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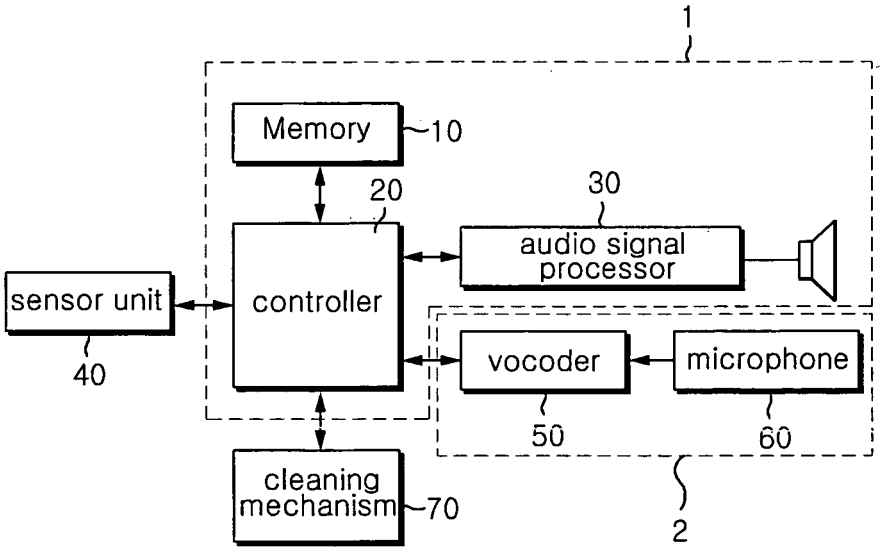
(54) Apparatus and method for notifying state of self-moving cleaning robot

(57) An apparatus and method for notifying the state of a self-moving cleaning robot using voice or a variety of melodies is provided. The self-moving state notification apparatus includes a voice notification unit (1) for outputting an audio signal notifying the operating state of the self-moving cleaning robot. The apparatus outputs voice or various melodies corresponding to states or errors of the self-moving cleaning robot while in operation, so that the user can be quickly and clearly notified of the state of the self-moving cleaning robot and thus can quickly take any necessary measures for the state, thereby ensuring that the self-moving cleaning robot operates reliably.

FIG.2



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Description

[0001] The present invention relates to a self-moving robot, and more particularly to an apparatus and method for notifying the state of a self-moving robot using voice or a variety of melodies.

[0002] Robots have been developed for industrial purposes and used as part of factory automation. Robots also have been used, in place of human beings, to collect information in extreme environments that human beings cannot access. Recently, human-friendly household robots have been developed. A typical example of the human-friendly household robot is a self-moving cleaning robot.

[0003] The self-moving cleaning robot is a device that sucks up dust or other foreign particles while automatically moving within a specific cleaning area as in a residence or office.

[0004] As shown in FIG. 1, a general cleaning robot includes a rechargeable battery, and drive wheels 5 provided on the cleaning robot are driven according to an operation command from a user so that the cleaning robot automatically moves to suck up foreign particles. The cleaning robot also includes a detection unit 8 that detects obstacles so that the cleaning robot avoids obstacles during movement.

[0005] When the battery level of the rechargeable battery becomes lower than a specific level while the cleaning robot performs a cleaning operation, the cleaning robot stores the current cleaning position in an internal memory and moves to a charger installed indoors. When the battery is completely charged, the cleaning robot moves back to the stored cleaning position and resumes the cleaning operation.

[0006] However, the conventional cleaning robot described above outputs a monotonous sound such as a buzzing sound to indicate a variety of states of the cleaning robot while in motion, such as a state in which the self-moving robot cannot move or displays information or error codes on a display unit.

[0007] For example, when moisture on the cleaning area impedes movement of the cleaning robot, the cleaning robot generates a buzzing sound "Bee~". In this case, the user cannot determine the cause of the buzzing sound without directly checking the state of the cleaning robot.

[0008] The conventional cleaning robot displays an information code such as "Info01", which indicates the state of the cleaning robot such as a power-on/off or charging state thereof, on the display unit or displays an error code such as "Err01", which indicates an error of the cleaning robot, on the display unit. However, when the information or error code is used to display the state of the cleaning robot, the user must refer to a manual in order to understand the information or error code.

[0009] Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide an apparatus and method for notifying the state of a self-moving cleaning robot, wherein voice or a variety of melodies are used to quickly and correctly notify the user of the state of the cleaning robot.

[0010] It is another object of the present invention to provide an apparatus and method for notifying the state of a self-moving cleaning robot, wherein the user's voice can be used as a notification message to notify the operating state of the cleaning robot.

[0011] In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of an apparatus for notifying the state of a self-moving robot, the apparatus comprising a voice notification unit for outputting a voice or melody notifying an operating state of the self-moving robot.

[0012] The voice notification unit includes a memory for storing a plurality of voice or melody data elements corresponding to operating states of the self-moving robot; an audio signal processor for signal-processing voice or melody data read from the memory and outputting the signal-processed audio data to a speaker; and a controller for reading a voice or melody data element corresponding to an operating state of the self-moving robot from the memory and controlling the audio signal processor to output the read voice or melody data element through the speaker.

[0013] Preferably, the apparatus further comprises a notification voice input unit for inputting a user's voice to be used as voice data notifying an operating state of the self-moving robot.

[0014] In accordance with another aspect of the present invention, there is provided a method for notifying the state of a self-moving robot, the method comprising the steps of a) checking an operating state of the self-moving robot; b) reading a voice or melody data element corresponding to the checked operating state from a memory; and c) signal-processing the read voice or melody data element and outputting the signal-processed voice or melody data element through a speaker.

[0015] Preferably, the method further comprises the step of receiving a user's voice to be used as voice data notifying an operating state of the self-moving robot and storing the received voice in the memory.

[0016] The apparatus and method according to the present invention outputs voice or various melodies corresponding to operating states or errors of the self-moving robot while in operation, so that the user can be quickly and clearly notified of the state of the cleaning robot and thus can quickly take any necessary measures for the state, thereby ensuring that the cleaning robot operates reliably.

[0017] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective external view of a general self-moving cleaning robot;

FIG. 2 is a block diagram of an apparatus for notifying the state of a self-moving cleaning robot according to an embodiment of the present invention;

FIG. 3 is a flow chart of a method for notifying the state of a self-moving cleaning robot according to an embodiment of the present invention; and

FIG. 4 is a flow chart of a procedure for inputting a user's voice to the cleaning robot according to an embodiment of the present invention.

[0018] Now, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. In the following description of the present invention, a detailed description of known functions and configurations incorporated herein will be omitted when it may obscure the subject matter of the present invention.

[0019] FIG. 2 is a block diagram of an apparatus for notifying the state of a self-moving cleaning robot according to an embodiment of the present invention.

[0020] In addition to the components of a general vacuum cleaner for sucking up dust or other foreign particles, the cleaning robot includes a cleaning mechanism 70 having a variety of motors for moving the cleaning robot. The basic configuration of the cleaning robot is known in the art and thus a detailed description thereof is omitted herein.

[0021] As shown in FIG. 2, the state notification apparatus according to the present invention includes a voice notification unit 1 that outputs an audio signal (i.e., voice or melody) that indicates operating states of the cleaning robot. The voice notification unit 1 includes a memory 10, a controller 20, and an audio signal processor 30.

[0022] The memory 10 stores audio information required to notify the states of the cleaner. The audio information stored in the memory 10 may be a plurality of voice or melody data elements that correspond respectively to a plurality of states of the cleaner. For example, when the cleaning robot is being charged, a notification message "cleaner is being charged" may be set as a voice data element corresponding to the charging state of the cleaning robot.

[0023] The controller 20 reads and outputs, from the memory 10, an audio information element corresponding to an output signal of a sensor unit 40 that detects the state of the cleaning robot.

[0024] For example, the controller 20 reads and outputs, from the memory 10, audio information elements that correspond respectively to a state in which the cleaning robot has started cleaning, a state in which the cleaning robot is powered on or off, a state in which in which the cleaning robot is being charged, a state in which a brush for sucking up foreign particles is not rotating, and a state in which the operation of the cleaning robot is restricted due to moisture on the floor.

[0025] The audio signal processor 30 signal-processes the audio information read by the controller 20 and outputs the signal-processed audio information to a speaker. The audio signal processor 30 may include a D/A converter to convert the audio information in digital format stored in the memory 10 into an analog signal and then to output the analog signal through the speaker.

[0026] The sensor unit 40 includes a variety of sensors for detecting states of the cleaning robot. For example, the sensor unit 40 is composed of a moisture sensor, a heat sensor, pressure sensor, and an infrared sensor.

[0027] The state notification apparatus according to the present invention may further includes a notification voice input unit 2 for storing a user's voice to be used as audio information to notify the states of the cleaning robot.

[0028] The notification voice input unit 2 includes a microphone 60 for receiving the user's voice and a vocoder 50 for encoding the user's voice input through the microphone 60 into a format suitable for storage. The user's voice encoded by the vocoder 50 is stored as audio information in the memory 10 under the control of the controller 20.

[0029] For example, the audio information stored through the microphone 60 and the vocoder 50 may be the user saying things such as "the cleaner starts", "power on", "power off", and "cleaner is being charged".

[0030] A description will now be given of how the self-moving robot state notification apparatus according to the present invention operates.

[0031] FIG. 3 is a flow chart of a method for notifying the state of a self-moving cleaning robot according to an embodiment of the present invention. This method is exemplified by a state in which the cleaning robot cannot move.

[0032] As shown in FIG. 3, when a user inputs an operation start command (S80), audio information "the cleaning robot starts operation" is output through the speaker (S90), and the cleaning robot starts a cleaning operation (S100).

[0033] During the cleaning operation, the controller 20 checks the state of the cleaning robot through the sensor unit 40 (S110). For example, when a state in which the cleaning robot cannot move is detected, the controller 20 checks audio information stored in the memory 10 and reads a notification message corresponding to the detected state such as "the cleaning robot cannot move" (S120).

[0034] The read audio information is signal-processed through the audio signal processor 30 and is then output through the speaker (S130). Accordingly, the user can be quickly and clearly notified of the state of the cleaning robot and thus can quickly take any necessary measures for the state, thereby ensuring that the cleaning robot operates reliably.

[0035] Until the user inputs a command to terminate the operation of the cleaning robot, the controller 20 repeats the above processes of checking the state of the cleaning robot and reading and outputting a corresponding notification message through the speaker (S140).

[0036] The user can record his or her voice to be used as a state or error notification message of the self-moving

cleaning robot.

[0037] FIG. 4 is a flow chart of a procedure for inputting the user's voice to the cleaning robot according to an embodiment of the present invention.

[0038] As shown in FIG. 4, when the user presses a specific button provided on the cleaning robot in order to request voice recording and to input his or her voice to be used as audio information indicating the operating state of the cleaning robot (S210), the controller 20 switches the operating mode of the cleaning robot to recording mode (S220).

[0039] When the user presses a specific button in order to start voice recording (S230), the user's voice input through the microphone 60 is encoded by the vocoder 50 and the encoded voice signal is stored in the memory 20 at a specific address specified by the controller 20.

[0040] Specifically, when the user speaks words "the charger is being charged" into the microphone 60 provided on the cleaning robot, the vocoder 50 converts the spoken words into audio information suitable for storage and stores the audio information in the memory 10.

[0041] When the user requests that the recording mode be terminated (S250), the controller 20 deactivates the recording mode and switches the operating mode of the cleaning robot according to a command input by the user afterwards.

[0042] Accordingly, the cleaning robot outputs a notification message recorded directly by the user, rather than a standard notification message stored by the manufacturer, thereby resulting in a more user-friendly cleaning robot.

[0043] As is apparent from the above description, the present invention provides an apparatus and method for notifying the state of a self-moving cleaning robot, which outputs voice or various melodies corresponding to states or errors of the self-moving robot while in operation, so that the user can be quickly and clearly notified of the state of the cleaning robot and thus can quickly take any necessary measures for the state, thereby ensuring that the cleaning robot operates reliably.

[0044] In addition, the method and apparatus according to the present invention uses a notification message recorded directly by the user as a message indicating the operating state of the self-moving robot, thereby resulting in a more user-friendly self-moving robot.

[0045] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

1. An apparatus for notifying the state of a self-moving robot, the apparatus comprising:

   a voice notification unit (1) for outputting an audio signal notifying an operating state of the self-moving robot.

2. The apparatus according to claim 1, wherein the voice notification unit (1) includes:

   a memory (10) for storing a plurality of audio data elements corresponding to operating states of the self-moving robot;
   an audio signal processor (30) for signal-processing audio data read from the memory (10) and outputting the signal-processed audio data to a speaker; and
   a controller (20) for reading an audio data element corresponding to an operating state of the self-moving robot from the memory (10) and controlling the audio signal processor (30) to output the read audio data element through the speaker.

3. The apparatus according to claim 1 or 2, wherein the audio signal is a voice signal.

4. The apparatus according to claim 1 or 2, wherein the audio signal is a melody signal.

5. The apparatus according to any of claims 1 to 4, further comprising:

   a notification voice input unit (2) for inputting a user's voice to be used as audio data notifying an operating state of the self-moving robot.

6. The apparatus according to any of claims 1 to 5, wherein the self-moving robot is a cleaning robot.

7. A method for notifying the state of a self-moving robot, the method comprising the steps of:

   a) checking an operating state of the self-moving robot;
   b) reading an audio data element corresponding to the checked operating state from a memory (10); and
   c) signal-processing the read audio data element and outputting the signal-processed audio data element through a speaker.

8. The method according to claim 7, wherein the audio data is voice data.

9. The method according to claim 7, wherein the audio data is melody data.

10. The method according to any of claims 7 to 9, further comprising the steps of:

d) receiving a user's voice to be used as audio data notifying an operating state of the self-moving robot and storing the received voice in the memory (10).

11. The method according to any of claims 7 to 10, wherein the self-moving robot is a cleaning robot.

FIG. 1

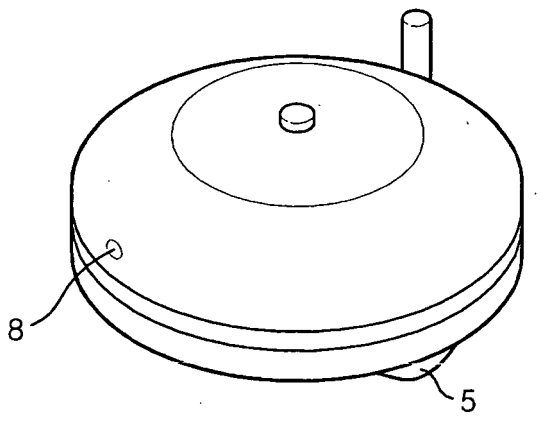


FIG.2

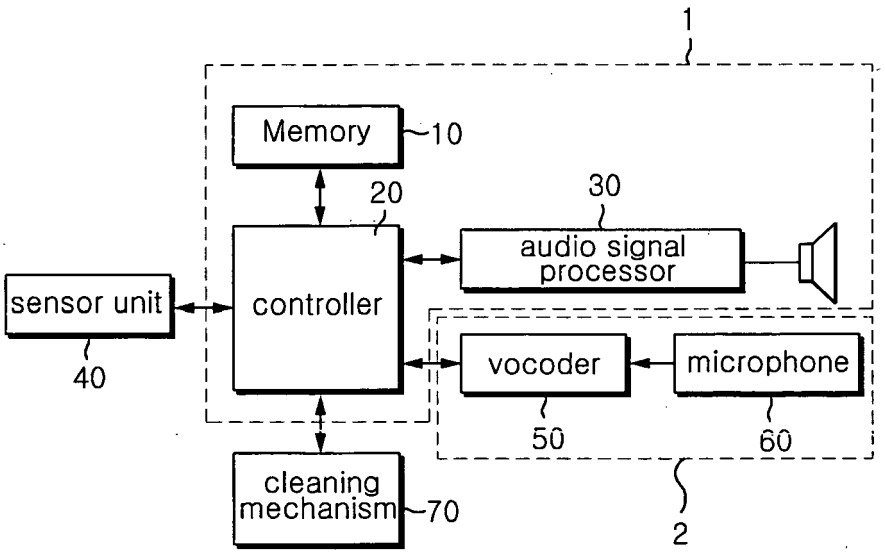

1
Memory
10
20
30
audio signal processor
sensor unit
controller
40
vocoder
microphone
50
60
cleaning mechanism
70
2

FIG.3

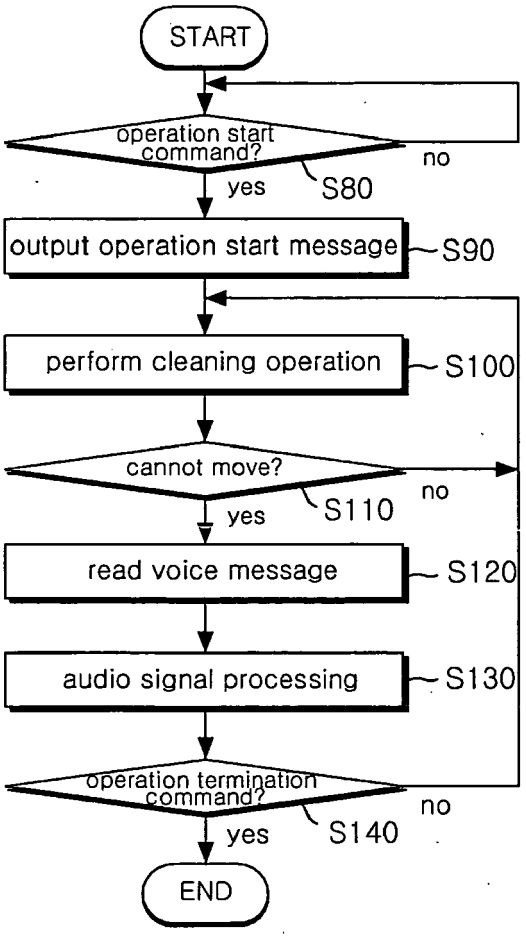
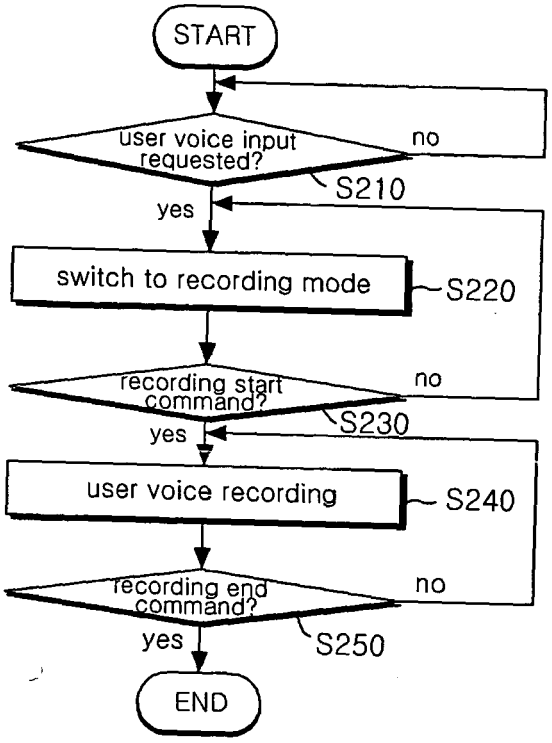

START
operation start command?
no
yes
S80
output operation start message
S90
perform cleaning operation
S100
cannot move?
no
yes
S110
read voice message
S120
audio signal processing
S130
operation termination command?
no
yes
S140
END

FIG.4


START
user voice input requested?
no
S210
yes
switch to recording mode
S220
recording start command?
no
S230
yes
user voice recording
S240
recording end command?
no
yes
S250
END