[0018]

Next, a fifth example embodiment will be described. The example embodiment is an example of performing re-authentication by changing setting of a focal position of an iris camera at a time of authentication failure in an imaging system that performs walk-through authentication. The walk-through authentication is an authentication method of authenticating a target person passing through the front of a camera while walking.

[0019]

Fig. 2 illustrates a configuration example of the imaging system according to the example embodiment. As illustrated in Fig. 2, the imaging system 100 includes a plurality of iris cameras 110, a wide field of view (WFOV) camera 120, a plurality of illumination devices 130, a human detection sensor 140, a gate 150, a display device 160, and a control device 200. The imaging system 100 authenticates a target person P walking toward the gate 150, and allows the target person P to pass through the gate 150 when authentication is successful.

[0020]

The iris camera 110 is an iris imaging device for capturing irises of the target person P. A resolution of the iris camera 110 is a resolution with which an iris pattern of the target person P can be extracted, and an angle of view of the iris camera 110 is an angle of view including at least both eyes of the target person P. Note that the angle of view is a capturing area (visual field area) of a camera at a capturing point (position of a capturing target). The iris camera 110 is formed of a general-purpose camera of 12 M pixels (horizontal 4000 pixels, vertical 3000 pixels) and 60 fps, which is becoming a diffused product, such as an industrial camera, for example.

[0021]

A position (height) of eyes of the target person P varies depending on a height of the target person P. Thus, for example, the plurality of iris cameras 110 are aligned in a vertical direction by height of the target person P. In this example, three iris cameras ~~110-1~~110-0 to 110-2 are disposed, but the number is not limited to three, and any number of the iris cameras 110 may be disposed. For example, the number of iris cameras is set according to an angle of view, a resolution, and the like of the iris camera 110.

[0022]

when walk-through authentication fails, a target person is made to stand still in front of a gate, and re-authentication is then performed by changing setting of an iris camera. In this way, a re-authentication gate does not need to be provided, and the same gate does not need to be passed again. Therefore, complicatedness of an authentication process at a time of re-authentication can be suppressed, and the re-authentication can be smoothly performed. Further, since the re-authentication is performed by changing setting of the same iris camera, an installation place and the number of cameras do not need to be increased.

[0068]

(Sixth Example Embodiment)

Next, a sixth example embodiment will be described. The example embodiment is an example of performing re-authentication by changing an angle of view and an imaging direction of an iris camera at a time of re-authentication in the imaging system in the fifth example embodiment. A configuration of an imaging system and a configuration of a control device according to the example embodiment are similar to those in the fifth example embodiment, and an operation at a time of walk-through authentication is also similar to that in the fifth example embodiment.

[0069]

Fig. 9 illustrates re-authentication processing according to the example embodiment. In Fig. 9, as compared to the processing in Fig. 7 in the fifth example embodiment, setting processing of an angle of view or an imaging direction of an iris camera (S310) is added.

[0070]

In other words, in the re-authentication processing according to the example embodiment, similarly to Fig. 7, imaging of a wide field of view image (S301), detection of eyes (S302), and application of ~~irradiation~~illumination light (S303) are performed. Then, a control device 200 sets an angle of view or an imaging direction of an iris camera 110 (S310). As illustrated in Fig. 10, since a fixed focusing position D1 at a time of walk-through authentication and a re-authentication position D2 at a time of re-authentication have different distances from the iris camera 110, the angle of view of the iris camera 110 changes. In other words, since the re-authentication position D2 is closer to the iris camera 110 than the fixed focusing position D1, an angle of view A2 in the re-

example embodiment, similarly to Fig. 9, imaging of a wide field of view image (S301) and detection of eyes (S302) are performed. Then, a control device 200 sets an amount of illumination light (S311). Since a fixed focusing position D1 at a time of walk-through authentication and a re-authentication position D2 at a time of re-authentication have different distances from an illumination device 130, intensity (brightness) by ~~irradiation~~illumination light changes. Then, when imaging is performed in the re-authentication position D2 at the same amount of ~~irradiation~~illumination light as that in the fixed focusing position D1, there is a risk that a feature value cannot be accurately extracted from an iris image of a target person. Thus, an illumination control unit 204 sets, as an amount of light of a plurality of the illumination devices 130, an amount of light according to the predetermined re-authentication position D2 (position of a target person P). Then, illumination light having the set amount of light is applied to the target person (S303), and, similarly to the sixth example embodiment, the iris camera 110 captures irises of the target person, and authenticates the target person (S301 and S304 to S308).

[0077]

As described above, in the example embodiment, an amount of illumination light is further changed at a time of re-authentication. Since intensity of illumination light changes between a time of walk-through authentication and the time of the re-authentication, by appropriately setting the amount of illumination light at the time of the re-authentication, accuracy of re-authentication processing can be further improved. Note that, at the time of the re-authentication, not only an amount of ~~irradiation~~illumination light but also an irradiation direction of ~~irradiation~~illumination light may be changed according to a re-authentication position.

[0078]

(Other Example Embodiment)

For example, in the imaging system according to any of the fifth to seventh example embodiments, imaging of a wide field of view image may not be performed at a time of re-authentication. In other words, in the re-authentication processing in Figs. 7, 9, and 12, imaging of a wide field of view image (S301) and detection of eyes (S302) may be omitted.

[0079]

In this case, in S304, selection and setting of the iris camera 110 may be

CLAIMS

1. An imaging system comprising:

first control means for controlling, in such a way as to fix a focal position in a predetermined position, iris imaging means for capturing an image focusing on an iris of a target person;

authentication means for authenticating the target person, based on an iris image of the target person being captured by the controlled iris imaging means; and

second control means for controlling the iris imaging means in such a way as to scan a focal position in a predetermined range, in order to re-authenticate the target person when authentication of the target person fails.

2. The imaging system according to Claim 1, wherein

the first control means performs control in such a way as to fix the focal position when the target person is authenticated in a first authentication mode, ~~and~~

the second control means performs control in such a way as to scan the focal position when the target person is authenticated in a second authentication mode.~~,~~

~~3. The imaging system according to Claim 2, wherein~~

the first authentication mode is an authentication mode of authenticating the target person while moving, and

the second authentication mode is an authentication mode of authenticating the target person while stopping.

~~4. The imaging system according to Claim 3, further comprising guide control means for controlling guide means for guiding movement of the target person,~~

~~wherein the guide control means controls the guide means in such a way as to stop the target person while moving when authentication of the target person fails.~~

~~5. The imaging system according to Claim 4, wherein~~

~~the guide means is a gate through which the target person passes, and~~

~~the guide control means performs control in such a way as to close the gate when authentication of the target person fails.~~

~~6. The imaging system according to Claim 4, wherein~~

~~the guide means is output means for outputting an authentication result of the target person, and~~

~~the guide control means outputs information for stopping movement of the target person from the output means when authentication of the target person fails.~~

~~7. The imaging system according to any one of Claims 1 to 6, wherein~~

~~the iris imaging means includes a variable focus lens, and~~

~~the first control means and the second control means control a lens focus driving value of the variable focus lens.~~

~~8. The imaging system according to any one of Claims 1 to 7, wherein the second control means sets a focal position of the iris imaging means according to a position of the target person.~~

3~~9~~. The imaging system according to Claim 1 or 2 ~~any one of Claims 1 to 8~~, wherein the second control means changes an angle of view of the iris imaging means when authentication of the target person fails, or~~.~~

~~10. The imaging system according to any one of Claims 1 to 8, wherein~~ the second control means changes an imaging direction of the iris imaging means when authentication of the target person fails.

4~~11~~. The imaging system according to any one of Claims 1 to 3~~10~~, wherein the first control means sets a region of interest (ROI) including an eye of the target person for the iris imaging means, based on a whole image being captured by whole imaging means for capturing the target person in a range wider than that of the iris imaging means.

5~~12~~. The imaging system according to Claim 4~~11~~, wherein the first control means transforms coordinates of an eye of the target person in the whole image into coordinates in the iris image by using a coordinate transformation matrix associated with the fixed focal position, and sets the ROI, based on the transformed coordinates.

6~~13~~. The imaging system according to Claim 5~~12~~, wherein the second control means sets the ROI for the iris imaging means, based on the transformed coordinates.

7~~14~~. The imaging system according to Claim 5~~12~~ or 6~~13~~, further comprising a plurality of iris imaging means as the iris imaging means,

wherein the first control means selects the set iris imaging means from among the plurality of iris imaging means, based on the transformed coordinates.

8~~15~~. The imaging system according to Claim 7~~14~~, wherein the second control means selects the set iris imaging means from among the plurality of iris imaging means, based on the transformed coordinates.

~~16. The imaging system according to any one of Claims 1 to 10, wherein the second control means sets an ROI including an eye of the target person for the iris imaging means, based on a whole image being captured by whole imaging means for capturing the target person in a range wider than that of the iris imaging means.~~

~~17. The imaging system according to Claim 16, wherein the second control means transforms coordinates of an eye of the target person in the whole image into coordinates in the iris image by using a coordinate transformation matrix associated with a position of the target person, and sets the ROI, based on the transformed coordinates.~~

~~18. The imaging system according to Claim 17, further comprising a plurality of iris imaging means as the iris imaging means,~~

~~wherein the second control means selects the set iris imaging means from~~

~~among the plurality of iris imaging means, based on the transformed coordinates.~~

~~19. The imaging system according to any one of Claims 1 to 18, further comprising illumination control means for performing control in such a way as to change an amount of light of illumination means for applying light to the target person when authentication of the target person fails.~~

9~~20~~. An imaging method comprising:

controlling, in such a way as to fix a focal position in a predetermined position, iris imaging means for capturing an image focusing on an iris of a target person;

authenticating the target person, based on an iris image of the target person being captured by the controlled iris imaging means; and

controlling the iris imaging means in such a way as to scan a focal position in a predetermined range, in order to re-authenticate the target person when authentication of the target person fails.

~~21. The imaging method according to Claim 20, further comprising:~~

~~performing control in such a way as to fix the focal position when the target person is authenticated in a first authentication mode; and~~

~~performing control in such a way as to scan the focal position when the target person is authenticated in a second authentication mode.~~

10~~22~~. A non-transitory computer-readable medium configured to store an imaging program for causing a computer to execute processing of:

controlling, in such a way as to fix a focal position in a predetermined position, iris imaging means for capturing an image focusing on an iris of a target person;

authenticating the target person, based on an iris image of the target person being captured by the controlled iris imaging means; and

controlling the iris imaging means in such a way as to scan a focal position in a predetermined range, in order to re-authenticate the target person when authentication of the target person fails.

~~23. The non-transitory computer-readable medium according to Claim 22, further causing:~~

~~performing control in such a way as to fix the focal position when the target person is authenticated in a first authentication mode; and~~

~~performing control in such a way as to scan the focal position when the target person is authenticated in a second authentication mode.~~