

DESCRIPTION

PASSENGER CONVEYOR SYSTEM AND PASSENGER CONVEYOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of and priority to Japanese Patent Application No. 2022-86587 filed on May 27, 2022, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

An embodiment of the present invention relates to a passenger conveyor system and a passenger conveyor capable of alerting a passenger to an emergency that occurs to the passenger conveyor.

2. Description of Related Art

Passenger conveyors such as an escalator and a moving walkway have potentials for accidents such as a passenger falling over, falling down, or being caught in a gap between a step and a skirt guard.

For this reason, in order to enhance safety, the passenger conveyor is provided with various safety devices such as a skirt guard catch detector, an inlet catch detector, and a step lift detector.

Examples of related art include JP2011-195289A and JP2014-15306A.

SUMMARY OF THE INVENTION

However, in the case where an emergency occurs when the escalator steps are

ascending or descending, a passenger on a lower step side of a position of the emergency may be hit by dropped baggage or another passenger who has fallen over and fallen down, causing secondary damage. In addition, in the case where the emergency occurs to the descending escalator step or the moving walkway, the passenger who is located behind the position of the emergency in an advancing direction may stumble on the dropped baggage or the other passenger who has fallen over, causing the secondary damage. However, conventionally, safety measures against such types of the secondary damage are not taken.

In view of the above problem, an embodiment of the invention has a purpose of providing a passenger conveyor system and a passenger conveyor capable of alerting a passenger to an emergency that occurs to the passenger conveyor.

An embodiment of the invention is a passenger conveyor system having: a passenger conveyor that has a step running in a front-rear direction, a balustrade made of a transparent member provided on both right and left sides of the step, and one or plural transparent displays provided to the balustrade; a camera that captures an image of the passenger conveyor; and a controller that displays an alert on the transparent display when detecting an emergency of the passenger conveyor on the basis of the image captured by the camera. The controller determines presence or absence of a passenger on a rear side in an advancing direction of a position where the emergency is detected, and displays the alert on the transparent display that is located ahead of the passenger in the advancing direction in the case where the passenger is present.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an explanatory view illustrating a side surface of an escalator according to an embodiment of the invention, and is a view in which a structure on a left side is not illustrated when a lower floor is seen from an upper floor;

FIG. 2 is a simplified view for explaining a control method 1 for the escalator according to the embodiment of the invention;

FIG. 3 is a block diagram for explaining an electrical configuration of the escalator according to the embodiment of the invention;

Fig. 4 is a flowchart for the escalator illustrating the control method 1 according to the embodiment of the invention;

FIG. 5 is a simplified view for explaining a control method 2 for the escalator according to the embodiment of the invention; and

Fig. 6 is a flowchart for the escalator illustrating the control method 2 according to the embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

A description will hereinafter be made on an escalator according to an embodiment of the invention with reference to FIGS. 1 to 6.

(1) Escalator 10

A description will be made on a structure of an escalator 10 with reference to FIGS. 1 to 3.

A truss 12 as a framework of the escalator 10 is supported by using support angles 2, 3 across an upper floor and a lower floor of a building 1.

A drive unit 18 for running a step 30 in a front-rear direction, a right and left pair of drive sprockets 24, 24, and a right and left pair of belt sprockets 27, 27 are provided in a machine room 14 on the upper floor side in an upper end portion of the truss 12. The drive unit 18 has: a motor 20 constructed of an induction motor; a decelerator; an output sprocket that is attached to an output shaft of this decelerator; a drive chain 22 that is driven by this output sprocket; and a disc brake that stops rotation of the motor 20 and keeps a stopped state

thereof. This drive chain 22 rotates the drive sprocket 24. The right and left pair of the drive sprockets 24, 24 and the right and left pair of the belt sprockets 27, 27 are coupled by a coupling belt, which is not illustrated, and are rotated synchronously. In addition, a controller 50 that controls the motor 20, the disc brake, and the like is provided in the machine room 14 on the upper floor side.

A driven sprocket 26 is provided in a machine room 16 on the lower floor side in a lower end portion of the truss 12. A right and left pair of endless step chains 28, 28 is hung between the drive sprocket 24 on the upper floor side and the driven sprocket 26 on the lower floor side. In other words, wheels 301 of the plural steps 30 are attached at equally-spaced intervals to the right and left pair of step chains 28, 28. The wheel 301 of the step 30 runs along a guide rail, which is not illustrated and is fixed to the truss 12, and turns upside down by engagement with a recess in an outer circumferential portion of the drive sprocket 24 and a recess in an outer circumferential portion of the driven sprocket 26. A wheel 302 runs on a guide rail 25 that is fixed to the truss 12.

A right and left pair of skirt guards 44, 44 and a right and left pair of balustrades 36, 36 vertically provided on both right and left sides of the truss 12. A handrail 39 is provided on top of the balustrade 36, and a handrail belt 38 moves along this handrail 39. A front skirt guard 40 on the upper floor side is provided to a front lower portion on the upper floor side of the balustrade 36. A front skirt guard 42 on the lower floor side is provided to a front lower portion on the lower floor side of the balustrade 36. Inlets 46, 48 as entry/exit points of the handrail belt 38 are projected from the front skirt guards 40, 42, respectively. The skirt guard 44 is provided to a lower side portion of the balustrade 36, and the step 30 runs between the right and left pair of the skirt guards 44, 44. Control panels 52, 56 and speakers 54, 58 are respectively provided on an inner surface of the skirt guard 44 on the upper and lower floor sides.

The balustrade 36 is made of a transparent member such as glass or an acrylic material. As illustrated in FIG. 2, transparent displays 74A to D constituting a display device 70, which will be described below, are provided inside the balustrade 36. The entire balustrade 36 is transparent and colorless to the extent that an object behind the balustrade 36 is visible through the transparent displays 74A to D. As illustrated in FIG. 3, the display device 70 has: a receiving section 72 that receives a signal from the controller 50; and the transparent displays 74A to D. The transparent display may be made from organic electroluminescent (EL) or an organic light-emitting diode (OLED), for example, and may project an image onto the transparent display from a projection section provided in the skirt guard 44.

The handrail belt 38 enters the front skirt guard 40 from the inlet 46 on the upper floor side, is wound around the belt sprocket 27 via a guide roller group 64, then moves inside the skirt guard 44 via a guide roller group 66, and moves out of the front skirt guard 42 from the inlet 48 on the lower floor side. Then, the handrail belt 38 synchronously moves with the step 30 by co-rotation of the belt sprocket 27 and the drive sprocket 24. This running handrail belt 38 is pressed against the rotating belt sprocket 27 by a pressing member 68.

A landing board 32 on the upper floor side is horizontally provided at a landing on a ceiling surface of the machine room 14 on the upper floor side, and a landing board 34 on a lower floor side is horizontally provided at a landing on a ceiling surface of the machine room 16 on the lower floor side. A comb 60 with teeth is provided at a tip of the landing board 32, and the step 30 advances or enters from this comb 60. In addition, a comb 62 with teeth is provided to the landing board 34.

As illustrated in FIG. 2, a ceiling surface of the building 1 is provided with a camera 80 that can capture an image of a situation from the upper floor side to the lower floor side of the escalator 10. The camera 80 is preferably of a model that can capture a wide-angle image in high-resolution. An installation position of the camera 80 is determined such that the entire

escalator 10 can be grasped. The plural cameras 80 may be used to capture the image.

(2) Electrical Configuration of Escalator 10

A description will be made on an electrical configuration of the escalator 10 with reference to FIGS. 2 and 3.

The controller 50 has a transmission section 51 that transmits a signal. The display device 70 has: the receiving section 72 that receives the signal from the controller 50; and the transparent display 74. The controller 50 and the display device 70 are connected via the transmission section 51 and the receiving section 72. The drive unit 18, the control panels 52, 56, the speakers 54, 58, and the camera 80 are also connected to the controller 50.

(3) Control method 1 for Display Device 70

A description will be made on a control method 1 for the escalator 10 in the embodiment with reference to FIGS. 2 to 4. This control method 1 is a control method to ensure safety of a passenger who is located on a rear side (the upper floor side) of a position of an emergency in an advancing direction when the emergency occurs while the steps 30 of the escalator 10 are descending as illustrated in FIG. 2, for example.

FIG. 4 is a flowchart of the control method 1 for the escalator according to this embodiment. In step S1, the controller 50 controls the camera 80 to capture an image of a predetermined imaging area from the upper landing to the lower landing of the escalator 10. Next, the processing proceeds to step S2.

In step S2, the controller 50 analyzes the image acquired in step S1. Through this image analysis, information is acquired to comprehend a position of the passenger on the escalator 10, a moving direction of the escalator 10, presence or absence of the passenger's hand baggage, a body posture of the passenger, and the like. Next, the processing proceeds to step S3.

In step S3, the controller 50 determines whether the emergency occurs on the basis

of the information acquired in step S2. If the emergency occurs, the processing proceeds to step S4 (YES). If the emergency does not occur, the processing returns to step S1 (NO). Here, examples of the emergency are falling over of the passenger, dropping of the passenger's hand baggage, and congestion at the lower landing.

In step S4, the controller 50 identifies the position where the emergency occurs (for example, a position of a point X in FIG. 2 when a passenger 100 falls over at the position X that is 5 m ahead of the upper floor) on the basis of the information acquired in step S2. Next, the processing proceeds to step S5.

In step S5, based on the information acquired in step S2, the controller 50 checks whether the passenger is present on the rear side of the position identified in step S4, where the emergency occurs, in the advancing direction, that is, in an area between the position of the point X in FIG. 2 and the landing board 32 (see FIG. 1) on the upper floor. If the passenger is present on the rear side in the advancing direction, the processing proceeds to step S6 (YES). If the passenger is not present on the rear side in the advancing direction, the processing returns to step S1 (NO).

In step S6, based on the information acquired in step S2, the controller 50 identifies a position of a passenger 101 who is located on the rear side in the advancing direction and is identified in step S5 (for example, a position of a point Y in FIG. 2 that is 1 m ahead of the upper floor). Next, the processing proceeds to step S7.

In step S7, the controller 50 transmits a signal indicative of occurrence of the emergency and positional information of the passenger 101 (the position of the point Y in FIG. 2 as the position that is 1 m ahead of the upper floor). Then, the display device 70 that receives the information displays an alert such as "ATTENTION TO FRONT" on the transparent display 74C that is located ahead of the passenger 101 in the advancing direction, so as to notify the passenger 101 that the emergency occurs ahead in the advancing direction. Next,

the processing proceeds to step S8.

In step S8, the controller 50 executes the processing in steps S1 to S3 and checks whether the emergency is resolved. If the emergency is resolved, the processing proceeds to step S9 (YES). If the emergency is not resolved, the processing returns to step S5 (NO).

In step S9, the controller 50 hides the transparent display 74 and terminates the display of the alert to the passenger. Then, the processing returns to step S1.

(4) Effects

According to this embodiment, the passenger 101 on the rear side (the upper floor side) in the advancing direction can be alerted when the emergency occurs ahead (on the lower floor side) in the advancing direction. Thus, it is possible to prevent the passenger 101 from stumbling on the dropped baggage or the passenger 100 who has fallen over. In particular, in the case of the alert from the speakers 54, 58, only the passenger near the speakers 54, 58 can hear the alert depending on a situation such as surrounding noise. However, by displaying the alert on the transparent display 74 in the balustrade 36, the passenger can effectively be alerted without being affected by the surrounding situation regardless of the position of the passenger.

In addition, when the emergency does not occur, the transparent display 74 can be hidden to maintain design or can effectively be used to display an advertisement, a pattern, or the like.

In this control method 1, also when the emergency occurs while the steps 30 of the escalator 10 are ascending, it is possible to ensure the safety of the passenger on the lower floor side of the position of the emergency. In other words, since the passenger on the rear side (the lower floor side) in the advancing direction can be alerted, the passenger can be prevented from being hit by the dropped baggage or the other passenger who has fallen over and fallen down.

(5) Control method 2 for Display Device 70

A description will be made on a control method 2 for the escalator 10 in the embodiment with reference to FIGS. 3, 5, and 6. This control method 2 is a control method to ensure the safety of the passenger who is located on the lower floor side of the position of the emergency when the emergency occurs while the steps 30 of the escalator 10 are descending as illustrated in FIG. 5, for example.

FIG. 6 is a flowchart of the control method 2 for the escalator according to this embodiment. In step S21, the controller 50 controls the camera 80 to capture the image of the predetermined imaging area from the upper landing to the lower landing of the escalator 10. Next, the processing proceeds to step S22.

In step S22, the controller 50 analyzes the image acquired in step S21. Through this image analysis, the information is acquired to comprehend the position of the passenger on the escalator 10, the moving direction of the escalator 10, the presence or the absence of the passenger's hand baggage, the body posture of the passenger, and the like. Next, the processing proceeds to step S23.

In step S23, the controller 50 determines whether the emergency occurs on the basis of the information acquired in step S22. If the emergency occurs, the processing proceeds to step S24 (YES). If the emergency does not occur, the processing returns to step S21 (NO). Here, the examples of the emergency are falling over of the passenger, dropping of the passenger's hand baggage, and the congestion at the lower landing.

In step S24, the controller 50 identifies the position where the emergency occurs (for example, a position of a point P in FIG. 5 when a passenger 103 falls over at the position P that is 1 m ahead of the upper floor) on the basis of the information acquired in step S22. Next, the processing proceeds to step S25.

In step S25, based on the information acquired in step S22, the controller 50 checks

whether the passenger is present on the lower floor side of the position identified in step S24, where the emergency occurs, that is, in an area between the position of the point P in FIG. 5 and the landing board 34 (see FIG. 1) on the lower floor. If the passenger is present on the lower floor side, the processing proceeds to step S26 (YES). If the passenger is not present on the lower floor side, the processing returns to step S21 (NO).

In step S26, based on the information acquired in step S22, the controller 50 identifies a position of a passenger 104 who is located on the lower floor side and is identified in step S25 (for example, a position of a point Q in FIG. 5 that is 5 m ahead of the upper floor). Next, the processing proceeds to step S27.

In step S27, the controller 50 transmits the signal indicative of the occurrence of the emergency and positional information of the passenger 104 (the position of the point Q in FIG. 5 as the position that is 5 m ahead of the upper floor). Then, the display device 70 that receives the information displays an alert such as "ATTENTION TO ABOVE" on the transparent display 74A that is located ahead of the passenger 104, who is unaware of falling over of the passenger 103 on the upper floor side, in the advancing direction, so as to notify the passenger 104 that the emergency occurs on the upper floor side. Next, the processing proceeds to step S28.

In step S28, the controller 50 executes the processing in steps S21 to S23 and checks whether the emergency is resolved. If the emergency is resolved, the processing proceeds to step S29 (YES). If the emergency is not resolved, the processing returns to step S25 (NO).

In step S29, the controller 50 hides the transparent display 74 and terminates the display of the alert to the passenger. Then, the processing returns to step S21.

(6) Effects

In the case where the emergency occurs on the upper floor side in the escalator 10, the steps 30 of which are descending, it is difficult for the passenger whose back is turned to

the upper floor side to recognize the emergency on the upper floor side. However, according to this embodiment, the passenger on the lower floor side can be alerted when the emergency occurs on the upper floor side. In addition, by displaying the alert on the transparent display 74 in the balustrade 36, the passenger can effectively be alerted without being affected by the situation such as the surrounding noise regardless of the position of the passenger.

In this control method 2, also when the emergency occurs while the steps 30 of the escalator 10 are ascending, it is possible to ensure the safety of the passenger on the lower floor side of the position of the emergency. In other words, according to this embodiment, since the passenger on the lower floor side can be alerted regardless of an operating direction of the escalator 10, the passenger can be prevented from being hit by the dropped baggage or the other passenger who has fallen over and fallen down.

In addition, when the emergency does not occur, the transparent display 74 can be hidden to maintain the design or can effectively be used to display the advertisement, the pattern, or the like.

(7) Modified Examples

In the above embodiment, the description has been made on the example in which the transparent displays 74A to D are disposed on the entire surface of the balustrade 36. However, the only one transparent display 74 may be provided. In such a case, for example, the transparent display 74 is preferably disposed in an area on the lower floor side from vicinity of a center in a height direction of the escalator 10. Alternatively, the transparent display 74 may be disposed on each of the right and left sides or may be disposed on one of the right and left sides.

In the above embodiment, the description has been made on the example in which the position of the passenger is identified and the alert is displayed on the transparent display 74 that is located ahead of the position of the passenger in the advancing direction. However,

the alert may be displayed on all of the transparent displays 74A to D.

In the above embodiment, the description has been made on the example in which the alert is provided by using the display device 70. However, in addition thereto, an audible alert may be provided from the speakers 54, 58.

In the above embodiment, the description has been made on the example in which the passenger conveyor is the escalator. However, the passenger conveyor may be a moving walkway, and, in such a case, similar control to that in the control method 1 can be executed.

The above description has been made on the embodiment of the invention. However, this embodiment is merely provided as the example and thus is not intended to limit the scope of the invention. These novel embodiments can be implemented in any of various other aspects, and various types of elimination, replacement, and changes can be made thereto within the scope that does not depart from the gist of the invention. These embodiments and the modifications thereof are included in the scope and the gist of the invention and are also included in the invention described in the claims and the equivalent scope thereof.

Reference Signs List

- 1: building
- 10: escalator
- 12: truss
- 30: step
- 36: balustrade
- 38: handrail belt
- 39: handrail
- 50: controller

51: transmission section

70: display device

72: receiving section

74: transparent display

80: camera

CLAIMS

1. A passenger conveyor system comprising:

a passenger conveyor that has a step running in a front-rear direction, a balustrade made of a transparent member provided on both right and left sides of the step, and one or plural transparent displays provided to the balustrade;

a camera that captures an image of the passenger conveyor; and

a controller that displays an alert on the transparent display when detecting an emergency of the passenger conveyor on the basis of the image captured by the camera, wherein

the controller determines presence or absence of a passenger on a rear side in an advancing direction of a position where the emergency is detected, and displays the alert on the transparent display that is located ahead of the passenger in the advancing direction in the case where the passenger is present.

2. A passenger conveyor system comprising:

a passenger conveyor that has a step running in a front-rear direction, a balustrade made of a transparent member provided on both right and left sides of the step, and one or plural transparent displays provided to the balustrade;

a camera that captures an image of the passenger conveyor; and

a controller that displays an alert on the transparent display when detecting an emergency of the passenger conveyor on the basis of the image captured by the camera, wherein

the passenger conveyor is an escalator that connects an upper floor and a lower floor, and

the controller determines presence or absence of a passenger on a lower floor side of a position where the emergency is detected, and displays the alert on the transparent display that is located ahead of the passenger in an advancing direction in the case where the passenger is present.

3. The passenger conveyor system according to claim 1 or 2, wherein the emergency is dropping of a passenger's hand baggage or falling of a passenger.

4. A passenger conveyor comprising:

a step that runs in a front-rear direction;

a balustrade that is made of a transparent member provided on both right and left sides of the step;

one or plural transparent displays provided to the balustrade; and

a controller that displays an alert on the transparent display when detecting an emergency of the passenger conveyor on the basis of a captured image of the passenger conveyor, wherein

the controller determines presence or absence of a passenger on a rear side in an advancing direction of a position where the emergency is detected, and displays the alert on the transparent display that is located ahead of the passenger in the advancing direction in the case where the passenger is present.

5. A passenger conveyor comprising:

a step that runs in a front-rear direction;

a balustrade that is made of a transparent member provided on both right and left sides of the step;

one or plural transparent displays provided to the balustrade; and

a controller that displays an alert on the transparent display when detecting an emergency of the passenger conveyor on the basis of a captured image of the passenger conveyor, wherein

the passenger conveyor is an escalator that connects an upper floor and a lower floor,
and

the controller determines presence or absence of a passenger on a lower floor side of a position where the emergency is detected, and displays the alert on the transparent display that is located ahead of the passenger in an advancing direction in the case where the passenger is present.

6. The passenger conveyor according to claim 4 or 5, wherein

the emergency is dropping of a passenger's hand baggage or falling of a passenger.