

ELEVATOR SYSTEM AND OPERATING TERMINAL WITH SITUATION
SPECIFIC DISPLAY OF INPUT BUTTONS

Description

5 The technology described herein relates to an elevator system having elevator operation terminals, an elevator operation terminal for such an elevator system, and a method for operating such an elevator system.

10 In buildings having elevator systems, an elevator operating terminal's principal function is allowing a user to call an elevator while being present on a building floor. For example, an elevator operating terminal arranged on a floor can be adapted to allow a user to input a destination floor. For this purpose, the elevator system is equipped with a destination call control technology, and the elevator operating terminals arranged on the floors each have either a keyboard, a touch-sensitive screen, and/or a data acquisition device (e. g. in
15 the form of an RFID card reader known from EP 0699617 B1) for input of the destination floor.

20 In addition to providing the principal elevator-call function, certain operating terminals enable special treatment of certain users. For example, the needs of users with impaired mobilities (e. g., due to impaired vision, hearing or physical mobility) can be addressed by displaying or providing a special button with a symbol or a pictogram of a wheelchair. If this button is actuated, the elevator system switches to an impairment-friendly operating mode. Further, US 8,136,636 B2 discloses the special treatment of a VIP (very important person). Upon a VIP's smart card being within RF range and signaling the
25 VIP's identity, the operating terminal alters its touch screen to display the VIP's possible destinations within the building. Special treatment of users travelling with large items is disclosed in US 9,731,934 B2. There, the operating terminal displays a plurality of representations of large items such as carts, luggage, and beds, from which a user can select the item to be transported by the user.

30 Although these special-treatment approaches facilitate the operation of an elevator system, some of them may not be suitable for a wide variety of buildings. For example, displaying a VIP's possible destinations requires that a database of registered users is maintained for the building. Further, displaying several options from which a user can

choose may slow down the call-entry process and cause other users to wait, in particular during peak travel times. There is therefore a need for a technology that provides for a control of an elevator system and its operating terminals to adapt to a variety of different users.

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One aspect of the technology described herein relates to an elevator system having an elevator controller, an elevator car movable under control of the elevator controller between floors of a building, an operating terminal communicatively coupled to the elevator controller, and an optical sensor system. The optical sensor system is arranged and adapted to detect a user within a detection range and to characterize the user as one of a regular user and a special-treatment user. The operating terminal includes a central control and processing unit communicatively coupled to receive data indicative of the user being one of the regular user and the special-treatment user as detected and characterized by the optical sensor system. Further, the operating terminal includes a touch-sensitive screen system having a touch-sensitive screen that is controllable to display a graphical user interface. The touch-sensitive screen system is controllable by the central control and processing unit to cause the graphical user interface to selectively display at least one of a set of floor identifiers and a functional indicator representative of a special-treatment function corresponding to a detected special-treatment user. The central control and processing unit is adapted to detect a touch signal generated by the touch-sensitive screen system in response to a displayed functional indicator being touched for selecting the special-treatment function, and to initiate execution of the special-treatment function.

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Another aspect relates to an operating terminal provided in such an elevator system. It includes a communication terminal configured to communicate with an elevator controller of an elevator system, a central control and processing unit, an optical sensor system communicatively coupled to the central control and processing unit, and a touch-sensitive screen system having a touch-sensitive screen that is controllable to display a graphical user interface. The optical sensor system is configured to detect a user within a detection range and to characterize the user as one of a regular user and a special-treatment user. The central control and processing unit is adapted to control the graphical user interface to selectively display at least one of a set of floor identifiers and a functional indicator representative of a special-treatment function, wherein the displayed

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functional indicator corresponds to a detected special-treatment user. The central control and processing unit is further adapted to detect a touch signal generated by the touch-sensitive screen system in response to the displayed functional indicator being touched for selecting the special-treatment function, and to initiate execution of the special-treatment function.

Yet another aspect relates to a method of operating the elevator system having such elevator operating terminals for inputting elevator calls. The method includes generating, by the touch-sensitive screen system, a graphical user interface for display on the touch-sensitive screen. The graphical user interface is controllable to selectively display at least one of a set of floor identifiers and a functional indicator representative of a special-treatment function. Further, the method includes detecting, by the optical sensor system, a user within a detection range and to characterize the user as one of a regular user and a special-treatment user. In response to the user being characterized as a special-treatment user, the method includes controlling the graphical user interface to display the functional indicator corresponding to the detected special-treatment user. In addition, the method includes detecting a touch signal generated by the touch-sensitive screen system in response to the displayed functional indicator being touched for selecting the special-treatment function, and initiating execution of the special-treatment function.

The various aspects of the technology disclosed herein improve the operation of the overall elevator system. For example, an improved operation results from the optical sensor system detecting if a regular user or a special-treatment user is at or near an operating terminal and then displaying corresponding situation-specific information on the operating terminal. In case of a regular user, general information is displayed, in particular the floor identifiers. In case of a special-treatment user, information is displayed that is specific to that user and the user's specific situation.

In one embodiment, which may be applicable in connection with one or more of the embodiments disclosed herein, the functional indicator includes an icon, a pictogram and/or text, in particular indicative of a user requiring mobility assistance, a user travelling in a group, or a user travelling with a large item. For example, if the user is in a wheelchair, the displayed functional indicator includes a symbol or icon of a wheelchair. Similarly, if a user travels in a group or with a large item, such as a hospital bed, the

displayed functional indicator includes a symbol or icon representing a group or a hospital bed. As the graphical user interface displays the situation-specific information, selection of the functional indicator by the special-treatment user is facilitated, e. g., selection takes place faster, and, hence, the processing of the corresponding function by the elevator system is faster.

In one embodiment, which may be applicable in connection with one or more of the embodiments disclosed herein, the graphical user interface may display the situation-specific information accentuated, e. g., it may display only the floor identifiers and a single touch button that represents the situation-specific information. This further facilitates the selection of the functional indicator by the special-treatment user. In one embodiment, which may be applicable in connection with one or more of the embodiments disclosed herein, the touch button may be displayed separate from the floor identifiers or as overlapping at least one of the floor identifiers.

In one embodiment, which may be applicable in connection with one or more of the embodiments disclosed herein, the floor identifiers and the touch button may be displayed sequentially, e. g., at first the touch button and then the floor identifiers. The special-treatment user, therefore, has to follow a set operating sequence. The operating terminal is adapted to generate an elevator call upon the user touching one of the floor identifiers after touching the displayed functional indicator to select the special-treatment function, wherein the elevator controller is adapted to serve the elevator call according to the special-treatment function and the touched floor identifier.

In one embodiment, which may be applicable in connection with one or more of the embodiments disclosed herein, the special-treatment user may select or ignore the functional indicator. For example, the functional indicator may be displayed for a set period of time; an expired time is indicative of the user ignoring the functional indicator.

In one embodiment, which may be applicable in connection with one or more of the embodiments disclosed herein, the touch-sensitive screen system is controllable by the central control and processing unit to cause the graphical user interface to display the set of floor identifiers to a detected regular user, and to display the set of floor identifiers and the functional indicator to the detected special-treatment user. The operating terminal is,

therefore, adapt for use by a variety of different users.

In one embodiment, which may be applicable in connection with one or more of the embodiments disclosed herein, the optical sensor system may be arranged in the operating terminal, or arranged on a floor separate from the operating terminal. This allows
5 adapting the technology to certain building requirements, e. g., regarding the location of an operating terminal and the environment of the operating terminal (e. g., size of an elevator hall).

10 In one embodiment, which may be applicable in connection with one or more of the embodiments disclosed herein, the optical sensor system includes one of a camera and a time-of-flight sensor. This allows adapting the technology to certain building requirements, e. g., regarding the location of an operating terminal and the environment of the operating terminal (e. g., size of an elevator hall).

15 In the following, various aspects of the improved technology are explained in more detail by means of exemplary embodiments in connection with the figures. All figures are merely schematic illustrations of methods and terminals or their components according to exemplary embodiments of the improved technology. In particular, distances and size
20 relations are not reproduced to scale in the figures. In the figures, identical elements have identical reference signs. In the drawings:

Fig. 1 shows a schematic illustration of an exemplary elevator system in a building having several floors;

25 Fig. 2 shows a schematic illustration of an exemplary operating terminal used in the elevator system of Fig. 1 and displaying one example of a default screen;

Fig. 3 shows a schematic illustration of an exemplary operating terminal used in the elevator system of Fig. 1 and displaying another example of a default
30 screen;

Fig. 4 – Fig. 6 show schematic illustrations of operating terminals displaying buttons for selecting a special-treatment functions;

Fig. 7 shows a schematic illustration of an operating terminal with exemplary components; and

Fig. 8 shows an example of an embodiment of a method for operating of the elevator system's operating terminal.

5 **Fig. 1** shows a schematic illustration of an exemplary embodiment of an elevator system 1 in a building; the building can be any type of multilevel building (e. g., residential building, hotel, office building, sports station, etc.). In the following, components and functions of the elevator system 1 are explained as far as they are believed to be helpful for an understanding of the technology described herein. The building shown in **Fig. 1** has a plurality of floors L1, L2, L3 served by the elevator system 1, e. g., a user 8 can be
10 transported from a boarding floor to a destination floor by the elevator system 1 after inputting an elevator call ("call") at an operating terminal 4 while at the boarding floor. In the shown embodiment, the elevator system 1 has an elevator car 6 that is movable along a travel path in the building. For example, the travel path extends along a vertical elevator shaft 10, without being limited to such a travel path. In the following, embodiments of the
15 technology disclosed herein are described with reference to the exemplary elevator system 1 shown in **Fig. 1**.

The elevator system 1 shown in **Fig. 1** also comprises an elevator controller (EC) 12, a drive machine (M) 14, a counterweight 18, a signal transmission system 20 (also referred to as hanging cable), a suspension means 16 (one or more steel ropes or flat belts) and a
20 plurality of deflection pulleys 24. The suspension means 16 has two ends, each end being attached to a fixed point 22 in the elevator shaft 10. Between the fixed points 22, the suspension means 16 partially wraps around the deflection pulley 24 on the counterweight 18, a traction sheave of the drive machine 14 and the deflection pulleys 24
25 on the elevator car 6. The elevator system 1 shown is thus a traction elevator, wherein further details, such as, for example, guide rails for the elevator car 6 and guide rails for the counterweight 18 are not shown in **Fig. 1**. The elevator controller 12 is connected to the drive machine 14 and controls it to move the elevator car 6 in the shaft 10 in response to a call. The function of a traction elevator, the components of which and the tasks of an
30 elevator control 12 are generally known to the person skilled in the art. The skilled person will recognize that the technology described here is not limited to a traction elevator. The skilled person will also recognize that the elevator system 1 can comprise a plurality of elevator cars 6 or multi-deck cars in one or more elevator shafts 10, or can comprise one or more groups of elevators controlled by a group controller.

In **Fig. 1**, an operating terminal 4 is arranged on each floor L1, L2, L3 and coupled to the elevator controller 12 by means of a communication connection 26. The communication connection 26 may be implemented wired (e. g., by individual lines or a communication bus) and/or wireless. Each of these operating terminals 4 can have, for example, a terminal identifier (also referred to as a terminal ID) by which an operating terminal 4 is identifiable and addressable, in particular if a communication bus is used; for example, the operating terminal 4 sends a call along with its terminal ID to the elevator controller 12 which confirms the call to the operating terminal 4 identified by the terminal ID. In this case, information about an elevator allocated to serve the call can also be sent.

As shown in **Fig. 1**, a further operating terminal 4a is arranged in the elevator car 6 and connected to the elevator controller 12 by means of the signal transmission system 20. The floor-side operating terminal 4 may be referred to as floor terminal and the car-side operating terminal 4a may be referred to as car terminal. The floor-side operating terminal 4 allows a user 8 to enter a destination floor, while the car terminal 4a may allow the user 8 only, e. g., to signal an emergency and/or to affect the closing of the elevator doors. In another embodiment, the car terminal 4a may allow a user 8 to enter a destination floor. Embodiments of the technology described herein are in the following described with reference to the destination call control technology and the operating terminals 4 arranged on the floors L1, L2, L3.

The operating terminal 4 can be arranged at a desired location on a floor L1, L2, L3, e. g., on a building wall or freestanding at a desired location. The location can be, e. g., an anteroom in front of one or more elevator (shaft) doors or an entrance to an elevator lobby. While the location is relatively freely selectable, there are specifications (e. g. according to a standard (e. g., EN81-70) or of legal nature) in terms of in which height range the operating terminal 4 or a user interface of the operating terminal 4 is to be arranged. This is to ensure that the operating terminal 4 is located at a height at which the operating terminal 4 or the user interface can be reached by a user 8 and displayed information can be perceived, whether the user 8 has a reduced mobility, e. g., a user 8 with impaired eyesight or a user 8 in a wheelchair.

The operating terminal 4 and, hence, the elevator system 1 according to the technology

described herein are provided with functionalities that improve their usability for a variety of different users 8. The operating terminal 4, for example, enables users 8 to request special-treatment functions. For illustrative purposes, **Fig. 1** shows by means of pictograms examples of such users 8, e. g., a user in a wheelchair, a group of users and a hospital bed pushed by a user. The pictograms illustrate that the users 8 are present on the floors L1, L2, L3; in addition, it is illustrated that each operating terminal 4 shows a pictogram corresponding to the user 8 present on the floor L1, L2, L3 on which the operating terminal 4 is arranged.

Further, **Fig. 1** shows an optical sensor system 20 (S) arranged on each floor L1, L2, L3. In one embodiment, the optical sensor system 20, or at least some of its components, can be arranged in an operating terminal 4. In another embodiment, the optical sensor system 20, or at least some of its components, can be arranged on a floor L1, L2, L3 separate from the operating terminal 4, as shown in **Fig. 1** on floor L3. It is contemplated that on all or only some floors L1, L2, L3 both options for arranging the optical sensor system 20 are implemented. For illustrative purposes, dashed lines are shown in **Fig. 1** that lead from the optical sensor systems 20 to the users 8 on the floors L1, L2, L3. As described in more detail below, the optical sensor system 20 is used to determine if a special-treatment function is to be offered to the user 8 detected by the optical sensor system 20; the operating terminal 4 is then controlled to display a functional indicator 36, 38, 40 representing the special-treatment function for the detected user 8 to select.

Referring to an exemplary (user-side) front-view illustration of the operating terminal 4 shown in **Fig. 2**, the operating terminal 4 includes a body with a touch-sensitive screen system 2. The body is a structure to which other components of the operating terminal 4 can be mounted. The body can at least partially be arranged in a housing, or such a housing may serve as the body to which other components are mounted. For example, an operating terminal 4 mounted at a building wall or a free-standing pedestal may have a housing, while an operating terminal 4 that is integrated at least partially into a building or car wall may not have a separate housing. In the illustrated embodiment, the body has a generally rectangular shape (without being limited to such a shape) and is shown in an upright position; with reference to this position, terms such a left, right, upper, lower, or similar may be used. The touch-sensitive screen system 2 is oriented towards a user-accessible side of the operating terminal 4.

The touch-sensitive screen system 2 is configured to generate a graphical user interface 30 to be displayed on a touch-sensitive screen 28 of the touch-sensitive screen system 2. For example, the graphical user interface 30 shown in **Fig. 2** depicts one example of a default screen that may be displayed, for example, when no user is present or no special-treatment function is to be presented. The exemplary default screen includes a display area that shows selectable floor identifiers 31, wherein each may correspond to one of the floors of the building (e. g., identifiers for floors 1 – 6, wherein the floor identifiers 31 may be numbered and/or labeled with names of residents or enterprises or services). It is contemplated that the default screen may display additional information, such as building-related information (e. g., location), time and date, or a greeting.

In one embodiment, the graphical user interface 30 includes a further display area 42 which is arranged below the display area for the floor identifiers 31, without being limited to that specific arrangement. It is contemplated, for example, that additional display areas may be provided, that they may have different dimensions, that they may partially overlap or that one area may cover another display area. Below the display area 42, a symbol indicative of a recognition device 44 is shown, as described below.

The graphical user interface 30 shown in **Fig. 3** depicts another example of a default screen. Unlike in **Fig. 2**, the touch-sensitive screen 28 is controlled so that a contour of the display area 42 is shown (and visible) when no user is present or no special-treatment function is to be presented. In that situation, any displayed content (e. g., pictograms, icons, or characters) may be shown contoured, as well, e. g., so that it is only slightly visible (e. g., due to a dimmed illumination); in that case, any touching of the display area 42 is not detected. In **Fig. 3**, the display area 42 shows for illustrative purposes content that includes the functional indicators 36, 38, 40. Indicating the display area 42 and any content by means of contours allows the operating terminal 4 to be recognizable as providing special-treatment functions.

The graphical user interface 30 is configured to display at least one functional indicator 36, 38, 40 that represents a special-treatment function the user 8 can select. Each functional indicator 36, 38, 40 includes, for example, a symbol, an icon, a pictogram, a number, a character/letter, a word/text, or a combination thereof. **Fig. 1** and **Fig. 3** show

examples of such functional indicators 36, 38, 40: an indicator 40 intended for use by a user 8 with restricted mobility and requiring mobility assistance ("accessibility indicator 40" indicated through an illustration of a wheelchair), an indicator 36 intended for use by a user travelling in a group ("group indicator 36" indicated through an illustration of two users and a plus sign "+"), and an indicator 38 intended for use by a user 8 pushing a bed or generally travelling with a large item ("large item indicator 36" indicated through an illustration of a hospital bed).

The one or more functional indicators 36, 38, 40 can be displayed within the display section 42 below the floor identifiers 31. The floor identifiers 31 may be displayed at the same time as the functional indicator 36, 38, 40 determined for the user 8 by means of the optical sensor system 20, as shown in **Fig. 1**. The user 8, therefore, sees the floor identifiers 31 and the functional indicator 36, 38, 40 at the same time. It is contemplated that the floor identifiers 31 may not be shown at the same time as the functional indicator 36, 38, 40 is displayed. For example, a functional indicator 36, 38, 40 may be displayed for a user 8 (after being detected) to select and then, after selection or expiration of a set period of time, the floor identifiers 31 may be displayed for the user 8 to enter the destination floor. Expiration of the time may happen, for example, if the user 8 ignores the functional indicator 36, 38, 40 because its corresponding function is not wanted. Further, it is contemplated that the functional indicators 36, 38, 40 may be displayed at positions of the graphical user interface 30 other than those shown in the figures.

The functional indicators 36, 38, 40 shown in **Fig. 1** are described in more detail in connection with **Fig. 4**, **Fig. 5**, and **Fig. 6** which show schematic illustrations of operating terminals 4 displaying the functional indicators 36, 38, 40. In **Fig. 4**, a user 8 pushing a hospital bed is detected by the optical sensor system 20. In response, the graphical user interface 30 is controlled to display the large item indicator 36 within the display area 42. In **Fig. 5**, a user 8 in a wheelchair is detected, and, in response, the graphical user interface 30 is controlled to display the accessibility indicator 40 within the display area 42. In **Fig. 6**, a user 8 travelling in a group is detected, and, in response, the graphical user interface 30 is controlled to display the group indicator 36 within the display area 42. For example, once the respective functional indicator 36, 38, 40 is displayed, the user 8 can touch it to select the assigned special-treatment function. In case of the group indicator 36, the graphical user interface 30 is controlled to allow the user 8 to enter the number of

users in the group. After selecting the special-treatment function, the user 8 can touch the floor identifier for the desired destination floor to call an elevator. As mentioned above, once the user 8 is detected, the functional indicator 36, 38, 40 can be displayed together with the floor identifiers 31 (at the same time), or without the floor identifiers 31. If the initial display does not show the floor identifiers 31, they are displayed after the user 8 selects the functional indicator 36, 38, 40 or upon expiration of a set period of time (e. g., because the user 8 decides not to request the special-treatment function). The period of time can be set depending on, e. g., a detection range of the optical sensor system 20 and an estimated reaction time for the user 8 to touch the functional indicator 36, 38, 40.

The touch-sensitive screen 28 is hereinafter referred to as "touch screen 28". The operating mode and principal structure of a touch-sensitive screen system 2 having a touch screen 28 are generally known to the person skilled in the art; the person skilled in the art knows, for example, from the programming and use of smartphones or other electronic terminals having graphical user interfaces, how text, symbols, pictograms, input and output fields, etc. are generated on a touch screen and displayed on a graphical user interface, and how to react when a user touches a certain area of the touch screen for selecting content represented by a symbol, pictogram or field (e. g., for entering a selection or command).

Fig. 7 shows a schematic representation of an example of an operating terminal 4 and some of its components; such an operating terminal 4 can be arranged in the elevator system 1 according to **Fig. 1** on one of the floors L1, L2, L3. The operating terminal 4 is communicatively connected to the elevator controller 12 via the communication network 26, and includes in one embodiment a housing for positioning the operating terminal 4 on a building wall or on a pedestal that stands on a building floor. A person skilled in the art recognizes that such a housing may not be necessary if the operating terminal 4 is installed completely or in part in a building wall or in a door frame of a floor-side elevator door.

In the embodiment shown, the operating terminal 4 includes: the touch-sensitive screen system 2 comprising the touch screen 28, a communication interface 48 (PoE), the optical sensor system 20, a storage device 58, an illumination device 62, and an electroacoustic transducer 52 (e. g., a loudspeaker). These components are directly or indirectly coupled

to a central control and processing unit 56 of the operating terminal 4. As mentioned above, in another embodiment, the optical sensor system 20 may be arranged separate from the operating terminal 4; image acquisition and processing may, therefore, be performed separate from the operating terminal 4, either by the (separate) optical sensor system 20, the elevator controller 12, or a combination of the optical sensor system 20 and the elevator controller 12 (and any additional equipment the skilled person may consider helpful). Hereinafter, the optical sensor system 20 is arranged in the operating terminal 4, which perform the image acquisition and processing.

In one embodiment, the touch screen 28 has a transparent glass cover which closes the housing externally and/or on a user side. The outer surface of the glass cover is a touch surface which the user 8 may touch, for example, when inputting a call. The skilled person recognizes that the glass cover can have a planar or curved glass plate.

The touch-sensitive screen system 2 comprises a processor 54. The processor 54 is connected to a central control and processing unit 56 (PU) and communicates, for example, with the elevator controller 12 and generates a touch signal when the user 8 touches the touch surface of the touch screen 28 using a finger. The processor 54 is configured to operate the graphical user interface 30 to display, for example, the floor identifiers 31 and the functional indicators 36, 38, 40.

The optical sensor system 20 includes in one embodiment an optical camera that generates digital image data, and a processor 60 that processes the digital image data using image processing software. The image processing software is configured to detect and recognize an object contained in or represented by the digital image data. For example, the processing by the image processing software compares a pattern (which may represent an object) contained in the digital image data with stored patterns of predetermined objects of interest. The stored patterns can represent a wheelchair, a hospital bed with or without being pushed by a user, a user, a group of users (e. g., two or more users), luggage with or without a user, carts with or without users etc. These patterns of predetermined objects may be stored in the storage device 58, which the image processing software can access for the comparison. In another embodiment, the processor 60 can contain the storage device 58 or its storage function. US 7,079,669 B2, for example, discloses a process of recognizing a user in a wheelchair. The processing

performed by the optical sensor system 20 includes detecting a user 8 that is within the set detection range and detecting if the user 8 is in wheelchair, pushes a hospital bed or cart. In case the user 8 is within the set detection range, the user 8 is considered to be present at the operating terminal 4 and about to call an elevator. The graphical user
5 interface 30 is then controlled accordingly.

In one embodiment, the optical sensor system 20 can include a 3D camera based on the principle of light runtime measurement (time of flight or TOF sensor). Such a 3D camera comprises a light-emitting diode unit or laser diode unit which, for example, emits light in
10 the infrared range, wherein the light is emitted in short pulses (e.g., several tens of nanoseconds). The 3D camera also comprises a sensor group consisting of a number of light-sensitive elements. The sensor group is connected to a processing chip (e. g., a CMOS sensor chip), which determines the time of flight of the emitted light. The processing chip simultaneously measures the distance to a number of target points in
15 space in a few milliseconds. The 3D camera can also be based upon a measuring principle according to which the time-of-flight of emitted light is captured via the phase of the light. The phase position when the light is emitted and when it is received is compared, and the time elapsed or the distance to the reflecting object is determined therefrom. For this purpose, a modulated light signal is preferably emitted, instead of short light pulses.
20 Further details of these measurement designs are given for example in EP 1 345 445 A1.

The optical sensor system 20 can include a 3D radar sensor, or the 3D radar sensor may be provided as a separate device, having an integrated microwave motion sensor. The microwave motion sensor includes antennas (antenna-in-package technology) and built-in
25 detectors for motion and direction of motion, wherein a state machine enables operation of the sensor without any external microcontroller. Such a sensor is available from, for example, Infineon Technologies AG, Germany. In another embodiment, the 3D sensor system 20 includes a 3D indirect Time-of-Flight (iToF) sensor for use in a small form-factor 3D camera producing a high-definition depth map. Such a sensor is available from,
30 for example, STMicroelectronics, Switzerland/Netherlands. Such sensors have a detection range of several meters, e. g., up to about 5-7 meters. The detection range may be set depending on the environment surrounding the operating terminal 4.

The electroacoustic transducer 52 can be provided in order to generate acoustic feedback

(voice announcement), e. g., when touching the touch screen 28.

In one embodiment, the illumination device 62 is used to illuminate the touch screen 28 and the interface section 42. In a manner controlled by the central control and processing
5 unit 56, the illumination device 62 can light up the graphical user interface 30 and the functional indicators 36, 38, 40 such that they and any displayed content can be perceived by the user 8, in particular in poor lighting conditions. The illumination device 62 can also illuminate fields or areas with colored light in order to confirm the input of an elevator call to the user 8. In one embodiment, the illumination device 62 comprises one
10 or more LED light sources.

Depending on the building and/or the elevator system 1, the operating terminal 4 may include the recognition device 44 to receive a credential of the user 8. The recognition device 44 can be provided in the building, for example, if users have to identify themselves
15 as being authorized before the operating terminal 4 can be enabled for a call input or a call is registered. The credentials can, for example, be in the form of a biometric feature (e. g., fingerprint, iris pattern, speech/voice characteristics) or an access code captured from a magnetic card, chip card or RFID card or from an electronic terminal (NFC-, Bluetooth- or cellular network-based). Users 8 present the credentials when they want to
20 input the elevator calls. The recognition device 44 is configured in accordance with the credentials provided in the elevator system 1. This means that the recognition device 44 has, for example, a terminal for capturing a biometric feature, a terminal for capturing an optical code, a reader for a magnetic stripe card or a chip card, or a transmitting and receiving terminal for radio signals. The skilled person recognizes that the operating
25 terminal 4 may be configured for more than one of these alternatives.

The credentials captured by the recognition device 44 are forwarded to the elevator controller 12, which carries out or initiates the authorization check, for example, by checking whether the captured credential is assigned to an authorized user 8 in a database.
30 The check can be carried out, for example, by an access control function of the elevator system 1 or of an (separate) access control system. If the user 8 is authorized to access, the elevator operating terminal 4 can be enabled, or an entered elevator call can be registered by the elevator controller 12.

In the embodiment shown in **Fig. 7**, the recognition device 44 is configured for transmitting and receiving radio signals (TX/RX). The recognition device 44 can include an RFID reader or a radio module which communicates with a portable communication terminal (e.g., mobile radio/mobile phone, smartphone, tablet PC) of a user 8. As an
5 alternative, a reader for an optical code presented by the user 8 (for example, a barcode, QR code or color code) can be provided.

The communication network 26 connects the elevator operating terminals 4 to the elevator controller 12 and thus makes communication possible between the elevator
10 controller 12 and the elevator operating terminals 4. For this communication, the elevator operating terminals 4 and the elevator controller 12 can be directly or indirectly connected to the communication network 26. The communication network 26 can comprise a communication bus system, individual data lines, a wireless communications system or a combination thereof. Depending on the implementation of the communication
15 network 26, individual addresses and/or identifiers can be allocated to the elevator controller 12 and each elevator operating terminal 6, such that, for example, the elevator controller 12 can send a message to a desired elevator operating terminal 4 in a targeted manner. Communication can take place in accordance with a protocol for wired or wireless communication, for example the Ethernet protocol. In one embodiment, the
20 operating terminals 4 are supplied with electrical energy via the communication network 26 using power of Ethernet (PoE) technology.

In one embodiment, the central control and processing unit 56 is configured to put the operating terminal 4 into an inactive state in order to reduce its consumption of electrical
25 energy. In this standby or energy-saving state, the control and processing terminal 56 switches off the illumination terminal 62. The switch-off can take place if no user 8 has been at or in the vicinity of the elevator operating terminal 4 for a set period of time. For this purpose, a dedicated sensor (not shown) can be used to detect the presence and/or a movement of a user 8. The dedicated sensor can be provided in the operating terminal 4
30 and can include a motion sensor that operates according to one of known functional principles, e. g., actively using electromagnetic waves (RF, UWB (ultra wideband) technology, microwaves or Doppler radar), using ultrasound (ultrasonic motion detector) or passively using infrared radiation (PIR sensor, pyroelectric infrared sensor) from the environment. If the operating terminal 4 is in the energy-saving state and the presence of

a user 8 is detected, the central control and processing terminal 56 switches the operating terminal 4 to an active state.

In one exemplary embodiment, the signal transmission system 20 shown in **Fig. 1**
5 includes an electric cable provided, for example, in a traction elevator for transmitting electrical energy and electrical signals and extending between the elevator car 6 and a fixed point to which the elevator controller 12 is coupled. For this purpose, the electrical cable has electrical power and signal lines. For example, the electrical cable supplies electrical energy to the elevator car 6 and transmits signals (e. g., load, status, and/or car
10 call information) to and from the elevator car 6. The electrical cable is also known to the person skilled in the art as a (flat) traveling cable. Terminals that couple the traveling cable, on the one hand, to the elevator controller 12 and its power/voltage supply and, on the other hand, to the elevator car 6 and its electrical and electronic components are therefore known to the person skilled in the art. The person skilled in the art will
15 recognize that the car terminal 4 is electrically coupled to the traveling cable.

With the understanding of the above-described principal system components of the elevator system 1 and its functionalities, a description of an exemplary method for operating the elevator system 1 having several operating terminals 4 is provided below
20 with reference to **Fig. 8**. The exemplary description is provided with reference to an operating terminal 4 arranged on one of the floors L1, L2, L3 shown in **Fig. 1**. Further, the description considers situations in which the users 8 shown in **Fig. 1** intend to enter an elevator call. The elevator system 1 is in operation. The method described with reference to **Fig. 8** starts in a step **S1** and ends in a step **S10**. The person skilled in the art will
25 recognize that the division into the steps shown is exemplary, and that one or more of these steps can be divided into one or more sub-steps, or that several of the steps can be combined into one step.

Referring to a step **S2**, a graphical user interface 30 is generated by the touch-sensitive
30 screen system 28 for display on the touch-sensitive screen 28. Generally, the graphical user interface 30 is controllable to selectively display a set of floor identifiers 31 and a functional indicator 36, 38, 40 representative of a special-treatment function. Exemplary graphical user interfaces 30 are shown in **Fig. 2** or **Fig. 3** (however, without being limited to the specific layout, or number of destination floors).

At a step **S3**, a user 8 is detected and characterized. The optical sensor system 20 detects the user 8 within its detection range. In one embodiment, the optical sensor system 20 further characterizes the user 8 as one of a regular user 8 and a special-treatment user 8.
5 For these tasks, the optical sensor system 20 performs image processing, as mentioned above. In another embodiment, at some image processing may be performed by the elevator controller 12.

At a step **S4**, it is determined if the detected user 8 is a special-treatment user or a regular user. As shown in **Fig. 1**, a special-treatment user 8 can be a user in a wheelchair, a user pushing a hospital bed or a user travelling in a group; it may further be a user 8 travelling with a large and/or bulky object (e. g., a stroller, a cart, a bicycle, luggage, furniture/furnishings) or requiring mobility assistance such as a rollator walker or a white cane. It is contemplated that the optical sensor system 20 and the associated image
10 processing are configured to detect and characterize such a user 8. A regular user 8 is a user that does not meet these characterizations. In that case, the method proceeds along the NO branch to a step **S8**; in case a special-treatment user 8 is detected, the method proceeds along the YES branch to a step **S5**.

At the step **S5**, in response to the user 8 being characterized as a special-treatment user, the graphical user interface 30 is controlled to display the functional indicator 36, 38, 40 corresponding to the detected special-treatment user 8. In one embodiment, the functional indicator 36, 38, 40 is displayed, as shown in **Fig. 4 – Fig. 6**; to select the corresponding special-treatment function, the user 8 can touch the functional indicator 36, 38, 40. For
20 example, as shown in **Fig. 4**, the special-treatment user 8 pushes a hospital bed and, correspondingly, the displayed functional indicator 38 includes a pictogram of a hospital bed. Similarly, as shown in **Fig. 5**, the special-treatment user 8 is a wheelchair user and, correspondingly, the displayed functional indicator 40 includes a pictogram of a wheelchair. And, as shown in **Fig. 6**, the special-treatment user 8 is travelling in a group
25 and, correspondingly, the displayed functional indicator 36 includes a pictogram of a user group.

It is contemplated that, in one embodiment, it is optional for the user 8 to touch and select the displayed functional indicator 36, 38, 40. Depending on a certain configuration of the

operating terminal 4 and/or its graphical user interface 30, the functional indicator 36, 38, 40 may be displayed only for a set period of time during which the user 8 may select the special-treatment function; after expiration of that period of time, the display of the functional indicator 36, 38, 40 ends and the special-treatment function can no longer be selected at that time. In one embodiment, in case the functional indicator 36, 38, 40 and the floor identifiers 31 are displayed contemporaneously, the user 8 can ignore the displayed functional indicator 36, 38, 40 and directly enter the desired destination floor.

At a step **S6**, a touch signal is detected. It is generated by the touch-sensitive screen system 2 in response to the displayed functional indicator 36, 38, 40 being touched for selecting the special-treatment function.

At a step **S7**, execution of the special-treatment function is initiated. For example, in case the wheelchair user 8 selects the special-treatment function, the operating terminal 4 may switch into a mode considered to be more user friendly, e. g., by generating audible instructions. Further, it can be registered that the user 8 requires, e. g., more space in the elevator car 6 and/or that a dwell time of the elevator doors is prolonged.

At a step **S8**, the floor identifiers 31 are displayed. Touching one of the floor identifiers 31 selects the destination floor assigned to the touched floor identifier which is then registered as an elevator call at a step **S9**. Depending on the configuration of the operating terminal 4, the floor identifiers 31 may be displayed at the step **S2** when the graphical user interface 30 is generated and remain displayed until the user 8 selects the destination floor at the step **S9**. In case the floor identifiers 31 are not displayed at the time the functional indicator 36, 38, 30 is displayed, the floor identifiers 31 are displayed at the step **S8** to allow the user 8 to enter the desired destination floor. As such, it is contemplated that the technology described herein is not limited to displaying the floor identifiers 31 at the step **S8**.

Once the elevator call is registered at the step **S9**, the elevator controller 12 controls the movement of the elevator car 6 to serve the elevator call. Depending on the selected special-treatment function, the elevator controller 12 may assign an empty elevator 6 to serve the elevator call entered by the user 8 travelling with a hospital bed or a large or bulky object. Further, at the boarding floor, the door dwell time is extended to allow

convenient boarding of the user 8. The illustrated method ends at the step **S10**.

The operating terminal 4 performs various processing tasks, as represented by "processor" components such as the central control and processing unit 56, the processors 54, 60 and other processing devices. A "processor" is implemented as hardware can run computer program code. Specifically, the specification teaches that the term "processor" is synonymous with terms like controller and computer and should be understood to encompass not only computers having different architectures such as single/multi-processor architectures and sequential (Von Neumann)/parallel architectures but also specialized circuits such as field-programmable gate arrays (FPGA), application specific circuits (ASIC), signal processing devices and other devices.

Claims

1. An elevator system (1), comprising:
an elevator controller (12),
5 an elevator car (6) movable under control of the elevator controller (12) between floors (L1, L2, L3) of a building,
an optical sensor system (20) arranged and adapted to detect a user (8) within a detection range and to characterize the user (8) as one of a regular user (8) and a special-treatment user (8), and
10 an operating terminal (4) communicatively coupled to the elevator controller (12), wherein the operating terminal (4) comprises:
a central control and processing unit (56) communicatively coupled to receive data indicative of the user (8) being one of the regular user (8) and the special-treatment user (8) as detected and characterized by the optical sensor system (20),
15 a touch-sensitive screen system (2) having a touch-sensitive screen (28) that is controllable to display a graphical user interface (30),
wherein the touch-sensitive screen system (2) is controllable by the central control and processing unit (56) to cause the graphical user interface (30) to selectively display at least one of a set of floor identifiers (31) and a functional indicator (36, 38, 40)
20 representative of a special-treatment function corresponding to a detected special-treatment user (8),
wherein the central control and processing unit (56) is adapted to detect a touch signal generated by the touch-sensitive screen system (2) in response to a displayed functional indicator (36, 38, 40) being touched for selecting the special-treatment
25 function, and to initiate execution of the special-treatment function.
2. The elevator system (1) according to claim 1, wherein the touch-sensitive screen system (2) is controllable by the central control and processing unit (56) to cause the graphical user interface (30) to display the set of floor identifiers (31) to a detected
30 regular user (8), and to display the set of floor identifiers (31) and the functional indicator (36, 38, 40) to the detected special-treatment user (8).
3. The elevator system (1) according to claim 1 or claim 2, wherein the optical sensor system (20) is arranged in the operating terminal (4).

4. The elevator system (1) according to claim 1 or claim 2, wherein the optical sensor system (20) is arranged on a floor (L1, L2, L3) separate from the operating terminal (4).
5. The elevator system (1) according to one of the preceding claims, wherein the functional indicator (36, 38, 40) includes an icon, a pictogram and/or text, in particular indicative of a user requiring mobility assistance, a user travelling in a group, or a user travelling with a large item.
6. The elevator system (1) according to one of the preceding claims, wherein the optical sensor system (20) includes one of a camera and a time-of-flight sensor.
7. The elevator system (1) according to one of the preceding claims, wherein the operating terminal (4) is further adapted to generate an elevator call upon the user (8) touching one of the floor identifiers (31) after touching the displayed functional indicator (36, 38, 40) to select the special-treatment function, wherein the elevator controller (12) is adapted to serve the elevator call according to the special-treatment function and the touched floor identifier (31).
8. An operating terminal (4), comprising:
a communication terminal (48) which is configured to communicate with an elevator controller (12) of an elevator system (1);
a central control and processing unit (56),
an optical sensor system (20) communicatively coupled to the central control and processing unit (56), wherein the optical sensor system (20) is configured to detect a user (8) within a detection range and to characterize the user (8) as one of a regular user (8) and a special-treatment user (8),
a touch-sensitive screen system (2) having a touch-sensitive screen (28) that is controllable to display a graphical user interface (30),
wherein the central control and processing unit (56) is adapted to control the graphical user interface (30) to selectively display at least one of a set of floor identifiers (31) and a functional indicator (36, 38, 40) representative of a special-treatment function, wherein the displayed functional indicator (36, 38, 40) corresponds to a detected special-treatment user (8),

wherein the central control and processing unit (56) is further adapted to detect a touch signal generated by the touch-sensitive screen system (2) in response to the displayed functional indicator (36, 38, 40) being touched for selecting the special-treatment function, and to initiate execution of the special-treatment function.

5

9. The operating terminal (4) according to claim 8, wherein the touch-sensitive screen system (2) is controllable by the central control and processing unit (56) to cause the graphical user interface (30) to display the set of floor identifiers (31) to a detected regular user (8), and to display the set of floor identifiers (31) and the functional indicator (36, 38, 40) to the detected special-treatment user (8).

10

10. The operating terminal (4) according to claim 8 or claim 9, wherein the optical sensor system (20) includes one of a camera and a time-of-flight sensor.

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11. The operating terminal (4) according to one of claims 8 – 10, further adapted to generate an elevator call upon the user (8) touching one of the floor identifiers (31) after touching the displayed functional indicator (36, 38, 40) to select the special-treatment function.

20

12. A method of operating an elevator system (1) comprising an elevator car (6), an elevator controller (12), an optical sensor system (20) and elevator operating terminals (4) which are communicatively connected to the elevator controller (12) and are arranged for inputting an elevator call, wherein an elevator operating terminal (4) comprises a touch-sensitive screen system (2) having a touch-sensitive screen (28), wherein the method comprises:

25

generating, by the touch-sensitive screen system (28), a graphical user interface (30) for display on the touch-sensitive screen (28), the graphical user interface (30) being controllable to selectively display at least one of a set of floor identifiers (31) and a functional indicator (36, 38, 40) representative of a special-treatment function;

30

detecting, by the optical sensor system (20), a user (8) within a detection range and to characterize the user (8) as one of a regular user (8) and a special-treatment user (8);

in response to the user (8) being characterized as a special-treatment user (8), controlling the graphical user interface (30) to display the functional indicator (36, 38, 40) corresponding to the detected special-treatment user;

detecting a touch signal generated by the touch-sensitive screen system (2) in response to the displayed functional indicator (36, 38, 40) being touched for selecting the special-treatment function, and
initiating execution of the special-treatment function.

5

13. The method according to claim 12, further comprising generating an elevator call by the operating terminal (4) upon the user (8) touching one of the floor identifiers (31) after touching the displayed functional indicator (36, 38, 40) to select the special-treatment function, and serving the elevator call by the elevator controller (12) according to the special-treatment function and the touched floor identifier (31).

10

14. The method according to claim 12, further comprising causing the graphical user interface (30) to display the set of floor identifiers (31) in response to a detected regular user (8).

15

15. The method according to claim 14, further comprising generating an elevator call by the operating terminal (4) upon the user (8) touching one of the floor identifiers (31), and serving the elevator call by the elevator controller (12) according to the touched floor identifier (31).