

FACE RECOGNITION DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present disclosure is based on, and claims benefit of priority to, Chinese Application No. 202020378787.6 filed on March 23, 2020. Disclosure of the Chinese Application is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of face recognition technology, and more particularly, to a face recognition device.

BACKGROUND

[0003] In epidemic prevention and control, monitoring information on public place accessing personnel plays a vital role. In this work, personnel working at a commutation entrance to a public place works with significant labor intensity and a high risk of being infected. People may be gathered at a gateway of a public place when labor efficiency fails to meet a traffic volume at the gateway, increasing the risk of infection. Information on gathered personnel is generally registered manually at the gateway of the public place. Consequently, cross infection may occur due to paper and pen sharing during registration of personnel information.

SUMMARY

[0004] The present disclosure provides a face recognition device, including a device body, a body temperature detector, a first camera, and a processor located on the device body. The first camera and the body temperature detector are both electrically connected

to the processor. The first camera is configured to take a face image of a detection object and transmit the face image to the processor. The body temperature detector is configured to detect a body temperature of the detection object and transmit the body temperature to the processor. The processor is configured to compare an identity of the detection object according to the face image, acquire a state of health of the detection object according to the body temperature of the detection object detected, and grant access in response to the face image matching the identity of the detection object and the detection object being in a healthy state.

[0005] A face recognition device according to embodiments of the present disclosure is provided with a processor, a first camera, and a body temperature detector. The first camera captures a face image. The processor authenticates a detection object through the face image, and determines a state of health of the detection object according to body temperature of the detection object detected by the body temperature detector. Clearance of access is granted only when the face image and the detection object are authenticated, and the detection object is in a healthy state, implementing automatic personnel information verification and health state verification, thereby reducing labor intensity of a staff member, improving traffic efficiency, reducing cross infection.

[0006] In one embodiment, the body temperature detector, the processor, and the first camera are integrated with the device body, rendering a compact structure, and an attractive appearance.

[0007] In one embodiment, the processor and the first camera are integrated with the device body, and the body temperature detector is externally connected to the device body, or the body temperature detector is connected to the device body through a network. The body temperature detector may be highly flexible. The body temperature detector may be connected when body temperature detection is required. The body temperature detector may be removed or disconnected from the network when body temperature detection is not required.

[0008] In one embodiment, the face recognition device further includes a card reader located on the device body and electrically connected to the processor. The card reader may be configured to read information on a card of the detection object, acquire

identity information on the card of the detection object, and return the identity information to the processor. The processor may be configured to determine a result of authentication of the detection object according to a matching degree between the face image and the identity information. The face recognition device according to embodiments of the present disclosure may be configured to compare a person to an ID card, and compare the face image to identity information on the card to ensure that access is granted when the person matches the card.

[0009] In one embodiment, the face recognition device further includes an access card reader located on the device body and electrically connected to the processor. The access card reader may be configured to read information on an access card of the detection object. Identity information of any detection object holding the access card may be pre-stored by the face recognition device. The identity information may be returned to the processor. The processor may be configured to determine whether to grant access in response to whether the face image matches the identity information of the any detection object holding the access card.

[0010] The face recognition device of embodiments of the present disclosure is provided with an access card reader. In addition, the face recognition device pre-stores identity information of any detection object holding an access card, determines, according to a result of face recognition, whether a detection object swiping an access card is a person belonging to a jurisdiction and whether the detection object is using someone else's card, and determines whether the detection object is healthy according to a detection result of a body temperature detector, thereby implementing automatic management of access by people in the jurisdiction, improving traffic efficiency, reducing labor intensity of a staff member, and reducing the risk of cross infection.

[0011] In one embodiment, the face recognition device may further include an infrared camera located on the device body and electrically connected to the processor. The infrared camera may be configured to take the face image of the detection object for liveness detection. Thus, by providing the infrared camera, suspicious person may be prevented from access.

[0012] In one embodiment, the face recognition device may further include a second

camera located on the device body and electrically connected to the processor. The second camera may be configured to an ID photo or scan a two-dimensional code image. The second camera may take an ID photo, and may scan a two-dimensional code image such as a health code, a back-to-work code in epidemic prevention and control, to acquire health information and identity information of the detection object.

[0013] In one embodiment, the face recognition device further includes a voice collecting unit located on the device body and electrically connected to the processor. The voice collecting unit may be configured to recognize a voice and return a voice recognition result to the processor. The processor may be configured to execute a preset program according to the voice recognition result returned by the voice collecting unit. In this way the face recognition device does not have to be touched by hand, and control is implemented via voice, reducing cross infection.

[0014] In one embodiment, the face recognition device may further include an alarm unit located on the device body and electrically connected to the processor. The alarm unit may be configured to give an alarm in response to at least one of the face image not matching the identity of the detection object or the detection object being in an unhealthy state, so that a suspicious person is found in time.

[0015] In one embodiment, the face recognition device may further include a network communication unit located on the device body and electrically connected to the processor. The network communication unit may be configured to communicate with a server or a cloud. The network communication unit may be a wired connector, a device for wirelessly connected Wireless Fidelity (WiFi), mobile data, etc., transmitting data of the face recognition device to a server or a cloud, thereby implementing networking of personnel information. Based on big data technology, historical data may be queried and personnel epidemic information may be monitored.

[0016] In one embodiment, the face recognition device may further include a positioning unit located on the device body and electrically connected to the processor. The positioning unit may be configured to locate geographical coordinates of the face recognition device, implementing grid layout in epidemic prevention and control. Once there is a suspicious person having a fever, the positioning unit can quickly locate the

geographical coordinates of the suspicious person, and record personnel itinerary information, facilitating tracing any close contact.

[0017] In one embodiment, the face recognition device further includes an interaction interface located on the device body and electrically connected to the processor. The interaction interface may be configured for interaction with at least one of the detection object or an administrator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Drawings herein are introduced briefly for clearer illustration of a technical solution herein. Note that the drawings described below refer merely to some embodiments of the present disclosure. For a person having ordinary skill in the art, other drawings may be acquired according to the drawings herein without creative effort.

[0019] FIG. 1 is an illustrative diagram of an exploded three-dimensional structure of a face recognition device according to an embodiment of the present disclosure.

[0020] FIG. 2 is an illustrative diagram of a structure of a face recognition device according to an embodiment of the present disclosure.

[0021] FIG. 3 is an illustrative diagram of a three-dimensional structure of a face recognition device according to an embodiment of the present disclosure.

[0022] FIG. 4 is an illustrative diagram of a structure of a face recognition device according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0023] Clear complete description to a technical solution herein is given below with reference to the drawings and embodiments of the present disclosure. Clearly, embodiments illustrated herein are but some, instead of all, embodiments according to the present disclosure. Based on the embodiments of the present disclosure, a person

having ordinary skill in the art may acquire another embodiment without creative effort. Any such embodiment falls within the scope of the present disclosure.

[0024] Referring to FIG. 1, embodiments of the present disclosure provide a face recognition device 100, including a device body. The device body may include a base 11 and a housing 12. The base 11 is a supporting base. Electronic equipment may be provided inside the base 11. The base 11 may also be provided with an external interface 112. The external interface 112 may be configured to be connected to an external device. The housing 12 may be located on the base 11. The housing 12 may include a front housing 121 and a rear housing 122. The front housing 121 and the rear housing 122 may be detachably connected to each other. There may be an accommodating space between the front housing 121 and the rear housing 122 for accommodating electronic equipment.

[0025] Referring to FIG. 1 and FIG. 2, the face recognition device 100 may further include a body temperature detector 105, a first camera 102, and a processor 101 located on the device body. The first camera 102 and the body temperature detector 105 are both electrically connected to the processor 101.

[0026] The processor 101 may be located in the accommodating space between the front housing 121 and the rear housing 122, or may be located in the base 11. The first camera 102 may be located at the front housing 121. The head of the first camera 102 may be exposed from the front housing 121. The front housing 121 may be disposed facing a detection object, so that the first camera 102 can take a face image of the detection object. The first camera 102 may be an RGB camera for acquiring a color image, facilitating face comparison. The body temperature detector 105 may be provided in the accommodating space between the front housing 121 and the rear housing 122, and exposed from the front housing 121, so that the body temperature detector 105, the processor 101, and the first camera 102 are integrated with the device body, rendering a compact structure, and an attractive appearance. The body temperature detector 105 may also be externally attached to the housing 12 and connected to the external interface 112 of the base 11 via a connection line. Alternatively, the body temperature detector 105 may not be physically connected to the device body, but may be connected via a network. Thus, the body temperature detector 105 may be highly flexible. The body temperature

detector 105 may be connected when body temperature detection is required. The body temperature detector 105 may be removed or disconnected from the network when body temperature detection is not required. The body temperature detector 105 may be a forehead thermometer for detecting body temperature of a detection object, to detect whether the detection object is having a fever. The body temperature detector 105 may detect the body temperature of the detection object using technical means such as thermal imaging, single-point/multi-point infrared sensing, etc., or any other technical means known in the art.

[0027] The face recognition device 100 may work as follows. The first camera 102 captures a face image of a detection object and transmits the face image to the processor 101. The body temperature detector unit 105 detects body temperature of the detection object and transmits the body temperature to the processor 101. The processor 101 compares an identity of the detection object according to the face image, and acquires a state of health of the detection object according to the body temperature of the detection object detected. The face recognition device 100 grants access when the face image and the detection object are authenticated and the detection object is in a healthy state.

[0028] If the face image does not match the identity of the detection object or if the detection object is in an unhealthy state, the face recognition device 100 does not grant access. Here, it may be determined whether the detection object is in a healthy state according to the body temperature of the detection object detected by the body temperature detector 105. When the body temperature of the detection object is higher than a threshold or lower than a threshold, it is determined that the detection object is not in a healthy state. For example, if the body temperature of the detection object is higher than 37.5° or lower than 35.5°, it is determined that the detection object is in an unhealthy state, and if the body temperature of the detection object is between 35.5° and 37.5°, it is determined that the detection object is in a healthy state.

[0029] When the processor 101 receives a face image captured by the first camera 102, the processor 101 may perform image processing to implement face recognition when the detection object is wearing a face mask.

[0030] A detection object may refer to a community member, a visitor, a staff member,

etc., who enters a surveillance or access control area.

[0031] Therefore, a face recognition device 100 according to embodiments of the present disclosure is provided with a processor 101, a first camera 102, and a body temperature detector 105. The first camera 102 captures a face image. The processor 101 authenticates a detection object through the face image, and determines a state of health of the detection object according to body temperature of the detection object detected by the body temperature detector 105. Clearance of access is granted only when the face image and the detection object are authenticated, and the detection object is in a healthy state, implementing automatic personnel information verification and health state verification, thereby reducing labor intensity of a staff member, improving traffic efficiency, reducing cross infection.

[0032] In one embodiment, referring to FIG. 1 and FIG. 2, the face recognition device 100 may further include a card reader 104 located on the device body and electrically connected to the processor 101. The card reader 104 may be configured to read information on a card of the detection object, and acquire identity information on the card of the detection object. The card may include, but is not limited to, an ID card, a passport, an Exit-Entry Permit for Travelling to and from Hong Kong and Macao, etc. A digital photo is usually stored in a built-in chip of the card. The processor 101 may determine a result of authentication of the detection object according to a matching degree between the face image and the identity information, such as whether the face image matches the digital photo.

[0033] The card reader 104 may be located on the base 11. The base 11 may be provided with a platform. The platform may have a sensing area. The card reader 104 may be disposed to correspond to the sensing area. An ID card may be placed on the sensing area of the platform. The card reader 104 may read information on a digital photo stored on a chip inside the ID card. Of course, the card reader 104 may also be provided on the housing 12, such as on the side of the front housing adjacent to the detection object. Specifically, the card reader 104 may be a contactless Integrated Circuit (IC) card, or may be another electronic device capable of reading the chip inside the ID card.

[0034] The face recognition device 100 according to embodiments of the present

disclosure may be configured to compare a person to an ID card, and compare the face image to identity information on the card to ensure that access is granted when the person matches the card. The face recognition device 100 according to embodiments of the present disclosure is mainly used at a place of person-card comparison, such as a government service hall, a certificate center of a public security bureau, customs entrance and exit, a hotel front desk, etc., and is applicable to a general community.

[0035] In one embodiment, referring to FIG. 3 and FIG. 4, the face recognition device 200 also includes a device body. The device body may include a support 21 and a housing 22, and also a processor 201 and a body temperature detector 205.

[0036] The face recognition device 200 according to embodiments of the present disclosure may further include an access card reader 204 located on the device body and electrically connected to the processor 201. The access card reader 204 may be configured to read information on an access card of the detection object. Identity information of any detection object holding the access card may be pre-stored by the face recognition device 200. The processor 201 may determine whether to grant access in response to whether the face image matches the identity information of the any detection object holding the access card.

[0037] The face recognition device 200 of embodiments of the present disclosure may be applied to jurisdiction management, such as management of internal personnel of an enterprise, a community, a school, etc. The face recognition device 200 may have pre-stored thereon identity information of any person in a jurisdiction. The identity information may include a digital photo. When a person in the jurisdiction swipes an access card, the face recognition device 200 may first determine whether the access card matches pre-stored access card information, that is, whether the access card is held by a person belonging to the jurisdiction. If the access card is held by a person belonging to the jurisdiction, it may be determined whether the detection object is one holding the access card by determining whether a face image captured by the first camera 202 matches a pre-stored digital photo. Then, it may be determined, through the body temperature detector 205, whether the detection object is in a healthy state. If it is determined that the detection object is a person belonging to the jurisdiction and holding

the access card, and is healthy, the face recognition device 200 may grant clearance for access.

[0038] Identity information of anyone holding an access card pre-stored by the face recognition device 200 may be stored locally, or may be stored in a database of a server or a cloud and the face recognition device 200 may be connected to the database through a network to read the identity information.

[0039] An access card may be a non-contact IC card supporting data acquisition of cards of ISO14443A, ISO14443B protocols.

[0040] In some jurisdictions, an ID card may be used instead of an access card. Unlike the face recognition device 100 including the card reader 104 described above, with the face recognition device 200 of the present embodiment, it is not required to read the digital photo of an ID card. Instead, the digital photo is pre-stored in the face recognition device 200.

[0041] Therefore, the face recognition device 200 of embodiments of the present disclosure is provided with an access card reader 204. In addition, the face recognition device 200 pre-stores identity information of any detection object holding an access card, determines, according to a result of face recognition, whether a detection object swiping an access card is a person belonging to a jurisdiction and whether the detection object is using someone else's card, and determines whether the detection object is healthy according to a detection result of a body temperature detector 205, thereby implementing automatic management of access by people in the jurisdiction, improving traffic efficiency, reducing labor intensity of a staff member, and reducing the risk of cross infection.

[0042] In one embodiment, referring to FIG. 3 and FIG. 4, the face recognition device 200 may further include an infrared camera 211 located on the device body and electrically connected to the processor 201. The infrared camera 211 may be configured to take the face image of the detection object for liveness detection. It will be appreciated that an infrared camera may also be provided in the face recognition device 100 of FIG. 1 and FIG. 2.

[0043] The infrared camera 211 may be provided in the device body at a location adjacent to the first camera 202. The infrared camera 211 is provided to put an end to use of a non-living tool. The first camera 202 can take only an image of visible light. For example, one may deceive the first camera 202 using a non-living tool such as a photo, thereby acquiring an erroneous result of matching the face image to the identity information of one holding an access card. In fact, the face image is a face image on the photo taken by the first camera 202, rather than a face image of an actual person. In order to put an end to such phenomena, an infrared camera 211 may be provided. Face images of visible light and of infrared light of a detection object may have to be taken by the first camera 202 and the infrared camera 211, and it may be recognized whether it is a non-living tool using the face image of infrared light. Therefore, by providing the infrared camera 211, suspicious person may be prevented from access.

[0044] A common feature in the two embodiments of FIG. 1 and FIG. 3 is introduced below.

[0045] In one embodiment, referring to FIG. 1 to FIG. 4, the face recognition device 100 (200) may further include an Optical Character Recognition (OCR) camera 103 (203) located on the device body and electrically connected to the processor 101 (201). The second camera 103 (203) may be configured to take an ID photo or scan a two-dimensional code image to acquire health information and identity information of the detection object. The second camera 103 (203) may take an ID photo, and may scan a two-dimensional code image such as a health code, a back-to-work code in epidemic prevention and control.

[0046] In one embodiment, referring to FIG. 1 to FIG. 4, the face recognition device 100 (200) may further include a voice collecting unit 110 (210) located on the device body and electrically connected to the processor 101 (201). The voice collecting unit 110 (210) may be configured to recognize a voice. The processor 101 (201) may be configured to execute a preset program according to a voice recognition result returned by the voice collecting unit 110 (210). The voice collecting unit 110 (210) may be an exposed microphone provided inside the body, or a microphone connected to the external interface 112 of the device body via a connection line. The processor 101 (201) may

execute a preset program according to the voice recognition result, including an operation such as inputting personnel information, editing person information, transmitting person information, etc. That is, the face recognition device 100 (200) does not have to be touched by hand, and control is implemented via voice, reducing cross infection.

[0047] In one embodiment, referring to FIG. 1 to FIG. 4, the face recognition device 100 (200) may further include an alarm unit 109 (209) located on the device body and electrically connected to the processor 101 (201). The alarm unit 109 (209) may give an alarm in response to at least one of the face image not matching the identity of the detection object or the detection object being in an unhealthy state. The alarm unit 109 (209) may be an acoustic, optical, or electrical alarm device. The alarm unit 109 (209) gives an alarm so that a suspicious person is found in time.

[0048] In one embodiment, referring to FIG. 1 to FIG. 4, the face recognition device 100 (200) may further include a network communication unit 106 (206) located on the device body and electrically connected to the processor 101 (201). The network communication unit 106 (206) may be configured to communicate with a server or a cloud. The network communication unit 106 (206) may be a wired connector, a device for wirelessly connected WiFi, mobile data, etc., transmitting data of the face recognition device 100 (200) to a server or a cloud, thereby implementing networking of personnel information. Based on big data technology, historical data may be queried and personnel epidemic information may be monitored. An external device may be connected to the face recognition device 100 (200) through the network communication unit 106 (206).

[0049] In one embodiment, referring to FIG. 1 to FIG. 4, the face recognition device 100 (200) may further include a positioning unit located on the device body and electrically connected to the processor 101 (201). The positioning unit may be configured to locate geographical coordinates of the face recognition device 100 (200). By locating the geographical coordinates of the face recognition device 100 (200), the positioning unit may implement grid layout in epidemic prevention and control. Once there is a suspicious person having a fever, the positioning unit can quickly locate the geographical coordinates of the suspicious person, and record personnel itinerary information, facilitating tracing any close contact. In other embodiments, the geographical coordinates

may be determined according to the installation location where the face recognition device 100 (200) is installed. The installation location may be determined once the face recognition device 100 (200) is mounted.

[0050] In one embodiment, referring to FIG. 1 to FIG. 4, the face recognition device 100 (200) may further include an interaction interface 108 (208) located on the device body and electrically connected to the processor 101 (201). The interaction interface 108 (208) may be configured for interaction with at least one of the detection object or an administrator. The interaction interface 108 (208) may be a display, a keyboard, a mouse, a speaker, etc.

[0051] what disclosed are merely embodiments of the present disclosure, and of course are not intended to limit the scope of the claims of the present disclosure. A person having ordinary skill in the art may appreciate all or some of the flow of implementing the embodiments, and make an equivalent variation according to the claims of the present disclosure, which still fall within the scope of the utility model.

INDUSTRIAL APPLICABILITY

[0052] The present disclosure provides a face recognition device, including a device body, a body temperature detector, a first camera, and a processor located on the device body. The first camera and the body temperature detector are both electrically connected to the processor. The first camera is configured to take a face image of a detection object and transmit the face image to the processor. The body temperature detector is configured to detect a body temperature of the detection object and transmit the body temperature to the processor. The processor is configured to compare an identity of the detection object according to the face image, acquire a state of health of the detection object according to the body temperature of the detection object detected, and grant access in response to the face image matching the identity of the detection object and the detection object being in a healthy state.

CLAIMS

What is claimed is:

1. A face recognition device, comprising a device body, a body temperature detector, a first camera, and a processor located on the device body,

wherein the first camera and the body temperature detector are both electrically connected to the processor,

wherein the first camera is configured to take a face image of a detection object and transmit the face image to the processor,

wherein the body temperature detector is configured to detect a body temperature of the detection object and transmit the body temperature to the processor,

wherein the processor is configured to compare an identity of the detection object according to the face image, acquire a state of health of the detection object according to the body temperature of the detection object detected, and grant access in response to the face image matching the identity of the detection object and the detection object being in a healthy state.

2. The face recognition device of claim 1, wherein the body temperature detector, the processor, and the first camera are integrated with the device body.

3. The face recognition device of claim 1, wherein the processor and the first camera are integrated with the device body, wherein the body temperature detector is externally connected to the device body, or the body temperature detector is connected to the device body through a network.

4. The face recognition device of claim 1, further comprising a card reader located on the

device body and electrically connected to the processor,

wherein the card reader is configured to read information on a card of the detection object, acquire identity information on the card of the detection object, and return the identity information to the processor,

wherein the processor is configured to determine a result of authentication of the detection object according to a matching degree between the face image and the identity information.

5. The face recognition device of claim 1, further comprising an access card reader located on the device body and electrically connected to the processor,

wherein the access card reader is configured to read information on an access card of the detection object, identity information of any detection object holding the access card being pre-stored by the face recognition device, the identity information being returned to the processor,

wherein the processor is configured to determine whether to grant access in response to whether the face image matches the identity information of the any detection object holding the access card.

6. The face recognition device of claim 1, further comprising an infrared camera located on the device body and electrically connected to the processor, the infrared camera being configured to take the face image of the detection object for liveness detection.

7. The face recognition device of any one of claims 1 to 6, further comprising a second camera located on the device body and electrically connected to the processor,

wherein the second camera is configured to take an ID photo or scan a two-dimensional code image to acquire health information and identity information of the

detection object.

8. The face recognition device of any one of claims 1 to 6, further comprising a voice collecting unit located on the device body and electrically connected to the processor,

wherein the voice collecting unit is configured to recognize a voice and return a voice recognition result to the processor, the processor being configured to execute a preset program according to the voice recognition result returned by the voice collecting unit.

9. The face recognition device of any one of claims 1 to 6, further comprising:

an alarm unit located on the device body and electrically connected to the processor, the alarm unit being configured to give an alarm in response to at least one of the face image not matching the identity of the detection object or the detection object being in an unhealthy state; and

a network communication unit located on the device body and electrically connected to the processor, the network communication unit being configured to communicate with a server or a cloud.

10. The face recognition device of any one of claims 1 to 6, further comprising an interaction interface located on the device body and electrically connected to the processor for interaction with at least one of the detection object or an administrator.