BUS TIME INFORMATION SYSTEM AND METHOD

FIELD OF INVENTION

The present invention relates broadly to a bus time information system and to a method of providing bus time information.

BACKGROUND

Currently, unlike passengers on many train-based public transport systems such as the Singapore Mass Rapid Transit (SMRT), bus passengers have no means of knowing the waiting time of buses at bus stops.

For a person who does not own self-transport and lives far away from the MRT, public or private bus and taxi services are probably the only options to travel long distances in a short time. Depending on the distance of the bus to the bus stop and unforeseen circumstances, such as car accidents, bus passengers can possibly have to wait a long time at a bus stop for their bus to arrive. Rather than waiting, they could have done something useful. Furthermore, if necessary, they could have taken the costlier taxi service earlier to avoid becoming late for an appointment.

Hence, it was with knowledge of the foregoing concern that the present invention was conceived and has now been reduced to practice.

SUMMARY OF INVENTION

In accordance with a first aspect of the present invention there is provided a bus time information system comprising a transmitter device located on-board of an associated bus; a receiver unit receiving information signals transmitted by the transmitter device and receiving a bus time request signal from a remote device; a transmitter unit sending a bus time response signal to the remote device; and a processor unit extracting a bus time request from the received bus time request signal, deriving a bus time response based on the bus time request and information

extracted from the received information signal, and processing the bus time response for sending as the bus time response signal to the remote device.

The bus time request signal and the bus time response signal may be SMS based.

The information signal may contain bus data identifying the associated bus and data identifying the location of the associated bus.

The extracted bus time request may comprise data identifying a bus stop and data identifying a bus service.

The data identifying the bus service may further comprise data identifying a route direction of the bus service.

The bus time response may comprise data identifying a calculated waiting time.

The bus time response may comprise data identifying the number of the bus stops that the nearest bus of the selected bus service will need to run through to the selected bus stop.

The on-board transmitter device may comprise a user interface for human-input stipulated assigning of current location data.

The on-board transmitter device may comprise a location data acquiring unit for automatic assigning of current location data.

The location data acquiring unit may be GPS based.

The processor may further base the deriving of the bus time response on additional information.

The additional information may comprise one or more of a group consisting of the time of day, bus breakdown information, bus accident information, and traffic condition information.

The additional information may be contained in the information signal received from the on-board transmitter device.

The receiver unit may comprise separate receiver elements for receiving the information signals transmitted by the transmitter device and for receiving the bus time request signal from the remote device respectively.

In accordance with a second aspect of the present invention there is provided a method of providing bus time information, the method comprising transmitting information signals from a bus; receiving the information signal; receiving a bus time

request; extracting a bus time request from the received bus time request signal; deriving a bus time response based on the bus time request and information extracted from the received information signal, and processing the bus time response for sending as a bus time response signal.

The bus time request signal and the bus time response signal may be SMS based.

The information signal may contain bus data identifying the bus and data identifying the location of the bus.

The extracted bus time request may comprise data identifying a bus stop and data identifying a bus service.

The data identifying the bus service may further comprise data identifying a route direction of the bus service.

The bus time response may comprise data identifying a calculated waiting time.

The bus time response may comprise data identifying the number of the bus stops that the nearest bus of the selected bus service will need to run through to the selected bus stop.

The method may comprise human-input stipulated assigning of current location data for the bus.

The method may comprise automatic assigning of current location data for the bus.

The assigning of the location data may be GPS based.

The method may further comprise the deriving of the bus time response based on additional information.

The additional information may comprise one or more of a group consisting of the time of day, bus breakdown information, bus accident information, and traffic condition information.

At least a portion of the additional information may be contained in the information signal received from the bus.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described, by way of example only, and in conjunction with the drawings, in which:

Figure 1 is a schematic drawing illustrating a bus time information system according to an embodiment to the present invention.

Figure 2 is a schematic drawing illustrating a bus service and bus stops on a single direction route in an example embodiment.

Figure 3 is a schematic drawing illustrating a bus service and bus stops on two different route directions in an example embodiment.

Figure 4 is a schematic drawing illustrating a bus service and bus stops on a loop route in an example embodiment.

Figure 5 is a schematic drawing illustrating the principle of calculation of bus waiting time in an example embodiment.

Figure 6 is a schematic drawing of a computer system for implementing the method and system according to an example embodiment.

DETAILED DESCRIPTION

In the example embodiment, a Short Messaging Service (SMS) based bus waiting time information system is described. The system provides SMS enabled mobile phone users with estimated bus waiting time at user-specified bus stops based on location and status updates from on-road bus services to a central server. Moreover, for identification purposes, the system allocates a unique Identification (ID) number for every bus stop, a unique Identification (ID) number for every bus and a unique Identification (ID) number for every bus service (bus service line) in a city. In other embodiments, besides using SMS, similar technologies such as Unstructured Supplementary Service Data (USSD), Multimedia Messaging Service (MMS), etc. can be used instead.

With reference to FIG.1, a bus time information system 100 according to an example embodiment will now be described. A bus 102 is capable of transmitting bus location and status updates wirelessly to a central server 104. The wireless

communication capability can be realised by mounting a signal–sending device (not shown) in the bus 102 and mounting a receiver device at the central server 104. An example technology for such signal sending/receiving device would be a Global Positioning System (GPS) based technology.

The central server 104 comprises a central database 106 to contain bus information. Bus information, in the example embodiment, is comprised of the unique ID numbers of different buses, bus services (bus service line), bus routes and bus stops, and real-time on-road bus location and status data updates. When a mobile phone 110 user specifies a certain bus stop and bus service in a SMS request message, the central server 104 looks up the central database 106 to retrieve the most recently calculated waiting time based on the unique ID numbers of the buses of that bus service and bus stops, after which, the central server 104 will send off the waiting time with the number of the bus stops that the nearest bus of the selected bus service will need to run through to the selected bus stop to the mobile phone user using SMS via a mobile phone system 108.

In the example embodiment, the mobile phone system 108 is used for establishing communication between the mobile phone 110 of the mobile phone user and the central server 104. It may be a Global System for Mobile Communications (GSM) modem with at least one Subscriber Identification Module (SIM) card. In addition, to provide for high traffic of SMS user requests, a direct link from the mobile phone system 108 to a SMSC (SMS Centre) (not shown in FIG. 1) may be established.

In the example embodiment, three bus route types are considered. The bus route types are single direction route (as shown in FIG.2), different direction route (as shown in FIG.3) and single direction loop route (as shown in FIG.4).

With reference to FIG. 2, each bus service (bus service line) can be represented by a series of unique Bus Stop ID numbers in sequence from the first bus stop to the last bus stop. For a single direction route, the first bus stop of the bus service is the last bus

stop of the bus service for the opposite route direction of the same bus service and vice versa. A bus stop may also be known as a bus station, bus interchange or bus terminal. In another embodiment, predetermined intervals along the routes can be used besides using bus stops as the only form of indication.

With reference to FIG.3, for the same bus service with two different route directions, the bus stop ID numbers are different for different route directions with the exception that the the first Bus Stop ID of one direction route is the same as the last Bus Stop ID of the opposite route direction of the same bus service(bus service line).

With reference to FIG.4, some bus lines provide loop services, which means the bus service direction is fixed in one direction and the starting point is also the ending point.

In detail, bus information stored in the central database (106 in FIG.1) comprises at least one set of bus information for each bus service. The set of bus information of each bus service consists of two parts in the example embodiment. One part comprising the unique ID numbers of buses of the bus service and the unique ID numbers of all bus stops along the route. The other part comprises current bus location and status updates from the buses, e.g. 102 in FIG. 1.

Current bus location updates comprise of data indicating the bus stops along the on-road bus service routes which the bus has arrived at or passed by. An example of an update may be sending off the Bus Stop ID the central server (104 in FIG.1) when the bus has just arrived at or passed by that bus stop.

Current bus status updates may include a unique ID number indicating predefined messages like “Bus accident”, “Bus breakdown”, “Slow Traffic” and “Road Blocks”, etc.

Another item in the central database (106 in FIG.1) with the example embodiment is the calculated waiting time and the number of the bus stops that the nearest bus of the selected bus service will need to run through for each bus stop. In

the example embodiment, at every time interval such as 5 seconds or 10 seconds, the central server (104 in FIG.1) will calculate the bus waiting time and the number of the bus stops that the nearest bus of the selected bus service will need to run through to the selected bus stop and refresh the central database (106 in FIG. 1) with the new time values and the number of the bus stops.

As mentioned earlier, the transmitter device on board the on-road bus (102 in FIG.1) sends bus information wirelessly to the receiver device that is connected to the central database (106 in FIG.1). This transmitter device can be manually and/or automatically controlled. During initialisation, the transmitter device is programmed such that users, e.g. the bus driver, are required to input or edit, the Bus Service ID number, Bus Stop ID numbers with the bus stop names, the Bus ID number and a list of bus stops running in sequence along the bus-servicing route. This may be facilitated /assisted through pre-stored data in the transmitter device and appropriate selection/editing by the driver.

In manual control, the bus driver controls the time a signal is sent out by pressing a button, which upon depressing, sends out a signal to the receiver device connected to the central server (104 in FIG.1). The signal contains updating data for the central database (106 in FIG.1) to indicate that the bus which has an unique ID number (102 in FIG.1) has just reached or passed by (if there is no stopping) a bus stop.

In automatic control, the transmitter device and central server (104 in FIG.1) each comprise an auto-tracking interface, which may be based on technologies such as Global Positioning System (GPS). With this interface, the central server (104 in FIG.1) can automatically detect movement and location of the device in real-time based wireless communication. The auto-tracking interface works by dividing the whole city area into many small zones such that every bus stop of a bus service (102 in FIG.1) travelling in a particular route type will fall into one of these zones. Each zone will have a unique ID number to be used by the auto-tracking interfaces to identify the location of the bus. Essentially, each zone ID number is linked directly with each bus stop ID number. As such, the auto-tracking interface enables real-time updates at each bus stop as the on-road bus (102 in FIG.1) travels through the various zones.

The transmitter device in the example embodiment also comprises a display for the bus driver to view, in sequence, the list of bus stops that is pre-stored in the device during initialisation. In manual control, when the bus driver manually selects an entry from the list and presses the button, the update for the selected entry would be sent off. In automatic control, the entry on the display is automatically selected and the update for the selected entry will be sent off. It is possible that no display is required for automatic control. The display is only required for the bus driver to monitor the auto-tracking process. After an update is sent off, an arrow or cursor on the display will automatically move on to the next pre-stored bus stop entry. In manual control, an update for this entry would be sent off manually when the bus driver presses the button again. In automatic control, an update for this entry would be communicated with the central server automatically when the bus (102 in FIG.1) moves into the next zone.

In addition, a panel of bus status buttons or electronic triggers connected to the bus engine may be linked to the transmitter device in the example embodiment. For instance, a "Bus accident" signal sent out by pressing one of these buttons or triggering the sensors of the electronic triggers (e.g. when engine abruptly cuts off in an accident) may temporarily remove the availability of the accident bus's waiting times to users. In such an event, the bus waiting time of the next available on-road bus will be sent off to the requesting mobile phone user.

In the example embodiment, mobile phone users who wish to know a particular bus waiting time at a particular bus stop may use of a formatted SMS request message to communicate with the central server (104 in FIG.1). As described earlier, the central server (104 in FIG.1) makes use of the mobile system (108 in FIG.1) to communicate with users. At the mobile system (108 in FIG.1), a telephone number is assigned to receive SMS requests from mobile phone users.

Assuming the telephone number assigned is "**888**", a mobile phone user may construct the SMS request message by first keying in the Bus service number, followed by route direction number, followed by a separator "@" and lastly, followed by the unique bus stop ID number. The route direction ID number may be defined as "**0**" for bus

services travelling on route types such as the single direction route or the single direction loop route or the predefined forward direction of a different direction route. "**1**" may be used to indicate the reverse direction of the different direction route.

Based on the description above, a typical generic SMS request message format will look like:

"<Bus service number><route direction ID number (**1** or **0**)>@<unique bus stop ID>".

After constructing the message, the mobile phone user sends off the message to the telephone number, **888**, to complete the request.

Through the mobile system (108 in FIG.1), the central server (104 in FIG.1) receives the SMS message.

Next, based on the bus information in the SMS message, the central server retrieves the most updated bus waiting time that is calculated and refreshed at 5 to 10 seconds interval in the central database (106 in FIG.1).

Then, the central server (104 in FIG.1) sends the waiting time to the mobile system (108 in FIG.1), which constructs a SMS message, indicating the retrieved waiting time for the specified bus service number at the specified bus stop, to be sent off to the mobile user.

Utilising the above-mentioned generic SMS request message format, an example for bus service number "**16**" at unique bus stop ID number "**18688**" and direction number "**0**", will be, "**160@18688**". A return message indicating the bus waiting time with the number of the bus stops that the nearest bus of the selected bus service will need to run through to the selected bus stop from the central server (104 in FIG.1) to the mobile phone user may look like, "**20 mins & 8 bus stops**".

The bus stop ID number of a bus stop and the route direction ID number of a bus service (bus service line) may be available at that bus stop (bus station) for passengers'

reference. The relevant ID numbers may additionally and/or alternatively be available from other public sources such as brochures or web-sites in different embodiments.

In the example embodiment, the calculation of waiting time occurring at every 5 to 10 seconds interval is as follow. To begin with, the running time between two bus stops including the time for customers to get on and off the bus is estimated to be about **1** minute (60 seconds). In order to estimate the waiting time more accurately, it may be necessary to reflect the impact from traffic situation and the time taken for the passengers to get on/off the buses. Hence, peak and off-peak time intervals will have different delays to be added on to the running time. For example, peak periods may refer to every weekday from 7:30am to 10:00am and from 5:30am to 8:30am where traffic is usually heavy. In this case, the time taken from one bus stop to the next bus stop is about 1 minute and 35 seconds (95 seconds). For the other time periods, they will be referred as off-peak period and the time taken from one bus stop to the next bus stop in this case is about 1 minute and 20 seconds (80 seconds).

A sample calculation is as follow. With reference to FIG.5, assuming off-peak, a Bus Service starts at Bus Stop **22281** and ends at Bus Stop **22288**. A customer 500 is waiting at Bus Stop **22286** for Bus Service **16** and the nearest Bus 502 of that service **16** to Bus Stop **22286** has just arrived at Bus Stop **22283**. When customer sends a SMS request message to the system, the system will calculate the waiting time for the customer, which is **80** (seconds) x **3** (Bus Stops) = **4** (minutes). After calculation, the system updates the central database (106 in FIG.1) with **4** minutes as the waiting time of Bus **16** at Bus Stop **22286**. When the customer requests for the waiting time, the value of **4** minutes would be retrieved from the central database (106 in FIG.1) with the number of the Bus Stops that the nearest Bus of the selected Bus Service will need to run through to the selected bus stop, which in this case is 3, and sent off as a SMS to the customer.

In another embodiment, the specific bus service starting and ending time on the time schedules of bus services can be recorded into the central database (106 in FIG.1) and form part of the bus time information that customers can inquire about.

In another embodiment, instead of calculating and refreshing bus waiting time values in the central database (106 in FIG.1) for the specified bus service and bus stop at 5 to 10 seconds intervals, the waiting time value can be calculated and refreshed in the central database (106 in FIG.1) only upon request by the mobile phone user. When multiple SMS requests are received, the requests can be buffered on first come first serve basis and handled one by one.

Embodiments of the present invention can provide the following advantages:

1) The bus waiting time at the bus stop can be minimised. At home or in the office, any mobile phone holder have the convenience of sending a SMS to the Telecommunications company to inquire for the arrival time of the next and subsequent bus classes at the selected bus stop for the selected bus line number. With this feature, the mobile phone holder can plan his or her time better if he or she is planning to travel to somewhere by public bus transport.

2) More accurate information of real-time bus classes can be readily available. With the information, passengers can easily decide whether to wait at the bus stop or to choose alternative options such as taking a taxi instead.

3) Regardless of the location of the bus passengers, the present invention described by the example embodiments allow them to get information of selected bus lines at a selected bus stop if they know the unique number of the bus stop and the bus line number. This is unlike the MRT system, where passengers can only get MRT classes information in MRT stations.

The method and system of the example embodiment can be implemented on a computer system 800, schematically shown in FIG. 6. It may be implemented as software, such as a computer program being executed within the computer system 800, and instructing the computer system 800 to conduct the method of the example embodiment.

The computer system 800 comprises a computer module 802, input modules such as a keyboard 804 and mouse 806 and a plurality of output devices such as a display 808, and printer 810.

The computer module 802 is connected to a computer network 812 via a suitable transceiver device 814, to enable access to e.g. the Internet or other network systems such as Local Area Network (LAN) or Wide Area Network (WAN).

The computer module 802 in the example includes a processor 818, a Random Access Memory (RAM) 820 and a Read Only Memory (ROM) 822. The computer module 802 also includes a number of Input/Output (I/O) interfaces, for example I/O interface 824 to the display 808, and I/O interface 826 to the keyboard 804.

The components of the computer module 802 typically communicate via an interconnected bus 828 and in a manner known to the person skilled in the relevant art.

The application program is typically supplied to the user of the computer system 800 encoded on a data storage medium such as a CD-ROM or floppy disk and read utilising a corresponding data storage medium drive of a data storage device 830. The application program is read and controlled in its execution by the processor 818. Intermediate storage of program data may be accomplished by using RAM 820.

In the foregoing manner, a message based bus time information system is disclosed. Only several embodiments are described. However, it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modifications may be made without departing from the scope of the invention.

For example, it will be appreciated that the return message to an inquiry may include only the waiting time, or only the number of bus stops that the nearest bus has to run through, or both, in different embodiments.

Claims

1. A bus time information system comprising

a transmitter device located on-board of an associated bus;

a receiver unit receiving information signals transmitted by the transmitter device and receiving a bus time request signal from a remote device;

a transmitter unit sending a bus time response signal to the remote device; and

a processor unit extracting a bus time request from the received bus time request signal, deriving a bus time response based on the bus time request and information extracted from the received information signal, and processing the bus time response for sending as the bus time response signal to the remote device.

2. The system as claimed in claim 1, wherein the bus time request signal and the bus time response signal are SMS based.

3. The system as claimed in claims 1 or 2, wherein the information signal contains bus data identifying the associated bus and data identifying the location of the associated bus.

4. The system as claimed in any one of the preceding claims, wherein the extracted bus time request comprises data identifying a bus stop and data identifying a bus service.

5. The system as claimed in claim 4, wherein the data identifying the bus service further comprises data identifying a route direction of the bus service.

6. The system as claimed in any one of the preceding claims, wherein the bus time response comprises data identifying a calculated waiting time.

7. The system as claimed in any one of the preceding claims, wherein the bus time response comprises data identifying the number of the bus stops that the nearest bus of the selected bus service will need to run through to the selected bus stop.

8. The system as claimed in any one of the preceding claims, wherein the on-board transmitter device comprises a user interface for human-input stipulated assigning of current location data.

9. The system as claimed in any one of the preceding claims, wherein the on-board transmitter device comprises a location data acquiring unit for automatic assigning of current location data.

10. The system as claimed in claim 9, wherein the location data acquiring unit is GPS based.

11. The system as claimed in any one of the preceding claims, wherein the processor further bases the deriving of the bus time response on additional information.

12. The system as claimed in claim 11, wherein the additional information comprises one or more of a group consisting of the time of day, bus breakdown information, bus accident information, and traffic condition information.

13. The system as claimed in claims 11 or 12, wherein at least a portion of the additional information is contained in the information signal received from the on-board transmitter device.

14. The system as claimed in any one of the preceding claims, wherein the receiver unit comprises separate receiver elements for receiving the information signals transmitted by the transmitter device and for receiving the bus time request signal from the remote device respectively.

15. A method of providing bus time information, the method comprising

transmitting information signals from a bus;

receiving the information signal;

receiving a bus time request;

extracting a bus time request from the received bus time request signal;

deriving a bus time response based on the bus time request and information extracted from the received information signal, and

processing the bus time response for sending as a bus time response signal.

16. The method as claimed in claim 15, wherein the bus time request signal and the bus time response signal are SMS based.

17. The method as claimed in claims 15 or 16, wherein the information signal contains bus data identifying the bus and data identifying the location of the bus.

18. The method as claimed in any one of claims 15 to 17, wherein the extracted bus time request comprises data identifying a bus stop and data identifying a bus service.

19. The method as claimed in claim 18, wherein the data identifying the bus service further comprises data identifying a route direction of the bus service.

20. The method as claimed in any one of claims 15 to 19, wherein the bus time response comprises data identifying a calculated waiting time.

21. The method as claimed in any one of claims 15 to 20, wherein the bus time response comprises data identifying the number of the bus stops that the nearest bus of the selected bus service will need to run through to the selected bus stop.

22. The method as claimed in any one of claims 15 to 21, comprising human-input stipulated assigning of current location data for the bus.

23. The method as claimed in any one of claims 15 to 22, comprising automatic assigning of current location data for the bus.

24. The method as claimed in claim 23, assigning of the location data is GPS based.

25. The method as claimed in any one of claims 15 to 24, further comprising the deriving of the bus time response based on additional information.

26. The method as claimed in claim 25, wherein the additional information comprises one or more of a group consisting of the time of day, bus breakdown information, bus accident information, and traffic condition information.

27. The method as claimed in claims 25 or 26, wherein at least a portion of the additional information is contained in the information signal received from the bus.