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### Image display device using sensor

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#### Abstract

A display image device includes a sensor in which when a surrounding object is detected through a scanning unit, an image display unit operates together with and the image for message delivery to an outside is implemented, so that Light Detection and Ranging (LiDAR) sensing function and image implementation may be integrated, a package may be reduced and a LiDAR sensing area may be secured.

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## Background/Summary

### CROSS REFERENCE TO RELATED APPLICATION

(1) The present application claims priority to Korean Patent Application No. 10-2021-0103413, filed Aug. 5, 2021, the entire contents of which is incorporated herein for all purposes by this reference.

### BACKGROUND OF THE PRESENT DISCLOSURE

#### Field of the Present Disclosure

(2) The present disclosure relates to an image display device using a sensor that implements an image for message delivery to an outside using a LiDAR.

#### Description of Related Art

(3) Recently, in the mobility including a vehicle or a mobile robot, a laser radar device such as a light detection and ranging (LiDAR) is used to detect a surrounding terrain or object.

(4) Since such LiDAR irradiates laser light into a surrounding area and utilizes the time, intensity and the like of the reflected light which is reflected from a surrounding object or terrain, it measures the distance, speed, and shape of the object to be measured, or precisely scans the surrounding object or terrain.

(5) In the case of a robotaxi among the mobility, a display capable of exchanging information with an outside is provided. Furthermore, the LiDAR is applied and provided on a top portion of the mobility to expand sensing accuracy and sensing range.

(6) Accordingly, there is a problem in that the display and the LiDAR are respectively provided on the top portion of the mobility, and the display interferes with the sensing region of the LiDAR, reducing the sensing area.

- (7) Furthermore, as the LiDAR and the display are provided separately, it is difficult to secure a space for installing the LiDAR and the display in a limited space on the top portion of the mobility.
- (8) Furthermore, when the LiDAR and the display are separately provided, a cost is increased.
- (9) Furthermore, as the display is configured in a way of simply projecting an image, there is a problem in that the image is distorted due to the formation of water droplets.
- (10) The information included in this Background of the present disclosure section is only for enhancement of understanding of the general background of the present disclosure and may not be taken as an acknowledgement or any form of suggestion that this information forms the prior art already known to a person skilled in the art.

#### BRIEF SUMMARY

- (11) Various aspects of the present disclosure are directed to providing an image display device using a sensor that implements an image for message delivery to an outside using a LiDAR.
- (12) In various aspects of the present disclosure, an image display device using a sensor according to an exemplary embodiment of the present disclosure includes a housing which is configured to be rotatable; a scanning unit that detects a surrounding object when the housing rotates; an image display unit which is provided on a side surface of the housing and includes a plurality of light sources each individually lighting; and a control unit that is configured to rotate the housing when sensing of the surrounding object or generating of an image is required, and controls to turn ON/OFF each light source of the image display unit in generating the image on the side surface of the housing by afterimage effect caused by the rotation of the housing.
- (13) The housing is formed in a shape of cylinder and a part of the side surface is formed to allow light transmission, and the scanning unit includes a light receiving unit to receive laser light and a light emitting unit to irradiate the laser light.
- (14) The scanning unit and the image display unit are spaced apart along the side surface of the housing and arranged so that the image display unit does not overlap a sensing area of the scanning unit.
- (15) The plurality of light sources of the image display unit is arranged in a vertical direction of the housing.
- (16) The control unit is configured to rotate the housing at a preset sensing speed when sensing of the surrounding object is required, rotates the housing at a preset image generation speed when generating of the image is required, and controls to turn ON/OFF each light source according to the image to be generated.
- (17) The control unit is configured to rotate the housing at the image generation speed when sensing of the surrounding object and generating of the image are required at a same time.
- (18) The image display unit is composed of a plurality and the plurality of image display units is spaced apart along the side surface of the housing.
- (19) The image display units are spaced at equal intervals and arranged so as not to overlap a sensing area of the scanning unit.
- (20) A number of the image display units is determined by comparing a rotation speed of the housing at which the scanning unit is configured for sensing and the rotation speed of the housing at which the image display unit is configured for generating the image and according to a difference in rotation speeds required for operations of the scanning unit and the image display unit.
- (21) The control unit is configured to operate one of the plurality of image display units in sensing the surrounding object when a rotation speed of the housing is greater than or equal to an image generation speed.
- (22) When the rotation speed of the housing is less than the image generation speed, the control unit increases a number of operations of the image display units according to a difference between the rotation speed of the housing and the image generation speed in sensing the surrounding object.
- (23) In the image display device using a sensor configured as described above, when the

surrounding object is detected through the scanning unit, the image display device operates together with and the image for message delivery to the outside is implemented. Thus, the LiDAR sensing function and image implementation may be integrated, the package may be reduced and the LiDAR sensing area may be secured.

(24) The methods and apparatuses of the present disclosure have other features and advantages which will be apparent from or are set forth in more detail in the accompanying drawings, which are incorporated herein, and the following Detailed Description, which together serve to explain certain principles of the present disclosure.

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## Description

### BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. 1 is a view showing a mobility according to an exemplary embodiment of the present disclosure.

(2) FIG. 2 is a view showing an image display device using a sensor according to various exemplary embodiments of the present disclosure.

(3) FIG. 3 is a view for explaining the image display device using a sensor shown in FIG. 2.

(4) FIG. 4 is a view for explaining image generation of the present disclosure.

(5) FIG. 5 is a view showing an image display device using a sensor according to various exemplary embodiments of the present disclosure.

(6) FIG. 6 is a view for explaining the image display device using a sensor shown in FIG. 5.

(7) It may be understood that the appended drawings are not necessarily to scale, presenting a somewhat simplified representation of various features illustrative of the basic principles of the present disclosure. The specific design features of the present disclosure as included herein, including, for example, specific dimensions, orientations, locations, and shapes will be determined in part by the particularly intended application and use environment.

(8) In the figures, reference numbers refer to the same or equivalent parts of the present disclosure throughout the several figures of the drawing.

### DETAILED DESCRIPTION

(9) Reference will now be made in detail to various embodiments of the present disclosure(s), examples of which are illustrated in the accompanying drawings and described below. While the present disclosure(s) will be described in conjunction with exemplary embodiments of the present disclosure, it will be understood that the present description is not intended to limit the present disclosure(s) to those exemplary embodiments of the present disclosure. On the other hand, the present disclosure(s) is/are intended to cover not only the exemplary embodiments of the present disclosure, but also various alternatives, modifications, equivalents and other embodiments, which may be included within the spirit and scope of the present disclosure as defined by the appended claims.

(10) Hereinafter, an image display device using a sensor according to various exemplary embodiments of the present disclosure will be described with reference to the accompanying drawings.

(11) FIG. 1 is a view showing a mobility according to an exemplary embodiment of the present disclosure, FIG. 2 is a view showing an image display device using a sensor according to various exemplary embodiments of the present disclosure, FIG. 3 is a view for explaining the image display device using a sensor shown in FIG. 2, FIG. 4 is a view for explaining image generation of the present disclosure, FIG. 5 is a view showing an image display device using a sensor according to various exemplary embodiments of the present disclosure, and FIG. 6 is a view for explaining the image display device using a sensor shown in FIG. 5.

(12) As shown in FIG. 1 and FIG. 2, an image display device **1000** using a sensor according to an

exemplary embodiment of the present disclosure includes a housing **100** which is configured to be rotatable; a scanning unit **200** which is provided inside the housing **100** and detects a surrounding object when the housing **100** rotates; an image display unit **300** which is provided on a side surface of the housing **100** and configured to include a plurality of light sources **310** each light source individually lighting; and a control unit **400** that rotates the housing **100** when sensing of the surrounding object or generating of an image is required, and controls to turn ON/OFF each light source **310** of the image display unit **300** in generating the image on the side surface of the housing by afterimage effect caused by the rotation of the housing.

(13) Here, the housing **100** may be provided on a top portion of a mobility **M**, and is configured to be rotated by a driving motor **D** in a rotatably provided on the mobility **M**.

(14) The scanning unit **200** is configured for a light detection and ranging (LiDAR), and detects a surrounding object when the housing **100** rotates.

(15) That is, the housing **100** is formed in a shape of cylinder, and is formed so that light passes through a part of the side surface thereof, and the scanning unit **200** includes a light receiving unit **210** to receive laser light and a light emitting unit **220** to irradiate the laser light.

(16) Accordingly, the housing **100** is formed in a shape of cylinder so that the upper and side surfaces of the housing **100** are closed, and a part of the side surface may be provided with a window **100a** made of a light-transmitting material through which the laser light irradiated from the scanning unit **200** passes.

(17) The scanning unit **200** is provided inside the housing **100**, and the scanning unit **200** includes the light receiving unit **210** to receive laser light and the light emitting unit **220** to irradiate the laser light. Here, a reflective mirror **230** may be disposed in the scanning unit **200** to easily receive and emit the laser light in a limited space inside the housing **100**. Furthermore, the reflective mirror **230** may be configured as a micro electro mechanical system (MEMS) mirror so that the laser light can accurately reach a target point.

(18) On the other hand, the side surface of the housing **100** is further provided with the image display unit **300** in which each of the light sources **310** individually emits light. Here, each light source **310** of the image display unit **300** may include an LED, and as each light source **310** is individually turned on, a specific image may be formed when the housing **100** rotates.

(19) The image display unit **300** may be configured so that the plurality of light sources **310** is arranged in the vertical direction of the housing **100**. In the present way, as each light source **310** is arranged in a straight line in the image display unit **300**, the image display unit **300** is formed in a straight line, so that it is easy to be provided in the housing **100**. Furthermore, each light source **310** of the image display unit **300** is turned on when the housing **100** rotates, which gives the afterimage effect, so that it is easy to implement an image according to the lighting position of each light source **310**.

(20) The scanning unit **200** and the image display unit **300** as described above may be spaced apart along the side surface of the housing **100**, but may be disposed so that the image display unit **300** does not overlap the sensing area of the scanning unit **200**.

(21) As shown in FIG. 3, the scanning unit **200** and the image display unit **300** are spaced from each other on the side surface of the housing **100**, so that the image display unit **300** does not interfere with the sensing area of the scanning unit **200**. Therefore, accurate sensing is possible through the scanning unit **200**.

(22) Accordingly, the image display unit **300** and the scanning unit **200** are spaced from each other on the side surface of the housing **100** in 180° direction, and the information display function through the image display unit **300** and the sensing function through the scanning unit **200** can be implemented without mutual interference.

(23) Through this, the control unit **400** rotates the housing **100** when sensing of the surrounding object or generating of an image is required.

(24) That is, the control unit **400** rotates the housing **100** when the sensing of the surrounding

object is required, so that the scanning unit **200** provided in the housing **100** detects the surrounding object, and receives information on the object detected through the scanning unit **200**.  
(25) Furthermore, the control unit **400** rotates the housing **100** when generating of an image is required, and controls to turn ON/OFF of each light source **310** of the image display unit **300** to generate an image on the side surface of the housing **100** by the afterimage effect caused by the rotation of the housing **100**.

(26) For example, when expressing a word 'H', the control unit **400** controls to turn ON/OFF each light source **310** of the image display unit **300** at a position where an image is to be generated, while rotating the housing **100**. That is, as shown in FIG. 4, as each light source **310** of the image display unit **300** is turned ON/OFF in accordance with the rotation of the housing **100**, the word 'H' is formed at a position where an image is to be generated.

(27) In the present way, the control unit **400** receives image information to be generated when generating of an image is required and controls to turn ON/OFF each light source **310** and the rotation of the housing **100**, and thus, as each light source **310** of the image display unit **300** is turned on according to the rotation of the housing **100**, a required image may be generated on the external surface of the housing **100**.

(28) As described above, in an exemplary embodiment of the present disclosure, the scanning unit **200** and the image display unit **300** are configured in the housing **100**, so that when the housing **100** rotates, the sensing function through the scanning unit **200** and the information display function through the image display unit **300** are implemented together.

(29) Meanwhile, various embodiments of the present disclosure will be referred to as follows.

(30) As various exemplary embodiments of the present disclosure, when the scanning unit **200** and the single image display unit **300** are provided in the housing **100**, the control unit **400** may perform the control as follows.

(31) The control unit **400** rotates the housing **100** at a preset sensing speed when sensing of a surrounding object is required, rotates the housing **100** at a preset image generation speed when generating of an image is required, and controls to turn ON/OFF each light source **310** according to the image to be generated.

(32) Accordingly, the sensing speed and the image generation speed for rotating the housing **100** are pre-stored in the control unit **400**. Here, the sensing speed is the rotation speed of the housing **100** at which the scanning unit **200** can detect a surrounding object, and the image generation speed is the rotation speed of the housing **100** at which an image may be generated when each light source **310** of the image display unit **300** is turned on.

(33) For example, the scanning unit **200** includes a Light Detection and Ranging (LiDAR), and in accordance with the sensing performance of the LiDAR, the rotation speed of the housing **100** may be required to be 300 to 900 rpm.

(34) Meanwhile, the rotation speed of the housing **100** required when the image display unit **300** is interlocked with the rotation of the housing **100** to generate an image through the afterimage effect may be 900 rpm. of course, in the case of the image display unit **300**, even when the rotation speed of the housing **100** is less than 900 rpm, an image may be generated, but since a frame is lowered and the sharpness of the image is reduced, the rotation speed of the housing **100** is preferably 900 revolutions per minute (rpm) or more.

(35) Accordingly, since the rotation speed of the housing **100** required for sensing by the scanning unit **200** and the rotation speed of the housing **100** required for generating an image by the image display unit **300** are different from each other, the sensing speed and the image generation rate may be stored in the control unit **400**, respectively.

(36) Through this, the control unit **400** rotates the housing **100** at a preset sensing speed when sensing of a surrounding object is required so that sensing of the surrounding object is performed through the scanning unit **200**. When generating of an image is required, the control unit **400** rotates the housing **100** at a preset image generation speed and controls to turn ON/OFF each light

source **310** according to the image to be generated, so that the image generation may be performed through the image display unit **300**.

(37) On the other hand, the control unit **400** rotates the housing **100** at the image generation speed when sensing of a surrounding object and generating of an image are required at the same time.

(38) The sensing speed of the housing **100** for sensing a surrounding object is relatively lower than an image generation speed of the housing **100** for generating an image. Accordingly, when the housing **100** rotates at a sensing speed in a state where sensing of a surrounding object and generating of an image are required at the same time, the sharpness of the image generated through the image display unit **300** may deteriorate.

(39) Accordingly, the control unit **400** rotates the housing **100** at the image generation speed when sensing of a surrounding object and generating of an image are requested at the same time, so that both the sensing function through the scanning unit **200** and the image generation through the image display unit **300** may be implemented smoothly.

(40) On the other hand, as various exemplary embodiments of the present disclosure, the image display unit **300** may be composed of a plurality, the plurality of image display units may be arranged spaced apart along the side surface of the housing **100**.

(41) As shown in FIG. 5 and FIG. 6, as the image display unit **300** is configured in plurality, the sharpness of the image by the image display unit **300** is increased when the housing **100** rotates.

(42) Furthermore, even if the housing **100** rotates at the rotation speed for the operation of the scanning unit **200**, a clear image may be generated without increasing the rotation speed of the housing **100** as the plurality of image display units **300** generate the image.

(43) The image display units **300** may be spaced apart at equal intervals and disposed so as not to overlap the sensing area of the scanning unit **200**.

(44) As may be seen in FIG. 6, the plurality of image display units **300** is spaced apart on the side surface of the housing **100** at equal intervals, so that when the housing **100** rotates, the image generated by lighting of each light source **310** of each image display unit **300** may be implemented with clarity. Furthermore, as the plurality of image display units **300** is spaced from each other at equal intervals, control of each image display unit **300** for generating a specific image may be accurately performed according to a predetermined rule.

(45) Furthermore, the scanning unit **200** is disposed between the plurality of image display units **300** spaced apart. In the instant case, the scanning unit **200** is disposed between the respective image display units **300** so that the sensing area does not interfere with the image display unit **300** to accurately perform that sensing through the scanning unit **200**.

(46) On the other hand, the number of the image display units **300** may be determined by comparing the rotation speed of the housing **100** at which the scanning unit **200** is configured for sensing with the rotation speed of the housing **100** at which the image display unit **300** is configured for generating an image, and according to a difference in the rotation speeds required for operations of the scanning unit **200** and the image display unit **300**.

(47) For example, the scanning unit **200** includes a Light Detection and Ranging (LiDAR), and in accordance with the sensing performance of the LiDAR, the rotation speed of the housing **100** may be required to be 300 to 900 rpm. Furthermore, the image display unit **300** is interlocked with the rotation of the housing **100** so that the rotation speed of the housing **100** required to generate an image through the afterimage effect may be 900 rpm.

(48) Accordingly, for the image display unit **300** to generate a clear image, the housing **100** must rotate at 900 rpm, but when the housing **100** rotates at 300 revolutions per minute (rpm) to implement the sensing function of the LiDAR, there is a problem in image generation.

(49) Accordingly, the number of the image display units **300** may be determined to be three or more so that the rotation speed of the housing **100** corresponds to 900 revolutions per minute (rpm) to generate a clear image even when the housing **100** rotates at 300 rpm. Accordingly, even when the housing **100** rotates at 300 rpm, an image may be clearly generated by the three or more image

display units **300**. These three image display units **300** may be spaced at intervals of 120° on the side surface of the housing **100**.

(50) On the other hand, the control unit **400** receives information according to the rotation speed of the housing **100**, and the image generation speed according to the rotation speed of the housing **100** is prestored in the control unit **400** when generating an image, and when the rotation speed of the housing **100** is greater than or equal to the image generation speed in sensing a surrounding object, the control unit **400** operates any one of the plurality of image display units **300**.

(51) Here, the control unit **400** may receive information according to the rotation speed of the housing **100** through a speed sensor provided in the housing **100**. Furthermore, the image generation speed prestored in the control unit **400** may be the rotation speed of the housing **100** at which a clear image may be generated according to the specifications of the image display unit **300** when the housing **100** rotates.

(52) That is, the rotation speed of the housing **100** may be changed according to the sensing situation of the LiDAR forming the scanning unit **200**. Since the number of installations of the image display units **300** is determined based on the lowest rotation speed of the LiDAR, a plurality of image display units **300** may be selectively operated.

(53) Accordingly, the control unit **400** receives the rotation speed of the housing **100** when sensing a surrounding object, and when the rotation speed of the housing **100** is greater than or equal to the image generation speed, and operates only any one of the plurality of image display units **300**. That is, when the rotation speed of the housing **100** is greater than or equal to the image generation speed, a clear image may be generated even if only one image display unit **300** is operated, and thus, the remaining image display units **300** are not operated. Therefore, all of the plurality of image display units **300** may be operated at all times, but to ensure durability of each image display unit **300** and to generate a constant image, the control unit **400** controls the plurality of image display units **300** to be selectively operated according to the rotation speed of the housing **100**.

(54) On the other hand, when the rotation speed of the housing **100** is less than the image generation speed when sensing the surrounding object, the control unit **400** may increase the number of operations of the image display units **300** according to the difference between the rotation speed of the housing **100** and the image generation speed when sensing the surrounding object.

(55) That is, when the rotation speed of the housing **100** due to sensing the surrounding object through the scanning unit **200** is less than the image generation speed, the sharpness of the image generated through the image display unit **300** may be lowered. Accordingly, the difference between the rotation speed required for sensing and the rotation speed required for image generation is resolved by increasing the number of operations of the image display units **300**.

(56) For example, in the case in which the image generation speed stored in the control unit **400** is 900 rpm, when the housing **100** rotates at 300 rpm according to sensing of a surrounding object, three image display units **300** are operated so that the clarity of the image generated by the image display unit **300** may be ensured.

(57) In the image display device using a sensor configured as described above, when the surrounding object is detected through the scanning unit, the image display device operates together with and the image for message delivery to the outside is implemented. Thus, the LiDAR sensing function and image implementation may be integrated, the package may be reduced and the LiDAR sensing area may be secured.

(58) Furthermore, the term related to a control device such as “controller”, “control apparatus”, “control unit”, “control device”, “control module”, or “server”, etc refers to a hardware device including a memory and a processor configured to execute one or more steps interpreted as an algorithm structure. The memory stores algorithm steps, and the processor executes the algorithm steps to perform one or more processes of a method in accordance with various exemplary embodiments of the present disclosure. The control device according to exemplary embodiments of



the present disclosure may be implemented through a nonvolatile memory configured to store algorithms for controlling operation of various components of a vehicle or data about software commands for executing the algorithms, and a processor configured to perform operation to be described above using the data stored in the memory. The memory and the processor may be individual chips. Alternatively, the memory and the processor may be integrated in a single chip. The processor may be implemented as one or more processors. The processor may include various logic circuits and operation circuits, may process data according to a program provided from the memory, and may generate a control signal according to the processing result.

(59) The control device may be at least one microprocessor operated by a predetermined program which may include a series of commands for carrying out the method disclosed in the aforementioned various exemplary embodiments of the present disclosure.

(60) The aforementioned invention can also be embodied as computer readable codes on a computer readable recording medium. The computer readable recording medium is any data storage device that can store data which may be thereafter read by a computer system and store and execute program instructions which may be thereafter read by a computer system. Examples of the computer readable recording medium include Hard Disk Drive (HDD), solid state disk (SSD), silicon disk drive (SDD), read-only memory (ROM), random-access memory (RAM), CD-ROMs, magnetic tapes, floppy discs, optical data storage devices, etc and implementation as carrier waves (e.g., transmission over the Internet). Examples of the program instruction include machine language code such as those generated by a compiler, as well as high-level language code which may be executed by a computer using an interpreter or the like.

(61) In various exemplary embodiments of the present disclosure, each operation described above may be performed by a control device, and the control device may be configured by a plurality of control devices, or an integrated single control device.

(62) In various exemplary embodiments of the present disclosure, the control device may be implemented in a form of hardware or software, or may be implemented in a combination of hardware and software.

(63) Furthermore, the terms such as “unit”, “module”, etc. disclosed in the specification mean units for processing at least one function or operation, which may be implemented by hardware, software, or a combination thereof.

(64) For convenience in explanation and accurate definition in the appended claims, the terms “upper”, “lower”, “inner”, “outer”, “up”, “down”, “upwards”, “downwards”, “front”, “rear”, “back”, “inside”, “outside”, “inwardly”, “outwardly”, “interior”, “exterior”, “internal”, “external”, “forwards”, and “backwards” are used to describe features of the exemplary embodiments with reference to the positions of such features as displayed in the figures. It will be further understood that the term “connect” or its derivatives refer both to direct and indirect connection.

(65) The foregoing descriptions of specific exemplary embodiments of the present disclosure have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the present disclosure to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teachings. The exemplary embodiments were chosen and described to explain certain principles of the present disclosure and their practical application, to enable others skilled in the art to make and utilize various exemplary embodiments of the present disclosure, as well as various alternatives and modifications thereof. It is intended that the scope of the present disclosure be defined by the Claims appended hereto and their equivalents.

## Claims

1. An image display apparatus using a sensor, the image display apparatus comprising: a housing which is configured to be rotatable; a scanning unit that detects a surrounding object when the

housing rotates; an image display unit which is provided on a side surface of the housing and includes a plurality of light sources each individually lighting; a driving unit configured for rotating the housing; and a control unit that is configured to rotate the housing by control of the driving unit when sensing of the surrounding object or generating of an image is required, and to control to turn ON/OFF each light source of the image display unit in generating the image on the side surface of the housing by afterimage effect caused by the rotation of the housing, wherein the scanning unit includes a light receiving unit to receive laser light and a light emitting unit to irradiate the laser light.

2. The image display apparatus of claim 1, wherein the housing is formed in a shape of cylinder and a part of the side surface is formed to allow light transmission.

3. The image display apparatus of claim 1, further including a reflective mirror disposed in the scanning unit to receive and emit the laser light inside the housing.

4. The image display apparatus of claim 1, wherein the scanning unit and the image display unit are spaced apart along the side surface of the housing and arranged so that the image display unit does not overlap a sensing area of the scanning unit.

5. The image display apparatus of claim 1, wherein the plurality of light sources of the image display unit is arranged in a vertical direction of the housing.

6. The image display apparatus of claim 1, wherein the control unit is configured to rotate the housing at a preset sensing speed when sensing of the surrounding object is required, to rotate the housing at a preset image generation speed when generating of the image is required, and to control to turn ON/OFF each light source according to the image to be generated.

7. The image display apparatus of claim 6, wherein the control unit is configured to rotate the housing at the image generation speed when sensing of the surrounding object and generating of the image are required at a same time.

8. The image display apparatus of claim 1, wherein the image display unit is composed of a plurality and the plurality of image display units is spaced apart along the side surface of the housing.

9. The image display apparatus of claim 8, wherein the image display units are spaced at equal intervals and arranged so as not to overlap a sensing area of the scanning unit.

10. The image display apparatus of claim 8, wherein a number of the image display units is determined by comparing a rotation speed of the housing at which the scanning unit is configured for sensing and the rotation speed of the housing at which the image display unit is configured for generating the image and according to a difference in rotation speeds required for operations of the scanning unit and the image display unit.

11. The image display apparatus of claim 10, wherein the number of the image display units is determined based on a lowest rotation speed of the scanning unit.

12. The image display apparatus of claim 8, wherein the control unit is configured to operate one of the plurality of image display units in sensing the surrounding object when a rotation speed of the housing is greater than or equal to an image generation speed.

13. The image display apparatus of claim 12, wherein when the rotation speed of the housing is less than the image generation speed, the control unit is configured to increase a number of operations of the image display units according to a difference between the rotation speed of the housing and the image generation speed in sensing the surrounding object.

14. A method of controlling an image display apparatus including a housing, a scanning unit, and a plurality of image display units spaced apart along a side surface of the housing, the method comprising: operating, by a control unit, one of the plurality of image display units in sensing a surrounding image when a rotation speed of the housing is greater than or equal to an image generation speed.

15. The method of claim 14, further including: when the rotation speed of the housing is less than the image generation speed, increasing, by the control unit, a number of operations of the image

display units according to a difference between the rotation speed of the housing and the image generation speed in sensing the surrounding object.

16. A non-transitory computer readable storage medium on which a program for performing the method of claim 14 is recorded.

17. An image display apparatus using a sensor, the image display apparatus comprising: a housing which is configured to be rotatable; a scanning unit that detects a surrounding object when the housing rotates; an image display unit which is provided on a side surface of the housing and includes a plurality of light sources each individually lighting; a driving unit configured for rotating the housing; and a control unit that is configured to rotate the housing by control of the driving unit when sensing of the surrounding object or generating of an image is required, and to control to turn ON/OFF each light source of the image display unit in generating the image on the side surface of the housing by afterimage effect caused by the rotation of the housing, wherein the image display unit is composed of a plurality and the plurality of image display units is spaced apart along the side surface of the housing.

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