VEHICLE COMMUNICATION SYSTEM

FIELD

Embodiments of the present invention described herein relate generally to a vehicle communication system.

BACKGROUND

Conventionally, there have been known techniques for transmitting and receiving predetermined information between on-vehicle devices provided to trains when the trains are passing each other. In the conventional techniques, a central device may be provided as a ground-side device, and the entire system including the on-vehicle devices and the central device may share (transmit and receive) the predetermined information on the trains.

In the above-described system including the on-vehicle devices and the central device, the improvement of communication environment between the on-vehicle devices and the central device is required. For example, failure information on a train, which is one example of the predetermined information to be transmitted from the on-vehicle device to the central device, is important information. Consequently, it is required to quickly notify an operator of the central device of the failure information.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is an exemplary diagram of a schematic configuration of a train communication system according to an embodiment.

FIG. 2 is an exemplary block diagram of a schematic internal configuration of a central device and an on-vehicle device according to the embodiment.

FIG. 3 is an exemplary diagram of a specific example of properties of predetermined information that can be considered in the embodiment.

FIG. 4 is an exemplary flowchart of a schematic procedure of processing performed by the central device according to the embodiment.

FIG. 5 is an exemplary flowchart of a schematic procedure of processing performed by the on-vehicle device according to the embodiment.

FIG. 6 is an exemplary flowchart of processing in response to the predetermined information performed by an on-vehicle communicator of the on-vehicle device according to the embodiment.

FIG. 7 is an exemplary flowchart of processing in response to the predetermined information performed by the on-vehicle communicator and a content controller of the on-vehicle device according to the embodiment.

FIG. 8 is an exemplary flowchart of processing in response to the predetermined information performed by the on-vehicle communicator and a predictive controller of the on-vehicle device according to the embodiment.

FIG. 9 is an exemplary diagram of a specific example of a radio wave environment that can be considered in a modification of the embodiment.

DETAILED DESCRIPTION

In general, according to one embodiment, a vehicle communication system includes a central device and an on-

vehicle device. The central device is connected to a terrestrial communication device capable of performing a wireless communication with an object present in a predetermined first communication available range. The on-vehicle device is provided to each of a plurality of vehicles running on a route connected to terrestrial equipment including the terrestrial communication device, and includes an on-vehicle communicator capable of performing a wireless communication with an object present in a predetermined second communication available range. The central device includes a path determiner and a central communicator. The path determiner is configured to determine an information transmission path between the vehicles for consolidating information in a vehicle that performs the wireless communication with the terrestrial communication device out of the vehicles based on at least operating information on the vehicles. The central communicator is configured to transmit and receive predetermined information including the information transmission path to and from a vehicle present in the first communication available range of the terrestrial communication device via the terrestrial communication device. The on-vehicle communicator is configured to acquire the information transmission path directly from the central device via the terrestrial communication device or indirectly from the central device via the terrestrial communication device and a second vehicle, and to transmit and receive the predetermined information to and from the terrestrial communication device or the second vehicle present in the second communication available range based on the acquired information transmission path.

<EMBODIMENT>

An embodiment is described below with reference to the accompanying drawings. The configuration of the embodiment described below and effects and results (advantageous effects) provided by the configuration are given by way of example only and are not limited to the contents described below.

FIG. 1 is an exemplary diagram of a schematic configuration of a train communication system according to an embodiment. As illustrated in FIG. 1, the train communication system according to the embodiment includes a central device 100 and on-vehicle devices 200. The central device 100 is connected to a terrestrial communication device 100a in terrestrial equipment 150 such as rail yards and stations. The on-vehicle devices 200 are provided to respective trains 200a that run on routes R1 and R2 connected to the terrestrial equipment 150.

The terrestrial communication device 100a includes an antenna 100b and is configured to be capable of performing wireless communications with an object present in a predetermined first communication available range A via the antenna 100b. The on-vehicle device 200 is configured to be capable of performing wireless communications with an object present in a predetermined second communication available range B via an antenna 200b provided to the train 200a.

While the number of routes connected to the terrestrial equipment 150 is two (routes R1 and R2) in FIG.

CLAIMS

1. A vehicle communication system comprising:

a central device (100) that is connected to a terrestrial communication device (100a) capable of performing a wireless communication with an object present in a predetermined first communication available range (A); and

an on-vehicle device (200) that is provided to each of a plurality of vehicles (200a) running on a route (R1, R2) connected to terrestrial equipment (150) including the terrestrial communication device (100a), the on-vehicle device (200) including an on-vehicle communicator (201) capable of performing a wireless communication with an object present in a predetermined second communication available range (B), wherein

the central device (100) comprises:

a path determiner (102) that is configured to determine an information transmission path between the vehicles (200a) for consolidating information in a vehicle (200a) that performs the wireless communication with the terrestrial communication device (100a) out of the vehicles (200a) based on at least operating information on the vehicles (200a); and

a central communicator (101) that is configured to transmit and receive predetermined information including the information transmission path to and from a vehicle (200a) present in the first communication available range (A) of the terrestrial communication device (100a) via the terrestrial communication device (100a), and

the on-vehicle communicator (201) is configured:

to acquire the information transmission path directly from the central device (100) via the terrestrial communication device (100a) or indirectly from the central

device (100) via the terrestrial communication device (100a) and a second vehicle (200a); and

to transmit and receive the predetermined information to and from the terrestrial communication device (100a) or the second vehicle (200a) present in the second communication available range (B) based on the acquired information transmission path.

2. The vehicle communication system according to claim 1, wherein

the central device (100) further comprises

a priority determiner (103) that is configured to determine priority in transmitting and receiving the predetermined information,

the predetermined information includes the priority, and

the on-vehicle communicator (201) is configured:

to acquire the priority directly from the central device (100) via the terrestrial communication device (100a) or indirectly from the central device (100) via the terrestrial communication device (100a) and the second vehicle (200a); and

to transmit and receive the predetermined information based on the acquired priority.

3. The vehicle communication system according to claim 2, wherein

the priority includes number of times of transmitting and receiving the same information in an overlapping manner in one wireless communication, and

the priority determiner (103) is configured:

to estimate number of the second vehicles (200a) capable of being a communication partner until the on-vehicle communicator (201) of each of the vehicles (200a)

performs the wireless communication with the terrestrial communication device (100a) based on the operating information; and

to determine the number of times of transmission and reception for each of the vehicles (200a) such that the number of times of transmission and reception is larger as the number of the second vehicles (200a) is smaller.

4. The vehicle communication system according to claim 2 or 3, wherein

the path determiner (102) is configured to determine the information transmission path based on a property of the predetermined information, and

the priority determiner (103) is configured to determine the priority based on a property of the predetermined information.

5. The vehicle communication system according to any one of claims 2 to 4, wherein

the path determiner (102) is configured to acquire a length of a time in which each of the vehicles (200a) performs the wireless communication with the second vehicle (200a) and the terrestrial communication device (100a) based on the operating information and to determine the information transmission path based on the acquired length of the time, and

the priority determiner (103) is configured to acquire the length of the time in which each of the vehicles (200a) performs the wireless communication with the second vehicle (200a) and the terrestrial communication device (100a) based on the operating information and to determine the priority based on the acquired length of the time.

6. The vehicle communication system according to any one

of claims 2 to 4, wherein

the central device (100) further comprises

an adjuster (104) that is configured to analyze the latest predetermined information acquired via the terrestrial communication device (100a), and to dynamically adjust the information transmission path and the priority based on an analysis result.

7. The vehicle communication system according to any one of claims 1 to 6, wherein

the predetermined information includes a content provided in the vehicles (200a) and a time stamp of the content, and

the on-vehicle communicator (201) is configured to transmit and receive the content to and from the terrestrial communication device (100a) or the second vehicle (200a) based on the time stamp such that the content provided in the vehicle (200a) provided with the on-vehicle communicator (201) is a later content.

8. The vehicle communication system according to any one of claims 1 to 7, wherein

the predetermined information includes sensor information indicating a result of sensing surroundings of the vehicles (200a), and

the on-vehicle device (200) further comprises

a predictive controller that is configured to assume the surroundings at a place where the vehicle (200a) provided with the predictive controller is going to run based on the sensor information acquired via the wireless communication by the on-vehicle communicator (201), and to predictively perform running control corresponding to an assumption result.