

Fig. 9 is a schematic block diagram for explaining the third modification of the present invention. .

Detailed Description of the Embodiments

[0023]

An embodiment of the present invention will be explained with reference to the accompanying drawings.

[0024]

(Configuration of the authentication system according to the present embodiment)

First, the configuration of the authentication system in an embodiment of the present invention will be explained with reference to Fig. 1.

[0025]

This authentication system includes an authentication image acquisition device 1, a template image acquisition device 2, and a matching unit 3 (see Fig. 1). In the present embodiment, transmission or reception of data can be carried out among the functional components through an appropriate network or communication path. The same can be said of the functional components in each of functional blocks.

[0026]

(The authentication image acquisition device)

The authentication image acquisition device 1 has an authentication light source 11, an authentication image acquisition unit 12 and an authentication image processing unit 13 (see Fig. 2).

[0027]

The authentication light source 11 is configured to irradiate light which contains at least red light in the visible light region toward the palm of the human body.

The authentication light source 11 may consist of an illuminant (e.g., LED) which can emit light having a wavelength in the visible light region including red light. Basically, sunlight or ambient light may be used as the light source. The accuracy of authentication, however, can be raised with artificial light as it allows for capturing correctly the wavelength range of the irradiating light. Red light as herein used means a light with a wavelength of about 580 to 750 μm (so-called reddish light). The optimal wavelength can be determined experimentally. It is thought that amber colored light (about 590 to 630 μm in wavelength) is more preferable. Although the light source may emit only the light with the wavelength range as mentioned above, it may contain the light having other wavelengths. The light source which emits a desired light by filtering may also be used. However, visible light other than red light has the possibility of producing noise when extracting the shape of the veins. Therefore, the light source which emits red light only is preferred from the viewpoint of reducing noise.

[0028]

The authentication image acquisition unit 12 is configured to acquire at least one reflection image (i.e. image data) to form by the light which is emitted from the authentication light source 11, and is reflected on the palm of the human body. The authentication image acquisition unit 12 may be made up of an appropriate device such as digital camera and image scanner. Alternatively, the authentication image acquisition unit 12 may consist of a camera mounted on a mobile terminal.

[0029]

The authentication image processing unit 13 is configured for performing image processing of the reflection image, thereby extracting the shape of the palm print and the shape of the veins in the palm respectively for authentication from one reflection image so as to generate the authentication data.

[0079]

(Step SC-2 in Fig.8)

Next, the authentication image processing unit 13 extracts said shape of the palm print in the palm for authentication from said reflection image as a first authentication data (see Fig. 7 (a)) by performing image processing of the reflected image data. The first authentication data may consist of the shape data of palm print portion only as shown in Fig. 7 (b) obtainable by abstracting the shape of Fig. 7(a). Whether or not the abstraction is made is determined during the processing to generate the template data.

[0080]

(Step SC-3 in Fig. 8)

During, before or after this step, the authentication image processing unit 13 carries out image processing of the reflected image and thereby extracts the vein shape in the said palm for authentication as the data for the second authentication (see Fig. 7 (c)). The data for the first authentication may be the data of vein portion only as shown in Fig. 7 (d) by abstracting the shape of Fig. 7 (c).

[0081]

(Step SC-4 in Fig. 8)

The authentication image processing unit 13 performs synthesis processing of the first authentication data and the second template data to generate the data for authentication as gray scale (see Fig. 7 (e)). The data in abstract manner as shown in Fig. 7 (f) may be used as the synthesized authentication data(a third authentication data).

[0082]

(Step SC-5 of Fig. 8)

Next, the authentication image processing unit 13 binarizes the gray scale data for authentication.

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[0023]

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[0024]

(Configuration of the authentication system according to the present embodiment)

First, the configuration of the authentication system in an embodiment of the present invention will be explained with reference to Fig. 1.

[0025]

This authentication system includes an authentication image acquisition device 1, a template image acquisition device 2, and a matching unit 3 (see Fig. 1). In the present embodiment, transmission or reception of data can be carried out among the functional components through an appropriate network or communication path. The same can be said of the functional components in each of functional blocks.

[0026]

(The authentication image acquisition device)

The authentication image acquisition device 1 has an authentication light source 11, an authentication image acquisition unit 12 and an authentication image processing unit 13 (see Fig. 2).

[0027]

The authentication light source 11 is configured to irradiate light which contains at least red light in the visible light region toward the palm of the human body.

The authentication light source 11 may consist of an illuminant (e.g., LED) which can emit light having a wavelength in the visible light region including red light. Basically, sunlight or ambient light may be used as the light source. The accuracy of authentication, however, can be raised with artificial light as it allows for capturing correctly the wavelength range of the irradiating light. Red light as herein used means a light with a wavelength of about 580 to 750 nm (so-called reddish light). The optimal wavelength can be determined experimentally. It is thought that amber colored light (about 590 to 630 nm in wavelength) is more preferable. Although the light source may emit only the light with the wavelength range as mentioned above, it may contain the light having other wavelengths. The light source which emits a desired light by filtering may also be used. However, visible light other than red light has the possibility of producing noise when extracting the shape of the veins. Therefore, the light source which emits red light only is preferred from the viewpoint of reducing noise.

[0028]

The authentication image acquisition unit 12 is configured to acquire at least one reflection image (i.e. image data) to form by the light which is emitted from the authentication light source 11, and is reflected on the palm of the human body. The authentication image acquisition unit 12 may be made up of an appropriate device such as digital camera and image scanner. Alternatively, the authentication image acquisition unit 12 may consist of a camera mounted on a mobile terminal.

[0029]

The authentication image processing unit 13 is configured for performing image processing of the reflection image, thereby extracting the shape of the palm print and the shape of the veins in the palm respectively for authentication from one reflection image so as to generate the authentication data.

[0079]

(Step SC-2 in Fig.8)

Next, the authentication image processing unit 13 extracts said shape of the palm print in the palm for authentication from said reflection image as a first authentication data (see Fig. 7 (a)) by performing image processing of the reflected image data. The first authentication data may consist of the shape data of palm print portion only as shown in Fig. 7 (b) obtainable by abstracting the shape of Fig. 7(a). Whether or not the abstraction is made is determined during the processing to generate the template data.

[0080]

(Step SC-3 in Fig. 8)

During, before or after this step, the authentication image processing unit 13 carries out image processing of the reflected image and thereby extracts the vein shape in the said palm for authentication as the data for the second authentication (see Fig. 7 (c)). The data for the first authentication may be the data of vein portion only as shown in Fig. 7 (d) by abstracting the shape of Fig. 7 (c).

[0081]

(Step SC-4 in Fig. 8)

The authentication image processing unit 13 performs synthesis processing of the first authentication data and the second authentication data to generate the data for authentication as gray scale (see Fig. 7 (e)).The data in abstract manner as shown in Fig. 7 (f) may be used as the synthesized authentication data(a third authentication data).

[0082]

(Step SC-5 of Fig. 8)

Next, the authentication image processing unit 13 binarizes the gray scale data for authentication.

CLAIMS

1. An authentication image acquisition device which has an authentication light source, an authentication image acquisition unit, and an authentication image processing unit,
wherein said authentication light source is configured for irradiating light that contains at least red light in the visible light region, toward a palm of human body,
wherein said authentication image acquisition unit is configured for obtaining at least one reflection image to form by the light which is emitted from said authentication light source and is reflected on said palm of human body, and
wherein said authentication image processing unit is configured for performing the image processing of said reflection image, and thereby extracting said shape of the palm print and vein pattern in the palm respectively from said one reflection image for authentication to conduct the processing to generate the authentication data.
2. The authentication image acquisition device as described in claim 1, wherein said authentication image processing unit is configured to perform the processing for extracting said shape of the palm print by transforming the data corresponding to said reflection image into the value of gray scale based on R signal, G signal, and B signal in RGB color space, and
wherein said authentication image acquisition unit is configured to extract said shape of the veins as chrominance obtained by transforming said data corresponding to the reflection image into HSV color space, altering the phase of H signal and the intensity of S signal in this HSV color space, and subsequently transforming said HSV color space into RGB color space and CMYK color space.
3. The authentication image acquisition device as described in claim 1 or 2, wherein said authentication image processing unit is configured to further perform the processing for generating said authentication data by performing

synthesis processing of said extracted shape of the palm print and said extracted shape of the veins for authentication.

4. The authentication image acquisition device as described in any one of claims 1 to 3, wherein said authentication light source and said image acquisition unit are both implemented on one mobile terminal.

5. The authentication image acquisition device as described in claim 4, wherein said mobile terminal is provided with a display screen capable of externally emitting light containing red light , and wherein said authentication light source is made up of said display screen.

6. A template image acquisition device which includes a template light source , a template image acquisition unit, a template image processing unit, and a template data storage unit, wherein said template light source is configured to be capable of irradiating light containing at least red light in the visible light region toward the palm of a human body, wherein said template image acquisition unit is configured to acquire at least one reflection image to form by the light which is irradiated from the template light source and is reflected on said palm of the human body, and wherein said template image processing unit is configured for performing image processing of said reflection image, thereby extracting the shape of palm print and the shape of the veins in the palm respectively from one sheet of said reflection image for template so as to perform the processing to generate the template data, wherein said template data storage unit is configured for storing said template data.

7. An individual authentication system which has the authentication image acquisition device as described in any one of claims 1 to 5, the template image acquisition device as described in claim 6, and a matching unit, wherein said

matching unit is configured to perform individual authentication by comparing said authentication data captured by said authentication image acquisition device with said template data stored in said template data storage unit.

8. The individual authentication system as described in claim 7 further includes an authentication processing drive device, a matching result transforming device, and a matching result receiving device, wherein said authentication processing drive device is configured to request said authentication image acquisition device to start the authentication processing when the prescribed conditions have been met, wherein said matching result transforming device is configured to receive the result of matching conducted by said matching unit , wherein said matching result transforming device is configured to generate a unique code to the person himself/herself or the terminal used by the same, when the result of said matching has been satisfactory in the individual authentication, and wherein said matching result receiving device is configured to receive said code generated by said matching result transforming device.

9. A method for individual authentication including the following steps:

(1) a step of acquiring at least one reflection image formed by light which is emitted from the authentication light source which emits at least red light in the visible light region and reflected on the palm of a human body;

(2) a step of extracting the shape of the palm print and the shape of the veins in said palm respectively from said one reflection image for authentication, by performing image processing of said one reflection image;

(3) a step of performing authentication by comparing said data for authentication with the template data previously registered .

10. The method for individual authentication as described in claim 9, wherein said authentication data includes a first authentication data that

corresponds to said shape of the palm print and a second authentication data that corresponds to said shape of the vein pattern, wherein said authentication includes a first authentication and a second authentication to be conducted after performing the first authentication, and wherein said first authentication is conducted using said first authentication data and said second authentication is conducted using said second authentication data.

11. The method for individual authentication as described in claim 9, wherein said authentication data includes a third authentication data created by integrating the first authentication data corresponding to said shape of the palm print with the second authentication data corresponding to said shape of the veins, and wherein said authentication is performed using said third authentication data.

12. The method for individual authentication as described in any one of claims 9 to 11 including the following steps to be performed prior to said authentication:

(a) a step of acquiring at least one reflection image to form by the light which is emitted from the template light source emitting at least red light in the visible light region, and is reflected on the palm of human body;

(b) a step of extracting the shape of the palm print and shape of the veins in said palm respectively from said one reflection image for template, by performing image processing of said reflection image, and

(c) a step of saving said template data for succeeding authentication.

13. A computer program to get a computer executing the method as described in any one of claims 9 to 12.

CLAIMS

1. An authentication image acquisition device which has an authentication light source, an authentication image acquisition unit, and an authentication image processing unit,
wherein said authentication light source is configured for irradiating light that contains at least red light in the visible light region, toward a palm of human body,
wherein said authentication image acquisition unit is configured for obtaining at least one reflection color image formed by the light which is emitted from said authentication light source and is reflected by said palm of human body, and
wherein said at least one reflection color image has RGB pixel values in RGB color space or pixel values equivalent thereto, and
wherein said authentication image processing unit is configured for performing the image processing of said one reflection color image, and thereby extracting said shape of the palm print and vein pattern in the palm respectively from said one reflection color image for authentication to conduct the processing to generate the authentication data.
2. The authentication image acquisition device as described in claim 1 wherein; said authentication image acquisition unit is for use of visible light, and said one reflection color image is formed by wavelength bandwidth in the visible light region.
3. The authentication image acquisition device as described in any one of claims 1 or 2, wherein said authentication image processing unit is configured to perform the processing for extracting said shape of the palm print by transforming the data corresponding to said reflection image into the value of gray scale based on R signal, G signal, and B signal in RGB color space, and
wherein said authentication image acquisition unit is configured to extract said shape of the veins as chrominance obtained by transforming said data corresponding to the reflection image into HSV color space, altering the phase of H signal and the intensity of S signal in this HSV color space, and subsequently transforming said HSV color space into RGB color space and CMYK color space.

4. The authentication image acquisition device as described in any one of claims 1 to 3, wherein said authentication image processing unit is configured to further perform the processing for generating said authentication data by performing synthesis processing of said extracted shape of the palm print and said extracted shape of the veins for authentication.

5. The authentication image acquisition device as described in any one of claims 1 to 4, wherein said authentication light source and said image acquisition unit are both implemented on one mobile terminal.

6. The authentication image acquisition device as described in claim 5, wherein said mobile terminal is provided with a display screen capable of externally emitting light containing red light, and wherein said authentication light source is made up of said display screen.

7. A template image acquisition device which includes a template light source, a template image acquisition unit, a template image processing unit, and a template data storage unit, wherein said template light source is configured to be capable of irradiating light containing at least red light in the visible light region toward the palm of a human body, wherein said template image acquisition unit is configured to acquire at least one reflection color image to form by the light which is irradiated from the template light source and is reflected on said palm of the human body, and wherein said at least one reflection color image has RGB pixel values in RGB space or pixel values equivalent thereto, wherein said template image processing unit is configured for performing image processing of said one reflection color image, thereby extracting the shape of palm print and the shape of the veins in the palm respectively from said one reflection color image for template so as to perform the processing to generate the template data, wherein said template data storage unit is configured for storing said template data.

8. An individual authentication system which has the authentication image acquisition device as described in any one of claims 1 to 6, the template image acquisition device as described in claim 7, and a matching unit, wherein said matching unit is configured to perform individual authentication by comparing said authentication data captured by said authentication image acquisition device with said template data stored in said template data storage unit.

9. The individual authentication system as described in claim 8 further includes an authentication processing drive device, a matching result transforming device, and a matching result receiving device, wherein said authentication processing drive device is configured to request said authentication image acquisition device to start the authentication processing when the prescribed conditions have been met, wherein said matching result transforming device is configured to receive the result of matching conducted by said matching unit, wherein said matching result transforming device is configured to generate a unique code to the person himself/herself or the terminal used by the same, when the result of said matching has been satisfactory in the individual authentication, and wherein said matching result receiving device is configured to receive said code generated by said matching result transforming device.

10. A method for individual authentication including the following steps:

- (1) a step of acquiring at least one reflection color image formed by light which is emitted from the authentication light source which emits at least red light in the visible light region and reflected on the palm of a human body; wherein at least one reflection color image has RGB pixel values in RGB color space or pixel values equivalent thereto;
- (2) a step of extracting the shape of the palm print and the shape of the veins in said palm respectively from said one reflection color image for authentication, by performing image processing of said one reflection color

image;

(3) a step of performing authentication by comparing said data for authentication with the template data previously registered .

11. The method for individual authentication as described in claim 10, wherein said authentication data includes a first authentication data that corresponds to said shape of the palm print and a second authentication data that corresponds to said shape of the vein pattern, wherein said authentication includes a first authentication and a second authentication to be conducted after performing the first authentication, and wherein said first authentication is conducted using said first authentication data and said second authentication is conducted using said second authentication data.

12. The method for individual authentication as described in claim 10, wherein said authentication data includes a third authentication data created by integrating the first authentication data corresponding to said shape of the palm print with the second authentication data corresponding to said shape of the veins, and wherein said authentication is performed using said third authentication data.

13. The method for individual authentication as described in any one of claims 10 to 12 including the following steps to be performed prior to said authentication:

- (a) a step of acquiring at least one reflection image to form by the light which is emitted from the template light source emitting at least red light in the visible light region, and is reflected on the palm of human body;
- (b) a step of extracting the shape of the palm print and shape of the veins in said palm respectively from said one reflection image for template, by performing image processing of said reflection image, and
- (c) a step of saving said template data for succeeding authentication.