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(54) **MAINTENANCE SOLUTION FOR CONVEYOR SYSTEMS**

(57) The invention relates to a method for determining a state of a conveyor system (100), the method comprises: receiving (210) a plurality of image frames (300) from an image capturing module (450); determining (220) at least one characteristic of a number of pixels from each of the plurality of image frames (300); comparing (230) the determined at least one characteristic of the number of the pixels to reference data; setting (240), in accordance with a comparison (230) of the determined at least one characteristic of the number of the pixels to the reference data, a detection result to express the state of the conveyor system (100). The invention also relates to an apparatus (150, 160), a computer program product, and to a system thereto.

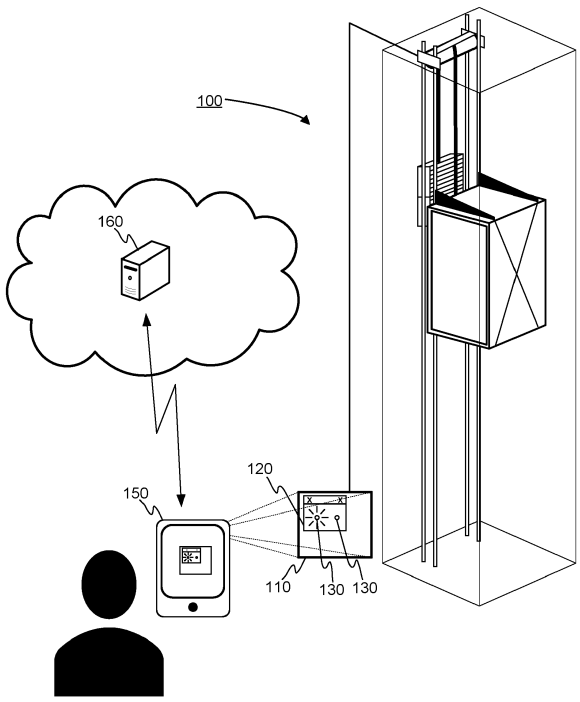

FIGURE 1

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Description

TECHNICAL FIELD

[0001] The invention concerns in general the technical field of conveyor systems. More particularly, the invention concerns maintenance of the conveyor systems.

BACKGROUND

[0002] Maintenance work of a conveyor system, such as an elevator system, an escalator, or moving walkway, has to be possible in a variety of situations. Some situations may e.g. relate to an installation phase of the conveyor system, but as important are situations which come up unexpectedly requiring maintenance work.

[0003] Typically the maintenance work is performed so that a technician connects her/his terminal device to data bus of the conveyor system in order to access one or more controllers of the conveyor system. By accessing the one or more controllers, such as an elevator controller, the technician may obtain data from the controllers, or from the respective entities, such as from data storages, for determining state information of the devices, or the system, the controller in question is configured to control. Especially in a situation that the device in question, or even the whole conveyor system, does not operate properly, error codes, if any, providing information regarding the error state are important to be retrieved with the terminal device in order to perform an analysis of the state of the respective entity. The analysis may provide important information for performing the maintenance work. This kind of approach in the maintenance is applicable as long as the device under maintenance and the data bus are operative.

[0004] In addition to the above described maintenance environment there may also be devices and apparatuses in the conveyor system which may not be accessed by the technician e.g. through a serial data bus. This applies with the devices and apparatuses which are configured to operate autonomously as a standalone devices and apparatuses, and, as a result, there is no way to access the data by the technician at the site.

[0005] However, in situations where the mains current is not available to the conveyor system, such as to an elevator system, at least the main entities for operating the conveyor system may be powered with reserve power sources, such as with batteries. In those situations there may be functionalities having a lower priority, such as a communication through the data bus, which might be disabled. This means that the technician cannot access the data, such as the error data, from which the state information may be derived. On the other hand, at least some of the entities are equipped with light sources, such as with a number of light emitting diodes, which may be controlled, e.g. by the controller of the respective entity, to output information representing a state of the respective entity. For example, different errors may be expressed by controlling the number of light sources to output light in different ways and the technician may then read the information by monitoring the light sources, and by applying cognitive skills to determine the reason for the error. However, visual capacity and cognitive skills of human being are limited and, hence, it further limits possible output schemes for communicating by controlling the light sources.

[0006] Hence, there is need to introduce novel approach for accessing data from which a state of the conveyor system, or at least one sub-entity, may be derived.

SUMMARY

[0007] The following presents a simplified summary in order to provide basic understanding of some aspects of various invention embodiments. The summary is not an extensive overview of the invention. It is neither intended to identify key or critical elements of the invention nor to delineate the scope of the invention. The following summary merely presents some concepts of the invention in a simplified form as a prelude to a more detailed description of exemplifying embodiments of the invention.

[0008] An object of the invention is to present a method, an apparatus, a computer program product, and a system for determining a state of a conveyor system.

[0009] The objects of the invention are reached by a method, an apparatus, a computer program product, and a system as defined by the respective independent claims.

[0010] According to a first aspect, a method for determining a state of a conveyor system is provided, the method comprises: receiving a plurality of image frames from an image capturing module; determining at least one characteristic of a number of pixels from each of the plurality of image frames; comparing the determined at least one characteristic of the number of the pixels to reference data; setting, in accordance with a comparison of the determined at least one characteristic of the number of the pixels to the reference data, a detection result to express the state of the conveyor system.

[0011] For example, a determination of the at least one characteristics of the number of pixels may comprise: identifying the number of pixels comprising information with respect to the at least one characteristic among all pixels of the image frame; determining at least one value representing the at least one characteristic of the identified number of pixels comprising information with respect to the at least one characteristic.

[0012] The at least one characteristic may e.g. represent at least one of the following: a brightness of the number of pixels; a colour of the number of pixels.

[0013] Moreover, the comparison may be performed for determining if at least one light source of a device belonging to the conveyor system emits light. A setting of the detection result may comprise: determining a data pattern from a plurality of image frames, the data pattern is generated by defining, for the plurality of image frames,

if the at least one light source emits light in the plurality of image frames; identifying the state of the conveyor system on a basis of the data pattern.

[0014] Alternatively or in addition, the method may further comprise: generating data in relation to the state of the conveyor system for outputting the data by a terminal device.

[0015] According to a second aspect, an apparatus for determining a state of a conveyor system is provided, the apparatus is configured to: receive a plurality of image frames from an image capturing module; determine at least one characteristic of a number of pixels from each of the plurality of image frames; compare the determined at least one characteristic of the number of the pixels to reference data; set, in accordance with a comparison of the determined at least one characteristic of the number of the pixels to the reference data, a detection result to express the state of the conveyor system.

[0016] The apparatus may be configured to perform a determination of the at least one characteristics of the number of pixels by: identifying the number of pixels comprising information with respect to the at least one characteristic among all pixels of the image frame; determining at least one value representing the at least one characteristic of the identified number of pixels comprising information with respect to the at least one characteristic.

[0017] Still further, the apparatus may e.g. be configured so that the at least one characteristic represents at least one of the following: a brightness of the number of pixels; a colour of the number of pixels.

[0018] Also, the apparatus may be configured to perform the comparison for determining if at least one light source of a device belonging to the conveyor system emits light. The apparatus may be configured to set the detection result by performing: determining a data pattern from a plurality of image frames, the data pattern is generated by defining, for the plurality of image frames, if the at least one light source emits light in the plurality of image frames; identifying the state of the conveyor system on a basis of the data pattern.

[0019] Alternatively or in addition, the apparatus may further be configured to: generate data in relation to the state of the conveyor system for outputting the data by a terminal device.

[0020] In some implementations, the image capturing module may be integrated in the apparatus.

[0021] According to a third aspect, a computer program product for determining a state of a conveyor system is provided, which computer program product, when executed by at least one processor, cause an apparatus to perform the method according to the first aspect as defined above.

[0022] According to a fourth aspect, a system for determining a state of a conveyor system is provided, the system comprising: an image capturing module; and an apparatus according to any the second aspect as defined above.

[0023] The expression "a number of" refers herein to any positive integer starting from one, e.g. to one, two, or three.

[0024] The expression "a plurality of" refers herein to any positive integer starting from two, e.g. to two, three, or four.

[0025] Various exemplifying and non-limiting embodiments of the invention both as to constructions and to methods of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific exemplifying and non-limiting embodiments when read in connection with the accompanying drawings.

[0026] The verbs "to comprise" and "to include" are used in this document as open limitations that neither exclude nor require the existence of unrecited features. The features recited in dependent claims are mutually freely combinable unless otherwise explicitly stated. Furthermore, it is to be understood that the use of "a" or "an", i.e. a singular form, throughout this document does not exclude a plurality.

BRIEF DESCRIPTION OF FIGURES

[0027] The embodiments of the invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings.

Figure 1 illustrates schematically an environment of a conveyor system according to an example.

Figure 2 illustrates schematically a method according to an example.

Figure 3 illustrates schematically aspects in relation to a method according to an example.

Figure 4 illustrates schematically an apparatus according to an example.

DESCRIPTION OF THE EXEMPLIFYING EMBODIMENTS

[0028] The specific examples provided in the description given below should not be construed as limiting the scope and/or the applicability of the appended claims. Lists and groups of examples provided in the description given below are not exhaustive unless otherwise explicitly stated.

[0029] Figure 1 illustrates schematically at least some aspects of the present invention applied in a conveyor system environment. The conveyor system 100 illustrated in Figure 1 is an elevator system, but it may also be an escalator, or a moving walkway, for example. The conveyor system 100 may comprise one or more devices 110 which may be configured to output information through a user interface 120 comprising a number of light sources 130. The information output with the number of light sources 130 of the user interface 120 may represent

a state of the conveyor system 100. The information on the state of the conveyor system 100 may relate to an overall situation in the conveyor system, or to a state of the device 110, or any other device, for example. In some example embodiments, the user interface 120 may be arranged to output error codes by controlling an output of the light sources 130 of the user interface 120. The device 110 of the conveyor system 100 having the user interface 120 may be e.g. a controller of the conveyor system 100 or a drive of the conveyor system, or any other entity having an applicable user interface 120. For sake of clarity, the user interface 120 may be a separate entity from the other entities of the conveyor system 100 and only arranged to output the state information in response to a receipt of a control signal carrying data defining the information to be output from another entity.

[0030] For sake of completeness, is may be necessary to mention that the state of the conveyor system, such as error codes therein, may be expressed with the user interface 120 comprising the number of light sources 130, such as light emitting diodes, in a plurality of way, such as being defined individually for each conveyor system 100, for example. Basically, the number of light sources 130 may be activated and inactivated so that for each signal, such as for each error code, it is developed a dedicated output pattern. The output pattern may be repeated by activating the user interface 120 in accordance with the type of the error e.g. with a predefined period or time, or it may be triggered in a predefined manner when needed, such as when a technician arrives to perform a maintenance work for the conveyor system 100. Furthermore, it may be arranged that a plurality pieces of state information, such as a plurality of error codes, may be output at the same time, e.g. by outputting the output patterns in turns by activating and inactivating the number of light sources accordingly. Still further, the data pattern expressed by controlling the number of light sources, i.e. one or more light sources, may be used for collecting measurement data e.g. by arranging that the data patterns may be used for expressing measurement values of a predefined parameter, for example.

[0031] The technician performing a maintenance work of the conveyor system 100 may carry a terminal device 150 comprising an image capturing module for capturing a plurality of images of an object. The image capturing module may refer to a digital video camera, for example. Advantageously, the image capturing module comprises a functionality, such as an operational mode, for capturing a digital video on the object. In other words, the image capturing module may capture a plurality of consecutive image frames at a high frame rate so as to generate image data of the object. In the context of the present solution the technician may be instructed to capture the image frames from the user interface 120 comprising the plurality of light sources 130 as shown in Figure 1. The duration for obtaining necessary number of image frames for analyzing a state of the conveyor system 100 may be known by the technician or alternatively an application used for the capturing of the image frames may be arranged to indicate the duration to the technician. In some sophisticated embodiment the application may analyse the pattern output with the activation of the light sources 130 so that when the application executed in the terminal device 150 indicates that the same pattern is initiated that already recorded to, it may be arranged to indicate to the technician that the capturing of the image frames may be discontinued or even automatically discontinue the capturing of the image frames with the image capturing module.

[0032] In order to obtain a necessary amount of data the frame rate of the image capturing module and an output of the state information with the number of light sources 130 are advantageously matched so that the frame rate of the image capturing module guarantees that even if the output is provided by blinking at least one light source 130, information is included in the image data for analysis. According to an example embodiment the conveyor system 100 under maintenance may be identified prior to capturing of the image frames so as to adjust settings of the image capture module optimally. For example, the user interface 120, or the device 110, from which the image data is captured to may be equipped with an identifier of the conveyor system 100, such as with a QR code or similar, which identifier may be interpreted to comprise data defining e.g. the settings for the image capturing module. The interpretation of the identifier may be performed by the terminal device 150. Alternatively or in addition, the terminal device 150 may be enabled to communicate with a server device 160 e.g. accessible through a communication network so as to deliver the identifier of the conveyor system 100, and/or any entity therein, to the server device 160 in order to inquire information, such as settings for the image capturing device to capture the image frames at a frame rate generating necessary amount of data for performing an analysis to determine the state of the conveyor system 100. In response to the determination of the settings for the image capturing module, such as in response to a receipt of the settings from the server device 160, the settings may be set into use and the monitoring of the user interface 120 may be initiated. As said, depending on the implementation the technician may initiate the output of the state information on the user interface 120 through an interaction with the user interface 120, such as by providing a predefined instruction through the user interface if it comprise means, such as one or more buttons, or other input devices, to input the instruction. Alternatively or in addition, if the user interface 120, or the conveyor system 100, may be accessed with the terminal device 150 e.g. by establishing a short-range communication connection between the entities and through that to input an instruction to initiate an output of the state information through the user interface 120 comprising the number of light sources 130.

[0033] In response to a capturing of the image frames with the image capturing module of the terminal device

150 as described the obtained image data is delivered to an analysis module which may be configured to determine the state of the conveyor system from the image data as received. The analysis module may refer to an implementation in which hardware components and software components may be arranged to interact in a manner that the determination may be performed. The hardware and software components may reside in a same device or shared between a plurality of devices. For example, according to an example embodiment the determination may be performed by the terminal device 150. According to another example embodiment, the image data may be delivered to the server device 150 which may perform the determination as is described in the forthcoming description. Hence, the analysis module may reside either in the terminal device 150 or in the server device 160. According to still further example embodiment, the determination steps may be shared between the terminal device 150 and the server device 160 in any applicable manner wherein operational steps of the analysis module is shared accordingly.

[0034] In Figure 2 it is schematically illustrated an example embodiment of a method for determining a state of a conveyor system 100 as seen from the analysis module. First, the analysis module is arranged to receive 210 image data comprising one or more image frames captured with the image capturing module of the terminal device 150. The image data may be received as a single data file or as a plurality of data files. Next, the analysis module may be arranged to perform a determination 220 of at least one characteristic from the image data. For example, the analysis module may be arranged to perform an analysis to image data of each image frame in order to determine at least one characteristic of a number of pixels forming at least a portion of the image data of the image frame in question. A non-limiting example of such a determination 220 is schematically illustrated in Figure 3 in which a captured image frame 300 is shown. The image frame comprises data defining an image of an object on which the image in question is captured. For the purpose of the present invention, the image shall be captured so that it illustrates at least a portion of the device 110 comprising the user interface 120 with the number of light sources 130. Especially, the light sources 130 shall be found from the image in order to perform the analysis. Hence, the analysis module may be configured to identify the light sources 130 from the image data. The identification may be performed with a pattern recognition procedure, for example. Alternatively or in addition, the analysis module may be configured to identify some other markers from the image data, such as reference markings 310 e.g. arranged in the device 110, or the user interface 120, by means of which the analysis module may determine the locations of the light sources 130. In other words, the identification of pixels in which the reference markings reside 310 allows the analysis module to define a number of pixels where the light sources 130 are depicted based on information about physical dimensions of the entities belonging to the device 110 e. g. with respect to the reference markings 310, but also applying information defining parameters relating to settings of the image capturing module and a geometry thereto, for example. In accordance with an example embodiment, the analysis module may determine an identifier of the device 110 from the image data and by applying the identifier inquire necessary information from data storage e.g. with respect to physical dimensions for identifying the pixels comprising information of the light sources 130. Alternatively or in addition, the analysis module may identify the device 120 of the conveyor system 100 on a basis of position data, if included in the image data, indicating a location in which the image frames are captured to. As a result, the analysis module may be determined a number of pixels defining image data representing the light sources 130. Such pixels are referred with a reference 320 in Figure 3, Naturally, in case the pixels defining the image data of the number of light sources are identifiable from the rest of the image data e.g. based on their characteristics, the analysis module may be arranged to scan the image data of each image frame as a whole, and to identify the at least one characteristic of the at least one pixel of the respective light source 130 from the image data. As mentioned, the analysis module may be arranged to determine 220 at least one characteristic of the at least one pixel for each of the light sources 130 in each of the image frames. The at least one characteristic may be such by means of which it is possible to determine if the light source 130 in question is activated or not, i.e. if it transmits light or not. In order to perform this the analysis module may determine a brightness of the respective pixels as the characteristic. Alternatively or in addition, the analysis module may determine at least one colour value, e.g. in RGB (Red, Green, Blue) colour space, to represent the characteristic of the pixels in question. The determination 220 of the predefined at least one characteristic may be performed with respect to each image frame received by the analysis module.

[0035] In response to the determination of one or more characteristics of the one or more pixels defining the one or more light sources 130 in the image data the at least one characteristic is compared to 230 reference data. The reference data may be a single value or comprise a plurality of values in accordance with the definition of the characteristic. For example, in case the at least one characteristic represents a brightness of the at least one pixel, or e.g. an average of the brightness if a plurality of pixels is taken into account, the comparison data may define a single comparison value for the brightness by means of which it is possible to determine, through the comparison, if the light source transmits light or not. The same kind of approach may be established if the colour values are used to express the characteristic of the pixels. Hence, the comparison is performed and defined so as to generate information if the light source 130 under analysis generates light or not on the basis of the image data of

the image frame under analysis.

[0036] The information obtained through the comparison 230 generates consecutive values for each of the number of light sources 130 obtained from the consecutive image frames indicating if the number of light sources 130 emits light or not. Hence, the consecutive values form a data pattern which may be used to set 240, in accordance with a comparison of the determined at least one characteristic of the number of the pixels to the reference data, a detection result to express the state of the conveyor system 100. In other words, it may be detected the state of the number of light sources 130 from the consecutive image frames and as a result the data pattern provided with the activation and inactivation of the number of light sources 130 may be interpreted, by the analysis module, to correspond data representing the state of the conveyor system 100. For example, error codes may be defined accordingly and by determining the data pattern from the output of the light sources 130 it is possible to find an error the conveyor system 100 is experiencing. Furthermore, the analysis module may be configured to be aware of the number of data values belonging to a certain state information, such as to a certain error code, the analysis module may be configured to determine a plurality of states by dividing the information derived from the image frames to discrete codes representing state, e.g. by taking first N values from first N image frames for the first state code and the next N values from the next N image frames for the second state code and so on. By having a plurality of light sources 130 in the user interface 120 it is possible to establish more sophisticated way, i.e. an output scheme, to indicate state of the conveyor system 100. As described, the step of setting 240 the detection result in accordance with the data received through the comparison 230 may comprise a sub-step in which the comparison result, such as the data pattern obtained from the consecutive image frames, may be used in the determination of the state information, such with respect to error code(s) output with the light sources 130.

[0037] In accordance with an example embodiment the generation of the detection result an identification of the state of the conveyor system 100, such as an error code expressing the state of the conveyor system 100, may cause the analysis module to request data from data storage, the data defining operational instructions to the technician residing at the location of the conveyor system. In other words, in order to improve the service, the technician may be provided details through the user interface of the terminal device by means of which the technician may perform a maintenance work of the conveyor system 100 in an efficient way.

[0038] For example, an apparatus suitable for performing at least part of the method as described may refer to a computing device, such as a server device 160 or a terminal device 150, such as a laptop computer, a tablet computer, or a mobile phone, or any similar data processing device, as schematically illustrated in Figure 4. Figure 4 illustrates schematically as a block diagram a non-limiting example of the apparatus applicable to perform the method as described in Figure 2 in cooperation with other entities if necessary. For sake of clarity, it is worthwhile to mention that the block diagram of Figure 4 depicts some components of a device that may be employed to implement an operation of the apparatus. The apparatus comprises a processor 410 and a memory 420. The memory 420 may store data, such as comparison data, and computer program code 425. The apparatus may further comprise communication means 430 for wired and/or wireless communication with other entities. Furthermore, I/O (input/output) components 440 may be arranged, together with the processor 410 and a portion of the computer program code 425, to provide a user interface for receiving input from a user, such as from a technician, and/or providing output to the user of the apparatus when necessary. In particular, the user I/O components may include user input means, such as one or more keys or buttons, a keyboard, a touchscreen, or a touchpad, etc. The user I/O components may include output means, such as a display or a touchscreen. The components of the apparatus may be communicatively coupled to each other via data bus that enables transfer of data and control information between the components.

[0039] The memory 420 and a portion of the computer program code 425 stored therein may further be arranged, with the processor 410, to cause the apparatus, i.e. the device, to perform at least a portion of the method as described in the foregoing description in relation to Figure 2. The processor 410 may be configured to read from and write to the memory 420. Although the processor 410 is depicted as a respective single component, it may be implemented as respective one or more separate processing components. Similarly, although the memory 420 is depicted as a respective single component, it may be implemented as respective one or more separate components, some or all of which may be integrated/removable and/or may provide permanent / semi-permanent / dynamic / cached storage.

[0040] The computer program code 425 may comprise computer-executable instructions that implement functions that correspond to steps of the method when loaded into the processor 410. As an example, the computer program code 425 may include a computer program consisting of one or more sequences of one or more instructions. The processor 410 is able to load and execute the computer program by reading the one or more sequences of one or more instructions included therein from the memory 420. The one or more sequences of one or more instructions may be configured to, when executed by the processor 410, cause the apparatus to perform the method be described herein. Hence, the apparatus may comprise at least one processor 410 and at least one memory 420 including the computer program code 425 for one or more programs, the at least one memory 420 and the computer program code 425 configured to, with the at least one processor 410, cause the apparatus to perform

the method as described.

[0041] The computer program code 425 may be provided e.g. a computer program product comprising at least one computer-readable non-transitory medium having the computer program code 425 stored thereon, which computer program code 425, when executed by the processor 410 causes the apparatus to perform the method. The computer-readable non-transitory medium may comprise a memory device or a record medium such as a CD-ROM, a DVD, a Blu-ray disc, or another article of manufacture that tangibly embodies the computer program. As another example, the computer program may be provided as a signal configured to reliably transfer the computer program.

[0042] Still further, the computer program code 425 may comprise a proprietary application, such as computer program code for causing an execution of the method in the manner as described in the description herein.

[0043] Any of the programmed functions mentioned may also be performed in firm-ware or hardware adapted to or programmed to perform the necessary tasks.

[0044] In case the apparatus performing the method as described is a terminal device 150 carried by the technician the apparatus may be equipped with an image capturing module 450, such as digital video camera, for capturing the image frames from an object as described. As discussed in the foregoing description in case the image data is delivered, e.g. through a wireless communication, to an apparatus configured to perform the method as described, the apparatus may e.g. reside in a communication network accessible either directly from the terminal device 150 configured to capture the image data or indirectly through one or more network nodes residing in the data path.

[0045] As mentioned in the foregoing description a functionality of the apparatus may be shared between a plurality of devices as a distributed computing environment. For example, the distributed computing environment may comprise a plurality of devices as schematically illustrated in Figure 4 arranged to implement the method in cooperation with each other in a predetermined manner. For example, each device may be arranged to perform one or more method steps and in response to a finalization of its dedicated step it may hand a continuation of the process to the next device.

[0046] In view of above the analysis module as mentioned in the context of the description of Figure 2 may be implemented with the hardware component as discussed in the context of Figure 4 together with one or more portions of a computer program code executed by the at least one processor 410 of the apparatus as described.

[0047] The solution of determining the state of the conveyor system in the manner as described in the foregoing description is especially applicable in a situation in which the conveyor system 100 is in a state that an access to the state information in a normal manner is prevented, such as during a power outage, and the state information is only available through one or more user interfaces 120 as described. Such user interfaces 120 may be controlled to output rich information representing the state of the conveyor system 100 as long as the output information may be analysed by the recipient in an effective manner, as by applying the solution according to the present invention as described.

[0048] The specific examples provided in the description given above should not be construed as limiting the applicability and/or the interpretation of the appended claims. Lists and groups of examples provided in the description given above are not exhaustive unless otherwise explicitly stated.

Claims

1. A method for determining a state of a conveyor system (100), the method comprises:

   receiving (210) a plurality of image frames (300) from an image capturing module (450),
   determining (220) at least one characteristic of a number of pixels from each of the plurality of image frames (300),
   comparing (230) the determined at least one characteristic of the number of the pixels to reference data,
   setting (240), in accordance with a comparison (230) of the determined at least one characteristic of the number of the pixels to the reference data, a detection result to express the state of the conveyor system (100).

2. The method of claim 1, wherein a determination (220) of the at least one characteristics of the number of pixels comprises:

   identifying the number of pixels comprising information with respect to the at least one characteristic among all pixels of the image frame (300),
   determining at least one value representing the at least one characteristic of the identified number of pixels comprising information with respect to the at least one characteristic.

3. The method of any of the preceding claims 1 to 2, wherein the at least one characteristic represents at least one of the following: a brightness of the number of pixels; a colour of the number of pixels.

4. The method of any of the preceding claims 1 to 3, wherein the comparison (230) is performed for determining if at least one light source (130) of a device belonging to the conveyor system (100) emits light.

5. The method of claim 4, wherein a setting of the de-

tection result comprises:

determining a data pattern from a plurality of image frames, the data pattern is generated by defining, for the plurality of image frames, if the at least one light source (130) emits light in the plurality of image frames,
identifying the state of the conveyor system (100) on a basis of the data pattern.

6. The method of any of the preceding claims 1 to 5, the method further comprising:
generating data in relation to the state of the conveyor system (100) for outputting the data by a terminal device.

7. An apparatus (150, 160) for determining a state of a conveyor system (100), the apparatus is configured to:

receive (210) a plurality of image frames (300) from an image capturing module (450),
determine (220) at least one characteristic of a number of pixels from each of the plurality of image frames (300),
compare (230) the determined at least one characteristic of the number of the pixels to reference data,
set (240), in accordance with a comparison (230) of the determined at least one characteristic of the number of the pixels to the reference data, a detection result to express the state of the conveyor system (100).

8. The apparatus (150, 160) of claim 7, wherein the apparatus (150, 160) is configured to perform a determination (220) of the at least one characteristics of the number of pixels by:

identifying the number of pixels comprising information with respect to the at least one characteristic among all pixels of the image frame (300),
determining at least one value representing the at least one characteristic of the identified number of pixels comprising information with respect to the at least one characteristic.

9. The apparatus (150, 160) of any of the preceding claims 7 to 8, wherein the apparatus (150, 160) is configured so that the at least one characteristic represents at least one of the following: a brightness of the number of pixels; a colour of the number of pixels.

10. The apparatus (150, 160) of any of the preceding claims 7 to 9, wherein the apparatus (150, 160) is configured to perform the comparison (230) for determining if at least one light source (130) of a device belonging to the conveyor system (100) emits light.

11. The apparatus (150, 160) of claim 10, wherein the apparatus (150, 160) is configured to set the detection result by performing:

determining a data pattern from a plurality of image frames, the data pattern is generated by defining, for the plurality of image frames, if the at least one light source (130) emits light in the plurality of image frames,
identifying the state of the conveyor system (100) on a basis of the data pattern.

12. The apparatus (150, 160) of any of the preceding claims 7 to 11, the apparatus (150, 160) is further configured to:
generate data in relation to the state of the conveyor system (100) for outputting the data by a terminal device.

13. The apparatus (150, 160) of any of the preceding claims 7 to 12, wherein the image capturing module (450) is integrated in the apparatus (150, 160).

14. A computer program product for determining a state of a conveyor system (100), which, when executed by at least one processor (410), cause an apparatus (150, 160) to perform the method according to any of claims 1 to 6.

15. A system for determining a state of a conveyor system (100), the system comprising:

an image capturing module (450), and
an apparatus (150, 160) according to any of claims 7 to 13.

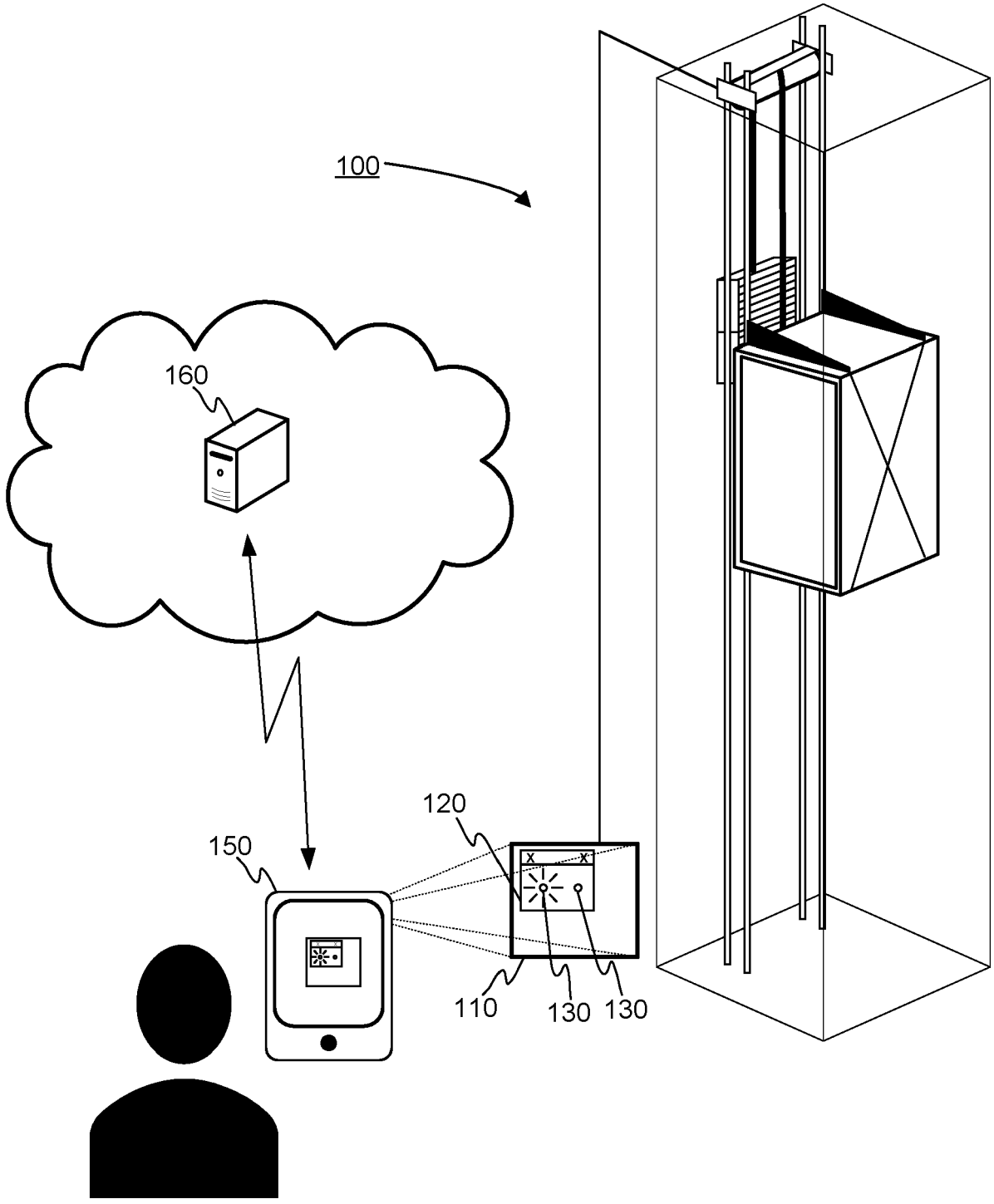

FIGURE 1

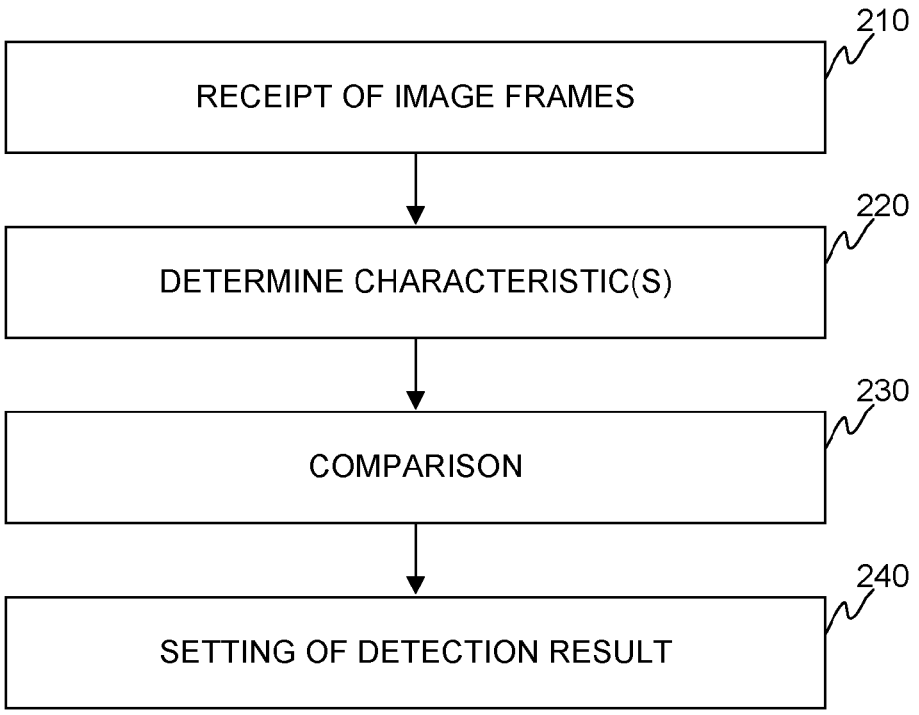

FIGURE 2

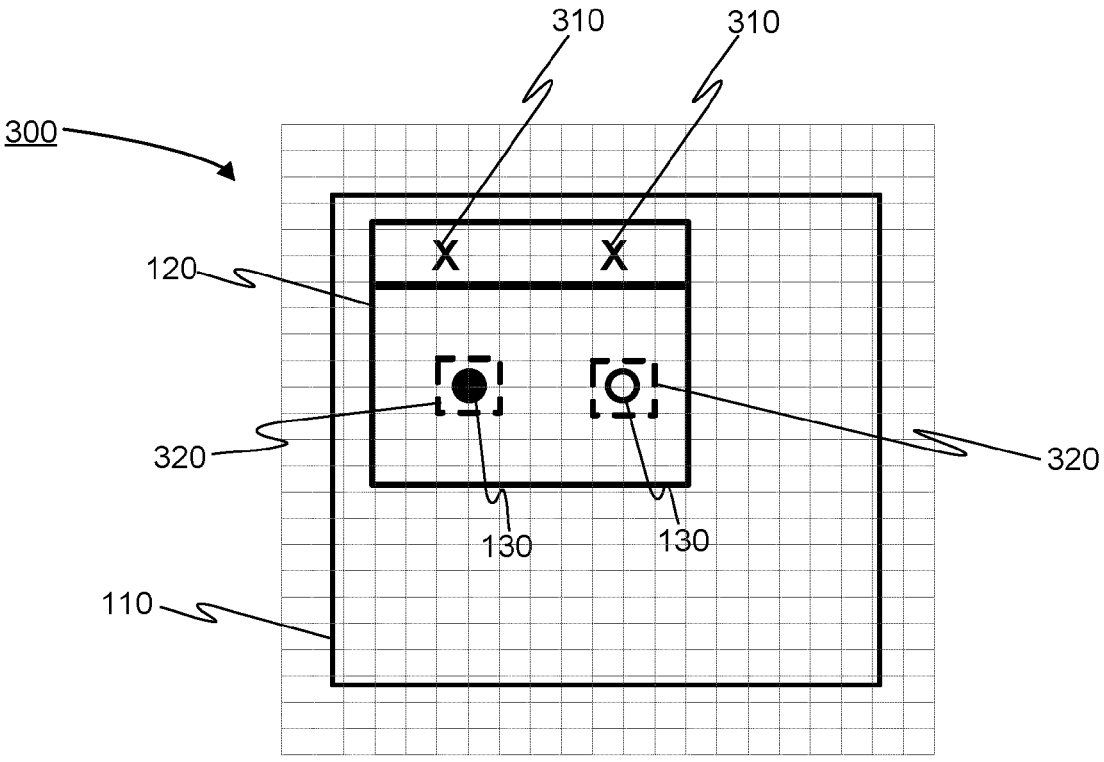

FIGURE 3

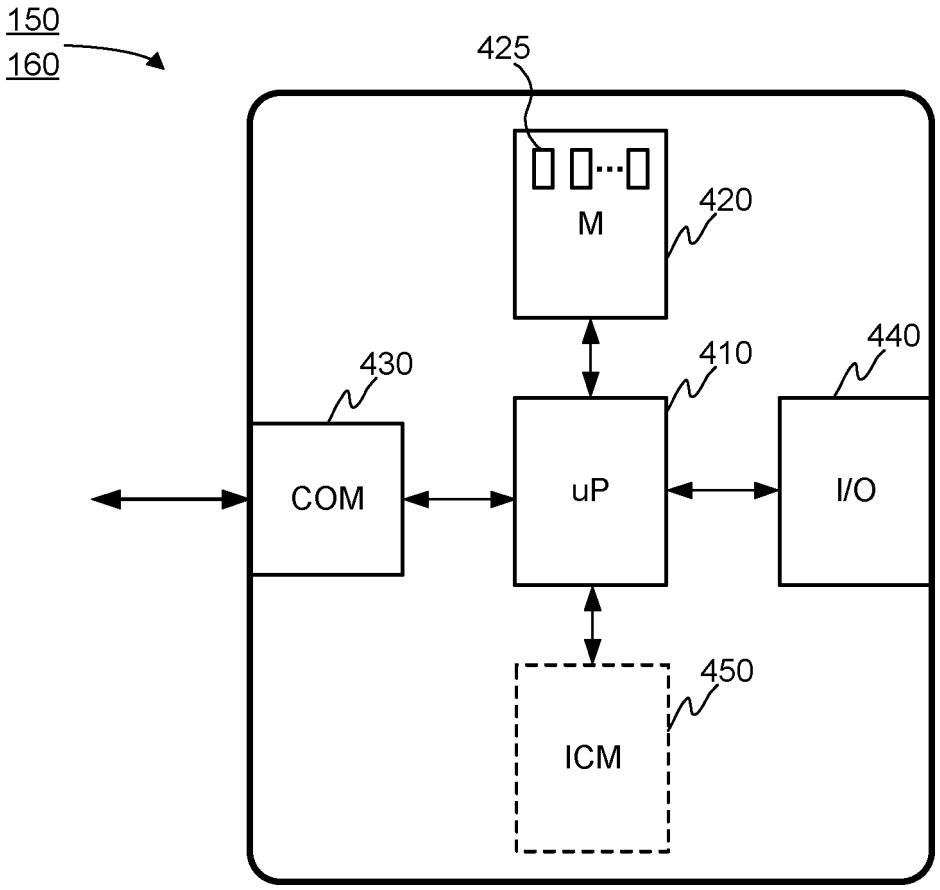

FIGURE 4

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EUROPEAN SEARCH REPORT

Application Number
EP 21 15 0508

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Place of search	Date of completion of the search	Examiner
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