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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 July 2010 (08.07.2010)

PCT

(10) International Publication Number
WO 2010/075874 A1

(51) International Patent Classification:
G01C 21/36 (2006.01) *B60H 1/00* (2006.01)

(21) International Application Number:
PCT/EP2008/068319

(22) International Filing Date:
29 December 2008 (29.12.2008)

(25) Filing Language: English

(26) Publication Language: English

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

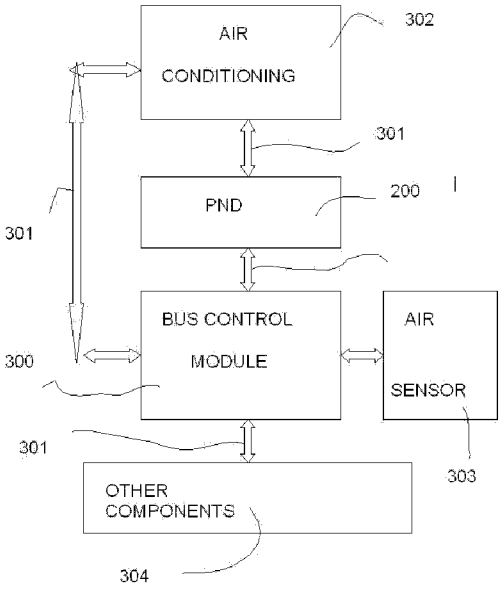
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*

(54) Title: VEHICLE AIR CIRCULATION CONTROL

FIGURE 8



(57) Abstract: A navigation apparatus (200) comprises a processing resource (202) that is operably coupled to a data store (214) comprising map data. A location determination unit (202, 224) is also provided and capable of determining a location. A view generation engine (292) supported by the processing resource (202) provides output data receivable by a display device (206). The feature data (296, 298) comprises information concerning a features relevant to the location. The processing resource (202) accesses a part of the terrain data (294) and a part of the feature data (296, 298) relevant to the location in order to control an air conditioning system appropriately.

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VEHICLE AIR CIRCULATION CONTROL

Field of the Invention

The present invention relates to a navigation apparatus of the type that for example provides an indication to a user of the location of a an object which may be the navigation apparatus itself or a vehicle associated with the object.

Background to the Invention

Portable computing devices, for example Portable Navigation Devices (PNDs) that include GPS (Global Positioning System) signal reception and processing functionality are well known and are widely employed as in-car or other vehicle navigation systems.

In general terms, a modern PND comprises a processor, memory (at least one of volatile and non-volatile, and commonly both), and map data stored within said memory. The processor and memory cooperate to provide an execution environment in which a software operating system may be established, and additionally it is commonplace for one or more additional software programs to be provided to enable the functionality of the PND to be controlled, and to provide various other functions.

Typically these devices further comprise one or more input interfaces that allow a user to interact with and control the device, and one or more output interfaces by means of which information may be relayed to the user. Illustrative examples of output interfaces include a visual display and a speaker for audible output. Illustrative examples of input interfaces include one or more physical buttons to control on/off operation or other features of the device (which buttons need not necessarily be on the device itself but could be on a steering wheel if the device is built into a vehicle), and a microphone for detecting user speech. In one particular arrangement, the output interface display may be configured as a touch sensitive display (by means of a touch sensitive overlay or otherwise) additionally to provide an input interface by means of which a user can operate the device by touch.

Devices of this type will also often include one or more physical connector interfaces by means of which power and optionally data signals can be transmitted to

and received from the device, and optionally one or more wireless transmitters/receivers to allow communication over cellular telecommunications and other signal and data networks, for example Bluetooth, Wi-Fi, Wi-Max, GSM, UMTS and the like.

PNDs of this type also include a GPS antenna by means of which satellite-broadcast signals, including location data, can be received and subsequently processed to determine a current location of the device.

The PND may also include electronic gyroscopes and accelerometers which produce signals that can be processed to determine the current angular and linear acceleration, and in turn, and in conjunction with location information derived from the GPS signal, velocity and relative displacement of the device and thus the vehicle in which it is mounted. Typically, such features are most commonly provided in in-vehicle navigation systems, but may also be provided in PNDs if it is expedient to do so.

Such PNDs are primarily used to determine a route between a first location (typically a start or current location) and a second location (typically a destination). These locations can be input by a user of the device, by any of a wide variety of different methods, for example by postcode, street name and house number, previously stored “well known” destinations (such as famous locations, municipal locations (such as sports grounds or swimming baths) or other points of interest), and favourite or recently visited destinations.

Typically, the PND is enabled by software for computing a "best" or "optimum" route between the start and destination address locations from the map data. A "best" or "optimum" route is determined on the basis of predetermined criteria and need not necessarily be the fastest or shortest route. The selection of the route along which to guide the driver can be very sophisticated, and the selected route may take into account existing, predicted and dynamically and/or wirelessly received traffic and road information, historical information about road speeds, and the driver's own preferences for the factors determining road choice (for example the driver may specify that the route should not include motorways or toll roads).

PNDs of this type may typically be mounted on the dashboard or windscreen of a vehicle, but may also be formed as part of an on-board computer of the vehicle radio or indeed as part of the control system of the vehicle itself. The navigation device may also

be part of a hand-held system, such as a PDA (Portable Digital Assistant), a media player, a mobile phone or the like, and in these cases, the normal functionality of the hand-held system is extended by means of the installation of software on the device to perform both route calculation and navigation along a calculated route.

Route planning and navigation functionality may also be provided by a desktop or mobile computing resource running appropriate software. For example, the Royal Automobile Club (RAC) provides an on-line route planning and navigation facility at http://www.rac.co.uk, which facility allows a user to enter a start point and a destination whereupon the server with which the user's computing resource is communicating calculates a route (aspects of which may be user specified), generates a map, and generates a set of exhaustive navigation instructions for guiding the user from the selected start point to the selected destination. The facility also provides for pseudo three-dimensional rendering of a calculated route, and route preview functionality which simulates a user travelling along the route and thereby provides the user with a preview of the calculated route.

In the context of a PND, once a route has been calculated, the user interacts with the navigation device to select the desired calculated route, optionally from a list of proposed routes. Optionally, the user may intervene in, or guide the route selection process, for example by specifying that certain routes, roads, locations or criteria are to be avoided or are mandatory for a particular journey. The route calculation aspect of the PND forms one primary function, and navigation along such a route is another primary function.

During navigation along a calculated route, it is usual for such PNDs to provide visual and/or audible instructions to guide the user along a chosen route to the end of that route, i.e. the desired destination. It is also usual for PNDs to display map information on-screen during the navigation, such information regularly being updated on-screen so that the map information displayed is representative of the current location of the device, and thus of the user or user's vehicle if the device is being used for in-vehicle navigation.

An icon displayed on-screen typically denotes the current device location, and is centred with the map information of current and surrounding roads in the vicinity of the current device location and other map features also being displayed. Additionally, navigation information may be displayed, optionally in a status bar above, below or to one side of the displayed map information, examples of navigation information include a distance to the next deviation from the current road required to be taken by the user, the

nature of that deviation possibly being represented by a further icon suggestive of the particular type of deviation, for example a left or right turn. The navigation function also determines the content, duration and timing of audible instructions by means of which the user can be guided along the route. As can be appreciated a simple instruction such as "turn left in 100 m" requires significant processing and analysis. As previously mentioned, user interaction with the device may be by a touch screen, or additionally or alternately by steering column mounted remote control, by voice activation or by any other suitable method.

Although the route calculation and navigation functions are fundamental to the overall utility of PNDs, it is possible to use the device purely for information display, or "free-driving", in which only map information relevant to the current device location is displayed, and in which no route has been calculated and no navigation is currentlly being performed by the device.

Devices of the type described above, for example the 920T model manufactured and supplied by TomTom International B.V., provide a reliable means for enabling users to navigate from one position to another.

As mentioned above, the memory of the PND stores map data used by the PND not only to calculate routes and provide necessary navigation instructions to users, but also to provide visual information to users through the visual display of the PND.

One problem encountered by drivers is the possibility of distraction from the main task at hand. Modern vehicles are being designed with the aim of minimising the burden placed on drivers by performing tasks such as speed dependent volume control, switching on screen wipers automatically and providing a degree of automatic control of headlights. The present invention is concerned with providing a system for removing another distraction from a driver which can particularly occur during long trips. During a trip a driver may wish to switch the vehicle's air conditioning between letting in new air into the vehicle or circulating the air within the vehicle. This can be particularly necessary when driving through a sequence of tunnels or when the route is through an area where the quality of the outside air is likely to be less than optimal.

Summary of the Invention

According to a first aspect of the present invention, there is provided a Navigation device comprising: a processing resource operably coupled to a data store, the data store comprising data defining to an area through which the device can navigate a user ; a location determination unit operably coupled to the processing resource and capable

of determining a location in respect of the area; a display device operably coupled to the processing resource so as to be capable of displaying an area surrounding the location of the device and the location of the device in respect of the displayed area, and wherein the processing resource is adapted to cooperate with a resource for controlling settings of an air circulation system so as to switch between settings in accordance the position of the device in respect of a route being travelled.

According to a feature of the invention the device may be arranged to control switching of air conditioning between an air circulation setting in which new air is to be circulated and a setting in which air already present is circulated within the vehicle.

According to another aspect of the invention there is provided a system for controlling the air circulation system of a vehicle comprising a navigation device as set out hereinbefore in combination with a sensor module arranged in operation to detect the quality of ambient air and a module responsive to the output of the sensor module to control the switching of the air circulation system between at least two modes of operation.

In a third aspect of the invention there is provided a method of controlling the air circulation system of a vehicle as it is travelling, the method comprising the steps of detecting the position of vehicle and in accordance with the detected position selecting between at least two modes of operation of the air circulation system.

In accordance with a feature of the method set out above one mode is that in which the air circulation system circulates external air within the vehicle and another mode is that on which the air circulation system circulates air already present within the vehicle.

Brief Description of the Drawings

At least one embodiment of the invention will now be described, by way of

example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic illustration of an exemplary part of a Global Positioning System (GPS) usable by a navigation device;

Figure 2 is a schematic diagram of a communications system for communication between a navigation device and a server;

Figure 3 is a schematic illustration of electronic components of one embodiment of the navigation device of Figure 2;

Figure 4 is a schematic diagram of an arrangement of mounting and/or docking a navigation device;

Figure 5 is a schematic representation of an architectural stack employed by the navigation device of Figure 3;

Figure 6 is a schematic illustration of entities supported by a processor of the navigation device of Figure 3;

Figure 7 is a block diagram showing one embodiment of the invention;

Figure 8 is detail of the control of a typical car air conditioning system;

Figure 9 is a flow diagram,and

Figures 10 to 19 are screen shots from a navigation device.

Detailed Description of Preferred Embodiments

Throughout the following description identical reference numerals will be used to identify like parts.

Embodiments of the present invention will now be described with particular reference to a PND. It should be remembered, however, that the teachings of the present invention are not limited to PNDs but are instead universally applicable to any type of processing device that is configured to execute navigation software in a portable manner so as to provide route planning and navigation functionality. It follows therefore that in the context of the present application, a navigation device is intended to include (without limitation) any type of route planning and navigation device, irrespective of whether that device is embodied as a PND, a vehicle such as an automobile, or indeed a portable computing resource, for example a portable personal computer (PC), a mobile telephone or a Personal Digital Assistant (PDA) executing route planning and navigation software.

It will also be apparent from the following that the teachings of the present invention even have utility in circumstances, where a user is not seeking instructions on how to navigate from one point to another, but merely wishes to be provided with a view of a given location. In such circumstances the “destination” location selected by the user need not have a corresponding start location from which the user wishes to start navigating, and as a consequence references herein to the “destination” location or indeed to a “destination” view should not be interpreted to mean that the generation of a route is essential, that travelling to the “destination” must occur, or indeed that the presence of a destination requires the designation of a corresponding start location.

With the above provisos in mind, the Global Positioning System (GPS) of Figure 1 and the like are used for a variety of purposes. In general, the GPS is a satellite-radio based navigation system capable of determining continuous position, velocity, time, and in some instances direction information for an unlimited number of users. Formerly known as NAVSTAR, the GPS incorporates a plurality of satellites which orbit the earth in extremely precise orbits. Based on these precise orbits, GPS satellites can relay their location to any number of receiving units.The GPS system is implemented when a device, specially equipped to receive GPS data, begins scanning radio frequencies for GPS satellite signals. Upon receiving a radio signal from a GPS satellite, the device determines the precise location of that satellite via one of a plurality of different conventional methods. The device will continue scanning, in most instances, for signals until it has acquired at least three different satellite signals (noting that position is not normally, but can be determined, with only two signals using other triangulation techniques). Implementing geometric triangulation, the receiver utilizes the three known positions to determine its own two-dimensional position relative to the satellites. This can be done in a known manner. Additionally, acquiring a fourth satellite signal allows the receiving device to calculate its three dimensional position by the same geometrical calculation in a known manner. The position and velocity data can be updated in real time on a continuous basis by unlimited number of users.

As shown in Figure 1, the GPS system 100 comprises a plurality of satellites 102 orbiting about the earth 104. A GPS receiver 106 receives spread spectrum GPS satellite data signals 108 from a number of the plurality of satellites 102. The spread spectrum data signals 108 are continuously transmitted from each satellite 102, the spread spectrum data signals 108 transmitted each comprise a data stream including information identifying a particular satellite 102 from which the data stream originates. The GPS receiver 106 generally requires spread spectrum data signals 108 from at least three satellites 102 in order to be able to calculate a two-dimensional position. Receipt of a fourth spread spectrum data signal enables the GPS receiver 106 to calculate, using a known technique, a three-dimensional position.

Turning to Figure 2, a navigation device 200 comprising or coupled to the GPS receiver device 106, is capable of establishing a data session, if required, with network hardware of a “mobile” or telecommunications network via a mobile device (not shown), for example a mobile telephone, PDA, and/or any device with mobile telephone technology, in order to establish a digital connection, for example a digital connection via known Bluetooth technology. Thereafter, through its network service provider, the

mobile device can establish a network connection (through the Internet for example) with a server 150. As such, a "mobile" network connection can be established between the navigation device 200 (which can be, and often is, mobile as it travels alone and/or in a vehicle) and the server 150 to provide a "real-time" or at least very "up to date" gateway for information.

The establishing of the network connection between the mobile device (via a service provider) and another device such as the server 150, using the Internet for example, can be done in a known manner. In this respect, any number of appropriate data communications protocols can be employed, for example the TCP/IP layered protocol. Furthermore, the mobile device can utilize any number of communication standards such as CDMA2000, GSM, IEEE 802.11 a/b/c/g/n, etc. Hence, it can be seen that the internet connection may be utilised, which can be achieved via data connection, via a mobile phone or mobile phone technology within the navigation device 200 for ex.

Although not shown, the navigation device 200 may, of course, include its own mobile telephone technology within the navigation device 200 itself (including an antenna for example, or optionally using the internal antenna of the navigation device 200). The mobile phone technology within the navigation device 200 can include internal components, and/or can include an insertable card (e.g. Subscriber Identity Module (SIM) card), complete with necessary mobile phone technology and/or an antenna for example. As such, mobile phone technology within the navigation device 200 can similarly establish a network connection between the navigation device 200 and the server 150, via the Internet for example, in a manner similar to that of any mobile device.

For telephone settings, a Bluetooth enabled navigation device may be used to work correctly with the ever changing spectrum of mobile phone models, manufacturers, etc., model/manufacturer specific settings may be stored on the navigation device 200 for example. The data stored for this information can be updated.

In Figure 2, the navigation device 200 is depicted as being in communication with the server 150 via a generic communications channel 152 that can be implemented by any of a number of different arrangements. The communication channel 152 generically represents the propagating medium or path that connects the navigation device 200 and the server 150. The server 150 and the navigation device 200 can communicate when a connection via the communications channel 152 is established between the server 150 and the navigation device 200 (noting that such a connection can be a data connection via mobile device, a direct connection via personal computer via the internet, etc.).

The communication channel 152 is not limited to a particular communication technology. Additionally, the communication channel 152 is not limited to a single communication technology; that is, the channel 152 may include several communication links that use a variety of technology. For example, the communication channel 152 can be adapted to provide a path for electrical, optical, and/or electromagnetic communications, etc. As such, the communication channel 152 includes, but is not limited to, one or a combination of the following: electric circuits, electrical conductors such as wires and coaxial cables, fibre optic cables, converters, radio-frequency (RF) waves, the atmosphere, free space, etc. Furthermore, the communication channel 152 can include intermediate devices such as routers, repeaters, buffers, transmitters, and receivers, for example.

In one illustrative arrangement, the communication channel 152 includes telephone and computer networks. Furthermore, the communication channel 152 may be capable of accommodating wireless communication, for example, infrared communications, radio frequency communications, such as microwave frequency communications, etc. Additionally, the communication channel 152 can accommodate satellite communication.

The communication signals transmitted through the communication channel 152 include, but are not limited to, signals as may be required or desired for given communication technology. For example, the signals may be adapted to be used in cellular communication technology such as Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA), Global System for Mobile Communications (GSM), etc. Both digital and analogue signals can be transmitted through the communication channel 152. These signals may be modulated, encrypted and/or compressed signals as may be desirable for the communication technology.

The server 150 includes, in addition to other components which may not be illustrated, a processor 154 operatively connected to a memory 156 and further operatively connected, via a wired or wireless connection 158, to a mass data storage device 160. The mass storage device 160 contains a store of navigation data and map information, and can again be a separate device from the server 150 or can be incorporated into the server 150. The processor 154 is further operatively connected to transmitter 162 and receiver 164, to transmit and receive information to and from navigation device 200 via communications channel 152. The signals sent and received may include data, communication, and/or other propagated signals. The transmitter 162

and receiver 164 may be selected or designed according to the communications requirement and communication technology used in the communication design for the navigation system 200. Further, it should be noted that the functions of transmitter 162 and receiver 164 may be combined into a single transceiver.

As mentioned above, the navigation device 200 can be arranged to communicate with the server 150 through communications channel 152, using transmitter 166 and receiver 168 to send and receive signals and/or data through the communications channel 152, noting that these devices can further be used to communicate with devices other than server 150. Further, the transmitter 166 and receiver 168 are selected or designed according to communication requirements and communication technology used in the communication design for the navigation device 200 and the functions of the transmitter 166 and receiver 168 may be combined into a single transceiver as described above in relation to Figure 2. Of course, the navigation device 200 comprises other hardware and/or functional parts, which will be described later herein in further detail.

Software stored in server memory 156 provides instructions for the processor 154 and allows the server 150 to provide services to the navigation device 200. One service provided by the server 150 involves processing requests from the navigation device 200 and transmitting navigation data from the mass data storage 160 to the navigation device 200. Another service that can be provided by the server 150 includes processing the navigation data using various algorithms for a desired application and sending the results of these calculations to the navigation device 200.

The server 150 constitutes a remote source of data accessible by the navigation device 200 via a wireless channel. The server 150 may include a network server located on a local area network (LAN), wide area network (WAN), virtual private network (VPN), etc.

The server 150 may include a personal computer such as a desktop or laptop computer, and the communication channel 152 may be a cable connected between the personal computer and the navigation device 200. Alternatively, a personal computer may be connected between the navigation device 200 and the server 150 to establish an internet connection between the server 150 and the navigation device 200.

The navigation device 200 may be provided with information from the server 150 via information downloads which may be periodically updated automatically or upon a user connecting the navigation device 200 to the server 150 and/or may be more dynamic upon a more constant or frequent connection being made between the server

150 and navigation device 200 via a wireless mobile connection device and TCP/IP connection for example. For many dynamic calculations, the processor 154 in the server 150 may be used to handle the bulk of processing needs, however, a processor (not shown in Figure 2) of the navigation device 200 can also handle much processing and calculation, independently of a connection to a server 150.

Referring to Figure 3, it should be noted that the block diagram of the navigation device 200 is not inclusive of all components of the navigation device, but is only representative of many example components. The navigation device 200 is located within a housing (not shown). The navigation device 200 includes a processing resource comprising, for example, the processor 202 mentioned above, the processor 202 being coupled to an input device 204 and a display device, for example a display screen 206.

Although reference is made here to the input device 204 in the singular, the skilled person should appreciate that the input device 204 represents any number of input devices, including a keyboard device, voice input device, touch panel and/or any other known input device utilised to input information. Likewise, the display screen 206 can include any type of display screen such as a Liquid Crystal Display (LCD), for example.

In one arrangement, one aspect of the input device 204, the touch panel, and the display screen 206 are integrated so as to provide an integrated input and display device, including a touchpad or touchscreen input 250 (Figure 4) to enable both input of information (via direct input, menu selection, etc.) and display of information through the touch panel screen so that a user need only touch a portion of the display screen 206 to select one of a plurality of display choices or to activate one of a plurality of virtual or "soft" buttons. In this respect, the processor 202 supports a Graphical User Interface (GUI) that operates in conjunction with the touchscreen.

In the navigation device 200, the processor 202 is operatively connected to and capable of receiving input information from input device 204 via a connection 210 operatively connected to at least one of the display screen 206 and the output device 208, via respective output connections 212, to output information thereto. The navigation device 200 may include an output device 208, for example an audible output device (e.g. a loudspeaker). As the output device 208 can produce audible information for a user of the navigation device 200, it is should equally be understood that input device 204 can include a microphone and software for receiving input voice commands as well. Further, the navigation device 200 can also include any additional input device 204 and/or any additional output device, such as audio input/output devices for example.

The processor 202 is operatively connected to memory 214 via connection 216

and is further adapted to receive/send information from/to input/output (I/O) ports 218 via connection 220, wherein the I/O port 218 is connectible to an I/O device 222 external to the navigation device 200. The external I/O device 222 may include, but is not limited to an external listening device, such as an earpiece for example. The connection to I/O device 222 can further be a wired or wireless connection to any other external device such as a car stereo unit for hands-free operation and/or for voice activated operation for example, for connection to an earpiece or headphones, and/or for connection to a mobile telephone for example, wherein the mobile telephone connection can be used to establish a data connection between the navigation device 200 and the Internet or any other network for example, and/or to establish a connection to a server via the Internet or some other network for example.

Figure 3 further illustrates an operative connection between the processor 202 and an antenna/receiver 224 via connection 226, wherein the antenna/receiver 224 can be a GPS antenna/receiver for example. It should be understood that the antenna and receiver designated by reference numeral 224 are combined schematically for illustration, but that the antenna and receiver may be separately located components, and that the antenna may be a GPS patch antenna or helical antenna for example.

In addition Figure 3 shows an additional interface 285 for interconnecting the processor 202 to, for example, the CAN system of a vehicle in which the navigation device is mounted. The Can system is just one example of a bus-based system which can link and control components of the vehicle in which the navigation system is mounted. Such systems enable commands and data to passed to and received from vehicle components such as external sensors, automatic headlights, windscreen wipers and the like. In the present embodiment the CAN system or its equivalent also controls an air conditioning system which can simply circulate air within a vehicle or which can either warm or cool the air being circulated.

It will, of course, be understood by one of ordinary skill in the art that the electronic components shown in Figure 3 are powered by one or more power sources (not shown) in a conventional manner. As will be understood by one of ordinary skill in the art, different configurations of the components shown in Figure 3 are contemplated. For example, the components shown in Figure 3 may be in communication with one another via wired and/or wireless connections and the like. Thus, the navigation device 200 described herein can be a portable or handheld navigation device 200.

In addition, the portable or handheld navigation device 200 of Figure 3 can be connected or “docked” in a known manner to a vehicle such as a bicycle, a motorbike, a

car or a boat for example. Such a device 200 is then removable from the docked location for portable or handheld navigation use.

Referring to Figure 4, the navigation device 200 may be a unit that includes the integrated input and display device 206 and the other components of Figure 2 (including, but not limited to, the internal GPS receiver 224, the microprocessor 202, a power supply (not shown), memory systems 214, etc.).

The navigation device 200 may sit on an arm 252, which itself may be secured to a vehicle dashboard/window/etc. using a suction cup 254. This arm 252 is one example of a docking station to which the navigation device 200 can be docked. The navigation device 200 can be docked or otherwise connected to the arm 252 of the docking station by snap connecting the navigation device 200 to the arm 252 for example. The navigation device 200 may then be rotatable on the arm 252. To release the connection between the navigation device 200 and the docking station, a button (not shown) on the navigation device 200 may be pressed, for example. Other equally suitable arrangements for coupling and decoupling the navigation device 200 to a docking station are well known to persons of ordinary skill in the art.

Turning to Figure 5, the processor 202 and memory 214 cooperate to support a BIOS (Basic Input/Output System) 282 that functions as an interface between functional hardware components 280 of the navigation device 200 and the software executed by the device. The processor 202 then loads an operating system 284 from the memory 214, which provides an environment in which application software 286 (implementing some or all of the above described route planning and navigation functionality) can run. The application software 286 provides an operational environment including the GUI that supports core functions of the navigation device, for example map viewing, route planning, navigation functions and any other functions associated therewith. In this respect, part of the application software 286 comprises a view generation module 288. Turning to Figure 6, the view generation module 288 supported by the processor 202 comprises a map data processor 290 capable of communicating with a view generation engine 292. The map data processor is capable of accessing the memory 214 in order to access map data 293, the map data comprising terrain data 294, land use data 296 and road data 298. The functionality of the view generation module 288 will now be described in the context of a journey. The terrain data 294 comprises data that, using the cartographic terminology, defines “relief” or elevations and depressions of land or sea bed. The land use data and road data constitute feature data. Using cartographic terminology again, the feature data relates to “culture” or any features constructed by

human-kind that are under, on, or above the ground which are delineated on a map.

From the above it will be understood that the feature data includes features such as tunnels. In addition the feature data includes data concerning any areas where poor air quality may be encountered such areas of heavy industrialisation or even individual buildings or factories which give rise to objectionable smells.

Tuning now to Figure 7 this shows the manual controls of an typical air conditioning system and in particular switches A and B for setting the system so that either external or internal air is circulated within the vehicle. As already mentioned the system can be one which only circulates air or a full air conditioning system. The present invention is of course applicable to either type of system.

Referring now to Figure 8 of the accompanying drawings this block diagram shows the main components in a system for controlling a number of functions which can be operated of a vehicle such as a car 300 during a journey. The system includes a control module 300 and a number of functional devices or components interconnected with module 300 by a bus 301. In this embodiment the bus is of the type known as a CAN bus. The devices controlled by this system vary and can include automatic headlights, windscreen wipers and movable wing mirrors. It will be appreciated that the above list is not exhaustive. For example the bus and the associated control module 300 may also be involved with entertainment systems in the vehicle and might also have the capability of controlling volume is response to the vehicle's speed. The present embodiment includes an air conditioning system 302 and a sensor module 303 for detecting external air quality. Such a sensor module is purely optional but may be advantageous. The other different functions and components are represented by a box 304. Figure 8 also shows a navigation device 200 similar to the one already described in this specification. This also connected to bus 300. As buses such as CAN buses and their associated modules are well known their actual operation will not be described further.

The operation of the system shown in Figure 8 will now be describe by referring to the flow diagram of Figure 9. In Figure 9 the switching on of the control module is shown at step S1 . In the present embodiment this step also switches on the navigation device 200 . However it will be appreciated that the individual functional devices such as the navigation device or an entertainment module could be switched on independently. In step S2 the location of the navigation device is determined and map data is retrieved from memory 214. In many cases the user will input a destination as will be described later and the navigation device will calculate a suggested route to be followed. However

the present invention is equally applicable when no destination has been input. When the vehicle 300 starts its journey it will be assumed that the air conditioning system, if on, will be in its default mode in which, for example external air is brought into the vehicle for circulation. Of course this need not be the default condition for in circumstances of low temperature a driver will want the external air to be warmed before it is fed into the vehicle interior. In step S4 the navigation device checks whether or not the retrieved map data in combination with the determined location of the vehicle indicates that the vehicle is about to enter a situation in which it would be advisable to switch form the default mode to the mode in which air within the vehicle is circulated. As already described one example of such a situation is if retrieved map data indicates that the vehicle is about to enter a tunnel. Other situations are possible in which this step might be desirable. One example of this that the map data may also include information regarding certain areas which do not include tunnels but within which air quality is likely to be degraded. This degradation can be caused by the knowledge that the route passages a manufacturing area which generates bad smells or where there is a likelihood of smoke. Such areas can be detected by prior analysis of air quality by for example what is known as Cayman technology . Thus when it is determined by the PND that the vehicle is about to enter such an area in step S3 it is checked in step S4 whether or not the air conditioning system has been switched on.. If not it switched on at step S5 to the mode in which internal air is circulated enabled. If on the other hand the air conditioning is already on then step S6 again ensures that internal air circulation is enabled. If an air condition sensor is present and switched on any data collected by the air sensor can be stored along with the map and if the trip is repeated frequently and the data with regard to air quality is statistically significant this data can be loaded into the memory 214 for subsequent use in controlling the air conditioning system. It will also be understood that the air conditioning system can be switched from its default mode when the quality of external air as detected by the air quality sensor module 307 has degraded so that it is below a preset limit. It will accordingly be seen that the control of the air conditioning between the default mode of air circulation and the circulation of internal air can be carried out in to different ways. In the main embodiment it is the determined location of the vehicle which controls switching. In the variant with the air sensor the quality of the sensed ambient air can also be used to control the air conditioning system. It will be appreciated that the invention is particularly appropriate where the vehicle is not fitted with an air quality sensor.

Referring now to Figures 10 to 19, an illustrative destination location input

process will firstly be described in respect of a user whose start location is an airport in Lyon, France, and who wishes to navigate to a street address in Grenoble, France, for which the user knows the street name and building number. Although not shown, the user can use a settings menu option supported by the application software 286 in order to select view generation in a three-dimensional mode. When this user switches on the navigation device 200, the device 200 acquires a GPS fix and calculates (in a known manner) the current location of the navigation device 200. The user is then presented, as shown in Figure 10, with a display 300 showing in pseudo three-dimensions the local environment 302 in which the navigation device 200 is determined to be located, and in a region 304 of the display 300 below the local environment a series of control and status messages.

By touching the display of the local environment 302, the navigation device 200 switches to display (as shown in Figure 11) a series of virtual or soft buttons 306 by means of which a user can, inter alia, input a destination to which they wish to navigate.

By touching the "Navigate to" virtual button 308, the navigation device 200 switches to display (as shown in Figure 12) a plurality of virtual buttons that are each associated with a different category of selectable destinations. In this instance, the display shows a "home" button that if pressed would set the destination to a stored home location. The "favourite" button, if pressed, reveals a list of destinations that the user has previously stored in the navigation device 200 and if one of these destinations is then selected the destination for the route to be calculated is set to the selected previously stored destination. The "recent destination" soft button, if pressed, reveals a list of selectable destinations held in the memory of the navigation device 200 and to which the user has recently navigated. Selection of one of the destinations populating this list would set the destination location for this route to the selected (previously visited) location. The "point of interest" button, if pressed, reveals a number of options by means of which a user can opt to navigate to any of a plurality of locations, such as Automatic Teller Machines (ATMs), petrol stations or tourist attractions for example, that have been pre-stored in the navigation device 200 as locations to which a user of the navigation device 200 might want to navigate to. The triangular "arrow" shaped virtual button provides access to additional sub-menu options relating to the "Navigate to ..." menu option, and an "address" button 310 commences a process by which the user can input the street address of the destination to which the user wishes to navigate.

Since the user, in this example, knows the street address of the destination to which the user wishes the navigation device 200 to navigate, it is assumed that the

"address" button 310 is operated (by touching the button displayed on the touchscreen), whereupon (as shown in Figure 13) the user is presented with a series of address input options – in particular for address input by "city centre", by "postcode", by "crossing or intersection" (for example a junction of two roads) and by "street and house number".

In this example, the user knows the street address and house number of the destination and hence selects the "street and house number" virtual button 312 whereupon the user is then presented, as shown in Figure 14, a prompt 314 to enter the name of the city to which they wish to navigate, a flag button 316 by means of which the user can select the country in which the desired city is located, and a virtual keyboard 318 that may be operated by the user, if necessary, to input the name of the destination city. In this instance the user has previously navigated to locations in Lyon and Grenoble, and the navigation device 200 therefore additionally provides the user with a list 320 of selectable cites.

The user in this instance wishes to navigate to Grenoble, and on selection of Grenoble from the list 320 the navigation device 200 displays, as shown in Figure 17, the virtual keyboard 318 by means of which a user can input street names, a prompt 322 for entry of a streetname and, in this instance, as the user has previously navigated to a street in Grenoble, a list 324 of selectable streets in Grenoble.

In this example, the user wishes to return to the street, Avenue Du Général De Gaulle previously visited by the user, the user selects Avenue Du Général De Gaulle from the displayed list 324.

Once a street has been selected, the navigation device 200 then displays a restricted, largely numeric, virtual keypad 326 and prompts the user, by means of prompt 328, to enter the number of the house in the selected street and city to which the user wishes to navigate. If the user has previously navigated to a building number in this street, then that number (as shown in Figure 18) is initially shown. If, as in this instance, the user wishes to navigate to No. 6, Avenue Du Général De Gaulle once again, then the user need only touch a "done" virtual button 330 displayed at the bottom right hand corner of the display 300. If the user should wish to navigate to a different building number in Avenue Du Général De Gaulle, then all the user need do is operate the virtual keypad 328 to input an appropriate building number. After selection of a destination th display will guide a user along the generated route. Figure 19 shows the display screen as a destination is approached.

Figure 7 shows a pair of press buttons A and B which can be operated manually so as respectively to control the air conditioning system to either circulate fresh air or to

circulate air within the vehicle. Normally a driver of the vehicle would select between buttons A and B in accordance with ambient conditions such as the vehicle being in a tunnel or in an area where the external air was particularly polluted. However such manual operations during driving can be a distraction and lead to mistakes.

It will also be appreciated that whilst various aspects and embodiments of the present invention have heretofore been described, the scope of the present invention is not limited to the particular arrangements set out herein and instead extends to encompass all arrangements, and modifications and alterations thereto, which fall within the scope of the appended claims.

For example, although the above embodiments have been described in the context of TIN data or pre-processed data constituting a conversion from grid cell data to TIN data, the skilled person should appreciate that the processor 202, for example the map data generator 290, can be arranged to generate TIN data from grid cell or other suitable polygonal data in real-time or near real-time.

Whilst embodiments described in the foregoing detailed description refer to GPS, it should be noted that the navigation device may utilise any kind of position sensing technology as an alternative to (or indeed in addition to) GPS. For example the navigation device may utilise using other global navigation satellite systems such as the European Galileo system. Equally, it is not limited to satellite based but could readily function using ground based beacons or any other kind of system that enables the device to determine its geographic location.

Alternative embodiments of the invention can be implemented as a computer program product for use with a computer system, the computer program product being, for example, a series of computer instructions stored on a tangible data recording medium, such as a diskette, CD-ROM, ROM, or fixed disk, or embodied in a computer data signal, the signal being transmitted over a tangible medium or a wireless medium, for example, microwave or infrared. The series of computer instructions can constitute all or part of the functionality described above, and can also be stored in any memory device, volatile or non-volatile, such as semiconductor, magnetic, optical or other memory device.

It will also be well understood by persons of ordinary skill in the art that whilst the preferred embodiment implements certain functionality by means of software, that functionality could equally be implemented solely in hardware (for example by means of one or more ASICs (application specific integrated circuit)) or indeed by a mix of hardware and software. As such, the scope of the present invention should not be

interpreted as being limited only to being implemented in software.

Lastly, it should also be noted that whilst the accompanying claims set out particular combinations of features described herein, the scope of the present invention is not limited to the particular combinations hereafter claimed, but instead extends to encompass any combination of features or embodiments herein disclosed irrespective of whether or not that particular combination has been specifically enumerated in the accompanying claims at this time.

5

CLAIMS

1 A Navigation device comprising: a processing resource operably coupled to a data store, the data store comprising data defining to an area through which the device can navigate a user ; a location determination unit operably coupled to the processing resource and capable of determining a location in respect of the area; a display device operably coupled to the processing resource so as to be capable of displaying an area surrounding the location of the device and the location of the device in respect of the displayed area, and wherein the processing resource is adapted to cooperate with a resource for controlling mode of operation of an air conditioning system so as to switch between settings in accordance the position of the device in respect of a route being travelled.

2. A device according to claim 1 and arranged to control switching of air conditioning between a first air circulation mode in which new air is to be circulated and a second mode in which air already present is circulated within the vehicle.

3. A device according to claim 2 and arranged to switch to the second setting when the device determines that the device is entering or about to enter a section of the road indicated by the retrieved map data as having ambient air of potentially degraded quality and to switch the air conditioning to the first mode on leaving the section.

4. A device according to claim 4 and arranged to check whether or not the air conditioning system is ON when it has been determined that the location of the device is entering or about to enter an area of degraded air quality and to switch the system ON with the appropriate setting.

5. A system for controlling the air conditioning of a vehicle comprising a navigation device according to any one of the preceding claims in combination with a sensor

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module arranged in operation to detect the quality of ambient air and a module responsive to the output of the sensor module to control the switching of an air conditioning system between at least two modes of operation.

6. A system according to claim 5 wherein the control module is adapted to switch the air conditioning system between a first mode in which external air is circulated within the vehicle and a second mode in which air already present is circulated within the vehicle.

7. A system according to claim 6 wherein the control module is arranged to switch the air conditioning when the vehicle as determined from the retrieved map data as entering or being about to enter an area where there is a possibility of degraded air quality or in response to the air sensor module detecting that the external air is below a preset quality level, and to switch the air conditioning to the first setting when the external air quality as detected by the sensor module is of acceptable quality.

8. A method of controlling the air conditioning system of a vehicle as it is travelling, the method comprising the steps of detecting the position of vehicle and in accordance with the detected position selecting between at least two modes of operation of the air conditioning system.

9. A method according to claim 8 wherein a first mode is that in which the air conditioning system circulates external air within the vehicle and a second mode is that on which the air conditioning system circulates air already present within the vehicle.

10. A method according to claim 9, and comprising switching to the second mode when the device determines that the vehicle is entering or about to enter a section of the road indicated by the retrieved map data as having external air of potentially degraded quality and to switch the air conditioning to the first mode on leaving the section.

11. A method according to claim 10 including checking if the air conditioning system is ON an if not switching the air conditioning system in the second mode

12. A method according to claim 11, and including sensing the quality of the external air and switching to the second mode when the quality of the sensed air is below a preset quality level.

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13. A computer program element comprising computer program code means to make a computer execute the method as claimed in any of Claims 8 to 12.

14. A computer program element as claimed in Claim 13, embodied on a computer readable medium.

15. A data store of a navigation device comprising map data together with data indicating areas represented by the map data where air quality may be degraded

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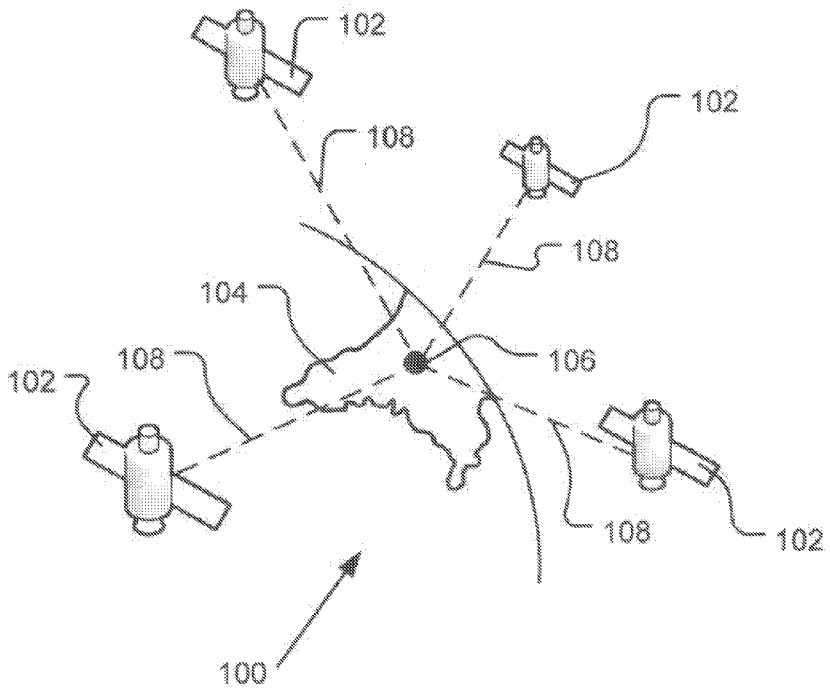


Figure 1

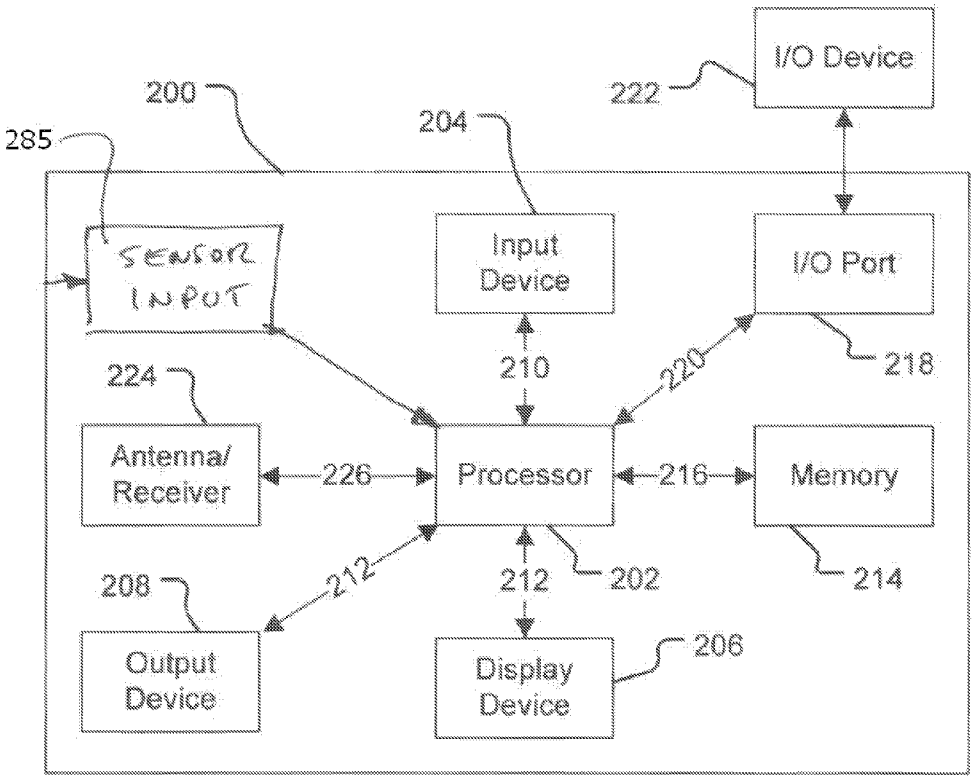


Figure 3

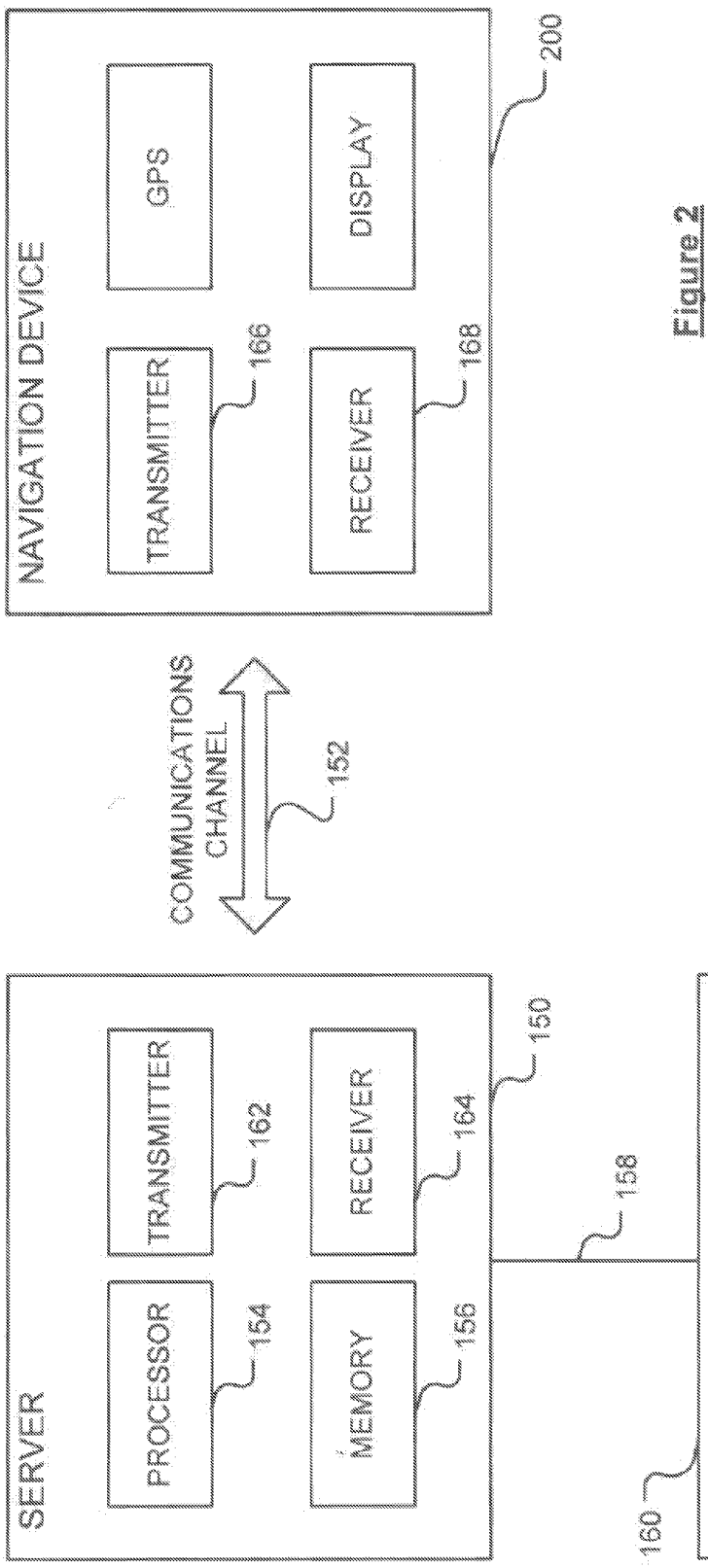

NAVIGATION DEVICE
GPS
DISPLAY
TRANSMITTER
166
RECEIVER
168
200
COMMUNICATIONS CHANNEL
152
SERVER
PROCESSOR
154
TRANSMITTER
162
MEMORY
156
RECEIVER
164
150
158
160
MASS DATA STORAGE

Figure 2

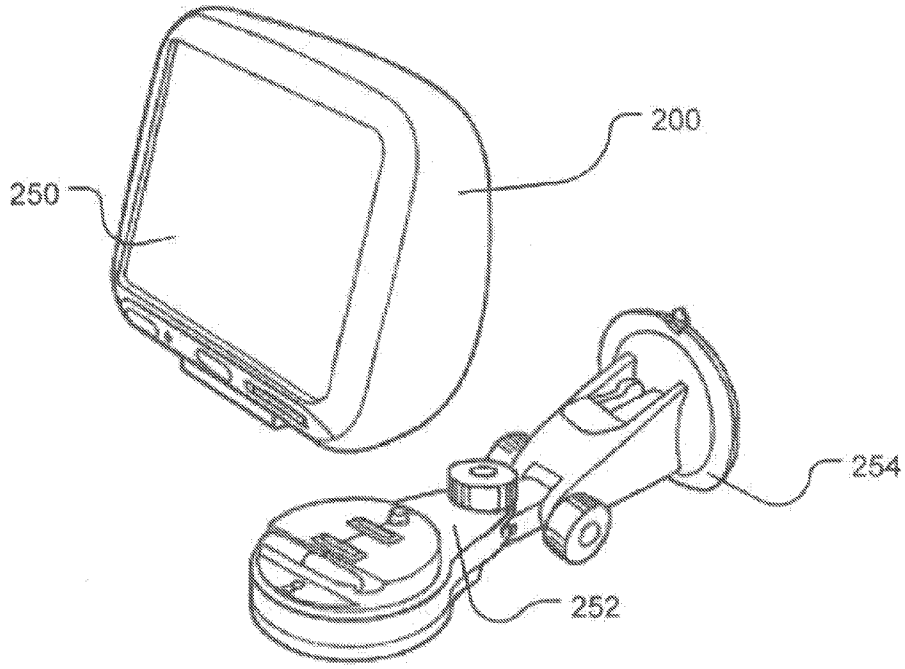


Figure 4

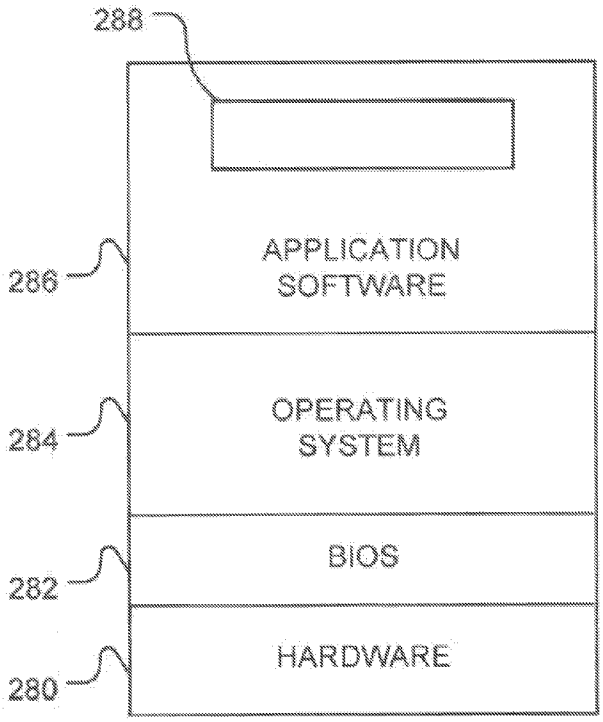


Figure 5

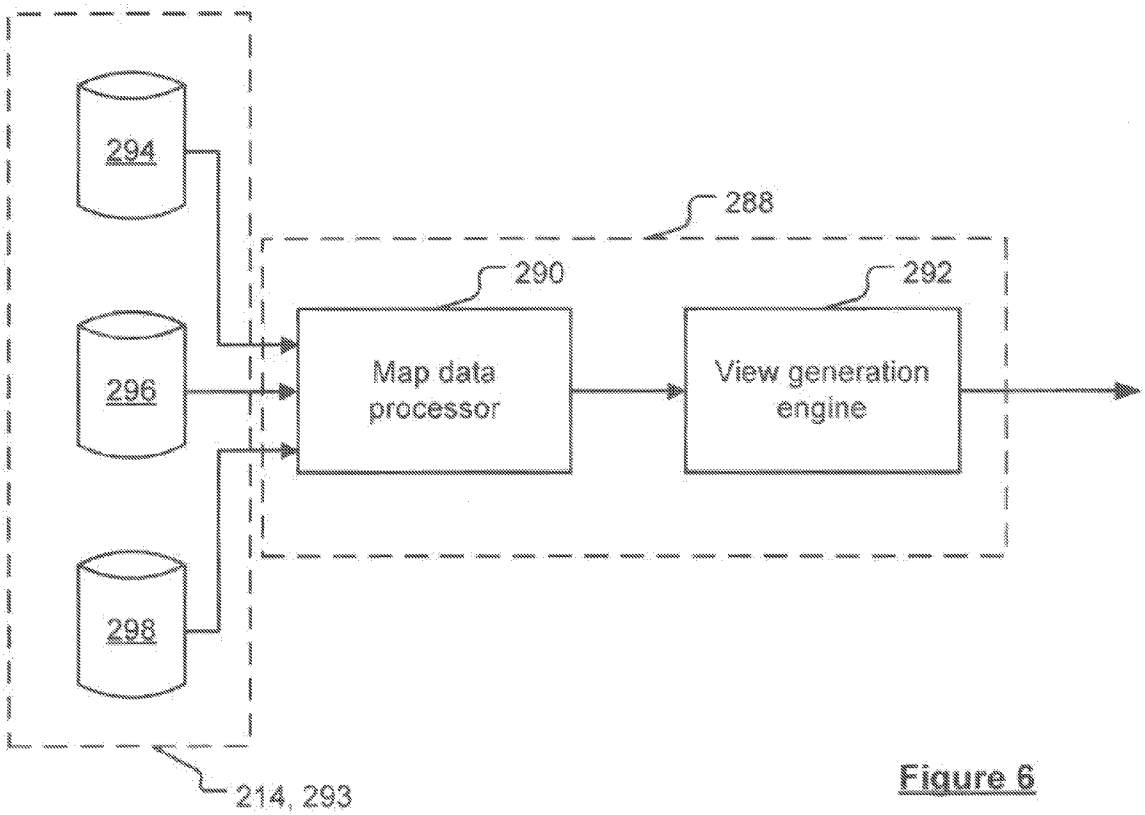

294
296
298
288
290
292
Map data processor
View generation engine
214, 293

Figure 6

Fig. 7



FIGURE 8

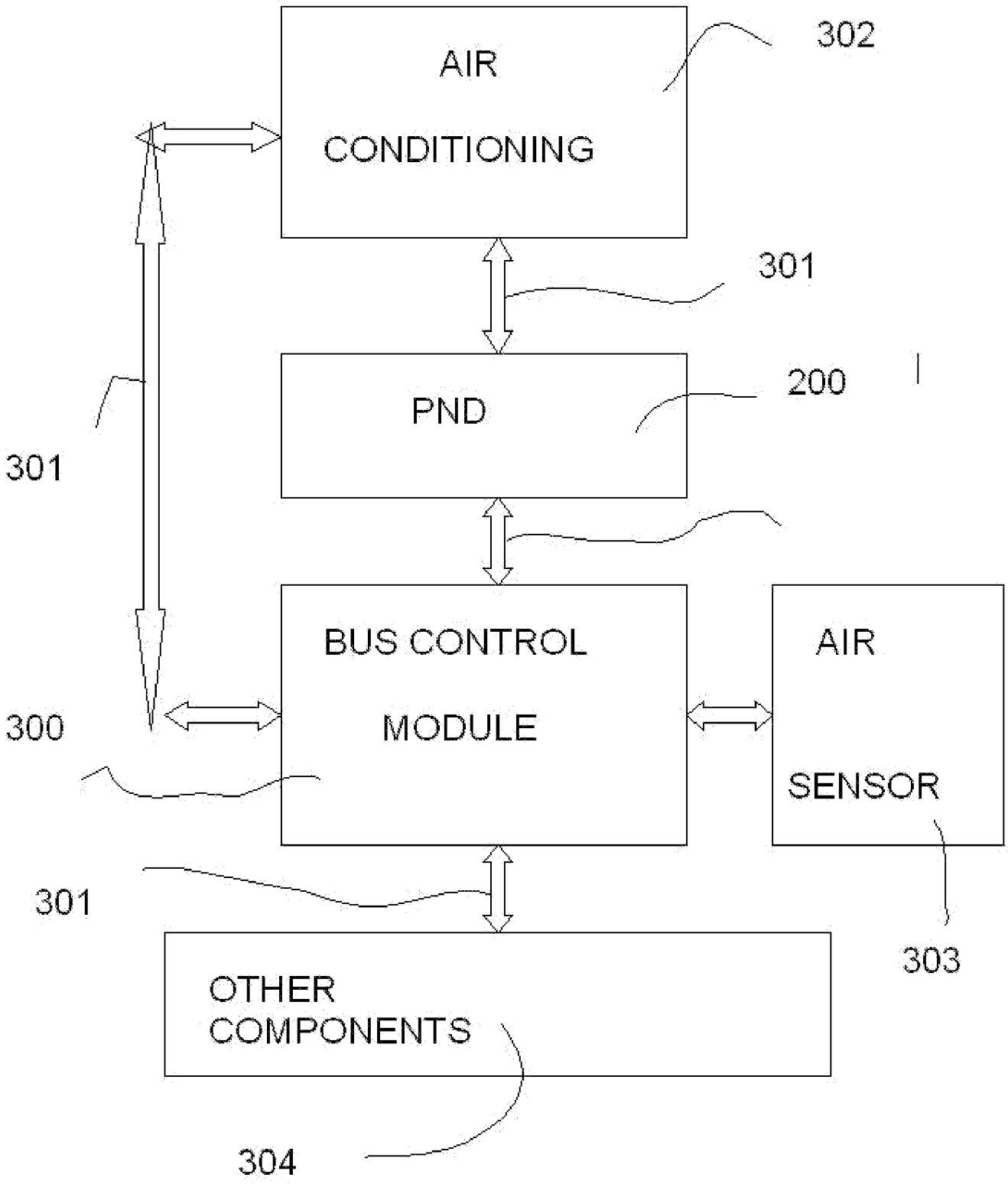

AIR
CONDITIONING
302
301
PND
200
301
BUS CONTROL
MODULE
300
AIR
SENSOR
301
303
OTHER
COMPONENTS
304

Figure 9

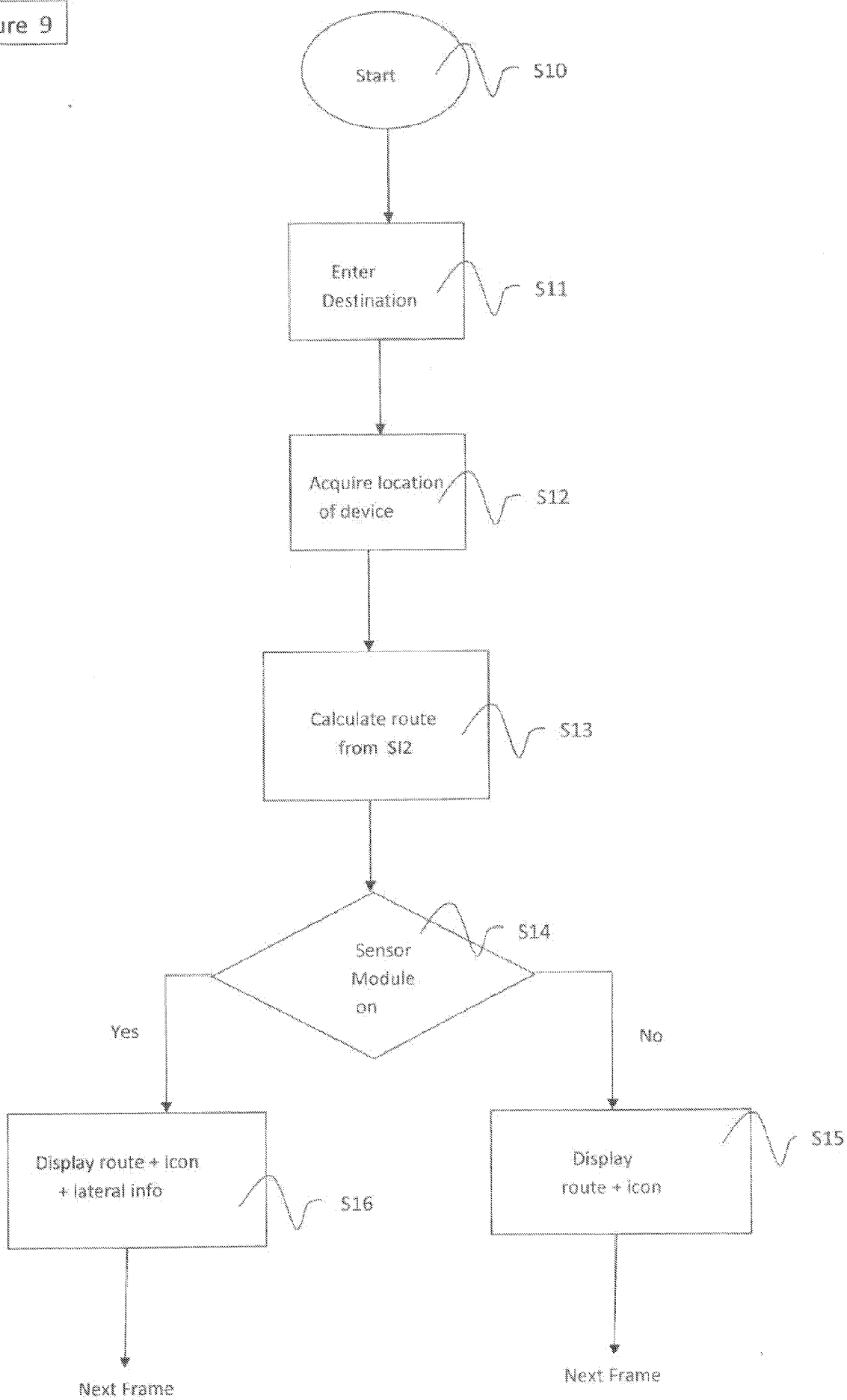

Start
S10
Enter Destination
S11
Acquire location of device
S12
Calculate route from SI2
S13
Sensor Module on
S14
Yes
No
Display route + icon + lateral info
S16
Display route + icon
S15
Next Frame
Next Frame

Figure 10

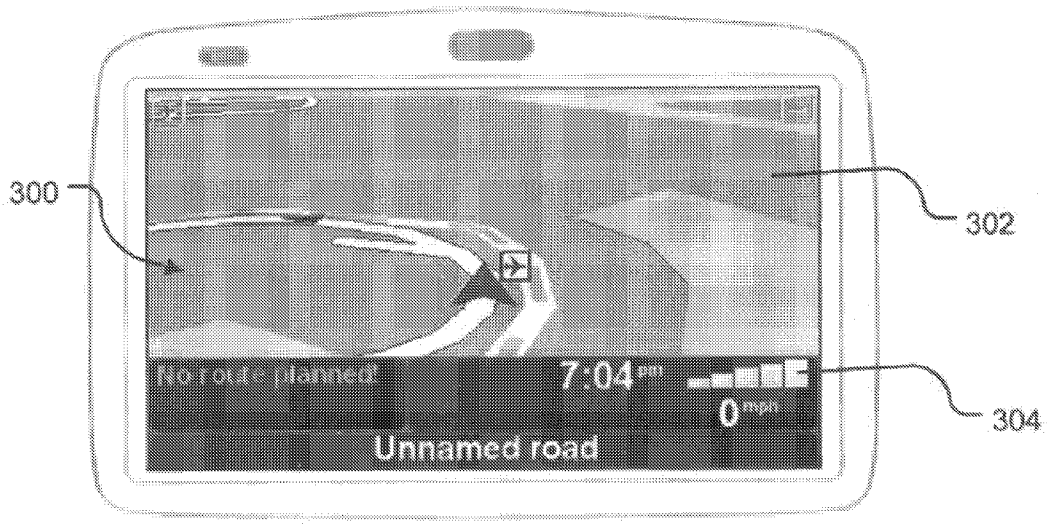


Figure 11

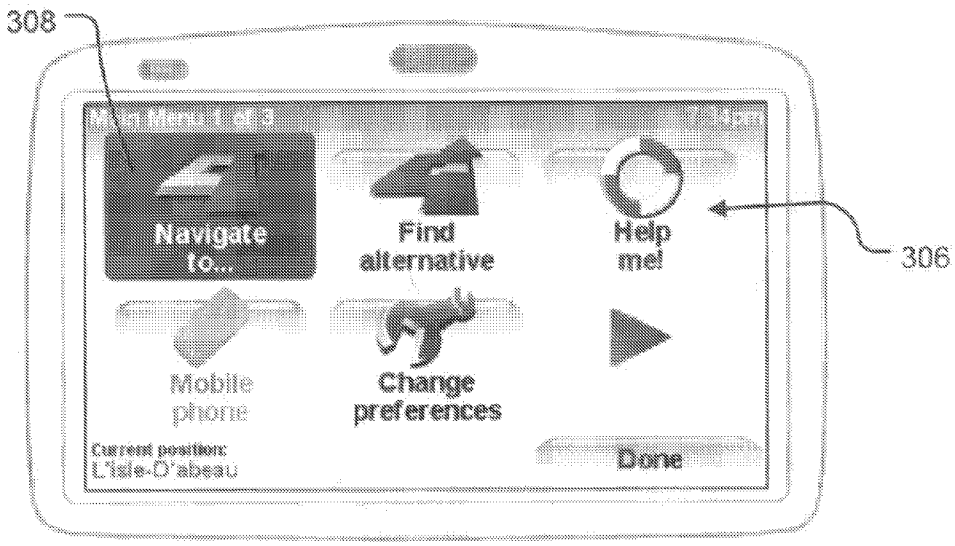


Figure 12

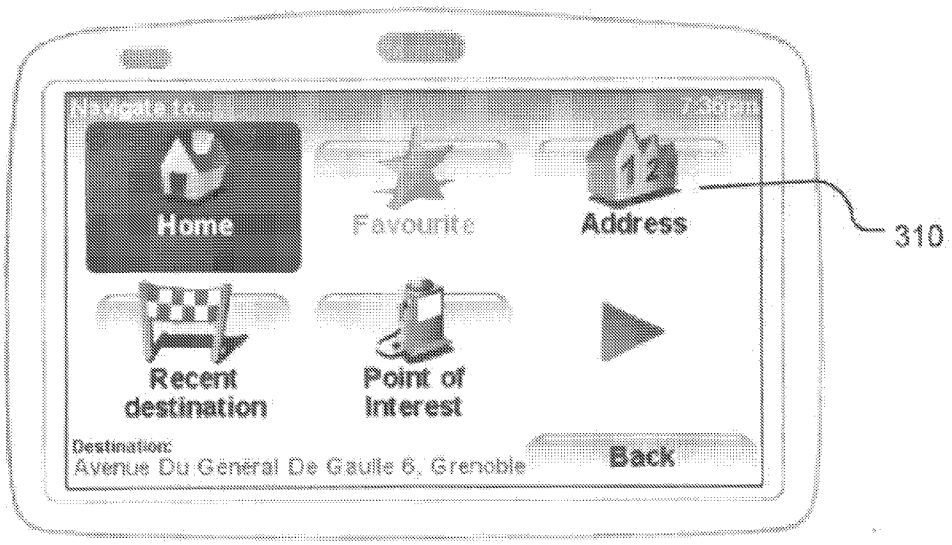


Figure 13

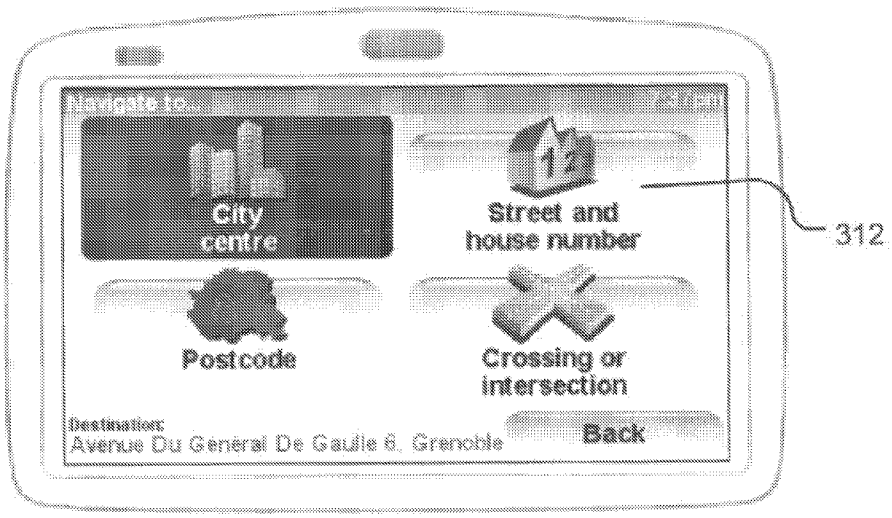


Figure 14

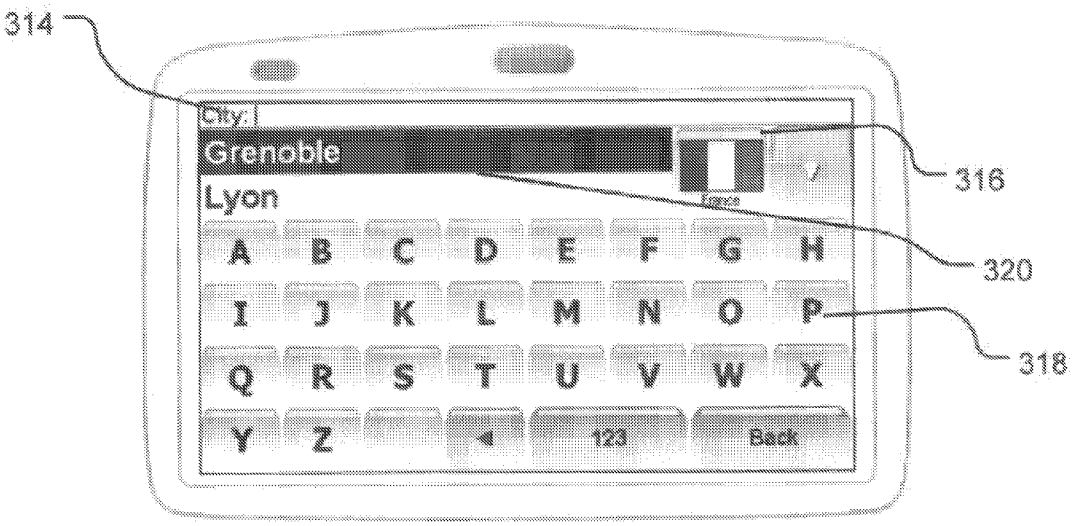


Figure 15

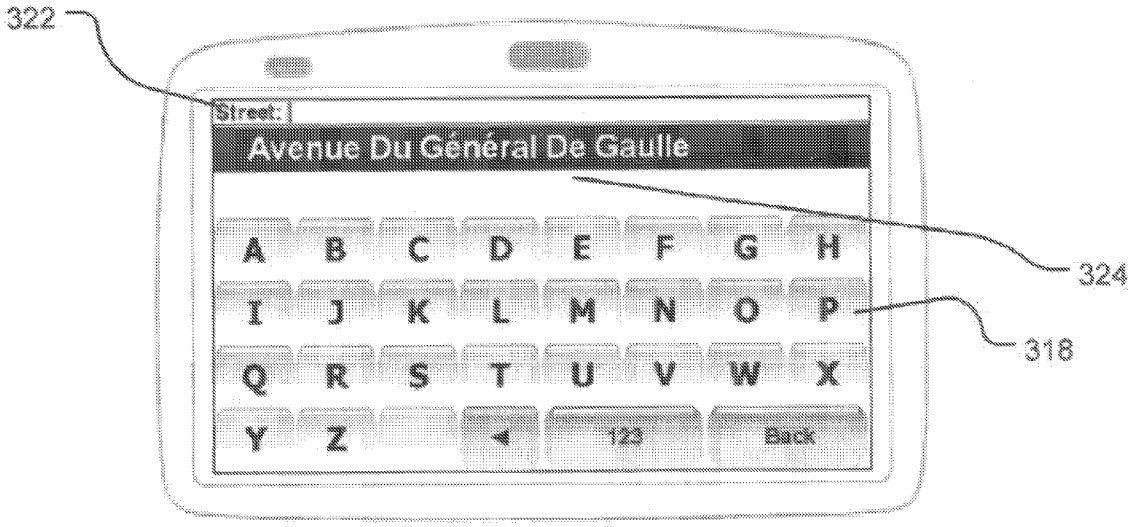


Figure 16

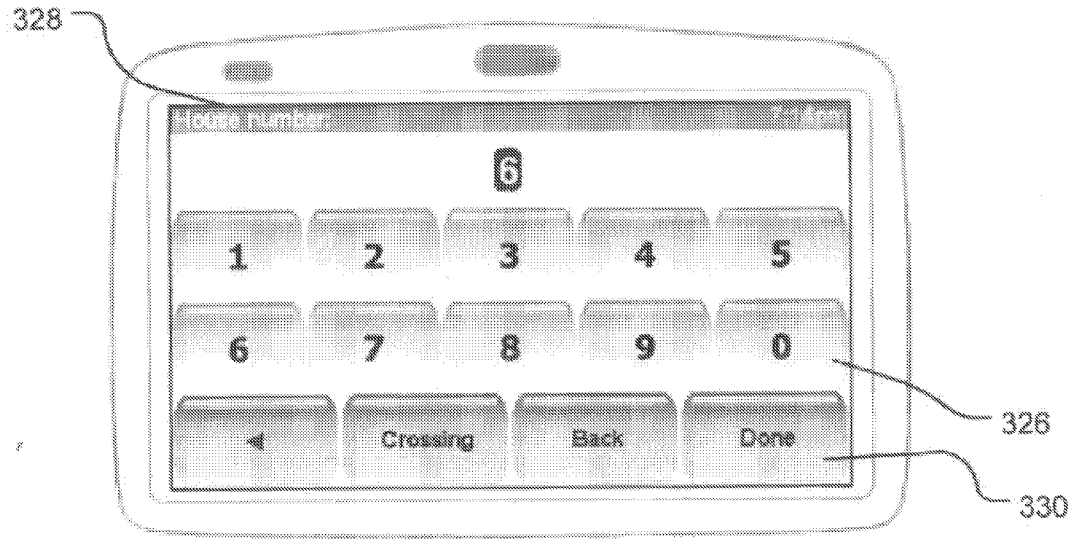


Figure 17



Figure 18

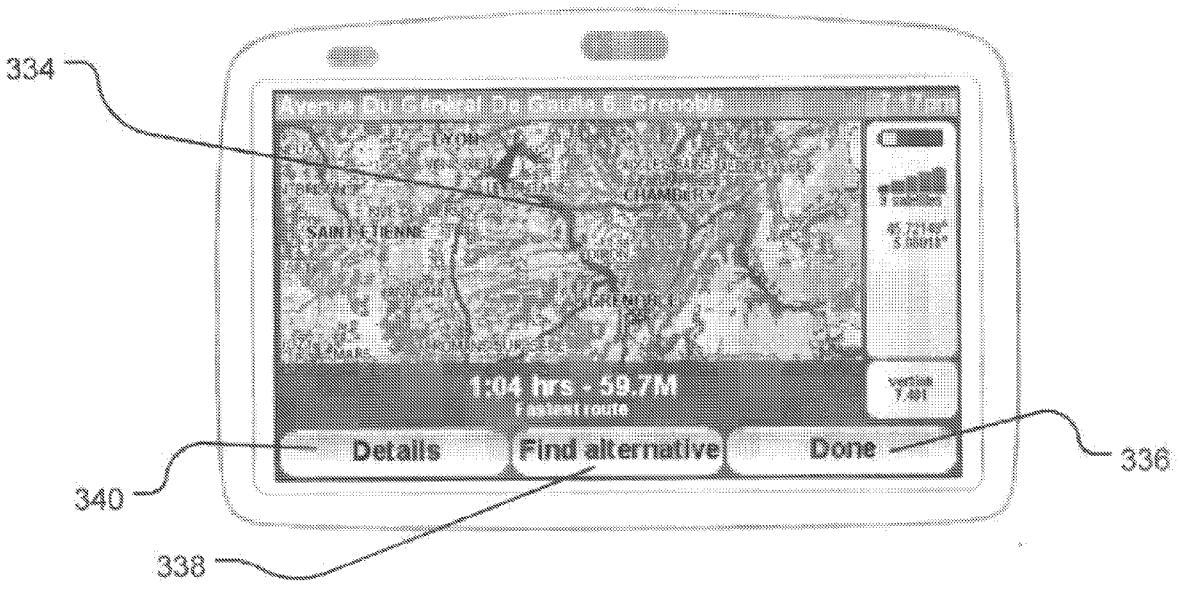
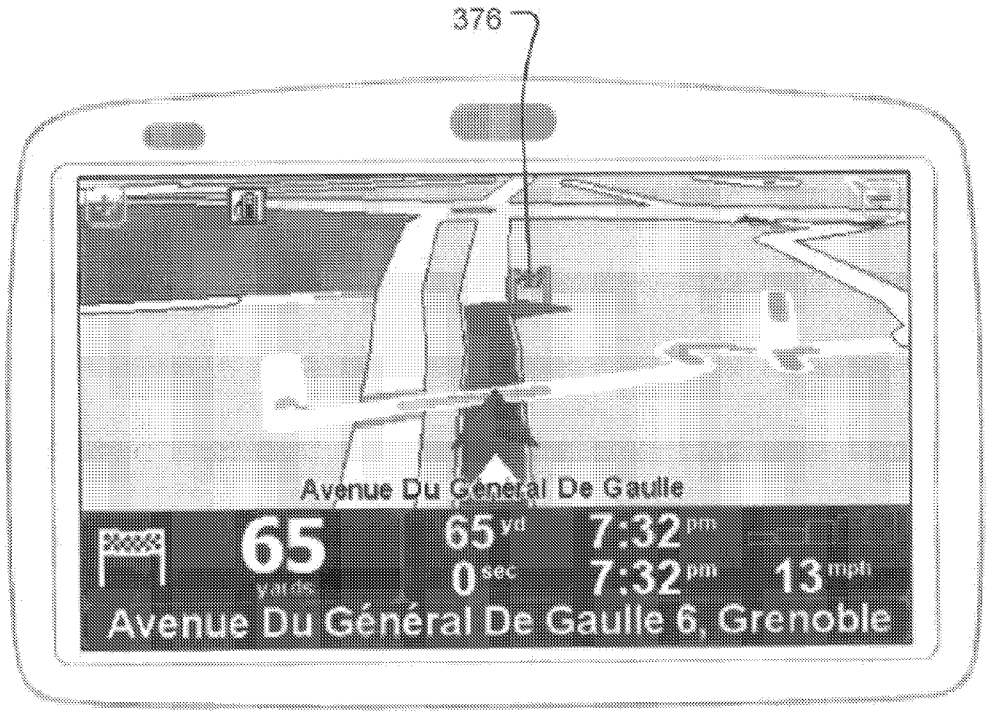


Figure 19


376
Avenue Du Général De Gaulle
65
yards
65 yd
0 sec
7:32 pm
7:32 pm
13 mph
Avenue Du Général De Gaulle 6, Grenoble

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/068319

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01C21/36 B60H1/00

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)
G01C B60H G08G E05F

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 practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	DE 43 00 927 A1 (KANG ANDREE DIPL ING [DE] KANG ANDREE [DE]) 21 July 1994 (1994-07-21) figure 1	1
X	EP 1 987 972 A (BAYERISCHE MOTOREN WERKE AG [DE]) 5 November 2008 (2008-11-05) paragraph [0011]; claims 1-3	1,8

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"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
8 October 2009	15/10/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	de la Rosa Rivera, E

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/068319

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X	DE 10 2004 002584 A1 (DAIMLER CHRYSLER AG [DE]) 18 August 2005 (2005-08-18) paragraphs [0007], [0008], [0011] - [0013], [0020]	8,9
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Information on patent family members

International application No
PCT/EP2008/068319

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