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(54) **Title**: NAVIGATION DEVICE AND NAVIGATION METHOD

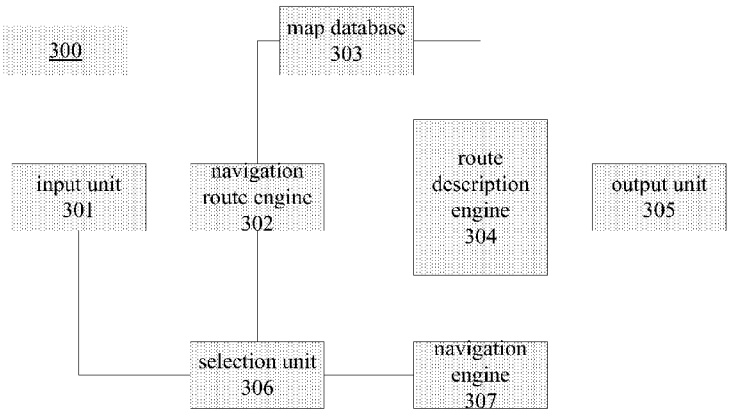

Fig. 3

(57) **Abstract**: A navigation device and a navigation method that provide a smooth user experience. A navigation method comprises: acquiring a destination and a current position (901); generating at least one route candidate based on the destination and the current position (902); providing information about the at least one route candidate via voice (903); receiving a selection of a route from the at least one route candidate (904); and navigating through the selected route (905).

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NAVIGATION DEVICE AND NAVIGATION METHOD

Field of the Invention

The present disclosure relates to a navigation device and a navigation method, more specifically, to a navigation device and a navigation method that provide a smooth user experience.

Description of the Related Art

Navigation devices are more and more popular and have been widely used on vehicles. In modern navigation system use flow, after a user selects the destination and the navigation route is computed, an overview of the route such as the map of Fig. 1 will be shown in a large scale map before the display turns into Turn By Turn (TBT) navigation procedure. In some navigation systems, several routes with different advantages (shortest distance, shortest travel time, most fuel efficient, etc.) are also shown on this overview map (see Fig. 2). Users can manually select a preferred route from the listed routes.

Summary of the Invention

However, it is dangerous for a driver to look at the overview map and select a preferred route while driving on the road. Usually, the driver has to slow down or even park the vehicle before operating the navigating device.

Further, the overview map as shown in Fig. 1 is usually in very large scale, and detailed information like road names is very difficult to be shown or identified. Therefore, a user can only have a general concept of the route(s), and cannot obtain detailed information from the overview map.

The route selection map as shown in Fig. 2 also has some defects. For example, the route candidates are shown with some key features such as time, distance and fuel efficiency. However, a user cannot recognize other differences among the route candidates. For example, a user may want to choose a route that goes through a road

named Huaihai Road. However, this information is not provided on the overview map in Fig. 2. Thus, the user will not know which route to choose.

Therefore, it is a purpose of the present application to provide a navigation device and a navigation method that will bring some advantages over the prior art.

A navigation method according to a first aspect of the disclosure includes acquiring a destination and a current position; generating at least one route candidate based on the destination and the current position; providing information about the at least one route candidate via voice; receiving a selection of a route from the at least one route candidate; and navigating through the selected route.

A navigation device according to a second aspect of the disclosure includes a navigation route engine configured to generate at least one route candidate based on a destination and a start position; a map database configured to provide information about the at least one route candidate; a route description engine configured to generate audio description of the information about the at least one route candidate and output the audio description via an output unit; a selection unit configured to receive a selection of a route from the at least one route candidate; and a navigation engine configured to navigate through the selected route.

A navigation device according to a third aspect of the disclosure includes a processor which is configured to acquiring a destination and a current position; generating at least one route candidate based on the destination and the current position; providing information about the at least one route candidate via voice; receiving a selection of a route from the at least one route candidate; and navigating through the selected route.

A non-volatile storage medium according to a fourth aspect of the disclosure has a program stored thereon. When the program is executed by a processor, the processor is configured to acquiring a destination and a current position; generating at least one route candidate based on the destination and the current position; providing information about the at least one route candidate via voice; receiving a selection of a route from the at least one route candidate; and navigating through the selected route.

Further features of the present invention and advantages thereof will become apparent from the following detailed description of exemplary embodiments according to the present invention with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

The present invention can be more clearly understood from the following detailed description with reference to the drawings, wherein:

Fig. 1 illustrates an overview map as shown on a navigation device.

Fig. 2 illustrates an overview map with route candidates superposed thereon.

Fig. 3 illustrates a configuration of a navigation device according to the present disclosure.

Fig. 4 illustrates a configuration of a route description engine according to an embodiment of the present disclosure.

Fig. 5 illustrates a configuration of a route description engine according to another embodiment of the present disclosure.

Fig. 6 illustrates a navigation device according to a further embodiment of the present disclosure.

Fig. 7 illustrates a configuration of the route description engine according to another embodiment of the present disclosure.

Fig. 8 illustrates a configuration of a navigation device according to another embodiment of the present disclosure.

Fig. 9 illustrates a navigation method according to an embodiment of the present disclosure.

Fig. 10 illustrate a hardware configuration of the navigation device according to an embodiment of the present disclosure.

DESCRIPTION OF THE EMBODIMENTS

Various exemplary embodiments of the present invention will now be described in detail with reference to the drawings. It should be noted that the relative arrangement of the components and steps, the numerical expressions and values set forth in these embodiments do not limit the scope of the present invention unless it is specifically stated otherwise.

The following description of at least one exemplary embodiment is merely illustrative in nature and is in no way intended to limit the invention, its application, or uses.

Techniques, methods and devices as known by one skilled in the art may not be discussed in detail but are intended to be part of the specification where appropriate.

In all of the examples illustrated and discussed herein, any specific values should be interpreted to be illustrative only and non-limiting. Thus, other examples of the exemplary embodiments could have different values.

Notice that similar reference numerals and letters refer to similar items in the following figures, and thus once an item is defined in one figure, it is possible that it need not be further discussed for following figures.

Fig. 9 illustrates a navigation method according to an embodiment of the present disclosure.

As shown in Fig. 9, the navigation method includes following steps:

acquiring a destination and a start position (step 901);

generating one or more route candidate based on the destination and the start position (step 902);

generating an audio description of the route candidates (step 903);

selecting a route from the route candidates (step 904); and

start navigating through the selected route (step 905).

Next, the detailed description of the above method will be provided in connection with the configuration of the navigation device.

Fig. 3 illustrates a configuration of a navigation device according to the present disclosure. As shown in Fig. 3, a navigation device 300 includes an input unit 301, a

navigation route engine 302, a map database 303, a route description engine 304, an output unit 305, a selection unit 306 and a navigation engine 307.

The input unit 301 may be used by a user to input information such a destination or provide instructions to the navigation device 300. For example, the input unit 301 may be a series of buttons, a touch screen, a key board or a combination thereof. In another example, the input unit 301 may include a microphone and a voice recognition unit for acquiring voice input from a user. In still another example, the input unit 301 may includes one or more cameras for capturing body movements of a user and identifying instructions from the body movements. For example, a user moving a hand from left to right may be associated with the instruction of sliding the map on the display to the right. When the cameras capture and recognize this gesture of a user, the map will slide to the right. Similar technologies have been applied to the Kinnect® (a product manufactured by Microsoft Inc.)

The map database 303 may store map data, such as road information and POI information. The road information may comprise names of the roads, the start point and end point of the roads, traffic information, subway information, etc. The POI information may comprise names of the places, the positions (such as GPS information) of the places, type of the place (such as a restaurant, a gas station or a parking lot), etc. Other components of the navigation device may acquire this information from the map database 303.

The navigation route engine 302 may generate one or more route candidates based on a destination and a start position (step 902). For example, a user may input a destination from the input unit 301. A map may be shown on the display of the navigation device. The user may zoom in/out and slide the map to find a target position. Then, the user may touch the target position on the display which includes a touch screen. The target position will be used as a destination and input to the navigation route engine 302. Alternatively, the user may directly input the name of the target position into a search box, and the navigation route engine 302 can locate this target position based on the map database. In still another example of the present

disclosure, the destination is input by receiving a voice input from the user (which will be described in detail below).

In many cases, a current position of the navigation device 300 will be used as the start position. In one example, the navigation device 300 may further include a locating unit (not shown) for acquiring the current position. For example, the locating unit may be a GPS device which may calculate its current longitude and latitude by receiving broadcast from satellites. In another example, the locating unit may receive wireless signals from nearby base stations, and the current position of the navigation device may be calculated based on the received signals as well as the known positions of the base stations.

The navigation route engine 302 may generate one or more route candidates based on the destination and the start position. All the route candidates will pass through the destination and the start position, with the destination on one ends of the route candidates and the start position on the other ends of the route candidates.

The route description engine 304 may generate an audio description of the route candidates. Specifically, the information about the route candidates may be transmitted from the navigation route engine 302 to the route description engine 304. For example, the information about a route candidate may include the road names on the route candidate and the start and end points on each road. In an alternative example, the information about a route candidate may further include directions to which the vehicle should turn to from one road to another road if it follows the route candidate.

Fig. 4 illustrates a configuration of a route description engine 304 according to an embodiment of the present disclosure. As shown in fig. 4, the route description engine 304 includes a text description unit 401, a template database 402 and an audio unit 403.

The text description unit 401 receives route candidates from the navigation route engine 302. Then, the text description unit 401 selects a template from the template database 402 in which a set of predetermined templates are stored. The selection may be based on many factors, such as amount of the route candidates.

For example, in case there are three route candidates, the template may be: “there are N route candidates. The recommend route will pass A. The normal route will pass B and take BO% extra oil cost. The short route will pass C and take CM more minutes with CO% extra oil cost. Which route do you prefer?” In this template, N is an integer larger than or equal to 1. In this example, N is 3. A, B and C are names of the roads. CM, BO and CO are usually positive numbers. The amount of the route candidates (N) and names of the roads (A, B and C) on each route candidate may be obtained from the output of the navigation route engine 302. CM, BO and CO may be calculated by the navigation route engine 302 or by a separate processor. The calculation of CM, BO and CO is well known for one skilled in the art and will not be described in detail.

In one example, the generated text description could be: “there are three route candidates. The recommend route will pass the Nanjing Road, Huaihai Road and Chongqing Road and oil cost is about 5 liter. The normal route will pass the Nanjing Road, Yanan Road and Chongqing Road and oil cost is about 5.1 liter. The short route will pass the Nanjing Road, Dalian Road and Chongqing Road and take 40 minutes with an oil cost of about 6.85 liter. Which route do you prefer?”

The above text description is transmitted to the audio unit 403 and is converted into audio data. Text-audio conversion is well known for one skilled in the art, and will not be described in detail.

The audio data can be provided to the output unit 305, such as a speaker. A user of the navigation device can listen to this audio description of the route candidates and then choose a preferred route based on the audio description. In an alternative embodiment, the navigation device 300 does not include a speaker, and the output unit 305 is wireless connected to a speaker on the vehicle and may transmit the audio data to the speaker via the wireless connection such as Bluetooth. The audio data will be reproduced by the speaker. In alternative embodiment, the output unit 305 is wirelessly connected with an earphone of the

driver, and the audio description is played to the driver without affecting other people on the vehicle.

As one may understand, a user usually makes a choice of the route candidates based on the differences rather than the common features of the route candidates. Fig. 5 illustrates another example of the present disclosure. In Fig. 5, the route description engine 304 further comprises a comparison unit 404. The comparison unit 404 also receives the route candidates from the navigation route engine 302, and performs a comparison among the route candidates. Based on the result of the comparison, the comparison unit 404 may identify the differences among the route candidates, such as the different roads on the route candidates.

Still, take the above three route candidates as an example, the common roads among the three route candidates are Nanjing Road and Chongqing Road. The difference is that the recommend route passes the Huaihai Road, the normal route passes Yanan Road, and the short route passes Dalian Road. This difference for the three route candidates can be identified by the comparison unit 404 and is then output to the text description unit 401.

The text description unit 401 can generate a text description based on the differences among the route candidates. For example, the text description may be: “there are three route candidates. The recommend route will pass the Huaihai Road. The normal route will pass the Yanan Road and take 2% extra oil cost. The short route will pass the Dalian Road and take 10 more minutes with 37% extra oil cost. Which route do you prefer?”

Similarly, the text description will be provided to the audio unit 403 to convert into audio data. The output unit 305 such as a speaker may output an audio description of the route candidates.

In the above description, the common roads among the three route candidates are omitted. Such a description is short and concise, and a user of the navigation device can easily grasp the difference among the route candidates. Therefore, the user may choose a preferred route without replaying the audio description.

In the above examples, the text/audio description also includes an estimated time and the oil cost for travelling through a route candidate. This information may be acquired by a calculation unit (not shown). This function has been provided on many products and is well known for one skilled in the art. In a similar manner, the comparison unit 404 can compare the time and oil cost for each route candidate and include the comparison result in the generated text descriptions. The user of the navigation device can take the time and oil cost into consideration when choosing a route.

The above text/audio descriptions of the route candidates are only examples, and the content of the description are not limited. For example, the text/audio description may be a summary of the route candidates. Such a summary can includes at least one of the following items: a destination, a heading information, a time for traveling through each route candidate, a real-time traffic information, names of roads and/or places on the route candidates, oil cost for the route candidates, etc.

The names of the roads on a route candidate are important information. In case a user of the navigation device is familiar with the roads, including this information in the text/audio description can also establish a general impression about the route candidate. With the help of this general impression, some minor errors during the later navigation may be neglected by the user because he already knows the next road to turn into.

However, there is one concern. A route candidate may pass through many roads, and a user will be overwhelmed by the names of all these roads. Therefore, in an embodiment of the present disclosure, only a portion of the road names are included in the summary. For example, the roads may be classified into major roads and minor roads, and only names of the major roads are included in the summary. Alternatively, the roads have already been classified in many countries. For example, the roads in China are classified into two categories, roads connecting the cities and roads within the cities. Each category is further classified into several sub-categories. The classification of the roads has been

standardized and is well known for one skilled in the art. The summary of the route candidates can be generated based on this standard. For example, the text description unit 401 can acquire the classification of the roads on a route candidate from the map database 303. Only the roads with high class(es) are included in the summary.

In an embodiment of the present disclosure, heading information can be provided in the summary. The user of the navigation device will understand the direction toward which the vehicle is driving. Such information can be calculated by a processor based on position information (such as GPS information) from a position sensor (such as a GPS unit, not shown). For example, at a timing T1, the GPS information is (LON1, LAT1). This means that the vehicle is at a position of longitude LON1 and latitude LAT1. At a later timing T2, the GPS information changes to (LON2, LAT2). This means that the vehicle has moved to another position of longitude LON2 and latitude LAT2. Based on this information, the processor can acquire a vector with a direction from (LON1, LAT1) to (LON2, LAT2). If Δ T=T2-T1 is short, the direction of the vector may approximate the direction of the vehicle. In another embodiment of the present disclosure, the heading information can also be calculated based on output from other sensors, such as an orientation sensor (e.g., a gyroscope). This is well known for one skilled in the art, and related description will be omitted for concise.

In a further embodiment of the present disclosure, the text/audio description will include a length of each route candidate. For example, the route description engine 304 may calculate the length of each route candidate based on the route candidates from the navigation route engine 302 and distance information from the map database 303. Specifically, a route candidate consists of sections of roads. The start and end points of each section of roads are usually contained in the information about the route candidate. The route description engine 304 may acquire a length of each section of roads for the route candidate from the map database 303. Then, the route description engine 304 adds up the length of each section of roads in a route candidate to acquire a total length of the route

candidate. Of course, the information about the route candidates is not limited to the form of the above example, and may be provided in various forms. But we may always acquire the length of the route candidate based on this information and the map database 303.

In a further embodiment of the present disclosure, the summary may includes a time for travelling through the route candidates. The time for traveling through a route candidate may be acquired by the route description engine in many ways. For example, the route description engine 304 may divide the length of the route candidate by a speed of the vehicle. In one example, the speed may be the current speed of the vehicle which can be acquired from the speedometer of the vehicle. In another example, the speed may be acquired from a remote server via wireless network. For example, the information about the route candidate may be transmitted from the navigation device to the remote server and request an average speed. There are many vehicles connected with the remote server via the wireless network. The remote server can collect information from these vehicles, such as speed and position. The remote server may calculate the average speed of the vehicles that are running on the route candidate. This average speed may be transmitted back to the navigation device in response to the request. The route description engine 304 will then calculate a time for traveling through the route candidate by dividing the length of the route candidate with the received average speed. In this example, the time for traveling through the route candidate is more accurate than using the current speed of the vehicle.

In still another example, the calculation of a travel time through the route candidate is performed by the remote server rather than the navigation device or the route description engine 304. The navigation device transmits the information about the route candidates to the remote server and request a travel time. The remote server, in response to the request, will return a time for traveling through the route candidates. In this manner, all the calculations are performed by the remote server. Usually, the remote server is much more powerful than the

navigation device. The calculation can use a much more complicated algorithm and is faster, and the load on the navigation device may be lowered.

In an alternative embodiment, the summary may include real-time traffic information such as whether there is any traffic jam or accident on the route candidates. The real-time traffic information may be provided from the remote server in response to a request from the navigation device. The remote server may collect the real-time traffic information in various ways. For example, the remote server may monitor the speed of vehicles on a road. If the vehicles are all running at a speed lower than a predetermined threshold, the remote server may determine that there is a traffic jam on that road. Alternatively, the users may notify the remote server that there is a traffic accident on the road. The present disclosure has no intention to limit how the remote server acquires the real-time traffic information, and such information may be acquired in many other ways.

In another embodiment, the summary may include an oil cost for each route candidate. The oil cost may be calculated by the route description engine 304, or other component can calculate the oil cost and send it to the route description engine 304. For example, the oil cost for a route candidate can be calculated by multiplying the length of the route candidate with an average oil cost per kilometer. The length of the route candidate can be acquired by the route description engine as described above. The average oil cost per kilometer is different for each vehicle, and this information can usually be provided by a computer on the vehicle. Even if this information cannot be acquired from the computer, the navigation device may try to acquire it from a remote server. For example, the navigation device can send the manufacture and the model of the vehicle to the remote server, and the remote server can search its database and feedback the average oil cost per kilometer for this specific type of vehicle. Alternatively, a user of the navigation device may manually input this information in advance.

With the oil cost for each route candidate acquired, the route description engine 304 may further process these data. For example, the comparison unit 404

may compare these oil costs and provide a relative value. As shown in fig. 2, the oil cost for the recommend route is adopted as a basis (i.e. 100%), the oil cost for the normal route is +2% (i.e. 102%), and the oil cost for the short route is +37% (i.e. 137%). The user of the navigation device may choose a most fuel efficient route from the route candidates (in this case, the recommended route).

Please note the summary as provided by the route description engine 304 may include at least one of the information described above. However, the summary is not limited to such information and may include other information such as a weather forecast along the route candidate and at the destination. This weather information is especially useful for a long distance route.

The user of the navigation device will listen to the audio description that is generated by the description engine 304, and select a route from the route candidates via the selection unit 306. For example, the user may input his selection of the route from the input unit 301. The selection unit 306, based on the input from the user, may identify the user selection and provide the selected route to the navigation engine 307. The navigation engine 307 then starts navigating and turns into TBT navigation procedure based on the selected route.

In the above embodiments, audio descriptions of the route candidates are provided to the user of the navigation device. If the navigation device is installed on a vehicle, the user is often the driver. By listening to the audio description instead of looking at the screen, the driver can keep his eyes on the road and continue driving while acquiring information about the route candidates. This will increase the safety.

Fig. 6 illustrates a navigation device 600 according to a further embodiment of the present disclosure. As shown in fig. 6, the navigation device 600 may include an input unit 601, a navigation route engine 602, a map data base 603, a route description engine 604, an output unit 605, a selection unit 606, a navigation engine 607 and a voice recognition unit 608.

Since most components and their functions are similar to those in fig. 3, only the differences are described below.

Input unit 601 may receive a voice input. For example, the input unit 601 may include a microphone (not shown) for picking up voices. In another example, the input unit 601 includes a Bluetooth unit (not shown) and may receive audio inputs via wireless connection. In an embodiment of the present disclosure, the Bluetooth unit of the input unit 601 may be connected to a mobile phone of the user via a wireless connection. The user may talk to the mobile phone which will pick up the user's voice, turn it into audio data and send it to the Bluetooth unit in the input unit 601. Therefore, the input unit 601 can have the user's voice input without having a microphone installed on the navigation device.

The voice recognition unit 608 can perform voice recognition on the user's voice from the input unit 601, and recognize a user inquiry. For example, the user of the navigation device may have listened to the summary of the route candidates and wants to learn more about the recommended route. The user can ask "can you give me a more detailed description of the recommended route?" The voice recognition unit 608 performs voice recognition on the user's voice and recognizes that the user needs a detailed description of the recommended route. Based on this recognition result, the voice recognition unit 608 sends an instruction to the route description engine 604 and instructs it to generate a detailed audio description about the recommended route. The route description engine 604 then generates a detailed audio description about the recommended route and sends it to the output unit 605. The detailed description of the recommended route may include more information. For example, some minor roads or low grade roads are included in this detailed description. The detailed audio description will be reproduced by the output unit 605 or by a speaker on the vehicle as a response to the user's inquiry.

The user may ask various other questions following the provision of the summary. For example, the user may ask "Does the normal route go through Xizang Road?" The voice recognition unit 608 recognizes this inquiry and instructs the route description engine 604 to generate an answer. The description engine 604 searches Xizang Road in the normal route and generates a audio

answer based on the search result, such as “Xizang Road is (not) on the normal route.” Other questions that a user of the navigation device may ask include “so, the recommended route will be 10 minutes faster than the short route. Is it correct?” “Show me the location of Dalian road on the map”, etc. The voice recognition unit 608 can recognize these questions and instruct a corresponding unit such as route description engine 604 to provide an answer or a related operation.

In a further embodiment of the present disclosure, the user of the navigation device 600 may select a route from the route candidates via voice. For example, after the summary of the route candidates are reproduced by a speaker, the user can talk to the microphone (not shown) “please select the recommended route”. The input unit 601 transmits this voice input as audio data to the voice recognition unit 608. The voice recognition unit 608 performs voice recognition and recognizes that the user has selected the recommended route. Then, the voice recognition unit 608 sends an instruction for selecting the recommended route to the selection unit 606. The selection unit 606 may select the recommended route from the route candidates and instructs the navigation engine 607 to start navigating according to the recommended route. At the same time, the voice recognition unit 608 may also send the result of the voice recognition to the route description engine 604. The route description engine 604 will generate an audio confirmation and output it via the output unit 605. For example, the user of the navigation device will hear “you have selected the recommended route, the navigation procedure starts now”. Based on this feedback, the user will learn that his voice instruction has been correctly recognized.

In another embodiment of the present disclosure, the user can select a route without providing the name of the route candidate. For example, the user may speak “please select the route going through Xizang Road”. This user voice is transmitted to the voice recognition unit 608. The voice recognition unit 608 performs voice recognition on the user voice and recognizes that the user has selected a route going through Xizang Road. The recognition result is transmitted

to the selection unit 606. The selection unit 606 searches the route candidates, looking for a route that goes through the Xizang Road, and transmits the selected route to the navigation engine 607. The navigation engine 607 then starts navigating based on the selected route.

In an alternative example, the recognition result is also transmitted to the route description engine 604, and the selection unit 606 also transmits the selected route to the route description engine 604. Based on the recognition result and the selected route, the route description engine 604 generates an audio description such as "the route that goes through the Xizang Road is the recommended route, and the navigation procedure starts now". With such a feedback, the user of the navigation device will know which route has been selected.

Alternatively, the user of the navigation device may select a route by speaking different sentences. For example, the user may speak "I want to take the route along Yan'an elevated Road", "go through the south route", "take the route that takes shortest time and avoids Dalian Road", etc. The voice recognition unit 608 can recognize these voice instructions and provides them to corresponding units such as the selection unit 606 and route description engine 604. The selection unit 606 can select a route based on the instruction, and the route description engine 604 can generate audio feedback to confirm the user selection.

In the above embodiments, the user's voice instructions are provided after reproduction of the description of the route candidates. In an alternative example, the user may provide a voice instruction during the navigation. For example, the user of the navigation device has selected a route and is driving a vehicle along the selected route. When the user wants to review the selected route again, he can speak "I want to have an overview of the route." Such a voice instruction may be picked up by a microphone and transmitted to the voice recognition unit 608 via the input unit 601. The voice recognition unit 608 then performs voice recognition on the user voice and recognizes that the user wants to overview the selected route. Based on this recognition result, the voice recognition unit 608

sends an instruction to the route description engine 604 and instructs the route description engine 604 to provide an audio description of the selected route again. In an example, the summary of the selected route which has been generated during the route selection is stored in a storage device (not shown). The summary may be stored in text or audio format, and the route description engine 604 can access the storage device and retrieve the summary.

Fig. 7 illustrates a configuration of the route description engine 604 according to another embodiment of the present disclosure. The route description engine 604 includes a text description unit 701, a template database 702, a audio unit 703, a comparison unit 704 and a route revising unit. Since the components of the route description engine 604 have similar functions to those of the route description 304, only the differences are described below. In this embodiment of the present disclosure, the summary can be revised or regenerated when the user wants to review the selected route again. Usually, the user wants to review the route to learn how to reach the destination, and does not have interest in the part of route that has gone through. In an example, the route description engine 604 will generate an audio description for a part of the selected route that the user has not gone through yet.

Specifically, when the route description engine 604 receives, from the voice recognition unit 608, an instruction to provide an audio description of the selected route again, the route revising unit 705 will acquire the current position of the navigation device from the locating unit (not shown). Since the user or the vehicle has driven along the selected route for a certain amount of time, the newly generated current position is different from the original start position of the selected route. The route revising unit 705 may also acquire the selected route from the storage device (not shown). Then, the route revising unit 705 will revise the selected route based on the current position of the navigation device. More specifically, the route revising unit 705 uses the current position as a start position and deletes all information related to roads/places from the selected route. The revised route starts from the current position of the navigation device,

ends at the destination. The revised route is sent to the text description unit 701 which may generate a text description of the revised route in a similar manner as described above. The text description is converted into audio data by the audio unit 703 and is output by the speaker.

Fig. 8 illustrates a configuration of a navigation device according to another embodiment of the present disclosure. The navigation device 800 includes an input unit 801, a navigation route engine 802, a map database 803, a route description engine 804, an output unit 805, a selection unit 806, a navigation engine 807, and an estimation unit 808. Since most components of the navigation device 800 have similar function to those of the navigation device 300, the descriptions thereof are omitted. Only the differences of the components are described below.

As described above, a user of the navigation device of the present disclosure may be provided with an audio description of the route candidates and may select a route via voice. Thus, a driver of a vehicle can select a route for navigation while driving the vehicle at a very fast speed. This is different from the traditional navigation devices which require the driver to stop the vehicle and push the buttons or touch the screen to select. As one skilled in the art may understand, people usually receive audio information more slowly than looking at text or graphic information because all the information has to be spoken out word by word. Further, the possible user inquiry will take more time before a route is finally selected. If the vehicle remains driving fast, several kilometers or tens of kilometers (e.g. on a highway) may have passed. In this case, the actual position of the vehicle may be very different from the start position of the selected route which is already a past position of the vehicle. Based on the above, the navigation device 800 of the present disclosure includes an estimation unit 808 which may estimate a start position for the route candidates. Specifically, in an example, the estimation unit 808 may acquire a current speed and heading of the vehicle. For example, the speed of the vehicle may be provided by the speedometer of the vehicle, and the heading of the vehicle is calculated from the

GPS information. In another example, both the speed and heading of the vehicle are calculated from the GPS information.

Based on the speed and heading information of the vehicle, the estimation unit 808 may estimate the start position. For example, the estimate unit 808 multiplies the speed by a time necessary for the driver to select a route. The product is the estimated distance between the current position and the estimated start position. The heading information provides the direction of the estimated start position relative to the current position. Based on this information, the estimation unit 808 may locate the start position.

In a further example, the map database 803 also provides information about the road on which the vehicle is running to the estimation unit 808. With this information, the estimation unit 808 is able to provide a more precise estimation on the start position. For example, it is assumed that the vehicle will remain on the same road while the driver selecting a route. With the help of information about the road, the estimation unit 808 may set the estimated start position on the road. The distance along the road from the current position to the estimated start position equals to the product of the speed of the vehicle and a time necessary for the driver to select a route.

If it takes some time for a driver of the vehicle to select a route for navigation while driving at a fast speed, the actual position of the vehicle might have passed the first turn of the selected route. In this case, the route is not appropriate, and the navigation device would have to adjust or regenerate the route almost immediately after the driver selects the route. With the estimation unit 808, the route candidates are generated based on the estimated start point. Thus, the selected route will always be correct, and the navigation device doesn't have to update the selected route immediately.

With reference to FIG. 10, a computing device 1000, which is an example of the hardware device that may be applied to the aspects of the present disclosures will now be described. The computing device 1000 may be any machine configured to perform processing and/or calculations. The various

components/units of the navigation device may be wholly or at least partially implemented by the computing device 1000 or a similar device or system.

The computing device 1000 may comprise elements that are connected with or in communication with a bus 1002, possibly via one or more interfaces. For example, the computing device 1000 may comprise the bus 1002, and one or more processors 1004, one or more input devices 1006 and one or more output devices 1008. The one or more processors 1004 may be any kinds of processors, and may comprise but are not limited to one or more general-purpose processors and/or one or more special-purpose processors (such as special processing chips). The input devices 1006 may be any kinds of devices that can input information to the computing device, and may comprise but are not limited to a mouse, a keyboard, a touch screen, a microphone and/or a remote control. The output devices 1008 may be any kinds of devices that can present information, and may comprise but are not limited to display, a speaker, a video/audio output terminal, a vibrator and/or a printer. The computing device 1000 may also comprise or be connected with non-transitory storage devices 1010 which may be any storage devices that are non-transitory and can implement data stores, and may comprise but are not limited to a disk drive, an optical storage device, a solid-state storage, a floppy disk, a flexible disk, hard disk, a magnetic tape or any other magnetic medium, a compact disc or any other optical medium, a ROM (Read Only Memory), a RAM (Random Access Memory), a cache memory and/or any other memory chip or cartridge, and/or any other medium from which a computer may read data, instructions and/or code. The non-transitory storage devices 1010 may be detachable from an interface. The non-transitory storage devices 1010 may have data/instructions/code for implementing the methods and steps which are described above. The computing device 1000 may also comprise a communication device 1012. The communication device 1012 may be any kinds of device or system that can enable communication with external apparatuses and/or with a network, and may comprise but are not limited to a modem, a network card, an infrared communication device, a wireless communication

device and/or a chipset such as a Bluetooth™ device, 1302.11 device, WiFi device, WiMax device, cellular communication facilities and/or the like.

When the computing device 1000 is used as an on-vehicle device, it may also be connected to external device, for example, a GPS receiver, sensors for sensing different environmental data such as an acceleration sensor, a wheel speed sensor, a gyroscope and so on. In this way, the computing device 1000 may, for example, receive location data and sensor data indicating the travelling situation of the vehicle. When the computing device 1000 is used as an on-vehicle device, it may also be connected to other facilities (such as an engine system, a wiper, an anti-lock Braking System or the like) for controlling the traveling and operation of the vehicle.

In addition, the non-transitory storage devices 1010 may have map information and software elements so that the processor 1004 may perform route guidance processing. In addition, the output device 1006 may comprise a display for displaying the map, the location mark of the vehicle and also images indicating the travelling situation of the vehicle. The output device 1006 may also comprise a speaker or interface with an ear phone for audio guidance.

The bus 1002 may include but is not limited to Industry Standard Architecture (ISA) bus, Micro Channel Architecture (MCA) bus, Enhanced ISA (EISA) bus, Video Electronics Standards Association (VESA) local bus, and Peripheral Component Interconnect (PCI) bus. Particularly, for an on-vehicle device, the bus 1002 may also include a Controller Area Network (CAN) bus or other architectures designed for application on an automobile.

Claims

1. A navigation method, comprising:

acquiring a destination and a current position;

generating at least one route candidate based on the destination and the current position;

providing information about the at least one route candidate via voice;

receiving a selection of a route from the at least one route candidate; and

navigating through the selected route.

2. The method of claim 1, wherein the route is selected based on a voice input.

3. The method of claims 1 or 2, further comprising:

updating the current position after receiving the selected route; and

amending the selected route based on the updated current position.

4. The method of claims 1 or 2, further comprising:

estimating a start position based on the current position; and

generating the at least one route candidate based on the destination and the estimated start position.

5. The method of claim 4, further comprising:

acquiring a speed of a vehicle which is being navigated; and

estimating the start position based on the speed of the vehicle.

6. The method of claim 5, further comprising:

acquiring information about a road on which the vehicle is driving and information about a heading of the vehicle; and

estimating the start position based on the speed of the vehicle, the information about the road and the information about the heading of the vehicle.

7. The method of claim 1, wherein the information about the at least one route candidate is a summary of the at least one route candidate.

8. The method of claim 7, wherein the summary includes at least one of the destination, a heading information, a length of the at least one route candidates, a time for traveling through the at least one route candidate, a real-time traffic information, names of roads and/or places on the at least one route candidate, and an oil cost for each of the at least one route candidate.

9. The method of claim 8, wherein only names of a part of the roads are included in the summary.

10. The method of claim 9, wherein the roads on the at least one route candidate are classified into major roads and minor roads, and only names of the majors roads are included in the summary.

11. The method of claims 1 or 2, further comprising:

acquiring a user inquiry, and

wherein the information about the at least one route candidate is provided in response to the user inquiry.

12. The method of claim 11, further comprising:

receiving a voice input from the user;

recognizing the voice input; and

generating the user inquiry based on a result of the recognition.

13. The method of claim 12, wherein the step of providing information about the at least one route candidate via voice includes:

generating a description of the information about the at least one route candidate

based on a template; and

output the description via voice.

14. The method of claim 13, wherein the template is selected from a set of predetermined templates based on the user inquiry.

15. The method of claim 7, further comprising:

estimating the oil cost for each of the at least one route candidate;

comparing the oil costs for the at least one route candidate; and

providing a route with least oil cost as an oil efficient route.

16. A navigation device, comprising:

a navigation route engine configured to generate at least one route candidate based on a destination and a start position;

a map database configured to provide information about the at least one route candidate;

a route description engine configured to generate audio description of the information about the at least one route candidate and output the audio description via an output unit;

a selection unit configured to receive a selection of a route from the at least one route candidate; and

a navigation engine configured to navigate through the selected route.

17. The navigation device of claim 16, further comprising:

a microphone configured to receive a voice input for selecting the route.

18. The navigation device of claim 16 or 17, further comprising:

an estimation unit configured to estimate the start position based on the current position,

wherein the navigation route engine generates the at least one route candidate

based on the destination and the estimated start position.

19. The navigation device of claim 18, further comprising:

a velocity sensor configured to detect a speed of a vehicle which is being naviagated,

wherein the estimation unit estimates the start position based on the detected speed.

20. The navigation device of claim 19, further comprising:

an orientation sensor configured to detect a heading of the vehicle,

wherein the map database is configured to provide information about a road on which the vehicle is driving, and the estimation unit is configured to estimate the start position based on the speed, the information about the road and the information about the heading of the vehicle.

21. The navigation device of claim 16, wherein the audio description is a summary of the at least one route candidate.

22. The navigation device of claim 21, wherein the summary includes at least one of the destination, a heading information, a length of the at least one route candidates, a time for traveling through the at least one route candidate, a real-time traffic information, names of roads and/or places on the at least one route candidate, and an oil cost for each of the at least one route candidate.

23. The navigation device of claim 21, wherein only names of a part of the roads are included in the summary.

24. The navigation device of claim 23, wherein the roads on the at least one route candidate are classified into major roads and minor roads, and only names of the majors roads are included in the summary.

25 The navigation device of claim 23, wherein the route description engine comprises:

a comparison unit configured to compare the route candidates and identify the differences among the route candidates,

wherein the route description engine generates the audio description based on the differences among the route candidates.

26. The navigation device of claim 16, further comprising:

a microphone configured to receive a user voice;

a voice recognition unit configured to recognize a user inquiry from the user voice,

wherein the route description engine is configured to generate the audio description of the information about the at least one route candidate based on the user inquiry.

27. The navigation device of claim 26, wherein the route description engine is configured to generate the audio description based on a template.

28. The navigation device of claim 27, wherein the route description engine is configured to select the template from a set of predetermined templates based on the user inquiry.

29. A navigation device, comprising a processor which is configured to

acquiring a destination and a current position;

generating at least one route candidate based on the destination and the current position;

providing information about the at least one route candidate via voice;

receiving a selection of a route from the at least one route candidate; and

navigating through the selected route.

30 A non-volatile storage medium with a program stored thereon, when the program is executed by a processor, the processor is configured to

acquiring a destination and a current position;

generating at least one route candidate based on the destination and the current position;

providing information about the at least one route candidate via voice;

receiving a selection of a route from the at least one route candidate; and

navigating through the selected route.

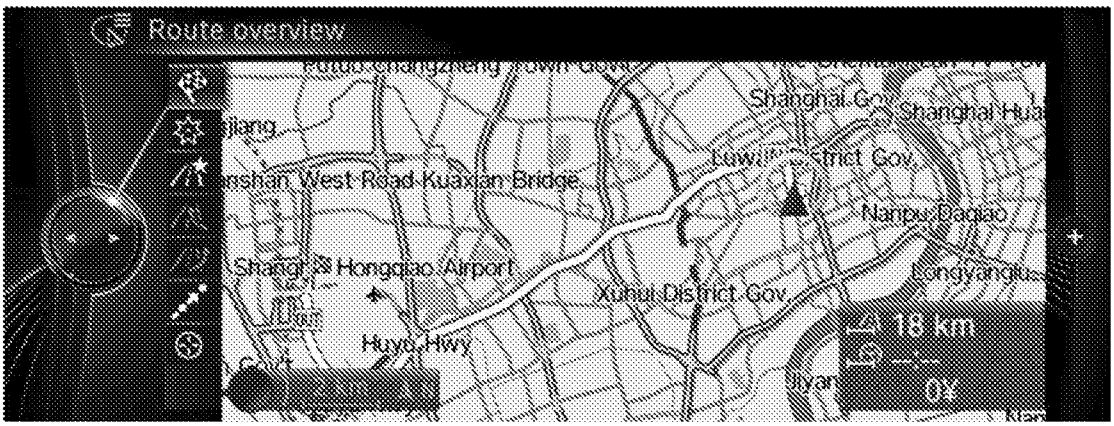
Route overview
Shanghai Gov
Shanghai Hua
Nanpu Daqiao
Hongqiao Airport
Xuhui District Gov
Huyu Hwy
18 km
0¥

Fig. 1


0:19 18 km 0¥
Recommen.
0:19 18 km 0¥
Normal +2%
0:19 18 km 0¥
Short +37%
0:29 17 km 0¥
Putuo District
Dongfang
Qibao Town
Xinlong Huajiao
Sanlin

Fig. 2

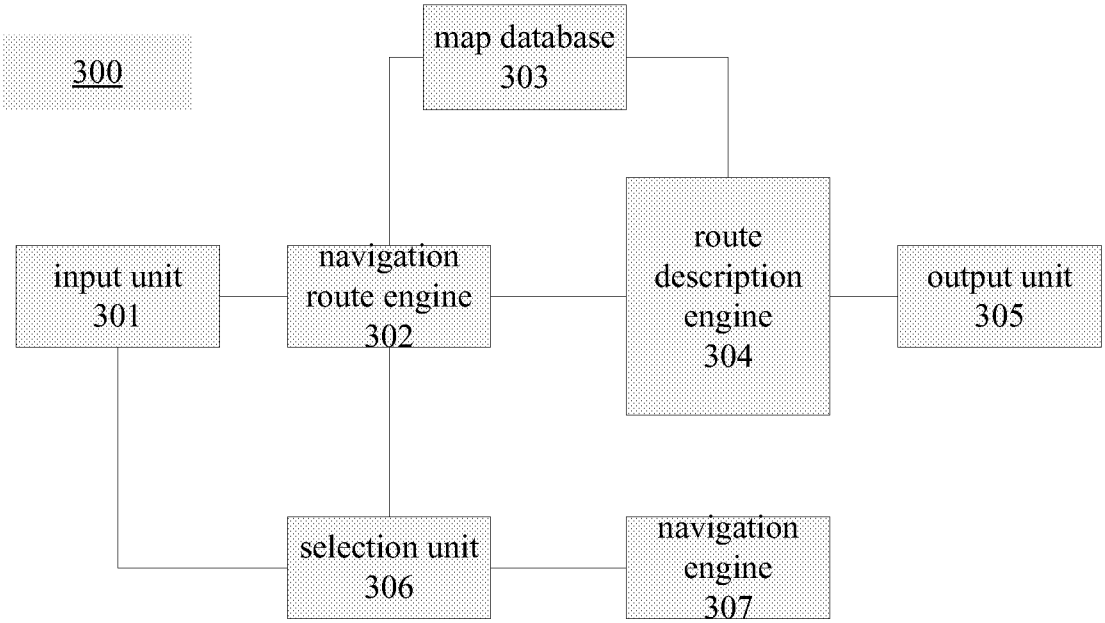
300
map database
303
input unit
301
navigation
route engine
302
route
description
engine
304
output unit
305
selection unit
306
navigation
engine
307

Fig. 3

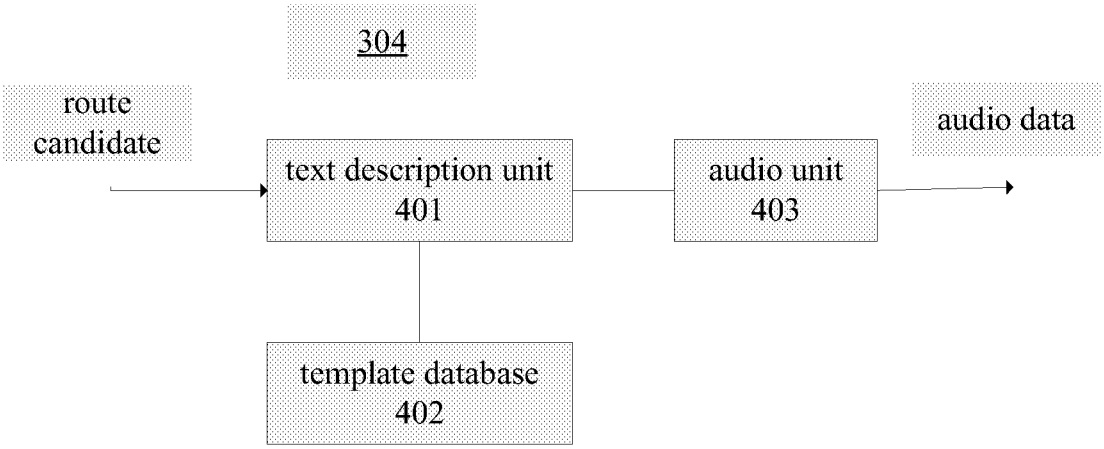
304
route
candidate
text description unit
401
audio unit
403
audio data
template database
402

Fig. 4

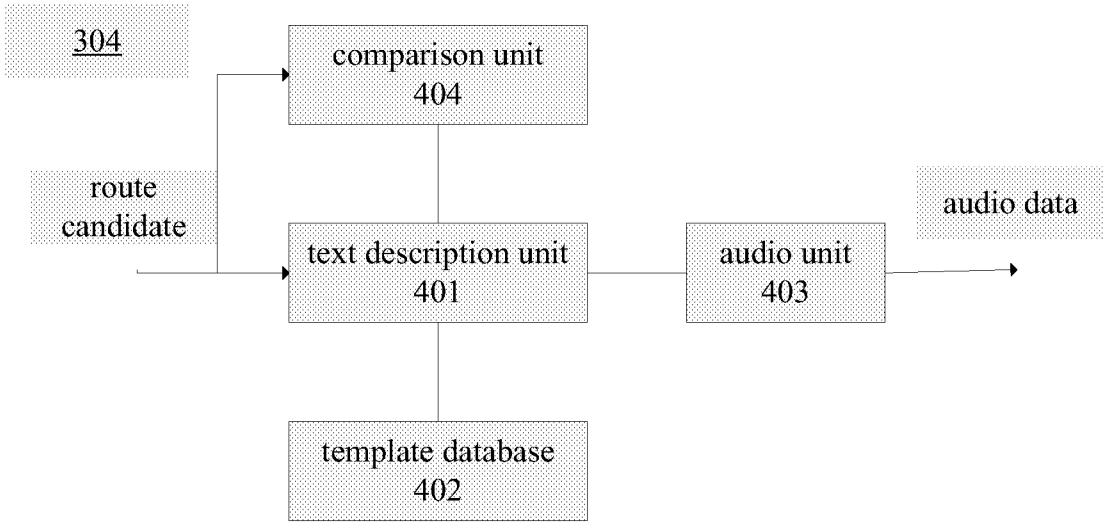
304
comparison unit
404
route
candidate
text description unit
401
audio unit
403
audio data
template database
402

Fig. 5

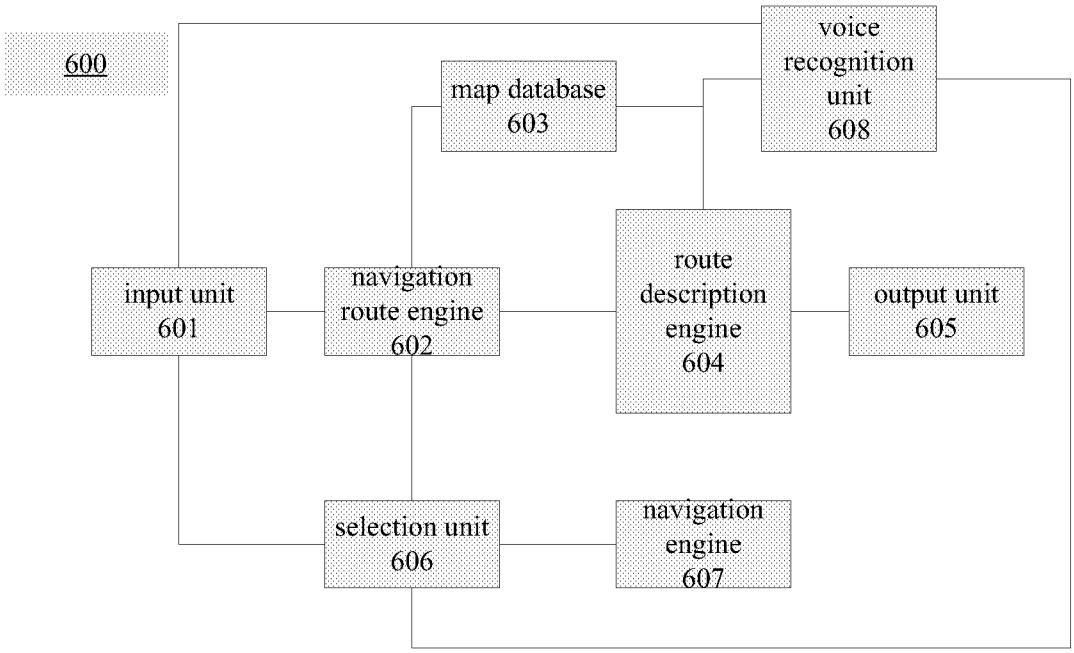
600
voice
recognition
unit
608
map database
603
route
description
engine
604
input unit
601
navigation
route engine
602
output unit
605
selection unit
606
navigation
engine
607

Fig. 6

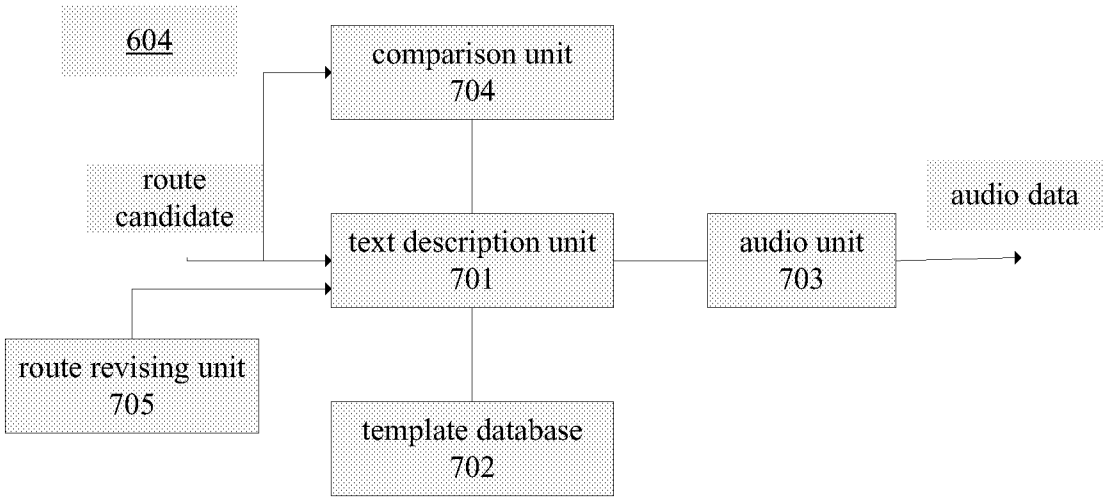
604
comparison unit
704
route
candidate
audio data
text description unit
701
audio unit
703
route revising unit
705
template database
702

Fig. 7

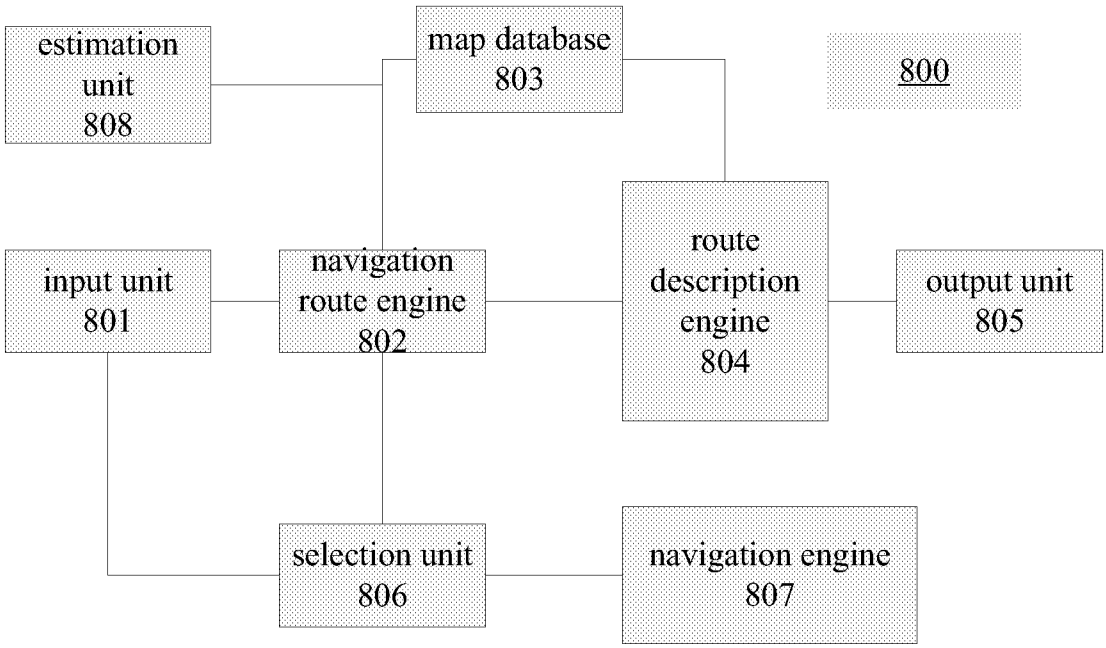
estimation
unit
808
map database
803
800
route
description
engine
804
input unit
801
navigation
route engine
802
output unit
805
selection unit
806
navigation engine
807

Fig. 8

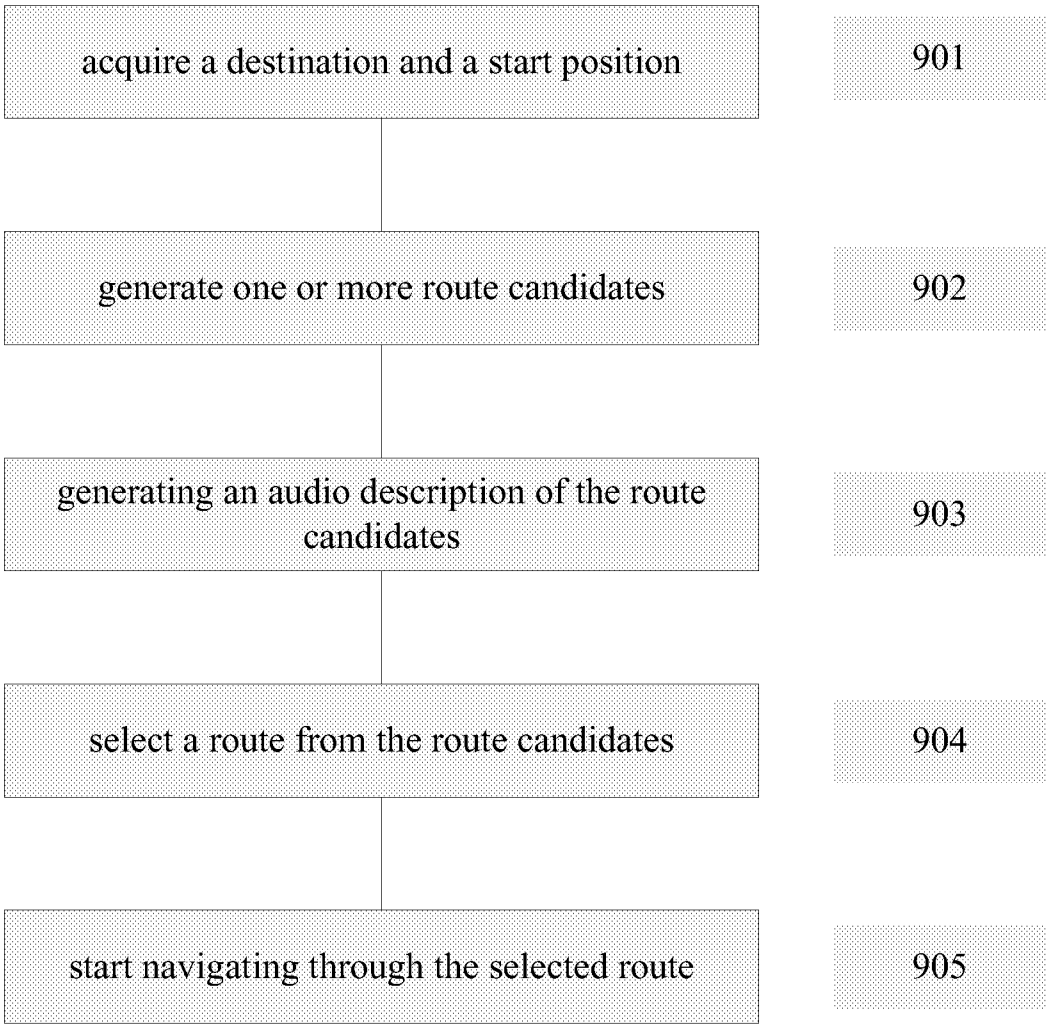
acquire a destination and a start position
901
generate one or more route candidates
902
generating an audio description of the route candidates
903
select a route from the route candidates
904
start navigating through the selected route
905

Fig. 9

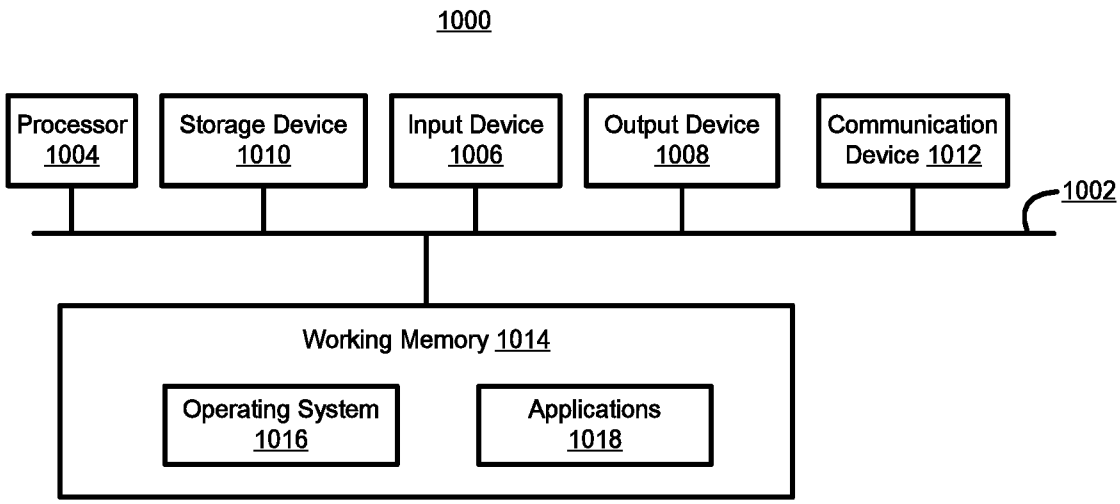
1000
Processor 1004
Storage Device 1010
Input Device 1006
Output Device 1008
Communication Device 1012
1002
Working Memory 1014
Operating System 1016
Applications 1018

Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/085375

A. CLASSIFICATION OF SUBJECT MATTER

G01C 21/30(2006.01)i

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

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 practicable, search terms used)

CNPAT,EPODOC,WPI,CNKI: navigat+, voice, sound, route,information, road, street

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 1685201 A (HARMAN BECKER AUTOMOTIVE SYSTEMS) 19 October 2005 (2005-10-19) description page 4 line 7 to page 11 line 10, figures 1-4	1-30
A	CN 1517251 A (AISIN AW CO., LTD.) 04 August 2004 (2004-08-04) the whole document	1-30
A	CN 101097155 A (FOSHAN SHUNDE SHUNDA COMPUTER FACTORY CO. ET AL.) 02 January 2008 (2008-01-02) the whole document	1-30
A	CN 104508429 A (AISIN AW CO., LTD.) 08 April 2015 (2015-04-08) the whole document	1-30
A	US 2012041766 A1 (HON HAI PRECISION INDUSTRY CO., LTD. ET AL.) 16 February 2012 (2012-02-16) the whole document	1-30
A	US 2006041379 A1 (BRULLE-DREWS, CHRISTIAN) 23 February 2006 (2006-02-23) the whole document	1-30

☐ 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 application or patent 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
05 April 2016	**28 April 2016**
Name and mailing address of the ISA/CN **STATE INTELLECTUAL PROPERTY OFFICE OF THE P.R.CHINA** **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer **HUANG,Tao** Telephone No. **(86-10)82245886**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/085375

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		DE 10361404 B4	12 September 2013
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		JP 2014044182 A	13 March 2014
		US 2015177014 A1	25 June 2015
US 2012041766 A1	16 February 2012	CN 102374864 B	31 December 2014
		CN 102374864 A	14 March 2012
		US 8412455 B2	02 April 2013
US 2006041379 A1	23 February 2006	US 7472020 B2	30 December 2008
		EP 1624288 A1	08 February 2006
		DE 102004037858 A1	16 March 2006