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(54) **METHOD, MEDIUM AND APPARATUS CLASSIFYING AND COLLECTING AREA FEATURE INFORMATION ACCORDING TO A ROBOT'S MOVING PATH, AND A ROBOT CONTROLLED BY THE AREA FEATURES**

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USPC **700/259**

(57) **ABSTRACT**

A method of classifying and collecting feature information of an area according to a robot's moving path, a robot controlled by area features, and a method and apparatus for composing a user interface using the area features are disclosed. The robot includes a plurality of sensor modules to collect feature information of a predetermined area along a moving path of the robot, and an analyzer to analyze the collected feature information of the predetermined area according to a predetermined reference range and to classify the collected feature information into a plurality of groups.

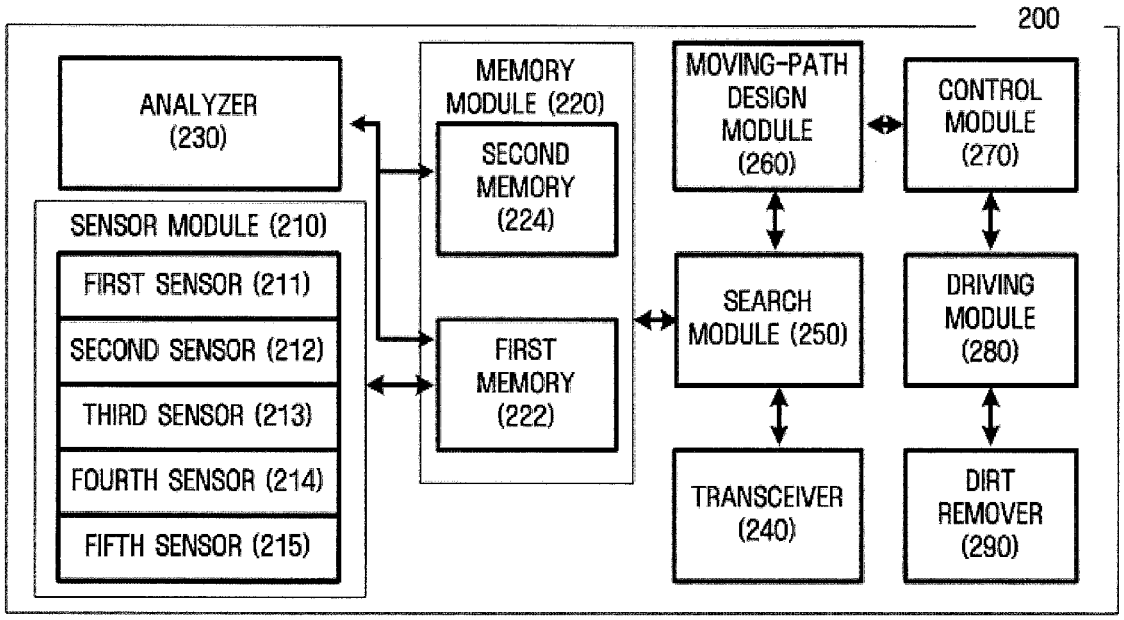


FIG. 1A (PRIOR ART)

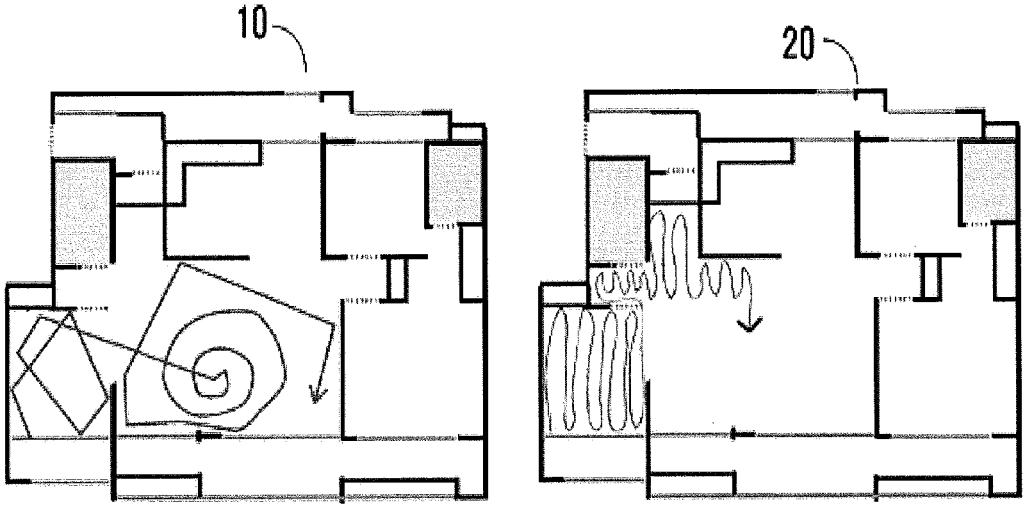
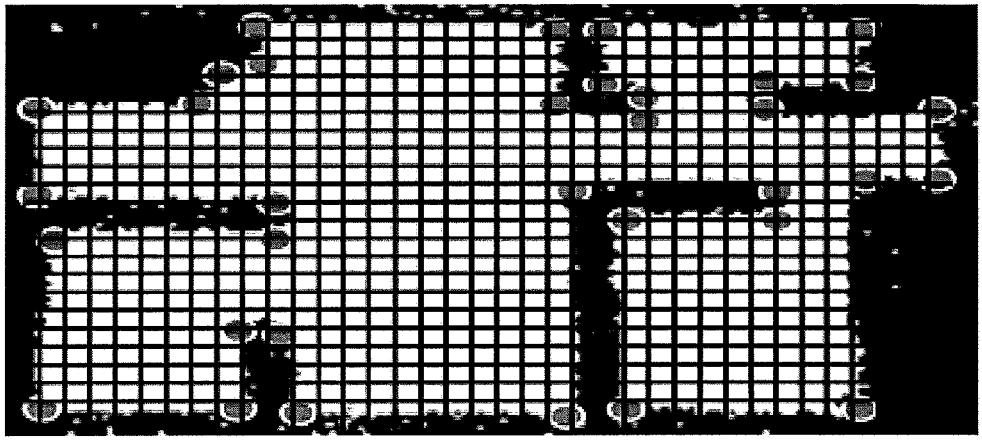


FIG. 1B (PRIOR ART)



30

255	255	150	3	...	...	...	...
255	143	72	4	...	...	...	...
255	101	22	2	...	...	...	...
255	102	12	...	...	...	...	...
...	...	...	...	...	...	...	...

FIG. 2A

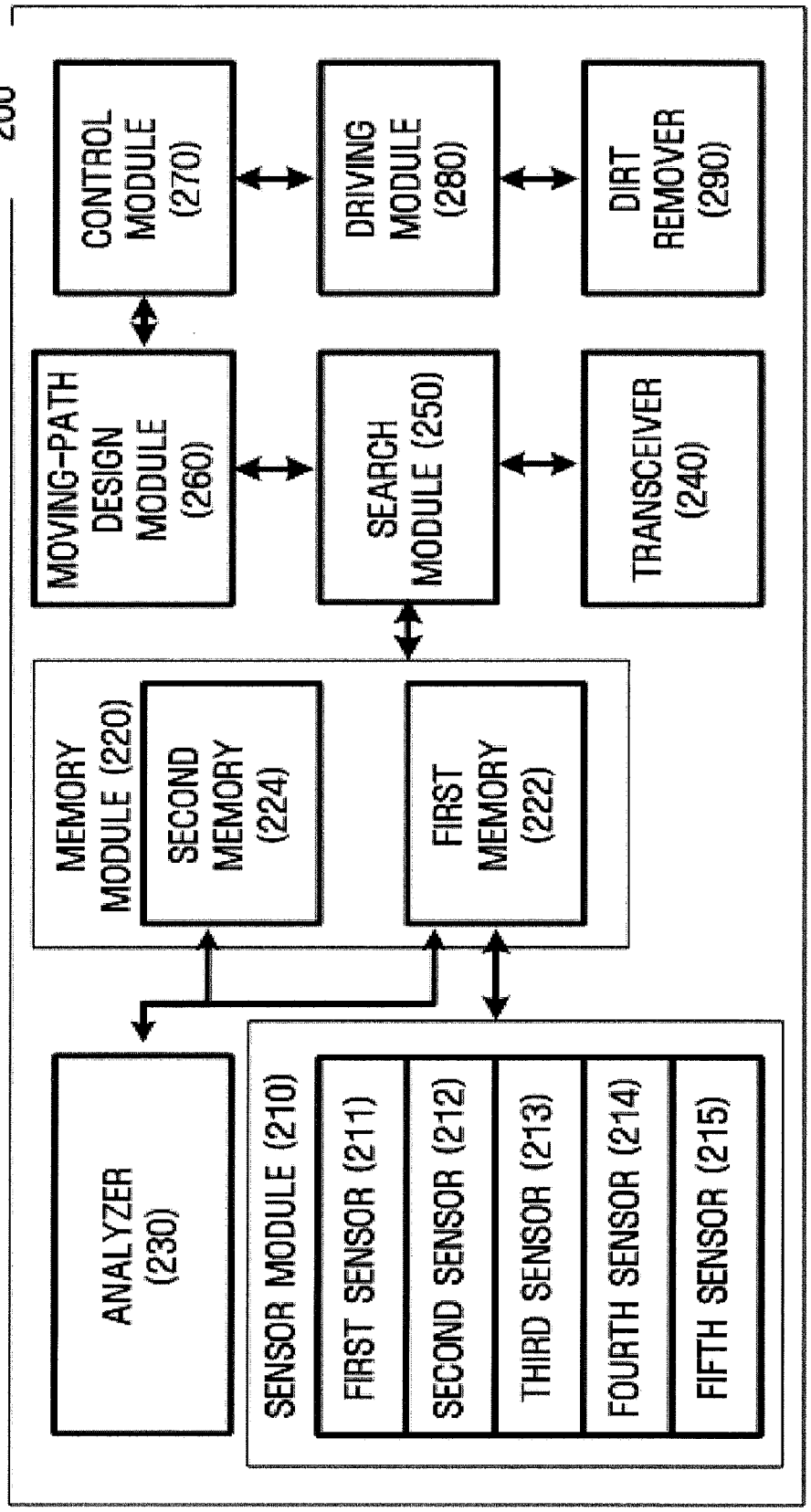

200
CONTROL MODULE (270)
DRIVING MODULE (280)
DIRT REMOVER (290)
MOVING-PATH DESIGN MODULE (260)
SEARCH MODULE (250)
TRANSCEIVER (240)
MEMORY MODULE (220)
SECOND MEMORY (224)
FIRST MEMORY (222)
ANALYZER (230)
SENSOR MODULE (210)
FIRST SENSOR (211)
SECOND SENSOR (212)
THIRD SENSOR (213)
FOURTH SENSOR (214)
FIFTH SENSOR (215)

FIG. 2B

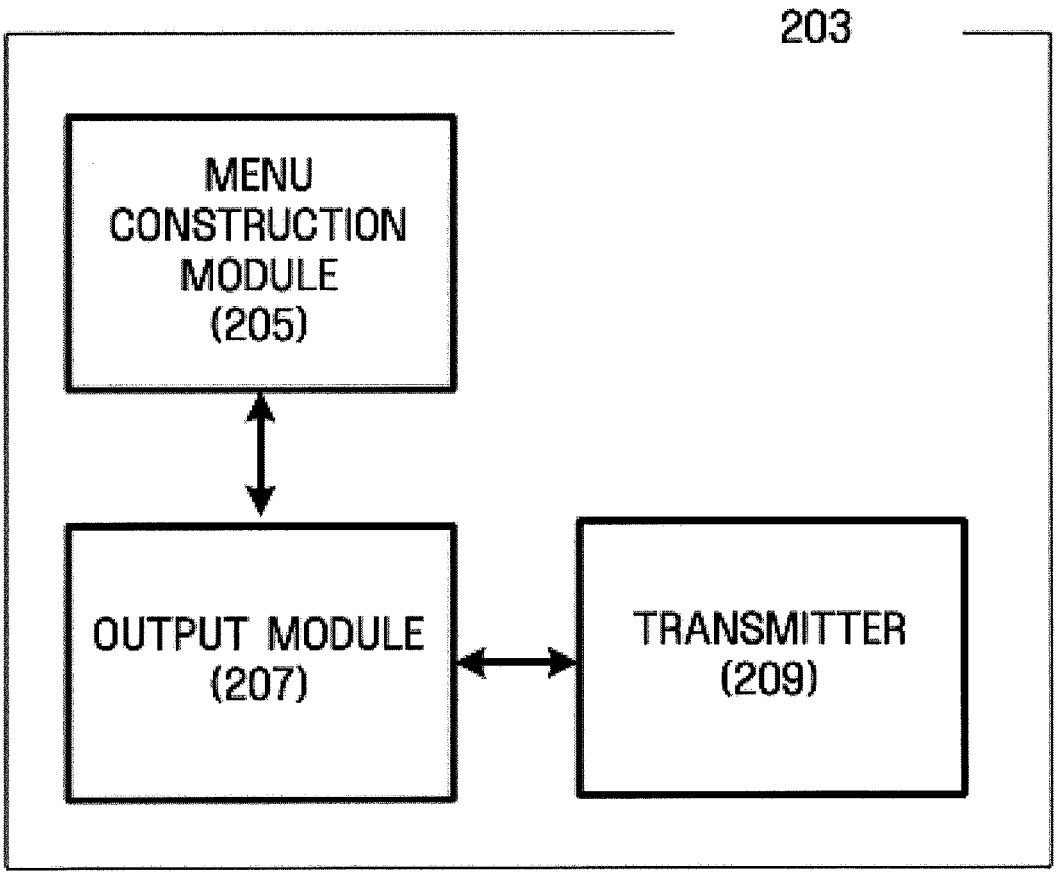

203
MENU CONSTRUCTION MODULE (205)
OUTPUT MODULE (207)
TRANSMITTER (209)

FIG. 3A

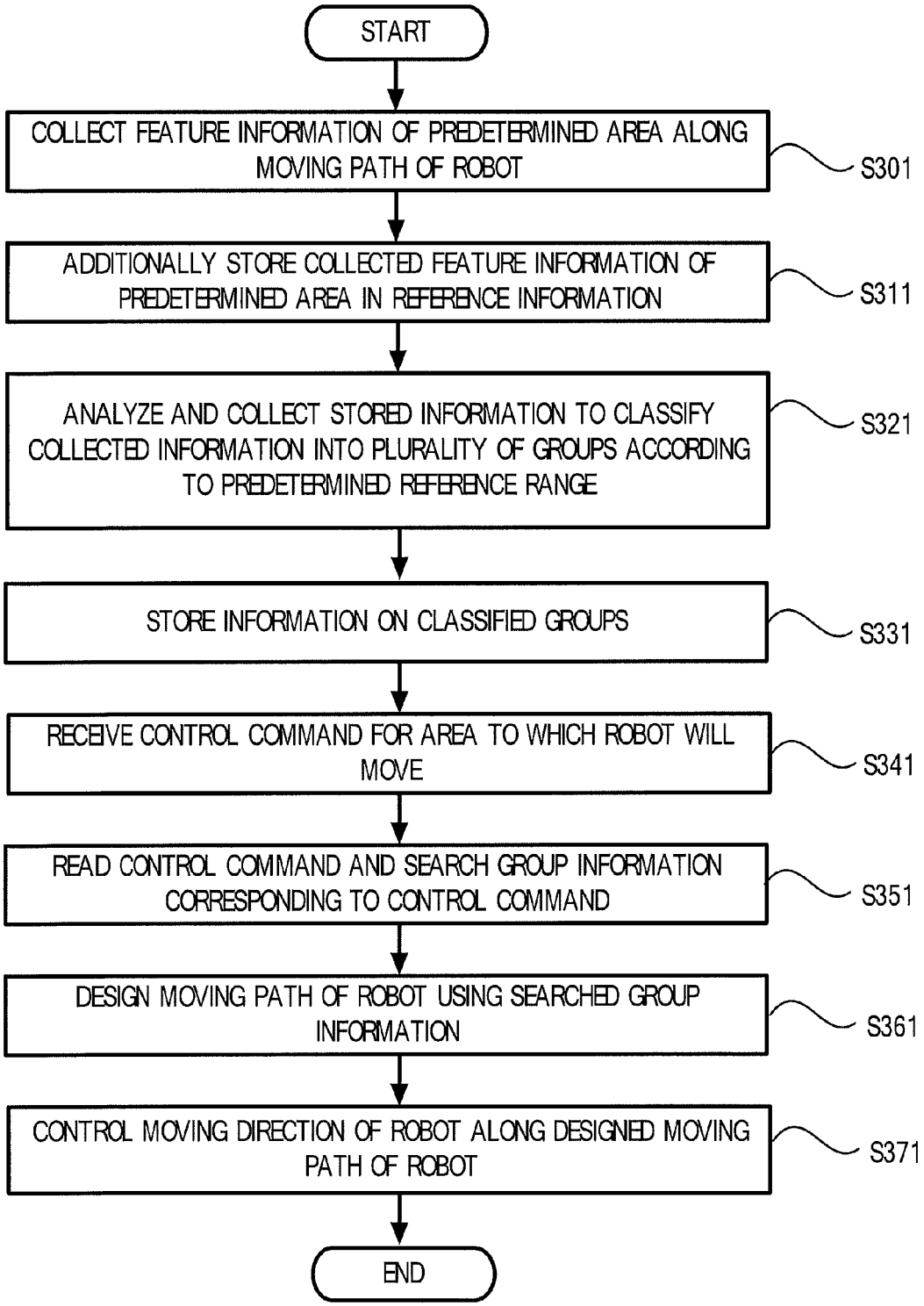

START
COLLECT FEATURE INFORMATION OF PREDETERMINED AREA ALONG MOVING PATH OF ROBOT
S301
ADDITIONALLY STORE COLLECTED FEATURE INFORMATION OF PREDETERMINED AREA IN REFERENCE INFORMATION
S311
ANALYZE AND COLLECT STORED INFORMATION TO CLASSIFY COLLECTED INFORMATION INTO PLURALITY OF GROUPS ACCORDING TO PREDETERMINED REFERENCE RANGE
S321
STORE INFORMATION ON CLASSIFIED GROUPS
S331
RECEIVE CONTROL COMMAND FOR AREA TO WHICH ROBOT WILL MOVE
S341
READ CONTROL COMMAND AND SEARCH GROUP INFORMATION CORRESPONDING TO CONTROL COMMAND
S351
DESIGN MOVING PATH OF ROBOT USING SEARCHED GROUP INFORMATION
S361
CONTROL MOVING DIRECTION OF ROBOT ALONG DESIGNED MOVING PATH OF ROBOT
S371
END

FIG. 3B

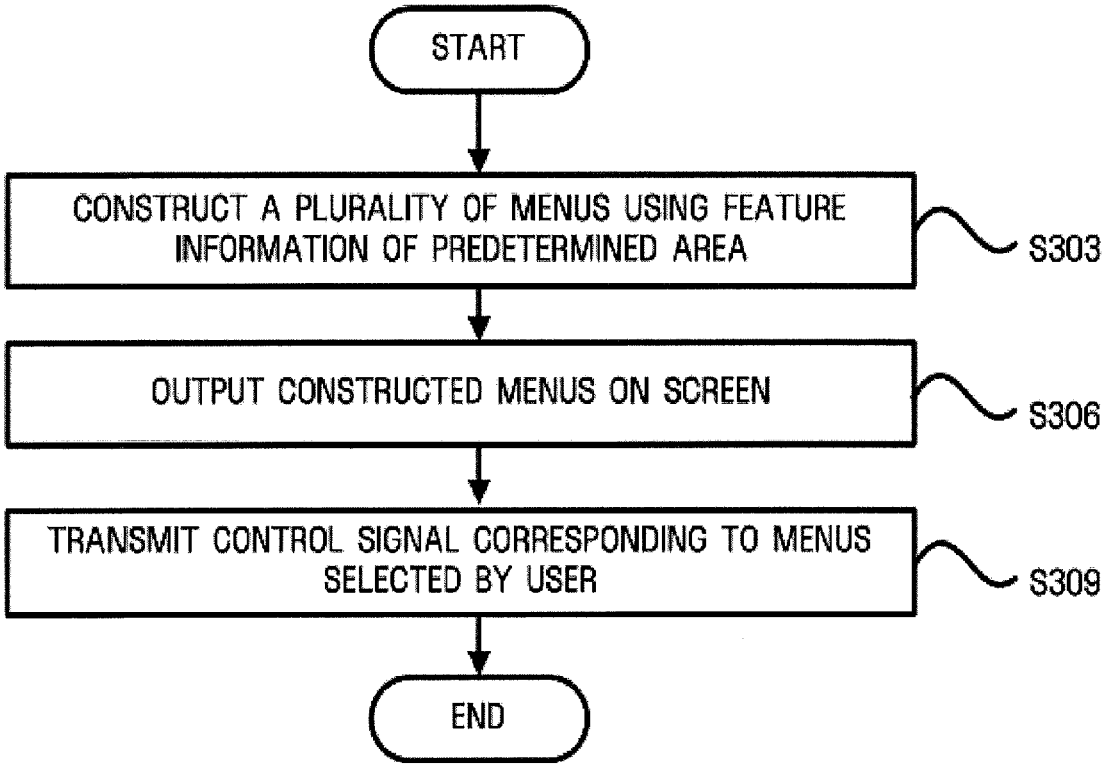

START
CONSTRUCT A PLURALITY OF MENUS USING FEATURE INFORMATION OF PREDETERMINED AREA
S303
OUTPUT CONSTRUCTED MENUS ON SCREEN
S306
TRANSMIT CONTROL SIGNAL CORRESPONDING TO MENUS SELECTED BY USER
S309
END

FIG. 4A

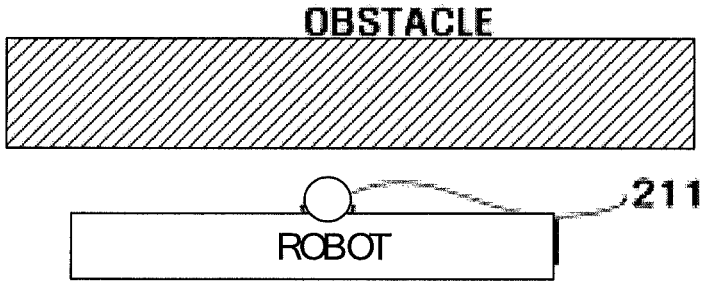


FIG. 4B

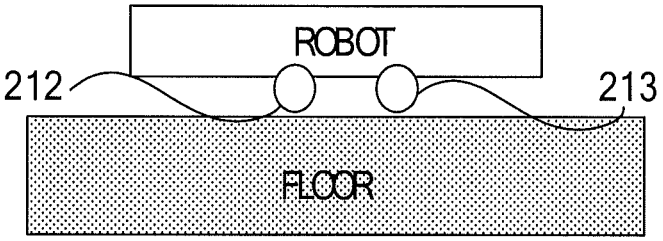


FIG. 4C

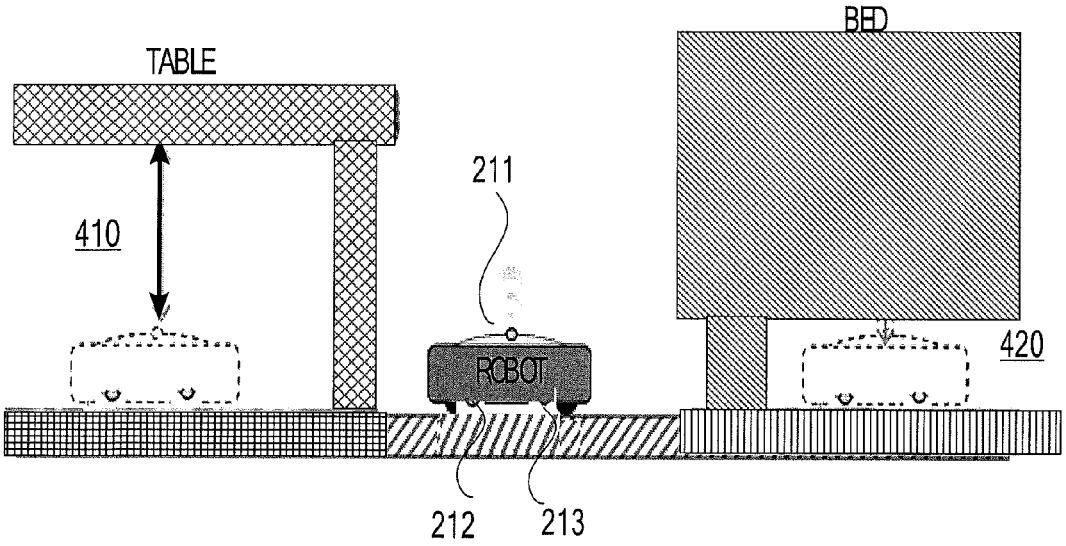


FIG. 5A

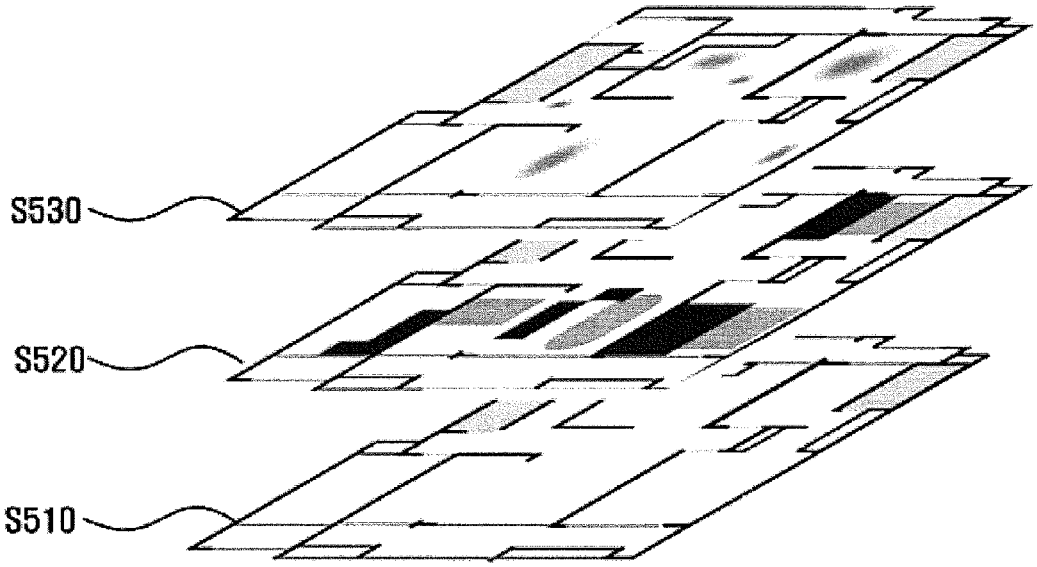


FIG. 5B

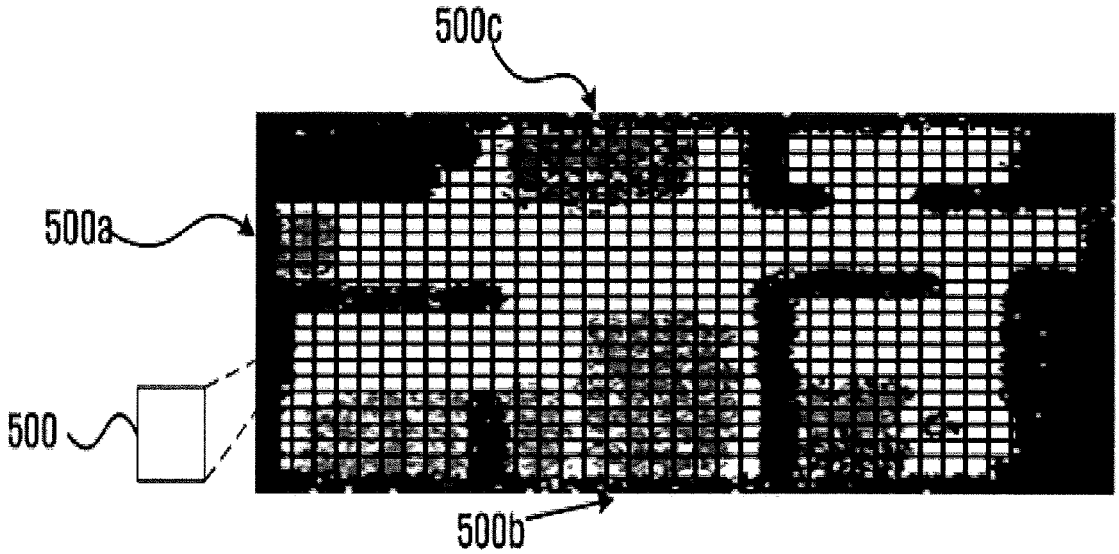


FIG. 5C

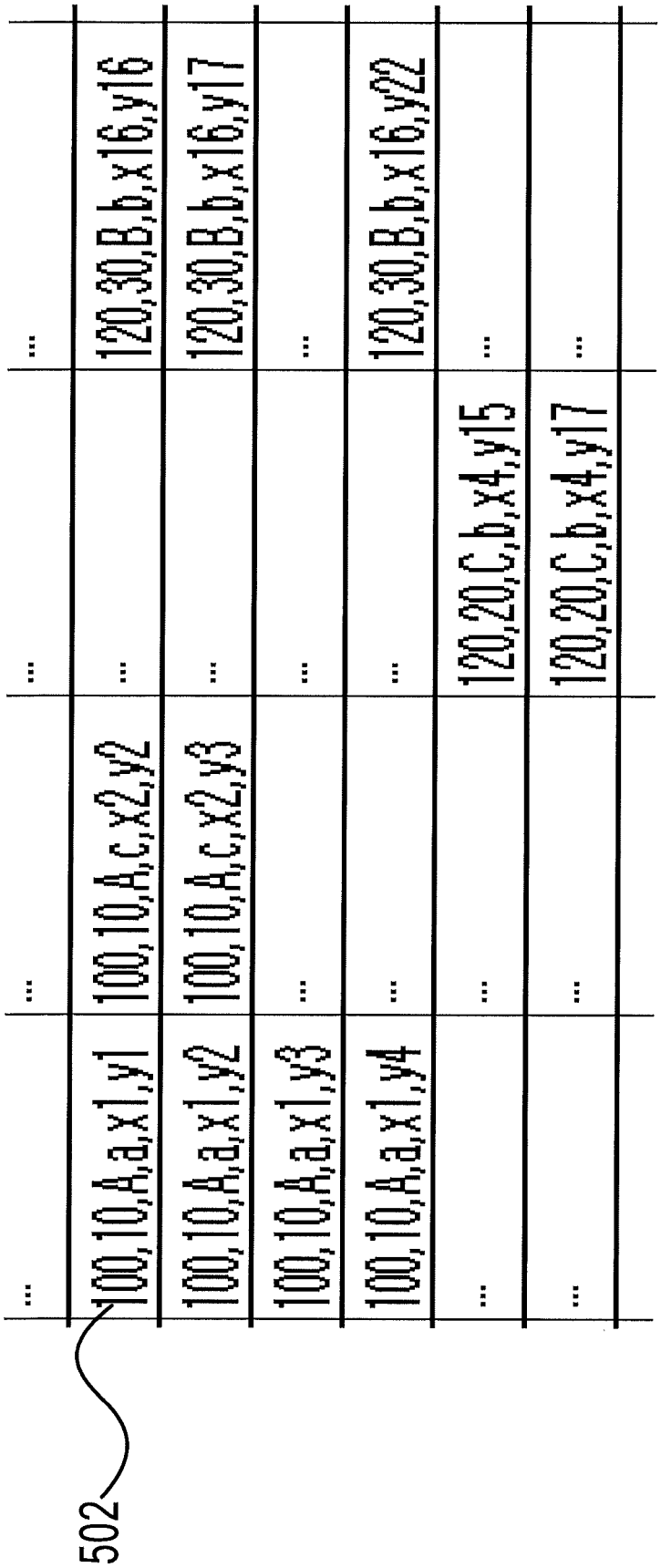

...
100,10,A,a,x1,y1
100,10,A,a,x1,y2
100,10,A,a,x1,y3
100,10,A,a,x1,y4
...
...
100,10,A,c,x2,y2
100,10,A,c,x2,y3
...
...
...
...
...
...
...
120,30,B,b,x16,y16
120,30,B,b,x16,y17
...
120,30,B,b,x16,y22
...
...
...
120,20,C,b,x4,y15
120,20,C,b,x4,y17
...
...
502

FIG. 6A

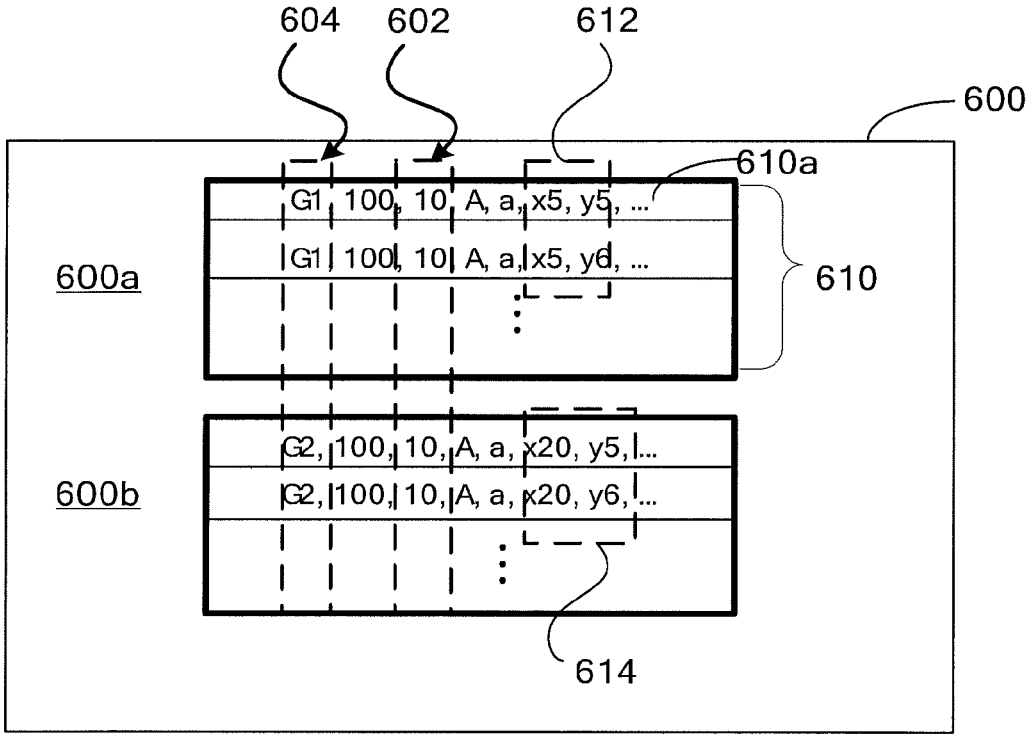

604
602
612
600
610a
G1, 100, 10, A, a, x5, y5, ...
G1, 100, 10, A, a, x5, y6, ...
600a
610
G2, 100, 10, A, a, x20, y5, ...
G2, 100, 10, A, a, x20, y6, ...
600b
614

FIG. 6B

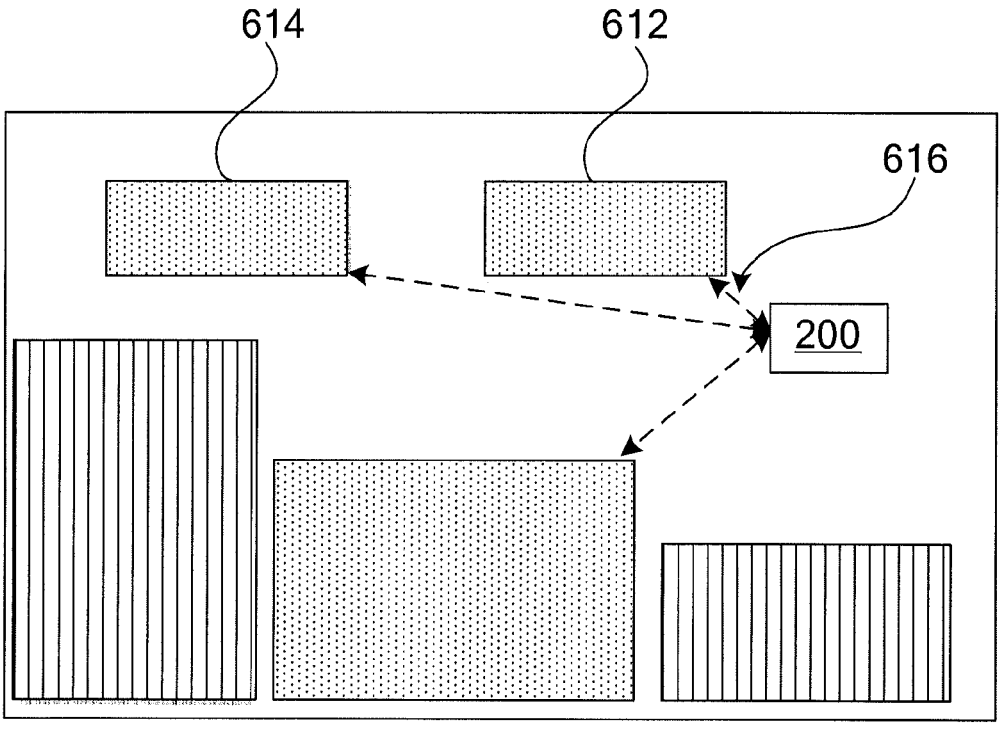

614
612
616
200

FIG. 7A

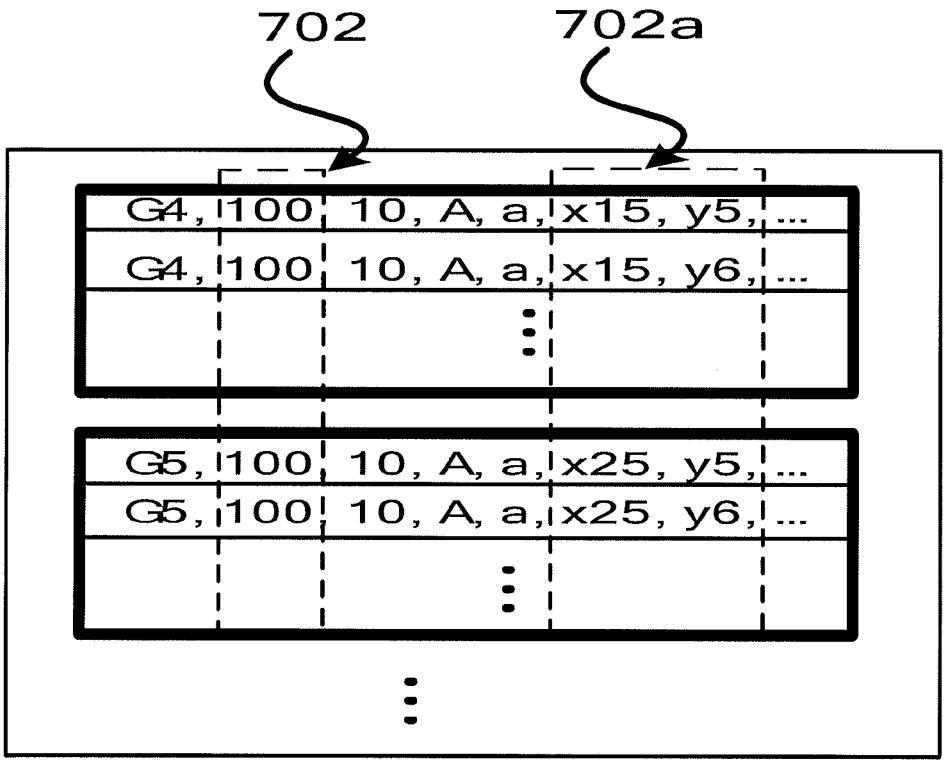

702
702a
G4, 100, 10, A, a, x15, y5, ...
G4, 100, 10, A, a, x15, y6, ...
G5, 100, 10, A, a, x25, y5, ...
G5, 100, 10, A, a, x25, y6, ...

FIG. 7B

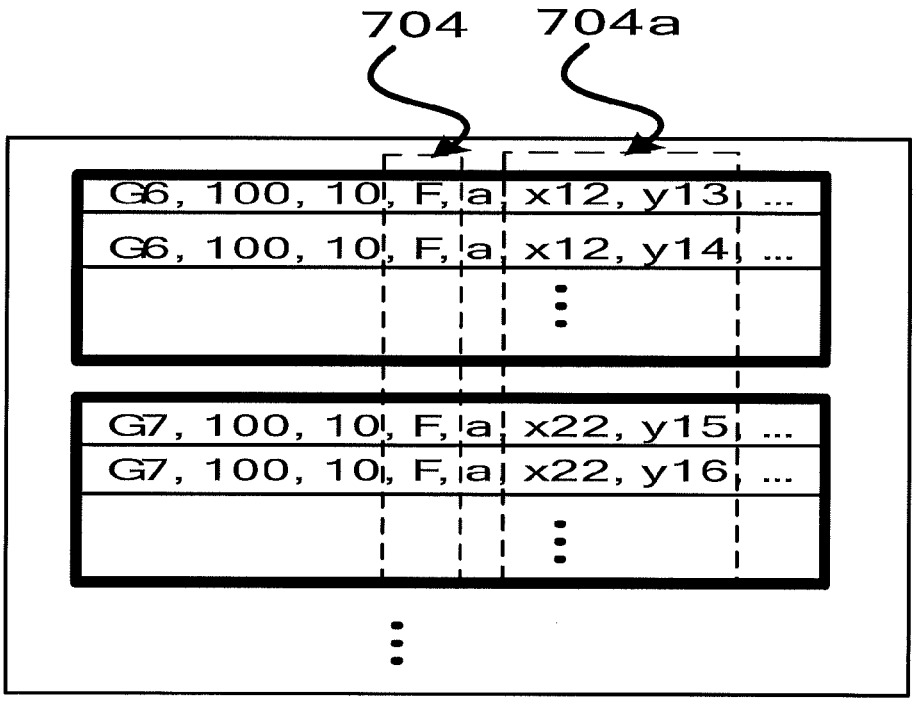

704
704a
G6, 100, 10, F, a, x12, y13, ...
G6, 100, 10, F, a, x12, y14, ...
G7, 100, 10, F, a, x22, y15, ...
G7, 100, 10, F, a, x22, y16, ...

FIG. 7C

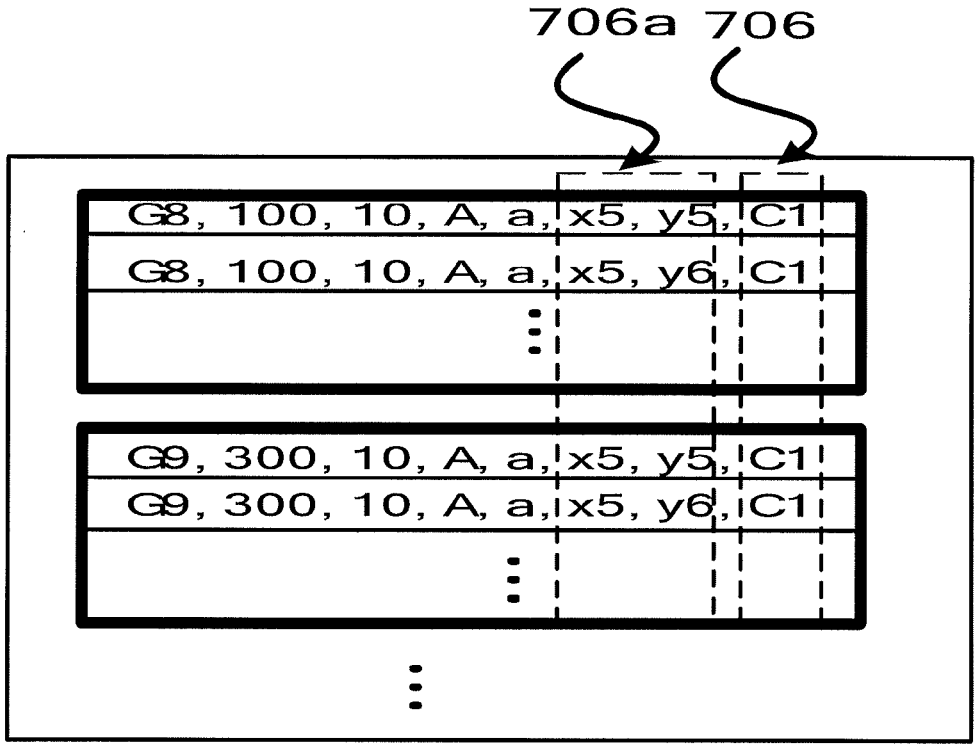

706a
706
G8, 100, 10, A, a, x5, y5, C1
G8, 100, 10, A, a, x5, y6, C1
G9, 300, 10, A, a, x5, y5, C1
G9, 300, 10, A, a, x5, y6, C1

FIG. 7D

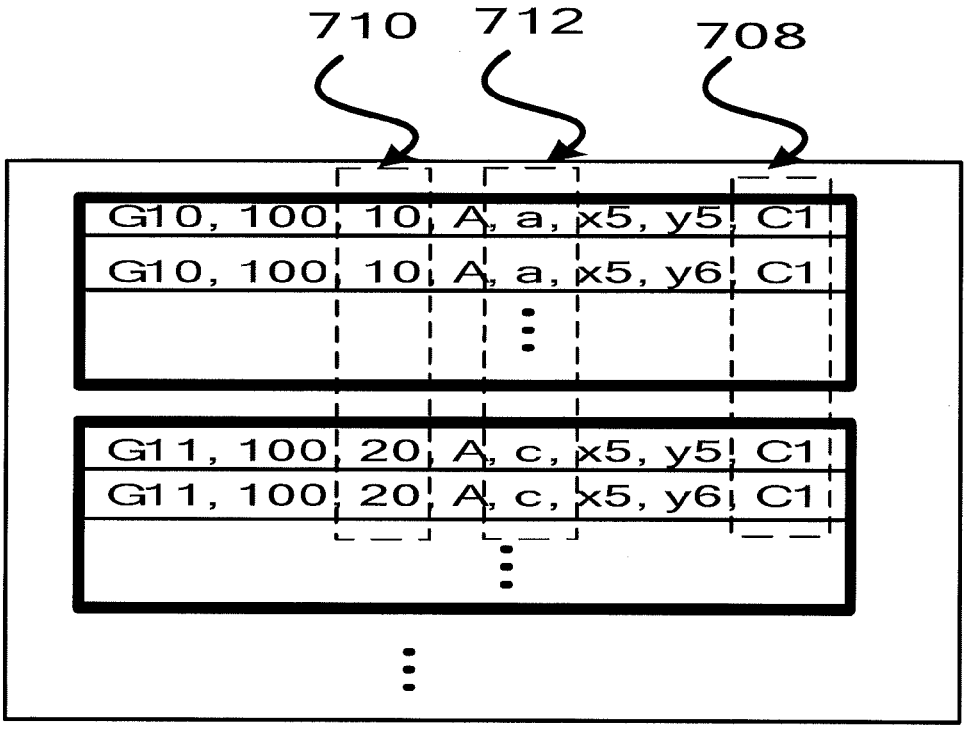
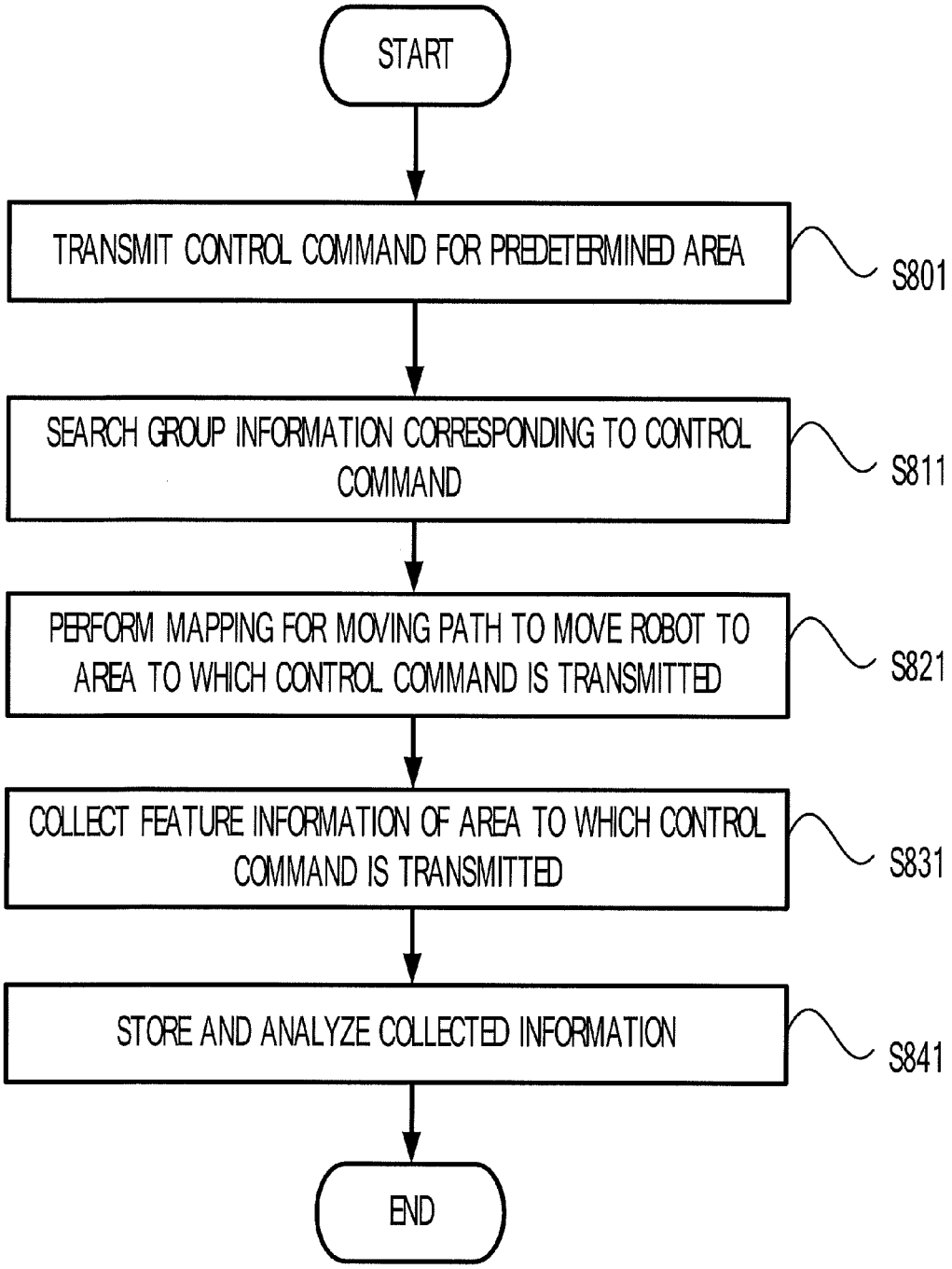

710
712
708
G10, 100, 10, A, a, x5, y5, C1
G10, 100, 10, A, a, x5, y6, C1
G11, 100, 20, A, c, x5, y5, C1
G11, 100, 20, A, c, x5, y6, C1

FIG. 8


START
TRANSMIT CONTROL COMMAND FOR PREDETERMINED AREA
S801
SEARCH GROUP INFORMATION CORRESPONDING TO CONTROL COMMAND
S811
PERFORM MAPPING FOR MOVING PATH TO MOVE ROBOT TO AREA TO WHICH CONTROL COMMAND IS TRANSMITTED
S821
COLLECT FEATURE INFORMATION OF AREA TO WHICH CONTROL COMMAND IS TRANSMITTED
S831
STORE AND ANALYZE COLLECTED INFORMATION
S841
END

METHOD, MEDIUM AND APPARATUS CLASSIFYING AND COLLECTING AREA FEATURE INFORMATION ACCORDING TO A ROBOT'S MOVING PATH, AND A ROBOT CONTROLLED BY THE AREA FEATURES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a divisional of U.S. application Ser. No. 11/711,635, filed Feb. 28, 2007, now pending, which is based on and claims priority from Korean Patent Application No. 10-2006-0049397 filed on Jun. 1, 2006, in the Korean Intellectual Property Office, the disclosures of all of which are incorporated herein by reference in its entirety.

BACKGROUND

[0002] 1. Field

[0003] The present invention relates to a method, medium and apparatus classifying and collecting information on area features according to a robot's moving path, a robot controlled by the area features, and a method and apparatus for composing a user interface using the area features, and more particularly to a method, medium and apparatus classifying and collecting information on area features according to a robot's moving path, a robot controlled by the area features, and a method, medium and apparatus composing a user interface using the area features, in which information on the area features is collected and classified according to the robot's moving path and the robot's moving path is planned and controlled using the information.

[0004] 2. Description of the Related Art

[0005] Various types of robots have been developed recently, using advanced technology. Particularly, a robot has been developed that executes tasks on behalf of a user while automatically moving in a room. Generally, a robot includes a driving module (e.g., a motor and wheels) provided with an encoder sensor (called an encoder or an odometry). The encoder sensor serves to determine the position of the robot. Furthermore, the robot is provided with a gyro sensor that exactly measures a rotational angle of the robot.

[0006] FIG. **1** illustrates a conventional technique of moving a cleaning robot and information for a prepared map.

[0007] As shown in FIG. **1**A, a conventional cleaning robot executes cleaning while randomly moving, without generating a predetermined map **10**, or executes cleaning while moving, according to a two-dimensional map, to only cover a given area without considering cleaning features **20**.

[0008] As shown in FIG. **1**B, a grid map may be prepared during an initial run of the robot. The probability of an obstacle existing in each grid is expressed as a predetermined value in the range of zero to two-hundred fifty five **30**. It should be noted that the probability that a given obstacle exists becomes greater as the predetermined value becomes greater. Accordingly, no obstacle exists in the corresponding grid if the value is equal to zero. A moving path for the robot may be designed according to the probability that an obstacle exists for each grid.

[0009] However, a problem with the conventional technique described is that the unique features of each area found on the moving path of the robot are not considered. Accordingly, a method that collects feature information for a predetermined area along a moving path of a robot and uses the collected information as data for motion control of the robot has been found desirable by the inventors.

SUMMARY

[0010] One or more embodiments of the present invention provides a method, medium and apparatus of classifying and collecting information on area features according to a robot's moving path, a robot controlled by the area features, and a method, medium and apparatus for composing a user interface using the area features.

[0011] Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

[0012] To achieve at least the above and/or other aspects and advantage, embodiments of the present invention include a robot controlled by area features. The robot includes a plurality of sensor modules to collect feature information of a predetermined area along a moving path of the robot, and an analyzer to analyze the collected feature information of the predetermined area according to a predetermined reference range and to classify the collected feature information into a plurality of groups.

[0013] To achieve at least the above and/or other aspects and advantage, embodiments of the present invention include a method of collecting and classifying feature information of a predetermined area according to a moving path of a robot. The method includes collecting feature information of the predetermined area along the moving path of the robot, and analyzing the collected feature information of the predetermined area according to a predetermined reference range to classify the feature information into a plurality of groups.

[0014] To achieve at least the above and/or other aspects and advantage, embodiments of the present invention include an apparatus for composing a user interface using area features. The apparatus includes a menu construction module to construct a plurality of menus using feature information of a predetermined area, the feature information being collected along a moving path of a robot, and a transmitter to transmit a control signal corresponding to the menus.

[0015] To achieve at least the above and/or other aspects and advantage, embodiments of the present invention include a method of composing a user interface using area features. The method includes constructing a plurality of menus using feature information of a predetermined area, the feature information being collected along a moving path of a robot, and transmitting a control signal corresponding to the menus.

[0016] To achieve at least the above and/or other aspects and advantage, embodiments of the present invention include a robot moving on a floor including a sensing system to collect feature information of a predetermined area along a moving path during a first pass of the robot, and a navigation system to use the collected feature information to adjust a movement of the robot during one or more subsequent passes.

[0017] To achieve at least the above and/or other aspects and advantage, embodiments of the present invention include a robot cleaning a floor including a sensing system to collect feature information of a predetermined area along a moving path during a first pass of the robot, and a cleaning adjustment system to use the collected feature information to adjust the cleaning of the robot during one or more subsequent passes.

[0018] To achieve at least the above and/or other aspects and advantage, embodiments of the present invention include a robot moving on a floor including a sensing system to

collect feature information of a predetermined area along a moving path during a first pass of the robot, a navigation system to use the collected feature information to adjust a movement of the robot during subsequent passes, and a cleaning adjustment system to use the collected feature information to adjust the cleaning of the robot during one or more subsequent passes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

[0020] FIGS. **1**A and **1**B illustrate a conventional method of moving a cleaning robot and information of a prepared map, respectively;

[0021] FIG. **2**A illustrates a robot controlled by area features, according to an embodiment of the present invention;

[0022] FIG. **2**B illustrates an apparatus composing a user interface (UI) using area features, according to an embodiment of the present invention;

[0023] FIG. **3**A illustrates a method of collecting and classifying feature information of a predetermined area along a moving path of a robot such as that of FIG. **2**, according to an embodiment of the present invention;

[0024] FIG. **3**B illustrates a method of composing a user interface such as by using the apparatus of FIG. **2**A, according to an embodiment of the present invention;

[0025] FIGS. **4**A-**4**C illustrate a method of collecting various kinds of feature information of a predetermined area along a moving path of a robot, according to an embodiment of the present invention;

[0026] FIG. **5**A-**5**C illustrate an example of feature data of a predetermined area, according to an embodiment of the present invention;

[0027] FIG. **6**A-**6**B illustrate one example of group information classified into predetermined groups using FIG. **5**, according to an embodiment of the present invention;

[0028] FIG. **7**A-**7**D illustrate another example of group information classified according to a predetermined reference range, according to an embodiment of the present invention; and

[0029] FIG. **8** illustrates a method of controlling a robot if a control command is transmitted to a predetermined area, according to an embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0030] Reference will now be made in detail to embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. Embodiments are described below to explain the present invention by referring to the figures.

[0031] FIG. **2**A illustrates a robot controlled by area features according to an embodiment of the present invention.

[0032] Referring to FIG. **2**A, a robot **200** controlled by area features may include a sensor module **210**, a memory module **220**, an analyzer **230**, a transceiver **240**, a search module **250**, a moving path design module **260**, a control module **270**, a driving module **280**, and a dirt remover **290**, for example.

[0033] The sensor module **210** may collect feature information for a predetermined area along a moving path of the robot **200**. The sensor module **210** may first collect position information and reference information regarding an obstacle when the robot **200** moves initially while preparing an inner structure map, hereinafter referred to as a base map, of a home. Also, the sensor module **210** may collect feature information regarding a predetermined area along the moving path after the base map is prepared, wherein the collected feature information of the predetermined area can later be added to the reference information collected, when the original base map is prepared. For example, if a user moves the robot **200** to a predetermined area using a button, e.g., attached to the robot **200**, the sensor module **210** may collect position information regarding the area and information regarding a dust pollution level and a floor material. The collected information can be added to the information of the original base map. Here, the feature information of the predetermined area may be collected and stored while the original base map is being prepared. The feature information of the area can be added to a memory area by matching the position information of the reference information stored when the original map is prepared with position information of a predetermined area, which is later collected.

[0034] The sensor module **210** may include a first sensor **211** providing information regarding a distance between the robot **200** and an obstacle above the robot **200** in a predetermined area where the robot **200** is located, and a second sensor **212** providing information regarding a floor material in the area where the robot is located. The sensor module **210** may further include a third sensor **213** providing information on dust, or other pollution, levels for the area where the robot **200** is located. The sensor module **210** may further include a fourth sensor **214** providing position information regarding the area where the robot **200** is located, and a fifth sensor **215** providing information regarding an obstacle on a moving path of the robot **200** in a predetermined area. The information provided by the sensors may be stored in a predetermined area, and then may be initiated according to the user's selection, or updated whenever the robot **200** moves to a predetermined area, for example.

[0035] Any one or more of an ultrasonic sensor, an infrared sensor, a laser sensor, an optical sensor, an image sensor, and a touch sensor may be used as the first sensor **211**, the second sensor **212**, the third sensor **213**, and the fifth sensor **215**. Also, a gyroscope (or compass) or a position sensor, such as an encoder, may be used as the fourth sensor **214**, wherein the gyroscope provides information regarding a rotational angle, and the encoder senses the operation of the robot's wheels, such as the rotational angle of the wheels, to provide information on motion speed. For example, a bumper may be fixed to the fifth sensor **215**. In addition, various sensors may be used, as apparent to one skilled in the art. A method of collecting feature information of the area will be described later with reference to FIG. **3**A through FIG. **5**C.

[0036] As an example, the memory module **220** may include a first memory **222**, storing feature information for the predetermined area collected by the sensor module **210**, and a second memory **224** storing group information classified into a plurality of groups by analyzing and collecting the information of the first memory **222**, according to a predetermined reference range. In an embodiment, the first memory **222** and the second memory **224** may be provided by dividing a single memory area or a hardware module. In addition, various memory areas may be provided as apparent to one skilled in the art.

[0037] The first memory **222** may store feature information for the predetermined area collected by the sensor module **210**, for example. The first memory **222** may include reference information, such as information regarding an obstacle on the robot's path, and position information, which is collected when the original base map is prepared. Also, the first memory **222** may include information regarding a floor material of the area where the robot **200** is located, the distance between the robot **200** and the obstacle in the robot's path, information on the dust pollution level of the area where the robot **200** is located, position information for the area where the robot **200** is located, and information regarding obstacles on the robot's path, in the predetermined area for example. In addition, the first memory **222** may include a variety of information, such as information regarding the cleaning frequency of an area. The cleaning frequency can be obtained by counting the number of cleanings required for an area per unit of time, where cleaning is frequently executed.

[0038] The second memory **224** may store group information classified into a plurality of groups by analyzing and collecting the information in the first memory **222** through the analyzer **230**. The second memory **224** may include identification information (e.g., G**1** and G**2**) that can identify the classified groups, wherein the group information may include feature information for each area, collected by the sensor module **210**, for example.

[0039] The analyzer **230** may analyze and collect the first memory **222** information according to a predetermined reference range, to classify the analyzed and collected information into a plurality of groups. In addition, the analyzer **230** may add feature information for the area to the reference information stored in the first memory **222**, by matching the reference information collected when the original base map is prepared, with the feature information for the area. For example, the analyzer **230** may add the area feature information to the first memory **222** by matching the position information of the reference information collected when the original base map is prepared, with the position information for the area where the feature information is collected, for example.

[0040] The analyzer **230** may analyze information regarding the floor material of the area where the robot **200** is located, to classify each area into a plurality of groups according to the floor material, such as carpet, linoleum, tile, wood, and mat, for example. In addition, in an embodiment, the analyzer **230** may classify each area into a plurality of groups such as a group of 0 cm~30 cm, a group of 30 cm~50 cm, a group of 50 cm~90 cm, for example, according to height using the information regarding the distance between the robot **200** and the obstacle located on the robot's path. The analyzer **230** may also classify each area into a plurality of groups using the information on the dust pollution level of the area where the robot **200** is located.

[0041] Furthermore, the analyzer **230** may collect information stored in the first memory **222**, relating to the floor material of the area where the robot **200** is located, the distance between the robot **200**, an obstacle on the robot's path, the dust pollution level of the area where the robot **200** is located, and the frequency of cleaning, so as to classify the information into the plurality of groups. In other words, the analyzer **230** may provide a classification reference range such as a first priority order and a second priority order according to the frequency of cleaning and the floor material, respectively, may align the feature information of the area stored in the first memory **222** according to the priority order, and may classify each area into a plurality of groups according to the predetermined reference range to store them in the second memory **224**, for example.

[0042] For example, in an embodiment a value of C1 can be given if the frequency of cleaning is greater than 10 times for a week, a value of C2 can be given if the frequency of cleaning belongs to a range of 6 times to 9 times, and a value of C3 can be given if the frequency of cleaning belongs to 1 time to 5 times. If each area is intended to be divided into the group having the greatest frequency of cleaning and a floor material of carpet, the analyzer **230** may search the information on the area corresponding to the frequency of cleaning of the value of C1 and the floor material of carpet from the first memory **222**, may align the searched information, and may classify the information into the plurality of groups on the basis of the frequency of cleaning and the floor material, for example. In one or more embodiments, the cleaning strength may be controlled by making the cleaning strength strong if the frequency of cleaning in the predetermined area is lower than that of the other area, or by making the relative cleaning strength weak if the frequency of cleaning in the predetermined area is higher than that of the other area.

[0043] The transceiver **240** may transmit and receive a control command for an area to which the robot **200** will be moved. If the user selects the area, to which the robot **200** will be moved, through an apparatus **203** for composing user interface, which will be described later with reference to FIG. **2**B, the transceiver **240** may receive the control command transmitted from a transmitter **209** of the apparatus **203** and may transmit the control command to the search module **250**, for example.

[0044] The search module **250** may read the control command received through the transceiver **240** and search and extract information corresponding to the control command from the group information. If the user transmits a predetermined control command, the search module **250** may read the control command received through the transceiver **240** and may extract the information corresponding to the control command while searching the group information stored in the second memory **224**. For example, if the user transmits the control command to move the robot **200** to an area having a high cleaning frequency by clicking a predetermined button, e.g., attached to the robot **200** to clean the area having a high cleaning frequency, the search module **250** may search the group information grouped by the areas having the high cleaning frequency from the second memory **224** according to the control command to extract the group information. Likewise, if the user selects carpet by clicking a touch screen of the robot **200** to clean the area of the floor having carpet, the search module **250** may search the group information grouped by the areas of the floor having carpet from the second memory **224** to extract the group information, for example.

[0045] Furthermore, if the user designates a predetermined area through a remote controller to transmit the control command toward the predetermined area, the search module **250** may read the control command and search the information corresponding to the control command from the group information to extract the information.

[0046] The moving path design module **260** may design the moving path of the robot **200** using the group information searched from the search module **250**, as an example. There, for example, if the predetermined area is classified into the groups such as carpet, linoleum, and tile and then stored in the

second memory **224**, the user may designate carpet to allow the search module **250** to search the group information corresponding to the area of the floor having carpet and extract the searched group information. Then, the moving path design module **260** may design the moving path of the robot **200** using the extracted group information. In an embodiment, the moving path design module **260** executes design of the moving path according to the group information having the floor covered with carpet by giving the priority order to an area closest to the area where the robot **200** is located. The control module **270** may control a moving direction of the robot **200** according to the moving path of the robot **200**, wherein the moving path is designed by the moving path design module **260**. If the user selects the area, to which the robot **200** will move, through a button or selection screen (e.g., a touch screen and an LCD, potentially) attached to the robot **200**, or a remote controller, the control module **270** may control the moving direction of the robot **200** according to the moving path of the robot, designed by the moving path design module **260**, using the group information searched from the search module **260** according to the user's selection, and may move the robot **200** through the driving module **280**. Accordingly, under various conditions such as a limited power supply and a limited cleaning time caused by peripheral circumstances, the collected feature information of the area is added to the reference information of the original base map and the moving path of the robot may be determined using the feature information of the area, whereby the robot may execute efficient cleaning. The driving module **280** may move the robot **200** under the control of the control module **270**. In an embodiment, a wheel-type device may be used as the driving module **280**, for example.

[0047] The dirt remover **290** may remove dirt or debris on the moving path of the robot **200**. The dirt remover **290** sucks external dust or contaminant material in the course of sucking external air. In addition, if the contaminant material is scattered on the floor due to jet of steam, the dirt remover **290** may collect the corresponding contaminant material, for example.

[0048] FIG. **2**B illustrates an apparatus for composing a user interface using the area features, according to an embodiment of the present invention.

[0049] The apparatus **203** using area features may include a menu construction module **205**, an output module **207**, and a transmitter **209**, for example.

[0050] The menu construction module **205** may construct a plurality of menus using feature information for a predetermined area. For example, the menu construction module **205** may construct the menus according to the floor material, the dust pollution level, the cleaning frequency, and home furniture (i.e. any obstacle located on the robot's path) using the group information classified by the analyzer **230**. In other words, the menu construction module **205** may construct the menus to reflect carpet and linoleum according to the floor material, using the information stored in the second memory, which stores the group information classified by the analyzer **230**. The menu construction module **205** may also construct the menus to reflect upper, middle and lower levels according to the dust pollution level, construct the menus to reflect upper, middle and lower levels according to the cleaning frequency, and construct the menus to reflect table and bed, according to the home's furniture. As another example, the menu construction module **205** can construct the menus by simplifying the menu to reflect only a dust pollution level at upper, middle and lower levels, or may construct the menu to reflect a home furniture name (e.g., bed), corresponding only to an area having a high pollution level.

[0051] The output module **207** may output the menus constructed by the menu construction module **205** to a screen or other display. For example, the output module **207** may output the menus to an LCD screen attached to the robot **200** or may output the menus to an LCD screen of a remote control. The LCD screen may include a touch screen. The output module **207** may output the menus to a communication device (e.g. a digital TV or a computer) connected with the robot through a wireless network. Accordingly, if the menus are constructed according to home furniture, a list including a table, a bed, and other home furniture may be output to the screen. The user may select a bed, or other item of furniture from the menu list using the output module **207** and may transmit the control command with the transmitter **209**.

[0052] In another embodiment, a plurality of buttons, e.g., attached to the robot/remote controller, for example, may be used instead of, or in addition to, the output module **207**. If the buttons are used as the output module **207**, a plurality of menus may be set by the buttons to allow the user to select them, for example.

[0053] The transmitter **209** may transmit a control signal corresponding to the menus selected by the user. For example, if the user clicks a dust pollution level menu, e.g., corresponding to the upper level, on the screen of the output module **207**, the transmitter **209** may transmit the corresponding control signal to the transceiver **240**.

[0054] Each component shown in FIGS. **2**A and **2**B may be made up of a "module".

[0055] FIG. **3**A illustrates a method of collecting and classifying the feature information of the predetermined area according to the moving path of the robot such as that of FIG. **2**A, according to an embodiment of the present invention.

[0056] The repeated description described in FIG. **2**A will be omitted, and the operations for designing the moving path of the robot **200**, using the feature information of the predetermined area will be now described in greater detail.

[0057] First, the sensor module **210** may collect the feature information of the predetermined area along the moving path of the robot **200** in operation S**301**. The sensor module **210** may collect various kinds of information, such as the floor material of the area where the robot **200** is located, the distance between the robot **200** and an obstacle above the moving path of the robot **200**, the dust pollution level of the area where the robot **200** is located, position information for the robot **200**, and information regarding an obstacle on the moving path of the robot **200** in the predetermined area. The information may be collected using the plurality of sensors.

[0058] The first memory **222** may store the feature information of the predetermined area collected by the sensor module **210**, in operation S**311**. Here, the feature information of the predetermined area may be added to the reference information stored in the first memory **222** when the original base map is prepared. The information may be added in such a manner that the position information of the reference information collected when the original base map is prepared is matched with the position information of the predetermined area collected later through the analyzer **230**, and then the feature information of the area is added to the position of the memory area where matching is executed, for example.

[0059] Next, for example, the analyzer **230** may analyze and collect the information stored in the first memory **222**,

according to the predetermined reference range, to classify the information into a plurality of groups, in operation S321.

[0060] Here, the second memory **224** may store the group information classified by the analyzer **230**, in operation S331. The second memory **224** may include identification information, e.g., G1 and G2, given to each group to identify the classified groups. The group information may include feature information for each area, for example, information collected by the sensor module **210**.

[0061] If the user commands the robot **200** to move to an area, such as by using the apparatus **203** such as the button or screen, e.g., a touch screen or an LCD screen, attached to the robot **200** or the remote controller, the transceiver **240** receives the control command for the area to which the robot **200** will move, in operation S341. For example, if the robot **200** (or remote controller) is provided with the plurality of buttons according to the floor material (e.g., carpet, linoleum, and wood) and the user selects the carpet group by clicking the first button, the transceiver **240** may receive the control command of the first button. Also, if the user transmits the control command towards the predetermined area using the remote controller, the transceiver **240** may receive the control command and the search module **250** may search group information corresponding to position information of the control command, for example.

[0062] Next, the search module **250** may read the control command received through the transceiver **240** to search the information corresponding to the control command from the group information in operation S351. In more detail, the search module **250** may read the control command received through the transceiver **240** if the user transmits the control command, and may extract the information corresponding to the control command while searching the group information stored in the second memory **224**, for example.

[0063] Then, the moving path design module **260** may design the moving path of the robot **200** using the group information searched by the search module **250**, in operation S361.

[0064] The control module **270** may control the moving direction of the robot **200** according to the moving path of the robot designed by the moving path design module **260**, in operation S371. At this time, the robot **200** removes dirt on the moving path.

[0065] FIG. **3**B illustrates a method of composing the user interface using FIG. **2**B, for example.

[0066] The repeated description described in FIG. **2**B will be omitted, and the operations of composing the user interface using area features will now be described in greater detail.

[0067] The menu construction module **205** constructs the plurality of menus using the feature information of the predetermined area, in operation S303. For example, the menu construction module **205** may construct the menus according to the floor material, the dust pollution level, the cleaning frequency, and the home furniture using the group information classified by the analyzer **230**.

[0068] The output module **207** may output the menus constructed by the menu construction module **205** onto the screen, in operation S306. For example, the output module **207** may output the menus onto the LCD screen attached to the robot **200**.

[0069] The transmitter **209** may transmit the control signal corresponding to the menus selected by the user, in operation S309.

[0070] FIGS. **4**A-**4**C illustrate a method of collecting various kinds of feature information of a predetermined area along the moving path of the robot, according to an embodiment of the present invention.

[0071] As shown in FIG. **4**A, the first sensor **211** may be attached to the upper portion of the robot **200**, so as to provide the distance information between the robot **200** and the obstacle above the robot **200** in the predetermined area where the robot **200** is located. Here, the ultrasonic sensor, the infrared sensor, the laser sensor, the optical sensor, the image sensor, and the touch sensor, or any other sensor may be used as the first sensor **211**. For example, if the ultrasonic sensor is attached to the upper portion of the robot **200**, the robot **200** may measure the distance to an obstacle located on the robot's path using a timing period corresponding to a restoring time of reflected ultrasonic waves, which are emitted toward the obstacle located above the robot **200**. Since a bed is generally lower than a table, each area may be classified into a plurality of groups according to a predetermined reference range using the distance information, for example. In other words, each area may be classified into a plurality of groups according to a predetermined reference range, such as a range of 0 cm~30 cm, a range of 30 cm~50 cm, and a range of 50 cm~90 cm, for example, using the distance information between the robot **200** and the obstacle located above the robot **200**. For example, the area where the bed is located is classified into one group according to a reference value of 0 cm~30 cm, and the area where the desk, table, and chair are located can be classified into another group according to a reference value of 30 cm~50 cm.

[0072] Furthermore, as shown in FIG. **4**B, the second sensor **212** may be attached to a lower surface of the robot **200**, for example, so as to provide information on the floor material corresponding to the area where the robot **200** is located. The third sensor **213** may also be attached to another lower surface of the robot **200**, for example, so as to provide the information on the dust pollution level corresponding to the area where the robot **200** is located. The ultrasonic sensor, the infrared sensor, the laser sensor, the optical sensor, the image sensor, the touch sensor, or any other sensor may be used as the second sensor **212**. The second sensor **212** may provide image information such as the floor material and shape, for example. The information regarding the floor material corresponding to the area where the robot **200** is located may be analyzed so as to classify each area into a plurality of groups according to the floor material such as carpet, linoleum, tile, wood, and mat. Various sensors for measuring a dust pollution level, for example, may be used as the third sensor **213**.

[0073] In addition to the sensors described in FIG. **4**A and FIG. **4**B, a fourth sensor or a fifth sensor, or both, may be attached to the robot **200** to collect the feature information of the predetermined area. The fourth sensor may provide position information regarding the area where the robot **200** is located, and the fifth sensor may provide information regarding any obstacle on the moving path of the robot **200** in the predetermined area. A position sensor such as a gyroscope or a compass and an encoder may be used as the fourth sensor, for example. Also, a bumper may be attached to the fifth sensor.

[0074] As shown in FIG. **4**C, the robot **200** may collect feature information regarding a predetermined area while moving to the area inside a home. The robot **200** may move to a table or a bed, or both, such as areas **410** and **420**, so that distance information between the table and the bed located

above the robot **200** can be sensed through the first sensor. Also, a floor material of the area where the robot **200** is located may be sensed through the second sensor **212**, for example. The dust pollution level of the area where the robot **200** is located may also be sensed through the third sensor **213**, for example, and the position information of the area where the robot **200** is located may be sensed through the fourth sensor, for example. Accordingly, the distance information between the robot **200** and the obstacle (e.g., table or bed) located above the robot **200**, the information on the floor material corresponding to an area where the robot **200** is located, the position information (coordinates) of the area where the robot **200** is located, and the information regarding the dust pollution level may be obtained through the aforementioned sensors, as examples only. These kinds of information may be stored in the memory area and then may be analyzed and collected to classify the information into a plurality of groups, whereby the information may be stored for each group.

[0075] FIGS. **5**A-**5**C illustrate an example of feature data of the predetermined area, according to an embodiment of the present invention.

[0076] As shown in FIG. **5**A, the robot **200** may originally prepare a base map of a structure inside a home along the moving path of the robot, in operation S**510**. The base map may be a grid type map, and the probability of an obstacle existing in each grid and the position information for the obstacle are expressed by a predetermined value that can be stored as reference information, for example.

[0077] If the base map is completely prepared, the feature information of the predetermined area may be collected along the moving path of the robot **200**, and the collected information may be added to the reference information of the base map in operation S**520**. Examples of the feature information of the predetermined area include the floor material, the distance between the robot **200** and an obstacle located above the robot **200**, the information on the dust pollution level of the area where the robot **200** is located, the position information of the area where the robot **200** is located, and the information regarding an obstacle on the moving path of the robot **200** in the predetermined area. For example, to store such feature information, the user may collect the feature information of the predetermined area by positioning the robot in the predetermined area, or when the base map is prepared in operation S**510**. In other words, the user may collect position information for an area having a high dust pollution level and the information on the floor material, by positioning the robot **200** in the high dust pollution area, and may add the collected information to the reference information of the base map. Alternatively, the user may collect the feature information of the predetermined area when the base map is prepared. The collected feature information may be stored in a database of the predetermined memory area.

[0078] Furthermore, for an area frequently cleaned by the robot **200**, the user may add information on the cleaning frequency, to the collected information or may separately process the feature information for each area, in operation S**530**. As shown in FIG. **5**B, the information collected in each of the operations S**510** to S**520** can be collected and then may be expressed as a grid type map according to features of the predetermined area. The grid **500** may represent the predetermined area where various kinds of information are collected by the robot **200**. In FIG. **5**B, areas **500***a*, **500***b*, and **500***c* expressed by the same color, have similar or identical features.

[0079] As shown in FIG. **5**C, the information collected by the plurality of sensors may be expressed by predetermined data values corresponding to each grid of FIG. **5**B. In other words, the information collected by the operations S**510** to S**520** may be expressed by predetermined data values. For example, the data values may be stored in such a manner that the feature information in operations S**520** to S**530**, of the predetermined area where the robot **200** is located, is added to the information (e.g., the position information, and the obstacle information) collected along the moving path of the robot **200** when the map is originally prepared, for example. Alternatively, the data values may be stored in such a manner that the feature information of the predetermined area is collected when the map is prepared.

[0080] The plurality of sensors may provide (a) information regarding the distance between the robot **200** and an obstacle located above the robot **200**, (b) information regarding the floor material of the area where the robot **200** is located, (c) information regarding the dust pollution level of the area where the robot **200** is located, (d) position information for the area where the robot **200** is located, and (e) information regarding an obstacle on the moving path of the robot **200** in the predetermined area, for example, in any manner or order.

[0081] For the distance information (a), the first sensor **211** may measure the distance between the robot **200** and the obstacle located above the robot **200**. The first sensor **211** may measure the distance value in any measurement unit such as a centimeter or a meter. In the case of home furniture, the distance value between the robot **200** and a lower surface of the home furniture located above the robot **200** may be measured and stored in the first sensor **211**, for example. For the floor information (b), the second sensor **212** may sense the floor material of the area where the robot **200** is located, so as to provide information regarding the floor material. The floor material may be classified into carpet, linoleum, tile, wood, and mat, as examples, so that a predetermined value may be given according to the material. For the dust pollution information (c), the third sensor **213** may measure the dust pollution level of the area where the robot **200** is located. For the position information (d), the fourth sensor **214** may measure the position information of the area where the robot **200** is located. The position information may be expressed by any coordinate values, such as x and y coordinates, for example. For the obstacle information (e), the fifth sensor **215** may provide information on an obstacle in the moving path of the robot **200** in the predetermined area. For example, a probability of a wall or other obstacle existing on the moving path of the robot **200** may be expressed by the predetermined value.

[0082] Identification values such as numerical value or character, or both, are given to the values measured in the information (a) to (e) according to the predetermined reference range and then may be stored in the memory area. In an embodiment, the predetermined reference range may be determined in the range of 0 cm~30 cm, 30 cm~50 cm, and 50 cm~90 cm using distance information between the robot **200** and the obstacle located above the robot **200**, and the predetermined identification value may be given according to each reference range. For example, the identification value of 100 may be given in the range of 0 cm~30 cm, the identification value of 110 may be given in the range of 30 cm~50 cm, and

the identification value of 120 may be given in the range of 50 cm~90 cm. Various numerical values may also be given according to the floor material. For example, a numerical value of 10 may be given to the floor material of carpet, a numerical value of 20 may be given to the floor material of linoleum, a numerical value of 30 may be given to the floor material of tile, and a numerical value of 50 may be given to the floor material of mat, as examples. Also, predetermined identification values of A through F, as examples only, may be given to each area according to the measured dust pollution leveling that area. For example, a value of A may be given to an area having a low dust pollution level, and a value of F may be given to an area having a relatively high dust pollution level. Furthermore, if existence probability values of the obstacle are classified into the range of 0 through 255, the existence probability of the obstacle is low in the range of 0 to 50 and is high in the range of 200 to 255, wherein the low existence probability of the obstacle may be expressed as "a" and the relatively high existence probability of the obstacle may be expressed as "c" to give such predetermined identification values according to the probability values. It is apparent that various reference ranges according to the measurement values measured by the plurality of sensors and various identification values given by the reference ranges may be provided, as may be determined by one skilled in the art.

[0083] Accordingly, referring to FIG. **5**C as only an example, for the feature information of the area where the robot **200** is located, if information on a predetermined grid is stored in the first memory **222** as 100, 10, A, a, x1, and y1 **502**, the numeral "100" represents that the distance between the robot **200** located on the predetermined area and the obstacle located above the robot **200** is in the range of 0 cm~3 cm, **10** represents that the floor material is of carpet, A represents that the dust pollution level is low, a represents that the existence probability of an obstacle is low, and x1 and y1 represent coordinates of x and y axes showing position information of the area where the feature information of the predetermined area is collected. The information of FIG. **5**C stored in the first memory **222** may be classified into groups according to the features of the area and then may be stored in the second memory **224** as shown in FIGS. **6**A-**6**B, for example.

[0084] FIGS. **6**A-**6**B illustrate one example of group information classified into predetermined groups using FIGS. **5**A-**5**C.

[0085] The feature information of the predetermined area collected by the sensor module **210** may be stored in the first memory **222**, and the analyzer **230** may analyze and collect the information in the first memory **222** according to the predetermined reference range and may classify the collected information into the plurality of groups. The classified group information may then be stored in the second memory **224**.

[0086] As shown in FIG. **6**A, if the collected information is intended to be classified into a plurality of groups according to the floor material, the highest priority order may be given to the floor material so that each group is classified first on the basis of the floor material, as an example. The analyzer **230** may give carpet the value of 10, as in **602**, linoleum the value of 20, tile the value of 30, wood the value of 40, and mat the value of 50, and the values may be stored in the first memory **222**. In addition, if a group of the information (a) to (e) described in FIGS. **5**A-**5**C is stored, the highest priority order may be given to the floor material. For example, the analyzer **230** may classify the group into a carpet group **600**, a linoleum group, and the like according to the floor material. The data may also be classified using any other group as a priority, allowing a plurality of groups to also be classified according to the level of dust pollution, as another example.

[0087] Furthermore, if an area of carpet located separately from another area of carpet in a predetermined area of a living room as shown in FIG. **6**B, the carpet group **600** may be classified into small groups **600***a* and **600***b*, using the position information of the carpet and the information on the floor material. For example, the carpet group **600** may be classified into small groups **600***a* and **600***b* using position information of areas **612** and **614** and the information on the floor material, wherein the area **612** is of carpet and has coordinate values of (x5, y5) to (x10, y10), and the area **614** is of carpet and has coordinate values of (x20, y5) to (x25, y10). Group information **610** that includes feature information **610***a* of an area may be included in the classified group, and also identification information (i.e., G**1** and G**2**) **604** according to each group may be given to the classified group. The feature information **610***a* of the area may include the floor material of the area where the robot **200** is located, the distance between the robot **200** and an obstacle located above the robot **200**, the information on the dust pollution level of the area where the robot **200** is located, the position information of the area where the robot **200** is located, and the information on the obstacle located on the moving path of the robot **200** in the predetermined area. In addition, it is apparent that the feature information **610***a* may include various kinds of information such as the cleaning frequency and identification information for each group, as may be determined by one skilled in the art.

[0088] Accordingly, if the user selects carpet (area) through the button or the selection screen (e.g., touch screen and LCD screen) attached to the robot **200**, the search module **250** may search the information corresponding to the floor material (e.g., carpet) from the group information, and may design the moving path of the robot **200** using the searched group information. In an embodiment, the search module **250** may design the moving path of the robot **200** to first move the robot to an area **616** nearest to the area where the robot **200** is located.

[0089] Furthermore, if the user transmits a control command toward a predetermined carpet area through the remote controller, the search module **250** may read the control command, search information corresponding to the control command from the group information, and extract the searched information. Thus, the search module **250** may design the moving path of the robot **200** using the extracted group information, for example. Here, as a result of the search, if the information corresponding to the control command does not exist, the control module **270** may move the robot **200** to an area to which the control command is transmitted, and collect the feature information of the area. The dirt remover **290** may be attached to the cleaning robot **200** so as to remove the dirt on the moving path of the robot **200** while the robot **200** is moving along the moving path.

[0090] As described above, the moving path of the robot **200** may be designed in such a manner that the group is classified according to the floor material and the stored group information is searched. However, the group may be classified according to various predetermined reference ranges as shown in FIGS. **7**A-**7**D, for example, and the moving path of the robot **200** may be designed and controlled using the principle of FIGS. **6**A-**6**D, as another example.

[0091] FIGS. **7**A-**7**D illustrates another example of group information classified according to a predetermined reference range.

[0092] As shown in FIG. **7**A, the analyzer **230** may classify the group using the distance information between the robot **200** and the obstacle located above the robot **200**. For example, the analyzer **230** may classify each area into groups for each type of furniture, such as a bed, a table and a sofa, using the distance information between the robot **200** and the furniture located above the robot **200**, or may classify the distance between the robot **200** and the furniture located above the robot **200** into predetermined reference ranges of, for example, 0 cm~30 cm, 30 cm~50 cm, 50 cm~90 cm, and 91 cm and greater. For example, an identification value of 100 may be given to the range of 0 cm~3 cm, an identification value of 110 may be given to the range of 30 cm~50 cm, and an identification value of 120 may be given to the range of 50 cm~90 cm. FIG. **7**A illustrates a group of areas **702** to which an identification value of 100 is given in the range of 0 cm~3 cm, for the distance between the robot **200** and the furniture located above the robot **200**. Here, the analyzer **230** may classify each group into small groups G**4** and G**5** using position information **702***a* of the furniture and the distance information **702** between the robot **200** and the furniture located above the robot **200**.

[0093] As shown in FIG. **7**B, the analyzer **230** may determine predetermined reference ranges according to a predetermined dust pollution level using the dust pollution level information for the area where the robot **200** is located, and may classify the group according to each reference range. If an identification value of A is given to the area having a low dust pollution level, and an identification value of F is given to an area having a relatively high pollution level, the robot **200** may be controlled to focus on an area having the highest relative dust pollution level, for example. FIG. **7**B illustrates a group of areas **704** to which the identification value of F is given using dust pollution level as the highest priority order, as an example. Here, the analyzer **230** may classify each group into small groups G**6** and G**7** using position information **704***a* for the area having the high dust pollution level, and the dust pollution level information **704**.

[0094] As shown in FIG. **7**C, since the group having the high dust pollution level in FIG. **7**B has a higher cleaning frequency than that of the other groups, the analyzer **230** may analyze the information on the cleaning frequency and classify the group according to the cleaning frequency. Here, the area having a high cleaning frequency may be controlled to have a lower cleaning strength than that of the area having a lower cleaning frequency, while the area having a low cleaning frequency may be controlled to have a higher cleaning strength than the area having the high cleaning frequency. For example, a value of C1 may be given to an area having a cleaning frequency of 10 times or greater for a week, a value of C2 may be given to an area having the cleaning frequency of 6 times to 9 times for a week, and a value of C3 may be given to an area having the cleaning frequency of 1 time to 6 times. FIG. **7**C illustrates a group of areas **706** to which the identification value of C1 is given using the cleaning frequency as the highest priority order. Here, the analyzer **230** may classify each group into small groups G**8** and G**9** using position information **706***a* for the area having the high cleaning frequency and the cleaning frequency information **706**.

[0095] As shown in FIG. **7**D, the analyzer **230** may collect a plurality of types of information to classify the information into the plurality of groups. The first priority order and the second priority order may be respectively given to the cleaning frequency and the floor material, and the feature information of the area stored in the first memory **222** may be aligned according to the priority order, classified into the plurality of groups according to a predetermined reference range, and stored in the second memory **224**, for example. FIG. **7**D illustrates groups G**10** and G**11** classified on the basis of the identification value **710** of the floor material corresponding to the second priority order, to which the identification value of C1 is given using the cleaning frequency as the first priority order, as an example.

[0096] The analyzer **230** may classify each group into small groups G**10** and G**11** using various kinds of information included in the group information, in addition to the aforementioned information. The moving path design module **260** may design the moving path of the robot **200** using the group information. In an embodiment, the moving path design module **260** may execute a design of the moving path by giving priority to an area closest to the area where the robot **200** is located. Here, the moving path design module **260** may execute the design of the moving path considering the information **712** of any obstacle on the moving path of the robot **200**, in the predetermined area.

[0097] FIG. **8** illustrates a method of controlling the robot **200** if the control command is transmitted to the predetermined area, according to an embodiment of the present invention.

[0098] The repeated description described in FIG. **3**A will be omitted, and the operations of controlling the robot using the group information of the classified groups will be described.

[0099] After the analyzer **230** analyzes and collects the information of the first memory **222** to store the group information, which is classified into the plurality of groups according to the predetermined reference range, in the second memory **224**, the moving path of the robot **200** may be controlled according to the features of the area, using the group information. For example, the robot **200** (or remote controller) may be provided with a plurality of buttons corresponding to the various types of floor materials (e.g., a button to select carpet, linoleum, and wood). A plurality of buttons may also be provided according to the cleaning frequency. Here, if the user selects the group corresponding to a carpeted section, by clicking the first button, the search module **250** may search the group information corresponding to floor material of carpet to allow the moving path design module **260** to design the moving path of the robot **200** using the searched group information. In an embodiment, the moving path design module **260** may execute design of the moving path by giving the priority to the area closest to the area where the robot **200** is located, for example.

[0100] If the user transmits the control command toward a predetermined area using the remote controller, the search module **250** may read the control command and search the information corresponding to the control command from the group information, as in operations S**801** and S**811**. Here, the search module **250** may search the group information using the position information, for the area to which the control command is transmitted, and the information on the floor material. As described above, if the search module **250** searches the information corresponding to the area, to which the control command is transmitted, from the group information, the moving path design module **260** may design the

moving path of the robot **200** using the group information searched by the search module **250** and the control module **270** may move the robot **200** along the designed moving path.

[0101] If the search module **250** fails to search the information corresponding to the area to which the control command is transmitted, from the group information, the moving path design module **260** may execute design of the moving path to move the robot **200** from the current position to the area to which the control command is transmitted, whereby the robot **200** may be driven toward the area to which the control command is transmitted in operation S**821**.

[0102] Next, the control module **270** may collect the feature information of the area, to which the control command is transmitted, through the sensor module **210** by moving the robot **200** to the area in which the control command is transmitted, in operation S**831**.

[0103] Afterwards, the first memory **222** may store the collected information, and the analyzer **230** may analyze and collect the information of the first memory **222** and classifies the collected information into the plurality of groups according to the predetermined reference range, whereby the group information may be stored in the second memory **224**, in operation S**841**.

[0104] The term "module", as used herein, may mean, but is not limited to, a software or hardware component, such as a Field Programmable Gate Array (FPGA) or Application Specific Integrated Circuit (ASIC), which performs certain tasks. A module may advantageously be configured to reside on the addressable storage medium and configured to execute on one or more processors. Thus, a module may include, by way of example, components, such as software components, object-oriented software components, class components and task components, processes, functions, attributes, procedures, subroutines, segments of program code, drivers, firmware, microcode, circuitry, data, databases, data structures, tables, arrays, and variables. The functionality provided for in the components and modules may be combined into fewer components and modules or further separated into additional components and modules.

[0105] In addition to this discussion, one or more embodiments of the present invention can also be implemented through computer readable code/instructions in/on a medium, e.g., a computer readable medium, to control at least one processing element to implement any above described embodiment. The medium can correspond to any medium/media permitting the storing and/or transmission of the computer readable code.

[0106] The computer readable code can be recorded/transferred on a medium in a variety of ways, with examples of the medium including magnetic storage media (e.g., ROM, floppy disks, hard disks, etc.), optical recording media (e.g., CD-ROMs, or DVDs), and storage/transmission media such as carrier waves, as well as through the Internet, for example. Here, the medium may further be a signal, such as a resultant signal or bitstream, according to one or more embodiments of the present invention. The media may also be a distributed network, so that the computer readable code is stored/transferred and executed in a distributed fashion. Still further, as only an example, the processing element could include a processor or a computer processor, and processing elements may be distributed and/or included in a single device.

[0107] As described above, in the method, medium and apparatus classifying and collecting information on area features according to a robot's moving path, the robot controlled by the area features, and the method, medium and apparatus composing a user interface using the area features according to the present invention, the moving path of the robot may be controlled according to the feature information of the predetermined area.

[0108] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. An apparatus for composing a user interface using area features, comprising:

a menu construction module to construct a plurality of menus using feature information of a predetermined area, the feature information being collected along a moving path of a robot; and

a transmitter to transmit a control signal corresponding to the menus.

2. The apparatus of claim **1**, further comprising an output module outputting the menus to a screen, wherein the menus comprise at least one of a floor material of an area where the robot is located, a dust pollution level, a cleaning frequency, and information regarding an obstacle located above the robot.

3. A method of composing a user interface using area features, comprising:

constructing a plurality of menus using feature information of a predetermined area, the feature information being collected along a moving path of a robot; and

transmitting a control signal corresponding to the menus.

4. The method of claim **3**, further comprising outputting the menus to a screen, wherein the menus comprise least one of a floor material of an area where the robot is located, a dust pollution level, a cleaning frequency, and information regarding an obstacle located above the robot.

5. At least one medium comprising computer readable code to control at least one processing element to implement the method of claim **4**.

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