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(54) **Distributed vehicle maintenance system and method**

(57) A system and method is provided for distributing vehicle maintenance data **405**. The system includes at least one module **102** configured with self-locating means **201**, local processing means **205**, memory means **204** and communicating means **207** for attachment to a vehicle **101** and remote processing means **801** configured with communication means **811**. Said self-locating **201** means acquires vehicle location data **413**, **414** at time intervals **154**, **416**. Said memory means **204** stores threshold data **403** and said acquired data **413**, **414**. Said local processing means **205** processes said acquired data **413, 414** into cumulative data **405** and compares (**601, 604, 607**) said cumulative data **405** to said threshold data **403** according to comparison parameters. Upon said data comparison returning a match, said local processing means **205** instructs said communication means **207** to broadcast said cumulative data **405** to said communication means **811** of said remote processing means **801**.

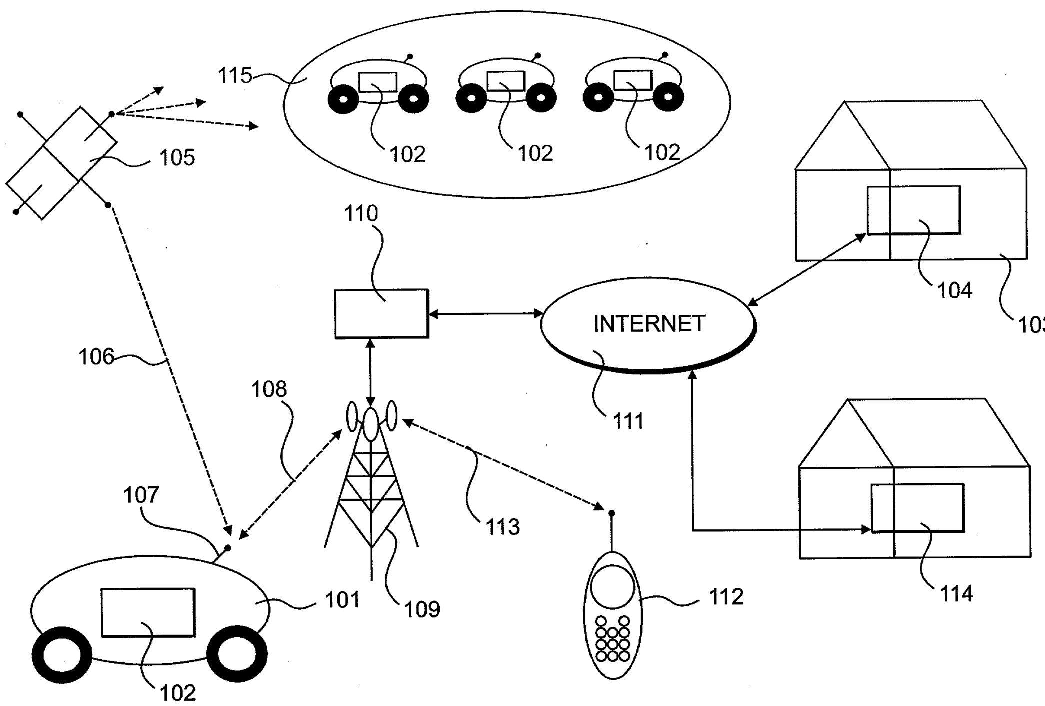

Figure 01

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Description

Field of the Invention

[0001] The present invention relates to a system and method for distributing vehicle maintenance data. More particularly, the present invention relates to collecting vehicle maintenance data and distributing said data to remote vehicle service providers.

Background of the invention

[0002] Systems are known with which to report the accurate location, operational parameters or a combination thereof of a vehicle to its user or to a remote monitoring station.

[0003] A proportion of such vehicle-based systems are further known, which make use of the satellite-based Global Positioning System to determine said accurate location at any precise time. Accurate vehicle location is useful in such applications as facilitating vehicle navigation throughout a journey, vehicle stopping and retrieving when taken without consent or simply tracking for delivery time estimation and, more recently, matching vehicle location to proximate services required by its user with making use of geo-fencing parameters.

[0004] The data distribution functionality of such systems is usually restricted to broadcasting GPS location data expressed as latitudinal and longitudinal co-ordinates, or other location data such as cell location in a mobile phone network, to a remote processing unit such as a network server, which is then processed for correlation with map data in order to output and send back the relevant information, whether it be street names or service provider names and addresses.

[0005] For instance, in the case of a remote monitoring station tracking a stolen vehicle or a delivery vehicle, a user at said monitoring station sends a processing command or simply a text-based communication to said vehicle-based system, whereby said GPS co-ordinates or cell location are sent back for mapping in response. In the case of location matching applications, a vehicle user enters journey or services parameters with activating keys of a vehicle-mounted keypad or user interface, whereby GPS co-ordinates or cell location are sent back to a network server for mapping, matching and broadcasting results back to said user.

[0006] In the context of the above prior art, a problem exists in that many vehicle users fail to regularly maintain their vehicle in optimum working order with timely mechanical maintenance, opting instead for punctual, as-needed maintenance, for instance as a result of uncertainty as to what frequency should said maintenance take place.

[0007] Indeed, whereas the above applications may be useful in locating a vehicle service provider in close vicinity or specialising in the vehicle make or model itself, they rely upon vehicle user-input at the time of the decision to carry out vehicle maintenance, such as search parameters for maintenance providers. Such systems therefore require the vehicle user to remain aware of vehicle service intervals and requirements throughout the useful life of the vehicle, whether such intervals are based upon the total distance covered by the vehicle, the total running time of its mechanical components or a combination thereof, which is a difficult and time-consuming task. A user may for example travel few miles in a given period but spend most of said period in urban traffic, whereby maintenance should take place based upon cumulative running time of the vehicle engine in that period rather than total distance travelled, but said user opting instead to maintain the vehicle at mileage intervals, such that engine wear is compounded by lack of timely maintenance.

[0008] It is known to provide a unit to connect to an odometer of the vehicle to monitor the mileage of the vehicle to indicate when a service is due, for example such a unit is supplied by the car manufacturer BMW. However a problem with this type of unit is that the unit gives an unreliable reading as to when a maintenance of the vehicle is due because it depends on distance travelled only and does not take account of when the odometer is not working properly, either due to a fault or deliberately tampered with. Additionally the odometer does not take account of when a vehicle has its engine running and stationary or other parameters, for example the average speed the vehicle was travelled. A more sophisticated solution is disclosed in Canadian patent publication number CA2359887 by 'Road Inc' wherein vehicle maintenance-related services are provided from a server over a wide area network, such as the Internet. A server that is accessible over the wide area network through a wireless communication link is provided. An apparatus is provided in a vehicle to collect, over a data bus in the vehicle, data relating to an operation of the vehicle. The data received from the data bus is then communicated to the server over the wireless communication link. Based on the data received at the server, the maintenance-related services is then initiated. The operation data of the vehicle can be collected from various subsystems of the vehicle. A problem with the Road Inc. solution is that it is reliant on the various subsystems of the vehicle to gather data, which are not accurate. Additionally the Road Inc solution is difficult to install as a data bus must be provided to connect to each subsystem in the vehicle in order to gather data, which is technically difficult to achieve

[0009] Moreover, a second problem exists in that vehicle service providers remain unaware of many variables, such as required maintenance points, stock of parts and staffing levels until vehicle users have contacted them to arrange vehicle maintenance and have been queried about their driving habits to determine maintenance points and parts. It is therefore difficult for said vehicle service providers to forecast any of the above variables with accuracy, thus providing their services economically and profitably, which detriments the user with, for instance, vehicle immobilisation for unnecessary lengths of time whilst maintenance is carried out (e.g. if awaiting parts).

Object of the Invention

[0010] A vehicle maintenance system and method is therefore required, which distributes vehicle maintenance data to vehicle maintenance professionals in advance of maintenance thresholds in order to regularly maintain said vehicle in optimum working order with timely mechanical servicing, such that said servicing is carried out more economically for both the user and the service provider.

Summary of the Invention

[0011] According to an aspect of the present invention, as set out in the appended claims, a system for distributing vehicle maintenance data is provided, which includes at least one module configured with self-locating means, local processing means, memory means and communicating means for attachment to a vehicle and remote processing means configured with communication means, wherein said self-locating means acquires vehicle location data at time intervals; said memory means stores instructions, threshold data and said acquired data; said local processing means is configured by said instructions to process said acquired data into cumulative data and compare said cumulative data to said threshold data according to comparison parameters; whereby upon said data comparison returning a match, said local processing means instructs said communication means to broadcast said cumulative data to said communication means of said remote processing means.

[0012] According to another aspect of the present invention, a method of distributing vehicle maintenance data is provided, said method comprising the steps of acquiring vehicle location data at time intervals with self-locating means in at least one module configured with self-locating means, local processing means, memory means and communicating means attached to a vehicle; storing instructions, threshold data and said acquired data in said memory means; configuring said processing means with said instructions to process said acquired data into cumulative data; comparing said cumulative data to said threshold data according to comparison parameters and upon said data comparison returning a match, instructing said communication means to broadcast said cumulative data to communicating means of remote processing means.

[0013] According to another aspect of the present invention, a computer system programmed to execute stored instructions is provided such that in response to said stored instructions said system is configured to acquire vehicle location data at time intervals from self-locating means; store threshold data and said acquired data in memory means; process said acquired data into cumulative data; compare said cumulative data to said threshold data according to comparison parameters and, upon said data comparison returning a match, instruct communication means to broadcast said cumulative data to communicating means of a remote terminal.

[0014] According to another aspect of the present invention, a computer-readable memory system having a plurality of data fields stored therein representing a data structure, wherein said data structure includes vehicle location data at time intervals, cumulative data and threshold data and further having instructions configured to process said vehicle location data at time intervals into said cumulative data; compare said cumulative data to said threshold data according to parameters and broadcast said cumulative data to a remote terminal upon said data comparison returning a match.

[0015] According to an aspect of the present invention, a module for attachment to a vehicle for distributing vehicle maintenance data is provided, which includes self-locating means, local processing means, memory means and communicating means, wherein said self-locating means acquires vehicle location data at time intervals; said memory means stores instructions, threshold data and said acquired data; said local processing means is configured by said instructions to process said acquired data into cumulative data and compare said cumulative data to said threshold data according to comparison parameters; whereby upon said data comparison returning a match, said local processing means instructs said communication means to broadcast said cumulative data.

[0016] According to an aspect of the present invention, a kit of parts for distributing vehicle maintenance data is provided, said parts including at least one module configured with self-locating means, local processing means, memory means and communicating means for attachment to a vehicle and remote processing means configured with communication means, wherein said self-locating means acquires vehicle location data at time intervals; said memory means stores instructions, threshold data and said acquired data; said local processing means is configured by said instructions to process said acquired data into cumulative data and compare said cumulative data to said threshold data according to comparison parameters; whereby upon said data comparison returning a match, said local processing means instructs said communication means to broadcast said cumulative data to said communication means of said remote processing means.

[0017] It will be appreciated that the self-locating means acquires the data independent of vehicle operating characteristics. The invention does not rely on measuring parameters of the vehicle to acquire the data, which has the advantage that the data acquired is not reliant on the vehicle itself, which can be unreliable. The invention also provides the advantage of facilitating automated vehicle management which allows vehicle maintenance operators take full control of their customers maintenance requirements.

[0018] In a preferred embodiment of the present invention, said threshold data and cumulative data is a distance, which may be expressed in any unit of measure such as imperial miles or metric kilometers or subdivisions thereof. In another preferred embodiment of the present invention, said module is further configured with sensor means for determining whether a vehicle engine is powered up or down, wherein said threshold data and cumulative data also includes engine running time, which may be expressed in any unit of measure of time such as a combination of days, hours, minutes and seconds.

[0019] In a preferred embodiment of the present invention, said memory means includes first non-volatile and second volatile random access memory, wherein said threshold data and cumulative is stored in first non-volatile RAM and acquired location data is stored in said second volatile RAM.

[0020] In a preferred embodiment of the present invention, said local processing means is further configured by said instructions to receive and process read requests from said remote processing means, whereby upon receiving a cumulative data read request from said remote processing means, said local processing means instructs said communication means to broadcast said cumulative data to said communication means of said remote processing means.

[0021] The self-locating means is preferably a Global Positioning System device receiving time and location data from orbiting satellites. Suitably the communication means is a modem configured to exchange data packets over a wireless network, such as the Global System for Mobile Communication ('GSM') or General Packet Radio Service ('GPRS') networks. In yet another preferred embodiment of the present invention, said cumulative data and read request are respectively communicated as text messages using Short Message Service ('SMS') protocol over said wireless network. Preferably, said remote processing means parse said text messages and store cumulative data therein in a database.

[0022] In yet another preferred embodiment of the present invention, said remote processing means are located at one or a plurality of vehicle maintenance providers. Preferably, said threshold data is updated when said vehicle is maintained by any of said vehicle maintenance providers.

Brief Description of the Drawings

[0023] The invention will be better understood upon consideration of the following detailed description and the accompanying drawings, in which:

Figure 1 shows a preferred embodiment of the present invention in an environment, including at least one vehicle to which a module is attached and at least one vehicle service provider equipped with a terminal;

Figure 2 shows the module of *Figure 1* in further detail, including memory means;

Figure 4 details the processing steps according to which the module of *Figures 1* and *2* operates, including a step of processing data at runtime;

Figure 4 illustrates the contents of the memory means shown in *Figure* 2 during the data processing step shown in *Figure 3;*

Figure 5 further details the data processing step of *Figure* 4, including a step of data comparison and a data broadcasting step;

Figure 6 further details the data comparing step of *Figure 5;*

Figure 7 further details the data broadcasting step of *Figure 5;*

Figure 8 provides an example of the terminal at the vehicle service provider shown in *Figure 1,* which includes processing means, memory means and communicating means;

Figure 9 details the processing steps according to which the terminal of *Figures 1* and *8* operates, including a step of updating a database and a step of processing database data according to user input;

Figure 10 illustrates the contents of the memory means of the terminal of *Figures 1, 8* and *9* according to the present invention, including an application and a database;

Figure 11 provides an example of the database shown in *Figure 10;*

Figure 12 shows a graphical user interface of the application shown in *Figure 10;*

Figure 13 further details the database updating step of *Figure 9;*

Figure 14 further details the database data processing step of *Figure 9;* and

Figure 15 shows the graphical user interface of *Figure* 12 upon performing either of the processing steps described in *Figures 13* and *14*.

Detailed Description of the Drawings

[0024] A preferred embodiment of the present invention is shown in an environment in Figure 1, which includes at least one vehicle **101,** for instance a car, to which a module **102** is attached and at least one vehicle service provider **103** equipped with a terminal **104.** Module **102** combines Global Positioning System (GPS) data processing functionality and wireless telecommunication emitting and receiving functionality, such as over a cellular telephone network configured according to the Global System for Mobile Communication ('GSM') or General Packet Radio Service ('GPRS') network industry standards. In yet another preferred embodiment of the present invention, said cumulative data and read request are respectively communicated as text messages using Short Message Service ('SMS') protocol. Module **102** receives GPS latitudinal data, longitudinal data and time data from GPS satellite **105** over wireless data transmission **106** by means of vehicle aerial **107,** preferably every second. Module **102** receives or emits voice and/or text data encoded as a digital signal over wireless data transmission **108** by means of the same vehicle aerial **107** or another dedicated aerial, wherein said signal is relayed respectively to or from module **102** in vehicle **101** by the geographically-closest communication link relay **109** of a plurality thereof. Said text data is preferably encoded as a SMS message, although it will be readily understood by those skilled in the art that the present invention is not limited thereto.

[0025] The plurality of communication link relays allows said digital signal to be routed between module **102** and its intended recipient or from its remote emitter, in the example terminal **104** of vehicle service provider **103,** by means of a remote gateway **110.** Gateway **110** is for instance a communication network switch coupling digital signal traffic between wireless telecommunication networks, such as the network within which wireless data transmission **108** takes place, and a wide area network (WAN) **111,** an example of which is the Internet. Said gateway **110** further provides protocol conversion if required, for instance if module **102** uses Wireless Application Protocol to distribute data to and optionally receive from terminal **104,** which is itself only connected to the WAN **111.**

[0026] The user of vehicle **101** preferably has the use of either a mobile communicating device **112** configured to at least receive text data encoded as a digital signal over a wireless data transmission **113,** such as a mobile telephone, or a terminal **114** connected to said WAN **111** and configured with electronic mail receiving and emitting functionality, or both. Thus, the potential exists for data exchange between any of module **102,** mobile communicating device **112** and terminals **104** and **113,** by way of wireless data transmissions **108,113** and the Internet **111** interfaced by gateway **110.**

[0027] In the example, many other vehicles shown as **115** are likewise respectively equipped with a module **102,** whereby the potential exists for likewise data exchange between any of said many modules **102,** terminal **104** and the respective wireless or WAN-connected communication devices (not shown) of said vehicles owners.

[0028] The module **102** is shown in Figure 2 in further detail. Module **102** includes self-locating means **201** in the form of a GPS receiver containing an analogue-to-digital converter **202,** which receives analogue positional and time data through aerial **107** from satellite **105** and processes it into digital data, and a processor **203** for outputting said converted data into latitude (Xn), longitude (Yn) and elevation (Zn) integers and time data into clock-time data (Tn). In the preferred embodiment of the present invention, said elevation (Zn) data is not processed, because the data processing and module cost overheads required to do so are not offset by the gain in module output accuracy, given that the output variation between processing Xn, Yn data as opposed to Xn, Yn, Zn is minimum. In an alternative embodiment of the present invention depending upon the available processing capacity within module **102,** however, said elevation (Zn) data may also be processed in order to further increase the accuracy of the output of module **102.** Xn, Yn data is regularly output by receiver **201** at time Tn and stored in memory means **204,** which includes non-volatile random-access memory (NVRAM) totalling **512** kilobytes in this embodiment. NVRAM **204** provides non-volatile storage for processing means **205,** which is a Central Processing Unit (CPU) such as a general-purpose microprocessor, acting as the main controller of module **102.**

[0029] Said GPS receiver **201,** NVRAM **204** and CPU **205** are connected by a data input/output bus **206,** over which they communicate and to which further components of module **102** are similarly linked in order to provide wireless communication functionality and receive user interrupts and configuration data. Accordingly, communication functionality is provided by a modem **207,** which provides the interface to external communication systems, such as the GSM or GPRS cellular telephone network shown in Figure 1. A user interrupt may be received from data input interface **208,** which is a switch. In this embodiment, a second interface **209** is provided as an industry-standard RS-**232** data input port for attachment to an external data input device, wherefrom input data configuring or upgrading module **102** for use may be stored in NVRAM **204.** Power may be provided to module **102** by an electrical converter **210** connected to the battery **211** of the vehicle or, alternatively, by an internal module battery **212** included as a redundant power source in the electrical circuit of module **102** in case of battery **211** failing.

[0030] The processing steps according to which module **102** operates are described in Figure 3. In order to distribute vehicle maintenance data to vehicle maintenance professionals in advance of maintenance thresholds, it is preferable to input threshold data in module **102,** for instance at first when a vehicle is new and, subsequently, every time said vehicle is maintained.

[0031] Upon completing the assembly of the vehicle **101** at a manufacturing facility, module **102** is configured to power up at step **301** when battery **211** is first connected to the electrical circuit thereof, whereby NVRAM **204** is initialised at step **302.** At said manufacturing facility still or, alternatively, upon a vehicle service provider **104** taking delivery of said new vehicle, the external data input device described in Figure 2 is connected thereafter to second interface **209,** whereby instructions for CPU **205** and reference data for receiver **201** may be uploaded into NVRAM **204** at step **303.** The processing of said CPU instructions starts at the next step **304** with first generating, then initialising a reference key in NVRAM **204** at steps **305, 306** respectively. In this embodiment, said reference key is a 3-bit key, but it will be understood by those skilled in the art that the present description is not limited thereto, as indeed even a 1-bit key or a key using much more than 3 bits may be usefully implemented instead. Moreover, in an alternative embodiment of the present invention, the referencing function of the above key is performed with several data accumulators instead.

[0032] The initialising of said reference key at said step **306** permits data input through interface **209,** which is otherwise not permitted. Said instructions optionally allow receiver **201** to be calibrated for location and/or time accuracy at step **307.** At step **308,** maintenance threshold data Dα is input, preferably as a distance, for instance expressed in imperial miles or metric kilometres, whereby it is permanently stored in NVRAM **204.** In another embodiment of the present invention, maintenance threshold data Tα is then input at step **309,** preferably as a period of time, for instance expressed in days, hours, minutes or any combination thereof, whereby it is also permanently stored in NVRAM **204.** Upon completing this threshold input, the external device may then be disconnected from interface **209** at the next step **310,** whereby module **102** now operates at runtime at step **311,** with processing location and time data according to the instructions loaded at step **303.**

[0033] A question is asked at step **312,** as to whether a user interrupt has been received from switch **208.** If the question of step **312** is answered positively, such as when vehicle **101** is being maintained upon reaching or approaching said maintenance thresholds Dα and/or Tα and a vehicle service provider activates switch **208** as a maintenance point, control proceeds to step **306,** whereby the reference key first generated at step **305** is again initialised and new maintenance threshold data Dα and/or Tα may thus be input as previously described. Alternatively, the question of step **312** is answered negatively and the runtime processing of step **311** continues.

[0034] The contents of NVRAM **204** are shown in Figure 4 upon starting the runtime step **311.** Memory **204** first contains an application **401** embodying the set of CPU instructions previously described, thus which processes positional data, time data, distributed and distributable data. Preferably, application **401** is configured to process local data as detailed below, packet and broadcast said data or receive remote data with modem **207,** wherein said distributed data is for instance encoded in a SMS text message. In order to identify the module **102** of vehicle **101** amongst the many modules **102** of vehicles **115,** memory **204** also stores a unique device ID **402,** which may for instance be a sequential integer ID or a vehicle-specific ID such as the registration number or VIN chassis number of vehicle **101**.

Memory **204** next contains distance maintenance threshold data Dα **403** and, optionally, time maintenance threshold data Tα **404.** Stored cumulative distance data D is shown at **405** and optional stored cumulative time data T is shown at **406.** Calculated distance data Dn is shown at **407,** which is processed from Xn, Yn data according to the present invention. Optional calculated time data Tn is shown at **408,** which is processed from Tn data according to the present invention. The 3-bit reference key of steps **305, 306** is shown at **409** as three bits initialised at zero, which may be respectively set to one by application **401** upon data D **405** or optional data T **406** meeting parameters relative to Dα **403** or Tα **404** respectively, which will be further described herein. Memory **204** next contains at least one communication address **410** of a remote recipient, such as the phone number or address in WAN **111** of terminal 104 of service provider **103,** in order for module **102** to distribute data thereto via modem **207.** GPS reference data is shown at **411** and Xn, Yn, and Tn location data communicated by processor **203** over bus **206** is preferably stored in a portion of memory **204** configured as a First-In-First-Out (FIFO) buffer **412.** Said location data is stored as a sequential collection of locations (Xn, Yn) **413, 414** sampled at respective, regular time intervals Tn **414, 415** which are preferably very short, such as one second in the example. For practical and costs purposes, the accuracy of said (Xn, Yn) data **413, 414** is two-times distance root mean square (2drms) plus or minus 5 meters.

[0035] The declared size of buffer **412** determines the amount of samples **413, 414** stored at any one time **414, 415** in memory **204,** which may thus vary according to whether a larger or smaller amount of NVRAM is provided and/or coding or compiling optimisation reduces the physical size of application **401** and/or the GPS data requirements for distance calculation. In the embodiment, it is preferable to store FIFO buffer **412** in NVRAM **204** as opposed to a volatile random access memory, to ensure successive samples provide accurate location and time data without interruption, irrespective of whether vehicle **101** is under power or not when its location changes, for instance for vehicle security purposes or, optionally, to compare total distance travelled D **405** against total engine running time T **406**.

[0036] The data processing step **311** is further detailed in Figure 5. Location and time data (Xn, Yn, Tn) **413** to **416** is regularly output by processor **203** at step **501** over bus **206** during runtime step **311,** whereby it is queued in buffer **412** in memory **204** according to said one-second sampling interval at step **502.** At step **503,** application **401** fetches said location data (Xn, Yn) **413** and (Xn+**1**, Yn+**1**) **414** from said queue at times Tn **415** and Tn+**1 416** respectively. A first question is asked at step **504,** as to whether a difference exists between said selected sets of location data **413, 414,** thus whether vehicle **101** has travelled in the sampling interval. If the question of step **504** is answered positively, application **401** calculates the distance Dn **407** travelled between said selected sets of location data **413, 414.** Examples of distance calculation are provided below for descriptive purposes, but it will be readily understood by those skilled in the art that the present description is not limited thereto.

$$Dn = \sqrt{(A \times A + B \times B)}$$

Where

$$A = [69.1 \times (Xn - Xn\text{-}1)]$$

$$B = [53.0 \times (Yn - Yn\text{-}1)]\}$$

[0037] The accuracy provided by the above calculation may be increased if CPU **205** can process cosine functions, whereby:

$$Dn = \sqrt{(A \times A + B \times B)}$$

Where

$$A = [\ 69.1 \times (Xn - Xn\text{-}1)\ ]$$

$$B = \{\ 69.1 \times (Yn - Yn\text{-}1) \times [\ \cos(Xn\text{-}1 / 57.3)\ ]\ \}$$

[0038] The above calculation is described for distances in imperial miles, but coefficients may be appropriately substituted for distances in metric kilometres or any other measurement system and/or subdivisions thereof. Likewise, the calculation described is relatively simple and thus very economic in processor usage, but greater accuracy may be obtained without departing from the scope of the present invention and will be dependent upon the processing capacity of CPU **205,** notably floating point mathematical accuracy, particularly double-precision floating point calculation. In particularly advantageous embodiment of the present invention, said distance Dn is adjusted for errors using GPS-based speed and heading filters, wherein said filters are Least Squares adjustment filters, for instance Kalman filters, which are known in the art of kinetic GPS data processing. Optionally, application **401** also calculates the time Tn **408** elapsed between said selected sets of location data **413, 414** based upon time data **415, 416** at said step **505.**

[0039] At the next step **506,** to which control also proceeds directly if question **504** is answered negatively, a second question is asked as to whether the vehicle engine is under power, in order to determine whether to update D **405** and optionally T **406.** Question **506** is answered for instance with polling an industry standard engine sensor device returning a binary response of zero (engine off) or one (engine on). If the question of step **506** is answered positively, application **401** updates the cumulative distance D **405** at step **507** with adding the distance Dn **407** calculated at step **505** to it. Optionally, application **401** also updates the cumulative running time D **406** at said step **507** with adding the elapsed time Tn **408** calculated at said step **505.**

[0040] At the next step **508,** to which control also proceeds directly if question **506** is answered negatively, a third is asked as to whether a remote data request has been received by module **102.** In the embodiment, it is possible for a user at terminal **104** of service provider **103** to poll module **102** for distance data D **405** and, optionally, time data T **406.** Said poll is preferably, but not necessarily, a function call encoded as a SMS message which, when received by modem **207** and then processed by application **401,** simply triggers the broadcasting function of said application **401** as will be further described below. If the question of step **508** is answered negatively, application **401** next compares the stored cumulative distance D **405,** possibly updated according to step **507,** with the stored maintenance threshold Dα **403** at step **509,** in order to determine whether a maintenance broadcasting event is triggered, the parameters of which may vary and examples of which will be provided further herein. Optionally, application **401** also compares the stored cumulative time T **406,** possibly updated according to step **507,** with the stored maintenance threshold Tα **404** at said step **509** for the same purpose. A fourth and final question is thus asked at step **510,** as to whether a maintenance broadcasting event is triggered by the comparison of step **509** which, if answered positively, triggers the broadcasting function of said application **401** at step **511,** as would be the case if the previous question **508** was answered positively instead.

[0041] Alternatively, the question of step **510** is answered negatively and, in the absence of user interrupt of step **312,** control returns to step **503.**

[0042] The data comparing step **509** is further detailed in Figure 6. In the embodiment, it is preferred that module **102** broadcasts cumulative distance D **405** at set ratios of the distance maintenance threshold Dα **403,** notably when said distance D **405** respectively reaches a third of threshold Dα **403,** two thirds of threshold Dα **403** and said threshold Dα **403.** At step **601,** a first question is asked at to whether the value of cumulative distance D **405** exceeds a third of distance maintenance threshold Dα **403.** If the question of step **601** is answered negatively, control proceeds to the question of step **510,** which is answered negatively also. Alternatively, the question of step 601 is answered positively, whereby a second question is asked at step **602** as to whether the bit in reference key **409** corresponding to the condition asked in question **601** is set, in the example the first bit of said key. If the question of step **602** is answered negatively, application **401** sets said first bit to one at step **603** and control proceeds to step **610,** wherein an event is declared which answers question **510** positively and triggers a broadcast. Upon the questions of steps **601, 602** being both answered positively, said first condition is ignored for the purpose of deciding whether to broadcast distance D **405,** thus avoiding unnecessary, repeated duplication of said broadcast and control proceeds to the next step **604.**

[0043] At step **604,** a third question is asked at to whether the value of cumulative distance D **405** exceeds two-thirds of distance maintenance threshold Dα **403.** If the question of step **604** is answered negatively, control proceeds to the question of step **510,** which is answered negatively also. Alternatively, the question of step **604** is answered positively, whereby a fourth question is asked at step **605** as to whether the bit in reference key **409** corresponding to the condition asked in question **604** is set, in the example the second bit of said key. If the question of step 605 is answered negatively, application **401** sets said first bit to one at step **606** and control again proceeds to step **610,** wherein an event is declared which answers question **510** positively and triggers a broadcast. Upon the questions of steps **601, 602, 604** and **605** being all answered positively, said first and second conditions are ignored for the purpose of deciding whether to broadcast distance D **405,** thus avoiding unnecessary, repeated duplication of said broadcast and control proceeds to the next step **607.** At step **607,** a fifth question is asked at to whether the value of cumulative distance D **405** exceeds distance maintenance threshold Dα **403.** If the question of step **607** is answered negatively, control proceeds to the question of step **510,** which is answered negatively also. Alternatively, the question of step **607** is answered positively, whereby a sixth question is asked at step **608** as to whether the bit in reference key **409** corresponding to the condition asked in question **607** is set, in the example the third bit of said key. If the question of step **608** is answered negatively, application **401** sets said first bit to one at step **609** and control again proceeds to step **610,** wherein an event is declared which answers question **510** positively and triggers a broadcast. Upon the questions of steps **601, 602, 604, 605, 607** and **608** being all answered positively, said first, second and third conditions are ignored for the purpose of deciding whether to broadcast distance D **405,** thus avoiding unnecessary, repeated duplication of said broadcast.

[0044] In the embodiment, vehicle maintenance takes place shortly upon broadcasting that the third condition is met, whereby the reference key is reset and a new value for Dα **403** is input, such that the above algorithm may be recycled for the next optimum maintenance threshold. In an alternative embodiment using data accumulators as opposed to a reference bit key or in conjunction therewith, cumulative distance data **405** is accumulated in at least one data accumulator stored in NVRAM **204,** which is compared to a distance broadcast threshold Dβ, for instance **2,000** miles or a metric equivalent, at step **601.** Upon said accumulator data exceeding said broadcast threshold Dβ, control proceeds to step **610** and the accumulator data is reinitialised for further accumulation and comparison to threshold Dβ until such time as the condition is again met, and so on and so forth.

[0045] It will be understood by those skilled in the art that the above ratios are provided herein by way of example only, and that the present description is not limited thereto. Indeed, the reference key **409** may be implemented with more or less bits to accommodate respective number of differing ratios, such as successive quarters or tenths of said threshold Dα **403.** Likewise, said comparison is limited to distance data for the purpose of not unnecessarily obscuring the present description, but it should be understood that it may instead or also incorporate comparison of running time data T **406** against respective threshold Tα **404** to optimise vehicle maintenance intervals. Broadcasting cumulative distance D **405** to vehicle service provider **103** according to the present invention allows said provider to initiate maintenance proceedings with the user of vehicle **101,** removing the need for said user to remain aware of vehicle service intervals and requirements throughout the useful life of the vehicle. Moreover, broadcasting cumulative distance **D 405** according to ratios of threshold Dα **403** to vehicle service provider **103** allows said provider to accurately forecast numerous variables, such as vehicle maintenance points based upon mileage, corresponding parts to order, required staffing levels and expected amount of business over given periods.

[0046] The data broadcasting step **511** is further detailed in Figure 7. Irrespective of whether a broadcasting event is declared as a result of step **610** or upon receiving a data request at step **508,** application **401** first fetches relevant data from memory **204** at step **701.** Preferably, emitting module identification data **402,** distance maintenance threshold data Dα **403** and cumulative distance data **D 405** are retrieved. Optionally, time maintenance threshold data Tα **404** and cumulative time data T **406** are retrieved also or instead. At step **702,** application **401** outputs said retrieved data as formatted ASCII text, which it then encodes for broadcast at step **703** by way of packing said formatted ASCII text into communicable data packets, preferably but not necessarily as a SMS text message. At step **704,** application **401** instructs modem **207** to dial phone number **410** and a question is asked at step **705** as to whether said modem **207** has successfully establishing a connection to the cellular telephone network. If the question of step **705** is answered negatively, a wait instruction elapses an arbitrary time period at step **706** before control returns to said question **705,** until it is eventually answered positively, whereby said data packets are sent to the recipient over wireless data transmission **108,** i.e. terminal **104** of vehicle service provider **103** at step **707.** In the example, said data packets are relayed as a digital signal from module **102** in vehicle **101** by the geographically-closest communication link relay **109** of a plurality thereof. Said plurality of communication link relays allows said digital signal to be routed between module **102**

and terminal **104** by means of remote gateway **110.**

[0047] An example of the terminal **104** at the vehicle service provider **103** shown in Figure 1 is provided in Figure 8. Terminal **104** is a computer terminal configured with a data processing unit **801,** data outputting means such as video display unit (VDU) **802,** data inputting means such as a keyboard **803** and a pointing device (mouse) **804** and data inputting/outputting means such as WAN connection **805,** magnetic data-carrying medium reader/writer **806** and optical data-carrying medium reader/writer **807.** Within data processing unit **801,** a central processing unit (CPU) **808,** such as an Intel Pentium **4** manufactured by the Intel Corporation, provides task co-ordination and data processing functionality. Instructions and data for the CPU **808** are stored in main memory **809** and a hard disk storage unit **810** facilitates non-volatile storage of data and several software applications. A modem **811** provides a wired connection to the Internet **111.** A universal serial bus (USB) input/output interface **812** facilitates connection to the keyboard and pointing device **803, 804.** All of the above devices are connected to a data input/output bus **813,** to which said magnetic data-carrying medium reader/writer **806** and optical data-carrying medium reader/writer **807** are also connected. A video adapter **814** receives CPU instructions over said bus **813** for outputting processed data to VDU **802.**

[0048] In the embodiment, data processing unit **801** is of the type generally known as a compatible Personal Computer ('PC'), but may equally be any device configured with data inputting, processing and outputting means providing at least the functionality described above. Any such device may include, but is not limited to, an iMac® computer manufactured by the Apple® Corporation of Cupertino, California, USA; a Portable Digital Assistant (PDA) such as a Palm m**505**® manufactured by PalmOne® Inc. of Milpitas, California, USA; a Portable Digital Computer (PDC) such as an IPAQ® manufactured by the Hewlett-Packard® Company of Palo Alto, California, USA; or even a mobile phone such as a Nokia **9500** manufactured by the Nokia® Group in Finland, all of which are generally configured with processing means, output data display means, memory means, input means and wired or wireless network connectivity.

[0049] Processing steps are described in Figure 9 according to which terminal **104** operates. Terminal **104** is first switched on at step **901.** At step **902,** the operating system is loaded which provides said terminal **104** with basic functionality, such as initialisation of data input and/or output devices, data file browsing, keyboard and/or mouse input processing, video data outputting, network connectivity and network data processing. At step **903,** an application is loaded into memory **809,** which is a set of instructions for configuring CPU **808** to process data according to rules described hereafter. A database is next loaded at step **904,** which organises application data referenced therein according to relational parameters.

[0050] A first question is asked at step **905,** as to whether a broadcast has been received from a module **102,** such as sent at vehicle **101** according to step **511.** If the question of step **905** is answered positively, the application loaded at step **903** updates the database with the data received in said broadcast and notifies said update to the user of terminal **104** at step **906,** for instance with generating a database record form summarising vehicle details and output to VDU **802,** a user-selectable portion of which allows said user to notify the vehicle owner that maintenance is required. Control proceeds to the next step **907,** as it would if the question of step **905** was answered negatively, whereby a second question asked as to whether user input has been received, for instance from keyboard **803** or mouse **804.**

[0051] If the question of step **907** is answered negatively, control returns to step **905,** whereby the next database update may then take place upon receiving another broadcast. Alternatively, the question of step **907** is answered positively and a third question is asked at to whether the user input corresponds to a request for a vehicle current distance D **405** or, optionally, current running time T **406.** Such user input may for instance be provided as the selection a particular vehicle or a criteria-based selection thereof in the database or even with selecting a 'refresh' query instructing the application to poll every vehicle referenced therein, in the absence of any module-initiated broadcast.

[0052] If the question of step **908** is answered positively, the application loaded at step **903** polls one or a plurality of modules **102** for broadcasting back said requested data at step **909,** as previously described in steps **508, 511** of Figure 5, according to whether said user has selected one vehicle **101** or a plurality of vehicles **101,115**. In the embodiment, said application broadcasts said poll command sequentially for each vehicle if many were chosen, whereby a question is asked after each poll at step **910,** as to whether another poll remains to be performed. If the question of step **910** is answered positively, control returns to step **909** whereby the next poll command is performed. Alternatively, question **910** is eventually answered negatively, whereby control returns to step **905.** If the question of step **908** is answered negatively, however, control proceeds to step **911,** wherein the application of step **903** processes database data according to user input and outputs said processed data to VDU **802.** Such user input may for instance be provided as the initialising of a new database vehicle record when a new vehicle is sold, the selection of a 'forecast' query instructing the application to select every vehicle referenced in the database, the respective distance D **405** and/or threshold Dα of which matches forecasting parameters or, in accordance with the above description, the selection of a vehicle user notification command.

[0053] A question is therefore asked at step **912,** as to whether said user input is a user notification command. If question **912** is answered affirmatively, control proceeds to step **909** such that a broadcast may be sent to said user, with retrieving said user contact details in said database and calling upon modem **811** to send a SMS text message requesting the arrangement of vehicle maintenance. In an alternative embodiment of the present invention, the application of step **903** is configured to send an electronic mail message to the electronic mail address of said user over the Internet, which is preferably also stored in said database. Alternatively, question **912** is answered negatively, whereby a final question is asked at step **913,** as to whether said user input is an application close command. If the question of step **913** is answered negatively, control returns to step **905,** whereby the next database update may then take place upon receiving another broadcast. Alternatively, the question of step **913** is answered positively and the application is closed and unloaded from memory **809** at step **914.** Terminal **104** may thus be eventually switched off at step **915.** It will be understood by those skilled in the art that the above-described types of user input are provided by way of example only and are not limited thereto.

[0054] The contents of the memory **809** of terminal **104** are shown in Figure 10 further to carrying out the database loading step **904** and whilst application closing step **914** is not selected, i.e. at application run time. Memory **809** first contains an operating system **1001** as loaded according to step **902,** embodying the set of basic CPU instructions previously described in Figure 9. Memory **809** next contains a communications manager **1002** also loaded according to step **902,** embodying the set of CPU instructions required to call upon the functionality of modem **811** and emit and receive network data. Memory **809** also contains an application **1003** as loaded according to step **903,** embodying the set of CPU instructions according to which data broadcast by module **102** and referenced in database **1004** is processed. In a particular embodiment of the present invention, application **1003** is known as AutoCall© and manufactured and distributed by the present Assignee. Said data received from any module **102** at step **905** is shown at **1005** as incoming SMS text messages and at **1006** as parsed runtime data, which is the data extracted from message **1005** by application **1003** with which it updates database **1004** at step **906.** Database data processed according to the user input of steps **908, 911,** for instance according to the processing parameters declared in the various database queries described in Figure 9, is shown at **1007.** Memory **809** also stores data broadcast by application **1003** as either module polls **1008** according to steps **908, 909,** outgoing SMS text messages **1009** to vehicle users according to steps **912, 909** and in an alternative embodiment, electronic mail **1010** to vehicle users.

[0055] An example of the database **1004** is described in Figure 11. Database **1004** is shown in a table form, which references and organises stored and received vehicle data in relation to the unique module ID **402** of each module **102.** Each of the plurality of vehicles **115** respectively configured with modules **102** is thus referenced in database **1004** as an individual record with a unique identifier in the [vehicle_ID] column **1101,** in the example identifiers **402, 1102, 1103** and **1104.** In order to facilitate the various aspects of vehicle maintenance, which may vary according to the make, model and usage history of any vehicle, it is preferable for database **1004** to reference said make, model, cumulative distance D **405,** maintenance threshold distance Dα **403** and vehicle owner contact details in respective columns [make] **1105,** [model] **1106,** [cumul_ dist] **1107,** [threshold_dist] **1108** and [contact] **1109.** In an alternative embodiment, database **1004** also references cumulative running time T **406** and maintenance threshold time Tα **404** in respective columns [cumul_ time] **1110** and [threshold_time] **1111.** Preferably, stored distance data and optional time data is formatted in respective columns **1107, 1108** and **1110, 1111** according to the format in which said data is stored and broadcast by module **102**.

[0056] The graphical user interface (GUI) of application **1003** is shown in Figure 12 upon completing the database loading step **904** of Figure 9. GUI **1201** is output to VDU **802** by CPU **808** outputting data to video adapter **814.** GUI **1201** first includes a device pointer **1202** having two-dimensional (x,y) screen co-ordinates, which the user of terminal **104** may translate by imparting a two-dimensional (x,y) motion to mouse **804,** whereby said two-dimensional (x,y) motion input data is routed by OS **1001** to application **1003** for processing and then updating said screen co-ordinates if required. GUI **1202** is preferably subdivided into a variety of user-selectable menu commands, for instance on-screen graphical representations of the various queries described in Figure 9. Upon said user translating pointer **1202** over any of said menu commands and providing an interrupt, such as with effecting a mouse button click or a key stroke, application **1003** processes motion input data, correlates the position of said pointer with on-screen menu command positions, then processes database data according to the parameters of the selected query. In the example, a non-exhaustive variety of processing functions provided of application **1003** are represented in GUI **1201** as user-selectable menu commands 'Add Car' **1203,** 'Query Car' **1204,** 'Query All Cars' **1205,** Forecast' **1206** and Notify' **1207.** Processed data is thus output to VDU **802** according to step **911.**

[0057] The database updating step **906** is further detailed in Figure 13. At step **1301,** application **1003** parses an incoming broadcast **1005** to generate runtime data **1006,** which it may process. The received unique ID **402** of the emitting module **102,** cumulative distance D **405** and threshold distance Dα **403** are thus read and, optionally, the cumulative running time T **406** and the threshold distance Tα **404** are also read or read instead.

[0058] At the next step **1302,** application **1003** matches the unique ID **402** of the emitting module **102** to its corresponding database record with looking up the [vehicle_ID] column **1101.** Upon establishing said match, a first question is asked at step **1303,** as to whether the value of the received cumulative distance **D 405** exceeds the corresponding value stored in the column [cumul_dist] **1107.** If the question of step **1303** is answered positively, application **1003** replaces the value stored in the column [cumul_ dist] **1107** with the value of said received cumulative distance D **405** at step **1304,** such that the record of the vehicle in the database is updated. Alternatively, the question of step **1303** is answered negatively, whereby a second question is asked at step **1305** as to whether the value of the received threshold distance Dα **403** exceeds the corresponding value stored in the column [threshold_dist] **1108.** If the question of step **1305** is answered positively, application **1003** replaces the value stored in the column [threshold_dist] **1108** with the value of said received threshold distance Dα **403** at step **1306,** such that the record of the vehicle in the database is updated. For instance, question **1305** is answered positively after a vehicle has been maintained and a new Dα value has been input at step **308,** thus avoiding the need for double data entry and the inherent risk of discrepancy between then two entries. Alternatively, the question of step 1305 is answered negatively whereby, in an alternative embodiment, a third question is asked at step **1307** as to whether the value of the received cumulative running time T **406** exceeds the corresponding value stored in the column [cumul_ time] **1110.** If the question of step **1307** is answered positively, application **1003** replaces the value stored in the column [cumul_ time] **1110** with the value of said received cumulative running time T **406** at step **1308,** such that the record of the vehicle in the database is updated. Alternatively, the question of step **1307** is answered negatively, whereby a fourth question is asked at step 1309 as to whether the value of the received maintenance threshold time Tα **404** exceeds the corresponding value stored in the column [threshold_time] **1111.** If the question of step **1305** is answered positively, application **1003** replaces the value stored in the column [threshold_time] **1111** with the value of said received threshold running time Tα **404** at step **1310,** such that the record of the vehicle in the database is updated. Again, question **1309** is answered positively after a vehicle has been maintained and a new Tα value has been input at step **309.** Upon completing the above data updating, application **1003** generates a database record form at step **1311,** which it populates with all or a relevant portion of the data relating to the matched unique ID **402** of the emitting module **102** and subsequently outputs to VDU **802** at the next step **1312,** an example of which is described further below.

[0059] The database data processing step **911** is further detailed in Figure 14. At step **1401,** a first question is asked as to whether the user input identifies a command to create a new record, such as when a new vehicle is sold. If the question of step **1401** is answered positively, application **1003** increments the database record count, wherein a new unique ID **402** is generated in the [vehicle_ID] column **1101** and keyboard input is read in order to update columns [make] **1105,** [model] **1106,** [threshold_dist] **1108** and [contact] **1109** at step **1402.** In an alternative embodiment, keyboard input is read in order to update column [threshold_time] **1111.** It is preferable for the user not to be allowed to input data to be referenced in columns [cumul_dist] **1107** and [cumul_time] **1110,** as such data should only be generated by module **102** to circumvent any form of odometer tampering. According to the present invention, correlation between distance data broadcast by module **102** stored in database **1004** and actual odometer value in vehicle **101** is not required, as trials of the preferred embodiment have shown the error to be normally not greater than **1.52%,** thus wherein module **102-generated** distance data is in the order of **1.52%** less than vehicle odometer data, i.e. **152** miles in every **10,000** miles, which is trivial. Control subsequently proceeds to step **912.**

[0060] Alternatively, the question of step **1401** is answered negatively, whereby a second question is asked at step **1403,** as to whether the user input identifies a command to process database data to retrieve records according to parameters, such as when a forecast database query is selected. If the question of step **1403** is answered positively, application **1003** processes said database data according to said parameters. In the example, application **1003** returns database records where the difference between cumulative distance D **405** and maintenance threshold distance Dα **403** represents a percent or less of said maintenance threshold distance Dα **403,** i.e. when a vehicle will shortly require maintenance. It will be understood by those skilled in the art that this example is not limitative and may indeed be extended to the alternative running time-based embodiment herein described, or to many more parameters and/or subdivisions and/or combinations thereof. Again, control proceeds to step **912.**

[0061] Alternatively, the question of step **1403** is answered negatively, whereby a third question is asked at step **1405,** as to whether the user input identifies a command to notify a vehicle user that vehicle maintenance is required. If the question of step **1405** is answered negatively, user input is ignored and control again proceeds to step **912.** Alternatively, the question of step **1405** is answered positively, whereby application **1003** processes said database data according to said parameters at step **1406.** In the example, application **1003** looks up the [vehicle_ID] **1101** value of the user-selected database record and generates a message, preferably filling a pre-existing template with corresponding record data read from columns [make] **1105,** [model] **1106,** [cumul_dist] **1107** and [threshold_dist] **1108.** Application **1003** then provides the data stored in the corresponding column [contact] **1109** to the communications manager **1002** with a command to broadcast the message according to steps **909, 910** at step **1407,** whereby control proceeds to step **912.**

[0062] The graphical user interface **1201** of application **1003** is shown in Figure 15 upon performing either of the processing steps **906, 911.** In the example, the user of terminal **104** calls application **1003** to process database data according to a forecast query as described at steps **1403, 1404** with translating pointer **1202** over menu command **1206** and effecting a mouse click. Application **1003** thus processes database data according to step **911,** whereby results are output to VDU **802** in GUI **1201** as a table **1501** of matching records. Each of said matching records is uniquely identified by its unique ID **402, 1102, 1104** in column [vehicle_ID] **1101.** Moreover, the respective, relevant maintenance data of each of said matching records is output in columns [cumul_ dist] **1107** and [threshold_dist] **1108,** such that the user of terminal **104** may prioritise vehicle user notification according to the variation between said cumulative and maintenance distances, if required. Application **1003** preferably outputs said table **1501** with a user-selectable Notify' menu command **1502** for each matching record, whereby the user of terminal **104** may translate device pointer **1202** over any such menu command **1502** and provide an interrupt as previously described, in order to answer the question of step **1405** positively. In the example the module **102** having a unique device ID **1103** in column [vehicle_ID] **1101** broadcasts an update to terminal **104** according to step **511,** for instance having met the distance comparison condition asked at question **604.** Accordingly, application **1003** receives and processes said update according to steps **905, 906,** whereby a database record form is generated at step **1311,** populated with the unique ID **1103** of the emitting module **102** in column [vehicle_ID] **1101** and maintenance data of the vehicle in columns [cumul_ dist] **1107** and [threshold_dist] **1108.** Said form is subsequently output as form **1503** within GUI **1201** to VDU 802 at the next step **1312.** Preferably, said form is a pop-up form or window (if OS **1001** supports multiple windowed tasks) to focus the attention of the terminal user upon the event. Preferably still, application **1003** configures form **1503** with user-selectable 'Notify' menu commands **1504** and 'Cancel' **1505,** whereby the user of terminal **104** may translate device pointer **1202** over menu command **1504** and provide an interrupt as previously described, in order to answer the question of step **1405** positively. In the example, the user translates device pointer **1202** over menu command **1505** and provides an interrupt as previously described in order to answer the question of step **1405** negatively, as the vehicle does not yet require maintenance.

[0063] It will be appreciated that the operation of the invention is not limited to GPS systems, other positioning systems can be used, for example GNSS and Galileo are systems which can be used to implement the present invention. Furthermore the invention can be carried out using any self locating system, for example technology used in Mobile phone telecommunication technology. Additionally the invention should not be limited to vehicles per se as the invention can be incorporate into mobile machinery or equipment which require maintenance.

[0064] It will also be appreciated that some aspects of the present invention can be used to assist in customer retention, mileage certification for use in example determining business miles travelled, insurance purposes, NCT or MOT testing purposes. The data gathered can be used for forecasting when a parts replacement is due in a vehicle.

[0065] The words "comprises/comprising" and the words "having/including" when used herein with reference to the present invention are used to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

[0066] The embodiments in the invention described with reference to the drawings may comprise a computer apparatus and/or processes performed in a computer apparatus. However, the invention also extends to computer programs, particularly computer programs stored on or in a carrier adapted to bring the invention into practice. The program may be in the form of source code, object code, or a code intermediate source and object code, such as in partially compiled form or in any other form suitable for use in the implementation of the method according to the invention. The carrier may comprise a storage medium such as ROM, e.g. CD ROM, or magnetic recording medium, e.g. a floppy disk or hard disk. The carrier may be an electrical or optical signal which may be transmitted via an electrical or an optical cable or by radio or other means.

[0067] The invention is not limited to the embodiments hereinbefore described but may be varied in both construction and detail.

Claims

1. A system for distributing vehicle maintenance data, comprising at least one module configured with self-locating means, local processing means, memory means and communicating means for attachment to a vehicle and remote processing means configured with communication means, wherein
   said self-locating means acquires vehicle location data at time intervals;
   said memory means stores instructions, threshold data and said acquired data;
   said local processing means is configured by said instructions to process said acquired data into cumulative data and compare said cumulative data to said threshold data according to comparison pa-

rameters; whereby
upon said data comparison returning a match, said local processing means instructs said communication means to broadcast said cumulative data to said communication means of said remote processing means.

2. A system according to claim 1, wherein said threshold data and cumulative data is a distance, which may be expressed in any unit of measure such as imperial miles or metric kilometers or sub-divisions thereof.

3. A system according to claim 2, wherein said module is further configured with sensor means for determining whether a vehicle engine is powered up or down, said threshold data and cumulative data also include engine running time, which may be expressed in any unit of measure of time such as a combination of days, hours and minutes.

4. A system according to any of claims 1 to 3, wherein said local processing means is further configured by said instructions to receive and process read requests from said remote processing means, whereby upon receiving a cumulative data read request from said remote processing means, said local processing means instructs said communication means to broadcast said cumulative data to said communication means of said remote processing means.

5. A system according to any of claims 1 to 4, wherein said self-locating means is a Global Positioning Apparatus device receiving time and location data from orbiting satellites.

6. A system according to any of claims 1 to 5, wherein said communication means is a modem configured to exchange data packets over a wireless network, for instance configured according to the Global System for Mobile Communications ('GSM') or General Packet Radio Service ('GPRS') network industry standards.

7. A system according to claim 6, wherein said cumulative data and read request are respectively communicated as text messages using Short Message Service ('SMS') protocol over said wireless network.

8. A system according to claim 7, wherein said remote processing means parse said text messages and store cumulative data therein in a database.

9. A system according to claim 8, wherein said remote processing means is located at one or a plurality of vehicle maintenance providers.

10. A system according to claim 9, wherein said threshold data is updated when said vehicle is maintained by any of said vehicle maintenance providers.

11. A method of distributing vehicle maintenance data, said method comprising the steps of
acquiring vehicle location data at time intervals with self-locating means in at least one module configured with self-locating means, local processing means, memory means and communicating means attached to a vehicle;
storing instructions, threshold data and said acquired data in said memory means;
configuring said processing means with said instructions to process said acquired data into cumulative data;
comparing said cumulative data to said threshold data according to comparison parameters; and
upon said data comparison returning a match, instructing said communication means to broadcast said cumulative data to communicating means of remote processing means.

12. A method according to claim 11, wherein said threshold data and cumulative data is a distance, which may be expressed in any unit of measure such as imperial miles or metric kilometers or subdivisions thereof.

13. A method according to claim 12, wherein said module is further configured with sensor means and said method includes the further step of determining whether a vehicle engine is powered up or down, whereby said threshold data and cumulative data also include engine running time, which may be expressed in any unit of measure of time such as a combination of days, hours, minutes and seconds.

14. A method according to any of claims 11 to 13, wherein said method includes the further steps of receiving and processing read requests from said remote processing means, whereby upon receiving a cumulative data read request from said remote processing means, said cumulative data is broadcast to said communicating means of said remote processing means.

15. A method according to any of claims 11 to 14, wherein said self-locating means is a Global Positioning Method device receiving time and location data from orbiting satellites.

16. A method according to any of claims 11 to 15, wherein said communication means is a modem configured to exchange data packets over a wireless network, , for instance configured according to the Global System for Mobile Communications ('GSM) or General Packet Radio Service ('GPRS') network industry standards.

17. A method according to claim 16, wherein said cumulative data and read request are respectively communicated as text messages request are respectively communicated as text messages using Short Message Service ('SMS') protocol over said wireless network.

18. A method according to claim 17, wherein said method includes the further steps of parsing said text messages and storing cumulative data therein in a database at said remote processing means.

19. A method according to claim 18, wherein said remote processing means is located at one or a plurality of vehicle maintenance providers.

20. A method according to claim 19, wherein said method includes the further step of updating said threshold data when said vehicle is maintained by any of said vehicle maintenance providers.

21. A computer system programmed to execute stored instructions such that in response to said stored instructions said system is configured to:

acquire vehicle location data at time intervals from self-locating means;
store threshold data and said acquired data in memory means;
process said acquired data into cumulative data;
compare said cumulative data to said threshold data according to comparison parameters; and upon said data comparison returning a match, instruct communication means to broadcast said cumulative data to communicating means of a remote terminal.

22. A computer-readable memory system having a plurality of data fields stored therein representing a data structure, wherein said data structure includes vehicle location data at time intervals, cumulative data and threshold data and further having instructions configured to:

process said vehicle location data at time intervals into said cumulative data;
compare said cumulative data to said threshold data according to parameters; and
broadcast said cumulative data to a remote terminal upon said data comparison returning a match.

23. A module for attachment to a vehicle for distributing vehicle maintenance data, comprising self-locating means, local processing means, memory means and communicating means, wherein
said self-locating means acquires vehicle location data at time intervals;
said memory means stores instructions, threshold data and said acquired data;
said local processing means is configured by said instructions to process said acquired data into cumulative data and compare said cumulative data to said threshold data according to comparison parameters; whereby
upon said data comparison returning a match, said local processing means instructs said communication means to broadcast said cumulative data.

24. A kit of parts for distributing vehicle maintenance data, said parts including at least one module configured with self-locating means, local processing means, memory means and communicating means for attachment to a vehicle and remote processing means configured with communication means, wherein
said self-locating means acquires vehicle location data at time intervals;
said memory means stores instructions, threshold data and said acquired data;
said local processing means is configured by said instructions to process said acquired data into cumulative data and compare said cumulative data to said threshold data according to comparison parameters; whereby
upon said data comparison returning a match, said local processing means instructs said communication means to broadcast said cumulative data to said communication means of said remote processing means.

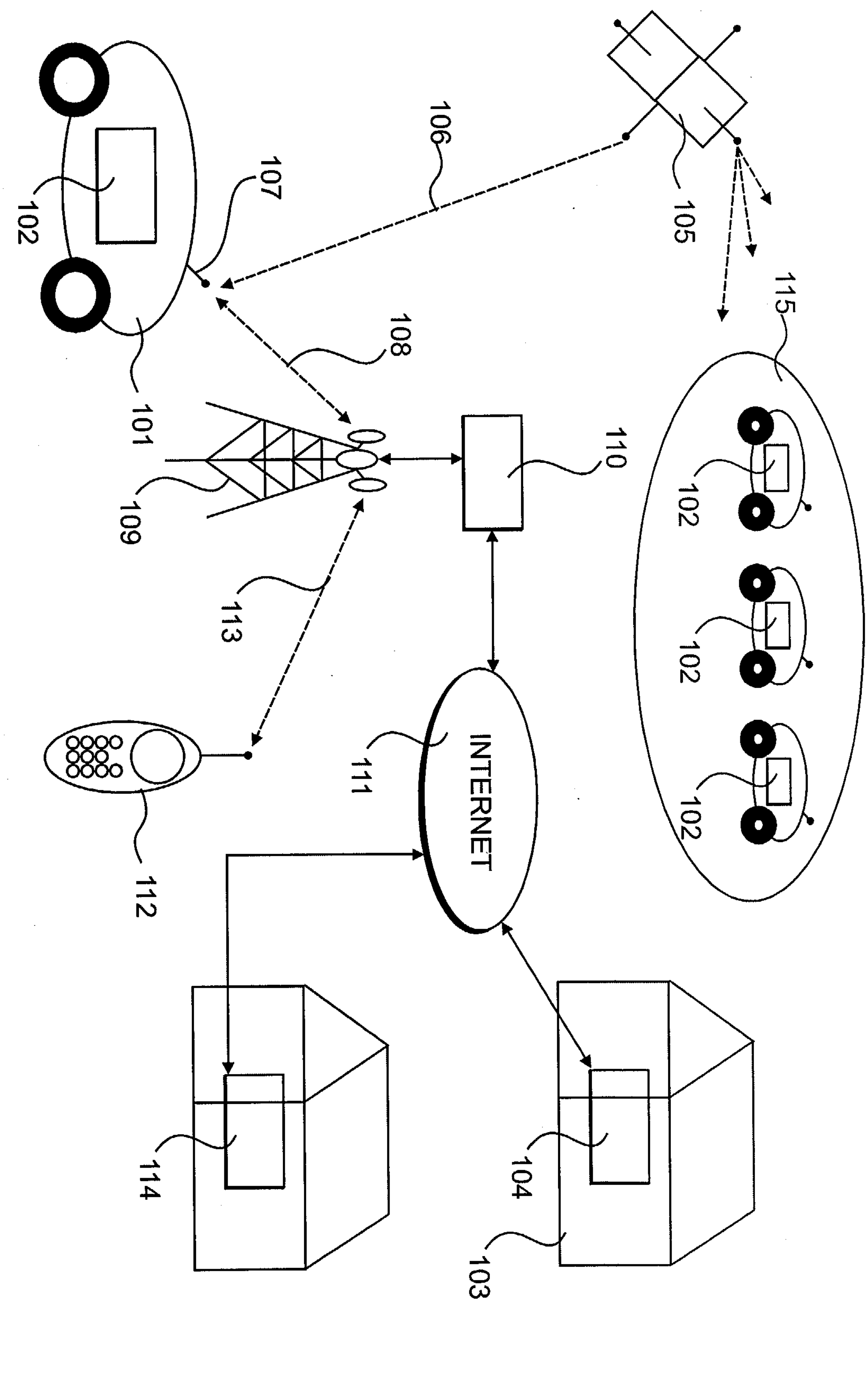
101
102
103
104
105
106
107
108
109
110
111
INTERNET
112
113
114
115

Figure 01

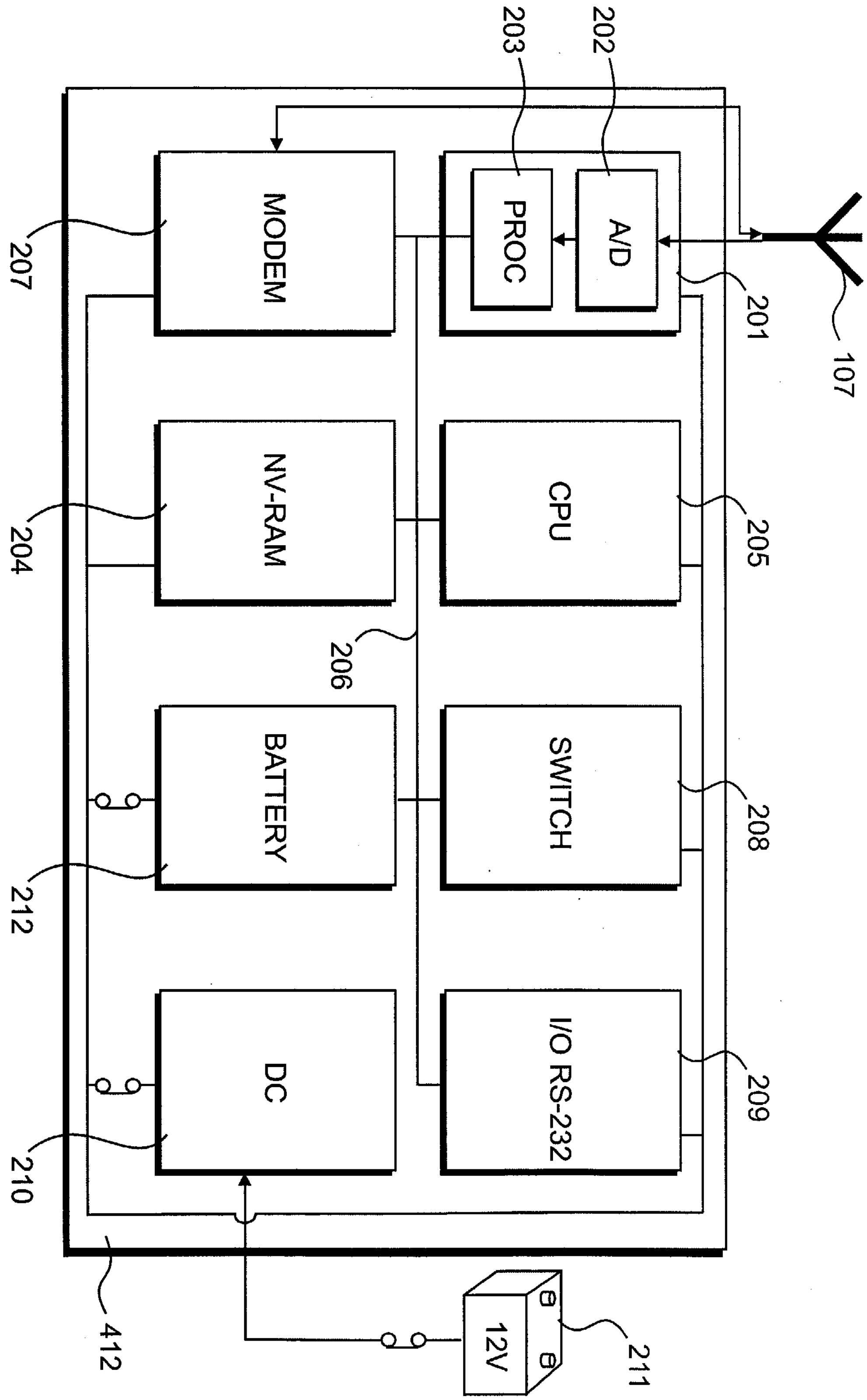
202
203
A/D
PROC
201
107
MODEM
207
NV-RAM
204
CPU
205
206
BATTERY
212
SWITCH
208
DC
210
I/O RS-232
209
412
12V
211

Figure 02

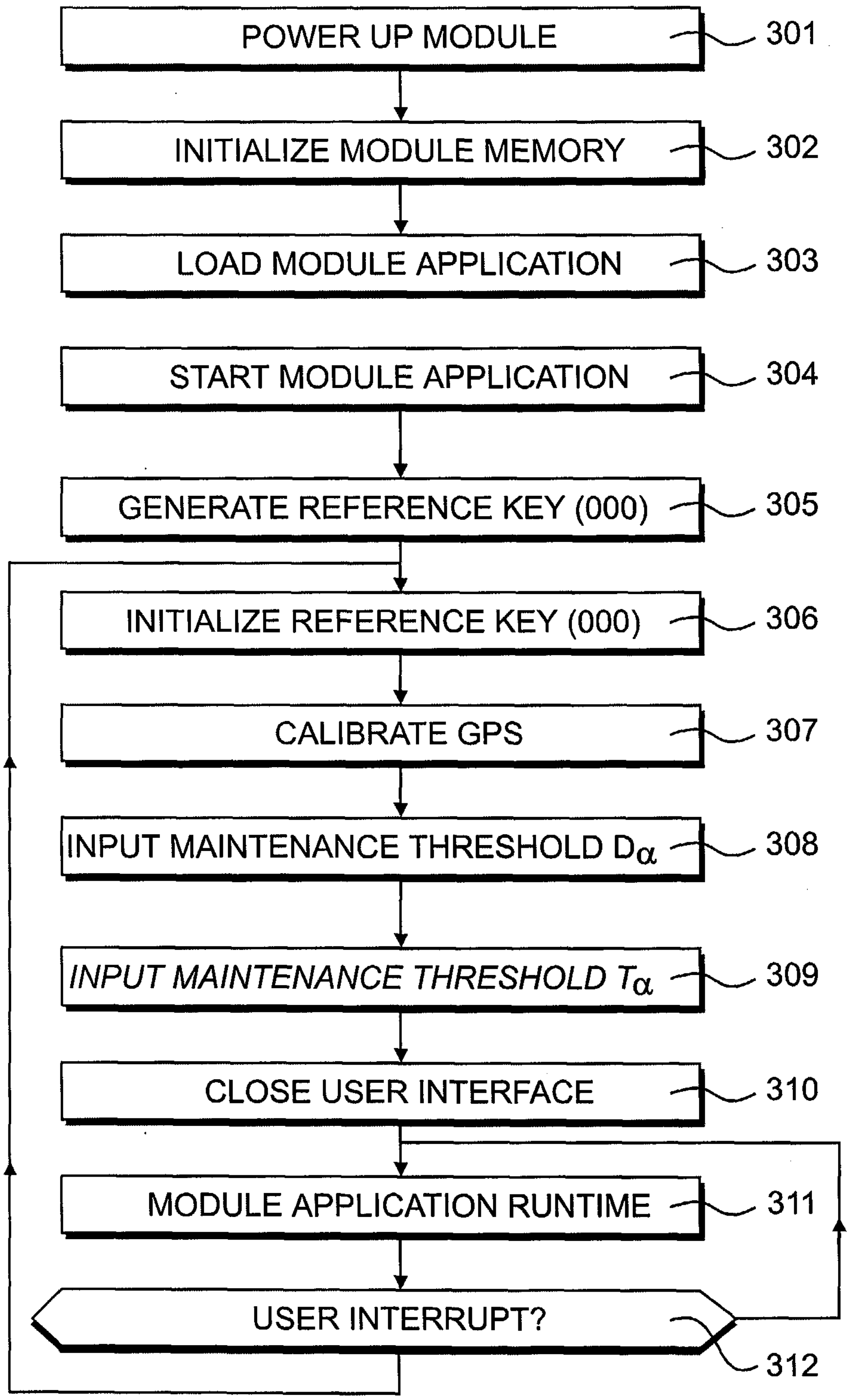
POWER UP MODULE
301
INITIALIZE MODULE MEMORY
302
LOAD MODULE APPLICATION
303
START MODULE APPLICATION
304
GENERATE REFERENCE KEY (000)
305
INITIALIZE REFERENCE KEY (000)
306
CALIBRATE GPS
307
INPUT MAINTENANCE THRESHOLD Dα
308
INPUT MAINTENANCE THRESHOLD Tα
309
CLOSE USER INTERFACE
310
MODULE APPLICATION RUNTIME
311
USER INTERRUPT?
312

Figure 03

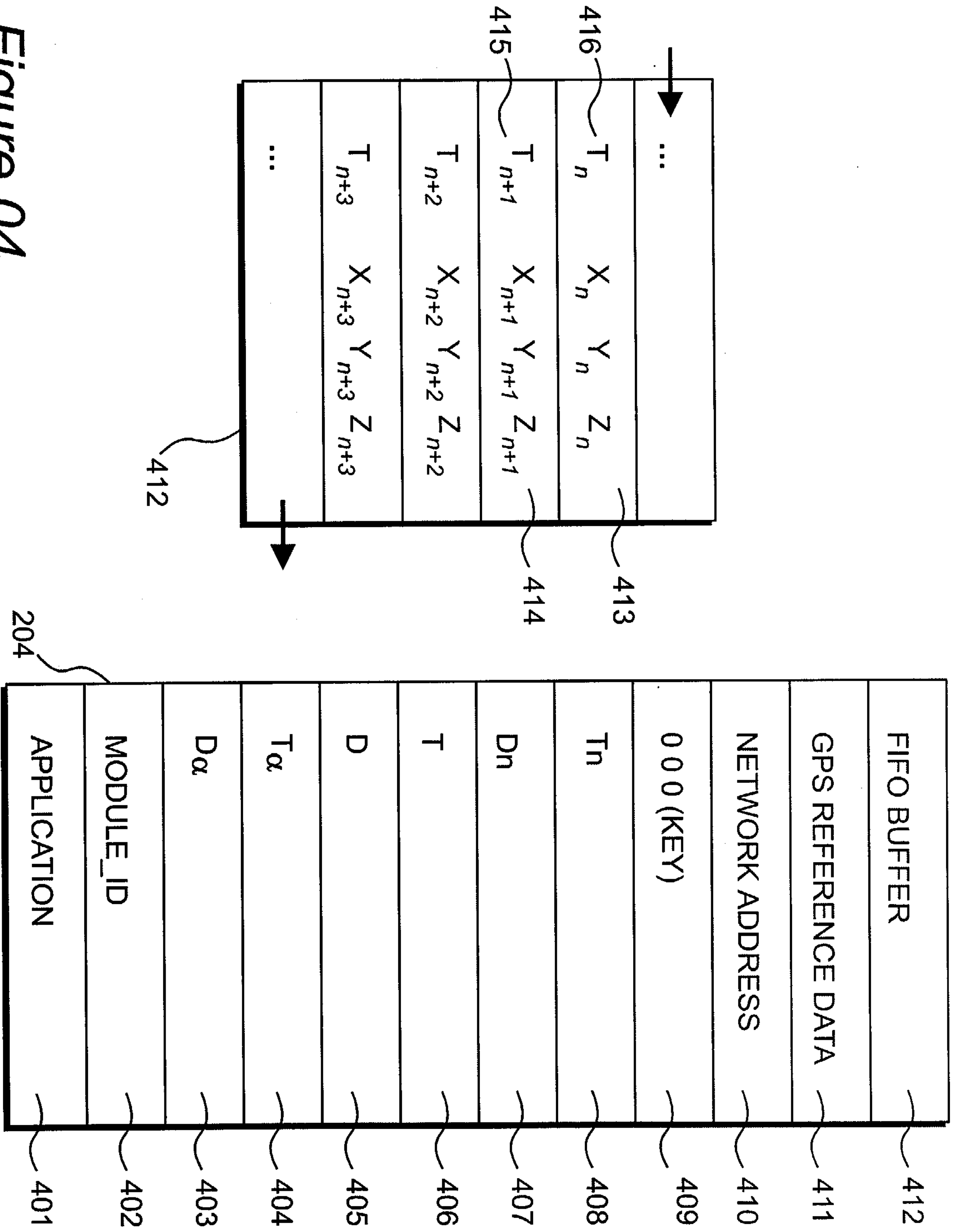
FIFO BUFFER
GPS REFERENCE DATA
NETWORK ADDRESS
0 0 0 (KEY)
Tn
Dn
T
D
Tα
Dα
MODULE_ID
APPLICATION
204
401
402
403
404
405
406
407
408
409
410
411
412
...
T_n X_n Y_n Z_n
T_{n+1} X_{n+1} Y_{n+1} Z_{n+1}
T_{n+2} X_{n+2} Y_{n+2} Z_{n+2}
T_{n+3} X_{n+3} Y_{n+3} Z_{n+3}
...
416
415
413
414
412

Figure 04

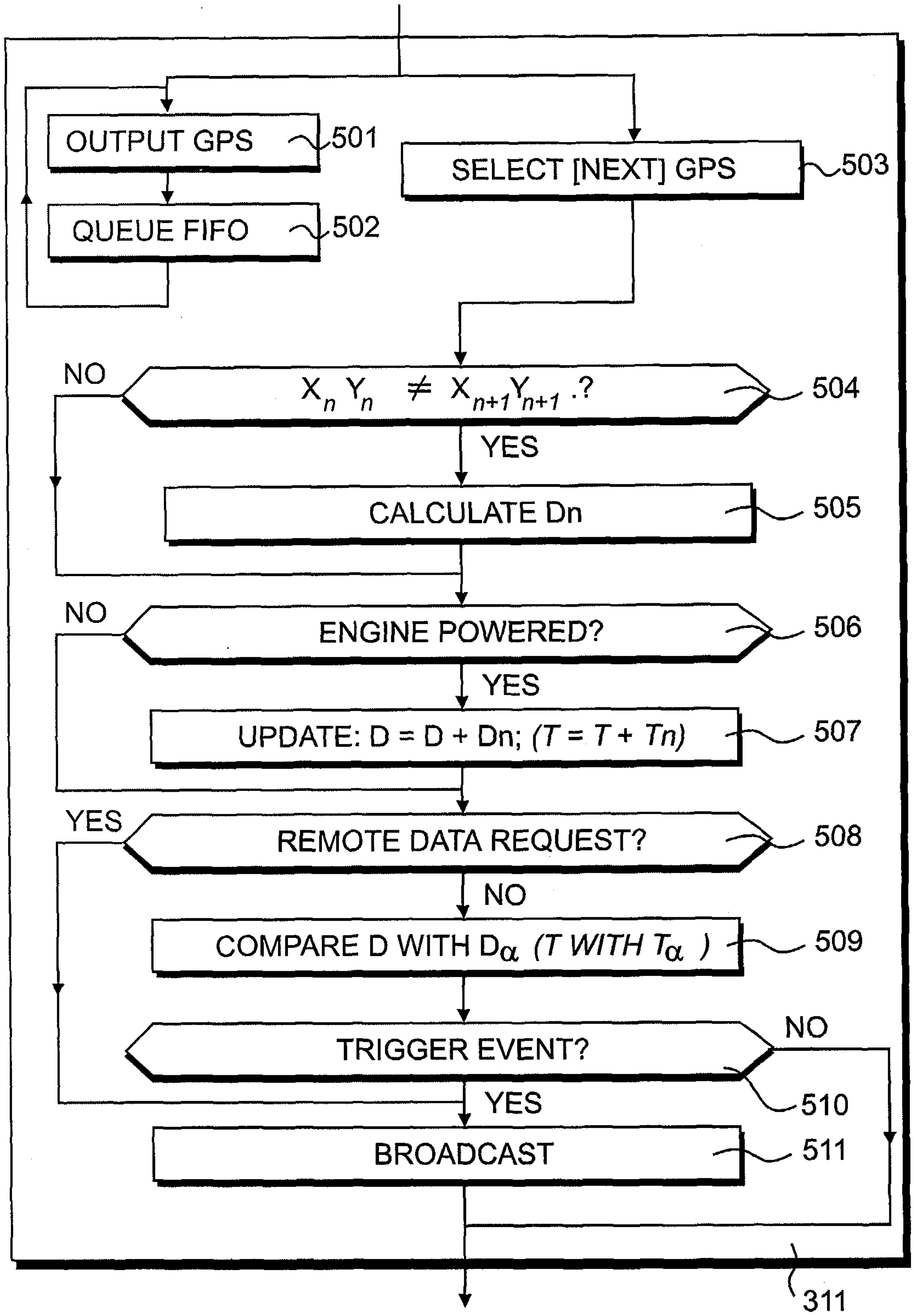
OUTPUT GPS
501
QUEUE FIFO
502
SELECT [NEXT] GPS
503
NO
$X_n Y_n \neq X_{n+1} Y_{n+1}$.?
504
YES
CALCULATE Dn
505
NO
ENGINE POWERED?
506
YES
UPDATE: D = D + Dn; (T = T + Tn)
507
YES
REMOTE DATA REQUEST?
508
NO
COMPARE D WITH Dα (T WITH Tα)
509
NO
TRIGGER EVENT?
510
YES
BROADCAST
511
311

Figure 05

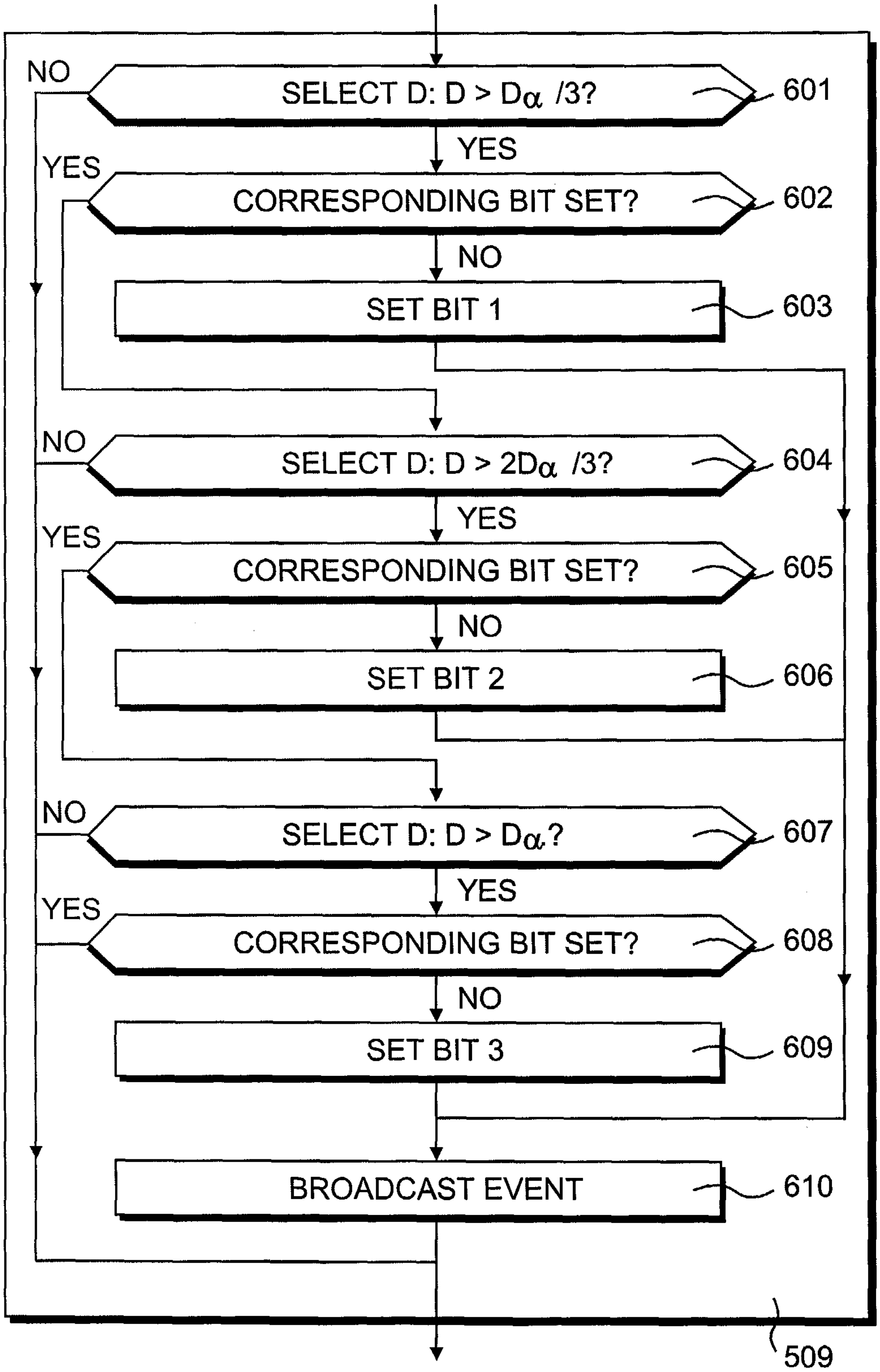
SELECT D: D > Dα /3?
601
NO
YES
CORRESPONDING BIT SET?
602
YES
NO
SET BIT 1
603
SELECT D: D > 2Dα /3?
604
NO
YES
CORRESPONDING BIT SET?
605
YES
NO
SET BIT 2
606
SELECT D: D > Dα?
607
NO
YES
CORRESPONDING BIT SET?
608
YES
NO
SET BIT 3
609
BROADCAST EVENT
610
509

Figure 06

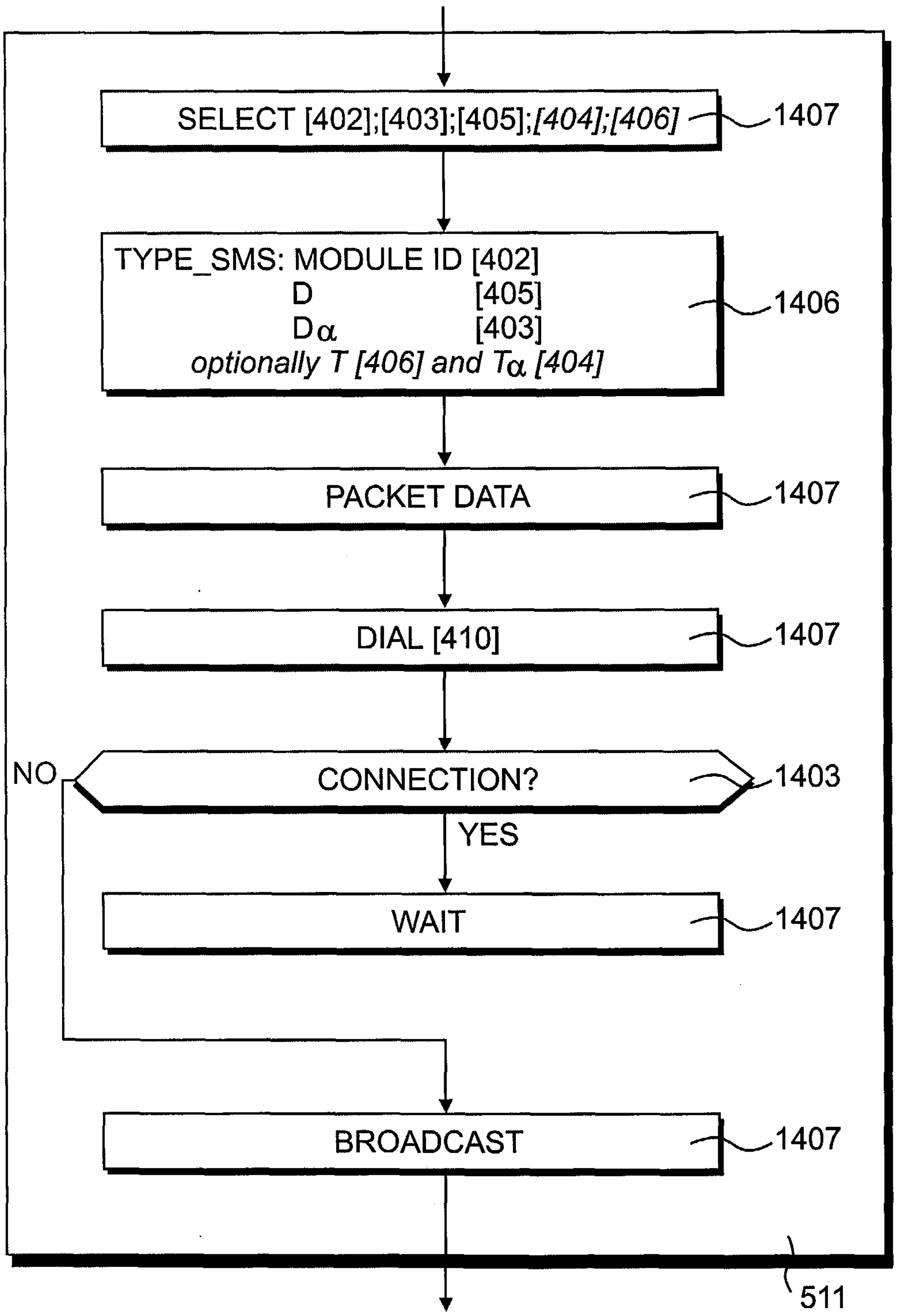
SELECT [402];[403];[405];[404];[406]
1407
TYPE_SMS: MODULE ID [402]
D [405]
Dα [403]
optionally T [406] and Tα [404]
1406
PACKET DATA
1407
DIAL [410]
1407
NO
CONNECTION?
1403
YES
WAIT
1407
BROADCAST
1407
511

Figure 07

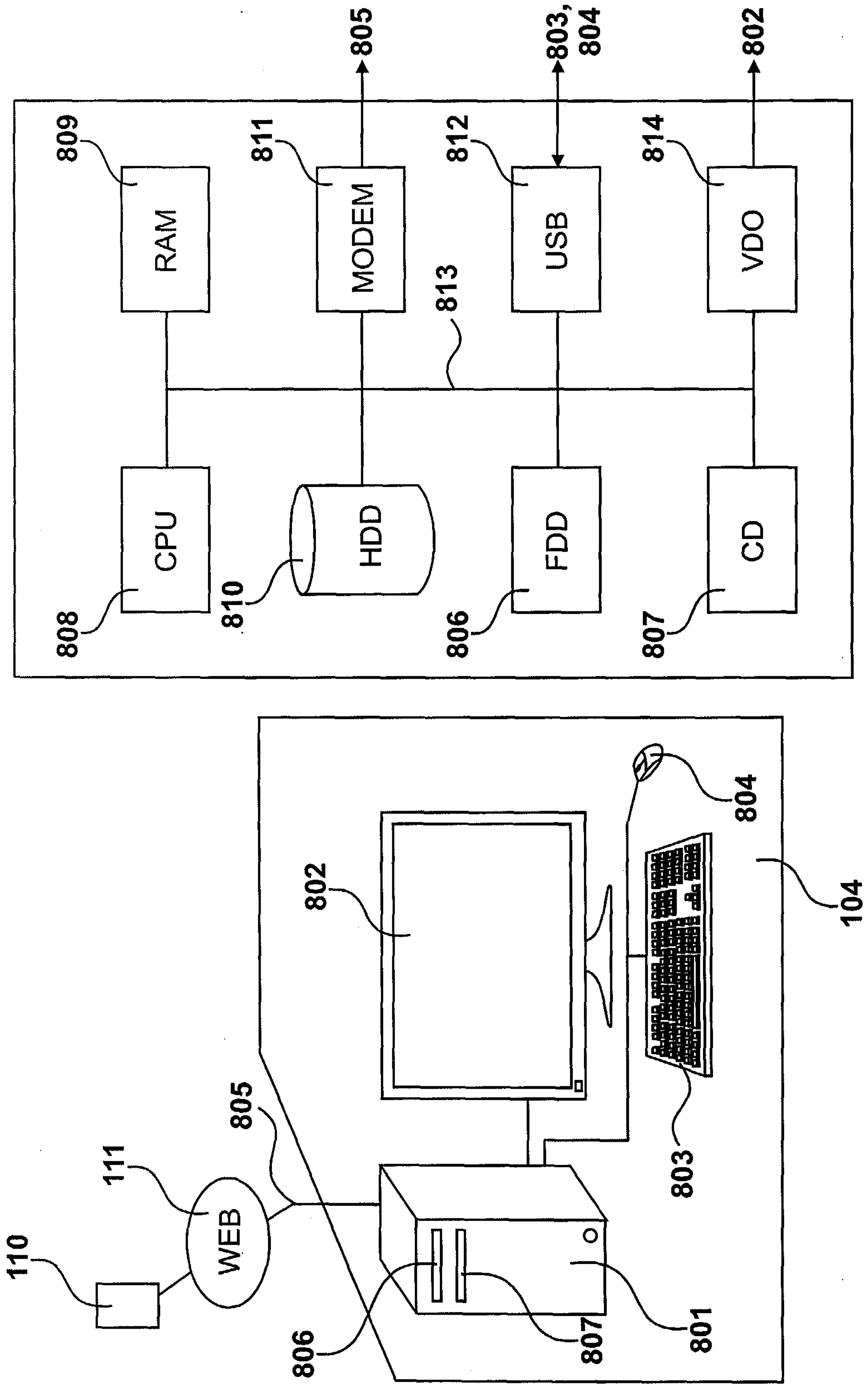
805
803,
804
802
809
811
812
814
RAM
MODEM
USB
VDO
813
CPU
HDD
FDD
CD
808
810
806
807
110
111
WEB
805
802
804
104
803
806
807
801

Figure 08

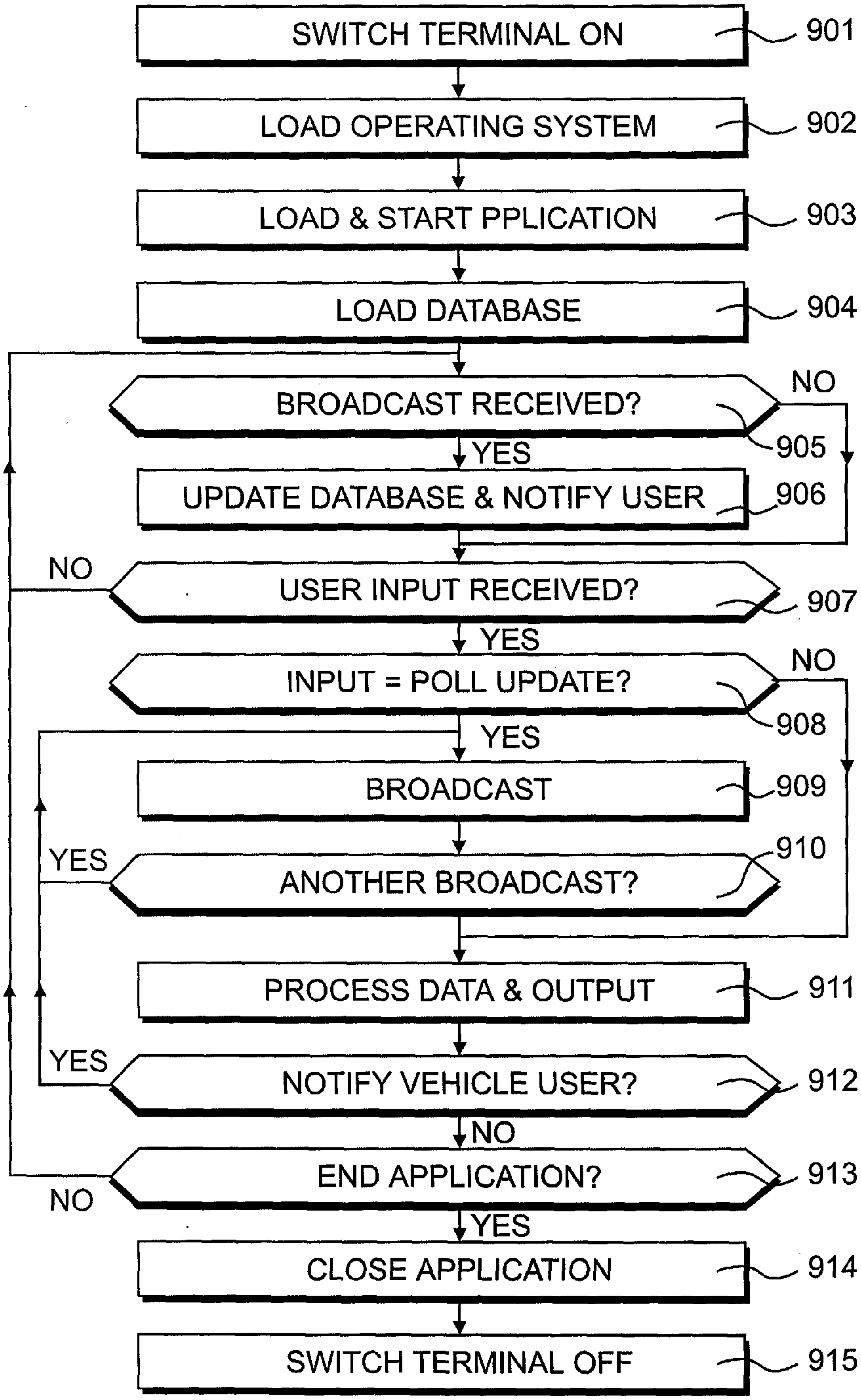
SWITCH TERMINAL ON
901
LOAD OPERATING SYSTEM
902
LOAD & START PPLICATION
903
LOAD DATABASE
904
BROADCAST RECEIVED?
NO
YES
905
UPDATE DATABASE & NOTIFY USER
906
NO
USER INPUT RECEIVED?
907
YES
INPUT = POLL UPDATE?
NO
908
YES
BROADCAST
909
910
YES
ANOTHER BROADCAST?
PROCESS DATA & OUTPUT
911
YES
NOTIFY VEHICLE USER?
912
NO
END APPLICATION?
913
NO
YES
CLOSE APPLICATION
914
SWITCH TERMINAL OFF
915

Figure 09

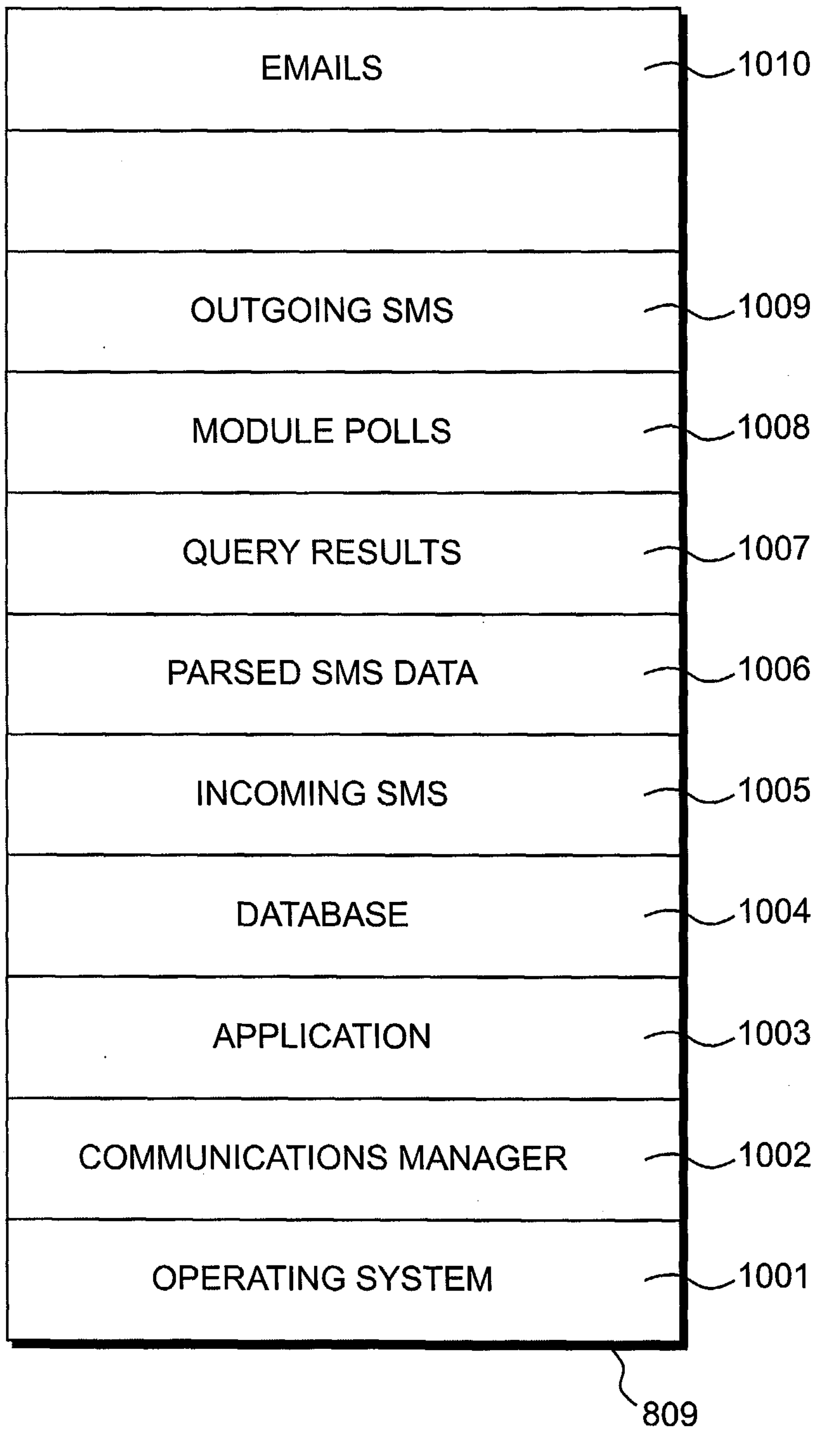
EMAILS
1010
OUTGOING SMS
1009
MODULE POLLS
1008
QUERY RESULTS
1007
PARSED SMS DATA
1006
INCOMING SMS
1005
DATABASE
1004
APPLICATION
1003
COMMUNICATIONS MANAGER
1002
OPERATING SYSTEM
1001
809

Figure 10

1101, 1105, 1106, 1107, 1108, 1109, 1110, 1111

vehicle ID	vehicle make	vehicle model	cumul dist	threshold dist	user contact	cumul time	threshold time
...							
0101	AUDI	A4 19TD	38,546	40,000	07919 123	200:05:57	250:00:00
1151	BMW	325 TDS	50,321	60,000	07919 234	269:23:21	350:00:00
1152	ROVER	75 2.5V6	2,789	3,000	07919 345	35:17:04	36:00:00
1153	MAZDA	626 2.0	17,001	26,000	07919 456	168:14:43	150:00:00
...							

402, 1102, 1103, 1104, 1004

Figure 11

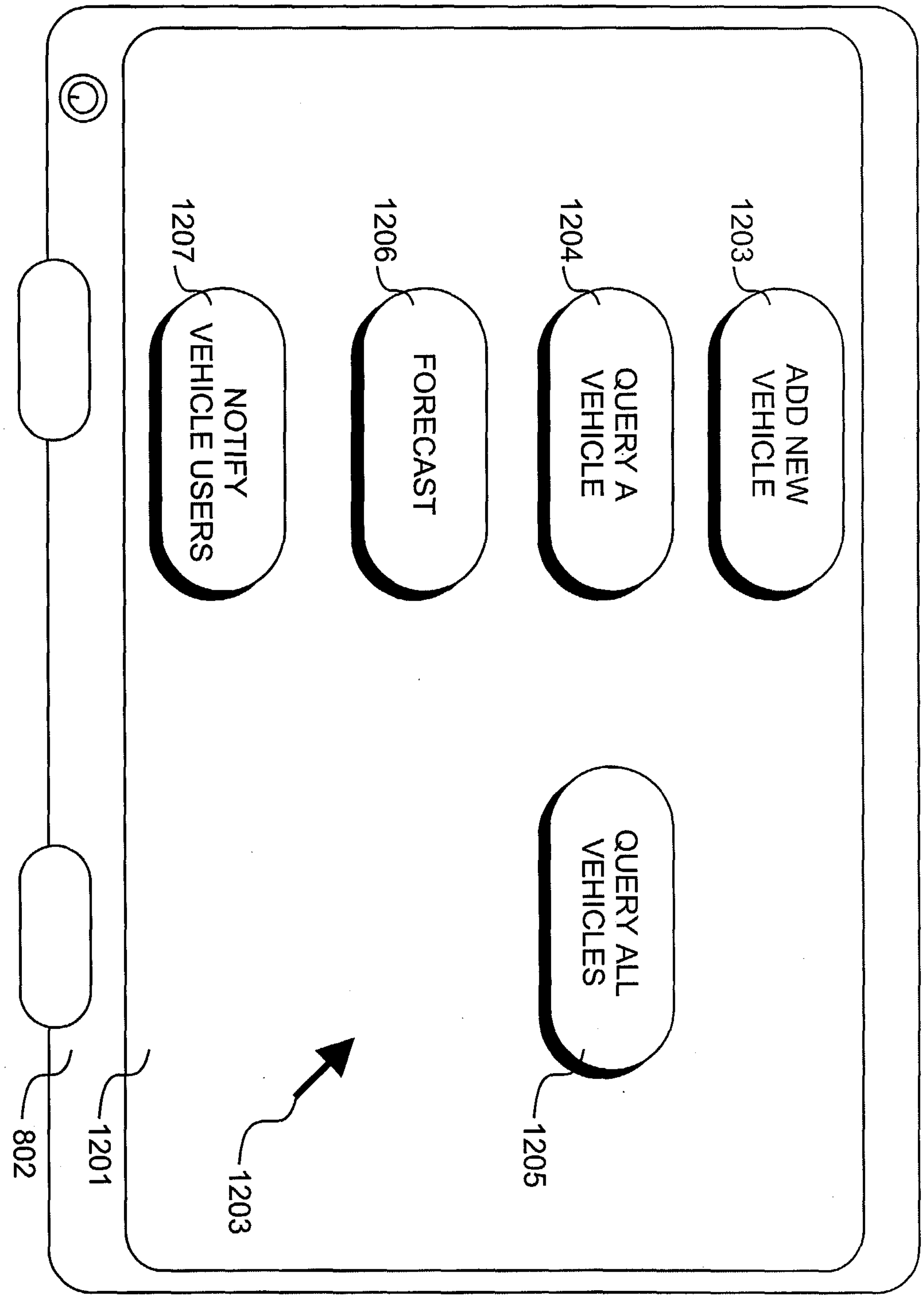
ADD NEW VEHICLE
QUERY A VEHICLE
FORECAST
NOTIFY VEHICLE USERS
QUERY ALL VEHICLES
1203
1204
1206
1207
1205
1203
1201
802

Figure 12

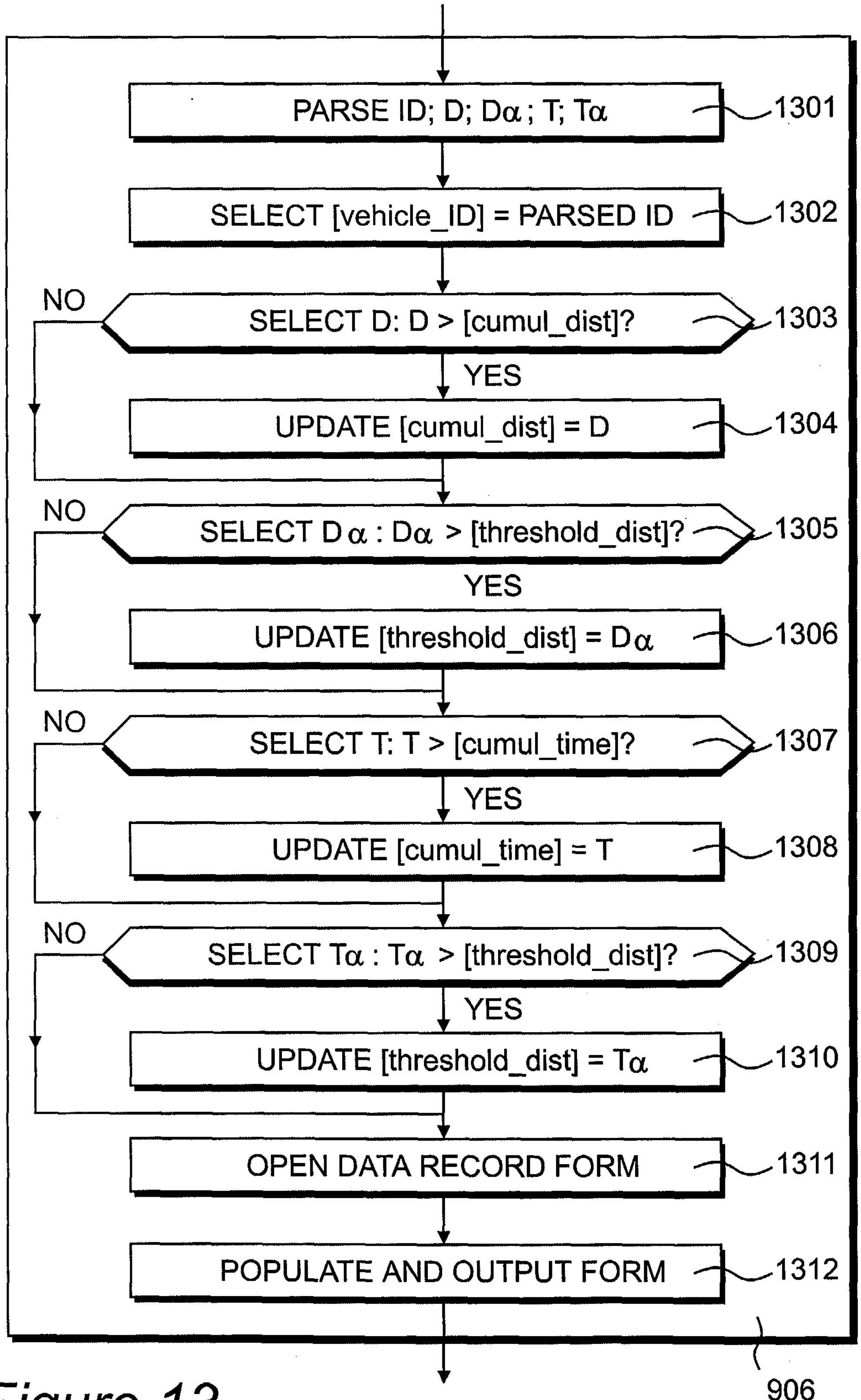
PARSE ID; D; Dα; T; Tα
1301
SELECT [vehicle_ID] = PARSED ID
1302
NO
SELECT D: D > [cumul_dist]?
1303
YES
UPDATE [cumul_dist] = D
1304
NO
SELECT Dα : Dα > [threshold_dist]?
1305
YES
UPDATE [threshold_dist] = Dα
1306
NO
SELECT T: T > [cumul_time]?
1307
YES
UPDATE [cumul_time] = T
1308
NO
SELECT Tα : Tα > [threshold_dist]?
1309
YES
UPDATE [threshold_dist] = Tα
1310
OPEN DATA RECORD FORM
1311
POPULATE AND OUTPUT FORM
1312
906

Figure 13

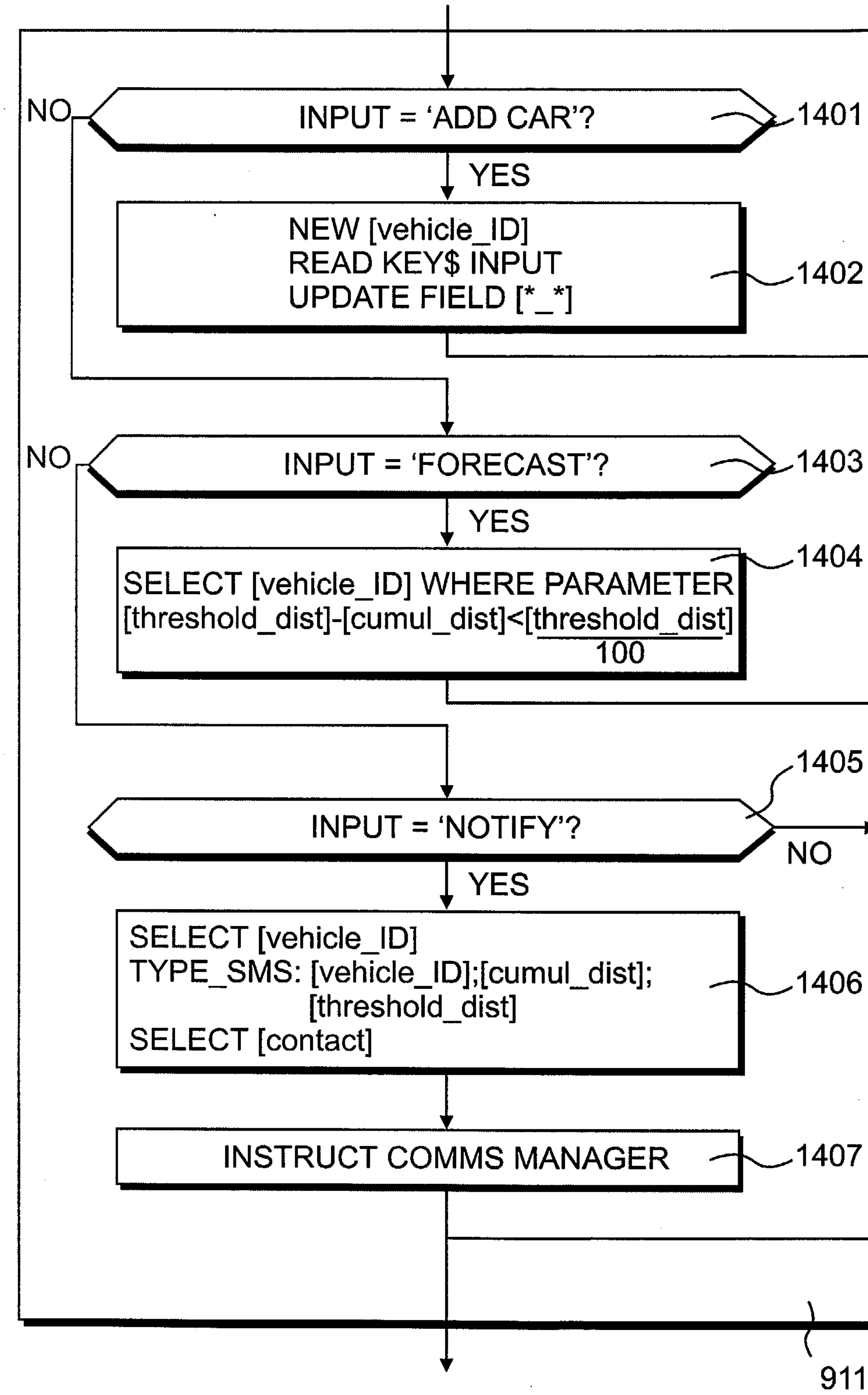
INPUT = 'ADD CAR'?
NO
YES
1401
NEW [vehicle_ID]
READ KEY$ INPUT
UPDATE FIELD [*_*]
1402
INPUT = 'FORECAST'?
NO
YES
1403
SELECT [vehicle_ID] WHERE PARAMETER
[threshold_dist]-[cumul_dist]<[threshold_dist]
100
1404
1405
INPUT = 'NOTIFY'?
NO
YES
SELECT [vehicle_ID]
TYPE_SMS: [vehicle_ID];[cumul_dist];
[threshold_dist]
SELECT [contact]
1406
INSTRUCT COMMS MANAGER
1407
911

Figure 14

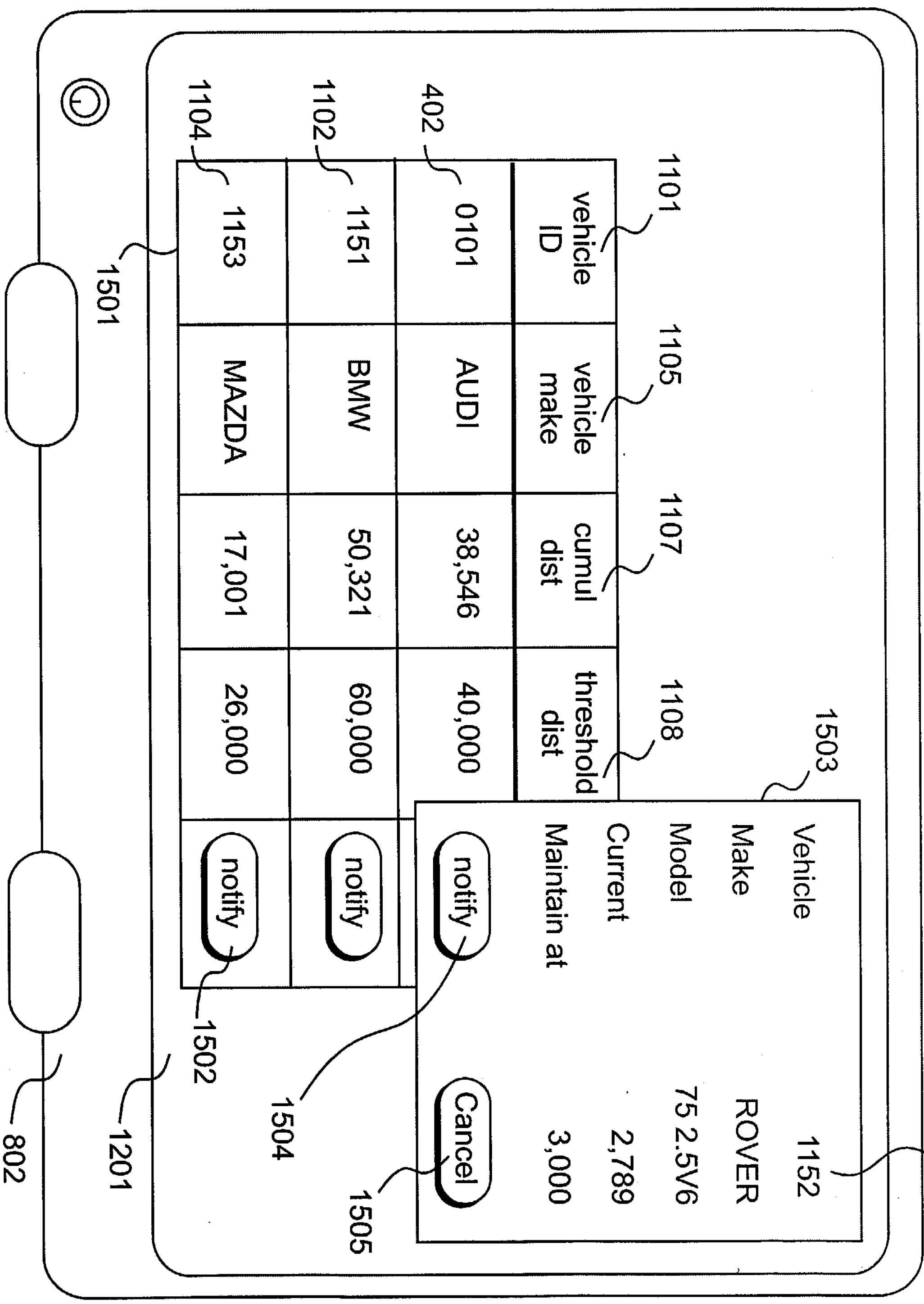
1101
1105
1107
1108
1503
1103
vehicle ID
vehicle make
cumul dist
threshold dist
402
0101
AUDI
38,546
40,000
notify
1102
1151
BMW
50,321
60,000
notify
1104
1153
MAZDA
17,001
26,000
notify
Vehicle
Make
Model
Current
Maintain at
1152
ROVER
75 2.5V6
2,789
3,000
Cancel
1501
1502
1504
1505
1201
802

Figure 15

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 07 5805

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y A	US 6 404 329 B1 (HSU CHANG-SHOU) 11 June 2002 (2002-06-11) * abstract * * column 2, line 65 - column 3, line 40 * * column 4, line 5 - line 11 * * figures 1a,1b * -----	1,11, 21-24 2-10, 12-20	G07C5/00
Y A	DE 100 18 942 A1 (CARGOCOM GMBH) 18 October 2001 (2001-10-18) * abstract * * column 1, line 36 - line 39 * * paragraphs [0006], [0013], [0018] * -----	1,11, 21-24 2-10, 12-20	
A	US 2002/173885 A1 (LOWREY LARKIN HILL ET AL) 21 November 2002 (2002-11-21) * abstract * * claim 1; figures 2-4,7 * * paragraphs [0007], [0012], [0016] * * paragraphs [0030], [0031], [0033] * * paragraphs [0034] - [0036] * * paragraphs [0038], [0039], [0048] * -----	1-24	TECHNICAL FIELDS SEARCHED (Int.Cl.7) G07C
A	US 6 370 454 B1 (MOORE JAMES T) 9 April 2002 (2002-04-09) * abstract * * column 2, line 25 - line 33 * * column 5, line 57 - column 6, line 54 * * column 2, line 52 - line 62 * * column 6, line 63 - column 7, line 4 * * column 7, line 27 - line 51 * * column 8, line 21 - column 9, line 6 * * column 9, line 31 - line 41 * * claim 1 * ----- -/--	1-24	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 February 2005	Rother, S

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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 07 5805

DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 5 819 201 A (DEGRAAF ET AL) 6 October 1998 (1998-10-06) * abstract * * the whole document * -----	1-24	
A	WO 2004/019251 A (TOYOTA JIDOSHA KABUSHIKI KAISHA) 4 March 2004 (2004-03-04) * abstract * -----		

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

The present search report has been drawn up for all claims

2

Place of search	Date of completion of the search	Examiner
Munich	24 February 2005	Rother, S

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Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
& : member of the same patent family, corresponding document

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The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

24-02-2005

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
US 6404329	B1	11-06-2002	NONE			
DE 10018942	A1	18-10-2001	NONE			
US 2002173885	A1	21-11-2002	NONE			
US 6370454	B1	09-04-2002	NONE			
US 5819201	A	06-10-1998	WO	9914684	A1	25-03-1999
			EP	1018079	A1	12-07-2000
			AU	4484797	A	05-04-1999
			CA	2303218	A1	25-03-1999
			NO	20001416	A	17-03-2000
WO 2004019251	A	04-03-2004	JP	2004082815	A	18-03-2004
			WO	2004019251	A1	04-03-2004

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