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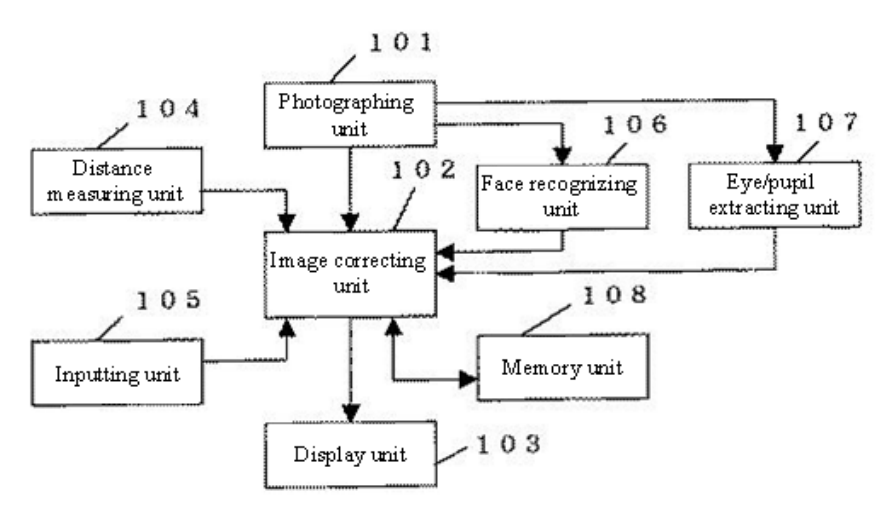
(54) [Title of the Invention] PHOTOGRAPHING DEVICE

(57) ABSTRACT(Amended)

[PROBLEM] To provide a photographing device capable of correcting an image so that the line of sight of a captured image and a displayed image match when a deviation in the orientation of the face occurs when photographing while checking the image due to separation of photographing means and displaying means.

[RESOLUTION MEANS] An image correcting unit 102 corrects orientation of a face image according to a degree of magnification input by a user from an inputting unit 105. The user confirms the corrected image by displaying the image on a display unit 103. If the correction is sufficient, the degree of magnification is determined, and the degree of magnification is also registered in a memory unit 108. When displaying the corrected image, a message such as "corrected image" is displayed to notify the user that it is a corrected image, and the degree of magnification is also displayed.

[Selected Drawing] FIG. 1



[What is claimed is]
[Claim 1]
A photographing device, comprising:
photographing means for photographing a face of a user to capture a face image;
displaying means provided at a position away from the photographing means and displaying the face image; and
correcting means for correcting an orientation deviation of the face image displayed on the displaying means, which occurs when a user views the face image.

[Claim 2]
The photographing device according to claim 1, wherein
the correcting means performs a correction that increases the magnification ratio of the face image in a direction perpendicular to the face orientation direction as the distance from the center of the face increases in the face orientation direction, and increases a reduction ratio in a direction perpendicular to the face orientation direction as the distance from the center of the face increases in the opposite direction as the face orientation direction.

[Claim 3]
The photographing device according to claim 1 or claim 2, wherein
a corrected face image and an uncorrected face image can be switched and displayed on the displaying means.

[Claim 4]
The photographing device according to claim 3, wherein
when displaying an image corrected by the correcting means on the displaying means, the display indicates that the displayed facial image is a corrected image.

[Claim 5]
The photographing device according to any one of claims 1 to 4, further comprising:
inputting means for changing correction parameters used by the correcting means.

[Claim 6]
The photographing device according to claim 4, further comprising:
storing means for storing correction parameters used for correction by the correcting means.

[Claim 7]
The photographing device according to any one of claims 1 to 4, further comprising:
storing means for storing in advance correction parameters used for correction by the correcting means.

[Claim 8]
The photographing device according to claim 7, further comprising:
distance measuring means for measuring distance from the photographing means to a photograph subject;
wherein the storing means has registered in advance a correction parameter corresponding to the distance from the photographing means to the photograph subject; and
the correcting means reads the correction parameters from the storing means and performs correction based on the distance measured by the distance measuring means.

[Claim 9]
The photographing device according to any one of claims 5 to 8, wherein:
the correction parameters used are displayed when displaying an image corrected by the correcting means on the displaying means.

[Claim 10]
The photographing device according to any one of claims 1 to 9, further comprising:
face recognizing means for recognizing a facial region from an image captured by the photographing means; wherein the correcting means enlarges or reduces the facial part region to a prescribed size.

[Claim 11]
The photographing device according to any one of claims 1 to 10, further comprising:

pupil detecting means for detecting orientation of a pupil due to a difference in position between the displaying means and photographing [sic]; wherein
the correcting means corrects the orientation of the pupil detected by the pupil detecting means so that the pupil faces forward.

[DETAILED DESCRIPTION OF THE INVENTION]

[TECHNICAL FIELD]

[0001]
The present invention relates to a photographing device that corrects deviations in orientation and line of sight of a captured facial image.

[BACKGROUND ART]

[0002]
In recent years, photographing devices such as digital cameras and camera-equipped mobile phones enable taking a photograph of oneself while viewing an image on a displaying means such as a liquid crystal display. Additionally, people also use a videophone function to make calls while showing their own face. However, since the photographing means and the displaying means are not placed at the same location, there is a problem that when photographing from a close position, such as when photographing oneself, the photographer may turn toward the displaying means, causing their line of sight to deviate, and creating an image where the orientation is not facing forward.
[0003]
For example, in the case of a camera-equipped cell phone, there is a misalignment between the display unit that displays a camera image and the location where the camera is mounted, so if you take a photo or make a video call while looking at the display, for example, if the camera is positioned below the display, the displayed face will face upward, making the orientation and line of sight look unnatural as compared to a face photographed from the front.
[0004]
Therefore, there are technologies that may address these problems for improvement disclosed in Patent Document 1 (Japanese Patent Application Publication 2002-247446) and Patent Document 2 (Japanese Patent Application Publication 2004-320236).
The technology disclosed in Patent Document 1 corrects image distortion that occurs when a photograph subject is photographed close to a photographing unit. The technology disclosed in Patent Document 2 uses a half mirror to place a photographing unit at the same position as the display unit, so that when taking a photograph of oneself, a photograph of one's own face can be taken without distorting the line of sight of the user.

[Patent Document 1] Japanese Patent Application Publication 2002-247446
[Patent Document 2] Japanese Patent Application Publication 2004-320236

[DISCLOSURE OF THE INVENTION]

[PROBLEMS TO BE SOLVED BY THE INVENTION]

[0005]
However, the technology disclosed in Patent Document 1 is a technique for correcting image distortion that occurs when a photograph subject is photographed up close, and cannot correct an image that does not originally have any distortion. Therefore, it is not possible to correct an image that has an unnatural line of sight or an unnatural face orientation due to a difference in the position of the photographing means and the displaying means.
[0006]
In addition, the technology of Patent Document 2 uses a half mirror to place the photographing unit at the same position as the display unit so that the line of sight of the captured image and the displayed image align when taking a photograph of oneself, and thus the structure is complicated. Furthermore, once a photograph is taken with a different line of sight, there is no way to correct the photograph.
[0007]
In view of these circumstances, an object of the present invention is to provide a photographing device that is capable of image correction so that the line of sight of the captured image and the displayed image are aligned, even if the photographing means and the displaying means are separated.

MEANS FOR SOLVING THE PROBLEM

[0008]

The first invention is a photographing device, including: photographing means for photographing a face of a user to capture a face image; displaying means provided at a position away from the photographing means and displaying the face image; and correcting means for correcting an orientation deviation of the face image displayed on the displaying means, which occurs when a user views the face image.

[0009]

The second invention is the photographing device according to the first invention, wherein the correcting means performs a correction that increases the magnification ratio of the face image in a direction perpendicular to the face orientation direction as the distance from the center of the face increases in the face orientation direction, and increases a reduction ratio in a direction perpendicular to the face orientation direction as the distance from the center of the face increases in the opposite direction as the face orientation direction.

[0010]

The third invention is the photographing device according to the first or second inventions, wherein a corrected face image and an uncorrected face image can be switched and displayed on the displaying means.

[0011]

The fourth invention is the photographing device according to the third invention, wherein when displaying an image corrected by the correcting means on the displaying means, the display indicates that the displayed facial image is a corrected image.

[0012]

The fifth invention is the photographing device according to any one of the first through the fourth inventions, further including:

inputting means for changing correction parameters used by the correcting means.

[0013]

The sixth invention is the photographing device according to the fourth invention, further including: storing means for storing correction parameters used for correction by the correcting means.

[0014]

The seventh invention is the photographing device according to any one of the first through fourth inventions, further including: storing means for storing in advance correction parameters used for correction by the correcting means.

[0015]

The eighth invention is the photographing device according to the seventh invention, further including: distance measuring means for measuring distance from the photographing means to a photograph subject; wherein the storing means has registered in advance a correction parameter corresponding to the distance from the photographing means to the photograph subject; and the correcting means reads the correction parameters from the storing means and performs correction based on the distance measured by the distance measuring means.

[0016]

The ninth invention is the photographing device according to any one of the fifth though eighth inventions, wherein: the correction parameters used are displayed when displaying an image corrected by the correcting means on the displaying means.

[0017]

The tenth invention is the photographing device according to any one of the first through ninth invention, further including: face recognizing means for recognizing a facial region from an image captured by the photographing means; wherein the correcting means enlarges or reduces the facial part region to a prescribed size.

[0018]

The eleventh invention is the photographing device according to any one of the first through tenth invention, further including: pupil detecting means for detecting orientation of a pupil due to a difference in position between the displaying means and photographing [sic]; wherein the correcting means corrects the orientation of the pupil detected by the pupil detecting means so that the pupil faces forward.

[EFFECT OF THE INVENTION]

[0019]

The first and second inventions correct the orientation deviation of the face image that occurs when the user views the face image displayed on the displaying means located at a distance from the photographing means, so a face image with a front orientation can be obtained even while checking the user's own face.

[0020]
Furthermore, with the third invention, the corrected face image and the uncorrected face image can be switched and displayed, so the user can confirm the degree of correction that has been made.
[0021]
Furthermore, with the fourth invention, an indication that the displayed face image is a corrected image is displayed, so it is possible to confirm whether or not the currently displayed image has been corrected.
[0022]
Furthermore, the fifth invention includes inputting means for changing the correction parameters used by the correcting means, so that the user can adjust the optimum correction parameters while looking at the displaying means.
[0023]
Furthermore, with the sixth invention, the correcting means includes storing means for storing the correction parameters used for correction, so the user can easily make corrections by calling up and using the data for correction parameters that have been adjusted previously.
[0024]
With the seventh invention, the correcting means includes storing means for storing in advance the correction parameters used for correction, so the correcting means can perform correction by selecting correction parameters from the storing means.
[0025]
With the eighth invention, the correction parameter corresponding to the distance from the photographing means to the subject is registered in advance in the storing means, and the correcting means uses the correction parameter based on the distance from the photographing means to the photograph subject measured by the distance measuring means. Therefore, the correction process can be performed automatically, eliminating the need for the user to input the correction parameters.
[0026]
Furthermore, with the ninth invention, the correction parameters used are displayed when displaying the image corrected by the correcting means on the displaying means, so the user can check the correction parameters as well as the corrected image.
[0027]
Furthermore, the tenth invention recognizes the facial region and enlarges or reduces the facial region to a prescribed size, so even if the distance from the user to the photographing means is slightly different, the image is converted to an image of optimal size, so correction processing can be performed to increase accuracy.
[0028]
Furthermore, with the eleventh invention, the orientation of the pupils detected by the pupil detecting means is corrected so as to face forward, and thus a face image in which the line of sight is oriented toward the photographing means can be generated.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0029]
The following is a description of embodiments of the present invention with reference to the drawings.
[0030]
FIG. 1 is a block diagram depicting one embodiment of a photographing device according to the present invention. The photographing device is a mobile phone equipped with a digital camera, and includes a photographing unit 101 such as a camera module, a display unit 103 such as a liquid crystal panel, an image correcting unit 102 that corrects orientation deviation of a face image, a distance measurement unit 104 for measuring the distance between the user and the device, an inputting unit 105 for performing key inputs, a face recognizing unit 106 for recognizing the face region, an eye/pupil recognizing unit 107 for recognizing an eye/pupil, and a memory unit 108 for storing correction parameters, and the like.
[0031]
FIG. 2 is an explanatory diagram when a user photographs their own face using this photographing device. FIG. 2(a) is an image displayed on the display unit 103 when the user faces the photographing unit 101. FIG. 2(b) is an image displayed on the display unit 103 when the user is oriented towards the display unit 103. FIG. 2(c) depicts how the user takes a picture while facing the photographing unit 101, and FIG. 2(d) depicts how the user photographs a picture while looking at the display unit 103 at the top.
[0032]
When photographing, if the photographing unit 101 takes a photograph in the state depicted in FIG. 2(b), the image shown in FIG. 2(a) should be captured, but if the user looks at the display unit 103 in order to check the captured

image as depicted in FIG. 2(d), the user will look up at the display unit 103, and as a result, as depicted in FIG. 2(b), a facial image captured from below the photographing unit 101 will be displayed. This problem arises because the photographing unit 101 and the display unit 103 are vertically separated from each other, and the image is captured while the user is looking at the upper display unit 103.

[0033]

FIG. 3 is a diagram depicting how to correct the image captured as depicted in FIG. 2(d). An image captured from below is best corrected, as shown in FIG. 3A, by extending the width while moving upwards from the center of the image and narrowing the width while moving downwards. When such image correction is performed, the corrected image appearing to be captured with front orientation can be obtained, as depicted in FIG. 3(b).

[0034]

Note that although this example shows a case where the photographing unit 101 is placed on the bottom side and the display unit 103 is placed on the top side, the present invention is not limited to this case. In some cases, the photographing unit 101 may be placed above the display unit 103, or the photographing unit 101 and the display unit 103 are arranged on the left and right sides. Therefore, correction is generally performed as follows. In other words, for a face image, the magnification ratio in the direction perpendicular to the orientation of the face is increased when moving further away from the center of the face in the direction the face is oriented, and the reduction rate in the direction perpendicular to the direction of the face is increased when moving further away from the center of the face in the opposite direction than the face is oriented.

[0035]

FIG. 4 is a graph depicting the relationship between the distance from the center of the face image and the magnification ratio for correction as depicted in FIG. 3. The horizontal axis represents the vertical distance from the center of the face image, and the vertical axis represents the magnification ratio. FIG. 5 depicts a graph with a plurality of magnification ratios. The degree of magnification increases in the order of FIG. 5A, FIG. 5B, and FIG. 5C. This shows that if the distance from the photographing unit 101 to the photograph subject (user) differs, the angle of the face oriented towards the display unit 103 will change, and in order to correct for this, naturally, the degree of magnification must be varied to correct the deviation in face orientation.

[0036]

The degree of magnification for correcting this orientation deviation of the face image is input by the user through the inputting unit 105. At this time, the corrected image is displayed on the display unit 103 for confirmation by the user, and if the correction is sufficient, the degree of magnification is set. At this time, when displaying the corrected image, a message such as "corrected image" is displayed to notify the user that this is a corrected image, and the degree of magnification is also displayed. Additionally, the degree of magnification is registered in the memory unit 108. In this manner, the next time the user makes a correction, the past degree of magnification is read out from the memory unit 108 and displayed on the display unit 103, and the user can select this value. The user can switch between the corrected face image and the uncorrected face image and display the images by operating the inputting unit 105. In this manner, by comparing both face images and displaying the correction parameters, the process of finding the optimal correction parameters can be simplified, reducing the time required for the process.

[0037]

Furthermore, the frequency of use of a degree of magnification registered in the memory unit 108 may be counted and displayed in order of frequency of use for the user to select. Alternatively, a plurality of degrees of magnification may be set in advance, stored in the memory unit 108, and displayed on the display unit 103 for the user to select using the inputting unit 105.

[0038]

Furthermore, since the distance between the photographing unit 101 and the display unit 103 is constant, the degree of magnification can be determined depending on the distance from the photographing unit 101 to the photograph subject (user). As depicted in FIG. 1, the distance measuring unit 104 measures the distance from the photographing unit 101 to the photograph subject (user) and outputs the distance to the image correcting unit 102. The memory unit 108 stores a table indicating the degree of magnification according to the distance from the photographing unit 101 to the photograph subject (user). The image correcting unit 102 can determine the degree of magnification based on the table and the distance from the photographing unit 101 to the photograph subject (user). In this manner, when the user provides instructions for correcting a photograph image from the inputting unit 105, the magnification ratio can be automatically determined, and the orientation of the face image can be corrected.

[0039]

FIG. 6 is a flowchart depicting a procedure for correcting an image by the image correcting unit 102 while displaying on the display unit 103.

[0040]

First, the photographing unit 101 photographs a user, who is the photograph subject, to capture an image (S1). Next, the image correcting unit 102 determines whether the degree of magnification (correction parameter) has been input by the inputting unit 105 (S2) and, if the degree of magnification has been input, changes the correction parameter in accordance with the instructions (S3) to correct the image distortion (S4). If the degree of magnification has not been input, the image correcting unit 102 corrects the image without changing the correction parameter (S4). Furthermore, the corrected image is displayed on the display unit 103 (S5), the correction parameters are displayed on the screen of the display unit 103 (S6), and the process ends.

[0041]

FIG. 7 is a flowchart depicting a procedure using face recognizing means for cutting the face size to an optimal size prior to correcting an image input from the photographing means.

[0042]

First, the photographing unit 101 photographs a photograph subject and captures an image (S11). Next, the face recognizing unit 106 acquires information about the size and location of the face (S12). Face recognition can be achieved using techniques such as skin color recognition, pattern matching, and the like. The image correcting unit 102 magnifies or reduces the face to a prescribed size (S13), and performs the correction described in FIG. 7 on the corrected image (S14). Furthermore, the corrected image is displayed on the display unit 103 (S15), and the process ends.

[0043]

FIG. 8 is a flowchart depicting a procedure for correcting the pupil orientation caused by the difference in the position of the displaying means and the photographing device using the eye/pupil detecting means.

[0044]

First, the photographing unit 101 photographs a photograph subject and captures an image (S21). Next, the eye/pupil extracting unit 107 acquires the size and location of the eyes (S22). After the image is corrected as described in FIG. 7 (S23), the black pupil is corrected (S24). Specifically, if the display unit is located above the photographing unit, the image will have the black pupil facing upward, so correction is performed to adjust the black pupil downward to face straight ahead. The corrected image is then displayed (S25), and the process ends.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0045]

FIG. 1 is a block diagram depicting one embodiment of a photographing device according to of the present invention.
FIG. 2 is an explanatory diagram when a user photographs their own face using this photographing device.
FIG. 3 is a diagram depicting how to correct the captured image.
FIG. 4 is a graph showing the relationship between the distance from the center of the face image and the magnification ratio.
FIG. 5 depicts a graph with a plurality of magnification ratios.
FIG. 6 is a flowchart depicting a procedure for correcting an image by the image correcting unit while displaying on the display unit.
FIG. 7 is a flowchart depicting a procedure using face recognizing means for cutting the face size to an optimal size prior to correcting an image input from the photographing means.
FIG. 8 is a flowchart depicting a procedure for correcting the pupil orientation caused by the difference in the position of the displaying means and the photographing device using the eye/pupil detecting means.

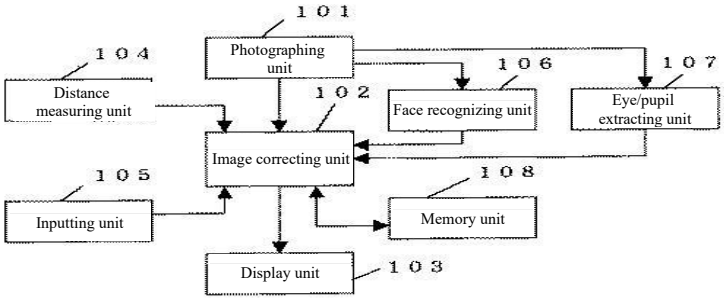
[DESCRIPTION OF REFERENTIAL NUMBERS]

[0046]

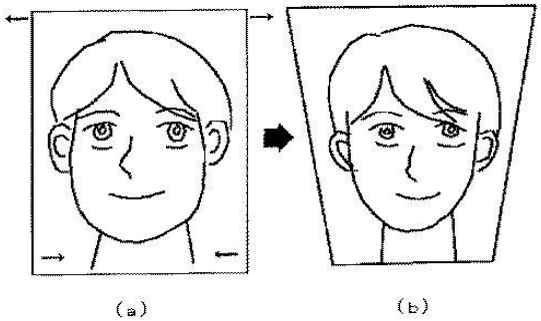
101. Photographing unit
102. Image correcting unit
103. Display unit
104. Distance measuring unit
105. Inputting unit

106. Face recognizing unit
107. Eye/pupil extracting unit
108. Memory unit

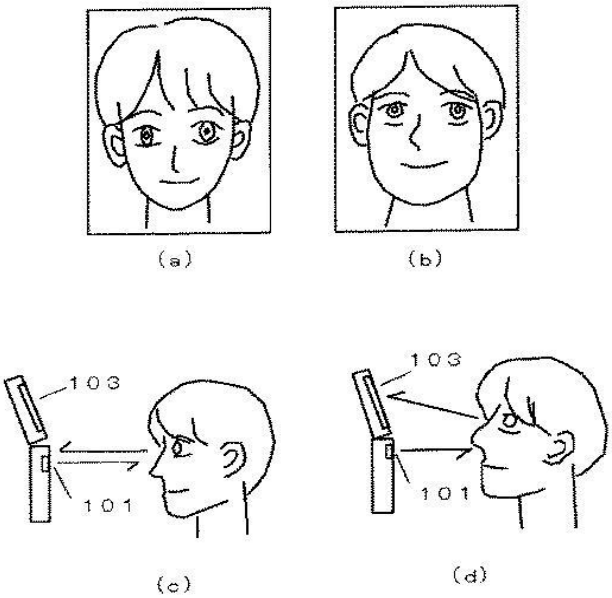
[FIG. 1]



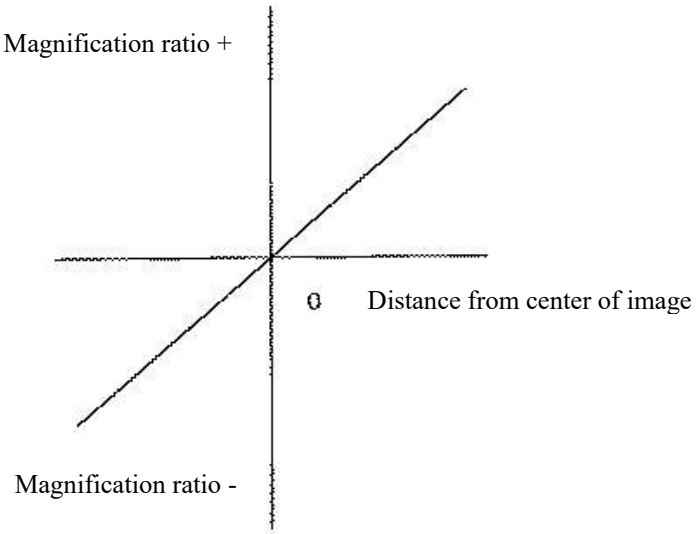

[FIG. 3]



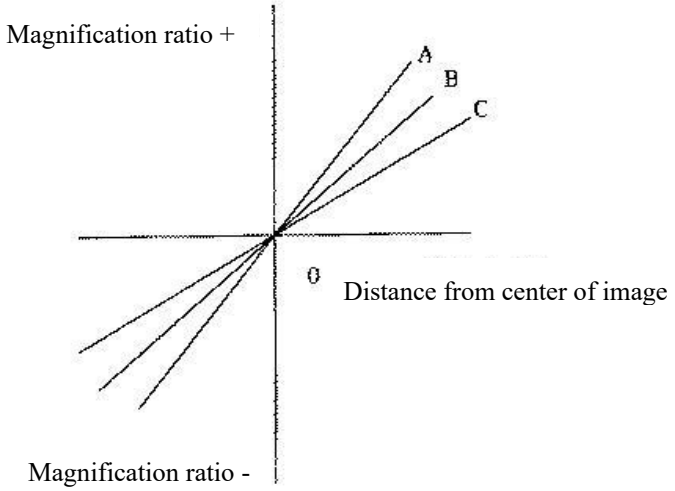

[FIG. 2]



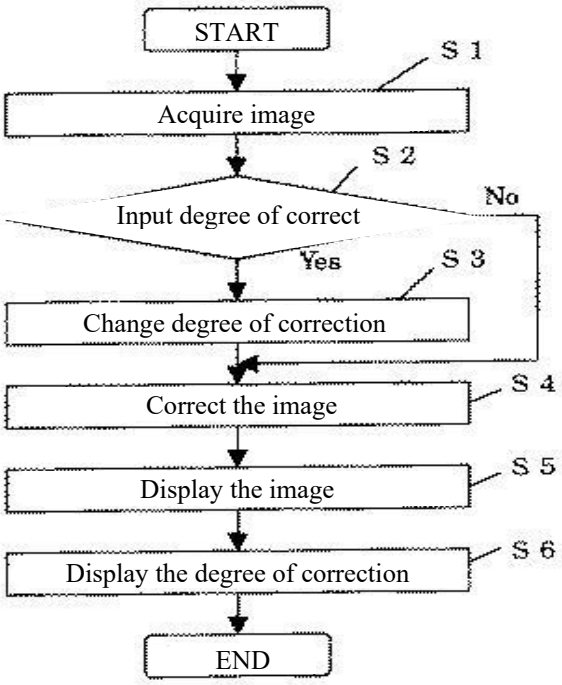

[FIG. 4]



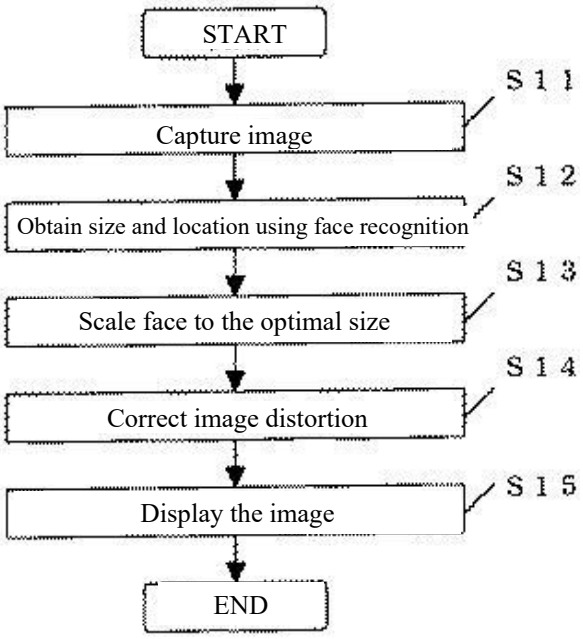
[FIG. 5]



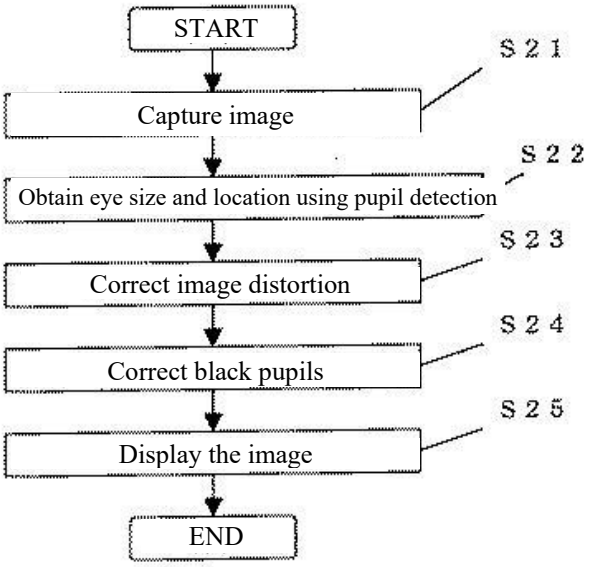

[FIG. 6]




[FIG. 7]




[FIG. 8]



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| | | HB01 | HB05 | HB06 | | | | | | | |

**CERTIFICATE OF TRANSLATION ACCURACY**

I, Dwaine Palmer, declare:

1. I am a native speaker of English and am well versed in both the Japanese and English languages and have over 25 years of experience translating Japanese patents and other technical documents into English.

2. The following translation of the corresponding source text from Japanese into English is accurate and complete to the best of my knowledge.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and accurate.

Statements made herein are to the best of my knowledge true and are based on information that I believe to be true and further these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the patent application in the United States of America or any patent issuing thereon.

Executed this 19th day of March 2024.

Dwaine Palmer

Dwaine Palmer, Translator