a technology with which a user can intuitively understand a plurality of piece of displayed railway operation information, and can unitarily make access to the plurality of pieces of railway operation information, thereby changing data.

Means for Solving the Problem

[0006]

A railway operation information change system according to the present invention is a railway operation information change system that changes information relating to railway operation displayed in a virtual space, by a computer including a processor and a memory, in which the processor: acquires information relating to a change operation via an avatar displayed in the virtual space for virtual space display data created on the basis of the information relating to the railway operation and a visualization rule that defines visualization of data in order to display the data in the virtual space, and stores the acquired information in the memory; determines a type of the change operation on the basis of the acquired information relating to the change operation; creates candidate nodes that serve as change destinations of the change operation made to the virtual space display data, on the basis of the determined

[FIG. 10] FIG. 10 is a view for illustrating a display output example in the virtual space (proposed train operation adjustment plan display example).

[FIG. 11] FIG. 11 is a view for illustrating a display output example in the virtual space (vehicle operation information display example).

[FIG. 12A] FIG. 12A is a table for illustrating an example of operation plan information on a train (Tr01) operating on a certain line L1.

[FIG. 12B] FIG. 12B is a table for illustrating an example of operation plan information on a train (Tr02) operating on another certain line L2.

[FIG. 13] FIG. 13 is a table for illustrating an example of a track information being one of pieces of railway operation information.

[FIG. 14] FIG. 14 is a table for illustrating an example of a vehicle depot information being one of the pieces of railway operation information.

[FIG. 15] FIG. 15 is a table for illustrating an example of a vehicle operation information being one of the pieces of railway operation information.

[FIG. 16] FIG. 16 is a table for illustrating an example of a visualization frame.

[FIG. 17] FIG. 17 is a table for illustrating an

[0016]

FIG. 1 includes a block diagram of a railway operation information change system 100 according to a present embodiment and a diagram for illustrating an example of related systems connected to the railway operation information change system 100. The railway operation information change system 100 is a system which executes train operation adjustment operations for railway transport commands. The train operation adjustment operations are operations which change an operation plan for trains in a case in which the operation plan is disrupted by a cause such as a delay of a train, and are operations of changing various operation plans relating to railway transport, such as an operation of switching travel orders of trains, an operation of changing a stop time, an operation of changing a vehicle allocation, an operation of changing a departure track and an arrival track, and an operation of stopping an operation.

[0017]

The railway operation information change system 100 is formed of a railway operation information acquisition unit 101, an avatar operation information acquisition unit 102, a data display control unit 103, a data change unit 104, and a data storage unit 105. The data display control

railway operation, and is information stored in the various railway operation systems. The railway operation information 1051 includes various types of information used for the railway operation, such as operation plan information which indicates a station and a time of arrival at this station and a time of departure from this station, track information which indicates the number of a platform of a station which a train arrives at and departs from, vehicle depot information which indicates a place at which storage, construction, maintenance, and the like is execute for a train, vehicle operation information which indicates allocation of a vehicle used for an operation plan for a train indicated by operation plan information, a timetable diagram being a line diagram (for example, a diagram in which a position is assigned to a vertical axis, and time is assigned to a horizontal axis, and which describes a position of a train at each time as train line) expressing the operation plan for a train indicated by the operation plan information, and proposed train operation adjustment plan information which is obtained by changing the operation plan disrupted by a delay of a train or the like. The railway operation system static information is information which is, out of the railway operation information 1051, defined independently of a time zone in which the railway operation is executed, and

includes, for example, the track information and the vehicle operation information described above. The railway operation system dynamic information is information which is, out of the railway operation information 1051, defined according to the time zone in which the railway operation is executed, and includes, for example, the operation plan information, the vehicle depot information, the timetable diagram, and the proposed train operation adjustment plan information described above. As described above, the railway operation information 1051 includes not only the information in an operation time zone being the time zone in which the train is operated according to a day-to-day timetable such as the operation plan and an operation record of the train, but also the information in a time zone other than the day-to-day operation time zone such as a train maintenance time zone and a train inspection time zone after the operation time zone.

[0019]

The virtual space display data 1055 is created by the data display control unit 103 through use of the visualization frame 1053, and is then stored. The visualization frame 1053 and the data change rule list 1054 are stored in advance. The virtual space display data 1055 and the operation target type information 1056 are data

The change target data information 1059 is information which defines a change target data type indicating a type of data (each piece of data in a case of a plurality of pieces of data) stored as the operation target data, change target data being operation target data indicated by this change target data type, and operation target source railway business information indicating the railway operation information 1051 including this change target data.

[0040]

For example, the change destination candidate node creation unit 1043 sets data on a "changeable portion" item of the data change rule 1058 extracted in S401 to the change target data type, and sets data which is out of data of "operation target data" item of the operation target type information and corresponds to the change target data type to the change target data. That is, the change destination candidate node creation unit 1043 extracts, as the change target data information 1059, the change target data type, the change target data, and the railway operation information 1051 to which the change target data belongs.

[0041]

Further, the change destination candidate node creation unit 1043 reads the change target data information 1059 created in S402 and the data change rules 1058

via a station A, a station B, a station C, and a station D, and the comparative line L2 runs via the station A, a station E, a station F, and the station D. In this case, the display data output unit 1033 of the railway operation information change system 100 outputs data for displaying the main timetable diagram on a flat surface 701. As described in S312 and S313 in the first embodiment, in a case in which the user executes an operation of griping the main timetable by both hands via an avatar 702, and pulling the main timetable, the virtual space display data determination unit 1031 of the railway operation information change system 100 determines that the timetable diagram of the comparative line as the display data, and the virtual space display data creation unit 1032 creates data for generating a curved surface 703 which crosses the flat surface 701 of the main timetable diagram on straight lines indicating the station A and the station D, and protrudes and recesses in a direction orthogonal to the flat surface 701, and displaying the timetable diagram of the comparative line on this curved surface. Note that the curved surface 703 is generated so that a travel distance or a travel time matches a length between the stations. A line T1 is an example of a timetable of a train traveling on the line L1, and a line T2 is example of a timetable of a train traveling on a line L2. This example is hereinafter

displaying change destination candidates of arrival and departure times of a change target train as nodes 704. In this example, four nodes are displayed, and the user moves the train line onto one node thereof to determine a final change destination node from these four nodes, thereby enabling changes in arrival and departure times of the train.

[0063]

Moreover, in FIG. 7, the object can be moved between the timetable diagrams (the line L1 on the flat surface 701 and the line L2 on the curved surface 703) being the plurality pieces of railway operation information 1051 of the same type, and a change destination of a travel section of the change target train is displayed as a node. In this example, the train which stops at the station E can be changed to a train which stops at the station B, and hence a node 705 of the station B is displayed as a node. After that, the train is moved onto this node 705 to change the train line in the travel section of the corresponding train, thereby being able to make a change from the line L2 to the comparative line L1.

[0064]

A specific description is given later, but, in the case in which the railway operation information 1051 is the timetable diagram, there is output, as the change destination

node 1062, the change destination candidate node on the time table diagram close in distance to a target which has been operated through the avatar operation information 1052. More specifically, in a case in which the operation according to the avatar operation information 1052 moves the node via the avatar, the data change reflection unit 1044 calculates the distance between the change destination candidate node (for example, 705) on the timetable diagram and the operation target (for example, T2) on the timetable diagram. After that, in a case in which the calculated distance is equal to or shorter than a predetermined threshold, the data change reflection unit 1044 determines that the user has intentionally executed the operation on this node, and outputs the node on the timetable diagram as the change destination node 1062.

[0065]

In FIG. 7, there is exemplified a case in which the railway operation information 1051 is the timetable diagram, but the present embodiment can similarly be applied to various types of the railway operation information 1051 as described below.

[0066]

The railway operation information change system 100 displays, for example, as in FIG. 8, a line L1 displayed in

train enters a vehicle depot stored in vehicle depot information 903 (vehicle depot B) being a change destination candidate for this train. After that, the virtual space display data creation unit 1032 creates data to be displayed, through moving the node 903a of the vehicle depot information relating to this train on the main timetable diagram to the node 903b of the vehicle depot information after the change. It is possible to change, by moving the train to this node 903b as indicated as M, the vehicle depot of the corresponding train and the depot entry time and the depot entry track at which and on which the train enters this vehicle depot. This example is hereinafter referred to as vehicle depot information display example.

[0069]

Further, regarding the proposed train operation adjustment plan information being one of the pieces of railway operation information 1051, the railway operation information change system 100 displays, in combination, a timetable diagram (main timetable diagram) 1001 and a proposed train operation adjustment plan of a train operating according to a timetable indicated by this timetable diagram 1001, as in FIG. 10, for example. In this example, a node (for example, node obtained by switching travel

sequence of trains disrupted by a delay or the like) 1002a relating to train operation adjustment of a train on a line L1 defined as a proposed train operation adjustment plan 1002 is displayed on the timetable 1001 as a node 1002b after the change determined from among a plurality of switching candidates. After that, the virtual space display data creation unit 1032 creates data to be displayed, through moving (indicated as M) the node 1002a of this train on the proposed train operation adjustment plan 1002 to the node 1002b after the change on the timetable 1001. It is possible to make, by moving the train to this node 1002b, a change to a timetable diagram reflecting the proposed train operation adjustment plan of the corresponding train. This example is hereinafter referred to as proposed train operation adjustment plan display example.

[0070]

Further, regarding the vehicle operation information being one of the pieces of railway operation information 1051, the railway operation information change system 100 displays, in combination, a timetable diagram (main timetable diagram) 1101 being a plurality of pieces of railway operation information 1051 of different types and

other. In FIG. 15, for example, there is illustrated that a train identified by a train ID "Tr01" is formed according to vehicle formation identified by the formation ID "V001." In practice, in association with this formation ID, vehicle information such as types of vehicles, the number of vehicles, and the like are stored.

[0079]

An example of the operation arrangement plan information, proposed train operation adjustment plan display example information illustrated in FIG. 10 includes, for example, the operation plan information (FIG. 12A and FIG. 12B) after the change in departure and arrival times for a train in which disruption has occurred due to a delay or the like, but the example of the operation plan information has already been described, and a description of the operation arrangement plan information, proposed train operation adjustment plan display example information is herein omitted.

[0080]

Returning to FIG. 3, the virtual space display data creation unit 1032 uses the acquired latest railway operation information 1051 and the visualization frame 1053 stored in advance to create the virtual space display data 1055 (S303). A description is now given of a case in which there are applied the operation plan information 1201 and 1202 illustrated in FIG. 12A and FIG. 12B out of the various types of railway operation information 1051

operation target type information 1901 created in S307 and the data change rules 2101 extracted in S401, and outputs change target data information 2201.

[0102]

FIG. 22 is a table for illustrating an example of change target data information 2301. The change target data information 2201 is information for applying the data change rules 2101 to the operation target data stored in the operation target type information 1901, thereby creating change destination candidate data ranges 2201. The change destination candidate data range 2201 is information which indicates candidates of a position after the change of the object or the visualization frame to be changed through the avatar operation.

[0103]

As illustrated in FIG. 22, the change target data information 2201 is information which defines a change target data type indicating a type of data stored as the operation target data, change target data which is operation target data indicated by this change target data type, and change target belonging destination railway operation information which indicates the railway operation information 1051 including this change target data.

[0104]

In FIG. 22, for example, each of "departure from

"departure from station A at 08:00:30" being the operation target data of the operation target type information 1901 out of the records 2102, 2103, and 2104 including the operation target type "train (station departure - station arrival)" out of the data change rules 2101. This method for the identification is only required to be implemented on the basis of, for example, whether or not the record includes the changeable portion (in this case, "departure time from departure station") containing the same concept or meaning as that of the operation target data "departure from station A at 08:00:30." After that, the change destination candidate node creation unit 1043 associates the identified changeable portion of the record with the change target data "departure from station A at 08:00:30" and the operation target belonging destination railway operation information "operation plan information (line L2)," and outputs as a record 2202 of the change target data information 2201.

[0106]

Similarly, the change destination candidate node creation unit 1043 identifies, for all of the other pieces of data "arrival at station E at 08:05:20" and "station A - station E" stored as the operation target data of the operation target type information 1901, the record 2102 and 2104 including changeable portions corresponding thereto,

various types of railway information according to the operation by the user. Note that the embodiments are merely an example, and, in practice, only required display output example is used, or new display output example is created and then used.

[0127]

In the above embodiment, as described with reference to FIG. 3 to FIG. 6 and the like, in the railway operation information change system (for example, the railway operation information change system 100) that changes the information relating to the railway operation displayed by the computer including the processor and the memory in the virtual space, the processor: acquires the information (for example, the avatar operation information 1052 and the operation target type information 1056) relating to the change operation via the avatar displayed in the virtual space for the virtual space display data (for example, the virtual space display data 1055) created on the basis of the information (for example, the railway operation information 1051) relating to the railway operation and the visualization rule (for example, the visualization frame 1053) that defines the visualization for the data in order to display the data in the virtual space, and stores the acquired information in the memory (the avatar operation information acquisition

interface, thereby changing the data. Moreover, as described in the second embodiment, the present system can be applied to the various types of railway operation information, as in the plurality-of-timetable display example (FIG. 7), the track information display example (FIG. 8), the vehicle depot information display example (FIG. 9), the operation arrangement plan information, proposed train operation adjustment plan display example (FIG. 10), and the vehicle operation information display example (FIG. 11), as the plurality of pieces of railway operation information, thereby being able to intuitively make the change by the user, and to reflect this change through a unified interface. As a result, the user can change the data on the various types of railway operation information effectively in an energy saving manner without operating a plurality of systems and computers, and thus an environmentally friendly system can be provided.

[0130]

As described with reference to FIG. 1, FIG. 2, and the like, the railway operation information change system may be included in the railway operation information management system formed by connecting, to one another via the network (for example, the networks N1 and N2), the railway operation information change system that is formed of the computer including the processor and the memory and

changes the information relating to the railway operation displayed in the virtual space, the railway operation system (for example, the railway operation system 200) that holds the information relating to the railway operation, and the user terminal (for example, the user terminal 300) that is operated by the user. In this case, the railway operation information change system: acquires the information relating to the railway operation from the railway operation system via the network (railway operation information acquisition unit 101); acquires, from the user terminal, the information (for example, the avatar operation information 1052 and the operation target type information 1056) relating to the change operation via the avatar displayed in the virtual space for the virtual space display data (for example, the virtual space display data 1055) created on the basis of the acquired information relating to the railway operation and the visualization rule (for example, the visualization frame 1053) that defines visualization of data in order to display the data in the virtual space (avatar operation information acquisition unit 102 and data change reception unit 1041); determines the type of the change operation on the basis of the acquired information relating to the change operation (operation target type determination unit 1042); creates the candidate nodes (for

FIG. 11, FIG. 12A, FIG. 12B, and the like, the processor uses at least one of pieces of information relating to the railway operation including the operation plan information that indicates the operation plan for the train, the track information relating to the departure and arrival of the train, the vehicle depot information relating to the train, the vehicle operation information that allocates the vehicle to be used to the operation plan, the timetable diagram that indicates the operation plan, and the proposed train operation adjustment plan information that is obtained by changing the operation plan, to acquire the change operation, to create the candidate nodes, and to update the information relating to the railway operation. As a result, the user can intuitively understand the information relating to these various types of railway operation, and can change the data for the plurality of pieces of railway operation information through a unified interface.

[0132]

Moreover, as described with reference to FIG. 19 and the like, the processor outputs, in the determination, the operation target type information that associates the type, the operation target data that has been the target of the change operation, and the information relating to the railway operation including this operation target data with