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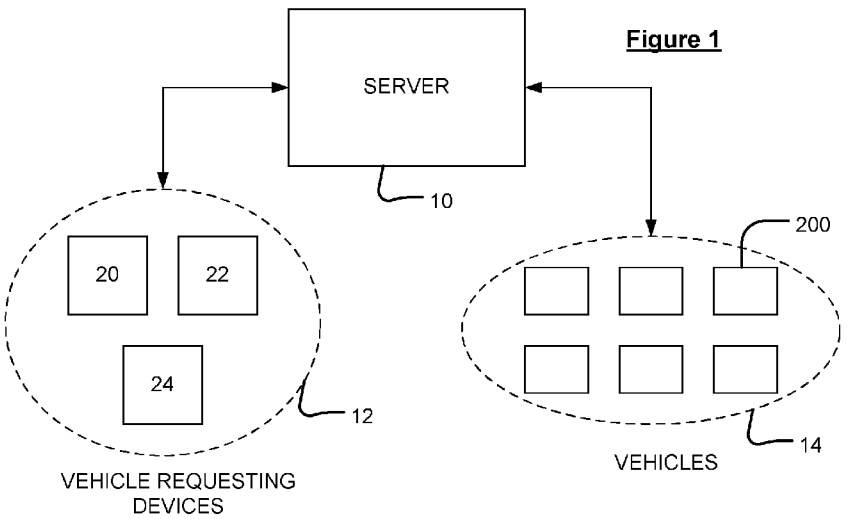
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(54) Title: VEHICLE REQUEST MANAGEMENT SYSTEM HAVING A CENTRAL SERVER

Figure 1



(57) Abstract: A vehicle request management system having a server (10) arranged to communicate with a plurality of vehicle requesting devices (12) and a plurality of vehicles (14), each being equipped with a device (200) having route planning and navigation functionality. Upon receipt of a vehicle request, the server (10) selects a suitable vehicle (14) and determines the route that the vehicle should travel to the pick-up location and then onto the drop-off location. The server (10) receives updates as to the position of the selected vehicle (14) as it completes the request, and uses data associated with the calculated route and the position of the selected vehicle (14) to provide enhanced functionality.

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VEHICLE REQUEST MANAGEMENT SYSTEM HAVING A CENTRAL SERVER

Field of Invention

The present invention relates to a system and method for managing vehicle requests, such as a requests by a user for a taxi or other similar form of transport. In preferred embodiments, a server of the system determines a route that is to be travelled by the taxi when completing the vehicle request, and uses this information, together with data relating to the position of the taxi, to provide enhanced functionality and information to the user.

Background to the Invention

In recent years, with the adoption of location-aware mobile devices, such as smart phones, by the general public, a number of software applications (or "apps") have been created to improve the experience of ordering and requesting taxis. Examples of these apps include: Hailo – http://hailocab.com; myTaxi – http://www.myaxi.net/; and Taxi Magic – http://taximagic.com.

Through the use of such apps on a location-aware mobile device, e.g. one having GNSS (Global Navigation Satellite Systems) signal reception and processing functionality, a user can easily request a taxi to their current location, even if they themselves are not aware of their surroundings.

For example, with the Hailo app, a user is shown a map on their mobile device, centred on their current location, indicating the real-time location of the closest available taxis to their location and an estimate of the time that it will take each taxi to reach the location. This information is downloaded from a server system that receives periodic updates from location-aware devices in each of the taxis. The user can select a taxi by touching an icon representative of the taxi on a touchscreen of their device, and an order request is then sent to the selected taxi via the server. If the driver accepts the order request, a confirmation message is sent to the user. The user is also provided with a profile picture of the driver, a user rating associated with the driver, details of the selected taxi and a real-time countdown of when the taxi should arrive at the pick-up location; this is an estimate as it doesn't take account of traffic, roadworks and other such events that may cause a delay to the taxi. The user can also see the current position of the selected taxi on a map as it approaches the pick-up location. A notification is sent to the user, again via the server, that the taxi has arrived at the pick-up location. Once the journey has been completed, the user can pay for the trip using a credit card or similar form of non-cash payment; assuming that the details of the card have been previously associated with their account on the server. The user then receives a message from the server confirming the details of the journey and a receipt for the amount paid. The user can also take the opportunity to rate their driver following completion of the journey.

Despite the improvements that have been made in relation to requesting taxis through the use of location-aware devices, the Applicant believes that there remains scope for further improvement and the provision of additional functionality to the user, for example, by using information obtained from navigation devices within the individual taxis. As is well known in the art, such navigation devices typically include GNSS signal reception and processing functionality, such as a GNSS antenna, by means of which satellite-broadcast signals, including location data, can be received and subsequently processed to determine a current location of the device. The navigation devices also typically have route planning functionality that allows a route to be calculated between an origin and a destination using digital map data, together with suitable means, such as a display and speaker, to provide navigation instructions to the driver based on the calculated route.

Summary of the Invention

In accordance with a first aspect of the invention there is provided a vehicle request management system, the system having a server comprising:

communication means arranged to communicate with a first device and a second device associated with a vehicle, the communication means being further arranged to receive a vehicle request from the first device, the vehicle request comprising a first location, and the communication means being further arranged to receive a second location from the first device or the second device;

data storage means comprising digital map data having a plurality of navigable segments representing segments of a navigable route in a geographical area covered by the map; and

processing means arranged to calculate a route between the received first location and second location to be travelled by the vehicle associated with the second device using the digital map data;

wherein said communication means is further arranged to receive positional data relating to the position of the second device over time.

Further, and in accordance with another aspect of the invention, there is provided a method of managing vehicle requests at a server between a first device and a second device associated with a vehicle, the method comprising:

receiving a vehicle request at the server from the first device, the vehicle request comprising a first location;

receiving a second location at the server from the first device or the second device;

calculating a route between the received first location and second location to be travelled by the vehicle associated with the second device using digital map data stored at the server having a plurality of navigable segments representing segments of a navigable route in a geographical area covered by the map; and

receiving positional data at the server relating to the position of the second device over time.

The present invention in this further aspect may include any or all of the features described in relation to the first aspect of the invention, and vice versa, to the extent that they are not mutually inconsistent. Thus, if not explicitly stated herein, the system of the present invention may comprise means for carrying out any of the steps of the method described.

The means for carrying out any of the steps of the computer implemented method may comprise a set of one or more processors configured, e.g. programmed, for doing so. A given step may be carried out using the same or a different set of processors to any other step. Any given step may be carried out using a combination of sets of processors.

The present invention relates to a system for managing vehicle requests, such as requests by people for a taxi or other similar form of transport, such as a sedan, limousine or the like. The system comprises a central controller, such as a server, which comprises communication means for communicating with one or more first devices, which may be carried by users and are used to make a vehicle request, and one or more second devices, which may be mounted within a vehicle available for fulfilling a submitted vehicle request. The communication means is arranged to receive a vehicle request from a first device, which includes at least a first location; the first location typically defining a pick-up location where a user desires to be picked-up by a vehicle. The communication means is further arranged to receive a second location from the first device or a second device; the second location typically defining a drop-off location where a user desires to be taken by a vehicle. The server of the present invention further comprises data storage means having digital map data stored therein. The digital map data has a plurality of navigable segments representing segments of a navigable route in a geographical area covered by the map, and can thus be used for route planning and navigable purposes. For example, in the present invention, the digital map data is used to calculate a route between the first location and the second location, which is to be travelled by the vehicle associated with the second device in order to move between the received first and second locations. As will be appreciated, conventional vehicle request management systems typically do not utilise digital map data at the server, the server simply acts as a means of dispatching vehicles in response to received vehicle requests, whilst route calculation through the use of digital map data typically only occurs on the second device. The server, in use, also receives positional data relating to position of the, and preferably each, of the second devices over time, and thus the vehicles associated therewith.

As will be discussed in more detail below, the calculation of a route to be travelled by the second device at the server, together with the knowledge as to the current location of the second device at a point in time, has numerous advantages.

For example, the server can be arranged to transmit data indicative of the calculated route and the received positional data to the first device, and preferably for display on the first device. The user is therefore able to monitor the route that a vehicle should be travelling whilst travelling in the taxi, thus bringing peace of mind that the driver of the vehicle is taking the optimum route. The user can also use this knowledge to, for example, send an alert to another person or downgrade a driver's rating if they ignore instructions relating to, or deviate from, optimum route, without a good reason.

The server can also monitor the position of the second device relative to the route that it should be travelling between two locations to determine if the second device, and thus vehicle, deviates from the route. In embodiments, the determination can be used to automatically reduce a driver's rating if they deviate from the calculated route, and the deviation has an effect on the time of a journey and/or the distance of a journey.

In other embodiments, the server can use the current position of the second device and the knowledge of the route it should be following to automatically determine when the second device, and thus vehicle in which it is being carried, arrives at and/or departs from a destination, e.g. a pick-up location and/or a drop-off location. This information can be provide suitable status updates to a first device, e.g. the device that made the vehicle request, or can be transmitted to the second device to all the device to provide continual guidance instructions to the driver without he or she needing to provide any manual input on the device.

As discussed above, the present invention is directed to a vehicle request management system. In other words, a system whereby a person, or typically a plurality of different people, can make a request for a vehicle to meet him or her at a particular location, and in some cases additionally at a particular time. The system is used to assign a vehicle to the request, and to monitor the position of the vehicle whilst the request is carried out. The vehicle request system of the present invention is particularly applicable to managing taxi requests, such as in large towns and cities, but it will be understood that the system can be used with any type of vehicle requests as appropriate.

The vehicle request management system comprises a server comprising communication means arranged to communicate with at least a first device and a second device associated with a vehicle. In preferred embodiments, however, the communication means will be arranged to communicate with a plurality of different first devices and a plurality of different second devices. It will be understood that the present invention therefore extends to encompass a vehicle request management system comprising a server, and at least one first device and/or second device, as appropriate. It will also be understood that a reference herein to a single first device or second device could be replaced with a reference to a plurality of such first devices or second devices.

In operation, the server uses the communication means to receive a first location, such as a location where the user is to meet with a vehicle to begin a journey (a "pick-up location"), and a second location, such as a location where the user desires to travel (a "drop-off location"). The first location will be received from the first device, i.e. as part of the vehicle request. The second location, meanwhile, may be received from either the first device, e.g. as part of the initial vehicle request or at a subsequent point in time, or from the second device in the vehicle, e.g. once the user has provided the destination to the vehicle's driver.

The first device can be of any suitable and desired form. For example, the first device may be a device having a fixed location, such as a personal computer or other computing resource. The first device may also comprise a device that is arranged to be positioned within a building or at an outdoor meeting point, such as a hotel, bar, restaurant, station or the like, and which typically is associated with only a single pick-up

location. In preferred embodiments, however, the first device comprises a mobile device, such as a mobile telephone, PDA, tablet computer or the like.

As will be appreciated, the server may be arranged to be in communication with any one or more of the types of first device mentioned above.

The first device is preferably capable of determining the current position of the device, and thus preferably comprises location determination means. The location determining means could be of any type. For example, the first device could comprise means for accessing and receiving information from WiFi access points or cellular communication networks, and using this information to determine its location. In preferred embodiments, however, the first device comprises a global navigation satellite systems (GNSS) receiver, such as a GPS receiver, for receiving satellite signals indicating the position of the receiver at a particular point in time, and which preferably receives updated position information at regular intervals.

The second device is associated with a vehicle that is capable of accepting a vehicle request submitted by a user, and is thus preferably of a form where it can be carried or transported in a vehicle. The second device may be a portable device, e.g. capable of being handheld, and which, for example, may be removably mounted within a vehicle. In other embodiments, the second device may be an in-vehicle system, i.e. that is permanently mounted within a vehicle. In preferred embodiments, the vehicle that carries the second device is a motor vehicle, such as a taxi or other similar powered vehicle. In other embodiments, the vehicle may be a human powered vehicle, such as a bicycle or rickshaw.

As will be discussed in more detail below, the second device is arranged to transmit positional data relating to the current position of the device, and thus the vehicle in which is it is associated, to the server. Accordingly, the second device is capable of determining the position of the device, and thus comprises location determination means. The location determining means could again be of any type. For example, a second mobile device could comprise means for accessing and receiving information from WiFi access points or cellular communication networks, and using this information to determine its location. In preferred embodiments, however, the second device comprises a global navigation satellite systems (GNSS) receiver, such as a GPS receiver, for receiving satellite signals indicating the position of the receiver at a particular point in time, and which preferably receives updated position information at regular intervals

The second device preferably also includes means for determining the relative displacement of the vehicle in which the device is carried, thereby allowing, for example, the speed and driving direction of the vehicle at any point in time to be determined. The means could comprise one or more electronic gyroscopes or accelerometers in the device, or the device could have access to such sensors in the vehicle itself, e.g. using the vehicle CAN bus.

Accordingly, in preferred embodiments, the second device that is utilised in the present invention comprises a navigation apparatus, such as portable navigation device (PND) that can be removably mounted within a vehicle or an in-vehicle navigation system, and which preferably includes GNSS signal reception and processing functionality. It will be appreciated, however, that the second device may also comprise a mobile telephone, PDA, tablet computer or the like running suitable software programs.

In the present invention, the server is arranged to receive at least a first location, e.g. a pick-up location, from the first device. The first location may be generated in any suitable manner. For example, the location may be input directly by the user on a user interface of the first device. This would be the case, for example, if the user wanted to be picked-up by a vehicle at a different location from their current location. In a preferred embodiment, however, the first location is generated at the first device using the device's location determination means. As will be appreciated this would typically be the case if the user wants to be picked-up by a vehicle at their current location.

The server is also arranged to receive a second location, e.g. a drop-off location, from either the first device (that submitted the vehicle request) or the second device. The calculated route is therefore preferably between a pick-up location and a drop-off location. The second location may also be the current geographical position of the second device, and thus the calculated route will be between the current location of the vehicle and the pick-up location. The second location may again be generated in any suitable manner. For example, the location may be input by the user on a user interface of the first device, or by the driver of the vehicle on a user interface of the second device. As will be appreciated, the server may receive the first and second locations at the same time, e.g. if they are both submitted with a vehicle request from a user. However, in other embodiments, the first and second locations may be received at different times, e.g. with the second location typically being received after the first location, such as when the user enters the requested vehicle and informs the driver of the desired destination.

As will thus be appreciated, the first and second devices comprise communication means for transmitting information to, and receiving information from, the other components of the system, such as the server. The information may comprise positional data, data to be displayed, route data, etc. The communication means can be of any type as desired. For example, the devices may comprise one or more physical connector interfaces by means of which data signals can be transmitted to and received from the device. In preferred embodiments, however, the communication means comprises one or more wireless transmitters/receivers to allow communication over cellular telecommunications and other signal and data networks, for example WiFi, GSM, GPRS and the like.

The vehicle request that is submitted by the first device, and subsequently received by the server, may only comprise data indicative of a first location, i.e. a pick-up location. In preferred embodiments, however, the vehicle request comprises additional data. For example, the vehicle request may comprise one or more of: data indicative of a desired pick-up time; vehicle preferences (e.g. size, model, disabled access, etc); data indicative of the number of people to be picked-up; a preferred driver and/or vehicle; and a desired driver rating.

The server preferably analyses the content of the received vehicle request, and selects a vehicle, i.e. a second device, that meets the criteria of the vehicle request. In other words, upon receipt of a vehicle request from a first device, the server is arranged to select a second device, from a plurality of available second devices, that matches the received vehicle request. The server may be arranged to make this selection in any suitable and desired manner. For example, the server may receive continual, e.g. periodic,

updates of the position and status of each of the vehicles having a second device, and which have the potential of meeting a received vehicle request. Some vehicles may, for example, be unavailable to meet a received vehicle request, e.g. because a vehicle may be completing a previous journey, or the driver of a vehicle may alternatively be taking a rest. The server is therefore aware of the vehicles that are available at a particular moment in time to accept a received vehicle request, in addition to the current position of the vehicle. Furthermore, and if a vehicle request is in relation to a predetermined time in the future – in contrast to a vehicle request from a user indicating that they would like to be picked-up immediately – the server is aware of the position and availability of vehicles at that future time, based on journeys that the vehicles may already be undertaking.

In the present invention, once the first and second locations have been received at the server, a route is calculated between the two locations using stored digital map data. As is known in the art, the digital map data comprises a plurality of navigable segments representing segments of a navigable route in a geographical area, e.g. roads that can be traversed by a vehicle. The digital map data may also comprise speed data for each navigable segment representative of an average speed of vehicles traversing the segment at different times, and which may be used to determine an estimated time of arrival (ETA) at the destination. The digital map data may also comprise, or have access to, historic and/or current traffic data, which can be used to modify the calculated route accordingly or vary the ETA.

The route calculated between the first and second locations will be a minimum cost route, such as the shortest distance or fastest time. The cost can be selected as desired, and may for example be dependent on the driver and/or user preference, such as the use or not of toll roads. The cost may also be selected based on the territory or country in which the vehicle is based, e.g. taxis in some areas charge according to the time of a journey, whilst in other areas taxis charge according to the distance of a journey.

The route calculated at the server is a route to be travelled by the vehicle carrying the second device. In some embodiments, the calculated route may be transferred to the second device from the communication means of the server, i.e. such that no route calculation is needed on the second device. Alternatively, in other embodiments, the route may be separately calculated on the second device. It will accordingly be appreciated that in such embodiments the server and the second device have access to the same digital map data, such that the same route will be calculated on both the server and the second device.

As discussed above, the server is arranged to receive positional data relating to the position of the second device over time. The positional data may be transmitted to the server in any suitable form that is representative of the position of the second device. For example, the positional data may comprise a pair of longitude and latitude coordinates, or it may comprise a location reference to a feature within a digital map, e.g. with respect to a road junction. As will be appreciated, the positional data is preferably associated with temporal data, e.g. a timestamp, representative of the time at which the positional data is generated at the second device. The positional data is preferably transmitted to the server from the second device at regularly intervals, e.g. at least every 5 minutes, and preferably at least every minute, or in some cases even more

frequently. The server can therefore determine the current position of the second device at a particular point in time from the received positional data to a high degree of accuracy.

In a preferred embodiment of the present invention, the server is further arranged to transmit data indicative of the calculated route (also referred to as "route data") and the received positional data (from the second device) to the first device, i.e. the device of the user that made the vehicle request. Preferably, the transmitted data is to be displayed on the first device, although in other embodiments the data may be further processed at the first device and/or used for a different purpose.

The server may transmit the positional and route data to the first device in any suitable form. For example, the route data may comprise a list of the navigable segments forming the route, and which are to be travelled by the vehicle. Additionally, or alternatively, the positional and route data may be transmitted in a form whereupon it can be superimposed on a digital map stored at the first device. In such embodiments, the digital map of the first device will typically be the same digital map as that found at the server (and thus second device), and which was used to calculate the route. The digital map on the first device may, in such embodiments, only comprise a portion of the data of the digital map of the server, e.g. segment geometry, segment connectivity, etc. Alternatively, in other embodiments, the positional and route data is superimposed on the digital map of the server, e.g. such that the data is transmitted (or streamed) to the first device for immediate display.

As will be appreciated, in preferred embodiments, the user of the first device is able to view the current position of the second device (and thus the vehicle in which it is positioned), together with the route that the second device should be traversing, superimposed on a digital map at least of the geographical area in which the user is located. The entire calculated route to be followed may be displayed to the user, e.g. from the origin (e.g. pick-up) location to the destination (e.g. drop-off) location. Alternatively, just the remainder of the route to be followed may be displayed to the user, e.g. from the vehicle's current position to the destination location. In yet other embodiments, only a portion of the calculated route may be displayed to the user, e.g. the portion of the route currently being travelled.

The user of the first device is therefore able to see if a driver is deviating from the calculated route by monitoring what is being displayed on the device. Accordingly, if a driver deviates from the optimum route, e.g. so as to take a longer route, either in terms of time and/or distance, then the user can inform the driver accordingly, make a complaint about the driver using their device, or in some cases send an alert to a third party, such as a contact stored on their device. In this regard, it will be appreciated that the positional and route data transmitted to the first device may additionally, or indeed alternatively, be transmitted to another device, for example, so as to be displayed on the other device. This other device may be a device mounted in the vehicle and viewable by the user whilst travelling in the vehicle, or the device may be a remote device, such as owned by the above mentioned third party. In such embodiments, the positional and route data may be transmitted to the other device from the first device or directly from the server, such as upon a request received from the first device.

Whilst the user may determine themselves from the first device whether the driver is following the calculated route, in preferred embodiments of the invention, the server may be further arranged to compare the position of the vehicle with respect to the calculated route, i.e. the route that it vehicle should be following. The comparison may be made at predetermined time intervals, e.g. each time new positional data is received from the second device. Alternatively, in other embodiments, the comparison can be made each time the vehicle reaches a decision point or junction in the road network, e.g. a point at which the driver is provided with a navigation instruction.

The result of the comparison may then be used to automatically make a determination that the driver has deviated from the calculated route. For example, if the vehicle is determined to have deviated from the calculated route by more than a predetermined amount, e.g. be more than a predetermined distance from the route, be more than a predetermined time of travel from the route, or has ignored a plurality (e.g. two, three or more) navigation instructions associated with the calculated route be more than a predetermined distance, then the vehicle may be said to no longer be following the optimum route.

As will be appreciated, the comparison and determination steps may be made using suitable processing means at the server. Thus, in preferred embodiments, processing means of the server is arranged to compare the received positional data and the calculated route, and to determine from said comparison whether said second device is traversing the calculated route. By tracking a device carried by a vehicle and comparing the movements of the device, and thus vehicle, to a calculated route allows the vehicle request management system to quickly determine whether a vehicle is carrying out an assigned journey, e.g. a journey to a pick-up location or a journey to a drop-off location. For example, in the case that it is determined a vehicle has deviated from an assigned route to a pick-up location, a new vehicle may be selected by the server to meet a vehicle request.

The determination that a vehicle has deviated from a calculated route may also result in a reduction of a rating associated with the driver of the vehicle. Such a reduction may occur immediately when a deviation is detected. Alternatively, in other embodiments, when the vehicle has completed the assigned journey, e.g. arrives at the drop-off location, a comparison is made between the estimated time of arrival and/or distance of the calculated route and the actual time of arrival and/or distance of the route travelled by the vehicle (which deviated from the calculated route). If the actual journey time and/or distance is less than the estimated time and/or distance, then it can be inferred that the deviation was valid, and that the driver's rating should not be reduced (despite the deviation from the calculated route). Conversely, of the actual time and/or distance is greater than the estimated time and/or distance, or greater than the estimated time and/or distance by more than a predetermined amount, e.g. by more than 1%, 5%, etc.

In an embodiment of the present invention, the server is arranged to determine the arrival at and/or departure from at least one of the first and second locations using one or both of the route data and received positional data. As will be appreciated by those skilled in the art, such a determination can be used, for example, to transmit alerts to the first device indicting the arrival and/or departure of the vehicle at the pick-up

location, and to allow route calculation and guidance on the second device to occur automatically without input from the driver.

Preferably, for one or both of the first and second locations, the server defines a geographical area containing the respective location. The geographical area could be defined in any suitable and desired manner. For example, the area could be a circle centred at the location and having a predetermined radius, such as a distance of between 50 to 500 metres, preferably about 250 metres. The area could be defined the same way for any location, or alternatively the geographical area may be defined in dependence on the location.

The route data calculated at the server provides an indication as the estimated time of arrival of the second device at the first and/or second location, as appropriate. Furthermore, the received positional data from the second device provides the server will an indication as to the speed of travel of the vehicle carrying the second device. As will be appreciated, the server can determine the speed of the vehicle by processing the positions and associated time data received from the second device. Alternatively, in other embodiments, the second device may transmit speed data to the server together with the positional data.

In a preferred embodiment, the server determines that a vehicle as arrived at a location when the positional data and route data indicates the vehicle has slowed and then stopped within the defined geographical area associated with the location for at least a predetermined period of time and at a time that is within a predefined time range including the estimated time of arrival at the location. The predetermined time range can be a time window of between 2 to 10 minutes centred about the estimated time of arrival, and the predetermined period of time can be between 1 and 5 minutes. Upon detection of the arrival of the vehicle at the location, data indicative of this determination can be sent to one or both of the first and second devices. Such data can be used, for example, to generate an alert on the first device that the requested vehicle has arrived at the pick-up location.

In additional embodiments, the server can determine that a vehicle has departed from a location when the positional data received from the second device indicates the vehicle has moved from a detected “arrived” condition and exits the geographical area associated with the location. Upon detection of the departure of the vehicle from the location, data indicative of this determination can again be sent to one or both of the first and second devices. Such data can be used, for example, when the first device is a fixed location device which can be used to make a plurality of simultaneous vehicle requests, to stop the request relating to the vehicle from being displayed on the device.

As will be appreciated, the present invention extends to a first and/or second device configured to operate with the vehicle request management system as described above. Furthermore, although certain steps have been described above as occurring only on the server, such as the determination as to whether the vehicle carrying the second device deviates from the calculated route, it will be appreciated that the steps could be made instead on one or both of the first and second devices, or on any combination of the first and second devices and the server, as appropriate.

It will also be understood by those skilled in the art that all of the described aspects and embodiments of the present invention can, and preferably do, include, as appropriate, any one or more or all of the preferred and optional features described herein.

The methods in accordance with the present invention may be implemented at least partially using software. It will thus be seen that, when viewed from further aspects, the present invention extends to a computer program product comprising computer readable instructions adapted to carry out any or all of he methods described herein when executed on suitable data processing means, such as a server.

The invention also extends to a computer software carrier comprising such software. Such a software carrier could be a physical (or non-transitory) storage medium or could be a signal such as an electronic signal over wires, an optical signal or a radio signal such as to a satellite or the like.

Advantages of these embodiments are set out hereafter, and further details and features of each of these embodiments are defined in the accompanying dependent claims and elsewhere in the following detailed description.

Brief Description of the Drawings

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

Figure 1 is an illustration of the structure of a vehicle request management system in accordance with the present invention;

Figures 2 and 3 show an exemplary fixed location device that can be used as a vehicle requesting device in the system;

Figure 4 is a schematic illustration of electronic components arranged to provide a navigation device associated with a vehicle in the system;

Figure 5 is a schematic illustration of the manner in which a navigation device may receive information over a wireless communication channel;

Figures 6 to 15 are exemplary display screens on a navigation device used in the system;

Figure 16 illustrates the steps of a method of automatically determining the arrival of a vehicle at a pick-up or drop-off location;

Figure 17 illustrates the steps of a method of forming an association between a mobile device carried by a user and navigation device in a vehicle.

Detailed Description of the Preferred Embodiments

The present invention, at least in preferred embodiments, is directed to a vehicle request management system, and in particular to a system for managing the requests for taxis between people and

the individual taxis. The architecture for a system in accordance with the present invention is described with reference to Figure 1.

As shown in Figure 1, the system comprises three principal components: a server 10; a plurality of vehicle requesting devices 12; and a plurality of vehicles 14, each being equipped with a device 200 having route planning and navigation functionality.

The vehicle requesting devices 12 can be of a number of different forms. For example, the vehicle requesting device could take the form of a fixed location device 20, as shown in Figures 2 and 3. A fixed location device, as the name suggests, is associated with only a single location and can only be used to request vehicles to this location. The vehicle requesting device can also take the form of a mobile device 22, such as a mobile telephone. Such mobile devices, as will be discussed in more detail below, are capable of determining their own location and can be used to request a vehicle to their current location, or any other location as desired. The vehicle requesting device can also be a computing resource 24, such as a desktop or portable personal computer, that does not have means for determining its own location, but nevertheless can still be used to request a vehicle pick-up at a particular location.

Each of the vehicle requesting devices 12 can be used by a user to send a request for a vehicle, such as a taxi, to the server 10. The request will typically include a pick-up location, or data that can be used to derive such a location, and may also include at least one of: a pick-up time; a drop-off location; a desired vehicle type or size (e.g. car, minivan, limousine, etc); the number of passengers to be picked-up; and any additional preferences, such as the need for a child seat, the need for disabled access or if a particular driver is desired. The vehicle requests can be transmitted to the server 10 using any suitable communication means, such as the mobile telecommunication network, the Internet, etc.

When a vehicle request is received at the server 10, the server will select a suitable vehicle 14 that meets the criteria set out in the request. The server 10 therefore functions as a dispatching system to dispatch a suitable vehicle based on the user's request.

The vehicles 14 are each equipped with a device 200 comprising a location determining means and a communication means for communicating with the server 10. The devices in the vehicles can be of any suitable form, but in illustrative embodiments are navigation apparatus. The navigation apparatus can be portable navigation devices (PNDs), which can be removably mounted in the vehicle, or a navigation device that is built into the vehicle. An illustrative representation of a navigation device 200 that can be positioned in one of the vehicles 14 is shown in Figure 4.

The vehicle devices each transmit their current location, and thus the location of the vehicle, to the server 10 at regular intervals. The server 10 therefore knows the current position of all vehicles within the system at any moment in time, at least to a reasonable degree of accuracy. The server is also aware of the current availability of a vehicle, e.g. whether a vehicle is already in the process of completing a request and whether the driver of the vehicle is unavailable for any other reason. In this regard, each driver may be able to input a range of times at which their vehicle is available to receive requests. Alternatively, the driver can

just activate or deactivate the device as desired. The driver may also input certain locations or areas where they will or will not operate.

The server 10 can select a vehicle 14 in response to a particular request, and thus form a temporary association between the requesting device 12 and the device 200 in the vehicle, according to one or more of the following systems: a bidding system; a rating-based system; and an automatic dispatching system. It will be understood, however, that any selection method or combination of selection methods could be used as desired at the server 10 to match a vehicle with a received request.

In a bidding system, each driver that is able to fulfil a vehicle request, is offered the opportunity to bid for a job. The bidding system can be a flower bid system wherein the job is offered to a plurality of drivers at a starting price that reduces over time until one driver accepts. Alternatively, the bidding system can be an auction bid system wherein each driver keeps bidding, and the highest bidder is awarded the job.

In a rating-based system, each driver is awarded a particular rating, e.g. based on previous customer reviews, and the customer request can include a desired driver rating that must be met. The job is accordingly only offered to those drivers with a rating equal to or better than the requested rating.

Meanwhile, in an automatic dispatching system, the server 10 assigns the vehicle request to a particular vehicle 14 based on one or more criteria, e.g. to minimise any waiting time by the vehicle based on their predicted arrival time at the requested location. The criteria can include, for example, the closest vehicle in terms of distance and/or time. This allows jobs to be assigned in an efficient manner, e.g. reducing mileage, fuel consumption, maintenance costs, fuel-related taxes, etc, of the vehicles. As will be appreciated, a driver may refuse a job, e.g. through a suitable user-input on their navigation device, even if they are selected by the server 10 as the most suitable.

Once a job has been given to a vehicle, and then accepted by the driver of the vehicle, and in some circumstances also accepted by the user who made the request, then an association is made between the requesting device and the navigation device in the vehicle. This association allows data to be exchanged between the two devices, until such a time as the association is broken, e.g. when the trip has been completed and a payment made.

Once a vehicle has won a job, details of the job are sent to the vehicle's navigation device 200. The details will include the pick-up location, and may also include the details of the person who made the request. The navigation device can automatically, or upon an input by the driver, calculate a route from the vehicle's current position to the pick-up location, and begin guiding the driver to the location. Alternatively, if the vehicle is currently finishing a job, the pick-up location can be temporarily stored in memory until it is needed, or a route can be calculated to the pick-up location using the drop-off location for the current job as a waypoint. Following the calculation of a route, an estimated time of arrival (ETA) at the pick-up location is generated, and this can be supplied to the requesting device 12. An updated ETA can be sent to the requesting device 12 whenever needed, e.g. if the ETA changes as the vehicle travels the calculated route.

The server 10 and the navigation device 200 of the vehicle 14 each have, or have access to, the same digital map data that can be used for route calculation. The map data can include, or be

supplemented, with historical and/or current traffic information, weather information, the presence of taxi-lanes or other information that may impact the optimum route and/or estimated time of arrival. Accordingly, the server 10 is aware of the route that will be calculated at the navigation device 200 of the vehicle, and can, for example, determine if the vehicle is deviating from the route that it should be following. If the server 10 identifies such a deviation, it may alert the passenger or another third party, or it may reduce the rating of the driver accordingly. The server 10 may also pass the request to another vehicle if the original vehicle is still heading away from the pick-up location. As there may be valid reasons for this deviation, which are not included in the digital map data available to the server, e.g. closed roads, accidents, road works, etc, in preferred embodiments, the deviation determination algorithm at the server 10 compares the actual time of arrival of the vehicle at the destination with the estimated time of arrival, and reduces the driver's rating only if the actual time is greater than the estimated time by more than a predetermined amount.

Upon picking up the user at the pick-up location, the navigation device 200 of the vehicle 14 will guide the driver to the desired drop-off location. The drop-off location could have been provided by the user in the original vehicle request, or it may be given to the driver by the passenger upon pick-up. Upon arrival at the drop-off location, the passenger will pay for the trip. The payment could be made using cash or by using a credit or debit card, however, preferably the passenger will have an account on the server 10 to which the trip can be assigned thereby allowing payment to be made electronically.

One form that the vehicle requesting devices 12 can take is a fixed location device 20. An example of a fixed location device is shown in Figures 2 and 3.

The fixed location device 20 is arranged to be positioned within a building or outdoor meeting point, such as a hotel, bar, restaurant, shopping mall, train station or the like, and be associated with a single pick-up location. The pick-up location may be the device's actual location, or it may be a location in the vicinity of the device, such as the street entrance of the hotel or bar, or the nearest point on the street where a taxi can safely stop.

The fixed location device 20 is configured to allow multiple vehicle requests to the pick-up location associated with the device to be placed, and have more than one of these requests pending at any one time. As shown in Figure 2, the device 20 has a first button 126 by means of which a user can make a vehicle request. In an embodiment, the button must be pressed for a predetermined period of time, such as 1 second, before a request is triggered. The device 20 also has a second button 128 by means of which a previously made vehicle request can be cancelled. Within a casing 122 of the device 20 is a means for communicating with the server 10. This will typically be a mobile telecommunications module, such as a GSM or GPRS. Additionally, or alternatively, the device 20 may contain a WiFi module, e.g. for areas with limited mobile telecommunications coverage. Such modules are preferably located on a printed circuit board (PCB) 136 within the casing 122 (as shown in Figure 3). The device 20 may also have a physical connection to the Internet, however, such an arrangement limits where the device 20 can be positioned.

The device 20 has a connection to an external power source 138, but it will be understood that the device 20 may additionally or alternatively have a battery or other internal power source.

The device 20 further comprises an output means, such as a LED or other similar light emitting device 130, and/or a speaker, which in preferred embodiments is used to indicate when a vehicle is within a predetermined distance of the pick-up location or has arrived at the pick-up location.

When the button 126 is pressed, a vehicle request is transmitted to the server 10 containing a reference number associated with the device 20. The server 10 has a list of reference numbers, one for each of the fixed location devices in the system, and a pick-up location associated with each reference number. This limits the amount of data that needs to be contained in the transmitted vehicle request, and also allows the pick-up location associated with a device 20 to be easily changed.

The device 20 has an associated display 124, which is used to display a message for each pending request; the message indicating the current status of the request. The display 124 may be located within the casing 22 of the device 20, as is shown in Figure 2. In other embodiments, however, the display 124 may be separate from the device, e.g. positioned on a nearby wall. For example, the message can initially say that a request has been placed. It is then changed to say that a vehicle has accepted the request and is en-route to the pick-up location. This message may also include details of the vehicle, the driver and/or the ETA at the pick-up location. The message can then change to indicate that the vehicle has arrived at the pick-up location.

A message is removed from the display when an indication is received from the server 10 that the vehicle associated with the request has left the pick-up location. This determination can be made automatically at the server 10, e.g. by determining that the vehicle has stopped within an area containing the pick-up location for a predetermined period of time and has then moved outside of the area (as will be discussed in more detail below). Alternatively, the driver of the vehicle can indicate on their navigation device 200 that they are leaving the pick-up location, and this indication can be transmitted via the server 10 to the device 20.

The device 20 is arranged is to affixed to a flat surface 142, such as a table, bar area or wall. The device 20 therefore has openings 134 through which screws 140 can be placed to fix the device to the surface 142. The base 135 of the device 20 also has support features, such as rubber feet 132, to aid in securing the device at a single location and preventing the device 20 from moving on a wet surface as may often be found in an environment such as a bar or restaurant. For this reason, the casing 122 of the device will typically be water resistant.

Another form that the vehicle requesting device 12 can take is a mobile device 22, such as a mobile telephone, tablet computer, portable digital assistant (PDA).

The mobile device 22 is located within a housing that includes a processor connected to an input device and a display screen. The input device can include a keyboard device, voice input device, touch panel and/or any other known input device utilised to input information; and the display screen can include any type of display screen, such as an LCD display. In a particularly preferred arrangement, the input device and display screen are integrated into an integrated input and display device, including a touchpad or

touchscreen input so that a user need only touch a portion of the display screen to select one of a plurality of display choices or to activate one of a plurality of virtual buttons.

The mobile device 22 has a location determination means, which is capable of determining the current location of the device 22. In a preferred embodiment, the location determination means is a global navigation satellite system (GNSS) receiver, such as a GPS receiver, that receives and processes satellite broadcast signals, including location data, to determine a current location of the device.

A software application runs on a processor of the mobile device 22 that allows a user to create a vehicle request, and to send this vehicle request to the server 10. The vehicle request is sent to the server 10 using a wireless communications module, such as a GSM or GPRS module. The vehicle request will include a pick-up location, which may be the current location of the mobile device 22 (obtained from the GNSS receiver) or can be a location input by the user on the input device. The vehicle request may also include a drop-off location, which again can be selected by the user on the input device, and may also include a pick-up time. The pick-up time can be an indication that a taxi is required as soon as possible, or it may be a specific future time that is input by the user on the input device.

As described above, once the vehicle request from the mobile device 22 is received at the server 10, a vehicle 14 is selected that meets the criteria in the request. A temporary association is then formed between the two devices at the server 10, i.e. such that the two devices will be linked on the system until the requested journey has been completed. The server 10 will transmit details of the selected vehicle 14 to the mobile device 22. The details can include: information about the vehicle, such as model, colour, registration number, etc; information about the driver, such as a picture, name, telephone number, etc; and information about the current position of the vehicle and/or the route that the vehicle will travel to the pick-up location and/or the estimated time of arrival at the pick-up location. The server 10 may continually send the position of the selected vehicle 14 to the mobile device 22, such that the user can see the progress of the vehicle as it travels to the pick-up location.

The user may include a preferred driver or set of drivers that they would like for their requested journey in the request that is transmitted to the server 10. Alternatively, a user may have a one or more preferred drivers associated with a profile stored on the server 10. The server 10 takes account of the preferred driver or drivers when selecting the vehicle to complete the request.

The arrival of the vehicle 14 at the pick-up location is transmitted to the mobile device 22, and an suitable alert is provided to the user. The alert may be a visual alert on the display screen of the device, an audible alert, a haptic alert, or any combination thereof. The arrival of the vehicle at the pick-up location may be automatically determined by the server 10, e.g. as discussed in more detail below. Alternatively, the vehicle's arrival may be determined when the driver provides an indication on their navigation apparatus 200. In addition to providing such an alert, an indication may be provided on the mobile device 22 as to the current position of the vehicle 14 at the pick-up location. The indication can be, for example, a directional pointer or arrow that points towards the current location of the vehicle 14, as received from the server 10, from the current location of the mobile device 22. This pointer could generated using any suitable means within the

mobile device 22, such as one or more of a compass, gyroscope and accelerometers. The use of such a pointer or arrow allows a user to identify his or her vehicle 14 even when, for example, it is parked on the street next to a number of other taxis, and thus be difficult for the user to identify.

When the user has found and entered the selected vehicle 14, the driver of the vehicle may immediately start travelling towards the drop-off location, if it was already known from the original vehicle request. Alternatively, the user may simply inform the driver directly of the drop-off location, and then the driver may input the destination into their navigation apparatus 200. In other embodiments, and due to the temporary association that is formed at the server 10 between the two devices, the user may input a desired drop-off location on their mobile device 22 and transmit this destination to the navigation device 200 of the vehicle. The user may even do this after providing the driver with an approximate destination so that the driver can begin the journey before a final drop-off location has been provided. As will be understood, this functionality also would allow the user to modify the drop-off destination en-route should this be desired.

During the journey from the pick-up location to the drop-off location, the user may be able to see on the display of their mobile device 22, a representation of the route that is being travelled by the vehicle together with the current position of the navigation apparatus, and thus the vehicle. The route information and position of the vehicle will be received from the server 10. The user is therefore able to see if the driver is travelling along the optimum route that has been determined by the navigation apparatus. Should the driver deviate from this route, then this can be seen by the user and they can enquire with the driver, if needed, as to the reason for the deviation. The software application running on the mobile device may also include a means by which the user can send an alert to the server 10 or to another third party if they feel uncomfortable in the vehicle in which they are travelling. This alert could be automatically generated at the server 10 by determining if the driver has deviated from the planned route by more than a predetermined amount, e.g. if more than a predefined number of navigation instructions are ignored by the driver or the vehicle is a predefined distance away from the calculated route. The user may be asked to confirm any automatically generated alert on their mobile device 22 before it is sent.

The payment for the journey may be made automatically, for example, by the user setting up an account on the server 10 having a certain amount of money associated with it. The cost of the journey may simply be deducted from the user's account. This may happen automatically, or upon confirmation from the driver and/or user on their respective devices as to the amount of money to be paid.

At the end of the journey, the user can also use their mobile device 22 to provide a rating of the journey and/or of the driver. This rating will be transmitted to the server 10 and associated with the relevant driver's details held at the server 10. The driver's rating can, as discussed above, be used by the user and/or server 10 when selecting a vehicle to complete a vehicle request. The rating associated with a driver may also be automatically reduced if the server 10 determines that the driver did not follow the calculated optimum route, and as a result caused the user's journey to be longer than necessary, either in terms of time and/or distance.

Figure 4 is an illustrative representation of a navigation device 200 that can be positioned in one of the vehicles 14. The navigation device 200 is shown in block 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 described in the following paragraphs as being a portable navigation device (PND) that can be removable mounted in a vehicle. It will be understood, however, that the navigation device 200 could in other embodiments be built into the vehicle.

The navigation device 200 will typically comprise digital map data having a plurality of navigable segments representing segments of a navigable route in a geographical area covered by the map. The digital map data is used by the navigation device 200 to calculate routes between locations that can be traversed by the vehicle carrying the navigation device, and to provide suitable navigation instructions to driver to guide him or her along the calculated route.

The navigation device 200 is location within a housing (not shown). The housing includes a processor 202 connected to an input device 204 and a display screen 206. The input device 204 can include a keyboard device, voice input device, touch panel and/or any other known input device utilised to input information; and the display screen 206 can include any type of display screen such as an LCD display, for example. In a particularly preferred arrangement the input device 204 and display screen 206 are integrated into an integrated input and display device, including a touchpad or touchscreen input so that a user need only touch a portion of the display screen 206 to select one of a plurality of display choices or to activate one of a plurality of virtual buttons.

The navigation device 200 may include an output device 208, for example an audible output device (e.g. a loudspeaker). As output device 208 can produce audible information for a user of the navigation device 200, it is should equally be understood that input device 204 can include a microphone and software for receiving input voice commands as well.

In the navigation device 200, processor 202 is operatively connected to and set to receive input information from input device 204 via a connection 210, and operatively connected to at least one of display screen 206 and output device 208, via output connections 212, to output information thereto. Further, the processor 202 is operably coupled to a memory resource 214 via connection 216 and is further adapted to receive/send information from/to input/output (I/O) ports 218 via connection 220, wherein the I/O port 218 is connectible to an I/O device 222 external to the navigation device 200. The memory resource 214 comprises, for example, a volatile memory, such as a Random Access Memory (RAM) and a non-volatile memory, for example a digital memory, such as a flash memory. The external I/O device 222 may include, but is not limited to an external listening device such as an earpiece for example. The connection to I/O device 222 can further be a wired or wireless connection to any other external device such as a car stereo unit for hands-free operation and/or for voice activated operation for example, for connection to an 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.

Figure 4 further illustrates an operative connection between the processor 202 and an antenna/receiver 224 via connection 226, wherein the antenna/receiver 224 can be a GPS antenna/receiver for example. It will be understood that the antenna and receiver designated by reference numeral 224 are combined schematically for illustration, but that the antenna and receiver may be separately located components, and that the antenna may be a GPS patch antenna or helical antenna for example.

Further, it will be understood by one of ordinary skill in the art that the electronic components shown in Figure 4 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 4 are considered to be within the scope of the present application. For example, the components shown in Figure 4 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 4 can be connected or "docked" in a known manner to a vehicle such as a bicycle, a motorbike, a car or a boat for example. Such a navigation device 200 is then removable from the docked location for portable or handheld navigation use.

Referring now to Figure 5, the navigation device 200 may establish a "mobile" or telecommunications network connection with a server 302 via a mobile device (not shown) (such as a mobile phone, PDA, and/or any device with mobile phone technology) establishing a digital connection (such as a digital connection via known Bluetooth technology for example). Thereafter, through its network service provider, the mobile device can establish a network connection (through the internet for example) with a server 302. As such, a "mobile" network connection is established between the navigation device 200 (which can be, and often times is mobile as it travels alone and/or in a vehicle) and the server 302 to provide a "real-time" or at least very "up to date" gateway for information.

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

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

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

The navigation device 200 may include its own mobile phone technology within the navigation device 200 itself (including an antenna for example, or optionally using the internal antenna of the navigation device 200). The mobile phone technology within the navigation device 200 can include internal components as specified above, and/or can include an insertable card (e.g. Subscriber Identity Module or SIM card), complete with necessary mobile phone technology and/or an antenna for example. As such, mobile phone technology within the navigation device 200 can similarly establish a network connection between the navigation device 200 and the server 302, via the internet for example, in a manner similar to that of any mobile device.

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

In Figure 5 the navigation device 200 is depicted as being in communication with the server 302 via a generic communications channel 318 that can be implemented by any of a number of different arrangements. The server 302 and a navigation device 200 can communicate when a connection via communications channel 318 is established between the server 302 and the navigation device 200 (noting that such a connection can be a data connection via mobile device, a direct connection via personal computer via the internet, etc).

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 4, 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. 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. 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, the communication channel 318 can be adapted to provide a path for electrical, optical, and/or electromagnetic communications, etc. As such, the communication channel 318 includes, but is not limited to, one or a combination of the following: electric circuits, electrical conductors such as wires and coaxial cables, fibre optic cables, converters, radio-frequency (RF) waves, the atmosphere, empty space, etc. Furthermore, the communication channel 318 can include intermediate devices such as routers, repeaters, buffers, transmitters, and receivers, for example.

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

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

The server 302 includes a remote server accessible by the navigation device 200 via a wireless channel. The server 302 may include a network server located on a local area network (LAN), wide area network (WAN), virtual private network (VPN), etc. In other embodiments, 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 automatically or upon a user connecting navigation device 200 to the server 302 and/or may be more dynamic upon a more constant or frequent connection being made between the server 302 and navigation device 200 via a wireless mobile connection device and TCP/IP connection for example. For many dynamic calculations, the processor 304 in the server 302 may be used to handle the bulk of the processing needs, however, processor 210 of navigation device 200 can also handle much processing and calculation, oftentimes independent of a connection to a server 302.

In preferred embodiments, the navigation device 200 is arranged to store a number of user profiles, such that the same device can be used by a number of different people. This is beneficial when the navigation device 200 is used within a taxi or other similar vehicle, which will often be shared between a number of different drivers. When a particular user logs onto the device, e.g. by touching the “Driver A” icon 400 or by entering his or her details using the “new user” icon 402 (as shown in Figure 6), an indication of this selection is sent to the server 10, such that the server can associate the driver with the vehicle. The correct driver details and/or rating can accordingly be supplied to a user when the vehicle is selected to complete a submitted vehicle request from the user.

When a vehicle request is received at the server 10, one or more suitable vehicles 14 are selected and the request is transmitted to the navigation device 200 within the or each vehicle. An exemplary screen that is shown on the navigation device 200 can be seen in Figure 7. In this instance, the vehicle request 404 relates to a person that is asking for a vehicle as soon as possible at a location in the centre of the city of Amsterdam.

In the lower left hand corner of the screen of Figure 7 is a selected icon marked “Break” 406. The driver can touch this icon at any time to indicate they are not available to take requests at the current time. As will be appreciated, when the icon 406 is touched, then an indication is transmitted to the server 10 from the navigation device 200 to notify the system that the vehicle is not currently available.

If the driver should touch the vehicle request message 404, then the navigation device pans the displayed map such that it is centred at the pick-up location associated with the request. The pick-up location is highlighted on the screen, e.g. by a circle 410 and/or by fading or greying the other portions of the map display, such that the driver can quickly identify the pick-up location. The current position of the vehicle 408 is also shown on the screen, again to aid the driver in identifying the pick-up location. If the driver wishes to apply for the vehicle request, then they can touch the icon 414. Alternatively, if the driver wishes to decline the vehicle request, then they can touch the icon 412.

If the driver applies for the vehicle request 404, then they will either win the request as shown in Figure 9 or lose the request as shown in Figure 10.

If the driver wins the request, then full details of the vehicle request will be sent by the server 10 to the navigation device 200. For example, for the vehicle request in question, and as shown in Figure 11, the request has been submitted by or on behalf of a Jonathan Miller Johnson. The details of the request will include at least the pick-up location (A) 424; in this case the Damrak in the centre of Amsterdam. The driver will also see the date of the request – 425 and an estimated time of arrival at the pick-up location – 423. The ETA at the pick-up location is determined by the navigation device 200 planning a route from the current location of the vehicle to the pick-up location, which in preferred embodiments takes account of historic, current and/or estimated future traffic conditions. As shown in Figure 11, the request may also include a message from the user indicating where they are currently located, e.g. "I'm standing in front of the yellow phone booth", and an icon 422 that allows the driver to contact the user.

The trip details screen shown in Figure 11 can be accessed at any time throughout a journey by the driver, and the information contained therein will be updated to reflect the current status of the journey. For example, when the user has been picked up at location A and has provided a destination location to the driver, then the screen will also include details of this location and an associated ETA. The trip details screen can also be used by the driver to cancel a trip that they had previously accepted. This can be done by selecting the "cancel trip" icon 426, and a suitable message will be sent to the server 10. The message may include a reason for the cancellation, such as traffic, the vehicle being in an accident or the vehicle breaking down. Upon receipt of such a cancellation, appropriate action can be taken at the server 10, such as sending another vehicle to the pick-up location and notifying the user accordingly, or, in the case that the current vehicle has broken down, sending another vehicle to location of the current vehicle. The rating of a driver could be automatically decreased by a certain amount if a trip is cancelled without a valid reason.

Once a trip is accepted and/or won by a driver, the navigation device 200 will automatically calculate a route to the pick-up location and provide guidance to the driver. This is shown, for example, in Figure 12. The arrival of the vehicle at the pick-up location can be indicated by the driver selecting the "arrived at pick up" icon 428, again as shown in Figure 12. It is also contemplated, however, that the arrival of the vehicle at the pick-up location may be determined automatically at the server 10, and a message indicative thereof being sent to the navigation device 200. The manner by which the server 10 can automatically detect the arrival and/or departure of a vehicle from a particular location will be described in more detail below.

When the vehicle reaches the pick-up location (A), the navigation device 200 will display the screen shown in Figure 13. The user will, at this point, get into the vehicle and if a drop-off location has not yet been provided, i.e. in the original vehicle request, then the driver will ask the user for the drop-off location. This may be input by the driver on the navigation device 200, or it may be provided by the user on the requesting device, e.g. mobile device 22. Once a drop-off location has been provided, then the driver can select the "go to drop off" icon 430 (as shown in Figure 13), and the navigation device 200 will calculate a route from the pick-up location (A) to the drop-off location (B) and provide navigational guidance to the driver.

As shown in Figure 13, if the driver and user are not able to immediately locate each other when the vehicle reaches the pick-up location, the driver can attempt to contact the user using the "contact customer"

icon 432. If the driver is still not able to locate the user, then they can select the "no show" icon 434, whereupon a suitable message is sent to the server 10. The server 10 may decrease a rating of the user associated with their account following such an event. This prevents a user from abusing the system and continually making invalid vehicle requests.

As the driver is guided to the drop-off location, a screen such as that shown in Figure 14 will be displayed on the navigation device 200. As with the arrival at the pick-up location, the arrival of the vehicle at the drop-off location can be indicated by the driver selecting the "arrived at drop off" icon 436, as shown in Figure 14. It is again contemplated, however, that the arrival of the vehicle at the drop-off location may be determined automatically at the server 10, and a message indicative thereof being sent to the navigation device 200.

When the vehicle reaches the drop-off location (B), the navigation device 200 will display the screen shown in Figure 15. From this screen, the driver can see a summary of the completed journey 438, including the journey time and distance. The driver can end the journey by selecting the "end trip" icon 439, which can cause a message to be sent by the server 10 to a mobile device 22 of the user to confirm payment for the journey. The driver can also select the "give feedback" icon 440 to provide information about the journey and/or the user. For example, the driver can indicate that they do not wish to receive further vehicle requests form the user.

The manner by which the server 10 can automatically determine the arrival of a vehicle at a pick-up or drop-off location will now be described with reference to Figure 16.

The server 10 defines a geographical area containing the pick-up or drop-off location - 500. Typically, this area is a circle of radius 250m centred at the location. The positional data relating to the vehicle travelling to the location can then analysed to determine if the vehicle has slowed down and stopped for a predetermined period of time within the defined area and has stopped at a moment in time that is within a time window containing the estimated time of arrival associated with the calculated route - 504. By utilising the ETA of the calculated route in the arrival detection algorithm, a chances of mistakenly determining that the vehicle has arrived at a location when in fact the vehicle is, for example, stopped at traffic lights on an adjacent road, are substantially reduced.

In the above description, it is assumed that the user will have made a request for a vehicle using one of the described vehicle requesting devices 12 and that they will enter the vehicle when it arrives at the requested pick-up location. In this scenario, the transmission of the vehicle request results in a temporary association being formed at the server 10 between the vehicle requesting device 12 and the vehicle 14. This temporary association can then be used to provide many of the benefits associated with the present invention, such as electronic payment, modifying the drop-off location en-route, rating the driver and/or passenger, and the passenger viewing the route that should be travelled by the vehicle. It will be understood, however, that if a user hails a nearby passing vehicle, then no such temporary association will be made even if both the user and the vehicle are part of the vehicle request management system of the present invention.

This problem can be overcome by using the method illustrated in Figure 17.

When a user hails a passing taxi, they can send an indication to the server 10 using their mobile device 22 that they have or are about to enter a vehicle 14 - 600. This indication can be generated, for example, simply by opening the appropriate software application on their mobile device 22. Using the positional data that is sent to the server 10 from the mobile device 22, and which is indicative if the position and movements of the mobile device 22, the server 10 can identify those vehicles that are within a predefined geographic area containing the mobile device 22. This area may be circle, e.g. having a radius of about 30 meters, centred at the current location of the mobile device 22 - 604. Once any such vehicles have been identified, then a comparison can be made at the server 10 between the positional data received from the mobile device 22 and the positional data of the identified vehicles to determine if any of the vehicles are moving concurrently with the mobile device 22 along the same travel path. Such concurrent movement can be indicated by similar speeds, accelerations, directional changes, and the like. If only a single vehicle is identified as moving concurrently with the mobile device 22, then it can be inferred that this must be the vehicle in which the user is currently travelled and the server 10 forms associates the mobile deice 22 with the navigation apparatus 200 within the vehicle. Alternatively, if a plurality of candidate vehicles are identified, then a list of the vehicles with suitable identification information, e.g. details of the vehicle and/or driver, are sent by the server 10 to the mobile device 22 - 608. The user can then select the appropriate vehicle from the list on the mobile device 22, and this selection can then be transmitted back to the server 10 - 610. The server 10 will then associate the mobile device 22 with the navigation device 200 within the selected vehicle - 612.

It will appreciated that whilst various aspects and embodiments of the present invention have heretofore been described, the scope of the present invention is limited to the particular arrangements set out herein and instead extends to encompass all arrangements, and modifications and alterations thereto. For example, whilst the embodiments described in the foregoing description refer to GPS, it should be noted that the devices may utilise any kind of position sensing technology as an alternative to, or indeed in addition to, GPS. For example, the devices may utilise other global navigation satellite systems, such as the European Galileo system. Equally, it is not limited to satellite-based systems, but could readily function using ground-based beacons or other kind of system that enables the device to determine its geographic location.

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

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

CLAIMS:

1. A vehicle request management system, the system having a server comprising:

communication means arranged to communicate with a first device and a second device associated with a vehicle, the communication means being further arranged to receive a vehicle request from the first device, the vehicle request comprising a first location, and the communication means being further arranged to receive a second location from the first device or the second device;

data storage means comprising digital map data having a plurality of navigable segments representing segments of a navigable route in a geographical area covered by the map; and

processing means arranged to calculate a route between the received first location and second location to be travelled by the vehicle associated with the second device using the digital map data;

wherein said communication means is further arranged to receive positional data relating to the position of the second device over time.

2. The system of claim 1, wherein the first device comprises a mobile device having location determining means arranged to determine the current geographical position of the device, and the first location comprises the current geographical position of the first device.

3. The system of claim 1, wherein the first device has an associated location stored at the server, and the first location corresponds to said associated location.

4. The system of any one of the preceding claims, wherein the first location comprises a pick-up location.

5. The system of any one of the preceding claims, wherein the second location comprises a drop-off location or the current geographical position of the second device.

6. The system of any one of the preceding claims, wherein the second device comprises a navigation device positionable within the vehicle and arranged to calculate a route between the first and second locations to be travelled by the vehicle, said route being substantially identical to the route calculated at the server.

7. The system of any one of the preceding claims, wherein the vehicle request further comprises one or more of: data indicative of a desired pick-up time; at least one vehicle preference; at least one driver preference; and data indicative of the number of people to be picked-up.

8. The system of any one of the preceding claims, wherein the processing means is arranged to analyse the content of the received vehicle request and select a vehicle that meets the criteria of the vehicle request, said first device being associated with the second device of the selected vehicle.

9. The system of any one of the preceding claims, wherein the communication means is arranged to transmit data indicative of at least a portion of the calculated route and the received positional data to the first device, optionally for display thereon.

10. The system of any one of the preceding claims, wherein the processing means is arranged to compare the received positional data with the calculated route, and to determine if the vehicle deviates from the calculated route.

11. The system of claim 10, wherein if the vehicle is determined to have deviated from the calculate route, the processing means is further arranged to compare the actual journey time and/or distance with the estimated journey time and/or distance associated with the calculated route, and to reduce a rating of the driver if the comparison indicates the actual journey time and/or distance is greater than the estimated journey time and/or distance.

12. The system of any one of the preceding claims, wherein the processing means is arranged to determine the arrival of the vehicle at and/or the departure of the vehicle from at least one of the first and second locations using data associated with the calculated route and the received positional data.

13. The system of claim 12, wherein the communication means is arranged to transmit an indication of the determined arrival and/or departure of the vehicle to at least one of the first device and second device.

14. A method of managing vehicle requests at a server between a first device and a second device associated with a vehicle, the method comprising:

receiving a vehicle request at the server from the first device, the vehicle request comprising a first location;

receiving a second location at the server from the first device or the second device;

calculating a route between the received first location and second location to be travelled by the vehicle associated with the second device using digital map data stored at the server having a plurality of navigable segments representing segments of a navigable route in a geographical area covered by the map; and

receiving positional data at the server relating to the position of the second device over time.

15. A computer program product comprising computer readable instructions executable to perform a method according to claim 14.

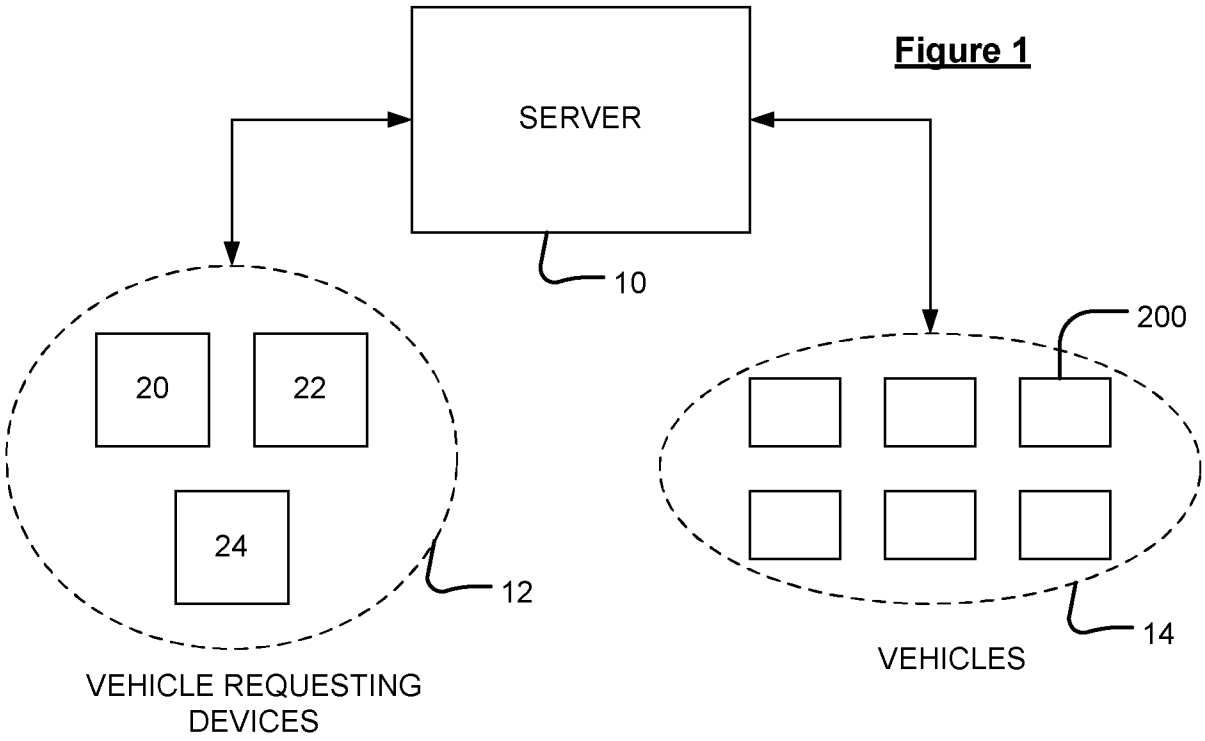


Figure 1

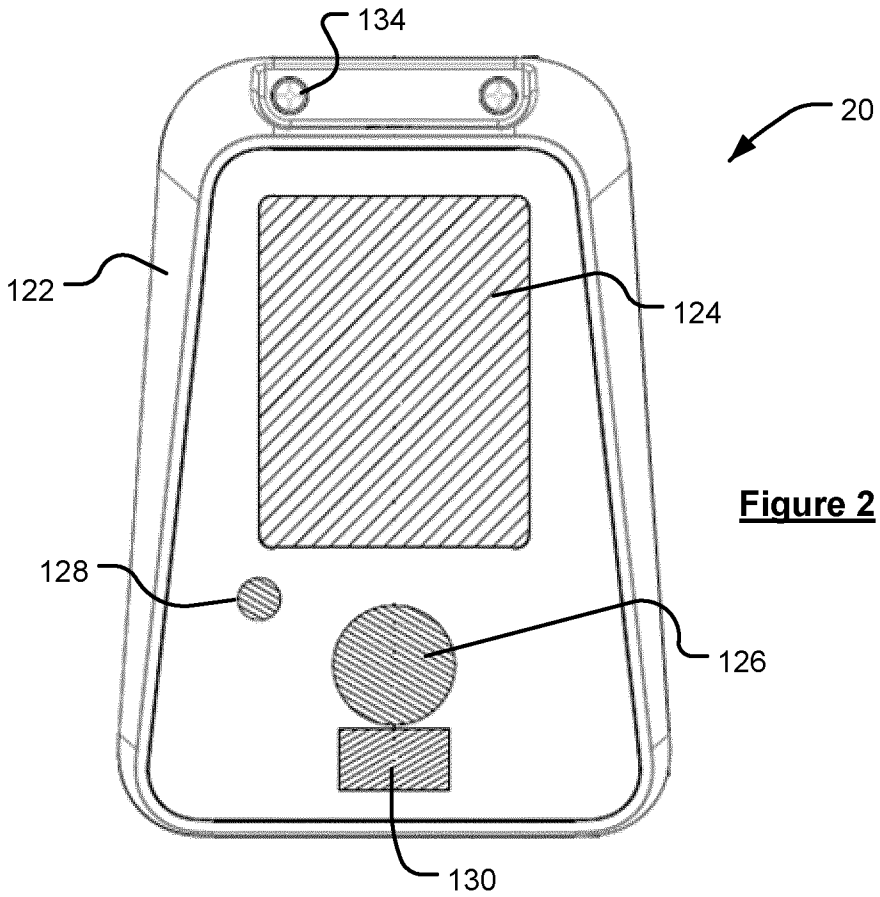


Figure 2

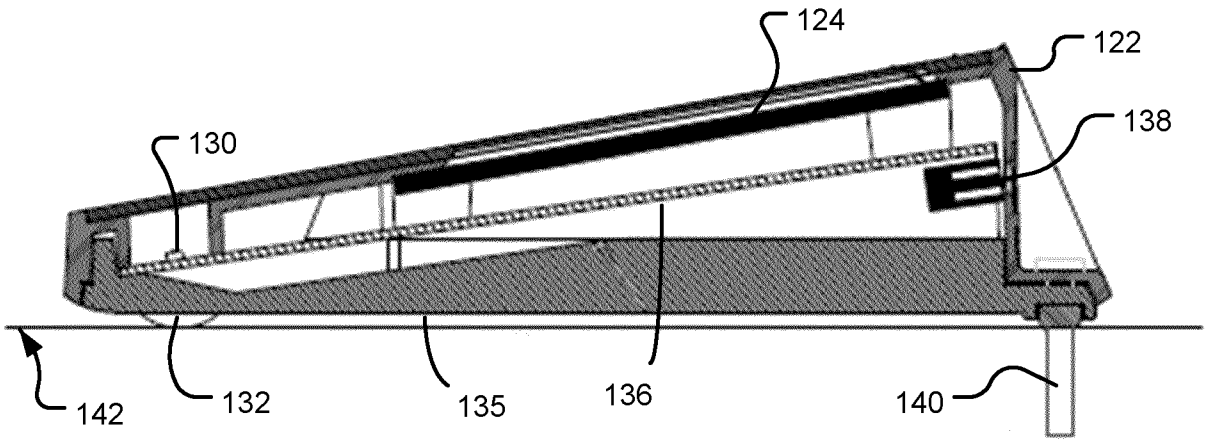


Figure 3

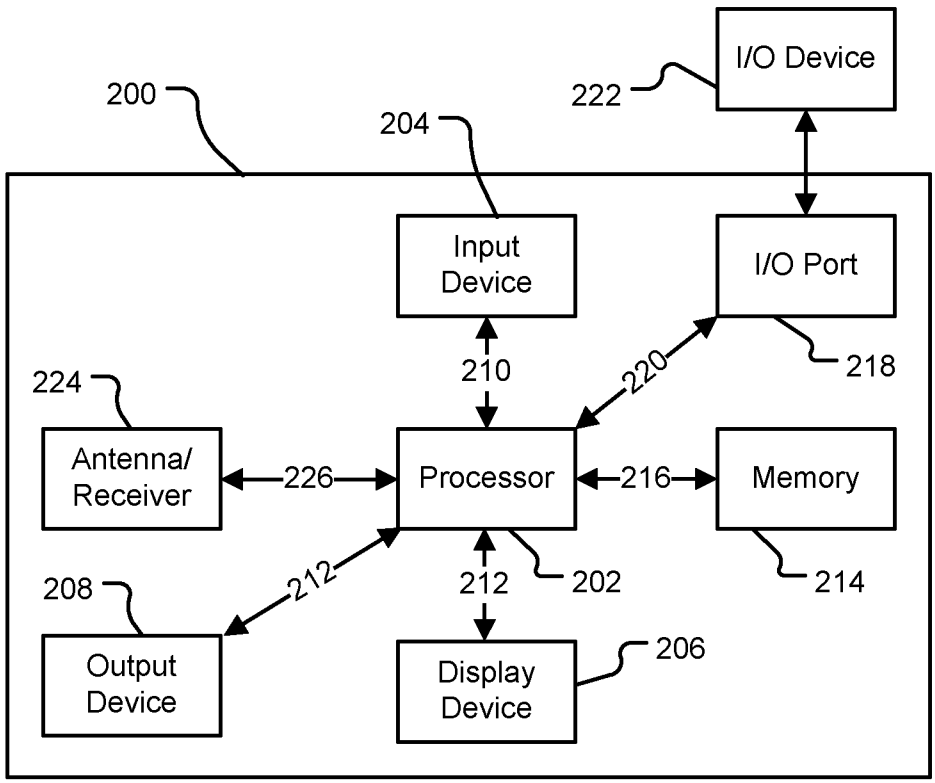
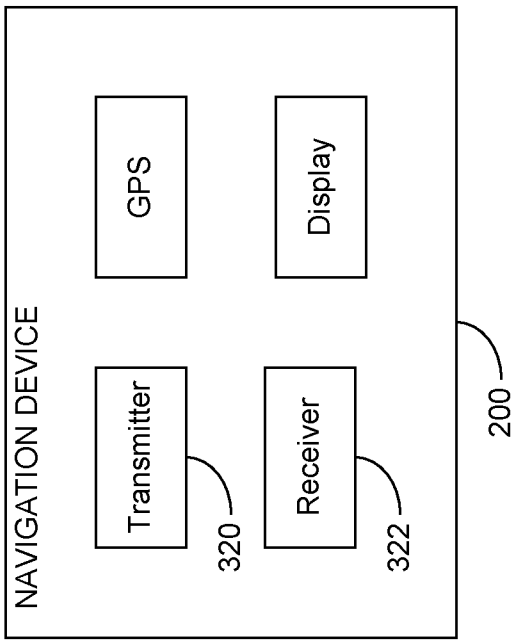
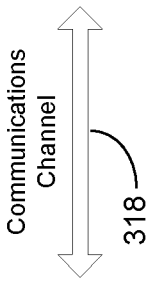


Figure 4


NAVIGATION DEVICE
GPS
Display
Transmitter
320
Receiver
322
200


Communications Channel
318

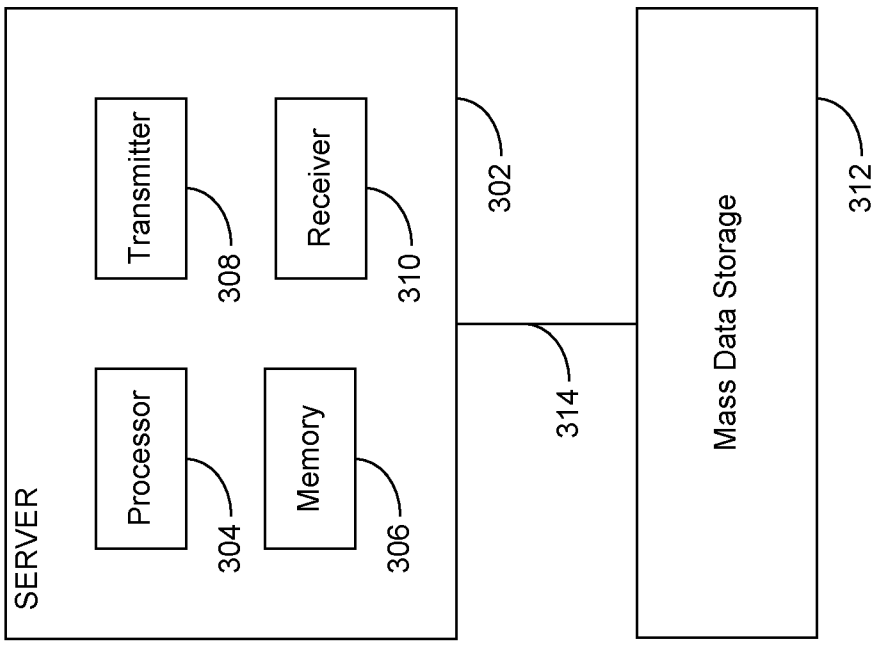

SERVER
Processor
304
Memory
306
Transmitter
308
Receiver
310
302
314
Mass Data Storage
312

Figure 5

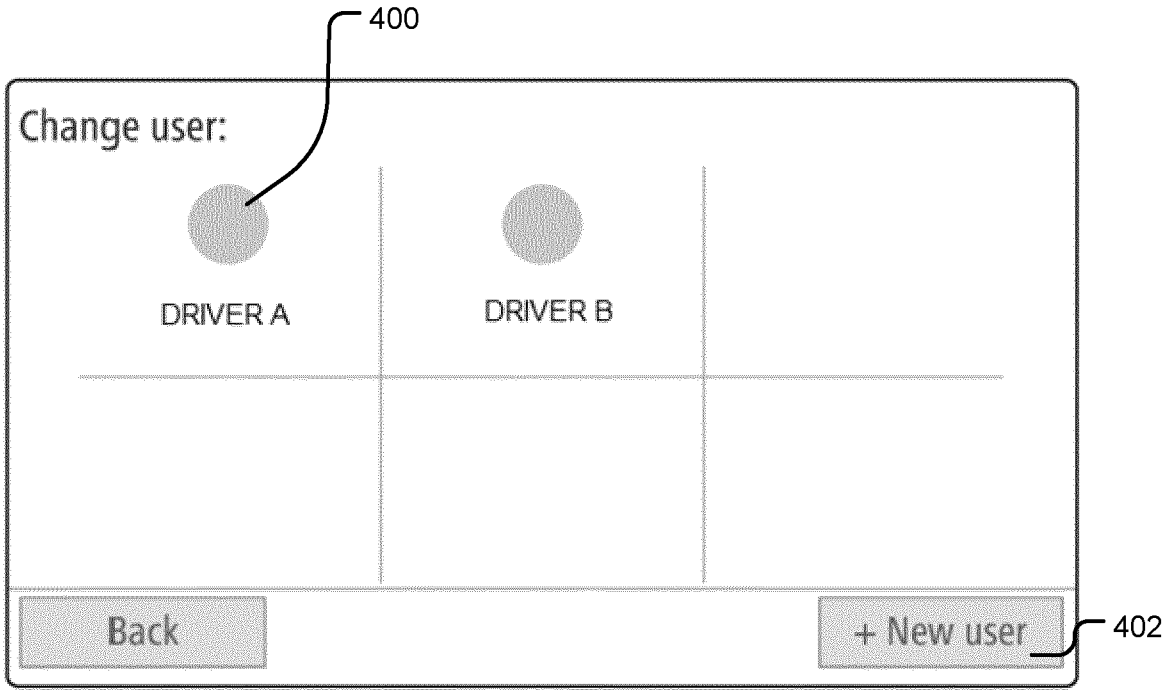


Figure 6



Figure 7

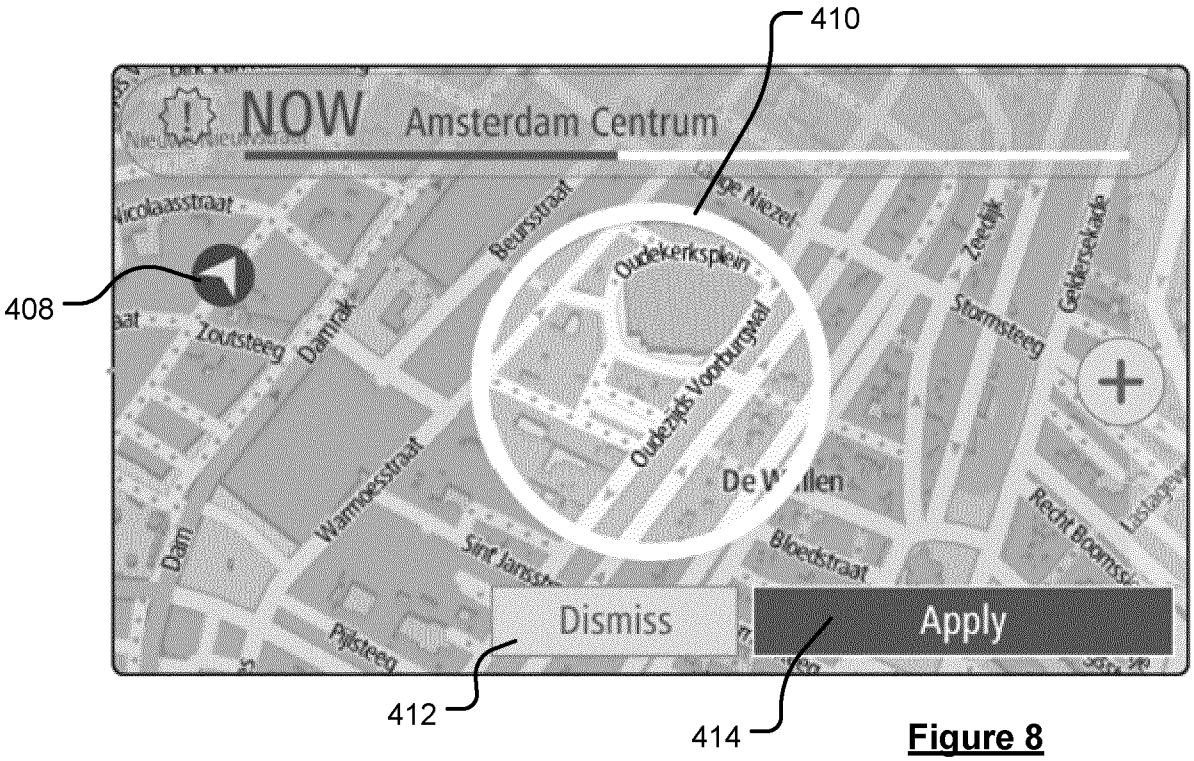


Figure 8

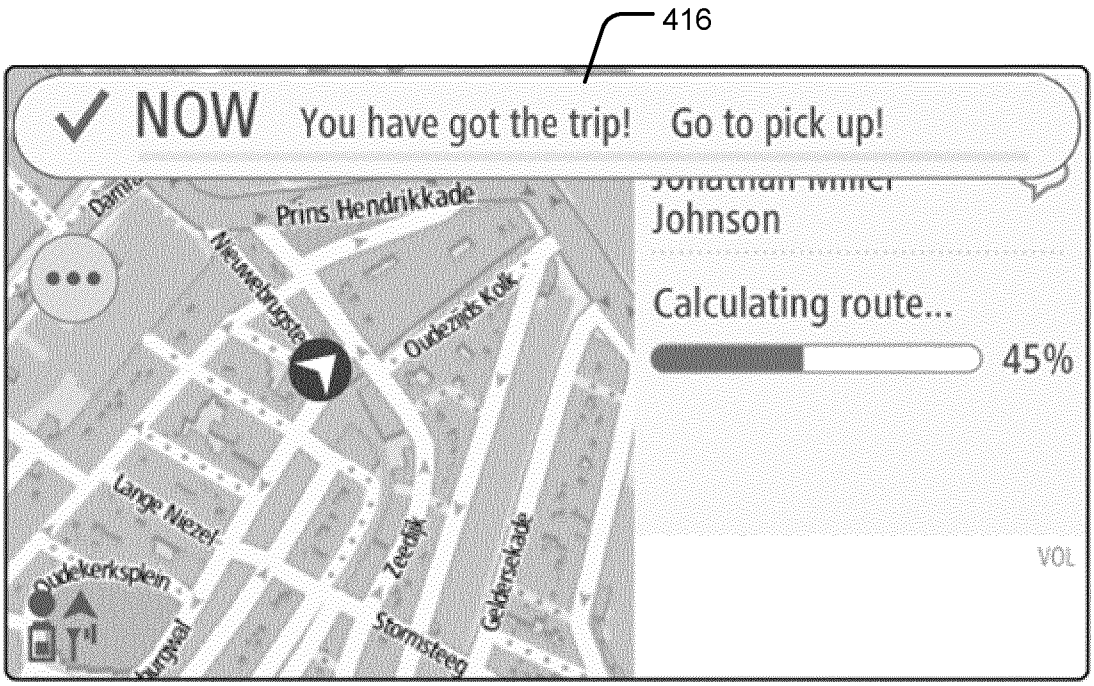


Figure 9

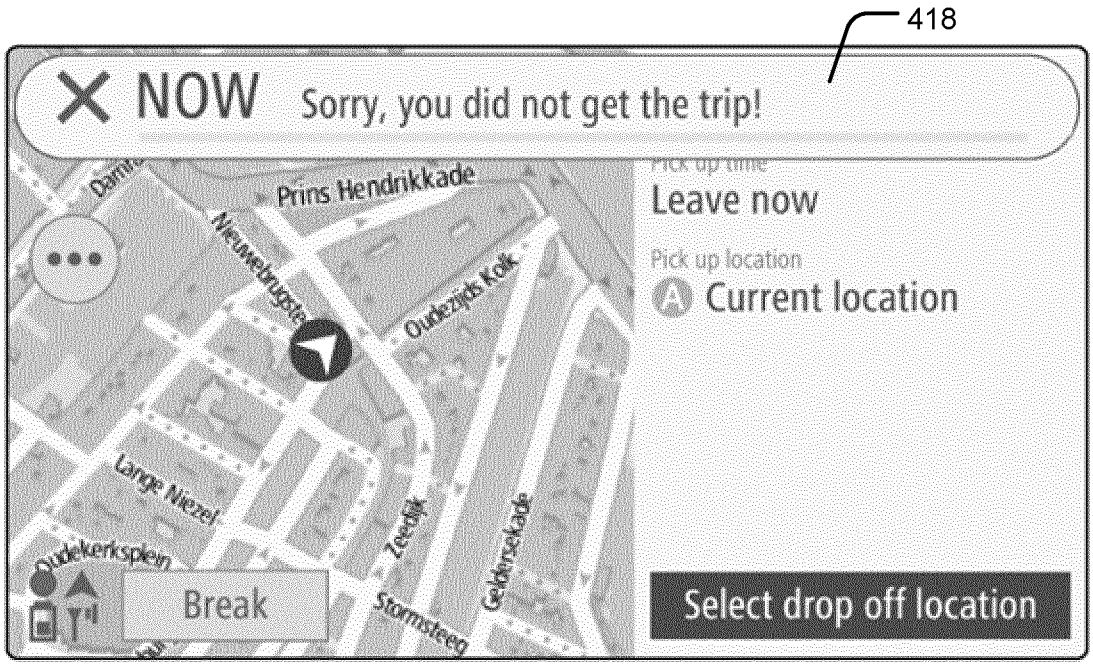


Figure 10

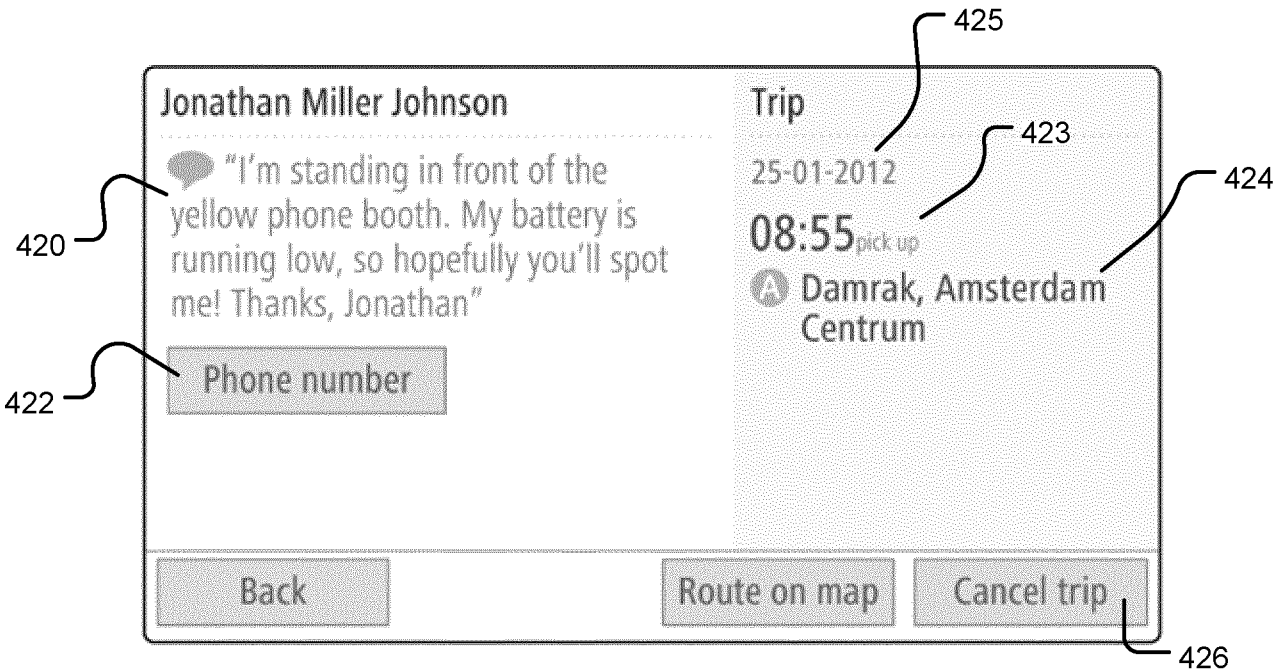


Figure 11

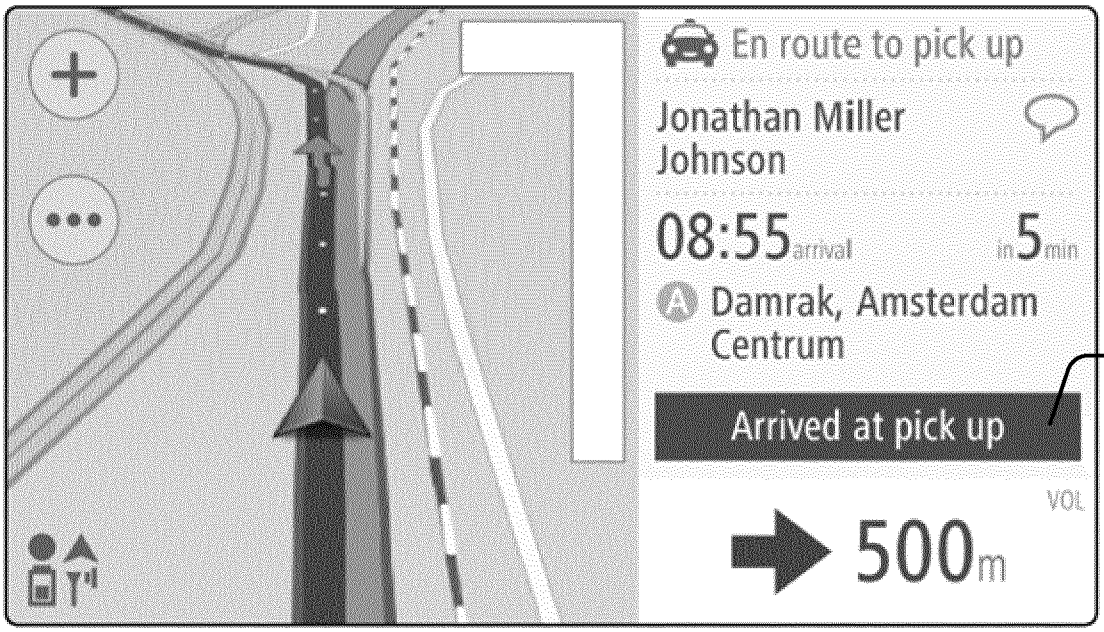


Figure 12

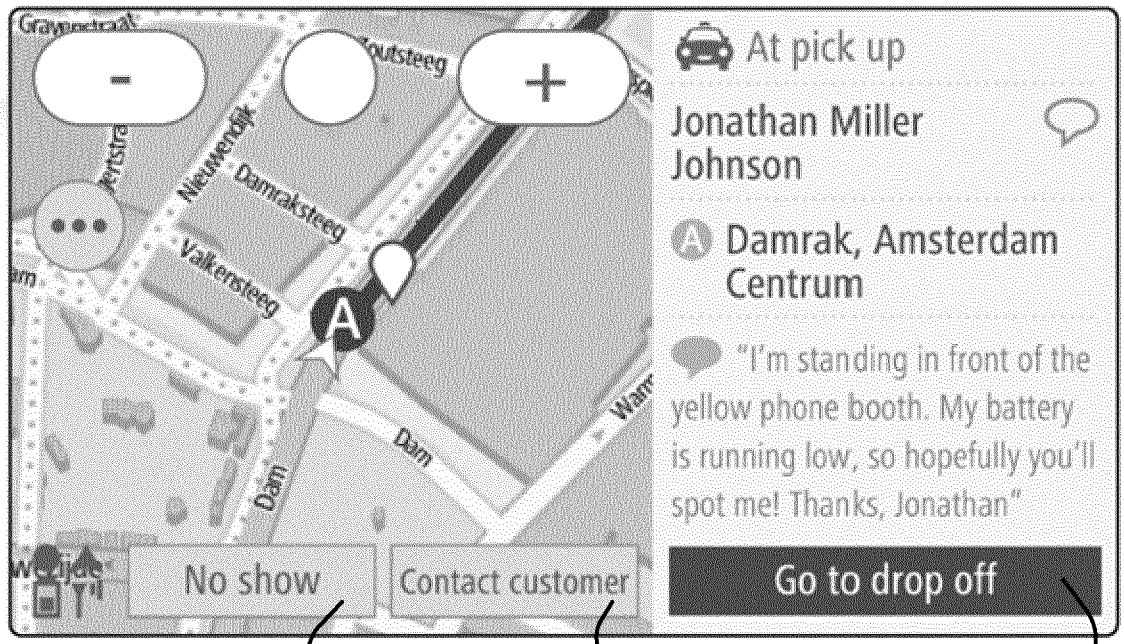


Figure 13

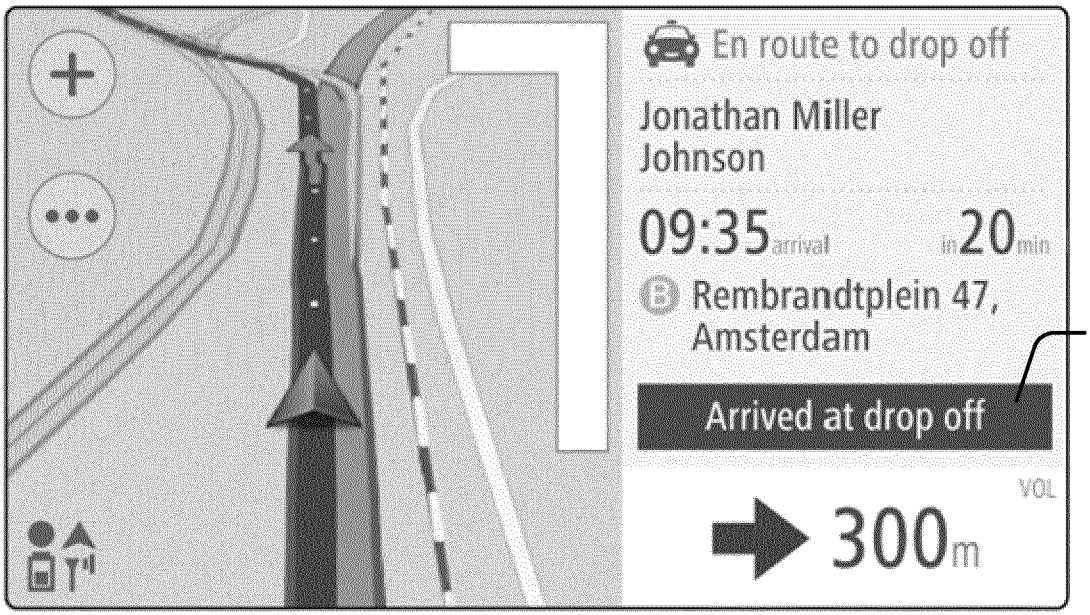


Figure 14



Figure 15

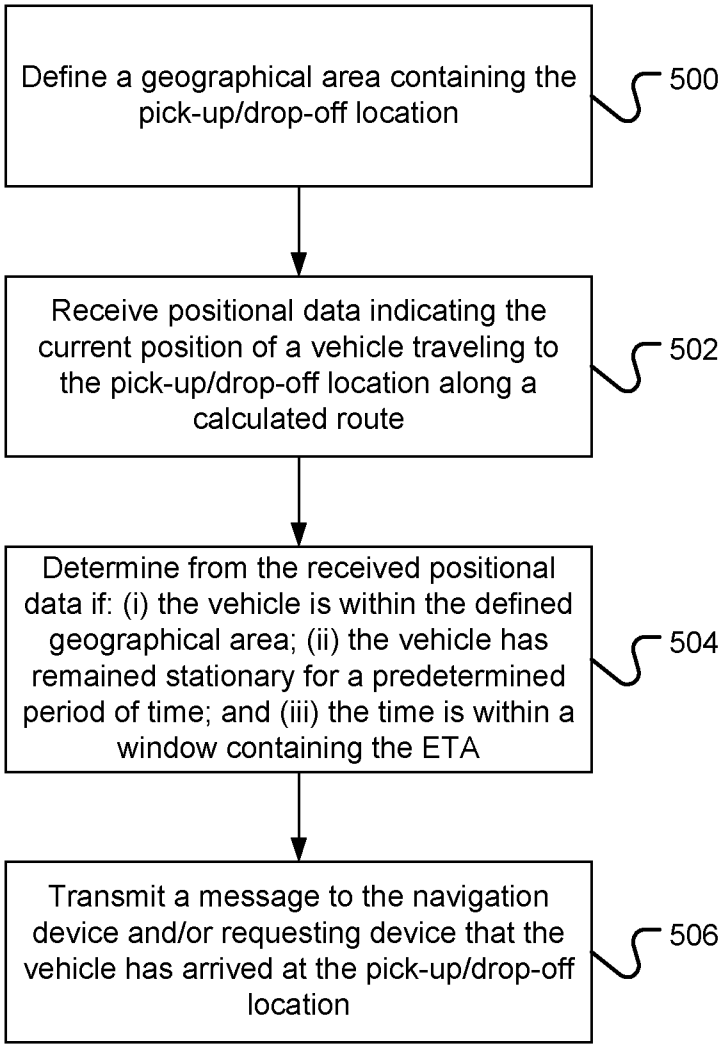

Define a geographical area containing the pick-up/drop-off location
500
Receive positional data indicating the current position of a vehicle traveling to the pick-up/drop-off location along a calculated route
502
Determine from the received positional data if: (i) the vehicle is within the defined geographical area; (ii) the vehicle has remained stationary for a predetermined period of time; and (iii) the time is within a window containing the ETA
504
Transmit a message to the navigation device and/or requesting device that the vehicle has arrived at the pick-up/drop-off location
506

Figure 16

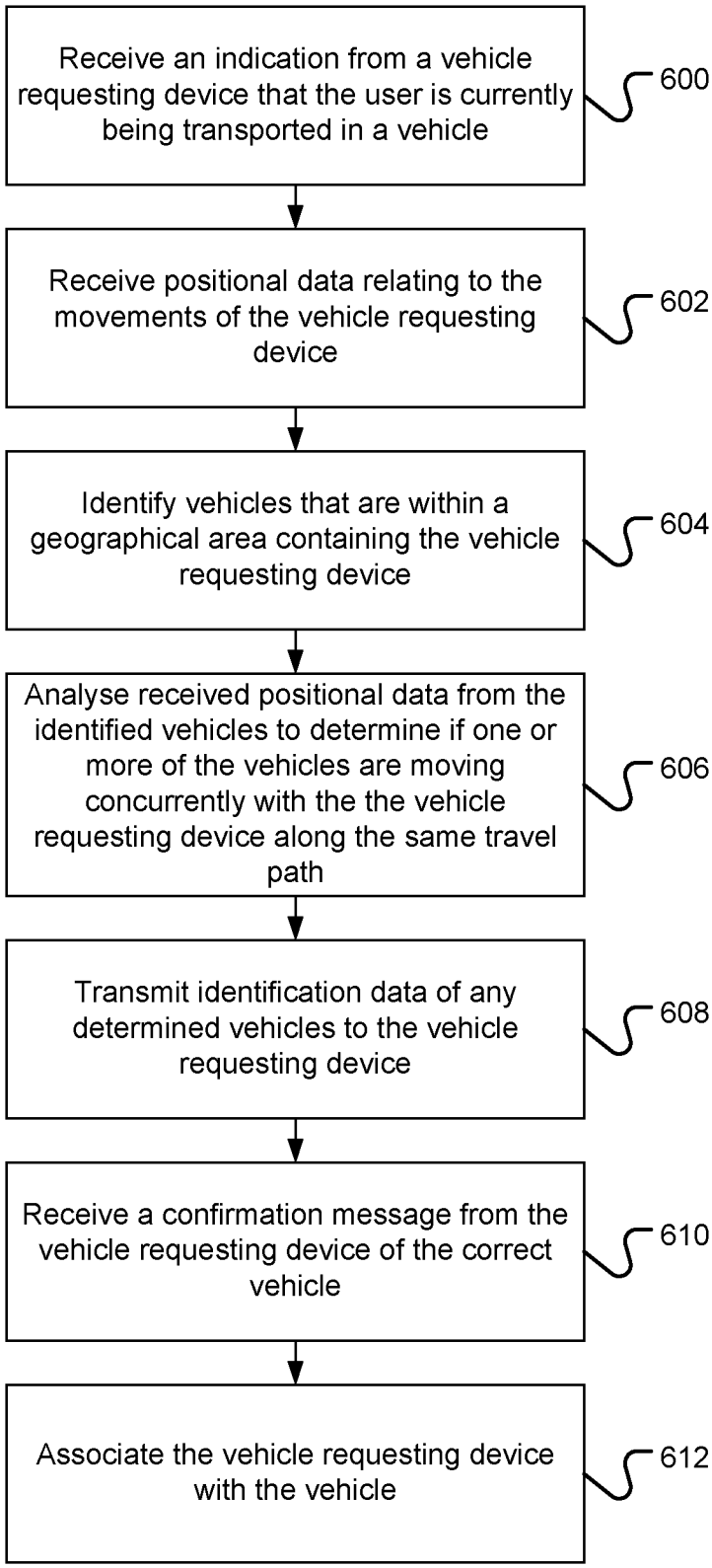

Receive an indication from a vehicle requesting device that the user is currently being transported in a vehicle
600
Receive positional data relating to the movements of the vehicle requesting device
602
Identify vehicles that are within a geographical area containing the vehicle requesting device
604
Analyse received positional data from the identified vehicles to determine if one or more of the vehicles are moving concurrently with the the vehicle requesting device along the same travel path
606
Transmit identification data of any determined vehicles to the vehicle requesting device
608
Receive a confirmation message from the vehicle requesting device of the correct vehicle
610
Associate the vehicle requesting device with the vehicle
612

Figure 17

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/056828

A. CLASSIFICATION OF SUBJECT MATTER
INV. G08G1/123
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G08G 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)

EPO-Internal, WPI Data

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X	WO 2005/022426 A1 (ECOLANE FINLAND OY [FI]; POEYKKOE SAMI [FI]) 10 March 2005 (2005-03-10)	1,4,5,8, 9,12-15
Y	abstract page 1, line 29 - page 2, line 18 page 4, line 14 - page 8, line 30	2,6,7, 10,11
Y	WO 00/11630 A1 (POMERANTZ DAVID [US]) 2 March 2000 (2000-03-02)	6,11
A	page 1, line 9 - page 2, line 19 page 3, line 5 - page 4, line 19	1-5, 7-10, 12-14
Y	US 2010/169199 A1 (FULLER MAX L [US] ET AL) 1 July 2010 (2010-07-01) paragraph [0094] - paragraph [0098]; figures 6A,6C	10

-/--

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

[X] See patent family annex.

* Special categories of cited documents :

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"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
18 July 2012	25/07/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Wagner, Ulrich

2

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

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/056828

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	EP 1 156 462 A2 (NEC CORP [JP]) 21 November 2001 (2001-11-21) paragraph [0042] - paragraph [0048]; figure 1 paragraph [0052] -----	1-15

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/056828

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