

IMAGE PROCESSOR

FIELD

Embodiments described herein relate generally to an image processor.

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BACKGROUND

In recent years, various techniques have been contrived to prevent a person or an object from getting stuck between the car doors of an elevator. For example, a technique of detecting a passenger who moves to the elevator by using a camera and extending the opening period of the elevator doors has been devised.

10 In this technique, it is necessary to accurately detect a passenger who moves to the elevator from an image captured by the camera. However, if the attachment position of the camera is deviated, an image captured by the camera is rotated or deviated in a horizontal direction. Thus, there is a possibility that the above-described detection accuracy of a passenger is reduced.

15 For this reason, a new technique which can prevent the reduction in the detection accuracy of a passenger even if the attachment position of a camera is deviated is desired.

SUMMARY

25 According to one embodiment, an image processor performs an image process for an image captured by a camera and including inside of a car and a hall to detect a passenger near doors of the car. The image processor includes an acquisition module, a detection module and a setting module. The acquisition module is configured to obtain an image captured in a state where a marker distinguishable from a floor surface of the car and a floor surface of the hall is provided from the camera. The detection module is configured to recognize the marker from the obtained image and detect

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a deviation of an attachment position of the camera based on the recognized marker. The setting module is configured to set a setting value related to the image process when a deviation of the attachment position of the camera is detected.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a general configuration example of an elevator system according to an embodiment.

FIG. 2 shows a hardware configuration example of an image processor included in the elevator system.

FIG. 3 shows an image captured when the attachment position of a camera is not deviated.

FIG. 4 shows an image captured when the attachment position of the camera is deviated.

FIG. 5 shows an example of a marker provided in the capturing range of the camera.

FIG. 6 is a block diagram showing a functional configuration example of the image processor.

FIG. 7 is a flowchart showing an example of the processing procedure of the image processor in a calibration function.

FIG. 8 is shown for supplementarily explaining the flowchart shown in FIG. 7 and shows an image captured by the camera.

DETAILED DESCRIPTION

Embodiments will be described hereinafter with reference to the accompanying drawings. The disclosure is merely an example and is not limited by contents described in the embodiments below. Modification which is easily conceivable by a person of ordinary skill in the art comes within the scope of the disclosure as a matter of course. In order to make the description clearer, the sizes, shapes and the like of the respective parts may be changed and illustrated schematically in the drawings as compared with those in

an accurate representation. Constituent elements corresponding to each other in a plurality of drawings are denoted by like reference numbers and their detailed descriptions may be omitted unless necessary.

5 FIG. 1 shows a general configuration example of an elevator system according to an embodiment.

 A camera 12 is installed in the upper part of the doorway of a car 11. Specifically, the camera 12 is installed within a board 11a covering the upper part of
10 the doorway of the car 11 such that the lens portion of the camera 12 faces a direction capturing both the inside of the car 11 and a hall 15. The camera 12 is a compact monitoring camera such as an in-vehicle camera, comprises a wide-angle lens, and sequentially captures
15 images of several frames in a second (for example, 30 frames per second).

 The camera 12 may be always turned on and always capture an image, or may be turned on and start capturing an image at a predetermined first time point
20 and be turned off and finish capturing an image at a predetermined second time point. For example, the camera 12 may be turned on when the travel velocity of the car 11 is less than a predetermined value, and may be turned off when the travel velocity of the car 11 is
25 greater than or equal to the predetermined value. In this case, when the travel velocity becomes less than the predetermined value after the car 11 starts decelerating to stop on a predetermined floor, the camera 12 is turned on and starts capturing an image.
30 When the travel velocity exceeds the predetermined value after the car 11 starts accelerating to travel to a floor different from the predetermined floor, the camera 12 is turned off and finishes capturing an image. Thus, the camera 12 continues to capture an
35 image from when the travel velocity becomes less than

the predetermined value after the car 11 starts decelerating to stop on a predetermined floor until the travel velocity exceeds the predetermined value after the car 11 starts accelerating to travel from the
5 predetermined floor to a different floor, including a period in which the car 11 stops on the predetermined floor.

The capturing range of the camera 12 is set to $L1 + L2$ ($L1 \geq L2$). $L1$ is the capturing range on the hall
10 15 side and is set in a direction from car doors 13 to the hall 15. $L2$ is the capturing range on the car 11 side and is set in a direction from the car doors 13 to the rear surface of the car. $L1$ and $L2$ are the ranges in the depth direction. The range in the width
15 direction (a direction orthogonal to the depth direction) is at least greater than the transverse width of the car 11.

In the hall 15 of each floor, hall doors 14 are provided in the gate of arrival of the car 11 such that
20 the hall doors 14 are allowed to open and close. The hall doors 14 open and close in connection with the car doors 13 when the car 11 arrives. A power source (door motor) is provided on the car 11 side. The hall doors 14 merely open and close following the car doors 13.
25 In the following explanation, it is assumed that the hall doors 14 open when the car doors 13 open, and the hall doors 14 close when the car doors 13 close.

An image process is applied to each image (video) sequentially captured by the camera 12 in real time by
30 an image processor 20. Specifically, the image processor 20 detects (the motion of) the passenger closest to the car doors 13 based on the change in the luminance value of an image in an area (hereinafter, referred to as a detection area) set in advance, and
35 for example, determines whether or not the detected

passenger intends to board the car 11, and determines whether or not there is a possibility that a hand or arm of the detected passenger gets stuck in the door pocket. The result of the image process by the image processor 20 is reflected in the control process (mainly, the door open/close control process) by an elevator controller 30 depending on the need.

The elevator controller 30 controls the opening and closing of the car doors 13 when the car 11 arrives at the hall 15. Specifically, the elevator controller 30 opens the car doors 13 when the car 11 arrives at the hall 15, and closes the doors after the elapse of a predetermined time.

However, when a passenger who intends to board the car 11 is detected by the image processor 20, the elevator controller 30 prohibits the closing operation of the car doors 13 and maintains the door opened state (in other words, extends the opening period of the car doors 13). When a passenger whose hand or arm may get stuck in the door pocket is detected by the image processor 20, the elevator controller 30 prohibits the opening operation of the car doors 13 or delays the opening velocity of the car doors 13 compared with the normal case, or notifies the passenger that there is a possibility that a hand or arm gets stuck in the door pocket by, for example, making an announcement which prompts the passenger to be away from the car doors 13 in the car 11.

In FIG. 1, for the sake of convenience, the image processor 20 is taken out from the car 11. However, in practice, the image processor 20 is housed in the board 11a together with the camera 12. Although the example of FIG. 1 shows a case where the camera 12 and the image processor 20 are separately provided, the camera 12 and the image processor 20 may be provided as a

single integrated device. Further, although the example of FIG. 1 shows a case where the image processor 20 and the elevator controller 30 are separately provided, the function of the image processor 20 may be mounted on the elevator controller 30.

FIG. 2 shows an example of the hardware configuration of the image processor 20.

As shown in FIG. 2, in the image processor 20, a nonvolatile memory 22, a CPU 23, a main memory 24, a communication device 25 and the like are connected to a bus 21.

The nonvolatile memory 22 stores various programs including, for example, an operating system (OS). The programs stored in the nonvolatile memory 22 include a program for performing the above image process (more specifically, the passenger detection process described later) and a program (hereinafter, referred to as a calibration program) for realizing the calibration function described later.

The CPU 23 is a processor which performs, for example, various programs stored in the nonvolatile memory 22. The CPU 23 performs the control of the entire image processor 20.

The main memory 24 is used as, for example, a work area which is required when the CPU 23 performs various programs.

The communication device 25 comprises a function of controlling the communication with (in other words, the transmission and reception of signals to/from) external devices such as the camera 12 and the elevator controller 30.

Here, as described above, the image processor 20 performs a passenger detection process for detecting the passenger closest to the car doors 13 based on the

change in the luminance value of an image in a detection area set in advance. Since this passenger detection process focuses on the change in the luminance value of an image in a detection area set in advance, the detection area needs to be always set at a fixed position on an image.

However, if the attachment position (attachment angle) of the camera 12 is deviated by, for example, a shock applied to the car 11 or the camera 12 during the operation of the elevator system, the detection area is also deviated. Thus, the image processor 20 focuses on the change in the luminance value of an image in an area different from the area to be actually focused on. As a result, for example, there is a possibility that a passenger (or an object) who (which) should be detected under normal circumstances cannot be detected, or a passenger (or an object) who (which) should not be detected under normal circumstances is incorrectly detected.

FIG. 3 shows an example of an image captured when the attachment position of the camera 12 is not deviated. Although not shown in FIG. 1, a sill (hereinafter, referred to as a car sill) 13a for guiding the opening and closing of the car doors 13 is provided on the car 11 side. Similarly, a sill (hereinafter, referred to as a hall sill) 14a for guiding the opening and closing of the hall doors 14 is provided on the hall 15 side. The portion of the hatch lines in FIG. 3 indicates a detection area e1 set on an image. Here, as an example, it is assumed that, to detect a passenger present in the hall 15, the detection area e1 is set so as to have a predetermined range from, of the long sides of the rectangular car sill 13a, the long side on the car 11 side, to the hall 15 side. The detection area may be set on the car 11

side to prevent a hand or arm from getting stuck in the door pocket. A plurality of detection areas may be set on both the hall 15 side and the hall 11 side.

5 FIG. 4 shows an example of an image captured when the attachment position of the camera 12 is deviated. The portion of the hatch lines in FIG. 4 indicates the detection area e1 set on an image in a manner similar to that of FIG. 3.

10 As shown in FIG. 4, when the attachment position of the camera 12 is deviated, an image captured by the camera 12 is, for example, a rotated image (inclined image) in comparison with the case shown in FIG. 3. Under normal circumstances, as shown in FIG. 3, the detection area e1 is set so as to have a predetermined
15 range from, of the long sides of the rectangular car sill 13a, the long side on the car 11 side, to the hall 15 side. However, in a manner similar to that of FIG. 3, the detection area e1 is set at a fixed position on an image. Thus, as shown in FIG. 4, the
20 detection area e1 is set so as to have a predetermined range from a position which is not related to the long sides of the rectangular car sill 13a at all. In this configuration, as described above, there is a
25 possibility that a passenger who should be detected under normal circumstances cannot be detected, or a passenger who should not be detected is incorrectly detected. In the example of FIG. 4, the image is rotated because of the deviation of the attachment position of the camera 12. However, the same
30 possibility is considered when the image is deviated in a horizontal direction because of the deviation of the attachment position of the camera 12.

35 To deal with this problem, the image processor 20 of the present embodiment comprises a calibration function configured to detect whether or not the

attachment position of the camera 12 is deviated and to
set a detection area at an appropriate position based
on the deviation when the attachment position is
deviated. Hereinafter, this specification explains the
5 details of the calibration function.

To realize the calibration function, for example,
a marker m as shown in FIG. 5 needs to be provided in
the capturing range of the camera 12. The marker m is
provided by, for example, a maintenance engineer who
10 carries out the maintenance and inspection of the
elevator system. Here, the marker m is a square and
includes four black circles as a design. However, the
marker m may be modified in various ways as long as it
is a rectangle, in which all the four corners are right
15 angles, and includes a design which can be
distinguished from the other objects (for example, the
floor surfaces of the car 11 and the hall 15) included
in the capturing range of the camera 12.

FIG. 6 is a block diagram showing an example of a
20 functional configuration of the image processor 20
according to the present embodiment. Here, a
functional configuration related to the above
calibration function is mainly explained.

The image processor 20 includes, as shown in
25 FIG. 6, a storage device 201, an image acquisition
module 202, a deviation detection module 203, a setting
processor 204, a notification processor 205, etc. The
deviation detection module 203 further includes, as
shown in FIG. 6, a recognition processor 231, a
30 computation processor 232, a detection processor 233,
etc.

The present embodiment is explained such that
these modules and processors 202 to 205 are realized
when, for example, the CPU 23 (in other words, the
35 computer of the image processor 20) shown in FIG. 2

executes the calibration program stored in the nonvolatile memory 22 (in other words, by software). However, the modules and processors 202 to 205 may be realized by hardware, or a combination of software and hardware. In the present embodiment, the storage device 201 is configured by, for example, the nonvolatile memory 22 shown in FIG. 2 or another storage device.

Setting values related to the calibration function are stored in the storage device 201. The setting values related to the calibration function include a value (hereinafter, referred to as a first setting value) indicating the relative position of the marker with respect to a reference point. The reference point is a position which is an index for detecting whether or not the attachment position of the camera 12 is deviated. For example, the center of, of the long sides of the rectangular car sill 13a, the long side on the car 11 side corresponds to the reference point. The reference point may not be the above-described center of the long side on the car 11 side of the long sides of the rectangular car sill 13a. An arbitrary position may be set as the reference point as long as the position is included in the capturing range of the camera 12 when the attachment position of the camera 12 is not deviated.

The setting values related to calibration include a value (hereinafter, referred to as a second setting value) indicating the relative position of the camera 12 with respect to the reference point included in an image (reference image) when the attachment position of the camera 12 is not deviated.

Moreover, the setting values related to calibration include a value (hereinafter, referred to as a third setting value) indicating the relative

position of each of the vertices (four corners) of the car sill 13a with respect to the reference point. The present embodiment assumes a case where the detection area is set so as to have a predetermined range from, of the long sides of the rectangular car sill 13a, the long side on the car 11 side, to the hall 15 side. Thus, as the third setting value, a value indicating the relative position of each of the vertices of the car sill 13a with respect to the reference point is included. However, the third setting value is not limited to this example. A value based on the area to be set as the detection area is set as the third setting value. For example, when the detection area is set near the door pocket to prevent a hand or arm from getting stuck in the door pocket, as the third setting value, a value indicating the relative position of each feature point of the door pocket with respect to the reference point may be included.

The setting values related to calibration include a value (hereinafter, referred to as a camera setting value) indicating the height from the floor surface of the car 11 to the camera 12 and the angle of view (focal length) of the camera 12.

An image (reference image) captured when the attachment position of the camera 12 is not deviated may be stored in the storage device 201.

The image acquisition module 202 obtains an image (hereinafter, referred to as a captured image) captured by the camera 12 in a state where a plurality of markers m are provided on the floor surface of the car 11. The present embodiment assumes a case where a plurality of markers m are provided on the floor surface of the car 11. However, the markers m may be provided on the floor surface on the hall 15 side, or on the car sill 13a, or on the hall sill 14a, as long

as the position can specify the relative position with respect to the reference point (in the present embodiment, the center of the car sill 13a).

5 The deviation detection module 203 performs a recognition process for a captured image obtained by the image acquisition module 202 and recognizes (extracts) the markers m included in the captured image. The deviation detection module 203 detects a deviation of the attachment position of the camera 12
10 based on the recognized markers m. The functions of the recognition processor 231, the computation processor 232 and the detection processor 233 included in the deviation detection module 203 are described later with the explanation of the flowchart. Thus, the
15 detailed explanation thereof is omitted here.

 When the deviation detection module 203 detects a deviation of the attachment position of the camera 12, the setting processor 204 sets a detection area at an appropriate position according to the deviation in the
20 captured image obtained by the image acquisition module 202. In this way, the detection area in consideration of the deviation of the attachment position of the camera 12 is set on the captured image. The coordinate value of the detection area set at the appropriate
25 position according to the deviation may be stored in the storage device 201.

 When the deviation detection module 203 detects a deviation of the attachment position of the camera 12, the notification processor 205 notifies (the manager
30 of) a monitoring center monitoring the operation state, etc., of the elevator system and (a terminal owned by) a maintenance engineer who provides the marker m and carries out the maintenance and inspection of the elevator system that the attachment position of the
35 camera 12 is deviated (in other words, abnormal). This

notification is performed via, for example, the communication device 25.

Now, this specification explains the processing procedure of the image processor 20 in the calibration function according to the present embodiment. The
5 series of processes shown in FIG. 7 may be performed, for example, at the time of periodical maintenance, or before the operation of the elevator system.

The image acquisition module 202 obtains an image
10 (captured image) captured in a state where a plurality of markers m are provided on the floor surface of the car 11 from the camera 12 (step S1). Here, as an example, it is assumed that the captured image i1 shown in FIG. 8 is obtained by the image acquisition module
15 202. As shown in FIG. 8, two markers m1 and m2 provided in the both end portions of the rectangular car sill 13a along the long side of the car sill 13a are included in the captured image i1.

Subsequently, the recognition processor 231
20 included in the deviation detection module 203 performs a recognition process for the captured image obtained by the image acquisition module 202 and recognizes (extracts) the markers m included in the captured image (step S2). As described above, when the captured image
25 i1 is obtained in step S1, the recognition processor 231 performs a recognition process for the captured image i1 shown in FIG. 8 and recognizes (extracts) markers m1 and m2 included in the captured image i1.

The recognition of the markers m included in the
30 captured image may be realized by, for example, setting in advance an object including the design included in each marker m, in the present embodiment, an object including four black circles in a square as a design, so as to be recognized as a marker m, or may be
35 realized by using other well-known image recognition

techniques.

Subsequently, the recognition processor 231 computes each relative position of the camera 12 with respect to the markers m obtained as a result of the recognition process of step S2 and the angle of the three axes of the camera 12 (the attachment angle of the camera 12) based on the camera setting value (the height of the camera 12 and the angle of view of the camera 12) stored in the storage device 201 as a setting value (step S3). As described above, when markers m1 and m2 are recognized from the captured image i1 in step S2, the recognition processor 231 computes, as the relative position of the camera 12 with respect to the markers m, each of the relative position of the camera 12 with respect to marker m1 and the relative position of the camera 12 with respect to marker m2. In FIG. 8, point p1 corresponds to the portion regarded as marker m1, and point p2 corresponds to the portion regarded as marker m2.

Here, as an example, it is assumed that the relative position of the camera 12 with respect to the markers m is computed on the assumption that the center point (barycenter) of each square marker m is regarded as a marker m. Here, it is assumed that the barycenter of each marker m is regarded as a marker m. However, the specific portion of each marker m to be regarded as a marker m may be arbitrarily set. For example, one of the vertices of each square marker m may be regarded as a marker m.

The computation processor 232 included in the deviation detection module 203 computes the relative position of the camera 12 with respect to the reference point based on each relative position of the camera 12 with respect to the markers m computed by the recognition processor 231 and the first setting value

stored in the storage device 201 as a setting value
(step S4).

As stated above, when the relative position of the
camera 12 with respect to markers m1 and m2 is computed
5 in step S3, the computation processor 232 computes the
relative position of the camera 12 with respect to the
reference point by synthesizing the relative position
of the camera 12 with respect to marker m1 and the
relative position of marker m1 with respect to the
10 reference point as the first setting value. Similarly,
the computation processor 232 computes the relative
position of the camera 12 with respect to the reference
point by synthesizing the relative position of the
camera 12 with respect to marker m2 and the relative
15 position of marker m2 with respect to the reference
point as the first setting value. In FIG. 8, point p3
corresponds to the reference point.

Subsequently, the detection processor 233 included
in the deviation detection module 203 determines
20 whether or not the attachment position of the camera 12
is deviated based on the relative position of the
camera 12 with respect to the reference point computed
by the computation processor 232 and the second setting
value stored in the storage device 201 as a setting
25 value (step S5). Specifically, the detection processor
233 detects whether or not the attachment position of
the camera 12 is deviated by determining whether or not
the relative position of the camera 12 with respect to
the reference point computed by the computation
30 processor 232 is matched with the relative position of
the camera 12 with respect to the reference point as
the second setting value.

When the relative positions of the camera 12 with
respect to the reference point are matched with each
35 other, and the detection processor 233 determines that

the attachment position of the camera 12 is not deviated (YES in step S5), the detection processor 233 determines that there is no need to set the detection area again as the attachment position of the camera 12 is not deviated, and terminates the series of processes here.

When the relative positions of the camera 12 with respect to the reference point are not matched with each other, and the detection processor 233 determines that the attachment position of the camera 12 is deviated (NO in step S5), the setting processor 204 sets the detection area at an appropriate position according to the deviation of the attachment position of the camera 12 in the captured image obtained by the image acquisition module 202 based on the relative position of the camera 12 with respect to the reference point computed by the computation processor 232 and the third setting value and the camera setting value stored in the storage device 201 as setting values (step S6).

The present embodiment assumes a case where the detection area is set so as to have a predetermined range from the car sill 13a to the hall 15 side. Therefore, the setting processor 204 firstly computes the relative position of each vertex of the car sill 13a with respect to the camera 12 by synthesizing the relative position of the camera 12 with respect to the reference point computed by the computation processor 232 and the relative position of each vertex of the car sill 13a with respect to the reference point as the third setting value. In FIG. 8, points p4 to p7 correspond to the vertices of the car sill 13a.

Subsequently, the setting processor 204 sets the detection area based on the computed relative position of each vertex of the car sill 13a with respect to the camera 12, the angle of the three axes of the camera 12

computed by the recognition processor 231 and the angle of view of the camera 12 stored in the storage device 201 as the camera setting value.

5 In this configuration, as shown in the portion of the hatch lines of FIG. 8, the detection area e1 according to the deviation of the attachment position of the camera 12, in other words, the detection area e1 having a predetermined range from, of the long sides of the car sill 13a, the long side on the car 11 side, to
10 the hall 15 side, is set in the captured image i1 obtained by the image acquisition module 202.

Subsequently, the notification processor 205 notifies (the manager of) a monitoring center and (a terminal of) a maintenance engineer that the attachment
15 position of the camera 12 is deviated via the communication device 25 (step S7), and terminates the series of processes here.

In step S5 shown in FIG. 7, it is assumed that whether or not the attachment position of the camera 12 is deviated is determined (detected) based on whether
20 or not the relative position of the camera 12 with respect to the reference point included in the captured image is matched with the relative position of the camera 12 with respect to the reference point included
25 in the reference image. However, even when the attachment position of the camera 12 is deviated, the detection area may not be set again as long as the deviation does not affect the accuracy of the above passenger detection process. In other words, the
30 process of step S5 may be performed based on whether or not the difference (gap) between the relative position of the camera 12 with respect to the reference point included in the captured image and the relative
position of the camera 12 with respect to the reference
35 point included in the reference image is within the

range set in advance. When the gap is not within the range set in advance, it may be determined that the attachment position of the camera 12 is deviated.

When the setting of a detection area in the present embodiment indicates that the detection area which has been already set is set again, the setting of the detection area may be expressed as the correction of the detection area. In this case, since the relative position of the camera 12 with respect to the reference point is a value necessary to realize the correction of the detection area together with the angle of the three axes of the camera 12, the relative position may be expressed as a correction value.

In the present embodiment, the image processor 20 obtains an image captured in a state where a plurality of markers m which can be distinguished from the floor surface of the car 11 and the floor surface of the hall 15 are provided from the camera 12, recognizes the markers m from the obtained image, and detects whether or not the attachment position of the camera 12 is deviated based on the recognized markers m. When the image processor 20 detects a deviation of the attachment position of the camera 12, the image processor 20 sets a setting value related to an image process (passenger detection process). The setting value related to an image process includes (the coordinate value of) a detection area for detecting the passenger closest to the car doors 13 set with respect to the captured image.

In this configuration, even when the attachment position of the camera 12 is deviated, an appropriate detection area can be set for an image (for example, a rotated image or an image deviating in a horizontal direction) captured by the camera 12, thereby preventing the reduction in the detection accuracy of a

passenger.

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

WHAT IS CLAIMED IS:

1. An image processor for performing an image process for an image captured by a camera and including inside of a car and a hall to detect a passenger near doors of the car, the image processor comprising:

an acquisition module configured to obtain an image captured in a state where a marker distinguishable from a floor surface of the car and a floor surface of the hall is provided from the camera;

a detection module configured to recognize the marker from the obtained image and detect a deviation of an attachment position of the camera based on the recognized marker; and

a setting module configured to set a setting value related to the image process when a deviation of the attachment position of the camera is detected,

wherein the marker is provided at a position allowed to specify a relative position with respect to a sill for guiding opening and closing of the doors of the car.

2. The image processor of Claim 1, wherein

the detection module is configured to:

compute a relative position of the camera with respect to a reference point included in the obtained image and an attachment angle of the camera based on the recognized marker; and

detect a deviation of the attachment position of the camera when the computed relative position of the camera with respect to the reference point is not matched with a relative position of the camera with respect to the reference point included in a reference image of a case where the attachment position of the camera is not deviated.

3. The image processor of Claim 2, wherein
the setting module is configured to set the setting value related to the image process based on the computed relative position of the camera with respect to the reference point and the computed attachment angle of the camera.

4. The image processor of any one of Claim 1 to Claim 3, wherein

the setting value related to the image process includes an area for detecting the passenger, the area being set for the image captured by the camera.

5. The image processor of any one of Claim 1 to Claim 4, wherein

a plurality of markers are provided on a floor surface of the car along both end portions of the sill.

6. The image processor of any one of Claim 1 to Claim 5, further comprising a notification module configured to notify a manager that an abnormality occurs when a deviation of the attachment position of the camera is detected.