, L.** [US/US]; 1040 Blue Spruce, Woodland Park, CO 80863 (US). **GEVING, Richard, A.** [US/US]; 410 Pembrook Lane, Woodland Park, CO 80863 (US).

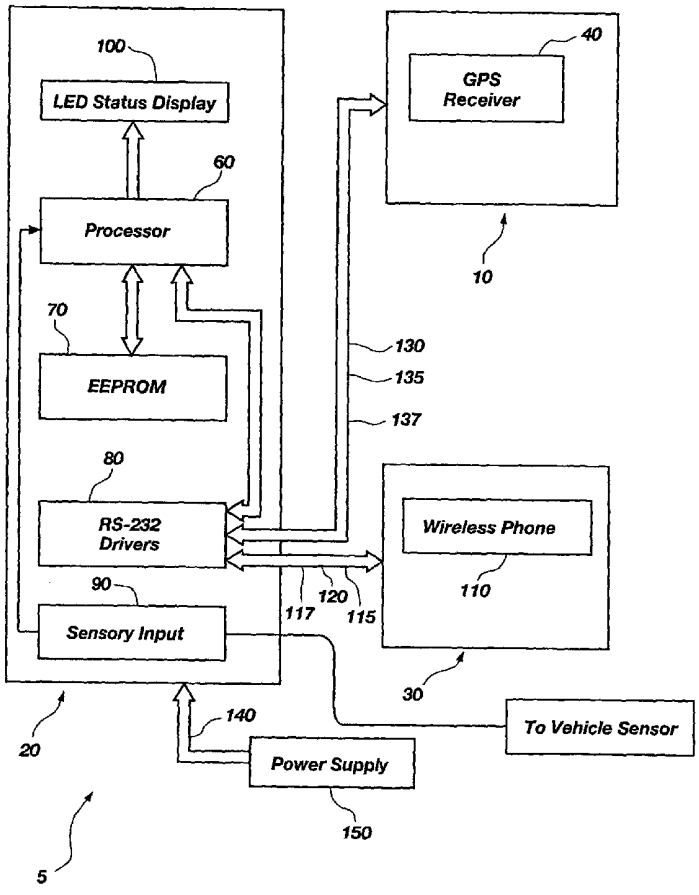
(74) Agents: **FARMER, James, R.** et al.; Holme Robert & Owen LLP, 111 East Broadway, Suite 1100, Salt Lake City, UT 84111-5233 (US).

(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

*[Continued on next page]*

(54) Title: DEVICE AND METHOD FOR TRANSMITTING VEHICLE POSITION




(57) Abstract: A vehicle mounted device (5) is configured to transmit vehicle position data to a network-based server (230) using a wireless communication system (110). The device includes first and second processing modules carried by a vehicle. The first module (10) receives positioning signals and processes the signals into vehicle position data representing date and time, and the position, velocity and direction of travel of the vehicle. The second module (20) stores the signals and communicates the signals to a network-based server using a wireless communications system (110). The signals are storable on-board the device during periods that the device is out of range of the wireless communication system (110) for later transmission to the network-based server (230).

WO 01/59601 A1

**Published:**
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

DEVICE AND METHOD FOR TRANSMITTING VEHICLE POSITION

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an apparatus and method for ascertaining the position, velocity and direction of travel of a vehicle at a remote location and for transmitting such information to a network-based server using a wireless communication system.

2. Description of the Related Art

Various apparatus and methods for ascertaining the position of individual vehicles and for communicating that information to a user at a location remote from said vehicles are known in the art. For example, U.S. Patent No. 5,043,736 to Darnell, et al., discloses a cellular position locating system for ascertaining the latitude and longitude of an individual or object at a remote location and transmitting such information to a base station using a portable hand-held remote unit. The portable unit includes a receiver circuit for use with a satellite navigation system, a microprocessor for analyzing coded signals, cellular phone and modem circuits for transmitting encoded signals to a base station and a time of day clock. The base station includes a computational system for decoding position data and a visual display device for presenting the remote unit map coordinates.

In U.S. Patent No. 5,742,509, Goldberg, et al., discloses a personal tracking system integrated with a base station. The tracking system includes a remote unit that includes a location determination means, a microprocessor, a modem, and a communication means connected to the modem. The base station includes a computer with software and a modem. The remote unit and the base station communicate with one another through a communication link.

In U.S. Patent No. 6,131,067, Girerd, et al., discloses a client-server computer network and the use of such a network to access remote sensors having associated position determination sensors. In one embodiment of the invention, a remote sensor transmits positioning data to a server where it is analyzed to derive the location of the remote sensor. The location so determined is then transmitted from the server to the client and is displayed at the client so that the user can identify the location of the remote sensor. Use of the Internet as the client-server computer network is disclosed, along with use of a web page at the server having means for the user to identify a particular remote sensor.

The available means with which to determine the position of a remote sensor, or of a plurality of remote sensors, can be improved upon. For instance, there is a need to

reduce the elapsed time that is presently required of a user in determining the position of each vehicle of a fleet of vehicles - e.g., each rental car of a fleet of rental cars or each truck of a fleet of transportation trucks. The present invention improves upon the currently available means for determining the several positions of a plurality of remote sensors by combining a fully integrated remote positioning sensor with currently available high speed telecommunications networks. The fully integrated remote positioning sensor carries out all position determining calculations, including and desired differential corrections and auxiliary calculations, on-board at the remote location. This enables all position and tracking data to be readily available for continuous or intermittent transmission of said data to a network-based server for data-basing the positional information. The data-based information is then available, on demand, when a user accesses the server to view positional information with regard to one or a plurality of vehicles. This obviates the need for polling the remote vehicle and substantially reduces the time required to access the positional information.

The device is also configured to store data on-board at the remote location during periods that the device is outside the communication range of a wireless network, and to automatically transmit the stored data as soon as the device returns to within the communication range of the wireless network. This last feature permits a history of the vehicle route and speed, etc., to be preserved for periods in which the vehicle is outside the communication range of the wireless network.

## SUMMARY OF THE INVENTION

A vehicle mounted device is configured to transmit vehicle position data to a network-based server using a wireless communication system. A preferred embodiment of the device includes first and second processing modules carried by a vehicle. The first processing module includes a positioning system receiver configured to receive positioning signals from at least one source remote from said vehicle and to process said positioning signals into vehicle position data representing date and time, and the position, velocity and direction of travel of the vehicle.

The second processing module includes a data storage device configured to store the vehicle position data, a wireless communication system link for connecting the second processing module to a wireless communication system, and a processor configured to control intermittent transmission of the vehicle position data to the wireless communication system link for subsequent transmission over the wireless communication system and, finally, to a network-based server. The processor is further configured to

control transmission of said position data to and from the data storage device, and to process incoming data sent from the network-based server.

In a preferred embodiment, the processor is a microcontroller that includes an erasable programable read only memory ("EPROM") and a random access memory ("RAM"). The data storage device is an electrically erasable programable read only memory ("EEPROM") or, more generally, an electrically erasable programmable memory. The positioning system receiver is a global positioning system ("GPS") receiver in communication with, preferably, four or more GPS satellites. The wireless communication system is selected from the group consisting of the Bluetooth™ wireless technology ("Bluetooth" is a defacto standard and specification for small form factor, low cost, short range radio links between mobile personal computers, mobile phones and other portable devices), wireless LAN/WAN (local area network/wide area network), AMPS (advanced mobile phone system), Satellite (satellite based system communication system), iDEN™, TDMA (time division multiple access), CDMA (code division multiple access), CDPD (cellular digital packet data) and GSM (groupe special mobile) infrastructures, while the network-based server is a computer connected to a network, such as the Internet, that can be accessed through a web-browser by a user logged on to the Internet. Alternative embodiments include use of the present invention with Intranet type networks.

A power supply powers the first and second processing modules. A first cable conducts power from the power supply to the second processing module. A second cable conducts power from the second module to the first module, and transmits vehicle position data from the first processing module to the second processing module.

The wireless communication system link is a wireless telephone, removably connected to the second processing module, and configured to transmit the vehicle position data over the wireless communication system to a network-based server. Alternative embodiments include use of wireless links between the second processing module and the wireless telephone, rather than removable connections. The processor is configured to establish a wireless communication between the wireless telephone and the network-based server upon start-up of the device. The processor is also configured to control transmission of the vehicle position data at predetermined periodic intervals during normal operation.

During an interruption in the wireless communication, the processor is configured to cease transmission of the vehicle position data and, rather, direct the data to be stored

in the on-board storage device. The processor is also configured to periodically attempt to reestablish the wireless communication between the wireless telephone and the network-based server during such interruption. The processor is further configured to retrieve the data from the storage device and transmit it over the wireless communication system to the network-based server following reestablishment of the wireless connection.

The second processing module further includes at least one sensory input connected to the processor, where such sensory input is connected to an event sensor carried by the vehicle. The event sensor is configured to detect the occurrence of an event involving the vehicle and to transmit information regarding the event to said sensory input for processing by the processor.

A software program is configured to control initialization of the processor and the storage device upon start-up of the vehicle mounted device. The program is further configured to control enabling of interrupts and to check for the presence and functionality of all hardware and the operational mode of the vehicle mounted device. Finally, the program is further configured to control loading of operational setup parameters stored in said storage device and to check for the presence of vehicle position data stored in the storage device.

The periodic transmission of the vehicle position data is based on predetermined distance intervals, time intervals, polling, speed triggers, vehicle stop, vehicle start, or signals from the sensory inputs. The first and second modules are positionable within first and second housings, respectively, and the power supply means is a plug configured for insertion into a vehicle cigarette lighter. Alternatively, the power supply means may be a wire directly connected to the vehicle storage battery or fuse box.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings which illustrate the preferred embodiments of carrying out the invention:

FIG. 1 is a block diagram of a preferred embodiment of the device of the present invention;

FIG. 2 is a block diagram of the vehicle mounted device of the present invention in communication with a network-based server using a wireless communication system;

FIG. 3 is a flowchart depicting the basic operational steps of a preferred embodiment of the device of the present invention.

FIG. 4 is a second flowchart depicting operational steps of a second preferred embodiment of the present invention.

FIG. 5 is a block diagram of the preferred embodiment of the present invention showing a wireless connection between the vehicle mounted device and the wireless phone or modem.

## DETAILED DESCRIPTION

Referring to FIG. 1, a preferred embodiment of the vehicle mounted device 5 includes a first processing module 10, a second processing module 20, and a wireless communication system link 30. The first processing module 10 includes a global positioning system ("GPS") receiver 40 for receiving and processing satellite signals into vehicle position data. The second processing module 20 includes a processor 60, an electrically erasable programmable read only memory ("EEPROM") 70 or, more generally, an electrically erasable programmable memory, at least one RS-232 driver 80, at least one sensory input 90, and a light emitting diode ("LED") display 100. Wireless communication system link 30 is a wireless phone 110, which is removably attached to the second processing module 20 through a connector means 50. An alternative embodiment includes use of a wireless link between the second processing module and the wireless communication system link 30.

Power supply 150 provides power to second module 20 through power supply cable 140. Power is supplied to wireless phone 110 through an on-board storage battery typical for wireless telephones, and power is supplied to GPS receiver 40 through power conductor means 135 in cable 130. Data communication between first module 10 and second module 20 is provided through data bus means 137, which are contained in cable 130, and data communication between wireless phone 110 and second module 20 is provided through data bus means 117, which are contained in cable 120.

More specifically, a preferred embodiment of the vehicle mounted device 5 includes:

(i) a 24 MHz, 8-bit CMOS Microcontroller, PIC17C256A, 68-pin PLCC for processor 60;

(ii) a 256K-bit serial EEPROM, 8-pin SO1C for EEPROM 70;

(iii) four +5V RS-232 Transceivers, 24-pin SSOP for RS-232 driver 80;

(iv) four LED's for indicating GPS status, phone status, wireless coverage and power status for display 100;

(v) a DB-9 male connector for an RS-232 connection to the phone for connector means 50; and

(vi) a Garmin, 12-channel GPS receiver, model GPS35-HVS for GPS receiver 40.

Referring now to FIGS. 2 and 3, GPS receiver 40 is configured to receive signals 260 from satellites 200 and to convert said signals into vehicle position data, which includes data representing the date and time, the number of satellites tracked, the GPS lock status, and the vehicle position, velocity and direction of travel. GPS receiver 40 is further configured to transmit 380 said data to processor 60 following processing of signals 260 into vehicle position data. Processor 60 is configured to then transmit the vehicle position data, along with any status data representing the status of sensory input 90, to wireless phone 110 for transmission to network server 230. Processor 60 is further configured to make such communications intermittently, depending upon whether the value of the time or distance parameters that are stored in EEPROM 70 are satisfied 370.

The operation of vehicle device 5 commences when the device receives power from power supply 150, which is supplied to device 5 through power cable 140. Upon receiving power, processor 60 is initialized. Processor 60 then checks for the presence and functionality of all hardware contained in device 5, and then loads the setup parameters in EEPROM 70, which include the host IP and port address, the dial string, the ISP phone number, user name and password, the time and distance reporting rates for both in and out of coverage reporting, the speed trigger, the sense input trigger, and enablement and disablement triggers. Following loading of setup parameters, device 5 attempts to establish a wireless connection over wireless communication system 210 to server 230 for automatic, but intermittent, transmission of vehicle position data. A point-to-point protocol ("PPP") connection is established between second module 20 and wireless phone 110 using a packet data or circuit-switched connection depending on the wireless communications system 210. Once the PPP connection is established, vehicle position data updates are transmitted, intermittently, each time one of the configured timers, either time or distance, has expired 370. At that time, a vehicle position data update is constructed as a UDP packet and transmitted over the wireless communication system 210 to server 230.

Referring still to FIGS. 2 and 3, processor 60 is configured to intermittently transmit 300 the vehicle position data to wireless phone 110 during periods when wireless phone 110 is in communication 310 with server 230. Wireless phone 110 then communicates the vehicle position data over wireless communications system 210 to network 220. Network 220 communicates the data through network service provider 240 to server 230. It is noted that wireless communication system 210 may be selected from the group of infrastructures that include Bluetooth™ wireless technology ("Bluetooth" is a

defacto standard and specification for small form factor, low cost, short range radio links between mobile personal computers, mobile phones and other portable devices), wireless LAN/WAN (local area network/wide area network), AMPS (advanced mobile phone system), Satellite (satellite based system communication system), iDEN™, TDMA (time division multiple access), CDMA (code division multiple access), CDPD (cellular digital packet data) and GSM (groupe special mobile) infrastructures. It is further noted that server 230 is configured to communicate with, and store vehicle position data received from, a plurality of individual vehicle mounted devices 5. In a preferred embodiment of the invention, network 220 is the Internet, although an alternative embodiment may have an Intranet as network 220.

During periods when wireless phone 110 is not in communication 320 with server 230 - e.g., when wireless phone 110 is disconnected or out of coverage of wireless communication system 210 - processor 60 directs the vehicle position data to EEPROM 70 for storage 330 until wireless phone 110 is able to reestablish communication with server 230. Processor 60 is configured to store said data sequentially in EEPROM 70 for subsequent retrieval 350. Use of a 256-K Bit Serial EEPROM, such as is used in a preferred embodiment, permits storage of up to 509 GPS positions in EEPROM 70. In the event all 509 storage locations are filled during a period when communication is not established 320, processor 60 is configured to overwrite the least recent data entries with current data entries. Once wireless phone 110 reestablishes communication with server 230, processor 60 retrieves 350 the vehicle position data stored in EEPROM 70 and transmits it to wireless phone 110 for subsequent communication 360 of said data over wireless communication system 210 to network 230.

Further referencing FIGS. 2 and 3, a user with access to a computer and network browser - USER "A" 250, for example - logs on to network 220 through network service provider 256 and accesses server 230. USER "A" 250 is then able to view the vehicle position data for a single vehicle or for a fleet of vehicles. Wireless phone 110 is also configured to receive messages sent by server 230 and to direct those messages back to processor 60. This permits USER "A" 250, for example, to communicate messages like ICMP ping messages, configuration messages, or poll messages to wireless phone 110, which is configured to transmit those messages to processor 60.

Receipt by device 5 of poll message 390 allows the user to request an immediate position update be determined and transmitted 305from vehicle device 5 to server 230. Receipt by device 5 of configuration message 315 allows the user to change and reload

325 the setup parameters stored in EEPROM 70. For example, configuration message 315 allows the user to change and reload 325 the setup parameters in order to change the interval at which data is transmitted 370 from device 5 to server 230. Processor 60 is further configured to respond 335 to a configuration inquiry 345from server 230 regarding the current configuration of parameters stored in EEPROM 70.

It is noted that processor 60 is configured to operate using a software program that controls initialization of said processor and said storage device upon start-up of said vehicle mounted device, that controls enabling of interrupts and checking for the presence and functionality of all hardware and operational modes of said vehicle mounted device, and that controls loading of operational setup parameters stored in said storage device and checking for the presence of vehicle position data stored in said storage device.

A preferred embodiment of the invention also enables indirect addressing to be used in the vehicle positioning process. For example, when vehicle position data is transmitted to a network-based server over a wireless network, a wireless carrier may translate the IP address ("Internet protocol address") that identifies the transmitting wireless communication system link - e.g., the wireless phone or modem - making it difficult or impossible to data-base the vehicle position data accurately. For devices and methods that depend on the IP-address of the wireless phone or modem to identify the vehicle mounted device, an identification problem can result. In order to overcome the problem, processor 60 is further configured to add an identification code to the vehicle position data and transmit the identification code along with the vehicle position data. The identification code is identified by the network-based server, enabling the vehicle position data to be data-based at the network-based server consistent with the transmitting vehicle mounted device. This further enables the device to be used with several different phones and wireless carriers, regardless of whether the carrier translates the IP-address code or not. In other words, this feature allows use with wireless systems that implement a firewall between their network and the Internet, where the wireless systems provider translates the provisioned IP address in the wireless phone or modem to a "Routable" IP address on the Internet. This feature further allows the vehicle mounted device to be connected to any model wireless phone or modem, where each wireless phone or modem has a uniquely provisioned IP-address. Stated otherwise, any wireless phone or modem can be connected to the same vehicle mounted device, and the network-based server will identify that device based on the data sent with the vehicle position data, and not on the IP-address of the wireless phone or modem. This method is referred to as indirect

addressing because the network-based server indirectly identifies each vehicle mounted device by the code sent with the vehicle position data, and not the IP address that routes the message to the network-based server.

What is claimed is:

1. A vehicle mounted device configured to transmit real time vehicle position data, using a wireless communication system connected to a network-based server, comprising:

a first processing module carried by a vehicle for computing real time vehicle position data reflecting real time geographic location of said vehicle, said first processing module including a positioning system receiver for receiving position signals from at least one source remote from said vehicle and for processing said position signals into said real time vehicle position data representing the date, time, and position of said vehicle;

a second processing module for storing said real time vehicle position data and for controlling transmission of said real time vehicle position data to a network-based server connected to a wireless communication system, said second processing module including data storage means for storing said real time vehicle position data, wireless communication system connecting means for transmitting data to said wireless communication system, and control means for controlling transmission of said real time vehicle position data to said network-based server, said control means being configured to:

receive said real time vehicle position data from said first processing module,

establish a wireless connection to said network-based server for a predetermined period of duration,

detect the establishment of a wireless connection,

transmit said real time vehicle position data to said network-based server during periods when said connection is established,

store said real time vehicle position data in said data storage means when said connection is not established,

reestablish said wireless connection to said network-based server following any period that said wireless connection is broken, and

retrieve said real time vehicle position data from said data storage means following reestablishment of said wireless connection, and thereafter transmit said real time vehicle position data to said network-based server;

a power supply means for powering said first processing module and said second processing module;

a first conductor means positionable between said power supply means and said second processing module, said first conductor means being configured to transmit power

from said power supply means to said second processing module; and

a second conductor means positionable between said first processing module and said second processing module, said second conductor means being configured to transmit said vehicle position data from said first processing module to said second processing module and being further configured to transmit power from said second processing module to said first processing module.

2. The vehicle mounted device of claim 1 further including event sensor means attached to said vehicle, wherein said second processing module further includes at least one sensory input connected to said processor, said at least one sensory input being connectable to said event sensor means for detecting the occurrence of an event involving the vehicle and transmitting information regarding said event to said sensory input, said event sensor means being positionable on said vehicle.

3. The vehicle mounted device of claim 2, wherein said first conductor means has a first power cable, and wherein said second conductor means has a data bus and a second power cable.

4. The vehicle mounted device of claim 3, wherein said control means is selected from the group consisting of a microcontroller, a microprocessor and an ASIC device, wherein said data storage means is an electrically erasable programmable memory, wherein said positioning system receiver is a global positioning system ("GPS") receiver, and wherein said at least one source remote from said vehicle is a plurality of GPS satellites.

5. The vehicle mounted device of claim 4, wherein said wireless communication system is selected from the group consisting of the Bluetooth, wireless LAN/WAN, AMPS, Satellite, iDEN™, TDMA, CDMA, CDPD and GSM infrastructures.

6. The vehicle mounted device of claim 5, wherein said control means is further configured to initialize all memory and data ports and said storage means upon start-up of said vehicle mounted device, enable of interrupts and check for the presence and functionality of all hardware and operational modes of said vehicle mounted device, load operational setup parameters stored in said storage means and check for the presence of real time vehicle position data stored in said storage means.

7. The vehicle mounted device of claim 6, wherein said network-based server is a computer and wherein said network is either the Internet network or Intranet network.

8. The vehicle mounted device of claim 7, wherein said first module is positioned within a first housing, wherein said second module is positioned within a second housing, and wherein said power supply means is selected from the group consisting of a plug

configured for insertion into a vehicle cigarette lighter, a wire connected to a fuse panel terminal, a wire connected to a vehicle storage battery, and a battery.

9. The vehicle mounted device of claim 8, wherein said wireless communication system connecting means is selected from the group consisting of a wireless telephone and a modem.

10. The vehicle mounted device of claim 9, further including receiving means for receiving incoming signals transmitted by said network-based server, said incoming signals including any one or more of ICMP ping messages, configuration messages, or poll messages.

11. The vehicle mounted device of claim 10, wherein said control means is further configured to update said setup parameters in response to receiving a configuration message, wherein said control means is further configured to immediately transmit said vehicle position data to said network-based server in response to receiving a poll message.

12. The vehicle mounted device of claim 11, wherein said control means is further configured to transmit said vehicle position data to said network-based server at predetermined intervals, said intervals being selected from the group consisting of distance intervals and time intervals.

13. The vehicle mounted device of claim 12, wherein said control means is further configured to transmit said vehicle position data to said network-based server upon the occurrence of predetermined triggers, said triggers being selected from the group consisting of speed triggers, vehicle start triggers, vehicle stop triggers and sensory input triggers.

14. The vehicle mounted device of claim 13, wherein said processor is further configured to establish a wireless connection to said network based server for predetermined time intervals.

15. The vehicle mounted device of claim 14, wherein said processor is further configured to query a signal level attached to said wireless communications system link prior to establishing said wireless connection.

16. A method for transmitting vehicle position data to a network-based server using a vehicle position locating device carried by a vehicle located remotely from said server and a wireless communication system, said device having a

a first processing module carried by a vehicle for computing real time vehicle position data reflecting real time geographic location of said vehicle, said first processing

module including a positioning system receiver for receiving position signals from at least one source remote from said vehicle and for processing said position signals into said real time vehicle position data representing the date, time, and position of said vehicle;

a second processing module for storing said real time vehicle position data and for controlling transmission of said real time vehicle position data to a network-based server connected to a wireless communication system, said second processing module including data storage means for storing said real time vehicle position data, wireless communication system connecting means for transmitting data to said wireless communication system, and control means for controlling transmission of said real time vehicle position data to said network-based server, said control means being configured to:

receive said real time vehicle position data from said first processing module,

establish a wireless connection to said network-based server for a predetermined period of duration,

detect the establishment of a wireless connection,

transmit said real time vehicle position data to said network-based server during periods when said connection is established,

store said real time vehicle position data in said data storage means when said connection is not established,

reestablish said wireless connection to said network-based server following any period that said wireless connection is broken, and

retrieve said real time vehicle position data from said data storage means following reestablishment of said wireless connection, and thereafter transmit said real time vehicle position data to said network-based server;

a power supply means for powering said first processing module and said second processing module;

a first conductor means positionable between said power supply means and said second processing module, said first conductor means being configured to transmit power from said power supply means to said second processing module; and

a second conductor means positionable between said first processing module and said second processing module, said second conductor means being configured to transmit said vehicle position data from said first processing module to said second processing module and being further configured to transmit power from

said second processing module to said first processing module;

said method comprising the steps of:

establishing a wireless connection between a vehicle position locating device and a network-based server located remote from said vehicle position locating device;

receiving position signals by said vehicle position locating device from at least one source remote from said vehicle and processing said position signals into vehicle position data representing date and time, and the position, velocity and direction of travel of said vehicle;

detecting whether said wireless connection is established;

transmitting said vehicle position data to said network-based server during periods when said wireless connection is established;

storing said vehicle position data to a storage device when said wireless connection is not established;

reestablishing said wireless connection following any period that said wireless connection is broken; and

retrieving said vehicle position data from said storage device following reestablishment of said wireless connection, and thereafter transmitting said vehicle position data to said network-based server.

17. The method of claim 16, wherein said at least one source is a plurality of GPS satellites.

18. The method of claim 17, wherein said network-based server is a computer and wherein said network is the Internet.

19. The method of claim 16, wherein said method further includes addition of an identification code, that uniquely identifies the vehicle mounted device, to said vehicle position data and to transmit said identification code along with said vehicle position data.

20. The vehicle mounted device of claim 1, wherein said control means is further configured to add an identification code, that uniquely identifies the vehicle mounted device, to said vehicle position data and to transmit said identification code along with said vehicle position data.

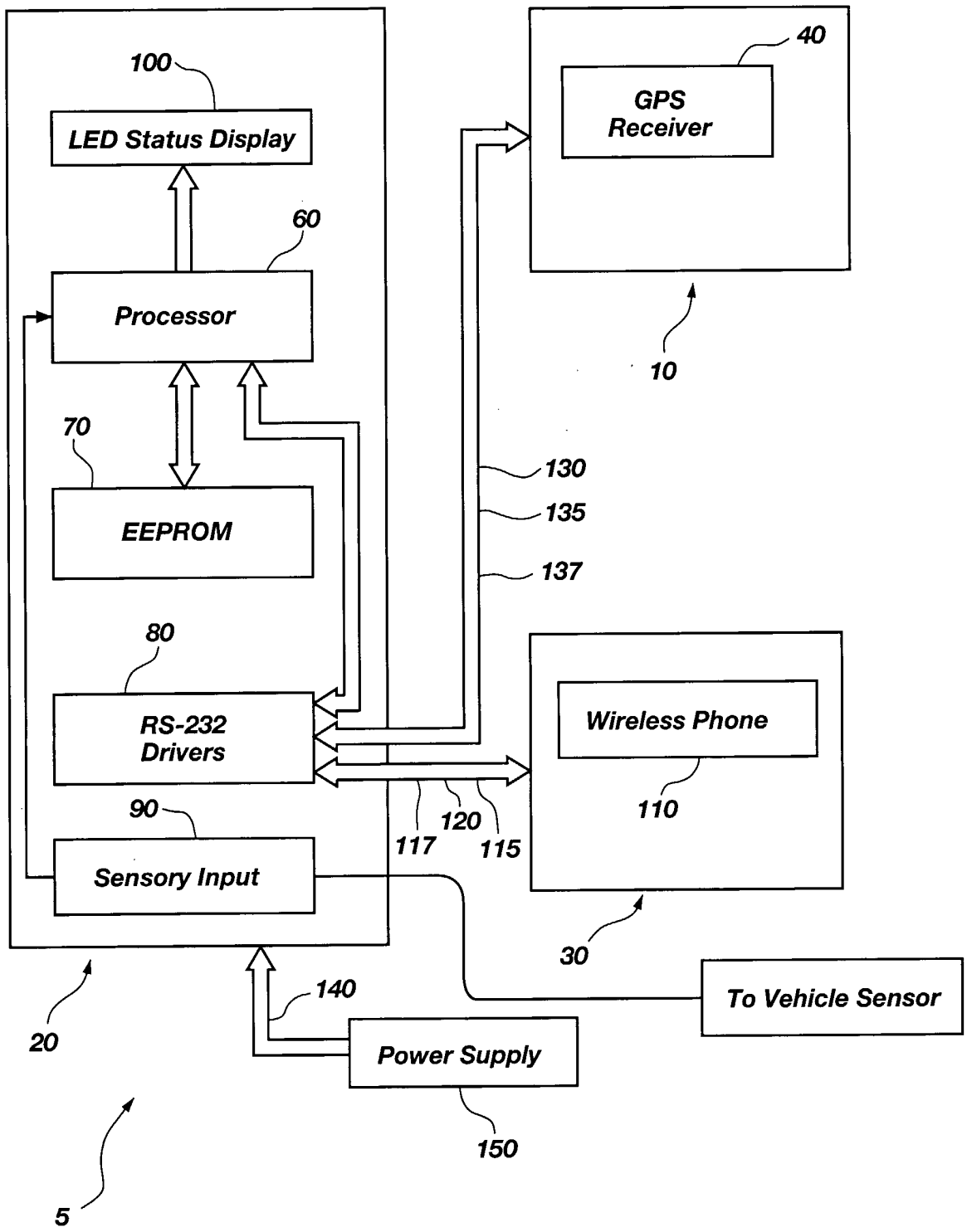

100
LED Status Display
60
Processor
70
EEPROM
80
RS-232
Drivers
90
Sensory Input
20
5
40
GPS
Receiver
10
130
135
137
Wireless Phone
110
30
117
120
115
140
Power Supply
150
To Vehicle Sensor

Fig. 1

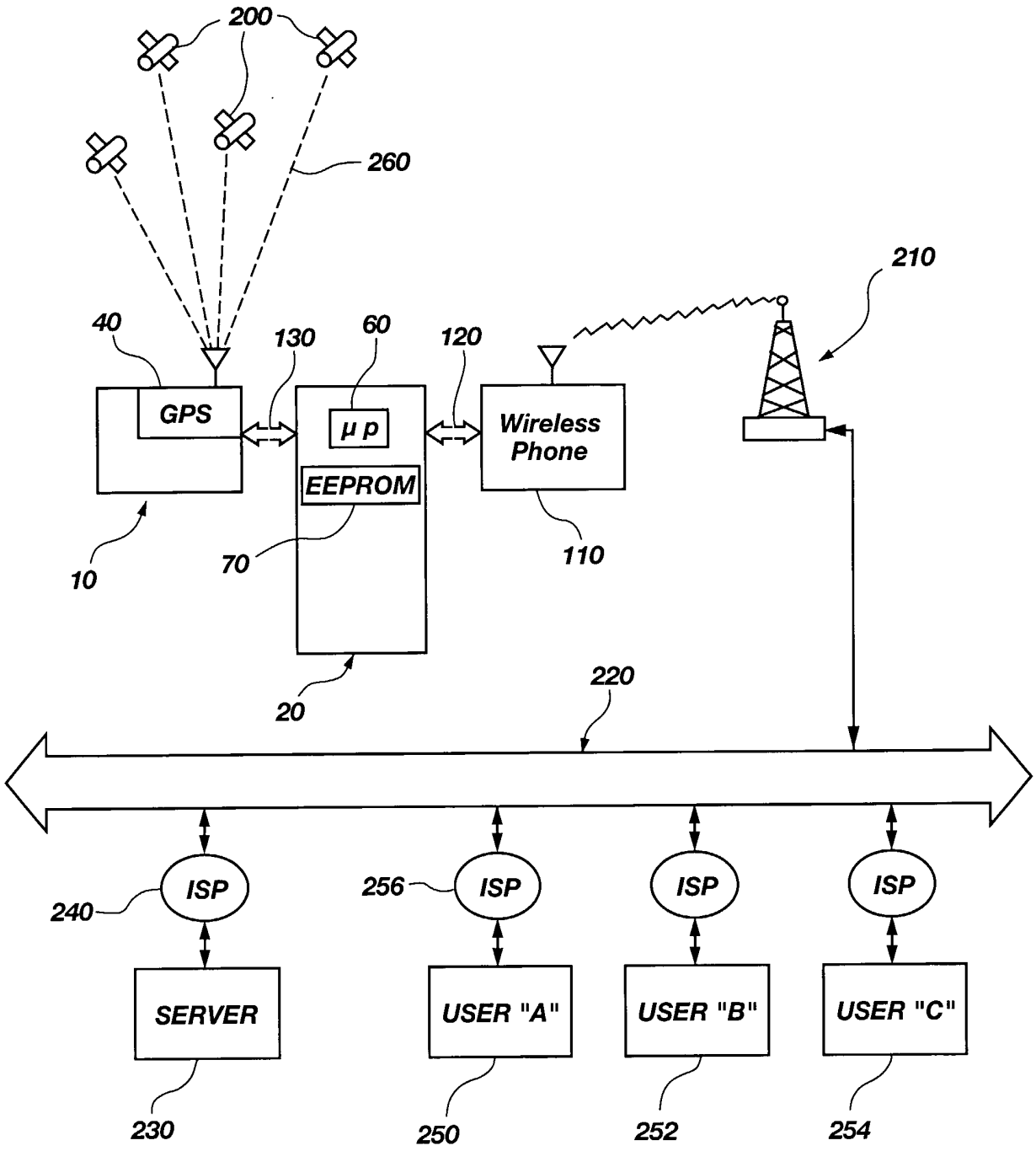

200
260
210
40
130
60
120
GPS
μ p
EEPROM
Wireless Phone
10
70
110
20
220
240
ISP
256
ISP
ISP
ISP
SERVER
USER "A"
USER "B"
USER "C"
230
250
252
254

Fig. 2

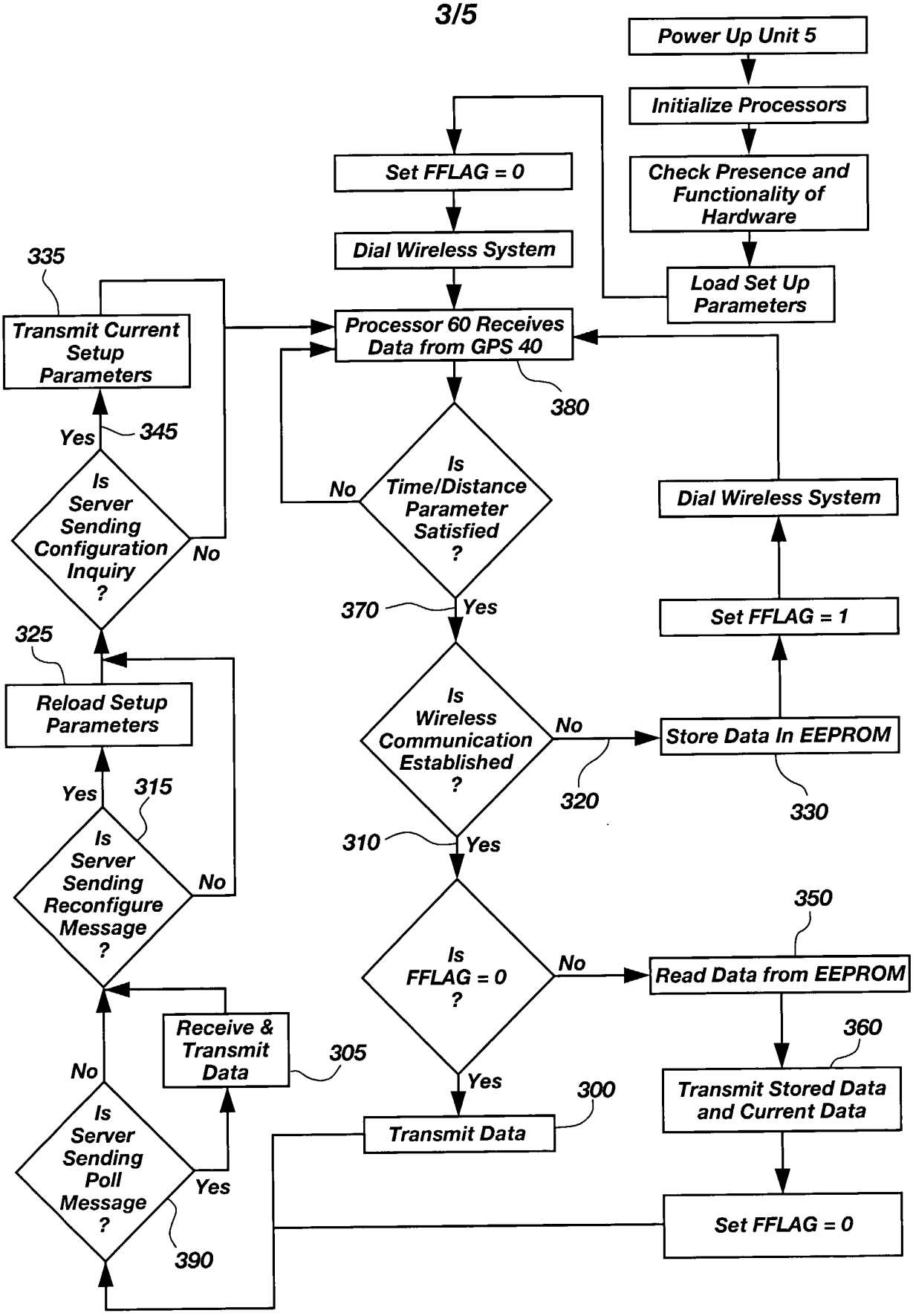

Power Up Unit 5
Initialize Processors
Check Presence and Functionality of Hardware
Load Set Up Parameters
Set FFLAG = 0
Dial Wireless System
Processor 60 Receives Data from GPS 40
380
Is Time/Distance Parameter Satisfied ?
No
Yes
370
Is Wireless Communication Established ?
No
320
Store Data In EEPROM
330
Set FFLAG = 1
Dial Wireless System
310
Yes
Is FFLAG = 0 ?
No
350
Read Data from EEPROM
360
Transmit Stored Data and Current Data
Set FFLAG = 0
Yes
300
Transmit Data
335
Transmit Current Setup Parameters
Yes
345
Is Server Sending Configuration Inquiry ?
No
325
Reload Setup Parameters
Yes
315
Is Server Sending Reconfigure Message ?
No
Receive & Transmit Data
305
No
Is Server Sending Poll Message ?
Yes
390

Fig. 3

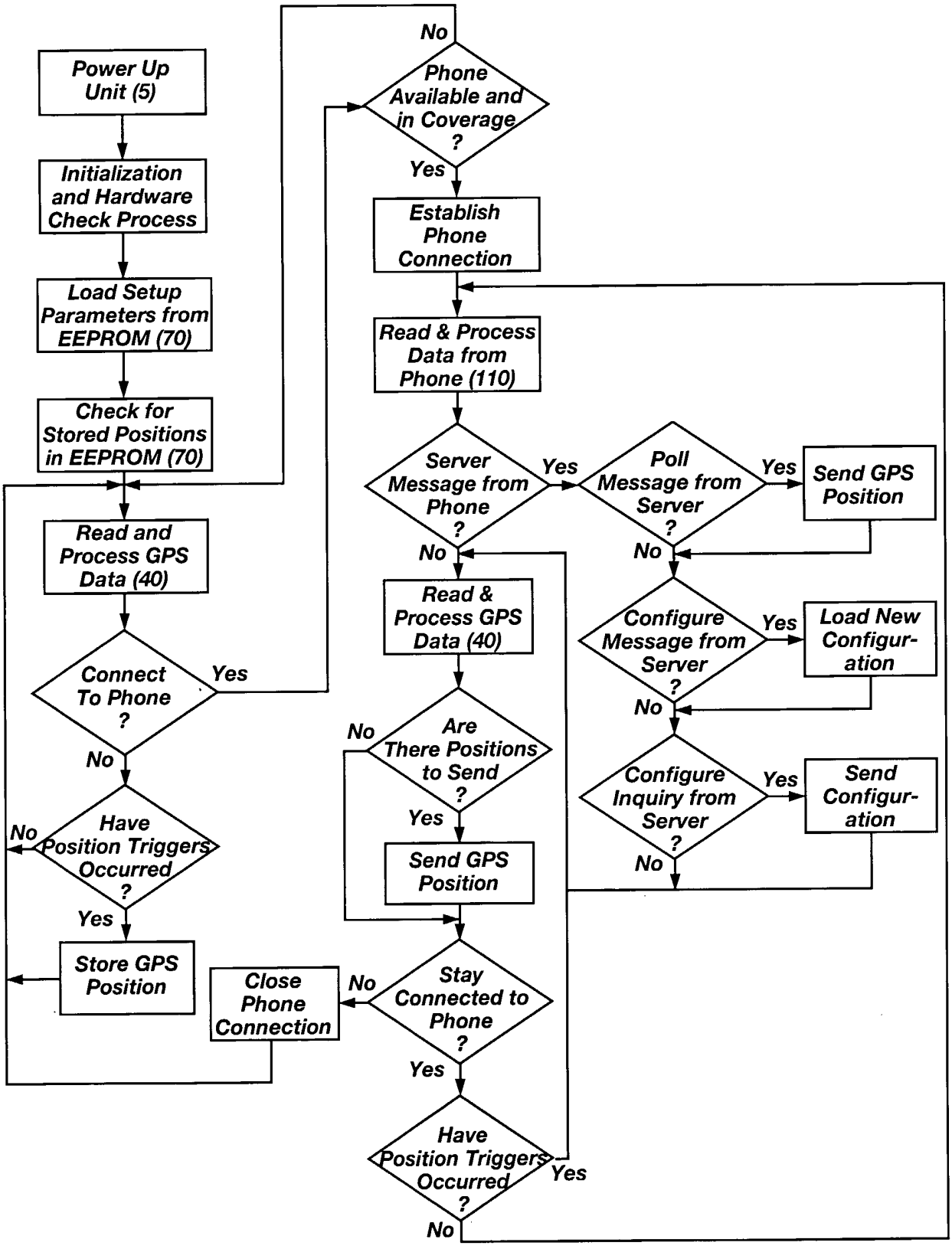

Power Up Unit (5)
Initialization and Hardware Check Process
Load Setup Parameters from EEPROM (70)
Check for Stored Positions in EEPROM (70)
Read and Process GPS Data (40)
Connect To Phone ?
Yes
No
Have Position Triggers Occurred ?
No
Yes
Store GPS Position
No
Phone Available and in Coverage ?
Yes
Establish Phone Connection
Read & Process Data from Phone (110)
Server Message from Phone ?
Yes
Poll Message from Server ?
Yes
Send GPS Position
No
No
Read & Process GPS Data (40)
Configure Message from Server ?
Yes
Load New Configur-ation
No
Configure Inquiry from Server ?
Yes
Send Configur-ation
No
No
Are There Positions to Send ?
Yes
Send GPS Position
Stay Connected to Phone ?
No
Close Phone Connection
Yes
Have Position Triggers Occurred ?
Yes
No

*Fig. 4*

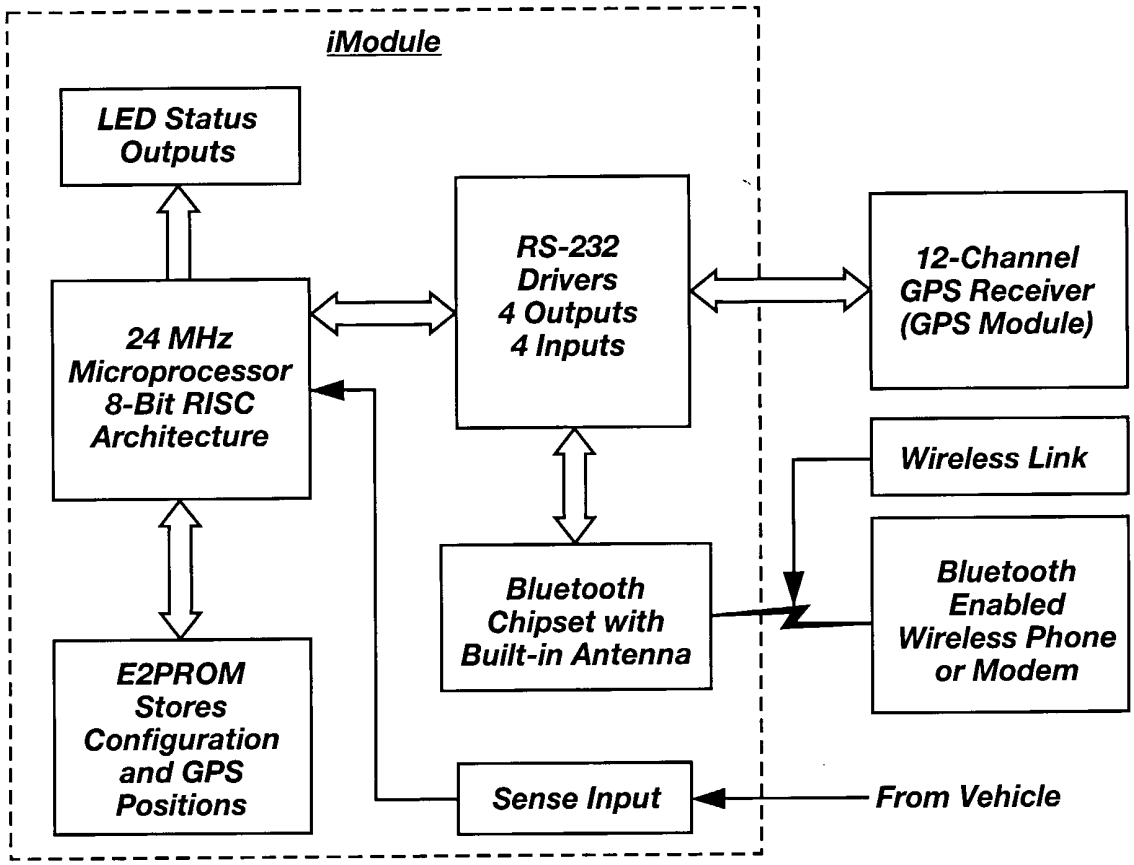

iModule
LED Status Outputs
24 MHz Microprocessor 8-Bit RISC Architecture
E2PROM Stores Configuration and GPS Positions
RS-232 Drivers 4 Outputs 4 Inputs
Bluetooth Chipset with Built-in Antenna
Sense Input
12-Channel GPS Receiver (GPS Module)
Wireless Link
Bluetooth Enabled Wireless Phone or Modem
From Vehicle

Fig. 5

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/04428

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) :G06F 17/00
US CL :701/213
According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 701/213, 24, 25

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A, E | US 6,208,290 B1 (KRASNER) 27 March 2001. | NONE |
| A, E | US 6,204,807 B1 (ODAGIRI ET AL) 20 March 2001. | |
| A | US 6,131,067 A (GIRERD ET AL) 10 October 2000. | |
| A, E | US 6,204,808 B1 (BLOEBAUM et al.) 20 MARCH 2001. | |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 30 MARCH 2001 | 08 JUN 2001 |


Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. (703) 305-3230

Authorized officer
RICHARD M. CAMBY Diane Smith for
Telephone No. (703) 308-1113