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(54) CONTROL SYSTEM AND CONTROL METHOD FOR AN ELEVATOR

(57) The present invention provides a control system (100, 200) for an elevator (150) with a passenger cabin (151, 251), the control system (100, 200) comprising a volume sensor (101) configured to sense the unoccupied volume (102) of the passenger cabin (151, 251), and a control unit (103, 203) coupled to the volume sensor (101) and configured to control the movement of the elevator (150) based on the unoccupied volume (102), wherein the control unit (103, 203) is configured to move the passenger cabin (151, 251) past an externally requested stop (152, 153, 154) if the unoccupied volume (102) is below a predetermined threshold value (104, 204). Further, the present invention provides a respective control method.

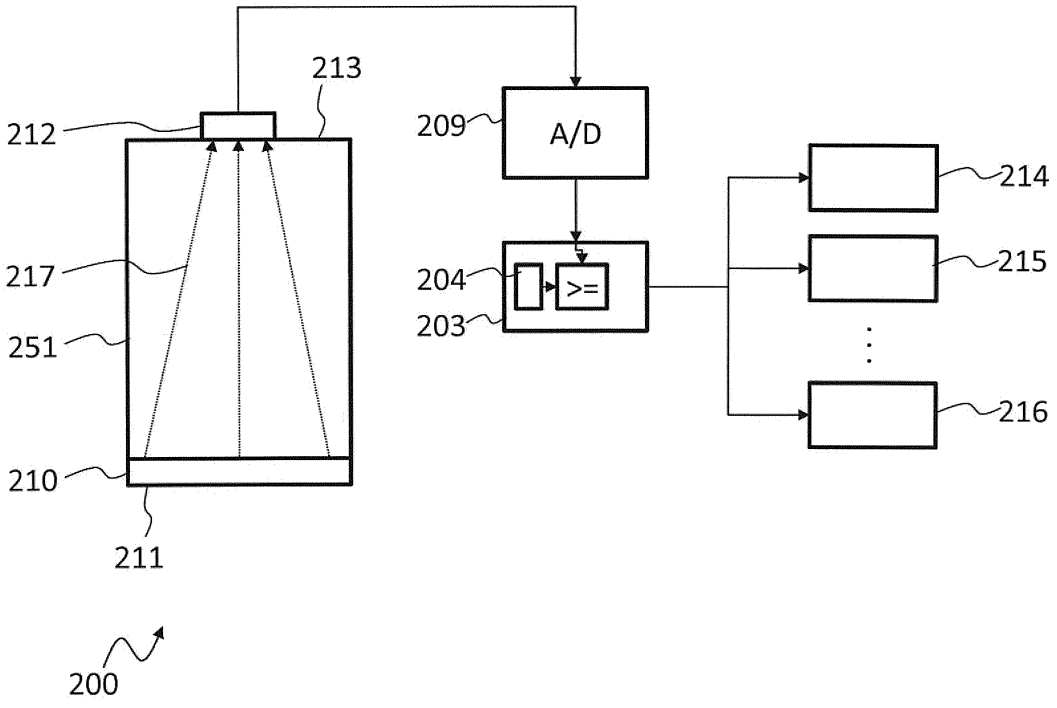

Fig. 2

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Description

TECHNICAL FIELD

[0001] The invention relates to a control system for an elevator. Further, the present invention relates to a respective control method.

BACKGROUND

[0002] Although applicable to any in building transport system, like airport terminal trains, the present invention will mainly be described in conjunction with elevators.

[0003] Elevators may be provided in buildings to transport people and objects between the different floors of that building. Lately elevators have been presented that also allow a horizontal movement in addition to a vertical movement.

[0004] Usually a person that wants to use the elevator will use a push button at the respective stop of the elevator to indicate the request to the control system of the elevator. The control system will then either dedicatedly move the elevator's passenger cabin to the stop at which the request was placed or will stop the passenger cabin at the respective stop while it is moving along the stop.

[0005] However, if the passenger cabin is already loaded to its maximum capacity, i.e. such that no further person may enter the passenger cabin, stopping the passenger cabin at the respective stop, delays the movement of the passenger cabin. The person that requested the stop will however not be able to enter the passenger cabin.

[0006] Accordingly, there is a need for an improved elevator control.

SUMMARY OF THE INVENTION

[0007] The present invention provides a control system with the features of claim 1 and a control method with the features of claim 7.

[0008] Accordingly, it is provided:

[0009] A control system for an elevator with a passenger cabin, the control system comprising a volume sensor configured to sense the unoccupied volume of the passenger cabin, and a control unit coupled to the volume sensor and configured to control the movement of the elevator based on the unoccupied volume, wherein the control unit is configured to move the passenger cabin past an externally requested stop if the unoccupied volume is below a predetermined threshold value.

[0010] Further, it is provided:

[0011] A control method for an elevator with a passenger cabin, the control method comprising sensing the unoccupied volume of the passenger cabin with a volume sensor, and controlling the movement of the elevator based on the unoccupied volume by moving the passenger cabin past an externally requested stop if the unoccupied volume is below a predetermined threshold value.

[0012] The present invention is based on the finding that elevator control that is based on requested stops may be inefficient, especially in large buildings with a plurality of floors or e.g. shopping malls, where the elevator is continuously requested.

[0013] The present invention therefore provides a control system for controlling an elevator that is not exclusively based on analyzing the requests that are provided by users via the respective call buttons in the respective floors.

[0014] Instead, the present invention provides a control system that analyzes the unoccupied volume in the passenger cabin of the elevator. The term "unoccupied volume" refers to the volume in the passenger cabin that is neither occupied by a person nor by another object, like e.g. a box or a palette.

[0015] The volume sensor may be any sensor that directly measures the unoccupied volume. Alternatively the sensor may also be a sensor that indirectly measures the unoccupied volume, e.g. by measuring a physical parameter in the passenger cabin.

[0016] Based on the unoccupied volume it is now possible to control the movement of the passenger cabin. The control unit may for example skip an externally requested stop if the passenger cabin is occupied at least to a predetermined extent.

[0017] An "externally requested stop" is a stop that is requested e.g. by the push of a button by a potential passenger outside of the passenger cabin. Usually an elevator will stop at every externally requested stop, even if no additional passenger may enter the passenger cabin because it is occupied. This may cause delays for the passengers. Further, such unneeded stops may increases the energy consumption of the elevator because accelerating from full stop is the most energy consuming movement of the passenger cabin.

[0018] With the present invention such unneeded stops may be avoided. Instead the control unit may determine based on the unoccupied volume that no further passengers may be accommodated in the passenger cabin. In this case the

control unit may determine to skip externally requested stops and move the passenger cabin to the next internally requested stop. An "internally requested stop" refers to a stop that is requested by a passenger in the passenger cabin.

[0019] It is understood, that an externally requested stop will not be skipped if it is also an internally requested stop, even if the unoccupied volume is below the predetermined threshold.

[0020] Summing up, the present invention provides an improved and more efficient control for elevators, i.e. the passenger cabin.

[0021] It is understood, that the control unit may e.g. comprise a processor, like e.g. in a microcontroller or in an industrial control computer. The control unit may e.g. be implemented as a firmware or a software that is executed by the processor. The processor may further be coupled via respective signal lines or digital data busses to the single elements of the control system. The processor may e.g. be coupled via an analog signal line to the light sensor. Further, the processor may e.g. be coupled via digital data lines to motor drivers of the elevator.

[0022] The control unit may also comprise a distributed arrangement, where a plurality of controllers or processors are interconnected in a data network.

[0023] Further embodiments of the present invention are subject of the further subclaims and of the following description, referring to the drawings.

[0024] In an embodiment, the volume sensor may comprise a light source and a light sensor arranged on opposite sides of the passenger cabin.

[0025] The light source may be any type of light source that generates and emits light of a wavelength that may be sensed by the light sensor. The light sensor may be any type of light sensor that converts the amount of incident light into a variable electric parameter, like e.g. a voltage, a current, a resistance or the like. It is understood, that the light source may provide light in the visible light spectrum or infrared light or the like.

[0026] It is further understood, that the light source may comprise more than a single light emitting element and/or a two-dimensional or flat light emitting element, like e.g. LED tiles. The same applies to the light sensor that may comprise more than a single light sensing element. The light source may e.g. comprise a plurality of light emitting elements that are distributed on a side of the passenger cabin. Respective light sensing elements may be provided on the opposite side of the passenger cabin.

[0027] Providing multiple light sources and multiple light sensors prevents the control unit from detecting a full passenger cabin if a single person occludes a single light source or light sensor.

[0028] With an empty passenger cabin, a maximum amount of light reaches the light sensor. In contrast, with a full passenger cabin, almost all light that is emitted by the light source will be blocked by people standing in the cabin or objects being transported in the cabin. The amount of light received by the light sensor will therefore be minimal.

[0029] The control unit may e.g. be pre-configured or parameterized with the maximum amount and the minimum amount of light that may reach the light sensor. With this knowledge the control unit may derive the filling level of the passenger cabin based on the amount of light that is sensed by the light sensor. The control unit may e.g. perform a linear mapping from the minimum amount of light to the maximum amount of light to a filling level, e.g. in percent. The maximum amount of light may e.g. reflect a 0% filling level or the respective amount of unoccupied volume and the minimum amount may reflect a 100% filling level or the respective amount of unoccupied volume in the passenger cabin.

[0030] The predetermined threshold value for the unoccupied volume may e.g. be determined such that at least one person may still fit into the passenger cabin if the unoccupied volume is below the predetermined threshold. This means that if the unoccupied volume is below the predetermined threshold, no further person will fit into the passenger cabin.

[0031] In an embodiment, the light source may comprise a planar light source, and the light sensor may comprise a light dependent resistor.

[0032] A planar light source may, as already indicated above, comprise LED tiles or the like. Such a light source may also be formed e.g. by tiles of frosted glass with a light source behind the frosted glass.

[0033] The light dependent resistor, also called photo resistor, is a light-controlled variable resistor. The resistance of the light dependent resistor decreases with increasing incident light. This means that in the dark the resistance value of the light dependent resistor may be as high as several mega ohms. In contrast under light illumination the resistance may be as low as a few hundred ohms.

[0034] This means that such a light sensor may easily be integrated into a variable voltage divider. The output of the voltage divider may then be sensed by the control unit, e.g. via an analog-to-digital converter.

[0035] In another embodiment, the planar light source may be arranged on a floor of the passenger cabin, and the light dependent resistor may be arranged on a ceiling of the passenger cabin. As an alternative, the planar light source may be arranged on the ceiling of the passenger cabin, and the light dependent resistor may be arranged on the floor of the passenger cabin.

[0036] When using the floor and the ceiling of the passenger cabin as the sides that hold the light source, a single person may not occlude at least the element on the ceiling. Especially if the light sensor is arranged on the ceiling and the light source is provided as a planar light source on the floor, it is made sure, that no single person completely occludes the light sensor or the light source. On the other hand, people and objects occlude as much of the light source as they

occupy of the surface of the floor of the passenger cabin. The measured amount of light therefore accurately represents the free space on the floor of the passenger cabin.

[0037] It is understood, that any other arrangement may be used. The light source and the light sensor may be provided on any opposing lateral sides of the passenger cabin. Further, the light source may e.g. comprise a plurality of laser light sources with respective light sensors that form a kind of grid for sensing the occupancy of the passenger cabin.

[0038] In a further embodiment, the volume sensor may comprise at least an ultrasonic sensor, especially a plurality of ultrasonic distance sensors.

[0039] Ultrasonic sensors may e.g. be distributed in the ceiling of the passenger cabin or on the lateral sides of the passenger cabin and measure the distance to the next object. If the passenger cabin is empty, the ultrasonic sensors will measure the distance to the opposite wall. If however, a person or an object is in the passenger cabin, the measured distance will be lower, i.e. the distance between the wall and the object. Therefore, the occupied space, and therefore also the unoccupied space, may be determined based on the measured distances.

[0040] If the distance sensors are provided in the ceiling, the sensors may e.g. be distributed based on an average surface that a person occupies in the passenger cabin. The distance sensors may e.g. be distributed in a grid with 30 cm distance between the distance sensors.

[0041] In another embodiment, the control system may comprise for at least one stop of the passenger cabin a display device that is coupled to the control unit. The control unit may be configured to display a status information about the unoccupied volume in the passenger cabin on the at least one display device.

[0042] Users that are waiting for the passenger cabin of the elevator may be informed by the status information on the display device about the situation in the passenger cabin. This information may e.g. be a binary-type information that indicates whether the passenger cabin will halt at the respective stop or not. Such a display device may e.g. be a single light, like a LED or the like.

[0043] As an alternative, this information may also comprise an indication of the unoccupied volume of the passenger cabin. This allows the user to decide whether he wants to wait for the passenger cabin or not. The indication of the unoccupied volume may e.g. be provided by colored lights, e.g. red, orange and green, by a bargraph light, or by a graphical display or e.g. 7-segment displays.

BRIEF DERCRIPTION OF THE DRAWINGS

[0044] For a more complete understanding of the present invention and advantages thereof, reference is now made to the following description taken in conjunction with the accompanying drawings. The invention is explained in more detail below using exemplary embodiments which are specified in the schematic figures of the drawings, in which:

Fig. 1 shows a block diagram of an embodiment of a control system according to the present invention;

Fig. 2 shows a block diagram of another embodiment of a control system according to the present invention;

Fig. 3 shows a flow diagram of an embodiment of a control method according to the present invention; and

Fig. 4 shows a flow diagram of another embodiment of a control method according to the present invention.

[0045] In the figures like reference signs denote like elements unless stated otherwise.

DETAILED DESCRIPTION OF THE DRAWINGS

[0046] Fig. 1 shows a block diagram of a control system 100 for controlling the movement of a passenger cabin 151 of an elevator 150. The elevator 150 comprises three exemplary stops 152, 153, 154 at which the passenger cabin 151 may stop for passengers to leave and enter the passenger cabin 151. It is understood, that although not shown, the elevator 150 may comprise a user interface, e.g. with push buttons installed inside of the passenger cabin 151 and at the stops 152, 153, 154, for users to request the passenger cabin 151 to halt at a specific stop 152, 153, 154.

[0047] The control system 100 comprises a volume sensor 101 that is installed inside of the passenger cabin 151 and provides a control unit 103 with an indication about the unoccupied volume 102 in the passenger cabin 151. The control unit 103 may then compare the value of the unoccupied volume 102 with a threshold value 104. If the unoccupied volume 102 is smaller than the threshold value 104, the control unit 103 determines that the passenger cabin 151 is fully occupied. In this case, the control unit 103 may ignore externally requested stops 152, 153, 154 and only halt the passenger cabin 151 at internally requested stops 152, 153, 154. Externally requested stops 152, 153, 154 are stops that are requested by passengers outside of the passenger cabin 151 on the respective floors. Internally requested stops 152, 153, 154 in contrast are stops 152, 153, 154 that are requested by a passenger inside of the passenger cabin 151.

[0048] It is understood, that the threshold value 104 may be determined based on a specific application of the control system 100 in an elevator 150. The threshold value 104 may e.g. be determined experimentally or by simulation or calculation.

[0049] It is further understood, that although not explicitly shown, the elevator 150 may comprise further elements, like e.g. a drive unit, a control device for the automatic doors, lighting in the passenger cabin 151, an intercom system and the like. It is further understood, that the control unit 103 may be integrated into a superordinate control of the passenger cabin 151. Such a superordinate control may e.g. take into account the time of day, and the number of externally and internally requested stops 152, 153, 154.

[0050] Fig. 2 shows a block diagram of another embodiment of a control system 200. The control system 200 is based on the control system 100. The control system 200 therefore also comprises a control unit 203 that analyzes the unoccupied volume and controls the movement of the passenger cabin 251 accordingly.

[0051] In the control system 200 the volume sensor comprises a light source 210 that is arranged on the floor 211 of the passenger cabin 251, and a light sensor 212 that is arranged on the ceiling 213 of the passenger cabin 251.

[0052] The light source 210 is a flat, panel-like light source that emits light from the surface of the floor 211 to the top or ceiling 213 of the passenger cabin 251. There the light sensor 212 receives a certain amount of incident light 217. The amount of incident light 217 that the light sensor 212 receives depends on the part of the floor 211 that is covered by objects or people. Therefore, with increasing occupancy of the passenger cabin 251 less light will reach the light sensor 212.

[0053] The signal from the light sensor 212 is provided via an analog-to-digital converter 209 to the control unit 203. In the control unit 203, the level of occupancy or the unoccupied volume is then compared with the threshold value 204. If the unoccupied volume is lower than the threshold value 204 the control unit 203 will control the movement of the passenger cabin 251 accordingly and not stop the passenger cabin 251 at externally requested stops.

[0054] It is understood, that the values provided by the light sensor 212 may be voltage levels that are converted by the analog-to-digital converter 209 into digital values for processing by the control unit 203. The control unit 203 may e. g. directly process the voltage values, i.e. the respective binary representations. It is understood, that the threshold value 204 will then be provided as voltage value or the respective binary value. As an alternative, the control unit 203 may also convert the voltage values into occupancy values and process the occupancy values.

[0055] The control unit 203 is coupled to display devices 214, 215, 216. Although only three display devices 214, 215, 216 are shown, it is understood, that any number of display devices is possible. For example, one display device may be provided on every floor of a building in which the elevator with the passenger cabin 251 is installed.

[0056] The control unit 203 may display on the display devices 214, 215, 216 the occupancy level of the passenger cabin 251. The control unit 203 may e.g. activate a red sign at the stops 152, 153, 154 if the passenger cabin 251 is occupied. Any other type of display is also possible.

[0057] In addition, the control unit 203 may for example indicate to waiting users via the display devices 214, 215, 216 that the occupancy of the passenger cabin 251 changed after people leave the passenger cabin 251 or large objects are removed from the passenger cabin 251.

[0058] Further, the control unit 203 may also comprise a timeout or skip counter. The timeout may e.g. determine a maximum time during which no halt is performed at a specific stop 152, 153, 154. The skip counter may instead of a time refer to the number of times that a stop 152, 153, 154 may be skipped.

[0059] For sake of clarity in the following description of the method based Figs. 3 and 4 the reference signs used above in the description of apparatus based Figs. 1 and 2 will be maintained.

[0060] Fig. 3 shows a flow diagram of an embodiment of a control method for an elevator 150 with a passenger cabin 151, 251.

[0061] The control method comprises sensing S1 the unoccupied volume 102 of the passenger cabin 151, 251 with a volume sensor 101. Further, the method comprises controlling S2 the movement of the elevator 150 based on the unoccupied volume 102 by moving the passenger cabin 151, 251 past an externally requested stop 152, 153, 154 if the unoccupied volume 102 is below a predetermined threshold value 104, 204. The requested stop 152, 153, 154 may be any stop 152, 153, 154 at which a user requested the elevator 150, i.e. the passenger cabin 151, 251, to stop.

[0062] Sensing S1 may be performed with a light source 210 and a light sensor 212 arranged on opposite sides of the passenger cabin 151, 251. The light source 210 may e.g. be provided as a planar light source 210, and the light sensor 212 may be provided as a light dependent resistor. The planar light source 210 may be arranged on a floor 211 of the passenger cabin 151, 251, and the light dependent resistor may be arranged on a ceiling 213 of the passenger cabin 151, 251, or vice versa.

[0063] Sensing S1 may further be performed with at least an ultrasonic sensor, especially a plurality of ultrasonic distance sensors.

[0064] In addition, the control method may comprise for at least one stop 152, 153, 154 of the passenger cabin 151, 251 displaying a status information about the unoccupied volume 102 in the passenger cabin 151, 251. It is understood, that the status information may e.g. be displayed via displays at every stop 152, 153, 154 of the passenger cabin 151, 251.

[0065] Fig. 4 shows a flow diagram of another embodiment of a control method for an elevator 150 with a passenger cabin 151, 251.

[0066] The control method starts in step S11 that leads to decision D11. In D11 it is verified if room is available in the passenger cabin 151, 251. The available room or the level of occupancy may e.g. be determined with the control system 100 or the control system 200 or based on the method explained with regard to Fig. 3.

[0067] If room for another person is available in the passenger cabin 151, 251, i.e. the passenger cabin 151, 251 is not fully occupied, in step S12 information about the passenger cabin 151, 251 not being fully occupied is displayed on display devices 214, 215, 216 in all floors or at least in the floor in which a halt was requested. In step S13 the passenger cabin 151, 251 will stop at all requested floors. In step S16 the method ends.

[0068] If in decision D11 it is determined that the passenger cabin 151, 251 is fully occupied, in step S14 this information is displayed on display devices 214, 215, 216 in all floors or at least in the floor in which a halt was requested. This will inform the waiting users that the passenger cabin 151, 251 will not stop immediately but will first deliver passengers to their requested stop.

[0069] In step S15 the passenger cabin 151, 251 is therefore controlled, to skip externally requested stops 152, 153, 154 and only halt on internally requested stops 152, 153, 154.

[0070] Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a variety of alternate and/or equivalent implementations exist. It should be appreciated that the exemplary embodiment or exemplary embodiments are only examples, and are not intended to limit the scope, applicability, or configuration in any way. Rather, the foregoing summary and detailed description will provide those skilled in the art with a convenient road map for implementing at least one exemplary embodiment, it being understood that various changes may be made in the function and arrangement of elements described in an exemplary embodiment without departing from the scope as set forth in the appended claims and their legal equivalents. Generally, this application is intended to cover any adaptations or variations of the specific embodiments discussed herein.

[0071] Thus the present invention provides a control system 100, 200 for an elevator 150 with a passenger cabin 151, 251, the control system 100, 200 comprising a volume sensor 101 configured to sense the unoccupied volume 102 of the passenger cabin 151, 251, and a control unit 103, 203 coupled to the volume sensor 101 and configured to control the movement of the elevator 150 based on the unoccupied volume 102, wherein the control unit 103, 203 is configured to move the passenger cabin 151, 251 past an externally requested stop 152, 153, 154 if the unoccupied volume 102 is below a predetermined threshold value 104, 204. Further, the present invention provides a respective control method.

List of reference signs

[0072]

100, 200	control system
101	volume sensor
102	unoccupied volume
103, 203	control unit
104, 204	predetermined threshold value
105	control signal
209	A/D converter
210	light source
211	floor
212	light sensor
213	ceiling
214, 215, 216	display device
217	light
150	elevator
151, 251	passenger cabin
152, 153, 154	stop
S1, S2	method step
S11, S12, S13, S14, S15, S16	method step
D11	decision

Claims

1. Control system (100, 200) for an elevator (150) with a passenger cabin (151, 251), the control system (100, 200) comprising:

   a volume sensor (101) configured to sense the unoccupied volume (102) of the passenger cabin (151, 251), and a control unit (103, 203) coupled to the volume sensor (101) and configured to control the movement of the elevator (150) based on the unoccupied volume (102),
   wherein the control unit (103, 203) is configured to move the passenger cabin (151, 251) past an externally requested stop (152, 153, 154) if the unoccupied volume (102) is below a predetermined threshold value (104, 204).

2. Control system (100, 200) according to claim 1, wherein the volume sensor (101) comprises a light source (210) and a light sensor (212) arranged on opposite sides of the passenger cabin (151, 251).

3. Control system (100, 200) according to claim 2, wherein the light source (210) comprises a planar light source (210), and wherein the light sensor (212) comprises a light dependent resistor.

4. Control system (100, 200) according to claim 3, wherein the planar light source (210) is arranged on a floor (211) of the passenger cabin (151, 251), and wherein the light dependent resistor is arranged on a ceiling (213) of the passenger cabin (151, 251); or
   wherein the planar light source (210) is arranged on a ceiling (213) of the passenger cabin (151, 251), and wherein the light dependent resistor is arranged on a floor (211) of the passenger cabin (151, 251).

5. Control system (100, 200) according to claim 1, wherein the volume sensor (101) comprises at least an ultrasonic sensor, especially a plurality of ultrasonic distance sensors.

6. Control system (100, 200) according to any one of the preceding claims, comprising for at least one stop (152, 153, 154) of the passenger cabin (151, 251) a display device (214, 215, 216) that is coupled to the control unit (103, 203), wherein the control unit (103, 203) is configured to display a status information about the unoccupied volume (102) in the passenger cabin (151, 251) on the at least one display device (214, 215, 216).

7. Control method for an elevator (150) with a passenger cabin (151, 251), the control method comprising:

   sensing (S1) the unoccupied volume (102) of the passenger cabin (151, 251) with a volume sensor (101), and controlling (S2) the movement of the elevator (150) based on the unoccupied volume (102) by moving the passenger cabin (151, 251) past an externally requested stop (152, 153, 154) if the unoccupied volume (102) is below a predetermined threshold value (104, 204).

8. Control method according to claim 7, wherein sensing is performed with a light source (210) and a light sensor (212) arranged on opposite sides of the passenger cabin (151, 251).

9. Control method according to claim 8, wherein the light source (210) is provided as a planar light source (210), and wherein the light sensor (212) is provided as a light dependent resistor.

10. Control method according to claim 9, wherein for sensing the planar light source (210) is arranged on a floor (211) of the passenger cabin (151, 251), and the light dependent resistor is arranged on a ceiling (213) of the passenger cabin (151, 251); or
    wherein for sensing the planar light source (210) is arranged on a ceiling (213) of the passenger cabin (151, 251), and the light dependent resistor is arranged on a floor (211) of the passenger cabin (151, 251).

11. Control method according to claim 7, wherein sensing is performed with at least an ultrasonic sensor, especially a plurality of ultrasonic distance sensors.

12. Control method according to any one of the preceding claims 7 to 11, comprising for at least one stop (152, 153, 154) of the passenger cabin (151, 251) displaying a status information about the unoccupied volume (102) in the passenger cabin (151, 251).

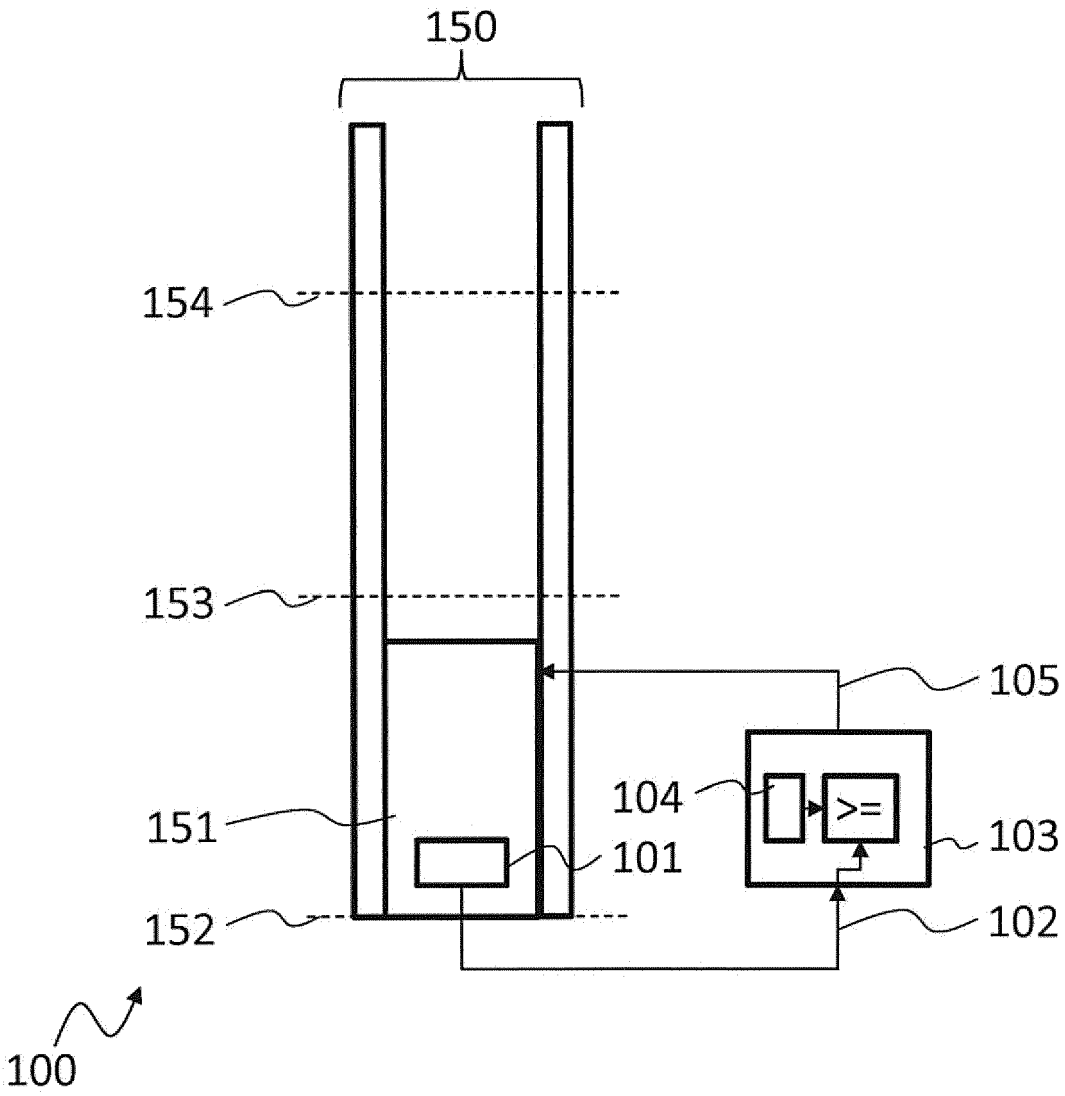

Fig. 1

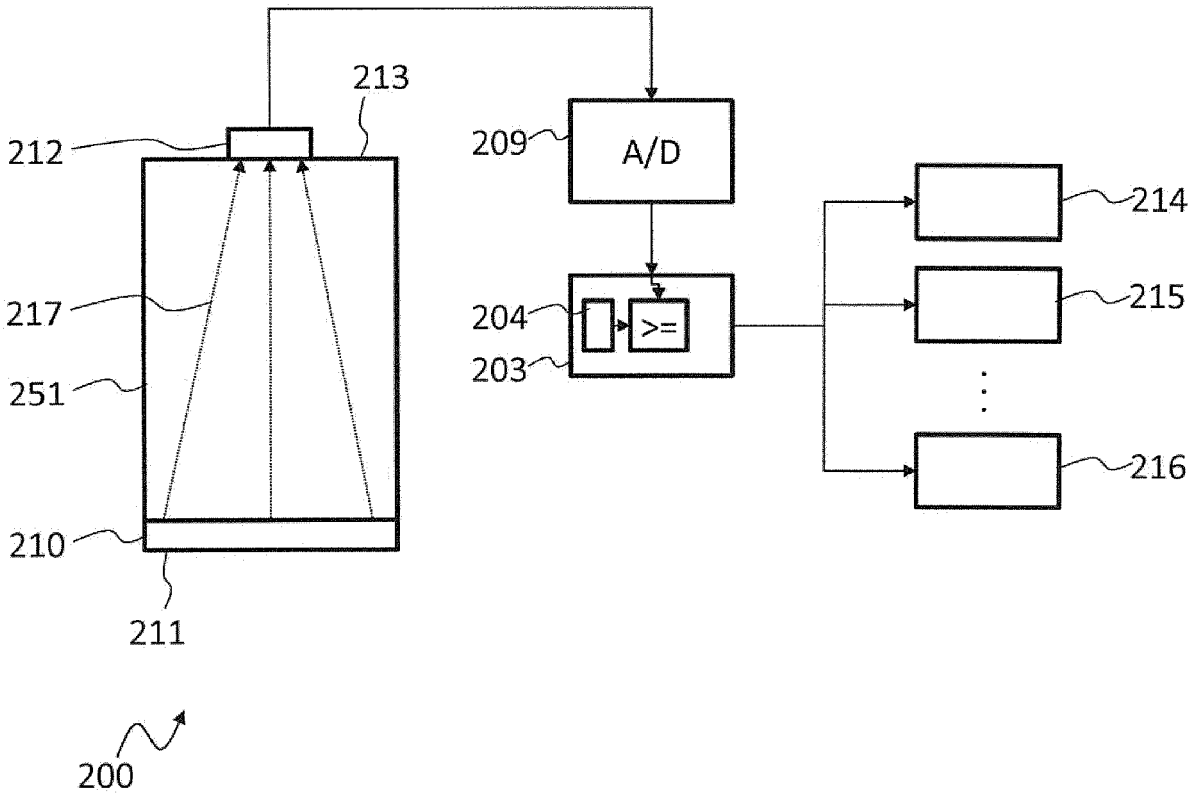

Fig. 2

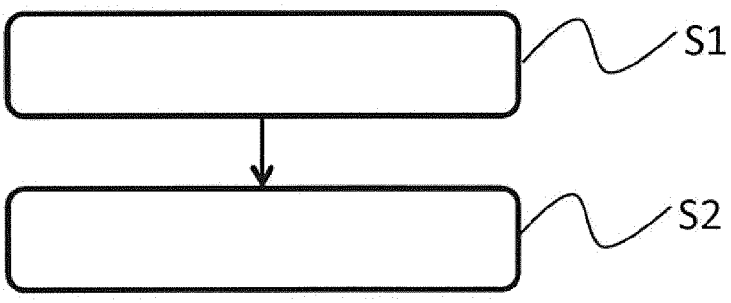

Fig. 3

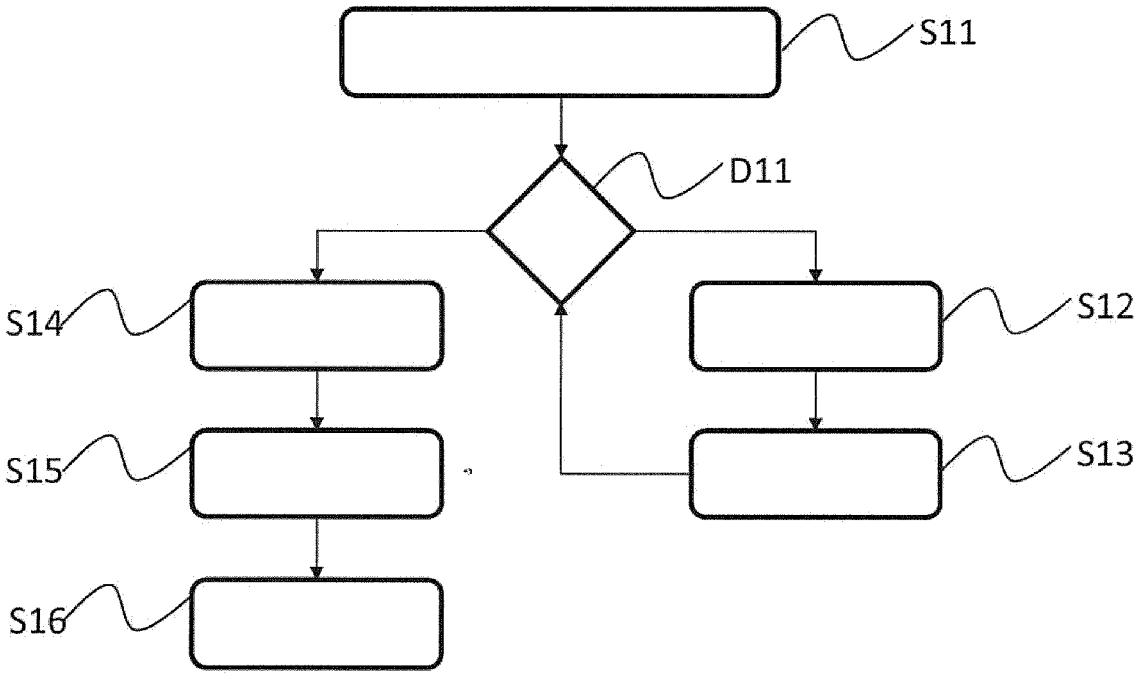

Fig. 4

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 4105

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 389 415 A (ROKE MANOR RESEARCH [GB]) 10 December 2003 (2003-12-10) * abstract; claims 1-16; figures 1-5 * * page 2, lines 4-18 * * page 3, lines 6-10 * * pages 11-12 *	1-12	INV. B66B1/34 B66B1/24
X	WO 2008/130392 A1 (OTIS ELEVATOR CO [US]; KATO MITSURU [JP]; FUJII TOSHIYUKI [JP]; OKAWA) 30 October 2008 (2008-10-30)	1-4,7-10	
A	* abstract; claims 1-9; figures 1-4 * * paragraphs [0001], [0005] - [0020] *	5,6,11, 12	
			TECHNICAL FIELDS SEARCHED (IPC)
			B66B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 January 2018	Dogantan, Umut H.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 19 4105

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19-01-2018

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