

TITLE OF THE INVENTION

GROUP CONTROL ELEVATOR

FIELD OF THE INVENTION

5 The present invention relates to a group control elevator adapted in consideration of physical impairment.

BACKGROUND OF THE INVENTION

 As related art concerning a group control elevator adapted
10 in consideration of physical impairment, techniques described in Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2007-537962 and in Japanese Unexamined Patent Application Publication No. 2012-254852 are known.

15 A technique described in Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2007-537962 is outlined below. When an elevator passenger operates a switch button for floor selection, situated nearby in an elevator hall, announcement of a destination floor or
20 floors with consideration for visual impairment is started. The passenger operates the button again upon the announcement of a desired destination floor or floors the passenger seeks to travel to. At this time, the group control elevator assigns the last announced destination floor or floors before the
25 passenger operates the button again to any elevator within a

group of elevators and causes an elevator car identifier to issue sound for identifying that elevator.

A technique described in Japanese Unexamined Patent Application Publication No. 2012-254852 is outlined below. A destination floor reservation apparatus is provided with a wheelchair button. When an own and other bank determination processing unit determines that a destination floor specified by a passenger is served by any other elevator bank and detects that the wheelchair button has been operated, the unit does not perform assignment and registration processing and causes the destination floor reservation apparatus operated for input by the passenger to display information to advise the passenger to move to that other bank.

SUMMARY OF THE INVENTION

The aforementioned techniques of related art enable a person with a certain physical impairment to use an elevator smoothly, but have a problem in which it is not necessarily possible to make an elevator easy to use for persons with other physical impairments.

Thus, the present invention provides a group control elevator that enables a passenger to surely get in the car of an elevator assigned, taking a plurality of physical impairments into consideration.

To address the above problem, a group control elevator

according to the present invention includes plural elevators,
a destination floor registration apparatus located in an
elevator hall floor, and a group controller that assigns any
of the elevators to a destination floor which is registered
5 by operating the destination floor registration apparatus. The
group controller includes a data storage unit that stores plural
pieces of control information with respect to plural properties
of physical impairment and a physical impairment property
determining unit that determines what property of physical
10 impairment a passenger has. The group controller retrieves,
from the data storage unit, control information associated with
a property of physical impairment the passenger has, determined
by the physical impairment property determining unit, and
assigns any of the elevators to a destination floor, based on
15 the retrieved moving time.

According to a group control elevator according to the
present invention, an elevator is assigned to a destination
floor, based on plural pieces of control information associated
with plural properties of physical impairment; therefore, a
20 passenger can surely get in the car of an elevator assigned.

Problems other than noted above, configurations, and
advantageous effects will be clarified by the following
description of embodiments.

25 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view depicting an elevator hall for a group control elevator which is a first embodiment of the present invention;

Fig. 2 is a front view of an operating panel of a destination floor registration apparatus in Fig. 1 to illustrate an example of the operating panel structure;

Fig. 3 is a block diagram depicting a control system of the group control elevator of the first embodiment;

Fig. 4 is a flowchart illustrating a procedure for destination floor registration, which is performed by the group control elevator of the first embodiment;

Fig. 5 represents an example of a situation where the first embodiment produces a beneficial effect;

Fig. 6 represents an example of a data table;

Fig. 7 represents an example of a data table;

Fig. 8 represents an example of a sensor which sends information on physical condition of a passenger;

Fig. 9 depicts a scene around the destination floor registration apparatus in a group control elevator which is a second embodiment of the present invention;

Fig. 10 is a block diagram depicting a control system of a group control elevator which is a third embodiment of the present invention;

Fig. 11 is a rough structure diagram representing an example of a space determining device which is used for

determination processing by a space inside car determining unit;
and

Fig. 12 is a rough structure diagram representing a space
inside car determining device in a group control elevator which
5 is a fourth embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In the following, embodiments of the present invention
are described based the drawings.

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First Embodiment

Fig. 1 is a perspective view depicting an elevator hall
for a group control elevator which is a first embodiment of
the present invention.

15

A group control elevator of the present embodiment
includes plural (four, according to Fig. 1) elevators (A to
D), a centralized destination floor registration apparatus 2
which is fixedly situated within the elevator hall or near the
entrance of the elevator hall in the floor of the elevator hall,
20 a hall lantern 3 indicating the arrival of the car of an elevator
in response to a hall call from upper or lower floors, and an
output device 4 which is disposed above a landing door of each
elevator and outputs information in audible or text form. A
hall call is registered when a passenger operates an operating
25 panel 1 of the destination floor registration apparatus 2 to

register a destination floor, as will be described later.

In the present embodiment, two elevator doors are located in both side walls of the elevator hall space. On the surface of a wall positioned between the two adjacent elevator doors, a destination floor registration apparatus 10 is provided. An elevator passenger can register or re-register a destination floor with the destination floor registration apparatus 10, if a passenger missed a chance to register a destination floor with the destination floor registration apparatus 2 or wants to change a destination floor once registered.

The present embodiment further includes an imaging camera 5 which takes an image of a passenger who is registering a destination floor by operating the destination floor registration apparatus 2 or the destination floor registration apparatus 10. The imaging camera 5 obtains image data for discerning a property of physical impairment (wheelchair use, crutch use, or visual impairment).

Fig. 2 is a front view of the operating panel 1 of the destination floor registration apparatus 2 in Fig. 1 to illustrate an example of the operating panel structure. The operating panel 1 of the destination floor registration apparatus 2 includes floor buttons 7 composed of plural numeric buttons (a numeric keypad according to Fig. 2) to be pressed by a passenger when registering a destination floor, a physical impairment signifying button 8 which is pressed by a passenger

who is registering a destination floor to tell the elevator system about a physical impairment, and a display/output unit 6 which displays the number of a destination floor pressed by the passenger, displays a character and symbol corresponding to a registered destination floor and an elevator assigned to the hall call in the floor where the destination floor registration apparatus 2 is installed or makes an output of audio guidance representing the above destination floor and elevator assigned to the hall call, if the physical impairment signifying button 8 has been operated. A detector 24 is a card reader for reading data from an IC card 23 in a second embodiment (Fig. 9) which will be described later.

Fig. 3 is a block diagram depicting a control system of the group control elevator of the present embodiment.

In the control system 30, a control unit 18 of a group controller 31 takes input of signals from the imaging camera 5 and from the output unit 6, the floor buttons 7, and the physical impairment signifying button 8 which are depicted in Fig. 2. According to signals input thereto, the control unit 18, in usual control operation, makes a hall lantern controller 20 control the hall lantern (reference numeral 3 in Fig. 1) and makes an output information controller 19 control the output device (reference numeral 4 in Fig. 1) for each elevator.

According to a signal from the physical impairment signifying button 8, the control unit 18 also controls the

components of the group controller 31 in accordance with software for control adapted for physical impairment, which is read in from a storage unit 17, and makes the components function as below.

5 A physical impairment cognizing unit 9 cognizes a passenger with physical impairment by a signal from the physical impairment signifying button 8. In this way, a physical impairment cognition device is configured with the physical impairment cognizing unit 9 and the physical impairment
10 signifying button 8 in the present embodiment. When the physical impairment cognizing unit 9 cognizes a passenger with physical impairment, a physical impairment property determining unit 10 determines what property of physical impairment the passenger has through image processing on image
15 data from the imaging camera 5. The physical impairment property determining unit 10 discerns wheelchair use, crutch use, or visual impairment as the property. In this way, a physical impairment property determination device is configured with the imaging camera 5 and the physical impairment
20 property determining unit 10 in the present embodiment.

 A moving time retrieving unit 12 retrieves, from a moving time data storage unit 11, control information associated with the property of physical impairment determined by the physical impairment property determining unit 10, that is, a moving time
25 estimated to take for a passenger to move to in front of an

elevator door. Here, the moving time data storage unit 11 stores time estimated to take for a passenger to move from the destination floor registration apparatus 2 to each elevator door and time estimated to take for a passenger to get in the elevator car with respect to each property. An elevator assignment unit 13 selects an elevator that can arrive in a shorter time at the floor where the passenger waits, taking account of the passenger's moving time retrieved by the moving time retrieving unit 12, and assigns that elevator to the registered destination floor and the hall call in the floor where the passenger waits.

An output notice unit 14 outputs the assigned elevator identification information such as its number and name to the output unit 6 of the destination floor registration apparatus 2, so that the information is displayed in characters or output in audible form by the output unit 6. A door opening/closing adjustment unit 16 gives a control command to an elevator control panel 15 to control opening/closing of the door of the elevator assigned by the elevator assignment unit 13, depending on the property of physical impairment determined by the physical impairment property determining unit 10.

Fig. 4 is a flowchart illustrating a procedure for destination floor registration, which is performed by the group control elevator of the present embodiment. Fig. 4 illustrates the procedure to be initiated when a passenger operates any

of the floor buttons 7 and the physical impairment signifying button 8 of the destination floor registration apparatus 2 in order to register a destination floor.

The group controller 31 of the group control elevator
5 of the present embodiment supervises the destination floor registration apparatus 2 when the elevators are in service and, in a supervisory operation, determines whether or not the physical impairment signifying button 8 has been pressed, according to whether or not it receives a notification signal
10 from the destination floor registration apparatus 2 (step S1). When it is determined that the physical impairment signifying button 8 has been pressed, software for control in consideration of physical impairment is activated (step S1, YES). If it is not determined that physical impairment signifying button 8
15 has been pressed, the group controller continues to supervise the destination floor registration apparatus 2 (step S1, NO).

Upon determining that the physical impairment signifying button 8 has been pressed or operated (step S1, YES), the group controller 31 then determines whether or not any of the floor
20 buttons 7 of the destination floor registration apparatus 2 has been pressed, according to whether or not it receives a destination floor signal from the destination floor registration apparatus 2 (step S2). When the group controller determines that any of the floor buttons 7 has been pressed
25 (step S2, YES), the output notice unit 14 outputs identification

information of a floor indicated by the destination floor signal to the output unit 6 of the destination floor registration apparatus 2, so that the information is displayed in characters or output in audible form by the output unit 6. At this moment, while the elevator assignment unit 13 has a function of assigning an elevator that is preferable according to a floor specified by the floor buttons 6, as described previously, it suspends processing of assigning an elevator to a destination floor and the hall call, because physical impairment is cognized by the physical impairment cognizing unit 9.

Then, prior to elevator assignment, by means of the physical impairment property determining unit 10 that received a cognition signal from the physical impairment cognizing unit 9, the group controller 31 determines the property of physical impairment, i.e., wheelchair use, crutch use, or visual impairment in the present embodiment, by executing image processing on image data obtained from the imaging camera 5 (step S3). For example, it may be possible to apply publicly known image processing like calculating a degree of match between the obtained image and each of the reference images of wheelchair use, crutch use, and visual impairment. The properties of physical impairment are not limited to these properties; properties can be set in such a way that some properties are consolidated or divided into subclasses, as appropriate depending on elevator usage conditions and a way of operation

control. For example, wheelchair use and crutch use may be consolidated into walk disabled.

Then, by means of the moving time retrieving unit 12, the group controller 31 retrieves data of time estimated to
5 take for a passenger to move from in front of the destination floor registration apparatus 2 being operated by the passenger to each elevator door and data of time estimated to take for a passenger to get in the elevator car out of the moving time data stored beforehand in the moving time data storage unit
10 11 as control information associated with the property determined at step S3 (step S4). After that, the moving time retrieving unit 12 sends the time data relevant to moving (moving time data) to the elevator assignment unit 13 and sends the time data relevant to getting in the elevator car (get-in time
15 data) to the door opening/closing time adjustment unit 16.

Then, by means of the elevator assignment unit 13, the group controller 31, based on the moving time data received by the elevator assignment unit 13 and the service conditions of elevators sent from the elevator control panel 15, selects
20 a preferable elevator that surely allows the passenger to get in the elevator car arrived and that can arrive in a shorter time at the floor where the passenger waits and assigns that elevator to the destination floor and the hall call (step S5). Here, the group controller 31 assigns an elevator in service
25 conditions in which the elevator car will arrive at the landing

floor after the lapse of the moving time.

Furthermore, the group controller 31 sends data on the assigned elevator, for example, identification data such as the elevator number and name via the output notice unit 14 to the destination floor registration apparatus 2 and sends signals relevant to the destination floor and the hall call to the elevator control panel 15 that controls the assigned elevator. The elevator identification data received by the destination floor registration apparatus 2 is displayed in characters or output in audible form by the output unit 6 and informed to the passenger who operated the destination floor registration apparatus 2 (step S6). The elevator identification data is also sent to the door opening/closing time adjustment unit 16.

Furthermore, by means of the door opening/closing time adjustment unit 16, the group controller 31, based on the get-in time data and the elevator identification data received by the door opening/closing time adjustment unit 16, as above, compares the get-in time associated with the determined property of physical impairment and the door opening/closing time of the assigned elevator. If the group controller has decided to elongate the door opening/closing time, it sends a command to adjust the door opening/closing to the elevator control panel 15 for the assigned elevator.

According to the present invention as described above, it is possible to assign a preferable elevator, taking account

of time estimated to take for a passenger to move from the position of the destination floor registration apparatus 2 to in front of the door of the assigned elevator, depending on the property of physical impairment. Consequently, the passenger can surely
5 get in the elevator car arrived even if it takes time for the passenger to move to in front of the elevator door.

Fig. 5 represents an example of a situation where the present embodiment produces a beneficial effect. Fig. 5 depicts a scene around the destination floor registration
10 apparatus 2. The detector 24 (see Fig. 2) of the destination floor registration apparatus 2 is omitted here.

In Fig. 5, it is assumed that a passenger 21 can move, walking in 5 seconds from the position of the destination floor registration apparatus 2 to in front of the door of an assigned
15 elevator B. It is also assumed that a passenger 22 can move with a wheelchair or crutch in 15 seconds between the same destination floor registration apparatus 2 and the door of the elevator B. Then, if the elevator group controller assigned the elevator B whose car will arrive at the floor five seconds
20 after in a manner as before, taking account of wait time for passengers in the elevator hall, the passenger 21 can get in the elevator car, but the passenger 22 will miss the elevator, because the passenger 22 will come in front of the elevator door after the departure of the car of the elevator B. In
25 contrast, if the elevator group controller assigns the elevator

B, taking account of passenger's moving time depending on the property of physical impairment, the elevator car will arrive at the landing floor after the elapse of the moving time, that is, after the time at which the passenger 22 has come in front of the door of the elevator B, and thus the passenger 22 will not miss the elevator. In addition, the elevator group controller assigns an elevator so that wait time will become shorter in a range beyond the moving time. Thus, the wait time for the passenger 22 after coming in front of the door of the elevator B can be decreased.

In the present embodiment, the group controller preliminarily stores a data table associating moving time with plural properties of physical impairment as moving time data. Fig. 6 represents an example of the data table. As in this example, moving time is set with respect to each property.

Here, taking account of the fact that moving time associated with even the same property varies by a difference in distance from the destination floor registration apparatus to each elevator door, moving time may be associated with plural properties of physical impairment and plural elevators in a data table. Fig. 7 represents an example of such a data table. As in this example, moving time is set for each elevator and with respect to each property. Consequently, a passenger can surely get in an elevator car even in an elevator bank having many elevators, e.g., eight elevators.

Furthermore, the group controller in the present embodiment is equipped with the door opening/closing adjustment unit 16 which gives a command to the elevator control panel 15 to control the door opening/closing of an elevator assigned by the elevator assignment unit 13, depending on the determined property of physical impairment, as depicted in Fig. 3. The door opening/closing adjustment unit 16 compares retrieved get-in time associated with the determined property of physical impairment and the door opening time of the elevator assigned by the elevator assignment unit 13 and, if the get-in time is longer, adjusts the door opening time to elongate the door opening time. Here, get-in time that varies depending on physical impairment properties is set in a data table as in Fig. 6 in the same way as for moving time.

The door opening/closing adjustment unit 16 may be provided with a function to temporarily disable a Door Close button, if operated when the door opening time is elongated, which is provided on an operating panel inside an elevator car. When the door opening/closing adjustment unit 16 gives a command signal to the elevator control panel 15, the elevator controlled by the panel may be caused to switch to a special operation mode adapted for physical impairment.

In an aforementioned data table, a property may be further divided into subclasses, namely, a detailed property of physical impairment and passenger's property according to, for example,

the size of a wheelchair and whether the passenger is an adult or child. For subclass properties also, what property is determined based on an image of a passenger who operates the destination floor registration apparatus 2, which is obtained
 5 by the imaging camera 5. The imaging camera also obtains an image of a passenger who moved to in front of the door of an elevator assigned through the use of a data table presented in Fig. 6 or 7. Based on the obtained image, a determination is made as to the size of a wheelchair or whether the passenger
 10 is an adult or child. Based on a result of the determination, a value of get-in time stored preliminarily may be modified. For example, if the size of a wheelchair is beyond a predetermined size, the value of get-in time multiplied by α (>1) is used.

Aforementioned moving time and get-in time may be modified,
 15 as appropriate according to physical condition of a passenger. For example, if the group controller has determined that physical condition of a passenger is bad, the controller uses a value set in a data table multiplied by β (>1) in elevator assignment processing.

20 Fig. 8 represents an example of a sensor which sends information on physical condition of a passenger. This example is a wristband type sensor 40 which is used for health monitoring. In Fig. 8, a portion of a band element 41 is omitted from depiction. This sensor is equipped with a sensor that measures pulsation
 25 and body temperature and sends data detected by the sensor by

a radio signal. The group controller obtains information on physical condition such as body temperature and pulsation of a passenger from a received radio signal and determines physical condition of the passenger from this information. A wearable
5 sensor that is attached to the human body can be applied, not limited to the wristband type.

Second Embodiment

Fig. 9 depicts a scene around the destination floor registration apparatus in a group control elevator which is
10 a second embodiment of the present invention. Fig. 9 depicts a situation similar to that depicted in Fig. 6. A description is provided below, focusing on differences from the first embodiment.

15 In the second embodiment, the group controller cognizes a passenger with physical impairment, when the detector 24 of the destination floor registration apparatus 2 has detected an IC card 23 for destination floor registration that a passenger carries, instead of the physical impairment signifying button
20 8 of the destination floor registration apparatus 2.

On the IC card 23, the following data are stored in advance: data on a property of physical impairment and data on a destination floor. The group controller determines the property of physical impairment and makes a destination floor
25 registration using data that is read when the IC card 23 has

been detected.

The group controller may store floor data in association with data identifying an IC card, retrieve floor data when having detected an IC card 23, and perform destination floor

5 registration processing using the floor data.

Instead of an IC card 23, a cellular terminal device or the like may be used. Data stored on an IC card may be read when a passenger passes the IC card 23 over the detector 24 or may be read automatically without a need for a passenger
10 to do some operation when a passenger has come close to a detecting device such as the detector 23.

Third Embodiment

Fig. 10 is a block diagram depicting a control system
15 of a group control elevator which is a third embodiment of the present invention.

The group controller in the present embodiment includes a space inside car determining unit 29 which determines whether or not there is a space enough for the passenger with physical
20 impairment to get in the elevator car, after retrieving moving time data per property of physical impairment by the moving time retrieving unit 12, in addition to the components depicted in Fig. 3. Because other components are the same as the components in Fig. 3, corresponding components are assigned
25 same reference numerals and their detailed description is

dispensed with.

Before an elevator is assigned by the elevator assignment unit 13, the space inside car determining unit 29 determines whether or not there is an empty space allowing the passenger to get in inside the elevator car of each elevator. The elevator assignment unit 13 receives a signal indicating an elevator for which it was determined that there is a space for the passenger to get in from the space inside car determining unit 29. When assigning an elevator to a destination floor and the hall call, the elevator assignment unit 13 assigns, as a preferable elevator, an elevator or one of elevators for which it was determined that there is an empty space by the space inside car determining unit 29. Consequently, the passenger can surely get in the car of an elevator assigned. Here, if required space sizes depending on physical impairment properties are set, it is possible to assign an elevator having a sufficient empty space according to the determined property. Consequently, comfort for passengers in an elevator car is enhanced.

Fig. 11 is a rough structure diagram representing an example of a space determining device which is used for determination processing by the above space inside car determining unit 29. A camera 26 is installed inside an elevator car 25 and the above space inside car determining unit 29 determines whether or not there is an empty space 27 inside the elevator car 25 through image processing on image data taken

by the camera 26.

Fourth Embodiment

Fig. 12 is a rough structure diagram representing a space
5 inside car determining device in a group control elevator which
is a fourth embodiment of the present invention. While the
structure of the space inside car determining device in the
fourth embodiment differs from the corresponding device in the
third embodiment, other components are the same as in the third
10 embodiment.

In the fourth embodiment, an elevator car 25 includes
a load detecting device 28 which detects a live load. The above
space inside car determining unit 29 determines whether or not
there is an empty space allowing the passenger to get in inside
15 the elevator car 25, based on a value detected by the load
detecting device 28.

The space inside car determining unit 29 determines
whether there is an empty space and how large the space is from
a value detected by the load detecting device 28, permissible
20 live load, and average weight, etc. and identifies an elevator
having a sufficient empty space for the passenger to get in.
The elevator assignment unit 13 receives a result of the
determination from the space inside car determining unit 29
when assigning an elevator and assigns only an elevator or one
25 of elevators in which a sufficient empty space was detected.

Consequently, comfort for passengers in an elevator car is enhanced, as is the case for the third embodiment.

The present invention is not limited to the described embodiments and various modifications are included therein.

5 For example, the foregoing embodiments are those described in detail to explain the present invention clearly and the invention is not necessarily limited to those including all components described. A part of the configuration of an embodiment can be replaced by the configuration of another embodiment. To
10 the configuration of an embodiment, the configuration of another embodiment can be added. As for a part of the configuration of each embodiment, another configuration can be added to it or it can be removed and replaced by another configuration.

For example, the destination floor registration apparatus
15 2 may be provided with physical impairment signifying buttons 8 for each property. By a notification signal from a button pressed by a passenger, a property of physical impairment may be determined.

The imaging camera 5 in Fig. 1 may be installed onto the
20 destination floor registration apparatus 2.

WHAT IS CLAIMED IS:

1. A group control elevator comprising a plurality of elevators, a destination floor registration apparatus located
5 in an elevator hall floor, and a group controller that assigns any of the plurality of elevators to a destination floor which is registered by operating the destination floor registration apparatus,

the group controller including:

10 a data storage unit that stores a plurality of pieces of control information with respect to a plurality of properties of physical impairment; and

a physical impairment property determining unit that determines what property of physical impairment a passenger
15 has,

wherein the group controller retrieves, from the data storage unit, control information associated with a property of physical impairment the passenger has, determined by the physical impairment property determining unit, and assigns any
20 of the plurality of elevators to the destination floor, based on the retrieved control information.

2. The group control elevator according to claim 1, wherein, based on an image of a passenger who operates the destination
25 floor registration apparatus, the physical impairment property

determining unit determines the property of physical impairment.

3. The group control elevator according to claim 1, wherein,
5 based on data that is read from a data storage device a passenger carries, the physical impairment property determining unit determines the property of physical impairment.

4. The group control elevator according to any one of claims
10 1 to 3,

wherein the control information includes moving time from the destination floor registration apparatus to the elevators, and

wherein the group controller assigns an elevator whose
15 car will arrive at the elevator hall floor after elapse of the moving time to the destination floor.

5. The group control elevator according to claim 4, wherein the group controller assigns the elevator to the destination
20 floor, taking account of wait time for the passenger after elapse of the moving time.

6. The group control elevator according to claim 4, wherein the moving time is set with respect to each of the plurality
25 of elevators.

7. The group control elevator according to claim 4,
wherein the control information further includes get-in
time estimated to take for a passenger to get in an elevator
5 car, and

wherein, if the get-in time is longer than door opening
time of an elevator assigned to the destination floor, the group
controller elongates the door opening time.

10 8. The group control elevator according to claim 7, wherein
the get-in time is modified, based on an image of a passenger
in front of an elevator assigned to the destination floor.

9. The group control elevator according to claim 4, wherein
15 the moving time is modified, based on physical condition of
a passenger.

10. The group control elevator according to claim 7, wherein
the get-in time is modified, based on physical condition of
20 a passenger.

11. The group control elevator according to claim 4, wherein
the group controller assigns an elevator having an empty space
enough for a passenger to get in inside its elevator car to
25 the destination floor.