non-limiting embodiments need not necessarily be executed with an individually different timing from each other. For example, execution of a step may allow another step to occur during the same, or an execution timing of a step may overlap a part or a whole of an execution timing of another step.

ADVANTAGEOUS EFFECTS

[0022]

According to the some non-limiting embodiments, a camera installed in a place requiring identity verification can image an image suitable for identity authentication and authentication accuracy can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

The abovementioned purpose, and other purposes, characteristics and advantages will be further clarified by the following suitable example embodiments and the following associated drawings.

[0024]

Fig. 1 illustrates a conceptual configuration example of a gate system according to an example embodiment.

Fig. 2 is a plan view of a gate system as viewed from above.

~~Fig. 3 illustrates~~ Figs. 3A and 3B each illustrate an example of a guide pattern.

Fig. 4 illustrates a functional configuration example of a gate apparatus according to the present example embodiment.

Fig. 5 is a block diagram illustrating a hardware configuration of a computer that achieves a gate apparatus.

Fig. 6 is a flowchart illustrating an operation example of the gate apparatus according to the present example embodiment.

~~Fig. 7 illustrates~~ Figs. 7A and 7B each illustrate an example of a guide pattern, a stepping position for a person, and a detection result.

Fig. 8 is a flowchart illustrating a specific operation example of the gate apparatus assumed when the guide pattern of Fig. 7 is used.

~~Fig. 9 illustrates~~ Figs. 9A and 9B each illustrate another example of a guide pattern.

~~Fig. 10 illustrates~~ Figs. 10A and 10B each illustrate an example of a guide pattern, a stepping position for a person, and a detection result.

Fig. 11 is a flowchart illustrating a specific operation example of a gate apparatus assumed when the guide pattern of Fig. 10 is used.

Fig. 12 is a top view of a gate apparatus illustrating another example of a guide pattern.

Fig. 13 illustrates a functional configuration example of the gate apparatus according to the present example embodiment.

Fig. 14 is a flowchart illustrating an operation example of the gate apparatus according to the present example embodiment.

Fig. 15 illustrates a functional configuration example of the gate apparatus according to the present example embodiment.

Fig. 16 is a front view of a camera unit.

Fig. 17 is a flowchart illustrating an operation example of the gate apparatus according to the present example embodiment.

Fig. 18 is a flowchart illustrating an operation example of the gate system according to the present example embodiment.

Fig. 19 illustrates a functional configuration example of the gate apparatus according to the present example embodiment.

Fig. 20 explains distribution of sensors in a guide pattern.

~~Fig. 21 illustrates~~ Figs. 21A and 21B each illustrate a distribution region of reaction of sensors in the guide pattern.

DESCRIPTION OF EMBODIMENTS

[0025]

Example embodiments will be described below with reference to drawings. Note that a similar sign is given to a similar component in all drawings and overlapping description is omitted as appropriate.

[0026]

In the example embodiments, the term “acquisition” includes at least one of the operations of an own apparatus: fetching data or information stored in another apparatus or a storage medium (positive acquisition) and inputting data or information output from another apparatus or a storage medium (passive acquisition). An example of positive acquisition is issuing a request or an inquiry to another apparatus and receiving the response, or accessing another apparatus or a storage medium to read out data. An example of passive acquisition is receiving information broadcasted (or transmitted/notified via push notice). Further, the term “acquisition” may refer to selectively acquiring a piece of data or information from received data or information, or selectively receiving broadcasted data or information.

least indicates a recommended standing position in order, for an imaging unit 102 provided halfway in the passage 12 toward the open/close flap door 16, to acquire an image suitable for face authentication. The guide pattern 30 may indicate a position in which a person places his/her feet while walking in the passage 12 when the face of the person is imaged. In the same position as the guide pattern 30 is arranged a sensor that detects presence of a person.

[0036]

As described later, for example, the guide pattern 30 may have a shape of a footprint-~~(Fig. 3)~~ Figs. 3A and 3B. A toe of a footprint indicates a direction in which a person moves his/her feet. For example, an axis line connecting a toe and a heel through the center of the footprint in the guide pattern 30 indicates an orientation of the toe of the footprint. Relationship between an optical axis of an imaging unit 102 and the footprint in the guide pattern 30 is preferably such that the optical axis of the imaging unit 102 is substantially in parallel to the direction of the axis line indicating the orientation of the footprint, for example when viewed from above, and that the optical axis passes between left and right footprints.

[0037]

As illustrated in Fig. 2, the camera unit 20 is installed beside the passage 12. The imaging unit 102 is installed in such a way that an angle formed between the optical axis of the imaging unit 102 and a travel direction of the passage 12 (a direction parallel to that of an inner side face of the housing 14) will be in a range of 0 degrees to 90 degrees. The imaging unit 102 may be installed in such a way that the optical axis of the imaging unit 102 will cross diagonally with the travel direction of the passage 12. For example, the imaging unit 102 may be installed in such a way that an angle formed between the optical axis of the imaging unit 102 and the travel direction of the passage 12 will be equal to or more than 30 degrees or equal to or less than 60 degrees.

[0038]

A sensor 34 is arranged at a plurality of points or in at least a partial region of the guide pattern 30. A control unit 106 causes the imaging unit 102 to execute imaging when sensors 34 exceeding a predetermined ratio among the sensors 34 have detected presence of a person.

[0039]

The sensor 34 is a photoelectronic sensor in this example. The sensor 34 may be a pressure sensor in another example. An example of a pressure sensor is described later. A photoelectronic sensor detects presence/absence of a subject depending on whether emitted signal light is received as reflected light, by using a reflective sensor for example. That is, a photoelectronic sensor detects whether a person is standing on the guide pattern 30. The sensor

34 according to the present example embodiment outputs an ON signal when detecting presence of a person. Note that signals output from the sensor 34 are not limited thereto.

[0040]

~~Fig. 3 illustrates~~ Figs. 3A and 3B each illustrate an example of the guide pattern 30. Fig. 3A is a top view of the guide pattern 30. Fig. 3B is a cross-sectional view taken along line I-I of the guide pattern 30 in Fig. 3A. The guide pattern 30 includes a plurality of sensors 34 dotting a foot mark region 32 having a shape of a footprint.

[0041]

A film of a coat or a print of a predetermined paint is formed in the foot mark region 32 in this example. In a layer of the film, a plurality of sensors 34 is embedded (Fig. 3B). The film may be formed directly on a floor of the passage 12 or a sheet on which the film formed may be laid on the floor of the passage 12.

[0042]

<Functional configuration example>

Fig. 4 illustrates a functional configuration example of the gate apparatus 10 according to the present example embodiment.

In the following figures, configuration of a part that is irrelevant to the essence of the some non-limiting embodiments is omitted and not illustrated.

The gate apparatus 10 includes the imaging unit 102, an acquisition unit 104, and the control unit 106. The imaging unit 102 images a person passing through a passage leading to a gate through which a face authentication target person passes. The acquisition unit 104 acquires a detection result from the detection unit (sensor 34) that detects presence of a person. The sensor 34 is provided on the floor of the passage 12. The floor of the passage 12 is not only a surface of the passage 12 but may be inside a flooring of the passage 12 or beneath the flooring of the passage 12. The sensor 34 is provided at a position on which a person who passes through the passage 12 toward a gate steps. The control unit 106 controls, by using the detection result of the sensor 34 acquired by the acquisition unit 104, imaging timing of the imaging unit 102 that images a person passing through the passage 12.

[0043]

The imaging unit 102 is a camera including imaging elements such as a lens and a charge coupled device (CCD) image sensor. The camera includes a mechanism that adjusts or controls focusing, exposure correction, an aperture value, a shutter speed, an ISO sensitivity or the like, or may be automatically controlled in order to improve a picture quality of an imaged face image of a person thereby obtaining an optimum feature value for face image

The storage device 1040 also functions as various types of storage units.

[0050]

A program module may be recorded on a storage medium. A storage medium that records a program module includes a medium available to a non-transitory tangible computer 1000 and a program code readable by the computer 1000 (processor 1020) may be embedded in the medium.

[0051]

The input/output interface 1050 is an interface used to connect the gate apparatus 10 to various input/output devices (such as the display unit 22).

[0052]

The network interface 1060 is an interface used to connect the gate apparatus 10 to another apparatus on the communication network 3 (such as the face authentication apparatus 50). Note that the network interface 1060 may be unused.

[0053]

<Operation example>

Fig. 6 is a flowchart illustrating an operation example of the gate apparatus 10 according to the present example embodiment. First, the acquisition unit 104 acquires a detection result of the sensor 34 that detects presence of a person (step S101). The control unit 106 controls imaging timing of the imaging unit 102 by using the detection result acquired in step S101 (step S103).

[0054]

~~Fig. 7 illustrates~~ Figs. 7A and 7B each illustrate an example of the guide pattern 30, a stepping position for a person (illustrated by broken lines 40 in the figure), and a detection result. Fig. 8 is a flowchart illustrating a specific operation example of the gate apparatus 10 assumed when the guide pattern 30 ~~of Fig. 7~~ Figs. 7A and 7B is used.

[0055]

A flow of Fig. 8 starts when entry of a person into the passage 12 is detected by an entry sensor 18 of Fig. 2. Various conditions for termination of a flow are perceived and exemplified below in a nonlimitative fashion. A flow may be terminated at least in any one of the following conditions:

(1) A face image of a person is acquired by the imaging unit 102;

(2) Face authentication by the face authentication apparatus 50 has succeeded;

(3) The open/close flap door 16 is opened; and

(4) A face size and an interpupillary distance of an authentication target person have satisfied

predetermined criteria in a captured image.

[0056]

The acquisition unit 104 determines whether a ratio of the sensor 34b outputting an ON signal is above a threshold (step S201). The ratio of the sensor 34b outputting the ON signal is represented by a ratio of the number of sensors 34b outputting the ON signal to the total number of sensors 34 embedded in the foot mark region 32 of ~~Fig. 7~~ Figs. 7A and 7B. A threshold is specified that determines how precisely a person is standing on the guide pattern 30 oriented in such a way that a person's face will be oriented to the imaging unit 102. Any deviation in a stepping position of a person from the foot mark region 32 of the guide pattern 30 increases the number of sensors 34a not outputting the ON signal and decreases the ratio of the sensor 34b outputting the ON signal.

[0057]

For example, when a person steps on the guide pattern 30 as in Fig. 7A, the guide pattern 30 and the stepping position 40 for the person substantially overlap each other. Accordingly, a ratio of the sensor 34b outputting the ON signal becomes equal to or more than the threshold in step S201. The acquisition unit 104 passes the detection result to the control unit 106. Since the ratio of the sensor 34b outputting the ON signal becomes equal to or more than the threshold (YES in step S201), the control unit 106 instructs, based on this detection result, the imaging unit 102 to perform imaging (step S203).

[0058]

When a person steps on the guide pattern 30 as in Fig. 7B, the guide pattern 30 and the stepping position 40 for the person deviate from each other. Thus, a ratio of the sensor 34b outputting the ON signal is below the threshold in step S201. The acquisition unit 104 passes the detection result to the control unit 106. Since the ratio of the sensor 34b outputting the ON signal is below the threshold (NO in step S201), the control unit 106 bypasses step S203 based on this detection result.

[0059]

In addition to the ratio of the sensor 34b outputting the ON signal, determination of imaging timing may be based on a distribution of sensors 34b outputting the ON signal. For example, as illustrated in Fig. 20, concerning a plurality of sensors 34 arranged at the guide pattern 30, a region of a footprint is divided by n in parallel with respect to a travel direction Y (a direction connecting a heel and a toe of the footprint) to obtain a ratio of the number of sensors 34b outputting the ON signal to the number of sensors 34 included in each region W1 to Wn (n being a natural number). The region of the footprint is divided by n in such a way that as many

sensors 34 as will allow a deviation between the footprint and the stepping position be detected within the threshold, for example, will be included in the region W.

[0060]

When a distribution of the number of sensors 34b in each region W has a small dispersion, it may be determined that it is imaging timing. For example, when regions W in which a ratio of sensors 34b outputting the ON signal is equal to or more than a threshold P exist in succession over a reference with respect to a travel direction, the distribution is determined to have no dispersion.

[0061]

To be more precise, when regions W in which a ratio (%) of the sensor 34b outputting the ON signal with respect to a travel direction is equal to or more than the threshold P exist in succession over a reference range D0 with respect to a travel direction, it may be determined that it is imaging timing. ~~Fig. 21 illustrates~~ Figs. 21A and 21B each illustrate a distribution of a response of a sensor 34b in Figs. 7a and 7b. Note that a region W0 in Fig. 20 includes no sensors 34, so that the region W0 is excluded in ~~Fig. 21~~ Figs. 21A and 21B. A start point of a horizontal axis in a travel direction Y in ~~Fig. 21~~ Figs. 21A and 21B indicates a state of reaction of sensors 34 in a region W1 at a heel of the footprint of the guide pattern 30 in Fig. 20. A right end of the horizontal axis in a travel direction Y in ~~Fig. 21~~ Figs. 21A and 21B indicates a state of reaction of sensors 34 in a region Wn at a toe of the footprint of the guide pattern 30 in Fig. 20.

[0062]

Fig. 21A illustrates a left foot and Fig. 21B illustrates a right foot. A ratio of the number of sensors 34b outputting the ON signal to the number of sensors 34 installed in regions W1 to Wn is illustrated in a dot chain line and a broken line. In both Fig. 21A and Fig. 21B, a dot chain line indicates a distribution of reaction of sensors 34b in Fig. 7A and a broken line indicates a distribution of reaction of sensors 34b in Fig. 7B. The threshold P is indicated by a two-dot chain line and a reference range D is indicated by an arrow of a two-dot chain line.

[0063]

With reference to ~~Fig. 21~~ Figs. 21A and 21B, a ratio of the sensor 34b outputting the ON signal as indicated by a dot chain line related to Fig. 7A exceeds, for the left foot in Fig. 21A and the right foot in Fig. 21B, the threshold P in the regions W1 to Wn. In other words, a range D2 of regions in succession exceeds the reference range D0, so that a distribution of the ratio is determined to have no dispersion. In the present example indicated by a dot chain line related to Fig. 7A, it is determined that it is imaging timing.

[0064]

On the other hand, a ratio of the sensor 34b outputting the ON signal as indicated by a broken line related to Fig. 7B substantially varies at first glance, for the left foot in Fig. 21A and the right foot in Fig. 21B, with respect to a travel direction.

[0065]

In particular, for the left foot in Fig. 21A, there is no region W in which a ratio of the sensor 34b outputting the ON signal as indicated by a broken line related to Fig. 7B exceeds the threshold P (a two-dot chain line). For the right foot in Fig. 21B, the range D1 including a succession of regions W in which a ratio of the sensor 34b outputting the ON signal as indicated by a broken line related to Fig. 7B exceeds the threshold P is indicated by an arrow of a broken line and is below the reference range D0 as indicated by a two-dot chain line. Accordingly, in the present example indicated by a broken line related to Fig. 7B, it is determined that it is not imaging timing.

[0066]

In this way, determination of imaging timing may be made based on a change in distribution of sensors 34b outputting the ON signal with respect to a travel direction.

[0067]

~~Fig. 9 illustrates~~ Figs. 9A and 9B each illustrate another example of the guide pattern 30. Fig. 9A is a top view of the guide pattern 30. Fig. 9B is a cross-sectional view taken along line I-I of the guide pattern 30 in Fig. 9A. The guide pattern 30 includes the foot mark region 32 and a sheet-shaped pressure sensor 34, and the sensor 34 has approximately the same shape as the foot mark region 32 and is arranged in approximately the same location. The sensor 34 extends beneath the foot mark region 32 while overlapping the foot mark region 32. The pressure sensor reacts to a pressure applied when a person stands on the same and outputs a value related to an area of a reacting region. Also in this example, as described earlier, determination that is based on distribution of reacting regions may be perceived. For example, when a distribution of regions in which sensors 34 are reacting has a small dispersion in a travel direction of a footprint of the guide pattern 30, it may be determined that it is imaging timing.

[0068]

~~Fig. 10 illustrates~~ Figs. 10A and 10B each illustrate an example of the guide pattern 30, a stepping position for a person (illustrated by a broken line 40 in the figure), and a detection result. Fig. 11 is a flowchart illustrating a specific operation example of the gate apparatus 10 assumed when the guide pattern 30 of ~~Fig. 10~~ Figs. 10A and 10B is used. Start and stop conditions for a flow in Fig. 11 are similar to those in ~~Fig. 7~~ Figs. 7A and 7B.

[0069]

In this example, the acquisition unit 104 determines whether an area ratio of a reacting region of the pressure sensor is equal to or more than a threshold (step S301). The area ratio of the reacting region is indicated by an area ratio of a reacting region of the sensor 34 (indicated as 34b in the figure) provided in the same shape as the foot mark region 32 below the foot mark region 32 in ~~Fig. 10~~ Figs. 10A and 10B to the entire area of the foot mark region 32. A non-reacting region of the sensor 34 is indicated as 34a.

When a stepping position is deviated from the foot mark region 32 of the guide pattern 30, the area ratio decreases and when a person stands on the guide pattern 30 in a precise position, the area ratio increases.

[0070]

For example, when a person stands on the guide pattern 30 as in Fig. 10A, the guide pattern 30 substantially overlaps the stepping position 40 for a person. Thus, in step S301, an area ratio of the reacting region 34b of the sensor 34 is equal to or more than a threshold. The acquisition unit 104 passes the detection result to the control unit 106. Since the area ratio of the reacting region 34b of the sensor 34 is equal to or more than the threshold (YES in step S301), the control unit 106 instructs, based on this detection result, the imaging unit 102 to perform imaging (step S303).

[0071]

When a person steps on the guide pattern 30 as in Fig. 10B, the guide pattern 30 and the stepping position 40 for the person deviate from each other. Thus, an area ratio of a reacting region 34b of the sensor 34 is below the threshold in step S301. The acquisition unit 104 passes the detection result to the control unit 106. Since the area ratio of the reacting region 34b of the sensor 34 is below the threshold (NO in step S301), the control unit 106 bypasses step S303 based on this detection result.

[0072]

Fig. 12 is a top view of the gate apparatus 10 illustrating an example of another guide pattern 30.

In this example, the guide pattern 30 is provided in a shape that indicates to a person a direction or a route in which the person must advance to guide the person toward the camera unit 20 provided beside the passage 12. In this example, the guide pattern 30 may be projected on a floor of the passage 12 by using a projector (not illustrated) installed above the housing 14. In this case, the guide pattern 30 may be an animation moving in a travel direction. In this example, the above-described sensor 34 is provided in a region, among the floor regions of the passage 12, in which it can be determined whether a person is stepping on a position to help the

CLAIMS

1. A gate apparatus comprising:

an imaging means for imaging a person passing through a passage leading to a gate;

an acquisition means for acquiring a detection result from a detection means which is provided on a floor of the passage and detects presence of the person; and

a control means for controlling imaging timing of the imaging means by using the detection result acquired by the acquisition means.

2. The gate apparatus according to claim 1, wherein

the acquisition means acquires a detection result of detection of presence of the person by using a sensor being provided on the floor of the passage and arranged in a same position as a guide pattern indicating a route to the gate.

3. The gate apparatus according to claim 2, wherein

the imaging means is installed beside the passage,

the sensors are arranged at a plurality of points or in at least a partial region in the guide pattern, and

the control means causes the imaging means to execute imaging when sensors exceeding a predetermined ratio among the sensors detect presence of the person.

4. A gate apparatus comprising:

an imaging means for imaging a verification target person in a place requiring identity verification;

an acquisition means for acquiring a detection result from a detection means which is provided at a stepping position for a person in the place requiring identity verification and detects presence of the person; and

a control means for controlling imaging timing of the imaging means by using the detection result acquired by the acquisition means.

5. The gate apparatus according to claim 4, wherein

the acquisition means acquires a detection result of detection of presence of the person by using a sensor being provided in the place requiring identity verification and arranged in a same position as a guide pattern indicating a route to the stepping position for a person.

6. The gate apparatus according to claim 5, wherein

the imaging means is installed beside the place requiring identity verification,

the sensors are arranged at a plurality of points or in at least a partial region of the guide pattern, and

the control means causes the imaging means to execute imaging when sensors exceeding a predetermined ratio among the sensors detect presence of the person.

7. The gate apparatus according to any one of claims 1 to 6, further comprising

an estimation means for estimating, based on an image of the person imaged by the imaging means, a line of sight or a face orientation of the person, wherein

the control means controls the imaging timing by using an estimation result by the estimation means.

8. The gate apparatus according to any one of claims 1 to 7, further comprising

an output means for performing predetermined output when the control means has determined that it is not appropriate timing for imaging to be executed.

9. A gate system comprising:

a gate apparatus; and

a foot mark that detects presence of a person and is provided on a floor of a passage, wherein

the gate apparatus includes

an imaging means for imaging a person passing through the passage leading to a gate,

an acquisition means for acquiring a result of detection of the person in the passage using the foot mark, and

a control means for controlling, by using the result of the detection acquired by the acquisition means, imaging timing of the imaging means.

10. The gate system according to claim 9, wherein

the acquisition means of the gate apparatus acquires a detection result of detection of presence of the person by using a sensor being provided on the floor of the passage and arranged in a same position as a guide pattern indicating a route to the gate.

11. The gate system according to claim 10, wherein

the imaging means of the gate apparatus is installed beside the passage,

the sensors are arranged at a plurality of points or in at least a partial region in the guide pattern, and

the control means of the gate apparatus causes the imaging means to execute imaging when sensors exceeding a predetermined ratio among the sensors detect presence of the person.

12. A gate system comprising:

a gate apparatus; and

a foot mark that detects presence of a person and is provided in a place requiring identity verification, wherein

the gate apparatus includes

an imaging means for imaging a person as a verification target in the place requiring identity verification,

an acquisition means for acquiring a detection result from a detection means which is provided at a stepping position for a person in the place requiring identity verification and detects presence of the person, and

a control means for controlling imaging timing of the imaging means by using the detection result acquired by the acquisition means.

13. The gate system according to claim 12, wherein

the acquisition means of the gate apparatus acquires a detection result of detection of presence of the person by using a sensor being provided in the place requiring identity verification and arranged in a same position as a guide pattern indicating a route to the stepping position for a person.

14. The gate system according to claim 13, wherein

the imaging means of the gate apparatus is installed beside the place requiring identity verification,

the sensors are arranged at a plurality of points or in at least a partial region of the guide pattern, and

the control means of the gate apparatus causes the imaging means to execute imaging when sensors exceeding a predetermined ratio among the sensors detect presence of the person.

15. The gate system according to any one of claims 9 to 14, wherein

the gate apparatus further includes an estimation means for estimating, based on an image of the person imaged by the imaging means, a line of sight or a face orientation of the person, and

the control means of the gate apparatus controls the imaging timing by using an estimation result by the estimation means.

16. The gate system according to any one of claims 9 to 15, further comprising

an output means for performing predetermined output when the control means of the gate apparatus has determined that it is not appropriate timing for imaging to be executed.

17. A control method for a gate apparatus, comprising:

by a gate apparatus,

acquiring a detection result from a sensor, the sensor which detects, in a passage leading to a gate, presence of a person passing through the passage and is provided on a floor of the passage; and

controlling, based on the detection result, imaging timing of a camera that images the person passing through the passage, in order to acquire a face image used for face authentication.

18. The control method for a gate apparatus according to claim 17, further comprising,

by the gate apparatus,

acquiring a detection result of detection of presence of the person by using a sensor being provided on the floor of the passage and arranged in a same position as a guide pattern indicating a route to the gate.

19. The control method for a gate apparatus according to claim 18, wherein

the camera is installed beside the passage,

the sensors are arranged at a plurality of points or in at least a partial region of the guide pattern, and

the control method further comprises, by the gate apparatus,

causing the camera to execute imaging when sensors exceeding a predetermined ratio among the sensors detect presence of the person.

20. A control method for a gate apparatus, comprising:

by a gate apparatus,

acquiring a detection result from a sensor which is provided in a stepping position for a person in a place requiring identity verification and detects presence of the person in the place requiring identity verification; and

controlling, based on the detection result, imaging timing of a camera that images a person as a verification target in the place requiring identity verification in order to acquire a face image used for face authentication.

21. The control method for a gate apparatus according to claim 20, further comprising,

by the gate apparatus,

acquiring a detection result of detection of presence of the person by using a sensor being provided in the place requiring identity verification and arranged in a same position as a guide pattern indicating a route to the stepping position for a person.

22. The control method for a gate apparatus according to claim 21, wherein

the camera is installed beside the place requiring identity verification,

the sensors are arranged at a plurality of points or in at least a partial region of the guide pattern, and

the control method further comprises, by the gate apparatus,

causing the camera to execute imaging when sensors exceeding a predetermined ratio among the sensors detect presence of the person.

23. The control method for a gate apparatus according to any one of claims 17 to 22, further comprising:

by the gate apparatus,

estimating, based on an image of the person imaged by the camera, a line of sight or a face orientation of the person; and

controlling the imaging timing by using an estimation result.

24. The control method for a gate apparatus according to any one of claims 17 to 23, further comprising,

by the gate apparatus,

performing predetermined output when having determined that it is not appropriate

timing for imaging to be executed.

25. A program recording medium, wherein the program causes ~~for causing~~ a computer to execute:

a procedure for detecting presence of a person detected by using a sensor which is provided on a floor of a passage leading to a gate; and

a procedure for controlling, based on a detection result, imaging timing of a camera that images the person passing through the passage in order to acquire a face image used for face authentication.

26. The program recording medium according to claim 25, wherein the program ~~for~~ further causes ~~causing~~ a computer to execute

a procedure for acquiring a detection result of detection of presence of the person by using a sensor being provided on a floor of the passage and arranged in a same position as a guide pattern indicating a route to the gate.

27. The program recording medium according to claim 26, wherein

the camera is installed beside the passage,

the sensors are arranged at a plurality of points or in at least a partial region of the guide pattern, and

the program ~~for~~ further causes ~~causing~~ a computer to execute

a procedure for causing the camera to execute imaging when sensors exceeding a predetermined ratio among the sensors detect presence of the person.

28. A program recording medium, wherein the program causes ~~for causing~~ a computer to execute:

a procedure for acquiring a detection result from a sensor being provided at a stepping position for a person in a place requiring identity verification and detecting presence of the person in the place requiring identity verification; and

a procedure for controlling, based on the detection result, imaging timing of a camera that images a person as a verification target in the place requiring identity verification in order to acquire a face image used for face authentication.

29. The program recording medium according to claim 28, wherein the program ~~for~~ further

causes ~~causing~~ a computer to execute

a procedure for acquiring a detection result of detection of presence of the person by using a sensor being provided in the place requiring identity verification and arranged in a same position as a guide pattern indicating a route to the stepping position for a person.

30. The program recording medium according to claim 29, wherein

the camera is installed beside the place requiring identity verification,

the sensors are arranged at a plurality of points or in at least a partial region of the guide pattern, and

the program ~~for~~ further causes ~~causing~~ a computer to execute

a procedure for causing the camera to execute imaging when sensors exceeding a predetermined ratio among the sensors detect presence of the person.

31. The program recording medium according to any one of claims 25 to 30, wherein the program ~~for~~ further causes ~~causing~~ a computer to execute:

a procedure for estimating, based on an image of the person imaged by the camera, a line of sight or a face orientation of the person; and

a procedure for controlling the imaging timing by using an estimation result in the estimating procedure.

32. The program recording medium according to any one of claims 25 to 31, wherein the program ~~for~~ further causes ~~causing~~ a computer to execute

a procedure for performing predetermined output when it is determined that it is not appropriate timing for imaging to be executed.

33. A gate apparatus comprising:

a first acquisition means for acquiring, from an imaging means, an image in which a person passing through a passage leading to a gate is imaged;

a second acquisition means for acquiring a detection result from a detection means which is provided on a floor of the passage and detects presence of the person; and

a control means for controlling imaging timing of the imaging means by using the detection result acquired by the second acquisition means.

34. A control method for a gate apparatus comprising:

by a gate apparatus,

acquiring a detection result from a detection means which is provided on a floor of a passage and detects presence of a person passing through the passage leading to a gate;

controlling, by using the acquired detection result, imaging timing of an imaging means for imaging a person passing through a passage leading to a gate; and

acquiring an image in which the person is imaged with the imaging timing from the imaging means.

35. A program recording medium, wherein the program causes ~~for causing~~ a computer to execute:

a procedure for acquiring a detection result from a detection means which is provided on a floor of a passage and detects presence of a person passing through the passage leading to a gate;

a procedure for controlling, by using the acquired detection result, imaging timing of an imaging means for imaging a person passing through a passage leading to a gate; and

a procedure for acquiring an image imaging the person with the imaging timing from the imaging means.