(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 065 867 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
21.08.2013 Bulletin 2013/34

(51) Int Cl.:
G08G 1/123 *(2006.01)*

(21) Application number: **07022238.5**

(22) Date of filing: **15.11.2007**

(54) **Method for providing transport time schedule information, mobile terminal and central processing unit**

Verfahren zur Bereitstellung von Transportzeitplaninformationen, mobiles Endgerät und Zentraleinheit

Procédé pour la fourniture d'informations de calendrier de transport, terminal mobile et unité de traitement

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR

(43) Date of publication of application:
03.06.2009 Bulletin 2009/23

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WO-A-98/08206

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EP 2 065 867 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a method for providing transport time schedule information as well as to a mobile terminal and a central processing unit for usage in this method.

[0002] In particular in public transport passengers often are faced with delays in arrival of the vehicle which they intend to use. In order to inform the passenger of such delays information systems such as display boards at the stops provided for passengers to board the vehicle, e.g. a bus stop or a train station, are known. One disadvantage of such display boards is, however, that the passenger already has to be at the stop in order to be able to be notified about the delay.

[0003] In US 2006/0074545A1 a system and method for controlling public transport is described, wherein information as to buses scheduled for arrival at respective bus stops, as well as travel values of the respective buses etc. which are calculated with reference to data collected from the buses can be provided to the passenger via different means. In particular, a service centre server can be accessed through a personal computer or a mobile terminal. One disadvantage of this system and method is that the user has to actively search for the respective information.

[0004] In US 6,253,148 B1 an information system for informing users of a public transport network about waiting times at stops in the network is suggested. In this information system receivers are provided which may be portable and are specifically designed for receiving one-way paging. In this system the positions of the public transport vehicles are being broadcast to the receivers by radio. The position information is provided by a central computer which repetitively broadcasts new positions for the public transport vehicles. The broadcasting begins at a successive transmission instance Θ. For each broadcast instance the transmission time to the receiver is considered and the estimated position of the vehicle after the estimated transmission time is transmitted as the current position. Thereby the determination of waiting times, which is carried out at the receiver can be improved.

[0005] One disadvantage of this system is that the receiver has to be adapted to not only display a waiting time to a passenger but also to determine the waiting time based on the received position information. Hence, the receiver has to be provided with a considerable amount of computing power and memory storage. Furthermore, the amount of data which has to be transmitted to the receiver is considerable.

[0006] Furthermore, WO 98/08206 A describes a public transit vehicle arrival information system. In this system a central computer calculates the predicted arrival time of a vehicle at a vehicle stop. This information is accessible from display units of the system, which may be a mobile device such as a pager. The calculation of the predicted arrival time is regularly updated. The updated data is broadcast throughout the area serviced by transit system. The update of the calculated arrival times is carried out continually to provide a real time system. Also with this system, the amount of data which has to be transmitted is considerable.

[0007] The problem to be solved by the present invention is thus to provide a solution, wherein users such as for example passengers can conveniently be provided with up-to-date information on transport time schedules, in particular public transport time schedules.

[0008] The invention is based on the finding that this problem can be solved by transmitting the estimated time of arrival of a transport vehicle to a mobile terminal and limiting the transmission to estimated time of arrival values which are of relevance to the user.

[0009] According to a first aspect of the invention, this problem is solved by a method for providing transport time schedule information, comprising the steps of determining position information of at least one vehicle of a transport network, calculating the estimated time of arrival of the at least one vehicle at a selected location, transmitting at least one calculated estimated time of arrival value to at least one mobile terminal. After a calculation of an initial estimated time of arrival value at least one additional calculation of the estimated time of arrival for the at least one vehicle of the transport network at the selected location is carried out. The method is characterized in that the difference between the calculated initial estimated time of arrival value and a subsequently calculated estimated time of arrival value is determined and that this difference is used for deciding on the necessity of transmittal of the subsequently calculated estimated time of value (ETA_1) to the mobile terminal.

[0010] Transport time schedule information according to the present invention comprises in particular the estimated time of arrival of a vehicle at a selected location. The transport time schedule information may further comprise an indication of the vehicle and/or of the selected location. The transport network may be a public transport network or a transport network for goods.

[0011] In case of a public transport network, the locations which can be selected are preferably stops or stations for the vehicle where passengers can board and exit the vehicle. The vehicle of the public transportation network may be a bus, a train, an airplane or any other vehicle of public transport.

[0012] In case of a transport network for goods, the locations which can be selected are for example the entrance to a plant or factory or a storage location within a storage facility for the goods. The vehicles of this network may for example be trucks, trains or forklifts.

[0013] In either transport network the position information of the vehicle which is used for the calculation of the estimated time of arrival value preferably comprises the current geographical position of the vehicle as well as the current travelling speed. At least the information on the current geographical position may be obtained by positioning systems such as Global Positioning System (GPS). Also the speed of the vehicle may be obtained

from the positioning system. Alternatively, the speed may also be obtained from the speedometer or tachometer of the vehicle.

[0014] The estimated time of arrival is preferably calculated based on the obtained position information as well as based on route or map information, wherein the geographic position of the selected location is contained. Thereby, the distance of the vehicle to the selected location, e.g. the bus stop, can be determined. Based on the current travelling speed the estimated time of arrival can then be calculated. The calculation may also consider information such as general information of the route between the current position and the selected location. Such general information may be traffic information, e.g. information about traffic lights and traffic jams, an average speed of vehicles for the route, speed information obtained from previous trips of the vehicle on the route etc.

[0015] The thus calculated estimated time of arrival value is transmitted to a mobile terminal. The mobile terminal may be a mobile phone and is associated to a user. The user or passenger associated to the mobile terminal is the user intending to obtain information on the transport time schedule. Preferably, the transmission is carried out via a mobile communication network, in particular a cellular mobile communication network such as GPRS. The transmission to the mobile terminal is preferably a directed transmission to individual mobile terminals rather then a broadcast. Thereby, the individual interests of individual users or passengers can be observed. The communication connection between the mobile terminal and a central processing unit, where the estimated time of arrival may be calculated or received from another unit, is preferably a bidirectional connection, so that information can not only be received at the mobile terminal but can also be transmitted from the mobile terminal.

[0016] By calculating the estimated time of arrival at least once again after an initial calculation of the estimated time of arrival, changes in the current situation can be addressed. The initial calculation may be the first calculation executed for a specific user or a first calculation executed for a specific vehicle for a selected location.

[0017] The difference between the calculation results will reflect changes of the current situation. In addition, the determination of the actual difference will give an indication of the deviation of the currently estimated time of arrival to a previously determined estimated time of arrival. By calculating the difference, the present invention thus provides an additional criterion which may be used for deciding on the necessity of transmittal of the newly calculated estimated time of arrival value to the mobile terminal. Also internal settings may use this additional criterion. For example the difference may be used for managing vehicles within the transport network.

[0018] According to a preferred embodiment, the difference between the calculated estimated time of arrival values is compared against a threshold value for the difference. By this comparison it will be possible to avoid further steps in cases where the difference between the two values is small. Such a small difference may for example occur due to rounding mistakes in the calculation. In these cases the difference between the calculated values should be ignored. If the difference, however, reaches or exceeds the threshold value, further steps may be necessary. The detection of whether the difference is of sufficient amount to justify further processing cannot be performed by systems, where only a comparison between two values is carried out.

[0019] As the difference between the calculated estimated time of arrival values may be a positive value or a negative value depending on whether the vehicles is delayed to or is going to arrive earlier than the initial estimated time of arrival, the threshold value is preferably compared to the absolute value of the difference, e.g. 10 minutes. Thereby, both a delay and an early arrival can be determined.

[0020] Preferably, the comparison is carried out at a central processing unit and the threshold value is received at the central processing unit from a mobile terminal. By comparing the calculated difference to a threshold value at a central processing unit, it will be possible to minimize the data transfer to a mobile terminal as differences occurring due to rounding errors or other calculation or measuring errors will be detected during the comparison. The threshold value may thus be set within the central processing unit to cover respective errors. Alternatively or additionally, it is, however, also possible that the threshold value is received at the central processing unit from a mobile terminal. Thereby, the user of the mobile terminal who wishes to be informed on the time schedule information will be able to set a personal threshold. The threshold can be input by the user at the mobile terminal and can be transferred to the central processing unit either together with a request for time schedule information or during a setup session, wherein the user can define his personal settings at the central processing unit. In the latter case, the threshold value may be used for all requests received from the mobile terminal after the setting has been defined. The personal threshold value will reflect the time difference between an estimated time of arrival value which the user received on his mobile terminal and the actual time of arrival of the vehicle.

[0021] Preferably, the initial estimated time of arrival value is the value which is transmitted to the mobile terminal. By using the value which has been transmitted to the mobile terminal and of which the user has thus been informed as a basis for the determination of a difference to current estimated time of arrival values, it can be assured that threshold, in particular the personal threshold value is applied to the values of relevance to the user. If more than one estimated time of arrival is transmitted to the mobile terminal, the estimated time of arrival value which was transmitted last will be considered as the initial estimated time of arrival which will be used to determine the difference to subsequently calculated values. Thereby, it can be assured that for example the personal

threshold is compared to the appropriate difference.

[0022] According to the present invention, it is, however, also possible that the initial estimated time of arrival value is the result of the calculation of the estimated time of arrival immediately preceding a present calculation of an estimated time of arrival. In this case, a threshold value set within the central processing unit for determining rounding errors or other errors will be used for the comparison to the difference between the calculated values.

[0023] According to a preferred embodiment of the present invention, the transmission of the estimated time of arrival value to a mobile terminal is dependent on the comparison result against the threshold value. In particular, an estimated time of arrival value will be transmitted to the mobile terminal only if a threshold value, in particular a personal threshold value of the user of the mobile terminal is reached or exceeded. It should be noted that this limitation of transmissions to the mobile terminal only applies to transmissions after a first transmission to the mobile terminal. By basing the decision on whether a new estimated time of arrival value is to be transmitted to the mobile terminal on the comparison to a threshold value, it will be possible to minimize the data transfer to the mobile terminal. At the same time, this selected transmission assures that the user will always be informed of the most updated estimated time of arrival.

[0024] Preferably, the transmission of an estimated time of arrival value to the mobile terminal will trigger the initial estimated time of arrival at the central processing unit to be replaced by the newly transmitted estimated time of arrival value. Thereby, the subsequent calculations of differences will be based on the value, which the user was made aware of most recently.

[0025] In a further preferred embodiment, the mobile terminal replaces a received estimated time of arrival value upon subsequent receipt of another estimated time of arrival value. Thereby, the information available to the user will always be up to date.

[0026] It is also possible that the mobile terminal starts a timer upon receipt of an estimated time of arrival value. Thereby, the mobile will be able to count-down to the estimated time of arrival value and alert the user of the mobile terminal once the estimated time of arrival has been reached. Preferably, a preset time limit is included in the timer. In this case the user may be alerted in advance of the upcoming reaching of the estimated time of arrival and the user will be able to take appropriate actions such as leaving for a bus stop in time.

[0027] In case of successive receipt of more than one estimated time of arrival value, the timer will preferably be restarted upon receipt of each estimated time of arrival value.

[0028] According to one embodiment, a mobile terminal issues a request for time schedule information, including an indication of a selected location, an indication of a vehicle of a transport network, an identification of the mobile terminal and/or a time specification. Upon receipt of this request at the central processing unit the calculation process of the estimated time of arrival will be initiated. By providing the information of the selected location, the relevant route and map information for the location can be considered. In addition, the vehicles related to this location, e.g. buses which stop at the bus stop can be identified. If the user provides an indication of the vehicle he is interested in such as a bus number, the calculation of the estimated time of arrival can be initiated at the central processing unit. In case the user only provides a time specification, in this request, the central processing unit may select a vehicle where the scheduled time of arrival matches the time specification and calculate the estimated time of arrival for this vehicle. An indication of the mobile terminal in the request may be used by the central processing unit to direct the transmission of estimated time of arrival values. This is advantageous since the mobile terminal will in that case not have to maintain a connection to the central processing unit. The central processing unit may rather establish a connection to the mobile terminal in case a transmission of information is to be carried out.

[0029] According to one embodiment of the invention, the at least one calculation of the estimated time of arrival is carried out at a remote central processing unit. The remote central processing unit is remote to both the vehicle and the mobile terminal and may for example be a central server. This server may be hosted at a management facility of the transport network. By executing the calculation at a remote central processing unit, the calculation power and memory capacities are not limited as is the case with mobile terminals. The calculation of the estimated time of arrival may thus be carried out more rapidly and the calculated values can be stored for future usage. One additional advantage of the calculation at a remote central processing unit is that the central processing unit may easily obtain additional information necessary for the calculation from other systems such as a positioning system. If the calculation of at least the estimated time of arrival is carried out at the central processing unit, the requirements for the mobile terminal are decreased. This means, that also a mobile phone or other mobile terminal with limited processing capability can be used as the mobile terminal for the inventive method. It will thus be possible to provide the necessary information to the user or passenger to a device which he or she is carrying for a different purpose. It will not be necessary for the user or passenger to carry an additional device in order to obtain the desired information. Finally, a data transfer of input values for the calculation via a mobile network to the mobile terminal is not necessary and the mandatory data traffic to the mobile terminal can thus be minimized.

[0030] In addition or alternatively, also the determination of the difference between the calculated values of the estimated time of arrival may be carried out at a remote central processing unit. Also in this case the remote central processing unit may be a server. By determining the difference at the remote central processing unit from

where the estimated time of arrival is preferably transmitted to the at least one mobile terminal, the difference can easily be integrated in the decision process of whether the newly calculated estimated time of arrival is to be transmitted to the mobile terminal.

[0031] The at least one calculation of the estimated time of arrival may according to the present invention also be carried out at the vehicle of the transport network, which is to be monitored, i.e. the arrival of which is of interest to the passenger. The advantage of this embodiment is that the position information of the vehicle which may be obtained by a positioning system will be readily available at the vehicle. In common positioning systems a receiver for the position information is provided at the vehicle. In this embodiment only the calculated estimated time of arrival has to be transmitted to the central processing unit, thus decreasing signalling between the vehicle and the central processing unit.

[0032] Alternatively or additionally also the determination of the difference between the calculated values can be carried out at the vehicle of the public transport. In this case it will be possible to only transmit the estimated time of arrival to the central processing unit once and subsequently to only transmit the difference of the newly calculated estimated time of arrival to the previously transmitted estimated time of arrival. Only if a comparison at the central processing unit to a threshold value, preferably a personal threshold of the user, shows that the threshold value has been reached, the last estimated time of arrival value, which was used for the determination of the difference has to be transmitted to the central processing unit for further transmission to the mobile terminal.

[0033] According to a further aspect, the present invention relates to a central processing unit for providing transport time schedule information having at least one communication interface for communication with at least one mobile terminal and at least one receiving unit for receiving information from a vehicle of a transport network. The central processing unit is characterized in that it comprises a unit for determining the difference between an initial estimated time of arrival value and at least one subsequently calculated estimated time of arrival value for at least one vehicle of a transport network at a selected location and that this difference is used for deciding on the necessity of transmittal of the subsequently calculated estimated time of value to the mobile terminal.

[0034] By providing a determining unit for determining the difference between these values, it will be possible to minimize data transfer to mobile terminals which are in communication with the central processing unit and to improve the reliability of the central processing unit as the determination unit can provide and additional criterion for the handling of estimated time of arrival values.

[0035] According to one embodiment, the central processing unit comprises storage means for storing a threshold value for the difference between the calculated values. By storing this value it will be readily available for comparison against a difference value which was calculated or received at the central processing unit. By providing storage means for the threshold value it will be possible for a user to provide a threshold value which should always be used for information to be transmitted to him, i.e. a personal threshold value. The storage means may also contain a threshold value set for or by the central processing unit to account for calculation or measuring errors.

[0036] In a preferred embodiment, the central processing unit comprises a calculation unit for calculating an estimated time of arrival of at least one vehicle of the transport network at a selected location. This calculation unit will be connected to the receiving unit for receiving position information of the vehicle. The calculation unit will further be connected to a memory unit where information on the transport network, in particular route information for individual vehicles and other traffic information may be stored. By considering both the position information of the vehicle as well as route and traffic information, it will be possible to calculate an accurate estimated time of arrival of the vehicle at a selected location.

[0037] The central processing unit is preferably adapted to be used in the inventive method.

[0038] According to a further aspect, the present invention relates to a mobile terminal for providing transport time schedule information of at least one vehicle of a transportation network, comprising a communication interface for communication with at least one central processing unit and at least one output device for output of the information. The mobile terminal comprises a receiving unit for receiving and handling information from the central processing unit on estimated time of arrival values. The mobile terminal is characterized in that the estimated time of arrival values are transmitted based on a difference between an initial estimated time of arrival value and at least one subsequently calculated estimated time of arrival value for at least one vehicle of the transport network at a selected location.

[0039] The mobile terminal may be a mobile telephone or any other mobile terminal device which is capable of communicating with a central processing unit via a communication network such as a cellular mobile network. The receiving unit at the mobile terminal is adapted to receive the information from the central processing unit and to handle or process it for output at the mobile terminal. For this reason the receiving unit will be connected to an output interface such as a display of the mobile terminal. The information from the central processing unit on estimated time of arrival values which are transmitted based on a difference between an initial estimated time of arrival value and at least one subsequently calculated estimated time of arrival value for at least one vehicle of the transport network at a selected location is preferably an updated estimated time of arrival value. The mobile terminal will thus be able to display or otherwise output the received information. In addition, the mobile terminal will be able to replace a previously received estimated

time of arrival value by the updated time of arrival value without necessitating further processing power.

[0040] The mobile terminal may further comprise an input unit for inputting a location, vehicle identification, a threshold value and / or a time specification to be transmitted to the central processing unit. The input unit may be connected to the keypad of the mobile terminal or any other input means provided at mobile terminals or mobile phones such as a touchpad. The input unit will also be connected to a transmitting unit of the mobile terminal for transmitting the information to the central processing unit. The information input into the input unit will be transmitted to the central processing unit within a request for time schedule information. The input may, however, also be transmitted to the central processing unit individually, e.g. during a set up session when the user of the mobile terminal sets up a service to use from the central processing unit for delivery of the time schedule information.

[0041] According to one embodiment, the mobile terminal comprises a timer connected to the receiving unit for counting down the remaining time difference to a received estimated time of arrival and/or to a preset time limit to the received estimated time of arrival. Thereby, the mobile terminal will be able to count-down to the estimated time of arrival value and alert the user of the mobile terminal once the estimated time of arrival or a preset time limit to this value has been reached. This will enable the user to take appropriate actions such as leaving for a bus stop in time.

[0042] The mobile terminal is preferably adapted to be used in the inventive method and /or is suitable for communication with the central processing unit according to present invention.

[0043] The units and modules of the mobile terminal and/or the central processing unit may be realized as hardware and/or software components and may at least partially be combined within one unit.

[0044] Features and advantages described in context with the mobile terminal and/or the central processing unit also apply to the inventive method and vice versa.

[0045] The invention will now be described again in detail with reference to the enclosed drawings, wherein:

Figure 1: shows a schematic depiction of a provisioning system where the method according to the present invention can be used; and

Figure 2: shows a flowchart of one embodiment of the inventive method.

[0046] In Figure 1 a provisioning system where the method according to the present invention can be used is shown. In this system a central processing unit 1 is comprised. The central processing unit 1 can communicate with a mobile terminal 2 which is depicted as a mobile phone as well as with a vehicle 3 via a vehicle unit 31. The communication between the vehicle unit 31 and the central processing unit 1 is carried out via a mobile network 4. The communication between the mobile terminal 2 and the central processing unit 1 is carried out via a mobile network 5. It should be noted that the two networks 4 and 5 could be the same communication network. The vehicle unit 31 can furthermore receive information from a positioning system 6 which may be a GPS system or other known positioning systems. The vehicle unit 31 may thus comprise or be connected to a receiver of a positioning system 6.

[0047] The positioning system 6 provides the vehicle unit 31 with current position information, which comprises the actual geographic location of the vehicle as well as the current speed of the vehicle 3. Alternatively, the speed of the vehicle 3 may be obtained for the speedometer of the vehicle 3.

[0048] As indicated by the arrows in Figure 1 the communication between the vehicle unit 31 and the central processing unit 1 is preferably only in one direction, i.e. from the vehicle unit 31 to the central processing unit 1. In some embodiments of the inventive method the central processing unit 1 may, however, also communicate with the vehicle unit 31, for example to request the transmission of information.

[0049] The communication between the mobile terminal 2 and the central processing unit 1 in contrast is bidirectional. The mobile terminal 2 can transmit requests and information supporting or relating to the request to the central processing unit 1. The central processing unit 1 will transmit information in response to the request and subsequent information, in particular updated information to the mobile terminal 2.

[0050] In Figure 2 a flowchart of one embodiment of the inventive method is shown and will now be described with reference to the example of a passenger using the inventive method to obtain information on arrival time of a bus.

[0051] The user may connect to the central processing unit 1, which will hereinafter also be referred to as the server, via his mobile phone 2. The server 1 may be part of or will be connected to a public transport network management system.

[0052] Via the mobile terminal 2 the user can send a request to obtain information on the estimated time of arrival of a specific bus, e.g. number 159, at a specific location, e.g. bus stop XX to the server. In this request or separate from the request the user can send a threshold value for the difference between the estimated time of arrival of the bus at the bus stop transmitted to his mobile terminal and a subsequently calculated estimated time of arrival of the bus at the bus stop.

[0053] The server 1 receives the request and the threshold value. Upon receipt thereof the server 1 will check the availability of position information of the requested bus 159. If the position information is not available the server 1 may send and invitation to the vehicle unit 31 of bus 159 to start transmitting this information. Once the position information is available at the server 1, the server 1 calculates the estimated time of arrival

ETA_0 of bus 159 at bus stop XX. The thus calculated estimated time of arrival ETA_0 is transmitted to the mobile phone 2 of the user from where the request originated. After transmittal of the estimated time of arrival value ETA_0 server 1 continues to receive positioning information from the vehicle unit 31 and calculates new estimated time of arrival values ETA_1 based on this information. From the new estimated time of arrival value ETA_1 and the initial estimated time of arrival value ETA_0 the difference Δ ETA between these two values is calculated. The absolute amount of the calculated difference Δ ETA is compared to the threshold value received from the mobile terminal 2. If the Δ ETA is smaller then the threshold value, the newly calculated ETA_1 is ignored and the server continues to calculate new estimated time of arrival values based on the received position information from the vehicle unit 31 of the bus 159. If the Δ ETA is larger then the threshold value, the newly calculated ETA_1 is sent to the mobile terminal 2. At the server 1 the newly calculated ETA_1 is used as the new initial estimated time of arrival ETA_0 for the determination of the difference to subsequently calculated estimated time of arrival values.

[0054] The following use cases describe the possible features and advantages of the present invention.

[0055] A user sends a request for information on arrival for a specific vehicle of public transport, such as a bus, a train, a tram, a metro, etc. at a selected location, i.e. a bus stop, train station, etc. to a server of a transport network or another central processing unit connected to the transport network. The request further comprises a threshold value which indicates the maximum deviation the user is willing to accept between the estimated time of arrival provided to him in response to the request and the actual time of arrival. The request is sent via a mobile network to the central server. The vehicles belonging to a public transport network regularly sends their actual GPS information and their identification, e.g. number, to the server. This information and identification is sent via a mobile network which may be identical to the mobile network used for the transmission of the request from the mobile terminal to the server. The mobile network may, however, also be a different network. In the server the route information for all vehicles of the public transport network are stored. This stored information is considered in combination with the selected location, e.g. bus stop, which was sent from the mobile terminal within the request for estimated time of arrival. From the GPS information together with the route information, the estimated time of arrival for the selected location can be calculated at the server. Once calculated, the result of this first calculation will be sent to the mobile terminal from which the request originated. At the mobile device, the receipt of the calculated estimated time of arrival from the first calculation will start a count-down unit and will count down the time remaining until the estimated time of arrival. The count-down will be displayed at the screen of the mobile terminal. The estimated time of arrival is calculated for the first vehicle to arrive at the selected location. The central server stores the calculated estimated time of arrival sent to the mobile terminal and will also store indicia of the mobile terminal to which this calculated value was sent.

[0056] The central server will continue calculating the current or actual estimated time of arrival which was requested by the mobile terminal. After each calculation the central server will compare the value of the most recent calculation to the value which was sent to the mobile terminal and will determine the difference between these two values. Once the difference determined at the central server exceeds the threshold value provided with the initial request from the mobile terminal, the most recently calculated estimated time of arrival will be sent to the mobile terminal from which the request originated.

[0057] Thereby, the user will be informed of any delay or early arrival of the vehicle of interest at the selected location and can plan his time accordingly, e.g. leave for the bus stop early to maximize available boarding time or leave later in case of a delay.

[0058] According to the invention also a synchronized system providing semi-real-time public transport estimated time of arrival information can be used as described now. A unit system is provided at the vehicle of the public transport. This unit is adapted to track the arrival time of the vehicle at specific locations such as a bus stop or any other selected location. Since this unit will also have GPS it can constantly check whether the estimated time of arrival currently calculated is still in line with an estimated time of arrival initially calculated. A second unit is provided centrally at the location of the public transport network management system. This central unit keeps track of the estimated time to the next bus stop or other selected location and keeps track of the selected location of interest to the customer. As soon as the difference between the initial estimated time of arrival and a subsequently calculated estimated time of arrival is larger than a threshold value, the initial estimated time of arrival will be updated at the central unit via the mobile data connection from the bus to the central unit. The central unit will then notify all users registered for that specific bus and the affected bus stop. A third unit resides on the mobile terminal of the waiting passenger. The passenger may set an alarm at the mobile terminal to notify him once the time difference between the actual time and the received estimated time of arrival drops below a given value. This given value may for example be the time the passenger requires for getting to the bus stop.

[0059] The present invention is not limited to the embodiments and use cases described above. In particular, individual steps of the described method may be omitted. It is for example possible that the mobile terminal does not count down the time until the estimated time of arrival. Also the setting of an alarm is not mandatory.

[0060] The present invention provides the possibility to reduce the time a passenger, in particular a commuter, has to wait for public transport vehicles to arrive, as he always is aware of the actual estimated time of arrival.

This awareness is independent of the current location of the passenger. Even though the invention has mainly been described with respect to public transport aspects where passengers are to be transported for one location to another, it is obvious that the invention also applies to transports of goods as the logistics are the same. A truck driver may also wish to be informed on the estimated time of arrival of the goods which he is supposed to be loading at a specific location. Also internal logistics of a plant or a factory may utilize the present invention, so that workers within the premises will be aware of the arrival time of a delivery vehicle.

Reference Numbers

[0061]

1	Central processing unit
2	Mobile terminal
3	Vehicle
31	Vehicle unit
4	Mobile network
5	Mobile network
6	Positioning system

Claims

1. Method for providing transport time schedule information, comprising the steps of determining position information of at least one vehicle (3) of a transport network, calculating the estimated time of arrival (ETA) of the at least one vehicle at a selected location, transmitting at least one calculated estimated time of arrival value (ETA) to at least one mobile terminal (2), wherein after a calculation of an initial estimated time of arrival value (ETA_0) at least one additional calculation of the estimated time of arrival for the at least one vehicle (3) of the transport network at the selected location is carried out, **characterized in that** the difference (ΔETA) between the calculated initial estimated time of arrival value (ETA_0) and a subsequently calculated estimated time of arrival value (ETA_1) is determined and that this difference is used for deciding on the necessity of transmittal of the subsequently calculated estimated time of value (ETA_1) to the mobile terminal (2).

2. Method according to claim 1, **characterized in that** the difference between the calculated estimated time of arrival values (ETA_0, ETA_1) is compared against a threshold value for the difference.

3. Method according to claim 2, **characterized in that** the comparison is carried out at a central processing unit (1) and the threshold value is received at the central processing unit (1) from a mobile terminal (2).

4. Method according to anyone of claims 1 to 3, **characterized in that** the initial estimated time of arrival value (ETA_0) is the value which is transmitted to the mobile terminal (2).

5. Method according to anyone of claims 2 to 4, **characterized in that** the transmission of the estimated time of arrival value (ETA_1) to a mobile terminal is dependent on the comparison result against the threshold value.

6. Method according to anyone of claims 1 to 5, **characterized in that** a mobile terminal (2) issues a request for time schedule information, including an indication of a selected location, an indication of a vehicle (3) of a transport network, an identification of the mobile terminal (2) and/or a time specification.

7. Method according to anyone of claims 1 to 6, **characterized in that** the at least one calculation of the estimated time of arrival ($ETA_{0,1}$) and/or the determination of the difference (ΔETA) between the calculated values (ETA_0, ETA_1) is carried out at a remote central processing unit (1).

8. Method according to anyone of claims 1 to 7, **characterized in that** the at least one calculation of the estimated time of arrival ($ETA_{0,1}$) and/or the determination of the difference (ΔETA) between the calculated values (ETA_0, ETA_1) is carried out at a vehicle (3) of the transport network.

9. Method according to anyone of claims 1 to 8, **characterized in that** the mobile terminal (2) replaces a received estimated time of arrival value (ETA_0) upon subsequent receipt of another estimated time of arrival value (ETA_1).

10. Method according to anyone of claims 1 to 9, **characterized in that** the mobile terminal (2) starts a timer upon receipt of an estimated time of arrival value ($ETA_{0,1}$).

11. Central processing unit (1) for providing transport time schedule information having at least one communication interface for communication with at least one mobile terminal (2) and at least one receiving unit for receiving information from a vehicle (3) of a transport network, **characterized in that** it comprises a unit for determining the difference (ΔETA) between an initial estimated time of arrival value (ETA_0) and at least one subsequently calculated estimated time of arrival value (ETA_1) for at least one vehicle (3) of a transport network at a selected location and that this difference is used for deciding on the necessity of transmittal of the subsequently calculated estimated time of value (ETA_1) to the mobile terminal (2).

12. Central processing unit according claim 11, **characterized in that** comprising storage means for storing a threshold value for the difference.

13. Central processing unit according to anyone of claims 11 or 12, **characterized in that** it comprises a calculation unit for calculating an estimated time of arrival ($ETA_{0,1}$) of at least one vehicle (3) of the transport network at a selected location.

14. Central processing unit according to anyone of claims 11 to 13, **characterized in that** it is adapted to be used in a method according to anyone of claims 1 to 10.

15. Mobile terminal for providing transport time schedule information of at least one vehicle (3) of a transportation network, comprising a communication interface for communication with at least one central processing unit (1) and at least one output device for output of the information, wherein the mobile terminal comprises a receiving unit for receiving and handling information from the central processing unit (1) on estimated time of arrival values ($ETA_{0,1}$), **characterized in that** the estimated time of arrival values ($ETA_{0,1}$) are transmitted based on a difference between an initial estimated time of arrival value (ETA_0) and at least one subsequently calculated estimated time of arrival value (ETA_1) for at least one vehicle (3) of the transport network at a selected location.

16. Mobile terminal according to claim 15, **characterized in that** it comprises an input unit for inputting a location, a vehicle identification, a threshold value and / or a time specification to be transmitted to the central processing unit (1).

17. Mobile terminal according to anyone of claims 15 or 16, **characterized in that** it comprises a timer connected to the receiving unit for counting down the remaining time difference to a received estimated time of arrival ($ETA_{0,1}$) and/or to a preset time limit to the received estimated time of arrival ($ETA_{0,1}$).

18. Mobile terminal according to anyone of claims 15 to 17, **characterized in that** it is adapted to be used in a method according to anyone of claims 1 to 10.

19. Mobile terminal according to anyone of claims 15 to 18, **characterized in that** it is suitable for communication with the central processing unit according to anyone of claims 11 to 14.

Patentansprüche

1. Verfahren zum zur Verfügung Stellen von Transportzeitplaninformationen, umfassend die Schritte des Bestimmens von Positionsinformationen von zumindest einem Fahrzeug (3) eines Transportnetzwerkes, Berechnen der voraussichtlichen Ankunftszeit (ETA) von dem mindestens einen Fahrzeug an einem ausgewählten Ort, Übermitteln von zumindest einem berechneten voraussichtlichen Ankunftszeitwertes (ETA) an zumindest ein mobiles Endgerät (2), wobei nach der Berechnung des ursprünglichen voraussichtlichen Ankunftszeitwertes (ETA_0) zumindest eine zusätzliche Berechnung der voraussichtlichen Ankunftszeit für das mindestens eine Fahrzeug (3) des Transportnetzwerkes an einem ausgewählten Ort durchgeführt wird, **dadurch gekennzeichnet, dass** die Differenz (ΔETA) zwischen dem berechneten ursprünglichen voraussichtlichen Ankunftszeitwert (ETA_0) und einem anschließend berechneten voraussichtlichen Ankunftszeitwert (ETA_1) bestimmt wird und dass diese Differenz verwendet wird, um über die Notwendigkeit der Übermittlung des anschließend berechneten voraussichtlichen Ankunftszeitwertes (ETA_1) an das mobile Endgerät (2) zu entscheiden.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Differenz zwischen den berechneten voraussichtlichen Ankunftszeitwerten (ETA_0, ETA_1) mit einem Schwellwert für die Differenz vergleichen wird.

3. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** der Vergleich an einer zentralen Verarbeitungseinheit (1) durchgeführt wird und der Schwellwert an der zentralen Verarbeitungseinheit (1) von einem mobilen Endgerät (2) empfangen wird.

4. Verfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** der ursprüngliche voraussichtliche Ankunftszeitwert (ETA_0) der Wert ist, der an das mobile Endgerät (2) übermittelt wird.

5. Verfahren nach einem der Ansprüche 2 bis 4, **dadurch gekennzeichnet, dass** die Übermittlung des voraussichtlichen Ankunftszeitwertes (ETA_1) an ein mobiles Endgerät von dem Vergleichsresultat mit dem Schwellwert abhängt.

6. Verfahren nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** ein mobiles Endgerät (2) eine Anfrage für Zeitplaninformationen ausgibt, die eine Angabe eines ausgewählten Ortes, eine Angabe eines Fahrzeuges (3) eines Transportnetzwerkes, eine Identifikation des mobilen Endgerätes (2) und/oder eine Zeitspezifikation enthält.

7. Verfahren nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** die zumindest eine Berechnung der voraussichtlichen Ankunftszeit ($ETA_{0,1}$) und/oder die Bestimmung der Differenz

(ΔETA) zwischen den berechneten Werten (ETA_0, ETA_1) an einer entfernten zentralen Verarbeitungseinheit (1) durchgeführt wird.

8. Verfahren nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** zumindest eine Berechnung der voraussichtlichen Ankunftszeit ($ETA_{0,1}$) und/oder der Bestimmung der Differenz (ΔETA) zwischen den berechneten Werten (ETA_0, ETA_1) an einem Fahrzeug (3) des Transportnetzwerkes durchgeführt wird.

9. Verfahren nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** das mobile Endgerät (2) einen empfangenen voraussichtlichen Ankunftszeitwert (ETA_0) bei anschließendem Erhalt eines anderen voraussichtlichen Ankunftszeitwertes (ETA_1) ersetzt.

10. Verfahren nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet, dass** das mobile Endgerät (2) bei Erhalt eines voraussichtlichen Ankunftszeitwertes ($ETA_{0,1}$) einen Timer startet.

11. Zentrale Verarbeitungseinheit (1) zum zur Verfügung Stellen von Transportzeitplaninformationen, aufweisend zumindest eine Kommunikationsschnittstelle zur Kommunikation mit zumindest einem mobilen Endgerät (2) und zumindest eine Empfangseinheit zum Empfangen von Informationen von einem Fahrzeug (3) eines Transportnetzwerkes, **dadurch gekennzeichnet, dass** diese eine Einheit zum Bestimmen einer Differenz (ΔETA) zwischen einem ursprünglichen voraussichtlichen Ankunftszeitwertes (ETA_0) und zumindest einem anschließend berechneten voraussichtlichen Ankunftszeitwertes (ETA_1) für zumindest ein Fahrzeug (3) eines Transportnetzwerkes an einem ausgewählten Ort umfasst und dass diese Differenz verwendet wird, um über die Notwendigkeit der Übermittlung des anschließend berechneten voraussichtlichen Ankunftszeitwertes (ETA_1) an das mobile Endgerät (2) zu entscheiden.

12. Zentrale Verarbeitungseinheit nach Anspruch 11, **dadurch gekennzeichnet, dass** diese Speichermittel zum Speichern eines Schwellwertes für die Differenz umfasst.

13. Zentrale Verarbeitungseinheit nach einem der Ansprüche 11 oder 12, **dadurch gekennzeichnet, dass** diese eine Berechnungseinheit zum Berechnen eines voraussichtlichen Ankunftszeitwertes ($ETA_{0,1}$) von zumindest einem Fahrzeug (3) des Transportnetzwerkes an einem ausgewählten Ort umfasst.

14. Zentrale Verarbeitungseinheit nach einem der Ansprüche 11 bis 1, **dadurch gekennzeichnet, dass** diese angepasst ist um in einem Verfahren nach einem der Ansprüche 1 bis 10 verwendet zu werden.

15. Mobiles Endgerät zum zur Verfügung Stellen von Transportzeitplaninformationen von zumindest einem Fahrzeug (3) eines Transportnetzwerkes, umfassend eine Kommunikationsschnittstelle zur Kommunikation mit zumindest einer zentralen Verarbeitungseinheit (1) und zumindest einer Ausgabevorrichtung zur Ausgabe von Informationen, wobei das mobile Endgerät eine Empfangseinheit zum Empfang und der Handhabung von Informationen von der zentralen Verarbeitungseinheit (1) über voraussichtliche Ankunftszeitwerte ($ETA_{0,1}$) umfasst, **dadurch gekennzeichnet, dass** die voraussichtlichen Ankunftszeitwerte ($ETA_{0,1}$) basierend auf einer Differenz zwischen einem ursprünglichen voraussichtlichen Ankunftszeitwert (ETA_0) und zumindest einem anschließend berechneten voraussichtlichen Ankunftszeitwert (ETA_1) für zumindest ein Fahrzeug (3) eines Transportnetzwerkes an einem ausgewählten Ort übermittelt werden.

16. Mobiles Endgerät nach Anspruch 15, **dadurch gekennzeichnet, dass** dieses eine Eingabeeinheit zur Eingabe eines Ortes, einer Fahrzeugidentifikation, eines Schwellwertes und/oder einer Zeitspezifikation, die an die zentrale Verarbeitungseinheit (1) übermittelt werden sollen, umfasst.

17. Mobiles Endgerät nach einem der Ansprüche 15 oder 16, **dadurch gekennzeichnet, dass** dieses einen Timer umfasst, der mit der Empfangseinheit zum Runterzählen der verbleibenden Zeitdifferenz zu einer empfangenen voraussichtlichen Ankunftszeit ($ETA_{0,1}$) und/oder zu einem vorgegebenen Zeitlimit zu der empfangenen voraussichtlichen Ankunftszeit ($ETA_{0,1}$) verbunden ist.

18. Mobiles Endgerät nach einem der Ansprüche 15 bis 17, **dadurch gekennzeichnet, dass** dieses ausgelegt ist, um in einem Verfahren nach einem der Ansprüche 1 bis 10 verwendet zu werden.

19. Mobiles Endgerät nach einem der Ansprüche 15 bis 18, **dadurch gekennzeichnet, dass** dieses geeignet ist für die Kommunikation mit der zentralen Verarbeitungseinheit gemäß einem der Ansprüche 11 bis 14.

Revendications

1. Procédé de fourniture d'informations de planification de transport, comprenant les étapes de détermination d'informations de position d'au moins un véhicule (3) d'un réseau de transport, de calcul de l'heure

d'arrivée estimée (ETA) du au moins un véhicule à un emplacement sélectionné, de transmission de la au moins une valeur d'heure d'arrivée estimée calculée (ETA) à au moins un terminal mobile (2), dans lequel, après un calcul d'une valeur d'heure d'arrivée estimée initiale (ETA_0), au moins un calcul supplémentaire d'heure d'arrivée estimée pour le au moins un véhicule (3) du réseau de transport à l'emplacement sélectionné est mis en oeuvre, **caractérisé en ce que** la différence (ΔETA) entre la valeur d'heure d'arrivée estimée initiale calculée (ETA_0) et une valeur d'heure d'arrivée estimée ultérieure calculée (ETA_1) est déterminée, et **en ce que** cette différence est utilisée afin de décider de la nécessité de transmission de la valeur d'heure d'arrivée estimée ultérieure calculée (ETA_1) au terminal mobile (2).

2. Procédé selon la revendication 1, **caractérisé en ce que** la différence entre les valeurs d'heures d'arrivée estimées calculées (ETA_0, ETA_1) est comparée à une valeur de seuil de la différence.

3. Procédé selon la revendication 2, **caractérisé en ce que** la comparaison est mise en oeuvre sur une unité centrale de traitement (1) et la valeur de seuil est reçue par l'unité centrale de traitement (1) à partir d'un terminal mobile (2).

4. Procédé selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** la valeur d'heure d'arrivée estimée initiale (ETA_0) est la valeur qui est transmise au terminal mobile (2).

5. Procédé selon l'une quelconque des revendications 2 à 4, **caractérisé en ce que** la transmission de la valeur d'heure d'arrivée estimée (ETA_1) à un terminal mobile dépend du résultat de comparaison par rapport à la valeur de seuil.

6. Procédé selon l'une quelconque des revendications 1 à 5, **caractérisé en ce qu'**un terminal mobile (2) délivre une demande d'information de planification, comportant une indication d'un emplacement sélectionné, une indication d'un véhicule (3) d'un réseau de transport, une identification du terminal mobile (2) et/ou une spécification temporelle.

7. Procédé selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** le au moins un calcul de l'heure d'arrivée estimée ($ETA_{0,1}$) et/ou la détermination de la différence (ΔETA) entre les valeurs calculées (ETA_0, ETA_1) est mis en oeuvre sur une unité de traitement centrale distante (1).

8. Procédé selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que** le au moins un calcul de l'heure d'arrivée estimée ($ETA_{0,1}$) et/ou la détermination de la différence (ΔETA) entre les valeurs calculées (ETA_0, ETA_1) est mis en oeuvre sur un véhicule (3) du réseau de transport.

9. Procédé selon l'une quelconque des revendications 1 à 8, **caractérisé en ce que** le terminal mobile (2) remplace une valeur d'heure d'arrivée estimée (ETA_0) reçue lors de la réception ultérieure d'une autre valeur d'heure d'arrivée estimée (ETA_1).

10. Procédé selon l'une quelconque des revendications 1 à 9, **caractérisé en ce que** le terminal mobile (2) initie une temporisation lors de la réception d'une valeur d'heure d'arrivée estimée ($ETA_{0,1}$).

11. Unité centrale de traitement (1) destinée à fournir des informations de planification de transport comportant au moins une interface de communication afin de communiquer avec au moins un terminal mobile (2) et au moins une unité de réception destinée à recevoir des informations à partir d'un véhicule (3) d'un réseau de transport, **caractérisée en ce qu'**elle comprend une unité de détermination de la différence (ΔETA) entre une valeur d'heure d'arrivée estimée initiale (ETA_0) et au moins une valeur d'heure d'arrivée estimée ultérieure calculée (ETA_1) pour au moins un véhicule (3) d'un réseau de transport à un emplacement sélectionné et **en ce que** cette différence est utilisée afin de décider de la nécessité de transmission de la valeur d'heure estimée ultérieure calculée (ETA_1) au terminal mobile (2).

12. Unité centrale de traitement selon la revendication 11, **caractérisée en ce qu'**elle comprend un moyen de mémorisation destiné à mémoriser une valeur de seuil de la différence.

13. Unité centrale de traitement selon l'une quelconque des revendications 11 ou 12, **caractérisée en ce qu'**elle comprend une unité de calcul destinée à calculer une heure d'arrivée estimée ($ETA_{0,1}$) d'au moins un véhicule (3) du réseau de transport à un emplacement sélectionné.

14. Unité centrale de traitement selon l'une quelconque des revendications 11 à 13, **caractérisée en ce qu'**elle est adaptée de manière à être utilisée dans un procédé selon l'une quelconque des revendications 1 à 10.

15. Terminal mobile destiné à fournir des informations de planification de transport d'au moins un véhicule (3) d'un réseau de transport, comprenant une interface de communication destinée à communiquer avec au moins une unité centrale de traitement (1) et au moins un dispositif de sortie destiné à délivrer les informations, dans lequel le terminal mobile comprend une unité de réception destinée à recevoir et à gérer des informations à partir de l'unité centrale

de traitement (1) sur des valeurs d'heures d'arrivée estimées ($ETA_{0,1}$), **caractérisé en ce que** les valeurs d'heures d'arrivée estimées ($ETA_{0,1}$) sont transmises sur la base d'une différence entre une valeur d'heure d'arrivée estimée initiale (ETA_0) et au moins une valeur d'heure d'arrivée estimée ultérieure calculée (ETA_1) pour au moins un véhicule (3) du réseau de transport à un emplacement sélectionné.

16. Terminal Mobile selon la revendication 15, **caractérisé en ce qu'**il comprend une unité d'entrée destinée à entrer un emplacement, une identification de véhicule, une valeur de seuil et/ou une spécification temporelle à transmettre à l'unité centrale de traitement (1).

17. Terminal mobile selon l'une quelconque des revendications 15 ou 16, **caractérisé en ce qu'**il comprend une temporisation raccordée à l'unité de réception afin de décompter la différence de temps restant par rapport à une heure d'arrivée estimée reçue ($ETA_{0,1}$) et/ou à une limite sur l'heure d'arrivée estimée reçue ($ETA_{0,1}$).

18. Terminal mobile selon l'une quelconque des revendications 15 à 17, **caractérisé en ce qu'**il est adapté de manière à être utilisé dans un procédé selon l'une quelconque des revendications 1 à 10.

19. Terminal mobile selon l'une quelconque des revendications 15 à 18, **caractérisé en ce qu'**il est approprié afin d'assurer la communication avec l'unité centrale de traitement selon l'une quelconque des revendications 11 à 14.

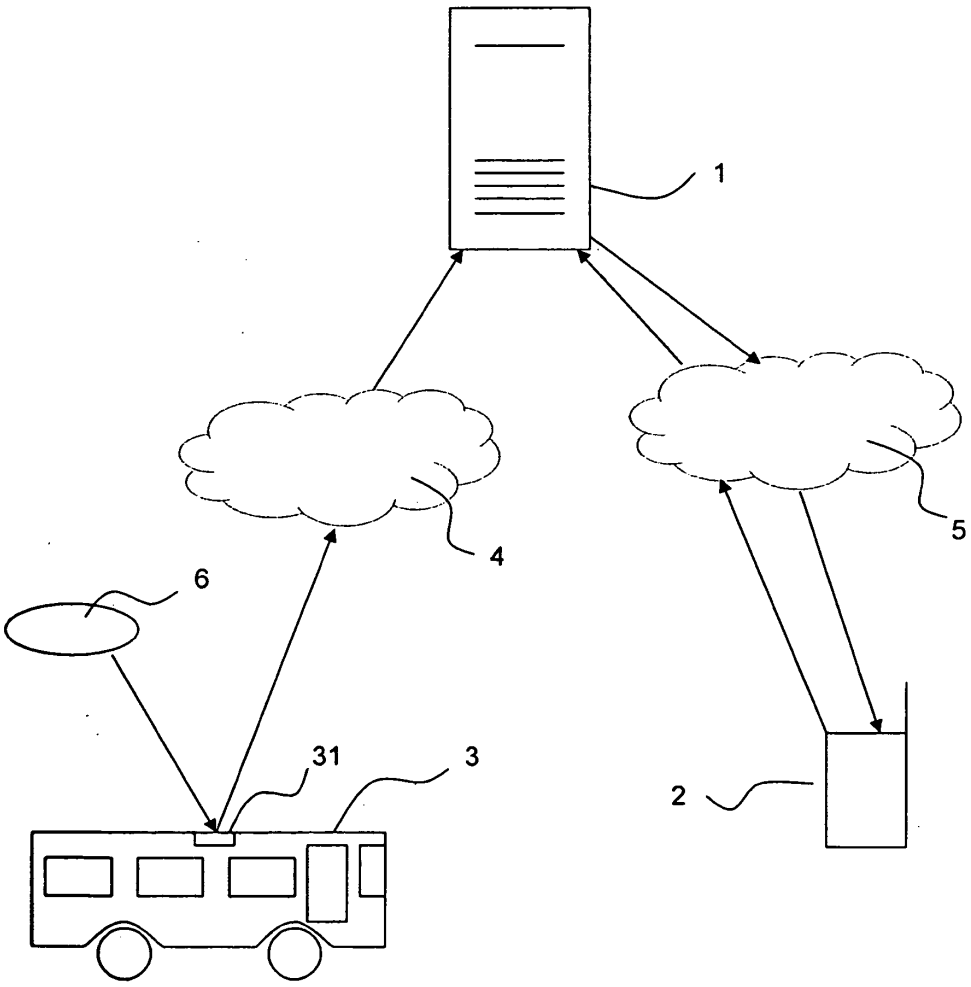


FIG. 1

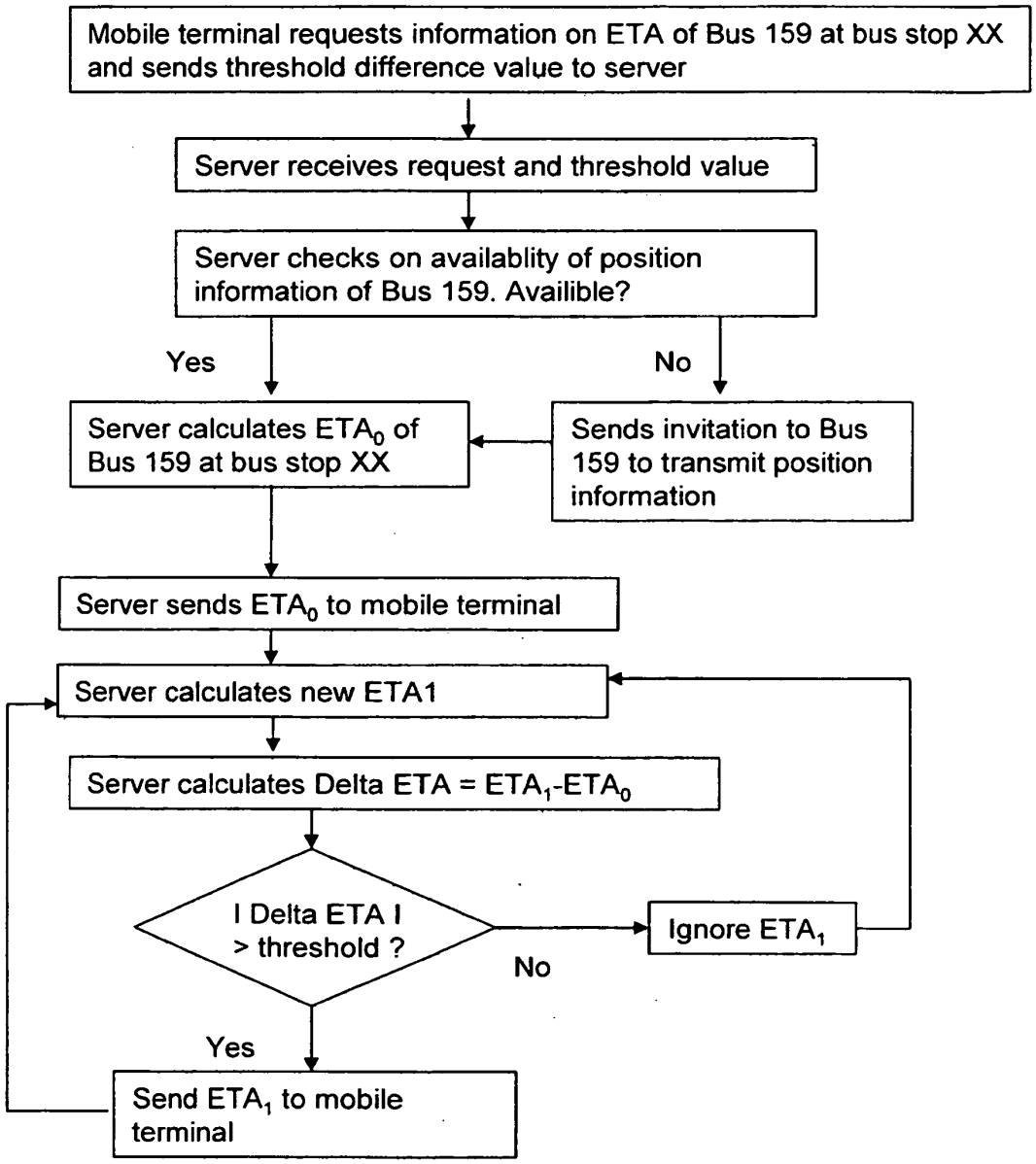

Mobile terminal requests information on ETA of Bus 159 at bus stop XX and sends threshold difference value to server
Server receives request and threshold value
Server checks on availablity of position information of Bus 159. Availible?
Yes
No
Server calculates ETA0 of Bus 159 at bus stop XX
Sends invitation to Bus 159 to transmit position information
Server sends ETA0 to mobile terminal
Server calculates new ETA1
Server calculates Delta ETA = ETA1-ETA0
I Delta ETA I > threshold ?
No
Ignore ETA1
Yes
Send ETA1 to mobile terminal

FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- US 6253148 B1 **[0004]**
- WO 9808206 A **[0006]**