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(54) **DISPLAY DEVICE AND METHOD FOR PROVIDING VR IMAGE**

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(57) **ABSTRACT**

Provided is a display device including: left and right displays that are spaced apart from each other; left and right lens groups respectively located at the rear of the left display and the rear of the right display; left and right display housings configured to surround the left and right displays and the left and right lens groups; a main frame provided between the left and right display housings; a connection structure capable of adjusting an angle between the main frame and a connector electrically connected to an external electronic device; and electronic components provided inside the main frame.

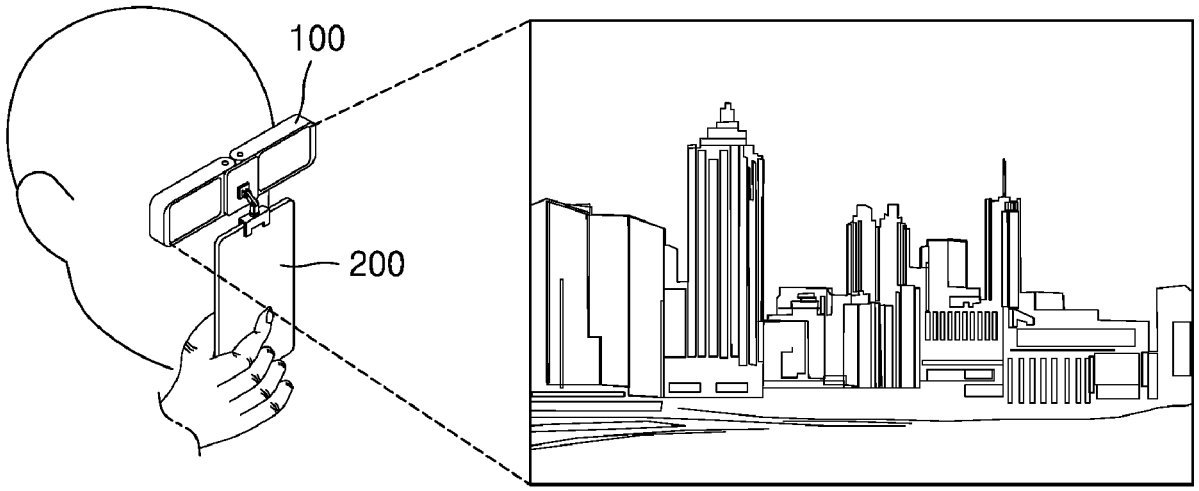


FIG. 1

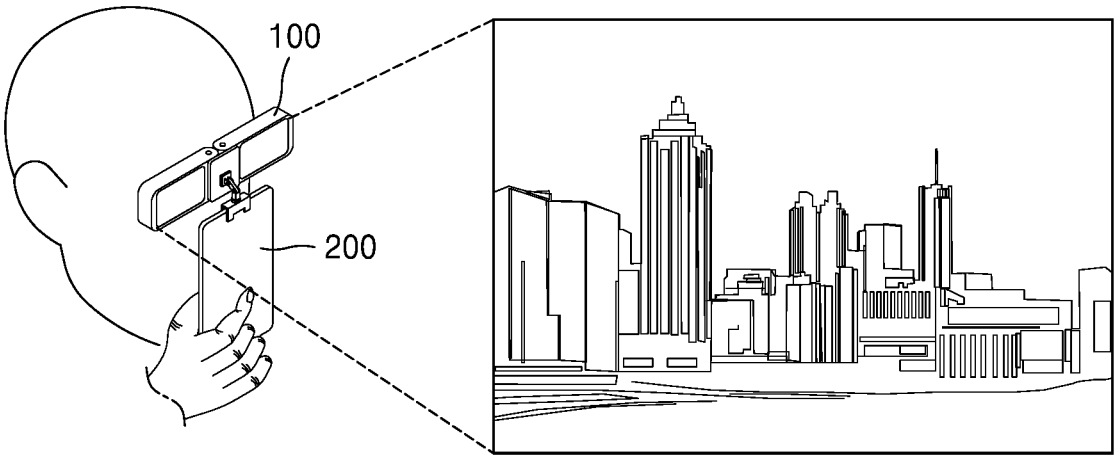


FIG. 2

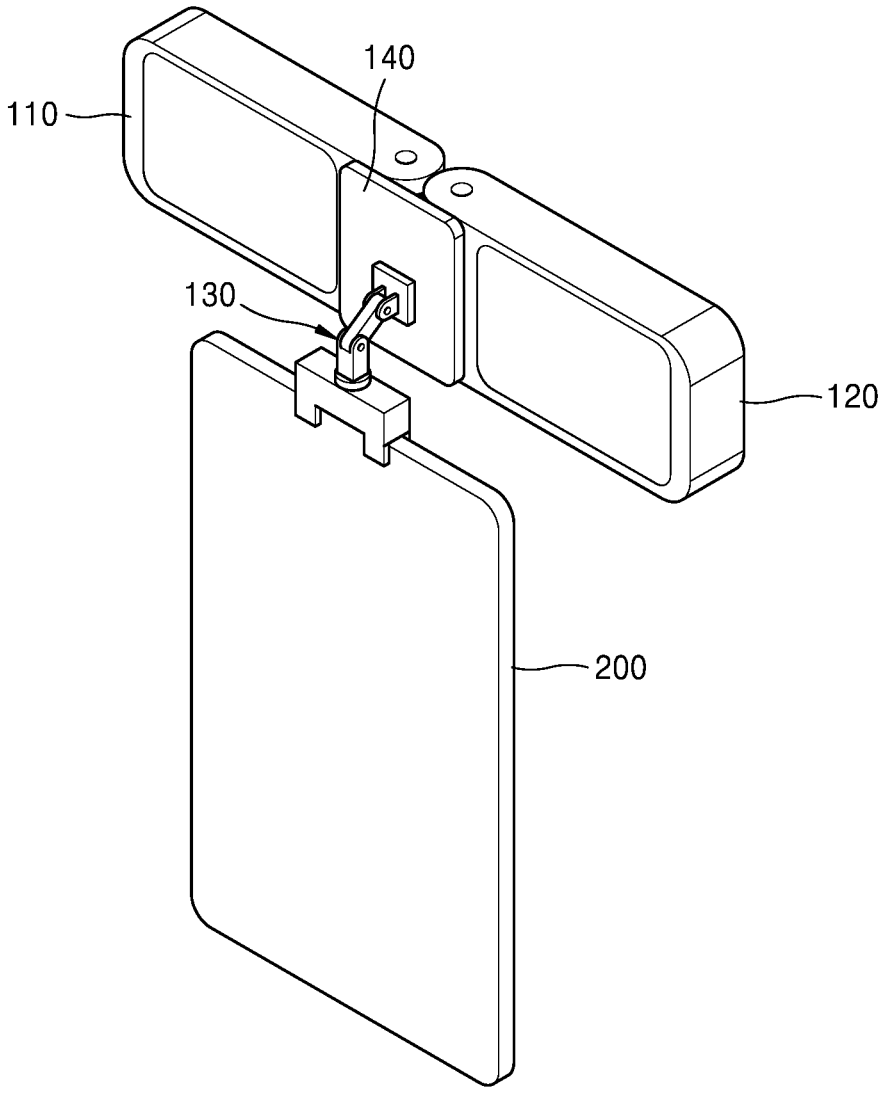


FIG. 3

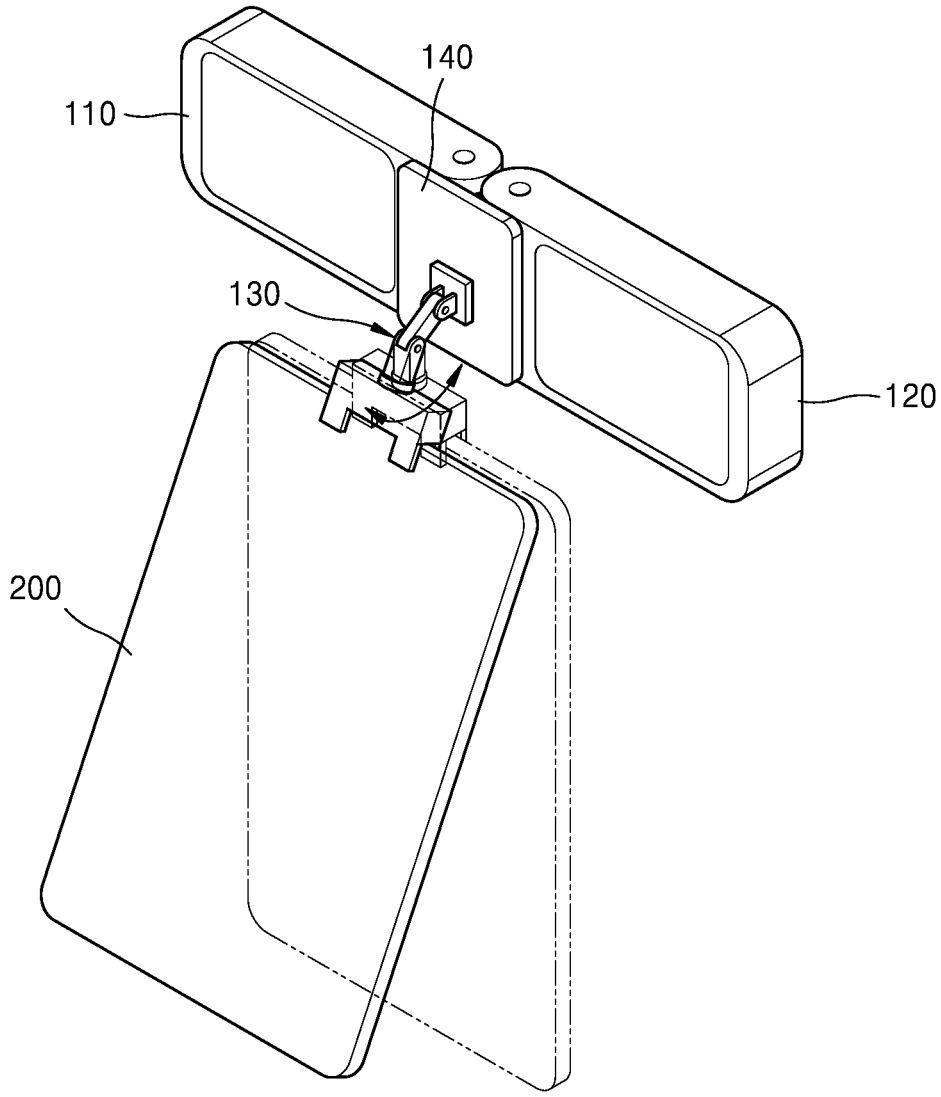


FIG. 4

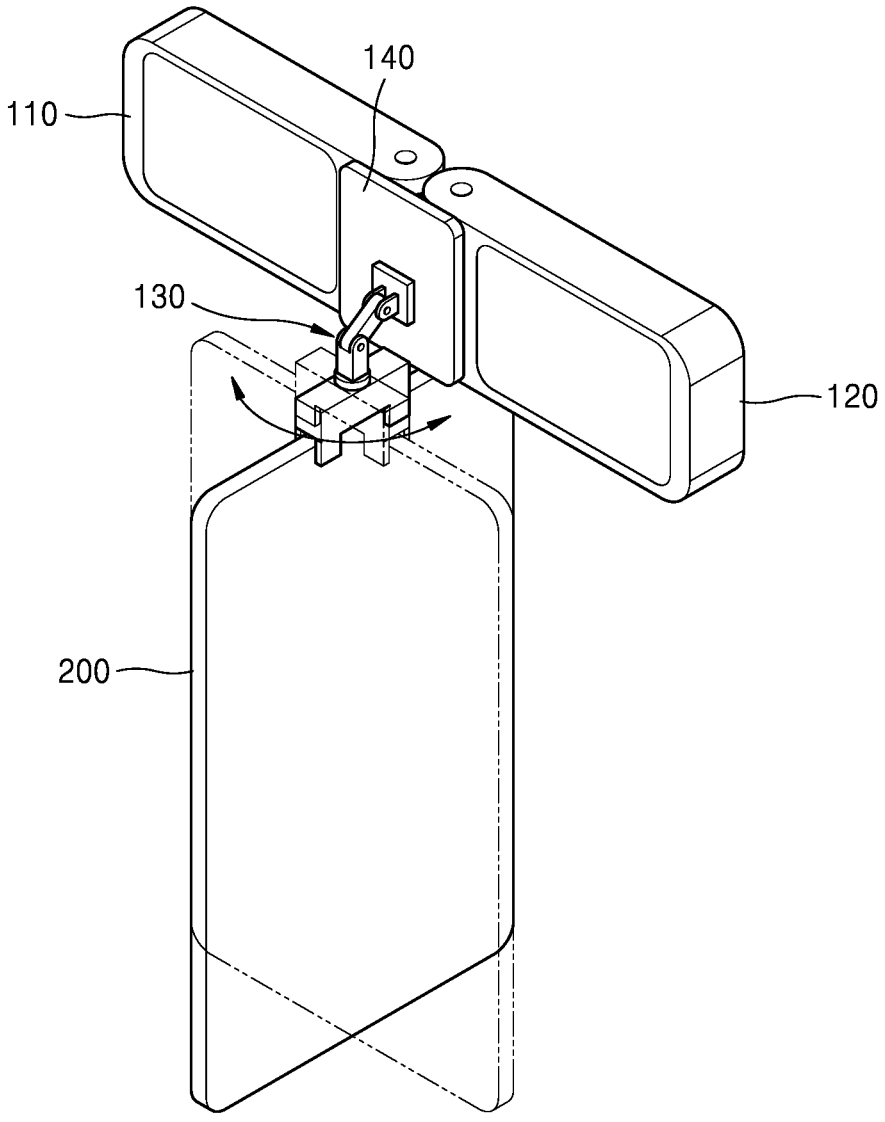


FIG. 5

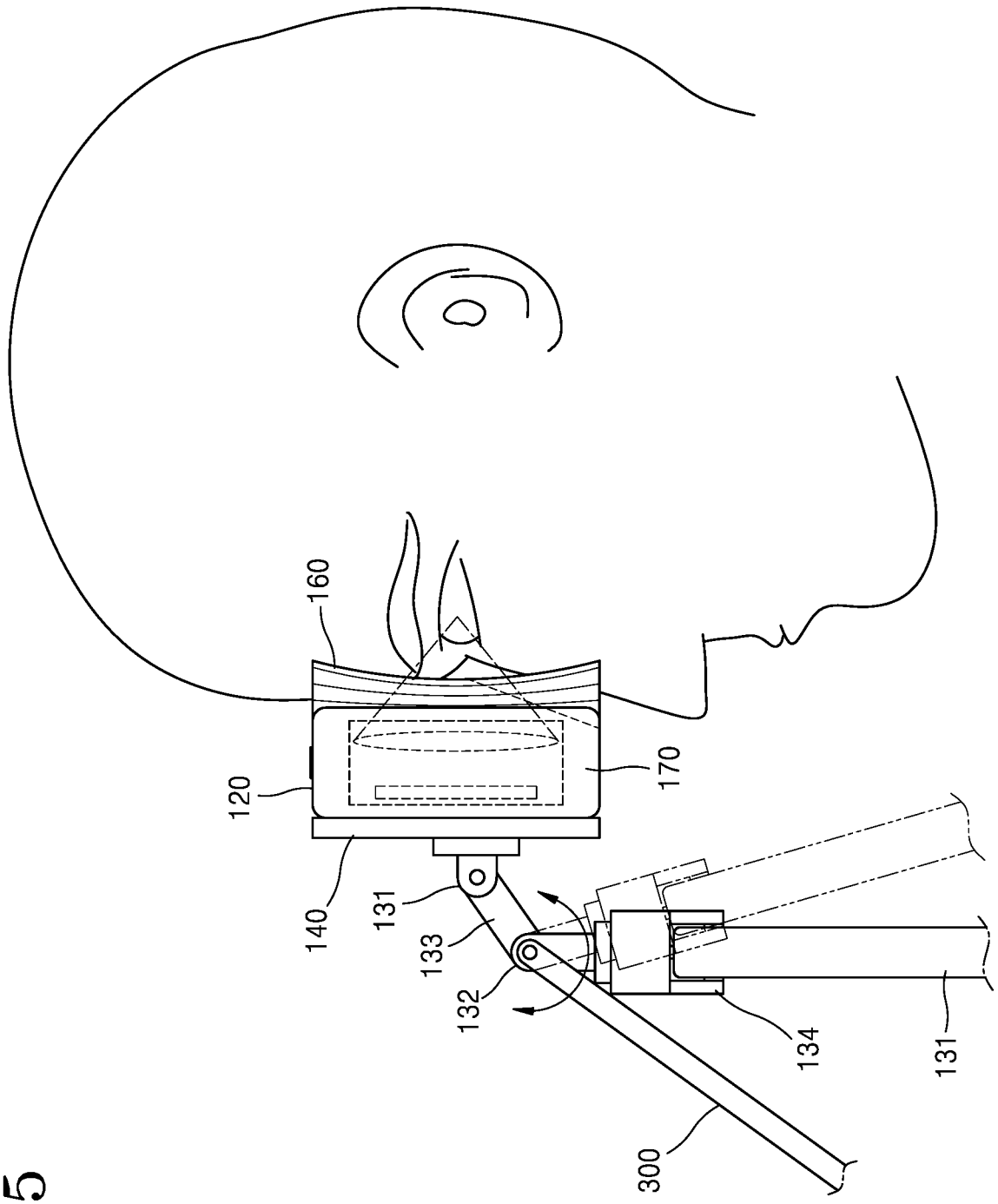
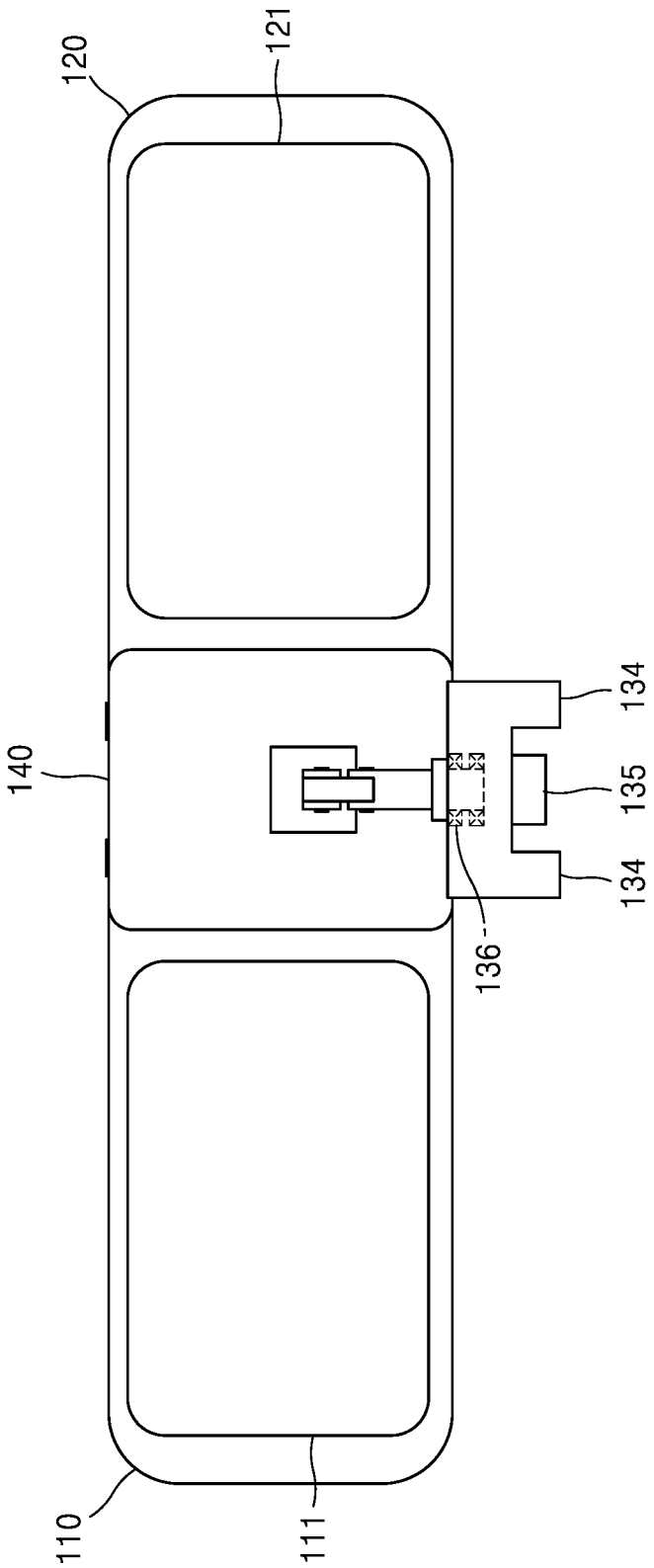


FIG. 6



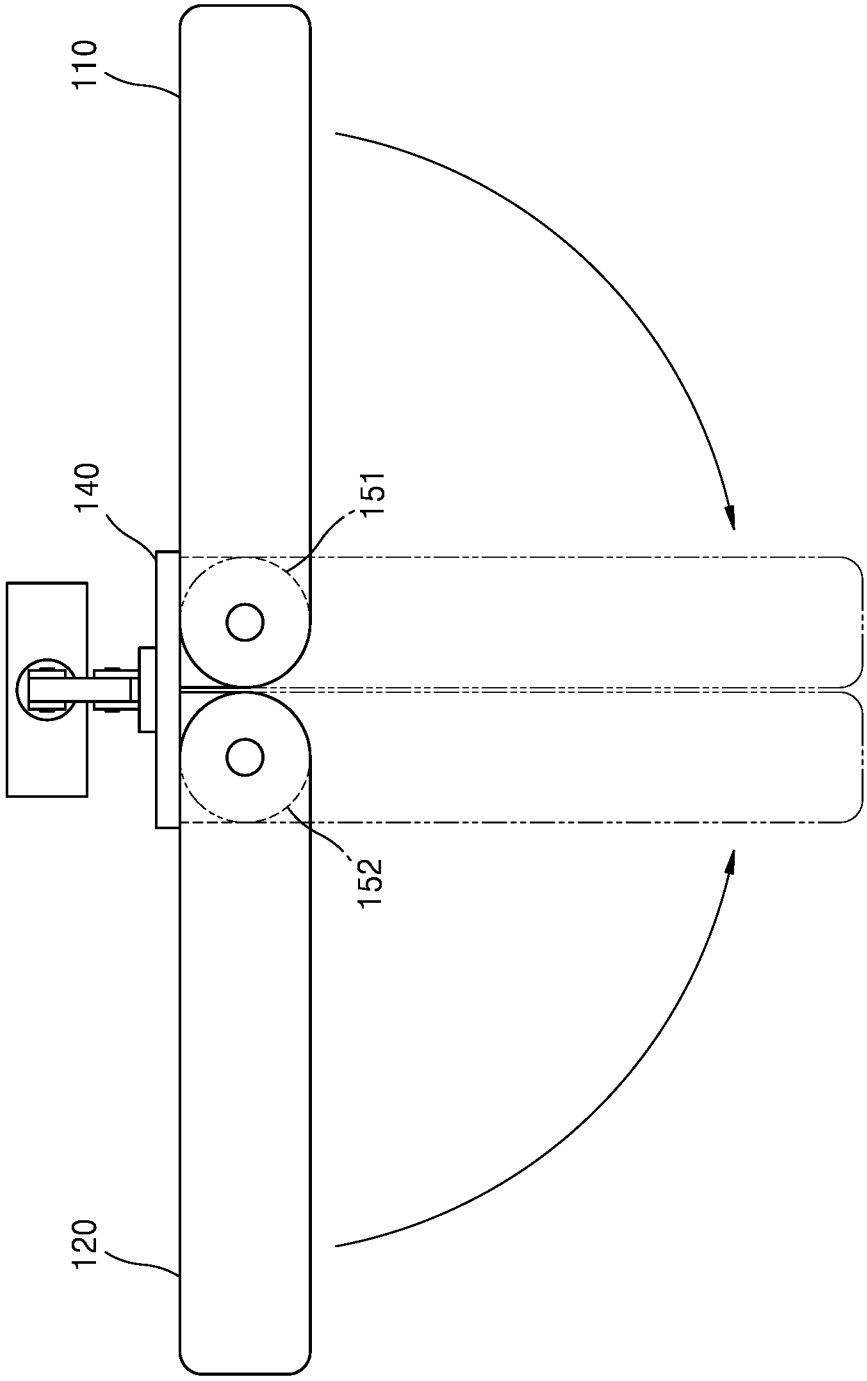


FIG. 7

FIG. 8

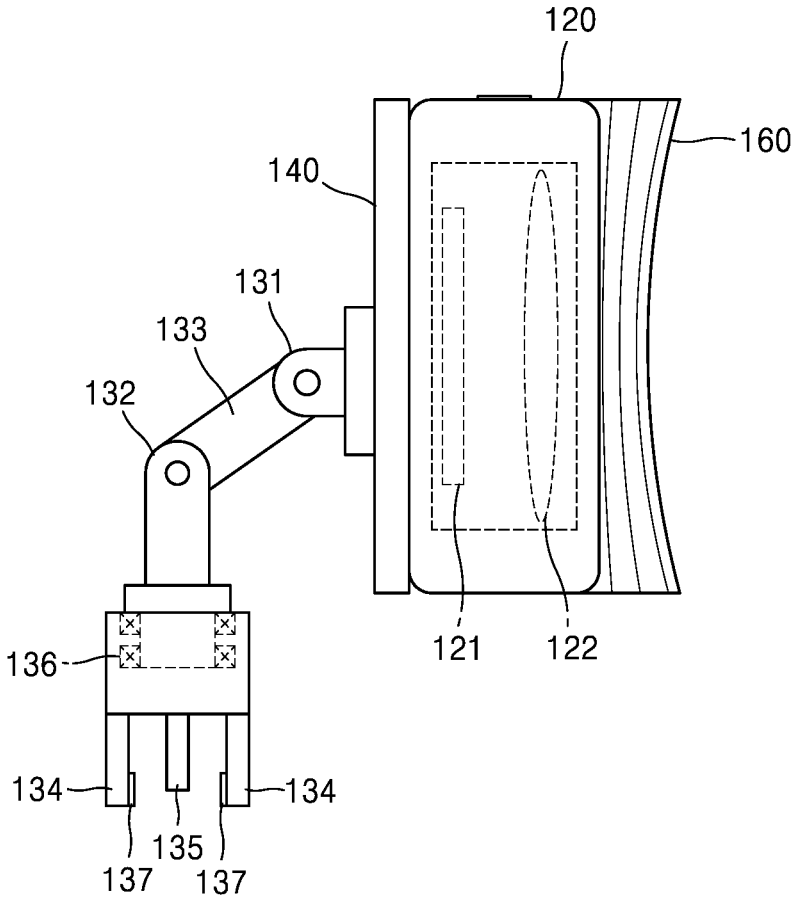


FIG. 9

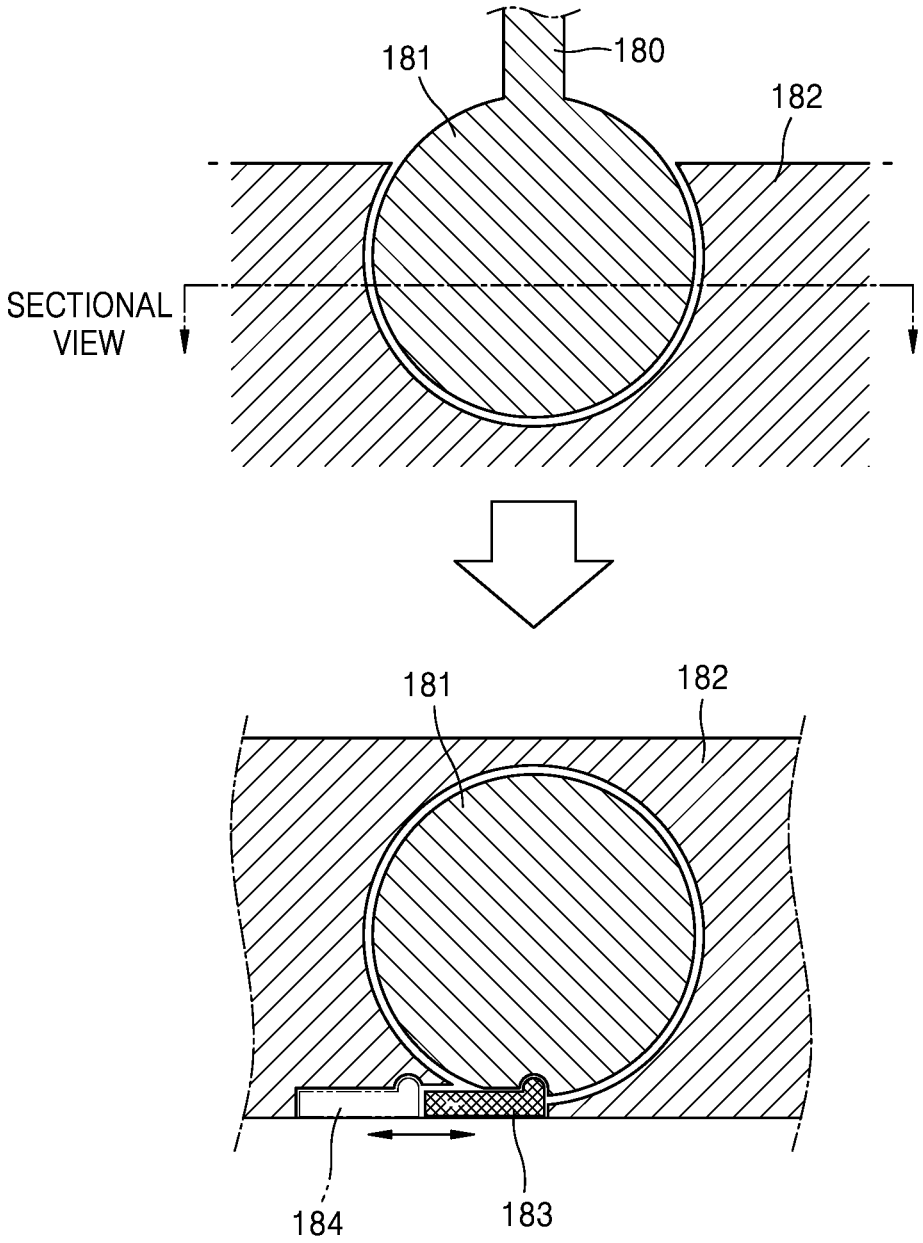


FIG. 10

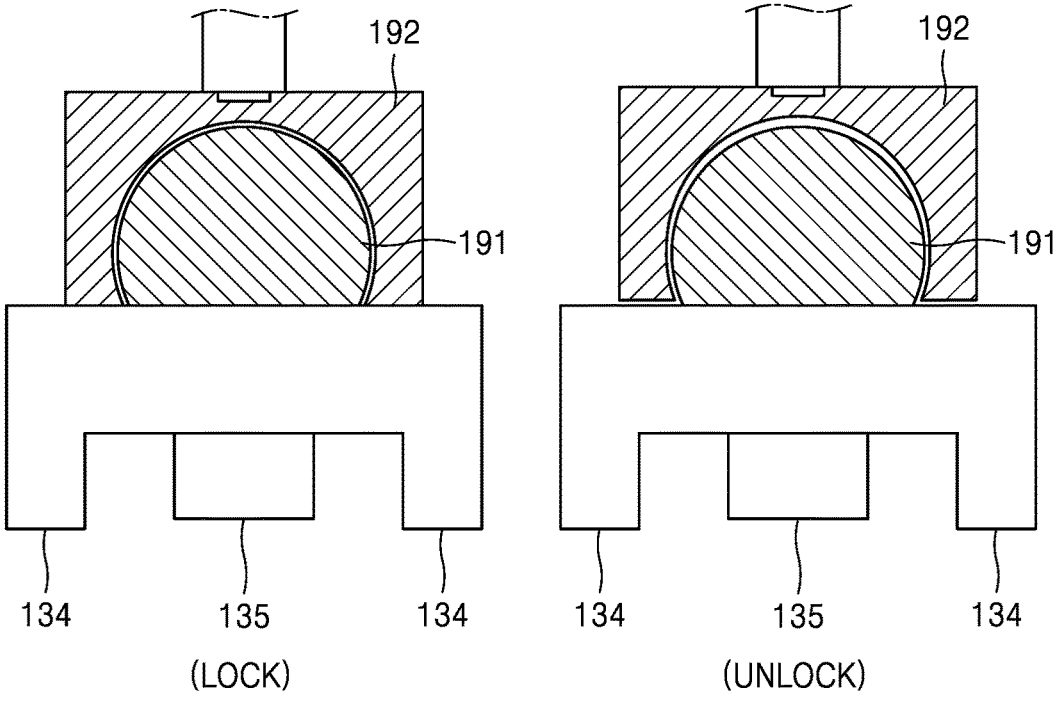

192
191
134
135
134
(LOCK)
192
191
134
135
134
(UNLOCK)

FIG. 11

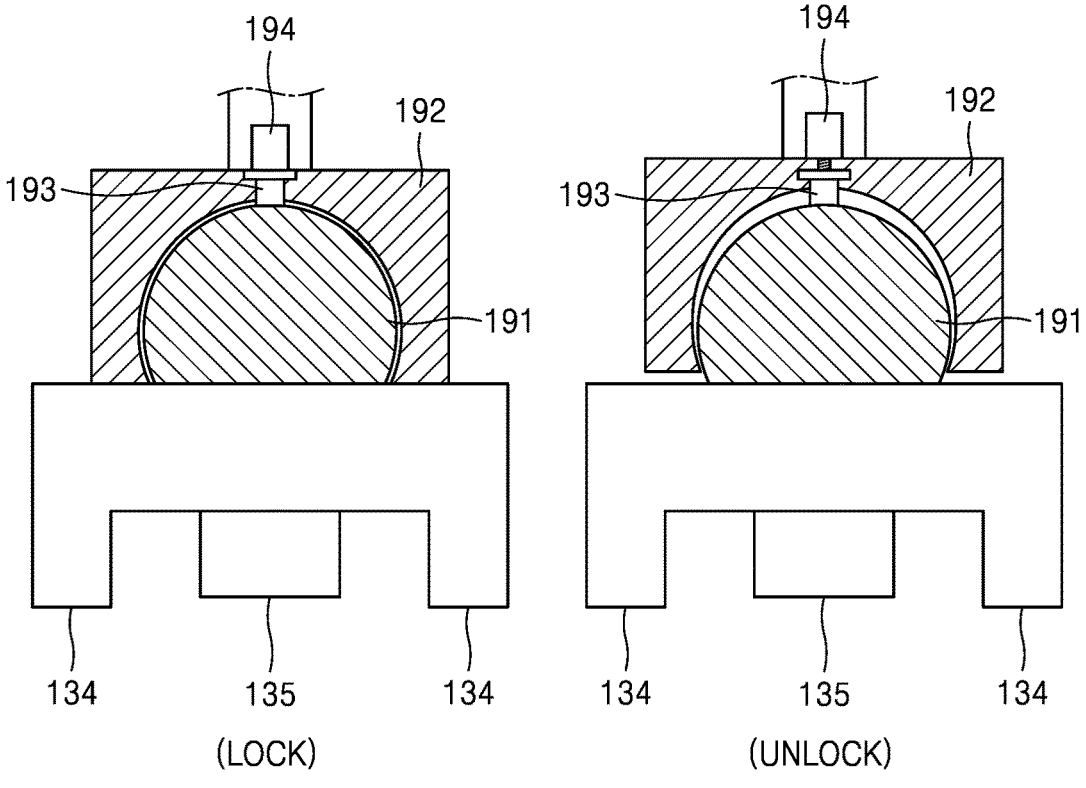

194
192
193
191
134
135
134
(LOCK)
194
192
193
191
134
135
134
(UNLOCK)

FIG. 12

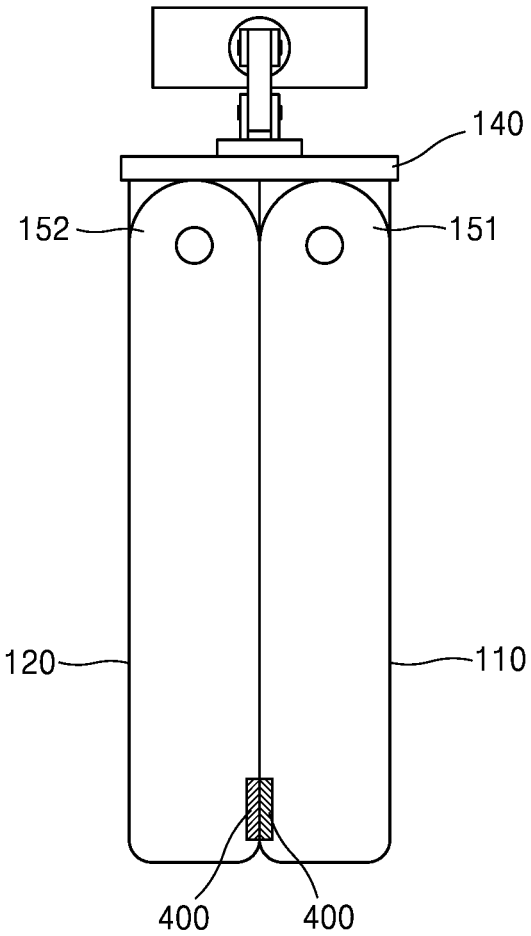


FIG. 13

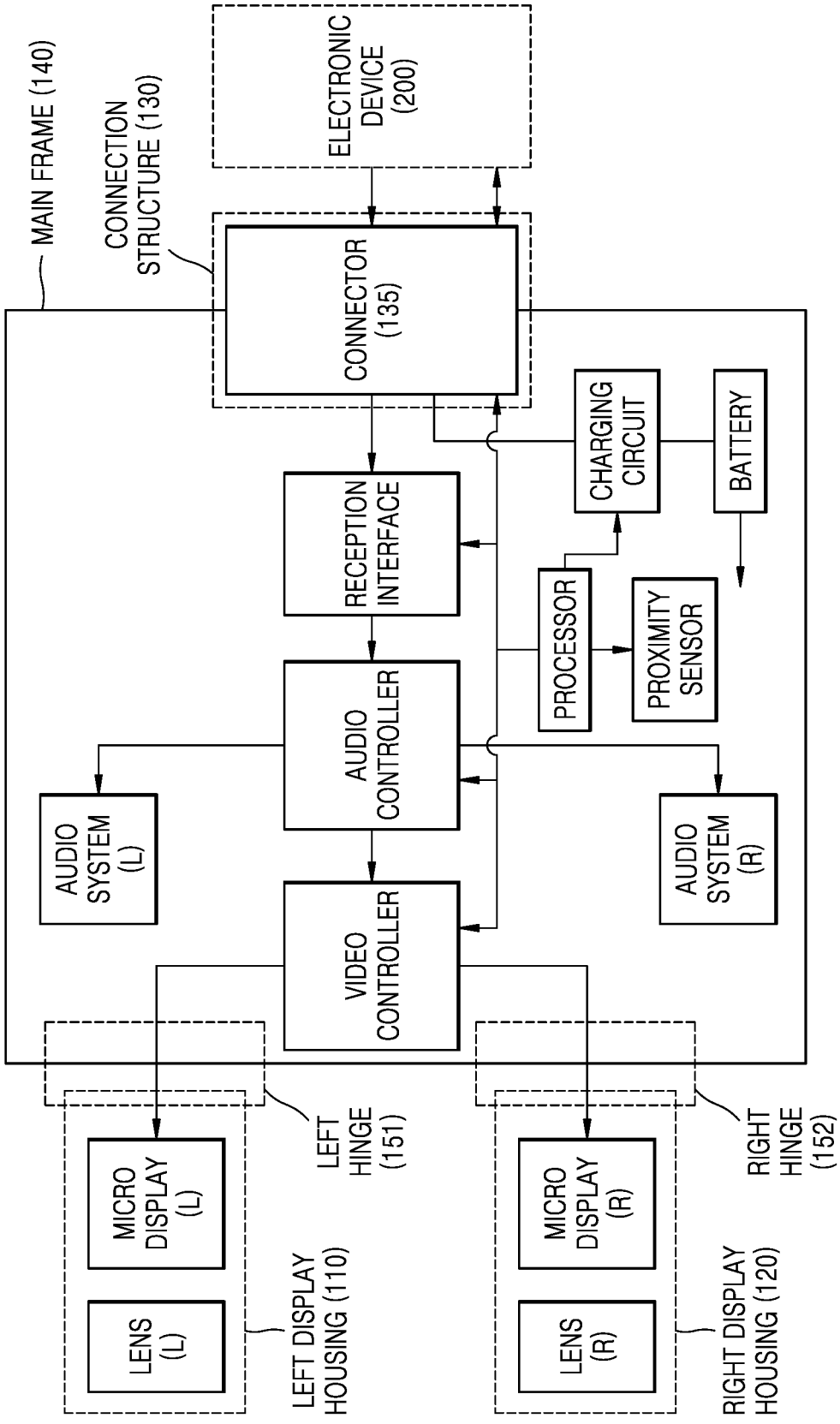
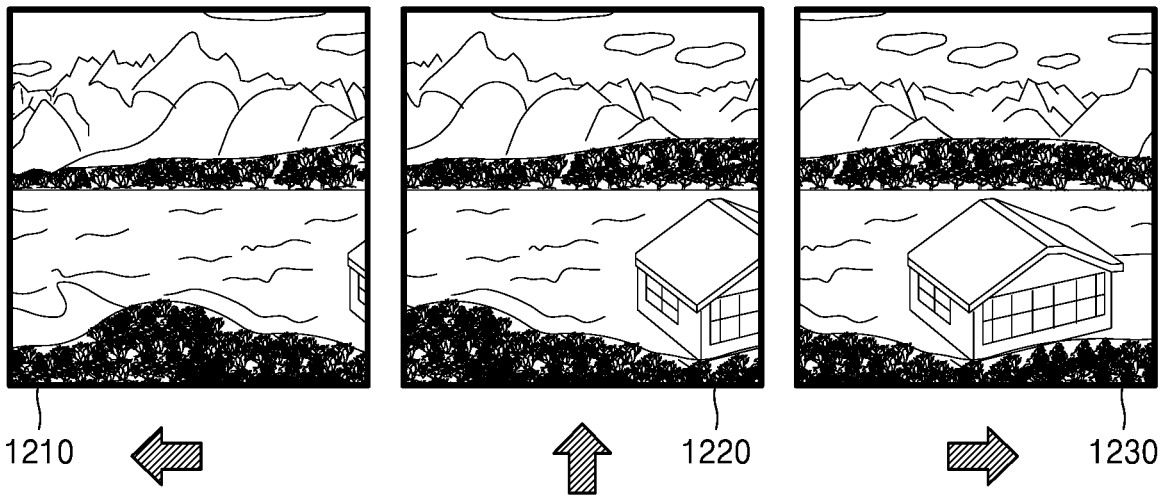

ELECTRONIC DEVICE (200)
MAIN FRAME (140)
CONNECTION STRUCTURE (130)
CONNECTOR (135)
CHARGING CIRCUIT
BATTERY
RECEPTION INTERFACE
PROCESSOR
PROXIMITY SENSOR
AUDIO CONTROLLER
AUDIO SYSTEM (L)
AUDIO SYSTEM (R)
VIDEO CONTROLLER
LEFT HINGE (151)
RIGHT HINGE (152)
MICRO DISPLAY (L)
MICRO DISPLAY (R)
LENS (L)
LENS (R)
LEFT DISPLAY HOUSING (110)
RIGHT DISPLAY HOUSING (120)

FIG. 14



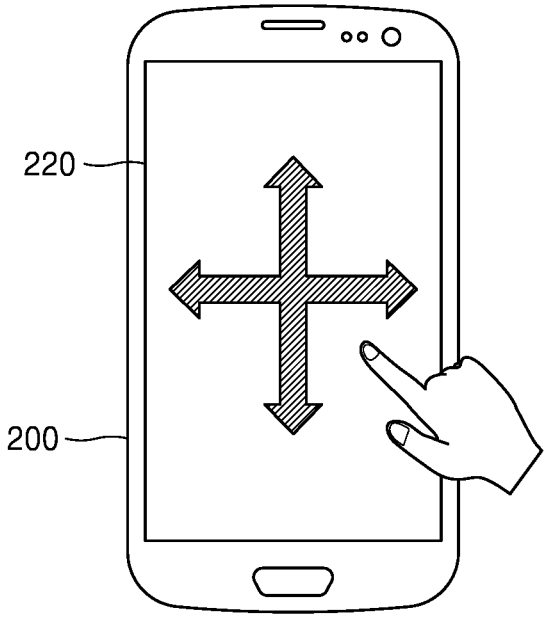


FIG. 15

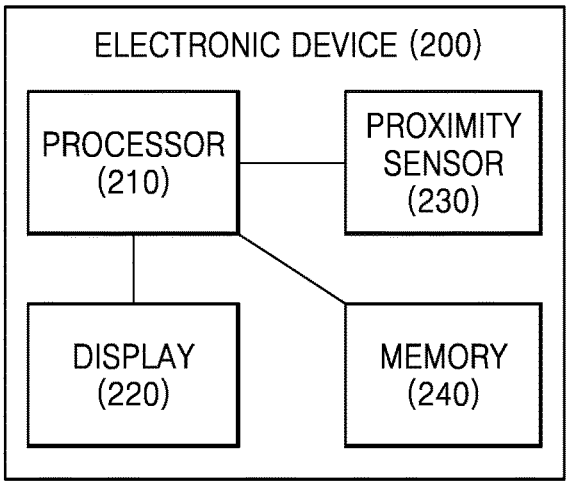
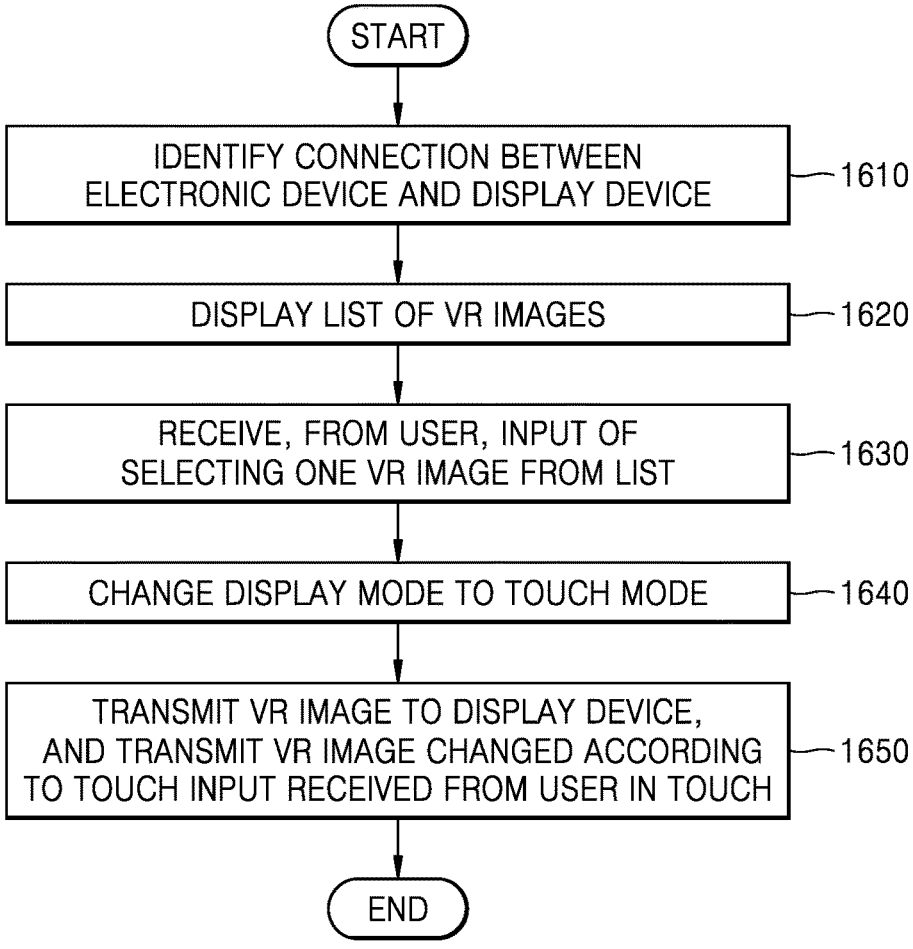

ELECTRONIC DEVICE (200)
PROCESSOR (210)
PROXIMITY SENSOR (230)
DISPLAY (220)
MEMORY (240)

FIG. 16


START
IDENTIFY CONNECTION BETWEEN ELECTRONIC DEVICE AND DISPLAY DEVICE
1610
DISPLAY LIST OF VR IMAGES
1620
RECEIVE, FROM USER, INPUT OF SELECTING ONE VR IMAGE FROM LIST
1630
CHANGE DISPLAY MODE TO TOUCH MODE
1640
TRANSMIT VR IMAGE TO DISPLAY DEVICE, AND TRANSMIT VR IMAGE CHANGED ACCORDING TO TOUCH INPUT RECEIVED FROM USER IN TOUCH
1650
END

DISPLAY DEVICE AND METHOD FOR PROVIDING VR IMAGE

TECHNICAL FIELD

[0001] The present disclosure relates to a display device and a method of providing a virtual reality (VR) image.

BACKGROUND ART

[0002] A user may view an image obtained by capturing a 3-dimensional (3D) space, by wearing a virtual reality (VR) device on his or her head. The user may turn his or her head while viewing the image and the VR device reproduces the image according to a direction in which the user's head is facing.

[0003] The VR device is manufactured to be wearable on the head, and the user may view a VR image while wearing the VR device on his or her head. The VR image is a 360° rotatable image.

DESCRIPTION OF EMBODIMENTS

Technical Problem

[0004] Provided are a display device and a method of providing a virtual reality (VR) image.

[0005] Also, provided is a computer-readable recording medium having recorded thereon a program which, when executed by a computer, performs the method.

Solution to Problem

[0006] According to an aspect of the present disclosure, a display device includes: left and right displays that are spaced apart from each other; left and right lens groups respectively located at the rear of the left display and the rear of the right display; left and right display housings configured to surround the left and right displays and the left and right lens groups; a main frame provided between the left and right display housings; a connection structure capable of adjusting an angle between the main frame and a connector electrically connected to an external electronic device; and electronic components provided inside the main frame.

[0007] According to another aspect of the present disclosure, a method of providing, by an electronic device, a virtual reality (VR) image to a display device, the method includes: identifying a connection between the electronic device and the display device; displaying a list of VR images; receiving, from a user, an input of selecting a VR image from the list; changing a display mode to a touch mode; and transmitting the VR image to the display device, wherein the transmitting of the VR image includes transmitting a changed VR image according to a touch input received from the user in the touch mode.

BRIEF DESCRIPTION OF DRAWINGS

[0008] FIG. **1** is a schematic diagram for describing a method of providing a virtual reality (VR) image, according to an embodiment.

[0009] FIG. **2** is a diagram for describing a connection between a display device and an electronic device, according to an embodiment.

[0010] FIG. **3** is a diagram for describing adjusting an angle of a display device, according to an embodiment.

[0011] FIG. **4** is a diagram for describing rotating a display device, according to an embodiment.

[0012] FIG. **5** is a diagram for describing a display device according to an embodiment.

[0013] FIG. **6** is a rear diagram of a display device according to an embodiment.

[0014] FIG. **7** is a diagram for describing folding a display device, according to an embodiment.

[0015] FIG. **8** is a diagram for describing a connection structure in detail.

[0016] FIG. **9** is a diagram for describing a bearing according to an embodiment.

[0017] FIG. **10** is a diagram for describing a bearing according to another embodiment.

[0018] FIG. **11** is a diagram for describing a bearing according to another embodiment.

[0019] FIG. **12** is a diagram for describing an assembling structure of a display device, according to an embodiment.

[0020] FIG. **13** is a diagram for describing a display device according to an embodiment.

[0021] FIG. **14** is a diagram for describing a method by which a user rotates a VR image by using an electronic device.

[0022] FIG. **15** is a block diagram of an electronic device according to an embodiment.

[0023] FIG. **16** is a flowchart of a method of providing a VR image, according to an embodiment.

BEST MODE

[0024] One or more embodiments of the present disclosure will now be described more fully with reference to the accompanying drawings. However, the one or more embodiments of the present disclosure may be embodied in many different forms, and should not be construed as being limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the concept of the one or more embodiments of the present disclosure to those of ordinary skill in the art. In the following description, well-known functions or constructions are not described in detail since they would obscure the one or more embodiments of the present disclosure with unnecessary detail, and like reference numerals in the drawings denote like or similar elements throughout the specification.

[0025] All terms including descriptive or technical terms which are used herein should be construed as having meanings that are obvious to one of ordinary skill in the art. However, the terms may have different meanings according to an intention of one of ordinary skill in the art, precedent cases, or the appearance of new technologies. Also, some terms may be arbitrarily selected by the applicant, and in this case, the meaning of the selected terms will be described in detail in the detailed description of the disclosure. Thus, the terms used herein have to be defined based on the meaning of the terms together with the description throughout the specification.

[0026] It will be understood that although the terms "first", "second", etc. may be used herein to describe various components, these components should not be limited by these terms. These components are only used to distinguish one component from another.

[0027] The terms used in the present specification are merely used to describe particular embodiments, and are not intended to limit the present disclosure. An expression used

in the singular encompasses the expression in the plural, unless it has a clearly different meaning in the context. Also, in the specification, when a region is "connected" to another region, the regions may not only be "directly connected", but may also be "electrically connected" via another device therebetween. Also, when a part "includes" or "comprises" an element, unless there is a particular description contrary thereto, the part can further include other elements, not excluding the other elements.

[0028] The use of the terms "a" and "an" and "the" and similar referents in the context of describing the disclosure (especially in the context of the following claims) are to be construed to cover both the singular and the plural. Also the steps of all methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context.

[0029] The phrase "some embodiments" or "an embodiment" used variously herein does not necessarily indicate the same embodiment.

[0030] Some embodiments of the present disclosure may be described in terms of functional block components and various processing steps. Such functional blocks may be realized by any number of hardware and/or software components configured to perform the specified functions. For example, the present disclosure may be implemented by one or more microprocessors or by circuit components for certain functions. Also, for example, the functional blocks of the present disclosure may be implemented using any programming or scripting language. The functional blocks may be implemented in algorithms that execute on one or more processors. Furthermore, the present disclosure could employ any number of conventional techniques for electronics configuration, signal processing and/or control, data processing and the like. The words "mechanism" and "element" are used broadly and are not limited to mechanical or physical embodiments, but can include software routines in conjunction with processors, etc.

[0031] Furthermore, the connecting lines, or connectors shown in the various figures presented are intended to represent exemplary functional relationships and/or physical or logical couplings between the various elements. It should be noted that many alternative or additional functional relationships, physical connections or logical connections may be present in a practical device.

[0032] Hereinafter, the present disclosure will be described in detail with reference to accompanying drawings.

[0033] FIG. **1** is a schematic diagram for describing a method of providing a virtual reality (VR) image, according to an embodiment. A user may view a VR image through a display device **100**. An electronic device **200** may transmit the VR image to the display device **100**, and the display device **100** may reproduce the VR image.

[0034] The user may view the VR image without having to fix the display device **100** on a head. The display device **100** does not include a structure being supported by the head of the user. Alternatively, the display device **100** is fixed to the electronic device **200**. The user may view the VR image by holding the display device **100** to the eyes while holding the electronic device **200**.

[0035] The user may rotate the VR image by touching a screen of the electronic device **200**. The electronic device **200** receives a touch input of the user, and determines a direction of the VR image according to a direction of the touch input. The electronic device **200** may transmit the VR image to the display device **100** according to the determined direction. Accordingly, the user may rotate the VR image via the touch input, without having to rotate the head.

[0036] FIG. **2** is a diagram for describing a connection between a display device and an electronic device, according to an embodiment. Referring to FIG. **2**, the display device **100** and the electronic device **200** are connected to each other via a connection structure **130**. The connection structure **130** may maintain positions of the display device **100** and the electronic device **200**.

[0037] The display device **100** includes a left display housing **110**, a right display housing **120**, the connection structure **130**, and a main frame **140**. The left display housing **110** is configured to surround a left display and a left lens group. The right display housing **120** is configured to surround a right display and a right lens group.

[0038] The connection structure **130** fixes the electronic device **200** and the display device **100** to each other. The connection structure **130** includes a holder **134**, and the electronic device **200** and the display device **100** are fixed by using the holder **134**.

[0039] An angle of the connection structure **130** may be adjustable with respect to the main frame **140**. An angle of the connection structure **130** may be adjusted. Also, an external structure may be rotatable in an axial direction with respect to the main frame **140**. Angle adjustment and rotation of the connection structure **130** are described in detail with reference to FIGS. **3** and **4**.

[0040] FIG. **3** is a diagram for describing adjusting an angle of a display device, according to an embodiment.

[0041] The angle of the connection structure **130** of the display device **100** is adjustable back and forth. The connection structure **130** includes at least one hinge. The user may connect the display device **100** and the electronic device **200**, and then adjust an angle between the display device **100** and the electronic device **200** by using the hinge. The hinge includes a friction member having a frictional force, and the angle is adjusted only when a force equal to or stronger than certain strength is applied. Accordingly, the angle is fixed as long as the user does not apply the force equal to or stronger than the certain strength. For example, the friction member may be a friction pad or a spring.

[0042] When the connection structure **130** includes two hinges, the user may adjust each of an angle between the display device **100** and the connection structure **130** and an angle between the electronic device **200** and the connection structure **130**. The user may adjust an angle to be most comfortable when the electronic device **200** is held and the display device **100** is brought close to the face.

[0043] FIG. **4** is a diagram for describing rotating a display device, according to an embodiment.

[0044] The connection structure **130** of the display device **100** is rotatable 360° around a shaft. The connection structure **130** may further include a bearing structure, and the user may rotate the display device **100** and the electronic device **200** around the shaft by using the bearing structure. A rotating direction of a bearing is a direction perpendicular to a rotating direction of the hinge.

[0045] FIG. **5** is a diagram for describing a display device according to an embodiment.

[0046] The display device **100** includes an arm structure. The arm structure includes first and second hinges **131** and **132**, and the first and second hinges **131** and **132** are

connected by a bar **133**. The first hinge **131** adjusts an angle between the bar **133** and the main frame **140**. The second hinge **132** adjusts an angle between the bar **133** and the electronic device **200**. The second hinge **132** is connected to the main frame **140**.

[0047] The holder **134** fixes the display device **100** and the electronic device **200**. The holder **134** may be manufactured in such a manner that the outside of the electronic device **200** may be held, but a form of the holder **134** is not limited thereto, and any form capable of fixing the display device **100** and the electronic device **200** may be used.

[0048] An auxiliary support **300** may be connected to the first hinge **131** or the second hinge **132**. In FIG. **5**, the auxiliary support **300** is connected to the second hinge **132**. The user may adjust an angle between the auxiliary support **300** and the display device **100**.

[0049] The auxiliary support **300** may be attached to or detached from the display device **100**. The user may use the auxiliary support **300** by attaching the auxiliary support **300** to the connection structure **130** only when required. The auxiliary support **300** may be used to prevent the arm of the user from becoming numb when the user is viewing the VR image for a long period of time.

[0050] The display device **100** further includes a contact structure **160**. The contact structure **160** is adhered to the face of the user such that the display device **100** does not shake and ambient light is blocked to enhance an immersive experience of the user.

[0051] For example, the contact structure **160** may be a bellow-type structure. Alternatively, the contact structure **160** may be formed of rubber.

[0052] The contact structure **160** may be provided to surround a left lens group **112** and a right lens group **122**. Also, the contact structure **160** may be provided at the edge of the left and right display housings **110** and **120**.

[0053] A nose hole **170** denotes a space where the noise of the user may be located when the user adheres the display device **100** to the face. The nose hole **170** may be formed between the left display housing **110** and the right display housing **120**.

[0054] FIG. **6** is a rear diagram of a display device according to an embodiment.

[0055] The main frame **140** is located at the center of the display device **100**. The left display housing **110** is located at the left of the main frame **140**, and the right display housing **120** is located at the right of the main frame **140**.

[0056] The connection structure **130** may be connected to the main frame **140**. The connection structure **130** includes the first hinge **131**, the second hinge **132**, the bar **133**, the holder **134**, and a bearing **136**. The bearing **136** may have a cylindrical shape or a ball joint shape.

[0057] The connection structure **130** may surround a connector **135**. The connector **135** is located inside the holder **134** to be connected to the electronic device **200**. The display device **100** and the electronic device **200** exchange data or a VR image through the connector **135**. The VR image is transmitted to the main frame **140** through the connector **135**.

[0058] FIG. **7** is a diagram for describing folding a display device, according to an embodiment. As shown in FIG. **7**, the left display housing **110** and the right display housing **120** are each folded by 90°. The left display housing **110** rotates 90° based on the first hinge **131** and the right display housing **120** rotates 90° based on the second hinge **132**.

[0059] FIG. **8** is a diagram for describing a connection structure in detail.

[0060] The holder **134** may be provided at two sides. The connector **135** may be provided between the two holders **134**. The holder **134** may include a friction member **137** on a surface contacting the electronic device **200**. The friction member **137** may be provided inside the holder **134**. The friction member **137** may be formed of a material having high frictional coefficient, such as rubber.

[0061] The bearing **136** may have a cylindrical shape or a ball shape, and may rotate 360°.

[0062] The bearing **136** may be in a flexible state or may be fixed based on a distance between the display device **100** and the user. The flexible state denotes a state in which the display device **100** does not shake even when the user moves slightly while holding the electronic device **200**. Also, the bearing **136** being fixed denotes a state in which the display device **100** is movable according to movement of the user.

[0063] The main frame **140** controls a state of the bearing **136**, based on the distance between the display device **100** and the user, the distance measured by a proximity sensor. For example, a processor of the main frame **140** may control the bearing **136** to be in the flexible state when a distance between the display device **100** and the face of the user is equal to or lower than a threshold value. When the display device **100** approaches the face of the user, the processor controls the bearing **136** to be in the flexible state such that the display device **100** does not shake even when the electronic device **200** shakes.

[0064] For example, the proximity sensor may be an infrared (IR) sensor, and may be provided at the left display housing **110** or the right display housing **120**. When the display device **100** does not include the proximity sensor, the display device **100** may calculate the distance between the display device **100** and the user by receiving a signal from a proximity sensor **230** of the electronic device **200**.

[0065] On the other hand, the processor controls the bearing **136** to be fixed when the distance between the display device **100** and the face of the user is higher than the threshold value. When the user is not viewing a VR image, the processor may control the bearing **136** to be fixed. For example, the processor may fix the bearing **136** by applying a current to an electromagnet located around the bearing **136**. When the bearing **136** is a magnetic substance, the bearing **136** and the electromagnet may be fixed via a magnetic force by applying a current to the electromagnet.

[0066] A left display **121** and a right display (not shown) may be a miniaturized display. For example, the left display **121** and the right display may be a liquid crystal display (LCD) or an organic light-emitting display (OLED).

[0067] The left lens group **112** and the right lens group **122** are lens units for enlarging an image. The left lens group **112** and the right lens group **122** each include at least one lens.

[0068] FIG. **9** is a diagram for describing a bearing according to an embodiment. A ball joint **180** of FIG. **9** may replace the bearing **136** of FIG. **7**.

[0069] The connection structure **130** may include the ball joint **180**. The ball joint **180** enables the display device **100** and the electronic device **200** to tilt and rotate.

[0070] The ball joint **180** includes a ball **181** and a ball housing **182**. The ball housing **182** surrounds the ball **181**. The ball **181** freely rotates within the ball housing **182**.

[0071] Looking at a sectional view of the ball joint **180**, the connection structure **130** may further include a locking

lever **183**. The locking lever **183** may fix the ball **181**. The locking lever **183** may be in a locking position or an unlocking position **184**, and may be driven by the user or electronically. For example, the locking lever **183** may move according to the distance between the display device **100** and the face of the user. When the distance between the display device **100** and the face of the user is equal to or lower than a threshold value, the locking lever **183** is arranged in the unlocking position **184**. On the other hand, when the display device **100** and the face of the user is higher than the threshold value, the locking lever **183** is arranged in the locking position. The distance between the display device **100** and the face of the user may be measured by a proximity sensor. Accordingly, the locking lever **183** may be arranged in the locking position or the unlocking position **184** automatically, based on the distance measured by the proximity sensor.

[0072] The locking position is a region where the locking lever **183** is displayed in solid lines in FIG. **9**, and the unlocking position **184** is a region where the locking lever **183** is displayed in broken lines in FIG. **9**.

[0073] The locking lever **183** may include a protrusion, and the ball **181** may include a groove. When the protrusion is coupled to the groove, the ball **181** may no longer move and be fixed.

[0074] FIG. **10** is a diagram for describing a bearing according to another embodiment. Referring to FIG. **10**, a ball **191** and a ball housing **192** may be spaced apart from each other by a magnetic force. The ball **191** may include a magnet. Alternatively, a surface of the ball **191** may be configured to be a magnet. The ball housing **192** include an electromagnet. The ball **191** has a magnetic property by applying electricity to the electromagnet, such that the ball **191** and the ball housing **192** have the same polarity. The ball **191** and the ball housing **192** having the same polarity are spaced apart from each other by a repulsive force.

[0075] The processor may apply a current to the electromagnet according to a signal received from the proximity sensor. The processor may calculate the distance between the display device **100** and the face of the user, based on the signal received from the proximity sensor, and apply the current to the electromagnet when the calculated distance is equal to or lower than the threshold value. In other words, while the user is viewing the VR image, the processor applies the current to the electromagnet to separate the ball **191** and the ball housing **192** so as to prevent the display device **100** from shaking due to hand shaking of the user.

[0076] FIG. **11** is a diagram for describing a bearing according to another embodiment. Referring to FIG. **10**, the ball **191** and the ball housing **192** may be spaced apart from each other by a fastener **193**. The fastener **193** may be loosened or fastened with respect to the ball housing **192** by a motor **194**. When the fastener **193** is fastened, the ball **191** and the ball housing **192** contact each other. When the fastener **193** is loosened, the ball **191** and the ball housing **192** are spaced apart from each other. The motor **194** is fixed to the ball housing **192**, and the fastener **193** pushes the ball **191** while being loosened, and thus the ball **191** and the ball housing **192** are spaced apart from each other.

[0077] The processor may drive the motor **194** according to a signal received from the proximity sensor. The processor may calculate the distance between the display device **100** and the face of the user, based on the signal received from the proximity sensor, and drive the motor **194** when the calculated distance is equal to or lower than the threshold value. In other words, while the user is viewing a VR image, the processor may separate the ball **191** and the ball housing **192** from each other by driving the motor **194**, to prevent the display device **100** from shaking due to hand shaking of the user.

[0078] FIG. **12** is a diagram for describing an assembling structure of a display device, according to an embodiment.

[0079] The left display housing **110** and the right display housing **120** may further include assembling structures **400** at the ends. The assembling structures **400** fix the left display housing **110** and the right display housing **120** when the left and right display housings **110** and **120** are folded. For example, the assembling structures **400** may include a groove and a protrusion, wherein the groove and the protrusion are coupled to be fixed to each other. The left display housing **110** may include the groove at the end, and the right display housing **120** may include the protrusion at the end.

[0080] As another example, the assembling structure **400** may be a magnet. An N-pole magnet may be provided at the end of the left display housing **110**, and an S-pole magnet may be provided at the end of the right display housing **120**. Accordingly, when the left and right display housings **110** and **120** are folded, the N-pole and the S-pole contact each other, and thus the left and right display housings **110** and **120** may be fixed to each other.

[0081] The groove and the protrusion, and the magnets are only examples of the assembling structure **400**, and the assembling structure **400** may have any structure as long as the left and right display housings **110** and **120** are fixed to each other.

[0082] FIG. **13** is a diagram for describing a display device according to an embodiment.

[0083] The left display housing **110** includes a lens (L) and a micro display (L). The left display housing **110** is configured to surround the lens (L) and the micro display (L). The left display housing **110** is connected to the main frame **140** through a left hinge **151**.

[0084] The right display housing **120** includes a lens (R) and a micro display (R). The right display housing **120** is configured to surround the lens (R) and the micro display (R). The right display housing **120** is connected to the main frame **140** through a right hinge **152**.

[0085] The main frame **140** includes an interface and a processor. The main frame **140** includes an audio system (L), an audio system (R), a video controller, an audio controller, a reception interface, a processor, a proximity sensor, a charging circuit, a battery, the connection structure **130**, and the connector **135**. The processor controls the proximity sensor, the charging circuit, the audio controller, the video controller, and the reception interface. The reception interface separates a video signal and an audio signal received from the electronic device **200**. The audio controller transmits the audio signal to the left audio system (L) and the right audio system (R). The video controller transmits the video signal to the left micro display (L) and the right micro display (R).

[0086] The connector **135** is connected to the electronic device **200**, and the display device **100** transmits and receives data to and from the electronic device **200** through the connector **135**.

[0087] FIG. **14** is a diagram for describing a method by which a user rotates a VR image by using an electronic device. The user may rotate the VR image by touching a

display **220** of the electronic device **200**. The electronic device **200** may transmit the rotated VR image to the display device **100**, according to a touch input of the user.

[0088] Based on a second image **1220**, a first image **1210** indicates an image when the user touches left direction and a third image **1230** indicates an image when the user touches right direction.

[0089] The electronic device **200** may not only detect directions shown in FIG. **14**, but also a direction of the touch input of the user, and transmit the VR image rotated in the detected direction to the display device **100**.

[0090] The electronic device **200** may determine a rotating angle of the VR image, according to a dragging speed of the user. For example, the electronic device **200** may determine a larger rotating angle when the dragging speed of the user is high. On the other hand, the electronic device **200** determines a smaller rotating angle when the dragging speed of the user is low. The electronic device **200** transmits the VR image rotated in the determined rotating angle to the display device **100**.

[0091] The electronic device **200** may transmit, to the display device **100**, a screen in which the VR image is rotated or a viewpoint of the VR image is moved, based on a type of the touch input of the user. For example, when the user inputs a one point touch-and-drag input, the electronic device **200** rotates the VR image. When the user inputs a two points touch-and-drag input, the electronic device **200** may move the viewpoint in the VR image.

[0092] In detail, as shown in FIG. **14**, when the user touches and drags the display **220** with one finger, the VR image is rotated in a dragged direction. The electronic device **200** transmits the VR image changed according to the dragged direction of the user to the display device **100**.

[0093] When the user touches and drags the display **220** with two fingers, the viewpoint is moved within the VR image in a dragged direction. In other words, when the user touches and drags the display **220** with two fingers, the electronic device **200** transmits, to the display device **100**, an image obtained as the viewpoint is moved forward, backward, or transversely within the VR image. For example, when the user touches the display **220** and drags from top to bottom with two fingers, the electronic device **200** transmits an image when the viewpoint is moved forward, to the display device **100**. When the user touches the display **220** and then drags from left to right with two fingers, the electronic device **200** transmits an image in which the viewpoint is moved to the right, to the display device **100**.

[0094] The electronic device **200** may determine a moved distance in the VR image according to a speed of the user touching two points and then dragging. For example, when a dragging speed of the user is high, the electronic device **200** may determine a long moved distance. On the other hand, when the dragging speed of the user is low, the electronic device **200** may determine a short moved distance. The electronic device **200** transmits the VR image moved by the determined moved distance, to the display device **100**.

[0095] As another example, the electronic device **200** may enlarge or reduce the VR image. When the user inputs the two points touch-and-drag input, but dragged directions of the two points are not the same, the electronic device **200** may enlarge or reduce the VR image. In other words, when the dragged directions of the two points are the same, the electronic device **200** moves the viewpoint of the VR image, and when the dragged directions of the two points are not the same, the electronic device **200** enlarges or reduces the VR image.

[0096] For example, when the two points are dragged in a direction away from each other, the electronic device **200** enlarges the VR image, and when the two points are dragged in a direction approaching each other, the electronic device **200** reduces the VR image. The electronic device **200** transmits the enlarged or reduced VR image to the display device **100**.

[0097] FIG. **15** is a block diagram of an electronic device according to an embodiment. In FIG. **15**, the electronic device **200** includes a processor **210**, the display **220**, the proximity sensor **230**, and a memory **240**, but the electronic device **200** may further include other electronic components, a universal serial bus (USB) terminal, a mobile high-definition link (MHL) terminal, etc.

[0098] The processor **210** controls the display **220**. The processor **210** determines a screen to be displayed on the display **220**. The processor **210** may display lists of VR images on the display **220** after identifying a connection with the display device **100**.

[0099] Also, the processor **210** executes a program or an application related to the display device **100** after identifying the connection with the display device **100**. The processor **210** may access a website providing a VR image.

[0100] The user may select one VR image from a displayed list of VR images, and the processor **210** transmits the selected VR image to the display device **100**. The VR image may be downloaded through the Internet or stored in a memory.

[0101] The processor **210** receives a user input from the display **220**. The processor **210** may change a state of the display **220** or transmit data to the display device **100**, according to the user input.

[0102] The processor **210** may transmit a VR image to the display device **100**, based on a signal received from the proximity sensor **230**. The proximity sensor **230** measures a distance between the electronic device **200** and the user, and outputs the measured distance to the processor **210**. The processor **210** may determine whether to transmit a VR image to the display device **100**, based on the measured distance. For example, the processor **210** transmits the VR image to the display device **100** when the measured distance is equal to or lower than a threshold value.

[0103] FIG. **16** is a flowchart of a method of providing a VR image, according to an embodiment.

[0104] In operation **1610**, the electronic device **200** identifies a connection between the electronic device **200** and the display device **100**. The electronic device **200** may execute a program or an application when the electronic device **200** and the display device **100** are connected to each other.

[0105] In operation **1620**, when the electronic device **200** and the display device **100** are connected to each other, the electronic device **200** displays a list of VR images on the display **220**. The list may be VR images provided from the Internet or VR images stored in the memory **240**.

[0106] In operation **1630**, the electronic device **200** receives, from the user, an input of selecting one VR image from the list.

[0107] In operation **1640**, the electronic device **200** changes a display mode to a touch mode. The display mode denotes a state in which content, an image, or the like is provided to the display **220**. The touch mode denotes a state

prepared to receive a touch input from the user. A touch input of the user received in the touch mode determines a direction of the VR image. In the touch mode, the electronic device **200** may not display anything on the display **220**. The electronic device **200** may receive the touch input of the user even when a screen is turned off.

[0108] In operation **1650**, the electronic device **200** transmits the VR image to the display device **100**, and transmits the VR image changed according to the touch input received from the user in the touch mode. The electronic device **200** may measure the distance between the electronic device **200** and the user, and determine whether to transmit the VR image, based on the measured distance. For example, the electronic device **200** may transmit the VR image when the measured distance is equal to or lower than a threshold value. The electronic device **200** does not transmit the VR image when the measured distance is higher than the threshold value.

[0109] When the measured distance is equal to or lower than the threshold value, the user may have approached the face to the display device **100** to view the VR image. When the measured distance is equal to or higher than the threshold value, the user is not viewing the VR image, and thus the electronic device **200** does not transmit the VR image.

[0110] Operations described in FIG. **16** may be stored in the memory **240** or executed by the processor **210**, in a form of programs.

[0111] A user may view a VR image without having to wear a display device on the head.

[0112] The display device may be connected and fixed to an electronic device through a connection structure.

[0113] The embodiments of the present disclosure can be written as computer programs and can be implemented in general-use digital computers that execute the programs using a non-transitory computer-readable recording medium. Also, a structure of data used in the above embodiments may be recorded on the non-transitory computer-readable recording medium via various manners. Also, the above embodiments may be implemented in a form of a recording medium including instructions executable by a computer, such as a computer-executed program module. For example, methods implemented in software modules or algorithms may be stored in the non-transitory computer-readable recording medium, as computer-readable and executable codes or program commands.

[0114] The non-transitory computer-readable recording medium may be an arbitrary recording medium accessible by a computer, and examples thereof include all volatile and non-volatile media and separable and non-separable media. Examples of the non-transitory computer-readable recording medium include magnetic storage media (e.g., ROM, floppy disks, hard disks, etc.), optical recording media (e.g., CD-ROMs, or DVDs), etc. Further, examples of the non-transitory computer-readable recording medium may include a computer storage medium and a communication medium.

[0115] Also, the non-transitory computer-readable recording medium can also be distributed over network coupled computer systems, and data (for example, program instructions and codes) stored in the non-transitory computer-readable recording medium is executed by at least one computer.

[0116] Terms such as "unit" and "module" indicate a unit for processing at least one function or operation, wherein the unit and the block may be embodied as hardware or software or embodied by combining hardware and software.

[0117] The "unit" may be formed so as to be in an addressable storage medium, or may be formed so as to operate one or more processors.

[0118] For example, the term "unit" may refer to components such as software components, object-oriented software components, class components, and task components, and may include processes, functions, attributes, procedures, subroutines, segments of program code, drivers, firmware, micro codes, circuits, data, a database, data structures, tables, arrays, or variables.

1. A display device comprising:

left and right displays that are spaced apart from each other;

left and right lens groups respectively located at the rear of the left display and the rear of the right display;

left and right display housings configured to surround the left and right displays and the left and right lens groups;

a main frame provided between the left and right display housings;

a connection structure capable of adjusting an angle between the main frame and a connector electrically connected to an external electronic device; and

electronic components provided inside the main frame.

2. The display device of claim **1**, wherein the connection structure comprises a hinge capable of adjusting a tilting angle of the main frame.

3. The display device of claim **1**, wherein the connection structure comprises a bearing rotatable with respect to the main frame.

4. The display device of claim **3**, further comprising a proximity sensor configured to measure a distance between the display device and a user,

wherein the main frame is configured to fix the bearing, based on the measured distance.

5. The display device of claim **1**, wherein the connection structure comprises a ball joint rotatable with respect to the main frame,

wherein the ball joint comprises a rotatable ball and a ball housing surrounding the ball.

6. The display device of claim **5**, wherein the connection structure further comprises a locking lever,

wherein the locking lever comprises a protrusion to fix the ball by being coupled to a groove of the ball.

7. The display device of claim **5**, wherein the ball comprises a magnet on a surface and the ball housing comprises an electromagnet,

wherein the ball and the ball housing are spaced apart from each other when electricity is applied to the electromagnet while a virtual reality (VR) image is reproduced.

8. The display device of claim **5**, wherein the ball housing comprises a motor and a fastener,

wherein the ball and the ball housing are spaced apart from each other by driving the motor to unfasten the fastener while a VR image is reproduced.

9. The display device of claim **1**, wherein each of the left and right display housings is foldable with respect to the main frame.

10. The display device of claim **1**, further comprising an assembling structure at an end of each of the left and right display housings,

wherein the left and right display housings are fixed by the assembling structure when the left and right display housings are folded.

11. The display device of claim **1**, further comprising a proximity sensor configured to measure a distance between the display device and a user,

wherein the left and right displays are turned on or off according to the distance.

12. A method of providing, by an electronic device, a virtual reality (VR) image to a display device, the method comprising:

identifying a connection between the electronic device and the display device;

displaying a list of VR images;

receiving, from a user, an input of selecting a VR image from the list;

changing a display mode to a touch mode; and

transmitting the VR image to the display device,

wherein the transmitting of the VR image comprises transmitting a changed VR image according to a touch input received from the user in the touch mode.

13. The method of claim **12**, further comprising measuring a distance between the electronic device and the user,

wherein the transmitting of the VR image comprises transmitting the VR image when the distance is equal to or lower than a threshold value.

14. The method of claim **13**, wherein the changing of the display mode to the touch mode comprises changing to the touch mode when the distance is equal to or lower than the threshold value.

15. A non-transitory computer-readable recording medium having recorded thereon a program which, when executed by a computer, performs the method of claim **12**.

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