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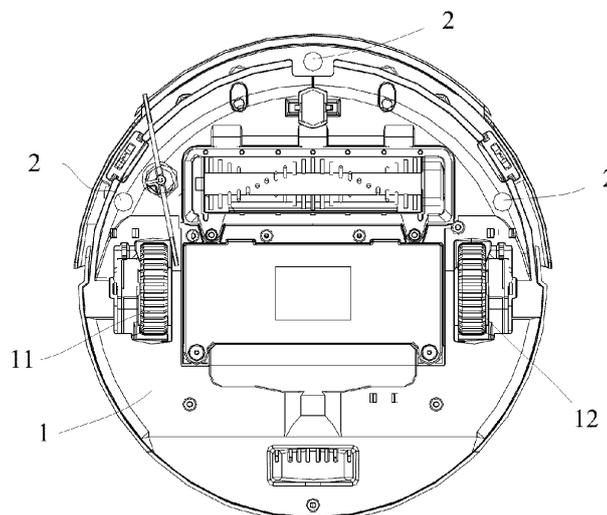
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(54) **SELF-MOVING DEVICE AND CONTROL METHOD THEREFOR**

(57) A self-moving device is disclosed, comprising a main body (1), downward-looking sensors (2) and a control module, wherein the number of the downward-looking sensors (2) is two or more, and all the two or more downward-looking sensors (2) are installed at the bottom of the main body (1); the control module is installed within the main body (1) and is connected to the downward-looking sensors (2), and the control module con-

trols actions of the main body (1) according to the number of suspending signals sent from the downward-looking sensors (2). The self-moving device enables the main body (1) to make correct actions, thereby avoiding falling caused by the turning to another suspending position, and avoiding power waste and possible pollution caused by the idling during suspending.

Fig. 1



**EP 3 007 023 A1**

**Description****Field of the Invention**

**[0001]** The present invention relates to a self-moving device, and particularly relates to a fall protection structure of the self-moving device and a control method thereof.

**Background art**

**[0002]** Currently, with the popularity of the self-moving type intelligent home appliances such as intelligent vacuum cleaner and intelligent sweeper, a growing number of families use the intelligent home appliances in order to relief work load and enhance life quality.

**[0003]** During the operation process, the intelligent vacuum cleaner or the like may encounter stairs, and an untimely power shut-off would cause falling, thereby resulting in damages to the machine and bringing about economic losses. Thus, it is necessary to provide a fall protection device. The conventional vacuum cleaner is installed with a detector on its front portion, and when an abnormal situation has been detected, the vacuum cleaner moves back or turns left/right so as to avoid falling. However, during the operation process, the intelligent vacuum cleaner or the like may also be knocked over, or the user may directly lift it up for checking or other purposes. In this situation, the intelligent vacuum cleaner or the like will keep operating if it is performing instructions for moving back or turning left/right, which results in not only energy waste but also secondary pollution due to the dust spatter caused by the rotation of the rolling brush.

**[0004]** For example, US patent No. 7155308 discloses a robot having a downward-looking sensor. When the downward-looking sensor detects no signal, the robot performs a turning action, thereby avoiding the risk of damage due to falling (e.g., from stairs). However, sometimes the robot may face the possibility of getting into a suspending state even after turning left or right. In this state, since it is too late for the robot to move back or turn, the robot will fall, or its one wheel will suspend and idle above a recess. Further, when the robot operates abnormally and is lifted up for checking or maintenance purposely, the robot cannot realize it is being lifted up, and still performs the turning action, which results in energy waste, secondary pollution, or the like.

**[0005]** In order to solve the above problems, the conventional intelligent vacuum cleaner is usually provided with a travel switch at a floating drive wheel. In case of normal operation, the drive wheel is pressed downward by the gravity of the machine body, and the travel switch senses no suspending signal. When the intelligent vacuum cleaner is lifted up, the drive wheel falls itself, and the travel switch acts to sense a suspending signal and controls the intelligent vacuum cleaner to stop operating and get into a standby state. However, it requires a large space for installing the floating drive wheel, and thus it

is necessary for the machine body to have an enough height. However, in order to adaptively clean a wide variety of cleaning areas, in particular a small area under the furniture such as a bed or a cabinet, the intelligent vacuum cleaner in the prior art is expected to have a lower height. Thus, it is impossible to install the floating drive wheel and the travel switch thereof on such vacuum cleaner.

**Summary of the Invention**

**[0006]** As to the above problem, the present invention provides a self-moving device that can detect a suspending situation in time so that the self-moving device performs correct actions, and thus can not only prevent falling but also recognize suspending actions, thereby reducing energy loss and avoiding possible pollution.

**[0007]** In the present invention, the technical problems are solved by the following technical solutions:

A self-moving device comprising:

a main body;

downward-looking sensors, the number of which is two or more, and all of which are installed at the bottom of the main body; and

a control module, which is installed within the main body and is connected to the downward-looking sensors, wherein the control module controls actions of the main body according to the number of suspending signals sent from the downward-looking sensors.

**[0008]** In the present invention, the two or more downward-looking sensors are installed at the bottom of the main body to facilitate the detection the suspending state. The suspending signals at different positions are sent to the control module, and the control module can determine the position state of the main body according to different numbers of the suspending signals, so that the main body can perform correct actions, thereby avoiding falling caused by the movement to a further suspending position, and avoiding waste and possible pollution caused by the idling during suspending. The present invention has a simple structure, requires no human intervention, is convenient and reliable, and has a good market prospect.

**[0009]** Preferably, the two or more downward-looking sensors are all located at the outer edge of the bottom of the main body. The suspending signals can be detected earlier by installing the downward-looking sensors at the outer edge of the bottom of the main body, and the main body has much room to avoid falling caused by an untimely turn in case of a relatively high speed.

**[0010]** Preferably, the number of the downward-looking sensors is three, wherein one downward-looking sen-

sor is located at the front portion of the main body, and the other two are located at both sides of the main body. The detections in the three directions of left, right and front eliminate blind spot, and can avoid falling and damage caused by the mistaken turning from one suspending position to another suspending position.

**[0011]** Preferably, the two or more downward-looking sensors comprise downward-looking sensors located at the outer edge of the bottom of the main body and downward-looking sensors located at the inner sides of drive wheels that are provided at the bottom of the main body. Because of the installation of the downward-looking sensors at the inner sides of the drive wheels, the state where the main body is knocked over or lifted up from the ground or the drive wheel is suspended at an edge can be further determined, so that a timely power shut-off can be performed under the state to avoid energy losses and possible pollution.

**[0012]** Preferably, an alarm module is further comprised, which is communicatively connected to the control module. Because of the alarm send by the alarm module, the operator's attention can be drawn, so that the self-moving device of the present invention can be maintained in time to prevent even greater accident.

**[0013]** In the present invention, the technical problems are also solved by the following technical solutions:

A control method of a self-moving device comprises the following steps:

step (1): two or more downward-looking sensors, which are located at the bottom of a main body, collecting suspending signals;

step (2): the downward-looking sensors sending the collected suspending signals to a control module;

step (3): the control module controlling the main body according to the number of the suspending signals sent from the downward-looking sensors in the following manner:

when there is only one downward-looking sensor sending the suspending signal, the control module controls the main body to turn; and

when there are two or more downward-looking sensors sending the suspending signals, the control module controls the main body to get into an operation interrupted state.

**[0014]** In the present invention, the two or more downward-looking sensors are installed at the bottom of the main body to facilitate the detection of the suspending state. The suspending signals at different positions are

sent to the control module, and the control module can determine the position state of the main body according to different numbers of the suspending signals, so that the main body can perform correct actions, thereby avoiding falling caused by the movement to a further suspending position, and avoiding waste and possible pollution caused by the idling during suspending. The present invention has a simple structure, requires no human intervention, is convenient and reliable, and has a good market prospect.

**[0015]** In another embodiment, the control method of the present invention comprises the following steps:

step (1): two or more downward-looking sensors, which are located at the bottom of a main body, collecting suspending signals;

step (2): the downward-looking sensors sending the collected suspending signals to a control module;

step (3): the control module controlling the main body according to the number of the suspending signals sent from the downward-looking sensors in the following manner:

when there is only one downward-looking sensor sending the suspending signal, the control module controls the main body to turn; and

when there are two or more downward-looking sensors sending the suspending signals, the control module controls the main body to turn within a time period T first, and once the time period T has elapsed, if there are still two or more downward-looking sensors sending the suspending signals, the control module controls the main body to get into an operation interrupted state; if there is only one downward-looking sensor sending the suspending signal, the control module controls the main body to further turn; and if there is no downward-looking sensor sending the suspending signal, the control module controls the main body to operate normally, wherein, the time period  $T > 0$ .

**[0016]** In the present invention, the two or more downward-looking sensors are installed at the bottom of the main body to facilitate the detection the suspending state. The suspending signals at different positions are sent to the control module, and the control module can determine the position state of the main body according to different numbers of the suspending signals, and can further determine the position state of the main body by the time delay when there are two or more downward-looking sensors sending the suspending signals, so that the main body can perform correct actions, thereby avoiding falling caused by the movement to a further suspending position, and avoiding waste and possible pollution caused

by the idling during suspending. The present invention has a simple structure, requires no human intervention, is convenient and reliable, and has a good market prospect.

**[0017]** Preferably, the time period T is 300~800 ms. The buffer time should not be too long or too short; otherwise the present invention cannot achieve the above functions or causes energy waste and makes the buffering meaningless.

**[0018]** In another embodiment, the control method of the present invention comprises the following steps:

step (1): two or more downward-looking sensors, which are located at the bottom of a main body, collecting suspending signals, wherein the two or more downward-looking sensors comprise downward-looking sensors located at the outer edge of the bottom of the main body and downward-looking sensors located at the inner sides of drive wheels that are provide at the bottom of the main body;

step (2): the downward-looking sensors sending the collected suspending signals to a control module;

step (3): the control module controlling the main body according to the number of the suspending signals sent from the downward-looking sensors in the following manner:

when there is only one downward-looking sensor sending the suspending signal, the control module controls the main body to turn; and when there are two or more downward-looking sensors sending the suspending signals, if the suspending signals sent from the downward-looking sensors located at the inner sides of the drive wheels are comprised, the control module controls the main body to get into an operation interrupted state; otherwise, the control module controls the main body to turn.

**[0019]** In the present invention, the two or more downward-looking sensors are installed at the bottom of the main body to facilitate the detection the suspending state. The suspending signals at different positions are sent to the control module, and the control module can determine the position state of the main body according to different numbers of the suspending signals, and can further determine the position state of the main body by the mark information of the signals from the downward-looking sensors when there are two or more downward-looking sensors sending the suspending signals, so that the main body can perform correct actions, thereby avoiding falling caused by the movement to a further suspending position, and avoiding waste and possible pollution caused by the idling during suspending. The present invention has a simple structure, requires no human intervention, is convenient and reliable, and has a good mar-

ket prospect.

**[0020]** Preferably, the control module is also connected to an alarm module. The alarm module sends an alarm while the control module controls the main body to get into the operation interrupted state. Because of the alarm sent by the alarm module, the operator's attention can be drawn, so that the self-moving device of the present invention can be maintained in time to prevent even greater accident.

## Description of accompanying drawings

### [0021]

Fig. 1 is a structure schematic view of the first embodiment of the self-moving device according to the present invention; and

Fig. 2 is a structure schematic view of the second embodiment of the self-moving device according to the present invention.

## Detailed Description of Preferred Embodiments

**[0022]** The present invention discloses a self-moving device, which may be an intelligent vacuum cleaner, an intelligent sweeper or other small devices that can move themselves, and a control method thereof. By detecting and recognizing suspending signals, the self-moving device may be controlled to perform corresponding actions to achieve the purposes of fall protection, energy saving and pollution prevention. Further, the self-moving device performs the process completely automatically without needing any human intervention, and has a simple structure without increasing the production and usage cost. Thus, the self-moving device has a great market value.

**[0023]** Hereinafter, the self-moving device and the control method thereof of the present invention will be described by referring to two embodiments shown in the accompanying drawings.

### First Embodiment

**[0024]** In the present embodiment, the self-moving device of the present invention comprises a main body 1, downward-looking sensors 2, a control module (not shown) and an alarm module (not shown). The main body 1 is a main component of the self-moving device for performing various actions, and drive wheels 11, 12 are installed at the bottom of the main body 1 for facilitating its own movement.

**[0025]** The number of the downward-looking sensors 2 is three (but is not limited to three, and may be two or four or more). All the three downward-looking sensors 2 are located at the outer edge of the bottom of the main body 1, wherein one downward-looking sensor 2 is located at the front portion of the main body 1, and the other two are located at both sides of the main body 1.

**[0026]** These three downward-looking sensors 2 are infrared sensors (but are not limited to the infrared sensors, and may be ultrasonic sensors, tactile sensors or the like) and each comprises an infrared transmitter and an infrared receiver. When the receiver receives an infrared signal reflected from the ground, it is determined that the main body is in a normal state, and when the receiver receives no reflected signal, it is determined that the main body is in a suspending state.

**[0027]** The control module is installed within the main body 1 and is connected to the downward-looking sensors 2. The control module controls the actions of the main body 1 according to the number of the suspending signals sent from the downward-looking sensors 2.

**[0028]** In the present embodiment, the alarm module is further comprised (which may not be provided if necessary), and is communicatively connected to and driven by the control module. The alarm module may be a speaker or an alarm light that sends an alarm signal to remind and warn the operator by whistling or flashing.

**[0029]** The control method of the self-moving device of the present embodiment has two modes, wherein one mode is described as below.

**[0030]** The control method of the self-moving device comprises the following steps:

Step (1): the three downward-looking sensors 2, which are located at the bottom of the main body 1, collecting the suspending signals;

Step (2): the downward-looking sensors 2 sending the collected suspending signals to the control module;

Step (3): the control module controlling the main body 1 according to the number of the suspending signals sent from the downward-looking sensors 2 in the following manner:

When there is only one downward-looking sensor 2 sending the suspending signal, the control module controls the main body 1 to turn; and

When there are two or more downward-looking sensors 2 sending the suspending signals, the control module controls the main body 1 to get into an operation interrupted state.

**[0031]** When there are two or more two or more downward-looking sensors 2 sending the suspending signals, the main body 1 may be in a state of being knocked over or lifted up, and should get into the operation interrupted state immediately, so as to avoid energy losses and possible pollution.

**[0032]** The other mode is described as below.

**[0033]** The control method of the self-moving device comprises the following steps:

Step (1): the three downward-looking sensors 2, which are located at the bottom of the main body 1, collecting the suspending signals;

Step (2): the downward-looking sensors 2 sending the collected suspending signals to the control module;

Step (3): the control module controlling the main body 1 according to the number of the suspending signals sent from the downward-looking sensors 2 in the following manner:

When there is only one downward-looking sensor 2 sending the suspending signal, the control module controls the main body 1 to turn; and When there are two or more downward-looking sensors 2 sending the suspending signals, the control module controls the main body 1 to turn within a time period T first. Once the time period T has elapsed, if there are still two or more downward-looking sensors 2 sending the suspending signals, the control module controls the main body 1 to get into the operation interrupted state; if there is only one downward-looking sensor 2 sending the suspending signal, the control module controls the main body 1 to further turn; and if there is no downward-looking sensor 2 sending the suspending signal, the control module controls the main body 1 to operate normally. Here, the time period  $T > 0$ .

**[0034]** In this control method, a time delay is provided to facilitate the further detection of the state of the main body 1, in order to make a more correct judgment and to avoid delaying the normal intelligent self-moving operation. In fact, when the control module receives two or more suspending signals, if the main body 1 just locates at an edge or corner and turns immediately at this time, the control module will not sense suspending signal or senses only one suspending signal after the delay of time period T; and if the main body 1 is knocked over or lifted up or the wheel is suspended at an edge, the control module will still receive two or more suspending signals after the delay of time period T. In the present embodiment, the time period T is 300~800 ms, preferably 500 ms.

## Second Embodiment

**[0035]** In the present embodiment, the self-moving device of the present invention also comprises a main body 1, downward-looking sensors 2, a control module (not shown) and an alarm module (not shown). The main body 1, the control module and the alarm module are substantially the same as those of the first embodiment, the description of which will be omitted.

**[0036]** In the present embodiment, the number of the

downward-looking sensors 2 is five (but is not limited to five, and may be two or more). The five downward-looking sensors 2 are located at the outer edge of the bottom of the main body 1 and at the inner sides of the drive wheels 11, 12 that are provided at the bottom of the main body 1, respectively. In the present embodiment, three of the downward-looking sensors 2 are located at the outer edge of the bottom of the main body 1, wherein one three downward-looking sensor 2 is located at the front portion of the main body 1, and the other two are located at both sides of the main body 1. Further, the remaining two downward-looking sensors 2 are located at the inner sides of the drive wheels 11, 12 that are provided at the bottom of the main body 1, and the two drive wheels 11, 12 correspond to the two downward-looking sensors 2 one-to-one.

**[0037]** Since the positions of the downward-looking sensors 2 are different, the signals sent to the control module by the downward-looking sensors of different positions may carry corresponding position coding information so that the control module can recognize and determine the positions of the signal senders on the main body 1. Undoubtedly, different types of downward-looking sensors may be adopted based on the different positions of the downward-looking sensor 2. For example, the downward-looking sensors 2 provided at the outer edge of the bottom of the main body 1 are infrared sensors, while the downward-looking sensors 2 provided at the inner sides of the bottom drive wheels 11, 12 are ultrasonic sensors, etc. As long as the control module can effectively recognize the sensors, the downward-looking sensors may be of same type or different types. Preferably, the suspending signal data itself received by the control module contains a mark, and the mark may be position coding information or type information of the downward-looking sensor 2. The control method of the self-moving device of the present embodiment comprises the following steps:

Step (1): the five downward-looking sensors 2, which are located at the bottom of the main body 1, collecting the suspending signals, wherein three of the downward-looking sensors 2 are located at the out edge of the main body 1, and the other two are located at the inner sides of the drive wheels 11, 12;

Step (2): the five downward-looking sensors 2 sending the collected suspending signals to the control module;

Step (3): the control module controlling the main body 1 according to the number of the suspending signals sent from the downward-looking sensors 2 in the following manner:

When there is only one downward-looking sensor 2 sending the suspending signal, the control module controls the main body 1 to turn; and

When there are two or more downward-looking sensors 2 sending the suspending signals, if the suspending signals sent from the downward-looking sensors 2 located at the inner sides of the drive wheels 11, 12 are comprised, the control module controls the main body 1 to get into an operation interrupted state; otherwise, the control module controls the main body 1 to turn.

**[0038]** After receiving the suspending signals sent from the downward-looking sensors 2 located at the outer edge of the bottom of the main body 1 and the downward-looking sensors 2 located at the inner sides of the drive wheels 11, 12, the control module recognizes whether the downward-looking sensors 2 are located at the outer edge of the bottom of the main body 1 or at the inner sides of the drive wheels 11, 12, and then makes a judgment and sends instructions. To be specific, when the two or more downward-looking sensors 2 comprises at least one downward-looking sensor 2 sending the suspending signal which is located at the inner side of the drive wheels 11, 12, the control module determines that the main body 1 is in a suspending state (the main body 1 may be knocked over or lifted up, or the wheels may be suspended at an edge) and sends an instruction for getting into the operation interrupted state.

**[0039]** In the present embodiment, since two downward-looking sensors 2 are provided at the inner sides of the drive wheels 11, 12, whether the self-moving device is knocked over or lifted up or not can be determined very accurately so that a correct judgment can be made immediately, thereby avoiding energy waste and possible pollution.

### Claims

1. A self-moving device, **characterized in that**, comprising:

a main body (1);  
downward-looking sensors (2), the number of which is two or more, and all of which are installed at the bottom of the main body (1); and  
a control module, which is installed within the main body(1) and is connected to the downward-looking sensors (2), wherein the control module controls actions of the main body (1) according to the number of suspending signals sent from the downward-looking sensors (2).

2. The self-moving device of claim 1, **characterized in that**, the two or more downward-looking sensors (2) are all located at the outer edge of the bottom of the main body (1).

3. The self-moving device of claim 2, **characterized in that**, the number of the downward-looking sensors

(2) is three, wherein one downward-looking sensor is located at the front portion of the main body (1), and the other two are located at both sides of the main body (1).

4. The self-moving device of claim 1, **characterized in that**, the two or more downward-looking sensors (2) comprise downward-looking sensors (2) located at the outer edge of the bottom of the main body (1) and downward-looking sensors (2) located at the inner sides of drive wheels that are provided at the bottom of the main body (1).

5. The self-moving device of claim 1, **characterized in that**, further comprising an alarm module which is communicatively connected to the control module.

6. A control method of a self-moving device, **characterized in that**, comprising the following steps:

- step (1): two or more downward-looking sensors (2), which are located at the bottom of a main body (1), collecting suspending signals;
- step (2): the downward-looking sensors (2) sending the collected suspending signals to a control module;
- step (3): the control module controlling the main body (1) according to the number of the suspending signals sent from the downward-looking sensors (2) in the following manner:

- when there is only one downward-looking sensor sending the suspending signal, the control module controls the main body (1) to turn; and
- when there are two or more downward-looking sensors sending the suspending signals, the control module controls the main body (1) to get into an operation interrupted state.

7. A control method of a self-moving device, **characterized in that**, comprising the following steps:

- step (1): two or more downward-looking sensors (2), which are located at the bottom of a main body (1), collecting suspending signals;
- step (2): the downward-looking sensors (2) sending the collected suspending signals to a control module;
- step (3): the control module controlling the main body (1) according to the number of the suspending signals sent from the downward-looking sensors (2) in the following manner:

- when there is only one downward-looking sensor sending the suspending signal, the control module controls the main body (1)

to turn; and  
 when there are two or more downward-looking sensors sending the suspending signals, the control module controls the main body (1) to turn within a time period T first, and once the time period T has elapsed, if there are still two or more downward-looking sensors sending the suspending signals, the control module controls the main body (1) to get into an operation interrupted state; if there is only one downward-looking sensor sending the suspending signal, the control module controls the main body (1) to further turn; and if there is no downward-looking sensor sending the suspending signal, the control module controls the main body (1) to operate normally, wherein, the time period  $T > 0$ .

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8. The control method of the self-moving device of claim 7, **characterized in that**, the time period T is 300~800 ms.

9. A control method of a self-moving device, **characterized in that**, comprising the following steps:

- step (1): two or more downward-looking sensors (2), which are located at the bottom of a main body (1), collecting suspending signals, wherein the two or more downward-looking sensors (2) comprise downward-looking sensors (2) located at the outer edge of the bottom of the main body (1) and downward-looking sensors (2) located at the inner sides of drive wheels (11, 12) that are provide at the bottom of the main body (1);
- step (2): the downward-looking sensors (2) sending the collected suspending signals to a control module;
- step (3): the control module controlling the main body (1) according to the number of the suspending signals sent from the downward-looking sensors (2) in the following manner:

- when there is only one downward-looking sensor sending the suspending signal, the control module controls the main body (1) to turn; and
- when there are two or more downward-looking sensors sending the suspending signals, if the suspending signals sent from the downward-looking sensors located at the inner sides of the drive wheels (11, 12) are included, the control module controls the main body (1) to get into an operation interrupted state; otherwise, the control module controls the main body (1) to turn.

10. The control method of the self-moving device of any

one of claims 6-9. **characterized in that**, the control module is further connected to an alarm module, wherein the alarm module sends an alarm while the control module controls the main body (1) to get into the operation interrupted state.

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Fig. 1

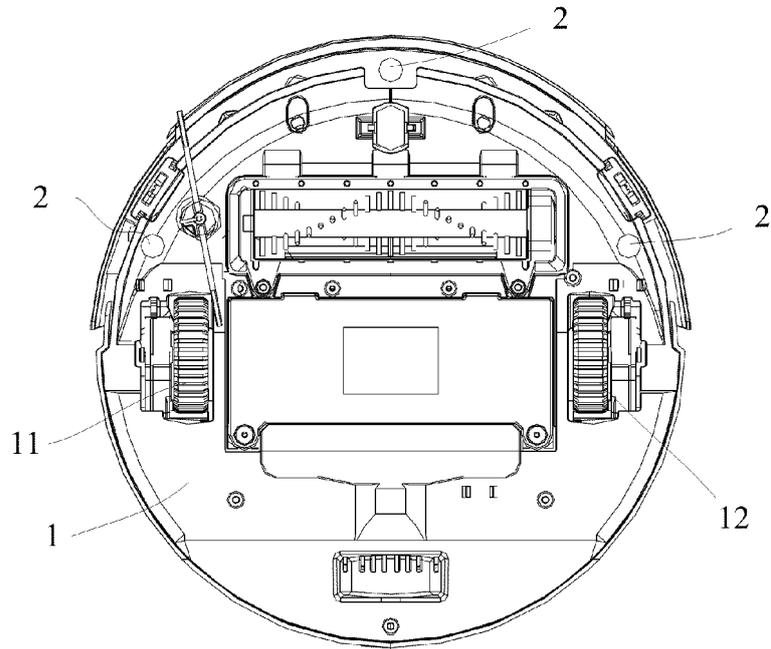
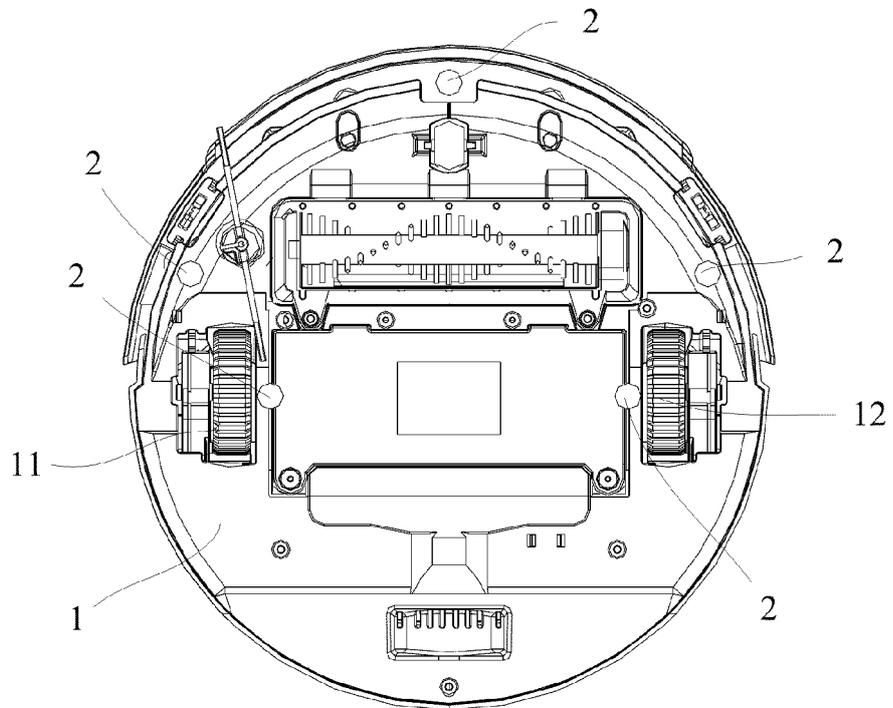


Fig. 2



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/078784

5 <b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
G05D 1/02 (2006.01) i; A47L 11/24 (2006.01) i According to International Patent Classification (IPC) or to both national classification and IPC		
10 <b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols) B25J; A01D; A47L; G05D; G06F		
15 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
20 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNABS; CNTXT; DWPI; VEN: cliff, stair?, edge, sens+, detect+, robot?, emit+, reflect+, fall+, move, intelligence, infrared, ultrasound, receive, signal, number		
25 <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012011669 A1 (SCHNITTMAN MARK et al.) 19 January 2012 (19.01.2012) description, paragraphs [0132] and figures 1 to 33	1-3, 5
Y	US 2012011669 A1 (SCHNITTMAN MARK et al.) 19 January 2012 (19.01.2012) description, paragraph [0132] and figures 1 to 33	4
Y	CN 102488481 A (MA, Yingnan) 13 June 2012 (13.06.2012) description, paragraph [0025] and figures 1 to 4	4
A	CN 103092206 A (CIXI SIDA ELECTRONIC TECHNOLOGY CO LTD) 08 May 2013 (08.05.2013) the whole document	1-10
35 <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents:	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
“A” document defining the general state of the art which is not considered to be of particular relevance	“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	
40 “E” earlier application or patent but published on or after the international filing date	“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	
“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	“&” document member of the same patent family	
45 “O” document referring to an oral disclosure, use, exhibition or other means		
“P” document published prior to the international filing date but later than the priority date claimed		
50 Date of the actual completion of the international search 26 August 2014	Date of mailing of the international search report 04 September 2014	
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