

ELEVATOR SYSTEM AND DISPLAY DEVICE

FIELD

Embodiments described herein relate generally to an elevator system and a display device.

5

BACKGROUND

As a system in which a security system of a building and a group management system of elevators are linked, there is known a system in which a security gate and a destination floor registration apparatus are linked. Recently, such a system has been introduced in a building such as an office building. This system reads information of a security card carried by a passenger when he/she passes through the security gate located at a base floor, etc., of the building, opens the gate when the passenger has been authenticated as an authorized passenger, and automatically registers a destination floor of the passenger.

When the passenger's destination floor is registered automatically, once a car which goes to the passenger's destination floor has been determined, information on that car is displayed on a display provided on the security gate. Thereby, the passenger can check the car he/she should get into when passing through the gate, and wait at a hall for that car.

25

SUMMARY

In general, according to one embodiment, an elevator system selects a suitable car for a passenger from among a plurality of cars on the basis of a destination floor of the passenger, and causes the selected car to respond. The elevator system includes a group management controller, standalone control devices, a destination floor registration apparatus and a car assignment controller. The group management controller performs group management control of operations of the cars. The standalone control devices

35

are provided for the cars, respectively, the standalone control devices controlling the operations of their corresponding cars in accordance with an instruction from the group management controller. The destination floor registration apparatus registers a hall call including the destination floor of the passenger. The car assignment controller selects the suitable car, on the basis of the hall call registered by the destination floor registration apparatus, and instructs the group management controller to make the selected car respond. The car assignment controller is configured to regularly acquire response possibility information indicating whether the cars are able to respond to the registered hall call from the corresponding standalone control devices, determine whether the selected car is able to respond to the registered hall call, on the basis of the acquired response possibility information, and transmit car information indicating that the selected car is an assigned car to the destination floor registration apparatus, when it is determined that the selected car is able to respond. The destination floor registration apparatus notifies the passenger of the assigned car indicated by the car information transmitted from the car assignment controller.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram showing the structure of an elevator system according to one embodiment.

FIG. 2 illustrates one example of data structure of passenger information according to the embodiment.

FIG. 3 illustrates a display example of a display unit according to the embodiment.

FIG. 4 is a flowchart showing an example of operation of the elevator system according to the

embodiment.

FIG. 5 is a sequence diagram showing an example of operation of a general system in which a security gate and a destination floor registration apparatus are linked.

FIG. 6 is a sequence diagram showing an example of operation of the elevator system according to the embodiment.

FIG. 7 is a flowchart showing an example of another operation of the elevator system according to the embodiment.

FIG. 8 illustrates another display example of the display unit according to the embodiment.

DETAILED DESCRIPTION

Embodiments will be described hereinafter referring to the accompanying drawings.

FIG. 1 is a schematic diagram showing the structure of an elevator system according to one embodiment. Note that in the present embodiment, a system in which a security gate and a destination floor registration apparatus are linked will be described. More specifically, a case where the security gate also serves as a destination floor registration apparatus in addition to preventing entry of an outsider is assumed.

A security gate 11 shown in FIG. 1 is located at a base floor of a building such as an office building. The base floor refers to a floor where people come and go frequently, such as a lobby, in the case of an office building. Although FIG. 1 only illustrates one security gate, the number of security gates is not limited, and a plurality of security gates may be arranged next to each other. On the side of an exit of the security gate 11, a door (gate) 12 for preventing entry is arranged to be openable and closable. In the vicinity of an entrance of the security gate 11, a

passenger authentication module 13 is provided. The passenger authentication module 13 is configured to read information of a security card SC possessed by a passenger (hereinafter referred to as "passenger information"), and to verify whether the possessor of the security card SC is an authorized passenger. Note that a method for reading the passenger information from the security card SC may be arbitrary, with the electromagnetic induction method, etc., at the head of the list.

The passenger information is information including at least a user ID for identifying the passenger, who is the owner of the security card SD, and destination floor information indicating a destination floor (also referred to as a target floor) of the passenger, as shown in FIG. 2. For example, passenger information A1 of FIG. 2 shows that the user ID is "user1", and a destination floor of the passenger identified by this user ID "user1" is the "fifth floor". Note that the passenger information may further include attribute information indicating attributes of the passenger, besides the above-described user ID and destination floor information. The attribute information is information indicating the specifics of the passenger (sex and age of the passenger, and whether the passenger uses a wheelchair or not, for example).

When the passenger authentication module 13 reads the passenger information from the security card SC, the passenger authentication module 13 determines whether the user ID included in this passenger information matches the user ID already registered in a user database (hereinafter referred to as a "user DB") 14 provided in the security gate 11. The passenger authentication module 13 thereby verifies whether the passenger is the authorized passenger. For example,

when the read passenger information is passenger information A1 of FIG. 2, the passenger authentication module 13 determines whether the user ID "user1" is registered in the user DB 14 or not, and verifies
5 whether the passenger is the authorized passenger. Note that the user DB 14 is not necessarily provided within the security gate 11, but may be provided separately from the security gate 11 as an external server device which can communicate with the security
10 gate 11.

As a result of the verification, when the passenger authentication module 13 could authenticate that the possessor of the security card SC is the authorized passenger, the passenger authentication
15 module 13 registers a hall call to a car assignment controller 50 to be described later. Specifically, the passenger authentication module 13 registers a hall call including a destination floor, which is indicated by the destination floor information included in the
20 read passenger information. More specifically, a hall call, which causes an elevator, which will go to the destination floor indicated by the destination floor information included in the read passenger information, to stop at the floor on which the security gate 11 is
25 located, is registered.

In the vicinity of the exit of the security gate 11, a display unit (display) 15 made of a liquid crystal panel, etc., is provided. The display unit 15 displays at least car information indicating a car
30 assigned to the passenger (hereinafter referred to as an "assigned car"). For example, according to display shown in FIG. 3, it can be understood that the passenger should wait for an elevator at a hall for "car X". Note that on the display unit 15, a direction
35 toward the hall at which the assigned car makes a stop,

for example, may be displayed, in addition to the above car information. Also, as long as the display unit 15 is provided near the exit of the security gate 11, the display unit 15 can be provided separately from the security gate 11 (for example, hung down from a ceiling near the exit of the security gate 11).

In front of the security gate 11, a hall 20 for a plurality of cars is provided. Although an example of FIG. 1 illustrates a case where three cars, i.e., cars A to C, are arranged side by side, the number of cars is not limited to the above, and it suffices that at least two cars are arranged side by side.

Note that in the present embodiment, an elevator is basically referred to as a "car". Also, in the present embodiment, a case where the security gate 11 is spaced apart from the hall 20 by a predetermined distance or more is assumed.

A group management controller 30 is an apparatus for performing group management control of operations of the respective cars. Elevator controllers (also referred to as standalone control devices) 40A, 40B, and 40C corresponding to the respective cars are connected to the group management controller 30. In other words, the group management controller 30 controls the operation of each of the elevator controllers 40A to 40C, and performs the group management control of the operations of these cars. For example, the group management controller 30 outputs an assignment signal to the elevator controller 40 corresponding to a specific car to respond to a specific hall call.

The elevator controllers 40A to 40C control the operations of the cars, respectively. More specifically, control of a motor for moving up and down the car, opening and closing control of the door, and

the like, are performed. In addition, each of the elevator controllers 40A to 40C transmits state information indicating the operation state of the corresponding car (for example, a current position of the car, an operation direction, a door opening/closing state, whether an abnormality has occurred, etc.). Also, each of the elevator controllers 40A to 40C transmits response possibility information indicating whether the car can respond to an assignment signal output from the group management controller 30 (in other words, whether the car can respond to the hall call). The state information and the response possibility information are transmitted to the group management controller 30 and the car assignment controller 50 on a regular basis (for example, every 0.5 seconds, every one second, and so on).

The car assignment controller 50 regularly acquires the state information and the response possibility information from the respective elevator controllers 40A to 40C, and stores these items of information in a temporary memory not illustrated. The state information and the response possibility information stored in the temporary memory are updated every time new state information and response possibility information are received.

In accordance with registration of a hall call including a destination floor from the passenger authentication module 13, the car assignment controller 50 selects a suitable car in response to the hall call from among a plurality of cars, on the basis of the state information stored in the temporary memory not shown. Also, the car assignment controller 50 determines whether the selected suitable car can respond to the hall call on the basis of the response possibility information stored in the temporary memory

not shown. Further, the car assignment controller 50 outputs an assignment command, which instructs the group management controller 30 to output an assignment signal to the elevator controller 40 corresponding to the selected suitable car, to the group management controller 30. For example, when the selected suitable car is car A, the car assignment controller 50 outputs, to the group management controller 30, an assignment command instructing an assignment signal to be output to the elevator controller 40A corresponding to car A.

The car assignment controller 50 transmits the car information indicating that the selected suitable car is the assigned car to the security gate 11. Note that the car assignment controller 50 stores at least the car information transmitted most recently as a log in the temporary memory not illustrated. When the security gate 11 receives the car information transmitted from the car assignment controller 50, this car information is displayed on the display unit 15.

Note that the car assignment controller 50 should preferably be installed on the same floor as the security gate, in other words, installed on the base floor. However, a place where the car assignment controller 50 is installed is not limited to the above, and the car assignment controller 50 may be installed at any place as long as it can communicate with the security gate 11. In addition, various functions of the car assignment controller 50 may be provided in the group management controller 30.

Here, before explaining the operation of the elevator system according to the present embodiment, a general system in which a security gate and a destination floor registration apparatus are linked will be briefly described.

In a general system in which a security gate and a

destination floor registration apparatus are linked,
first, in response to a call registered by the security
gate (destination floor registration apparatus), the
group management controller selects a suitable car from
5 among a plurality of cars, in consideration of the
operation states of the respective cars. Next, the
group management controller outputs, to the elevator
controller corresponding to the selected suitable car,
an answer request inquiring whether or not the selected
10 car can respond to the registered call. And, when an
answer back indicating that the selected car can
respond to the call is obtained from this elevator
controller, the selected car is formally determined as
the assigned car. After that, in order to notify the
15 passenger which car he/she should get into, the car
information indicating the assigned car is transmitted
to the security gate.

In this case, although a suitable car has been
selected from among the cars, after the selection, an
20 answer request inquiring whether or not the selected
car can respond to the registered call must be output,
and the assigned car is confirmed after an answer back
indicating that the car can respond to the call is
obtained. For this reason, an inconvenience that it
25 takes time to transmit the car information indicating
the assigned car to the security gate may be caused.
According to the above method, since it takes time for
the display unit provided at the security gate to
display information on the assigned car, an
30 inconvenience that the passenger is stopped at the
vicinity of the exit of the security gate may also be
caused.

Accordingly, the elevator system according to the
present embodiment adopts a structure which uses the
35 state information and the response possibility

information that are acquired regularly to select a suitable car and determine whether the selected car can respond to the registered call, thereby confirming the assigned car promptly. An example of the operation of the elevator system according to the present embodiment will be described with reference to the flowchart of FIG. 4.

FIG. 4 is a flowchart showing an example of operation of the elevator system according to one embodiment. However, it is assumed that the passenger information including the user ID and destination floor information is already stored in the security card SC possessed by the passenger, user IDs of authorized passengers are already registered in the user DB 14 in advance, and the state information and the response possibility information which are regularly acquired from the elevator controllers 40A to 40C are stored in the temporary memory, not shown, in the car assignment controller 50.

First, when the security card SC is held over the passenger authentication module 13 provided at the security gate 11, the passenger authentication module 13 reads the passenger information already stored in the security card SC (step S1).

Next, the passenger authentication module 13 determines whether the user ID included in the read passenger information matches any of many user IDs already registered in the user DB 14 (step S2). As a result of this determination, if the user ID included in this passenger information does not match any of the user IDs registered in the user DB 14 (NO in step S2), the passenger authentication module 13 determines that the possessor of this security card SC is not an authorized passenger, and displays a message on the display unit 15, while the door 12 of the security gate

11 is kept closed, urging the passenger to present the security card SC again (step S3), and a process in this step is completed.

5 Meanwhile, when the user ID included in the passenger information matches the user ID registered in the user DB 14 (YES in step S2), the passenger authentication module 13 determines that the possessor of this security card SC is the authorized passenger, and opens the door 12 of the security gate 11 (step 10 S4), and registers a hall call including the destination floor, which is indicated by the destination floor information included in the read passenger information (step S5).

15 When the above hall call is registered, the car assignment controller 50 selects a suitable car from among a plurality of cars (step S6), on the basis of the state information stored in the temporary memory not shown, and determines whether the selected suitable car can respond to the hall call or not, on the basis 20 of the response possibility information stored in the temporary memory not shown (step S7). Further, as a result of the determination, when the selected suitable car cannot respond to the hall call (NO in step S7), the flow returns to the above process of step S6, and 25 the car assignment controller 50 reselects another suitable car.

30 Meanwhile, as a result of the determination, when the selected suitable car can respond to the hall call (YES in step S7), the car assignment controller 50 transmits car information indicating the selected suitable car as the assigned car to the security gate 11 (step S8). At this time, the car assignment controller 50 stores the car information transmitted to the security gate 11 as a log in the temporary memory 35 not shown.

When the security gate 11 receives the car information transmitted from the car assignment controller 50, this car information is displayed on the display unit 15 (step S9).

5 In parallel with transmission of the car information, the car assignment controller 50 outputs an assignment command, which instructs the group management controller 30 to output an assignment signal to the elevator controller 40 corresponding to the
10 selected suitable car, to the group management controller 30 (step S10).

 When the group management controller 30 receives the assignment command output from the car assignment controller 50, the assignment signal is output to the
15 elevator controller 40 corresponding to the suitable car (step S11). After that, when the elevator controller 40 receives the assignment signal output from the group management controller 30, the car is made to respond to the registered hall call (step S12),
20 and a process in this step is completed.

 According to the operation of FIG. 4 described above, the car assignment controller 50 can select a suitable car by using the state information and the response possibility information which are regularly
25 acquired, determine whether the selected car can respond to the registered hall call, confirm the assigned car promptly, and transmit the car information to the security gate 11. Therefore, the above-described inconveniences can be resolved.

30 Here, referring to FIGS. 5 and 6, a difference between a general system in which a security gate and a destination floor registration apparatus are linked and the elevator system according to the present embodiment will be complementarily described. FIG. 5 is a
35 sequence diagram showing an example of operation from

when the hall call is registered to when the car information is displayed in the general system in which the security gate and the destination floor registration apparatus are linked. FIG. 6 is a sequence diagram showing an example of operation from when the hall call is registered to when the car information is displayed in the elevator system according to the present embodiment.

As has been explained briefly in the above, in the general system, as shown in FIG. 5, after a suitable car is selected by the group management controller, the group management controller communicates with the elevator controller and outputs an answer request. The assigned car is confirmed after an answer back is obtained from the elevator controller.

Meanwhile, in the elevator system according to the present embodiment, as shown in FIG. 6, after a suitable car is selected by the car assignment controller 50, the car assignment controller 50 can confirm the assigned car without communicating with the elevator controller 40. In other words, according to this elevator system, not only can processes of answer request and answer back, which are required in the general system, be omitted, but there is also no need to communicate with the elevator controller 40. Accordingly, as compared to a general system, the assigned car can be promptly confirmed.

On the other hand, the response possibility information stored in the temporary memory, which is not shown, is not necessarily the latest response possibility information. (For example, when the response possibility information is acquired every 0.5 seconds, response possibility information older by 0.5 seconds is used in the determination of the response possibility, and the situation may be

different from the current situation). For this reason, while operation efficiency of the elevator may be slightly reduced as compared to the general system, it is possible to obtain a great advantage that
5 stopping of the passenger at the exit of the security gate 11 can be reduced.

Next, referring to the flowchart of FIG. 7, the operation of the elevator system when it is known that an abnormality has occurred in a predetermined car and
10 the predetermined car cannot respond to the hall call, immediately after the car information has been transmitted to the security gate 11 (for example, after 0.5 seconds), will be described. The abnormality is detected based on the state information and the
15 response possibility information which are regularly acquired from the respective elevator controllers 40A to 40C.

FIG. 7 is a flowchart showing an example of another operation of the elevator system according to
20 one embodiment.

The car assignment controller 50 regularly acquires the state information and the response possibility information from the respective elevator controllers 40A to 40C. At this time, when the
25 acquired state information and response possibility information show that an abnormality has occurred in a predetermined car and thus this car cannot respond to the hall call, the car assignment controller 50 checks whether the assigned car, which is indicated by car
30 information that is recorded in the temporary memory not shown as a log, and transmitted to the security gate 11 most recently, is a car which cannot respond to the hall call (step S21).

As a result of the above checking, when it has
35 been confirmed that the assigned car is not the car

that is unable to respond to the hall call (NO in step S21), a process in this step is completed.

Meanwhile, a result of the above checking, when it has been recognized that the assigned car corresponds
5 to the car that is unable to respond to the hall call (YES in step S21), the car assignment controller 50 transmits message information indicating that the security card SC should be held over the passenger authentication module 13 again, to the security gate 11
10 (step S22). When the security gate 11 receives the message information transmitted from the car assignment controller 50, the message information is displayed on the display unit 15 instead of the car information currently displayed on the display unit 15, as shown in
15 FIG. 8, the door 12 is closed (step S23), and a process in this step is completed.

According to the operation of FIG. 7 described above, even if an abnormality occurs in an assigned car immediately after the assigned car has been confirmed,
20 message information indicating that the security card SC should be presented again to register a hall call again can be displayed on the display unit 15, instead of displaying the car information. Consequently, a possibility of the passenger directly going to the car which cannot respond to the hall call mistakenly can be
25 reduced.

Further, immediately after the process of step S21, a step of determining whether a time elapsed from transmitting the car information to the security gate
30 11 has exceeded a predetermined length of time or not may further be added. By the addition of this step, whether or not the passenger has seen the erroneous car information and has already passed the security gate 11 can be determined, and furthermore, a possibility of
35 erroneously displaying the above message information to

the next passenger can be reduced.

According to the embodiment described above, time taken for displaying information on the car on a display (display unit 15) can be reduced.

5 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;
10 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
15 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 which selects a suitable car for a passenger from among a plurality of cars on the basis of a destination floor of the passenger, and causes the selected car to respond, the elevator system comprising:

a group management controller which performs group management control of operations of the cars;

standalone control devices provided for the cars, respectively, the standalone control devices controlling the operations of their corresponding cars in accordance with an instruction from the group management controller;

a destination floor registration apparatus which registers a hall call including the destination floor of the passenger; and

a car assignment controller which selects the suitable car, on the basis of the hall call registered by the destination floor registration apparatus, and instructs the group management controller to make the selected car respond,

the car assignment controller being configured to regularly acquire response possibility information indicating whether the cars are able to respond to the registered hall call from the corresponding standalone control devices, determine whether the selected car is able to respond to the registered hall call, on the basis of the acquired response possibility information, and transmit car information indicating that the selected car is an assigned car to the destination floor registration apparatus, when it is determined that the selected car is able to respond,

the destination floor registration apparatus notifying the passenger of the assigned car indicated by the car information transmitted from the car

assignment controller.

2. The elevator system of Claim 1, wherein the car assignment controller transmits the car information indicating that the selected car is the assigned car
5 directly to the destination floor registration apparatus without confirming the standalone control device corresponding to the selected car whether or not the selected car is able to respond to the registered hall call.

10 3. The elevator system of Claim 1, wherein the car assignment controller regularly acquires state information indicating operation states of the cars from the corresponding standalone control devices, together with the response possibility information, and
15 selects the suitable car on the basis of the destination floor of the passenger included in the hall call registered by the destination floor registration apparatus, and the acquired state information.

4. The elevator system of Claim 1, wherein the
20 destination floor registration apparatus and a hall at which each of the cars makes a stop are spaced apart from each other by a predetermined distance or more.

5. The elevator system of Claim 1, wherein the destination floor registration apparatus is a security
25 gate.

6. The elevator system of Claim 5, wherein the destination floor registration apparatus is configured to:

read, from a security card possessed by the
30 passenger, a user ID and destination floor information recorded in the security card;

determine whether a possessor of the security card is an authorized passenger, on the basis of the read user ID; and

35 register the hall call including the destination

floor indicated by the read destination floor information, when the possessor of the security card is determined as being the authorized passenger.

7. The elevator system of Claim 1, wherein:

5 the car assignment controller transmits, to the destination floor registration apparatus, message information indicating that the hall call should be registered again, when the response possibility information regularly acquired from each of the
10 standalone control devices shows that the car indicated by the transmitted car information is unable to respond to the hall call, immediately after the car information has been transmitted to the destination floor registration apparatus; and

15 the destination floor registration apparatus notifies the passenger of the message information transmitted from the car assignment controller, instead of the car information.

20 8. A display device included in an elevator system, the elevator system comprising a group management controller which performs group management control of operations of a plurality of cars; standalone control devices provided for the plurality of cars, respectively, the standalone control devices
25 controlling the operations of their corresponding cars in accordance with an instruction from the group management controller; and a car assignment controller which selects a suitable car, on the basis of a hall call including a destination floor which is registered
30 in accordance with a passenger's operation, and instructs the group management controller to make the selected car respond, the car assignment controller being configured to regularly acquire response possibility information indicating whether the cars are
35 able to respond to the registered hall call from the

corresponding standalone control devices, determine whether the selected car is able to respond to the registered hall call, on the basis of the acquired response possibility information, and transmit car
5 information indicating that the selected car is an assigned car, when it is determined that the selected car is able to respond, the display device comprising:
a registration unit which registers the hall call in accordance with the passenger's operation; and
10 a display unit which displays information on the assigned car indicated by the car information transmitted from the car assignment controller.