(19) IPOS INTELLECTUAL PROPERTY OFFICE OF SINGAPORE

(11) Publication number: **SG 190836 A1**
(43) Publication date: **31.07.2013**
(51) Int. Cl: **B61L 25/02;**

(12) Patent Application

(21) Application number: **2013038633**
(22) Date of filing: **04.03.2011**

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(54) **Title:**
IN-VEHICLE GUIDANCE DISPLAY SYSTEM AND IN-VEHICLE GUIDANCE DISPLAY METHOD

(57) **Abstract:**
29 ABSTRACT IN-VEHICLE GUIDANCE DISPLAY SYSTEM AND IN-VEHICLE GUIDANCE DISPLAY METHOD 5 A ground system 10 includes a guidance-display-data creation device 11 that creates a dataset including information on a stop station pattern, effective-period related information, and train number information as guidance display data, and an information distribution 10 server 12 that wirelessly distributes all or a part of a dataset included in the guidance display data to an on board system 20. The on-board system 20 includes a central distribution server 21 that manages the distributed dataset, and when a train number is set, distributes the dataset to 15 each vehicle if the central distribution server 21 holds a dataset corresponding to the train number and within an effective period, and notifies the information distribution server 12 of the train number to acquire a corresponding dataset and distributes the corresponding dataset to each 20 vehicle if the central distribution server 21 does not hold the dataset corresponding to the train number and within the effective period; and a display terminal device 26 that displays a guidance on display devices 27L and 27R based on the dataset distributed from the central distribution 25 server 21. Figure 2

ABSTRACT

IN-VEHICLE GUIDANCE DISPLAY SYSTEM AND IN-VEHICLE GUIDANCE DISPLAY METHOD

A ground system 10 includes a guidance-display-data creation device 11 that creates a dataset including information on a stop station pattern, effective-period related information, and train number information as guidance display data, and an information distribution server 12 that wirelessly distributes all or a part of a dataset included in the guidance display data to an on-board system 20. The on-board system 20 includes a central distribution server 21 that manages the distributed dataset, and when a train number is set, distributes the dataset to each vehicle if the central distribution server 21 holds a dataset corresponding to the train number and within an effective period, and notifies the information distribution server 12 of the train number to acquire a corresponding dataset and distributes the corresponding dataset to each vehicle if the central distribution server 21 does not hold the dataset corresponding to the train number and within the effective period; and a display terminal device 26 that displays a guidance on display devices 27L and 27R based on the dataset distributed from the central distribution server 21.

Figure 2

DESCRIPTION

IN-VEHICLE GUIDANCE DISPLAY SYSTEM AND IN-VEHICLE GUIDANCE DISPLAY METHOD

Field

[0001] The present invention relates to an in-vehicle guidance display system and an in-vehicle guidance display method for displaying a guidance in each vehicle of a train.

Background

[0002] In recent years, in railway trains, a system of installing an LCD display at a predetermined position (such as a door header in the upper portion of a door) in each vehicle and giving passengers a guidance of the running position of a train and of the next stop station, a transfer guidance at the next stop station, and the like is popular.

[0003] To display the above guidance, line information (information on each stop station on a line on which the train is running, information on stop stations for each train type, and the like) is necessary. In addition, it is often necessary to provide information (such as image data) for creating a guidance display screen.

[0004] While the information necessary for the guidance display is registered in a data server or the like within the train in advance, it is necessary to update the registered information when a train schedule is revised. When it is necessary to update the information, then updated information (new information) is created and manual update is performed individually for each train using personal computers, dedicated devices, or the like. Alternatively, a storage medium that stores therein the created new information is prepared and replaced with a storage medium that stores therein un-updated information (old information). There is also proposed a system of

transmitting running data including a train destination, a train type, and stop stations to each train over wireless communication (for example, Patent Literature 1).

Citation List

Patent Literature

[0005] Patent Literature 1: Japanese Patent Application Laid-open No. 2003-48543

Summary

Technical Problem

[0006] In a case of updating the information necessary for the guidance display using the personal computers, the dedicated devices, or the like for each train individually or a case of replacing the storage medium, the burden imposed on an operator is large because of the need to perform manual working. Furthermore, because of the manual working, there are problems such that it is necessary to multiplex confirmation work so as to prevent human errors and it is difficult to realize both the improvement in work reliability and the reduction in a working time. Further, because it takes a quite long time and much labor to update the information, once each train is allocated to an operation on a certain line at a time of revising the train schedule, the train is unable to display a guidance of lines other than the line to which the train is allocated. Therefore, there is a problem that it is difficult to allow the train to operate on another line and it is impossible for the train to flexibly operate. According to the technique using the wireless communication as described in Patent Literature 1, it is unnecessary for a train driver to manually input a train number at the start of the operation. This in turn requires the train to always communicate with outside (a base station) and to receive the train number and running data when the train starts

operating, which unnecessarily increases communication traffic. Further, there is also a problem that it is necessary to update a database on the base station side to allow the train to operate on another line, and similarly to the problems with the manual data update, it is difficult for the train to flexibly operate.

[0007] The present invention has been achieved to solve the above problems, and an object of the present invention is to achieve an in-vehicle guidance display system and an in-vehicle guidance display method capable of reducing work load required to update data necessary for guidance display in a vehicle (hereinafter, "guidance display data") and improving the reliability of update work. Another object of the present invention is to achieve an in-vehicle guidance display system and an in-vehicle guidance display method capable of realizing a flexible train operation.

Solution to Problem

[0008] To solve the above problems and achieve an object, there is provided an in-vehicle guidance display system according to the present invention including: a ground system that creates guidance display data to be used to display a guidance in a vehicle of a train; and an on-board system that is mounted on the train and displays a guidance using guidance display data created by the ground system, wherein the ground system includes a guidance-display-data creation device that creates, for each line as the guidance display data, a dataset including information on a stop station pattern for each train type, effective-period related information indicating at least one of a start date and time and an end date and time of an effective period, and train number information, and a data distribution server that holds the guidance display data and that wirelessly distributes all or a part of the dataset

included in the held guidance display data to the on-board system at a predetermined timing, and the on-board system includes a central distribution server that manages the dataset distributed from the ground system, and when a train number of a train in which the on-board system is installed is set, distributes the dataset to each vehicle if the central distribution server holds a dataset corresponding to the train number and within the effective period, and notifies the data distribution server of the train number to acquire a corresponding dataset and distributes the corresponding dataset to each vehicle if the central distribution server does not hold the dataset corresponding to the train number and within the effective period, and a display terminal device that is installed in each vehicle and that displays a guidance on a display device in the vehicle based on the dataset distributed from the central distribution server.

Advantageous Effects of Invention

[0009] According to the present invention, it is possible to realize a reduction in the time required for work of updating guidance display data and a reduction in work burden imposed on an operator. It is also possible to avoid the occurrence of human errors and to realize an improvement in work reliability. Furthermore, even in a case where a train runs on whatever line in a railway system, it is possible to display guidance and to realize that the train operates flexibly.

Brief Description of Drawings

[0010] FIG. 1 is a configuration example of an in-vehicle guidance display system according to the present invention.

FIG. 2 is a configuration example of an on-board system.

FIG. 3 is a flowchart of an example of an operation performed by a ground system for creating guidance display data and distributing the guidance display data to each of on-board systems.

FIG. 4 is a configuration example of train number original data.

FIG. 5 is an example of stop pattern data.

FIG. 6 is an example of train number data.

FIG. 7 is an example of guidance-display control data.

FIG. 8 is an example of guidance display.

FIG. 9 is a flowchart of an example of an operation for distributing guidance display data to a display terminal device in each vehicle.

Description of Embodiments

[0011] Exemplary embodiments of an in-vehicle guidance display system and an in-vehicle guidance display method according to the present invention will be explained below in detail with reference to the accompanying drawings. The present invention is not limited to the embodiments.

[0012] First embodiment.

FIG. 1 is a configuration example of an in-vehicle guidance display system according to the present invention. As shown in FIG. 1, the in-vehicle guidance display system includes a ground system 10 configured to include a guidance-display-data creation device 11, an information distribution server 12, and an information transmitter/receiver 13, and an on-board system configured to include various devices (not shown) installed in respective vehicles. FIG. 2 is a configuration example of an on-board system 20. FIG. 2 also depicts a configuration of the ground system 10. As shown in FIG. 2, one on-board system 20 is configured to include a central distribution server 21, a train-information central unit 22, a train-

information terminal device 23, a transmission device 24, an information transmitter/receiver 25, a display terminal device 26, display devices 27L and 27R, a train-number setting device 28, and a storage device 29. The central distribution server 21, the train-information central unit 22, the information transmitter/receiver 25, and the train-number setting device 28 are installed only in a part of the vehicles and, in the example shown in FIG. 3, installed in a first vehicle (Vehicle 1). The train-number setting device 28 is desirably installed near a driver's platform in a driver's cabin. For example, the display device 27L is a display device installed on a door header in an upper portion of a door on the left side relative to a traveling direction of the train, and the display device 27R is a display device installed on a door header in the upper portion of the door on the opposite side. While FIG. 2 depicts only the Vehicles 1 and 2 in a train of a plurality of vehicles, similar devices to those of Vehicle 2 are installed in third and the following vehicles. The present invention is not limited to a case of the train of a plurality of vehicles but applicable to a train of one vehicle.

[0013] In the ground system 10, the guidance-display-data creation device 11 creates guidance display data to be displayed in each vehicle. The information distribution server 12 holds the guidance display data created by the guidance-display-data creation device 11 and distributes the guidance display data to each vehicle in a railway system at a predetermined timing. The information transmitter/receiver 13 is a wireless communication device installed in each station, each vehicle station, or the like. The information transmitter/receiver 13 communicates with trains in a wirelessly communicable area and makes

distribution of the guidance display data stored in the information distribution server 12 and the like.

[0014] In the on-board system 20, the central distribution server 21 holds the guidance display data received from the ground system 10 via the information transmitter/receiver 25, extracts necessary data for guidance display on a running line (or a running route) and distributes the extracted data to the display terminal device 26 of each vehicle when the train starts running. Furthermore, the on-board-system central distribution server 21 is connected to the train-information central unit 22 and acquires various types of train information (described later in detail) from the train-information central unit 22.

[0015] The train-information central unit 22 is a central unit of train information devices and is installed in the Vehicle 1, for example. The train-information terminal device 23 is a terminal device of the train information devices and is installed in each vehicle. The train-information central unit 22 and the train-information terminal device 23 are connected to each other via a transmission line and collect train information in association with each other. That is, the train-information terminal devices 23 in the vehicles collect, transmit, and share train information on the respective vehicles. The train-information central unit 22 collectively controls the train-information terminal devices 23. Examples of the train information include train identification information, train position information such as kilometer mileage and a running area, train running information such as stop stations, a line, a destination, and a predicted station arrival time, train current-status information such as the current time, a

station arrival time, and the number of passengers, train command information such as a door opening/closing command and a stop command, and weather information such as temperature information.

[0016] The transmission device 24 is installed in each vehicle and connected to the central distribution server 21 via a transmission line. The transmission device 24 of each vehicle transmits the guidance display data distributed from the central distribution server 21 to the display terminal device 26 in the same vehicle, and transfers the guidance display data to the transmission device 24 of the adjacent vehicle. Furthermore, the transmission device 24 acquires train information necessary for the guidance display among the various types of train information collected by the train-information terminal device 23 and transmits the acquired train information to the display terminal device 26 in the same vehicle.

[0017] The information transmitter/receiver 25 communicates with the information transmitter/receiver 13 of the ground system 10 installed in each station, each vehicle station, or the like and receives the distributed guidance display data or the like.

[0018] The display terminal device 26 stores the guidance display data distributed from the central distribution server 21 in the storage device 29, creates a guidance display screen based on the guidance display data stored in the storage device 29 and the train information acquired via the transmission device 24, and displays the created guidance display screen on the display devices 27L and 27R.

[0019] The train-number setting device 28 is a device for allowing a crew (for example, a train driver) to set a train number before the train starts running, and notifies

the central distribution server 21 of the set train number when the train number is set (input).

[0020] The outline of a characteristic operation of the in-vehicle guidance display system configured as described above is as follows. That is, in the in-vehicle guidance display system, when the ground system 10 creates the guidance display data and is ready for distributing the guidance display data to each train (each on-board system 20), the ground system 10 individually distributes the guidance display data to the on-board system 20 of each train at a predetermined timing. The guidance display data includes various types of information necessary for the guidance display on each line in the railway system and the various types of information are put together per line and managed as one dataset. While depending on the content of the guidance to be displayed, the various types of information include, for example, data on stop stations on each line for each train type (corresponding to guidance-display control data (described later)) and data on images constituting the guidance display screen (corresponding to the guidance content (described later)). Furthermore, train schedule information or the like can be included in the various types of information. The central distribution server 21 within the on-board system 20 manages the guidance display data distributed from the ground system 10, selects a dataset corresponding to a running itinerary (the train number designated by a crew), and distributes the selected dataset to the display terminal device 26 of each vehicle. At this time, unless holding an effective dataset corresponding to the designated train number for some reason, the central distribution server 21 communicates with the information distribution server 12 of the ground system 10 via the information transmitter/receiver 25 and

acquires the dataset (guidance display data) corresponding to the train number designated by the crew.

[0021] Characteristic operations of the in-vehicle guidance display system according to the present embodiment are explained below in detail. The characteristic operations are explained while separately referring to (1) creation of the guidance display data by the ground system and distribution of the guidance display data from the ground system to each on-board system, and (2) distribution of the guidance display data to each vehicle by the on-board system.

[0022] (1) Creation of guidance display data by ground system and distribution of guidance display data from ground system to each on-board system

FIG. 3 is a flowchart of an example of an operation performed by the ground system 10 for creating guidance display data and distributing the guidance display data to each of the on-board systems 20. First, in this operation, the guidance-display-data creation device 11 in the ground system 10 creates the guidance display data and stores the guidance display data in the information distribution server 12 (Step S11).

[0023] At Step S11, the guidance-display-data creation device 11 creates train number data (see FIG. 6) and the guidance-display control data (see FIG. 7) based on train number original data (see FIG. 4) and stop pattern data (see FIG. 5) created in advance by a railway system staff or the like, and the guidance-display-data creation device 11 creates the guidance display data based on these train number data and guidance-display control data as well as guidance content data created separately.

[0024] Various types of data used in a process of creating the guidance display data are explained here. FIG.

4 is a configuration example of train number original data. As shown in FIG. 4, the train number original data is constituted by various types of information including, for example, operating days, work numbers, train orders, train numbers, start stations, last stations, train types, and pattern codes. The operating day is information indicating a day when a train having a corresponding train number operates, the work number is a number indicating an operation itinerary (a route) of one train per day, and the train order is information indicating an operating order under the same work number. According to the contents of FIG. 4, for example, a train having a work number 102 runs from a station C to a station D as a train having a train number 3204M (a first-train-order train), runs from the station D to a station E as a train having a train number 3104M (a second-train-order train), and runs from the station E to the station D as a train having a train number 3139M (a third-train-order train). Subsequently, the train sequentially runs as trains having train numbers according to the train order of the work number 102, and when the train runs up to the station C as a train having a train number 3301M (a ninth-train-order train), the train finishes operating. The start station is a station at which the train starts running as the train having the corresponding train number, and the last station is a station at which the train ends running as the train having the corresponding train number. As for the train type, trains equal in a stop station pattern are classified into the same type. In the example shown in FIG. 4, the trains are classified into three types of Rapid C, Local, and Rapid. The pattern code indicates a pattern of the stations at which the trains having the corresponding train numbers stop, and an identical pattern code is allocated to

the train numbers identical in the train type.

[0025] FIG. 5 is an example of stop pattern data, which is information indicating a train of what type stops at what station on a certain line.

[0026] FIG. 6 is an example of train number data and FIG. 7 is an example of guidance-display control data. These train number data and guidance-display control data are obtained by extracting necessary information from the train number original data shown in FIG. 4 and the stop pattern data shown in FIG. 5 and reconfiguring the necessary information. Furthermore, the train number data includes effective period information input from outside (by an operator) to the guidance-display-data creation device 11. This effective period information indicates an effective period of the train number data, the guidance-display control data created together with the train number data, and the guidance content data (that is, a period for which these pieces of data are used when the train runs), and is used, for example, to update data at a time of revising a train schedule. For example, the guidance-display-data creation device 11 creates the guidance display data including the train number data, the guidance-display control data, and the guidance content data corresponding to a revised train schedule in advance and distributes the guidance display data to the on-board system of each train, and each on-board system starts using the guidance display data distributed in advance at a time point when the time of the on-board system enters the effective period. The effective period information can indicate a plurality of effective periods. For example, in a case where the train runs in a special schedule different from a normal schedule such as at the end and beginning of the year, the effective period information is set so as to indicate a plurality of

periods except for periods to which the special schedule is applied as the effective period. This can avoid the occurrence of the distribution of the guidance display data before and after the periods to which the special schedule is applied.

[0027] The train number data includes the work number, the train number, a train type code, a stating station code, a terminal station code, and the pattern code. The starting station corresponds to the start station and the terminal station corresponds to the last station in the train number original data (see FIG. 4). The guidance-display control data is information used for the guidance display in each vehicle and created for each line. This guidance-display control data includes information on the stop stations of each train type on the corresponding line. These train number data and guidance-display control data as well as the guidance content data (described later) are distributed to the display terminal device 26 of each vehicle at a predetermined timing. While it is described that the guidance-display-data creation device 11 creates the train number data and the guidance-display control data as different information at Step S11, the guidance-display-data creation device 11 can create these information as one set of information (one piece of information).

[0028] The guidance content data is image data that forms the basis of images to be displayed on the display devices 27L and 27R during the guidance display in each vehicle. For example, in a case of displaying a destination guidance configured as shown in FIG. 8, the guidance content data is image data for parts other than character (text) display parts shown in FIG. 8 and to be displayed fixedly.

[0029] As described above, the train number data, the

guidance-display control data and the guidance content data are collected into one dataset for each line and managed as the guidance display data. That is, the guidance display data is configured to include a plurality of datasets corresponding to the respective lines.

[0030] In the creation of the guidance display data at Step S11, the guidance-display-data creation device 11 executes work of verifying the created data and the like as needed.

[0031] Referring back to the explanation of FIG. 3, when the guidance-display-data creation device 11 newly creates guidance display data and stores the new guidance display data in the information distribution server 12, the information distribution server 12 distributes the newly created guidance display data (hereinafter, "new guidance display data") to the on-board system 20 of each train at a predetermined timing (Step S12).

[0032] For example, at Step S12, the information distribution server 12 transmits a wireless signal for notifying the on-board system 20 of holding the new guidance display data from the information transmitter/receiver 13 installed in each station, each vehicle station, or the like. The on-board system 20 of the train receiving this signal transmits back a response signal including management information that uniquely identifies the train such as a train management number of the train into which the on-board system 20 is installed. The on-board system 20 grasps the on-board systems 20, to which the new guidance display data has been distributed, by the management information (the train management number or the like). The on-board system 20 distributes the new guidance display data to the on-board system 20 if not having completed distributing the new guidance display data

to the on-board systems 20 corresponding to the management information included in the response signal. The ground system 10 stores therein the completion of distributing the new guidance display data to the on-board systems 20 by registration of the management information notified from the on-board systems 20 or the like when having completed distributing the new guidance display data. The ground system 10 notifies the on-board system 20 that has transmitted the response signal that the new guidance display data is already distributed to the on-board system 20 when having completed distributing the new guidance display data to the on-board system 20 corresponding to the management information included in the response signal.

[0033] The guidance display data can include information on the guidance display data such as a creation date and time or a management version, and the information distribution server 12 can notify the train of the creation date and time, the version or the like of the new guidance display data via the information transmitter/receiver 13. In this case, each of the on-board systems 20 of the train can recognize whether the data (new guidance display data) different from the held guidance display data is present in the ground system 10. As a result, it suffices that the on-board system 20 transmits a response for receiving the distributed data only when it is necessary, and it is possible to prevent communication traffic from increasing more than necessary.

[0034] Furthermore, in a case of distributing the new guidance display data, the information distribution server 12 can selectively distribute only a part of the dataset without distributing the entire dataset of the held new guidance display data. For example, each of the on-board systems 20 of the train can notify the ground system 10 of

information on the line on which the train is running (information by which the ground system 10 can identify the line on which the train is running) in the response for receiving the distributed data, and the information distribution server 12 can distribute the dataset corresponding to the notified line on which the train is running or the datasets corresponding to the line on which the train is running and neighboring lines to the on-board system 20. This can suppress a capacity of a memory necessary for the on-board system 20 to be small. Alternatively, the on-board system 20 can notify the ground system 10 of not only the information on the running line but also the capacity (or a free space) of the memory that the on-board system 20 includes, and the information distribution server 12 can select the dataset to be distributed in light of not only the notified running line but also the notified capacity (or a free space) of the memory. For example, when the capacity of the memory is small, the information distribution server 12 distributes only a minimum dataset (a dataset corresponding to the running line) to the on-board system 20. With this configuration, even when the trains differ in the capacity of the memory within the on-board system 20, the information distribution server 12 can distribute the guidance display data to each of the on-board systems 20 flexibly and surely so as to correspond to the capacity of the memory. It is also possible to prevent the communication traffic from increasing.

[0035] The new guidance display data distributed at Step S12 is stored in the central distribution server 21 in the on-board system 20 (Step S13). The central distribution server 21 checks the effective period by analyzing the new guidance display data and monitors whether the time enters

the effective period (Step S14). When the time enters the effective period (YES at Step S14), the central distribution server 21 starts using the new guidance display data and deletes (discards) the guidance display data used so far (old guidance display data) (Step S15). When a part of the dataset of the guidance display data is distributed to the on-board system 20 and the time enters the effective period, the central distribution server 21 deletes an old dataset corresponding to each dataset included in the new guidance display data (a dataset on the same line as that of each dataset included in the new guidance display data among those of the old guidance display data). As for the old guidance display data, the central distribution server 21 can delete the old guidance display data at a time point when the time of the central distribution server 21 is out of the effective period (the date and time of the end of the effective period), instead of deleting the old guidance display data at a time point of starting using the new guidance display data. In this manner, the central distribution server 21 holds the old guidance display data until the time enters the effective period of the new guidance display data. Therefore, it is possible to smoothly replace the old guidance display data by the new guidance display data so as to correspond to the revision of the train schedule if a schedule revision date and time is set to the date and time of starting the effective period of the new guidance display data. Furthermore, after starting using the new guidance display data, the central distribution server 21 deletes the old guidance display data used so far. Therefore, it is possible to prevent unnecessary data from being left in the memory for a long period of time.

[0036] The operations at Steps S14 and S15 described

above are performed on an assumption that the guidance display data includes the effective period information and that the start date and time and the end date and time of the effective period (the date and time of starting using data and date and time of ending using the data) are clear. However, the guidance display data suffices to include only information on either the start date and time or the end date and time of the effective period. For example, when the guidance display data includes only the information on the end date and time of the effective period, the central distribution server 21 monitors whether the effective period of the old guidance display data has ended, and starts using the new guidance display data and deletes the old guidance display data at the time point of the end of the effective period at Step S14. When the guidance display data includes only the information on the start date and time of the effective period, the central distribution server 21 deletes the old guidance display data after the time enters the effective period of the new guidance display data similarly to Step S14 described above. In a case where the central distribution server 21 deletes the old guidance display data after the time enters the effective period of the new guidance display data, even when the central distribution server 21 re-distributes error-corrected, correct guidance display data after the guidance display data having a content with errors is distributed, the central distribution server 21 deletes the guidance display data with errors after the time enters the effective period of the correct guidance display data. Therefore, it is possible to avoid leaving the unnecessary data (guidance display data with errors) in the memory up to the time point of the end of the effective period.

[0037] The in-vehicle guidance display system according

to the present embodiment creates the guidance display data and distributes the guidance display data to each on-board system according to the procedures described above.

[0038] (2) Distribution of guidance display data to each vehicle in on-board system

FIG. 9 is a flowchart of an example of an operation performed by the on-board system 20 for distributing the guidance display data to the display terminal device 26 in each vehicle. This on-board system 20 executes the distribution of the guidance display data when the train starts operating (running), for example, when a crew such as a train driver sets the train number.

[0039] First, in this operation, the train-number setting device 28 acquires the train number of the own train into which the train-number setting device 28 is installed from outside (Step S21). The train-number setting device 28 also notifies the central distribution server 21 of the acquired train number. The central distribution server 21 notified of the train number confirms whether the central distribution server 21 holds the dataset corresponding to the notified train number (Step S22). Specifically, the central distribution server 21 confirms the train number data (see FIG. 6) included in the dataset, and determines that the central distribution server 21 holds the corresponding dataset when the notified train number is included in the train number data, or otherwise determines that the central distribution server 21 does not hold the corresponding dataset. As a result of the confirmation, when the central distribution server 21 holds the corresponding dataset (YES at Step S22), the central distribution server 21 extracts the dataset corresponding to the train number and distributes the extracted dataset to the display terminal device 26 of each

vehicle (Step S24). When the central distribution server 21 holds a plurality of datasets corresponding to the train number, that is, when the central distribution server 21 holds two or more datasets having different effective periods, the central distribution server 21 selects the dataset within the effective period and distributes the selected dataset to the display terminal device 26 of each vehicle. While it is described in the present embodiment that the dataset is created for each line, it is considered that there are some cases where a certain train runs on a plurality of lines with the same train number allocated to the certain train. Accordingly, at Step S24, the central distribution server 21 possibly extracts and distributes a plurality of datasets (each dataset includes the same train number) within the effective period.

[0040] On the other hand, when the central distribution server 21 does not hold the corresponding dataset (No at Step S22), the central distribution server 21 communicates with the information distribution server 12 of the ground system 10 via the information transmitter/receiver 25, notifies the information distribution server 12 of the notified train number (a train number acquired by the train-number setting device 28), and acquires the corresponding dataset (guidance display data) (Step S23). When the central distribution server 21 does not hold the corresponding dataset and is in a state of being unable to communicate with the ground system 10, the central distribution server 21 acquires a necessary dataset from the information distribution server 12 at a time point when the central distribution server 21 becomes communicable with the ground system because of the movement or the like of the train. Such an operation enables the on-board system 20 to acquire necessary data from the ground system

10 at a necessary timing and to display the guidance, for example, even when the capacity of the memory of the central distribution server 21 is limited and the central distribution server 21 is unable to receive all the guidance display data created by the ground system 10 and to hold the received data or even when a data amount of the distributed guidance display data is larger than the free space of the memory and the central distribution server 21 can hold only a part of the received guidance display data. In the case where the capacity of the memory is limited such as a case where the capacity of the memory is smaller than the data amount of the guidance display data distributed from the ground system 10, the central distribution server 21 suffices to sequentially delete unnecessary datasets according to, for example, a train running status and to acquire necessary datasets for the subsequent guidance display from the information distribution server 12. It is assumed that a timing of deleting the dataset is a time point when a certain dataset has become unnecessary because the train ends running in a section corresponding to this dataset when, for example, datasets are constituted at an interval of a constant section on a certain line (a plurality of datasets of a plurality of types are present in the respective sections on one line).

[0041] When acquiring the dataset at Step S23, the central distribution server 21 distributes the acquired dataset to the display terminal device 26 of each vehicle (Step S24). The display terminal device 26 of each vehicle that has received the distributed dataset used for the guidance display from the central distribution server 21 stores the received information in the storage device 29 and starts displaying the guidance according to the train

running status (Step S25). For example, the display terminal device 26 displays the destination guidance (see FIG. 8) according to the train type, a running position, or the like based on the dataset stored in the storage device 29. The content of this guidance display are appropriately changed according to the train running status. For example, the display terminal device 26 displays a transfer guidance at a next stop station when the train is closer to the next stop station, and displays a guidance of an arrival station when the train arrives at the station. Furthermore, after departure, the display terminal device 26 displays a guidance of the next stop station or the like. The display terminal device 26 can grasp the train running status based on train running information that can be acquired from the train-information terminal device 23 via the transmission device 24.

[0042] In the explanations of the present embodiment, a case where guidance display data includes only data for displaying a destination guidance has been described; however, the guidance display data can include data for the guidance display other than a destination guidance.

[0043] In this manner, in the in-vehicle guidance display system according to the present embodiment, the guidance display data including the effective period information is created and distributed from the ground system to each on-board system, and the on-board system holds the distributed guidance display data (new guidance display data) and uses the guidance display data for the guidance display in each vehicle when the time enters the effective period. Furthermore, the guidance display data out of the effective period is deleted. When the train number is designated when the train starts running, the central distribution server that collectively manages the

guidance display data in the train extracts the necessary data for the guidance display in the case where the train runs as the train having the designated train number from the managed guidance display data. The central distribution server distributes the extracted necessary data to the display terminal device that controls the guidance display in each vehicle. With this operation, work efficiency improves, and it is possible to realize the reduction in the time required for the operation for updating the guidance display data and the reduction in the work load imposed on the operator. It is also possible to realize the improvement in the work reliability by avoiding the occurrence of human errors.

[0044] Furthermore, the central distribution server wirelessly communicates with the ground-system-side information distribution server and acquires the necessary data when the central distribution server does not hold the necessary data for the guidance display when the train runs as the train having the designated train number. Therefore, on whatever line the train runs in the railway system, it is possible to display a guidance and to realize the flexible train operation.

Industrial Applicability

[0045] As described above, the in-vehicle guidance display system according to the present invention is useful for a case of realizing a railway system of allowing a train that displays a guidance such as a destination guidance to passengers to run.

Reference Signs List

[0046] 10 ground system

11 guidance-display-data creation device

12 information distribution server

13, 25 information transmitter/receiver

20 on-board system

21 central distribution server

22 train-information central unit

23 train-information terminal device

24 transmission device

26 display terminal device

27L, 27R display device

28 train-number setting device

29 storage device

CLAIMS

1. An in-vehicle guidance display system comprising:

a ground system that creates guidance display data to be used to display a guidance in a vehicle of a train; and

an on-board system that is mounted on the train and displays a guidance using guidance display data created by the ground system, wherein

the ground system includes

a guidance-display-data creation device that creates, for each line as the guidance display data, a dataset including information on a stop station pattern for each train type, effective-period related information indicating at least one of a start date and time and an end date and time of an effective period, and train number information, and

a data distribution server that holds the guidance display data and that wirelessly distributes all or a part of the dataset included in the held guidance display data to the on-board system at a predetermined timing, and

the on-board system includes

a central distribution server that manages the dataset distributed from the ground system, and when a train number of a train in which the on-board system is installed is set,

distributes the dataset to each vehicle if the central distribution server holds a dataset corresponding to the train number and within the effective period, and

notifies the data distribution server of the train number to acquire a corresponding dataset and distributes the corresponding dataset to each vehicle if the central distribution server does not hold the dataset corresponding to the train number and within the effective period, and

a display terminal device that is installed in each vehicle and that displays a guidance on a display device in

the vehicle based on the dataset distributed from the central distribution server.

2. The in-vehicle guidance display system according to claim 1, wherein

in a case where the effective-period related information indicates a start date and time of an effective period,

when the central distribution server acquires a new dataset and holds an old dataset identical to the acquired dataset in a line but different from the acquired dataset in the start date and time of the effective period, the central distribution server discards the old dataset after a time enters the effective period of the newly acquired dataset.

3. The in-vehicle guidance display system according to claim 1, wherein

in a case where the effective-period related information indicates an end date and time of an effective period,

the central distribution server discards each held dataset after the end date and time of the effective period.

4. The in-vehicle guidance display system according to claim 1, wherein the effective-period related information indicates at least one of a start date and time and an end date and time of each effective period for a plurality of effective periods.

5. The in-vehicle guidance display system according to claim 1, wherein the guidance display data includes at least a data creation date and time or a data version as

data management information.

6. The in-vehicle guidance display system according to claim 1, wherein the data distribution server acquires information on a running line of the train, in which the on-board system is installed, from the on-board system that is a dataset distribution destination, and selects a dataset to be distributed based on the acquired information.

7. The in-vehicle guidance display system according to claim 1, wherein the data distribution server acquires information on a capacity of a memory included in the central distribution server of the on-board system from the on-board system that is a dataset distribution destination, and selects a dataset to be distributed based on the acquired information.

8. The in-vehicle guidance display system according to claim 1, wherein the central distribution server deletes a managed dataset at a time point when a time of the dataset is out of the effective period.

9. The in-vehicle guidance display system according to claim 1, wherein a start date and time or an end date and time of the effective period indicated by the effective-period related information is set to a schedule revision date and time of a railway system.

10. An in-vehicle guidance display method executed by a railway system including a ground system that creates guidance display data to be used to display a guidance in a vehicle of a train, and an on-board system that is mounted on the train and displays a guidance using guidance display

data created by the ground system, the in-vehicle guidance display method comprising:

a guidance-display-data creating step of, by the ground system, creating, for each line as the guidance display data, a dataset including information on a stop station pattern for each train type, effective-period related information indicating at least one of a start date and time and an end date and time of an effective period, and train number information;

a data distributing step of, by the ground system, wirelessly distributing all or a part of the dataset included in the guidance display data to the on-board system at a predetermined timing; and

a guidance displaying step of, by the on-board system, managing the dataset distributed from the ground system, and when the train number of the train in which the on-board system is installed is set,

distributing the dataset to each vehicle and displaying a guidance on a display device in each vehicle if a dataset corresponding to the train number and within the effective period is held, and

notifying the ground system of the train number to acquire a corresponding dataset, distributing the acquired dataset to each vehicle, and displaying the guidance on the display device in each vehicle if the dataset corresponding to the train number and within the effective period is not held.

FIG.1

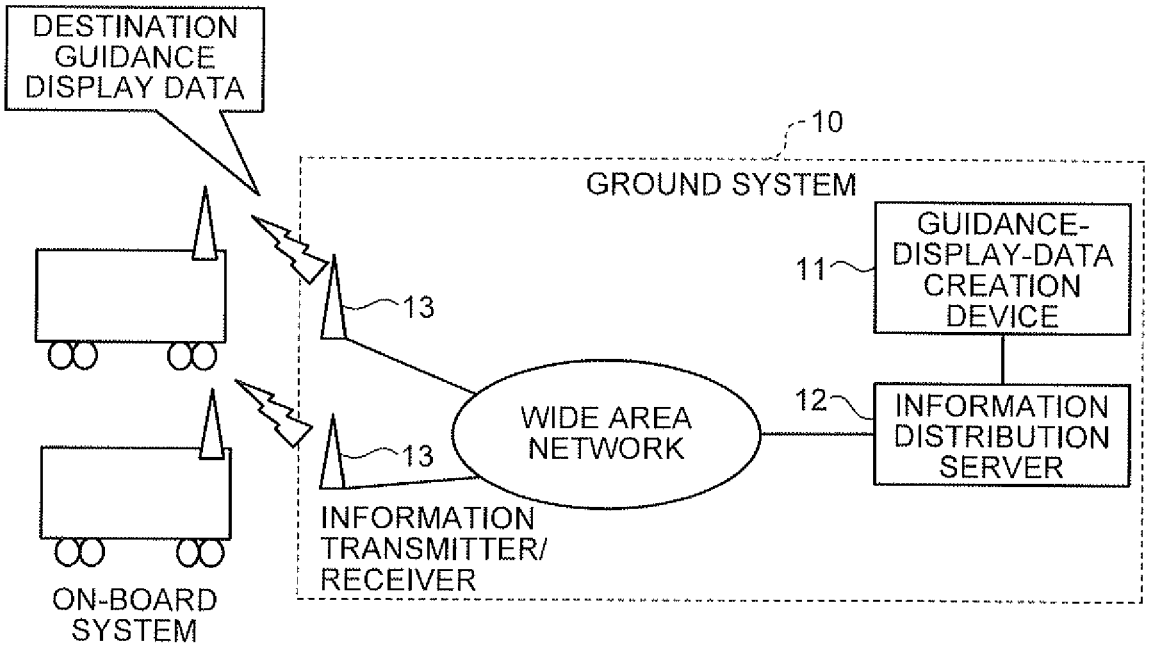

DESTINATION GUIDANCE DISPLAY DATA
10
GROUND SYSTEM
GUIDANCE-DISPLAY-DATA CREATION DEVICE
11
13
WIDE AREA NETWORK
12
INFORMATION DISTRIBUTION SERVER
13
INFORMATION TRANSMITTER/ RECEIVER
ON-BOARD SYSTEM

FIG.2

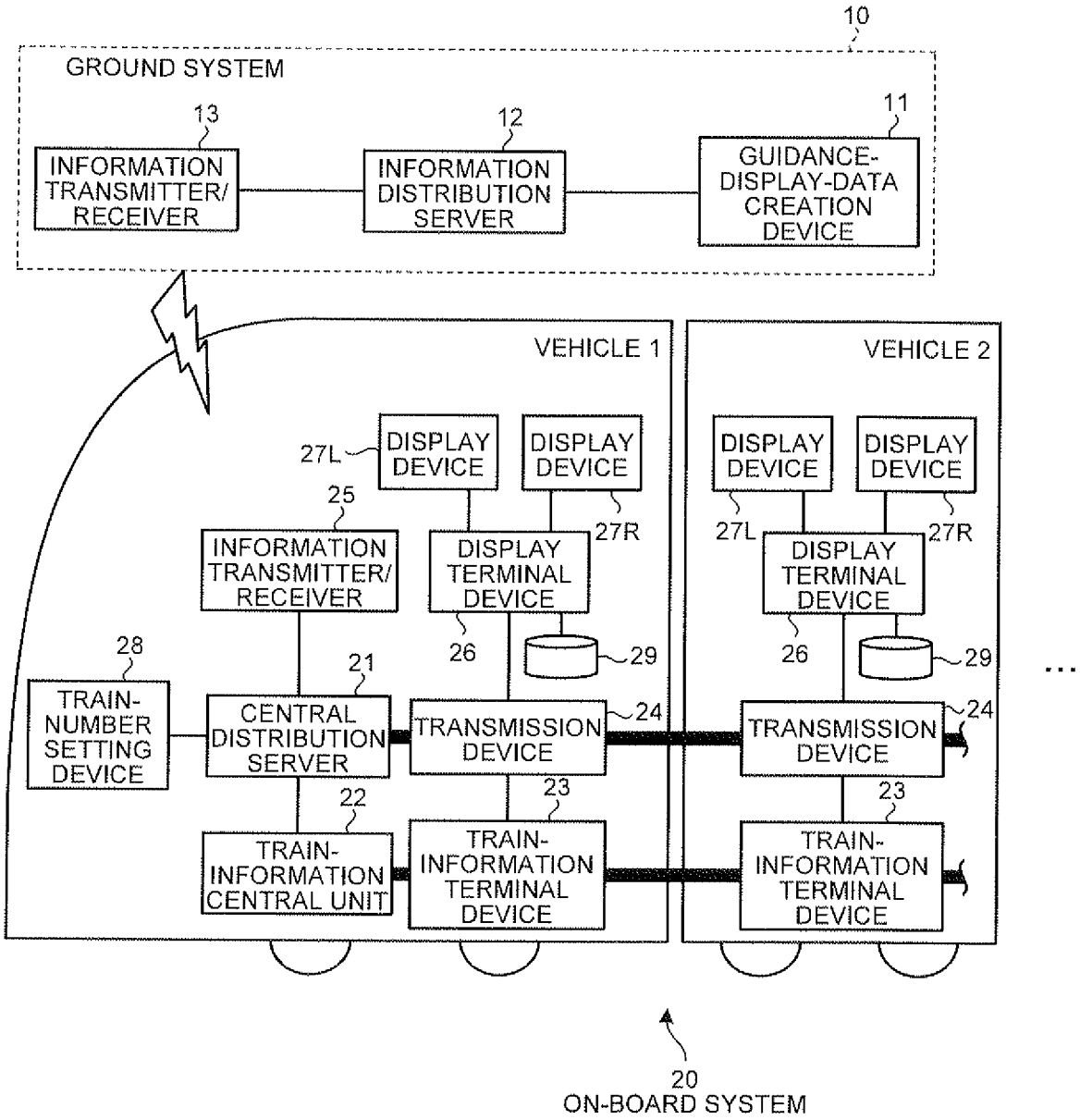

10
GROUND SYSTEM
13
INFORMATION TRANSMITTER/ RECEIVER
12
INFORMATION DISTRIBUTION SERVER
11
GUIDANCE-DISPLAY-DATA CREATION DEVICE
VEHICLE 1
VEHICLE 2
27L
DISPLAY DEVICE
DISPLAY DEVICE
27R
25
INFORMATION TRANSMITTER/ RECEIVER
DISPLAY TERMINAL DEVICE
26
29
28
TRAIN-NUMBER SETTING DEVICE
21
CENTRAL DISTRIBUTION SERVER
TRANSMISSION DEVICE
24
22
TRAIN-INFORMATION CENTRAL UNIT
23
TRAIN-INFORMATION TERMINAL DEVICE
20
ON-BOARD SYSTEM

FIG.3

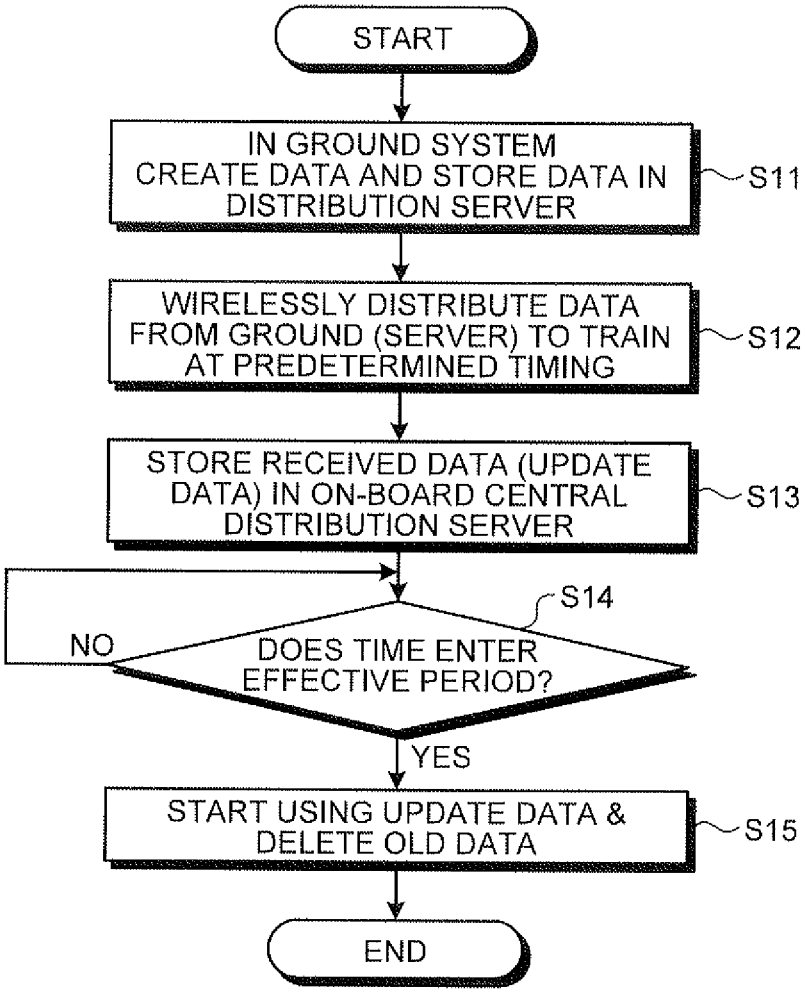

START
IN GROUND SYSTEM CREATE DATA AND STORE DATA IN DISTRIBUTION SERVER
S11
WIRELESSLY DISTRIBUTE DATA FROM GROUND (SERVER) TO TRAIN AT PREDETERMINED TIMING
S12
STORE RECEIVED DATA (UPDATE DATA) IN ON-BOARD CENTRAL DISTRIBUTION SERVER
S13
S14
NO
DOES TIME ENTER EFFECTIVE PERIOD?
YES
START USING UPDATE DATA & DELETE OLD DATA
S15
END

FIG.4

No.	OPERATING DAY	WORK NUMBER	TRAIN ORDER	TRAIN NUMBER	START STATION	LAST STATION	TRAIN TYPE	PATTERN CODE
1	SATURDAYS AND HOLIDAYS	101	1	3209M	A	B	RAPID C	30
2	SATURDAYS AND HOLIDAYS	102	1	3204M	C	D	RAPID C	30
3	SATURDAYS AND HOLIDAYS	102	2	3104M	D	E	RAPID C	30
4	SATURDAYS AND HOLIDAYS	102	3	3139M	E	D	RAPID C	30
5	SATURDAYS AND HOLIDAYS	102	4	3239M	D	B	RAPID C	30
6	SATURDAYS AND HOLIDAYS	102	5	3264M	B	D	RAPID C	30
7	SATURDAYS AND HOLIDAYS	102	6	3164M	D	E	RAPID C	30
8	SATURDAYS AND HOLIDAYS	102	7	8301M	E	D	LOCAL	1
9	SATURDAYS AND HOLIDAYS	102	8	3301M	F	G	RAPID C	30
10	SATURDAYS AND HOLIDAYS	102	9	3301M	G	C	RAPID C	30
11	SATURDAYS AND HOLIDAYS	103	1	3224M	C	H	RAPID C	30
12	SATURDAYS AND HOLIDAYS	103	2	3224M	H	D	RAPID C	30
13	SATURDAYS AND HOLIDAYS	103	3	3124M	D	E	RAPID C	30
14	SATURDAYS AND HOLIDAYS	103	4	3155M	E	D	RAPID C	30
15	SATURDAYS AND HOLIDAYS	103	5	3255M	D	B	RAPID C	30
16	SATURDAYS AND HOLIDAYS	103	6	806T	B	G	RAPID	40
17	SATURDAYS AND HOLIDAYS	103	7	3228F	G	I	LOCAL	1
18	SATURDAYS AND HOLIDAYS	104	1	3203F	I	G	LOCAL	1
19	SATURDAYS AND HOLIDAYS	104	2	731T	G	B	RAPID	40
20	SATURDAYS AND HOLIDAYS	104	3	758T	B	G	RAPID	40
21	SATURDAYS AND HOLIDAYS	104	4	783T	G	B	RAPID	40
22	SATURDAYS AND HOLIDAYS	104	5	3310M	B	G	RAPID C	30
23	SATURDAYS AND HOLIDAYS	104	6	923K	G	H	LOCAL	1
24	SATURDAYS AND HOLIDAYS	105	1	3247M	D	B	RAPID C	30
25	SATURDAYS AND HOLIDAYS	105	2	3296M	B	A	RAPID C	30
26	SATURDAYS AND HOLIDAYS	105	3	3313M	A	C	RAPID C	30
27	SATURDAYS AND HOLIDAYS	106	4	3214M	C	G	RAPID C	30
28	SATURDAYS AND HOLIDAYS	106	5	3281M	G	B	RAPID C	30
29	SATURDAYS AND HOLIDAYS	106	6	3281M	B	J	RAPID C	30
30	SATURDAYS AND HOLIDAYS	106	7	370M	J	B	LOCAL	1
31	SATURDAYS AND HOLIDAYS	106	8	317M	B	K	LOCAL	1
32	SATURDAYS AND HOLIDAYS	106	9	316M	K	B	LOCAL	1
33	SATURDAYS AND HOLIDAYS	107	1	7227	B	G	RAPID	40
34	SATURDAYS AND HOLIDAYS	107	2	3233M	G	B	RAPID C	30
35	SATURDAYS AND HOLIDAYS	107	3	3278M	B	G	RAPID C	30
36	SATURDAYS AND HOLIDAYS	107	4	3305M	G	B	RAPID C	30
37	SATURDAYS AND HOLIDAYS	107	5	3322M	B	A	RAPID C	30
38	SATURDAYS AND HOLIDAYS	108	1	743T	A	L	RAPID	40
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

FIG.5

No.		code	1	30	40	41	・
	LINE NAME	STATION NAME \ TRAIN TYPE	LOCAL	RAPID C	RAPID A	RAPID B	⋮
⋮	XXX MAINLINE	⋮	⋮	⋮	⋮	⋮	⋮
281		STATION #1	○	○	○	○	・
282		STATION #2	○	○	○	○	・
283		STATION #3	○	|	○	○	・
284		STATION #4	○	|	○	○	・
285		STATION #5	○	|	○	○	・
286		STATION #6	○	○	○	○	・
287		STATION #7	○	|	○	○	・
288		STATION #8	○	○	○	○	・
289		STATION #9	○	|	○	○	・
290		STATION #10	○	○	○	○	・
⋮		⋮	⋮	⋮	⋮	⋮	⋮
314		STATION #34	○	○	○	○	・
315		STATION #35	○	○	○	○	・
316		STATION #36	○	|	|	|	・
317		STATION #37	○	○	○	○	・
318		STATION #38	○	|	|	|	・
319		STATION #39	○	|	|	|	・
320		STATION #40	○	|	○	○	・
321		STATION #41	○	|	|	|	・
322		STATION #42	○	○	○	○	・
323		STATION #43	○	|	|	|	・
324		STATION #44	○	|	|	|	・
325		STATION #45	○	|	○	○	・
326		STATION #46	○	|	○	○	・
327		STATION #47	○	|	|	|	・
328		STATION #48	○	○	○	○	・
329		STATION #49	○	|	○	○	・
330		STATION #50	○	○	○	○	・
331		STATION #51	○	|	○	○	・
332		STATION #52	○	|	|	|	・
333		STATION #53	○	|	|	|	・
334		STATION #54	○	|	|	|	・
335		STATION #55	○	|	○	○	・
336		STATION #56	○	|	|	|	・
337		STATION #57	○	|	○	○	・
338		STATION #58	○	|	○	○	・
339		STATION #59	○	|	|	|	・
340		STATION #60	○	○	○	○	・
⋮		⋮	⋮	⋮	⋮	⋮	⋮

FIG.6

TRAIN NUMBER DATA
<EFFECTIVE PERIOD data>
  <DATE>
    START=14th March, 2010 3:00
    END=14th March, 2011 2:59
  </DATE>
</EFFECTIVE PERIOD data>
<TRAIN NUMBER DATA>
  <TRAIN NUMBER LIST>
    <TRAIN NUMBER TYPE=1> 1=WEEKDAY
      WORK NUMBER=101, TRAIN NUMBER=3407, TYPE CODE=5, START STATION CODE=290,
      TERMINAL STATION CODE=354, PATTERN CODE=30
      WORK NUMBER=102, TRAIN NUMBER=3410, TYPE CODE=5, START STATION CODE=354,
      TERMINAL STATION CODE=300, PATTERN CODE=30
      WORK NUMBER =102, TRAIN NUMBER=3800, TYPE CODE=5, START STATION CODE=300,
      TERMINAL STATION CODE=234, PATTERN CODE=30
      WORK NUMBER=102, TRAIN NUMBER=3890, TYPE CODE=5, START STATION CODE=234,
      TERMINAL STATION CODE=211, PATTERN CODE=30
        .
        .
        .
    </TRAIN NUMBER TYPE>
  </TRAIN NUMBER LIST>
</TRAIN NUMBER DATA>

FIG.7

DESTINATION GUIDANCE-DISPLAY CONTROL DATA

<STOP STATION CODE>
<STOP STATION CODE_LIST>
<STOP STATION_code=1>
•
STATION #35=315
STATION #36=316
STATION #37=317
•
</STOP STATION_code>
<STOP STATION_code=30>
•
STATION #35=315
STATION #37=317
STATION #42=322
•
</STOP STATION_code>
<STOP STATION_code=40>
•
STATION #35=315
STATION #37=317
STATION #40=320
•
</STOP STATION_code>
<STOP STATION_code=41>
•
STATION #35=315
STATION #37=317
STATION #40=320
•
</STOP STATION_code>
•
•
</STOP STATION CODE_LIST>
</STOP STATION CODE>

FIG.8

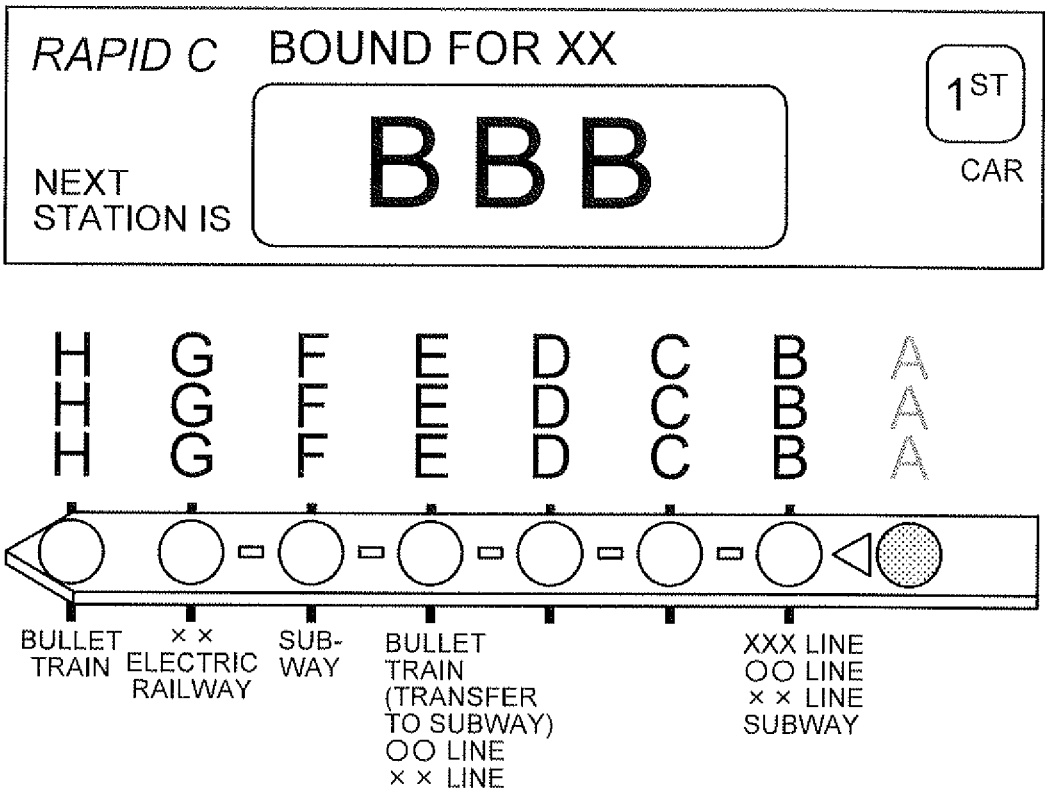
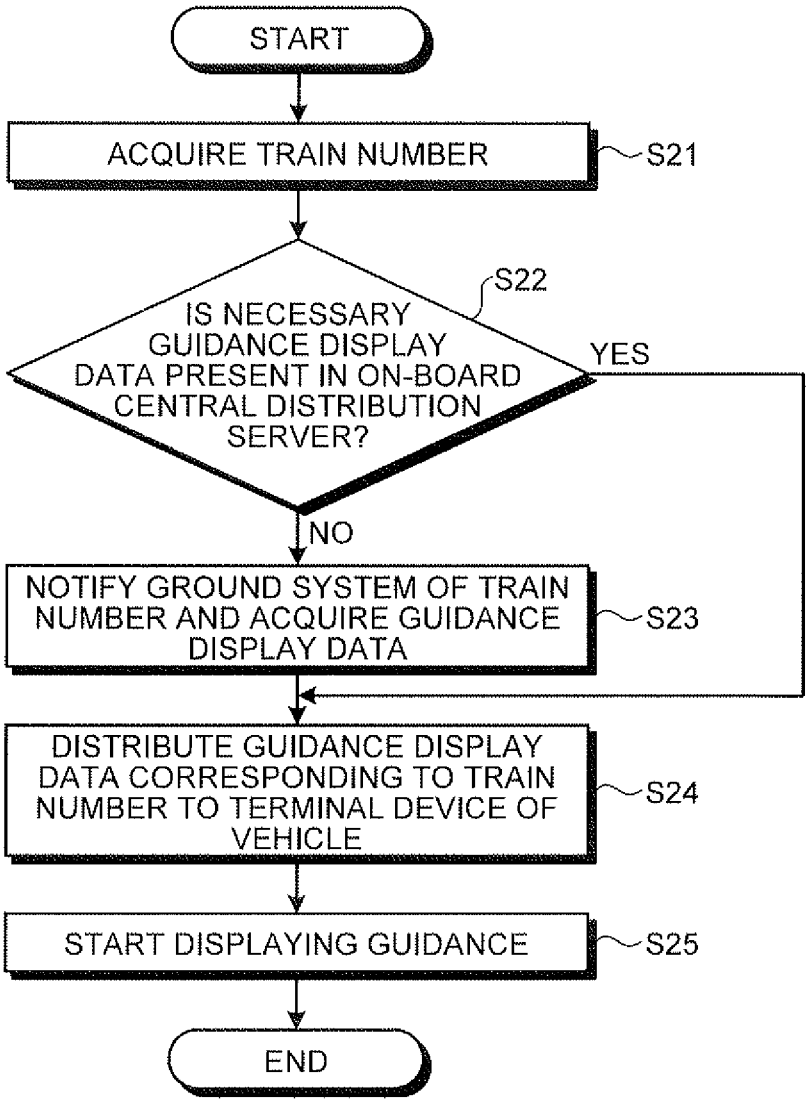

RAPID C
BOUND FOR XX
NEXT STATION IS
B B B
1ST CAR
H G F E D C B A
H G F E D C B A
H G F E D C B A
BULLET TRAIN
×× ELECTRIC RAILWAY
SUB-WAY
BULLET TRAIN (TRANSFER TO SUBWAY) ○○ LINE ×× LINE
XXX LINE ○○ LINE ×× LINE SUBWAY

FIG.9


START
ACQUIRE TRAIN NUMBER
S21
S22
IS NECESSARY GUIDANCE DISPLAY DATA PRESENT IN ON-BOARD CENTRAL DISTRIBUTION SERVER?
YES
NO
NOTIFY GROUND SYSTEM OF TRAIN NUMBER AND ACQUIRE GUIDANCE DISPLAY DATA
S23
DISTRIBUTE GUIDANCE DISPLAY DATA CORRESPONDING TO TRAIN NUMBER TO TERMINAL DEVICE OF VEHICLE
S24
START DISPLAYING GUIDANCE
S25
END