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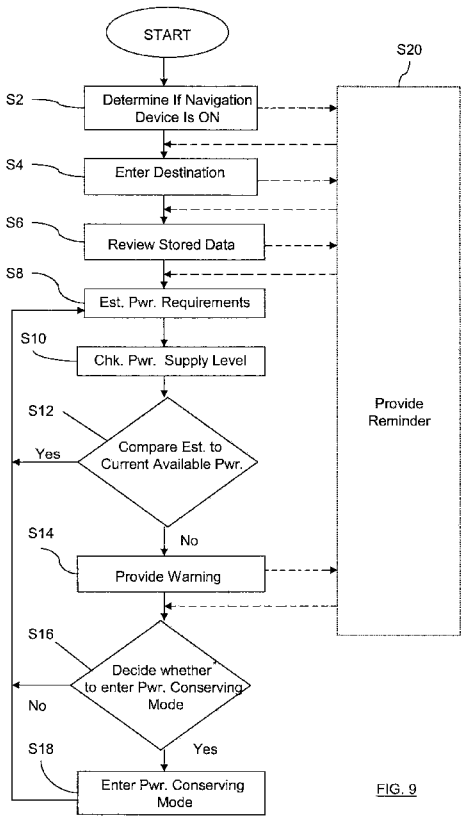



FIG. 9

(57) Abstract: A method and apparatus for determining, using a processor (210) of the navigation device (200), at least one of a target destination and a planned travel route; determining, using the processor of the navigation device, a charge level of a power supply (285) connected to the navigation device; determining, using the processor of the navigation device, if a detected power supply level is sufficient to power the navigation device to at least one of the target destination and throughout the planned travel route; and providing a warning when an amount of charge is insufficient to sufficiently power the navigation device to at least one of the target destination and during the planned travel route.

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# METHOD FOR WARNING OF INSUFFICIENT BATTERY LEVEL IN A NAVIGATION DEVICE

## Field

**[0001]** This disclosure generally relates to navigation devices and/or to methods for determining a route of travel from a first location to a second location, such as portable navigation devices (so-called PNDs); in particular PNDs that include Global Positioning System (GPS) signal reception and processing functionality. More specifically, this disclosure relates to warnings of low battery life in navigation devices. Other embodiments relate, more generally, to any type of processing device that is configured to execute navigation software so as to provide route planning, and preferably also navigation, functionality.

## Background

**[0002]** 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.

**[0003]** Such devices are of great utility when the user is not familiar with the route to the destination to which they are navigating. However, determining a route of travel to a destination takes time. In order to calculate a "best" or "optimum" route, the average speed for each road segment along a possible route of travel is typically used. As the distance to the destination increases, the time to determine the route of travel generally increases. Users of a navigation device may become impatient waiting for the navigation device to determine the route of travel. Although using a faster processor in the navigation device may increase the speed at which the route of travel is calculated, faster processors are more expensive and tend to increase the cost of producing a navigation device.

**[0004]** Such devices rely on a power source, such as a battery, to power the various aspects of the device. The portability of such devices allows device users to carry a PND with them throughout the day. For example, a user may move their PND from their home to their automobile for use during a trip. Daily commuters may also remove their PND from their automobile to charge the device by connection to a computer or other charging device. Due to the ease of use and the availability of charging the PND while at work on a computer, users

often do not bring a power cable to charge the PND in their automobile, which may result in the PND becoming discharged while on a long distance trip, thereby rendering the PND useless.

**[0005]** While current PNDs may have a low level charge warning, such devices usually include a visual warning when the battery is running out of power which leaves the user a finite period of time, often approximately fifteen minutes, to charge the device before the device shuts down. Due to the limitations of current devices and methods of providing battery level warnings, there is a high probability that the PND will shutdown in an environment unknown or undesired to the user.

## Summary

**[0006]** According to an example embodiment, a method is disclosed for determining, using a processor of the navigation device, at least one of a target destination and a planned travel route; determining, using the processor of the navigation device, a charge level of a power supply connected to the navigation device; determining, using the processor of the navigation device, if a detected power supply level is sufficient to power the navigation device to at least one of the target destination and throughout the planned travel route; and providing a warning when an amount of charge is insufficient to sufficiently power the navigation device to at least one of the target destination and during the planned travel route.

**[0007]** According to an example embodiment of the present disclosure, a navigation device having a battery level warning delivers a "smart warning" when there is a high probability that the battery is likely to discharge prematurely. The navigation device may include a housing; a power source within the housing; a memory resource to store at least one of a target destination and a calculated travel route; a processor to determine if a detected power supply level is sufficient to power the navigation device to at least one of the target destination and throughout the calculated travel route; and an output device to provide a warning upon failing to determine that the detected power supply level is sufficient to power the navigation device to at least one of the target destination and throughout the calculated travel route.

**[0008]** Advantages of these embodiments are set out hereafter, and further details and features of each of these embodiments are defined in the

accompanying dependent claims and elsewhere in the following detailed description.

## Brief Description of the Drawings

**[0009]** Various aspects of the teachings of the present disclosure, and arrangements embodying those teachings, will hereafter be described by way of illustrative example with reference to the accompanying drawings, in which:

**[0010]** Fig. 1 is a schematic illustration of a Global Positioning System (GPS);

**[0011]** Fig. 2 is a schematic illustration of electronic components arranged to provide a navigation device;

**[0012]** Fig. 3 is a schematic illustration of the manner in which a navigation device may receive information over a wireless communication channel;

**[0013]** Figs. 4A and 4B are illustrative perspective views of a navigation device;

**[0014]** Figs. 5a to 5i are illustrative screenshots from a navigation device for a destination input process;

**[0015]** Fig. 6 is an illustrative screenshot from a navigation device depicting a start location for an illustrative calculated route; and

**[0016]** Fig. 7 is a schematic illustration of electronic components arranged to provide a navigation device;

**[0017]** Fig. 8 is a schematic illustration of a processor associated with the navigation device of the present application;

**[0018]** Fig. 9 is an illustrative flow diagram depicting steps of an example embodiment of a method of the present disclosure;

**[0019]** Figs. 10a and 10b show example messages associated with the navigation device of the present application; and

**[0020]** Figs. 11a and 11b show example user selectable screens associated with the navigation device of the present application.

## Detailed Description of Example Embodiments

**[0021]** Various example embodiments will now be described more fully with reference to the accompanying drawings in which some example embodiments are illustrated.

**[0022]** Accordingly, while example embodiments are capable of various modifications and alternative forms, embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be

understood, however, that there is no intent to limit example embodiments to the particular forms disclosed, but on the contrary, example embodiments are to cover all modifications, equivalents, and alternatives falling within the scope of example embodiments. Like numbers refer to like elements throughout the description of the figures.

**[0023]** It will be understood that, although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example, a first element could be termed a second element, and, similarly, a second element could be termed a first element, without departing from the scope of example embodiments. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

**[0024]** It will be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element or intervening elements may be present. In contrast, when an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements present. Other words used to describe the relationship between elements should be interpreted in a like fashion (*e.g.*, "between" versus "directly between," "adjacent" versus "directly adjacent," etc.).

**[0025]** The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of example embodiments. As used herein, the singular forms "a," "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises," "comprising," "includes" and/or "including," when used herein, specify the presence of stated features, integers, steps, operations, elements and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components and/or groups thereof.

**[0026]** Spatially relative terms, e.g., "beneath," "below," "lower," "above," "upper" and the like, may be used herein for ease of description to describe one element or a relationship between a feature and another element or feature as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if

the device in the figures is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, for example, the term "below" can encompass both an orientation which is above as well as below. The device may be otherwise oriented (rotated 90 degrees or viewed or referenced at other orientations) and the spatially relative descriptors used herein should be interpreted accordingly.

**[0027]** It should also be noted that in some alternative implementations, the functions/acts noted may occur out of the order noted in the figures. For example, two figures shown in succession may in fact be executed substantially concurrently or may sometimes be executed in the reverse order, depending upon the functionality/acts involved.

**[0028]** Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which example embodiments belong. It will be further understood that terms, e.g., those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

**[0029]** Portions of example embodiments and corresponding detailed description are presented in terms of software, or algorithms and symbolic representations of operation on data bits within a computer memory. These descriptions and representations are the ones by which those of ordinary skill in the art effectively convey the substance of their work to others of ordinary skill in the art. An algorithm, as the term is used here, and as it is used generally, is conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of optical, electrical, or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It is convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

**[0030]** In the following description, illustrative embodiments will be described with reference to acts and symbolic representations of operations (e.g., in the form of flowcharts) that may be implemented as program modules or functional processes include routines, programs, objects, components, data structures,

that perform particular tasks or implement particular abstract data types and may be implemented using existing hardware at existing network elements or control nodes (e.g., a database). Such existing hardware may include one or more Central Processing Units (CPUs), digital signal processors (DSPs), application-specific-integrated-circuits, field programmable gate arrays (FPGAs) computers or the like.

**[0031]** It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise, or as is apparent from the discussion, terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical, electronic quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

**[0032]** Note also that the software implemented aspects of example embodiments are typically encoded on some form of computer readable medium or implemented over some type of transmission medium. The computer readable medium may be magnetic (e.g., a floppy disk or a hard drive) or optical (e.g., a compact disk read only memory, or "CD ROM"), and may be read only or random access. Similarly, the transmission medium may be twisted wire pairs, coaxial cable, optical fiber, or some other suitable transmission medium known to the art. Example embodiments are not limited by these aspects of any given implementation.

**[0033]** Example embodiments will now be described with particular reference to a portable navigation device (PND). It should be understood that the teachings of the present disclosure are not limited to PNDs and are universally applicable to any type of processing device that is configured to execute navigation software 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/or navigation device, irrespective of whether that device is embodied as a PND, a navigation device built into a vehicle, or indeed a computing resource (such as a

desktop or portable personal computer (PC), mobile telephone or portable digital assistant (PDA) executing route planning and navigation software).

**[0034]** It will also be apparent from the following that the teachings of the present disclosure 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.

**[0035]** With the above provisos in mind, Fig. 1 illustrates an example view of Global Positioning System (GPS), usable by navigation devices. Such systems are known and are used for a variety of purposes. In general, 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.

**[0036]** 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 will allow 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 an unlimited number of users.

**[0037]** As shown in Figure 1, the GPS system is denoted generally by reference numeral 100. A plurality of satellites 120 are in orbit about the earth 124. The orbit of each satellite 120 is not necessarily synchronous with the orbits of other satellites 120 and, in fact, is likely asynchronous. A GPS receiver 140 is shown receiving spread spectrum GPS satellite signals 160 from the various satellites 120.

**[0038]** The spread spectrum signals 160, continuously transmitted from each satellite 120, utilize a highly accurate frequency standard accomplished with an extremely accurate atomic clock. Each satellite 120, as part of its data signal transmission 160, transmits a data stream indicative of that particular satellite 120. It is appreciated by those skilled in the relevant art that the GPS receiver device 140 generally acquires spread spectrum GPS satellite signals 160 from at least three satellites 120 for the GPS receiver device 140 to calculate its two-dimensional position by triangulation. Acquisition of an additional signal, resulting in signals 160 from a total of four satellites 120, permits the GPS receiver device 140 to calculate its three-dimensional position in a known manner.

**[0039]** Figure 2 is an illustrative representation of electronic components of a navigation device 200 according to an example embodiment of the present disclosure, in block component format. 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.

**[0040]** The navigation device 200 is located within a housing (not shown). The housing includes a processor 210 connected to an input device 220 and a display screen 240. The input device 220 can include a keyboard device, voice input device, touch panel and/or any other known input device utilised to input information; and the display screen 240 can include any type of display screen such as an LCD display, for example. In an example arrangement, the input device 220 and display screen 240 are integrated into an integrated input and display device, including a touchpad or touch screen input so that a user need only touch a portion of the display screen 240 to select one of a plurality of display choices or to activate one of a plurality of virtual buttons.

**[0041]** The navigation device may include an output device 260, for example an audible output device (e.g. a loudspeaker). As output device 260 can produce

audible information for a user of the navigation device 200, it is should equally be understood that input device 240 can include a microphone and software for receiving input voice commands as well.

**[0042]** In the navigation device 200, processor 210 is operatively connected to and set to receive input information from input device 220 via a connection 225, and operatively connected to at least one of display screen 240 and output device 260, via output connections 245, to output information thereto. Further, the processor 210 is operably coupled to a memory resource 230 via connection 235 and is further adapted to receive/send information from/to input/output (I/O) ports 270 via connection 275, wherein the I/O port 270 is connectible to an I/O device 280 external to the navigation device 200. The memory resource 230 comprises, for example, a volatile memory, such as a Random Access Memory (RAM) and a non-volatile memory, for example a digital memory, such as a flash memory. The external I/O device 280 may include, but is not limited to an external listening device such as an earpiece for example. The connection to I/O device 280 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 ear piece or head phones, and/or for connection to a mobile phone for example, wherein the mobile phone connection may 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.

**[0043]** Fig. 2 further illustrates an operative connection between the processor 210 and an antenna/receiver 250 via connection 255, wherein the antenna/receiver 250 can be a GPS antenna/receiver for example. It will be understood that the antenna and receiver designated by reference numeral 250 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.

**[0044]** Further, it will be understood by one of ordinary skill in the art that the electronic components shown in Fig. 2 are powered by 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 Fig. 2 are considered to be within the scope of the present application. For example, the

components shown in Fig. 2 may be in communication with one another via wired and/or wireless connections and the like. Thus, the scope of the navigation device 200 of the present application includes a portable or handheld navigation device 200.

**[0045]** In addition, the portable or handheld navigation device 200 of Fig. 2 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 navigation device 200 is then removable from the docked location for portable or handheld navigation use.

**[0046]** Referring now to Fig. 3, the navigation device 200 may establish a "mobile" or telecommunications network connection with a server 302 via a mobile device (not shown) (such as a mobile phone, PDA, and/or any device with mobile phone technology) establishing a digital connection (such as a digital connection via known Bluetooth technology for example). Thereafter, through its network service provider, the mobile device can establish a network connection (through the internet for example) with a server 302. As such, a "mobile" network connection is established between the navigation device 200 (which can be, and often times is mobile as it travels alone and/or in a vehicle) and the server 302 to provide a "real-time" or at least very "up to date" gateway for information.

**[0047]** The establishing of the network connection between the mobile device (via a service provider) and another device such as the server 302, using an internet (such as the World Wide Web) for example, can be done in a known manner. This can include use of TCP/IP layered protocol for example. The mobile device can utilize any number of communication standards such as CDMA, GSM, WAN, etc.

**[0048]** As such, an internet connection may be utilised which is achieved via data connection, via a mobile phone or mobile phone technology within the navigation device 200 for example. For this connection, an internet connection between the server 302 and the navigation device 200 is established. This can be done, for example, through a mobile phone or other mobile device and a GPRS (General Packet Radio Service)-connection (GPRS connection is a high-speed data connection for mobile devices provided by telecom operators; GPRS is a method to connect to the internet).

**[0049]** The navigation device 200 can further complete a data connection with the mobile device, and eventually with the internet and server 302, via existing

Bluetooth technology for example, in a known manner, wherein the data protocol can utilize any number of standards, such as the GSRM, the Data Protocol Standard for the GSM standard, for example.

**[0050]** The navigation device 200 may include its own mobile phone 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 as specified above, and/or can include an insertable card (e.g. Subscriber Identity Module or 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 302, via the internet for example, in a manner similar to that of any mobile device.

**[0051]** For GRPS phone settings, a Bluetooth enabled navigation device may be used to correctly work 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.

**[0052]** In Fig. 3 the navigation device 200 is depicted as being in communication with the server 302 via a generic communications channel 318 that can be implemented by any of a number of different arrangements. The server 302 and a navigation device 200 can communicate when a connection via communications channel 318 is established between the server 302 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.).

**[0053]** The server 302 includes, in addition to other components which may not be illustrated, a processor 304 operatively connected to a memory 306 and further operatively connected, via a wired or wireless connection 314, to a mass data storage device 312. The processor 304 is further operatively connected to transmitter 308 and receiver 310, to transmit and send information to and from navigation device 200 via communications channel 318. The signals sent and received may include data, communication, and/or other propagated signals. The transmitter 308 and receiver 310 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 308 and receiver 310 may be combined into a signal transceiver.

**[0054]** Server 302 is further connected to (or includes) the mass storage device 312, noting that the mass storage device 312 may be coupled to the server 302 via the communication link 314. The mass storage device 312 contains a store of navigation data and map information, and can again be a separate device from the server 302 or can be incorporated into the server 302.

**[0055]** The navigation device 200 is adapted to communicate with the server 302 through communications channel 318, and includes processor, memory, etc. as previously described with regard to Fig. 2, as well as transmitter 320 and receiver 322 to send and receive signals and/or data through the communications channel 318, noting that these devices can further be used to communicate with devices other than server 302. Further, the transmitter 320 and receiver 322 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 320 and receiver 322 may be combined into a single transceiver.

**[0056]** Software stored in server memory 306 provides instructions for the processor 304 and allows the server 302 to provide services to the navigation device 200. One service provided by the server 302 involves processing requests from the navigation device 200 and transmitting navigation data from the mass data storage 312 to the navigation device 200. Another service provided by the server 302 includes processing the navigation data using various algorithms for a desired application and sending the results of these calculations to the navigation device 200.

**[0057]** The communication channel 318 generically represents the propagating medium or path that connects the navigation device 200 and the server 302. Both the server 302 and navigation device 200 include a transmitter for transmitting data through the communication channel and a receiver for receiving data that has been transmitted through the communication channel.

**[0058]** The communication channel 318 is not limited to a particular communication technology. Additionally, the communication channel 318 is not limited to a single communication technology; that is, the channel 318 may include several communication links that use a variety of technology. For

example, the communication channel 318 can be adapted to provide a path for electrical, optical, and/or electromagnetic communications, etc. As such, the communication channel 318 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, empty space, etc. Furthermore, the communication channel 318 can include intermediate devices such as routers, repeaters, buffers, transmitters, and receivers, for example.

**[0059]** In one illustrative arrangement, the communication channel 318 includes telephone and computer networks. Furthermore, the communication channel 318 may be capable of accommodating wireless communication such as radio frequency, microwave frequency, infrared communication, etc. Additionally, the communication channel 318 can accommodate satellite communication.

**[0060]** The communication signals transmitted through the communication channel 318 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 318. These signals may be modulated, encrypted and/or compressed signals as may be desirable for the communication technology.

**[0061]** The server 302 includes a remote server accessible by the navigation device 200 via a wireless channel. The server 302 may include a network server located on a local area network (LAN), wide area network (WAN), virtual private network (VPN), etc.

**[0062]** The server 302 may include a personal computer such as a desktop or laptop computer, and the communication channel 318 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 302 to establish an internet connection between the server 302 and the navigation device 200. Alternatively, a mobile telephone or other handheld device may establish a wireless connection to the internet, for

connecting the navigation device 200 to the server 302 via the internet.

**[0063]** The navigation device 200 may be provided with information from the server 302 via information downloads which may be periodically updated automatically or upon a user connecting navigation device 200 to the server 302 and/or may be more dynamic upon a more constant or frequent connection being made between the server 302 and navigation device 200 via a wireless mobile connection device and TCP/IP connection for example. For many dynamic calculations, the processor 304 in the server 302 may be used to handle the bulk of the processing needs, however, processor 210 of navigation device 200 can also handle much processing and calculation, oftentimes independent of a connection to a server 302.

**[0064]** As indicated above in Fig. 2, the navigation device 200 includes a processor 210, an input device 220, and a display screen 240. The input device 220 and display screen 240 may be integrated into an integrated input and display device to enable both input of information (via direct input, menu selection, etc.) and display of information through a touch panel screen, for example. Such a screen may be a touch input LCD screen, for example, as is well known to those of ordinary skill in the art. Further, the navigation device 200 can also include any additional input device 220 and/or any additional output device 260, such as audio input/output devices for example.

**[0065]** Figs 4A and 4B are perspective views of a navigation device 200. As shown in Fig. 4A, the navigation device 200 may be a unit that includes an integrated input and display device 290 (a touch panel screen for example) and the other components of Fig. 2 (including but not limited to internal GPS receiver 250, microprocessor 210, a power supply, memory systems 230, etc.).

**[0066]** The navigation device 200 may sit on an arm 292, which itself may be secured to a vehicle dashboard/window/etc. using a suction cup 294. This arm 292 is one example of a docking station to which the navigation device 200 can be docked.

**[0067]** As shown in Fig. 4B, the navigation device 200 can be docked or otherwise connected to an arm 292 of the docking station by snap connecting the navigation device 292 to the arm 292 for example. The navigation device 200 may then be rotatable on the arm 292, as shown by the arrow of Fig. 4B. To release the connection between the navigation device 200 and the docking station, a button on the navigation device 200 may be pressed, for example.

Other equally suitable arrangements for coupling and decoupling the navigation device to a docking station are well known to persons of ordinary skill in the art.

**[0068]** Referring now to Figs. 5a to 5i there is depicted a series of screenshots from a navigation device 200. This navigation device 200 has a touch screen interface for displaying information to a user and for accepting input to the device from the user. The screenshots show an illustrative example embodiment of a destination location input process for a user whose home location has been set to the offices in The Hague of the European Patent Office, and who wishes to navigate to a street address in Amsterdam, The Netherlands for which they know the street name and building number.

**[0069]** When this user switches on their navigation device 200, the device 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 Fig. 5a, with a display 340 showing in pseudo three-dimensions the local environment 342 in which the navigation device 200 is determined to be located, and in a region 344 of the display 340 below the local environment a series of control and status messages.

**[0070]** By touching the display of the local environment 342, the navigation device 200 switches to display (as shown in Fig. 5b) a series of virtual buttons 346 by means of which a user can, inter alia, input a destination that they wish to navigate to.

**[0071]** By touching the "navigate to" virtual button 348, the navigation device 200 switches to display (as shown in Fig. 5c) 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 the stored home location. However, in this instance as the user is already at their home location (namely the EPO's offices in the Hague) selecting this option would not cause a route to be generated. 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" button, if pressed, reveals a list of selectable destinations held in the memory 230 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 which a user can opt to navigate to any of a plurality of locations, such as cash machines, petrol stations or tourist attractions for example, that have been pre-stored in the device as locations that a user of the device might want to navigate to. The "arrow" shaped virtual button opens a new menu of additional options, and the "address" button 350 commences a process by which the user can input the street address of the destination that they wish to navigate to.

**[0072]** Since the user, in this example, knows the street address of the destination that they wish to navigate to, it is assumed that this "address" button is operated (by touching the button displayed on the touch screen), whereupon (as shown in Fig. 5d) 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".

**[0073]** 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 352 whereupon the user is then presented, as shown in Fig. 5e, a prompt 354 to enter the name of the city that they wish to navigate to, a flag button 356 by which the user can select the country in which the desired city is located, and a virtual keyboard 358 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 Rijswijk and Amsterdam, and the PND therefore additionally provides the user with a list 360 of selectable cites.

**[0074]** The user in this instance wishes to navigate to Amsterdam, and on selection of Amsterdam from the list 360 the navigation device 200 displays, as shown in Fig. 5f, a virtual keyboard 362 by means of which a user can input street names, a prompt 364 for entry of a street name 364 and, in this instance, as the user has previously navigated to a street in Amsterdam, a list 366 of selectable streets in Amsterdam.

**[0075]** In this example the user wishes to return to the street, Rembrandtplein, that they have previously visited and so selects Rembrandtplein from the displayed list 366.

**[0076]** Once a street has been selected, the navigation device 200 then displays

a smaller virtual keypad 368 and prompts the user, via prompt 370, to enter the number of the house in the selected street and city that they wish to navigate to. If the user has previously navigated to a house number in this street, then that number (as shown in Fig. 5g) is initially shown. If, as in this instance, the user wishes to navigate to No. 35, Rembrandtplein once again, then the user need only touch a "done" virtual button 372 displayed at the bottom right hand corner of the display. If the user should wish to navigate to a different house number in Rembrandtplein, then all they need do is operate the keypad 368 to input the appropriate house number.

**[0077]** Once the house number has been input, the user is asked in Fig. 5h, whether they wish to arrive at a particular time. If the user should push the "yes" button, then functionality is invoked that estimates the time required to travel to the destination and advises the user when they should leave (or if they are running late, should have left) their current location in order to arrive at their destination on time. In this instance the user is not concerned about arriving at a particular time and hence selects the "no" virtual button.

**[0078]** Selecting the "no" button 374 causes the navigation device 200 to calculate a route between the current location and the selected destination and to display that route 376, as shown in Fig. 5i, on a relatively low magnification map that shows the entire route. The user provided with a "done" virtual button 378 which they can press to indicate that they are happy with the calculated route, a "find alternative" button 380 that the user can press to cause the navigation device 200 to calculate another route to the selected destination, and a "details" button 382 that a user can press to reveal selectable options for the display of more detailed information concerning the currently displayed route 376.

**[0079]** In this instance it is assumed that the user is happy with the displayed route, and once the "done" button 378 has been pressed the user is presented, as shown in Fig. 6, with a pseudo three-dimensional view of the current, start, location for the navigation device 200. The display depicted in Fig. 6 is similar to that shown in Fig. 5a except that the displayed local environment 342 now includes a start location flag 384 and a waypoint indicator 386 indicating the next manoeuvre (in this instance, a left hand turn). The lower part of the display has also changed and now displays the name of the street in which the navigation device 200 is currently located, an icon 388 indicating the distance

to and type of the next manoeuvre (from the current location of the navigation device 200), and a dynamic display 390 of the distance and time to the selected destination.

**[0080]** The user then commences their journey and the navigation device 200 guides the user, in a known manner, by updating the map in accordance with determined changes in navigation device 200 location, and by providing the user with visual and, optionally, audible navigation instructions.

**[0081]** As shown in Fig. 7, all of the aforementioned components of Figures 2, 3, 4a and 4b of the navigation device 200 can be powered by either an internal power source 285, such as a battery for example, or via connection to an external power source 295 (for example a vehicle battery, a home outlet, etc.). This external connection can be via a direct cable 288 or other connection between the navigation device 200 and an external power source 295 (for providing power from the vehicle battery), and/or can be a cable 288 or other connection between the docking station 292 and the external power source 295, with the docking station 292 being connected to the navigation device 200 as shown in Figure 4b for example.

**[0082]** Upon the navigation device 200 being connected to the external power source, no real power problems exist as long as the vehicle is running (the vehicle recharges the battery while the vehicle is running and thus the navigation device 200 is constantly supplied with power). However, if the vehicle is stopped, or if the components (of Figure 2 for example) of the navigation device 200 are otherwise running off the internal power source 285 of the navigation device 200 (if the navigation device 200 is not connected to the external power source 295 while in the vehicle, if the navigation device 200 is being used in a hand-held mode for walking navigation and/or for its other functions such as an MP3 player for example, etc.), the relatively smaller internal power source 285 can have its power used up quickly. Such an internal power source 285, for example 3.7 volt lithium-ion batteries can last for only a limited time (e.g., 2-5 hours) in normal use. However, based upon the power saving of embodiments of the present application, the useful life of the battery may be significantly extended.

**[0083]** According to various embodiments of the present application, and as illustrated in Fig. 7, the navigation device 200 is located within a housing 205 (Figs. 4a, 4b) and may include a processor 210 connected to an input device

220 and a display device 240. The input device 220 can include a keyboard device, voice input device, touch panel and/or any other known input device utilised to input information; and the display device 240 can include any type of display screen such as an LCD display, for example. In an example arrangement, the input device 220 and display device 240 are integrated into an integrated input and display device, including a touchpad or touch screen input so that a user need only touch a portion of the display device 240 to select one of a plurality of display choices or to activate one of a plurality of virtual buttons.

**[0084]** The navigation device may include an output device 260, for example an audible output device (e.g. a loudspeaker 265 and/or the display device 240). As output device 260 can produce audible information for a user of the navigation device 200, it is should equally be understood that input device 220 can include a microphone and software for receiving input voice commands as well.

**[0085]** In the navigation device 200, the processor 210 is operatively connected to and set to receive input information from input device 220 via a connection 225, and operatively connected to at least one of the display screen 240 and the output device 260, via output connections 245, to output information thereto. Further, the processor 210 is operably coupled to a memory resource 230 via connection 235 and is further adapted to receive/send information from/to input/output (I/O) ports 270 via connection 275, wherein the I/O port 270 is connectible to an I/O device 280 external to the navigation device 200. The memory resource 230 comprises, for example, a volatile memory, such as a Random Access Memory (RAM) and a non-volatile memory, for example a digital memory, such as a flash memory. The external I/O device 280 may include, but is not limited to an external listening device such as an earpiece for example. The connection to the I/O device 280 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 ear piece or head phones, and/or for connection to a mobile phone for example, wherein the mobile phone connection may 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.

**[0086]** Fig. 7 further illustrates an operative connection between the processor 210 and an antenna/receiver 250 via connection 255, wherein the antenna/receiver 250 can be a GPS antenna/receiver for example. It will be understood that the antenna and receiver designated by reference numeral 250 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.

**[0087]** Further, the electronic components shown in Fig. 7 may be powered by power sources such as an internal power source 285 within the housing 205 and/or an external power source 295 outside of the housing 205. In an example embodiment, the internal power source 285 may be a battery and the external power source may be a power source of a vehicle in which the navigation device is contained. A battery charging device 288 may be connected to the external power source 295 and the navigation device 200 to provide power to the navigation device 200 and/or charge the navigation device 200. In an example embodiment, the battery charging device 288 may be a cable that interfaces with the navigation device 200 and a power source of the vehicle. As will be understood by one of ordinary skill in the art, different configurations of the components shown in Fig. 7 are considered to be within the scope of the present application. For example, the components shown in Fig. 7 may be in communication with one another via wired and/or wireless connections and the like. Thus, the scope of the navigation device 200 of the present application includes a portable or handheld navigation device 200.

**[0088]** In addition, the portable or handheld navigation device 200 of Fig. 7 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 navigation device 200 is then removable from the docked location for portable or handheld navigation use.

**[0089]** In an example embodiment, the navigation device 200 may include a housing 205; a power source 285 within the housing 205; a memory resource 230 to store at least one of a target destination and a calculated travel route; a processor 210 to determine if a detected power supply level is sufficient to power the navigation device to at least one of the target destination and throughout the calculated travel route; and an output device 260 to provide a warning upon failing to determine that the detected power supply level is sufficient to power the navigation device 200 to at least one of the target

destination and throughout the calculated travel route.

**[0090]** In one example embodiment as shown in Fig. 8, the processor 210 may include a charge level sensor 410 that monitors a charge level of the internal power source 285 housed within the navigation device 200. The charge level sensor 410 may be further connected to a memory 420, such as a ROM device. In an example embodiment, memory 420 includes a look-up table of correlations between a charge level of the internal power source 285 and a corresponding estimated time or amount of useful battery life. By accessing the look-up table in the memory 420, the processor 210 can compare the current battery charge level detected by the charge level sensor 410 to a corresponding estimated useful battery life to determine if the current battery charge is sufficient to power the navigation device 200 for a period relating to an estimated time to reach a destination entered into the navigation device 200 via the input device 220. In an example embodiment, the memory 420 including the look-up table may be updated in a known manner in the event of a change of battery type or the like.

**[0091]** The device of Figs. 7 and 8 may operate to provide warning of a low power level and/or to provide a reminder to connect the navigation device 200 to a charging source, such as a power source external to the navigation device 200 which may include, but is not limited to a vehicle battery. The reminder may also include a reminder to bring along a battery charging device, such as a charging cable 288 to interface between the navigation device 200 and the external power source 295. In an example embodiment, the navigation device 200 may execute or otherwise perform a method for providing a warning of low power level in the navigation device 200. It should be understood that this example method can be used anytime the navigation device 200 is operating using a power source, such as internal power source 285. It should also be understood that the method applies equally to vehicle and walking or "foot travel" navigation. The warning and/or the reminder may be provided visually and/or audibly. In an example embodiment, a visual warning and/or a visual reminder may be displayed on the display device 240 of the navigation device 200. An audible warning and/or reminder may be provided via the loudspeaker 265 of the navigation device 200.

**[0092]** A method of providing a warning of low power level in the navigation device 200 may include determining, using a processor 210 of the navigation

device 200, at least one of a target destination and a planned travel route; determining, using the processor 210 of the navigation device 200, a charge level of a power source 285 connected to the navigation device 200; determining, using the processor 210 of the navigation device 200, if a detected power supply level is sufficient to power the navigation device 200 to at least one of the target destination and throughout the planned travel route; and providing a warning when an amount of charge is insufficient to sufficiently power the navigation device to at least one of the target destination and during the planned travel route.

**[0093]** In one example embodiment as shown in Figure 9, at step S2, a determination is made as to the current state of the navigation device 200. For example, a processor 210 of the navigation device 200 may initially determine whether or not the navigation device 200 is ON. This determination can include a determination of whether or not the navigation device 200 is operating from an internal power source, such as internal battery, or an external power source, such a vehicle battery for example. For example, the internal power source 285 or the external power source 295 may send a signal to the processor 210 to enable a determination of whether the internal or external power source is being used. However, irrespective of whether or not this determination is made, the process steps of Figure 9 can still continue as power level determining steps and can be achieved irrespective of whether the navigation device 200 is operating from the internal power source285 or the external power source295, such as vehicle battery power.

**[0094]** Thereafter, at step S4 it is determined, by the processor 210 for example, whether or not a travel route/destination has been entered into the navigation device 200 and calculated. If no travel route and/or destination has been entered, the travel route and/or destination may be entered for example, by one or more of the methods described above with reference to Figs. 5a-5i for example or by audible input via the input device 220. A travel route is typically determined in a known manner based upon an input destination location, of a desired destination of a user for example, and a GPS signal received in the GPS receiver 250 of the navigation device 200, indicating a current location of the navigation device 200. Once the travel destination has been input into the navigation device 200, either audibly, via the input device 240, or an integrated input and display device 290 for example, the processor 210 of the navigation

device 200 can then determine and/or calculate a route of travel in a known manner based upon map information stored in the memory 230 of the navigation device 200, the input travel destination, and a current location of the navigation device.

**[0095]** Once a route of travel has been calculated in step S4, the process proceeds to step S6 where a memory, such as the memory 230, of the navigation device 200, is checked by, for example a processor 210, to determine if the destination entered at step S4 is a known destination or a previously travelled route.

**[0096]** Upon completion of step S6, the process proceeds to step S8 where an amount of power required to supply the navigation device 200 throughout the planned trip is estimated based on at least one of an amount of time to reach the destination or to travel a calculated travel route, and estimated power requirements of the navigation device 200 and/or its functions. For example, a navigation device with multiple available functions active, such as MP3 capabilities, telephone capabilities, volume control, screen brightness control, audio output, and the like, may be expected to use available power at a rate greater than a navigation device without such functions being active.

**[0097]** Thereafter, at step S10, the processor 210 may initially determine a power supply level of an available power source from which the navigation device 200 is presently drawing power. For example, the processor 210 can compare the current battery charge level detected by the charge level sensor 410 to a corresponding estimated useful battery life to determine if the current battery charge is sufficient to power the navigation device 200 for a period relating to an estimated time to reach a destination entered into the navigation device 200 via the input device 220.

**[0098]** The process proceeds to step S12 where the estimated required power supply determined from step S8 needed to support the navigation device 200 throughout the calculated trip may be compared to a present power supply level of a power source determined at step S10. If a determination is made that there is sufficient power available to enable the navigation device 200 throughout the estimated trip, the process proceeds back to step S8 whereby the status of the power source will be continuously monitored and estimated based on remaining time and/or distance remaining on the trip and detected usage of power currently being used by the navigation device 200 to update the estimated

needed power supply to power the navigation device for the duration of the trip.

**[0099]** In the event a determination is made at step S12 that there is an insufficient amount of power available to the navigation device 200, the process continues to step S14 whereby a warning will be activated by, for example by the processor 210, to warn that an insufficient amount of power exists to operate the navigation device 200 throughout the planned trip. In an example embodiment, the warning may include an estimated amount of time remaining until the navigation device will no longer have sufficient power to operate. The warning may be provided audibly and/or visually using an output 260, such as the loudspeaker 265 and/or the display device 240.

**[0100]** An example of a visual warning and/or reminder is shown for example in Figs. 10a and 10b which provide example warnings and/or reminders indicating that the planned trip exceeds current battery power and/or not forget to bring a battery charger or to plug the navigation device into an external power source. Although examples of visual warnings and reminders are shown in Figs. 10a and 10b, one of skill in the art would recognize that additional warning and/or reminder messages could be displayed or provided audibly. Audible warnings may include, but are not limited to a voice message reciting the displayed message, alert signals, chimes, or the like that would alert a user of the navigation device that there is insufficient battery life and/or that the navigation device should be connected to an external power source via a charging device.

**[0101]** Upon completion of step S14, the process may continue to step S16 whereby the processor 210 may output a signal to enter the navigation device 200 into a power conserving mode. Placing the navigation device 200 in a power conserving mode may be done in a number of different ways which conserve the use of power in the navigation device 200. In an example embodiment, the processor 210 may shut down functions that are not essential to navigating to the desired destination and/or travelling the calculated travel route. For example, placing of the navigation device 200 in the power conserving mode may include at least one of shutting down or otherwise suspending certain "non-essential" functions of the navigation device 200 including, but not limited to MP3 capabilities, telephone capabilities, volume control, screen brightness control, audio output, relatively dimming a backlight of an integrated input and display device 290 of the navigation device 200, and

the like. Further, the relative dimming of the display device 290 can include turning a backlight of the navigation device off to conserve power. The control of these "non-essential" functions can be done, for example, by the processor 210 controlling the supply of power from an internal power source 285, such as a battery, of the navigation device 200.

**[0102]** Upon completion of step S16, the process may proceed back to step S8 whereby the status of the power source will be continuously estimated based on remaining time to reach the desired destination and/or the distance remaining on the trip and detected usage of power currently being used by the navigation device to update the estimated needed power supply to power the navigation device for the duration of the trip. If a determination is made that sufficient power exists to allow the navigation device to function for the remaining duration of the trip, the warning may be removed and/or the power conserving mode may be exited.

**[0103]** In an example embodiment of the present application, a user of the navigation device 200 can initially elect to display a screen (on the integrated input and display device 290 of the navigation device 200, for example) or otherwise select or set a power conserving mode or battery saving preference as shown in Figs. 11a and 11b. One such selectable/settable preference can be to never turn the screen off. Another such selectable/settable preference can be to turn off the screen unless a next navigation instruction is near (for example, via use of a distance threshold and/or time threshold), or alternatively to always turn the screen off until determining that at least one of the visual and the audible warning is to be provided, determining that a navigation instruction is to be implemented by the navigation device 200, within at least one of a distance less than a second distance threshold and a time less than a second time threshold; and determining receipt of at least one of an incoming message signal and an incoming telephone signal to the navigation device. In this context, "turn off screen" can mean at least one of at least relatively dimming a backlight of an integrated input and display device 290 of the navigation device 200, and turning the backlight off.

**[0104]** In an example embodiment, a user of the navigation device 200 can initially elect to turn off one or more other "non-essential" functions, such as turning off an MP3 function, Bluetooth™ function and audio functions. One of skill in the art may recognize other functions of the navigation device 200 may

be selectively turned off or otherwise suspended and that the current application is not intended to be limited to the functions shown in Figs. 11a and 11b or described herein.

**[0105]** In the event of turning off or dimming a backlight of the navigation device 200, the screen of the integrated input and display device 290 of the navigation device 200 will most likely not be totally black, it will merely be very dark. Thus, under good conditions, users will still be able to see that their navigation device 200 is still on and working, whereas under normal conditions, the screen will appear to be turned off. Furthermore, when the screen's backlight is relatively dimmed or turned off, the navigation device 200 may further stop updating the screen, thus saving more power. The screen may be updated again as soon as the backlight is turned on or removed from its relatively dim state. The updating of the screen is optional and/or can be part of the placing the navigation device 200 in a power conserving mode in step S18 of Fig. 9. Thus, the placing of the navigation device 200 in the power conserving mode may include at least one of pausing and temporarily ceasing an update of a display of an integrated input and display device of the navigation device.

**[0106]** In addition to allowing a user to initially select to display a screen providing control of "non-essential functions," such screens may be presented at the time of providing the warning of insufficient power to allow a user to optionally select which functions to suspend to conserve power. For example, a user may wish to maintain a communication function in the event an important telephone call, text message, etc. is expected.

**[0107]** As stated previously with regard to Figure 9, the navigation device 200 may be placed in a power conserving mode in step S18. Thereafter, the navigation device 200 may be taken out of the power conserving mode upon other conditions taking place. For example, if it is determined, by the processor 210, that an instruction is set to be output to an integrated input and display device 290 or speaker 265 of the navigation device 200, wherein the determination of an instruction needed to navigate to the desired destination and/or along a calculated travel route, one or more of the functions controlled by the power conserving mode may be temporarily suspended. The instruction may be for example, an upcoming turn, lane change, route change, destination point, set way point, or the like. If such an instruction is set to be output as determined by the processor 210, then the navigation device 200 is taken out of

the power conserving mode, for example by turning the backlight on and/or removing the relatively dim state of the backlight, for example.

**[0108]** As shown in Figures 11a and 11b, the user may be optionally prompted with preferences regarding setting the navigation device 200 in a power conserving mode. This navigation device 200 may operate so as not to provide the user with such preferences, and can merely enter the power conserving mode upon any of the conditions set forth in steps S12-S18 of Figure 9 being met for example. In an example embodiment, the system can automatically save battery power. For example, if the battery is low on power, only critical navigation instructions may be given (e.g., follow City X for Y kilometres). As such, several minor instructions can be skipped (and the user should attend more to the available road signs placed in the environment by the government). However, if the user is provided with a preference as shown in Figures 11a and/or 11b, the user may selectively save available power while retaining certain features the user desires. For example, the user may select the "never turn off screen" preference as shown in Fig. 11a, then the process of the step S16 of Figure 9 may not include turning off the display screen. Similarly, if the "always turn off screen" preference is selected, the screen may be always turn off during use in a moving map mode, namely after a travel route has been calculated.

**[0109]** Thus, as shown in Figures 11a and 11b, a plurality of selectable power conserving mode options can be displayed to the user, wherein the navigation device 200 is placed in the selected mode upon the determination being made. It should be noted that these modes are not limited to those shown in Figures 11a and 11b and can include different selectable aspects of power conservation including, for example, turning the backlight off, dimming the backlight of the integrated input and display device 290, etc.

**[0110]** In an embodiment, entry of the power conserving mode at step S18 may include prompting the user to save battery power. For example, the user may be requested to dim the screen (namely relatively dim or turn off the backlight of the integrated input and display device 290) upon a next instruction being more than a certain distance or a certain time away (for example, five miles or five minutes) or turn off certain other "non-essential" functions. Thus, the user can select whether or not to enter the power conserving mode. As such, the placing in the power conserving mode may only occur upon the determination

being made and subsequent to receipt of an indication of a selection by a user, to enter the power conserving mode. The selection may be received, by the processor 210 for example, at least one of before and after the determination is made, and subsequent to a prompt.

**[0111]** In an example embodiment, the reminder to insure that a cable is available to connect the navigation device 200 to the external power source 295 may be provided through the output device 260 of the navigation device. The reminder may be presented in an audible format via the loudspeaker 265 and/or in a visual format via the display device 240. For example, upon determining that the navigation device 200 is ON at step S2, the reminder to connect the navigation device 200 to an external power source and/or to insure that a cable is available to connect the navigation device 200 to the external power source 295 may be provided through the output device 260 of the navigation device.

**[0112]** Similarly, at step S4, upon entry of the destination and/or travel route, a reminder to connect the navigation device 200 to an external power source and/or to insure that a cable is available to connect the navigation device 200 to an external power source may be provided through an output device of the navigation device. If the destination entered at step S4 is not a known destination or a previously travelled route, a reminder to connect the navigation device 200 to an external power source and/or to insure that a charging cable is available to connect the navigation device 200 to an external power supply may also be issued.

**[0113]** In an embodiment, the reminder, as discussed above may also be provided when a detour from the calculated travel route is detected and when a warning is provided at step S14.

**[0114]** 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 or program segments stored on a tangible data recording medium (computer readable 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 or program segments can constitute all or part of the functionality of the method of embodiments described above, and

can also be stored in any memory device, volatile or non-volatile, such as semiconductor, magnetic, optical or other memory device.

**[0115]** It will also be appreciated that whilst various aspects and embodiments of the present disclosure have heretofore been described, the scope of the present disclosure 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.

**[0116]** For example, whilst embodiments described in the foregoing detailed description refer to GPS, it should be noted that the navigation device 200 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.

**[0117]** It will also be well understood by persons of ordinary skill in the art that whilst the example embodiment implements certain functionality by means of software, that functionality could equally be implemented solely in hardware (for example by way 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 disclosure should not be interpreted as being limited only to being implemented in software.

**[0118]** Lastly, it should also be noted that whilst the accompanying claims set out particular combinations of features described herein, the scope of the present disclosure 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.

**CLAIMS**

1. A method for providing a warning of low power level in a navigation device, comprising:

determining, using a processor (210) of the navigation device (200), at least one of a target destination and a planned travel route;

determining, using the processor (210) of the navigation device (200), a charge level of a power source (285) connected to the navigation device (200);

determining, using the processor (210) of the navigation device (200), if a detected power supply level is sufficient to power the navigation device (200) to at least one of the target destination and throughout the planned travel route; and

providing a warning when an amount of charge is insufficient to sufficiently power the navigation device (200) to at least one of the target destination and during the planned travel route.

2. The method of claim 1, wherein determining if the detected power supply is sufficient includes comparing the determined charge level to an amount of charge sufficient to power the navigation device (200) to at least one of the target destination and during the planned travel route.

3. The method of claim 1, wherein providing the warning includes at least one of displaying a warning on a display device (240) of the navigation device (200) and providing an audible warning via a loudspeaker (265) of the navigation device (200).

4. The method of any of claims 1-3 further comprising, providing, using the processor (210) of the navigation device (200), a reminder to at least one of attach the navigation device (200) to a power source (295) external to the navigation device (200) and to bring a battery charging device (288) when the determined charge level is insufficient to sufficiently power the navigation device to at least one of the target destination and during the planned travel route.

5. The method of any of claims 1-4 further comprising, providing a reminder to at least one of attach the navigation device (200) to a power source (295) external to the navigation device and to bring a battery charging device (288) at start-up of the navigation device (200).

6. The method of any of claims 1-5 further comprising, providing a reminder to at least one of attach the navigation device (200) to a power source (295) external to the navigation device (200) and to bring a battery charging device (288) when detouring from the planned travel route.

7. The method of any of claims 4-6, wherein providing the reminder includes at least one of displaying the reminder on a display device (240) of the navigation device (200) and providing an audible reminder via a loudspeaker (265) of the navigation device (200).

8. The method of claim 1 further comprising, placing, using the processor (210), the navigation device (200) in a power conservation mode when the determined charge level is insufficient to sufficiently power the navigation device (200) to at least one of the target destination and during the planned travel route.

9. The method of claim 8, wherein placing the navigation device in a power conservation mode includes shutting down, using the processor (210) of the navigation device (200), non-essential functions of the navigation device (200) when the determined charge level is insufficient to sufficiently power the navigation device (200) to at least one of the target destination and during the planned travel route.

10. The method of any of claims 8 and 9, further comprising removing the navigation device from the power conserving mode upon at least one of:

determining that at least one of a visual and an audible warning is to be provided;

determining that a navigation instruction is to be implemented by the navigation device (200); and

determining receipt of at least one of an incoming message signal and an incoming telephone signal to the navigation device.

11. The method of claim 8, further comprising:

displaying a plurality of selectable power conserving mode options to a user of the navigation device (200) when the determined charge level is insufficient to sufficiently power the navigation device (200) to at least one of the target destination and during the planned travel route.

12. A computer readable medium including program segments for, when executed on a processor (210) of a navigation device (200), causing the navigation device (200) to implement the method of any of claims 1 to 11.

13. A navigation device (200), comprising:

a housing (205);

a power source (285) within the housing (205);

a memory resource (230) to store at least one of a target destination and a calculated travel route;

a processor (210) to determine if a detected power supply level is sufficient to power the navigation device to at least one of the target destination and throughout the calculated travel route; and

an output device (260) to provide a warning upon failing to determine that the detected power supply level is sufficient to power the navigation device (200) to at least one of the target destination and throughout the calculated travel route.

14. The navigation device (200) of claim 13, wherein the output device (260) is at least one of a display device (240) to display a visual warning and a loudspeaker (265) to provide an audible warning when the determined charge level is insufficient to sufficiently power the navigation device (200) to at least one of the target destination and during the planned travel route.

15. The navigation device (200) of claim 13, wherein the processor (210) is further configured to place the navigation device (200) in a power conserving mode when the determined charge level is insufficient to sufficiently power the

navigation device (200) to at least one of the target destination and during the planned travel route.

16. The navigation device (200) of claim 15, wherein the processor (210) is configured to at least one of shut-down and suspend non-essential functions of the navigation device (200) when placing the navigation device in the power conservation mode.

17. The navigation device (200) of claim 13, wherein the processor (210) is further configured to provide at least one of a visual and an audible reminder to at least one of attach the navigation device (200) to a power source (295) external to the navigation device (200) and to bring a battery charging device (288).

18. The navigation device (200) of claim 17, wherein the processor (210) is further configured to provide the reminder at start-up of the navigation device.

19. The navigation device (200) of claim 17, wherein the processor (210) is further configured to provide the reminder when a detour is made from at least one of the target destination and the calculated travel route.

20. The navigation device (200) of any of claims 17-19, wherein the processor (210) is configured to override the reminder.

21. The navigation device (200) of any of claims 13-20, wherein the navigation device (200) is a portable navigation device (200).

22. The navigation device (200) of any of claims 13-20, wherein the memory resource (230) is configured to store at least one of records of previous target destinations and records of previous calculated travel routes.

23. The navigation device (200) of claim 22, wherein the processor (210) is further configured to compare at least one of a current target destination and a current calculated travel route to at least one the stored records of previous target destinations and the stored records of previous calculated travel routes

stored in the memory resource (230), and provide the reminder when at least one of a current target destination and a current calculated travel route is not stored in the memory resource.

24. The navigation device of claim 15, wherein the processor (210) is further configured remove the navigation device (200) from the power conserving mode upon at least one of:

determining that a at least one of the visual and the audible warning is to be provided;

determining that a navigation instruction is to be implemented by the navigation device (200), within at least one of a distance less than a second distance threshold and a time less than a second time threshold; and

determining receipt of at least one of an incoming message signal and an incoming telephone signal to the navigation device.

25. The navigation device (200) of claim 13, wherein the processor (210) is further configured to provide a reminder when the navigation device (200) is disconnected from the external power source.

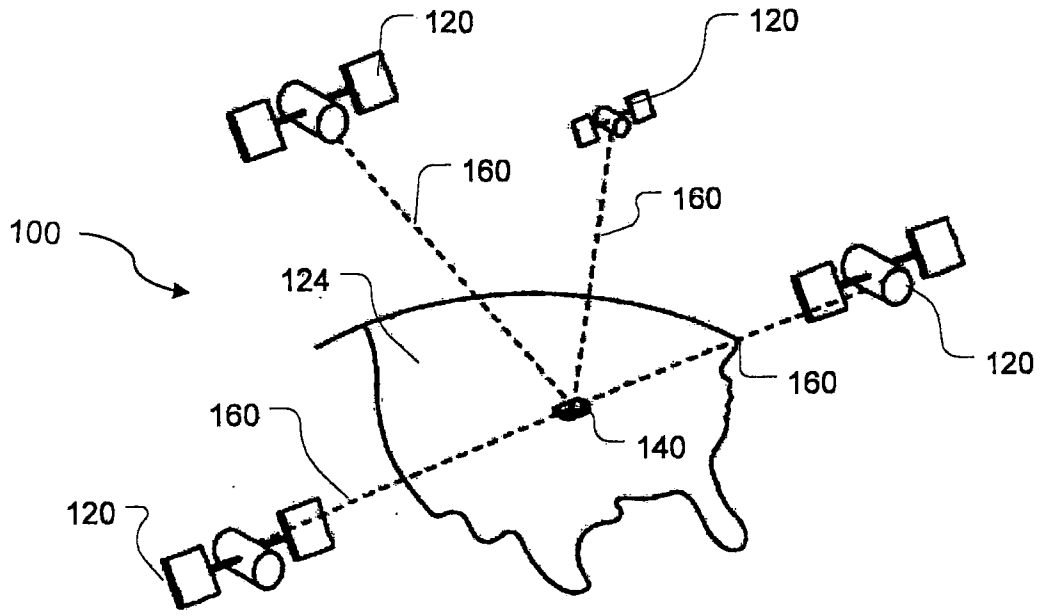

120
120
160
160
100
124
120
160
160
140
120

FIG. 1

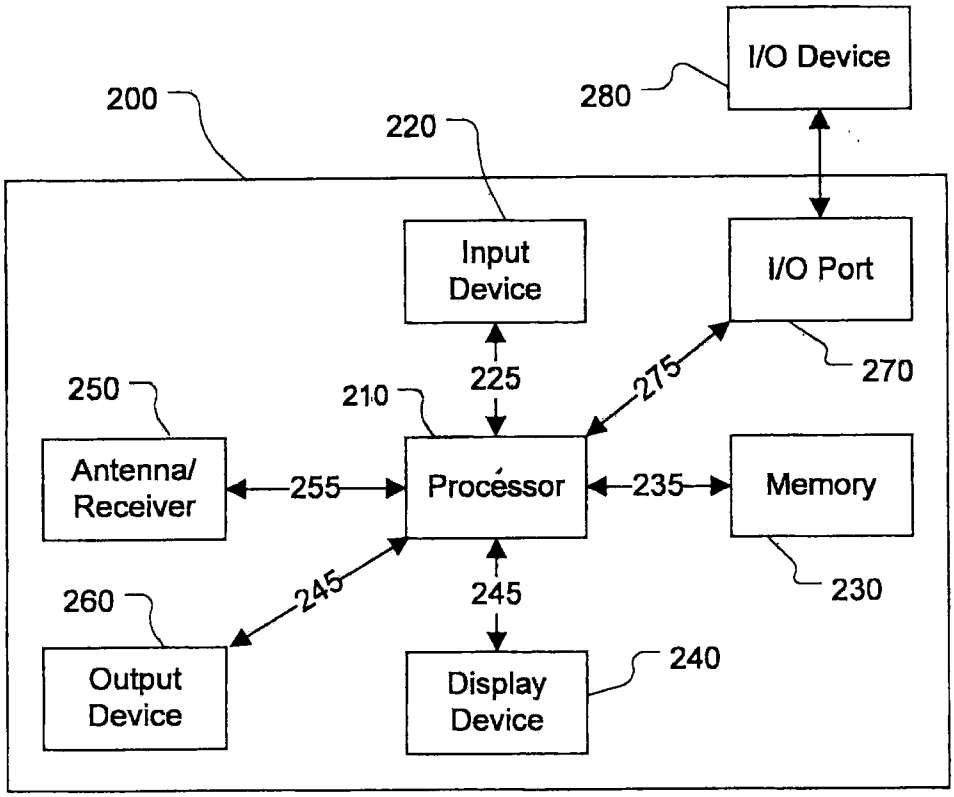
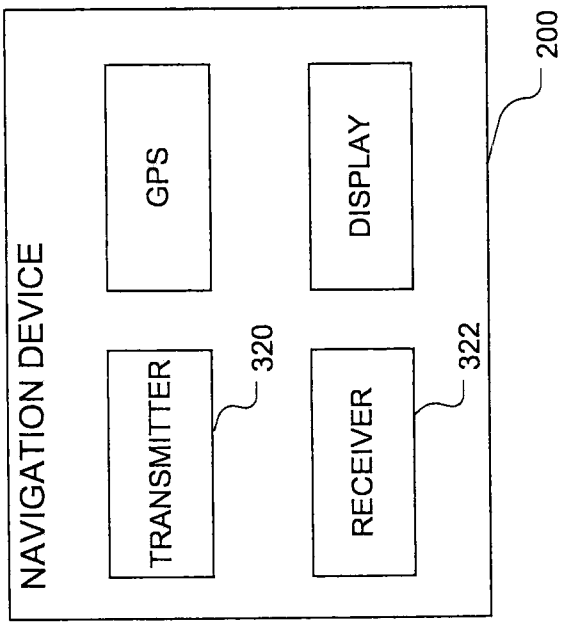
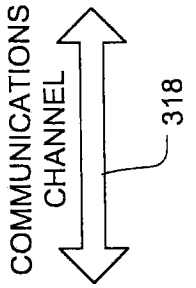

I/O Device
280
200
220
Input Device
I/O Port
270
225
275
250
210
Antenna/ Receiver
255
Processor
235
Memory
230
245
245
260
Output Device
Display Device
240

FIG. 2


NAVIGATION DEVICE
GPS
DISPLAY
TRANSMITTER
320
RECEIVER
322
200


COMMUNICATIONS CHANNEL
318

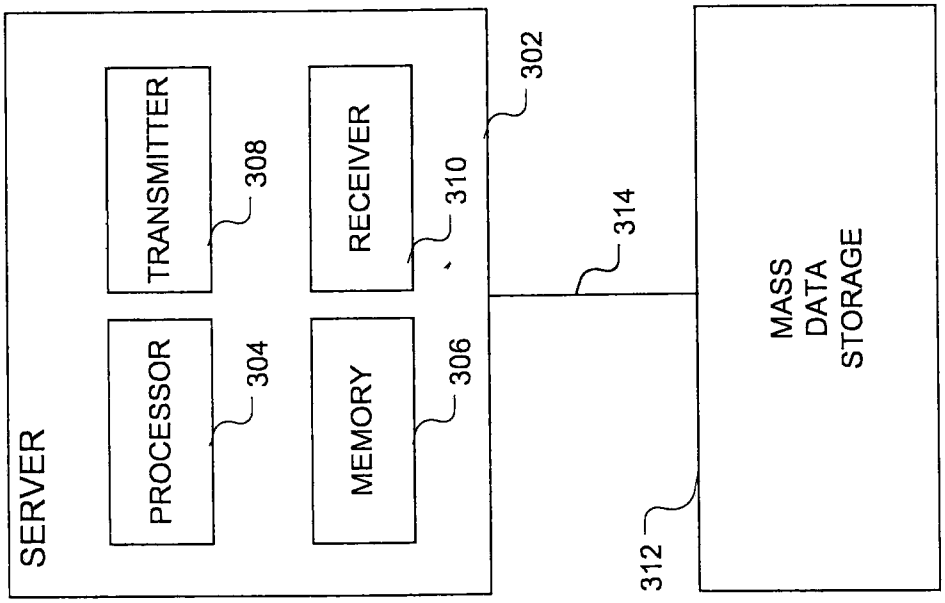

SERVER
PROCESSOR
304
TRANSMITTER
308
MEMORY
306
RECEIVER
310
302
314
312
MASS DATA STORAGE

FIG. 3

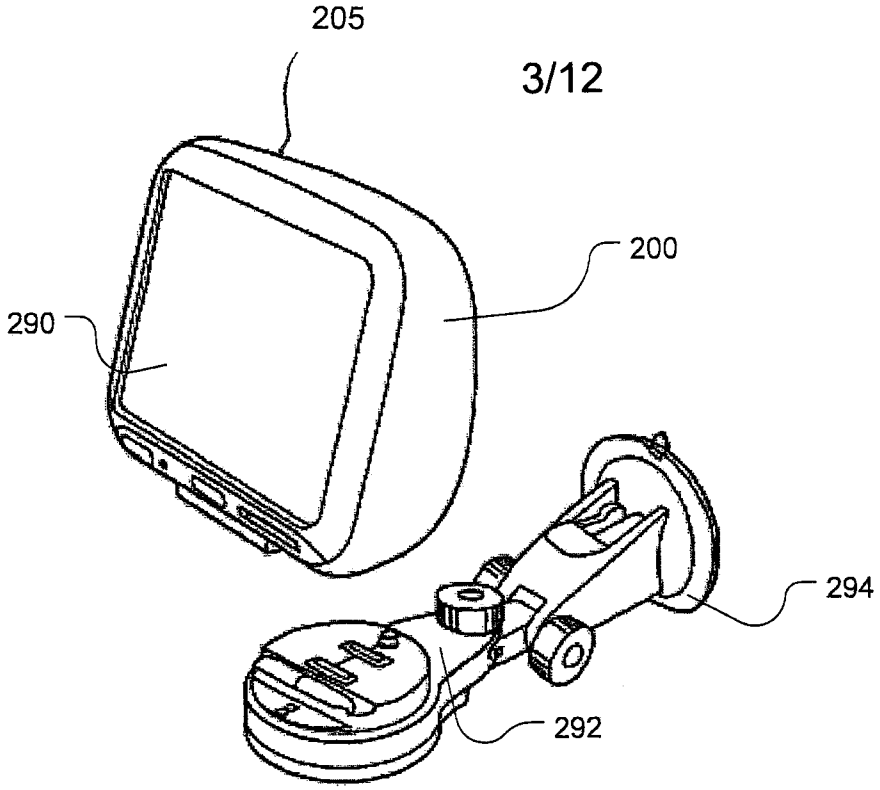



FIG. 4a

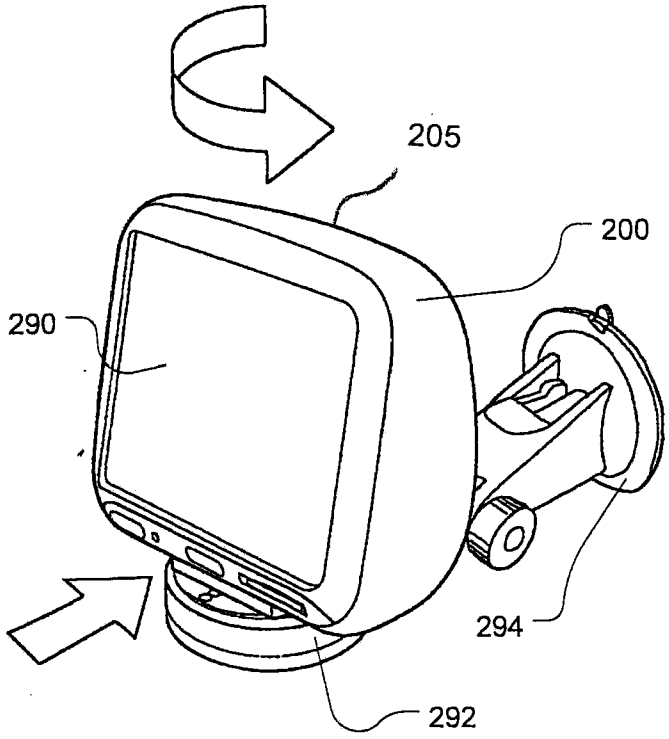



FIG. 4b

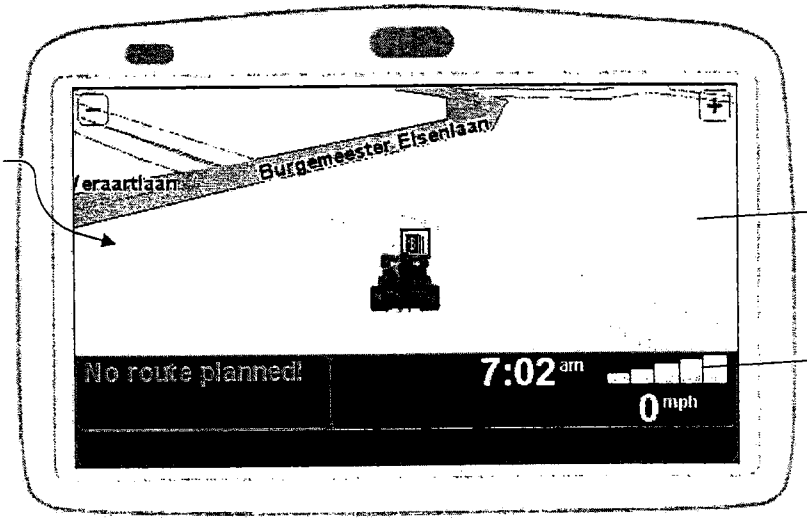



FIG. 5a

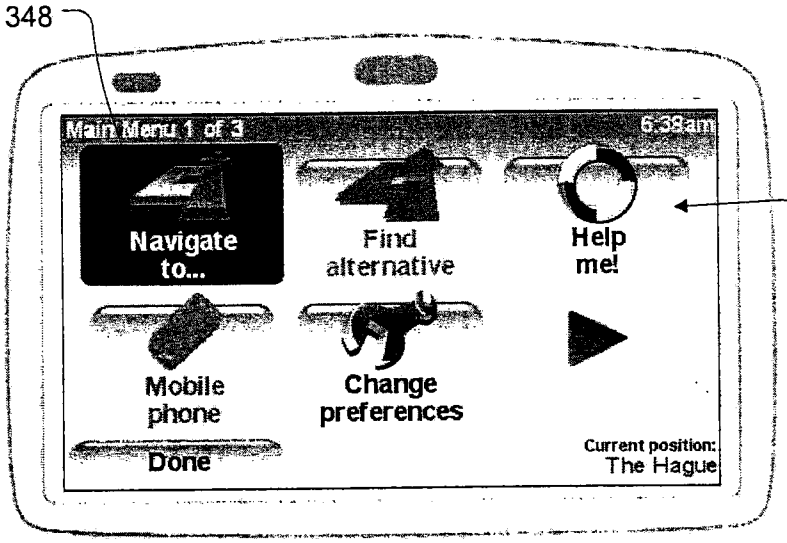



FIG. 5b

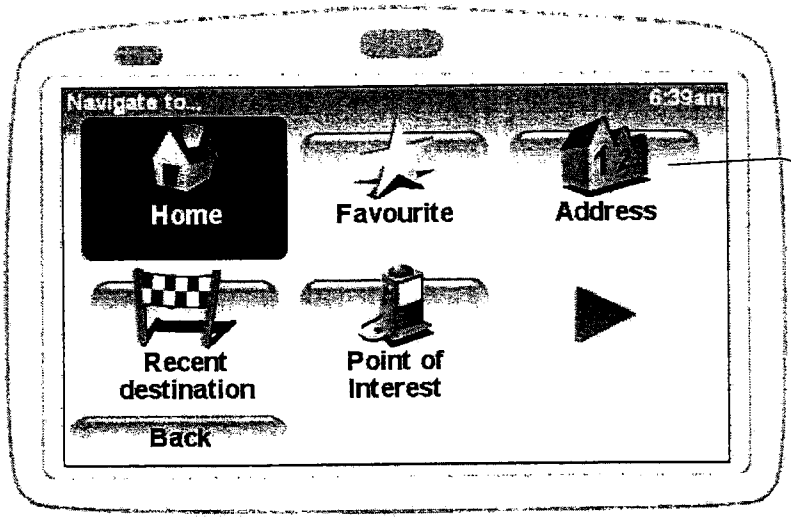



FIG. 5c

FIG. 5d

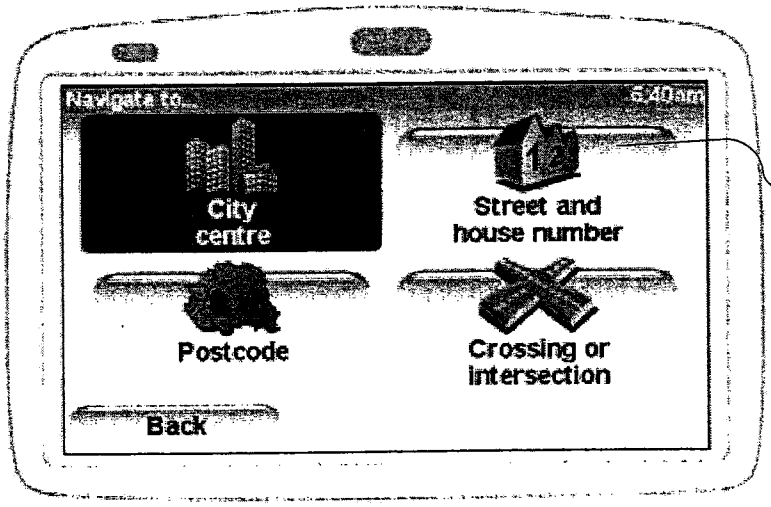



FIG. 5e




FIG. 5f

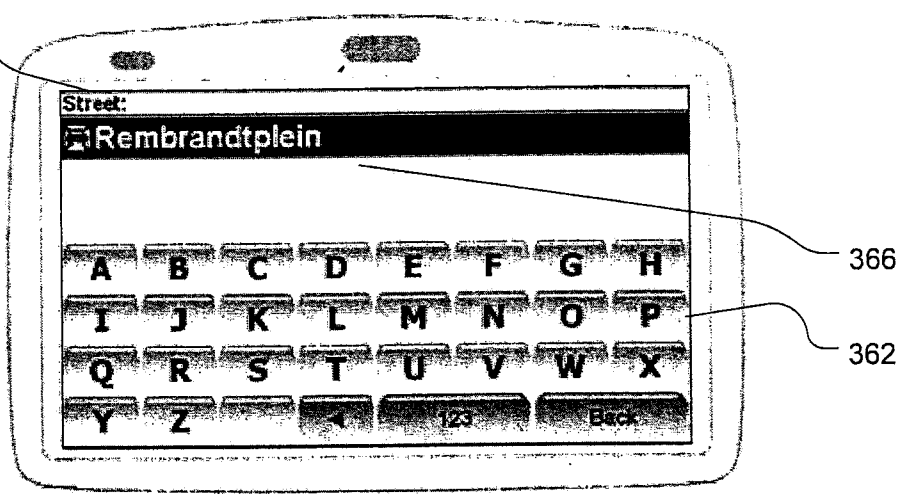


FIG. 5g

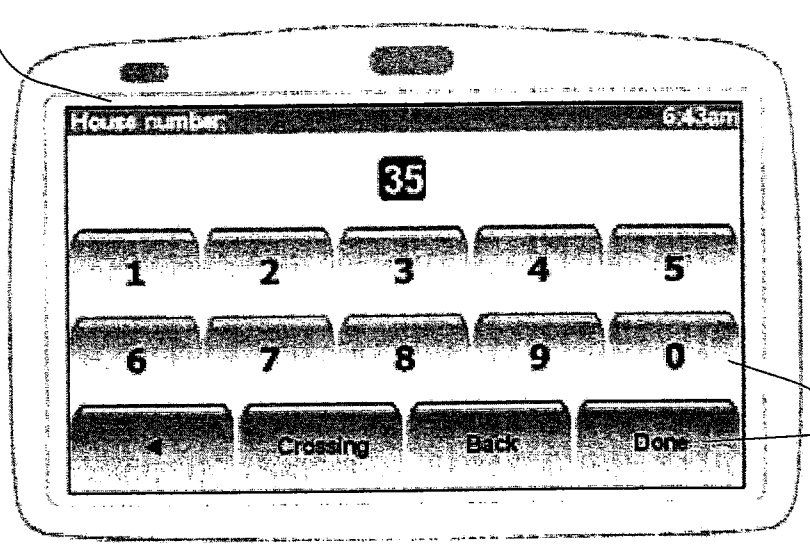



FIG. 5h

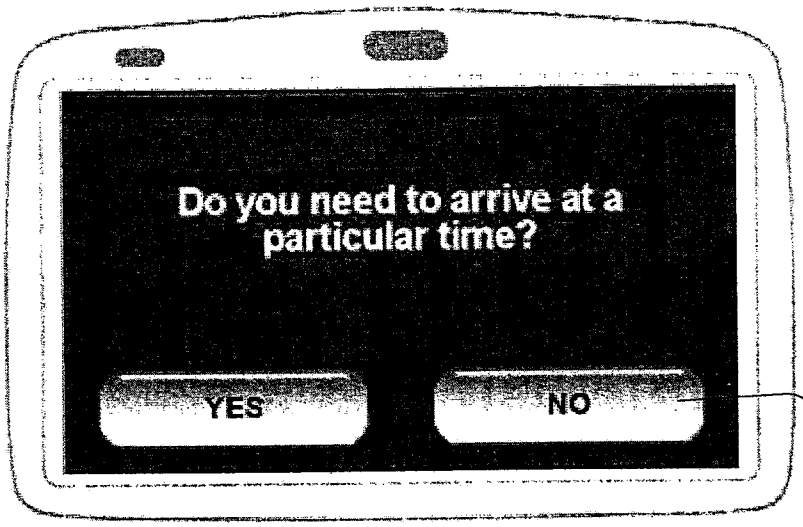
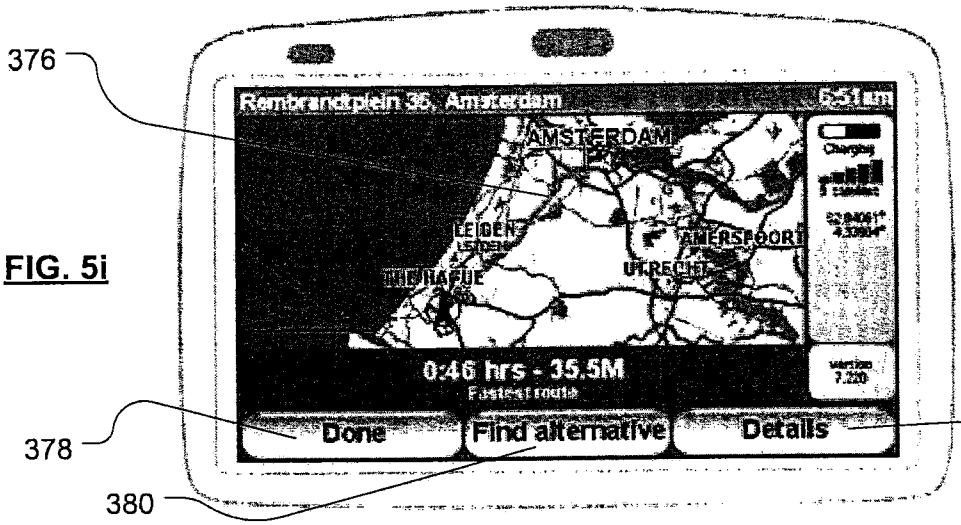



FIG. 5i



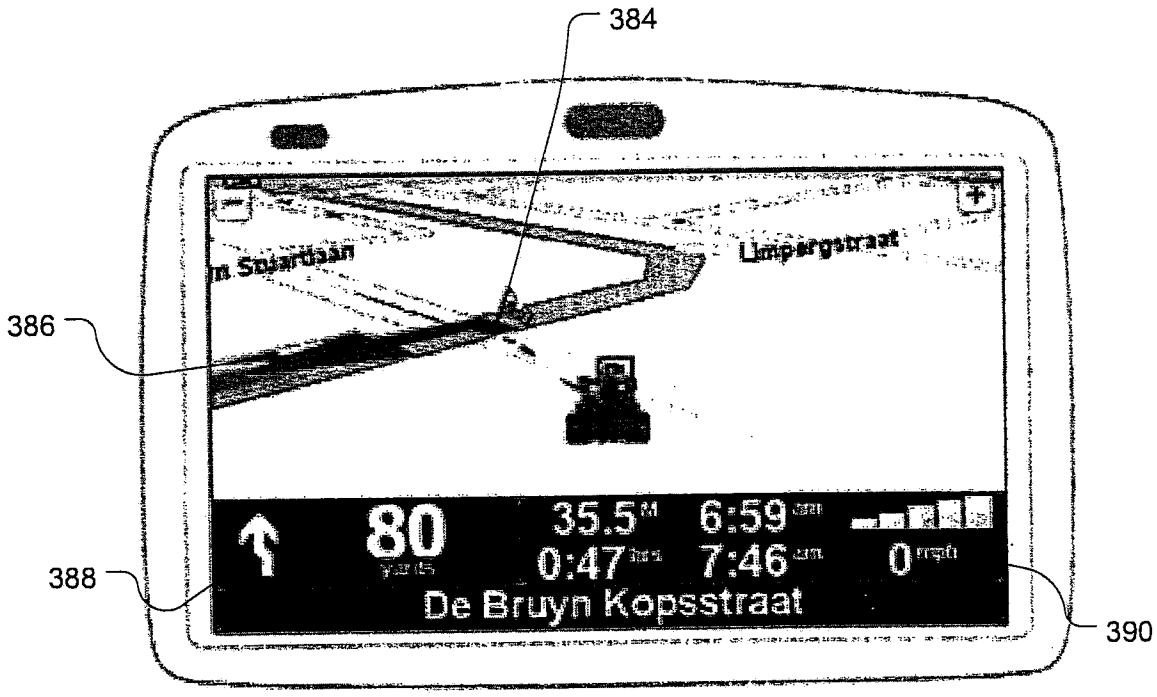



FIG. 6

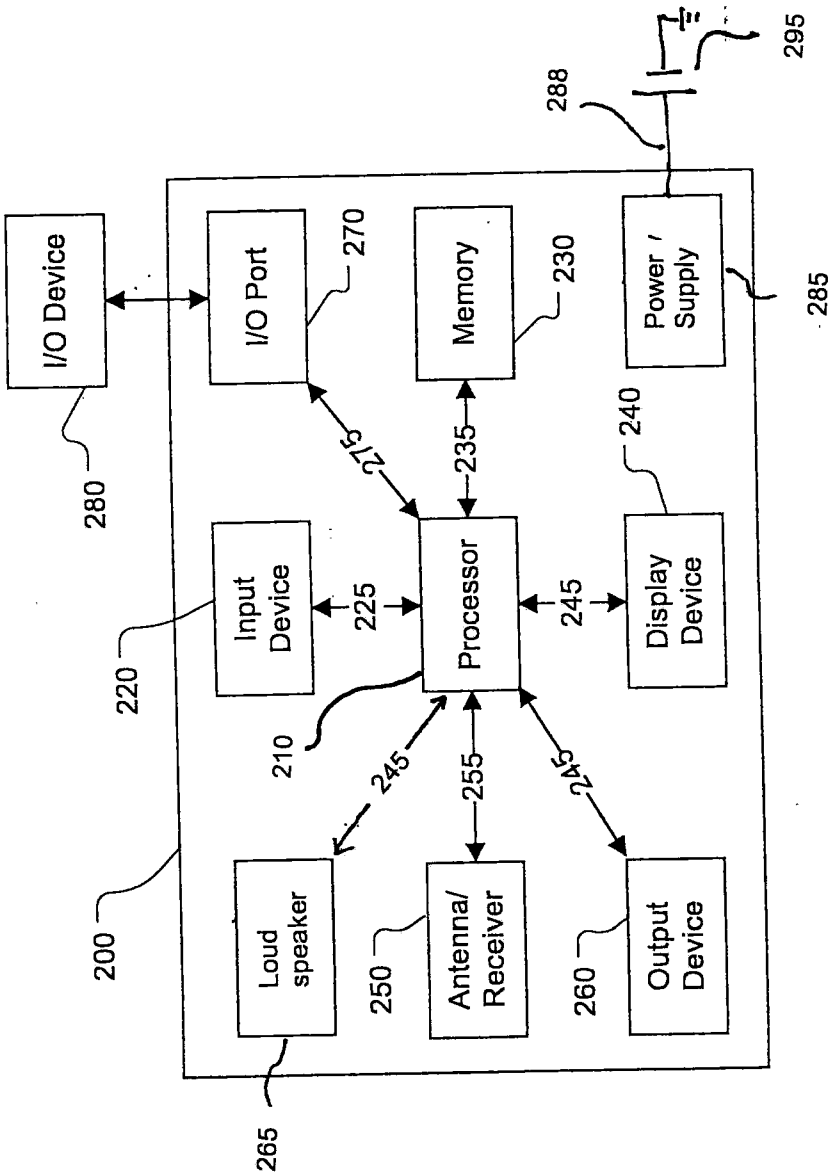

I/O Device
280
I/O Port
270
Memory
230
Power / Supply
285
288
295
215
235
240
Input Device
220
225
Processor
245
Display Device
210
245
255
245
Loud speaker
265
Antenna/ Receiver
250
Output Device
260
200

FIG. 7

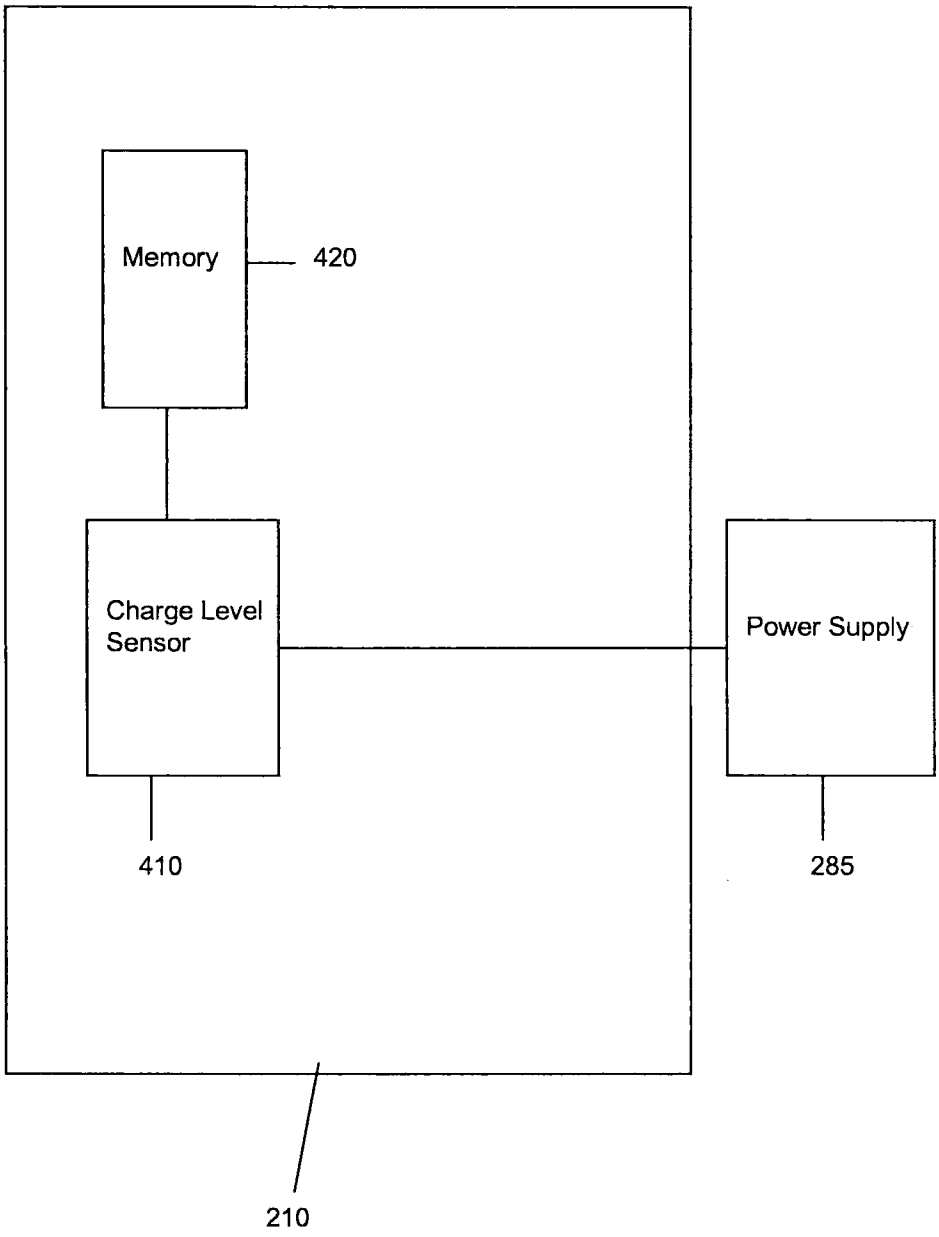



FIG. 8

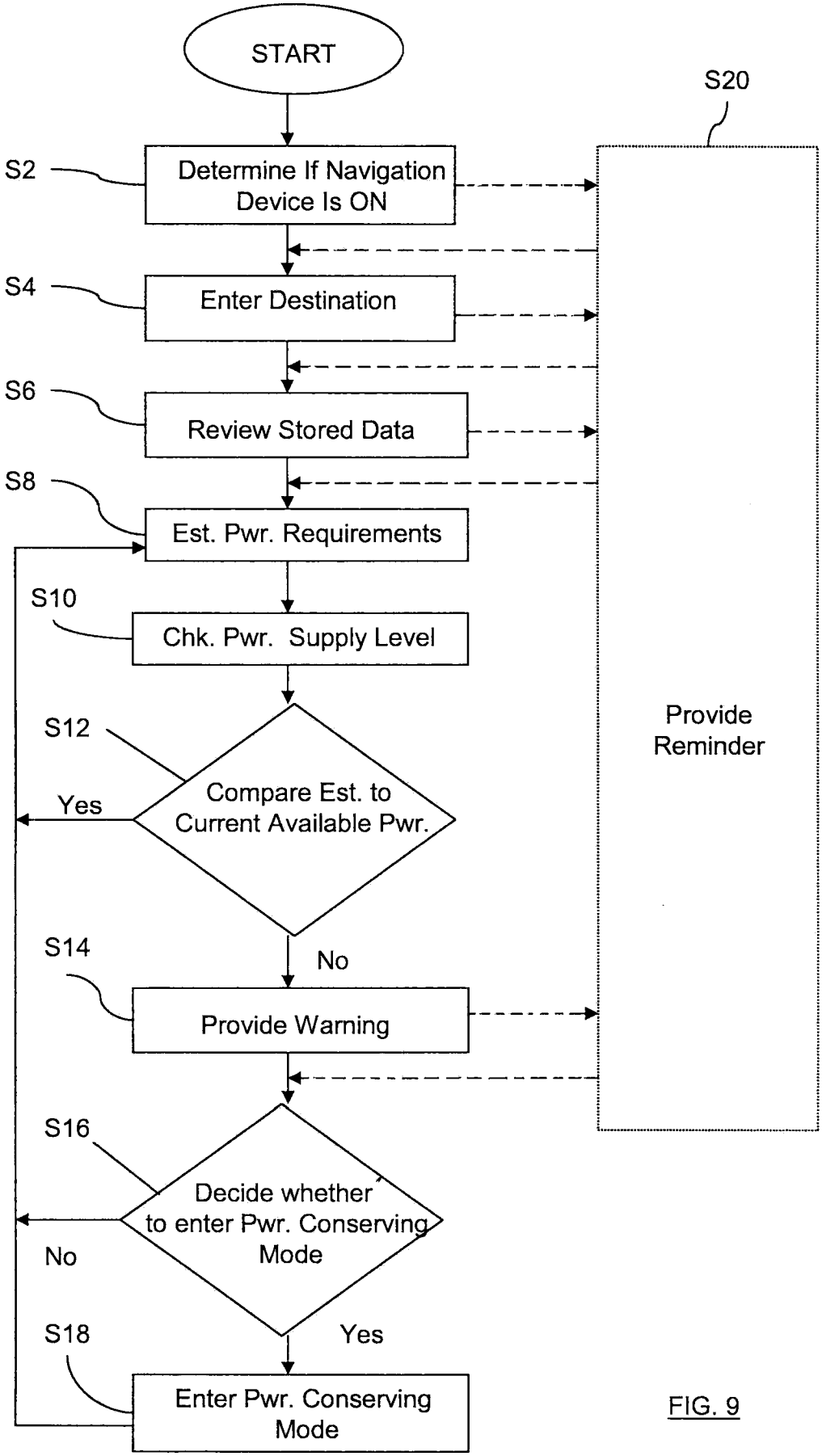

START
S20
S2
Determine If Navigation Device Is ON
S4
Enter Destination
S6
Review Stored Data
S8
Est. Pwr. Requirements
S10
Chk. Pwr. Supply Level
S12
Compare Est. to Current Available Pwr.
Yes
No
S14
Provide Warning
S16
Decide whether to enter Pwr. Conserving Mode
No
Yes
S18
Enter Pwr. Conserving Mode
Provide Reminder

FIG. 9

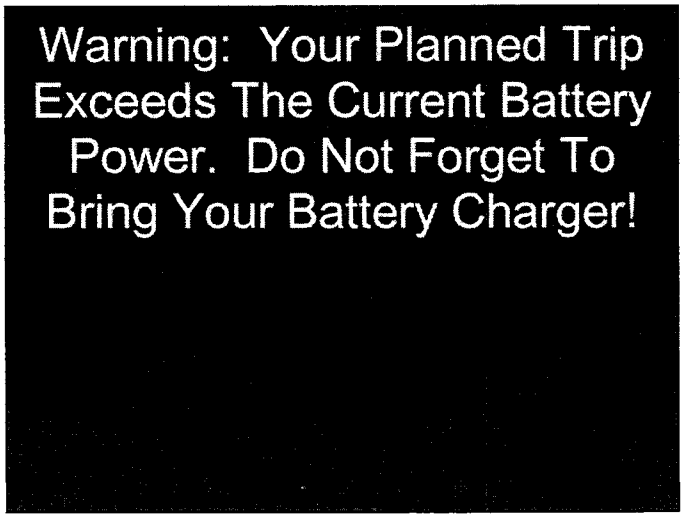



FIG. 10a

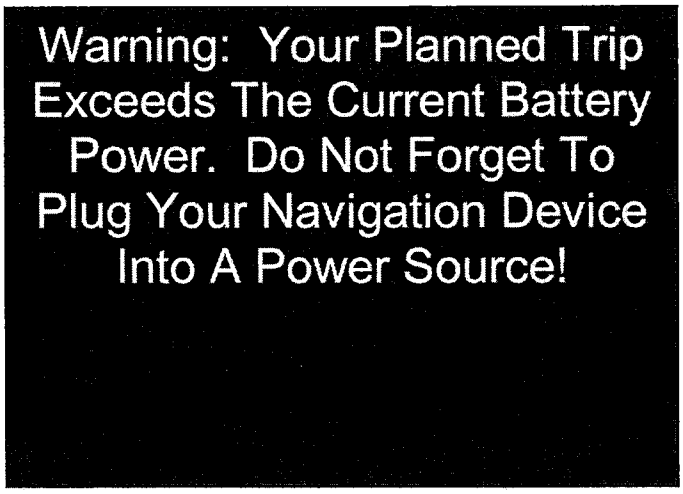



FIG. 10b

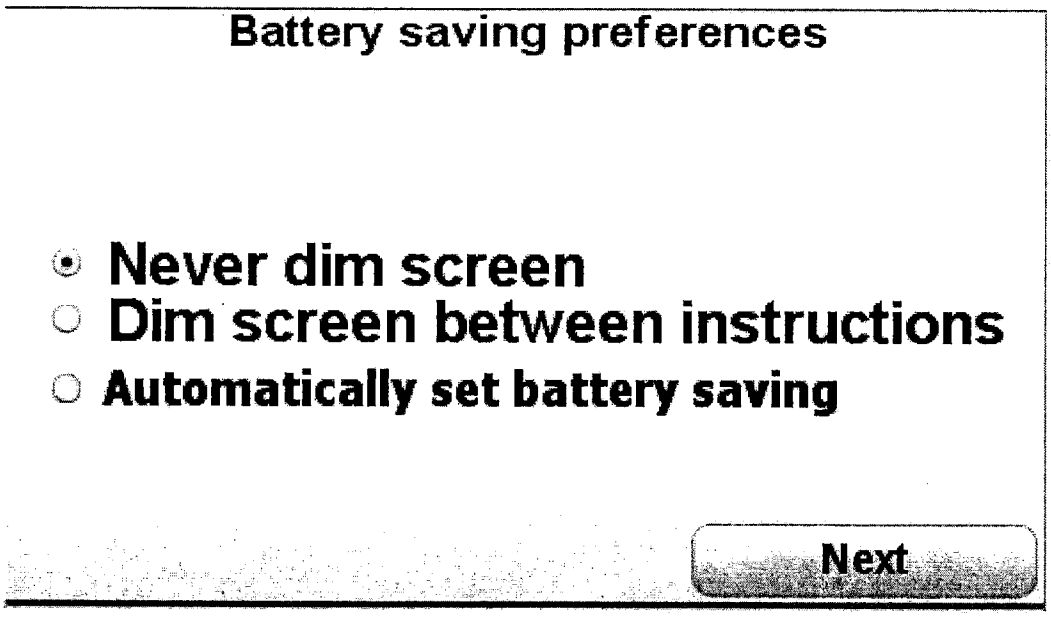



Fig 11a

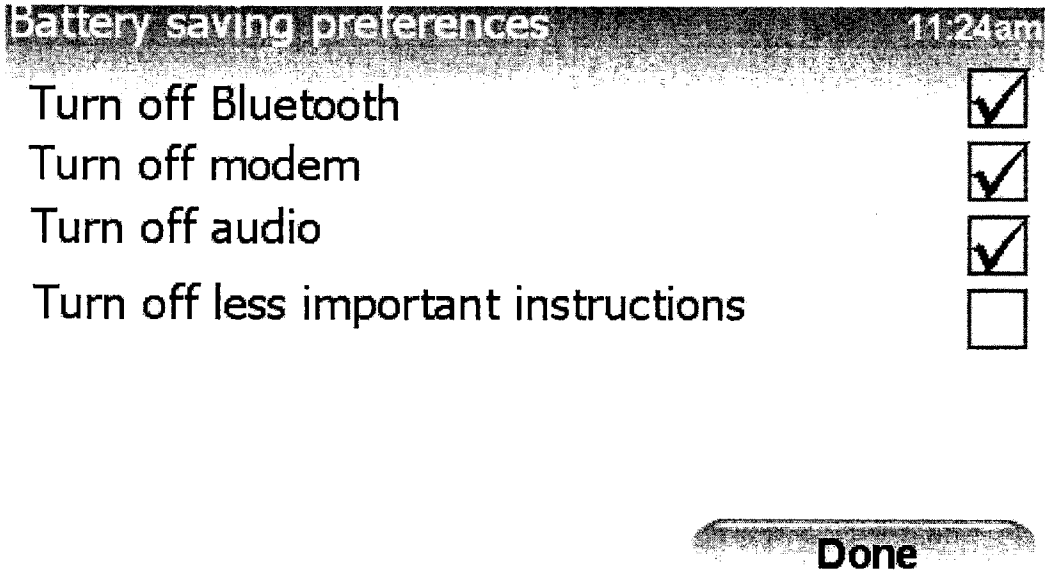



Fig 11b

# INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/068037

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01C21/20 G01C21/36 G06F1/32
ADD.

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 G06F

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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| X | JP 2009 204590 A (HITACHI LTD; CLARION CO LTD) 10 September 2009 (2009-09-10) * abstract | 1,5,6, 10,12, 13, 18-20, 22-25 |
| A | US 2008/167797 A1 (GEELEN PIETER [NL] ET AL) 10 July 2008 (2008-07-10) * abstract figure 5 | 1-25 |

-/--

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

[X] See patent family annex.

* Special categories of cited documents :

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"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 |
|---|---|
| 20 August 2010 | 03/09/2010 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Berbil Bautista, L |

3

Form PCT/ISA/210 (second sheet) (April 2005)

# INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/068037

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
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3

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Information on patent family members

International application No
PCT/EP2009/068037

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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| | | EP 2102596 A1 | 23-09-2009 |
| | | WO 2008083862 A1 | 17-07-2008 |
| | | JP 2010515901 T | 13-05-2010 |
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| | | US 2009043491 A1 | 12-02-2009 |