

ELEVATOR SYSTEM

FIELD

Embodiments described herein relate generally to an elevator system provided with a hall destination controller.

BACKGROUND

In general, in the elevator hall of each of the floors of a building, call buttons for registering a hall call are provided. When a user operates any of the call buttons to register a hall call, a car is moved in response to the hall call to a registration floor at which the hall call is registered. When the user gets into the car, and operates a destination floor button of a car operation panel, a destination floor is registered and the car is moved to the destination floor.

In recent years, an elevator system including a hall destination controller (HDC) in place of the call buttons described above has been put into practical use. The HDC enables a user in a hall to directly specify a destination floor. Such an elevator system is referred to as a "destination control system (DCS)". The DCS selects an optimal one of a plurality of cars based on a destination floor registered by the user in a hall, and causes the selected car to move to a floor at which the hall is situated. In this case, users who wish to go to the same destination floor are invited to get into the same car in order to improve transportation efficiency.

It should be noted that a DCS in which hall destination controllers are installed in all the floors, respectively, is referred to as a "full DCS". In the full DCS, since a destination floor can be registered in the hall of any floor, it is not necessary to provide designation buttons in each car.

In the above elevator system, if a failure is caused in a DCS control, the operation of the elevator

system is switched to a backup operation (emergency operation), and it is continued with a specified car only. In this case, in the full DCS, a specified car is caused to stop at all the floors one by one, since a user is unable to specify a designation floor in a car. However, such an operation greatly reduces transport efficiency, and inconveniences users.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing the configuration of an elevator system according to an embodiment.

FIG. 2 is a block diagram showing the functional configuration of an elevator controller in the embodiment.

FIG. 3 is a flowchart showing the operation of the elevator system according to the embodiment.

FIG. 4 is a view showing a concrete example to explain an operation of the elevator system according to the embodiment in the case where a failure is caused in the elevator system.

FIG. 5 is a view showing an example of an indication of a designated car which is given in a hall destination controller in the embodiment.

FIG. 6 is a view showing an example of an indication of a destination floor which is given in one of indicators for elevators in the embodiment.

DETAILED DESCRIPTION

Embodiments will be described with reference to the accompanying drawings.

In general, according to one embodiment, an elevator system includes: a hall destination controller installed in a hall; a first controller which selects one of a plurality of cars as a designated car and causes the designated car to move to a registration floor, under a DCS control which considers a destination floor registered by a user with the hall destination controller; and a plurality of second

controllers which control operations of the cars in accordance with an instruction given by the first controller.

5 If a failure has occurred in the DCS control of the first controller, one of the second controllers which is set as a master in advance converts a first call signal of a DCS control system which is output from the hall destination controller into a second call signal to be used in a group management control system,
10 and continues an operation.

 FIG. 1 is a block diagram showing the configuration of an elevator system according to an embodiment, and also showing a system in which a group of elevators are managed. It should be noted that an
15 elevator described herein basically means a car, and a plurality of elevators are also referred to as cars of elevators. Also, a car to which a hall call has been assigned is referred to as a "designated car" or "car of a designated elevator".

20 This elevator system comprises a single DCS controller 11 and a plurality of elevator controllers 12a, 12b, 12c, The DCS controller 11 and the elevator controllers 12a, 12b, 12c, . . . are connected to each other by cables 13 for group management
25 control.

 The DCS controller 11 is a main controller for achieving a control system of a DCS, and used as a first controller. The DCS controller 11 includes a control program for DCS, selects an optimal one of cars
30 24a, 24b, 24c, . . . as a designated car based on a destination floor registered by a user with a hall destination controller 21, and causes the selected car to move to a registration floor (a floor at which the destination floor is registered).

35 The hall destination controller 21 is a device for a user in a hall to register a destination floor in advance. The hall destination controller 21 comprises

an operation module 22 which is operated to register a destination floor and an indicator 23 which indicates the destination floor registered by the user and a car (designated car) selected as a car to be moved to the destination floor.

It should be noted that in general, a destination floor is registered by operating a numeric (10-digit) key unit; however, it may be registered using, for example, an IC card. Furthermore, the hall destination controller 21 may be installed at a place distant from the hall.

The embodiment is provided on the premise that a "full DCS" in which hall destination controllers 21 are installed in halls of respective floors is applied.

Those hall destination controllers 21 are connected to the DCS controller 11 by a cable 14 for the controllers, and also connected to the elevator controllers 12a, 12b, 12c, . . . by a cable 15 for the controllers. Thereby, when a destination floor is registered by the hall destination controller 21 at an arbitrary floor, a call signal of a DCS control system which is output from the hall destination controller 21 is sent to not only the DCS controller 11, but the elevator controllers 12a, 12b, 12c,

The elevator controllers 12a, 12b, 12c, . . . are provided in association with the cars 24a, 24b, 24c, . . . , respectively. The elevator controllers 12a, 12b, 12c, . . . are used as second controllers. At a regular operation time, the elevator controllers 12a, 12b, 12c, . . . exercise controls of the respective associated cars independently, which include a drive control of a hoist not shown and an opening/closing control of a door, in accordance with an instruction from the DCS controller 11.

The cars 24a, 24b, 24c, . . . are moved up and down in elevator shafts by driving the hoist not shown. In the cars 24a, 24b, 24c, . . . , destination floor

buttons for specifying a destination floor are not provided.

Furthermore, indicators 25a, 25b, 25c, . . . for the respective elevators are connected to the elevator controllers 12a, 12b and 12c, . . . , respectively. The indicator 25a for elevator A is provided close to a hall door of the car 24a of elevator A, and indicates a destination floor, a traveling direction, etc. of the car 24a. The same is true of the indicators 25b, 25c, . . . for the other elevators. The indicators 25a, 25b, 25c, . . . are provided as ones for the respective elevators in the hall of each of the floors.

It should be noted that in the embodiment, the elevator controllers 12a, 12b, 12c, . . . have an operation control function (group management control) for use in an ordinary group management system. In the case where a DCS control failure has occurred, one of the elevator controllers 12a, 12b, 12c, . . . which is set as a master in advance performs a backup operation under a group management control. It should also be noted that "DSC control failure" means a state in which some failure has occurred in the DCS controller 11, and the DCS control cannot be correctly performed. Suppose that although a DCS control failure has occurred, the hall destination controller 21 correctly operates, and can thus register a destination floor.

The following explanation is given with respect to the case where the elevator controller 12a is set as a master in advance.

FIG. 2 is a block diagram showing a function configuration of the elevator controller 12a. It should be noted that the elevator controllers 12b, 12c, . . . have the same structure as the elevator controller 12a.

The elevator controller 12a comprises as functions for continuing the operation in the case where a DCS control failure has occurred, a signal conversion

module 31, an assignment controller 32, an operation controller 33, a first indication controller 34, a second indication controller 35, and a notification module 36.

5 In the case where a failure has occurred in a DCS control system, the signal conversion module 31 converts a call signal of the DCS control system (which will be hereinafter referred to as a first call
10 signal), which indicates a destination floor registered by the hall destination controller 21 and a registration floor (a floor at which an operation for registering the destination floor was performed), into a call signal for use in a group management control system (which will be hereinafter referred to as a
15 second call signal).

 The assignment controller 32 selects an optimal one of the cars 24a, 24b, 24c, . . . as a designated car, based on the second call signal obtained by the signal conversion module 31, and causes the designated
20 car to move to the registration floor. The operation controller 33 registers the destination floor in the designated car selected by the assignment controller 32, and causes the designated car to move to the destination floor after the car is moved to the
25 registration floor.

 The first indication controller 34 causes an indicator 23 provided at the hall destination controller 21 to indicate the name of the elevator of the designated car selected by the assignment
30 controller 32 as information on a car on which a user will get. The second indication controller 35 causes an indicator associated with the designated car, which is one of indicators 25a, 25b, 25c, . . . provided for the elevators, respectively, to indicate the
35 destination floor to which the designated car will move.

 The notification module 36 notifies an external

section of a failure of the control system (DCS controller 11). The external section is, for example, a monitor center not shown or a monitor room of a building. The monitor center is situated in a remote place, and remotely monitors the operation states of elevators installed in various regions through a communication network.

Next, the operation of the elevator system according to the embodiment will be explained.

FIG. 3 is a flowchart of the operation of the elevator system according to the embodiment.

In the case where the DCS control is normal, i.e., the DCS controller 11 normally operates (No in step S10), an assignment control is executed in consideration of the destination floor registered by the user with the hall destination controller 21 (step S12).

To be more specific, when the user registers the destination floor by operating the hall destination controller 21, a first call signal including a combination of two information items indicating the destination floor and the registration floor (a floor at which the destination floor is registered) is sent to the DCS controller 11. At this time, the indicator 23 of the hall destination controller 21 indicates the destination floor registered by the user.

Upon reception of the first call signal, the DCS controller 11 selects as a designated car an optimal one of the cars 24a, 24b, 24c, . . . based on the destination floor registered by the user, which is indicated by the first call signal. In this case, a DCS control based on the destination floor is executed, and an optimal car which can be most efficiently operated is determined as a designated car. When the designated car is determined, the DCS controller 11 gives an instruction to one of the elevator controllers 12a, 12b, 12c, . . . which is associated to the

designated car to cause the designated car to move to the registration floor.

5 In addition, when the designated car is determined, the indicator 23 of the hall destination controller 21 indicates the type (the name of the elevator) of the car selected as the designated car. The user will see this indication to confirm a car into which the user will get, and wait near its elevator entrance. Since the destination floor for the user is
10 already registered in the car, it is not necessary to perform an operation for specifying the destination floor (an operation for registering a car call) in the car.

On the other hand, in the case where a failure has
15 occurred in the DCS control, i.e., the DCS controller 11 does not normally operate because of some abnormality (Yes in step S11), the elevator controller 12a set as a master in advance notifies an external section of the abnormality of the car (step S12), and
20 applies a backup operation (step S13).

The above "backup operation" refers to an emergency operation to be performed when an abnormality has occurred in the DCS controller 11, which is a main controller. The DCS controller 11 and the elevator
25 controllers 12a, 12b, 12c, . . . are connected to each other by the cables 13 for group management control such that they can transmit and receive data to and from each other. When receiving no signal response from the DCS controller 11, the elevator controller 12a
30 determines that some abnormality has occurred in the DCS controller 11, and applies the backup operation.

It should be noted that the above external section is, for example, a monitor center not shown or a monitor room of a building not shown. If the external
35 section is a monitor center, it is notified of the failure of the DCS control through a communication network. If the external section is a monitor room of

a building, it is notified of the failure of the DCS control through wires or wirelessly.

Furthermore, if a failure has occurred in the elevator controller 12a for elevator A which is set as the master, any of the elevator controllers 12b, 12c, . . . for the other elevators is set as the master, issues a notification indicating occurrence of an abnormality, and applies the backup operation.

If the backup operation is applied, and no failure has occurred in the elevator controller 12a serving as the master, the elevator controller 12a acquires a first call signal for use in the DCS control system, from the hall destination controller 21, and holds the first call signal in an internal memory not shown (step S14). The first call signal indicates both the destination floor registered by the user and the registration floor. The elevator controller 12a converts the first call signal into a second call signal for use in the group management control system (step S15). The second call signal indicates both a traveling direction of a car and the registration floor.

To be more specific, the elevator controller 12a determines a desired traveling direction of a car for the user, based on the relationship between the destination floor and the registration floor indicated by the first call signal held in the internal memory. For example, if the registration floor is the first floor, and the destination floor is the fourth floor, the traveling direction is an upward direction. By contrast, if the registration floor is the fourth floor, and the destination floor is the first floor, the traveling direction is a downward direction. The elevator controller 12a adds information regarding "registration floor" obtained from the first call signal to the "traveling direction" determined in the above manner, thereby producing a second call signal.

Next, the elevator controller 12a performs an assignment control based on the second call signal obtained by the conversion (step S16). To be more specific, the elevator controller 12a determines
5 evaluation values of the cars 24a, 24b, 24c, . . . using a predetermined arithmetic expression with respect to the case where the second call signal is supplied to each of those cars, and selects a car (optimal car) having the highest evaluation value among
10 from the cars as a designated car.

It should be noted that the "predetermined arithmetic expression" is, for example, an evaluation arithmetic expression using neuro fuzzy or another method. However, the method which can be applied in
15 the invention is not limited to such a method. That is, in the embodiment, suppose the above evaluation values are calculated in consideration of the operation efficiency of all the elevators and using a method for use in an ordinary elevator management control.
20 Furthermore, "evaluation value" is an index of optimality of a car in the case where a hall call is assigned to the car. The evaluation value means the smaller the numerical value, the higher the evaluation, and the greater the numerical value, the lower the
25 evaluation.

When a designated car is selected, the elevator controller 12a causes it to move to a registration floor (a floor at which a destination floor is registered) (step S17). In this case, the operation of
30 the designated car is controlled by one of the elevator controllers 12a, 12b, 12c, . . . which is associated with the designated car.

That is, in the case where the car 24a of elevator A is selected as a designated car, the operation of the
35 car 24a is controlled by the elevator controller 12a for elevator A which is set as the master. On the other hand, in the case where the car 24b of elevator B

is selected as a designated car, an assignment command is sent from the elevator controller 12a serving as the master to the elevator controller 12b, the operation of the car 24b is controlled by the elevator controller 12b receiving the assignment command.

The following explanation is given on the premise that the car 24b of elevator B is selected as a designated car.

In the case where the car 24b of elevator B is selected as a designated car, the elevator controller 12a sends the first call signal indicating the destination floor, which is held in the internal memory, to the elevator controller 12b for elevator B, and causes the elevator controller 12b to register the first call signal as a car call to the car 24b (step S18). For example, in the case where the fourth floor is registered as the destination floor, the fourth floor is registered as a destination floor of a car call to the car 24b.

It should be noted that as the timing at which the destination floor (car call) is registered in the designated car, for example, time when the designated car is selected may be set, or time when the designated car is moved to (arrives at) the registration floor may be set.

Furthermore, when the designated car is selected, the elevator controller 12a causes the hall destination controller 21 to indicate the designated car, and also causes the indicator 25b associated with the designated car to indicate the destination floor (step S19).

Specifically, first, the elevator controller 12a selects one of the hall destination controllers 21 installed in the respective floors, which is the hall destination controller 21 used by the user to register the destination floor, as a hall destination controller 21 to be used in a display operation, and sends information on the designated car to the selected hall

destination controller 21. Thereby, the indicator 23 of the hall destination controller 21 indicates the elevator name of the designated car (see FIG. 5).

5 Subsequently, the elevator controller 12a selects the indicator 25b for elevator B from among the indicators 25a, 25b, 25c, . . . installed in the hall of the registration floor, as an indicator to be used in a display operation, and sends to the indicator 25b information indicating the destination floor for which
10 a car call to the car of elevator B is registered. Thereby, the indicator 25b indicates the destination floor for the car of elevator B (see FIG. 6).

In such a manner, even during a DCS failure, it is possible to correctly guide the user to the designated
15 car by indicating the designated car and the destination floor as in DCS. When the car 24b of elevator B, which is selected as the designated car, moves to (arrives at) the registration floor, the elevator controller 12a causes the door of the car 24b
20 to be opened by the elevator controller 12b for elevator B, thereby allowing the user to get into the car 24b, and then causes the car 24b to move to the destination floor (step S19). At this time, since the destination floor for the user is registered in the car
25 24b of elevator B which is selected as the designated car, it is not necessary to register the destination floor (register a car call) in the car.

It should be noted that if a failure has occurred in the DCS control, for example, the monitor center or
30 the monitor room of a building is notified of occurrence of an abnormality (step S12). Until a maintenance worker goes to the scene of the abnormality upon receipt of the above notification, and makes repairs, such a backup operation as described above is
35 carried out. After the DCS control is repaired, as usual, the operations of the cars 24a, 24b, 24c, . . . of the elevators are controlled by the elevator

controllers 12a, 12b, 12c, . . . in accordance with an instruction given by the DCS controller 11.

FIG. 4 shows a concrete example.

5 Suppose in a building having first to fifteenth
floors, three cars 24a to 24c (of elevators A to C) are
moving to respective floors. In each of the floors, at
least one hall destination controller 21 is installed.
Each of the hall destination controllers 21 is used by
a user to register a destination floor; and ordinarily,
10 an assignment control of DCS is performed based on the
destination floor registered by the user to select a
car as a designated car. In this case, the car is
selected such that users who wish to go to the same
destination floor can get into the selected car, in
15 order to improve transportation efficiency.

 If a failure has occurred in such a control system
(the DCS controller 11) of DCS, a backup operation
under the group management control is applied. For
example, suppose as shown in FIG. 4, the user uses the
20 hall destination controller 21 at the first floor to
register the fourth floor as a destination floor. In
this case, the indicator 23 of the hall destination
controller 21 indicates "4F" as the destination floor
registered by the user.

25 Then, the hall destination controller 21 at the
first floor outputs a first call signal of DCS control
system which indicates that the destination floor is
the fourth floor, and the registration floor is the
first floor. After receiving the first call signal, an
30 elevator controller serving as a master (for example,
the elevator controller 12a) converts the first call
signal to a second call signal to be used in the group
management control system. In this example, since the
registration floor is the first floor, and the
35 destination floor is the fourth floor, the traveling
direction of a car is an upward direction. Therefore,
the first call signal is converted into a second call

signal indicating that the traveling direction is the upward direction, and the registration floor is the first floor.

5 Using the second call signal, an assignment control is performed. In this case, without considering the destination floor, for example, based on the positions, the traveling direction, etc., of the cars of the elevators, a car which can earliest move to the registration floor is selected as an optimal car,
10 and the second call signal is supplied to the optimal car.

 In the example shown in FIG. 4, the car 24b of elevator B is selected as a designated car, and is moved to the first floor corresponding to the
15 registration floor. At this time, the destination floor indicated by the first call signal is registered in the car 24b as a floor for which a car call is made. As described above, as the timing at which the destination floor (car call) is registered in the
20 designated car, for example, time when the designated car is selected may be set, or time when the designated car is moved to (arrives at) the registration floor may be set.

 When the car 24b of elevator B is determined as a
25 designated car, as shown in FIG. 5, the indicator 23 of the hall destination controller 21 at the first floor indicates the mark "B" as the elevator of the designated car, instead of "4F" indicating the destination floor registered by the user.

30 Furthermore, as shown in FIG. 6, in the hall of the first floor, the indicators 25a, 25b and 25c are provided, for example, close to hall doors 26a, 26b and 26c of the elevators. Of the indicators 25a, 25b and 25c, the indicator 25b for elevator B indicates "4F" as
35 the destination floor.

 In such a manner, if a failure has occurred in the DCS control, the operations of the cars are continued

by the group management control. Therefore, unlike a general backup operation in which only a specified car is stopped at all the floors one by one, the transportation efficiency is not greatly lowered. In this case, since the designated car and the destination floor are displayed as in DCS, it is possible to continue the operation while making the user consider that an optimal car is applied; that is, the operation can be continued while a display is present as if an optimal car were applied.

As described above, according to at least one embodiment, it is possible to provide an elevator system which can continue the operations of cars without stopping a specified one of the cars at all the floors one by one, even if a failure is caused in a DCS control.

While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

WHAT IS CLAIMED IS:

1. An elevator system comprising:
 - a hall destination controller installed in a hall;
 - a first controller which selects one of a
 - 5 plurality of cars as a designated car and causes the designated car to move to a registration floor, under a DCS control which considers a destination floor registered by a user using the hall destination controller; and
 - 10 second controllers which control operations of the cars in accordance with an instruction given by the first controller,
 - wherein if a failure has occurred in the DCS control by the first controller, one of the second
 - 15 controllers which is set as a master in advance converts a first call signal of a DCS control system which is output from the hall destination controller into a second call signal to be used in a group management control system, and continues an operation.
 - 20 2. The elevator system of Claim 1, wherein the second controller set as the master comprises:
 - signal conversion means for converting the first call signal of the DCS control system which is output from the hall destination controller into the second
 - 25 call signal to be used in the group management control system;
 - assignment control means for selecting an optimal one of the cars as the designated car based on the second call signal obtained by the signal conversion
 - 30 means, and causing the car selected as the designated car to move to a floor at which the destination floor is registered; and
 - operation control means for registering the destination floor in the car selected as the designated
 - 35 car by the assignment control means, and causing the selected car to move to the destination floor after the selected car is moved to the floor at which the

destination floor is registered.

5 3. The elevator system of Claim 2, wherein the
signal conversion means determines a traveling
direction of the selected car based on a relationship
between the destination floor and the registration
floor which are indicated by the first call signal, and
adds the traveling direction to the registration floor
to convert the first call signal into the second call
signal.

10 4. The elevator system of Claim 2, wherein the
second controller set as the master further comprises
first display control means for causing an indicator
provided in the hall destination controller to indicate
a name of the car selected as the designated car by the
15 assignment control means, as information on a car on
which the user is to get.

 5. The elevator system of Claim 2, wherein the
second controller set as the master further comprises
second display control means for causing one of
20 indicators provided for the cars, respectively, to
indicate the destination floor as a floor to which the
designated car is to move, the one of the indicators
being associated with the designated car.

 6. The elevator system of Claim 2, wherein the
25 second controller set as the master further comprises
notification means for notifying an external section of
a failure of the DCS control.