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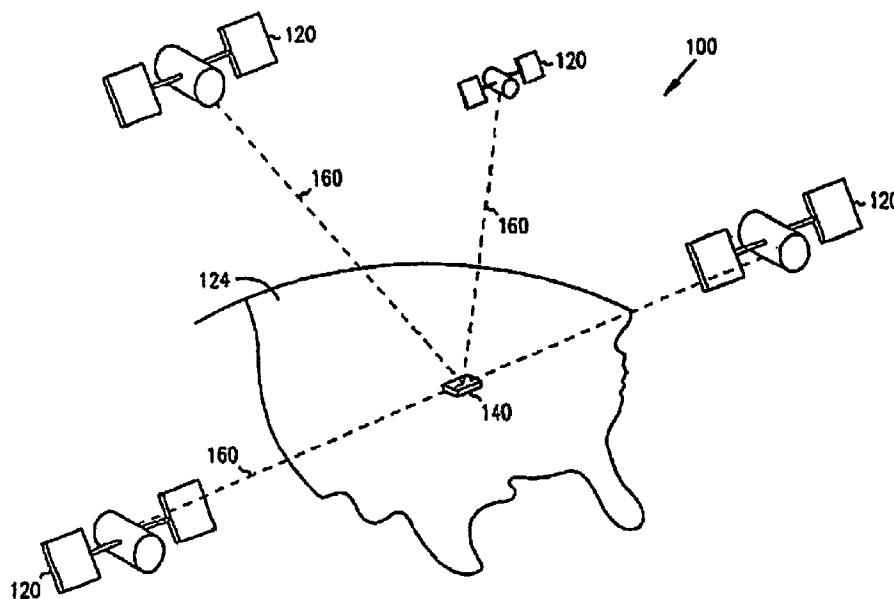
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(54) Title: A METHOD AND DEVICE FOR PROVIDING PREFERENCES DURING ROUTE TRAVEL CALCULATION ON A NAVIGATION DEVICE



(57) Abstract: A method and device are disclosed for providing preferences during route travel calculation on a navigation device. In one embodiment, the method includes receiving a travel destination input into a navigation device; and calculating a travel route to the input travel destination, potential turns in one direction incurring a relatively higher penalty during travel route calculation than potential turns in an opposite direction. In another embodiment, the method includes receiving a travel destination input to a navigation device; and calculating a travel route to the received travel destination, the travel route calculation including a relative preference of potential turns in one direction over potential turns in an opposite direction.

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A METHOD AND DEVICE FOR PROVIDING PREFERENCES DURING ROUTE TRAVEL CALCULATION ON A NAVIGATION DEVICE

Priority Statement

The present application hereby claims priority under 35 U.S.C. §119 on each of Great Britain Patent Application numbers 0604709.6 filed March 8, 2006; 0604708.8 filed March 8, 2006; 0604710.4 filed March 8, 2006; 0604704.7 filed March 8, 2006; and 0604706.2 filed March 8, 2006, the entire contents of each of which is hereby incorporated herein by reference.

Field

The present application generally relates to navigation methods and devices.

Background

Navigation systems are known to calculate travel routes based upon receiving an input travel destination, and calculating a current location of the navigation device by receiving Global Positioning System (GPS) signals and triangulating the position. A basic route from the GPS position of the navigation device to an input travel destination can be calculated.

Alternatively, other routes can be calculated using only highways, avoiding detours around one or more portions of a thoroughfare, utilizing traffic information when performing a travel route calculation, etc. Essentially, known navigation systems go through a route cost analysis as discussed in United States Patent Number 7,120,539, for example, the entire contents of which are hereby incorporated herein by reference. A route cost analysis can be done based upon a number of factors.

Known navigation systems are constantly trying to refine their route processing algorithm, and specifically, the route cost analysis portion of their algorithm.

As the route cost analysis improves, the route processing algorithm can improve, and in effect, can better provide a travel route to the user of the navigation device which is closer to an optimum travel route.

SUMMARY

In at least one embodiment, the present application is directed to providing improvements to a route cost analysis aspect of a route processing algorithm in a navigation device. This can be done, for example, by providing preferences during route calculation.

In at least one embodiment of the present application, a method includes receiving a travel destination input into a navigation device and calculating a travel route to the input destination, potential turns in one direction incurring a relatively higher penalty during travel route calculation than potential turns in an opposite direction. For example, in a country where a vehicle normally drives on the right side of the road, potential left turns incur a relatively higher penalty during travel route calculation than potential right turns.

In at least one other embodiment of the present application, a navigation device includes an integrated input and display device to prompt input of a travel destination, and a processor to calculate a travel route to the input travel destination, potential turns in one direction incurring relatively higher penalty during travel route during travel route calculation than potential turns in an opposite direction.

In at least one other embodiment of the present application, a method includes receiving a travel destination input into a navigation device, and calculating a travel route to the received travel destination, the travel route calculation including a relative preference of potential turns in one direction over potential turns in an opposite direction. For example, in a country where a vehicle normally drives on the right side of the road, a relative preference is given to potential right turns over potential left turns.

In at least one other embodiment, a navigation device includes an integrated input and display device to prompt input of a travel destination, and a processor to calculate a travel route to the input travel destination, the travel route calculation including a relative preference of potential turns in one direction over potential turns in an opposite direction.

BRIEF DESCRIPTION OF THE DRAWINGS

The present application will be described in more detail below by using example embodiments, which will be explained with the aid of the drawings, in which:

Figure 1 illustrates an example view of a Global Positioning System (GPS);

Figure 2 illustrates an example block diagram of electronic components of a navigation device of an embodiment of the present application; and

Figure 3 illustrates an example block diagram of a server, navigation device and connection therebetween of an embodiment of the present application.

DETAILED DESCRIPTION OF THE EXAMPLE EMBODIMENTS

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

In describing example embodiments illustrated in the drawings, specific terminology is employed for the sake of clarity. However, the disclosure of this patent specification is not intended to be limited to the specific terminology so selected and it is to be understood that each specific element includes all technical equivalents that operate in a similar manner.

Referencing the drawings, wherein like reference numerals designate identical or corresponding parts throughout the several views, example embodiments of the present patent application are hereafter described. Like numbers refer to like elements throughout. As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

Figure 1 illustrates an example view of Global Positioning System (GPS), usable by navigation devices, including the navigation device of embodiments of the

present application. Such systems are known and are used for a variety of purposes. In general, GPS is a satellite-radio based navigation system capable of determining continuous position, velocity, time, and in some instances direction information for an unlimited number of users.

Formerly known as NAVSTAR, the GPS incorporates a plurality of satellites which work with 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 will allow the receiving device to calculate its three dimensional position by the same geometrical calculation in a known manner. The position and velocity data can be updated in real time on a continuous basis by an unlimited number of users.

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

The spread spectrum signals 160, continuously transmitted from each satellite 120, utilize a highly accurate frequency standard accomplished with an extremely accurate atomic clock. Each satellite 120, as part of its data signal transmission 160, transmits a data stream indicative of that particular satellite 120. It is appreciated by those skilled in the relevant art that the GPS receiver

device 140 generally acquires spread spectrum GPS satellite signals 160 from at least three satellites 120 for the GPS receiver device 140 to calculate its two-dimensional position by triangulation. Acquisition of an additional signal, resulting in signals 160 from a total of four satellites 120, permits the GPS receiver device 140 to calculate its three-dimensional position in a known manner.

Figure 2 illustrates an example block diagram of electronic components of a navigation device 200 of an embodiment of the present application, in block component format. It should be noted that the block diagram of the navigation device 200 is not inclusive of all components of the navigation device, but is only representative of many example components.

The navigation device 200 is located within a housing (not shown). The housing includes a processor 210 connected to an input device 220 and a display screen 240. The input device 220 can include a keyboard device, voice input device, and/or any other known input device utilized to input information; and the display screen 240 can include any type of display screen such as an LCD display, for example. In at least one embodiment of the present application, the input device 220 and display screen 240 are integrated into an integrated input and display device, including a touchpad or touchscreen input wherein a user need only touch a portion of the display screen 240 to select one of a plurality of display choices or to activate one of a plurality of virtual buttons.

In addition, other types of output devices 250 can also include, including but not limited to, an audible output device. As output device 250 can produce audible information to a user of the navigation device 200, it is equally understood that input device 240 can also include a microphone and software for receiving input voice commands as well.

In the navigation device 200, processor 210 is operatively connected to and set to receive input information from input device 240 via a connection 225, and operatively connected to at least one of display screen 240 and output device 250, via output connections 245, to output information thereto. Further, the processor 210 is operatively connected to memory 230 via connection 235 and is further adapted to receive/send information from/to input/output (I/O) ports 270 via connection 275, wherein the I/O port 270 is connectible to an I/O

device 280 external to the navigation device 200. The external I/O device 270 may include, but is not limited to an external listening device such as an earpiece for example. The connection to I/O device 280 can further be a wired or wireless connection to any other external device such as a car stereo unit for hands-free operation and/or for voice activated operation for example, for connection to an ear piece or head phones, and/or for connection to a mobile phone for example, wherein the mobile phone connection may be used to establish a data connection between the navigation device 200 and the internet or any other network for example, and/or to establish a connection to a server via the internet or some other network for example.

The navigation device 200, in at least one embodiment, may establish a "mobile" network connection with the server 302 via a mobile device 400 (such as a mobile phone, PDA, and/or any device with mobile phone technology) establishing a digital connection (such as a digital connection via known Bluetooth technology for example). Thereafter, through its network service provider, the mobile device 400 can establish a network connection (through the internet for example) with a server 302. As such, a "mobile" network connection is established between the navigation device 200 (which can be, and often times is mobile as it travels alone and/or in a vehicle) and the server 302 to provide a "real-time" or at least very "up to date" gateway for information. The establishing of the network connection between the mobile device 400 (via a service provider) and another device such as the server 302, using the internet 410 for example, can be done in a known manner. This can include use of TCP/IP layered protocol for example. The mobile device 400 can utilize any number of communication standards such as CDMA, GSM, WAN, etc. As such, an internet connection may be utilized which is achieved via data connection, via a mobile phone or mobile phone technology within the navigation device 200 for example. For this connection, an internet connection between the server 302 and the navigation device 200 is established. This can be done, for example, through a mobile phone or other mobile device and a GPRS (General Packet Radio Service)-connection (GPRS connection is a high-speed data connection for mobile devices provided by telecom operators; GPRS is a method to connect to the internet.

The navigation device 200 can further complete a data connection with the mobile device 400, and eventually with the internet 410 and server 302, via existing Bluetooth technology for example, in a known manner, wherein the data protocol can utilize any number of standards, such as the GSRM, the Data Protocol Standard for the GSM standard, for example.

The navigation device 200 may include its own mobile phone technology within the navigation device 200 itself (including an antenna for example, wherein the internal antenna of the navigation device 200 can further alternatively be used). The mobile phone technology within the navigation device 200 can include internal components as specified above, and/or can include an insertable card, complete with necessary mobile phone technology and/or an antenna for example. As such, mobile phone technology within the navigation device 200 can similarly establish a network connection between the navigation device 200 and the server 302, via the internet 410 for example, in a manner similar to that of any mobile device 400.

For GRPS phone settings, the Bluetooth enabled device may be used to correctly work 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 a manner discussed in any of the embodiments, previous and subsequent.

Figure 2 further illustrates an operative connection between the processor 210 and an antenna/receiver 250 via connection 255, wherein the antenna/receiver 250 can be a GPS antenna/receiver for example. It will be understood that the antenna and receiver designated by reference numeral 250 are combined schematically for illustration, but that the antenna and receiver may be separately located components, and that the antenna may be a GPS patch antenna or helical antenna for example.

Further, it will be understood by one of ordinary skill in the art that the electronic components shown in Figure 2 are powered by power sources (not shown) in a conventional manner. As will be understood by one of ordinary skill in the art, different configurations of the components shown in Figure 2 are considered within the scope of the present application. For example, in one

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

In addition, the portable or handheld navigation device 200 of Figure 2 can be connected or "docked" in a known manner to a motorized vehicle such as a car or boat for example. Such a navigation device 200 is then removable from the docked location for portable or handheld navigation use.

Figure 3 illustrates an example block diagram of a server 302 and a navigation device 200 of the present application, via a generic communications channel 318, of an embodiment of the present application. The server 302 and a navigation device 200 of the present application can communicate when a connection via communications channel 318 is established between the server 302 and the navigation device 200 (noting that such a connection can be a data connection via mobile device, a direct connection via personal computer via the internet, etc.).

The server 302 includes, in addition to other components which may not be illustrated, a processor 304 operatively connected to a memory 306 and further operatively connected, via a wired or wireless connection 314, to a mass data storage device 312. The processor 304 is further operatively connected to transmitter 308 and receiver 310, to transmit and send information to and from navigation device 200 via communications channel 318. The signals sent and received may include data, communication, and/or other propagated signals. The transmitter 308 and receiver 310 may be selected or designed according to the communications requirement and communication technology used in the communication design for the navigation system 200. Further, it should be noted that the functions of transmitter 308 and receiver 310 may be combined into a signal transceiver.

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

The navigation device 200 is adapted to communicate with the server 302 through communications channel 318, and includes processor, memory, etc. as previously described with regard to Figure 2, as well as transmitter 320 and receiver 322 to send and receive signals and/or data through the communications channel 318, noting that these devices can further be used to communicate with devices other than server 302. Further, the transmitter 320 and receiver 322 are selected or designed according to communication requirements and communication technology used in the communication design for the navigation device 200 and the functions of the transmitter 320 and receiver 322 may be combined into a single transceiver.

Software stored in server memory 306 provides instructions for the processor 304 and allows the server 302 to provide services to the navigation device 200. One service provided by the server 302 involves processing requests from the navigation device 200 and transmitting navigation data from the mass data storage 312 to the navigation device 200. According to at least one embodiment of the present application, another service provided by the server 302 includes processing the navigation data using various algorithms for a desired application and sending the results of these calculations to the navigation device 200.

The communication channel 318 generically represents the propagating medium or path that connects the navigation device 200 and the server 302. According to at least one embodiment of the present application, both the server 302 and navigation device 200 include a transmitter for transmitting data through the communication channel and a receiver for receiving data that has been transmitted through the communication channel.

The communication channel 318 is not limited to a particular communication technology. Additionally, the communication channel 318 is not limited to a single communication technology; that is, the channel 318 may include several communication links that use a variety of technology. For example, according to at least one embodiment, the communication channel 318 can be adapted to provide a path for electrical, optical, and/or electromagnetic communications, etc. As such, the communication channel 318 includes, but is not limited to, one or a combination of the following: electric circuits, electrical conductors

such as wires and coaxial cables, fiber optic cables, converters, radio-frequency (rf) waves, the atmosphere, empty space, etc. Furthermore, according to at least one various embodiment, the communication channel 318 can include intermediate devices such as routers, repeaters, buffers, transmitters, and receivers, for example.

In at least one embodiment of the present application, for example, the communication channel 318 includes telephone and computer networks. Furthermore, in at least one embodiment, the communication channel 318 may be capable of accommodating wireless communication such as radio frequency, microwave frequency, infrared communication, etc. Additionally, according to at least one embodiment, the communication channel 318 can accommodate satellite communication.

The communication signals transmitted through the communication channel 318 include, but are not limited to, signals as may be required or desired for given communication technology. For example, the signals may be adapted to be used in cellular communication technology such as Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA), Global System for Mobile Communications (GSM), etc. Both digital and analogue signals can be transmitted through the communication channel 318. According to at least one embodiment, these signals may be modulated, encrypted and/or compressed signals as may be desirable for the communication technology.

The mass data storage 312 includes sufficient memory for the desired navigation applications. Examples of the mass data storage 312 may include magnetic data storage media such as hard drives for example, optical storage media such as CD-Roms for example, charged data storage media such as flash memory for example, molecular memory, etc.

According to at least one embodiment of the present application, the server 302 includes a remote server accessible by the navigation device 200 via a wireless channel. According to at least one other embodiment of the application, the server 302 may include a network server located on a local area network (LAN), wide area network (WAN), virtual private network (VPN), etc.

According to at least one embodiment of the present application, the server 302 may include a personal computer such as a desktop or laptop computer, and the communication channel 318 may be a cable connected between the personal computer and the navigation device 200. Alternatively, a personal computer may be connected between the navigation device 200 and the server 302 to establish an internet connection between the server 302 and the navigation device 200. Alternatively, a mobile telephone or other handheld device may establish a wireless connection to the internet, for connecting the navigation device 200 to the server 302 via the internet.

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

The mass storage device 312 connected to the server 302 can include volumes more cartographic and route data than that which is able to be maintained on the navigation device 200 itself, including maps, etc. The server 302 may process, for example, the majority of the devices of a navigation device 200 which travel along the route using a set of processing algorithms. Further, the cartographic and route data stored in memory 312 can operate on signals (e.g. GPS signals), originally received by the navigation device 200.

In an embodiment of the present application, a method includes receiving the travel destination input into a navigation device 200 and calculating a travel route to the input travel destination. During travel route calculations, potential turns in one direction incur a relatively higher penalty than potential turns in an opposite direction. For example, in a country where a vehicle normally drives on the right side of the road (such as the United States, mainland Europe, etc.), potential left turns incur a relatively higher penalty during travel

route calculation than potential right turns. Further, it should be understood that in a country where a vehicle normally drives on the left side of the road (such as the United Kingdom, Japan, etc.), potential right turns will incur a relatively higher penalty during travel route calculation than potential left turns.

After receiving a travel destination input into a navigation device 200, the processor 210 of the navigation device 200 is then able to calculate a travel route to the input travel destination based on algorithmic data stored in memory 230 and using map information from the memory 230. The processor 210 determines an initial current location of the navigation device 200, via GPS data received via antenna/receiver 250 from Global Positioning Satellites. This occurs in a known manner. Using the detected GPS position of the navigation device 200 as an initial position from which the route is to begin, and using the input travel destination, the processor 210 can then calculate a travel route, in conjunction with map information and algorithmic information stored in memory 230.

During the aforementioned travel route calculation, many factors can be taken into account as there are many alternative roads which can be taken to go from the initial GPS current location of the navigation device 200 to the input travel destination. During this calculation, the processor 210 performs a route cost analysis using algorithmic data stored in memory 230, and using particular alternative routes stored in the mapping information of memory 230. This general aspect of performing a route cost analysis in general route calculation is known to those of ordinary skill and will not be explained in detail for the sake of brevity.

During the route cost analysis, certain types of routes may be preferenced (assigned a relative preferential value, a relatively higher weight, for example) over other types of routes. For example, highway and interstates may be preferenced over small streets and travel through a city, for example, as taking a highway is often quicker and thus preferred over traveling through a city. By way of example, the preference level data used in the route cost analysis of the travel calculation can include a relatively high, a relatively medium, or a relatively low preference level (a relatively high, medium or low weight for use in

a route cost analysis algorithm, for example) which can be operated upon during a route cost analysis. It should be appreciated that the present application is not limited to three levels of preference, as such is merely set forth as an example.

In connection with at least one embodiment of the present application, the route cost analysis of the travel route calculation may include a calculation wherein potential turns in one direction incur relatively higher penalties during travel route calculation than potential turns in an opposite direction. For example, in a country where a vehicle normally drives on the right side of the road (such as the United States, mainland Europe, etc.), potential left turns incur a relatively higher penalty during travel route calculation than potential right turns. Further, it should be understood that in a country where a vehicle normally drives on the left side of the road (such as the United Kingdom, Japan, etc.), potential right turns will incur a relatively higher penalty during travel route calculation than potential left turns.

Thus, while a route cost analysis algorithm, used when calculating a travel route typically prefers highways over city streets and may prefer to avoid all turns for example, the inventors of the present application have discovered that by taking into account a relatively higher penalty for potential turns in one direction as compared to potential turns in an opposite direction (weighting potential left turns differently than potential right turns in a route cost analysis when calculating a travel route in a country where a vehicle normally drives on the right side of the road, such as the United States, mainland Europe, etc.), a potentially faster travel route can be calculated. Further, in at least one embodiment, in such a route cost analysis, any potential U-turns can incur a relatively higher penalty during travel route calculation, than both potential left turns and potential right turns.

For example, on most roads in a country where a vehicle normally drives on the right side of the road, such as the United States for example, drivers are generally allowed to turn right on a red light. Further, making a turn right is generally quicker than turning left in these countries. This means that the penalty taken into account during route cost analysis by processor 210, can be slightly relatively higher for that of a left turn and slightly relatively reduced for

that of a right turn (at least relative to a potential left turn). Therefore, the right turn penalty can be slightly less than a left turn penalty. For example, the right turn penalty may be 20 seconds in the route cost analysis, as compared to 25 seconds for the left turn penalty.

Again, these are merely example penalties, and the embodiments of the present application should not be limited as such. Further, turn penalties can be the same in calculations for all roads. In addition, it should be understood that in a country where a vehicle normally drives on the left side of the road (such as the United Kingdom, Japan, etc.), potential right turns will incur a relatively higher penalty during travel route calculation than potential left turns.

Similarly, as potential U-turns can further slow down travel on a route, a U-turn penalty can be substantially higher during travel route calculation relative to both potential right turns and left turns. For example, the U-turn penalty can be 2 minutes or above, so as to potentially avoid U-turns, whenever possible. It should be noted that the aforementioned time penalties can be varied, noting that it is the relative nature of the time penalties that is important in the travel route calculation. Again, these are merely example penalties, and the embodiments of the present application should not be limited as such.

In at least one other embodiment, a navigation device 200 includes an integrated input and display device (not shown), integrating both the input device 220 and the display screen 240 for example. The integrated input and display device is able to prompt input of a travel destination. Thereafter, a processor 210 is included for calculating a travel route to the input travel destination. During travel route calculation, potential turns in one direction incur a relatively higher penalty than potential turns in an opposite direction. In a further alternative embodiment of the present application, a method can include receiving a travel destination input into a navigation device 200, and calculating a travel route to the received travel destination. In this embodiment, the travel route calculation includes a relative preference of potential turns in one direction over potential turns in another direction. For example, in a country where a vehicle normally drives on the right side of the

road, a relative preference is given to potential right turns over potential left turns.

Thus, during a route cost analysis to a travel destination, the processor 210 can prefer to include a right turn over a left turn (in a country where a vehicle normally drives on the right side of the road, such as the United States for example), as drivers are generally allowed to turn right on red lights in countries where a vehicle normally drives on the right side of the road, including the United States. As such, a relative preference can be given to potential right turns over potential left turns. Again, similar to that set forth above, it should be understood that in a country where a vehicle normally drives on the left side of the road (such as the United Kingdom, Japan, etc.), potential left turns can be given preference over potential right turns during travel route calculation. In a further aspect of this embodiment, the travel route calculation can include a preference of both potential right turns and potential left turns over potential U-turns.

In an alternative embodiment of the present application, a navigation device 200 can include an integrated input and display device, integrating input 220 and display screen 240 of the present application for example. The device can further include a processor 210 to calculate a travel route to the received destination. The travel route calculation can include a relative preference of turns in one direction over turns in an opposite direction.

In each of the aforementioned embodiments of the present application, additional penalties and/or preferences can be taken into consideration during a route cost analysis of a travel route calculation, in addition to those described above. Thus, it should be understood that the aforementioned penalties and/or preferences should not be considered as the only penalties and/or preferences taken into consideration during a route cost analysis of a travel route calculation. In addition, any of the aforementioned methods can include outputting the calculated travel route via the navigation device 200, and further can include outputting a visual display of the calculated travel route. The navigation device 200 of embodiments of the present application can include an integrated input and display device to visually display the calculated route.

The methods of at least one embodiment expressed above may be implemented as a computer data signal embodied in the carrier wave or propagated signal that represents a sequence of instructions which, when executed by a processor (such as processor 304 of server 302, and/or processor 210 of navigation device 200 for example) causes the processor to perform a respective method. In at least one other embodiment, at least one method provided above may be implemented above as a set of instructions contained on a computer readable or computer accessible medium, such as one of the memory devices previously described, for example, to perform the respective method when executed by a processor or other computer device. In varying embodiments, the medium may be a magnetic medium, electronic medium, optical medium, etc.

Even further, any of the aforementioned methods may be embodied in the form of a program. The program may be stored on a computer readable media and is adapted to perform any one of the aforementioned methods when run on a computer device (a device including a processor). Thus, the storage medium or computer readable medium, is adapted to store information and is adapted to interact with a data processing facility or computer device to perform the method of any of the above mentioned embodiments.

The storage medium may be a built-in medium installed inside a computer device main body or a removable medium arranged so that it can be separated from the computer device main body. Examples of the built-in medium include, but are not limited to, rewriteable non-volatile memories, such as ROMs and flash memories, and hard disks. Examples of the removable medium include, but are not limited to, optical storage media such as CD-ROMs and DVDs; magneto-optical storage media, such as MOs; magnetism storage media, including but not limited to floppy disks (trademark), cassette tapes, and removable hard disks; media with a built-in rewriteable non-volatile memory, including but not limited to memory cards; and media with a built-in ROM, including but not limited to ROM cassettes; etc. Furthermore, various information regarding stored images, for example, property information, may be stored in any other form, or it may be provided in other ways.

As one of ordinary skill in the art will understand upon reading the disclosure, the electronic components of the navigation device 200 and/or the components

of the server 302 can be embodied as computer hardware circuitry or as a computer readable program, or as a combination of both.

The system and method of embodiments of the present application include software operative on the processor to perform at least one of the methods according to the teachings of the present application. One of ordinary skill in the art will understand, upon reading and comprehending this disclosure, the manner in which a software program can be launched from a computer readable medium in a computer based system to execute the functions found in the software program. One of ordinary skill in the art will further understand the various programming languages which may be employed to create a software program designed to implement and perform at least one of the methods of the present application.

The programs can be structured in an object-orientation using an object-oriented language including but not limited to JAVA, Smalltalk, C++, etc., and the programs can be structured in a procedural-orientation using a procedural language including but not limited to COBAL, C, etc. The software components can communicate in any number of ways that are well known to those of ordinary skill in the art, including but not limited to by application of program interfaces (API), interprocess communication techniques, including but not limited to report procedure call (RPC), common object request broker architecture (CORBA), Component Object Model (COM), Distributed Component Object Model (DCOM), Distributed System Object Model (DSOM), and Remote Method Invocation (RMI). However, as will be appreciated by one of ordinary skill in the art upon reading the present application disclosure, the teachings of the present application are not limited to a particular programming language or environment.

The above systems, devices, and methods have been described by way of example and not by way of limitation with respect to improving accuracy, processor speed, and ease of user interaction, etc. with a navigation device 200. Further, elements and/or features of different example embodiments may be combined with each other and/or substituted for each other within the scope of this disclosure and appended claims.

Still further, any one of the above-described and other example features of the present invention may be embodied in the form of an apparatus, method, system, computer program and computer program product. For example, of the aforementioned methods may be embodied in the form of a system or device, including, but not limited to, any of the structure for performing the methodology illustrated in the drawings.

Example embodiments being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

What is claimed is:

1. A method, comprising:
receiving a travel destination input into a navigation device; and
calculating a travel route to the input travel destination, potential turns in one direction incurring a relatively higher penalty during travel route calculation than potential turns in an opposite direction.
2. The method of claim 1, wherein, in a country where a vehicle normally drives on the right side of the road, potential left turns incur a relatively higher penalty during travel route calculation than potential right turns.
3. The method of claims 1-2, wherein, in a country where a vehicle normally drives on the left side of the road, potential right turns incur a relatively higher penalty during travel route calculation than potential left turns.
4. The method of claims 1-3, further comprising outputting the calculated travel route via the navigation device.
5. The method of claim 5, wherein the output includes a visual display of the calculated travel route.
6. The method of claims 1-5, wherein potential U-turns incur a relatively higher penalty during travel route calculation, relative to turns in one direction and potential turns in an opposite direction.
7. A computer readable medium including program segments for, when executed on a processor of a navigation device, causing the navigation device to implement the method of claim 1.
8. A navigation device, comprising:
means for inputting a travel destination into a navigation device; and

means for calculating a travel route to the input travel destination, potential turns in one direction incurring a relatively higher penalty during travel route calculation than potential turns in an opposite direction.

9. The navigation device of claim 8, wherein, in a country where a vehicle normally drives on the right side of the road, potential left turns incur a relatively higher penalty during travel route calculation than potential right turns.

10. The navigation device of claims 8-9, wherein, in a country where a vehicle normally drives on the left side of the road, potential right turns incur a relatively higher penalty during travel route calculation than potential left turns.

11. The navigation device of claims 8-10, further comprising means for outputting the calculated travel route.

12. The navigation device of claims 8-11, wherein the output includes a visual display of the calculated travel route.

13. The navigation device of claim 12, wherein the means for inputting and the means for outputting include an integrated input and display device.

14. The navigation device of claims 8-13, wherein potential U-turns incur a relatively higher penalty during route calculation, relative to potential turns in one direction and potential turns in an opposite direction.

15. A navigation device, comprising:
an integrated input and display device to prompt input of a travel destination; and
a processor to calculate a travel route to the input travel destination, potential turns in one direction incurring a relatively higher penalty during travel route calculation than potential turns in an opposite direction.

16. The navigation device of claim 15, wherein, in a country where a vehicle normally drives on the right side of the road, potential left turns incur a relatively higher penalty during travel route calculation than potential right turns.

17. The navigation device of claims 15-16, wherein, in a country where a vehicle normally drives on the left side of the road, potential right turns incur a relatively higher penalty during travel route calculation than potential left turns.

18. The navigation device of claims 15-17, wherein the integrated input and display device is further used to visually display the calculated travel route.

19. The navigation device of claims 15-18, wherein potential U-turns incur a relatively higher penalty during travel route calculation, relative to potential turns in one direction and potential turns in an opposite direction.

20. A method, comprising:
receiving a travel destination input to a navigation device; and
calculating a travel route to the received travel destination, the travel route calculation including a relative preference of potential turns in one direction over potential turns in an opposite direction.

21. The method of claim 20, wherein, in a country where a vehicle normally drives on the right side of the road, a relative preference is given to potential right turns over potential left turns.

22. The method of claims 20-21, wherein, in a country where a vehicle normally drives on the left side of the road, a relative preference is given to potential left turns over potential right turns.

23. The method of claims 20-22, further comprising outputting the calculated travel route via the navigation device.
24. The method of claim 23, wherein the output includes a visual display of the calculated travel route.
25. The method of claims 20-24, wherein the travel route calculation includes a relative preference of both potential turns in one direction and potential turns in an opposite direction, over potential U-turns.
26. A computer readable medium including program segments for, when executed on a processor of a navigation device, causing the navigation device to implement the method of claim 20.
27. A navigation device, comprising:
means for inputting a travel destination into a navigation device; and
means for calculating a travel route to the received travel destination, the travel route calculation including a relative preference of potential turns in one direction over potential turns in an opposite direction.
28. The navigation device of claim 27, wherein, in a country where a vehicle normally drives on the right side of the road, a relative preference is given to potential right turns over potential left turns.
29. The navigation device of claims 27-28, wherein, in a country where a vehicle normally drives on the left side of the road, a relative preference is given to potential left turns over potential right turns.
30. The navigation device of claims 27-29, further comprising means for outputting the calculated travel route.
31. The navigation device of claim 30, wherein the output includes a visual display of the calculated travel route.

32. The navigation device of claim 31, wherein the means for inputting and the means for outputting include an integrated input and display device.

33. The navigation device of claims 27-32, wherein the travel route calculation includes a relative preference of both potential turns in one direction and potential turns in an opposite direction, over potential U-turns.

34. A navigation device, comprising:

an integrated input and display device to prompt input of a travel destination; and

a processor to calculate a travel route to the received travel destination, the travel route calculation including a relative preference of potential turns in one direction over potential turns in an opposite direction.

35. The navigation device of claim 34, wherein, in a country where a vehicle normally drives on the right side of the road, a relative preference is given to potential right turns over potential left turns.

36. The navigation device of claims 34-35, wherein, in a country where a vehicle normally drives on the left side of the road, a relative preference is given to potential left turns over potential right turns.

37. The navigation device of claims 34-36, wherein the integrated input and display device is further used to visually display the calculated travel route.

38. The navigation device of claims 34-37, wherein the travel route calculation includes a relative preference of both potential turns in one direction and potential turns in an opposite direction, over potential U-turns.

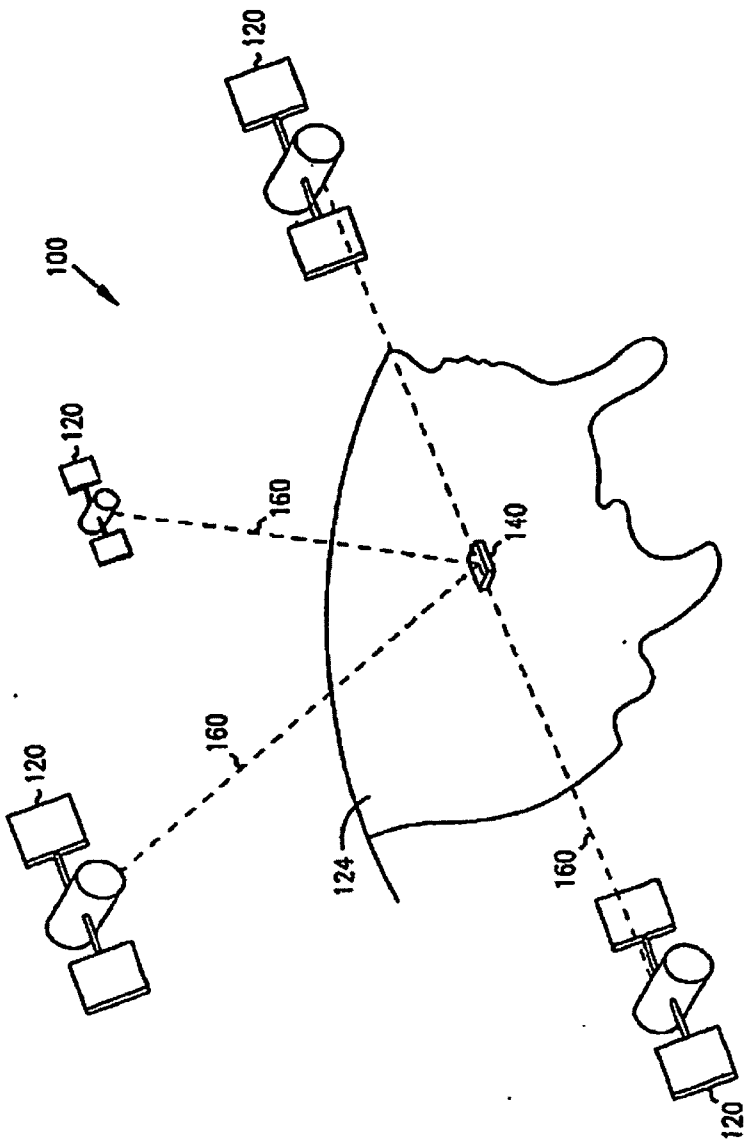
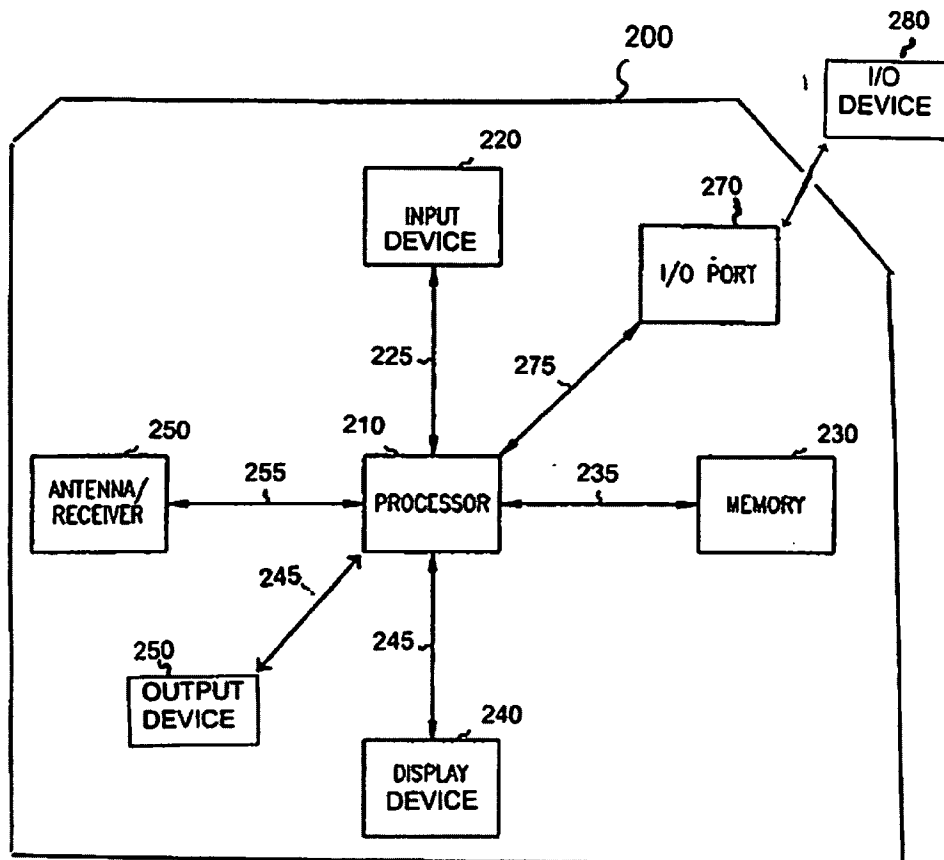


FIG. 1

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**Fig. 2**

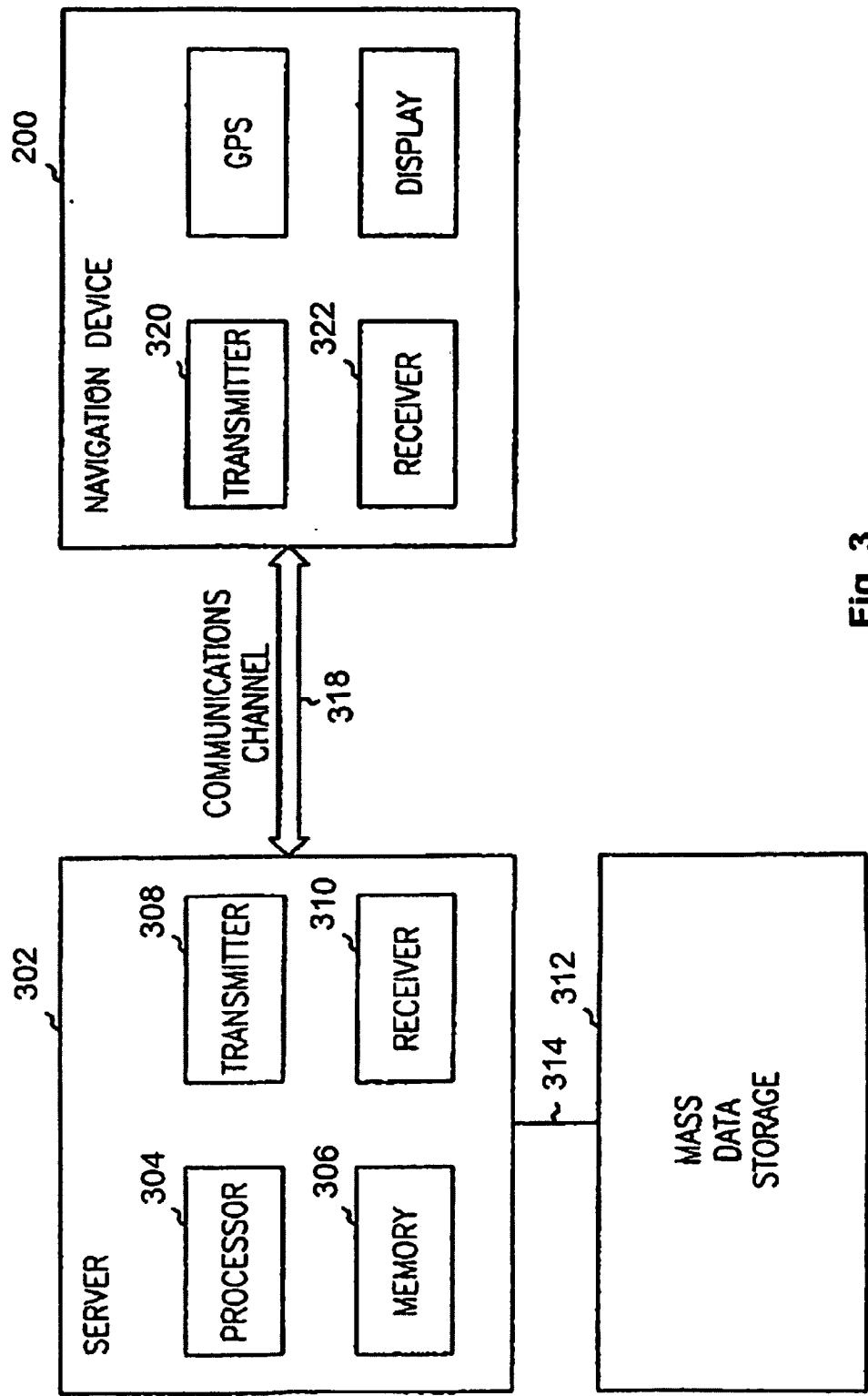


Fig. 3