

TITLE OF THE INVENTION

LIFT CONGESTION-STATE DISPLAY SYSTEM AND LIFT CONGESTION- STATE DISPLAY METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a lift congestion-state display system and a lift congestion-state display method for visualizing congestion information of a lift.

2. Description of the Related Art

When constructing an office building or a commercial building, the number of users of elevators is predicted at the time of planning the construction, and the elevators are installed with optimal equipment specifications regarding the number of elevators to be installed, the speed, the capacity, and the like such that smooth operation can be performed. However, the number of users also varies depending on a use of a building, a floor, types and the number of tenants occupied, and the like.

Therefore, an operation state of an elevator after installation is sometime different from the prediction at the time of planning the construction. In particular, there is congestion in a morning commuting time zone and a lunch break time zone. Therefore, after installation of elevators, a building management company or a maintenance

company that performs maintenance of the elevators monitors the operation states, collects operation information of the elevators, and performs data analysis. Then, operation control of the plurality of elevators and setting change of a departure reference floor and the like are performed at appropriate times, to perform adjustment such that a waiting time at a hall on each floor is short and optimal operation can be performed.

As the related art related thereto, JP 2012-246115 A describes a technique for providing a visualizing device and a visualizing program for boarding/deboarding operation history information in order to facilitate analysis of movement tendencies of passengers of an elevator such that the technique is utilized in consulting business such as optimization of building tenant arrangement.

SUMMARY OF THE INVENTION

In JP 2012-246115 A, it is possible to analyze the movement tendencies, the number of passengers in a car, and the like from boarding/deboarding floor history of passengers of the elevator, but an index of congestion (degree of congestion) such as a waiting time at a hall is unknown. Therefore, an object of the present invention is to make it possible to more easily grasp a congestion state of a lift.

In order to solve the above problems, the present invention visualizes a relative congestion state of a lift in multiple ways. Specifically, provided is a lift congestion-state display system, which displays a congestion state regarding a lift, including: an information search unit that identifies a first congestion state of a lift designated by a user and searches for history data of congestion states of a plurality of similar lifts similar to the designated lift; and a congestion-state screen generation unit that calculates a second congestion state representing the congestion states of the plurality of similar lifts based on the history data, compares the first congestion state with the second congestion state for each of predetermined comparison units, identifies a relative congestion degree of the lift designated by the user using a result of the comparison, and causes a display device to display information indicating the first congestion state and the second congestion state in a display form according to the relative congestion degree for each of the comparison units. Note that the present invention also includes a lift congestion-state display method and a computer program for executing the lift congestion-state display method.

When implementing the present invention, it is possible to compare relative congestion states of lifts,

and to grasp the congestion state for each comparison unit such as a floor and a time zone.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a functional block diagram according to an embodiment of the present invention;

Fig. 2 is a functional block diagram illustrating a configuration example of a group management elevator and a people flow monitoring related device according to the embodiment of the present invention;

Fig. 3 is a screen example for selecting a building in which an elevator whose congestion state is confirmed according to the embodiment of the present invention has been installed;

Fig. 4 is a screen example for selecting an elevator whose congestion state is confirmed according to the embodiment of the present invention;

Fig. 5 is a screen example illustrating a congestion degree (absolute evaluation) of an elevator according to the embodiment of the present invention;

Fig. 6 is a screen example illustrating a congestion degree (relative evaluation) of an elevator according to the embodiment of the present invention;

Figs. 7A and 7B are views illustrating elevator information according to the embodiment of the present

invention;

Fig. 8 is a view illustrating average waiting time evaluation criteria used in the embodiment of the present invention;

Fig. 9 is a graph for describing a method for calculating a value of a relative congestion degree according to the embodiment of the present invention;

Fig. 10 is a view illustrating average waiting time relative evaluation criteria used in the embodiment of the present invention;

Fig. 11 is a screen example illustrating details of an elevator relative congestion degree for each time zone according to the embodiment of the present invention;

Fig. 12 is a screen example of elevator congestion state prediction after improvement according to the embodiment of the present invention;

Fig. 13 is an operation flow illustrating a procedure for responding to a claim from a user regarding elevator congestion according to the embodiment of the present invention;

Fig. 14 is a diagram illustrating a hardware configuration of a data center server according to the embodiment of the present invention;

Fig. 15 is a view illustrating elevator operation information used in the embodiment of the present

invention;

Fig. 16 is a view illustrating people flow monitoring information used in the embodiment of the present invention;

Fig. 17 is a view illustrating congestion-state information used in the embodiment of the present invention; and

Fig. 18 is a flowchart illustrating a processing procedure for displaying a congestion state (relative evaluation) of an elevator according to the embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In order to describe the present invention in more detail, the present invention will be described based on an embodiment illustrated in the drawings. Note that grasping of a congestion state of an elevator will be described as an example of a lift in the present embodiment.

Fig. 1 is a functional block diagram illustrating a data center server 5 according to the present embodiment and a system configuration related to the data center server 5. Reference sign 1 denotes an owner who owns a building or a customer who manages a building. Reference sign 2 denotes a customer terminal configured to confirm a congestion state of an elevator of the building managed by

the customer 1. Reference sign 3 denotes an engineer 3 of an elevator maintenance company. Reference sign 4 denotes an engineer terminal 4 that allows the engineer 3 to confirm the congestion state of the elevator and to perform an operation simulation of a group management elevator.

Reference sign 5 denotes a data center server installed in a so-called data center. Reference sign 6 denotes a server processing unit. The server processing unit 6 includes a congestion-state screen generation unit 7 and an information search unit 8 in order to generate screen data to be displayed on the customer terminal 2 and the engineer terminal 4. In addition, the server processing unit 6 includes an elevator operation simulator 9 configured to perform an operation simulation of the group management elevator from the engineer terminal 4 used by the engineer 3 of the elevator maintenance company.

Reference sign 13 denotes an elevator operation data collection device 13 that collects elevator operation data 25 and people flow monitoring data 28 from the group management elevator 20 of a customer building via a communication device 12. Here, it is desirable that the elevator operation data collection device 13 collect these pieces of information periodically through a high-speed communication network. Reference sign 14 denotes an elevator operation information storage unit that stores

elevator operation information 15 and people flow monitoring information 16 obtained by converting (unifying formats of) the elevator operation data 25 and the people flow monitoring data 28 collected by the elevator operation data collection device 13. Note that this conversion will be described later.

Here, the elevator operation information 15 and the people flow monitoring information 16 will be described with reference to Figs. 15 and 16. First, Fig. 15 illustrates the elevator operation information 15. The elevator operation information 15 is data in which an arrival time and a departure time of a car to each floor are recorded for each elevator. As an example, a building ID 151, a bank ID 152, a building name 153, a bank name 154, a unit 155, a floor 156, an arrival time 157, and a departure time 158 are recorded.

Next, Fig. 16 illustrates the people flow monitoring information 16. The people flow monitoring information 16 is data recording an arrival time to a lobby in front of the elevator and a boarding time of the elevator for each monitored person. As an example, a building ID 161, a bank ID 162, a building name 163, a bank name 164, a unit 165, a floor 166, a person 167, a lobby arrival time 168, and a boarding time 169 are recorded in association with each other. Note that the person 167 only needs to be a unit

for measuring the number of users, and may be data having anonymity. In addition, different identification information may be assigned to the same person for each time zone.

Further, a building/elevator information storage unit 17 stores building master information 10 and elevator information 11.

Here, a hardware configuration for realizing the data center server 5 as a computer will be described with reference to Fig. 14. The data center server 5 includes a processor 51, a memory 52, a storage device 514, and the communication device 12.

The processor 51 has a function of performing computation according to a program such as a CPU. In the present embodiment, the processor 51 executes processes according to a congestion-state screen generation program 507, an information search program 508, an elevator operation simulation program 509, and an elevator operation data collection program 513 expanded in the memory 52. Here, each program illustrated in Fig. 2 and each configuration of Fig. 1 has the following correspondence relationship. That is, the function of each configurations in Fig. 1 can be realized by the computation performed according to each program.

Congestion-state screen generation program 507:

congestion-state screen generation unit 7

Information search program 508: information search unit 8

Elevator operation simulation program 509: elevator operation simulator 9

Elevator operation data collection program 513: elevator operation data collection device 13

The storage device 514 stores the above-described various types of information. The communication device 12 is connected to the customer terminal 2, the engineer terminal 4, and the group management elevator 20 via the above-described high-speed communication network.

The description of the data center server 5 has ended as above. Next, the group management elevator 20 and a people flow monitoring device 26 connected to the group management elevator 20 will be described with reference to Fig. 2.

Fig. 2 is a functional block diagram of the group management elevator 20 and the people flow monitoring device 26. The group management elevator 20 is installed in a customer building, includes a plurality of elevators 23a to 23n, and has a configuration for controlling the elevators. This configuration includes the communication device 21 connected to the high-speed communication network and a group management control device 22 that controls

operation of the plurality of elevators 23a to 23n. The group management elevator 20 includes an operation data storage unit 24 that stores the elevator operation data 25. Note that the operation data storage unit 24 can be realized by a storage medium such as a hard disk drive (HDD) and a memory card.

In addition, the people flow monitoring device 26 connected to the group management elevator 20 is installed in the customer building. The people flow monitoring device 26 includes various devices that measure the number of users such as people flow, that is, the number of people waiting for an elevator. The various devices include a people flow monitoring apparatus 30 configured to measure the number of passers, such as a hall camera 29 having a number-of-people measuring function, such as the number of waiting people at a hall and the number of occupants in a car, and a security gate of the customer building. The people flow monitoring device 26 also includes a people flow monitoring data storage device 27 that stores the people flow monitoring data 28 collected from the above devices.

Here, the data center server 5 and the group management elevator 20 are connected via the high-speed communication network. Then, the elevator operation data collection device 13 periodically connects to the

communication device 21 through the communication device 12 to collect the elevator operation data 25 and the people flow monitoring data 28. That is, the elevator operation data collection device 13 collects the elevator operation data 25 and the people flow monitoring data 28 from the operation data storage unit 24 and the people flow monitoring data storage device 27. Then, the elevator operation data collection device 13 converts the elevator operation data 25 and the people flow monitoring data 28 into the elevator operation information 15 and the people flow monitoring information 16, and stores the elevator operation information 15 and the people flow monitoring information 16 in the elevator operation information storage unit 14. The elevator operation data 25 and the people flow monitoring data 28 are the same as the elevator operation information 15 and the people flow monitoring information 16 in terms of content. Therefore, as the above-described conversion, the elevator operation data collection device 13 converts the elevator operation data 25 and the people flow monitoring data 28, which are unstructured data, into the elevator operation information 15 and the people flow monitoring information 16, which are structured information.

Next, a conventional procedure for responding to a claim from a user regarding elevator congestion will be

described. The group management elevator 20 is controlled to operate optimally in response to car calls or hall calls of the plurality of elevators 23a, 23b, ..., and 23n.

However, for example, in the case of an office building or the like, there is a case where a queue of users occurs at a hall of an elevator in a time zone of office attendance or lunch and boarding is impossible because a car is full even when the car arrives in response to a call from the hall. In such a case, a claim or an improvement request sometimes occurs from a user of the elevator.

In such a case, in a conventional response procedure, first, a management company or a building owner investigates elevator congestion and a cause of the claim. Depending on a result of the investigation, the management company or the building owner requests an elevator maintenance company to investigate operation of the elevator.

Then, the elevator maintenance company collects operation data for a certain period, and also investigates a congestion state of the hall and the car on site. Then, the setting related to operation control of the elevator is changed to an optimum setting based on the result. In addition, there is a case where it is necessary to continue the field investigation of the congestion state thereafter, and it takes several months to complete a countermeasure.

Therefore, in the present embodiment, in order to prevent such a delay, the elevator operation data collection device 13 collects operation states of a plurality of group management elevators such that a congestion state can be confirmed using the operation states. Hereinafter, a response procedure of the present embodiment will be described with reference to an operation flow illustrated in Fig. 13. Hereinafter, a processing subject of processing performed on a system side will be described mainly with configuration requirements illustrated in the functional blocks of Figs. 1 and 2.

First, in Step S1, the customer 1 or the engineer 3 accesses the data center server 5 via the customer terminal 2 or the engineer terminal 4, and confirms a congestion state of an elevator for which a claim has been made. Specifically, the customer terminal 2 or the engineer terminal 4 receives input of a building in which the elevator for which the claim has been made by the customer 1 or the engineer 3 is installed, a unit of the elevator, a target floor, and date and time. In the present embodiment, either a group management elevator or each of elevators constituting the group management elevator can be used as a target. Therefore, the both will be hereinafter referred to as "elevators" unless otherwise specified.

Here, a display screen of the customer terminal 2 or

the engineer terminal 4 at the time of performing such input will be described. Fig. 3 is a screen on which the customer 1 or the engineer 3 selects a building in which a target elevator is installed when confirming a congestion state of the elevator.

In a case where there are a plurality of buildings managed and handled by the customer 1 or the engineer 3, data serving as a search key is set in a building contractor name 101, a building name 102, and an address input field on this screen, and a search button 104 is selected. As a result, the customer terminal 2 or the engineer terminal 4 transmits a search request using the building contractor name 101, the building name 102, and the address input field as keys to the data center server 5. In response to the request, the information search unit of the data center server 5 executes a search corresponding to the search request on the building master information 10 of the building/elevator information storage unit 17. Although not illustrated, the building master information 10 stores a building name and an address thereof displayed in "management building selection" in Fig. 3 in association with a building ID for identifying a building. In addition, a bank name and a unit are also stored in association with each building.

As a result, the congestion-state screen generation

unit 7 that has received a search result from the information search unit 8 causes the customer terminal 2 to the customer engineer terminal 4 to display the search result, that is, a management building name list 105 in Fig. 3. Note that a contractor name is determined from a login ID at the time of system login, and one contractor of a current target management building can be selected when there is a plurality of contractor names according to a contract form or the like.

Thereafter, the customer terminal 2 or the engineer terminal 4 receives selection of a corresponding building from the management building name list 105 performed using a radio button 106 from the customer 1 or the engineer 3. Then, the customer terminal 2 or the engineer terminal 4 receives pressing of a building selection button 107 from the customer 1 or the engineer 3, thereby transitioning to a screen of Fig. 4.

Fig. 4 is the screen configured to select a group management elevator, which is a congestion state confirmation target, among elevators installed in the building selected on the screen of Fig. 3. In a case where there is a plurality of group management elevators in a building to be managed, a group management elevator can be identified by confirming a bank name and a unit from a bank list 201, which is a management unit of the group

management elevator, and selecting the corresponding bank from a selection field 202. Note that an elevator can be identified by using a unit when each of the elevators is set as a target. For this purpose, the customer terminal 2 or the engineer terminal 4 transmits a search request using a previously identified building as a key to the data center server 5. In response to the request, the information search unit of the data center server 5 executes a search corresponding to the search request on the building master information 10. The description of Step S1 has ended as above.

Next, in Step S2, congestion information of the elevator identified in Step S1 is displayed on the customer terminal 2 or the engineer terminal 4. For this purpose, the customer terminal 2 or the engineer terminal 4 transmits a search request using a selected target unit as a key to the data center server 5. In response to the request, the information search unit 8 of the data center server 5 searches the elevator operation information storage unit 14. In the present embodiment, the elevator operation information 15 and the people flow monitoring information 16 illustrated in Figs. 15 and 16 are retrieved.

Then, the congestion-state screen generation unit 7 creates congestion-state information 18 indicating a

congestion state from the retrieve elevator operation information 15 and people flow monitoring information 16. The congestion-state information 18 stores a congestion state of each elevator in association with each comparison unit for grasping the congestion state. Fig. 17 illustrates an example of the congestion-state information 18. The congestion-state information 18 includes a building ID 181, a bank ID 182, a building name 183, a bank name 184, a unit 185, a floor 186, date and time 187, an average waiting time 188, and the number of users 189. Here, the floor 186 and the date and time 187 are used as comparison units in the example of Fig. 17, but either one thereof or the others may be used. Although the date and time is set on an hourly basis, the date and time may be set in another unit. Although the average waiting time 188 and the number of users are used as the congestion state, either one thereof or the others may be used.

Then, the congestion-state screen generation unit 7 generates a screen indicating a congestion degree, obtained from a congestion state of an elevator based on absolute evaluation illustrated in Fig. 5, from the congestion-state information 18. Then, the congestion-state screen generation unit 7 causes the screen of the customer terminal 2 or the engineer terminal 4 to transition to a screen illustrated in Fig. 5.

Here, details of the screen illustrated in Fig. 5 will be described. Fig. 5 displays a graph of the number of users for each time zone on designated date and time in Step S1 and a congestion degree for each floor and time zone of a hall. The number of users indicates the number of people getting on an elevator car per hour, and the number of users 189 of the congestion-state information 18 is used. As the elevator congestion degree for each time zone and floor, the average waiting time 188 of the number of users of the congestion-state information 18 is used. Here, the following information can be used as the average waiting time 188, that is, the elevator congestion degree for each time zone and floor. The information includes an average waiting time until a user can get on an elevator car after lining up at a hall that is represented on a second basis, a long-waiting rate obtained by calculating an occurrence frequency (%) of a waiting time of a user exceeding 60 seconds, the number of waiting people at a hall per unit time, and the like. These congestion indices are often used to visualize the congestion state of the elevator hall. Meanwhile, elevator operation state data such as a congestion degree in an elevator car or the number of times of activation indicating a use frequency of an elevator may be used in order to visualize the congestion state of the elevator.

Note that the congestion-state screen generation unit 7 may perform processing as follows in order to display the screen of Fig. 5. First, the congestion-state screen generation unit 7 displays a building name of the building selected as illustrated in Fig. 3 in a building name display field 301 of the customer terminal 2 or the engineer terminal 4. Then, the congestion-state screen generation unit 7 initially displays a bank name of the group management elevator selected in Fig. 4 in a bank name display field 302 of the customer terminal 2 or the engineer terminal 4.

Next, the congestion-state screen generation unit 7 receives designation of a corresponding date via a target date designation field 303 of the customer terminal 2 or the engineer terminal 4. These may be displayed on a sub screen for displaying a calendar such that selection can be made from the sub screen. In addition, the congestion-state screen generation unit 7 sets a start time and an end time in a time zone designation field 304 in a case where the time zone is limited for display. This designation may also be performed by a pull-down for selecting the time (hour and minute).

Next, the congestion-state screen generation unit 7 receives selection of an item of a congestion degree to be displayed, such as an average waiting time and a long-

waiting rate, via a congestion degree display item pull-down 305 of the customer terminal 2 or the engineer terminal 4. In addition, the congestion-state screen generation unit 7 receives selection of a unit per hour (hour, 30 min, 5 min, 1 min, or the like) used for the congestion degree display via a display unit pull-down 306 of the customer terminal 2 or the engineer terminal 4. Then, when receiving selection of a search button 307 via the customer terminal 2 or the engineer terminal 4, the congestion-state screen generation unit 7 displays the number of elevator users 310 at the designated date and time and a hall congestion degree 311 for each floor and time zone as illustrated in Fig. 5. Note that the congestion-state screen generation unit 7 may create the congestion-state information 18 in advance and display the stored information, or may create congestion-state information for each request.

Note that it is desirable that the number of elevator users 310 and the hall congestion degree 311 for each floor and time zone be displayed by changing a display form according to values indicated by these pieces of information. For example, corresponding colors may be displayed to be distinguished for each range of a reference value, or a code (alphabet) indicating the congestion degree may be described. Either one thereof may be used.

In the case of distinguishing colors, it is desirable to use a color having a higher density or a more conspicuous color as the congestion degree is higher.

Note that Fig. 8 illustrates average waiting time evaluation criteria 601 for changing and displaying a display form according to such a congestion degree. The congestion-state screen generation unit 7 determines any of the average waiting time evaluation criteria 601 stored in the server processing unit 6 to which the congestion degree (average waiting time) of each of the comparison units (time zone and floor) corresponds, and performs display in a display form such as a color of a corresponding field in the hall congestion degree 311.

Next, in Step S3, congestion information based on relative evaluation of an elevator of a specific unit is displayed on the customer terminal 2 or the engineer terminal 4. Although the congestion degree is displayed by the absolute evaluation in Fig. 5, the display based on the relative evaluation is possible in the present embodiment.

For this purpose, the customer terminal 2 or the engineer terminal 4 receives selection of a relative evaluation tab 309 illustrated in Fig. 5 from the customer 1 or the engineer 3. As a result, a display screen illustrated in Fig. 6 is displayed on the customer terminal 2 or the engineer terminal 4. This content indicates a

congestion state based on the relative evaluation obtained by comparing the congestion degree with an elevator of a similar building. In an office building or the like, a congested state always continues at the time of attending offices or during a lunch break, and thus, the congestion degree is always determined to be congested in the absolute evaluation of Fig. 5. Therefore, in such a case, it is possible to evaluate a congestion state of an elevator of a building based on a relative congestion degree with other buildings in the present embodiment.

First, before describing the content of the screen of Fig. 6, a processing procedure for displaying the screen will be described with reference to Fig. 18. Fig. 18 is a flowchart illustrating the processing procedure for displaying a congestion state (relative evaluation) of an elevator illustrated in Fig. 6. In this flowchart, information indicating a congestion state of an elevator (similar elevator) of a similar building, which is a reference of the relative evaluation, is searched, and the screen illustrated in Fig. 6 is created using the information.

First, in Step S31, the customer terminal 2 or the engineer terminal 4 transmits a relative evaluation request to the data center server 5 in response to input from the customer 1 or the engineer 3. This may be triggered by

designation of the relative evaluation tab 309 in Fig. 5, or access in Step S1.

Next, in Step S32, the information search unit 8 of the data center server 5 uses a building and an elevator unit received in Step S1 to search for elevator information related to the target elevator from the elevator information 11. As a result, elevator information 11-1 of the target elevator illustrated in Fig. 7A is retrieved. The elevator information 11-1 includes a building ID 111-1, a bank ID 112-1, a building name 113-1, a bank name 114-1, a building use 115-1, the number of floors 116-1, the number of delivered elevators 117-1, a rated speed 118-1, a transport amount 119-1, and the like. Here, the number of delivered elevators 117-1 is preferably the number of elevators in a predetermined group such as the number of elevators constituting the group management elevator 20. In addition, the information search unit 8 may identify this information from the building master information 10.

Next, in Step S33, the information search unit 8 searches for a similar elevator from the elevator information 11 using a predetermined item indicating a feature of the elevator out of the searched elevator information 11-1 as a key. In the present embodiment, the building use 115-1, the number of floors 116-1, the number of delivered elevators 117-1, the rated speed 118-1, and

the transport amount 119-1 are used as keys. Then, the information search unit 8 searches for elevator information in which these values coincide or fall within a certain range.

An example of elevator information 11-2 as such a search target is illustrated in Fig. 7B. The elevator information 11-2 is information corresponding to the elevator information 11-1. The elevator information 11-2 includes a building ID 111-2, a bank ID 112-2, a building name 113-2, a bank name 114-2, a building use 115-2, the number of floors 116-2, the number of delivered elevators 117-2, a rated speed 118-2, a transport amount 119-2, and the like. Note that the number of delivered elevators 117-2 is preferably the number of elevators in a predetermined group such as the number of elevators constituting the group management elevator 20.

This search will be described by exemplifying a case where the building use 115-1 is 'office building', the number of floors 116-1 of '18', the number of delivered elevators 117-1 of '6', the rated speed 118-1 of '60', and the transport amount 119-1 of '120' in the target elevator information 11-1. In the elevator information 11-2 of Fig. 7B, the following two records are retrieved as data in which all values of the five items coincide. Elevators used in banks indicated by these pieces of data are

identified as similar elevators.

- The building ID 111-2 is '10003' and the bank ID 112-2 is '10003-001'.

- The building ID 111-2 is '10003' and the bank ID 111-2 is '10003-002'.

Note that data in which the respective items coincide is retrieved in the present example, but data satisfying a predetermined condition within a certain range or the like may be retrieved. For example, grouping may be performed in advance for each predetermined range regarding the number of floors, and determination may be made based on whether the number of floor matches this group. The determination may be made based on whether a difference falls within a certain range defined in advance. Note that the above-described process of extracting the data of the elevator of the similar building includes extraction other than extraction performed when all the five items coincide (AND condition) by performing narrowing in another customer building or area and extraction is. The extraction may be performed by determining a condition or a range for each item, such as extraction performed with coincidence in at least one of the five items (OR condition). In addition, regarding the elevator information 11-1, a building ID and a bank ID of a similar elevator or information for identifying the similar elevator may be stored, and the

time and effort for a search may be omitted using this data.

In Step S34, the information search unit 8 searches for the elevator operation information 15 and the people flow monitoring information 16 of the similar elevators. That is, pieces of data corresponding to the building ID 111-2 of '10003' and the bank IDs 112-2 of '10003-001' and '10003-002' are extracted.

Next, in Step S35, the congestion-state screen generation unit 7 creates congestion-state information indicating congestion states of the similar elevators. This is created similarly to the congestion-state information 18 of the target elevator described in Step S2. That is, information in which the congestion state of the similar elevator is associated for each comparison unit for grasping the congestion state is created for each of the similar elevators.

Then, the congestion-state screen generation unit 7 calculates representative values representing the entire similar elevator for the respective comparison units using the congestion state (the average waiting time and the number of users) of each of the similar elevators. The representative value includes an average value. Here, information for a certain period in the past in the similar elevator is used at the time of calculating these

representative values. Note that it is desirable to use information corresponding to the date and time of a claim or an inquiry as the information for the certain period in the past. For example, if the date and time of the claim or the inquiry is weekdays, information during the weekdays is also used as the information of the certain period in the past.

Next, in Step S36, the congestion-state screen generation unit 7 compares the created representative value (congestion-state information) of the similar elevator with the congestion-state information of the target elevator for each comparison unit. In the present example, the time zone and the floor are used as the comparison units.

Then, the congestion-state screen generation unit 7 identifies a relative congestion degree indicating a relative congestion state from a result of the comparison. The relative congestion degree indicates a difference, which is the result of the comparison, and a magnitude relationship. For example, in a case where an average value of average waiting times (seconds) in a corresponding time zone of a similar building is 702 and a value of an average waiting time of a corresponding elevator managed by the customer 1 is 701 as illustrated in Fig. 9, a difference obtained by subtracting the value of 702 from 701 is identified as a relative congestion degree value

703.

Then, the congestion-state screen generation unit 7 determines a display form according to the relative congestion degree value 703, and causes the customer terminal 2 or the engineer terminal 4 to display the content illustrated in Fig. 6 according to the display form. Here, the congestion-state screen generation unit 7 uses, for example, average waiting time relative evaluation criteria as illustrated in Fig. 10 in order to determine the display form. Specific content of the display form determined in this manner will be described. In Fig. 6, a value of an average waiting time from 12 o'clock to 13 o'clock on the first floor indicated by 403 is 45 seconds, and an average value of average waiting times of a similar elevator is 40 seconds. In this case, the difference is -5 seconds, and thus, "slightly better than the average" in Fig. 10 is identified. Therefore, the congestion-state screen generation unit 7 displays "B+" in the corresponding field.

Although the relative congestion degree is calculated using the difference from the average regarding the relative congestion degree value 703, but the relative congestion degree may be calculated by a method using a standard deviation. Since the relative congestion degrees with other building groups are displayed side by side to be

compared for each floor and for each time zone, it is possible to grasp the congestion state in the comparison units, such as for each floor and for each time zone, at a glance.

The description of Fig. 18 has ended as above. Next, details of the display content of Fig. 6 will be described before returning to the operation flow of Fig. 13. Fig. 6 is the screen illustrating the congestion degree (relative evaluation) of the elevator. In Fig. 6, reference sign 401 denotes a screen area for comparing and displaying the number of users of the elevator of the target building (own building) and the average number of users of the similar elevator for each time zone.

In addition, reference sign 402 denote a screen area for displaying the relative congestion degree created in Step S36. That is, reference sign 402 denotes a display area for displaying the elevator congestion degree based on relative evaluation for each time zone and floor. In the present example, a display color is set to a colorless place (difference is -) or a colored place (difference is +) using a sign (difference is + or -) indicated by the relative congestion degree, and the degree thereof is indicated by A+ to C- as illustrated in the average waiting time relative evaluation criteria. In addition, the display color may be divided into a red color system

(difference is -) and a blue color system (difference is +), and the color may be changed stepwise to represent the congestion degree.

In addition, reference sign 404 denotes a check box that enables selection of a floor for which the congestion state is desirably confirmed. The customer terminal 2 or the engineer terminal 4 receives the selection of the check box and selection of an individual floor detailed congestion degree button 405 from the customer 1 or the engineer 3. In response to the selection, the congestion-state screen generation unit 7 displays a screen of Fig. 11 on the customer terminal 2 or the engineer terminal 4.

Fig. 11 is the screen illustrating relative congestion degree details for each time zone of an elevator using an average waiting time. With a screen 901, the customer terminal 2 or the engineer terminal 4 can confirm details of the relative congestion degree exemplified by the average waiting time. For example, when confirming details in a time zone of 8 o'clock on the first floor in Fig. 6, the customer 1 or the engineer 3 selects only the first floor in the floor selection field 404 via the customer terminal 2 or the engineer terminal 4 and presses the individual floor detailed congestion degree button 405. Then, the congestion-state screen generation unit 7 generates a relative congestion degree graph 902 in the

time zone of 8 o'clock from the screen of Fig. 11 and displays the graph on the customer terminal 2 or the engineer terminal 4.

In addition, the relative congestion degree value (903) can be confirmed by clicking the corresponding graph on the screen in a case where the customer terminal 2 or the engineer terminal 4 is a so-called personal computer, or touching the corresponding graph with a finger on the screen in a case where the customer terminal 2 or the engineer terminal 4 is a tablet. The description of the processing up to Step S3 of the operation flow has ended as above.

Through the above-described procedure, the customer 1 and the engineer 3 can confirm the congestion state of the elevator of the building to be managed. Then, the customer 1, that is, the manager or the owner of the building determines whether the congestion can be handled by himself/herself. If a negative determination is made (No), the processing proceeds to Step S5, and the maintenance company of the elevator is requested to investigate a cause of the elevator congestion. This request may be made by any means such as a phone call, an e-mail, or a letter. In addition, if a positive determination is made (Yes), it is determined that the customer himself/herself takes some measures, and the

present operation flow ends.

Next, in the maintenance company of the elevator that has received the request, the engineer 3 of the elevator investigates the congestion of the elevator on site. Therefore, in Step S6, the elevator operation simulator 9 of the data center server 5 executes an operation simulation in response to an input instruction from the engineer 3 via the engineer terminal 4. For this purpose, first, the elevator operation simulator 9 analyzes an operation state of the elevator based on the elevator operation information 15 and the people flow monitoring information 16 which are periodically collected, and investigates a cause.

Thereafter, the elevator operation simulator 9 executes the operation simulation according to a congestion mitigation measure input from the engineer terminal 4 by the engineer 3 based on a result of the investigation. Then, the elevator operation simulator 9 displays a result of the operation simulation on the engineer terminal 4. The engineer 3 understands this content and verifies an effect of the input congestion mitigation measure. At this time, it is desirable to input a plurality of types of congestion mitigation measures and perform operation simulation for each of the congestion mitigation measures.

Note that an elevator simulator proposed in JP 2018-

167966 A can be used as the operation simulator. In addition, at this time, it is desirable that the elevator operation simulator 9 display the result of the operation simulation in a format similar to that of the congestion state of the elevator illustrated in Fig. 5 or 6 or display a screen of Fig. 12 to be described later. In this case, the congestion state calculated in Step S3 is used as the congestion state of the similar elevator in Fig. 6.

Next, the engineer 3 presents, to the customer 1, a plan that can be expected to be effective from the result of the operation simulation among the plurality of congestion mitigation measures in Step S6. The customer 1 confirms an elevator congestion state prediction after improvement using the customer terminal 2. Fig. 12 is an example of the screen in which the elevator congestion state prediction after improvement when the congestion mitigation measure is implemented is displayed on the customer terminal 2. For example, a description will be given regarding a case where a plurality of plans, such as user operation improvement (peak shift operation by changing lunch time) in Proposal 1, are proposed as the congestion mitigation measures.

In this case, selection of each plan is received in an improvement plan display switching pull-down 1001 in Fig. 12. As a result, the display screen of the customer

terminal 2 is switched, and the customer 1 can confirm the content. Specifically, the engineer terminal 4 displays current congestion degree 1004 and a congestion degree after improvement 1005 in the predicted number of elevator users for each time zone 1002 (current number of users and predicted number of user after improvement) calculated based on the simulation result, and a predicted elevator congestion degree 1003. As a result, the engineer 3 can compare these values. Note that this display may be controlled to be displayed on the engineer terminal 4 by the elevator operation simulator 9. In Step S7, it is desirable that the elevator operation simulator 9 display the result of the operation simulation in a format similar to the congestion state of the elevator illustrated in Fig. 5 or 6, which is similar to Step S6. However, this display may be performed by the engineer terminal 4 alone according to information stored in advance in the engineer terminal 4.

Thereafter, if the customer 1 does not agree with the congestion mitigation measure presented in Step S7, that is, the proposal content (No) in Step S8, the processing returns to Step S6. In the case of agreement (Yes), the processing proceeds to Step S9. Here, as a method for confirming the agreement of the customer 1, agreement may be obtained by presenting an investigation

report on elevator congestion separately submitted by the elevator maintenance company or the above-described plan of each congestion mitigation measure to the customer terminal 2.

Next, the customer 1 or the elevator maintenance company actually implements the congestion mitigation measure agreed in Step S8. Then, after implementing the congestion mitigation measure in Step S9, the customer 1 or the engineer 3 determines whether a response to congestion has been completed in Step S9. That is, it is determined whether the congestion mitigation measure is effective. For this purpose, processing similar to that in Steps S1 to S4 described above (In particular, Step S3) is executed. As a result, the engineer 3 of the maintenance company of the elevator has been required to periodically perform monitoring on site so far, but the customer 1 such as the management company of the building can use the customer terminal 2 and grasp the congestion state as needed.

CLAIMS

1. A lift congestion-state display system for displaying a congestion state regarding a lift, the lift congestion-state display system comprising:

an information search unit that identifies a first congestion state of a lift designated by a user and searches for history data of congestion states of a plurality of similar lifts similar to the lift designated,

wherein the similar lifts are identified by the information search unit by comparison of elevator information of the lift designated and the similar lifts; and

wherein the elevator information includes at least one of a use of an installed building, a number of available floors, a number of delivered lifts, a speed, and a transport amount in the lift designated; and

a congestion-state screen generation unit that calculates a second congestion state representing the congestion states of the plurality of similar lifts based on the history data, compares the first congestion state with the second congestion state for each of a plurality of predetermined comparison units, identifies a relative congestion degree of the lift designated by the user using a result of the comparison, and causes a display device to display information related to at least one of the first congestion state, the second congestion state, and the relative congestion degree for each of the comparison units.

2. The lift congestion-state display system according to claim 1, wherein

the comparison units are date and time and floors at which the lift designated by the user is used, and

the first congestion state and the second congestion state are average waiting times at the date and time for each of the floors.

3. A lift congestion-state display method for displaying a congestion state regarding a lift, the lift congestion-state display method comprising:

identifying a first congestion state of a lift designated by a user and searching for history data of congestion states of a plurality of similar lifts similar to the lift designated,

wherein the similar lifts are identified by the information search unit by comparison of elevator information of the lift designated and the similar lifts; and

wherein the elevator information includes at least one of a use of an installed building, a number of available floors, a number of delivered lifts, a speed, and a transport amount in the lift designated;

calculating a second congestion state representing the congestion states of the plurality of similar lifts based on the history data;

comparing the first congestion state with the second congestion state for each of a plurality of predetermined comparison units;

identifying a relative congestion degree of the lift

designated by the user using a result of the comparison;
and

causing a display device to display information related to at least one of the first congestion state, the second congestion state, and the relative congestion degree for each of the comparison units.

4. The lift congestion-state display method according to claim 3, wherein

the comparison units are date and time and floors at which the lift designated by the user is used, and

the first congestion state and the second congestion state are average waiting times at the date and time for each of the floors.