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(71) Applicant *(for all designated States except US)*: **SAMSUNG ELECTRONICS CO., LTD.** [KR/KR]; 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do 443-742 (KR).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **CHO, Bong-Hwan** [KR/KR]; Sinmaetan Weve Haneulchae Apt., #117-401, Maetan 3-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do 443-373 (KR). **KOO, Jae-Phil** [KR/KR]; Geoyeo 4-danji Apt. #405-304, Geoyeo 2-dong, Songpa-gu, Seoul 138-904 (KR). **CHUN, Kang-Wook** [KR/KR]; Bundang Doosan Weve Apt. #106-804, Geumgok-dong, Bundang-gu, Seongnam-si, Gyeonggi-do 463-480 (KR). **HA, Tae-Hyeun** [KR/KR]; Hyundai Apt.#313-906, Gwonseon-dong, Gwonseon-gu, Suwon-si, Gyeonggi-do 441-390 (KR). **KIM, Hyung-Rae** [KR/KR]; Guro Jugong Apt. #118-904, Guro 1-dong, Guro-gu, Seoul 152-761 (KR).

(74) Agents: **HUH, Sung-Won** et al.; Leaders Bldg. 3F., 1599-11, Seocho-dong, Seocho-gu, Seoul 137-912 (KR).

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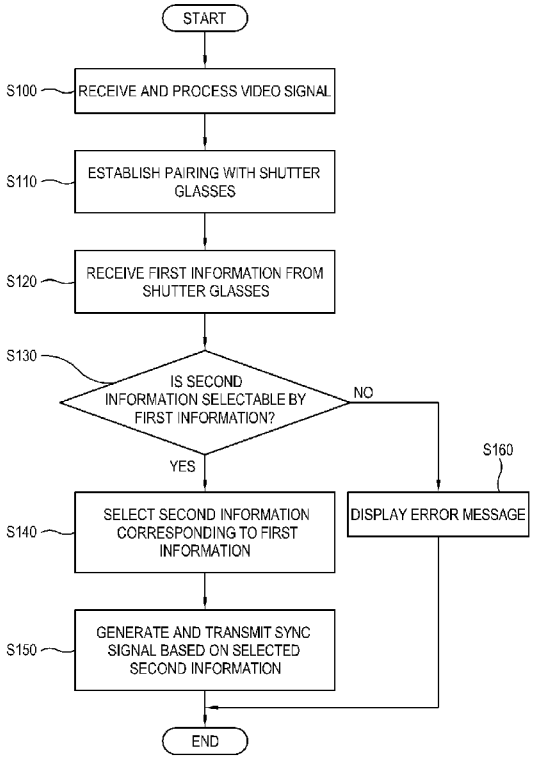
[Continued on next page]

(54) Title: DISPLAY APPARATUS, CONTROL METHOD THEREOF, SHUTTER GLASSES AND CONTROL METHOD THEREOF

[Fig. 3]



(57) Abstract: Disclosed is a method of controlling a display apparatus, a display apparatus and shutter glasses, the method including: establishing a pairing with three dimensional (3D) glasses (S110); receiving first information related to at least one of an operation, a status and a structure of the 3D glasses (S120); storing the first information; and displaying based on the first information.

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Description

Title of Invention: DISPLAY APPARATUS, CONTROL METHOD THEREOF, SHUTTER GLASSES AND CONTROL METHOD THEREOF

Technical Field

[1] Apparatuses and methods consistent with exemplary embodiments relate to a display apparatus, a control method thereof, shutter glasses and a control method thereof, and more particularly to a display apparatus, a control method thereof, shutter glasses and a control method thereof, in which a structure for interactive operation between the display apparatus and the shutter glasses in accordance with display images is improved.

Background Art

[2] A display apparatus processes a video signal input from an external video source and displays it as an image on a display panel achieved by a liquid crystal or the like. The display apparatus scans scan lines containing video information on the panel in order to display an image on the panel, and the scan lines are sequentially arranged on the panel, thereby forming one video frame.

[3] An image displayed by the display apparatus can be categorised a two dimensional (2D) image and a three dimensional (3D) according to its characteristics. A user's two eyes are different in a view angle, and thus a user can recognize a 3D structure of an object. According to this principle, a 3D image is divided into a left-eye image and a right-eye image and displayed on the display apparatus. Further, the display apparatus is provided with 3D glasses for selectively transmitting/blocking light with respect to a user's two eyes. The 3D glasses typically comprise shutter glasses that operate to selectively transmit light in accordance with whether voltage is applied, or polarizing glasses capable of transmitting light of a preset polarizing direction.

[4] In the case where the 3D glasses are achieved by the shutter glasses, the display apparatus generates a synchronisation or "sync" signal corresponding to a displayed 3D image, and transmits it to the shutter glasses. The shutter glasses operate in synchronicity (i.e., "in sync") with the sync signal received from the display apparatus, so that image transmission can be selected with regard to a user's two eyes.

Disclosure of Invention

[5] An aspect of an exemplary embodiment provides a method of controlling a display apparatus, wherein the method may include: establishing a pairing with three dimensional (3D) glasses; receiving first information related to at least one of an operation characteristic, a status and a structure of the 3D glasses; storing the received

first information; and controlling the display apparatus to display based on the first information.

[6] The receiving may comprise receiving at the display apparatus, from the 3D glasses.

[7] The method may further include determining whether a type of 3D glasses is supported by the display apparatus based on the first information; and informing a user of a determination result through a user interface (UI) if the 3D glasses are not supported by the display apparatus. The determining may be performed by the display apparatus.

[8] The method may further include transmitting second information, which is related to at least one of: the operation characteristic; the status; and the structure previously stored in the display apparatus.

[9] The transmitting may comprise transmitting from the display apparatus, to the 3D glasses.

[10] The second information may include information related to an on/off driving timing of the 3D glasses.

[11] The second information may include a time delayed sync signal.

[12] The second information may include an on/off duty ratio related to a shuttering operation of the 3D glasses.

[13] The second information may include information on a protocol employed in an indicating method of an indicator mounted to the 3D glasses, the indicating method for indicating an operating status of the 3D glasses.

[14] The first information may include a use time of the 3D glasses. The use time may comprise the amount of time the 3D glasses have been switched on for in total, or since their last switch-on.

[15] The first information may include information about a battery state of the 3D glasses.

[16] The first information may include information about an abnormal state of the 3D glasses.

[17] The first information may include information about a polarizing structure of the 3D glasses.

[18] The first information may include at least one of a driving frequency, a rising time and a falling time of the 3D glasses.

[19] The first information may include a representation of the transmissivity of the 3D glasses depending on optical wavelength.

[20] The first information may include information about colour coordinates.

[21] Another aspect of an exemplary embodiment provides method of controlling three-dimensional (3D) glasses, wherein the method may include: establishing a pairing with a display apparatus; receiving second information related to at least one of an operation characteristic, a status and a structure of the display apparatus; transmitting first in-

formation related to at least one of the operation characteristic, the status and the structure and previously stored in the 3D glasses to the display apparatus; storing the second information; and driving the 3D glasses based on the received second information.

[22] Another aspect of an exemplary embodiment provides a display apparatus which may include: a display unit; a video processor operable to process a video signal to be displayed as an image on the display unit; a communication unit operable to communicate with three-dimensional (3D) glasses; a storage; and a controller operable to receive first information related to at least one of an operation characteristic, a status and a structure of the 3D glasses through the communication unit during pairing with the 3D glasses, operable to store the first information in the storage, and operable to control the video processor to display the image on the display unit based on the first information.

[23] The controller may be further operable to determine whether a type of 3D glasses is supported in the display apparatus based on the first information, and further operable to inform a user of a determination result through a user interface (UI) if the 3D glasses are not supported in the display apparatus.

[24] The storage may be operable to previously store second information related to at least one of the operation characteristic, the status and the structure, wherein the controller is further operable to transmit the second information through the communication unit.

[25] Another aspect of an exemplary embodiment provides three-dimensional (3D) glasses, which may include: a communication unit operable to communicate with a display apparatus; a storage operable to store first information related to at least one of an operation characteristic, a status and a structure of the 3D glasses; and a controller operable to receive second information related to at least one of an operation characteristic, a status and a structure of the display apparatus through the communication unit during pairing with the display apparatus, operable to store the second information in the storage, operable to drive the 3D glasses based on the second information, and operable to transmit the first information to the display apparatus through the communication unit.

[26] Another aspect of an exemplary embodiment provides a display apparatus, which may include: a display unit; a communication unit operable to communicate with shutter glasses, wherein the communicating is operable to receive first information related to characteristics of the shutter glasses; a sync signal processor operable to generate a sync signal and to transmit the sync signal through the communication unit so that the shutter glasses can operate in accordance with a three-dimensional (3D) image displayed on the display unit; a storage operable to store second information; and a controller operable to receive the first information from the shutter glasses

through the communication unit, and operable to perform at least one of: a first operation, which includes generating and transmitting the sync signal based on the first information and the second information if the first information is received; and a second operation, which includes transmitting the second information to the shutter glasses.

[27] The controller may be further operable to select the second information based on a correspondence with the first information, and further operable to control the sync signal processor based on the selected second information.

[28] The controller may be further operable to control display of an error message on the display unit if the received second information, which corresponds with the first information, is not stored in the storage.

[29] The display apparatus may further include a video processor operable to process a video signal, wherein the controller is further operable to control the video processor to adjust display characteristics of the image based on the first information.

[30] The display characteristics of the image may include at least one of brightness, contrast, colour temperature, and colour coordinates of the image.

[31] The communication unit may wirelessly communicate with the shutter glasses via one of a radio frequency (RF), Zigbee and Bluetooth.

[32] Another aspect of an exemplary embodiment provides a display apparatus, which may include: a display unit operable to display an image; a video processor operable to process a video signal to be displayed on the display unit; a communication unit operable to communicate with shutter glasses; a sync signal processor operable to generate a sync signal and to transmit the sync signal via the communication unit; and a controller operable to receive the first information from the shutter glasses via the communication unit, and to control the video processor to adjust display characteristics of the image displayed on the display unit based on the received first information.

[33] The first information may include at least one of manufacturer or model information of the shutter glasses, a current or accumulated use time, a battery state, a polarizing method, an available frequency domain, an operating response time of the shutter glasses and a representation of the transmissivity of the shutter glasses depending on optical wavelength.

[34] Another aspect of an exemplary embodiment provides shutter glasses which may include: a lens unit operable to selectively transmit light; a communication unit operable to communicate with a display apparatus; a storage operable to store first information related to characteristics of the shutter glasses; a lens driver operable to drive the lens unit based on a sync signal received from the display apparatus via the communication unit; and a controller operable to perform at least one of: a first operation, which includes transmitting the first information to the display apparatus;

and a second operation, which includes controlling an operation of the lens driver based on second information received from the display apparatus via the communication unit when the sync signal is received via the communication unit.

[35] Another aspect of an exemplary embodiment provides a method of controlling a display apparatus, wherein the method may include: receiving from the shutter glasses first information related to characteristics of shutter glasses; previously setting up second information to be referenced when generating a sync signal for operating the shutter glasses in accordance with a displayed three-dimensional (3D) image; and performing at least one of: a first operation, which includes generating and transmitting the sync signal, based on the first information and the second information, to the shutter glasses when receiving the first information; and a second operation, which includes transmitting the second information to the shutter glasses.

[36] The performing at least one of the first operation and the second operation includes selecting the second information corresponding to the first information, and generating and transmitting the sync signal based on the selected second information.

[37] The generating and transmitting the sync signal based on the selected second information comprises displaying an error message when there is no second information corresponding to the first information.

[38] The first information may include at least one of manufacturer or model information of the shutter glasses, a current or accumulated use time, a battery state, a polarizing method, an available frequency domain, an operating response time of the shutter glasses and a representation of the transmissivity depending on optical wavelength.

[39] The second information may include at least one of a delayed value of the sync signal and a duty value of the sync signal, and the performing at least one of the first and second operations includes adjusting a timing of the sync signal based on the second information selected corresponding to the first information.

[40] The performing at least one of the first and second operations may include adjusting display characteristics of the image corresponding to the first information.

[41] Another aspect of an exemplary embodiment provides a method of controlling shutter glasses having a lens unit, wherein the method may include: driving the lens unit to selectively transmit light in accordance with a sync signal received from a display apparatus; previously storing first information related to characteristics of the shutter glasses; and performing at least one of: a first operation, which includes transmitting the first information to the display apparatus; and a second operation, which includes controlling an operation of the lens unit based on second information received from the display apparatus when generating the sync signal is received from the display apparatus.

[42] According to the present invention there is provided an apparatus and method as set

forth in the appended claims. Other features of the invention will be apparent from the dependent claims, and the description which follows.

Brief Description of Drawings

[43] The above and/or other aspects will become apparent and more readily appreciated from the following description of the exemplary embodiments, taken in conjunction with the accompanying drawings, in which:

[44] FIG. 1 shows an example of a display system according to a first exemplary embodiment;

[45] FIG. 2 is a block diagram of a display apparatus and shutter glasses in the display system of FIG. 1;

[46] FIG. 3 is a control flowchart showing a control method of the display apparatus of FIG. 1;

[47] FIG. 4 is a control flowchart showing a control method of the shutter glasses of FIG. 1;

[48] FIG. 5 is a control flowchart showing a control method of a display apparatus according to a second exemplary embodiment;

[49] FIG. 6 is a control flowchart showing a control method of shutter glasses according to a second exemplary embodiment;

[50] FIG. 7 is a control flowchart showing a control method of a display apparatus according to a third exemplary embodiment; and

[51] FIG. 8 is a control flowchart showing a control method of a display system according to a fourth exemplary embodiment.

Best Mode for Carrying out the Invention

[52] Below, exemplary embodiments will be described in detail with reference to accompanying drawings.

[53] FIG. 1 shows an example of a display system 1 according to a first exemplary embodiment.

[54] As shown in FIG. 1, the display system 1 in this exemplary embodiment includes a display apparatus 100 that processes a video signal input from the exterior and displays it as an image, and three dimensional (3D) glasses 200 that operate to selectively transmit or interrupt light if an image displayed on the display apparatus 100 is a 3D image.

[55] The display apparatus 100 receives a video signal from an external video source (not shown). Such a video source is not limited, and thus the display apparatus 100 may receive video signals from various video sources such as a computer main body (not shown) that generates a video signal with a central processing unit (CPU, not shown) and a graphic card (not shown), and provides it locally; a server (not shown) that

provides a video signal via a network; a transmitter (not shown) of a broadcasting station that transmits a broadcasting signal via airwaves or cables; etc.

[56] The display apparatus 100 receives a two dimensional (2D) video signal corresponding to a 2D image or a 3D video signal corresponding to a 3D image from the external source, and processes it to be displayed as an image. As opposed to the 2D image, the 3D image includes a left-eye video frame corresponding to a user's left eye, and a right-eye video frame corresponding to a user's right eye. If receiving the 3D video signal, the display apparatus 100 alternately displays the left eye video frame and the right-eye video frame on the basis of the 3D video signal.

[57] The 3D glasses 200 are provided as shutter glasses 200. When the display apparatus 100 displays a 3D image, the shutter glasses 200 selectively opens and shuts view for a user's left or right eye in accordance with which one of the left-eye video frame and the right-eye video frame is being currently displayed. For example, if the display apparatus 100 is displaying the left-eye video frame, the shutter glasses 200 open a user's left-eye view and shut a user's right-eye view. On the other hand, if the display apparatus 100 is displaying the right-eye video frame, the shutter glasses 200 opens a user's right-eye view and shuts a user's left-eye view.

[58] Thus, to match the 3D image displayed on the display apparatus 100 with selective light transmission and/or interruption of the shutter glasses 200, the display apparatus 100 generates a sync signal corresponding to display timing of a video frame and sends it to the shutter glasses 200, and the shutter glasses 200 operate on the basis of the received sync signal.

[59] Below, respective configurations of the display apparatus 100 and the shutter glasses 200 will be described with reference to FIG. 2. FIG. 2 is a block diagram of the display apparatus 100 and the shutter glasses 200 in the display system, an example of which is shown in FIG. 1.

[60] As shown in FIG. 2, the display apparatus 100 includes a video receiver 110 that receives a video signal, a video processor 120 that processes the video signal received in the video receiver 110, the display unit 130 that displays the video signal processed by the video processor 120 into an image, a display communication unit 140 that communicates with the shutter glasses 200, and a sync signal processor 150 that generates a sync signal corresponding to a 3D image displayed on the display unit 130 and transmits the sync signal through the display communication unit 140.

[61] Meanwhile, the shutter glasses 200 includes a glasses communication unit 210 that communicates with the display communication unit 140 and receives the sync signal, a lens unit 220 that operates to transmit/interrupt light with respect to a user's left and right eyes, and a lens driver 230 that drives the lens unit 220 in sync with the sync signal received by the glasses communication unit 210.

[62] Below, each element of the display apparatus 100 will be described.

[63] The video receiver 110 receives a video signal and transmits it to the video processor 120, and may be achieved in various forms according to formats of the received video signals and the types of display apparatus 100.

[64] For example, if the display apparatus 100 is a television, the video receiver 110 may wirelessly receive a radio frequency (RF) signal from a broadcasting station (not shown), or may receive a video signal based on composite video, component video, super video, Syndicat des Constructeurs des Appareils Radiorecepteurs et Televiseurs (SCART), high definition multimedia interface (HDMI) or the like standards via a cable. If the video signal is a broadcasting signal, the video receiver 110 includes a tuner to be tuned to a channel corresponding to the video signal.

[65] If the display apparatus 100 is a monitor for a computer, the video receiver 100 may comply with D-SUB capable of transmitting RGB signals based on video graphics array (VGA); digital video interactive (DVI)-analog (A), DVI-integrated digital/analog (I), DIV-digital (D), based on DVI; HDMI, or the like standards. Also, the video receiver 110 may be achieved by DisplayPort, unified display interface (UDI), or wireless HD, etc.

[66] The video processor 120 may perform various video processes previously set up to a video signal. The video processor 120 performs such a process and outputs the video signal to the display unit 130 so that the display unit 130 can display an image.

[67] The kind of video processes performed by the video processor 120 is not limited, and may for example include decoding and encoding corresponding to various video formats, de-interlacing, frame refresh rate conversion, scaling, noise reduction for improving picture quality, detail enhancement, line scanner, etc. The video processor 120 may be achieved by individual configurations where respective processes are independently performed, or an integrated configuration where many functions are integrated.

[68] There is no limit to a method of achieving the display unit 130, and for example, a liquid crystal display (LCD) panel may be used for the display unit 130. The display unit 130 displays an image based on the video signal processed by the video processor 120. The display unit 130 may display a video frame by vertically arranging a plurality of horizontal scan lines scanned by the video processor 120.

[69] The display communication unit 140 transmits a sync signal from the sync signal processor 150 to the shutter glasses 200. The display communication unit 140 may comply with RF, Zigbee, Bluetooth or the like interactive wireless communication standards. Thus, various signal/information/data may be transmitted and received between the display apparatus 100 and the shutter glasses 200 without limitation.

[70] The sync signal processor 150 generates a sync signal synchronized with display

timing of a 3D image displayed on the display unit 130, and sends it to the display communication unit 140 so that the sync signal can be transmitted to the shutter glasses 200. The sync signal processor 150 generates and sends the sync signal on the basis of information previously set up when generating the sync signal, details of which will be described later.

[71] Below, each element of the shutter glasses 200 will be described.

[72] The glasses communication unit 210 is provided to comply with the communication standards of the display communication unit 140, and interactively communicates with the display communication unit 140. As a 3D image is displayed in the display apparatus 100, the glasses communication unit 210 receives the sync signal from the display apparatus 100.

[73] The lens unit 220 operates to selectively transmit/interrupt light with regard to a user's two eyes under control of the lens driver 230. Like this, the lens unit 220 selectively transmits light with regard to a user's two eyes, so that a user can perceive a left-eye video frame and a right-eye video frame displayed on the display unit 130 through his/her left and right eyes, respectively.

[74] There is no limit to a method of achieving the lens unit 220, and for example, the lens unit 220 may be achieved by a liquid crystal lens that interrupts light when receiving a predetermined voltage from the lens driver 230, but transmits light when receiving no voltage. However, this is only an example. Alternatively, the lens unit 220 may transmit light when receiving the voltage, and interrupt light when receiving no voltage. Also, the lens unit 220 may have light transmissivity varied depending on the applied voltage levels.

[75] The lens driver 230 selectively applies voltage to the lens unit 220 in sync with the sync signal received in the glass communication unit 210. For example, the lens driver 230 drives the lens unit 220 to transmit light for a user's left eye and interrupt light for a user's right eye in a vertical sync section where the left-eye video frame is displayed. Further, the lens driver 230 drives the lens unit 220 to interrupt the light while a video frame is scanned in the display unit 130. However, this is only one example of a method in which the lens driver 230 drives the lens unit 220.

[76] With this structure, the display apparatus 100 displays a 3D image based on the video signal on the display unit 130, and generates a sync signal corresponding to the displayed image and transmits it to the shutter glasses 200. The shutter glasses 200 drives the lens unit 220 in sync with the sync signal received from the display apparatus 100. Accordingly, the shutter glasses 200 operate to selectively transmit/interrupt light in accordance with the 3D image displayed on the display apparatus 100, and a user can perceive the left-eye video frame and the right-eye video frame with his/her left and right eyes through the shutter glasses 200, respectively.

[77] However, the display apparatus 100 and the shutter glasses 200 are separate from each other, and therefore at least one of the display apparatus 100 and the shutter glasses 200 may be replaced by a new different one. For example, the shutter glasses 200 may be replaced by new ones different in a manufacturer or a model.

[78] At interactive operation between the display apparatus 100 and the shutter glasses 200 as the 3D image is displayed, the display apparatus 100 typically generates and transmits a sync signal based on preset information. Such preset information is set up in consideration of the characteristics of the shutter glasses 200, and therefore if the shutter glasses 200 are replaced by new ones different in a manufacturer or a model as described above, there may be an operation error since the operation of the shutter glasses may not match the display apparatus 100 due to difference in operating characteristics between the shutter glasses. In this case, a user may not appreciate the 3D image in the normal way, if at all.

[79] According to this exemplary embodiment, the shutter glasses 200 includes a glasses storage 240 in which preset first information is stored, and a glasses controller 250 operating to transmit the first information to the display apparatus 100 when the display apparatus 100 displays a 3D image.

[80] Further, the display apparatus 100 includes a display storage 160 in which preset second information is stored, and a display controller 170 operating to generate and transmit a sync signal based on the first and second information when receiving the first information from the shutter glasses 200.

[81] Here, the first information and the second information may be information related to at least one of operation characteristics, status and structure of the shutter glasses 200 and the display apparatus 100.

[82] In more detail, the first information is preset information/data related to the shutter glasses' own characteristics without limitation, and may for example include a serial number of the shutter glasses 200, a manufacturer or model of the shutter glasses 200, a current or accumulative use time of the shutter glasses 200, a current residual battery quantity of the shutter glasses 200, a polarizing type of the lens unit 220, a switching frequency domain available for the shutter glasses 200, rising and falling time corresponding to light transmission and/or interruption, operating response time of the shutter glasses 200, transmissivity of the lens unit 220 according to optical wavelength, colour coordinates information, unusual condition information of the shutter glasses 200, on/off driving timing information, etc.

[83] Also, the second information is information/data referred to by the sync signal processor 150 for generating the sync signal without limitation, and may for example include various information for driving the shutter glasses 200 such as a delay value related to delayed time of a sync signal, an on/off duty ratio of a sync signal related to

a shuttering operation of the shutter glasses 200, an indicating method of an indicator (not shown) mounted to the shutter glasses 200 according to the operating status of the shutter glasses 200, etc. Here, the indicating method according to the operating status of the shutter glasses 200 is for individually corresponding to protocols different according to respective products with regard to indication of power on/off, pairing, abnormal operation, etc.

[84] In the following description, the first and second information comply with the above definition, and such terms are just for convenience of classification.

[85] With this configuration, a control method of a display apparatus 100 according to an exemplary embodiment will be described with reference to FIG. 3. FIG. 3 is a control flowchart showing an example of the control method of the display apparatus 100.

[86] As shown in FIG. 3, if the video receiver 110 receives a 3D video signal, the video processor 120 processes this video signal to be displayed on the display unit 130 at operation S100.

[87] At operation S110, the display controller 170 establishes pairing with the shutter glasses 200 through the display communication unit 140. The pairing is a connecting operation for enabling interactive communication between the display apparatus 100 and the shutter glasses 200, which complies with one of various communication standards such as RF, Zigbee, Bluetooth, etc.

[88] At operation S120, the display controller 170 receives the first information from the shutter glasses 200. The reception of the first information may be set up to be automatically implemented during a pairing process, or may be achieved as the display controller 170 transmits a signal requesting for the first information to the shutter glasses 200 when the pairing is completed.

[89] At operation S130, the display controller 170 determines whether suitable second information is selectable according to the first information received from the shutter glasses 200.

[90] If it is determined that the second information is selectable, the display controller 170 selects the second information corresponding to the first information at operation S140. At operation S150, the sync signal processor 150 generates and transmits a sync signal based on the selected second information.

[91] A method of selecting the second information by the first information may be performed in various ways. For example, the display storage 160 may store a plurality of second information corresponding to a plurality of first information in the form of a table. In this case, the display controller 170 may select one of the second information corresponding to the received first information, among the plurality of second information stored in the display storage 160.

[92] More specifically, for example, the display storage 160 stores setup tables where

delayed values of the sync signal are respectively set up corresponding to the serial numbers of the shutter glasses 200. The display controller 170 may search the setup table for a delayed value of the sync signal corresponding to the serial number received from the shutter glasses 200.

[93] In the case where the display controller 170 selects one among the plurality of second information, the sync signal processor 150 generates and transmits a sync signal on the basis of the selected second information. Specifically, the sync signal processor 150 may apply an offset to a default value of a timing period of a sync signal on the basis of the selected second information, thereby adjusting the timing period of the sync signal.

[94] On the other hand, if it is determined that the second information is not selectable by reference to the first information, the display controller 170 controls the display unit 130 to display an error message at operation S160. Such an error message may be accomplished by a user interface (UI), on screen display (OSD), etc. As illustrated above, if there is no value corresponding to the serial number of the shutter glasses 200 in the setup table of the display storage 160, the display controller 170 controls the display unit 130 to display a message to the effect that these shutter glasses 200 are not supported in this display apparatus 100, thereby giving information to a user.

[95] Thus, according to an exemplary embodiment, the display apparatus 100 receives characteristic information of the shutter glasses 200, and generates and transmits a sync signal on the basis of the received information, so that the display apparatus 100 and the shutter glasses 200 can interactively operate even though at least one of the display apparatus 100 and the shutter glasses 200 is replaced by a new one different in a model. Accordingly, a user can normally appreciate a 3D image.

[96] Meanwhile, a control method of the shutter glasses 200 corresponding to the above control method of the display apparatus 100 will be described with reference to FIG. 4. FIG. 4 is a control flowchart showing an example of a control method of the shutter glasses of FIG. 1.

[97] At operation S200, the shutter glasses 200 establish pairing with the display apparatus 100. At operation S210, the glasses controller 250 transmits the first information stored in the glasses storage 240 to the display apparatus 100 in response to the establishment of the pairing with the display apparatus 100 or a request from the display apparatus 100.

[98] At operation S220, the glasses controller 250 monitors whether the sync signal is received from the display apparatus 100. If receiving the sync signal generated based on the first and second information from the display apparatus 100, the glasses controller 250 controls the lens unit 220 to operate in sync with this sync signal at operation S230.

[99] As an alternative to the first exemplary embodiment, the shutter glasses 200 may receive the second information from the display apparatus 100 and operate on the basis of the received second information, which will be described as a second exemplary embodiment.

[100] Below, a control method of a display apparatus according to the second exemplary embodiment will be described with reference to FIG. 5. FIG. 5 is a control flowchart showing an example of such processes.

[101] As shown in FIG. 5, if the video receiver 110 receives a 3D video signal at operation S300, the display controller 170 establishes the pairing with the shutter glasses 200 through the display communication unit 140 at operation S310.

[102] At operation S320, the display controller 170 transmits the second information stored in the display storage 160 to the shutter glasses 200. At operation S330, the video processor 120 displays an image on the display unit 130, and the sync signal processor 150 transmits a sync signal corresponding to the displayed image to the shutter glasses 200.

[103] Below, a control method of the shutter glasses 200 will be described with reference to FIG. 6. FIG. 6 is a control flowchart showing an example of such processes.

[104] As shown in FIG. 6, the shutter glasses 200 establish the pairing with the display apparatus 100 at operation S400. At operation S410, the glasses controller 250 receives the second information from the display apparatus 100 in accordance with the pairing with the display apparatus 100.

[105] At operation S420, the glasses controller 250 receives a sync signal from the display apparatus 100. At operation S430, the glasses controller 250 controls the lens unit 220 to be driven on the basis of the received second information.

[106] Such a method of controlling the lens unit 220 to be driven on the basis of the second information may be performed in various ways. For example, the second information may contain a duty value of the sync signal, i.e., a value for designating a light transmission and/or interruption ratio of the lens unit 220 per unit period. The glasses controller 250 may read such a designation value from the second information, and compensates for the operation of the lens unit 220 by taking this read value into account when controlling the light transmission and/or interruption of the lens unit 220 in sync with the sync signal.

[107] Thus, although at least one of the display apparatus 100 and the shutter glasses 200 is replaced, it is possible to adjust interactive operation to be enabled between the display apparatus 100 and the shutter glasses 200.

[108] In the foregoing first exemplary embodiment, the display apparatus 100 is configured to receive the first information from the shutter glasses 200, and generate and transmit the sync signal based on the first and second information, but not limited thereto. Al-

ternatively, the display apparatus 100 may be configured to adjust display characteristics of an image displayed on the display unit 130 instead of the sync signal, on the basis of the received first information, which will be described as a third exemplary embodiment in the following.

[109] FIG. 7 is a control flowchart showing an example of a control method of a display apparatus according to the third exemplary embodiment.

[110] As shown therein, if the video receiver 110 receives a video signal at operation S500, the display controller 170 establishes the pairing with the shutter glasses 200 at operation S510.

[111] At operation S520, the display controller 170 receives the first information from the shutter glasses 200. At operation S530, the display controller 170 searches whether there is video process information corresponding to the received first information among preset video process information stored in the display controller 160.

[112] If there is the video process information corresponding to the first information, at operation S540 the display controller 170 controls the video processor 120 to adjust the display characteristics of an image on the basis of the corresponding video process information. Accordingly, the image of which display characteristics are adjusted is displayed on the display unit 130. Also, at operation S550 the display controller 170 generates a sync signal corresponding to the displayed image, and transmits it to the shutter glasses 200.

[113] Accordingly, characteristics of an image displayed in the display apparatus 100 can be adjusted in accordance with the characteristics of the shutter glasses 200.

[114] Specific methods of adjusting the display characteristics of the image may be performed in various ways. For example, the display storage 160 may store video process information containing offset values to the brightness, contrast, colour temperature, colour coordinates, etc. of a displayed image in accordance with various shutter glasses 200. The display controller 170 selects one corresponding to the received first information among the video process information and transmits it to the video processor 120.

[115] On the basis of the selected video process information, the video processor 120 adjusts a value such as the brightness, contrast, colour temperature, colour coordinates, etc. of an image displayed on the display unit 130.

[116] On the other hand, if there is no video process information corresponding to the first information, the display controller 170 displays an error message on the display unit 130 at operation S560. Alternatively, the display controller 170 may display an image based on default settings instead of displaying the error message.

[117] Meanwhile, the foregoing first exemplary embodiment may be applied to the control method of the shutter glasses 200 according to this exemplary embodiment, and thus

repetitive descriptions thereof will be avoided as necessary.

[118] In the foregoing exemplary embodiments, only one of the display apparatus 100 and the shutter glasses 200 receives the information and operates in accordance with the received information, but not limited thereto. Alternatively, the display apparatus 100 and the shutter glasses 200 may exchange their information with each other, and respectively operate in accordance with the exchanged information, which will be described as a fourth exemplary embodiment in the following.

[119] FIG. 8 is a control flowchart showing an example of a control method of a display system according to the fourth exemplary embodiment.

[120] As shown in FIG. 8, the display apparatus 100 receives a video signal at operation S600. The display apparatus 100 and the shutter glasses 200 establish pairing therebetween at operation S610.

[121] On the basis of the pairing, the display apparatus 100 and the shutter glasses 200 exchange the first information and the second information with each other at operation S620. That is, the display apparatus 100 receives the first information from the shutter glasses 200, and transmits the second information to the shutter glasses 200. On the other hand, the shutter glasses 200 receive the second information from the display apparatus 100 and transmit the first information to the display apparatus 100.

[122] At operation S630, the display apparatus 100 and the shutter glasses 200 determine whether they can interactively support the other parties 100 and 200 on the basis of the exchanged first and second information. That is, the display apparatus 100 determines whether the shutter glasses 200 are supportable on the basis of the first information, and the shutter glasses 200 determine whether the display apparatus 100 is supportable on the basis of the second information.

[123] For example, the display apparatus 100 determines that the corresponding shutter glasses 200 are supportable if the adjustment of the sync signal, the adjustment of image display characteristics, or the like operation control of the display apparatus 100 is possible in accordance with characteristic information of the shutter glasses 200 contained in the first information. Such a determination method may be performed in various ways.

[124] If it is determined that the support is possible, the display apparatus 100 and the shutter glasses 200 perform preset operations on the basis of the first/second information, respectively (S640).

[125] For example, the display apparatus 100 may adjust a timing period of a sync signal by a predetermined value from a default value on the basis of the first information and transmit it, or adjust display characteristics of a 3D image. The shutter glasses 200 may adjust a light transmission and/or interruption ratio of the lens unit 220 per unit period on the basis of the second information. The above preset operations may be performed

in various ways, and the foregoing exemplary embodiments may be applied to these operations. Therefore, repetitive descriptions thereof will be avoided.

[126] If it is determined that at least one of the display apparatus 100 and the shutter glasses 200 is not supportable, the display apparatus 100 may display an error message containing a corresponding determination result at operation S650.

[127] Thus, the display apparatus 100 and the shutter glasses 200 exchanges information with each other, and may perform the preset operations corresponding to the exchanged information, respectively.

[128] As described above, the display apparatus 100 receives the first information from the shutter glasses 200 when displaying a 3D image, and performs at least one of a first operation of generating and transmitting a sync signal based on the first and second information when receiving the first information and a second operation of transmitting the second information to the shutter glasses 200 so that the shutter glasses 200 can operate on the basis of the second information. A setting indicative of whether to perform one of the first and second operations or to perform both operations is previously set up in the display apparatus 100 and the shutter glasses 200, and may be changed as necessary.

[129] Also, the shutter glasses 200 may perform at least one of a third operation of transmitting the first information to the display apparatus 100 so as to receive the sync signal generated by the display apparatus 100 based on the first information, and a fourth operation of controlling the light transmission and/or interruption of the lens unit 220 on the basis of the second information received from the display apparatus 100. A setting indicative of whether to perform one of the third and fourth operations or to perform both operations is previously set up in the display apparatus 100 and the shutter glasses 200, and may be changed as necessary.

[130] Meanwhile, in the operation of establishing the pairing, the display apparatus 100 may store the first information about the paired shutter glasses 200 in the display storage 160. If it is determined that the first information about the paired shutter glasses 200 has already been stored in the display storage 160 in the next pairing operation, the display apparatus 100 may read and use the first information stored in the display storage 160 without receiving the whole or the first information from the shutter glasses 200. The same approach may also apply to the shutter glasses 200.

[131] Although a few preferred embodiments have been shown and described, it will be appreciated by those skilled in the art that various changes and modifications might be made without departing from the scope of the invention, as defined in the appended claims.

[132] Attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to

public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

[133] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[134] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[135] The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

[Claim 1] A method of controlling a display apparatus (100), the method comprising:
establishing a pairing with three dimensional (3D) glasses (S110);
receiving first information related to at least one of an operation characterised, a status and a structure of the 3D glasses (S120);
storing the received first information; and
displaying based on the first information.

[Claim 2] The method according to claim 1, further comprising
determining whether a type of 3D glasses (200) is supported by the display apparatus (100) based on the first information (S530); and
informing a user of a determination result through a user interface (UI) if the 3D glasses (200) are not supported by the display apparatus (S560).

[Claim 3] The method according to claim 1, further comprising transmitting second information, which is related to at least one of the operation characteristics, the status and the structure of the display apparatus (100) and which previously stored in the display apparatus (100).

[Claim 4] The method according to claim 3, wherein the second information further comprises information related to on/off driving timing of the 3D glasses (200).

[Claim 5] The method according to claim 4, wherein the second information further comprises a time delayed sync signal.

[Claim 6] The method according to claim 4, wherein the second information further comprises an on/off duty ratio related to a shuttering operation of the 3D glasses (200).

[Claim 7] The method according to claims 3, wherein the second information further comprises information on a protocol employed in an indicating method of an indicator mounted to the 3D glasses (200), the indicating method for indicating an operating status of the 3D glasses (200).

[Claim 8] The method according to claim 1, wherein the first information further comprises use time of the 3D glasses (200).

[Claim 9] The method according to claim 1, wherein the first information further comprises information about a battery state of the 3D glasses (200).

[Claim 10] The method according to claim 1, wherein the first information further comprises information about an abnormal state of the 3D glasses (200).

[Claim 11] The method according to claim 1, wherein the first information further

comprises information about a polarizing structure of the 3D glasses (200).

[Claim 12] The method according to claim 1, wherein the first information further comprises at least one of a driving frequency, a rising time and a falling time of the 3D glasses (200).

[Claim 13] The method according to claim 1, wherein the first information further comprises a representation of the transmissivity of the 3D glasses (200) depending on optical wavelength.

[Claim 14] The method according to claim 1, wherein the first information further comprises information about colour coordinates.

[Claim 15] A method of controlling three-dimensional (3D) glasses (200), the method comprising:

establishing a pairing with a display apparatus (100);

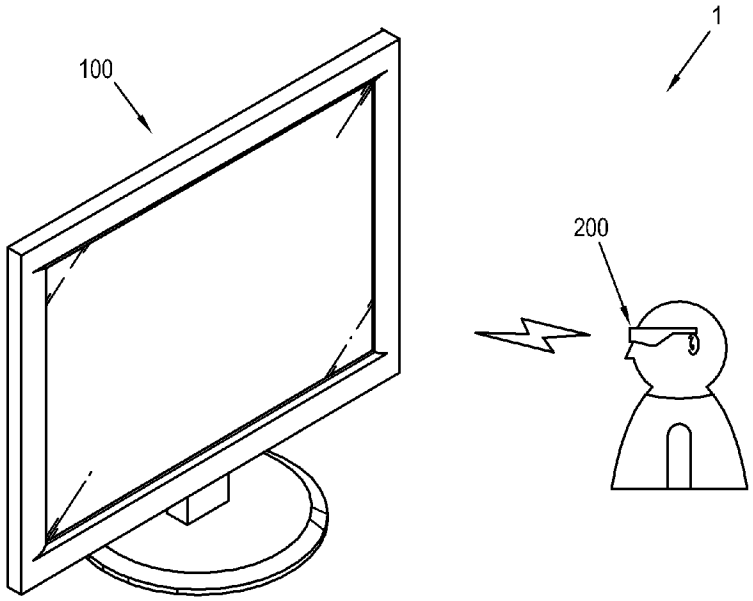
receiving second information related to at least one of an operation characteristic, a status and a structure of the display apparatus (100);

transmitting first information related to at least one of the operation characteristic, the status and the structure and previously stored in the 3D glasses (200) to the display apparatus (100),

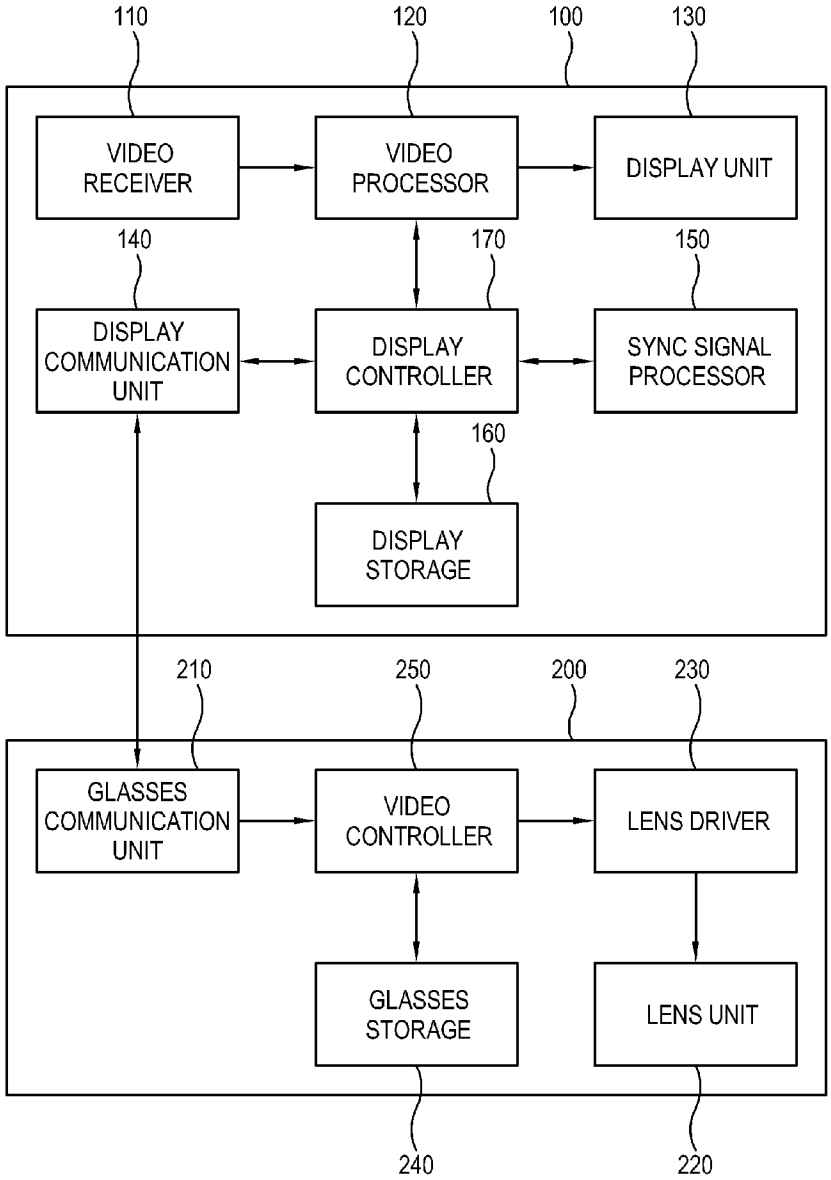
storing the second information; and

driving the 3D glasses (200) based on the received second information.

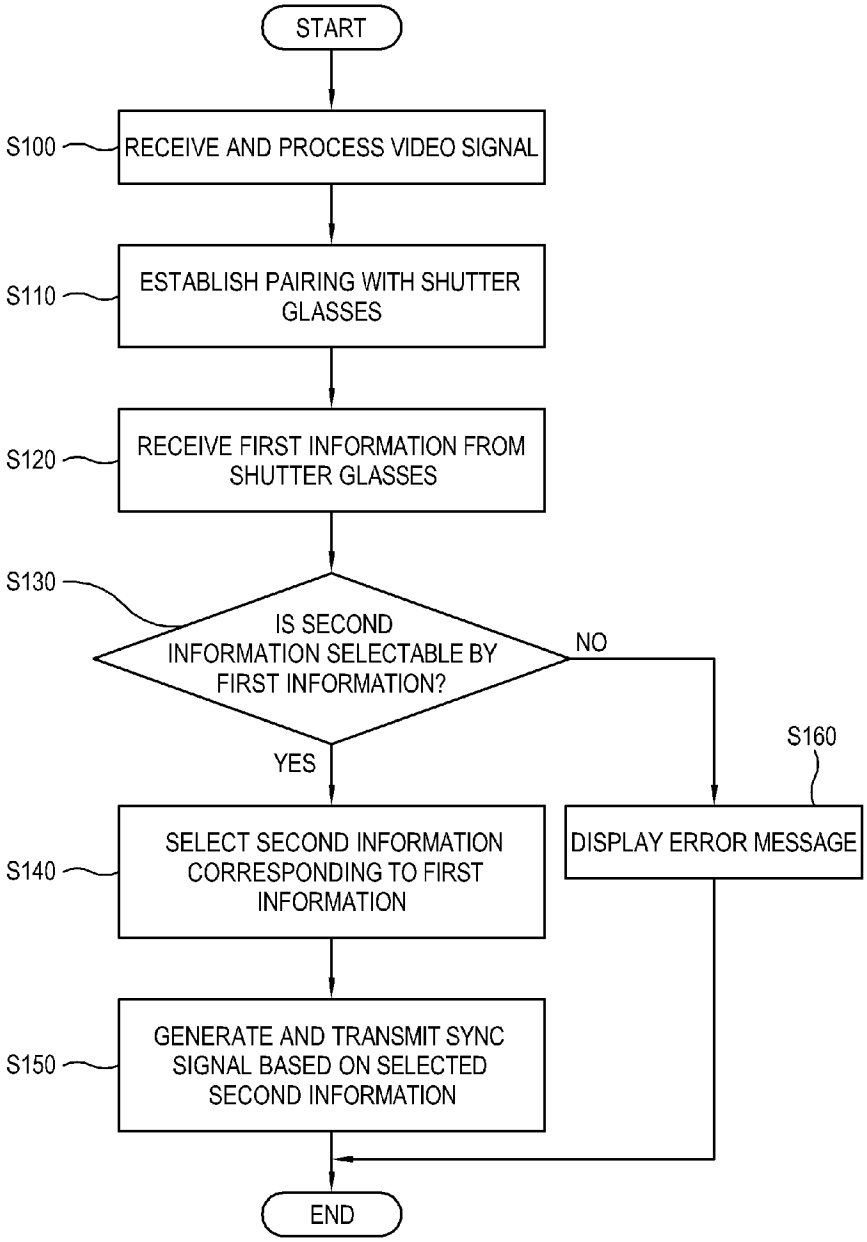
[Fig. 1]


1
100
200

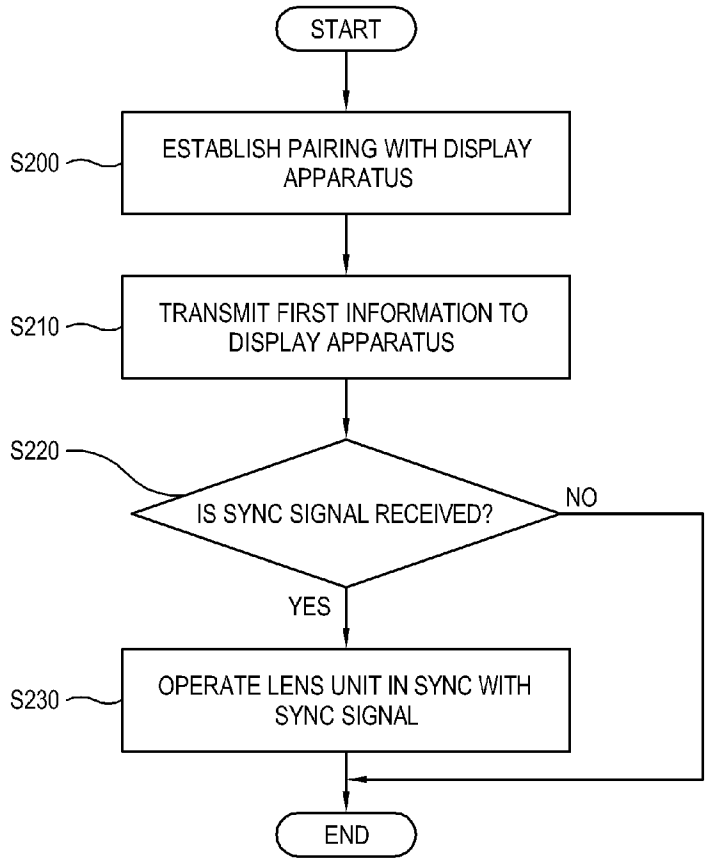
[Fig. 2]


110
120
100
130
VIDEO RECEIVER
VIDEO PROCESSOR
DISPLAY UNIT
140
170
150
DISPLAY COMMUNICATION UNIT
DISPLAY CONTROLLER
SYNC SIGNAL PROCESSOR
160
DISPLAY STORAGE
210
250
200
230
GLASSES COMMUNICATION UNIT
VIDEO CONTROLLER
LENS DRIVER
GLASSES STORAGE
LENS UNIT
240
220

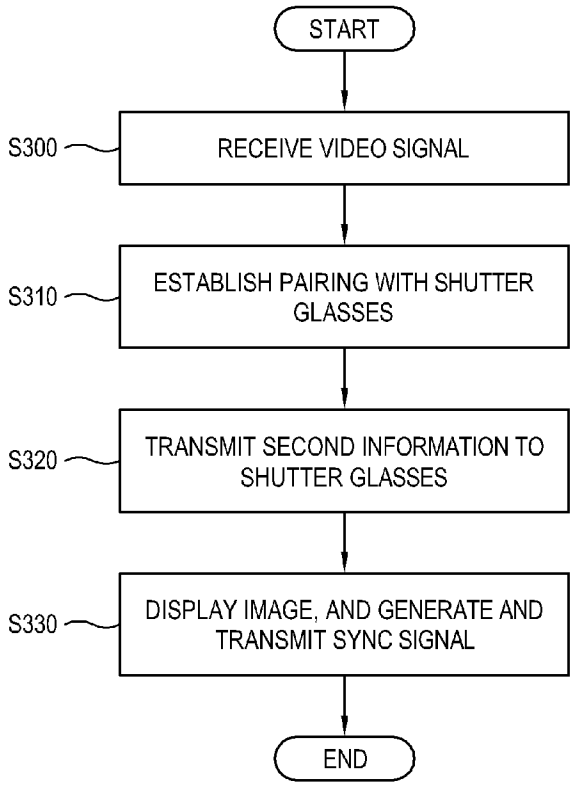
[Fig. 3]


START
S100
RECEIVE AND PROCESS VIDEO SIGNAL
S110
ESTABLISH PAIRING WITH SHUTTER GLASSES
S120
RECEIVE FIRST INFORMATION FROM SHUTTER GLASSES
S130
IS SECOND INFORMATION SELECTABLE BY FIRST INFORMATION?
NO
YES
S160
DISPLAY ERROR MESSAGE
S140
SELECT SECOND INFORMATION CORRESPONDING TO FIRST INFORMATION
S150
GENERATE AND TRANSMIT SYNC SIGNAL BASED ON SELECTED SECOND INFORMATION
END

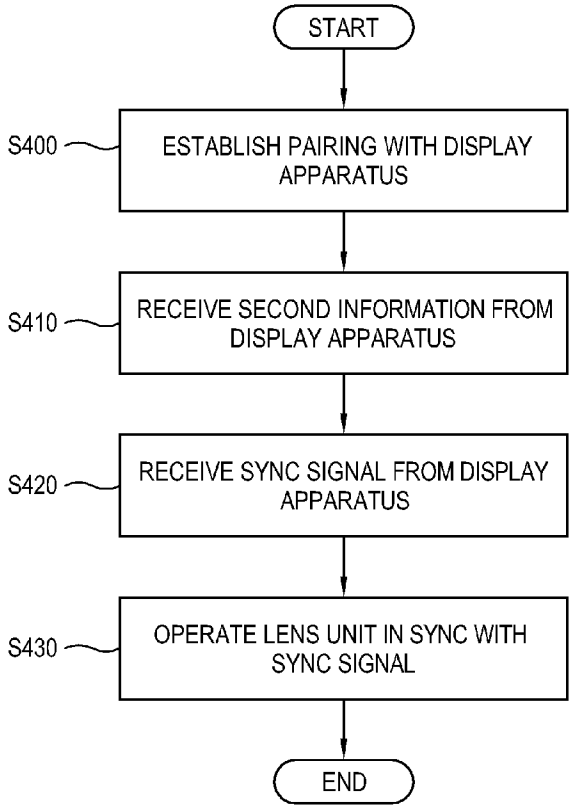
[Fig. 4]


START
S200
ESTABLISH PAIRING WITH DISPLAY APPARATUS
S210
TRANSMIT FIRST INFORMATION TO DISPLAY APPARATUS
S220
IS SYNC SIGNAL RECEIVED?
NO
YES
S230
OPERATE LENS UNIT IN SYNC WITH SYNC SIGNAL
END

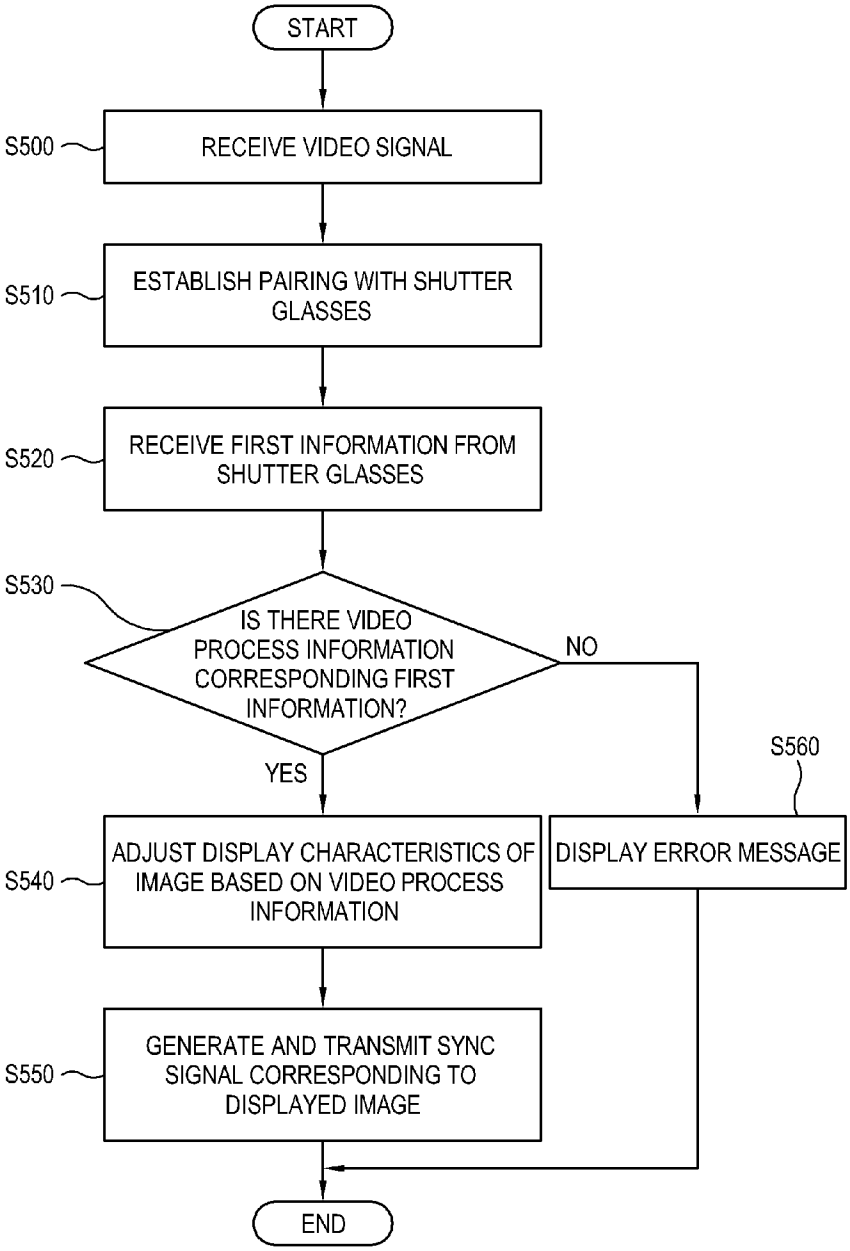
[Fig. 5]


START
S300
RECEIVE VIDEO SIGNAL
S310
ESTABLISH PAIRING WITH SHUTTER GLASSES
S320
TRANSMIT SECOND INFORMATION TO SHUTTER GLASSES
S330
DISPLAY IMAGE, AND GENERATE AND TRANSMIT SYNC SIGNAL
END

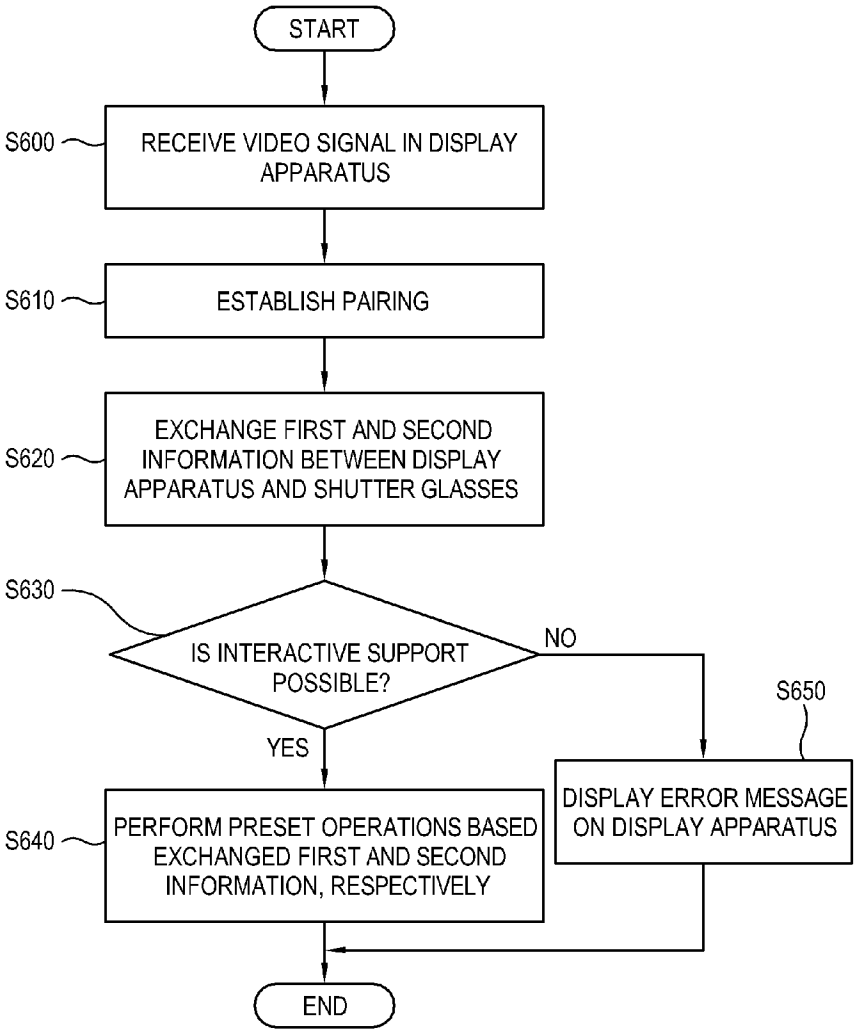
[Fig. 6]


START
S400
ESTABLISH PAIRING WITH DISPLAY APPARATUS
S410
RECEIVE SECOND INFORMATION FROM DISPLAY APPARATUS
S420
RECEIVE SYNC SIGNAL FROM DISPLAY APPARATUS
S430
OPERATE LENS UNIT IN SYNC WITH SYNC SIGNAL
END

[Fig. 7]


START
S500
RECEIVE VIDEO SIGNAL
S510
ESTABLISH PAIRING WITH SHUTTER GLASSES
S520
RECEIVE FIRST INFORMATION FROM SHUTTER GLASSES
S530
IS THERE VIDEO PROCESS INFORMATION CORRESPONDING FIRST INFORMATION?
NO
YES
S560
DISPLAY ERROR MESSAGE
S540
ADJUST DISPLAY CHARACTERISTICS OF IMAGE BASED ON VIDEO PROCESS INFORMATION
S550
GENERATE AND TRANSMIT SYNC SIGNAL CORRESPONDING TO DISPLAYED IMAGE
END

[Fig. 8]


START
S600
RECEIVE VIDEO SIGNAL IN DISPLAY APPARATUS
S610
ESTABLISH PAIRING
S620
EXCHANGE FIRST AND SECOND INFORMATION BETWEEN DISPLAY APPARATUS AND SHUTTER GLASSES
S630
IS INTERACTIVE SUPPORT POSSIBLE?
NO
YES
S650
DISPLAY ERROR MESSAGE ON DISPLAY APPARATUS
S640
PERFORM PRESET OPERATIONS BASED EXCHANGED FIRST AND SECOND INFORMATION, RESPECTIVELY
END