

GROUP MANAGEMENT CONTROL SYSTEM AND GROUP MANAGEMENT CONTROLLER

FIELD

Embodiments described herein relate generally to a
5 group management control system and a group management
controller.

BACKGROUND

In skyscrapers, etc., an elevator which comprises
two cars stacked vertically and enables mass transport
10 is used as a vertical transportation means inside such
buildings. This type of elevator is called a double-
deck elevator.

The double-deck elevator allows the mass transport
of passengers. However, even if a passenger finished
15 getting into one of the cars, and the doors of the car
were closed, the closed car cannot depart for the
destination floor unless another passenger finishes
getting into the other car.

Thus, the passenger in the closed car has to wait
20 in the car until another passenger finishes getting
into the other car. If this waiting time is long, the
passenger who is waiting in the closed car is stressed
out.

SUMMARY

25 According to an aspect, there is provided a group
management control system which includes a plurality of
double-deck elevators each including upper and lower
cars vertically connected to each other, and applies
group management control to operation of each of the
30 elevators, the system characterized by comprising: a
call acquisition means which obtains a destination call
registered by a hall destination controller installed
at each floor; an additional assignment permission
determination means which determines, when an assigned
35 elevator responding to a different destination call

registered in a registration floor of the destination call is present, whether additional assignment of the destination call to the assigned elevator is permitted; and an extension controller which extends a door
5 opening period of a door of the assigned elevator to an estimated arrival time as the additional assignment of the destination call is permitted, characterized in that the additional assignment permission determination means calculates a time at which a person who registers
10 the destination call is expected to get into the assigned elevator as the estimated arrival time, sets an additional assignment permission period for permitting additional assignment of a destination call in each of the upper and lower cars vertically
15 connected to each other, and determines whether the estimated arrival time is within the additional assignment permission periods set for the assigned elevator, and permits the additional assignment of the destination call to the assigned elevator when the
20 estimated arrival time is within the additional assignment permission periods as a result of the determination, and does not permit the additional assignment of the destination call to the assigned elevator when the estimated arrival time is outside the
25 additional assignment permission periods as a result of the determination.

According to another aspect, there is provided a group management controller which applies group
management control to operation of a plurality of
30 double-deck elevators each including upper and lower cars connected to each other, the controller characterized by comprising: a call acquisition means which obtains a destination call registered by a hall destination controller installed at each floor; an
35 additional assignment permission determination means

which determines, when an assigned elevator responding to a different destination call registered at a registration floor of the destination call is present, whether additional assignment of the destination call to the assigned elevator is permitted; and an extension controller which extends a door opening period of a door of the assigned elevator to an estimated arrival time as the additional assignment of the destination call is permitted, characterized in that the additional assignment permission determination means calculates a time at which a person who registers the destination call is expected to get into the assigned elevator as the estimated arrival time, sets an additional assignment permission period for permitting additional assignment of a destination call in each of the upper and lower cars vertically connected to each other, and determines whether the estimated arrival time is within the additional assignment permission periods set for the assigned elevator, and permits the additional assignment of the destination call to the assigned elevator when the estimated arrival time is within the additional assignment permission periods as a result of the determination, and does not permit the additional assignment of the destination call to the assigned elevator when the estimated arrival time is outside the additional assignment permission periods as a result of the determination.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a schematic configuration example of a group management control system according to one embodiment.

FIG. 2 shows an example of the data structure of call information according to the embodiment.

FIG. 3 is a flowchart showing an example of the operation of a group management controller according to

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the embodiment.

FIG. 4 is a timing chart shown for explaining the

general additional assignment of calls.

FIG. 5 is a timing chart shown for explaining the operation of the group management controller according to the embodiment.

5 FIG. 6 is a timing chart shown for explaining the operation of the group management controller according to a first modification example of the embodiment.

 FIG. 7 is a timing chart shown for explaining the operation of the group management controller according to a second modification example of the embodiment.

10 FIG. 8 is a timing chart shown for explaining the operation of the group management controller according to a third modification example of the embodiment.

DETAILED DESCRIPTION

15 Embodiments will be described hereinafter with reference to the accompanying drawings.

 The present embodiment assumes a group management control system including a plurality of double-deck elevators. In the following explanation, when a plurality of double-deck elevators are described, each double-deck elevator is referred to as an elevator. Further, of the two cars stacked vertically in each double-deck elevator, the car located on the upper side is referred to as the upper car, and the car located on the lower side is referred to as the lower car.

20 The group management control system of the present embodiment assumes a destination controller system (DCS) using a hall destination controller (HDC) which allows a passenger to directly specify the destination floor at the hall.

30 Further, the present embodiment assumes that each double-deck elevator operates in a double operation mode or a semi-double operation mode. The double operation mode is, for example, a mode for causing the upper and lower cars to stop at consecutive floors such

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that the lower car stops at an odd floor (the 1st floor, the 3rd floor, the 5th floor, . . .) and the upper car stops at an even floor (the 2nd floor, the 4th floor, the 6th floor, . . .). The semi-double operation mode is a mode which allows both the upper car and the lower car to stop at all the floors excluding the highest floor and the lowest floor.

FIG. 1 shows a schematic configuration example of a group management control system according to an embodiment. As shown in FIG. 1, the group management control system includes a plurality of double-deck elevators 10A, 10B and 10C, a hall destination controller 20, a group management controller 30 and elevator controllers 40A, 40B and 40C corresponding to elevators 10A, 10B and 10C, respectively.

Each of double-deck elevators 10A to 10C comprises two cars which are vertically connected to each other, in other words, an upper car 11A, 11B or 11C and a lower car 12A, 12B or 12C.

In the example shown in FIG. 1, three double-deck elevators are provided as elevators A to C. However, the number of double-deck elevators is not limited to this example. At least two double-deck elevators should be provided.

As shown in FIG. 1, the hall destination controller 20 comprises an operation module (for example, a numerical keypad) 21 for inputting the destination floor, and a display 22. A passenger specifies (inputs) his/her destination floor by operating the operation module 21. When a passenger inputs his/her destination floor, the hall destination controller 20 registers a hall call (hereinafter, referred to as a destination call) including the input destination floor. More specifically, the hall destination controller 20 registers a destination call

for calling a double-deck elevator to be headed to the input destination floor to the installation floor of the hall destination controller 20.

The display 22 displays elevator information indicating the elevator into which the passenger should get. In addition to the elevator information, for example, the display 22 may display the direction to the hall at which the elevator indicated by the elevator information stops.

In the present embodiment, a destination call is registered by operating the operation module 21 such as a numerical keypad. However, the registration method is not limited to this example. For example, a destination call may be registered, using an IC card in which destination floor information indicating the destination floor of a passenger is stored in advance.

The group management controller 30 is a device for applying group management control to the operation of elevators 10A to 10C. Elevator controllers (standalone controllers) 40A to 40C corresponding to elevators 10A to 10C, respectively, are connected to the group management controller 30. The group management controller 30 applies group management control to the operation of elevators 10A to 10C by controlling the operation of elevator controllers 40A to 40C.

As shown in FIG. 1, the group management controller 30 comprises a communication processor 31, call information storage 32, an operation status management module 33, an assignment controller 34, an additional assignment permission determination module 35, a door-opened state extension controller 36, etc. Here, all of the functional modules 31 to 36 are provided in the group management controller 30 for the sake of convenience. However, they are not necessarily provided in the same device. They may be provided in

different devices.

The communication processor 31 is a communication module capable of communicating with the hall destination controller 20 installed at each floor, and
5 comprises a call acquisition function for obtaining the destination call registered by each hall destination controller 20. The obtained destination call is stored in the call information storage 32 as call information.

The communication processor 31 transmits, to the
10 hall destination controller 20, elevator information indicating the assigned elevator selected by the assignment controller 34 described later. The hall destination controller 20 receives the elevator information transmitted from the communication
15 processor 31 and causes the display 22 to display the elevator information.

Regarding the destination call obtained by the communication processor 31, the call information storage 32 stores call information in which the
20 registration floor of the destination call, the destination floor indicated by the destination call, the registration time of the destination call and the elevator (assigned elevator) assigned to the destination call by the assignment controller 34 are
25 associated with each other. The call information stored in the call information storage 32 is deleted when the assigned elevator indicated by the call information departs for the destination floor indicated by the call information.

Of the above items included in the call
30 information, the registration floor, the destination floor and the registration time are stored when the destination call is obtained by the communication processor 31. The assigned elevator is separately
35 stored when the assigned elevator for the destination

call indicated by the call information is selected by the assignment controller 34. FIG. 2 shows some examples of call information.

FIG. 2 shows an example of the data structure of call information. Call information C1 shown in FIG. 2 indicates that: the registration floor of a destination call is the 1st floor; the destination floor indicated by the destination call is the 5th floor; the registration time of the destination call is 12:00:00; and the assigned elevator for the destination call is the lower car of elevator A. Call information C2 shown in FIG. 2 indicates that: the registration floor of a destination call is the 1st floor; the destination floor indicated by the destination call is the 5th floor; the registration time of the destination call is 12:00:05; and the assigned elevator for the destination call is blank (-), in other words, the elevator to be assigned has not been determined yet. Like call information C2, call information in which the assigned car is blank is call information newly stored, and is hereinafter referred to as new call information.

The same explanation as the above call information C1 and C2 is applicable to the other call information C3 and C4 shown in FIG. 2. Thus, detailed description thereof is omitted here.

The operation status management module 33 obtains status information indicating the operation status of each of elevators 10A to 10C (for example, the current positions of the upper and lower cars, the traveling direction, the door-opened/closed status and the presence or absence of an abnormality) from a corresponding elevator controller 40A, 40B or 40C, and manages the status information. The managed status information is used in the assignment control process performed by the assignment controller 34.

In response to an instruction from the additional assignment permission determination module 35 described later, the assignment controller 34 performs an assignment control process for selecting a preferred
5 elevator for the destination call indicated by new call information as the assigned elevator from the elevators based on the status information managed by the operation status management module 33. The assignment controller 34 outputs an assignment instruction for
10 causing the selected assigned elevator to respond to the destination call to an elevator controller 40 corresponding to the assigned elevator.

When new call information is stored in the call information storage 32, the additional assignment
15 permission determination module 35 determines whether or not an elevator (hereinafter, referred to as an already assigned elevator) to which a different destination call registered at the same floor as the destination call indicated by the new call information
20 has been already assigned is present. When an already assigned elevator is present, the additional assignment permission determination module 35 determines whether or not the destination call indicated by the new call information can be additionally assigned to the already
25 assigned elevator.

When no already assigned elevator is present, the additional assignment permission determination module 35 instructs the assignment controller 34 to perform the above assignment control process. When the
30 assigned elevator for the destination call indicated by the new call information is selected by the assignment controller 34, the additional assignment permission determination module 35 sets an additional assignment permission period as an index for determining whether
35 or not different destination calls subsequently

registered can be additionally assigned to the assigned elevator.

5 The additional assignment permission period is the period which is set based on the earliest registered destination call (the first destination call) of the destination calls registered at a predetermined floor. For example, a predetermined period after the passenger of the first destination call gets into the assigned elevator corresponds to the additional assignment
10 permission period.

In connection with the permission of the additional assignment to the already assigned elevator by the additional assignment permission determination module 35, the door opened-state extension controller
15 36 instructs an elevator controller 40 corresponding to the already assigned elevator to extend the door opening period of the already assigned elevator.

Elevator controllers 40A to 40C control the operation of elevators 10A to 10C, respectively.
20 Specifically, elevator controllers 40A to 40C control the motors for moving up and down the double-deck elevators, the opening/closing operation, etc.

Now, this specification explains an example of the operation of the group management controller 30 having
25 the above structure with reference to the flowchart of FIG. 3.

When a new destination call is registered by the hall destination controller 20, the communication processor 31 of the group management controller 30
30 obtains the destination call (step S1), and stores it in the call information storage 32 as new call information.

When new call information is stored in the call information storage 32, the additional assignment
35 permission determination module 35 refers to the call

information storage 32, and determines whether or not an already assigned elevator to which a different destination call registered at the same floor as the destination call indicated by the new call information has been already assigned is present (step S2).

When no already assigned elevator is present as a result of the determination (NO in step S2), the additional assignment permission determination module 35 instructs the assignment controller 34 to perform an assignment control process. In response to the instruction, the assignment controller 34 obtains the status information of elevators 10A to 10C from the operation status management module 33, and selects, in consideration of the obtained status information, a preferred elevator for the destination call indicated by the new call information as the assigned elevator from the elevators (step S3).

When the assigned elevator is selected by the assignment controller 34, the additional assignment permission determination module 35 calculates the time (estimated arrival time) the passenger who registered the destination call gets into the assigned elevator based on the registration time of the destination call indicated by the new call information. Subsequently, the additional assignment permission determination module 35 sets, as the additional assignment permission period, the period starting from the calculated estimated arrival time and ending a predetermined period after (step S4).

In the present embodiment, the additional assignment permission period starts from the estimated arrival time. However, the start time is not limited to this example. For example, the additional assignment permission period may start from the door closing start time the doors are expected to start to

close.

When the additional assignment permission period is set by the additional assignment permission determination module 35, the communication processor 31
5 transmits elevator information indicating the selected assigned elevator to the hall destination controller 20 (step S5).

When the elevator information is transmitted to the hall destination controller 20, the additional
10 assignment permission determination module 35 instructs the assignment controller 34 to output an assignment instruction for causing the selected assigned elevator to respond to the destination call indicated by new call information (step S6).

15 In response to the instruction from the additional assignment permission determination module 35, the assignment controller 34 outputs an assignment instruction to an elevator controller 40 corresponding to the selected assigned elevator (step S7). Only when
20 the calculated estimated arrival time is after the door closing start time (for example, when, in a state where a destination call has been already assigned to one of the upper and lower cars, a destination call is first assigned to the other car), the door-opened state
25 extension controller 36 instructs an elevator controller 40 corresponding to the selected assigned elevator to extend the door opening period to the estimated arrival time (step S8), and terminates the operation here.

30 When an already assigned elevator is present as a result of the above process of step S2 (YES in step S2), the additional assignment permission determination module 35 determines whether or not the destination call indicated by the new call information can be
35 additionally assigned to the already assigned elevator.

Specifically, the additional assignment permission determination module 35 determines whether or not additional assignment is permitted by determining whether or not the estimated arrival time calculated
5 based on the registration time of the destination call indicated by the new call information is within the additional assignment permission period (alternatively, whether or not the estimated arrival time is after the end time of the additional assignment permission
10 period) (step S9).

When the estimated arrival time is outside the additional assignment permission period and thus additional assignment is not permitted as a result of the above determination (NO in step S9), the additional
15 assignment permission determination module 35 instructs the assignment controller 34 to perform an assignment control process for selecting the elevator to be assigned from the elevators other than the already assigned elevator (step S10).

In response to the instruction from the additional assignment permission determination module 35, the assignment controller 34 selects a preferred elevator for (the elevator to be assigned to) the destination call indicated by the new call information from the
20 elevators other than the already assigned elevator based on the obtained status information (step S11).
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When the assigned elevator is selected by the assignment controller 34, the communication processor 31 transmits elevator information indicating the
30 assigned elevator to the hall destination controller 20 (step S12).

Subsequently, the assignment controller 34 outputs an assignment instruction to an elevator controller 40 corresponding to the selected assigned elevator (step
35 S13), and terminates the operation here.

When the estimated arrival time is within the additional assignment period and thus additional assignment is permitted as a result of the process of step S9 (YES in step S9), the communication processor
5 31 transmits elevator information indicating the already assigned elevator to the hall destination controller 20 (step S14).

When the elevator information is transmitted to the hall destination controller 20, the additional
10 assignment permission determination module 35 notifies the assignment controller 34 and the door-opened state extension controller 36 that additional assignment is permitted for the destination call indicated by the new call information, and instructs the assignment
15 controller 34 to output an assignment instruction to the already assigned elevator (step S15).

In response to the instruction from the additional assignment permission determination module 35, the assignment controller 34 outputs an assignment
20 instruction to an elevator controller 40 corresponding to the already assigned elevator (step S16).

Subsequently, only when the calculated estimated arrival time is after the door closing start time, the door-opened state extension controller 36 instructs an
25 elevator controller 40 corresponding to the already assigned elevator to extend the door opening period to the estimated arrival time (step S17), and terminates the operation here.

Now, this specification explains the general
30 additional assignment of calls with reference to the timing chart of FIG. 4.

In the following description, it is assumed that the period (hereinafter, referred to as the waiting period) from when a destination call is registered by a
35 passenger with the hall destination controller 20

installed at a predetermined floor to when the assigned elevator arrives at the predetermined floor and the doors start to open is five seconds. It is assumed that the period (hereinafter, referred to as the moving
5 period) it takes for the passenger to get into the assigned elevator from the hall destination controller 20 is eight seconds. Further, it is assumed that the period (hereinafter, referred to as the standard door opening period) in which the doors of the upper and
10 lower cars of the assigned elevator are open, in other words, the period from when the doors open to when the doors start to close, is five seconds.

The above waiting period, moving period and standard door opening period can be arbitrarily set,
15 and may be appropriately changed. For example, the moving period may be appropriately changed based on the distance between the hall at which each double-deck elevator 10 is installed and a corresponding hall destination controller 20.

20 FIG. 4 assumes that a destination call is registered at 12:00:00 by passenger a with hall destination controller 20A installed at a predetermined floor, and the upper car of a predetermined elevator is selected as the assigned elevator for the destination
25 call.

In this case, as described above, the waiting period from when the destination call is registered to when the assigned elevator arrives at the predetermined floor and the doors start to open is five seconds.
30 Thus, the assigned elevator (specifically, the upper car of the predetermined elevator) starts to open at the predetermined floor at 12:00:05. As described above, the moving period of passenger a is eight seconds. Thus, the estimated arrival time of passenger
35 a is calculated as 12:00:08.

FIG. 4 assumes that no additional destination call is present for the upper car. Thus, the doors of the upper car start to close at 12:00:10, five seconds as the standard door opening period after the doors open.

5 FIG. 4 also assumes that a destination call is registered by passenger b at 12:00:03 with hall destination controller 20B installed at a floor (hereinafter, referred to as the adjacent floor) adjacent to the predetermined floor, and the lower car
10 of the predetermined elevator is selected as the assigned elevator for this destination call.

In this case, the assigned elevator has already stated to travel to cause the upper car to arrive at the predetermined floor. Thus, the assigned elevator
15 (specifically, the lower car of the predetermined elevator) starts to open at the adjacent floor at 12:00:05 in the same manner as the upper car. Since the moving period of passenger b is eight seconds in the same manner as passenger a, the estimated arrival
20 time of passenger b is calculated as 12:00:11.

If the doors of the lower car are closed at 12:00:10 in the same manner as the doors of the upper car, passenger b cannot get into the lower car. Thus, the door opening period of the lower car is extended to
25 12:00:11 which is the estimated arrival time of passenger b.

Similar operation is performed for passengers c to e. Every time a destination call is registered by passengers c to e with hall destination controller 20B,
30 the door opening period of the lower car is extended to the estimated arrival time of passengers c to e. Ultimately, the door opening period of the lower car is extended to 12:00:28 which is the estimated arrival time of passenger e. Although not shown in FIG. 4, if
35 a further destination call is registered after

passenger e, the door opening period of the lower car could be further extended.

As explained above, when the general additional assignment of calls is performed, the door opening
5 period is extended many times. In this case, as described above, even when the upper car of the predetermined elevator is closed at 12:00:10, passenger a has to wait in the closed upper car for the lower car to close and for the assigned elevator to depart.
10 Thus, passenger a has to wait for departure in the closed space while he or she does not know when the elevator departs. This situation causes passenger a to be really stressed out.

The group management controller 30 of the present
15 embodiment eliminates the above inconvenience by operating as explained with reference to the flowchart of FIG. 3. Now, this specification explains the operation of the group management controller 30, in particular, the operation of the additional assignment
20 permission determination module 35 and the door-opened state extension controller 36, on the assumption of a specific situation, with reference to the timing chart of FIG. 5.

Similar to the above case, FIG. 5 assumes that:
25 the waiting period is five seconds; the moving period is eight seconds; and the standard door opening period is five seconds.

FIG. 5 assumes that a destination call is registered by passenger a at 12:00:00 with hall
30 destination controller 20A installed at a predetermined floor, and the upper car of a predetermined elevator is selected as the assigned elevator for the destination call. Thus, the situation of the upper car is the same as that of FIG. 4.

35 In this case, since the waiting period is five

seconds, the assigned elevator (specifically, the upper car of the predetermined elevator) starts to open at the predetermined floor at 12:00:05. Since the moving period is eight seconds, the estimated arrival time of passenger a is calculated as 12:00:08 by the additional assignment permission determination module 35.

At the time passenger a registers the destination call in FIG. 5, no different destination call registered at the predetermined floor is assigned to the assigned elevator, in other words, no already assigned elevator is present. Thus, the additional assignment permission determination module 35 does not determine whether or not additional assignment is permitted. The additional assignment permission determination module 35 sets an additional assignment permission period starting from the estimated arrival time of passenger a and ending a predetermined period (here, 15 seconds) after. Specifically, the period from 12:00:08 to 12:00:23 is set as the additional assignment permission period of the upper car.

In a manner similar to that of FIG. 4, FIG. 5 assumes that no additional destination call is present for the upper car. Thus, the doors of the upper car start to close at 12:00:10, five seconds as the standard door opening period after the doors open.

In this way, in a state where the time of the generation of the next destination call is uncertain (in other words, the next destination call is not generated until the estimated arrival time of passenger a), even within the additional assignment permission period for which additional assignment is permitted for destination calls, the doors of the car is preferably closed at a possible time point. In this configuration, an increase in the number of travels of double-deck elevators can be expected. When the number

of travels is increased, the capacity of transport can be also increased.

FIG. 5 also assumes that a destination call is registered by passenger b at 12:00:03 with hall destination controller 20B installed at a floor adjacent to the predetermined floor, and the lower car of the predetermined elevator is selected as the assigned elevator for this destination call.

In this case, the assigned elevator has already stated to travel to cause the upper car to arrive at the predetermined floor. Thus, the assigned elevator (specifically, the lower car of the predetermined elevator) arrives at the adjacent floor and starts to open at 12:00:05 in the same manner as the upper car. Since the moving period is eight seconds, the estimated arrival time of passenger b is calculated as 12:00:11 by the additional assignment permission determination module 35.

At the time passenger b registers the destination call in FIG. 5, no different destination call registered at the adjacent floor is assigned to the assigned elevator, in other words, no already assigned elevator is present. Thus, the additional assignment permission determination module 35 does not determine whether or not additional assignment is permitted. The additional assignment permission determination module 35 sets an additional assignment permission period starting from the estimated arrival time of passenger b and ending a predetermined period (here, 15 seconds) after. Specifically, the period from 12:00:11 to 12:00:26 is set as the additional assignment permission period of the lower car.

The estimated arrival time of passenger b is 12:00:11. If the doors of the lower car are closed at 12:00:10 after the standard door opening period in the

same manner as the doors of the upper car, passenger b cannot get into the lower car. Thus, the door-opened state extension controller 36 instructs an elevator controller 40 corresponding to the assigned elevator to
5 extend the door opening period of the lower car to the estimated arrival time of passenger b.

FIG. 5 also assumes that a new destination call is registered by passenger c at 12:00:09 with hall destination controller 20B installed at the adjacent
10 floor.

In this case, the already assigned elevator to which the different destination call registered by passenger b at the adjacent floor has been already assigned is present, the additional assignment
15 permission period is not set here. Since the moving period is eight seconds, the estimated arrival time of passenger c is calculated as 12:00:17 by the additional assignment permission determination module 35.

Here, the additional assignment permission determination module 35 determines whether or not the
20 estimated arrival time of passenger c is within the additional assignment permission period of the lower car. In this case, the estimated arrival time of passenger c is 12:00:17, and the end time of the additional assignment permission period of the lower
25 car is 12:00:26. Thus, the estimated arrival time of passenger c is within the additional assignment permission period. The additional assignment permission determination module 35 determines that the
30 destination call of passenger c can be additionally assigned to the already assigned elevator (specifically, the lower car of the predetermined elevator).

If the doors of the lower car are closed at
35 12:00:11 which is the estimated arrival time of

passenger b even in a situation where the destination call of passenger c is additionally assigned, passenger c cannot get into the lower car. Thus, the door-opened state extension controller 36 instructs an elevator controller 40 corresponding to the already assigned elevator to extend the door opening period of the lower car to the estimated arrival time of passenger c.

FIG. 5 also assumes that a new destination call is registered by passenger d at 12:00:16 with hall destination controller 20B installed at the adjacent floor.

This case is similar to the case of passenger c, detailed description thereof being omitted here. The destination call of passenger d is additionally assigned to the lower car of the predetermined elevator. The door opening period of the lower car is extended to 12:00:24 which is the estimated arrival time of passenger d.

FIG. 5 also assumes that a new destination call is registered by passenger e at 12:00:20 with hall destination controller 20B installed at the adjacent floor.

In this case, the already assigned elevator to which the different destination calls registered by passengers b to d at the adjacent floor have been already assigned is present, the additional assignment permission period is not set here. Since the moving period is eight seconds, the estimated arrival time of passenger e is calculated as 12:00:28 by the additional assignment permission determination module 35.

Here, the additional assignment permission determination module 35 determines whether or not the estimated arrival time of passenger e is within the additional assignment permission period of the lower car. In this case, the estimated arrival time of

passenger e is 12:00:28, and the end time of the additional assignment permission period of the lower car is 12:00:26. Thus, the estimated arrival time of passenger e is outside the additional assignment permission period. The additional assignment permission determination module 35 determines that the additional assignment of the destination call of passenger e to the already assigned elevator (specifically, the lower car of the predetermined elevator) is not permitted.

Thus, the additional assignment permission determination module 35 instructs the assignment controller 34 to select a preferred elevator (the elevator to be assigned) from the elevators other than the already assigned elevator.

As described above, the additional assignment of the destination call of passenger e is not permitted. Thus, the doors of the lower car of the predetermined elevator start to close at 12:00:24 which is the estimated arrival time of passenger d. In this configuration, passenger a of the upper car needs to wait in the closed upper car for 14 seconds from 12:00:10 to 12:00:24. However, as the additional assignment permission period is set, the waiting period is not elongated beyond necessity. Thus, in comparison with the case shown in FIG. 4, it is possible to reduce the stress put on the passenger of the upper car (in other words, the car which is closed earlier).

In the present embodiment, the group management controller 30 sets an additional assignment permission period, and determines whether or not additional assignment is permitted based on whether or not the estimated arrival time of a passenger calculated from the registration time of a destination call is within the additional assignment permission period. However,

the method is not limited to this example. The group management controller 30 may determine whether or not additional assignment is permitted by a different method.

5 Modification examples are explained below.

<First Modification Example>

 In FIG. 5, the group management controller 30 sets an additional assignment permission period for both the upper car and the lower car, and determines whether
10 additional assignment is permitted based on whether or not the estimated arrival time of a passenger is within the additional assignment permission period of an already assigned elevator. However, in a first modification example, the permission of additional
15 assignment is determined based on two conditions.

 As the first condition, in a manner similar to that of FIG. 5, additional assignment is not permitted when the estimated arrival time of a passenger is outside the additional assignment permission period set
20 for each of the upper and lower cars. As the second condition, additional assignment is not permitted after the doors of either the upper car or the lower car start to close. In the second condition, additional assignment is not permitted after the doors start to
25 close instead of after the doors are completely closed since the re-opening of doors is not desirable in terms of the characteristics of DCS.

 Now, this specification explains the operation of the group management controller 30 of the first
30 modification example, in particular, the operation of the additional assignment permission determination module 35 and the door-opened state extension controller 36, with reference to the timing chart of FIG. 6.

35 In a manner similar to that of the above

description, FIG. 6 assumes that: the waiting period is five seconds; the moving period is eight seconds; and the standard door opening period is five seconds.

FIG. 6 assumes that a destination call is registered by passenger a at 12:00:00 with hall destination controller 20A installed at a predetermined floor, and the upper car of a predetermined elevator is selected as the assigned elevator for the destination call.

In this case, since the waiting period is five seconds, the assigned elevator (specifically, the upper car of the predetermined elevator) starts to open at the predetermined floor at 12:00:05. Since the moving period is eight seconds, the estimated arrival time of passenger a is calculated as 12:00:08 by the additional assignment permission determination module 35.

At the time passenger a registers the destination call in FIG. 6, no different destination call registered at the predetermined floor is assigned to the assigned elevator, in other words, no already assigned elevator is present. Thus, the additional assignment permission determination module 35 does not determine whether or not additional assignment is permitted based on the first condition. The additional assignment permission determination module 35 sets an additional assignment permission period starting from the estimated arrival time of passenger a and ending a predetermined period (here, 15 seconds) after. Specifically, the period from 12:00:08 to 12:00:23 is set as the additional assignment permission period of the upper car.

At this stage, as shown in FIG. 6, neither the upper car nor the lower car starts to close. Thus, in the same manner as the first condition, the permission of additional assignment based on the second condition

is not determined.

FIG. 6 also assumes that a new destination call is registered by passenger b at 12:00:06 with hall destination controller 20A installed at the predetermined floor.

In this case, the already assigned elevator to which the different destination call registered by passenger a at the predetermined floor has been already assigned is present, the additional assignment permission period is not set here. Since the moving period is eight seconds, the estimated arrival time of passenger b is calculated as 12:00:14 by the additional assignment permission determination module 35.

Here, the additional assignment permission determination module 35 determines whether or not the estimated arrival time of passenger b is within the additional assignment permission period of the upper car based on the first condition. In this case, the estimated arrival time of passenger b is 12:00:14, and the end time of the additional assignment permission period of the upper car is 12:00:23. Thus, the estimated arrival time of passenger b is within the additional assignment permission period. The additional assignment permission determination module 35 determines that the destination call of passenger b can be additionally assigned to the already assigned elevator (specifically, the upper car of the predetermined elevator).

At this stage, as shown in FIG. 6, neither the upper car nor the lower car starts to close. Thus, the permission of additional assignment based on the second condition is not determined.

If the doors of the upper car are closed at 12:00:10, five seconds as the standard door opening period after the doors of the upper car are open, even

in a situation where the destination call of passenger b is additionally assigned, passenger b cannot get into the upper car. Thus, the door opened-state extension controller 36 instructs an elevator controller 40
5 corresponding to the assigned elevator to extend the door opening period of the upper car to the estimated arrival time of passenger b.

FIG. 6 assumes that no additional destination call is present for the upper car after the destination call
10 of passenger b. Thus, the doors of the upper car start to close at 12:00:14 which is the estimated arrival time of passenger b.

FIG. 6 also assumes that a destination call is registered by passenger c at 12:00:08 with hall
15 destination controller 20B installed at a floor adjacent to the predetermined floor, and the lower car of the predetermined elevator is selected as the assigned elevator for this destination call.

In this case, the assigned elevator has already
20 stated to travel to cause the upper car to arrive at the predetermined floor. Thus, the assigned elevator (specifically, the lower car of the predetermined elevator) arrives at the adjacent floor and starts to open at 12:00:05 in the same manner as the upper car.
25 Since the moving period is eight seconds, the estimated arrival time of passenger c is calculated as 12:00:16 by the additional assignment permission determination module 35.

At the time passenger c registers the destination
30 call in FIG. 6, no different destination call registered at the adjacent floor is assigned to the assigned elevator, in other words, no already assigned elevator is present. Thus, the additional assignment permission determination module 35 does not determine
35 whether or not additional assignment is permitted based

on the first condition. The additional assignment permission determination module 35 sets an additional assignment permission period starting from the estimated arrival time of passenger c and ending a predetermined period (here, 15 seconds) after. Specifically, the period from 12:00:16 to 12:00:31 is set as the additional assignment permission period of the lower car.

At this stage, as shown in FIG. 6, neither the upper car nor the lower car starts to close. Thus, in the same manner as the first condition, the permission of additional assignment based on the second condition is not determined.

The estimated arrival time of passenger c is 12:00:16. If the doors of the lower car are closed at 12:00:10, five seconds as the standard door opening period after the doors of the lower car are open, passenger c cannot get into the lower car. Thus, the door-opened state extension controller 36 instructs an elevator controller 40 corresponding to the assigned elevator to extend the door opening period of the lower car to the estimated arrival time of passenger c.

FIG. 6 also assumes that a new destination call is registered by passenger d at 12:00:15 with hall destination controller 20B installed at the adjacent floor.

Since the moving period is eight seconds, the estimated arrival time of passenger d is calculated as 12:00:23 by the additional assignment permission determination module 35.

Here, the additional assignment permission determination module 35 determines whether or not the estimated arrival time of passenger d is within the additional assignment permission period of the lower car based on the first condition. In this case, the

estimated arrival time of passenger d is 12:00:23, and the end time of the additional assignment permission period of the lower car is 12:00:31. Thus, the estimated arrival time of passenger d is within the additional assignment permission period of the lower car. The additional assignment permission determination module 35 determines that the destination call of passenger d can be additionally assigned to the already assigned elevator (specifically, the lower car of the predetermined elevator).

However, as shown in FIG. 6, at the time the destination call of passenger d is registered, the doors of the upper car of the predetermined elevator start to close (specifically, at 12:00:14).

As described above, the estimated arrival time of passenger d is within the additional assignment permission period. Based on the first condition, additional assignment is permitted. However, based on the second condition, additional assignment is not permitted after the doors of the upper car start to close. Thus, the additional assignment permission determination module 35 determines that the additional assignment of the destination call of passenger d to the already assigned elevator (specifically, the lower car of the predetermined elevator) is not permitted.

Thus, the additional assignment permission determination module 35 instructs the assignment controller 34 to select a preferred elevator (the elevator to be assigned) from the elevators other than the already assigned elevator.

As described above, the additional assignment of the destination call of passenger d is not permitted. Thus, the doors of the lower car of the predetermined elevator start to close at 12:00:16 which is the estimated arrival time of passenger c. In this

configuration, passengers a and b of the upper car have to wait in the closed upper car only for two seconds from 12:00:14 to 12:00:16. In comparison with the case shown in FIG. 5, it is possible to further reduce the stress put on the passengers of the upper car (in other words, the car which is closed earlier).

<Second Modification Example>

Now, a second modification example is explained.

In the second modification example, in a manner similar to that of the first modification example, the permission of additional assignment is determined based on two conditions.

As the first condition, in a manner similar to that of FIG. 5 and FIG. 6, additional assignment is not permitted when the estimated arrival time of a passenger is outside the additional assignment permission period set for each of the upper and lower cars. As the second condition, additional assignment is not permitted when the estimated arrival time of a passenger is outside, of the additional assignment permission periods set for both the upper car and the lower car, the additional assignment permission period set earlier.

Now, this specification explains the operation of the group management controller 30 of the second modification example, in particular, the operation of the additional assignment permission determination module 35 and the door-opened state extension controller 36, with reference to the timing chart of FIG. 7.

In a manner similar to that of the above description, FIG. 7 assumes that: the waiting period is five seconds; the moving period is eight seconds; and the standard door opening period is five seconds.

FIG. 7 assumes that a destination call is

registered by passenger a at 12:00:00 with hall destination controller 20A installed at a predetermined floor, and the upper car of a predetermined elevator is selected as the assigned elevator for the destination call.

In this case, since the waiting period is five seconds, the assigned elevator (specifically, the upper car of the predetermined elevator) starts to open at the predetermined floor at 12:00:05. Since the moving period is eight seconds, the estimated arrival time of passenger a is calculated as 12:00:08 by the additional assignment permission determination module 35.

At the time passenger a registers the destination call in FIG. 7, no different destination call registered at the predetermined floor is assigned to the assigned elevator, in other words, no already assigned elevator is present. Thus, the additional assignment permission determination module 35 does not determine whether or not additional assignment is permitted based on the first condition. The additional assignment permission determination module 35 sets an additional assignment permission period starting from the estimated arrival time of passenger a and ending a predetermined period (here, 15 seconds) after. Specifically, the period from 12:00:08 to 12:00:23 is set as the additional assignment permission period of the upper car.

At this stage, as shown in FIG. 7, the additional assignment permission period of the lower car is not set. Thus, in a manner similar to that of the first condition, the permission of additional assignment based on the second condition is not determined.

FIG. 7 assumes that no additional destination call is present for the upper car. Thus, the doors of the upper car start to close at 12:00:10, five seconds as

the standard door opening period after the doors are open.

FIG. 7 also assumes that a destination call is registered by passenger b at 12:00:08 with hall destination controller 20B installed at a floor adjacent to the predetermined floor, and the lower car of the predetermined elevator is selected as the assigned elevator for this destination call.

In this case, the assigned elevator has already stated to travel to cause the upper car to arrive at the predetermined floor. Thus, the assigned elevator (specifically, the lower car of the predetermined elevator) arrives at the adjacent floor and starts to open at 12:00:05 in the same manner as the upper car. Since the moving period is eight seconds, the estimated arrival time of passenger b is calculated as 12:00:16 by the additional assignment permission determination module 35.

At the time passenger b registers the destination call in FIG. 7, no different destination call registered at the adjacent floor is assigned to the assigned elevator, in other words, no already assigned elevator is present. Thus, the additional assignment permission determination module 35 does not determine whether or not additional assignment is permitted based on the first condition. The additional assignment permission determination module 35 sets an additional assignment permission period starting from the estimated arrival time of passenger b and ending a predetermined period (here, 15 seconds) after. Specifically, the period from 12:00:16 to 12:00:31 is set as the additional assignment permission period of the lower car.

At this stage, as shown in FIG. 7, the additional assignment permission period has been already set for

the upper car (the other car). Thus, the additional assignment permission determination module 35 determines whether or not the estimated arrival time of passenger b is within the additional assignment permission period of the upper car based on the second condition. In this case, the estimated arrival time of passenger b is 12:00:16, and the end time of the additional assignment permission period of the upper car is 12:00:23. Thus, the estimated arrival time of passenger b is within the additional assignment permission period of the upper car. The additional assignment permission determination module 35 permits the assignment of the destination call of passenger b to the assigned elevator (specifically, the lower car of the predetermined elevator).

The estimated arrival time of passenger b is 12:00:16. If the doors of the lower car are closed at 12:00:10, five seconds as the standard door opening period after the doors are open, passenger b cannot get into the lower car. Thus, the door-opened state extension controller 36 instructs an elevator controller 40 corresponding to the assigned elevator to extend the door opening period of the lower car to the estimated arrival time of passenger b.

FIG. 7 also assumes that a new destination call is registered by passenger c at 12:00:10 with hall destination controller 20B installed at the adjacent floor.

Since the moving period is eight seconds, the estimated arrival time of passenger c is calculated as 12:00:18 by the additional assignment permission determination module 35.

Here, the additional assignment permission determination module 35 determines whether or not the estimated arrival time of passenger c is within the

additional assignment permission period of the lower car (self-car) based on the first condition. In this case, the estimated arrival time of passenger c is 12:00:18, and the end time of the additional assignment permission period of the lower car is 12:00:31. Thus, the estimated arrival time of passenger c is within the additional assignment permission period of the lower car. Based on the first condition, the additional assignment permission determination module 35 determines that the destination call of passenger c can be additionally assigned to the already assigned elevator (specifically, the lower car of the predetermined elevator).

The additional assignment permission determination module 35 determines whether or not the estimated arrival time of passenger c is within the additional assignment permission period of the upper car (the other car) based on the second condition. In this case, the estimated arrival time of passenger c is 12:00:18, and the end time of the additional assignment permission period of the upper car is 12:00:23. Thus, the estimated arrival time of passenger c is within the additional assignment permission period of the upper car. Based on the second condition, similarly, the additional assignment permission determination module 35 determines that the destination call of passenger c can be additionally assigned to the already assigned elevator (specifically, the lower car of the predetermined elevator).

If the doors of the lower car are closed at 12:00:16 which is the estimated arrival time of passenger b even in a situation where the additional assignment of the destination call of passenger c is permitted, passenger c cannot get into the lower car. Thus, the door-opened state extension controller 36

instructs an elevator controller 40 corresponding to the already assigned elevator to extend the door opening period of the lower car to the estimated arrival time of passenger c.

5 FIG. 7 also assumes that a new destination call is registered by passenger d at 12:00:18 with hall destination controller 20B installed at the adjacent floor of the predetermined floor.

10 Since the moving period is eight seconds, the estimated arrival time of passenger d is calculated as 12:00:26 by the additional assignment permission determination module 35.

 Here, the additional assignment permission determination module 35 determines whether or not the
15 estimated arrival time of passenger d is within the additional assignment permission period of the lower car (self-car) based on the first condition. In this case, the estimated arrival time of passenger d is 12:00:26, and the end time of the additional assignment
20 permission period of the lower car is 12:00:31. Thus, the estimated arrival time of passenger d is within the additional assignment permission period. Based on the first condition, the additional assignment permission determination module 35 determines that the destination
25 call of passenger d can be additionally assigned to the already assigned elevator (specifically, the lower car of the predetermined elevator).

 The additional assignment permission determination module 35 determines whether or not the estimated
30 arrival time of passenger d is within the additional assignment permission period of the upper car (the other car) based on the second condition. In this case, the estimated arrival time of passenger d is 12:00:26, and the end time of the additional assignment
35 permission period of the upper car is 12:00:23. Thus,

the estimated arrival time of passenger d is outside the additional assignment permission period of the upper car. Based on the second condition, the additional assignment permission determination module
5 35 determines that the destination call of passenger d cannot be additionally assigned to the already assigned elevator (specifically, the lower car of the predetermined elevator).

Thus, the additional assignment permission
10 determination module 35 instructs the assignment controller 34 to select a preferred elevator for (the elevator to be assigned to) the destination call of passenger d from the elevators other than the already assigned elevator.

15 As described above, the additional assignment of the destination call of passenger d is not permitted. Thus, the doors of the lower car of the predetermined elevator start to close at 12:00:18 which is the estimated arrival time of passenger c. In this
20 configuration, passenger a of the upper car has to wait in the closed upper car only for eight seconds from 12:00:10 to 12:00:18. In comparison with the case shown in FIG. 5, it is possible to further reduce the stress put on the passenger of the upper car (in other
25 words, the car which is closed earlier).

<Third Modification Example>

A third modification example is explained.

In the third modification example, in the same manner as the first and second modification examples,
30 the permission of additional assignment is determined based on two conditions.

As the first condition, in the same manner as FIG. 5 to FIG. 7, additional assignment is not permitted when the estimated arrival time of a
35 passenger is outside the additional assignment

permission period set for each of the upper and lower cars.

However, in the third modification example, in a manner different from that of FIG. 5 to FIG. 7, the additional assignment permission period is updated every time the assignment of a destination call is permitted. In the third modification example, the additional assignment permission period starts from the door closing start time at which the doors are expected to start to close. Thus, in the third modification example, the additional assignment permission period is set so as to be short. Here, the additional assignment permission period is set to the period of five seconds after the door closing start time.

When the doors of one of the upper and lower cars are closed, an additional assignment permission period associated with closing operation (in other words, a second additional assignment permission period) is set as a period starting from the door closing time and ending a predetermined period (here, five seconds) after. As the second condition, additional assignment is not permitted when the estimated arrival time of a passenger of the other car is outside the additional assignment permission period associated with closing operation.

Now, this specification explains the operation of the group management controller 30 of the third modification example, in particular, the operation of the additional assignment permission determination module 35 and the door-opened state extension controller 36, with reference to the timing chart of FIG. 8.

In a manner similar to that of the above description, FIG. 8 assumes that: the waiting period is five seconds; the moving period is eight seconds; and

the standard door opening period is five seconds.

FIG. 8 assumes that a destination call is registered by passenger a at 12:00:00 with hall destination controller 20A installed at a predetermined floor, and the upper car of a predetermined elevator is selected as the assigned elevator for the destination call.

In this case, since the waiting period is five seconds, the assigned elevator (specifically, the upper car of the predetermined elevator) starts to open at the predetermined floor at 12:00:05. Since the moving period is eight seconds, the estimated arrival time of passenger a is calculated as 12:00:08 by the additional assignment permission determination module 35.

At the time passenger a registers the destination call in FIG. 8, no different destination call registered at the predetermined floor is assigned to the assigned elevator, in other words, no already assigned elevator is present. Thus, the additional assignment permission determination module 35 does not determine whether or not additional assignment is permitted based on the first condition. The additional assignment permission determination module 35 sets an additional assignment permission period starting from the door closing start time at this stage, in other words, 12:00:10, the standard door opening period after the doors of the upper car are open and ending a predetermined period (here, five seconds) after. Specifically, the period from 12:00:10 to 12:00:15 is set as the additional assignment permission period of the upper car.

At this stage, as shown in FIG. 8, neither the upper car nor the lower car starts to close. Thus, in the same manner as the first condition, the permission of additional assignment based on the second condition

is not determined.

FIG. 8 also assumes that a new destination call is registered by passenger b at 12:00:03 with hall destination controller 20A installed at the predetermined floor.

Since the moving period is eight seconds, the estimated arrival time of passenger b is calculated as 12:00:11 by the additional assignment permission determination module 35.

Here, the additional assignment permission determination module 35 determines whether or not the estimated arrival time of passenger b is within the additional assignment permission period of the upper car based on the first condition. In this case, the estimated arrival time of passenger b is 12:00:11, and the end time of the additional assignment permission period of the upper car is 12:00:15. Thus, the estimated arrival time of passenger b is within the additional assignment permission period of the upper car. Based on the first condition, the additional assignment permission determination module 35 determines that the destination call of passenger b can be additionally assigned to the already assigned elevator (specifically, the upper car of the predetermined elevator).

At this stage, as shown in FIG. 8, neither the upper car nor the lower car starts to close. Thus, the permission of additional assignment based on the second condition is not determined.

If the doors of the upper car are closed at 12:00:10, five seconds as the standard door opening period after the doors are open, even in a situation where the additional assignment of the destination call of passenger b is permitted, passenger b cannot get into the upper car. Thus, the door-opened state

extension controller 36 instructs an elevator controller 40 corresponding to the assigned elevator to extend the door opening period of the upper car to the estimated arrival time of passenger b.

5 As the additional assignment of the destination call of passenger b is permitted, the additional assignment permission determination module 35 updates the additional assignment permission period of the upper car. Specifically, the additional assignment
10 permission period of the upper car is updated so as to start at 12:00:11 which is the current door closing start time of the upper car and end at 12:00:16, a predetermined period (here, five seconds) after.

FIG. 8 assumes that no additional destination call
15 is present for the upper car after the destination call of passenger b. Thus, the doors of the upper car start to close at 12:00:11 which is the estimated arrival time of passenger b.

As the doors of the upper car start to close, an
20 additional assignment permission period associated with closing operation is set so as to start from the door closing start time of the doors of the upper car and end a predetermined period (here, five seconds) after. Specifically, the period from 12:00:11 to 12:00:16 is
25 set as the additional assignment permission period associated with closing operation.

FIG. 8 also assumes that a destination call is registered by passenger c at 12:00:01 with hall destination controller 20B installed at an adjacent
30 floor, and the lower car of the predetermined elevator is selected as the assigned elevator for this destination call.

In this case, the assigned elevator has already stated to travel to cause the upper car to arrive at
35 the predetermined floor. Thus, the assigned elevator

(specifically, the lower car of the predetermined elevator) arrives at the adjacent floor and starts to open at 12:00:05 in the same manner as the upper car. Since the moving period is eight seconds, the estimated arrival time of passenger c is calculated as 12:00:09 by the additional assignment permission determination module 35.

At the time passenger c registers the destination call in FIG. 8, no different destination call registered at the adjacent floor is assigned to the assigned elevator, in other words, no already assigned elevator is present. Thus, the additional assignment permission determination module 35 does not determine whether or not additional assignment is permitted based on the first condition. The additional assignment permission determination module 35 sets an additional assignment permission period starting from the door closing start time at this stage, in other words, starting at 12:00:10, the standard door opening period after the doors of the lower car are open, and ending a predetermined period (here, five seconds) after. Specifically, the period from 12:00:10 to 12:00:15 is set as the additional assignment permission period of the lower car.

At this stage, as shown in FIG. 8, neither the upper car nor the lower car starts to close. Thus, in the same manner as the first condition, the permission of additional assignment based on the second condition is not determined.

FIG. 8 also assumes that a new destination call is registered by passenger d at 12:00:07 with hall destination controller 20B installed at the adjacent floor.

Since the moving period is eight seconds, the estimated arrival time of passenger d is calculated as

12:00:15 by the additional assignment permission determination module 35.

Here, the additional assignment permission determination module 35 determines whether or not the
5 estimated arrival time of passenger d is within the additional assignment permission period of the lower car based on the first condition. In this case, the estimated arrival time of passenger d is 12:00:15, and the end time of the additional assignment permission
10 period of the lower car is 12:00:15. Thus, the estimated arrival time of passenger d is within the additional assignment permission period of the lower car. Based on the first condition, the additional assignment permission determination module 35
15 determines that the destination call of passenger d can be additionally assigned to the already assigned elevator (specifically, the lower car of the predetermined elevator).

At this stage, as shown in FIG. 8, neither the
20 upper car nor the lower car starts to close. Thus, the permission of additional assignment based on the second condition is not determined.

If the doors of the lower car are closed at 12:00:10, five seconds as the standard door opening
25 period after the doors are open, even in a situation where the additional assignment of the destination call of passenger d is permitted, passenger d cannot get into the lower car. Thus, the door-opened state extension controller 36 instructs an elevator
30 controller 40 corresponding to the already assigned elevator to extend the door opening period of the lower car to the estimated arrival time of passenger d.

As the additional assignment of the destination call of passenger d is permitted, the additional
35 assignment permission determination module 35 updates

the additional assignment permission period of the lower car. Specifically, the additional assignment permission period of the lower car is updated so as to start at 12:00:15 which is the current door closing
5 start time of the lower car and end at 12:00:20, a predetermined period (here, five seconds) after.

FIG. 8 also assumes that a new destination call is registered by passenger e at 12:00:12 with hall destination controller 20B installed at the adjacent
10 floor.

Since the moving period is eight seconds, the estimated arrival time of passenger e is calculated as 12:00:20 by the additional assignment permission determination module 35.

15 Here, the additional assignment permission determination module 35 determines whether or not the estimated arrival time of passenger e is within the additional assignment permission period of the lower car based on the first condition. In this case, the
20 estimated arrival time of passenger e is 12:00:20, and the end time of the additional assignment permission period of the lower car is 12:00:20. Thus, the estimated arrival time of passenger e is within the additional assignment permission period of the lower
25 car. Based on the first condition, the additional assignment permission determination module 35 determines that the destination call of passenger e can be additionally assigned to the already assigned elevator (specifically, the lower car of the
30 predetermined elevator).

At this stage, as shown in FIG. 8, the doors of the upper car have already started to close. Thus, the additional assignment permission determination module 35 determines whether or not the estimated arrival time
35 of passenger e is within the additional assignment

permission period associated with closing operation based on the second condition. In this case, the estimated arrival time of passenger e is 12:00:20, and the end time of the additional assignment permission period associated with closing operation is 12:00:16. Thus, the estimated arrival time of passenger e is outside the additional assignment permission period associated with closing operation. Based on the second condition, the additional assignment permission determination module 35 determines that the destination call of passenger e cannot be additionally assigned to the already assigned elevator (specifically, the lower car of the predetermined elevator).

Thus, the additional assignment permission determination module 35 instructs the assignment controller 34 to select a preferred elevator for (the elevator to be assigned to) the destination call of passenger e from the elevators other than the already assigned elevator.

As described above, the additional assignment of the destination call of passenger e is not permitted. Thus, the doors of the lower car of the predetermined elevator start to close at 12:00:15 which is the estimated arrival time of passenger d. In this configuration, passengers a and b of the upper car have to wait in the closed upper car only for four seconds from 12:00:11 to 12:00:15. In comparison with the case shown in FIG. 5, it is possible to further reduce the stress put on the passengers of the upper car (in other words, the car which is closed earlier).

According to the third modification example, the additional assignment permission period can be updated every time the assignment of a destination call is permitted. Therefore, a large number of passengers can be transported at a time. In contrast, when a large

number of passengers successively register their destination calls at a predetermined floor, the first passenger of the assigned elevator may have to wait for a long time in the car. However, while a destination
5 call is successively registered at the predetermined floor, and thus, the additional assignment permission period is continuously updated, the doors of the car are not closed. Thus, the first passenger of the assigned elevator does not necessarily have to wait for
10 a long time in the closed space. In this way, it is possible to reduce the stress put on the first passenger of the assigned elevator in comparison with a case where the passenger waits for a long time in the closed space.

15 Further, in the third modification example, when the doors of one of the upper and lower cars are closed, an additional assignment permission period associated with closing operation is set. Thus, it is possible to reduce the ultimate period in which the
20 first passenger of the assigned elevator waits in the closed space.

According to the embodiment explained above, it is possible to provide a group management control system and a group management controller capable of reducing
25 the stress put on the passengers of a double-deck elevator.

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
30 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
35 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.

CLAIMS

1. A group management control system which includes a plurality of double-deck elevators each including upper and lower cars vertically
5 connected to each other, and applies group management control to operation of each of the elevators, the system characterized by comprising:

a call acquisition means which obtains a destination call registered by a hall destination controller installed at each floor;

10 an additional assignment permission determination means which determines, when an assigned elevator responding to a different destination call registered in a registration floor of the destination call is present, whether additional assignment of the destination call to the assigned elevator is permitted; and

15 an extension controller which extends a door opening period of a door of the assigned elevator to an estimated arrival time as the additional assignment of the destination call is permitted, characterized in that

the additional assignment permission determination means

20 calculates a time at which a person who registers the destination call is expected to get into the assigned elevator as the estimated arrival time,

sets an additional assignment permission period for permitting additional assignment of a destination call in each of the
25 upper and lower cars vertically connected to each other, and determines whether the estimated arrival time is within the additional assignment permission periods set for the assigned elevator, and

permits the additional assignment of the destination call to the assigned elevator when the estimated arrival time is within the
30 additional assignment permission periods as a result of the determination, and does not permit the additional assignment of the destination call to the assigned elevator when the estimated arrival time is outside the additional assignment permission periods as a result of the determination.

35 2. The system of Claim 1, characterized by further comprising

an assignment controller which selects a preferred elevator for the destination call from the elevators other than the assigned elevator as the additional assignment of the destination call is not permitted.

5 3. The system of Claim 2, characterized in that

the additional assignment permission determination means sets a period starting from the calculated estimated arrival time related to the destination call and ending a predetermined period after as the additional assignment permission periods when no assigned elevator
10 responding to a different destination call registered at the registration floor of the destination call is present, and

the assignment controller causes the preferred elevator for the destination call to respond to the destination call when the additional assignment permission periods of the assigned elevator are
15 set.

4. The system of Claim 1, characterized in that

the additional assignment permission determination means calculates the estimated arrival time based on a distance between the hall destination controller by which the destination call is
20 registered and the assigned elevator.

5. The system of Claim 4, characterized in that

the additional assignment permission determination means calculates the estimated arrival time by adding a moving period set based on the distance between the hall destination controller and the
25 assigned elevator to a registration time of the destination call.

6. The system of Claim 1, characterized in that

the additional assignment permission means does not permit, after one of the upper and lower cars starts to close, additional assignment to the other car.

30 7. The system of Claim 1, characterized in that

the additional assignment permission determination means does not permit, after, of the additional assignment permission periods set for the upper and lower cars, the additional assignment permission period of one of the upper and lower cars ends, additional assignment to the
35 other car.

8. The system of Claim 1, characterized in that

the additional assignment permission determination means updates the additional assignment permission periods based on the calculated estimated arrival time related to the destination call every time additional assignment of a destination call to the assigned elevator is permitted.

9. The system of Claim 1, characterized in that

the additional assignment permission determination means sets, when one of the upper and lower cars starts to close, a period starting from a time the car starts to close and ending a predetermined period after as a second additional assignment permission period, and subsequently does not permit additional assignment to the other car when the estimated arrival time is outside the second additional assignment permission period.

10. A group management controller which applies group management control to operation of a plurality of double-deck elevators each including upper and lower cars connected to each other, the controller characterized by comprising:

a call acquisition means which obtains a destination call registered by a hall destination controller installed at each floor;

an additional assignment permission determination means which determines, when an assigned elevator responding to a different destination call registered at a registration floor of the destination call is present, whether additional assignment of the destination call to the assigned elevator is permitted; and

an extension controller which extends a door opening period of a door of the assigned elevator to an estimated arrival time as the additional assignment of the destination call is permitted, characterized in that

the additional assignment permission determination means

calculates a time at which a person who registers the destination call is expected to get into the assigned elevator as the estimated arrival time,

sets an additional assignment permission period for

permitting additional assignment of a destination call in each of the

upper and lower cars vertically connected to each other, and determines whether the estimated arrival time is within the additional assignment permission periods set for the assigned elevator, and

permits the additional assignment of the destination call
5 to the assigned elevator when the estimated arrival time is within the additional assignment permission periods as a result of the determination, and does not permit the additional assignment of the destination call to the assigned elevator when the estimated arrival time is outside the additional assignment permission periods as a
10 result of the determination.