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(54) Title: NAVIGATION APPARATUS AND METHOD OF PROVIDING POINTS OF INTEREST

(57) Abstract: A navigation and/or mapping apparatus (200) comprises an input device (204) for receiving input from a user for selecting a category of point of interest; and a device (206) for indicating areas dependent on the density of points of interest in the selected category.

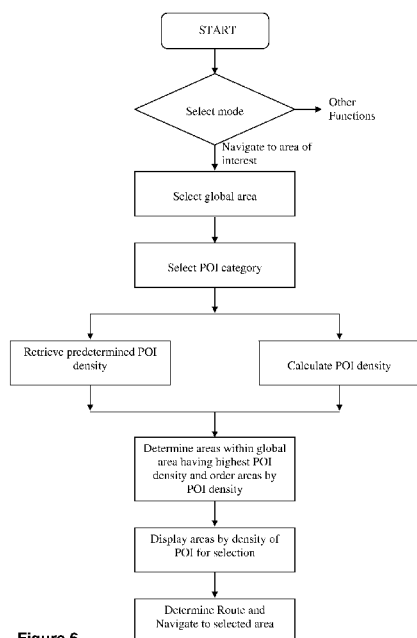


Figure 6



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NAVIGATION APPARATUS AND METHOD OF PROVIDING POINTS OF INTEREST**Field of the Invention**

The present invention relates to navigation methods and devices providing
5 navigation to points of interest.

Background to the Invention

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

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

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

Devices of this type will also often include one or more physical connector
30 interfaces by means of which power and optionally data signals can be transmitted to
and received from the device, and optionally one or more wireless transmitters/receivers
to allow communication over cellular telecommunications and other signal and data
networks, for example Bluetooth, Wi-Fi, Wi-Max, GSM, UMTS and the like.

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

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

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

PNDs of this type may be mounted on the dashboard or windscreen of a vehicle, but may also be formed as part of an on-board computer of the vehicle radio or indeed as part of the control system of the vehicle itself. The navigation device may also be part of a hand-held system, such as a PDA (Portable Digital Assistant), a media player, a mobile phone or the like, and in these cases, the normal functionality of the hand-held system is extended by means of the installation of software on the device to perform both route calculation and navigation along a calculated route.

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

An icon displayed on-screen typically denotes the current device location, and is centred with the map information of current and surrounding roads in the vicinity of the current device location and other map features also being displayed. Additionally, navigation information may be displayed, optionally in a status bar above, below or to one side of the displayed map information, examples of navigation information include a distance to the next deviation from the current road required to be taken by the user, the nature of that deviation possibly being represented by a further icon suggestive of the particular type of deviation, for example a left or right turn. The navigation function also determines the content, duration and timing of audible instructions by means of which

the user can be guided along the route. As can be appreciated a simple instruction such as "turn left in 100 m" requires significant processing and analysis. As previously mentioned, user interaction with the device may be by a touch screen, or additionally or alternately by steering column mounted remote control, by voice activation or by any
5 other suitable method.

Although the route calculation and navigation functions are fundamental to the overall utility of PNDs, it is possible to use the device purely for information display, or "free-driving", in which only map information relevant to the current device location is displayed, and in which no route has been calculated and no navigation is currently
10 being performed by the device. Such a mode of operation is often applicable when the user already knows the route along which it is desired to travel and does not require navigation assistance.

Devices of the type described above, for example the 920T model manufactured and supplied by TomTom International B.V., provide a reliable means for enabling users
15 to navigate from one position to another. Such devices are of great utility when the user is not familiar with the route to the destination to which they are navigating.

As mentioned above, some navigation devices allow a user to select a POI, such as a restaurant, night club, car park or shop and the navigation device determines a route to the selected POI.

20 However, the user is often unsure if a particular POI meets their expectations, particularly if they are unfamiliar with the POI or the area in which they are looking. This can lead to long additional journeys to an alternative POI if the first selected POI is not acceptable. The user may also have to use a map functionality of the navigation device to display the POIs on a map and manually hunt for a close alternative POI. Manual
25 searching is particularly disadvantageous in transport based PNDs as this requires significant manual input from the user and/or requires the user's attention for an extended period.

Summary of the Invention

30 According to a first aspect of the present invention, there is provided navigation and/or mapping apparatus comprising: an input device for receiving input from a user for selecting a category of point of interest; and a device for indicating areas dependent on the density of points of interest in the selected category.

The apparatus may comprise a processing resource operably coupled to a data
35 store. The data store may store point of interest data.

The processing resource may be arranged to determine the density of points of

interest. The processing resource may be adapted to determine the number of points of interest belonging to the selected category per area or distance they are apart.

The device for indicating may be a display for displaying areas having a high density of the selected point of interest type. The displayed areas may be areas having
5 a density of selected point of interest type above a specified threshold. The display of each area may vary with the density of POI within that area. The display of areas may be in the form of a list. The list may be ordered by density of point of interest. A display feature may be provided for each point of interest. At least one of the colour and highlighting of the displayed areas and/or the display features may be varied in
10 dependence upon the density of points of interest. The processing resource may be configured to plan a route between each point of interest in each area, and displaying the planned route to the user.

The input device may be adapted to receive input from a user for selecting a region in which to determine the density of points of interest. The region may be the
15 current vicinity of the user, a specified city or town or along a route.

The input device may be adapted to receive user input selecting an area from the displayed areas. The processing resource may be adapted to calculate a route to the selected area.

The navigation and/or mapping apparatus may be adapted to determine a
20 current location of a user. The navigation and/or mapping device may be adapted to calculate a route from the current location to the selected area.

According to a second aspect of the present invention, there is provided a navigation system comprising: a navigation apparatus as set forth above in relation to a first aspect of the invention; wherein the data store is remotely located from the
25 navigation apparatus and accessible via a communications network.

According to a third aspect of the present invention there is provided a method of operating a navigation and/or mapping apparatus, the method comprising: selecting a category of point of interest data and providing an indication of areas depending on the density of points of interest in the selected category.

30 The method may comprise determining the density of points of interest in the selected category. The determination may be made by dividing the number of points of interest belonging to the selected category by the space they are apart.

The method may comprise displaying areas having a high density of the selected point of interest type. The area may be an area having a density of selected point of
35 interest type above a specified threshold. The display of areas may be in the form of a list. The list may be ordered by density of point of interest.

The method may comprise selecting a region in which to determine the density of points of interest. The region may be the current vicinity of the user, a specified city or town or along a route.

5 The method may comprise receiving input from the user indicating an area having a high density of the selected point of interest type. The method may comprise calculating a route to the indicated area.

10 According to a fourth aspect of the present invention, there is provided a computer program element comprising computer program code means to make a computer execute the method as set forth above in relation to the third aspect of the invention.

The computer program element may be embodied on a computer readable medium.

15 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.

20 By determining a density of POIs and providing this to the user, navigation devices of the present invention allow a user to navigate to areas having the best choice of POIs in a region of interest. Such areas may be displayed and quickly identified with the minimum of distraction to the user. The user may then select an area with a high density of the required POI and the navigation device navigates the user to it. Once at the area, the user can walk or drive around the area, view the POIs and select an individual POI that meets their preferences from among a wide range of choices. Furthermore, improved navigation is provided, as the user is navigated to an area having a wide choice of alternate points of interest in close proximity, which in turn minimises any onward travel should an individual POI prove undesirable. By providing areas
25 having a high density of point of interest within a category rather than individual points of interest, and prioritising the presentation of the areas by density of point of interest, information is communicated in a clear manner and minimises user intervention, thereby reducing instances of driver confusion, insecurity, hesitation and hence driver workload
30 resulting in a safer driving experience.

Any feature in one aspect of the invention may be applied to other aspects of the invention, in any appropriate combination. In particular, apparatus features may be applied to method features and vice versa.

35 **Brief Description of the Drawings**

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

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

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

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

Figure 3 is a schematic illustration of electronic components of the navigation device of Figure 2 or any other suitable navigation device;

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

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

Figure 6 is a flow diagram of a method of operation of a navigation device of Figure 3 and constituting a first embodiment of the invention; and

Figures 7 to 9 are screen shots from the navigation device in accordance with a
15 part of the method of Figure 6;

Detailed Description of Preferred Embodiments

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

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

It will also be apparent from the following that the teachings of the present
30 invention even have utility in circumstances where a user is not seeking instructions on how to navigate from one point to another but merely wishes to be provided with a view of a particular region. 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
35 indeed to a "destination" view should not be interpreted to mean that the generation of a route is essential, that travelling to the "destination" must occur, or indeed that the

presence of a destination requires the designation of a corresponding start location.

With the above provisos in mind, the Global Positioning System (GPS) of Figure 1 and the like are used for a variety of purposes. In general, the GPS is a satellite-radio based navigation system capable of determining continuous position, velocity, time, and in some instances direction information for an unlimited number of users. Formerly known as NAVSTAR, the GPS incorporates a plurality of satellites that orbit the earth in extremely precise orbits. Based on these precise orbits, GPS satellites can relay their location to any number of receiving units.

The GPS system is implemented when a device, specially equipped to receive GPS data, begins scanning radio frequencies for GPS satellite signals. Upon receiving a radio signal from a GPS satellite, the device determines the precise location of that satellite via one of a plurality of different conventional methods. The device will continue scanning, in most instances, for signals until it has acquired at least three different satellite signals (noting that position is not normally, but can be determined, with only two signals using other triangulation techniques). Implementing geometric triangulation, the receiver utilizes the three known positions to determine its own two-dimensional position relative to the satellites. This can be done in a known manner. Additionally, acquiring a fourth satellite signal allows the receiving device to calculate its three dimensional position by the same geometrical calculation in a known manner. The position and velocity data can be updated in real time on a continuous basis by an unlimited number of users.

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

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

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

The establishing of the network connection between the mobile device (via a service provider) and another device such as the server 150, using the Internet for example, can be done in a known manner. In this respect, any number of appropriate data communications protocols can be employed, for example the TCP/IP layered protocol. Furthermore, the mobile device can utilize any number of communication standards such as CDMA2000, GSM, IEEE 802.11 a/b/c/g/n, etc.

Hence, it can be seen that the internet connection may be utilised, which can be achieved via data connection, via a mobile phone or mobile phone technology within the navigation device 200 for example.

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

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

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

via mobile device, a direct connection via personal computer via the internet, etc.).

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

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

The communication signals transmitted through the communication channel 152
20 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
25 signals can be transmitted through the communication channel 152. These signals may be modulated, encrypted and/or compressed signals as may be desirable for the communication technology.

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

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

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

Software stored in server memory 156 provides instructions for the processor 154 and allows the server 150 to provide services to the navigation device 200. One service provided by the server 150 involves processing requests from the navigation device 200 and transmitting navigation data from the mass data storage 160 to the navigation device 200. Another service that can be provided by the server 150 includes processing the navigation data using various algorithms for a desired application and sending the results of these calculations to the navigation device 200. An example of such processing is determining densities of points of interest (POI) in various categories of point of interest.

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

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

The navigation device 200 may be provided with information from the server 150 via information downloads which may be periodically updated automatically or upon a

user connecting the navigation device 200 to the server 150 and/or may be more dynamic upon a more constant or frequent connection being made between the server 150 and navigation device 200 via a wireless mobile connection device and TCP/IP connection for example. For many dynamic calculations, the processor 154 in the server 150 may be used to handle the bulk of processing needs, however, a processor (not shown in Figure 2) of the navigation device 200 can also handle much processing and calculation, oftentimes independent of a connection to a server 150.

Referring to Figure 3, it should be noted that the block diagram of the navigation device 200 is not inclusive of all components of the navigation device, but is only representative of many example components. The navigation device 200 is located within a housing (not shown). The navigation device 200 includes a processing resource comprising, for example, the processor 202 mentioned above, the processor 202 being coupled to an input device 204 and a display device, for example a display screen 206. Although reference is made here to the input device 204 in the singular, the skilled person should appreciate that the input device 204 represents any number of input devices, including a keyboard device, voice input device, touch panel and/or any other known input device utilised to input information. Likewise, the display screen 206 can include any type of display screen such as a Liquid Crystal Display (LCD), for example.

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

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

The processor 202 is operatively connected to memory 214 via connection 216 and is further adapted to receive/send information from/to input/output (I/O) ports 218 via connection 220, wherein the I/O port 218 is connectible to an I/O device 222 external to the navigation device 200. The external I/O device 222 may include, but is not limited to an external listening device, such as an earpiece for example. The connection to I/O device 222 can further be a wired or wireless connection to any other external device such as a car stereo unit for hands-free operation and/or for voice activated operation for example, for connection to an earpiece or headphones, and/or for connection to a mobile telephone for example, wherein the mobile telephone connection can be used to establish a data connection between the navigation device 200 and the Internet or any other network for example, and/or to establish a connection to a server via the Internet or some other network for example.

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

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

In addition, the portable or handheld navigation device 200 of Figure 3 can be connected or "docked" in a known manner to a vehicle such as a bicycle, a motorbike, a car or a boat for example. Such a navigation device 200 is then removable from the docked location for portable or handheld navigation use.

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

The navigation device 200 may sit on an arm 252, which itself may be secured to a vehicle dashboard/window/etc. using a suction cup 254. This arm 252 is one example of a docking station to which the navigation device 200 can be docked. The navigation

device 200 can be docked or otherwise connected to the arm 252 of the docking station by snap connecting the navigation device 200 to the arm 252 for example. The navigation device 200 may then be rotatable on the arm 252. To release the connection between the navigation device 200 and the docking station, a button (not shown) on the navigation device 200 may be pressed, for example. Other equally suitable arrangements for coupling and decoupling the navigation device 200 to a docking station are well known to persons of ordinary skill in the art.

Turning to Figure 5, the processor 202 and memory 214 cooperate to support a BIOS (Basic Input/Output System) 282 that functions as an interface between functional hardware components 280 of the navigation device 200 and the software executed by the device. The processor 202 then loads an operating system 284 from the memory 214, which provides an environment in which application software 286 (implementing some or all of the above described route planning and navigation functionality) can run. The application software 286 provides an operational environment including the GUI that supports core functions of the navigation device, for example map viewing, route planning, navigation functions and any other functions associated therewith.

The device is operable to navigate a user to an area having a high density of POI, as shown in Figure 6. In use, the GUI, presented via touch-screen 250 is operable to allow the user to indicate which mode he wishes to use the device in, including an option to indicate that he wishes to navigate to an area of interest. Upon selection of this option, the device is arranged to provide a global area selection screen, as shown in Figure 7. The global area selection acts as a guide indicating a macro-area, within which to search for smaller areas of interest within the global area.

Examples of global area options shown in Figure 7 include "POI near you" 702 (i.e. within a predetermined distance of the present location of the navigation device), "POI in city" 704 (which searches within a city specified by the user), "POI near home" 706 (i.e. within a predetermined distance of the user's home), "POI near destination" 708 (within a predetermined range of a destination previously provided by the user, such as an address or postcode), and if a route has already been planned, "POI along route" 710 (i.e. within a predetermined maximum distance off the planned route). The options shown in Figure 7 are merely examples, and are not representative of all possible options. Alternate terms may also be used to describe each option.

Once the global area or general region in which the user wishes to locate a point of interest (POI) has been selected, a POI category input interface screen 802 is displayed as a GUI on touch-screen 250, as shown in Figure 8. The POI category input interface screen 802 comprises selection means, such as a text input box 804, virtual or

soft buttons (not shown) and/or a list of categories 806, which may be a scrollable list, as is known in the art. The user then uses the selection means, via touch screen 250, to input or select a category of POI, such as "restaurant area".

In one embodiment, the destination and category of POI required is received by processor 202 and relevant pre-calculated POI density data is retrieved from device memory 214 and/or from server 150 via communication channel 152. In an alternate embodiment, individual POI data and map data is retrieved from the memory 214 and/or mass storage device 160 as appropriate and the device processor 202 and/or server processor 154 are adapted to determine POI density data for the destination region and category of POI specified by the user. It will be appreciated that pre-determining POI density data allows quicker provision of such data but requires greater memory resource, whilst determining the data in response to a request or user input allows minimisation of memory usage at the expense of increase time to provide such data.

Regardless of whether or not the POI density data is precalculated or calculated in real time, the device processor 202 and/or server processor 154, as appropriate, are adapted to use a varying calculation for determining the density of POI depending on the type of POI selected. For example, as a default, the processor 202, 154 determines the POI density by dividing the number of POIs of the selected category by the space they are apart. This method is particularly suitable for determining the density of small POIs such as bars and restaurants. Other methods, as would be known to a person skilled in the art, may be used to determine the density of larger POIs, such as football stadiums.

The GUI is arranged to present the areas within or in the vicinity of the selected destination that have the highest density of POIs of the selected category.

In one embodiment of the invention, the GUI displays 902 the areas as a list 904, with the highest density of POI at the top of the list, as shown in Figure 9. In this way, the areas with the greatest choice of the selected POI category can be easily selected by a user by pressing on an area at the top of the list 904 on the GUI via the touch screen 250. Further information to assist the user in selecting an area is also displayed, such as the density of POI in that area, the distance from the user's current position to each area, whether or not the POI is currently open (opening hours), the level of traffic in the region and/or other information, as would be appreciated by a person skilled in the art.

Another option for display of the areas having a high density of POI involves highlighting the areas having a high density of POI on a map 1002, as shown in Figure 10. A map of at least part of the global area is displayed on touch screen 250. Outlines 1004, 1006 of a contrasting colour can be displayed around areas having a high density

of POI. The weight of the outline 1004, 1006 is varied depending on the size of the area, with large areas having heavy outlines 1004 and smaller areas having a lighter outline 1006. Alternatively, the weight of the outline can vary by density of POI. Individual POIs within each area are displayed as icons 1008. The user can select an area that he
5 wishes to navigate to by touching the touch screen 250 within the area bounded by the appropriate outline or alternatively selected from a list.

A further option for display of the areas having a high density of POI is providing the area as displayed on a map 1102 on the touch screen 250 with shading 1104 of a contrasting colour, as shown in Figure 11. The density of shading 1104 is proportional
10 to the density of POI within the area. No shading 1104 is provided for areas having a POI density below a pre-determined cut-off threshold. As with the display shown in Figure 10, individual POIs are displayed as icons 1106 and a particular area from the displayed options is selected by touching the touch screen 250 within the shaded area 1104.

15 The navigation device 200 is then operable to calculate a route from an origin, such as the present location of the user as determined using the GPS functionality, a home location or another specified origin location, to the selected area having a high density of POI. The user then commences their journey and the navigation device 200 guides the user, in a known manner, by displaying and updating a
20 map in accordance with determined changes in location of the navigation device 200, and by providing the user with visual and, optionally, audible navigation instructions.

When the user nears the area of interest, the device 200 is adapted to inform the user could that they are about to enter the area of interest. Optionally, the device 200 is arranged to navigate the user to the centre of the selected area and once there, inform
25 the user that they have reached their destination. In an optional embodiment, as shown in Figure 12, the navigation device 200 is arranged to provide the user with a 'looping-route' 1202 within the selected area of interest 1204. The looping route 1202 is a route that navigates the user in a continuous circuit within the selected area until they have scouted all the POI options (maybe several times). The user can choose where to park
30 closest to their selected POI. As a further option, the device 200 is arranged to navigate the user to car parking within the area or close to the user's preferred POI.

It will be appreciated that the described embodiments may provide improved functionality, in that a user may be navigated to an area having the widest choice of alternate POIs, not just one specific POI. In addition, it results in a device that is simpler
35 to operate and requires less user input than devices that simply offer a list of individual POIs or where a user was forced to scroll around a map manually in order to identify

further POIs. This is particularly advantageous in PND's, such as those used in cars, where any distraction of the user is unfavourable.

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

For example, although the present invention may be exemplified as a portable navigation device, it would be appreciated that route planning and navigation functionality may also be provided by a desktop or mobile computing resource running appropriate software. For example, the Royal Automobile Club (RAC) provides an on-line route planning and navigation facility at <http://www.rac.co.uk>, which facility allows a user to enter a start point and a destination whereupon the server with which the user's computing resource is communicating calculates a route (aspects of which may be user specified), generates a map, and generates a set of exhaustive navigation instructions for guiding the user from the selected start point to the selected destination.

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

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

It will also be well understood by persons of ordinary skill in the art that whilst the preferred embodiment implements certain functionality by means of software, that functionality could equally be implemented solely in hardware (for example by means of one or more ASICs (application specific integrated circuit)) or indeed by a mix of

hardware and software. As such, the scope of the present invention should not be interpreted as being limited only to being implemented in software.

Furthermore, whilst some examples are given of categories of POIs, such as restaurants, nightlife, parking, bars and football stadiums, it will be appreciated that the device and method can be equally applied to other POIs such as shopping areas, starting points for walking routes, mountain peaks, parks and the like.

It will be understood that the present invention has been described above purely by way of example, and modifications of detail can be made within the scope of the invention.

Each feature disclosed in the description, and (where appropriate) the claims and drawings may be provided independently or in any appropriate combination.

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

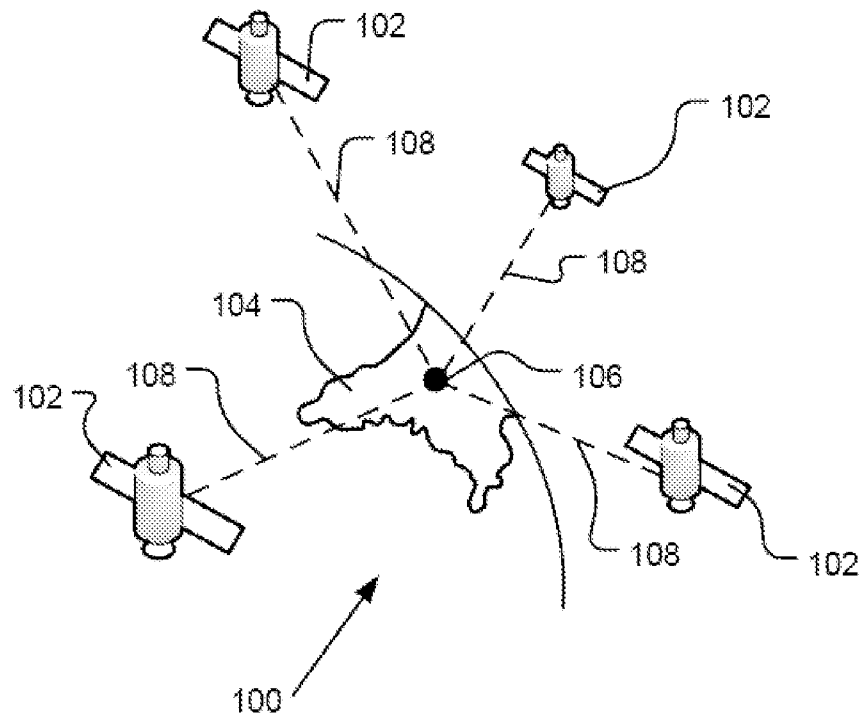
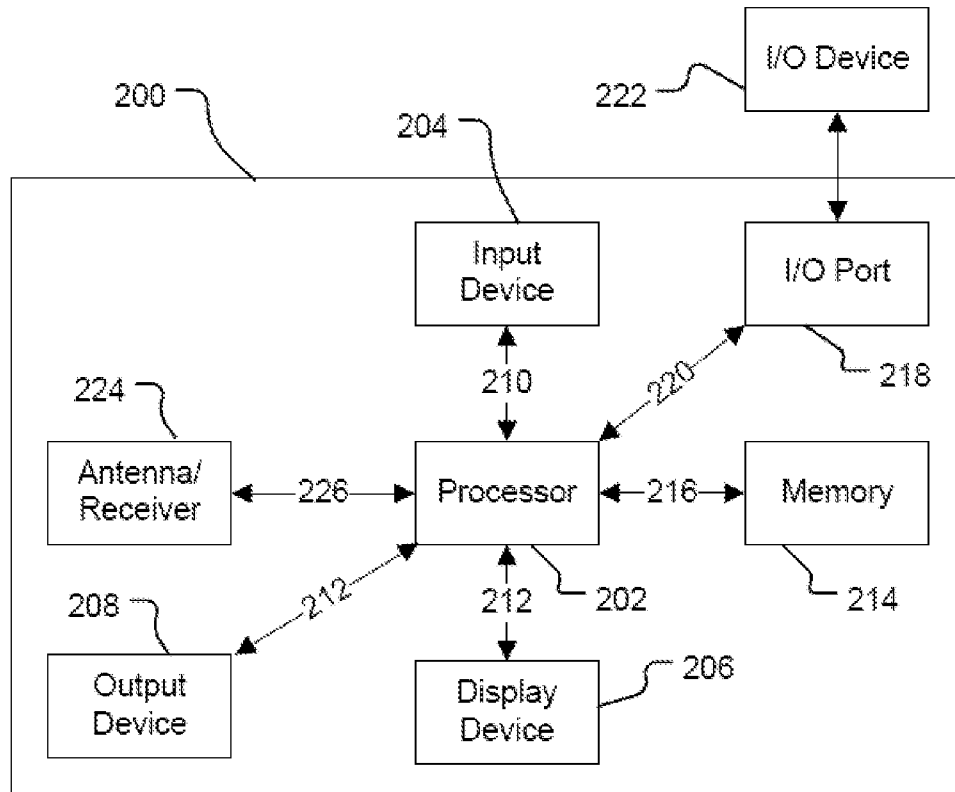
CLAIMS

1. A navigation and/or mapping apparatus (200) comprising: an input device (204)
for receiving input from a user for selecting a category of point of interest; and a
5 device (206) for indicating areas dependent on the density of points of interest in
the selected category.
2. An apparatus as claimed in Claim 1, wherein the apparatus comprises a
processing resource operably coupled to a data store.
- 10 3. An apparatus as claimed in Claim 2, wherein the processing resource is
arranged to determine the density of points of interest.
4. An apparatus as claimed in Claim 3, wherein the processing resource is adapted
15 to determine the number of points of interest belonging to the selected category
per area they are apart.
5. An apparatus as claimed in any of the preceding Claims, wherein the device for
indicating is a display for displaying areas having a density of selected point of
20 interest type above a specified threshold.
6. An apparatus as claimed in Claim 5, wherein the display of each area varies with
the density of POI within that area.
- 25 7. An apparatus as claimed in Claim 6, wherein the display of areas is in the form of
a list ordered by density of point of interest.
8. An apparatus as claimed in any of the preceding claims, wherein the input device
is adapted to receive user input selecting an area from the indicated areas and
30 the processing resource is adapted to calculate a route to the selected area.
9. A navigation system comprising: a navigation apparatus (200) according to Claim
2 and/or any claim dependent thereon, wherein the data store is remotely located
35 from the navigation apparatus and accessible via a communications network.
10. A method of operating a navigation and/or mapping apparatus (200), the method

comprising: selecting a category of point of interest data and providing an indication of areas depending on the density of points of interest in the selected category.

- 5 11. A method according to Claim 10, wherein the method comprises determining the density of points of interest in the selected category.
- 10 12. A method according to Claim 10 or Claim 11, wherein the method comprises displaying areas having a density of selected point of interest type above a specified threshold.
13. A method according to claim 10, wherein the display of areas is in the form of a list that is ordered by density of point of interest.
- 15 14. A method according to any of claims 10 to 13, the method comprising calculating a route to an indicated area.
15. A computer program product comprising computer executable instructions for performing a method according to any of Claims 10 to 14.

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**Figure 1****Figure 3**

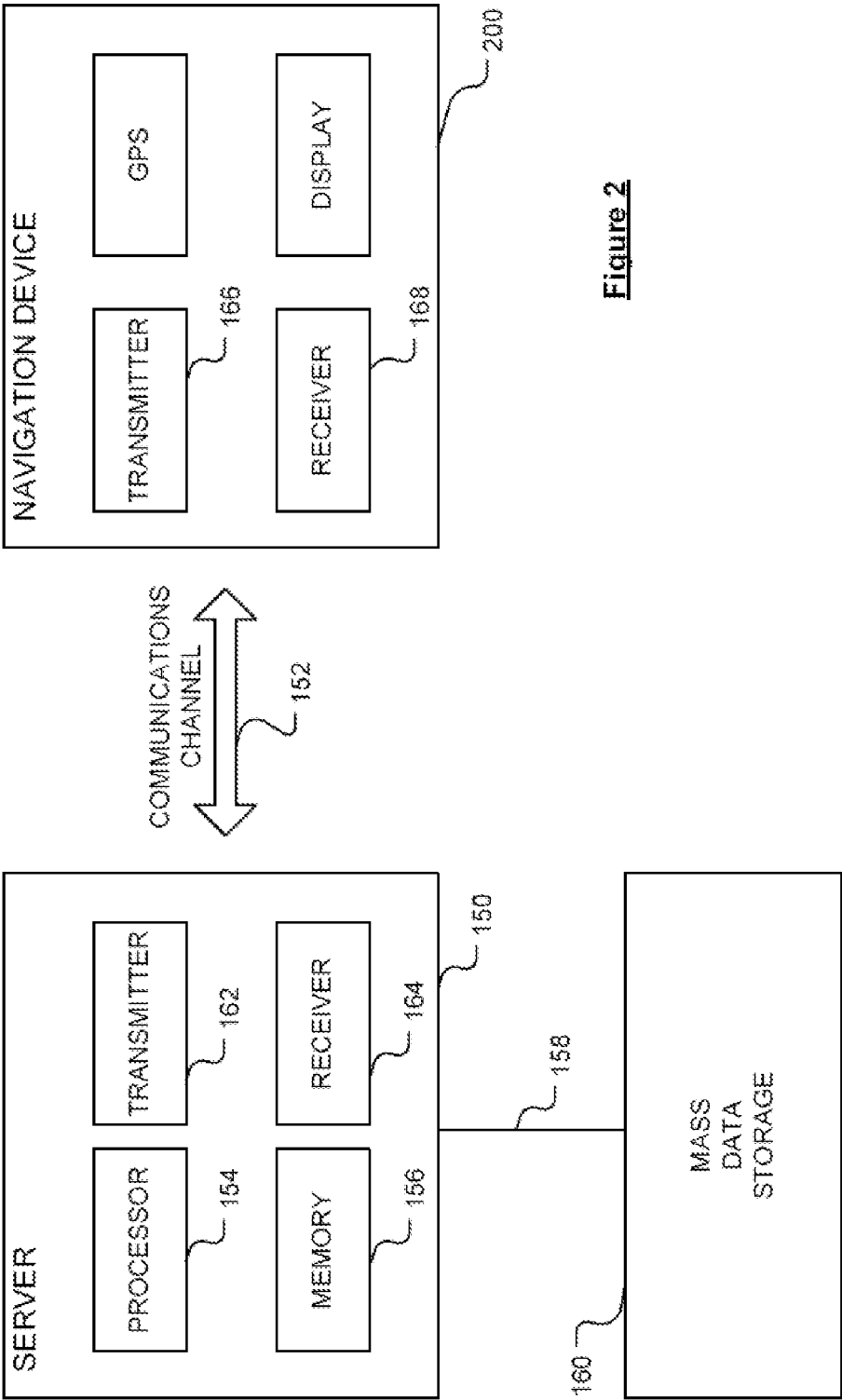
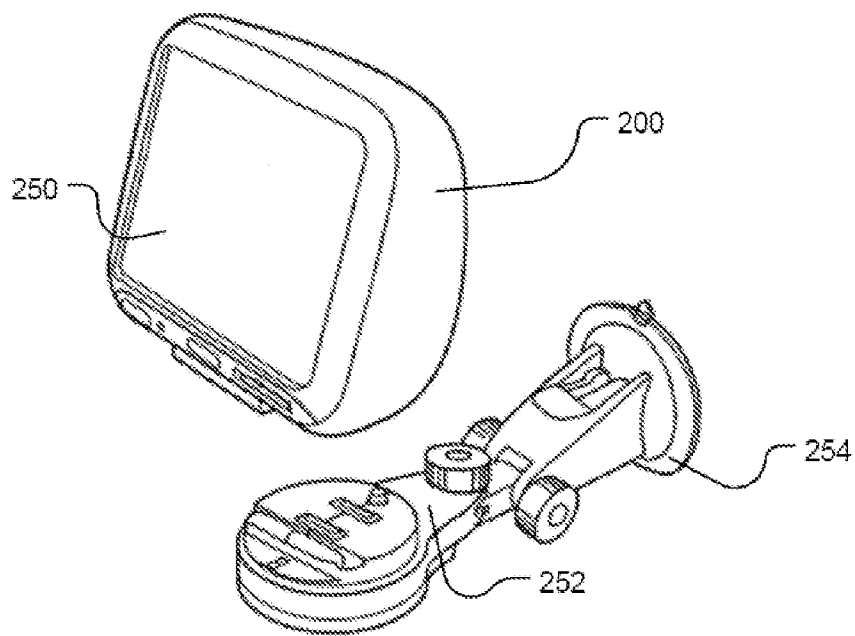
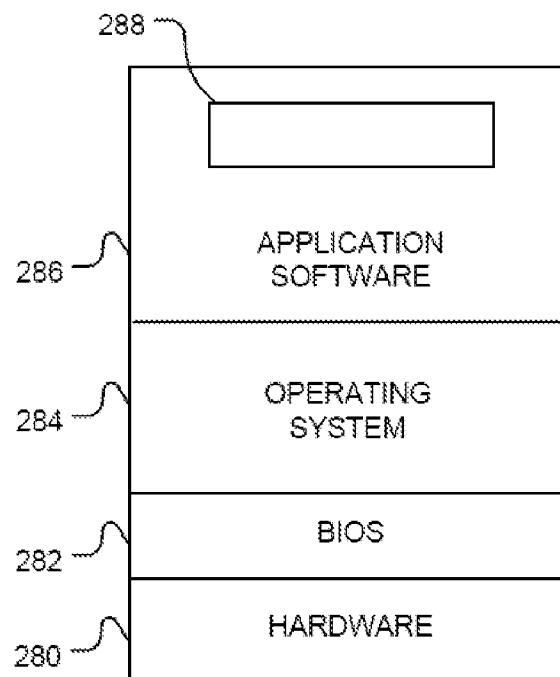
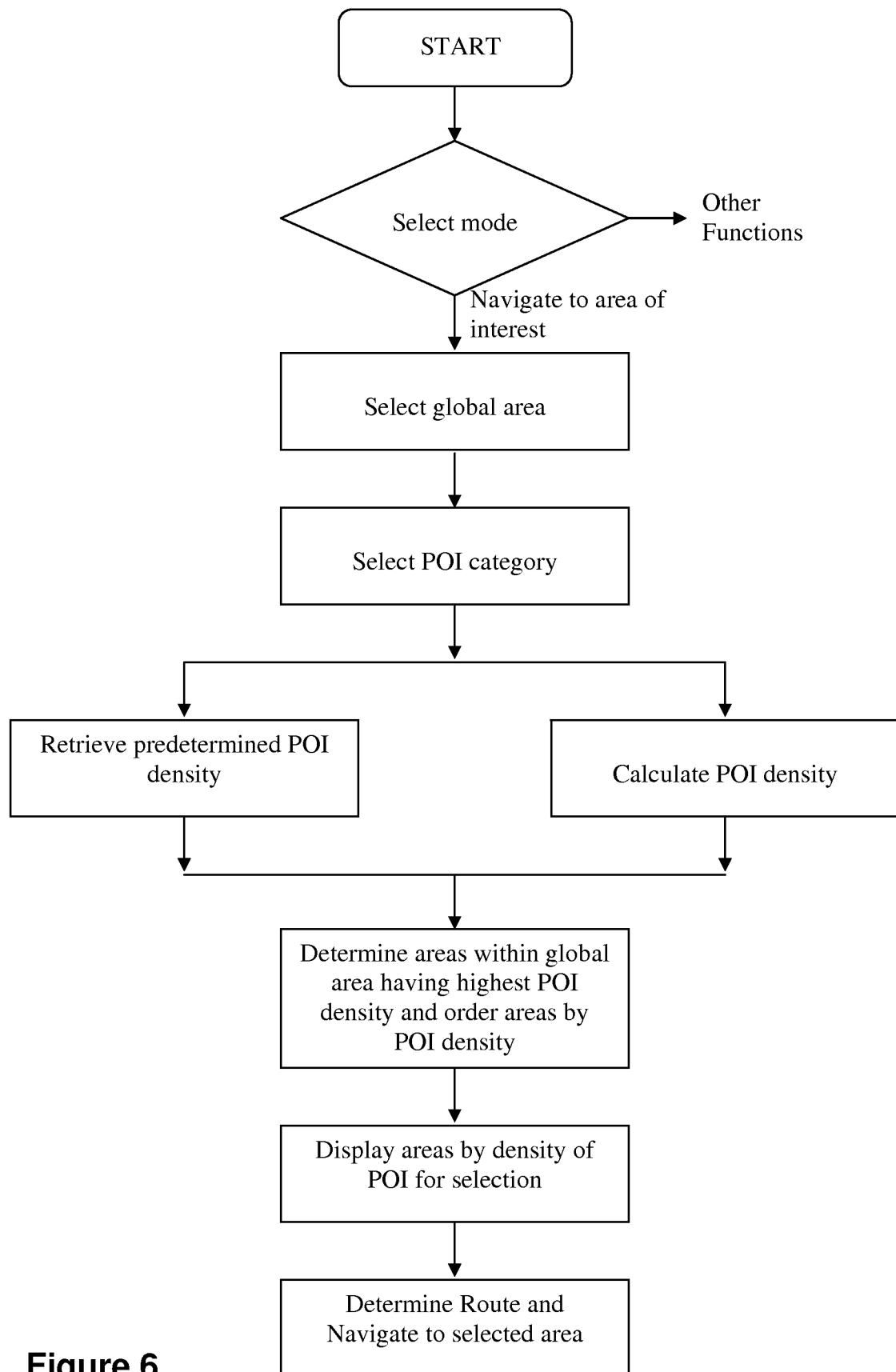


Figure 2

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**Figure 4****Figure 5**

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**Figure 6**

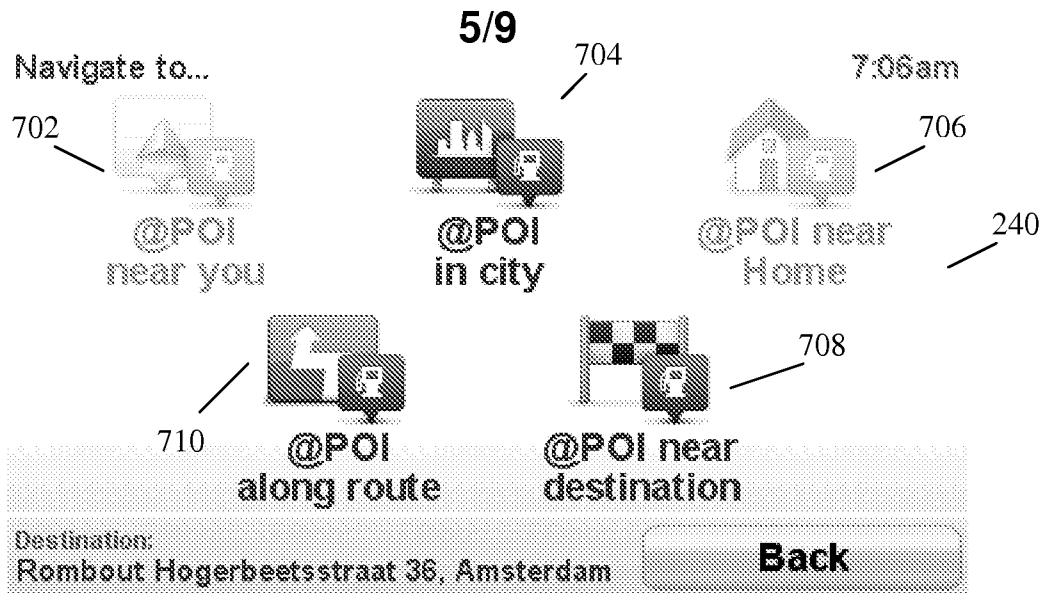


Figure 7

802

PLEASE SELECT POI CATEGORY

Input Text: Restaurant 804

or

Select from List: 806

Restaurants

Car Parks

Bars

Shops

Figure 8

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PLEASE SELECT AREA

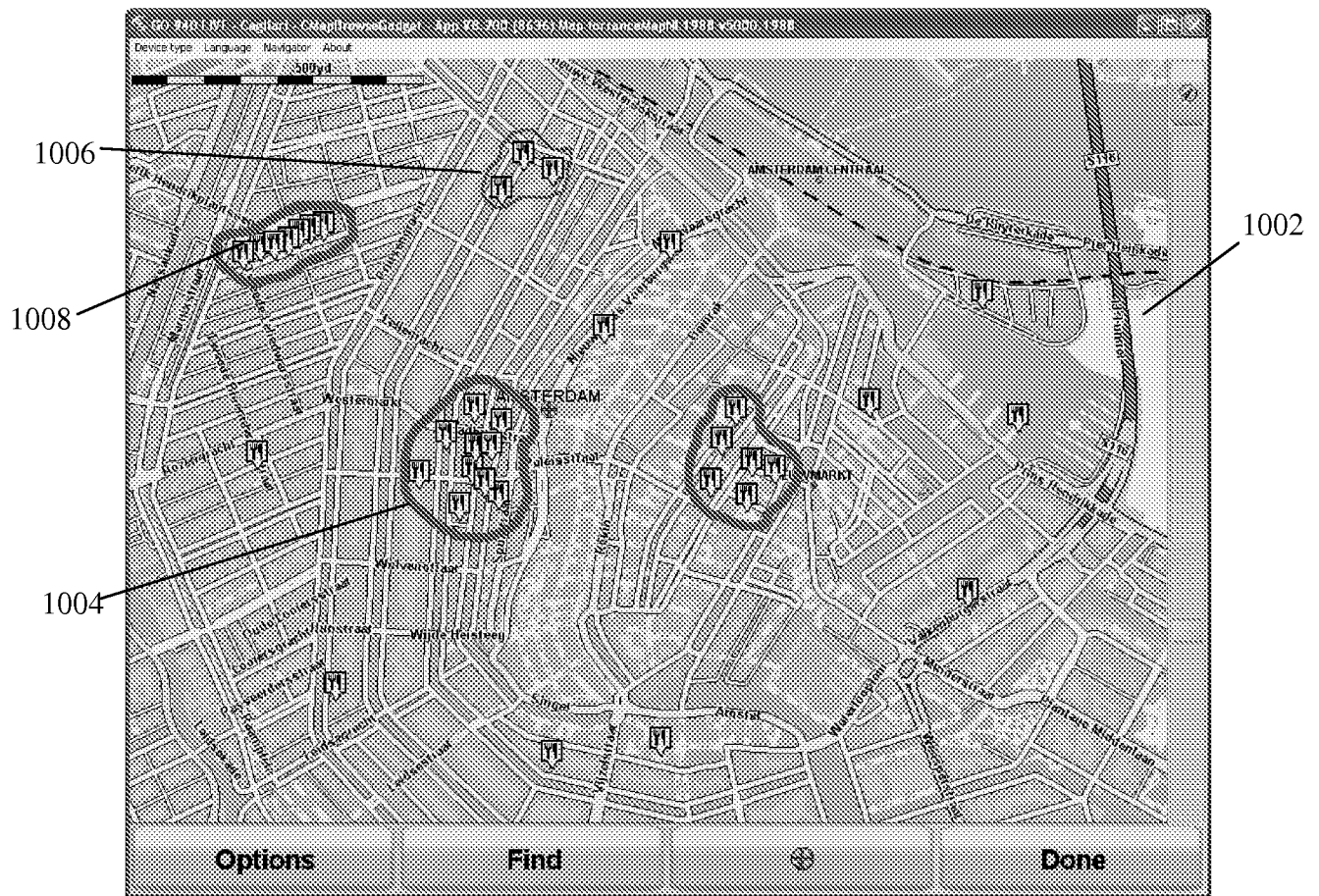
Select from List:

Area	Density	Dist/mi
Region 1	22.6	1.4
Region 2	20.2	0.4
Region 3	18.2	2.6
Region 4	12.4	1.8
Region 5	4.6	0.7

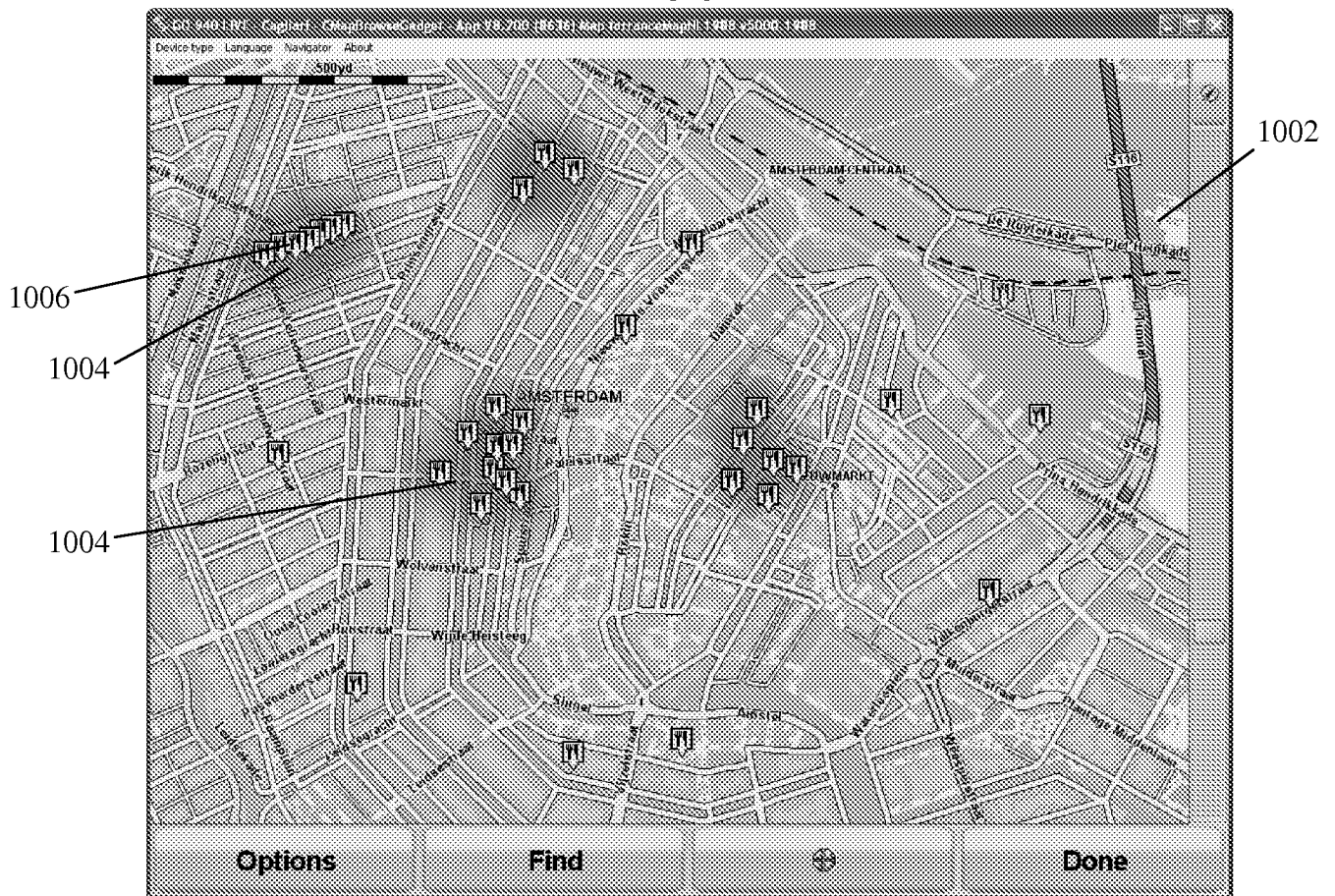
904

Figure 9

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**Figure 10**

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**Figure 11**

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2008/063480

A. CLASSIFICATION OF SUBJECT MATTER

INV. G01C21/36 G09B29/10 G08G1/0969

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 G08G G09B

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.
X	US 2005/177303 A1 (HAN MAUNG W [US]) 11 August 2005 (2005-08-11)	1-15
Y	paragraphs [0011], [0012], [0014], [0072], [0086], [0088], [0089]	1-9, 13, 14
X	US 6 397 143 B1 (PESCHKE GEORGE [US]) 28 May 2002 (2002-05-28)	10-12, 15
Y	column 1, line 54 - line 58 column 3, line 48 - line 52 column 4, line 47 - line 59 column 4, line 64 - line 67 column 5, line 32 - line 47	1-9, 13, 14
E	US 2009/024315 A1 (SCHEIBE BERND [DE]) 22 January 2009 (2009-01-22) abstract; claim 19 ----- -/--	1-15

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

23 September 2009

Date of mailing of the international search report

02/10/2009

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2008/063480

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	WO 2009/066393 A (PIONEER CORP [JP]; INCREMENT P CORP [JP]; IWAHORI YASUFUMI [JP]) 28 May 2009 (2009-05-28) abstract -----	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2008/063480

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005177303 A1	11-08-2005	JP 2005221497 A	18-08-2005
US 6397143 B1	28-05-2002	NONE	
US 2009024315 A1	22-01-2009	NONE	
WO 2009066393 A	28-05-2009	NONE	