

ELEVATOR WITH INTER-FLOOR ADJUSTMENT FUNCTION

FIELD

Embodiments described herein relate generally to an elevator with an inter-floor adjustment function, comprising a car frame comprising at least two cars vertically connected and being capable of adjusting a distance between the cars in the car frame in accordance with an inter-floor distance between destination floors.

BACKGROUND

In skyscrapers, etc., in order to improve space efficiency, an elevator comprising two cars vertically connected is used as a vertical transportation means inside such buildings. This type of elevator is called a "double-deck elevator".

In the double-deck elevator, there is a type equipped with an inter-floor adjustment function, which adjusts the distance between upper and lower cars within a car frame by moving the cars relative to each other. Even when the height of each floor of the building is not constant, the upper and lower cars can stop in accordance with heights of the respective floors, by the inter-floor adjustment function.

In addition, for example, if an earthquake occurs, "earthquake emergency operation" of making an emergency stop on nearest floors and allowing the passengers to get off is executed at an elevator. At this time, it is determined whether the elevator can stop on the nearest floors within a predetermined period (approximately ten seconds) after occurrence of an earthquake. If the elevator cannot stop on the nearest floors within a predetermined period, the elevator is forced to reduce the speed and immediately stopped.

However, even if the double-deck elevator with an inter-floor adjustment function can stop on the nearest floors within a predetermined period, inter-floor adjustment between the upper and lower cars may not

have been ended. In such a case, since doors of the upper and lower cars cannot be opened, the passengers may be trapped in the cars.

5 The embodiments described herein aim to provide an elevator with an inter-floor adjustment function, capable of preventing a trap accident which may occur for the reason that the inter-floor adjustment is not completed when abnormal conditions occur.

SUMMARY

10 In general, according to one embodiment, an elevator with an inter-floor adjustment function, including a car frame in which at least two cars are vertically connected to each other and being capable of adjusting a distance between the cars in the car frame,
15 includes an elevator controller and an inter-floor adjustment controller.

The elevator controller urges the car frame to run to nearest floors when abnormal conditions occur.

20 The inter-floor adjustment controller comprises a completion possibility determining module configured to determine whether an inter-floor adjustment operation of the car frame is completed within a preset first period when the car frame is urged to run to the nearest floors by the elevator controller, and stops
25 the inter-floor adjustment operation of the car frame if it is determined that the inter-floor adjustment operation of the car frame is completed within the first period.

BRIEF DESCRIPTION OF THE DRAWINGS

30 FIG. 1 is an illustration showing a structure of an elevator with an inter-floor adjustment function according to First Embodiment.

FIG. 2 is a diagram showing a constitution of a memory device provided on the elevator according to
35 First Embodiment.

FIG. 3 is an illustration showing an inter-floor distance table provided on the elevator according to

First Embodiment.

FIG. 4 is an illustration showing an operation speed table provided on the elevator according to First Embodiment.

5 FIG. 5 is a block diagram showing a functional configuration of an elevator controller and an inter-floor adjustment controller according to First Embodiment.

10 FIG. 6 is a flowchart showing processing at an earthquake emergency operation of the elevator according to First Embodiment.

15 FIG. 7 is a block diagram showing a functional configuration of an elevator controller and an inter-floor adjustment controller according to Second Embodiment.

FIG. 8 is an illustration for explanation of a door-open permission zone of the elevator according to Second Embodiment.

20 FIG. 9 is a flowchart showing processing at an earthquake emergency operation of the elevator according to Second Embodiment.

DETAILED DESCRIPTION

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

25 (First Embodiment)

FIG. 1 shows a structure of an elevator with an inter-floor adjustment function according to First Embodiment. The elevator is explained as a double-deck elevator comprising two cars 2 and 3 (hereinafter referred to as an upper car and a lower car) in a car frame 1.

30 A main rope 13 is wound around a traction machine 11 via a deflector sheave 12, etc. A car frame 1 ascends and descends in a hoistway via the main rope 13, by the drive of the traction machine 11. An upper car 2 and a lower car 3 are connected to the car frame 1 by means of ball screws 5a, 5b, 6a and 6b so as to be

freely movable in a vertical direction. The ball screws 5a, 5b, 6a and 6b are supported by an upper beam 1a and an intermediate beam 7, and move the upper car 2 and the lower car 3 in the upper and lower directions, by driving motors 4a and 4b.

An inter-floor adjustment controller 20, a door controller (not shown), etc., are mounted in the car frame 1. These devices are connected to an elevator controller 10 via a tail cord 14 arranged on a duct-under-car 15.

The elevator controller 10 is a so-called "control panel", which is installed in a machine room, etc. of a building. The elevator controller 10 executes overall control of the elevator including the drive control of the traction machine 11. A seismic sensor 16 is connected to the elevator controller 10.

When an earthquake of a predetermined level or higher is detected by the earthquake sensor 16, the elevator controller 10 stops the running car frame 1 at nearest floors, allows the passengers to get off and stands by. Such an operation is called "earthquake emergency operation".

On the other hand, the inter-floor adjustment controller 20 drives the motors 4a and 4b and adjusts a distance between the upper car 2 and the lower car 3 in accordance with instructions from the elevator controller 10. The inter-floor adjustment controller 20 comprises an exchangeable memory device 30. As the memory device 30, for example, an EEPROM, a memory card or a USB memory can be used.

At the memory device 30, an inter-floor table 31 (FIG. 3) corresponding to a destination floor under control and an operation speed table 32 (FIG. 4) corresponding to a departure floor and a destination floor are provided as shown in FIG. 2.

FIG. 3 shows an example of the inter-floor table 31. In this example, an inter-floor distance between

destination floors under control as designated by a floor command signal output from the elevator controller 10 is indicated.

5 FIG. 4 shows an example of the operation speed table 32. A speed at an inter-floor adjustment operation is set in the operation speed table 32. For example, a parameter to allow the upper car 2 and the lower car 3 to move at a speed of 45 mm/s, for running from 1F to 3F, is set. In the figure, a "-(minus)"
10 symbol indicates reducing the distance between the upper car 2 and the lower car 3.

A landing control of the double-deck elevator will be briefly described.

15 In the double-deck elevator, when the elevator moves to the destination floors, the car frame 1 is positioned by a landing vane 21 for the car frame to urge the elevator to stop at the destination floors. More specifically, the elevator stops when a landing switch 24 provided at the car frame 1 enters a range of
20 the landing vane 21. In the double-deck elevator with the inter-floor adjustment function, a position of the landing vane 21 is determined to set a center of the car frame 1 to be a center of the inter-floor distance between the upper car 2 and the lower car 3.

25 In addition, at a moment when destination floors are determined, the inter-floor adjustment is started by driving the motors 4a and 4b and the interval between the upper car 2 and the lower car 3 in the car frame 1 is adjusted in accordance with an inter-floor
30 distance between the destination floors. Landing switches 25 and 26 are also provided for the upper car 2 the lower car 3, respectively, similarly to the car frame 1. Positioning (level adjustment) of the upper car 2 the lower car 3 can be confirmed, based on a
35 positional relationship between the landing switches 25 and 26 and landing vanes 22 and 23. The landing vanes 21 to 23 are arranged on a hoistway wall. In the

figure, 27a and 27b denote landing halls of the respective floors.

5 In the figure, 40 to 42 denote pulse generators (PGs). The PG 40 is mounted on a rotary shaft of the traction machine 11 and configured to output a pulse signal synchronously with the rotation of the traction machine 11. The PGs 41 and 42 are mounted on rotary shafts of the motors 4a and 4b for inter-floor adjustment, respectively, and configured to output pulse signals synchronously with rotations of the
10 motors 4a and 4b, respectively. The pulse signals are supplied to the elevator controller 10.

The elevator controller 10 and the inter-floor adjustment controller 20 are functionally separated in
15 FIG. 1. However physically, drive control portions of the motors 4a and 4b alone may be mounted on the car frame 1 and the other portions may be provided on the elevator controller.

FIG. 5 is a block diagram illustrating a
20 functional configuration of the elevator controller 10 and the inter-floor adjustment controller 20 according to the First Embodiment.

Each of the elevator controller 10 and the inter-floor adjustment controller 20 is equipped with an
25 input-output device (not shown) and various signals are handled via the input-output device. More specifically, when the destination floors (also called target floors) of the car frame 1 are determined, signals indicating the destination floors and an
30 adjustment command are output from the elevator controller 10 to the inter-floor adjustment controller 20. Thus, the inter-floor adjustment controller 20 reads inter-floor distance data corresponding to the destination floors from the memory device 30 and
35 adjusts the interval between the upper car 2 and the lower car 3 in the car frame 1 in accordance with an inter-floor distance between the destination floors.

The destination floors of the car frame 1 include the floor corresponding to the upper car 2 and the floor corresponding to the lower car 3.

5 The inter-floor adjustment controller 20 comprises
a completion possibility determining module 20a
configured to determine whether the inter-floor
adjustment operation of the car frame 1 (upper car 2
and lower car 3) is completed within a predetermined
period K_0 (approximately ten seconds) when the inter-
10 floor adjustment controller 20 receives an adjustment
command from the elevator controller 10. If the inter-
floor adjustment operation cannot be completed within
the predetermined period K_0 , the inter-floor adjustment
controller 20 outputs a determination result (No) to
15 the elevator controller 10. The elevator controller 10
thereby recognizes that the inter-floor adjustment
operation cannot be completed.

 If an earthquake of a predetermined level or
higher is detected by the seismic sensor 16, the
20 elevator controller 10 executes the earthquake
emergency operation of stopping the car frame 1 on the
nearest floors. The elevator controller 10 comprises a
stop possibility determining module 10a configured to
determine whether the car frame 1 can be stopped on the
25 nearest floors within a predetermined period T_0 in this
case. If the car frame 1 can be stopped on the nearest
floors within the predetermined period T_0 , the elevator
controller 10 urges the car frame 1 to run to the
nearest floors that are regarded as destination floors
30 and outputs the adjustment command to the inter-floor
adjustment controller 20.

 In contrast, if the car frame 1 cannot be stopped
on the nearest floors within the predetermined period
 T_0 , the elevator controller 10 forces the car frame 1
35 to decelerate and stop immediately. In addition, if
the determination result (No) is output from the inter-
floor adjustment controller 20 after the adjustment

command is output, the elevator controller 10 cancels the adjustment command and forces the car frame to decelerate and stop immediately.

5 It should be noted that if the determination result (No) is output from the inter-floor adjustment controller 20 to the elevator controller 10, the elevator controller 10 stops outputting the adjustment command to the inter-floor adjustment controller 20. The operation of the inter-floor adjustment controller
10 20 is thereby stopped. The elevator controller 10 mainly takes charge of the adjustment operation, to prevent the inter-floor adjustment controller 20 from arbitrarily stopping the adjustment operation under conditions other than the occurrence of earthquake.

15 Processing of the earthquake emergency operation will be hereinafter described.

FIG. 6 is a flowchart showing processing of an earthquake emergency operation of the elevator according to the First Embodiment.

20 If an earthquake of a predetermined level or higher is detected by the seismic sensor 16 (Yes in step A11), the elevator controller 10 determines whether the car frame 1 can be stopped on the nearest floors within the predetermined period T_0 (step A12).
25 More specifically, the floors nearest from a current position of the car frame 1 are regarded as the nearest floors. The elevator controller 10 determines whether the car frame 1 can be stopped, by calculating a time to reach the nearest floors, based on a distance to the
30 nearest floors and a running speed. The period T_0 is preset at, for example, ten seconds, based on a running speed at the control operation, etc.

35 If the car frame 1 cannot be stopped on the nearest floors within the predetermined period T_0 (No in step A13), the elevator controller 10 forces the car frame 1 to decelerate and stop immediately in vicinity of the nearest floors (step A23). This is because the

running is dangerous when an earthquake occurs on the way to the nearest floors. After the deceleration and stop, the car frame 1 awaits the predetermined period elapsing. If no earthquake occurs again during the
5 predetermined period, the car frame 1 restarts to the nearest floors from a position where the car frame 1 has decelerated and stopped, and the inter-floor adjustment is newly executed. When the car frame 1 lands on the nearest floors, the elevator controller 10
10 opens the door and allows the passengers to get off.

If the car frame 1 can be stopped on the nearest floors within the predetermined period To (Yes in step A13), the elevator controller 10 forces the car frame 1 to run to the nearest floors at a predetermined speed
15 (step A14). At this time, the elevator controller 10 outputs the adjustment command to set the nearest floors as the destination floors to the inter-floor adjustment controller 20 (step A15).

The inter-floor adjustment controller 20 receives
20 the adjustment command and starts the inter-floor adjustment operation (step A16). More specifically, the inter-floor adjustment controller 20 reads inter-floor distance data corresponding to the nearest floors from the inter-floor distance table 31 and reads
25 operation speed data corresponding to the distance from the current position to the nearest floors, from the operation speed table 32. The inter-floor adjustment controller 20 drives the motors 4a and 4b based on the data to match the distance between the upper car 2 and
30 the lower car 3 with the inter-floor distance between the nearest floors.

At this time, the inter-floor adjustment controller 20 determines whether the inter-floor adjustment operation can be completed within the
35 predetermined period Ko (step A17). If the inter-floor adjustment controller 20 determines that the inter-floor adjustment operation can be completed within the

predetermined period K_0 (Yes in step A18), the inter-floor adjustment controller 20 continues executing the inter-floor adjustment operation and matches the distance between the upper car 2 and the lower car 3 with the inter-floor distance between the nearest floors (step A19). The period K_0 is preset at, for example, ten seconds, based on the running speed of the inter-floor adjustment controller 20.

When the car frame 1 lands on the nearest floors, the elevator controller 10 opens the doors of the upper car 2 and the lower car 3, allows the passengers to get off, and stops the operation (step A20). The landing of the car frame 1 on the nearest floors can be recognized from a positional relationship between the landing switch 24 and the landing vane 21. In addition, it can be understood whether the upper car 2 and the lower car 3 are stopped at landing positions of the respective nearest floors, from the landing switches 25 and 26 and the landing vanes 22 and 23.

In contrast, if the inter-floor adjustment operation cannot be completed within the predetermined period K_0 (No in step A18), the elevator controller 10 stops outputting the adjustment command to the inter-floor adjustment controller 20 (step A21). The inter-floor adjustment controller 20 thereby stops the inter-floor adjustment operation (step A22).

In addition, when the elevator controller 10 receives a determination result (No) of the adjustment operation from the inter-floor adjustment controller 20, the elevator controller 10 forces the car frame 1 to decelerate and stop immediately (step A23). After the deceleration and stop, the car frame 1 awaits the predetermined period elapsing. If no earthquake occurs again during the predetermined period, the car frame 1 restarts to the nearest floors from a position where the car frame 1 has decelerated and stopped, and the inter-floor adjustment is newly executed. When the car

frame 1 lands on the nearest floors, the elevator controller 10 opens the doors and allows the passengers to get off.

5 Thus, the embodiment comprises the function of determining whether the inter-floor adjustment operation is completed within the predetermined period K_0 when the car frame 1 is stopped on the nearest floors when an earthquake occurs. If it is determined that the inter-floor adjustment operation is completed,
10 the inter-floor adjustment operation is stopped. Occurrence of a situation that the doors cannot be opened and the passengers may be trapped in the cars after stop on the nearest floors can be thereby prevented.

15 When the inter-floor adjustment operation is stopped, the car frame 1 is decelerated and stopped. After that, the car frame 1 is moved to the nearest floors from the position where the car frame 1 has been decelerated and stopped, at the time when the safety is
20 confirmed. Since the inter-floor adjustment is restarted at this time, the doors can be opened on the nearest floors to allow the passengers to get off in safety.

(Second Embodiment)

25 Next, Second Embodiment will be described.

In the First Embodiment, the inter-floor adjustment operation is stopped when it is determined that the inter-floor adjustment operation is not completed within the predetermined period K_0 . In the
30 Second Embodiment, the operation speed for the inter-floor adjustment and the inter-floor distance are varied arbitrarily.

FIG. 7 is a block diagram showing a functional configuration of an elevator controller 10 and an
35 inter-floor adjustment controller 20 according to the Second Embodiment.

Portions like those of the First Embodiment shown

in FIG. 5 are denoted by the same reference numbers and their detailed descriptions are omitted.

In the Second Embodiment, the inter-floor adjustment controller 20 comprises a speed variation
5 determining module 20b and an inter-floor distance variation determining module 20c besides a completion possibility determining module 20a.

If it is determined by the completion possibility determining module 20a that the inter-floor adjustment
10 operation of a car frame 1 is not completed within a predetermined period K_0 , the speed variation determining module 20b determines whether the inter-floor adjustment operation can be completed within the period K_0 by increasing the operation speed of the
15 adjustment up to a maximum speed. If it is determined by the speed variation determining module 20b that the inter-floor adjustment operation can be completed within the period K_0 , the inter-floor adjustment controller 20 increases the operation speed to the
20 maximum speed and executes the inter-floor adjustment of the car frame 1.

If it is determined that the inter-floor adjustment operation of the car frame 1 is not
completed within predetermined period K_0 , the inter-floor distance variation determining module 20c
25 determines whether the inter-floor adjustment operation can be completed within the period K_0 by varying the inter-floor distance in a door-open permission zone. If it is determined by the inter-floor distance
30 variation determining module 20c that the inter-floor adjustment operation can be completed within the period K_0 , the inter-floor adjustment controller 20 varies the inter-floor distance between the nearest floors and executes the inter-floor adjustment of the car frame 1.

35 The door-open permission zone is a range in which the doors can be opened as defined by landing vanes 22 and 23 for cars and is also called "door-open run

protection zone". When the upper car 2 and the lower car 3 are landed within the door-open permission zone, opening the doors is permitted. If the doors are opened outside the door-open permission zone for any abnormal conditions, running is prohibited.

If the upper car 2 and the lower car 3 are correctly landed on landing halls 27a and 27b of respective floors as shown in FIG. 8, the landing switches 25 and 26 are positioned within ranges of the landing vanes 22 and 23, i.e., door-open permission zones, respectively. 2a and 3a denote car doors, which are opened in accordance with landing doors (not shown) at the landing.

It is desirable that when the upper car 2 and the lower car 3 are landed on arbitrary floors, the upper car 2 and the lower car 3, ideally, should be landed such that the landing switches 25 and 26 are at central positions of the landing vanes 22 and 23, respectively. However, if the landing switches 25 and 26 are positioned within the ranges of the landing vanes 22 and 23, opening the doors of the upper car 2 and the lower car 3 are permitted. Thus, if the inter-floor adjustment operation can be completed within the period K_0 , the inter-floor distance between the nearest floors is varied within the ranges of the landing vanes 22 and 23, i.e., the door-open permission zones and the inter-floor adjustment of the car frame 1 is executed.

Next, processing of an earthquake emergency operation will be described.

FIG. 9 is a flowchart showing the processing of the earthquake emergency operation of the elevator according to the Second Embodiment. The processing in steps B11 to steps B20 in FIG. 9 is the same as the processing in steps A11 to steps A20 in FIG. 6. In addition, processing of No→B28 in step B13 is the same as the processing of No→A23 in step A13 in FIG. 6.

In the Second Embodiment, if it is determined in

step B18 that the inter-floor adjustment operation cannot be executed within the predetermined period Ko (No in step B18), the inter-floor adjustment controller 20 acquires the maximum speed of the article (step B21). The inter-floor adjustment controller 20 determines whether the inter-floor adjustment operation can be executed within the predetermined period Ko by increasing the operation speed for the adjustment up to the maximum speed (step B22). The "maximum speed of the article" indicates the maximum speed defined by the inter-floor adjustment control function mounted on the elevator of the present embodiment.

The operation speed of the inter-floor adjustment is preset based on a relationship between the departure floors and the destination floors as shown in FIG. 4. The operation speed is not the maximum speed, but a rated speed including a margin to some extent. This is because if the operation speed of the inter-floor adjustment becomes higher, the upper car 2 and the lower car 3 are greatly vibrated and the passengers often feel uncomfortable and noise is often generated. In preparation for emergency caused by the occurrence of earthquake, however, the inter-floor adjustment is granted higher priority than riding comfort.

If the inter-floor adjustment operation can be completed within the period Ko at the maximum speed (Yes in step B23), the inter-floor adjustment controller 20 increases the operation speed of the inter-floor adjustment up to the maximum speed, executes the inter-floor adjustment, and completes the operation within the period Ko (step B19).

If the inter-floor adjustment operation cannot be completed within the period Ko by increasing the operation speed of the inter-floor adjustment up to the maximum speed (No in step B23), the inter-floor adjustment controller 20 determines whether the inter-floor adjustment operation can be completed within the

period Ko by varying the inter-floor distance in the door-open permission zone as described in FIG. 8 (step B24). If the inter-floor adjustment operation can be completed within the period Ko by varying the inter-floor distance (Yes in step B25), the inter-floor adjustment controller 20 adjusts the inter-floor distance between the nearest floors in the door-open permission zone and completes the inter-floor adjustment operation within the period Ko (step B19).

If the inter-floor adjustment operation cannot be completed within the period Ko by even varying the inter-floor distance (No in step B25), the inter-floor adjustment controller 20 outputs a determination result (No) to the elevator controller 10 (step B26) and stops the inter-floor adjustment operation (step B27).

In addition, when the elevator controller 10 receives the determination result (No) of the adjustment operation from the inter-floor adjustment controller 20, the elevator controller 10 compulsorily decelerates and immediately stops the car frame 1 (step B28). After the deceleration and stop, the elevator controller 10 awaits a predetermined period elapsing. If an earthquake does not occur again during the period, the elevator controller 10 moves the car frame 1 to the nearest floors from the position where the car frame 1 has decelerated and stopped, restarts the inter-floor adjustment and allows the passengers to get off on the nearest floors.

Thus, according to the Second Embodiment, the operation speed of the inter-floor adjustment and the inter-floor distance are arbitrarily varied such that the inter-floor adjustment operation can be completed within the period Ko. Occurrence of a situation that the doors cannot be opened and the passengers are trapped in the cars after the stop on the nearest floors can be thereby prevented, similarly to the First Embodiment.

The embodiments have been described on an assumption that an earthquake would occur. However, they can be applied to occurrence of abnormal conditions that require the elevator (car frame 1) to
5 be stopped on the nearest floors, such as a case where a building is greatly rocked by a strong wind.

According to at least one of the above-described embodiments, the elevator with the inter-floor adjustment function, capable of preventing a trap
10 accident which may occur for the reason that the inter-floor adjustment is not completed on the nearest floors when abnormal conditions occur, can be provided.

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

WHAT IS CLAIMED IS:

1. An elevator with an inter-floor adjustment function, including a car frame in which at least two cars are vertically connected to each other and being
5 capable of adjusting a distance between the cars in the car frame,

the elevator comprising:

an elevator controller configured to urge the car frame to run to nearest floors when abnormal conditions
10 occur; and

an inter-floor adjustment controller configured to comprise a completion possibility determining module configured to determine whether an inter-floor adjustment operation of the car frame is completed
15 within a preset first period when the car frame is urged to run to the nearest floors by the elevator controller, and to stop the inter-floor adjustment operation of the car frame if it is determined that the inter-floor adjustment operation of the car frame is
20 completed within the first period.

2. The elevator of Claim 1, wherein the inter-floor adjustment controller starts the inter-floor adjustment operation of the car frame when the car frame runs to the nearest floors and, if it is
25 determined during the operation by the completion possibility determining module that the inter-floor adjustment operation of the car frame is not completed within the first period, stops the inter-floor adjustment operation of the car frame.

3. The elevator of Claim 1, wherein the inter-floor adjustment controller further comprises a speed variation determining module configured to determine whether the inter-floor adjustment operation of the car frame is completed by increasing an operation speed at
35 the adjustment up to a maximum speed if it is determined that the inter-floor adjustment operation of the car frame is not completed within the first period

and, if it is determined that the inter-floor
adjustment operation is completed within the first
period, increases the operation speed to the maximum
speed and executes the inter-floor adjustment operation
5 of the car frame.

4. The elevator of Claim 1, wherein the inter-
floor adjustment controller further comprises an inter-
floor distance variation determining module configured
to determine whether the inter-floor adjustment
10 operation of the car frame is completed by varying the
inter-floor distance within a door-open permission zone
if it is determined that the inter-floor adjustment
operation of the car frame is not completed within the
first period and, if it is determined that the inter-
15 floor adjustment operation is completed within the
first period, varies the inter-floor distance between
the nearest floors within the door-open permission zone
and executes the inter-floor adjustment operation of
the car frame.

5. The elevator of Claim 1, wherein the elevator
controller comprises a stop possibility determining
module configured to determine whether the car frame is
able to be stopped on the nearest floors within a
preset second period and, if the car frame is unable to
25 be stopped within the second period or if it is
determined that the inter-floor adjustment operation of
the car frame is not completed within the first period,
forces running of the car frame to decelerate and stop.