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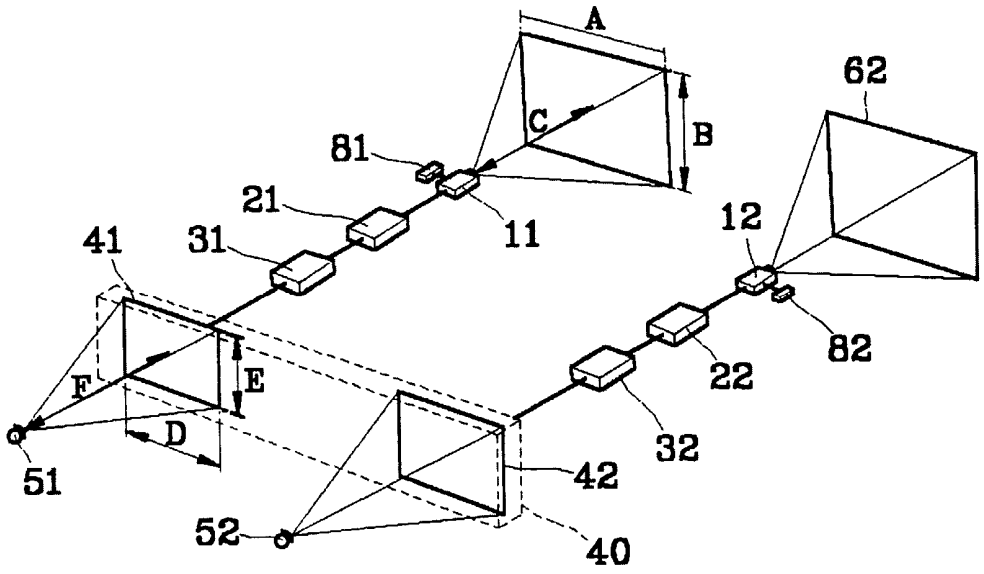
(54) **Title:** A METHOD AND SYSTEM OF REVISION FOR 3-DIMENSIONAL IMAGE



(57) **Abstract:** In a method and system of correcting deformation of a 3-D image, display of different sense of distance as a photographing ratio of the left and right cameras (11 and 12) to the object (60) changes according to the movement of the object or magnification and reduction photographing of the object by the cameras, and display of a 3-D image partially deformed as the distance between the left and right eyes (51 and 52)) of a viewer changes, are corrected by the magnification and reduction control of the left and right images by the left and right image magnifying and reducing apparatus (21 and 22) and the movement of the left and right images (41 and 42). Thus, an actual shape of the object is displayed so that the quality of a 3-D image is improved.

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A METHOD AND SYSTEM OF REVISION FOR 3-DIMENSIONAL IMAGE

Technical Field

The present invention relates to a method of correcting deformation of a 3-D (3-dimensional) image which can occur during generation and display steps of the 3-D image so that a more realistic 3-D image can be generated and displayed, and a system thereof.

Background Art

In general, a man can recognize an object by seeing it through eyes. Also, as two eyes of a man is separated a predetermined distance from each other, the object perceived by the two eyes are formed into two images, each formed by the left and right eyes. The object is recognized as the two images are partially overlapped. Here, in the portion where the images perceived by two eyes of a man overlap, as the tow different images transmitted to the brain through the left and right eyes are synthesized in the brain, a sense of 3-dimension is felt.

By using the above principle, various conventional 3-D image generating and reproducing apparatuses using photographing apparatuses have been developed. The 3-D imaging apparatus includes two cameras, separated a predetermined distance each other in the same ratio as the distance between the two eyes of a man, for photographing the same object at the two positions, a synthesizing apparatus for receiving two images photographed by the two cameras and sequentially irradiate the received images to a displaying apparatus, and the displaying apparatus for

displaying the two images irradiated from the synthesized apparatus so that eyes of a man can recognize the photographed object.

The synthesizing apparatus receives the left and right images respectively transmitted from the two cameras, that is, left and right cameras, and sequentially transmits the received images to the displaying apparatus according to the control of a controller.

The displaying apparatus is formed of an LCD screen for receiving and displaying the two images transmitted from the left and right synthesizing apparatuses or a 3-D glasses for displaying an image though a screen on the left and right eyes of a viewer to be separated at a predetermined distance. Also, for the two eyes of the viewer to feel a sense of 3-dimension, the image is displayed at a distance forming the same ratio as the distance formed by the two cameras and the left and right eyes of the viewer.

Here, the left and right images displayed in the displaying apparatus are sequentially displayed on the left and right eyes of the viewer with a predetermined time interval so that the viewer can recognize a 3-D image by simultaneously or sequentially perceiving the left and right images.

Thus, the photographing of the object is simultaneously performed by the left and right cameras so that the left and right images are generated and the left and right images are transmitted to the left and right synthesizing apparatus. The images transmitted to the synthesizing apparatus are sequentially displayed on the displaying apparatus by the controller. Thus, a man can feel a sense of 3-dimension of the left and right images displayed on the displaying apparatus.

Here, according to the ratio of the distance between the left and right cameras and the object to be photographed by the left and right cameras and the size of the object photographed by the cameras, the size of the image displayed to the viewer and the distance between the image and the left and right eyes are determined.

Also, as the distance between the left and right images displayed on the displaying apparatus is formed to have the same ratio as the distance between the two eyes of a man, the viewer feels a sense of 3-dimension as if he sees an actual object.

According to the above conventional technology, when an object is photographed by a camera while the object moves, the camera moves, or a magnifying or reducing photographing is made with respect to the object, not in a state in which a fixed object is photographed by a fixed camera, the distance between the camera or the photographed sized of the object photographed by the camera changes and a photographing ratio at which the shape of the object is input to the camera changes. Accordingly, the image ration of the image displayed on the displaying apparatus changes so that an image having a sense of distance different from the actual object is presented.

Also, when the distance between the object and the left and right cameras and the object are fixed during photographing, since the distance between the two eyes of a man is not constant, in particular, the distance between the eyes of an adult is quite different from that of the eyes of a kid, a sense of 3-dimension is lowered such as the rear portion of the

photographed object is seen to be small or great, or the sense of 3-dimension is not felt at all.

Disclosure of the Invention

To solve the above-described problems, it is an object of the present invention to provide a method of correcting deformation of a 3-D image according to a change in position of the camera by correcting a photographing ratio according to the height, direction, and tilt of the camera with respect to the object and an image ratio of the left and right images with respect to both eyes of a viewer observing an image photographed by the camera to be identical.

It is another object of the present invention to provide a method of correcting deformation of a 3-D image due to the distance between the left and right eyes of a man so that a view can observe the left and right images which are moving according to the various distance between the left and right eyes of the man who is an observer.

To achieve the above object of the present invention, there is provided a method of correcting deformation of a 3-D image comprising the steps of (a) establishing reference data by measuring a photographing ratio, an image ratio, and an image separation ratio with respect to an object, and an eye separation ratio with respect to a viewer, and colleting and storing the measure ratios, (b) inputting changed data by measuring changes in the photographing ratio, the image ratio, and the image separation ratio, and the eye separation ratio with respect to the viewer generated when the object which is moving is photographed or magnification or reduction photographing is performed, and transmitting the measured changes to an

image magnifying and reducing apparatus, (c) generating an image by defining left and right images photographed by the left and right cameras by the reference data generated in the reference data establishing step and the changed data generated in the changed data inputting step, and transmitting the defined images to the image magnifying and reducing apparatus, (d) calculating a correction ratio by calculating the photographing ratio and the image ratio to be the same and the image separation ratio and the eye separation ratio to be the same, and transmitting the calculated values to the image magnifying and reducing apparatus, (e) correcting images by controlling the size of the left and right images to be magnified or reduced according to the values calculated in the correction ratio calculating step with respect to a set value of the reference data, (f) synthesizing images by transmitting the left and right images of which the size is corrected and controlled from an image synthesizing apparatus to the display apparatus, and (g) outputting a corrected image by transmitting a corrected image which is magnified or reduced by the image magnifying and reducing apparatus to the display apparatus and displaying the correction image to be displayed by the control of the image synthesizing apparatus.

To achieve another object of the present invention, there is provided a system for correcting deformation of a 3-D image comprising left and right cameras installed to be capable of photographing the same object at different positions to generate left and right photographs, left and right image magnifying and reducing apparatus for correcting the left and right images to be magnified or reduced by a set value by controlling a photographing ratio of the cameras and an image ratio of a viewer to be the same by receiving

the left and right photographs of the object photographed by the cameras, and by controlling a distance ratio between the left and right images of the object and a distance ratio between two eyes of the viewer to be the same, left and right image synthesizing apparatus for transmitting the left and right images which are magnified or reduced by the left and right image magnifying and reducing apparatus, to a display apparatus, and the display apparatus for displaying the left and right images transmitted from the image synthesizing apparatus so that the viewer can observe.

Brief Description of the Drawings

FIG. 1 is a view showing a method of correcting deformation of a 3-D image according to the present invention;

FIG. 2 is a view showing the structure of a system of correcting deformation of a 3-D image according to the present invention; and

FIGS. 3, 4 and 5 are views for explaining the ratio between the left and right eyes and the left and right images according to the present invention.

Best mode for carrying out the Invention

FIG. 1 shows a method of correcting deformation of a 3-D image according to the present invention. FIG. 2 is a view showing the structure of a system of correcting deformation of a 3-D image according to the present invention. The method according to the present invention includes a reference data establishing step S10, a changed data inputting step S20, an image generating step S30, a correction ratio calculating step S40, an

image correcting step S50, an image synthesizing step S60, and a corrected image outputting step S70.

The reference data establishing step S10 includes a photographing ratio establishing step S11, an image ratio establishing step S12, an image separation ratio establishing step S13, and an c.

In the photographing ratio establishing step S11, the ratio of size between left and right photographs 61 and 62 of an object 60 having a predetermined size and standing still at a predetermined position which are photographed by left and right cameras 11 and 12, and the ratio of distance between the left and right photographs 61 and 62, and the left and right cameras 11 and 12, that is, a photographing ratio α, are collected and stored.

Here, the ratio of size between the left and right photographs 61 and 62 are measured by the ratio **A** of distance in the horizontal direction and the ratio **B** of distance in the vertical direction of the object 60 photographed by the left and right cameras 11 and 12, respectively. The distance ratio **C** is measured by the distance between the left and right photographs 61 and 62, and the left and right cameras 11 and 12.

Also, in the photographing ratio establishing step S11, a plurality of photographing ratios α formed by the various object 60 having a predetermined size and the various cameras 11 and 12 installed predetermined positions are collected and stored.

In the image ratio establishing step S12, various image ratios β including a size ratio formed by the left and right images 41 and 42 photographed by the left and right cameras 11 and 13 and displayed on a

display apparatus 40 and a distance ratio formed by the left and right images 41 and 42 and the left and right eyes 51 and 52 are collected and stored.

Here, the size ratio formed by the left and right images 41 and 42 is formed of a horizontal ratio **D** of the left and right images 41 and 42 and a vertical ratio **E** of the left and right images 41 and 42 which are displayed on the display apparatus 40. The image ratio β is determined by the distance ratio **F** according to the distance between the left and right images 41 and 42 forming the size ratio and the left and right eyes 51 and 52.

Also, the horizontal and vertical sizes of the left and right images 41 and 42 are preferably measured and stored by comparing the size of the left and right images 41 and 42 to the horizontal and vertical sizes of the display apparatus 40.

In the image separation ratio establishing step S13, various distance ratios **X** formed of the distance between the center points of the left image 41 and the right image 42 which are photographed by the left and right cameras 11 and 12 in a predetermined photographing ratio α and displayed on the display apparatus 40 in a predetermined image ratio β are collected and stored.

In the eye separation ratio establishing step S14, various distance ratios **N** formed of the distance ratio between the left eye 51 and the right eye 52 of a viewer viewing the left and right images 41 and 42 are collected and stored.

The changed data inputting step S20 includes a photographing ratio measuring step S21, an image ratio measuring step S22, an image separation ratio measuring step S23, and an eye separation ratio measuring

step S24.

In the photographing ratio measuring step S21, a single image forming the photographing ratio α formed of the size ratio of the left and right photographs 61 and 62 and the distance ratio between the left and right photographs 61 and 62 and the left and right cameras 11 and 12 which are changed as the object 60 moves, the left and right cameras 11 and 12 move, or magnification or reduction photography is performed with respect to the object 60, is transmitted to image magnifying and reducing apparatuses 21 and 22 which will be described later.

Here, the photographing ratio α is obtained by left and right position detectors 81 and 82 installed outside or inside the left and right cameras 11 and 12.

The left and right position detectors 81 and 82 measure the height of the left and right cameras 11 and 12 from the ground, the directions and the angles of the left and right cameras 11 and 12, the distance between the object 60 and the left and right cameras 11 and 12, and the position of the object 60 with respect to the left and right cameras 11 and 12, so that the photographing ratio α of the left and right cameras 11 and 12 with respect to the object 60 is detected.

In the image ratio measuring step S22, the size of the left and right images 41 and 42 photographed in a predetermined photographing ratio α and displayed on the display apparatus 40 is measured in comparison of the size of the display apparatus 40, and the distance ratio between the left and right images 41 and 42 and the left and right eyes 51 and 52 of a viewer

viewing the left and right images 41 and 42 are measured. The measured ratios are transmitted to the image magnifying and reducing apparatuses 21 and 22.

Here, as the distance ratio formed by the left and right images 41 and 42 and the left and right eyes 51 and 52 of a viewer, the distance from the left and right eyes 51 and 52 of a viewer to 3-D glasses or an LCD separated a predetermined distance therefrom is preferably measured.

In the image separation ratio measuring step S23, the distance between the center points of the left and right images 41 and 42 displayed on the display apparatus 40 is measured with respect to the center point of the display apparatus 40. The measured distance is transmitted to the image magnifying and reducing apparatuses 21 and 22.

In the eye separation ratio measuring step S24, the distance between the left eye 51 and the right eye 52 of a viewer viewing the left and right images 41 and 42 is measured by a detector (not shown) attached to the 3-D glasses the viewer wears or by manual operation. The measured distance is transmitted to the image magnifying and reducing apparatuses 21 and 22.

In the image generating step S30, different images of the object 60 are photographed and generated by the left and right cameras 11 and 12 separated a predetermined distance from each other. The generated image is transmitted to the image magnifying and reducing apparatuses 21 and 22.

Here, by setting the distance between the left and right cameras 11 and 12 and the distance between the left and right eyes 51 and 52 of a viewer viewing the image generated by the left and right cameras 11 and 12

to be the same, magnification or reduction of the image generated by the left and right cameras 11 and 12 is prevented from being displayed.

The correction ratio calculating step S40 includes a photographing/image ratio calculating step S41 and a image/eye separation ratio calculating step S42.

In the photographing/image ratio calculating step S41, a value of a difference between a photographing ratio α' and an image ratio β' changed due to the movement of the object 60 or the magnification and reduction by the left and right cameras 11 and 12 when the object 60 is photographed is calculated by comparing it with the photographing ratio α to the object 60 fixed at a predetermined position established in the photographing ratio establishing step S11 and the image ratio β to the image generated by photographing the object 60. The calculated data from the above value is transmitted to the image magnifying and reducing apparatuses 21 and 22 together with a single image forming the photographing ratio α', so that the photographing ratio α and the image ratio β match each other.

Here, the relationship between the photographing ratio α and the image ratio β is shown in the following Equation 1.

[Equation 1]

A:B:C=D:E:F

$$\frac{D}{A}=\frac{E}{B}=\frac{F}{C}$$

$$D=A\times(\frac{F}{C})$$

$$E = B \times (\frac{F}{C})$$

In the image/eye separation ratio calculating step S42, comparing with the separation distance ratio X between the left image 41 and the right image 42 generated by photographing the object 60 fixed at a predetermined position and displayed on the display apparatus 40 obtained in the image separation ratio establishing step S13 and the separation distance ratio N between the left eye 51 and the right eye 52 of a viewer, the separation distance ratios S and L between the changed left and right eyes 51 and 52 and the separation distance ratios Y and Z between the left and right images 41 and 42 changed accordingly are calculated. According to the calculated values, the separation distance ratios X, Y and Z between the center points of the left and right images 41 and 42 are calculated and transmitted to the image magnifying and reducing apparatus.

Here, the relationship of the separation distance ratios N, S and L between the left and right eyes 51 and 52 and the separation distance ratios X, Y and Z between the center points of the left and right images 41 and 42 is shown as follows.

[Equation 2]

X:N=Y:S=Z:L

In the above equation according to the preferred embodiment, N signifies the initial or average separation distance ratio between the left and

right eyes 51 and 52 of a viewer, S signifies the separation distance ratio between the left and right eyes 51 and 52 having a narrow interval than the left and right eyes 51 and 52 of a viewer, and L signifies the separation distance ratio between the left and right eyes 51 and 52 having a wider interval than the initial or average interval N between the left and right eyes 51 and 52 of a viewer.

Also, X signifies the initial or average separation distance ratio between the left and right images 41 and 42 displayed on the displaying apparatus 40 when the initial or average left and right eyes 51 and 52 is N. Thus, when the separation distance ratio between the left and right eyes 51 and 52 of a viewer is N, the distance between the center points of the left and right images 41 and 42 is X so that viewing a normal image is available.

Also, Y indicates the separation ratio between the center points of the left and right images 41 and 42 when the separation ratio between the left and right eyes 51 and 52 is **s** smaller than the reference ratio. Z indicates the separation ratio between the center points of the left and right images 41 and 42 when the separation ratio between the left and right eyes 51 and 52 is L greater than the reference ratio.

In the image correcting step S50, the image ratio β and the image separation ratio of the left and right images 41 and 42 are set by the value calculated in the photographing/image ratio calculating step S41 and the image/eye separation ratio calculating step S42. Thus, the image display size of the left and right images 41 and 42 are set by the above set image ratio β and the image separation ratio and the set values are transmitted to left and right image synthesizing apparatuses 31 and 32.

Here, the calculated correction information to match the photographing ratio α and the image ratio β and the calculated correction information to match the image separation ratio and the eye separation ratio are transmitted to the left and right image magnifying and reducing apparatuses 21 and 22 together with the image photographed by the left and right cameras 11 and 12.

Also, the correction information is included in each scene of the images generated by the left and right cameras 11 and 12 and transmitted to the left and right image magnifying and reducing apparatuses 21 and 22. Thus, each of the images generated by the left and right cameras 11 and 12 is corrected and these corrected images are preferably incorporated into a motion picture.

Since the size of the display apparatus 40 on which the left and right images 41 and 42 are displayed is constant, the magnification of the left and right images 41 and 42 is performed by cutting a portion to be magnified with respect to the center point of a magnified image of the left and right images 41 and 42 and magnifying the cut image according to the value set in the left and right image magnifying and reducing apparatuses 21 and 22 to have a size similar to the size of a screen of the display apparatus40. When the left and right images 41 and 42 are to be reduced, the image is reduced according to the value set in the left and right image magnifying and reducing apparatuses 21 and 22 and displayed on a screen of the display apparatus 40. Here, as the image is reduced, a blank portion of the screen of the display apparatus 40 is preferably filled with a particular color suitable for generation of a 3-D image (black in the present invention) to form a

reduced image.

The equation to obtain a magnification or reduction ratio of the left and right images 41 and 42 with respect to the display apparatus 40 having a predetermined size is shown below.

[Equation 3]

$$d = \frac{D}{G} = \frac{A}{G} \cdot \frac{F}{C}$$

$$e = \frac{E}{H} = \frac{B}{H} \cdot \frac{F}{C}$$

Here, **d** signifies a horizontal correction ratio of the left and right images 41 and 42 and **e** signifies a vertical correction ratio of the left and right images 41 and 42. G and H signify the horizontal and vertical sizes of the display apparatus 40, respectively.

In the image synthesizing step S60, image data containing the set image ratio β and image separation ratio of the left and right images 41 and 42 is applied to the left and right images generated by the left and right cameras 11 and 12 and sequentially or simultaneously transmitted to the display apparatus 40.

In the corrected image outputting step S70, the corrected images magnified or reduced by the left and right image magnifying and reducing apparatuses 21 and 22 is transmitted to the display apparatus 40 and sequentially displayed by the control of the left and right image synthesizing apparatuses 31 and 32.

Next, a system of correcting deformation of a 3-D image according to a preferred embodiment of the present invention will now be described.

FIG. 2 shows a 3-D image deformation correction system according to the present invention. Referring to the drawing, the 3-D image deformation correction system according to the present invention includes the left and right cameras 11 and 12, the left and right position detectors 81 and 82, the left and right image magnifying and reducing apparatuses 21 and 22, the left and right image synthesizing apparatuses 31 and 32, and the display apparatus 40.

The left and right cameras 11 and 12 are installed to be separated a predetermined distance from each other to photograph different images of the same object 60 from different positions.

The left and right position detectors 81 and 82 are attached to one side of each of the left and right cameras 11 and 12 to measure the original installation positions of the left and right cameras 11 and 12, that is, a distance from the ground, directions in which the left and right cameras 11 and 12 photograph images, and inclinations of the left and right cameras 11 and 12.

Here, it is obvious that the left and right position detectors 81 and 82 can be installed inside the left and right cameras 11 and 12 to measure the above distance, directions, and inclinations of the left and right cameras 11 and 12 according to the focus of each camera.

The left and right image magnifying and reducing apparatuses 21 and 22 sets the size of the horizontal ratio and the vertical ratio of the left and right images 41 and 42 displayed on the display apparatus 40 according to

the calculated comparison values with respect to the photographing ratio α, the image ratio β, the image separation ratio X, and the eye separation ration N of the left and right images photographed by the left and right cameras 11 and 12. The set size is transmitted to the left and right image synthesizing apparatuses 31 and 32.

The displaying apparatus 40 is an LCD having a plurality of liquid crystal pixels to display a 3-D image. Here, it is obvious that the display apparatus 40 includes a typical screen on which the 3-D image is displayed to be separated from each other or to be in front and rear, and 3-D glasses which enables a viewer to have a sense of 3 dimension as part of the two or more 3-D images displayed on the screen overlap.

Hereinafter, the correction of deformation in a 3-D image and the output of the corrected image according to the preferred embodiment of the present invention will be described.

In the preferred embodiment of the present invention, a method of correcting deformation in a 3-D image generation system including two left and right cameras 11 and 12 and the display apparatus 40 are described. The left and right cameras 11 and 12 are installed such that the centers of objective lenses of the cameras are positioned linearly and simultaneously have the separation distance same as the eye separation distance N of a viewer among a plurality of cameras photographing the same object. The display apparatus 40 outputs the two left and right images 41 and 42 photographed by the cameras 11 and 12, respectively, to a single LCD screen in a state of being separated a predetermined distance from each other.

After the object 60 fixed at the original or reference position is photographed, the photographing ratio α, the image ratio β, the image separation ratio X, and the eye separation ratio N are measured and transmitted to and stored in the left and right image magnifying and reducing apparatuses 21 and 22.

A new photographing ratio α' is measured according to the photographing horizontal ratio A, the photographing vertical ratio B, and the photographing distance ratio C changed by the movement of the object 60 and the magnification or reduction photographing of the left and right cameras 11 and 12. The respective still images corresponding to the photographing ratio α' are transmitted to the left and right image magnifying and reducing apparatuses 21 and 22 together with the photographing ratio α'.

Here, a change of a photographing area of the cameras 11 and 12 according to the cameras 11 and 12 moving as the movement of the object 60 or the magnified or reduced shape of the object 60 is measured by the left and right position detectors 81 and 82 connected to the left and right cameras 11 and 12 and converted into measured data and transmitted to the left and right image magnifying and reducing apparatuses 21 and 22.

The photographing ratio α according to the reference data and the photographing ratio α' changed by the movement of the object 60 and the magnification and reduction photographing of the cameras 11 and 12 are compared and calculated to obtain the ratio of size with respect to the left and right images 41 and 42 displayed on the display apparatus 40. The

calculated set value and the left and right images 41 and 42 photographed by the left and right cameras 11 and 12 are transmitted to the left and right image magnifying and reducing apparatuses 21 and 22.

The left and right images 41 and 42 transmitted to the left and right image magnifying and reducing apparatuses 21 and 22 are magnified or reduced by the image size ratio set value.

Here, correction information of the left and right images 41 and 42 and scenes of the images are input to the left and right image magnifying and reducing apparatuses 21 and 22 so that corrections are made to the left and right images 41 and 42. Each image scene which is completely corrected is transmitted to the left and right image synthesizing apparatuses 31 and 32.

The left and right images 41 and 42 transmitted to the left and right image synthesizing apparatuses 31 and 32 are sequentially transmitted to the display apparatus 40.

The left and right images 41 and 42 transmitted to the display apparatus 40, forming a new image ratio β' which is the same ratio as the newly set photographing ratio α', are viewed by the left and right eyes of a viewer.

Also, when the eye separation distance N of a viewer observing the left and right images 41 and 42 is changed differently, the left and right images 41 and 42 are moved by the left and right image synthesizing apparatuses 31 and 32 in the lateral directions with respect to the viewer in the display apparatus 40 so that the image separation distances X, Y and Z changing to the same distance as the eye separation distances N, S and L

of the viewer.

Here, by the coordinates to the overall surface of the display apparatus 40 input in advance to the left and right image synthesizing apparatuses 31 and 32, the positional coordinates of each image to be transmitted to the display apparatus 40 is set according to the image separation ratio defined by the eye separation ratio and then transmitted and displayed.

Thus, as the sizes of the left and right images 41 and 42 are magnified or reduced according to a change of the photographing ratio α generated as the object 60 moves or the magnification and reduction photographing is performed to the object 60, the image ratio β observed by a viewer is changed so that an actual 3-D image of the object 60 is continuously displayed. As the interval between the center points of the left and right images 41 and 42 changes according to the change of distance between the left and right eyes 51 and 52 of a viewer, the 3-D image is displayed on the display apparatus 40 and deformation of the left and right images 41 and 42 is corrected.

While this invention has been particularly shown and described with reference to preferred embodiments thereof, 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.

Industrial Applicability

As described above, according to the present invention, a sense of

different distance of an image displayed on the display apparatus according to the movement of the object or the magnification and reduction photographing of the object is corrected by the image magnification and reduction operation and displayed. The deformation of a 3-D image generated due to a different distance between the left and right eyes of a viewer are corrected by the adjustment of the distance between the left and right images. Therefore, an actual 3-D image can be displayed so that the quality of a 3-D image is improved.

What is claimed is:

1. A method of correcting deformation of a 3-D image comprising the steps of:

(a) establishing reference data by measuring a photographing ratio, an image ratio, and an image separation ratio with respect to an object, and an eye separation ratio with respect to a viewer, and colleting and storing the measure ratios;

(b) inputting changed data by measuring changes in the photographing ratio, the image ratio, and the image separation ratio, and the eye separation ratio with respect to the viewer generated when the object which is moving is photographed or magnification or reduction photographing is performed, and transmitting the measured changes to an image magnifying and reducing apparatus;

(c) generating an image by defining left and right images photographed by the left and right cameras by the reference data generated in the reference data establishing step and the changed data generated in the changed data inputting step, and transmitting the defined images to the image magnifying and reducing apparatus;

(d) calculating a correction ratio by calculating the photographing ratio and the image ratio to be the same and the image separation ratio and the eye separation ratio to be the same, and transmitting the calculated values to the image magnifying and reducing apparatus;

(e) correcting images by controlling the size of the left and right images to be magnified or reduced according to the values calculated in the correction ratio calculating step with respect to a set value of the reference

data;

(f) synthesizing images by transmitting the left and right images of which the size is corrected and controlled from an image synthesizing apparatus to the display apparatus; and

(g) outputting a corrected image by transmitting a corrected image which is magnified or reduced by the image magnifying and reducing apparatus to the display apparatus and displaying the correction image to be displayed by the control of the image synthesizing apparatus.

2. The method as claimed in claim 1, wherein, in step (a), the photographing ratio is formed of a size ratio of left and right photographs and a distance ratio between the left and right photographs and the cameras generated as the object is photographed by the left and right cameras.

3. The method as claimed in claim 1, wherein, in step (a), the photographing ratio is formed of a size ratio of the left and right images and a distance ratio between two eyes of the viewer formed as an image of the object photographed by the left and right cameras is displayed on the display apparatus.

4. The method as claimed in claim 1, wherein, in step (a), the image separation ratio is a distance ratio between the center points of the left and right images photographed by the left and right cameras in a predetermined photographing ratio and displayed on the display apparatus in a predetermined image ratio.

5. The method as claimed in claim 1, wherein photographing and image correction information with respect to each scene of the images photographed by the left and right cameras and image separation ratio and eye separation correction information are transmitted to an image correcting means together with each scene of the images.

6 A system for correcting deformation of a 3-D image comprising:

left and right cameras installed to be capable of photographing the same object at different positions to generate left and right photographs;

left and right image magnifying and reducing apparatus for correcting the left and right images to be magnified or reduced by a set value by controlling a photographing ratio of the cameras and an image ratio of a viewer to be the same by receiving the left and right photographs of the object photographed by the cameras, and by controlling a distance ratio between the left and right images of the object and a distance ratio between two eyes of the viewer to be the same;

left and right image synthesizing apparatus for transmitting the left and right images which are magnified or reduced by the left and right image magnifying and reducing apparatus, to a display apparatus; and

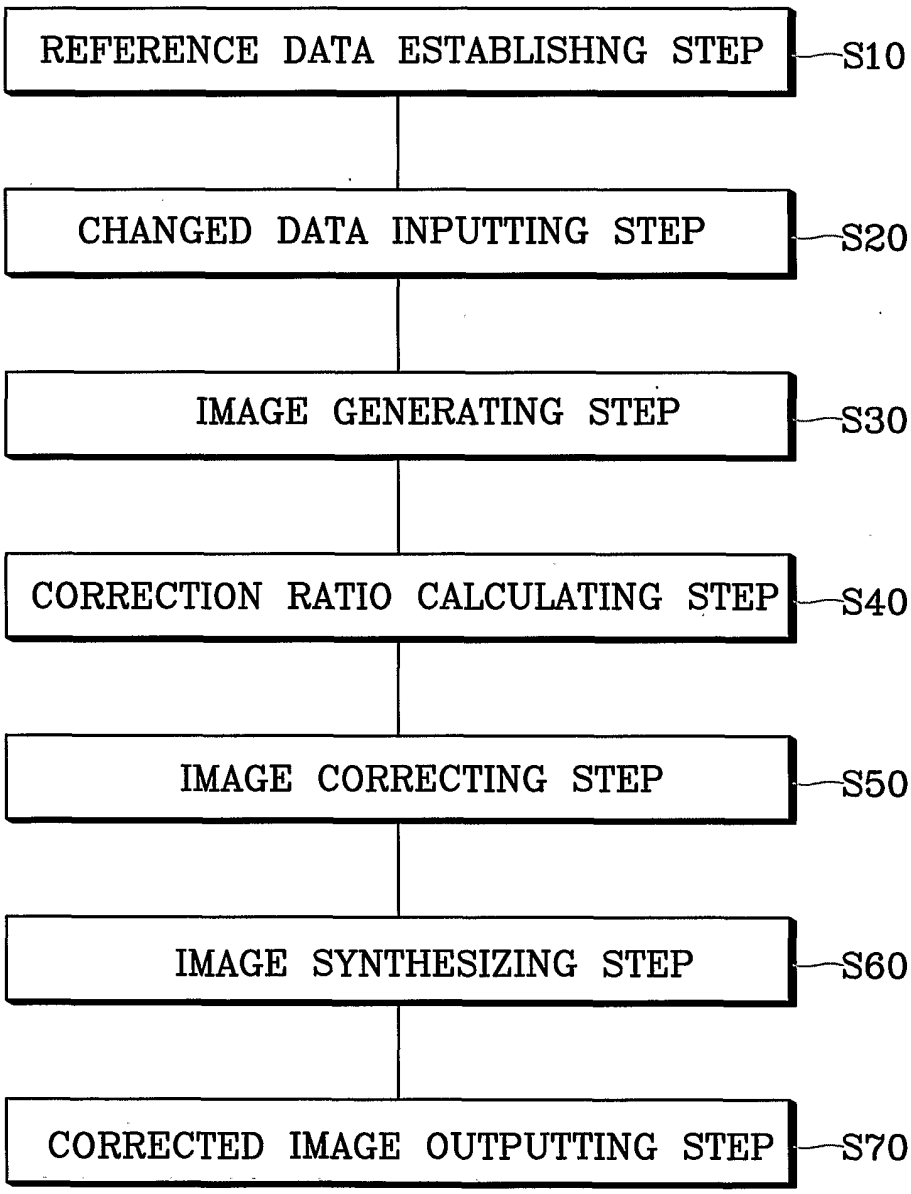
the display apparatus for displaying the left and right images transmitted from the image synthesizing apparatus so that the viewer can observe.

7. The system as claimed in claim 6, wherein left and right position detectors for measuring a photographing ratio of the left and right

cameras with respect to left and right photographs of the object by detecting a height, direction, and inclination of the left and right cameras, and transmitting the measured value to the left and right image magnifying and reducing apparatus, are respectively installed at the left and right cameras.

5

FIG.1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S10
CHANGED DATA INPUTTING STEP
S20
IMAGE GENERATING STEP
S30
CORRECTION RATIO CALCULATING STEP
S40
IMAGE CORRECTING STEP
S50
IMAGE SYNTHESIZING STEP
S60
CORRECTED IMAGE OUTPUTTING STEP
S70

FIG.2

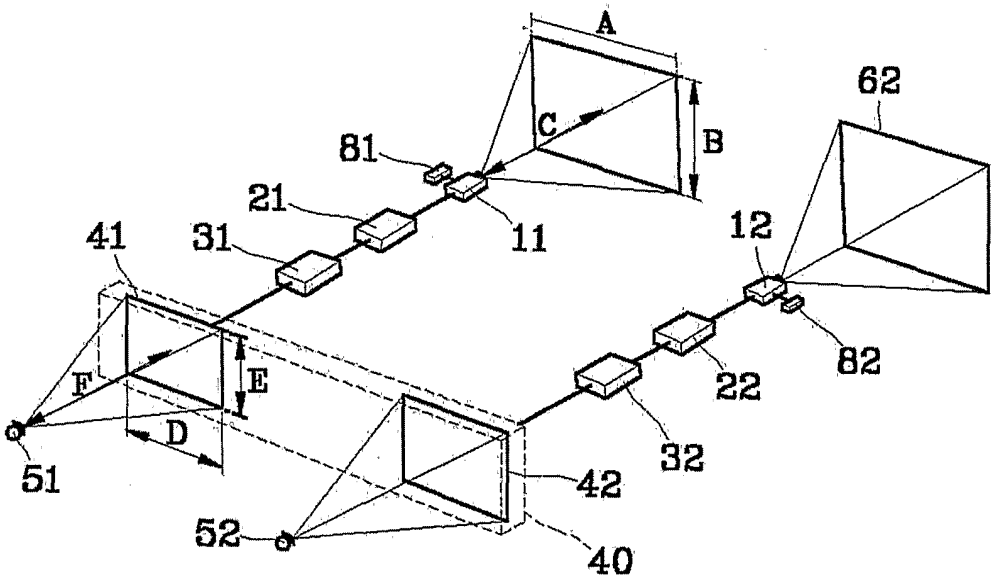


FIG.3

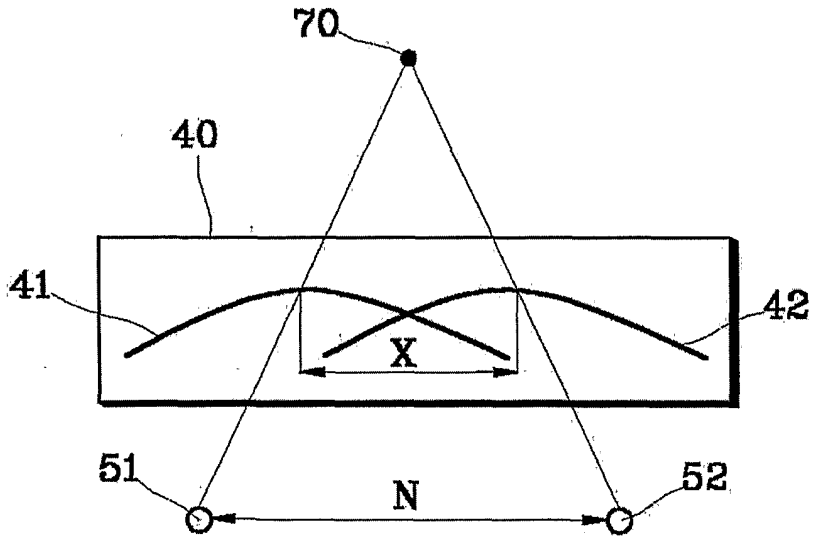


FIG.4

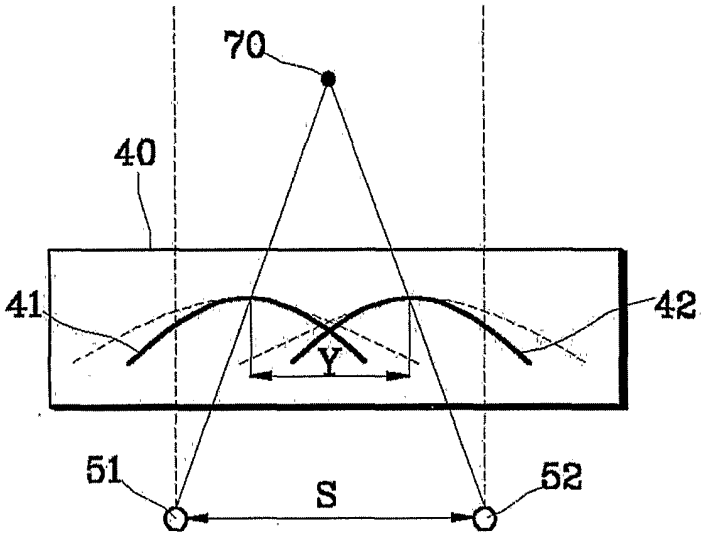
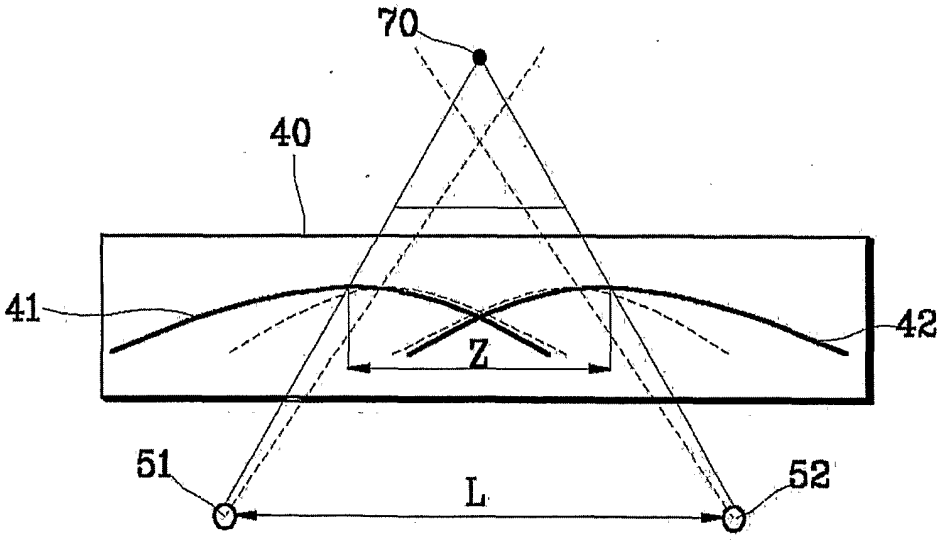


FIG.5



INTERNATIONAL SEARCH REPORT

:rnational application No.
PCT/KR01/01398

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04N 13/00

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

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)

IPC7 H04N

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched

KR, JP :as above

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

PAJ "stereoscopic", "camera", "distance"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 9074573 A2 (MATSUSHITA ELECTRICINDUSTRIAL CO. LTD.) 02. JAN. 1997 see the whole document	1, 6
Y	JP 4035395 A2 (NAKAGAWA) 06.FEB. 1992 see the whole document	1, 6
PA	KR 2001-1341(SAMSUNG ELECTRIC CO.) 05. JAN. 2001 see the whole document	1-7

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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"Y" document of particular relevence; 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	Date of mailing of the international search report
05 DECEMBER 2001 (05.12.2001)	07 DECEMBER 2001 (07.12.2001)

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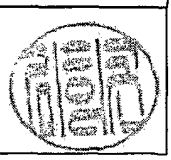

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR01/01398

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 9074573	02-01-1997	EP751689 US6005607	02-01-1997 21-12-1999
JP 4035395	06-02-1992	NONE	
KR 2001-1341	05-01-2001	NONE	