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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 March 2011 (10.03.2011)

PCT

(10) International Publication Number
WO 2011/026530 A1

(51) International Patent Classification:
*G01C 21/36* (2006.01) *H04M 1/253* (2006.01)
*G08G 1/0968* (2006.01)

(21) International Application Number:
PCT/EP2009/068036

(22) International Filing Date:
30 December 2009 (30.12.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/240,253 7 September 2009 (07.09.2009) US

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

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

**Declarations under Rule 4.17**:

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

**Published**:

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

(54) **Title**: NAVIGATION APPARATUS AND METHOD OF SUPPORTING HANDS-FREE VOICE COMMUNICATION

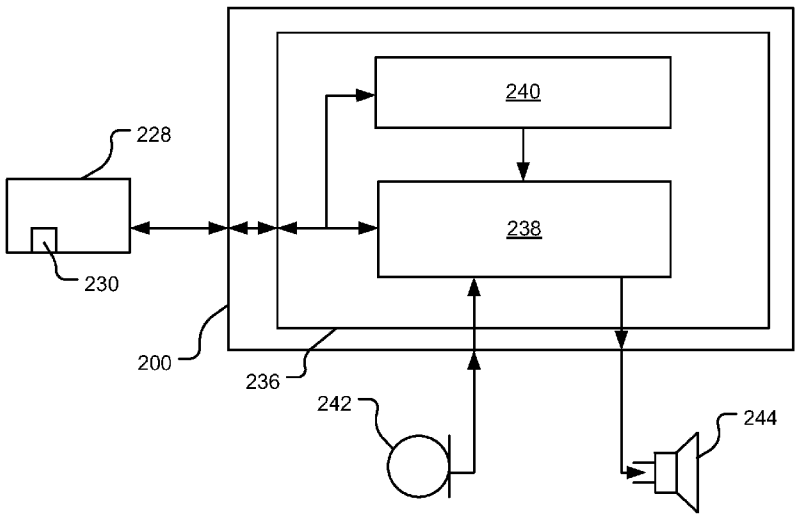


Figure 5

(57) **Abstract**: A navigation apparatus (200) comprises a processing resource (200) arranged to support an operating environment (236), and a subscriber communications module (228) arranged to support wireless data communications for communicating data over a wireless communications network. The apparatus (200) also comprises a Voice-over-Internet Protocol client module (238) supported, when in use, by the operating environment. The Voice-over- Internet Protocol client module (238) is capable of establishing a voice communication session in accordance with a Voice-over- Internet Protocol protocol for communicating with a destination user equipment unit.

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# NAVIGATION APPARATUS AND METHOD OF SUPPORTING HANDS-FREE VOICE COMMUNICATION

## Field of the Invention

The present invention relates to navigation apparatus of the type that, for example, is capable of receiving and audibly reproducing voice communications in respect of communications between parties communicating over a communications network. The present invention also relates to a method of supporting hands-free voice communication using a navigation apparatus, the method being of the type that, for example, receives and audibly reproduces voice communications in respect of communications between parties communicating over a communications network.

## Background to the Invention

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

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

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

Devices of this type will also often include one or more physical connector

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

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

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

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.

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

The device may continually monitor road and traffic conditions, and offer to or choose to change the route over which the remainder of the journey is to be made due to changed conditions. Real time traffic monitoring systems, based on various technologies (e.g. mobile phone data exchanges, fixed cameras, GPS fleet tracking), are being used to identify traffic delays and to feed the information into notification systems.

PNDs of this type may typically be mounted on the dashboard or windscreen of a vehicle, but may also be formed as part of an on-board computer of the vehicle radio or

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

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

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

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

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

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

A further important function provided by the device is automatic route re-calculation in the event that: a user deviates from the previously calculated route during navigation (either by accident or intentionally); real-time traffic conditions dictate that an alternative route would be more expedient and the device is suitably enabled to recognize such conditions automatically, or if a user actively causes the device to perform route re-calculation for any reason.

As mentioned above, it is also known to allow a route to be calculated with user defined criteria; for example, the user may prefer a scenic route to be calculated by the device, or may wish to avoid any roads on which traffic congestion is likely, expected or currently prevailing. The device software would then calculate various routes and weigh more favourably those that include along their route the highest number of points of interest (known as POIs) tagged as being for example of scenic beauty, or, using stored information indicative of prevailing traffic conditions on particular roads, order the calculated routes in terms of a level of likely congestion or delay on account thereof. Other POI-based and traffic information-based route calculation and navigation criteria are also possible.

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 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 GO 940 LIVE model manufactured and supplied by TomTom International B.V., provide a reliable means for enabling users 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.

In order to improve in-vehicle safety, PNDs are known to possess functionality and hardware that support hands-free operation of a portable wireless communications device, for example a cellular telephone handset. In this respect, the communications device is coupled to the PND either via a wired connection or a wireless connection, for example a BlueTooth™ wireless connection.

By virtue of this tethering, a user of the PND is able to control certain functional aspects of the cellular telephone handset through interaction with a user interface of the PND. Additionally, a user of the PND is able to participate in telephone calls via the PND using the microphone and loudspeaker of the PND instead of the microphone and speaker of the communications device. Hence, the PND serves as a so-called hands-free device to enable the user to avoid manipulation of the telephone handset, for example whilst driving.

Furthermore, in some instances, the PND is equipped with voice-recognition functionality, thereby enabling the user to issue voice commands to the PND in order to make and/or receive voice telephone calls.

As one would expect, use of the cellular telephone handset via the PND does, still, incur call costs when the cellular telephone is used to make outgoing "hands-free" telephone calls through the PND. The additional flexibility provided by the PND can therefore result in a larger communications bill than would otherwise result, because the user is provided with additional safe opportunities to make telephone calls. Similarly, if the user's subscription to a cellular telecommunications network includes a predetermined number of inclusive voice call minutes, increased consumption of the inclusive voice call minutes can occur, possibly also resulting in a larger communications bill in the event that the number of voice call minutes consumed exceeds the predetermined number of inclusive voice call minutes provided with the subscription.

In some instances, the subscription may comprise a substantially limited data download allocation or no data download allocation. In such circumstances, the user may be reluctant to tether the cellular telephone handset to the PND for fear that such tethering will result in unwanted data download, possibly at an unacceptable cost.

## Summary of the Invention

According to a first aspect of the present invention, there is provided a navigation apparatus comprising: a processing resource arranged to support an operating environment; a subscriber communications module arranged to support wireless data communications for communicating data over a wireless communications network; and a Voice-over-Internet Protocol client module supported, when in use, by the operating

environment, the Voice-over-Internet Protocol client module being capable of establishing a voice communication session in accordance with a Voice-over-Internet Protocol protocol for communicating with a destination user equipment unit.

The apparatus may further comprise: an input device for translating sound into an electrical signal; and an output device for translating electrical signals into sound; wherein the Voice-over-Internet protocol client module may be operably coupled to the input device and operably coupled to the output device in order to support hands-free voice communications.

The input device may be a microphone. The output device may be a loudspeaker.

The apparatus may further comprise: a subscription for communicating data over the wireless communications network; the subscription may be associated with a predetermined use of the subscriber communications module; wherein the voice communication session may be established in relation to the subscription. The predetermined use of the subscriber communications module may preclude making voice calls.

The apparatus may further comprise: a data allocation monitoring module arranged to manage a data allowance associated with a subscription for communicating data over the wireless communications network. The data allocation monitoring module may be arranged to meter consumption of a data allocation for voice communication; the data allocation may be less than or equal to the data allowance.

The Voice-over-Internet Protocol client module may be arranged to prevent voice communications in respect of the subscription when the data allocation has been expended.

The data allowance may be periodically renewable; the data allocation monitoring module may be arranged to renew the data allocation in response to renewal of the data allowance.

The wireless communications system may be a cellular telecommunications system.

According to a second aspect of the present invention, there is provided a method of supporting hands-free voice communications using a navigation apparatus, the method comprising: a subscriber module supporting wireless data communications for communicating data over a wireless communications network; and a Voice-over-Internet Protocol establishing a voice communication session in accordance with a Voice-over-Internet Protocol protocol for communicating with a destination user equipment unit.

The method may further comprise: a subscription for communicating data over the wireless communications network; the subscription may be associated with a predetermined use of the subscriber communications module; wherein the voice communication session may be established in relation to the subscription.

The predetermined use of the subscriber communications module may not include making voice calls.

According to a third 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 second aspect of the invention.

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

It is thus possible to provide a navigation apparatus and a method of supporting hands-free voice communications that avoids the need for and additional complexity of tethering a communications device to the navigation apparatus when support for voice communications via a communications network is required. User-experience is therefore improved in relation to the navigation apparatus. In particular, a need to repeatedly tether the communications device to the navigation apparatus every time the navigation apparatus is to be used with the communications device is overcome. Furthermore, the apparatus and method also obviate the need to configure the navigation apparatus for use with the communications device and the need for different configurations where different models and makes of communications devices are to be used with the navigation apparatus. Also, the enticement of a low-cost or no-cost communications service encourages the use of the hands-free facility of the apparatus and so serves to improve driver safety and legal compliance in circumstances where the user is reluctant or unwilling to tether the communications device to the navigation apparatus due to laziness or technical inability or lack of confidence. In such circumstances, where the user would normally prefer not to use the hands-free facility of the navigation apparatus, driver workload is also reduced.

Other 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

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 apparatus;

Figure 2 is a schematic diagram of electronic components of a navigation apparatus constituting an embodiment of the invention;

Figure 3 is a schematic diagram of a docking arrangement for optional use in a vehicle;

Figure 4 is a schematic representation of an architectural stack employed by the navigation apparatus of Figure 2;

Figure 5 is a schematic diagram of a client communications module of Figure 4;

Figure 6 is a schematic diagram of a communications system using the navigation apparatus of Figure 2;

Figures 7 to 12 are screen shots of the navigation apparatus in relation to establishing a voice call; and

Figure 13 is a screen shot of the navigation apparatus in relation to receipt of a voice call;

Figure 14 is a first part of a flow diagram of a method of supporting hands-free voice communications using the navigation apparatus of Figure 2; and

Figure 15 is a second part of the flow diagram of Figure 14.

**Detailed Description of Preferred Embodiments**

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

One or more embodiments of the present invention will now be described with particular reference to a PND. It should be remembered, however, that the teachings herein are not limited to PNDs but are instead universally applicable to any type of electronic processing device having a subscription associated therewith for communication of data for navigation-related purposes, but not voice calls, and where the electronic processing device is capable of determining a location thereof, for example but not essentially those configured to execute navigation software in a portable and/or mobile manner so as to provide route planning and navigation functionality. It follows therefore that in the context of the embodiments set forth herein, an electronic apparatus is intended to include (without limitation) any type of route planning and navigation apparatus, 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) or a Personal Digital Assistant (PDA) subject to the subscription being provided for a limited purpose narrower than general data communication.

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

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

Referring to Figure 2, it should be noted that the block diagram of the navigation apparatus 200 is not inclusive of all components of the navigation apparatus, but is only representative of many example components. The navigation apparatus 200 is located within a housing (not shown). The navigation apparatus 200 includes a processing resource, for example a processor 202, the processor 202 being coupled to an input device 204 and a display device, for example a display screen 206. The processing

resource and the communications interface (mentioned above) constitute parts of an alert content reception apparatus. 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 apparatus 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 an output device 208, via respective output connections 212, to output information thereto. The output device 208 is, for example, an audible output device (e.g. including a loudspeaker). As the output device 208 can produce audible information for a user of the navigation apparatus 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 apparatus 200 can also include any additional input device 204 and/or any additional output device, such as audio input/output devices. The processor 202 is operably coupled to a memory resource 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 apparatus 200. The memory resource 214 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 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.

Figure 2 further illustrates an operative connection between the processor 202

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

In order to support communications in a Universal Mobile Telecommunications System (UMTS), the processor 202 is also coupled to a cellular communications module 228 constituting the mobile telephone technology mentioned above. The cellular communications module 228 supports a communications interface 229 for transmitting and receiving data wirelessly. The cellular communications module 228 comprises a Subscriber Identity Module (SIM) 230 coupled thereto having a data subscription associated therewith. The subscription is, in this example, for a limited data usage over a pre-determined period of time, for example a calendar month. For example, the data limit may be 1GB per month. In other embodiments, the subscription need not have a data usage limit. The cellular communications module 228 supports a bidirectional data communications service, for example a packet switched data service, such as a General Packet Radio Service (GPRS) supported by the GSM communications network and/or a High Speed Downlink Packet Access (HSDPA) service supported by the UMTS network. The communications interface 229 is therefore compatible with the bidirectional data communications service. The bidirectional data communications service supports an Internet Protocol (IP) for data communications although use of other protocols is contemplated.

It will, of course, be understood by one of ordinary skill in the art that the electronic components shown in Figure 2 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 2 are contemplated. For example, the components shown in Figure 2 can be in communication with one another via wired and/or wireless connections and the like. Thus, the navigation apparatus 200 described herein can be a portable or handheld navigation apparatus.

To facilitate use thereof, the portable or handheld navigation apparatus 200 of Figure 2 can be connected or “docked” (Figure 3) in a known manner in an automobile, or any other suitable vehicle, for example to a bicycle, a motorbike or a boat. The navigation apparatus 200 is then removable from the docked location for portable or handheld navigation use.

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

Turning to Figure 4, the memory resource 214 of the navigation apparatus 200 stores a boot loader program (not shown) that is executed by the processor 202 in order to load an operating system 234 from the memory resource 214 for execution by functional hardware components 232, which provides an environment in which application software 236 can run. The operating system 234 serves to control the functional hardware components 232 and resides between the application software 236 and the functional hardware components 232. The application software 236 provides an operational environment including the GUI that supports core functions of the navigation apparatus 200, for example map viewing, route planning, navigation functions and any other functions associated therewith. In this example, in order to implement or support Voice-over-Internet Protocol (IP) communications, the application software 236 supports Voice-over-IP (VoIP) client module 238. The applications software 236 also supports an optional data allocation monitoring module 240.

Referring to Figure 5, the VoIP client module 238 is capable of communicating with the cellular communications module 228. The data allocation monitoring module 240 is capable of receiving data and monitoring data sent and received via the cellular communications module 238, the data allocation module 240 being operably coupled to the VoIP client module 238. The VoIP client module 238 is operably coupled to a microphone 242 constituting one of the input devices 204 and a loudspeaker 244 constituting one of the output devices 208. The microphone 242 is an example of a device capable of translating sound, for example voice, into electrical signals and the loudspeaker 244 is an example of a device capable of translating electrical signals into sound. The skilled person should appreciate that, although not shown in Figure 5, various interfaces exist between the VoIP client module 238 and the cellular communications module 228, the microphone 242 and VoIP client module 238, and the loudspeaker 244 and the VoIP client module 238. However, these interfaces will not be described in further detail in order not to distract from the salient aspects of the embodiments described herein.

Turning to Figure 6, the navigation apparatus 200 is capable of communicating with a cellular communications network 260, for example the UMTS network mentioned above, via one or more Node Bs 262 thereof. Whilst reference herein is made to the UMTS network, the skilled person should appreciate that the embodiments described herein are not limited to the UMTS network and use of other, subscription-based, wireless communications networks is contemplated where the subscription is confined to communications of data and the intention of the subscription is the communication of data for a predetermined purpose, for example the communication of data in relation to core functionality of the navigation apparatus 200, such as navigation-related data. In this example, the subscription precludes voice calls, but does not preclude VoIP calls.

The cellular communications network 260 is operably coupled to the Internet 264 and a VoIP gateway server 266 is "attached" or operably coupled to the Internet 264 in order to support communications in relation to a VoIP protocol, for example a Session Initiation Protocol (SIP). However, support for other protocols in addition to or alternative to the SIP protocol, for example custom protocols associated with the skype™ VoIP service.

As explained above, the establishment of the network connection between the navigation apparatus 200 (via a service provider) and another device such as the VoIP server 266, using the Internet for example, can be done in any suitable known manner. In this respect, any number of appropriate data communications protocols can be employed. Furthermore, the communications module 228 can utilize any number of communication standards such as CDMA2000, GSM, IEEE 802.11 a/b/c/g/n, etc.

A first user terminating equipment 268, for example a so-called "SIP telephone", is operably coupled to the Internet 264, for example via a router (not shown) and an Internet Service Provider (ISP) and is capable of making and receiving voice calls via the VoIP gateway server 266. Additionally or alternatively, the VoIP gateway server 266 is operably coupled to a Time Division Multiplexing – Private Branch eXchange (TDM – PBX) 288 in order to support voice calls with a second, analogue, terminating equipment 290 associated with a Public Switched Telephone Network (PSTN).

In operation, it is assumed, for the sake of conciseness of description, that the user is located in a vehicle, for example an automobile, and is driving to a destination. In this example, it is assumed that the user is availing him or herself to the navigation assistance functionality of the navigation apparatus 200. However, this is not mandatory and the user can simply be using the navigation apparatus 200 for "free driving" as mentioned earlier above and/or as a hands-free communications device.

In the present example, it is therefore assumed that the user has set a

destination to which the user wishes to be guided and the navigation device 200 has been instructed to provide navigation assistance to the destination set.

However, during the journey, the user wishes to initiate a voice call to the second terminating equipment 290. The user therefore takes appropriate action to place the vehicle in a state where it is safe to initiate the voice call, for example by halting the vehicle in a safe location. Of course, the following steps can be obviated if voice recognition functionality of the navigation apparatus 200 is being used. However, for the sake of clarity and conciseness of description and not to distract from the salient aspects of this embodiment, the use of the navigation apparatus 200 will be described in the context of user interaction with the touch screen of the navigation apparatus 200.

In order to establish a voice call session with the terminating equipment 268, the user controls the navigation apparatus as follows. Referring to Figures 7 to 12, the user undertakes an illustrative call establishment process described hereinbelow using the VoIP client module 238 mentioned above via the user interface.

During navigation, the user is presented, as shown in Figure 7, with a display 300 showing in pseudo three-dimensions: a local environment 302 in which the navigation apparatus 200 is determined to be located and, in a region 304 of the display 300 below the local environment 302, a set of control and status messages.

By touching the display at the local environment 302, the navigation apparatus 200, through the user interface, updates the display 300 by displaying (as shown in Figure 8) a series of virtual or soft buttons 306 by means of which the user can, inter alia, initiate voice call functionality, for example a VoIP call.

Referring to Figures 14 and 15, the VoIP client module 238 therefore monitors incoming packets from the VoIP gateway server 266 in order to detect (Step 400) an incoming voice call. While no incoming voice call is being detected, the VoIP client module 238 also monitors (Step 402) messages from the user interface in order to detect when the user attempts to use the telephone call functionality of the navigation apparatus 200.

By touching the “Phone” virtual button 308, the navigation apparatus 200 initiates a voice call control procedure. In accordance with the VoIP establishment procedure, the navigation apparatus 200 displays (as shown in Figure 9) a plurality of virtual buttons (Step 404) that are each associated with a different aspect of telephony using the navigation apparatus 200. In this instance, the display shows a “Call...” virtual button 310 that if pressed would initiate a dial-out procedure. A “Redial” virtual button, which if pressed, initiates establishment of a call to an immediately preceding telephone number or VoIP destination “dialled”. A “Read/Write message” option enables the user to

message or text a destination address, if pressed. The "Phone preferences" virtual button, if pressed, reveals a number of options by means of which the user can review and/or alter settings associate with the VoIP client module 138. The "Manage phone" virtual button, if pressed, reveals a number of options by means of which the user can alter the service provider used to provide VoIP service, for example skype™ or Vonage™.

In this example, the user operates, by touch, the "Call..." virtual button 310, which is detected (Step 406) by the navigation apparatus 200 and results in the navigation apparatus 200 initiating a VoIP call establishment procedure whereby, using the user interface, the navigation apparatus 200 displays (Figure 10) a further plurality of virtual buttons (Step 408). In this respect, the further plurality of virtual buttons comprises a "Home" virtual button for telephoning a predefined telephone number or other indicator associated with a home location, a "Number" virtual button 312 to enable the user to specify a telephone number or other indicator, a "Point of Interest" virtual button to enable a telephone number or other indicator associated with a point of interest to be called, a "Phonebook entry" virtual button to enable the user to identify and select a destination telephone number or other indicator, a "Recently dialled" virtual button to reveal a list of recently called telephone numbers or other identifiers that the user can select in order to call, and a "Recent caller" virtual button to reveal a list of recent callers by telephone number or other identifiers that can be selected by the user in order to call.

In the present example, the user operates, by touch, the "Number" virtual button 312, which is detected (Step 410) by the navigation apparatus 200 and so the VoIP client module 238 responds by displaying (Step 412), using the user interface, a telephone number entry screen 314 (Figure 11). The user entry screen 314 comprises a prompt 316 to enter the telephone number of the second terminating equipment 290 and a virtual keyboard 318 that may be operated by the user, if necessary, to input the telephone number. In this example, identification of the second terminating equipment 290 is by telephone number. However, the skilled person should appreciate that the virtual numeric keypad 318 can be replaced by an alphanumeric keypad 318 for identification of terminating equipment by another type of identifier, for example an e-mail address or other "handle".

In this example, the user enters (Step 414) a telephone number of the terminating equipment 290 using the virtual keypad 318 and then presses (Step 416) a call virtual button 320 represented by an icon of a telephone handset.

Thereafter, the VoIP client module 238 uses the telephone number provided in order to establish (Step 418) a VoIP voice call using the subscription provided in relation

to the cellular communications module 228 and/or the SIM card 230. Once the voice call has been established, datagrams, for example packets of data, are communicated between the VoIP client module 238 and the cellular communications module 240 in relation to a VoIP call with the second terminating equipment 290, the user using the microphone and loudspeaker to send and receive audible voice information. In order to support connectivity with the second terminating equipment 290, the datagrams are communicated by the cellular communications module 240 and the VoIP gateway server 266 via the communications network 260 and the Internet 264. Using the Internet 264, the VoIP gateway 266 supports communication of the datagrams with the TDM-PBX 288 and hence voice communications are possible with the terminating equipment 290.

The VoIP call is established in accordance with the VoIP protocol(s) employed, and during the voice call, the VoIP client module 238 displays (Step 420), using the user interface, a further set of virtual buttons (Figure 12), including an "End call" virtual button 322 for terminating the voice call in progress, a "Switch call" virtual button to switch between multiple established calls, and a "Tone Keypad" virtual button to support transmission of Dual Tone Multi-Frequency (DTMF) tones if required, for example when interacting with automated telephone systems.

When the voice telephone conversation has finished or when the user wishes to end the voice telephone call, the user operates, for example by touch, the "End call" virtual button 322 in order to end the VoIP voice call session. The VoIP client module 238 detects (Step 422) the instruction to terminate the VoIP call and terminates the call in accordance with the VoIP protocol(s) employed.

The VoIP client module 238 also supports, in this example, receipt of incoming VoIP voice calls (Step 400). In this regard, while the navigation apparatus 200 is displaying the display 300 showing in pseudo three-dimensions the local environment 302, the first terminating equipment 268 attempts to establish an incoming VoIP call to the navigation apparatus 200. In response to detection of an attempt to establish the VoIP call, the VoIP client module 238, using the user interface, displays (Step 424) an incoming call display 324 (Figure 13). The incoming call display 324 comprises a "Pick up" virtual button 326 to accept the incoming VoIP call and permit voice communication between the user and a user of the first terminating equipment 268, and a "Refuse" virtual button 328 to decline the incoming VoIP call, in which case the VoIP call is not established. In the event that the incoming VoIP call is accepted (Step 426), the VoIP client module 238, using the user interface, displays (Step 420) the further set of virtual buttons of Figure 12 for controlling aspects of an in-progress VoIP call. The voice call can then be terminated in the manner already described above (Step 422) when desired.

In the above example, it is assumed that the subscription associated with the cellular communications module 228 is limitless in respect of data usage or generally very large subject to a fair usage policy. However, where the subscription has a limit associated therewith in relation to data communication usage, the data allocation module 240 is, in another embodiment, used to monitor and manage usage of a data allowance associated with the subscription.

In this respect, the data allocation module 240 is, in this example, preconfigured to apportion a data allocation from the data allowance in order to provide for usage of a part of the data allowance for VoIP communications. The data allocation is set in order to ensure that data communications for which the data allowance is intended can still take place, for example for navigation-related functionality such as traffic-related data download. For example, the data allocation can be set to a percentage of the data allowance, for example 50% of the data allowance, or a fixed data capacity, for example 1GB. It is conceivable that the data allocation is set to be less than or equal to the data allocation.

The data allocation module 240 monitors or meters consumption of the data allowance for VoIP traffic and determines when the VoIP traffic has consumed the data allocation set. When the data allocation has been expended, the data allocation module 240 sends a “no credit” type message to the VoIP client module 238 and the VoIP client module 238 prevents further VoIP communications from taking place. If desired, the data allocation module 240 can also send one or more warning messages to the VoIP client module 238 when the user is nearing consumption of all of the data allocation and the VoIP client module 238, using the user interface, can provide an appropriate advance warning to the user.

The data allowance is typically in respect of a predetermined period of time, for example a calendar month and so is automatically periodically renewed upon the commencement of a new calendar month. The data allocation module 240 is therefore provided, in this example, with a calendar function in order to determine when a new calendar month begins in order to trigger a renewal of the data allocation. Alternatively, if desired, the data allocation module 240 can be arranged to communicate with the cellular communications module 228 in order to determine when the data allowance is renewed and hence when the data allocation can be renewed.

It should 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, whilst embodiments described in the foregoing detailed description refer to GPS, it should be noted that the navigation apparatus may utilise any kind of position sensing technology as an alternative to (or indeed in addition to) the GPS. For example the navigation apparatus may utilise other global navigation satellite systems (GNSS) such as the proposed European Galileo system when available. 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, for example the long range navigation (LORAN)-C system.

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

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

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

**CLAIMS**

1. A navigation apparatus comprising:

a processing resource arranged to support an operating environment;

a subscriber communications module arranged to support wireless data communications for communicating data over a wireless communications network; and

a Voice-over-Internet Protocol client module supported, when in use, by the operating environment, the Voice-over-Internet Protocol client module being capable of establishing a voice communication session in accordance with a Voice-over-Internet Protocol protocol for communicating with a destination user equipment unit.

2. An apparatus as claimed in Claim 1, further comprising:

an input device for translating sound into an electrical signal; and

an output device for translating electrical signals into sound; wherein

the Voice-over-Internet protocol client module is operably coupled to the input device and operably coupled to the output device in order to support hands-free voice communications.

3. An apparatus as claimed in Claim 2, wherein the input device is a microphone.

4. An apparatus as claimed in Claim 2 or Claim 3, wherein the output device is a loudspeaker.

5. An apparatus as claimed in any one of the preceding claims, further comprising:

a subscription for communicating data over the wireless communications network, the subscription being associated with a predetermined use of the subscriber communications module; wherein

the voice communication session is established in relation to the subscription.

6. An apparatus as claimed in Claim 5, wherein the predetermined use of the subscriber communications module precludes making voice calls.

7. An apparatus as claimed in Claims1 to 4, further comprising:

a data allocation monitoring module arranged to manage a data allowance associated with a subscription for communicating data over the wireless communications network.

8. An apparatus as claimed in Claim 7, wherein the data allocation monitoring module is arranged to meter consumption of a data allocation for voice communication, the data allocation being less than or equal to the data allowance.

9. An apparatus as claimed in Claim 8, wherein the Voice-over-Internet Protocol client module is arranged to prevent voice communications in respect of the subscription when the data allocation has been expended.

10. An apparatus as claimed in Claim 8, wherein the data allowance is periodically renewable, the data allocation monitoring module being arranged to renew the data allocation in response to renewal of the data allowance.

11. An apparatus as claimed in any one of the preceding claims, wherein the wireless communications system is a cellular telecommunications system.

12. A method of supporting hands-free voice communications using a navigation apparatus, the method comprising:

a subscriber module supporting wireless data communications for communicating data over a wireless communications network; and

a Voice-over-Internet Protocol establishing a voice communication session in accordance with a Voice-over-Internet Protocol protocol for communicating with a destination user equipment unit.

13. A method as claimed in Claim 12, further comprising:

a subscription for communicating data over the wireless communications network, the subscription being associated with a predetermined use of the subscriber communications module; wherein

the voice communication session is established in relation to the subscription.

14. A method as claimed in Claim 13, wherein the predetermined use of the subscriber communications module does not include making voice calls.

15. A computer program element comprising computer program code means to make a computer execute the method as claimed in Claim 12 or Claim 13 or Claim 14.

16. A computer program element as claimed in Claim 15, embodied on a computer readable medium.

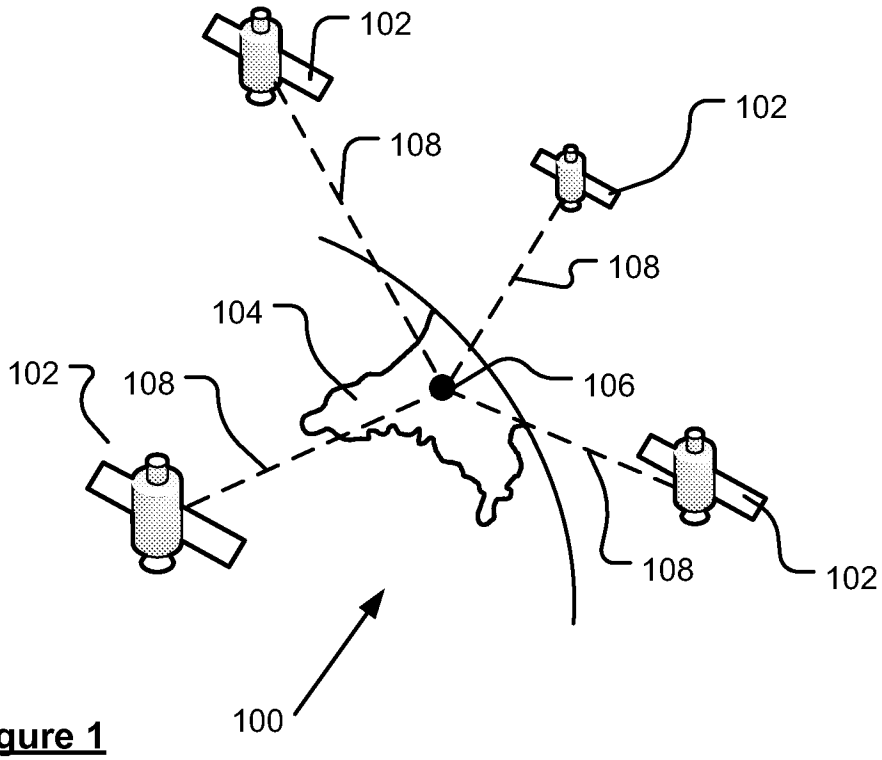



**Figure 1**

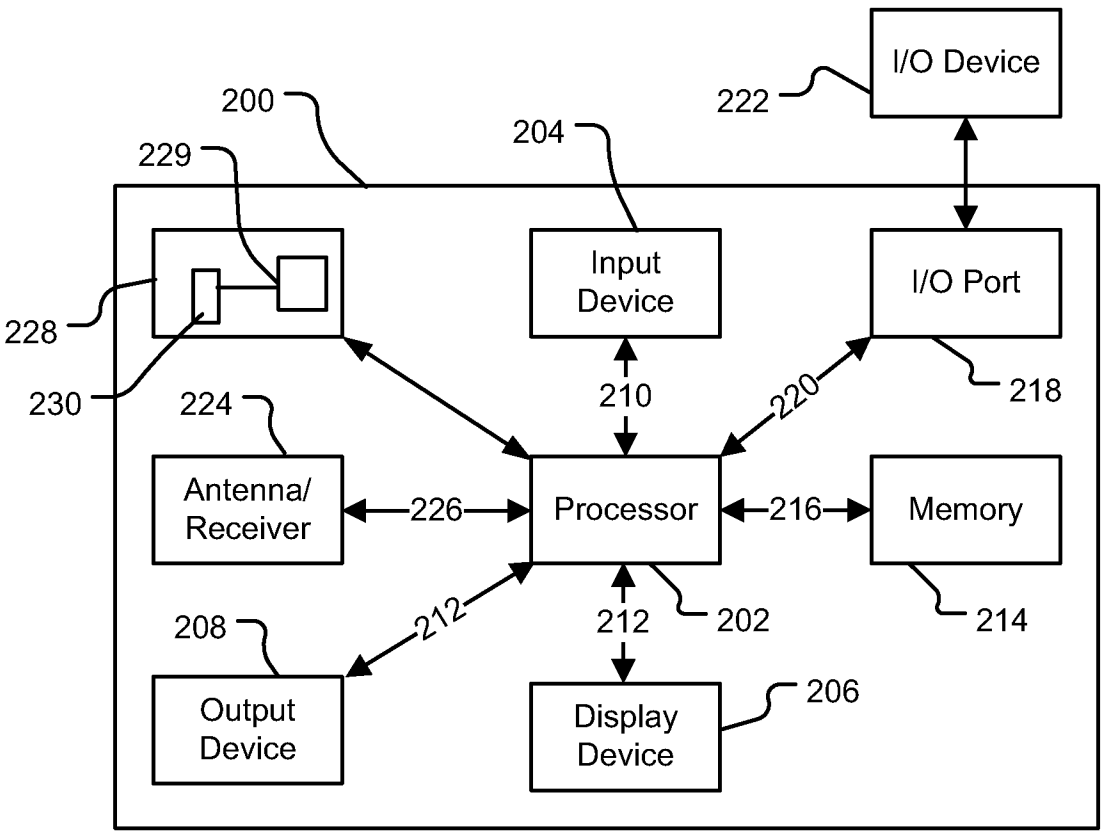



**Figure 2**

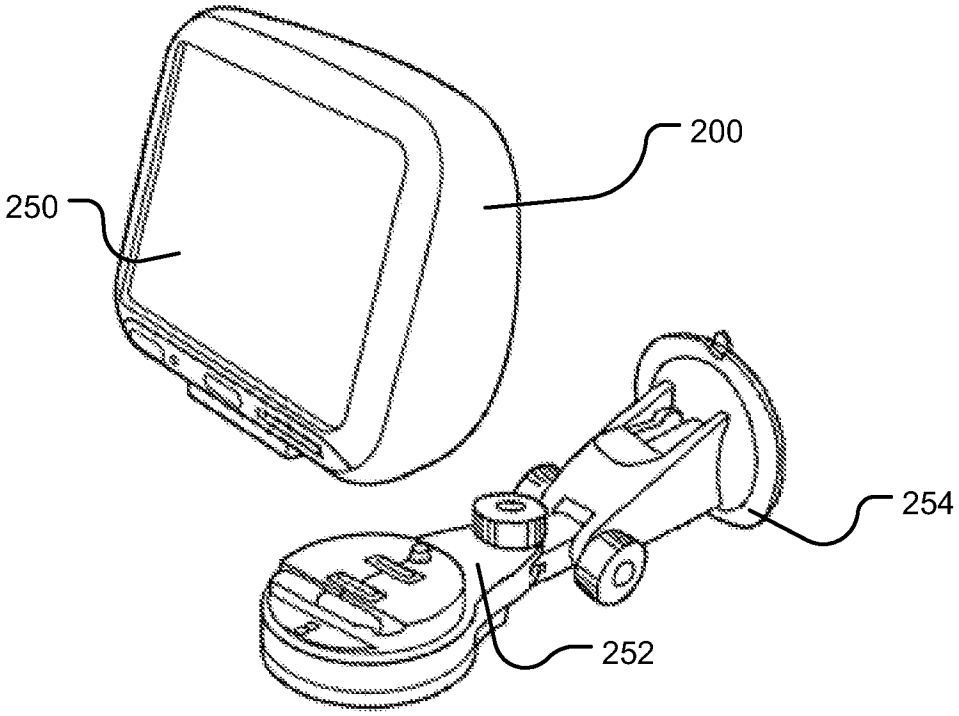



**Figure 3**

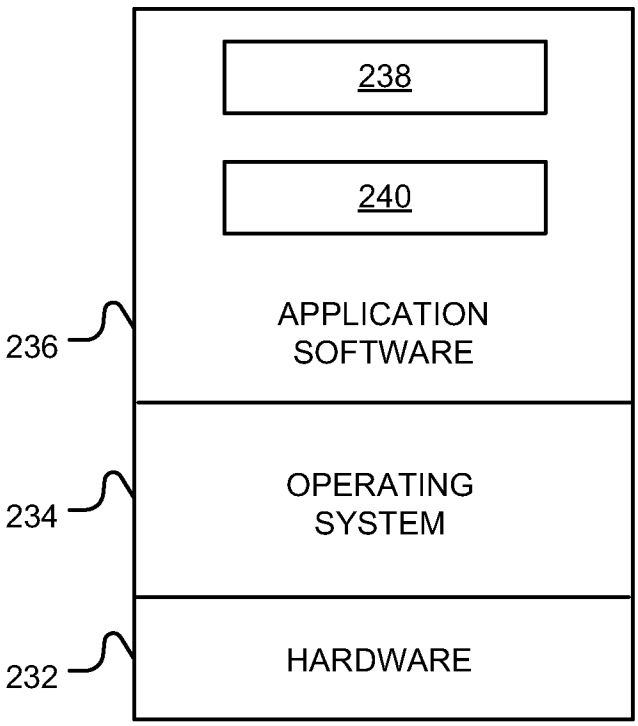



**Figure 4**

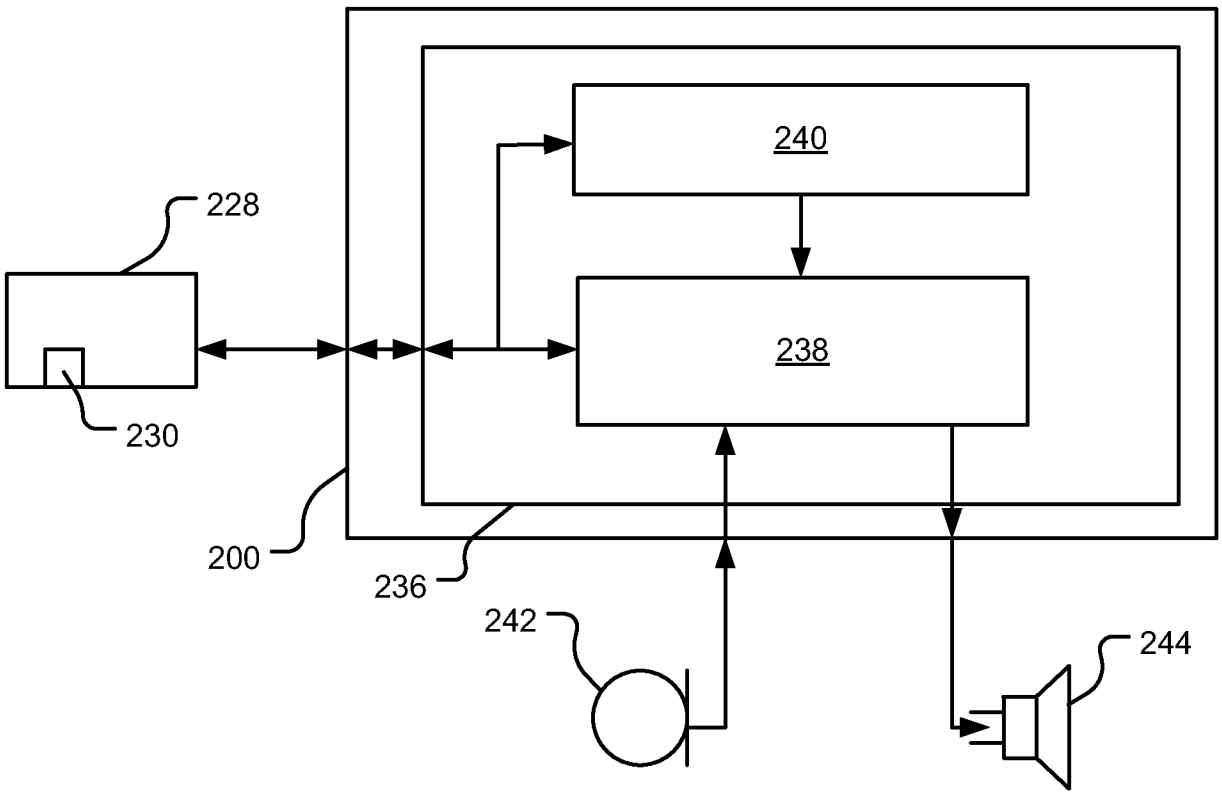



Figure 5

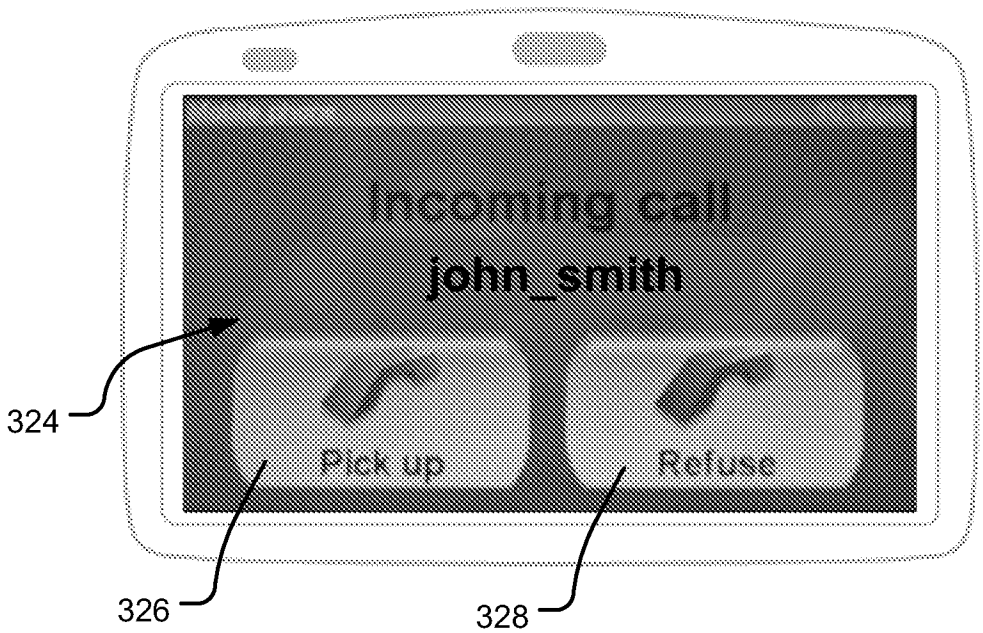



Figure 13

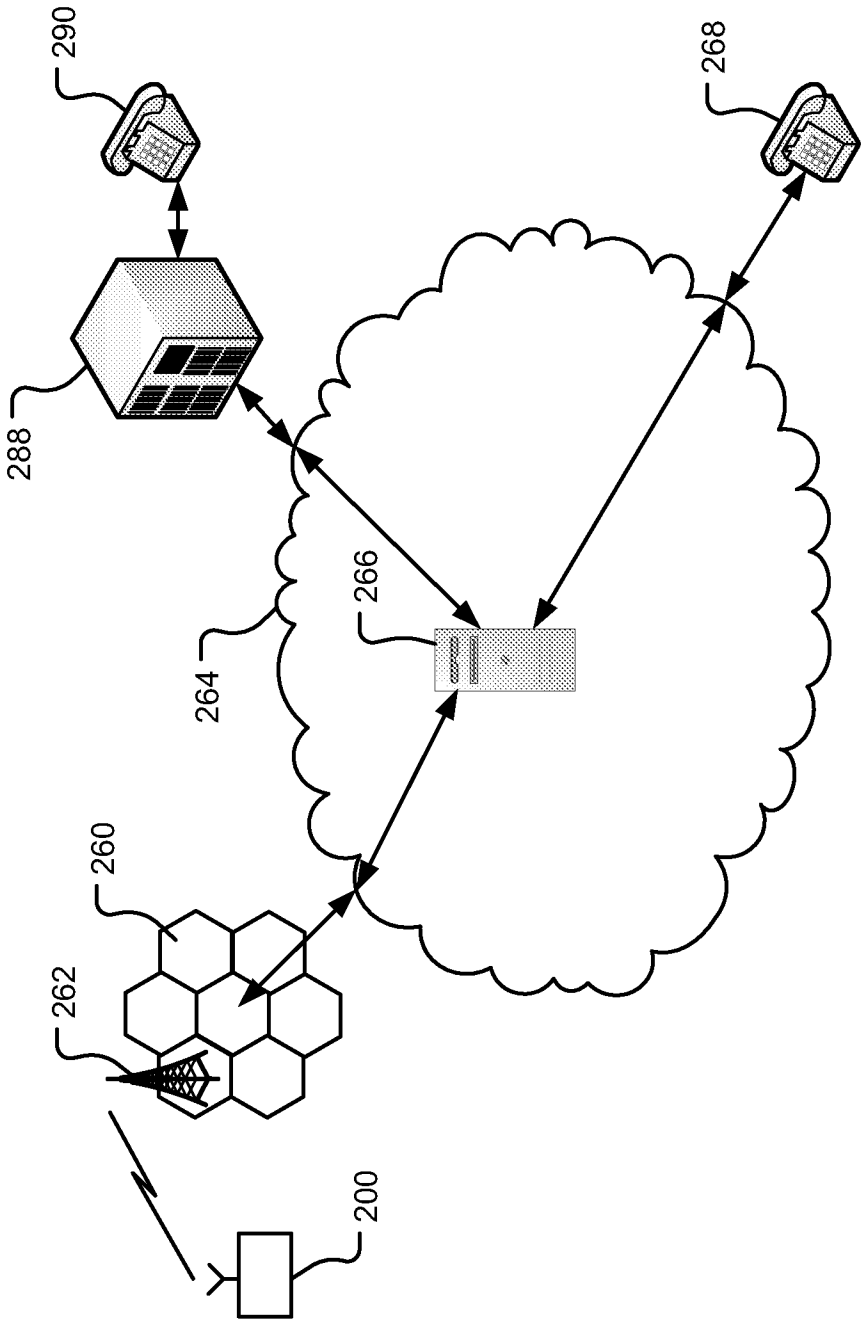



Figure 6

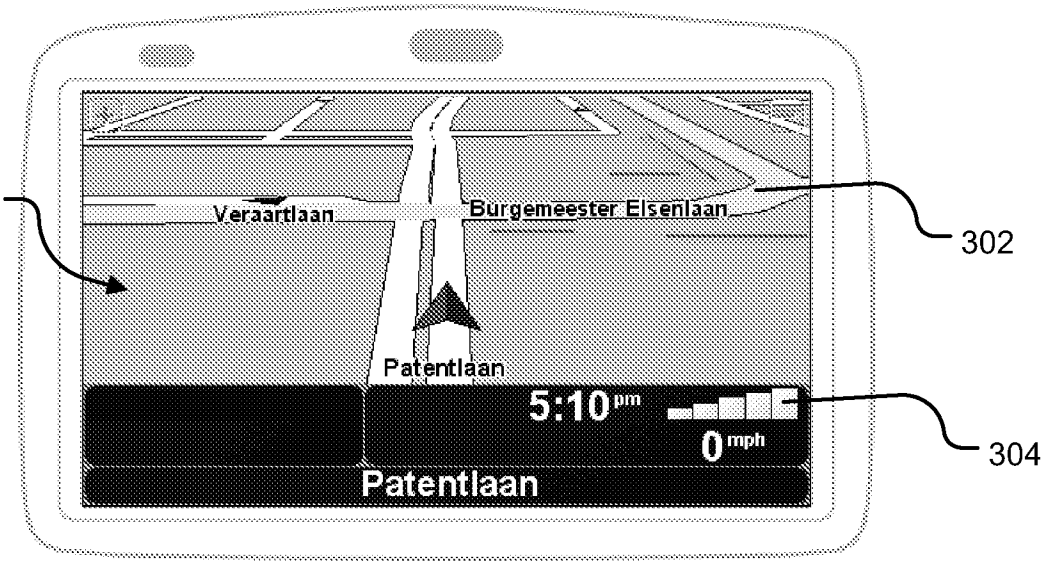



Figure 7

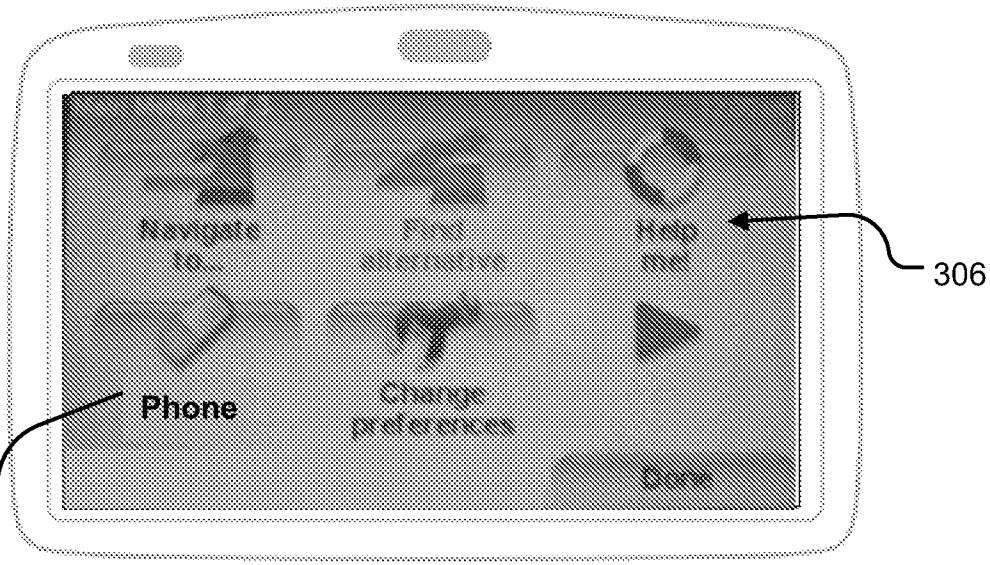



Figure 8

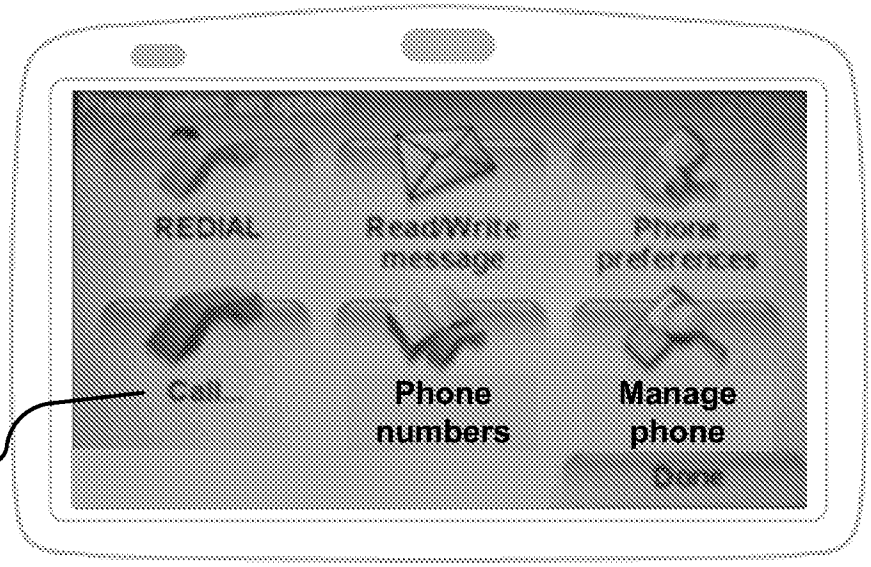



Figure 9

Figure 10

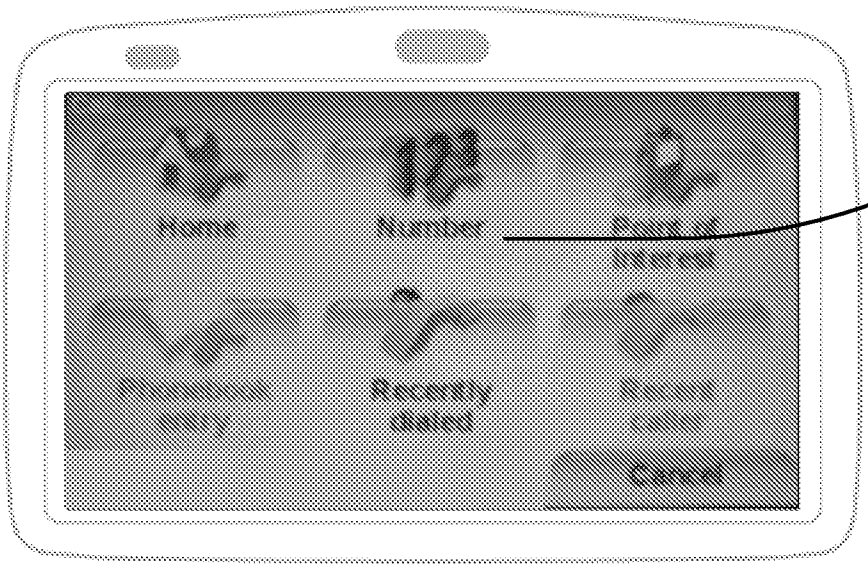



Figure 11

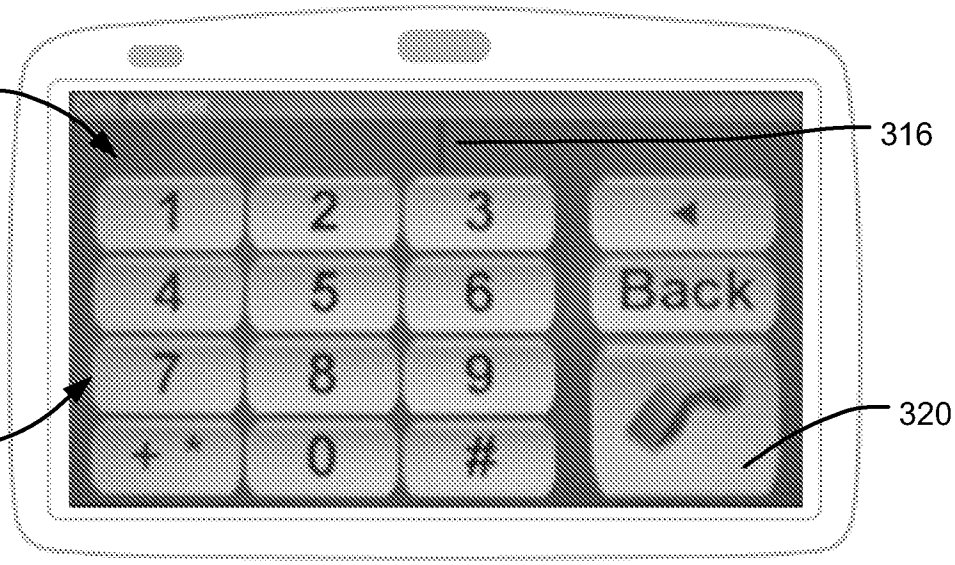
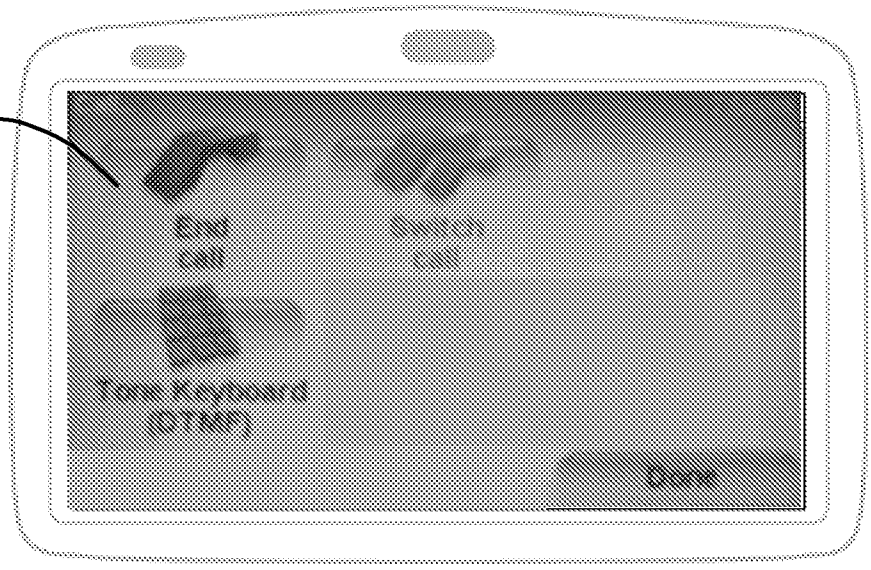



Figure 12



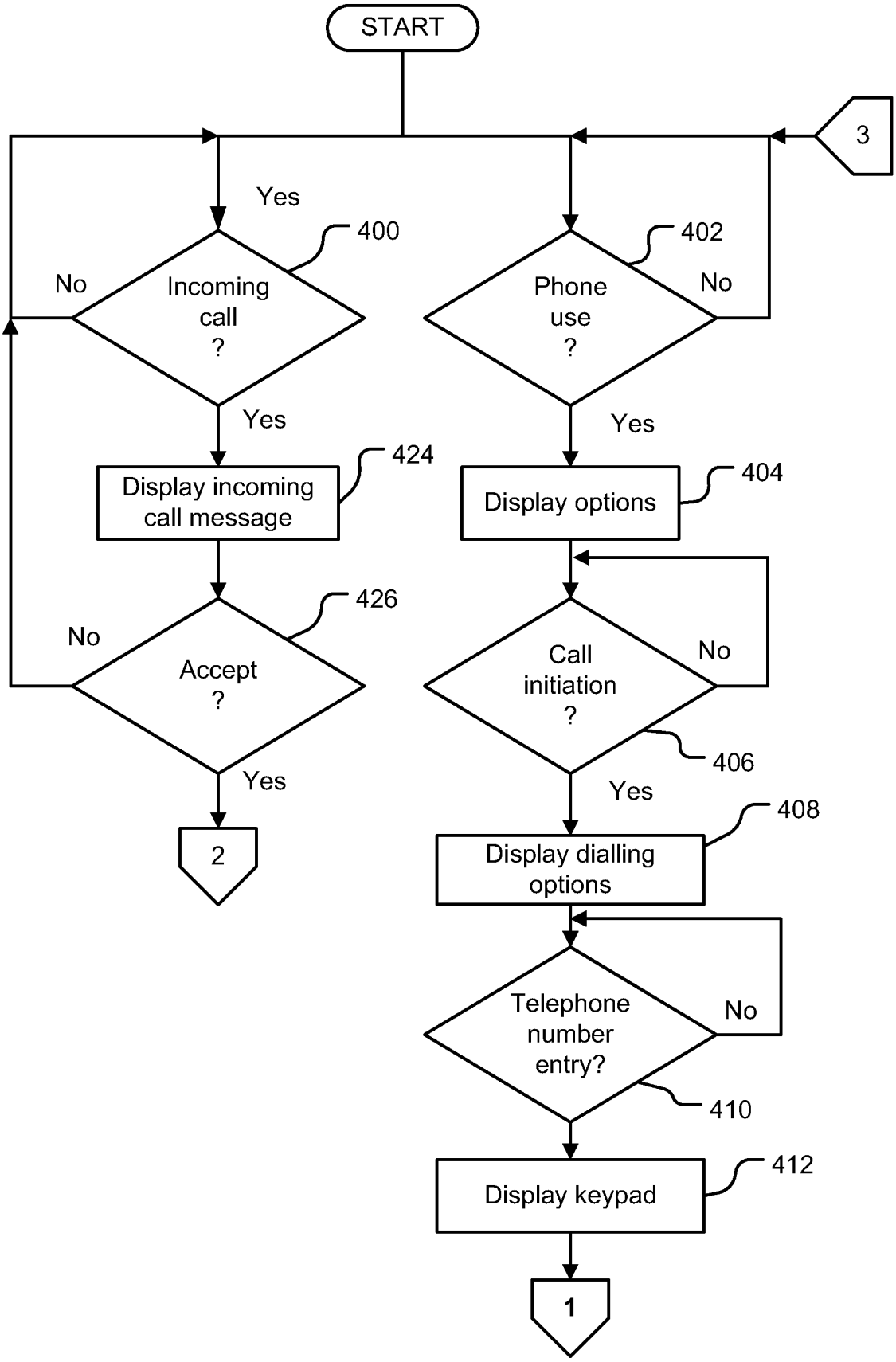

START
3
Yes
400
Incoming call ?
No
Yes
424
Display incoming call message
426
Accept ?
No
Yes
2
402
Phone use ?
No
Yes
404
Display options
Call initiation ?
No
406
Yes
408
Display dialling options
Telephone number entry?
No
410
412
Display keypad
1

**Figure 14**

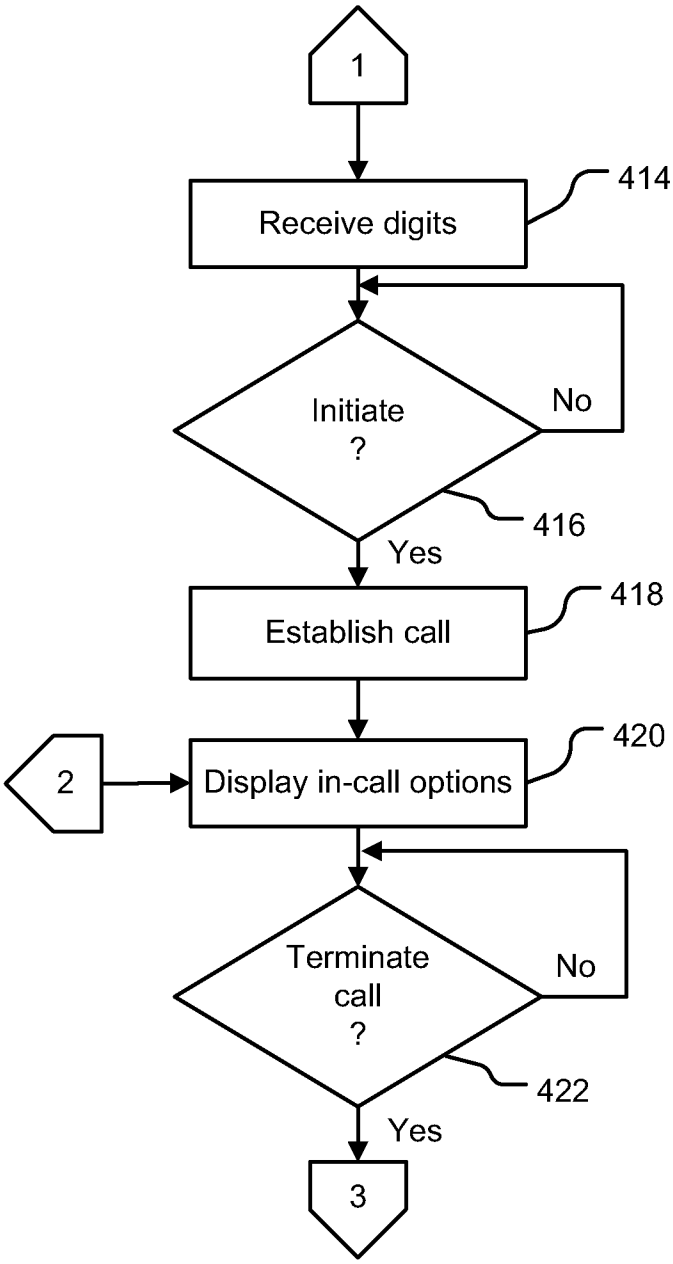

1
Receive digits
414
Initiate ?
No
416
Yes
Establish call
418
2
Display in-call options
420
Terminate call ?
No
422
Yes
3

**Figure 15**

# INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/068036

**A. CLASSIFICATION OF SUBJECT MATTER**
INV. G01C21/36 G08G1/0968 H04M1/253
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 G08G H04M

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | WO 03/050557 A2 (DASHSMART INVESTMENTS LLC [US]; RODRIGUEZ ROBERT MICHAEL [US]; REXRODE) 19 June 2003 (2003-06-19)<br>* abstract<br>page 5, paragraph 2<br>page 8, lines 6-26<br>page 10, paragraph 3 | 1-16 |
| X | US 2008/195306 A1 (MOINZADEH KAMYAR [US] ET AL) 14 August 2008 (2008-08-14)<br>figures 4,5<br>paragraphs [0008], [0009], [0013] - [0016], [0039] - [0042], [0047] - [0049]<br>paragraph [0025] - paragraph [0026]<br>paragraph [0030]<br>paragraph [0037]<br>paragraph [0024] | 1-16 |

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

☒ See patent family annex.

* Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 19 July 2010 | 23/07/2010 |

| 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 | Willems, Branko |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2009/068036

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| WO 03050557 A2 | 19-06-2003 | AU 2002357064 A1 | 23-06-2003 |
| US 2008195306 A1 | 14-08-2008 | WO 2009111646 A1 | 11-09-2009 |