

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
11 May 2006 (11.05.2006)

PCT

(10) International Publication Number
WO 2006/049394 A1

(51) International Patent Classification:
G06K 9/00 (2006.01)

(21) International Application Number:
PCT/KR2005/003473

(22) International Filing Date: 19 October 2005 (19.10.2005)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:
10-2004-0089877
5 November 2004 (05.11.2004) KR

(71) Applicant (for all designated States except US): **NITGEN CO., LTD.** [KR/KR]; Korea Sanhak Foundation Bldg. 5F, 1337-31, Seocho-dong, Seocho-gu, Seoul 137-860 (KR).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KIM, Chong-soo** [KR/KR]; 201-1917, Daegwang Apartment 2Cha, 121, Dae-ri, Hwasoon-eup, Hwasoon-gun, Jeollanam-do 519-805 (KR). **SUH, Byunghee** [KR/KR]; Ra203, Mirib House, 920-30, Daechi-dong, Gangnam-gu, Seoul 135-843 (KR). **KANG, Seungil** [KR/KR]; 201, 239-10, Guui 1-dong, Gwangjin-gu, Seoul 143-824 (KR). **RYU, Han-min** [KR/KR]; 711-901, Manhyunmaul Ssangyong 1Cha, Apartment, 850, Sanghyun-dong, Yongin-si, Gyeonggi-do

449-521 (KR). **JUNG, Soonwon** [KR/KR]; 1-1105, Jamwonhanshin Apartment, 56-3, Jamwon-dong, Seocho-gu, Seoul 137-796 (KR). **SHIN, Sunghyu** [KR/KR]; 301-202, Hyundai Apartment, 671, Jayang-dong, Gwangjin, Seoul 143-772 (KR).

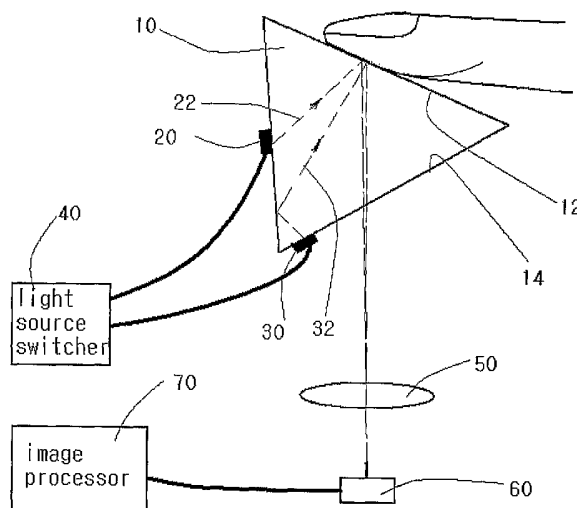
(74) Agent: **Y.P. LEE, MOCK & PARTNERS**; The Cheonghwa Bldg., 1571-18, Seocho-dong, Seocho-gu, Seoul 137-874 (KR).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,

[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR DISTINGUISHING FORGED FINGERPRINT FOR OPTICAL FINGERPRINT ACQUISITION APPARATUS



(57) Abstract: The present invention relates generally to a method and apparatus for distinguishing forged fingerprint from living human's real fingerprint, by using differences in characteristics of an absorption mode and a scattering mode fingerprint acquisition apparatuses. A method according to the present invention is comprised of the steps of: 1) acquiring a first image from the object being in contact with a fingerprint input window, by using an optical scattering mode (or an absorption mode), 2) acquiring a second image from the object being in contact with a fingerprint input window, by using an optical absorption mode (or a scattering mode), and 3) comparing the first and second images and determining that the object is a bodily fingerprint if image values for valleys and ridges of the first and second images are inverse; while that the object is a replica fingerprint if image values for valleys and ridges of the first and second images are not inverse.

WO 2006/049394 A1



RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *with international search report*

METHOD AND APPARATUS FOR DISTINGUISHING FORGED FINGERPRINT FOR OPTICAL FINGERPRINT ACQUISITION APPARATUS

Technical Field

The present invention relates generally to a method and apparatus for distinguishing forged fingerprint (also referred to as a replica fingerprint) from living human's real fingerprint (also referred to as a bodily fingerprint), by using differences in characteristics of an absorption mode and a scattering mode fingerprint acquisition apparatuses.

Background Art

As fingerprint recognition apparatuses are broadly popularized in personal authentication fields such as access and settlement authentication, it is required to tighten security. As various fingerprint recognition algorithms are developed to enhance the accuracy of the fingerprint recognition, fingerprint replica producing techniques are also being developed accordingly. .

There are several preceding patents relating to methods of distinguishing forged fingerprints. First, Japanese Patent Laid-open Publication No. Hei 11-45338 discloses a method of detecting a bioelectric potential generated in a human body to recognize forged fingerprints. However, in the above method, if only an electrode for potential detection is touched on a human body in a state of bringing a forged fingerprint into contact with a fingerprint input window, the forged fingerprint cannot be distinguished. Further, the above method requires additional hardware and operating units since it additionally needs

a detection signal process and a frequency analysis procedure. Second, Japanese Patent Laid-open Publication No. Hei 10-290796 discloses a method of applying various stimulations to a human body and measuring types of reactions to the stimulations to distinguish forged fingerprints. However, the second method of analyzing biological reactions to external stimulations is too artificial, thus giving an unpleasant feeling to a user. Further, this method is problematic in that it is difficult to formally quantify the types of reactions to stimulations. Third, Japanese Patent Laid-open Publication No. 9-259272 discloses a method of detecting the existence of sweat glands and the number of them in a fingerprint image to distinguish forged fingerprints. This third method is impractical because even sweat glands can be copied as well as the patterns of a fingerprint according to current forged fingerprint producing techniques. Fourth, Japanese Patent Laid-open Publication No. Hei 7-308308 discloses a method of emitting specific wavelengths of light and detecting variations of oxygen density and blood flow using the amount of transmitted light to distinguish forged fingerprints. However, this method is limited in that if a forged fingerprint is produced using a material enabling the frequency of light emitted from the light emitting device to be easily transmitted therethrough and is put on a finger to be used, the forged fingerprint cannot be distinguished. Fifth, there has been also developed a technology to distinguish forged fingerprints by a method, which recognizes pulsation of a fingertip using a pressure sensor. However, this fifth method is limited in that it cannot cope with other information similar to the pulsation.

In addition to the above examples, there are recently developed technologies of thinly producing forged fingerprints using materials such as silicone, film, etc. Accordingly, if such forged fingerprints are directly put on human bodies, it is very difficult to distinguish forged fingerprints from authentic fingerprints even though any of

the above methods is employed. Especially, it is also difficult to distinguish the fingerprint-like matters printed on an OHP film.

Disclosure of Invention

5

Technical Problem

The present invention has been developed to avoid the problems of the conventional replica fingerprint distinguishing method, which cannot distinguish the fingerprint replica printed on a film-like material. This invention has been developed, based on the fact that the images acquired from a bodily fingerprint are inversed between the absorption mode and the scattering mode, while in the case of a replica fingerprint printed on a film or the like, the acquired images are not inverse but the same regardless of the absorption mode and the scattering mode.

Therefore it is an object of the present invention to provide a method and apparatus for distinguishing a replica fingerprint from a bodily fingerprint, by utilizing both an optical scattering mode and an optical absorption mode fingerprint acquisition apparatus to compare the differently acquired images.

15

Technical Solution

An optical fingerprint input apparatus is generally classified into an optical absorption mode and an optical scattering mode. Fig. 1 is a schematic diagram illustrating an operational principle of a fingerprint input apparatus of an absorption mode, which comprises a backlight 112, a triangular prism 110, a lens 114, an image sensor 116, and an image processor 125.

20

Under no input of a fingerprint to the imaging surface 118, like in Fig. 2, the light

originating from the backlight 112 is totally reflected from inside of the imaging surface of the triangular prism 110, and is incident on the image sensor 116 through the lens 114. If a finger is laid on the imaging surface, the light illuminated onto the valleys of the fingerprint is totally reflected from the internal surface of the imaging surface 118 and reaches the
5 image sensor 116 because the valleys of the fingerprint are not in contact with the imaging surface. By contrast, the light illuminated onto the ridges of the fingerprint is not totally reflected from the internal surface of the imaging surface 118 but only a part thereof reaches the image sensor 116.

Accordingly, the amounts of light incident on the image sensor 116 differ between
10 the valleys and the ridges, and as a consequence, the image sensor 116 outputs electrical signals of different levels depending on a pattern of a fingerprint. The image processor 125 formulates the output values of the image sensor 116 into digital signals so as to recognize a fingerprint pattern.

Fig. 3 is a schematic diagram illustrating an operational principle of a fingerprint
15 input apparatus of a scattering mode. The fingerprint input apparatus in Fig. 3 comprises a backlight 312, a prism 310, a lens 314, and an image sensor 316 to have a similar construction to the one in Fig. 1. However, unlike the absorption mode shown in Figs. 1 and 2, the light is incident on the imaging surface 318 of the prism 310 from the backlight 312 at an angle far smaller than the right angle or a critical angle. Therefore, the light 327
20 illuminated onto the valleys of the fingerprint not in contact with the imaging surface 318 penetrates the imaging surface 318 and does not reach the image sensor 316. On the other hand, the light 327' illuminated onto the ridges of the fingerprint is scattered on the ridges. The scattered light 329 is incident to the lens 314, and is sensed by the image sensor 316 (see Fig. 4).

In the case of the fingerprint input apparatus of an absorption mode, the light is absorbed at ridges of a fingerprint. Therefore, the image of the fingerprint appearing on the image sensor is dark at the ridges and bright at the valleys. In the case of the fingerprint input apparatus of a scattering mode, on the other hand, the light is scattered at ridges of a fingerprint. Therefore, the image of the fingerprint appearing on the image sensor is bright image at the ridges and dark at the valleys, thereby reflecting a comprehensively contrary image to the case of the fingerprint input apparatus of an absorption mode. It can be noted that in Fig. 5 the fingerprint images are inversed between the absorption mode and the scattering mode. Fig. 5 (a) shows a bodily fingerprint image acquired by the scattering mode fingerprint acquisition apparatus, while Fig. 5 (b) shows a bodily fingerprint image acquired by the absorption mode fingerprint acquisition apparatus.

Meanwhile, in the case of a replica fingerprint printed on a film or the like, the acquired images are not inverse but the same between the absorption mode and the scattering mode. Referring to Fig. 6, in a replica fingerprint 400 printed on a film-like material, the light is absorbed, and thus the image is acquired dark, at the dark portions (i.e., inked portions), while the light is reflected, and thus the image is acquired bright, at the bright portions (i.e., background portions of the film), regardless of either the absorption mode (see Fig. 6 (a)) or the scattering mode (see Fig. 6(b)). Therefore, image from the replica fingerprint printed on a film is acquired similarly either the absorption mode or the scattering mode. Fig. 7 exemplarily shows images acquired from the replica fingerprint 400 printed on a film. Fig. 7 (a) shows an image acquired by the absorption mode fingerprint acquisition apparatus, and Fig. 7 (b) shows an image acquired by the scattering mode fingerprint acquisition apparatus. Comparing to Fig. 5, it can be noted that there is no image inversion.

Like this, since the bodily fingerprint and the replica fingerprint are differently imaged from the absorption mode to the scattering mode, the present invention can perfectly distinguish the replica fingerprint printed on a film, by using the above properties.

Accordingly, a method according to the present invention is for distinguishing a replica fingerprint from a bodily fingerprint, by acquiring a fingerprint image from an object being in contact with a fingerprint input window of a fingerprint acquisition apparatus, which comprises the steps of: 1) acquiring a first image from the object being in contact with a fingerprint input window, by using an optical scattering mode (or an absorption mode), 2) acquiring a second image from the object being in contact with a fingerprint input window, by using an optical absorption mode (or a scattering mode), and 3) comparing the first and second images and determining that the object is a bodily fingerprint if image values for valleys and ridges of the first and second images are inverse; while that the object is a replica fingerprint if image values for valleys and ridges of the first and second images are not inverse.

In the step 3) above, the following steps may be applied: summing difference of grey levels of the first and second images over a predetermined area, and determining that the object is a bodily fingerprint if the summed value is greater than a predetermined reference value, while that the object is a replica fingerprint if the summed value is less than the reference value.

Specifically, the summation of the difference between the grey levels can be calculated with this equation:

$$S = \sum_{a=j}^{j+m} \sum_{b=k}^{k+n} |G_a(a,b) - G_s(a,b)|$$

Where, $G_a(a,b)$ is the grey level of coordinate (a,b) in an image acquired by an absorption

mode; $G_s(a,b)$ is the grey level of coordinate (a,b) in an image acquired by a scattering mode; j and k are starting points in the predetermined area; and $(m+1) \times (n+1)$ is a size of the predetermined area. The above equation means that the difference between pixels in the same position in the predetermined area is first calculated, and then the difference between
5 all pixels over the predetermined area is calculated.

Advantageous Effects

According to the present invention, the forged fingerprint distinguishing method and apparatus can distinguish forged fingerprints made of film-like materials, which
10 cannot be distinguished by using conventional methods. Further, the present invention is simple in its hardware and software constructions. The present invention employs only a simple algorithm to distinguish forged fingerprints. Since in the present invention the replica fingerprint can be distinguished just by comparing a first image and a second image, the present invention has little software overhead. Further, the present invention is
15 highly reliable in terms of security. That is, it does not require additional facilities, and it only adds a light source. If it is installed in a concealed place so as not to be seen from outside, a user is prevented from knowing of the existence of the forged fingerprint distinguishing apparatus and whether its operation is performed. In the case of the optical fingerprint input apparatus, in addition, sebum or a contaminated material leaves a latent
20 fingerprint on the fingerprint recognition apparatus due to a contact of a fingerprint therewith. If a light is incident on the imaging surface from an external light, rather than from a backlight, at a particular angle, the image sensor is apt to sense a latent fingerprint. Thus, if the image sensor senses any latent fingerprint, the fingerprint recognition apparatus mis-recognizes the latent fingerprint as a fingerprint of a biomass. This causes a problem

that an unauthorized user may be authenticated for access by using the latent fingerprint left on the fingerprint recognition apparatus instead of inputting a fingerprint of himself or herself. However, the present invention resolves this latent fingerprint problem, since the latent fingerprint remaining on the fingerprint contact window effects similarly to the
5 replica fingerprint printed on film-like materials.

Description of Drawings

The above and other objects, features, and advantages of the present invention will become more apparent from the following description when taken in conjunction with the
10 accompanying drawings, in which:

Fig. 1 is a schematic of a conventional absorption mode fingerprint acquisition apparatus,

Fig. 2 shows how the absorption mode apparatus operates with regard to a bodily fingerprint,

15 Fig. 3 is a schematic of a conventional scattering mode fingerprint acquisition apparatus,

Fig. 4 shows how the scattering mode apparatus operates to a bodily fingerprint,

Fig. 5 shows images acquired from a bodily fingerprint by using the absorption mode and the scattering mode, respectively,

20 Fig. 6 shows how the absorption mode and the scattering mode apparatuses operate with regard to a replica fingerprint,

Fig. 7 shows images acquired from a replica fingerprint by using the absorption

mode and the scattering mode, respectively, and

Fig. 8 is a schematic of an apparatus for distinguishing a replica fingerprint according to the present invention.

Best Mode for Invention

Hereinafter, an apparatus for distinguishing a replica fingerprint according to the present invention will be described in detail with reference to the attached drawings. As explained above, the difference between the absorption mode and the scattering mode fingerprint acquisition apparatus is whether or not the light incident to the fingerprint input window is internally totally reflected in a prism. Therefore, to implement this mechanism by using a single optical system, like in Fig. 8, one prism 10 and two light sources 20, 30 are employed to simultaneously embody the absorption mode and the scattering mode.

Specifically, as in Fig. 8, the fingerprint acquisition apparatus of the present invention is composed of a prism 10 including a fingerprint input window 12 on which a fingerprint to be acquired contacts thereon and a fingerprint exit face 14 from which a fingerprint image leaves therefrom; a first light source 20 positioned at the place where it radiates a light 22 so as to be totally reflected on the internal surface of the fingerprint input window 12; a second light source 30 positioned at the place where it radiates a light 32 so as not to be totally reflected on the internal surface of the fingerprint input window 12; a light source switcher 40 for alternately switching the operation of the first and second light sources 20, 30; a focusing lens 50 for focusing a first image and a second image leaving the fingerprint exit face 14 when the first and the second light sources 20, 30 turn on; an image sensor 60 for detecting the images from the focusing lens 50; and an image processor 70 for

processing the first image signal and the second image signal detected by the image sensor 60, and for determining that the fingerprint being in contact with the fingerprint input window 12 is a bodily fingerprint or a replica fingerprint. The image processor 70 determines the bodily fingerprint if image values for the valleys and the ridges of the first and second images are inverse; while it determines the replica fingerprint if image values for the valleys and the ridges of the first and second images are not inverse.

For the prism 10 above, a triangular prism can be used, but not limited to this. Generally, trapezoidal or parallelogram-like prism may also be used.

The first light source 20 is for implementing the absorption mode fingerprint acquisition apparatus, and so it is disposed at the place where it radiates a light 22 to the fingerprint input window 12 so that the light is internally totally reflected thereon. The location may differ according to the shape or the refractive index of the prism 10.

The second light source 30 is for implementing the scattering mode fingerprint acquisition apparatus, and so it is disposed at the place where it radiates a light 32 to the fingerprint input window 12 so that the light is not totally reflected but is maximally scattered thereon.

The locations of the first light source 20 and the second light source 30 are easily designed from the conventional fingerprint acquisition apparatus.

The light source switcher 40 alternately turns on the first and the second light sources 20, 30. If the two light sources are turned on simultaneously, the fingerprint acquisition apparatus of the present invention will not work.

The focusing lens 50 and the image sensor 60 are indispensable elements for the optical fingerprint acquisition apparatuses, and thus the detailed explanation is omitted.

The image processor 70 first compares the image acquired when the first light

source 20 turns on (i.e., the image from the absorption manner) and the image acquired when the second light source 30 turns on (i.e., the image from the scattering manner), and thereafter determines whether or not both the images are inverse against each other.

Such a determination method by comparing the images is well known to those who skilled in the field of image processing or graphics. For example, the difference of grey levels of the acquired images can be summed over a predetermined area. If the images are inverse, the summed value of the difference of the grey levels will be quite large. On the other hand, if the images are not inverse but substantially the same, the summed value of the difference of the grey levels will be substantially the same. Therefore, by comparing the difference between the grey levels of both images with a certain reference value, the image processor can determine whether an object being in contact with the fingerprint input window is a bodily fingerprint or a replica fingerprint. (Actually, this summed value may slightly be different due to image noise. However, such a difference due to the noise can be sufficiently eliminated by the known image processing techniques.) In addition to the above example, those who skilled in the art can monitor the inversion of the images by using various known techniques.

Further, if the image processor 70 determines the fingerprint being in contact with the fingerprint input window is a replica fingerprint, it can stop further fingerprint authentication procedures; while if it determines the bodily fingerprint, further procedures, i.e., extracting fingerprint minutiae and authenticating a fingerprint, can go on.

In the meantime, as in Fig. 8, since the two light sources 20, 30 are used in the apparatus for acquiring a fingerprint according to the present invention, the following constructional problems may arise. For example, referring to Fig. 9, a prism 904 is built in a housing 902, and a light source for the scattering mode (not shown) and a light source for the absorption

mode 908 are externally disposed. In this construction, since the light source for the absorption mode 908 is located so as to confront to a fingerprint input window 905, the housing 902 must have a light penetrating hole 910 for the light source 908 to penetrate therethrough towards the inside of the prism 904. However, in such a construction, a light from the light source for the scattering mode may unexpectedly enter the prism through the penetration hole 910, when acquiring the image from the contacting object by using the scattering method. This functions as a noise or disturbance to the optical system which has been precisely designed with sophisticated optical parameters. To solve this problem, it is preferable that a non-reflection scattering shield 920 is installed to cover the light penetration hole 910, through which the light from the light source for the absorption mode 908 enters the prism 904 (see Fig. 10). The non-reflection scattering shield 920 can be a kind of plate which does not reflect the light leaving the prism 904 but scatters the light from the light source for the absorption mode 908 to have it enter the prism 904.

While the invention has been shown and described with reference to certain embodiments to carry out this invention, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

Claims

1. A method of distinguishing forged fingerprint (referred to as a replica fingerprint) from living human's real fingerprint (referred to as a bodily fingerprint), by
5 acquiring a fingerprint image from an object being in contact with a fingerprint input window of a fingerprint acquisition apparatus, the method comprising steps of:

1) acquiring a first image from the object being in contact with a fingerprint input window, by using an optical absorption mode,

2) acquiring a second image from the object being in contact with a fingerprint
10 input window, by using an optical scattering mode, and

3) comparing the first and second images and determining that the object is a bodily fingerprint if image values for valleys and ridges of the first and second images are inverse; while the object is a replica fingerprint if image values for valleys and ridges of the first and second images are not inverse.

15 2. A method of distinguishing forged fingerprint (referred to as a replica fingerprint) from living human's real fingerprint (referred to as a bodily fingerprint), by acquiring a fingerprint image from an object being in contact with a fingerprint input window of a fingerprint acquisition apparatus, the method comprising steps of:

1) acquiring a first image from the object being in contact with a fingerprint input
20 window, by using an optical scattering mode,

2) acquiring a second image from the object being in contact with a fingerprint input window, by using an optical absorption mode, and

3) comparing the first and second images and determining that the object is a bodily fingerprint if image values for valleys and ridges of the first and second images are

inverse; while that the object is a replica fingerprint if image values for valleys and ridges of the first and second images are not inverse.

3. The method of claim 1 and 2, wherein step 3) comprises steps of:

summing difference of grey levels of the first and second images over a

5 predetermined area, and

determining that the object is a bodily fingerprint if the summed value is greater than a predetermined reference value, while that the object is a replica fingerprint if the summed value is less than the reference value.

10 4. An apparatus for distinguishing forged fingerprint (referred to as a replica fingerprint) from living human's real fingerprint (referred to as a bodily fingerprint), by acquiring a fingerprint image from an object being in contact with a fingerprint input window of a fingerprint acquisition apparatus, the apparatus comprising:

a prism including a fingerprint input window and a fingerprint exit face from which a fingerprint image leaves therefrom;

15 a first light source positioned at the place where it radiates a light so as to be totally reflected on the internal surface of the fingerprint input window;

a second light source positioned at the place where it radiates a light so as not to be totally reflected on the internal surface of the fingerprint input window;

20 a light source switcher for alternately switching the operation of the first and second light sources;

a focusing lens for focusing a first image and a second image leaving the fingerprint exit face when the first and the second light sources turn on;

an image sensor for detecting the images from the focusing lens; and

an image processor for processing the first image signal and the second image

signal detected by the image sensor, and for determining that the fingerprint being in contact with the fingerprint input window is a bodily fingerprint or a replica fingerprint,

the image processor determining that the object is a bodily fingerprint if image values for valleys and ridges of the first and second images are inverse, while that the object is a replica fingerprint if image values for valleys and ridges of the first and second images are not inverse.

5. The apparatus of claim 4, wherein the prism is a triangular prism.

6. The apparatus of claim 4, wherein the first light source implements an optical system for an absorption mode fingerprint acquisition apparatus, and wherein the second light source implements an optical system for a scattering mode fingerprint acquisition apparatus.

7. The apparatus of claim 4, wherein the image processor comprises:
means for summing difference of grey levels of the first and second images over a predetermined area, and
means for determining that the object is a bodily fingerprint if the summed value is greater than a predetermined reference value, while that the object is a replica fingerprint if the summed value is less than the reference value.

8. The apparatus of claim 4, further comprising:
a non-reflection scattering shield installed between the first light source and the prism,
the non-reflection scattering shield not reflecting a light leaving the prism but scattering a light from the first light source to have it enter the prism.

DRAWINGS

Fig. 1

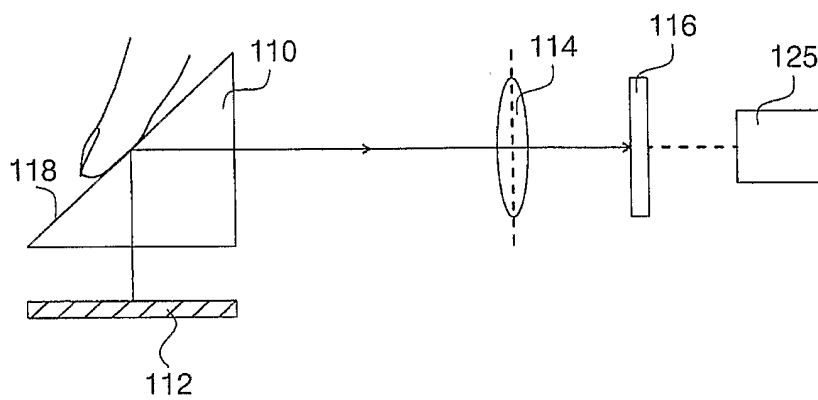


Fig. 2

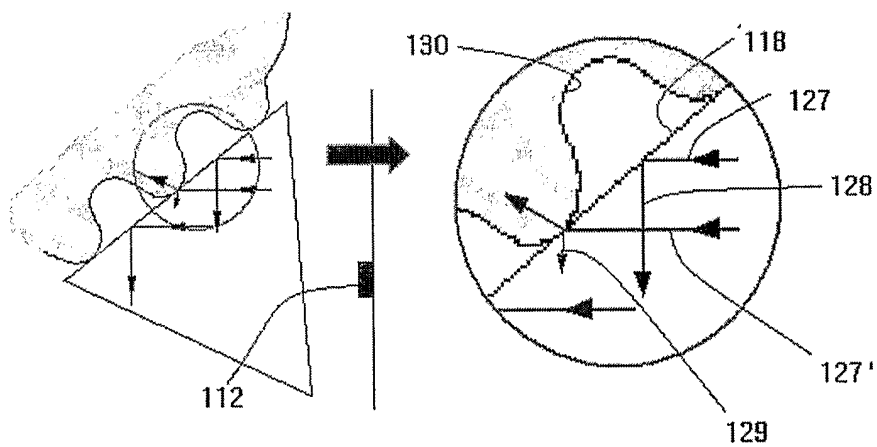


Fig. 3

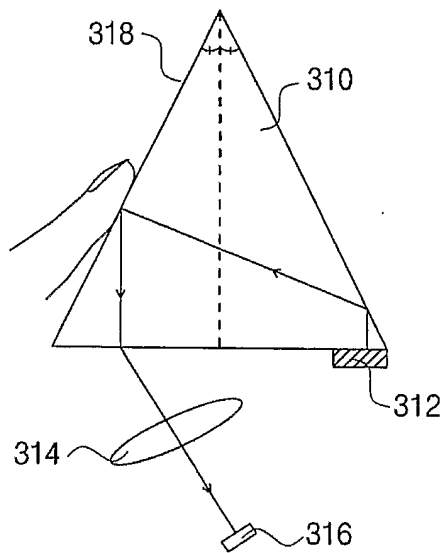


Fig. 4

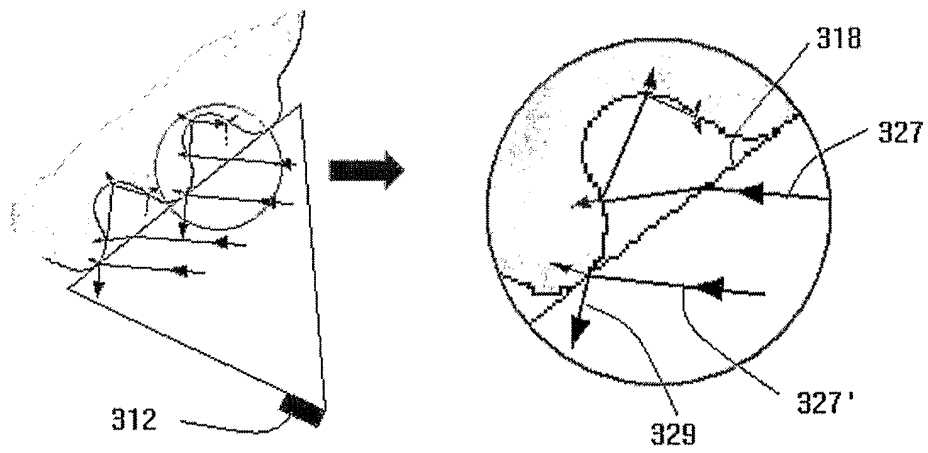


Fig. 5

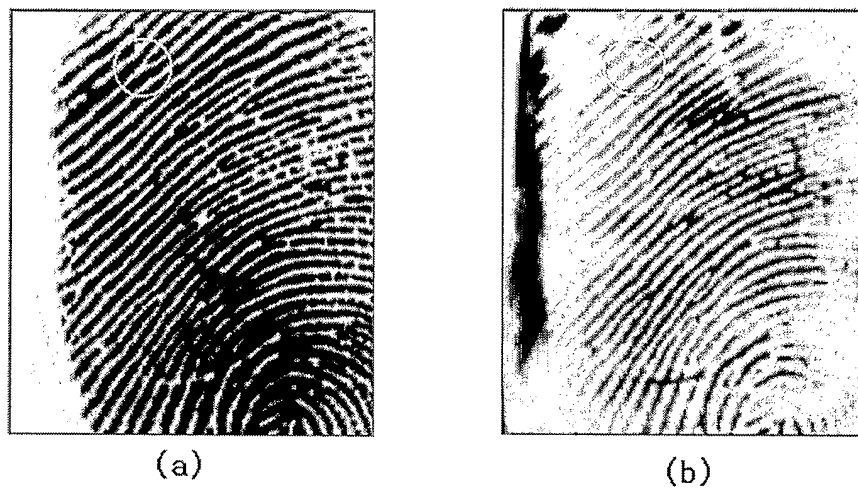


Fig. 6

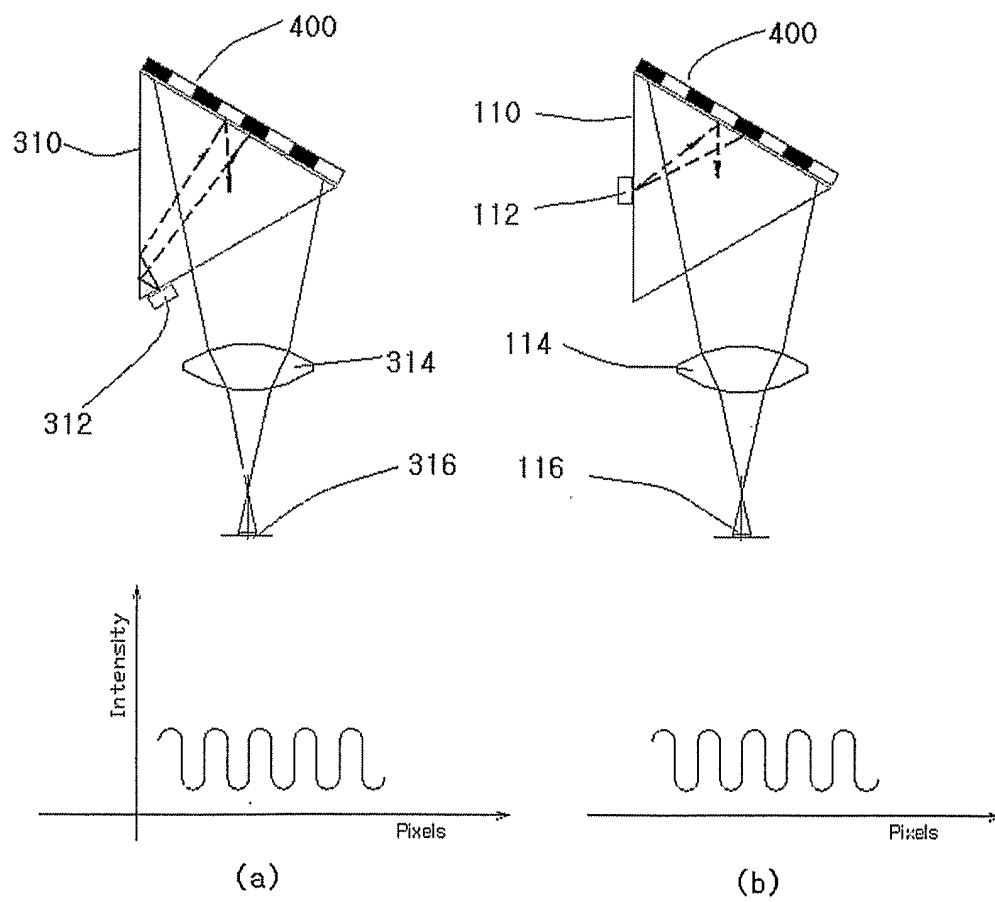


Fig. 7

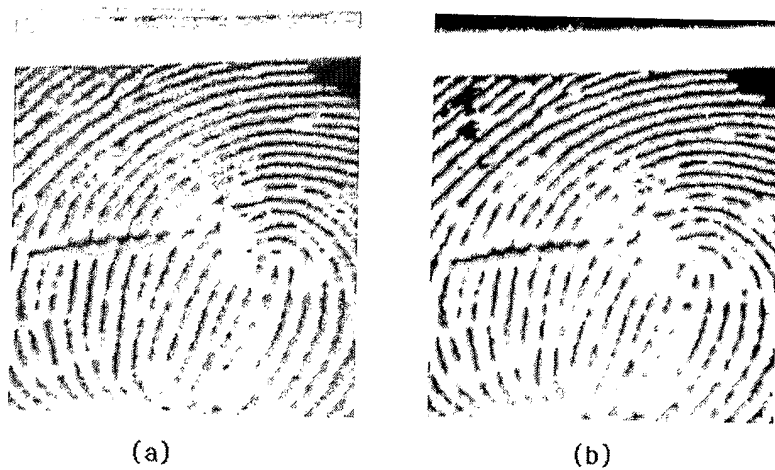


Fig. 8

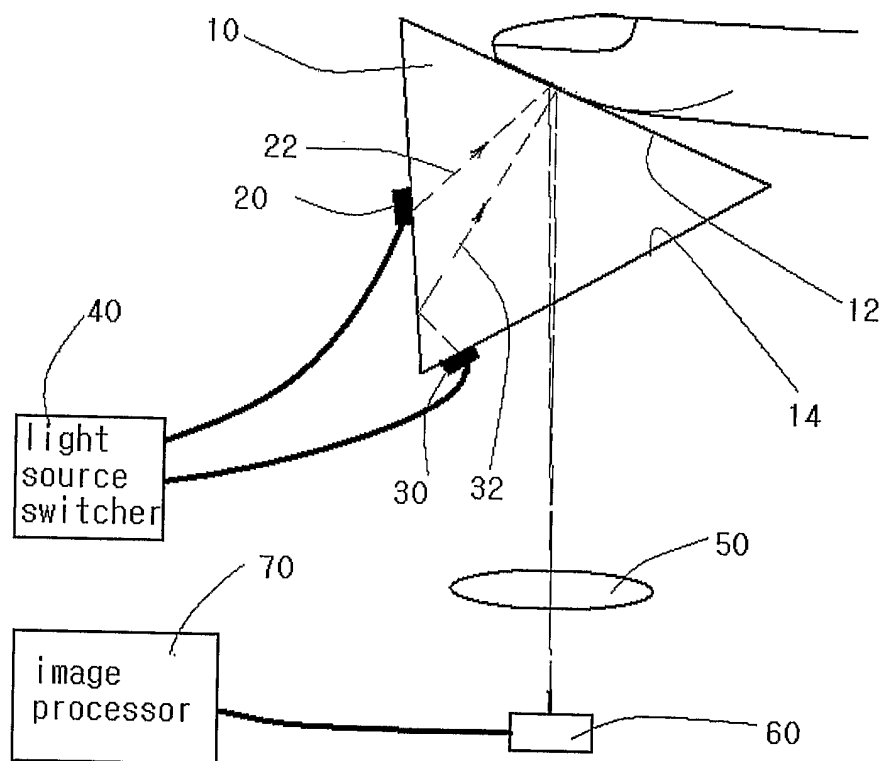


Fig. 9

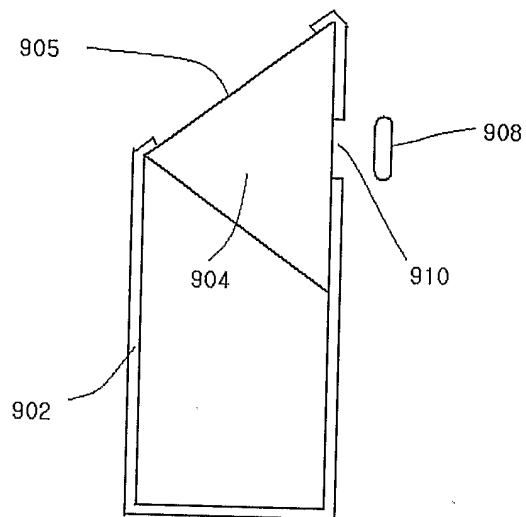
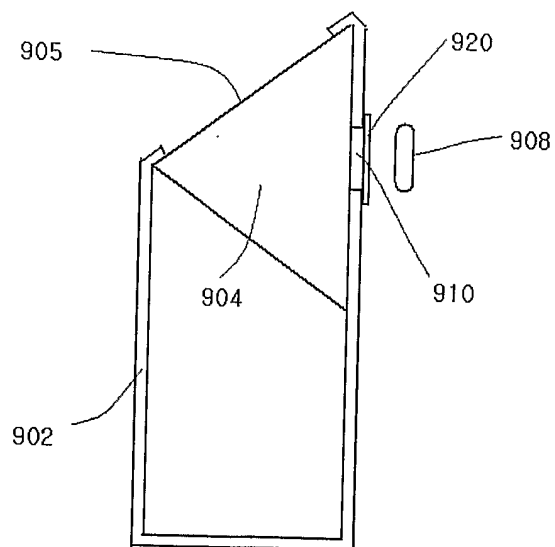


Fig. 10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2005/003473

A. CLASSIFICATION OF SUBJECT MATTER

G06K 9/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8, G06K 9/00, G06K 9/74,

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean patent applications for inventions published since 1975.

Korean utility model applications published since 1975.

Japanese utility models applications published since 1975.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, KIPASS(Searching system of Korean Intellectual Property Office)

Keywords : fingerprint, detect, forge, fake, optic, and prism.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	KR 10-2004-0016664 A (HUNNO TECHNOLOGIES INC. (KR)), Feb.25,2004 The paragraphs related to fig.1 and fig.3 of the detailed description Fig.1 and fig.3	1 - 2, 4 - 6 3, 7 - 8
Y A	KR 1000968780000 B1 (SON, KWANG-SUB ; CHO, YE-DONG ; LEE, SANG-TAEK ; JUN, SEUNG-YONG (KR)), Dec.23,1995 The paragraphs related to fig.1 and fig.2 of the detailed description Fig.1 and fig.2	1 - 2, 4 - 6 3, 7 - 8
A	US 5,629,764 A (ADVANCED PRECISION TECHNOLOG, Inc., (US)), May.13,1997 Column 4, line 8 ~ column 4, line 57 Fig.1	1 - 8
A	JP 06-176134 A (HAMAMATSU PHOTONICS KK(JP)), Jun.24,1994 [0013] of the detailed description Fig.1 and fig.7	1 - 8



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

26 JANUARY 2006 (26.01.2006)

Date of mailing of the international search report

27 JANUARY 2006 (27.01.2006)

Name and mailing address of the ISA/KR



Korean Intellectual Property Office
920 Dunsan-dong, Seo-gu, Daejeon 302-701,
Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

PARK, Sung Ho

Telephone No. 82-42-481-5724



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2005/003473

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 10-2004-0016664 A	25.02.2004	None	
KR 1000968780000 B1	23.12., 1995	None	
US 5629764 A	13.05.1997	AU6542596A1	10.02.1997
		US5892599A	06.04.1999
		US6002499A	14.12.1999
		US6038043A	14.03.2000
		US6111671A	29.08.2000
		US6341028B1	22.01.2002
		W09703412A1	30.01.1997
JP 06-176134 A	24.06.1994	None	