US 20220035370A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2022/0035370 A1**

KIM (43) **Pub. Date: Feb. 3, 2022**

(54) **REMOTE CONTROL METHOD AND SYSTEM FOR ROBOT**

(71) Applicant: **NAVER LABS CORPORATION**, Seongnam-si (KR)

(72) Inventor: **Kahyeon KIM**, Seongnam-si (KR)

(73) Assignee: **NAVER LABS CORPORATION**, Seongnam-si (KR)

(21) Appl. No.: **17/381,800**

(22) Filed: **Jul. 21, 2021**

(30) **Foreign Application Priority Data**

Jul. 29, 2020 (KR) 10-2020-0094178

Publication Classification

(51) **Int. Cl.**
G05D 1/00 (2006.01)
G06F 3/14 (2006.01)

(52) **U.S. Cl.**
CPC ***G05D 1/0044*** (2013.01); ***G05D 1/0038*** (2013.01); ***G05D 1/0022*** (2013.01); ***G06F 3/14*** (2013.01)

(57) **ABSTRACT**

A robot remote control method and system capable of remotely controlling navigation of a robot. The robot remote control method includes outputting both a map image and an ambient image to a display, the map image including location information corresponding to the ambient image, the ambient image being of surroundings of a robot, and the ambient image being received from a camera at the robot, generating a control command for controlling the robot in response to an input to the display during the outputting, and causing the robot to drive according to the control command by transmitting the control command to the robot.

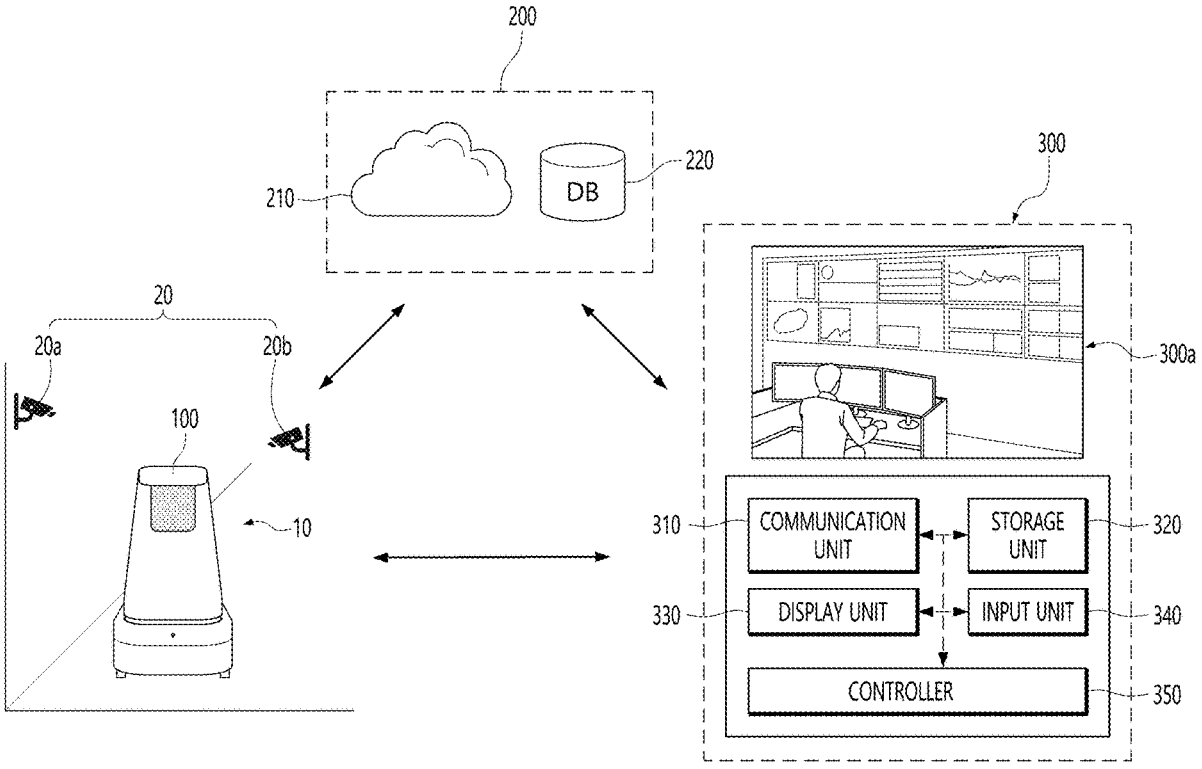


FIG. 1

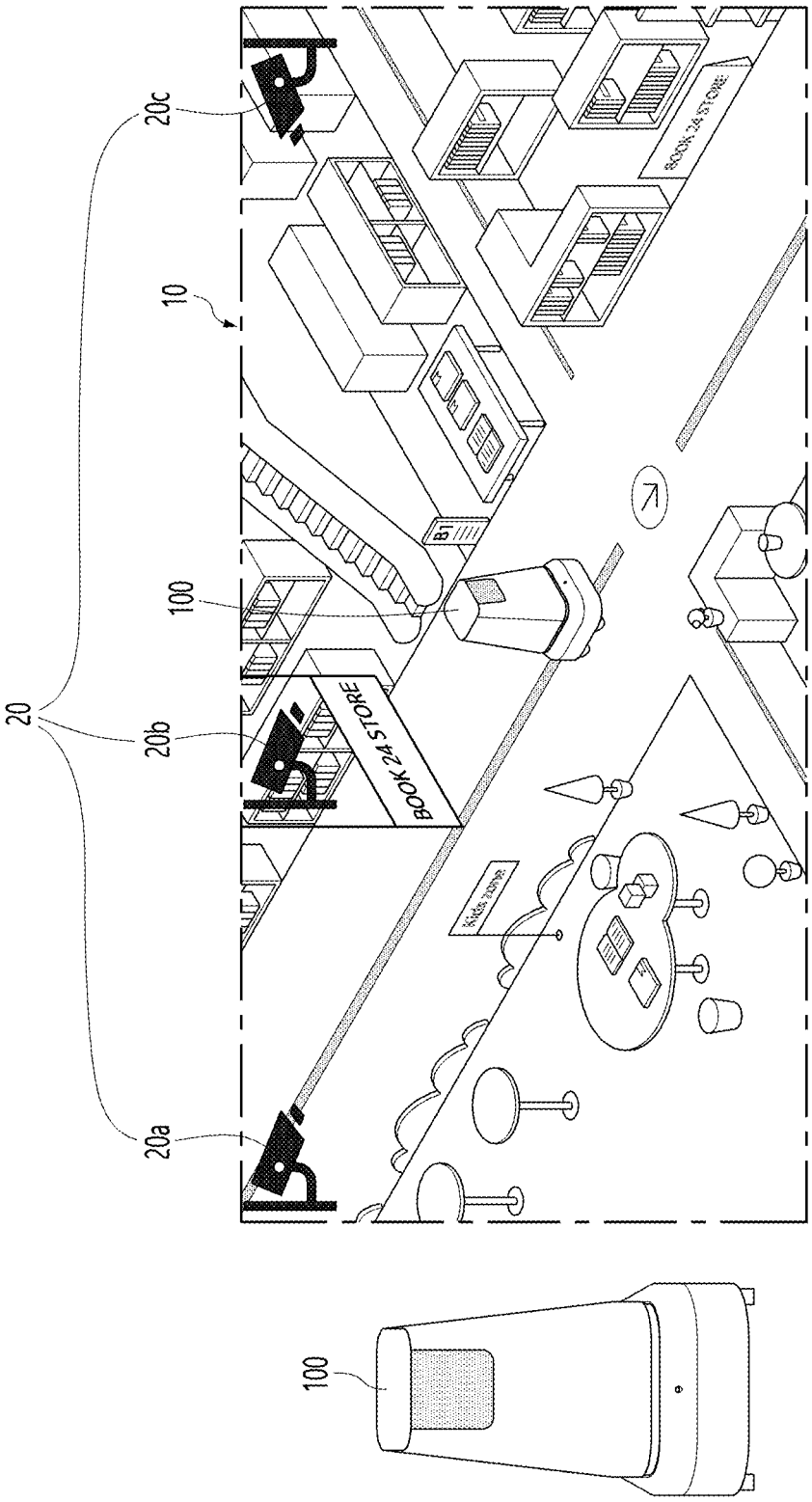


FIG. 2

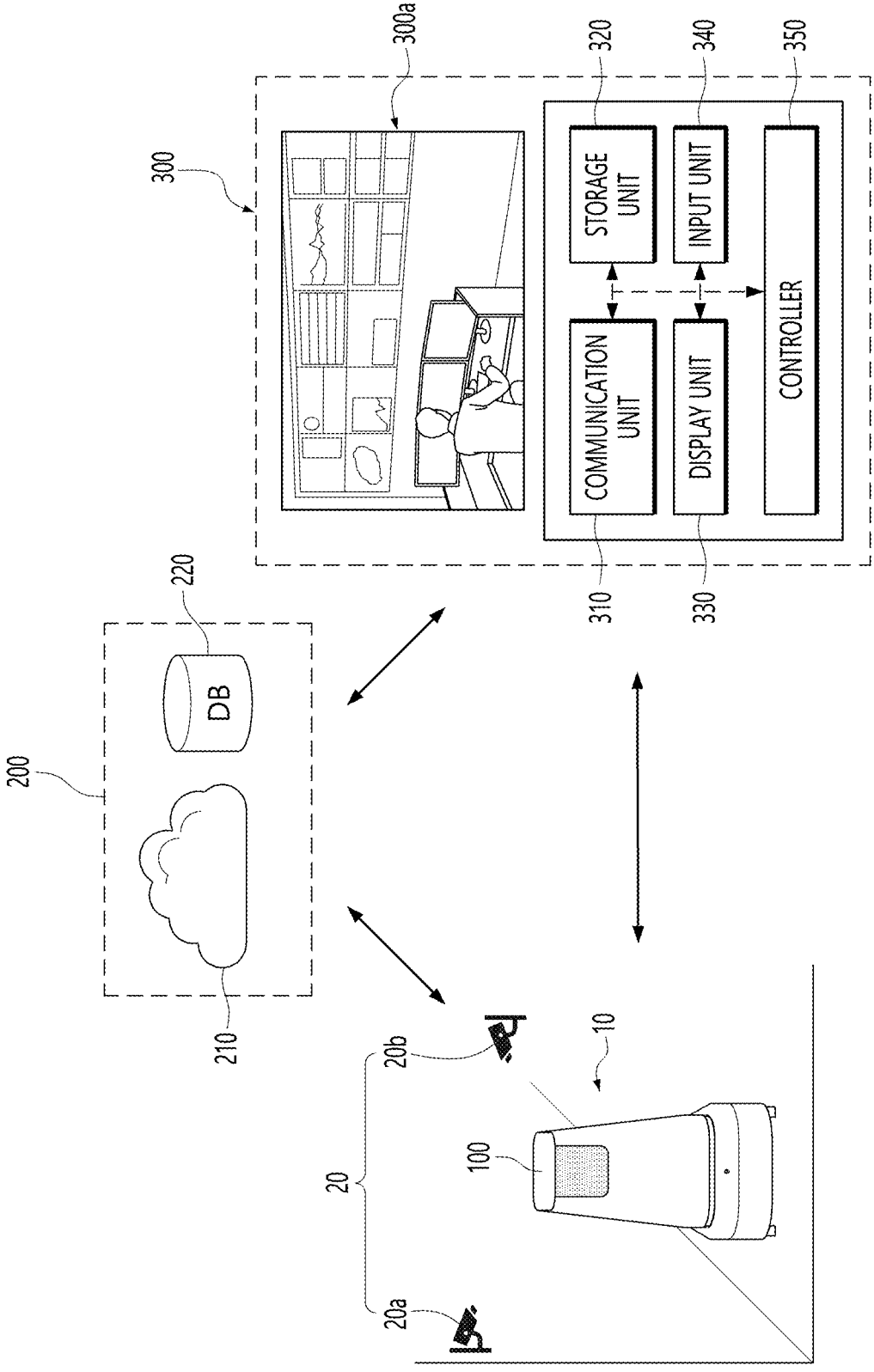

300
300a
320
340
350
STORAGE UNIT
INPUT UNIT
CONTROLLER
COMMUNICATION UNIT
DISPLAY UNIT
310
330
200
220
DB
210
10
20
20b
20a
100

FIG. 3B

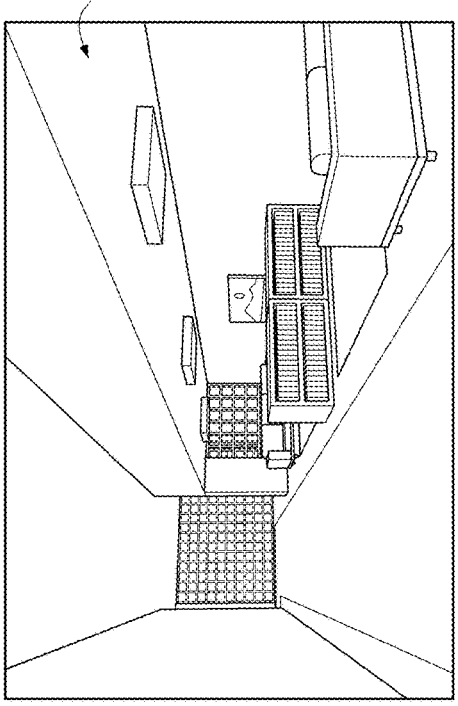


FIG. 3C

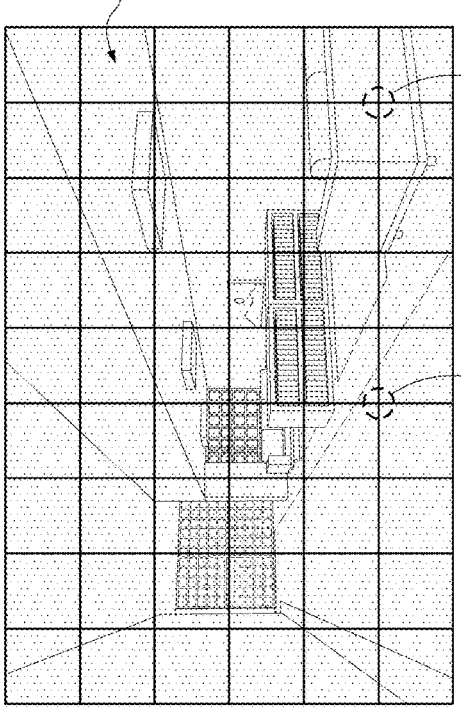


FIG. 3A

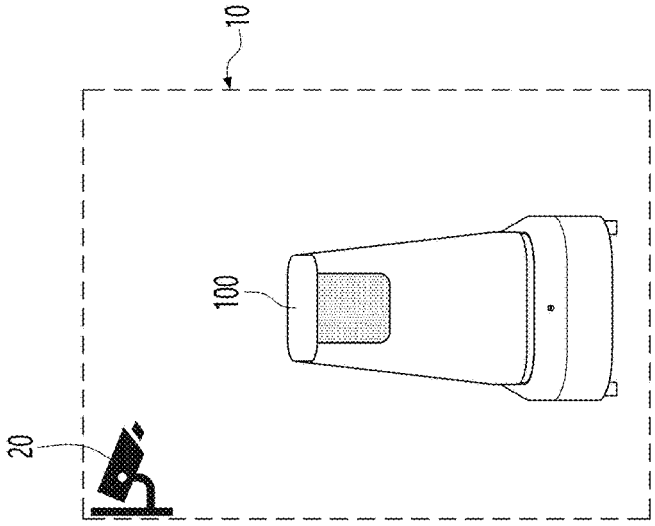


FIG. 4A

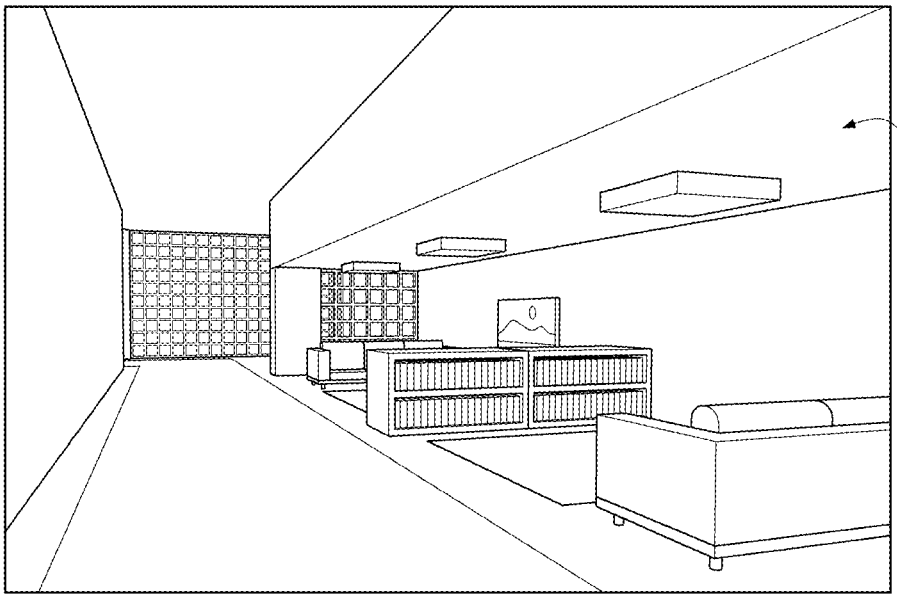


FIG. 4B

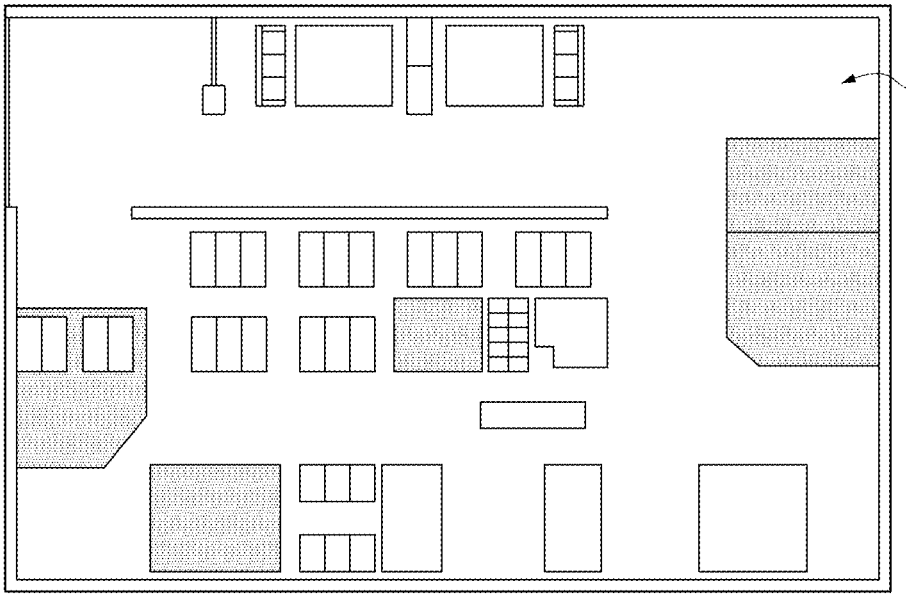


FIG. 5

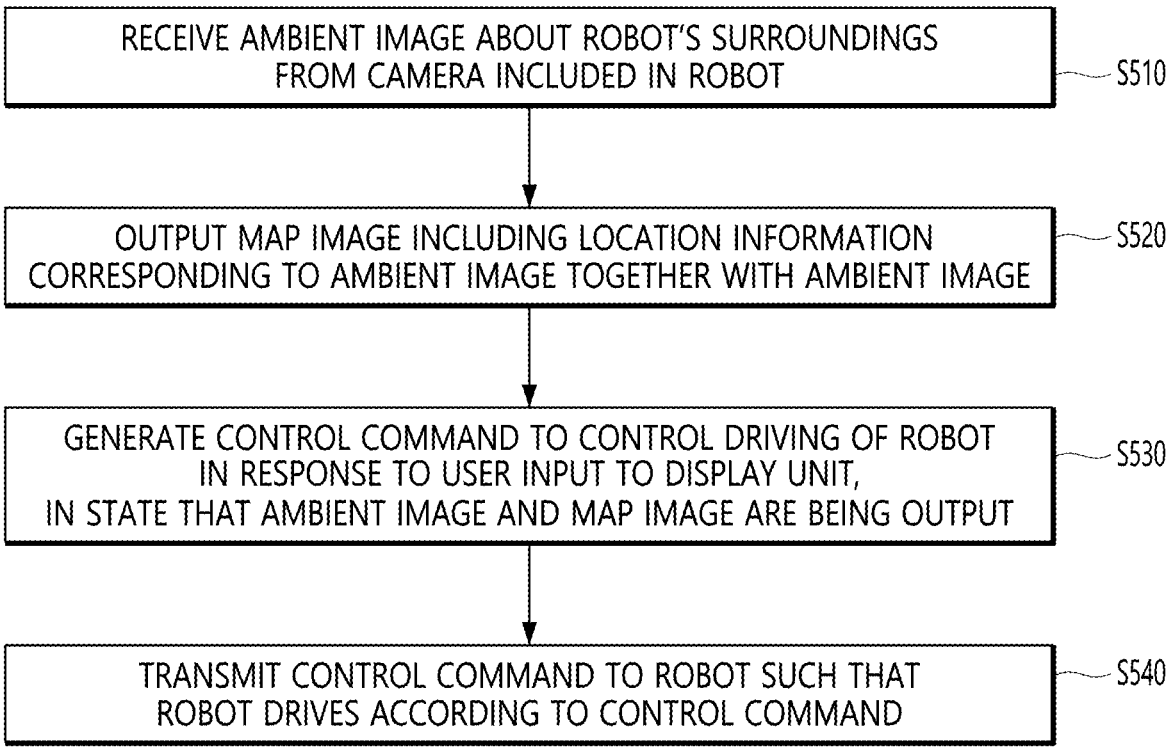

RECEIVE AMBIENT IMAGE ABOUT ROBOT'S SURROUNDINGS FROM CAMERA INCLUDED IN ROBOT
S510
OUTPUT MAP IMAGE INCLUDING LOCATION INFORMATION CORRESPONDING TO AMBIENT IMAGE TOGETHER WITH AMBIENT IMAGE
S520
GENERATE CONTROL COMMAND TO CONTROL DRIVING OF ROBOT IN RESPONSE TO USER INPUT TO DISPLAY UNIT, IN STATE THAT AMBIENT IMAGE AND MAP IMAGE ARE BEING OUTPUT
S530
TRANSMIT CONTROL COMMAND TO ROBOT SUCH THAT ROBOT DRIVES ACCORDING TO CONTROL COMMAND
S540

FIG. 6A

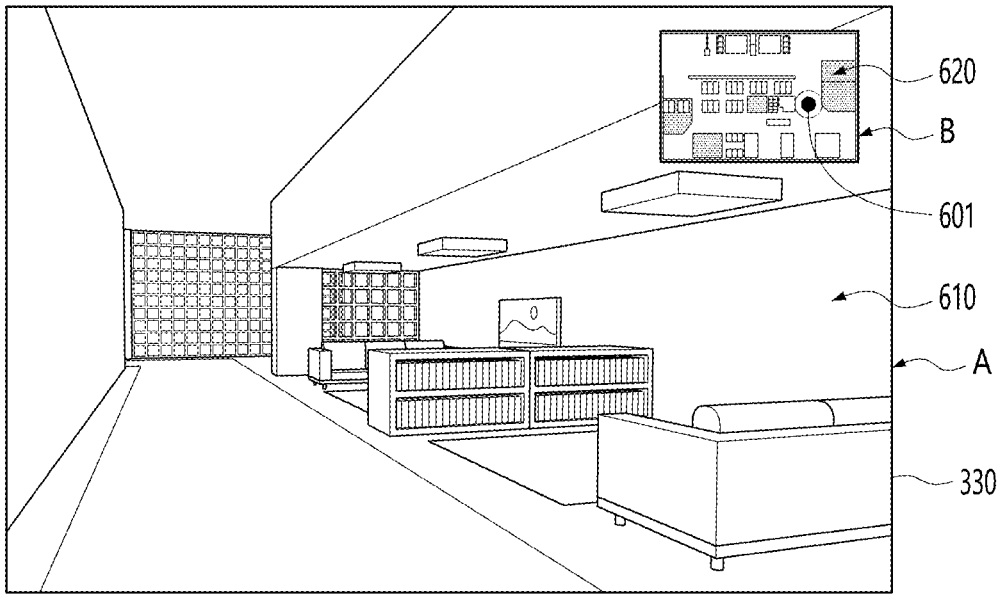
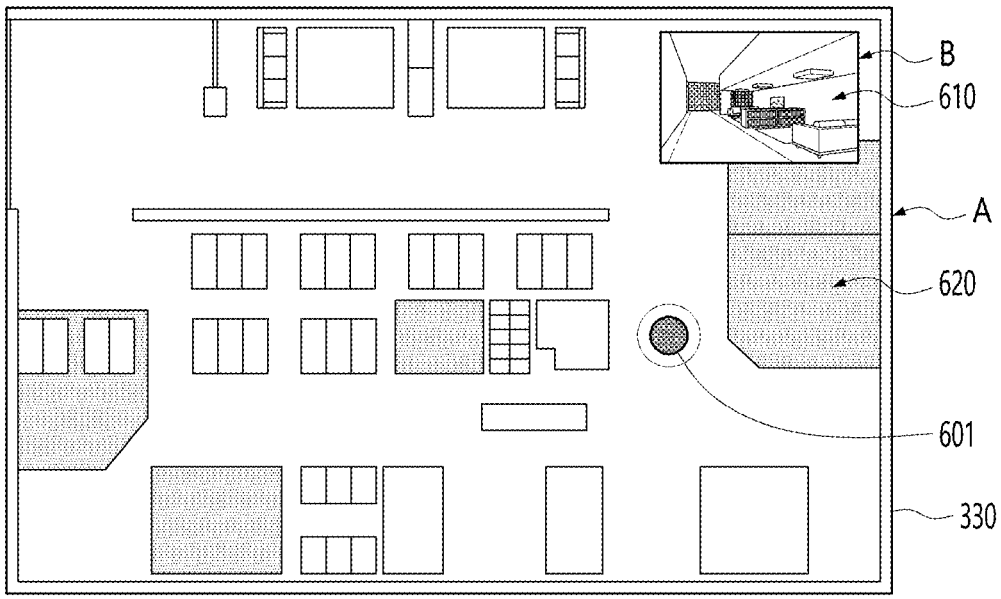


FIG. 6B



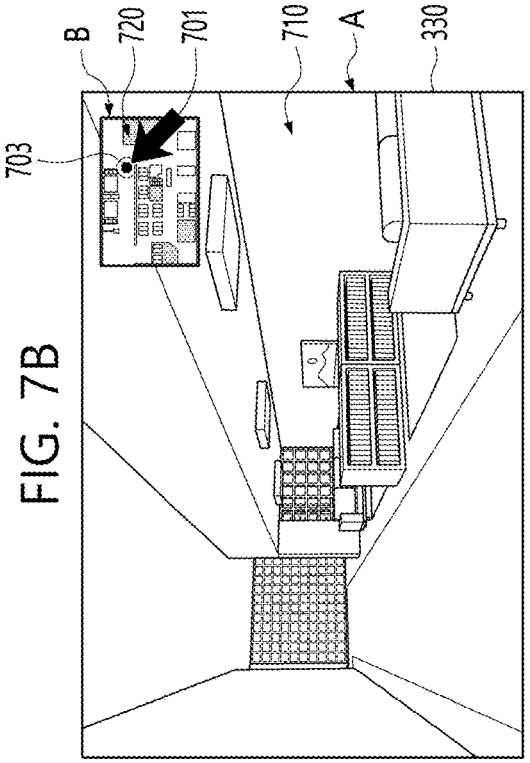


FIG. 7B

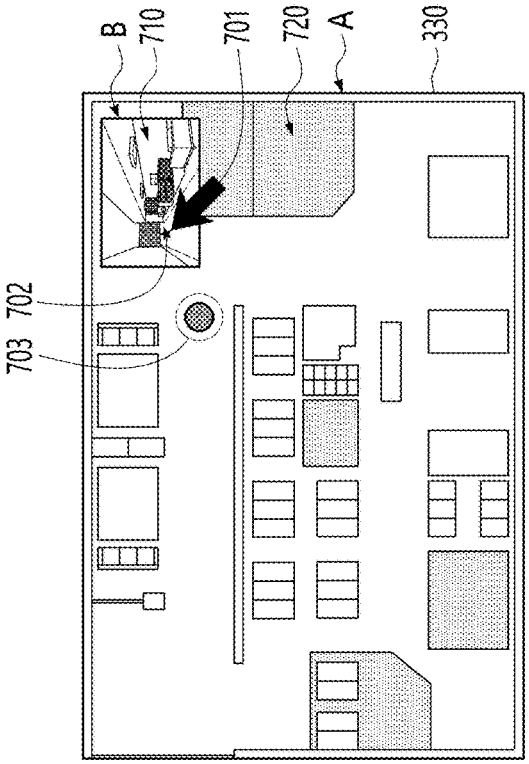


FIG. 7D

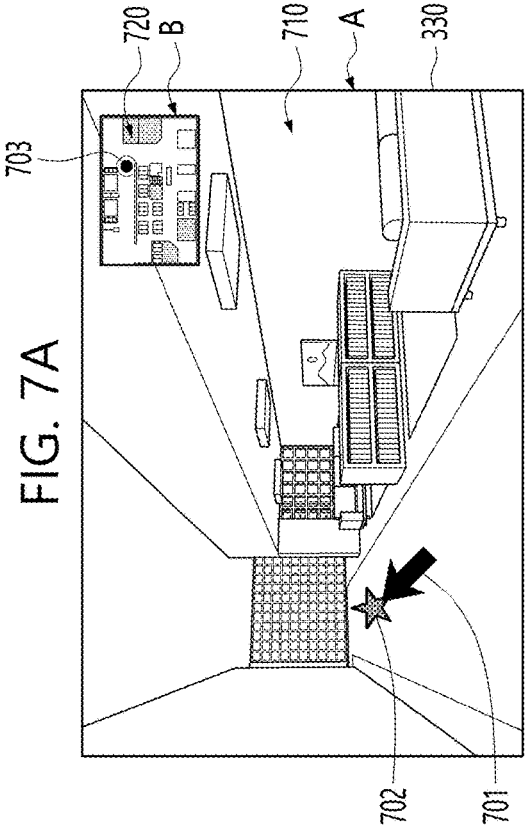


FIG. 7A

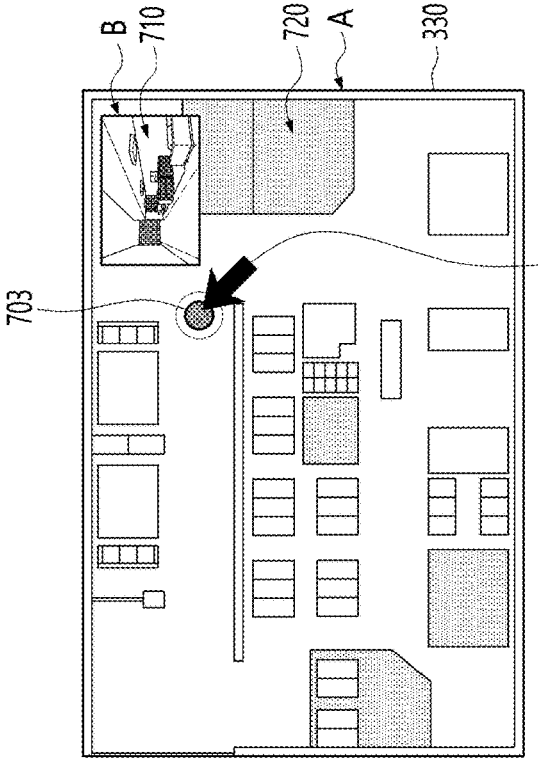


FIG. 7C

FIG. 8A

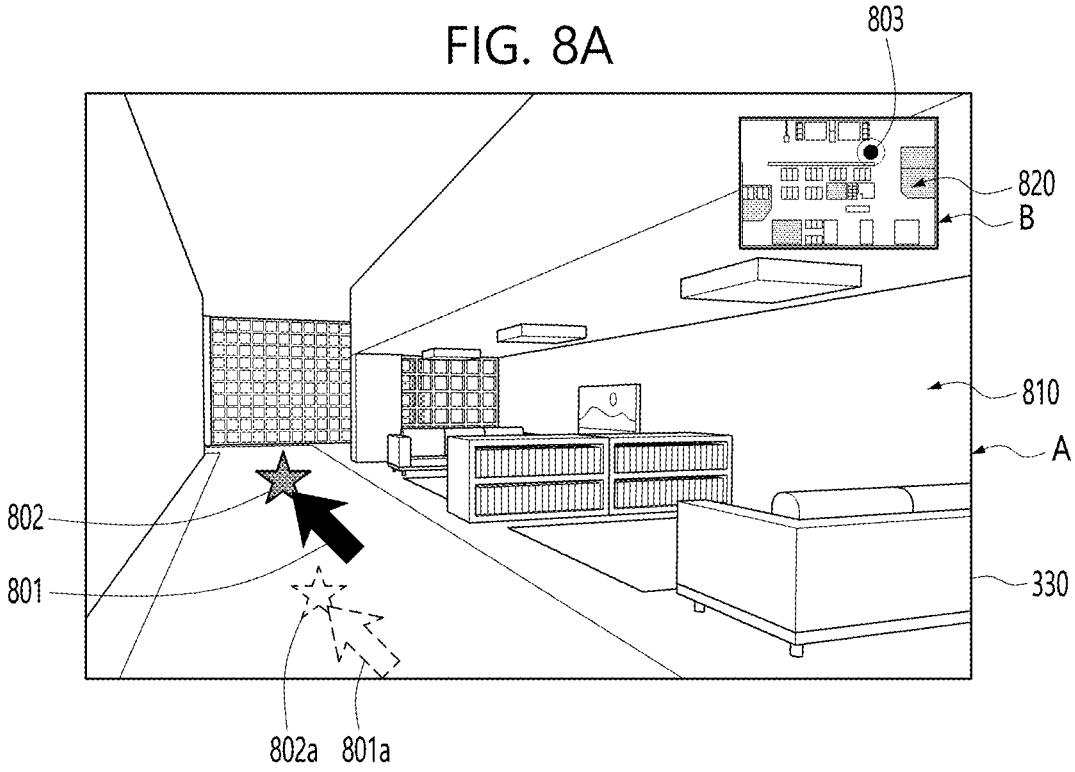


FIG. 8B

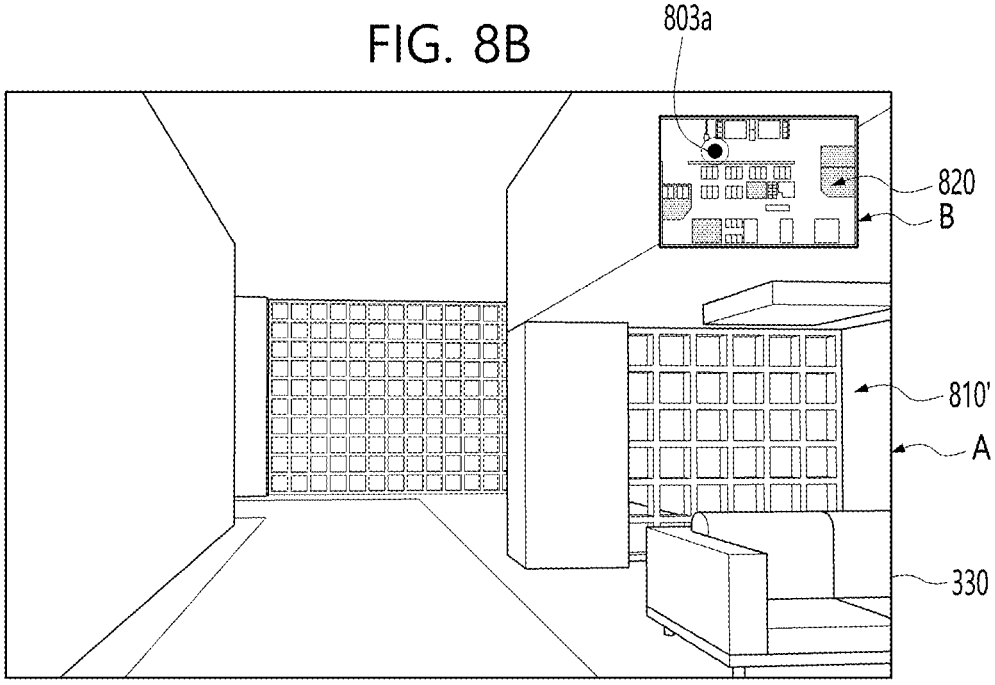


FIG. 8C

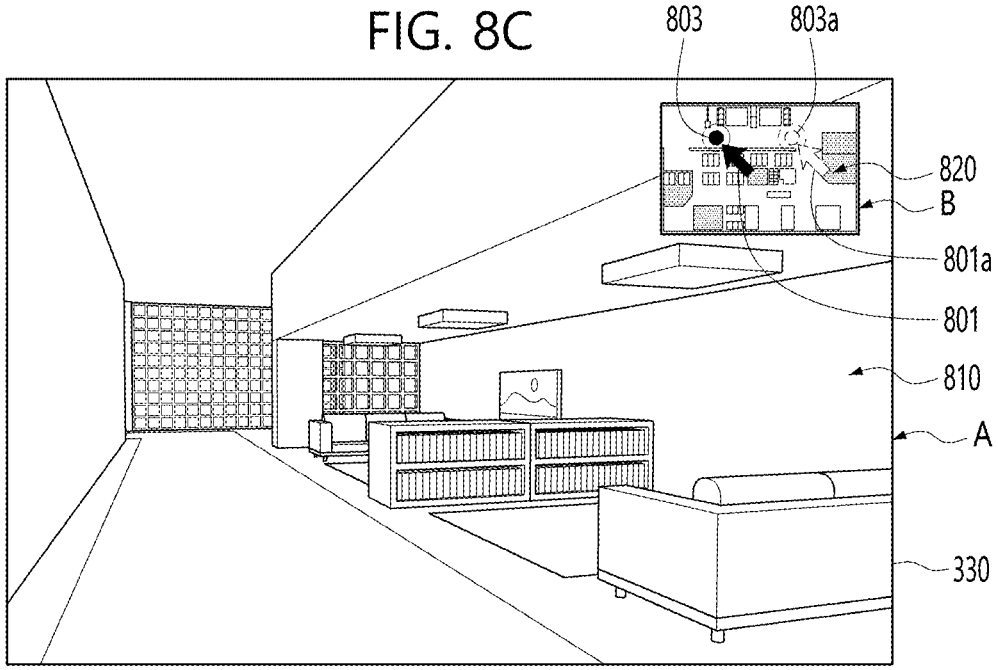


FIG. 8D

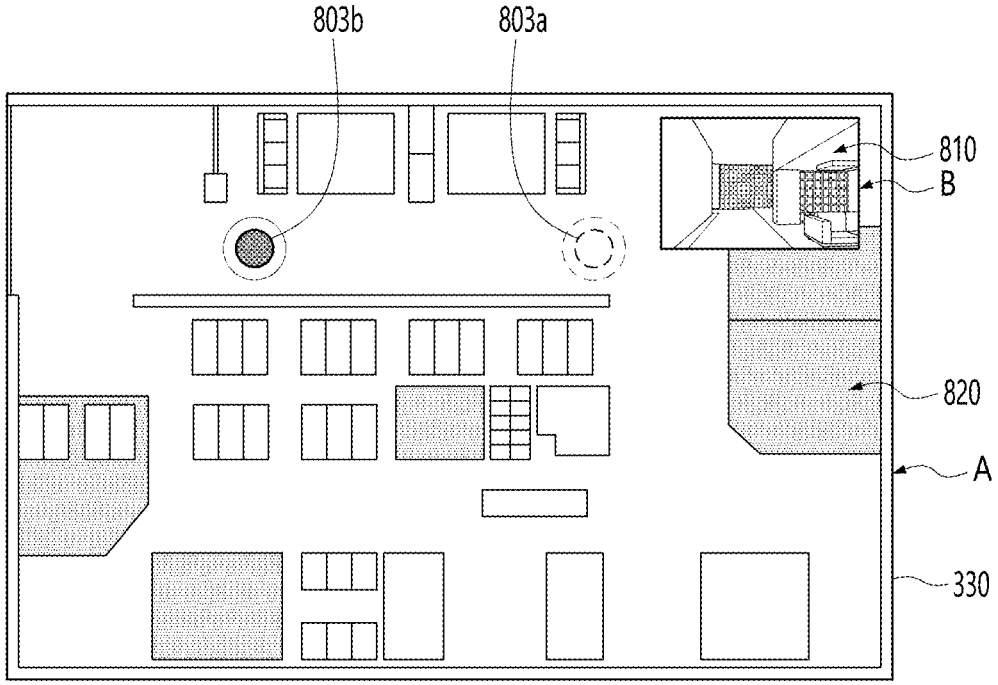


FIG. 9A

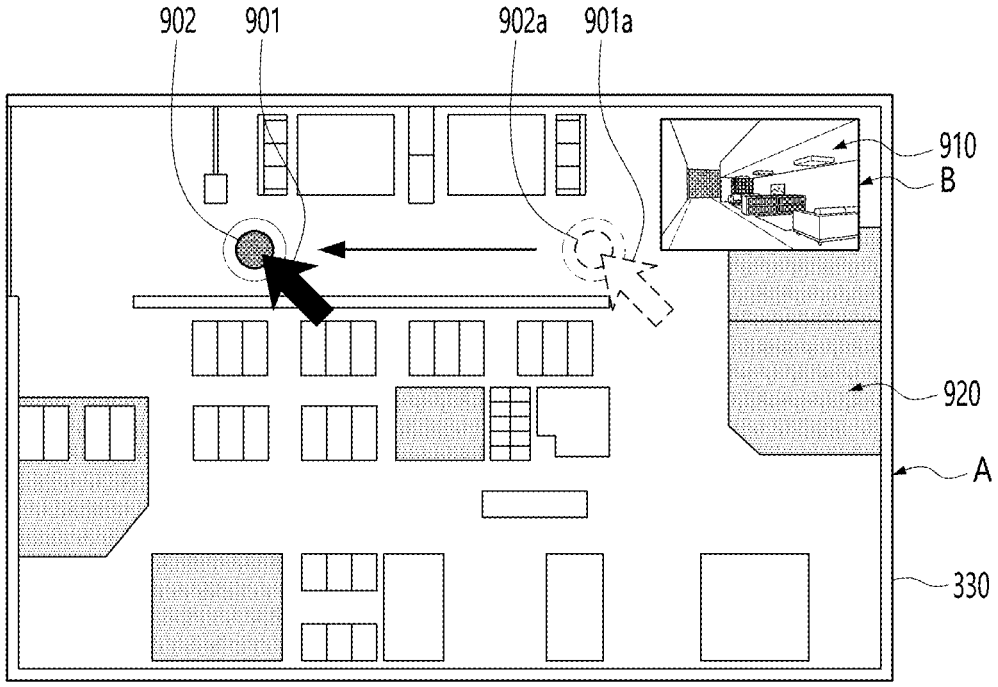


FIG. 9B

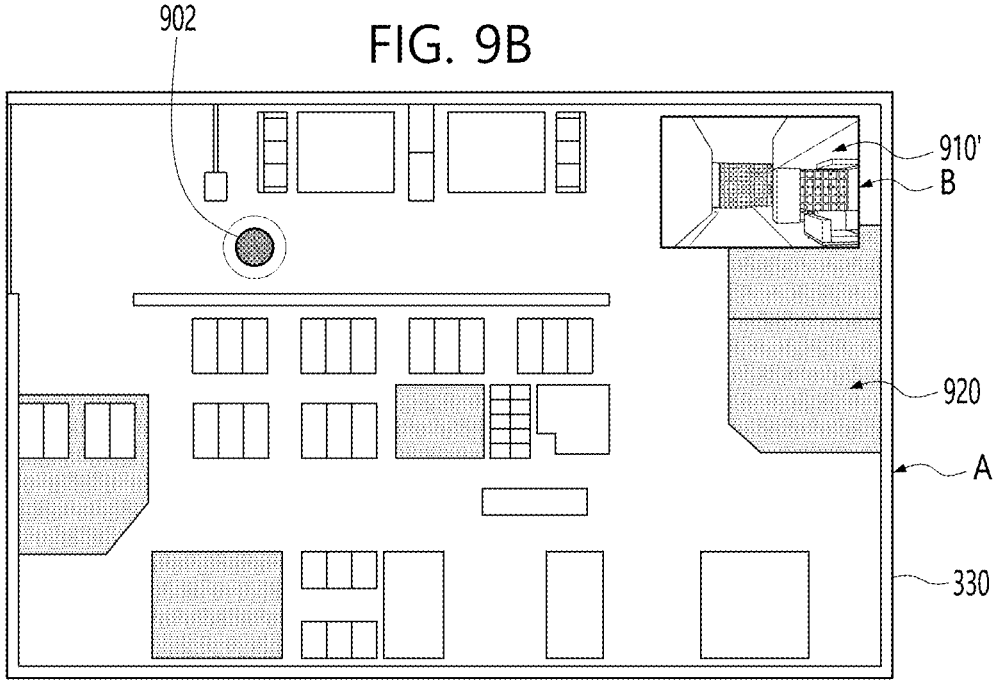


FIG. 9C

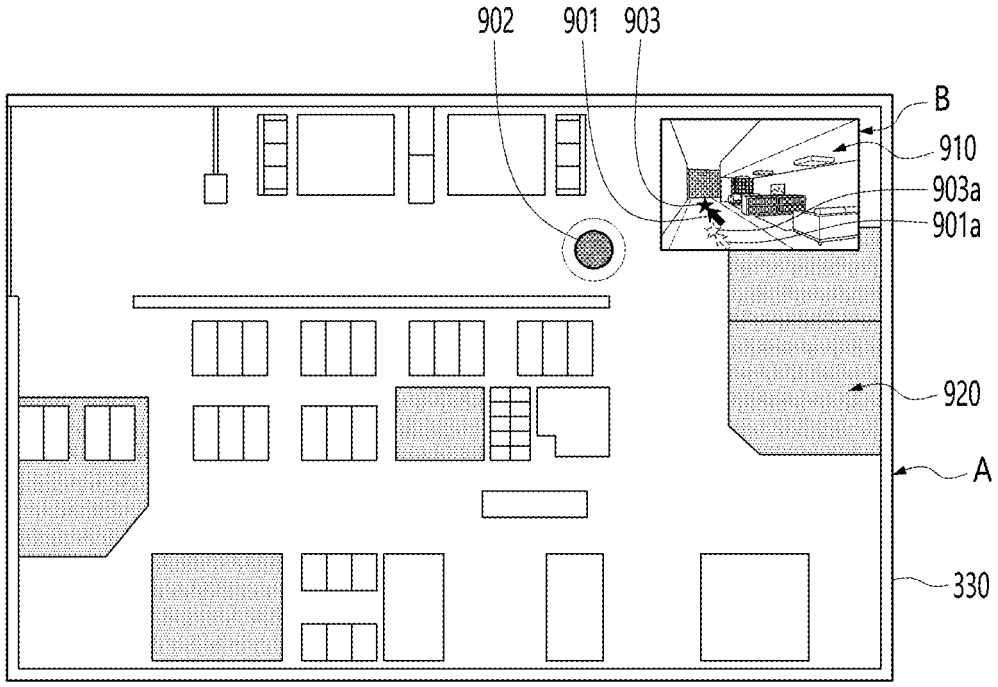


FIG. 9D

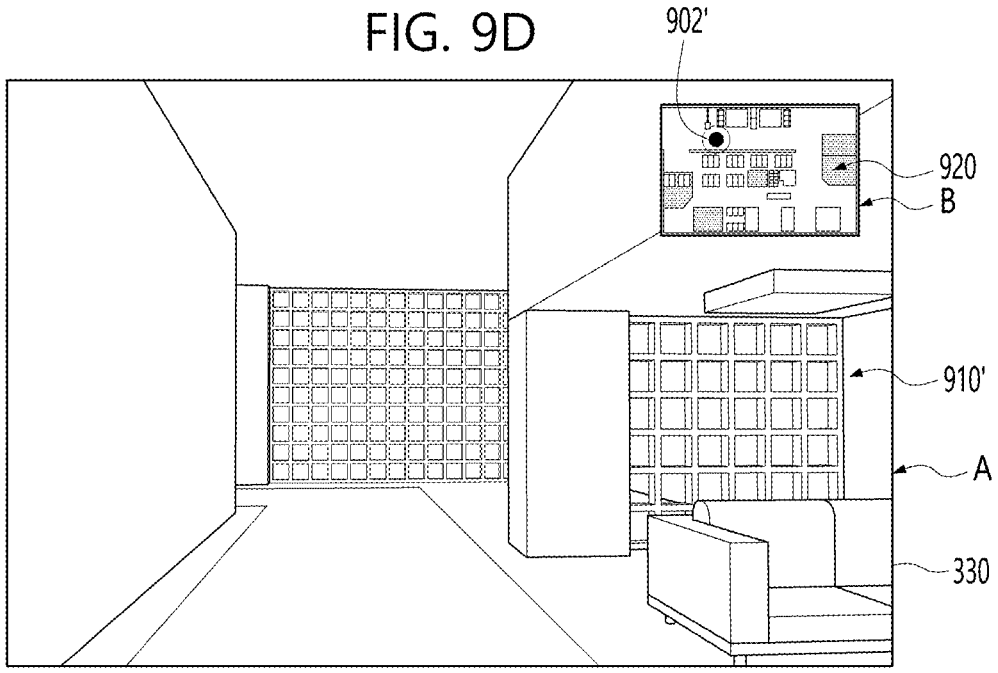


FIG. 10

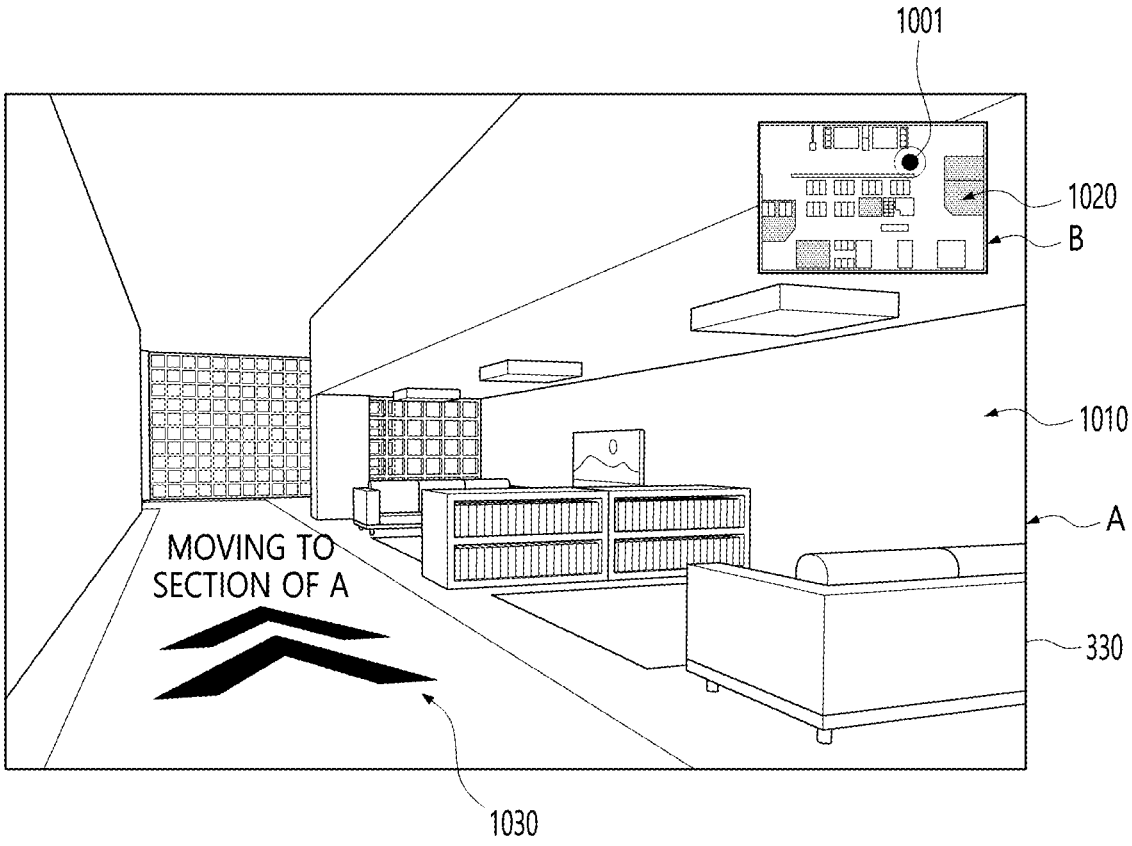


FIG. 11

INPUT TYPE	INPUT FEATURE	DRIVING ATTRIBUTES
DRAG	LENGTH	MOVING DISTANCE
	SPEED	MOVING SPEED
	DIRECTION	MOVING DIRECTION
	LENGTH + SPEED	MOVING DISTANCE + MOVING SPEED
	LENGTH + DIRECTION	MOVING DISTANCE + MOVING DIRECTION
	SPEED + DIRECTION	MOVING SPEED + MOVING DIRECTION
CLICK	INTERVAL	MOVING DISTANCE
	NUMBER OF TIMES	MOVING SPEED
	LOCATION	MOVING DIRECTION
	INTERVAL + NUMBER OF TIMES	MOVING DISTANCE + MOVING SPEED
	INTERVAL + LOCATION	MOVING DISTANCE + MOVING DIRECTION
	NUMBER OF TIMES + LOCATION	MOVING SPEED + MOVING DIRECTION

REMOTE CONTROL METHOD AND SYSTEM FOR ROBOT

CROSS-REFERENCE TO RELATED APPLICATION

[0001] Pursuant to 35 U.S.C. § 119(a), this application claims the benefit of earlier filing date and right of priority to Korean Application No. 10-2020-0094178, filed on Jul. 29, 2020, the contents of which is incorporated by reference herein in its entirety.

BACKGROUND

1. Technical Field

[0002] Some example embodiments relate to a control method and system for a robot, and particularly, to a control method and system for a robot capable of remotely controlling navigation of a robot.

2. Background

[0003] As technology advances, various service devices emerge, especially in recent years, technology development for robots that perform various tasks or services is actively ongoing.

[0004] Furthermore, recently, as artificial intelligence technologies and cloud technologies have evolved, the utilization of robots is gradually increased.

[0005] On the other hand, in order to provide various tasks or services with robots, it is important to control the robot accurately. However, the desire for techniques to remotely manage and control robots become important gradually, as there are realistic limitations for users to perform a control over robots one by one therearound.

[0006] For example, a technique is used to remotely manage and control a robot by providing cameras around the robot, acquiring images around the robot, and using the acquired images.

[0007] However, when the surroundings of the robot are identified only by the cameras provided at the robot, location information indicating where the robot is located may not be accurately identified. Therefore, a control system that may more intuitively provide location information and surrounding environment information of the robot would be desirable.

SUMMARY

[0008] Therefore, an aspect of the detailed description is to provide a remote control method and system for a robot. More specifically, some example embodiments provide a remote control method and system for a robot, capable of remotely controlling navigation of a robot more intuitively.

[0009] Furthermore, some example embodiments provide a remote control method and system for a robot, capable of remotely controlling a robot by considering surrounding environment of the robot and a current location of the robot.

[0010] In addition, some example embodiments provide a remote control method and system for a robot, capable of providing a user experience to intuitively control an interface for controlling a robot.

[0011] To achieve these and other advantages and in accordance with some example embodiments, as embodied and broadly described herein, there is provided a remote control method for a robot, including outputting both a map image and an ambient image to a display, the map image including location information corresponding to the ambient image, the ambient image being of surroundings of a robot, and the ambient image being received from a camera at the robot, generating a control command for controlling the robot in response to an input to the display during the outputting, and causing the robot to drive according to the control command by transmitting the control command to the robot.

[0012] To achieve these and other advantages and in accordance with some example embodiments, as embodied and broadly described herein, there is also provided a remote control system for a robot, including a display, a communication unit configured to receive an ambient image from a camera provided at a robot, the ambient image being of surroundings of the robot, and a controller configured to control the display to output both a map image and the ambient image, the map image including location information corresponding to the ambient image, generate a control command for controlling the robot in response to an input while the display outputs both the map image and the ambient image, and cause the robot to drive according to the control command by controlling the communication unit to transmit the control command to the robot.

[0013] As described above, the remote control method and system according to some example embodiments may provide a map image containing information on the location where the robot is located together with images received from the robot. Through this, the remote control method and system for a robot according to some example embodiments may provide a user experience that may comprehensively provide environmental information surrounding the robot under remote control situations. Therefore, users who remotely control the robot may perform more accurate control of the robot, taking into account its surroundings when remotely controlling the robot.

[0014] Furthermore, the remote control method and system according to some example embodiments may provide a user experience that may perform control over the display area together as well as control over the robot based on the user input for remote control of the robot. Therefore, users who remotely control the robot may perform tasks more easily and intuitively, depending on the situation, by performing control of the robot and control over the display area with one control command.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIGS. **1** and **2** are conceptual views illustrating a remote control method and system for a robot according to some example embodiments.

[0016] FIGS. **3**A, **3**B, **3**C, **4**A and **4**B are conceptual views illustrating a method to estimate a current location of a robot based on images collected by the robot, in the remote control method and system for a robot according to some example embodiments.

[0017] FIG. **5** is a flowchart illustrating a remote control method for a robot according to some example embodiments.

[0018] FIGS. **6**A, **6**B, **7**A, **7**B, **7**C, **7**D, **8**A, **8**B, **8**C, **8**D, **9**A, **9**B, **9**C, **9**D and **10** are conceptual views illustrating a method to remotely control a robot in the remote control method and system for a robot according to some example embodiments.

[0019] FIG. **11** is a conceptual view for explaining control commands for remotely controlling a robot in the remote control method and system for a robot according to some example embodiments.

DETAILED DESCRIPTION

[0020] Description will now be given in detail according to some example embodiments disclosed herein, with reference to the accompanying drawings. For the sake of brief description with reference to the drawings, the same, similar or equivalent components may be provided with the same or similar reference numbers, and description thereof will not be repeated. In general, a suffix such as "module" and "unit" may be used to refer to elements or components. Use of such a suffix herein is merely intended to facilitate description of the specification, and the suffix itself is not intended to give any special meaning or function. In some example embodiments, that which is well-known to one of ordinary skill in the relevant art has generally been omitted for the sake of brevity. The accompanying drawings are used to help easily understand various technical features and it should be understood that some example embodiments presented herein are not limited by the accompanying drawings. As such, some example embodiments should be construed to extend to any alterations, equivalents and substitutes in addition to those which are particularly set out in the accompanying drawings.

[0021] It will be understood that although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are generally only used to distinguish one element from another.

[0022] It will be understood that when an element is referred to as being "connected with" another element, the element may be connected with the other element or intervening elements may also be present. In contrast, when an element is referred to as being "directly connected with" another element, there are no intervening elements present.

[0023] A singular representation may include a plural representation unless it represents a definitely different meaning from the context.

[0024] Terms such as "include" or "has" are used herein and should be understood that they are intended to indicate an existence of features, numbers, operations, functions, several components, or combinations thereof, disclosed in the specification, and it is also understood that greater or fewer features, numbers, operations, functions, several components, or combinations thereof may likewise be utilized.

[0025] Some example embodiments provide a remote control method and system for a robot, and more particularly, provides a method and system that remotely controls navigation of a robot more intuitively. Hereinafter, a space where a robot drives and a robot remote control system surrounding the space will be described, with reference to the accompanying drawings. FIGS. **1** and **2** are conceptual views illustrating a remote control method and system for a robot according to some example embodiments.

[0026] As shown in FIG. **1**, as technology advances, the utilization of robots is gradually increasing. Robots have traditionally been used in special industries (e.g., industrial automation related fields), but are increasingly transformed into service robots that may perform useful tasks for humans or facilities.

[0027] A robot capable of providing such diverse services may be configured to drive in the space **10**, as shown in FIG. **1**, to perform assigned tasks. There is no limit in the type of space in which the robot drives, and it may be made to drive at least one of indoor and/or outdoor spaces. For example, indoor spaces may be a variety of spaces, such as department stores, airports, hotels, schools, buildings, subway stations, train stations and/or bookstores. Thus, the robot may be arranged in various spaces to provide useful services to humans.

[0028] In order to provide a variety of services using a robot, accurate control of the robot is an important factor. Thus, some example embodiments provide a method to remotely and more accurately control the robot using a camera provided at the robot and a map image for the space. The robot according to some example embodiments may be referred to variously, for instance, as an unmanned moving machine, an autonomous moving machine, etc.

[0029] As shown in FIG. **1**, a camera **20** may be placed in the space **10** where the robot **100** is located. As shown, the number of the camera **20** placed in the space **10** is unlimited. Multiple cameras **20***a*, **20***b* and **20***c* may be placed in the space **10**, as shown. The type of the cameras **20** placed in the space **10** may vary, and in some example embodiments, a closed circuit television (CCTV) placed in the space **10** may be utilized.

[0030] As shown in FIG. **2**, some example embodiments allow a robot remote control system **300** to remotely control navigation of the robot **100**.

[0031] As shown in FIG. **2**, the robot remote control system **300** according to some example embodiments may include at least one of a communication unit **310**, a storage unit **320**, a display unit **330** (also referred to herein as a "display"), an input unit **340**, and/or a controller **350**.

[0032] The communication unit **310** may be configured to communicate with a variety of devices placed in the space **10**, in a wireless and/or wired manner. The communication unit **310** may communicate with the robot **100** as shown in the drawings. The communication unit **310** may be configured to communicate with the robot **100** to receive images captured from a camera provided at the robot **100**.

[0033] Furthermore, the communication unit **310** may perform direct communication with the camera **20** placed in the space **10**. Furthermore, the communication unit **310** may be configured to communicate with an image control system that controls the camera **20**.

[0034] Furthermore, the communication unit **310** may be configured to communicate with at least one external server (or external storage unit **200**). The external server **200** may be configured to include at least one of a cloud server **210** and/or a database **220** as shown. The external server **200** may be configured to perform at least a part of the controller **350**. In other words, performance such as data processing or data computation may be performed on the external server **200** (instead of or in addition to on the controller **350**), and some example embodiments do not impose any particular restrictions on this approach.

[0035] The communication unit **310** may support a variety of communication methods according to communication standards of devices with which it communicates.

[0036] For instance, the communication unit **310** may be configured to communicate with a device (including a cloud server) located in and out of the space **10**, using at least one of WLAN(Wireless LAN), Wi-Fi(Wireless-Fidelity) Direct,

DLNA(Digital Living Network Alliance), WiBro(Wireless Broadband), WiMAX(World Interoperability for Microwave Access), HSUPA(High Speed Uplink Packet Access), LTE(Long Term Evolution-Advanced), 5G(5th Generation Mobile Telecommunication), Bluetooth™, RFID(Radio Frequency Identification), Infrared Data Association; IrDA, UWB(Ultra-Wideband), ZigBee, NFC(Near Field Communication), and/or Wireless USB(Wireless Serial Bus).

[0037] The storage unit **320** may be configured to store various information. In some example embodiments, the storage unit **320** may be provided at the robot remote control system **300** itself. In contrast, at least a part of the storage unit **320** may mean at least one of the cloud server **210** and/or the database **220**. That is, it may be understood that the storage unit **320** is sufficient if information used for robot remote control according to some example embodiments is stored, and there is no constraint on physical space. Thus, the storage unit **320**, the cloud server **210** and/or the database **220** may not be separately identified, but all of them may be described as the storage unit **320**. The cloud server **210** may mean "cloud storage".

[0038] First, information on the robot **100** may be stored in the storage unit **320**.

[0039] Information about the robot **100** may vary widely and may include, for example, i) identification information (for instance, serial numbers, TAG information, Quick Response (QR) code information, and etc.) for identifying the robot **100** placed in the space **10**, ii) task information assigned to the robot **100**, iii) navigation path information set to the robot **100**, iv) location information of the robot **100**, v) status information of the robot **100** (for example, a power condition, presence of a malfunction, a battery condition, etc.), vi) image information received from the camera provided at the robot **100**, etc.

[0040] In the storage unit **320**, a map (or map information) for the space **10** may be stored. The map may be configured as at least one of a two dimensional map and/or a three dimensional map. The map for the space **10** may mean a map which may be utilized to grasp (check, determine, etc.) a current location of the robot **100**, and/or to establish the robot's navigation path.

[0041] In particular, in the remote control system **300** according to some example embodiments, it is possible to grasp a location of the robot **100** based on images received from the robot **100**. To this end, a map for the space **10** stored in the storage unit **320** may consist of data that allows location estimation based on images.

[0042] The map for the space **10** may be a map preset or alternatively, given based on Simultaneous Localization and Mapping (SLAM) by at least one robot moving in the space **10**. The map for the space **10** may be represented as a map image.

[0043] In addition to the types of information listed above, various information may be stored in the storage unit **320**.

[0044] The display unit **330** may be configured to output at least one of an image received from the camera provided at (e.g., on) the robot **100** and/or a map image of the space **10**. The display unit **330** may be equipped in a device of a manager who manages the robot **100** remotely, and may be installed in a remote control room **300***a* as shown in FIG. **2**. Alternatively, the display unit **330** may be a display equipped in a mobile device. As such, some example embodiments do not have any restrictions on the type of the display unit.

[0045] The input unit **340** is for inputting information from a user (or a manager), which may be a medium between the user (or the manager) and the robot remote control system **300**. More specifically, the input unit **340** may mean an input means of receiving a control command for remotely controlling navigation of the robot **100** from the user.

[0046] There may be no specific restrictions on the type of the input unit **340**, and the input unit **340** may include at least one of a mechanical input means (or mechanical keys, e.g., a mouse, a joystick, physical buttons, a dome switch, a jog wheel, a jog switch, etc.) and/or a touch-type input means. For example, the touch-type input means may be a virtual key, a soft key, or a visual key that is displayed on a touch screen through software processing, or may be a touch key that is placed outside the touch screen. The virtual key or the visual key may be displayed on the touch screen in various forms, for example, graphics, texts, icons, videos, or a combination thereof. When the input unit **340** includes a touch screen, the display unit **330** may be configured as a touch screen. In this instance, the display unit **330** may perform both a role of outputting information and a role of receiving information.

[0047] The controller **350** may be configured to control the overall operations of the robot remote control system **300**. The controller **350** may process signals, data, information, etc. that are input or output through the components shown above (e.g., the communication unit **310**, the storage unit **320**, the display unit **330** and/or the input unit **340**), or provide or process appropriate information or functions to the user.

[0048] In particular, the controller **350** may be configured to remotely control the robot **100** using an image received from the camera provided at the robot **100**, and a map image about the space **10**. For intuitive remote control of the robot **100**, the controller **350** may extract location information where the robot **100** is located in the space from an image received from the camera provided at the robot **100**. In addition, the controller **350** may extract a map image corresponding to the location information of the robot **100** extracted from the storage unit **320**. Furthermore, the controller **350** may control the display unit **330** to output the image and the map image together. In addition, the controller **350** may perform remote control over the robot **100**, based on a user input that is input to the display unit **330** via the input unit **340**.

[0049] Below, descriptions will be more specifically given of a method to estimate the current location of the robot **100** and to specify a map image based on the image received from the robot **100** with the accompanying drawings. FIGS. **3**A, **3**B, **3**C, **4**A and **4**B are conceptual views illustrating a method to estimate the current location of the robot based on images collected from the robot.

[0050] As described above, the controller **350** according to some example embodiments may be configured to, using the camera (not shown) provided at the robot **100** (e.g., a camera on the robot **100** and/or a camera nearby the robot **100**), receive images about the space **10** and to perform Visual Localization to estimate the robot's location from the received images. Referring to FIG. **3**A, the camera provided at the robot **100** may be configured to capture (or sense) images about the space **10**, e.g., images around the robot **100**. Hereinafter, for convenience of explanation, images

acquired using the camera provided at the robot **100** may be referred to as "ambient images".

[0051] The controller **350** may be configured to acquire am ambient image **410** through the camera provided at the robot **100** as shown in FIG. **3**B. In addition, the controller **350** may estimate the current location of the robot **100** based on the acquired ambient image **410**.

[0052] The controller **350** may compare the ambient image **410** with the map information stored in the storage unit **320** to extract location information corresponding to the current location of the robot **100**, as shown in FIG. **3**C.

[0053] As described above, the map for the space **10** according to some example embodiments may be a map preset or alternatively, given based on Simultaneous Localization and Mapping (SLAM) by at least one robot moving in the space **10**. Specifically, the map for the space **10** may be a map generated based on image information.

[0054] In other words, the map for the space **10** may be a map generated by a vision (or visual)-based SLAM technology.

[0055] Thus, the controller **350** may specify coordinate information (e.g., section of B on the third floor (3,1,1)), section of B on the third floor (7, 1, 1)) with respect to the ambient image acquired from the robot **100**, as shown in FIG. **3**C. As such, the specific coordinate information may become the current location information of the robot **100**.

[0056] Here, the controller **350** may estimate the current location of the robot **100** by comparing the ambient image **410** acquired from the robot **100** with the map generated by the vision (or visual)-based SLAM technology. In this case, the controller **350** may i) specify an image most similar to the ambient image **410** by using image comparison between the ambient image **410** and images that constitute the pre-generated or generated map, and ii) specify location information of the robot **100** by acquiring location information that is matched with the specified image.

[0057] As such, the controller **350** may specify the current location of the robot by using the ambient image **410** acquired from the robot **100**, as shown in FIG. **4**A. As described above, the controller **350** may extract location information (e.g., coordinate information) corresponding to the ambient image **410**, from the map information stored in the storage unit **320** (e.g., may be also referred to as a "reference map").

[0058] In addition, the controller **350** may specify a map image **420** corresponding to the extracted location information, as shown in FIG. **4**B. The map image, in some example embodiments, which consists of a two-dimensional image or a three-dimensional image, may be configured as an image which visualizes the space **10** where the robot is located. The map image may be made to contain location information corresponding to the ambient image **410** acquired from the robot **100**.

[0059] The map image may be in a variety of forms, and may be configured as an image substantially acquired from the camera. In this case, the map image may be constructed by using at least one of an image acquired from the camera **20** placed in the space **10** and/or an image acquired from the robot **100**.

[0060] In contrast, the map image may consist of an image that reduces the space **10** to a certain scale, rather than an image acquired from the camera. The map image may be an image configured to contain some information on the space **10**, rather than all the real objects that constitute the space **10**. Some information on the space **10**, may be used to determine navigation and a path of the robot **100**, may include column information, ceiling information, wall information, space separation information, and/or information on furniture placed in the space **10**.

[0061] In some example embodiments, the controller **350** may output the map image corresponding to the space in which the robot is located, as well as the ambient image **410** acquired by the robot itself, for remote control of the robot **100**. Therefore, some example embodiments allow a manager who remotely controls the robot **100**, to perform remote control over the robot **100**, by considering the space in which the robot **100** is located, as well as the ambient image acquired from the robot **100**.

[0062] When outputting the map image to the display unit **330**, the controller **350** may control an output magnification of the map image **420** so as to provide information about the space **10** at a different magnification from the ambient image **410** of the robot **100**. In other words, the controller may control the output magnification of the map image **420** so as to provide information about the space **10** at a wider angle of view than the ambient image **410**. In this case, the user may consider information about the space **10** more comprehensively when remotely controlling the robot **100**.

[0063] In some example embodiments, the ambient image and the map image may be output together to the display unit **330**, and the robot **100** may be controlled remotely, based on a user input applied to at least one of the ambient image and the map image via the input unit **340**. In some example embodiments, user convenience may be enhanced by utilizing a control command for remotely controlling the robot **100** as a control command to control the display unit **330** as well as the robot **100**. According to some example embodiments, the robot **100** may include a communication unit to receive the control command from the robot remote control system **300**; a controller; and a driving unit to move under the control of the controller. The controller may determine a control instruction based on the control command (e.g., to effect movement of the robot to a position indicated by the control command), and control the driving unit to move the robot using the control instruction. According to some example embodiments, the driving unit may include a motor and/or servo connected to a power source. According to some example embodiments, the communication unit of the robot **100** may be the same as or similar to the communication unit **310**. According to some example embodiments, the controller **350** may cause the robot **100** to drive to a position corresponding to the control command by transmitting the control command to the robot **100**.

[0064] Below, detailed descriptions will be given with reference to the attached drawings. FIG. **5** is a flowchart illustrating a robot remote control method according to some example embodiments. In addition, FIGS. **6**A, **6**B, **7**A, **7**B, **7**C, **7**D, **8**A, **8**B, **8**C, **8**D, **9**A, **9**B, **9**C, **9**D, and FIG. **10** are conceptual views illustrating how to remotely control the robot in the robot remote control method and system according to some example embodiments. And FIG. **11** is a conceptual view for explaining a control command for remotely controlling the robot, in the robot remote control method and system according to some example embodiments.

[0065] First, in the robot remote control method according to some example embodiments, a process of receiving an

ambient image about the surroundings of the robot from the camera provided at the robot may be performed (S**510**).

[0066] The controller **350** may receive the ambient image from the robot **100** using the communication unit **310**. The robot **100** may be a robot which is a subject to remote control. Specifying the robot **100** which is a subject to remote control may be performed variously, and there is no concrete limitation in some example embodiments. In other words, once the robot which is a subject to be remotely controlled is specified in various ways, the controller **350** may receive the ambient image from the robot **100** which is a subject to remote control.

[0067] As such, when the ambient image is received from the robot **100**, the controller **350** may estimate the current location of the robot **100** by using the received ambient image. Through Visual Localization, the controller **350** may specify the current location of the robot **100**. The controller **350** may compare the ambient image with the map information stored in the storage unit **320**, thereby extracting location information corresponding to the current location of the robot **100** as shown in FIG. **3**C.

[0068] As described above, in some example embodiments, the map for the space **10** may be a map prepared in advance based on Simultaneous Localization and Mapping (SLAM) by at least one robot that moves in the space **10**, and may be a map generated based on image information. In other words, the map for the space **10** may be a map generated by vision (or visual)-based SLAM technology.

[0069] The controller **350** may estimate the current location of the robot **100** by comparing the ambient image obtained from the robot **100** with the map generated by the vision (or visual)-based SLAM technology. In this case, the controller **350** may specify the location information of the robot **100** by i) specifying an image most similar to the ambient image, using image comparison between the ambient image **410** with images that constitute the pre-generated or generated map, and ii) acquiring location information that is matched with the specified image. As such, the controller **350** may specify the robot's current location, by using the acquired ambient image **410** when the ambient image **410** is acquired from the robot **100**, as shown in FIG. **4**A. As noted earlier, the controller **350** may extract location information (e.g., coordinate information) corresponding to the ambient image **410**, from the map information stored in the storage unit **320** (e.g., may also be referred to as "reference map").

[0070] In addition, the controller **350** may specify a map image corresponding to the location information extracted by using the ambient image, as shown in FIG. **4**B, as previously described. In some example embodiments, the map image implemented as a two-dimensional image or a three-dimensional image may be configured as an image to visualize the space **10** where the robot is located. The map image may be made to contain location information corresponding to the ambient image **410** acquired from the robot **100**.

[0071] As described above, the controller **350** may specify the map image containing location information corresponding to the ambient image acquired from the robot **100**. The map image may be stored in the storage unit **320**.

[0072] The controller **350** may specify a location corresponding to coordinate information corresponding to image information, and may specify a map image corresponding to the location. The specific map image may correspond to at least a part of the entire map image for the space **10**. In other words, the controller **350** may extract a part containing a location corresponding to the ambient image from the entire map image for the space **10**, and specify the extracted part as a map image corresponding to the robot's current location **100**.

[0073] As such, in some example embodiments, when the current location of the robot **100** is specified, may be performed a process of outputting the map image containing location information corresponding to the ambient image, together with the ambient image acquired from the robot (S**520**).

[0074] More specifically, the controller **350** may control the display unit **330** to output an ambient image **610** and a map image **620** together, as shown in FIGS. **6**A and **6**B.

[0075] As shown in FIGS. **6**A and **6**B, the display unit **330** may include a main area (A) and a sub-area (B) that overlaps at least a part of the main area (A). On the display unit **330**, an area where visual information is displayed may be referred to as a "display area". In this case, the display area of the display unit **330** may be expressed to contain the main area (A) and the sub-area (B) that overlaps at least a part of the main area (A).

[0076] The position where the sub-area (B) overlaps the main area (A) may be changed based on a user input. Furthermore, of course, an output size of at least one of the main area (A) and the sub-area (B) may also be changed based on a user input.

[0077] In the above example, the case where the sub-area (B) is overlapped on the main area (A) was described, but some example embodiments are not limited to the above example. For example, the display unit **330** may be divided into multiple display areas, one of them may be the main area (A) and the other may be the sub-area (B). The main area (A) and the sub-area (B) may not overlap each other, or at least a part may overlap each other. In the some example embodiments, the size of the main area (A) may be larger than that of the sub-area (B).

[0078] For convenience of explanation, it may be explained in an example that the sub-area (B) overlaps at least a part of the main area (A). However, controls and interactions described below may also be applied to other screen configurations.

[0079] As described above, the display unit **330** may include the main area (A) and the sub-area (B), and in some example embodiments, one of an ambient image received from the robot **100** and/or a map image containing location information corresponding to the ambient image may be output to the main area (A) and the other may be output to the sub-area (B).

[0080] As shown in FIGS. **6**A and **6**B, the controller **350** may control the display unit **330** to output the ambient image **610** to one of the main area (A) and/or the sub-area (B), and to output the map image **620** to the other. For example, when the ambient image **610** captured from the robot **100** is output to the main area (A) as shown in FIG. **6**A, the map image **620** containing the location information corresponding to the ambient image may be output to the sub-area (B). Contrary to this, when the map image **620** containing the location information corresponding to the ambient image **610** is output to the main area (A) as shown in FIG. **6**B, the ambient image **610** captured by the robot **100** may be output to the sub-area (B).

[0081] Furthermore, a graphic object **601** representing a current location of the robot **100** may be further output to the

area where the map image **620** is output between the main area (A) and the sub-area (B) of the display unit **330**. In other words, the controller **350** may display information on a location of the robot **100** in a space corresponding to the map image **620**, by using the graphic object **601** such that the user remotely controls the robot **100** in an intuitive manner.

[0082] As such, the map image **620** output to the display unit **330** may contain the graphic object **601** representing the robot **100**. And, the graphic object **601** may be located in the area corresponding to the current location of the robot on the map image **620**.

[0083] When the robot **100** drives, the output location of the graphic object **601** on the map image **620** may change in conjunction with the navigation of the robot **100**. The controller **350** may control the display unit **330** to change the output location of the graphic object **601** according to a changed current location of the robot **100**, in a case that the current location of the robot **100** is changed. Thus, the user may intuitively grasp the location of the robot **100** in the space **10** through the location of the graphic object **601** on the map image **620**. The controller **350** may continuously track the location of the robot **100** from images received from the robot **100** by using visual localization, while the robot **100** drives.

[0084] While the ambient image and the map image are being output to the display unit **330**, when a user input to the display unit **330** is received, in some example embodiments, a process of generating a control command to control the robot's navigation may be performed (S**530**). In addition, in some example embodiments, a process of transmitting the control command to the robot **100** may be performed (S**540**) such that the robot **100** drives according to the control command. Upon receipt of the control command, the robot **100** may be controlled to drive according to the control command.

[0085] More specifically, as previously described, the user input may be applied through the input unit **340**. The type of the input unit **340** may be various, and the input unit **340** may include at least one of a mechanical input means (or mechanical keys, for example, a mouse, a joystick, physical buttons, a dome switch, a jog wheel, a jog switch, etc.), and/or a touch input means.

[0086] Furthermore, the user input to the display unit **330** may include at least one of i) an input applied through a direct touch to the display unit **330** configured as a touch screen, and/or ii) an input applied to the display unit **330** by using a separate input means such as a mouse as a medium.

[0087] For example, when the user input is received by an input means such as a mouse, the display unit **330** may output a graphic object (e.g., cursor image **701**) moving on the display unit **330** in response to the user input, as shown in FIGS. **7**A, **7**B, **7**C and **7**D. Through the cursor image **701**, the user may see a point (or an area) on the display unit **330**, to which the user input through the input unit **340** is being applied. The graphic object such as the cursor image **701** may be output, even when the user input is performed through the touch screen. Hereinafter, descriptions will be explained without a limitation to a specific input means of receiving an input from the user. In other words, a user input applied to the display unit **330** via the touch screen or other input means will be described as "a user input to the display unit". According to some example embodiments, the user input corresponding to the cursor image **701** may correspond to the graphic object **702** indication a current location of the robot.

[0088] The controller **350** may generate a control command to control navigation of the robot **100** in response to a user input, in a case that the user input to the display unit **330** is received while the ambient image and the map image are being output to the display unit **330**, as shown in FIGS. **6**A and **6**B. For example, the control command may include various commands related to navigation of the robot, such as a navigation direction of the robot, a navigation speed, whether there exists navigation or not, a navigation distance, a navigation path, etc. The robot **100** may drive based on a control command received through the robot remote control system **300**.

[0089] The controller **350** may generate a control command related to the robot's navigation, based on a user input applied to the display unit **330** through the input unit **340**. In this case, the controller **350** may also perform control of the display unit **330**, according to an area (a point) on the display unit **330** to which the user input through the input unit **340** has been applied.

[0090] In other words, the controller **350** may process the user input to the display unit **330** as a control command for the display unit **330**, as well as a control command for the robot **100**.

[0091] As such, the controller **350** may perform different controls (or different data processing) according to a point (an area) on the display unit **330** to which the user input through the input unit **340** has been applied.

[0092] More specifically, the controller **350** may perform control over the display area, together with generation of the control command to control navigation of robot, according to whether the user input has been applied to the main area (A) or the sub-area (B) of the display unit **330**.

[0093] As described above, the size of the main area (A) may be formed to be larger than that of the sub-area (B), and the user may want to see information displayed on the sub-area (B) larger. That is, in this case, visual information being output to the main area (A) and the sub-area (B), respectively, should be converted from each other. In some example embodiments, a user input to control the robot **100** may also be utilized for control over the display unit **330** in order to solve or reduce the user's inconvenience in inputting an additional control command to switch information output from the main area (A) and the sub-area (B) from each other.

[0094] The controller **350** may determine that a control command has been input to convert information output to the main area (A) and the sub-area (B) from each other, in a case that a user input is applied to the sub-area (B) between the main area (A) and the sub-area (B), as shown in FIG. **7**B. In other words, the controller **350** may process an event that a user input has been applied to the sub-area (B) (in which may be output the map image **720** or the ambient image **710**), as shown in FIG. **7**B and FIG. **7**D, as a control command to "convert information output to the main area (A) and the sub-area (B)".

[0095] Thus, the controller **350** may perform control related to the display areas of the display unit **330** (e.g., the main area (A) and the sub-area (B)) together with generation of a control command to control navigation of the robot **100**, in a case that a user input is applied to the sub-area (B), as shown in FIG. **7**B and FIG. **7**D.

[0096] Conversely, the controller **350** may generate only a control command for controlling the robot **100**, without performing control associated with the display unit **330** (e.g., the main area (A) and the sub-area (B)), in a case that a user input is applied to the main area (A) (in which may be output the map image **720** or the ambient image **710**), as shown in FIG. **7**A and FIG. **7**C.

[0097] For specific example, as shown in FIGS. **8**A and **8**B, an ambient image **810** captured by the robot **100** may be output to the main area (A) of the display unit **330** and a map image **820** for a location corresponding to the location information of the robot **100** may be output to the sub-area (B) of the display unit **330**. As such, while the ambient image **810** and the map image **820** are being output to the main area (A) and the sub-area (B), respectively, when a user input via the input unit **340** is applied to the main area (A), the controller **350** may generate a control command related to navigation of the robot **100** corresponding to the user input, in response to the user input. For example, when the user input is a control command that allows the robot **100** to drive forward in one direction (from **802***a* to **802**), the robot **100** may drive along the one direction according to the control command. As a result, as shown in FIG. **8**B, an ambient image **810'** output to the main area (A) may differ from the ambient image **810** (refer to FIG. **8**A), before the robot **100** drives based on the control command. In other words, the controller **350** may receive images from the robot **100** in real time or at preset (or alternatively, given) time intervals, and output a most-recently received ambient image to the main area (A).

[0098] The user input to control navigation of the robot **100** may be a drag input applied to the display unit **330** via the input unit **340**. The controller **350** may generate a control command to control the robot's navigation, based on a user input to drag cursor images **801***a* and **801** along one direction (from **802***a* to **802**), as shown in FIG. **8**B.

[0099] Furthermore, when the robot's current location is changed as the robot drives according to the above control command, the output location of a graphic object **803***a* representing the robot's current (e.g., final) location on the map image **820** output to the sub-area (B) may be also changed (e.g., with respect to the initial output location of a graphic object **803** as shown in FIG. **8**A), as shown in FIG. **8**B. Though not shown, location information contained in the map image may be changed at least partially in conjunction with navigation of the robot **100**. In other words, the controller **350** may update the map image in real time or at preset (or alternatively, given) time intervals so that the map image contains location information which is within a preset or alternatively, given range on the basis of the robot's current location.

[0100] As shown in FIGS. **8**A and **8**B, the controller **350** may generate a control command to control only navigation of the robot **100** when a user input is applied to the main area (A).

[0101] Next, will be described the opposite case to the example shown above. As shown in FIG. **8**C, the main area (A) of the display unit **330** may output the ambient image **810** captured by the robot **100**, and the sub-area (B) of the display unit **330** may output the map image **820** of a location corresponding to the location information of the robot **100**. As such, while the ambient image **810** and the map image **820** are being output to the main area (A) and the sub-area (B), respectively, when a user input through the input unit **340** is applied to the sub-area (B), the controller **350** may generate a control command related to navigation of the robot **100** corresponding to the user input in response to the user input. For example, when the user input is a control command that allows the robot **100** to drive forward in one direction, the robot **100** may drive along the one direction according to the control command.

[0102] Furthermore, in response to a user input applied to the sub-area (B) as shown in FIG. **8**C, the controller **350** may i) generate a control command to control navigation of the robot **100**, ii) control the display unit **330** to output the map image **820** that was being output to the sub-area (B) to the main area (A), as shown in FIG. **8**C and (b), and/or iii) control the display unit **330** to output the ambient image **810** that was being output to the main area (A) to the sub-area (B).

[0103] In other words, the controller **350** may convert visual information output to the main area (A) and the sub-area (B) from each other when a user input is applied to the sub-area (B).

[0104] As described above, the user input to control navigation of the robot **100** may be a drag input applied to the display unit **330** via the input unit **340**. The controller **350** may generate a control command to control the robot's navigation, based on the user input which drags cursor images **801***a* and **801** along one direction (from **803***a* to **803**), as shown in FIG. **8**C.

[0105] As such, when the current location of the robot **100** is changed as the robot drives according to a control command, the output position of a graphic object **803***b* representing the robot's current location included in the map image **820** that is output to the main area (A) may be also changed, as shown in FIG. **8**D (see the output position of the graphic object: refer to reference numeral **803***a*). As such, when the user input is applied to the sub-area (B), the controller **350** may perform control related to the display areas (e.g., the main area (A) and the sub-area (B)) of the display unit **330**, together with generation of a control command to control navigation of the robot **100**. Therefore, when a screen conversion between the main area (A) and the sub-area (B) is desired while controlling the robot's navigation, the user may easily perform the screen conversion by selecting the area to which a user input is applied.

[0106] Hereinbefore, described was a method to perform a screen conversion between the main area (A) and the sub-area (B) in a state that the ambient image has been output to the main area (A). Hereinafter, will be described how to perform a screen conversion between the main area (A) and the sub-area (B) in a state that the map image has been output to the main area (A).

[0107] As shown in FIG. **9**A, the main area (A) of the display unit **330** may output a map image **920** about a location corresponding to the location information of the robot **100**, and the sub-area (B) of the display unit **330** may output an ambient image **910** captured by the robot **100**. As such, while the map image **920** and the ambient image **910** are being output to the main area (A) and the sub-area (B), respectively, when a user input through the input unit **340** is applied to the main area (A), the controller **350** may generate a control command related to navigation of the robot **100** corresponding to the user input in response to the user input. For example, when the user input (e.g., a cursor movement from **901***a* to **901**) is a control command that allows (e.g., causes) the robot **100** to drive forward in one direction (from

902*a* to 902), the robot **100** may drive along the one direction according to the control command. When the current location of the robot **100** is changed as the robot drives according to the control command, the output location of a graphic object (see **902**, **902***a* of FIG. **9**A) representing the robot's current location in the map image **920** that is output to the main area (A) may be also changed, as shown in FIG. **9**B. Though not shown, location information contained in the map image may be changed at least partially, in conjunction with navigation of the robot **100**. In other words, the controller **350** may update the map image **920** in real time or at preset or alternatively, given time intervals such that the map image **920** contains location information which is within a preset or alternatively, given range based on the robot's current location.

[0108] As shown in FIGS. **9**A and **9**B, the controller **350** may generate a control command to control only navigation of the robot **100** when a user input is applied to the main area (A). That is, in this case, the type of information output to the main area (A) and the sub-area (B) remains unchanged, and may be the same as or similar to that before the user input is applied.

[0109] Furthermore, as shown in FIG. **9**B, an ambient image **910'** output to the sub-area (B) may differ from the ambient image **910** (refer to FIG. **9**A) before the robot **100** drives based on the control command. In other words, the controller **350** may receive images from the robot **100** in real time or at preset (or alternatively, given) time intervals, and output an ambient image which has been received the most recently to the sub-area (B). As described above, the user input to control navigation of the robot **100** may be a drag input applied to the display unit **330** through the input unit **340**.

[0110] Next, will be described the opposite case to the example shown above. As shown in FIG. **9**C, the main area (A) of the display unit **330** may output the map image **920** about a location corresponding to the location information of the robot **100**, and the sub-area (B) of the display unit **330** may output the ambient image **910** captured by the robot **100**. As such, while the map image **920** and the ambient image **910** are being output from the main area (A) and the sub-area (B), respectively, when a user input through the input unit **340** is applied to the sub-area (B), the controller **350** may generate a control command related to navigation of the robot **100** in response to the user input. For example, when the user input is a control command that allows the robot **100** to drive forward in one direction, the robot **100** may drive along the one direction according to the control command.

[0111] Furthermore, in response to a user input applied to the sub-area (B) as shown in FIG. **9**C, the controller **350** may i) generate a control command to control navigation of the robot **100**, ii) control the display unit **330** to output the ambient image **910** that was being output to the sub-area (B) to the main area (A), as shown in FIGS. **9**C and **9**D, and/or iii) control the display unit **330** to output the map image **920** that was being output to the main area (A) to the sub-area (B).

[0112] In other words, the controller **350** may convert visual information output to the main area (A) and the sub-area (B) when a user input is applied to the sub-area (B). As described above, the user input to control navigation of the robot **100** may be a drag input applied to the display unit **330** through the input unit **340**.

[0113] The controller **350** may generate a control command to control the robot's navigation, based on a user input which drags cursor images **901***a* and **901** along one direction (from **903***a* to **903**), as shown in FIG. **9**C.

[0114] As such, the output position of a graphic object **902'** representing the robot's current (e.g., updated) location in the map image **920** may be also changed (see the output position of the graphic object before the robot drives: refer to reference numeral **902***a*). As such, the controller **350** may perform control related to the display area (e.g., main area (A) and the sub-area (B) of the display unit **330**), together with generation of a control command to control navigation of the robot **100** when a user input is applied to the sub-area (B).

[0115] As such, in some example embodiments, control over the display unit **330** may be performed together with remote control over the robot's navigation, based on a user input to the display unit **330**. The controller **350** may output guide information **1030** related to the robot's navigation to the display unit **330**, as shown in FIG. **10**, to provide the user with information about the robot's navigation. The guide information **1030** may vary in a visual shape based on at least one of a navigation path and/or a navigation speed of the robot. The guide information **1030** may be displayed in an overlapped state with an ambient image **1010** received from the robot, as shown. According to some example embodiments, the sub-area (B) may output the map image **1020** including the graphic object **1001** representing the robot's current location.

[0116] In contrast, the controller **350** may display the guide information **1030** on the main area (A). In this case, the main area (A) may output either the ambient image or the map image. The guide information **1030** allows the user to remotely control the robot easily.

[0117] In some example embodiments, a user input to the display unit **330** may be applied through the input unit **340**. The controller **350** may perform different control commands related to navigation of the robot **100** according to attributes of the user input. In other words, navigation attributes of the robot **100** may vary according to the attributes of the user input. For example, when the user input is a drag input which drags the cursor image (e.g., refer to reference numeral **801** in FIGS. **8**A and **8**B) by using the input unit, the controller **350** may determine the navigation attributes of the robot based on a dragging degree and/or a dragging direction of the cursor image **801** which moves according to the user input.

[0118] Here, the navigation attributes of the robot **100** may include at least one of a navigation direction (or the robot's moving direction), a navigation speed (or the robot's moving speed), whether the robot drives or not, a navigation path, and/or a navigation distance (or the robot's moving distance).

[0119] For example, the controller **350** may control the robot's navigation speed based on a drag speed of the cursor image **801** according to the user input.

[0120] As shown in FIG. **11**, the controller **350** may include matching information in which the attributes of the user input (e.g., input features, such as features of drag and/or click input types) and the navigation attributes (e.g., driving attributes) of the robot have been matched with each other. Various control commands to control the robot's navigation may be generated based on a method of the user input, an input feature, etc. The matching information shown

in FIG. **11** is an example, and may be varied in some cases. For example, the user may apply various control commands about the robot's navigation by transforming various input attributes (or input features) of an input method called "drag". For example, when a drag length of the cursor image **801** is longer, the controller **350** may control a navigation distance of the robot **100** to be farther. As such, in some example embodiments, based on a user's intuitive input to the display unit **330**, a screen conversion with respect to the display unit **330** may be performed together with control over the robot's navigation. This may maximize or improve user convenience for remotely controlling the robot.

[0121] In the above description, an example of estimating the location of the robot **100** by the controller **350** was explained. However, some example embodiments are not limited to this. In other words, estimation of the location of the robot **100** may be done by the robot **100** itself. In other words, the robot **100** may estimate its current position in the aforementioned way, based on images received from the robot itself **100**. In addition, the robot **100** may transmit estimated location information to the controller **350**. In this case, the controller **350** may perform a set of controls as seen above, based on the location information received from the robot.

[0122] Conventional devices for remote control of a robot determine a location of the robot based only on images obtained from a camera at the robot. The robot location information acquired by such conventional devices is insufficiently accurate. Accordingly, the conventional devices consume excessive resources (e.g., processor, memory, power, bandwidth, delay, etc.) in executing erroneous navigation instructions and corresponding backtracking, and cause excessive user inconvenience in attempting to remotely control the robot.

[0123] However, according to some example embodiments, improved devices and methods are provided for remote control of a robot. For example, according to some example embodiments, an image obtained from a camera at the robot may be compared with stored map images to determine the location of the robot and a corresponding map image of the location. The corresponding map image may be provided with the image from the camera on the robot to aid in the remote control of the robot. Accordingly, the improved devices and methods overcome the deficiencies of the conventional devices to reduce resource consumption (e.g., processor, memory, power, bandwidth, delay, etc.) and user inconvenience caused by erroneous navigation instructions.

[0124] According to some example embodiments, operations described herein as being performed by the robot remote control system **300**, the controller **350**, communication unit **310**, the display unit **330**, the input unit **340**, the external server **200**, the cloud server **210**, the device of the manager, the remote control room **300***a*, the robot **100**, the controller of the robot **100**, the driving unit of the robot **100** and/or the communication unit of the robot **100** may be performed by processing circuitry. The term 'processing circuitry,' as used in the present disclosure, may refer to, for example, hardware including logic circuits; a hardware/software combination such as a processor executing software; or a combination thereof. For example, the processing circuitry more specifically may include, but is not limited to, a central processing unit (CPU), an arithmetic logic unit (ALU), a digital signal processor, a microcomputer, a field programmable gate array (FPGA), a System-on-Chip (SoC), a programmable logic unit, a microprocessor, application-specific integrated circuit (ASIC), etc.

[0125] As described above, the robot remote control method and system according to some example embodiments may provide a map containing location information where the robot is located, together with images received from the robot. Through this, the robot remote control method and system according to some example embodiments may provide a user experience that may comprehensively provide environmental information surrounding the robot under remote control situations. Therefore, a user who remotely controls the robot may perform more accurate control of the robot, by considering surrounding environments when remotely controlling the robot.

[0126] Furthermore, the robot remote control method and system according to some example embodiments may provide a user experience (e.g., interface) that may perform control over the display area together as well as control over the robot based on a user input for remote control of the robot. Therefore, a user who remotely controls the robot may perform tasks more easily and intuitively according to a situation, by performing control over the robot and control over the display area with one control command.

[0127] One or more of the aforementioned operations may be executed by one or more processes in a computer, and may be implemented as a program which may be stored in a computer-readable medium.

[0128] Further, one or more of the aforementioned operations may be implemented as a computer-readable code or instruction word (e.g., a program) in a program-recorded medium.

[0129] The computer-readable medium (e.g., the storage unit **320**, the database **220**, etc.) may include all types of recording devices for storing data which may be read by a computer system. Examples of the computer-readable medium (e.g., the storage unit **320**, the database **220**, etc.) include a Hard Disk Drive (HDD), a Solid State Disk (SSD), a Silicon Disk Drive (SDD), Read-Only Memory (ROM), Random Access Memory (RAM), Compact Disk ROM (CD-ROM), a magnetic tape, a floppy disk, an optical data storage device, etc.

[0130] Further, the computer-readable medium may include a storage unit which may be a server and/or a cloud storage unit which an electronic device may access through communications. In this case, the computer may download a program of configured to implement one or more of the aforementioned operations from the server and/or the cloud storage unit, through wired and/or wireless communications.

[0131] Further, in some example embodiments, the aforementioned computer may be an electronic device where a processor, e.g., a Central Processing Unit (CPU) is mounted, and there is no limitation in a type of the computer.

[0132] The examples are not to be construed as limiting some example embodiments. The scope of some example embodiments should be determined by reasonable interpretations of the appended claims, and all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

What is claimed is:

1. A remote control method for a robot, comprising:

outputting both a map image and an ambient image to a display, the map image including location information corresponding to the ambient image, the ambient image

being of surroundings of a robot, and the ambient image being received from a camera at the robot;

generating a control command for controlling the robot in response to an input to the display during the outputting; and

causing the robot to drive according to the control command by transmitting the control command to the robot.

2. The method of claim **1**, wherein

a display area of the display includes a main area and a sub-area that overlaps with a part of the main area; and

the outputting includes outputting one of the ambient image or the map image to the main area, and another one of the ambient image or the map image to the sub-area.

3. The method of claim **2**, wherein the generating the control command comprises controlling the display area according to whether the input is applied to the main area or the sub-area.

4. The method of claim **3**, wherein the generating the control command comprises:

controlling the display area in response to the input being applied to the sub-area; and

not controlling the display in response to the input being applied to the main area.

5. The method of claim **4**, wherein the controlling the display area includes switching visual information output to the main area with visual information output to the sub-area.

6. The method of claim **5**, wherein the generating the control command comprises outputting the map image to the main area and the ambient image to the sub-area in response to the input being applied to the sub-area while the map image is being output to the sub-area.

7. The method of claim **1**, wherein

the map image includes a graphic object indicating the robot; and

an output location of the graphic object on the map image corresponds to a current location of the robot.

8. The method of claim **7**, further comprising:

changing the output location of the graphic object is changed based on a changed position of the robot.

9. The method of claim **1**, further comprising:

outputting a cursor image on the display, an output location of the cursor image changing in response to the input; and

determining navigation attributes of the robot based on a dragging degree of the cursor image and a dragging direction of the cursor image, the dragging degree of the cursor image and the dragging direction of the cursor image corresponding to a change in the output location of the cursor.

10. The method of claim **9**, wherein

the navigation attributes of the robot include at least one of a moving direction, a moving speed, or a moving distance of the robot; and

the determining navigation attributes of the robot determines the moving speed of the robot based on a drag speed of the cursor image, the drag speed of the cursor image corresponding to a change in the output location of the cursor.

11. A robot remote control system, comprising:

a display;

a communication unit configured to receive an ambient image from a camera provided at a robot, the ambient image being of surroundings of the robot; and

a controller configured to,

control the display to output both a map image and the ambient image, the map image including location information corresponding to the ambient image,

generate a control command for controlling the robot in response to an input while the display outputs both the map image and the ambient image, and

cause the robot to drive according to the control command by controlling the communication unit to transmit the control command to the robot.

12. The robot remote control system of claim **11**, wherein

a display area of the display includes a main area and a sub-area that overlaps with a part of the main area; and

the controller is configured to control the display to output one of the ambient image or the map image to the main area, and another one of the ambient image or the map image to the sub-area.

13. The robot remote control system of claim **12**, wherein the controller is configured to generate the control command including controlling the display area according to whether the input is applied to the main area or the sub-area.

14. The robot remote control system of claim **13**, wherein the controller is configured to generate the control command including:

controlling the display area in response to the input being applied to the sub-area; and

not controlling the display in response to the input being applied to the main area.

15. The robot remote control system of claim **14**, wherein the controlling the display area includes switching visual information output to the main area with visual information output to the sub-area.

16. The robot remote control system of claim **15**, wherein the controller is configured to generate the control command including outputting the map image to the main area and the ambient image to the sub-area in response to the input being applied to the sub-area while the map image is being output to the sub-area.

17. The robot remote control system of claim **11**, wherein

the map image includes a graphic object indicating the robot; and

an output location of the graphic object on the map image corresponds to a current location of the robot.

18. The robot remote control system of claim **17**, wherein the controller is configured to control the display to change the output location of the graphic object based on a changed position of the robot.

19. The robot remote control system of claim **11**, wherein the controller is configured to:

control the display to output a cursor image, an output location of the cursor image changing in response to the input; and

determine navigation attributes of the robot based on a dragging degree of the cursor image and a dragging direction of the cursor image, the dragging degree of the cursor image and the dragging direction of the cursor image corresponding to a change in the output location of the cursor.

20. The robot remote control system of claim **19**, wherein

the navigation attributes of the robot include at least one of a moving direction, a moving speed, or a moving distance of the robot; and

the controller is configured to determine the moving speed of the robot based on a drag speed of the cursor image, the drag speed of the cursor image corresponding to a change in the output location of the cursor.

* * * * *