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(54) CLEANING DEVICE CONTROL METHOD AND CLEANING DEVICE

(57) A cleaning device control method and a cleaning device. The cleaning device comprises a driving assembly (200) and a track-type cleaning cloth (300), and independent power members are provided for the driving assembly (200) and the track-type cleaning cloth (300). During normal walking, the corresponding power members drive rotation directions of the driving assembly (200) and the track-type cleaning cloth (300) to be opposite, so as to improve cleaning efficiency.

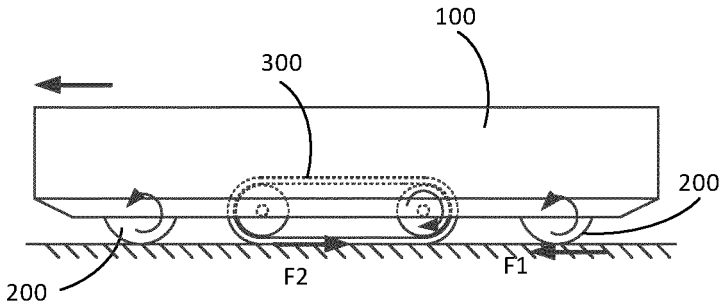

FIG. 10

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Description

[0001] This application claims priority of Chinese Patent Application No. 2021105012503, filed on May 8, 2021, entitled "METHOD AND DEVICE FOR CONTROLLING CLEANING DEVICE AND CLEANING DEVICE", and Chinese Patent Application No. 202111343423X, filed on November 13, 2021, entitled "METHOD FOR CONTROLLING THE TRAVELLING OF MOBILE ROBOT".

TECHNICAL FIELD

[0002] The present application relates to the technical field of intelligent devices, and in particular to a method for controlling a sweeping device and a sweeping device.

BACKGROUND

[0003] With the improvement of technology, people are increasingly benefiting from a variety of intelligent devices, such as sweeping robots as products that can replace manual cleaning is used in many occasions. However, people have a higher pursuit of cleaning effect, the conventional sweeping robot is difficult to meet the demand.

SUMMARY

[0004] In view of this, it is necessary to provide a method for controlling a sweeping device and a sweeping device to address the above technical problem.

[0005] The present application provides a method for controlling a sweeping device. The sweeping device includes a driving assembly and a crawler-type cleaning cloth, the driving assembly is configured to enable the sweeping device to move on the surface to be cleaned, and the crawler-type cleaning cloth is configured to sweep the surface to be cleaned. The method includes: providing independent power members for the driving assembly and the crawler-type cleaning cloth, respectively; and enabling rotation directions of the driving assembly and the crawler-type cleaning cloth that are driven by the corresponding power members to be opposite during normal traveling, so as to improve cleaning efficiency.

[0006] In an embodiment, when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, a movement mode of the driving assembly or the crawler-type cleaning cloth is changed to increase a force vector provided by the driving assembly and the crawler-type cleaning cloth to the surface to be cleaned.

[0007] In an embodiment, the sweeping device being about to travel abnormally or being traveling abnormally includes any one of being blocked by an obstacle, the driving assembly being stuck, the driving assembly being suspended, or the driving assembly slipping.

[0008] In an embodiment, a first abnormality level and a second abnormality level are preset according to a height of the obstacle, the height of the obstacle at the first abnormality level is lower than the height of the obstacle at the second abnormality level, when detecting that the sweeping device is about to be at the first abnormality level, the movement mode of the driving assembly or the crawler-type cleaning cloth is changed to provide a first force vector to the surface to be cleaned, when detecting that the sweeping device is about to be at the second abnormality level, the movement mode of the driving assembly or the crawler wiper is changed to provide a second force vector to the surface to be cleaned, and the first force vector is less than the second force vector.

[0009] In an embodiment, when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, the crawler-type cleaning cloth stops rotating autonomously.

[0010] In an embodiment, when the detecting that sweeping device is about to travel abnormally or is traveling abnormally, the rotation direction of the driving assembly is the same as the rotation direction of the crawler-type cleaning cloth.

[0011] In an embodiment, the crawler-type cleaning cloth is configured to be lifted and lowered, when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, the crawler-type cleaning cloth is lifted to be separated from the surface to be cleaned.

[0012] In an embodiment, the sweeping device further includes a scraping strip arranged telescopically relative to the crawler-type cleaning cloth, during normal traveling, the scraping strip extends out to scrape the crawler-type cleaning cloth, when the detecting that sweeping device is about to travel abnormally or is traveling abnormally, the scraping strip retracts and is separated from the crawler-type cleaning cloth.

[0013] In an embodiment, the sweeping device further includes a housing and a cleaning pump, the crawler-type cleaning cloth and the cleaning pump are mounted in the housing, the housing is provided with a spraying port in communication with the cleaning pump, during normal traveling, the cleaning pump is turned on to spray cleaning liquid to the surface to be cleaned through the spraying port, when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, the cleaning pump is turned off.

[0014] In an embodiment, the driving assembly is capable of deflecting within a preset range of deflection angle, when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, the deflection angle is reduced compared with traveling normally to increase the force vector provided by the driving assembly and the crawler-type cleaning cloth to the surface to be cleaned.

[0015] The present application provides another method for controlling a sweeping device. The sweeping device includes a power member, a first crawler-type cleaning cloth, and a second crawler-type cleaning cloth. The

power member drives the first crawler-type cleaning cloth and the second crawler-type cleaning cloth to rotate in opposite directions, so as to sweep a surface to be cleaned.

[0016] In an embodiment, the power member includes a first power member and a second power member, the first power member drives the first crawler-type cleaning cloth to rotate in a forward direction, and the second power member drives the second crawler-type cleaning cloth to rotate in a reverse direction, so as to improve cleaning efficiency.

[0017] The present application provides a sweeping device, including a detection assembly, a driving assembly, and a crawler-type cleaning cloth. The detection assembly is configured to provide detection information that determines a movement mode of the driving assembly and the crawler-type cleaning cloth, so as to implement any one of the above methods for controlling the sweeping device.

[0018] In an embodiment, a control assembly is further included, the control assembly is configured to receive detection information provided by the detection assembly and thereby control the movement mode of the driving assembly and the crawler-type cleaning cloth.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] In order to illustrate the embodiments of the present application more clearly, the drawings used in the embodiments will be described briefly. Apparently, the following described drawings are merely for the embodiments of the present application, and other drawings can be derived by those of ordinary skill in the art without any creative effort.

FIG. 1 is a schematic perspective view of a sweeping device according to an embodiment, showing a bottom structure of the sweeping device.

FIG. 2 is a schematic view of a crawler-type cleaning cloth of the sweeping device according to an embodiment.

FIGS. 3, 4, and 5 are schematic side views of the sweeping device according to different embodiments.

FIG. 6 is a plan view of the sweeping device shown in FIG. 1, showing the bottom structure of the sweeping device;

FIG. 7 is another view of the sweeping device shown in FIG. 1, in which part of a top structure of the sweeping device is removed to show an internal structure.

FIG. 8 is another view of the sweeping device shown in FIG. 1, in which part of the structure of the bottom of the sweeping device is removed to show the internal structure.

FIG. 9 is a block diagram of the sweeping device according to an embodiment.

FIGS. 10 to 15 are schematic views of an operating state of the sweeping device under methods for controlling a sweeping device according to different embodiments.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0020] The present application will now be described in detail with reference to the accompanying drawings and embodiments in order to make the objects, technical solutions, and advantages of the present application clearer. It should be understood that the specific embodiments described herein are only for explaining the present application, and not intended to limit the present application.

[0021] As shown in FIG. 1, a sweeping device according to an embodiment of the present application can autonomously clean floors, carpets and other surfaces to be cleaned. The sweeping device includes a housing 100, a driving assembly 200, and a crawler-type cleaning cloth 300. The housing 100 is a mounting carrier for various components of the sweeping device. Unless otherwise specified, all components of the sweeping device mentioned below are directly or indirectly mounted in the housing 100. For example, the driving assembly 200 and the crawler-type cleaning cloth 300 are both mounted in the housing 100. The driving assembly 200 is configured to drive the sweeping device to move on a surface to be cleaned. The crawler-type cleaning cloth 300 is configured to sweep the surface to be cleaned.

[0022] The driving assembly 200 and the crawler-type cleaning cloth 300 each has an independent power member, so as to provide power for their respective autonomous rotations. Referring to FIG. 2, in an embodiment, the crawler-type cleaning cloth 300 includes a first transmission shaft 301, a second transmission shaft 302, a first power member 303, and a cleaning member 304.

[0023] The first transmission shaft 301 and the second transmission shaft 302 are arranged in parallel. The cleaning member 304 is arranged in a ring belt shape to be wound around the first transmission shaft 301 and the second transmission shaft 302. The first power member 303 may include an electric motor, a gearbox, etc. The first power member 303 is in transmission connected to the first transmission shaft 301 and/or the second transmission shaft 302 to provide power for the rotation of the first transmission shaft 301 and the second transmission shaft 302. When the first transmission shaft 301 and the second transmission shaft 302 rotate, the cleaning member 304 can be driven to operate to clean the surface to be cleaned.

[0024] The cleaning member 304 is made of a flexible material, which may be a sponge or cloth material, a mop made of silicone or rubber, or a material layer with adsorption properties. When a mop or sponge is used as the cleaning member 304, the mop or sponge comes into contact with the surface to be cleaned, thereby removing stains or debris on the surface to be cleaned. When the cleaning member 304 is made of a material layer with adsorption properties, the material layer is in contact with

the surface to be cleaned, thereby adsorbing stains or debris on the surface to be cleaned. Stains include but are not limited to traces of various liquid substances remaining on the surface to be cleaned, such as oil stains, etc. Debris includes various types of solid dirt, such as paper scraps, hair or dust.

[0025] When the cleaning member 304 cleans the surface to be cleaned, the cleaning member 304 is in contact with and slides relative to the surface to be cleaned, thereby generating friction between the cleaning member 304 and the surface to be cleaned. In other words, the cleaning member 304 generates a force on the surface to be cleaned, and the force can exert a traction effect on the sweeping device. The configuration of the material of the cleaning member 304 and a contact area between the cleaning member and the surface to be cleaned, etc., has an influence on the magnitude of the above-mentioned force.

[0026] As shown in FIGS. 1 and 6, the driving assembly 200 adopts a wheel-type traveling mechanism, including a first driving wheel 201, a second driving wheel 203, and a second power member 205. In some embodiments, the first driving wheel 201 and the second driving wheel 203 can be arranged coaxially, one of the first driving wheel 201 and the second driving wheel 203 serves as a driving wheel to obtain the power of the second power member 205 to generate rotation, and the other of the first driving wheel 201 and the second driving wheel 203 serves as a driven wheel to rotate following the rotation of the driving wheel. The axial connection between the first driving wheel 201 and the second driving wheel 203 is parallel to the first transmission shaft 301 and the second transmission shaft 302 of the crawler-type cleaning cloth 300. In other embodiments, the first driving wheel 201 and the second driving wheel 203 may be provided separately and are respectively connected to one second power member 205 in transmission to obtain rotational power. The second power member 205 may include an electric motor, a gearbox and other components, and may provide power for the rotation of the first driving wheel 201 and the second driving wheel 203.

[0027] Friction is generated between the first driving wheel 201 and the second driving wheel 203 and the surface to be cleaned, that is, the first driving wheel 201 and the second driving wheel 203 exert force on the surface to be cleaned, and the force exerts a traction effect on the sweeping device. In the case where the surface to be cleaned is substantially horizontal" the sum of the force vectors generated by the driving assembly 200 and the crawler-type cleaning cloth 300 on the surface to be cleaned is used as a driving force to drive the sweeping device to move relative to the surface to be cleaned, so as to determine a movement direction of the sweeping device relative to the surface to be cleaned, such as forward, stationary, backward, etc. relative to the surface to be cleaned.

[0028] As an example, as shown in FIG. 6, the positive Y-axis direction is taken as a forward direction, which points to the front of the sweeping device, and the negative Y-axis direction is taken as a backward direction, which points to the rear of the sweeping device. When the force vector provided by the sweeping device to the surface to be cleaned points in the negative direction of the Y-axis, according to Newton's third law, the surface to be cleaned provides a reaction force in the positive direction of the Y-axis to the sweeping device, so that the sweeping device moves forward relative to the surface to be cleaned. On the contrary, when the force vector provided by the sweeping device to the surface to be cleaned points in the positive direction of the Y-axis, the surface to be cleaned provides a reaction force in the negative direction of the Y-axis to the sweeping device, so that the sweeping device moves backward relative to the surface to be cleaned. When the force vector provided by the sweeping device to the surface to be cleaned is approximately zero, the sweeping device is stationary relative to the surface to be cleaned.

[0029] It should be noted that the description of the number and type of the driving assembly 200 in the above embodiments is only an example. In other embodiments, the number and type of the driving assembly 200 may be different from the above embodiments. For example, FIG. 3 shows a sweeping device provided by an embodiment, which includes two groups of driving assemblies 200, which are respectively located at the front and rear sides of the crawler-type cleaning cloth 300. It should be understood that each group of driving assemblies 200 has the independent power member respectively. As another example, FIG. 4 shows a sweeping device provided by an embodiment, in which one group of driving assemblies 200 is a crawler-type traveling mechanism, that is, the driving assembly 200 is a combination of a wheel-type traveling mechanism and a crawler-type traveling mechanism. The specific structure of the crawler-type traveling mechanism can be referred to the crawler-type cleaning cloth 300 in the above embodiment, the difference between the crawler-type traveling mechanism and the cleaning member 304 in the crawler-type cleaning cloth 300 is only that the corresponding components in the crawler-type traveling mechanism are mainly used for walking, not mainly used for sweeping, so that a structure more suitable for realizing the walking function can be adopted.

[0030] Similarly, the present application does not limit the number of crawler-type cleaning clothes 300. Referring to the embodiment provided in FIG. 5, the sweeping device includes two groups of crawler-type cleaning clothes 300, and the two groups of crawler-type cleaning clothes 300 are arranged adjacently. The driving assembly 200 is disposed on a front side or a rear side of the crawler-type cleaning clothes 300. It should be understood that each group of crawler-type cleaning clothes 300 has the independent power member, respectively.

[0031] In addition, in embodiments with one or more groups of crawler-type cleaning clothes 300, the crawler-type cleaning clothes 300 may be configured to be lift-

edand lowered relative to the housing 100. For example, a lifting mechanism may include a motor, and a transmission mechanism such as gears or slide rails, etc. The motor is provided on the housing 100, and the transmission mechanism is in transmission connection with the motor and the crawler-type cleaning cloth 300. The crawler-type cleaning cloth 300 can be lifted and lowered relative to the housing 100 with the help of the motor, that is, the crawler-type cleaning cloth 300 can be lifted and lowered relative to the surface to be cleaned. With such an arrangement, the crawler-type cleaning cloth 300 can be separated from the surface to be cleaned to meet the needs of specific usage scenarios.

[0032] As shown in FIG. 6, in the Y-axis direction, the driving assembly 200 is provided at a middle position of a bottom portion of the housing 100. Positioning the driving assembly 200 in the middle position allows the driving assembly 200 to provide better driving force for the sweeping device and improve the capability of the sweeping device to cross obstacles and get out of the way. The crawler-type cleaning cloth 330 is provided adjacent to one side of the driving assembly 200. Compared with the configuration with a larger distance, such an adjacent configuration allows the sweeping device to have a larger continuous contact area with the surface to be cleaned, so that the sweeping device has better capability to cross obstacles and get out of the way when facing obstacles such as depressions. At the same time, the crawler-type cleaning cloth 300 has a larger contact area, and when the sweeping device faces obstacles such as depressions, it has greater power to assist in crossing obstacles and getting out of the way.

[0033] As shown in FIG. 6, the crawler-type cleaning cloth 300 is located behind the driving assembly 200, and a projection of the crawler-type cleaning cloth 300 on a horizontal plane is at least partially located outside ta projection of the housing 100 on the horizontal plane. Intuitively, the crawler-type cleaning cloth 300 extends beyond a range covered by the housing 100, so that the crawler-type cleaning cloth 330 has a larger cleaning area, thereby improving the cleaning efficiency. At the same time, when the sweeping device faces obstacles such as depressions, it has greater power to assist in crossing obstacles and getting out of the way.

[0034] From the aspect of FIG. 6, an outer end of the first driving wheel 201 is coplanar with a left end of the crawler-type cleaning cloth 300, more specifically, the outer end of the first driving wheel 201 is coplanar with a left end of the cleaning member 304. An outer end of the second driving wheel 203 is coplanar with a right end of the crawler-type cleaning cloth 300, more specifically, the outer end of the second driving wheel 203 is coplanar with a right end of the cleaning member 304. In other words, a distance between the outer end of the first driving wheel 201 and the outer end of the second driving wheel 203 is equal to a distance between two ends of the cleaning member 304. The arrangement provides the sweeping device with better operational stability and the capability to cross obstacles and get out of the way.

[0035] As shown in FIG. 6, the driving assembly 200 can deflect within a preset range of deflection angles relative to the Y-axis direction to change a traveling direction of the sweeping device. Therefore, the driving assembly 200 further includes a power member for deflecting the first driving wheel 201 and the second driving wheel 203. A large opening is provided at a position where the first driving wheel 201 and the second driving wheel 203 are provided in the housing 100, so as to provide sufficient space for the deflection of the first driving wheel 201 and the second driving wheel 203 to avoid interference with the housing 100 during deflection.

[0036] Referring to FIGS. 6 and 7, in an embodiment, a cleaning pump 101 and a clean water tank 105 are further mounted in the housing 100, and a spraying port 103 is provided at the bottom portion of the housing 100. A water inlet of the cleaning pump 101 is in communication with the clean water tank 105, and a water outlet of the cleaning pump 101 is in communication with the spraying port 103. The spraying port 103 is provided adjacent to the crawler-type cleaning cloth 300. Optionally, a plurality of spraying ports 103 may be provided, and the plurality of spraying ports 103 may be evenly spaced along tan axial direction parallel to the crawler-type cleaning cloth 300. During the cleaning process of the sweeping device, the cleaning pump 101 can pump out the cleaning liquid from the clean water tank 105 and spray the cleaning liquid to the surface to be cleaned through the spraying port 103. The surface to be cleaned is first wetted and impregnated by the cleaning liquid, and then cleaned by the crawler-type cleaning cloth 300 to improve the cleaning effect of the crawler-type cleaning cloth 300 on the surface to be cleaned.

[0037] As shown in FIG. 8, in an embodiment, the sweeping device is further provided a sewage tank 107 mounted in the housing 100, and a scraping strip 305 is provided facing the crawler-type cleaning cloth 300. During the cleaning process of the sweeping device, in cooperation with the sweeping fluid sprayed by the cleaning pump 101, the crawler-type cleaning cloth 300 will mix the cleaning fluid with stains and debris on the surface to be cleaned to form sewage. By providing the scraping strip 305, the sewage attached to the crawler-type cleaning cloth 300 can be scraped and separated to the sewage tank 107 to be collected and temporarily stored. The sewage in the sewage tank 107 can be treated periodically. Optionally, both the sewage tank 107 and the clean water tank 105 are detachably mounted in the housing 100 to facilitate the replenishment of cleaning liquid and the treatment of sewage.

[0038] Furthermore, the scraping strip 305 is configured to be controllably telescopically arranged relative to the crawler-type cleaning cloth 300. Therefore, when the crawler-type cleaning cloth 300 needs to be scraped, the scraping strip 305 extend out to abut against and scrape the crawler-type cleaning cloth 300. When the crawler-type cleaning cloth 300 does not need to be scraped, the

scraping strip 305 retracts and is separated from the crawler-type cleaning cloth 300.

[0039] FIG. 9 shows a block diagram of the sweeping device according to an embodiment. The sweeping device includes a detection assembly 400 configured to detect environmental information or operating information of the sweeping device, and a control assembly 500 that is communicatively connected to the driving assembly 200, the crawler-type cleaning cloth 300 and the detection assembly 400.

[0040] The detection assembly 400 may include one or more of an infrared sensor, an inertial sensor (IMU), an angle sensor, an optical flow sensor, a camera, a LIDAR, a wheel odometer, a visual odometer, and a laser odometer that are disposed at a suitable location on the housing 100. The environmental information detected by the detection assembly 400 includes but is not limited to a distance between the sweeping device and a target object in the working environment, a motion state of the target object, and a three-dimensional data of a shape of the target object, etc. The environmental information can be presented as static pictures or dynamic videos. The operating information of the sweeping device detected by the detection assembly 400 includes but is not limited to a rotation speed of the driving assembly 200 of the sweeping device, a deflection angle of the driving assembly 200, a rotation speed of the crawler-type cleaning cloth 300, a lifting state of the crawler-type cleaning cloth 300 relative to the housing 100, and a telescopic state of the scraping strip. 305, etc. The information obtained by the detection assembly 400 can be used to directly or indirectly determine whether the sweeping device travels normally. It should be understood that during normal traveling, the sweeping device can be better maintained in the cleaning state to continuously and effectively clean the surface to be cleaned. If the sweeping device travels abnormally, or is about to move abnormally, the continuity and stability of the cleaning state of the sweeping device may be affected, so that the expected cleaning effect cannot be achieved.

[0041] Abnormal traveling includes the traveling state of the sweeping device in the following situations: the sweeping device is blocked by obstacles, the driving assembly 200 is stuck, the driving assembly 200 is suspended, or the driving assembly 200 slips. There are three situations in which sweeping device is blocked by obstacles. The first situation is that the impact of obstacles on the traveling of the sweeping device can be basically ignored. The sweeping device in normal traveling with the capability to cross the obstacle can cross the obstacle. During crossing the obstacle process, the traveling state may be slightly affected, which is different from normal traveling, but after crossing the obstacle, the sweeping device can automatically restore to the normal traveling state to maintain the normal cleaning state. It should be understood that in this case, if the movement mode of the driving assembly 200 and the crawler-type cleaning cloth 300 of the sweeping device is changed, so that the sweeping device has a better capability to cross obstacles than during traveling normally, and the obstacle can also be crossed.

[0042] The second situation is that the impact of obstacles on the traveling of the sweeping device is controllable. It is necessary to change the movement mode of the driving assembly 200 and the crawler-type cleaning cloth 300 of the sweeping device, so that the sweeping device has a better obstacle-crossing capability than during traveling normally to cross the obstacle, so as to achieve normal traveling and maintain normal cleaning status.

[0043] The third situation is that the obstacle has exceeded the obstacle-crossing capability of the sweeping device, ultimately resulting in the sweeping device being in a trapped state. Unless avoidance or manual intervention is chosen, the sweeping device is unable to get out of the trap on its own.

[0044] If the above three situations are simplified by using obstacle height, the obstacle height demarcation thresholds in the three situations can be represented by A0 and A1, where A0 is less than A1. When the obstacle height is less than or equal to A0, it belongs to the first situation above. When the obstacle height is between A0 and A1, it belongs to the second situation above. When the obstacle height is greater than or equal to A1, it belongs to the third situation mentioned above.

[0045] The driving assembly 200 is stuck, the driving assembly 200 is suspended, or the driving assembly 200 slips due to various abnormal factors that cause the driving assembly 200 to be unable to provide normal driving force, thereby being unable to drive the sweeping device to move relative to the surface to be cleaned. For example, when an obstacle has a gap of a specific height and the sweeping device cannot pass through the gap and is trapped in the gap, the driving assembly 200 may often become stuck. For another example, when the obstacle is a depression with a certain depth and area, the sweeping device cannot pass through the depression and the driving assembly 200 may be suspended in the depression. For another example, when there are oil stains and other friction-reducing substances on the surface to be cleaned, the sweeping device may not be able to move normally due to the driving assembly 200 slipping on the oil stains.

[0046] The control assembly 500 is configured to receive the detection information provided by the detection assembly 400, and then control the operation of relevant components of the sweeping device according to a preset algorithm, such as controlling the driving assembly 200 and the crawler-type cleaning cloth 300 to operate according to corresponding movement modes. The control assembly 500 may include a processor, a memory, etc. A processor may include one or more processing cores. The processor uses various interfaces and lines to connect various components of the sweeping device, and executes various functions of the sweeping device and processes data by running or executing instructions, pro-

grams, code sets or sets of instructions stored in the memory and by calling up data stored in the memory. Optionally, the processor can be implemented in at least one hardware form among digital signal processing (Digital Signal Processing, DSP), field-programmable gate array (Field-Programmable Gate Array, FPGA), and programmable logic array (Programmable Logic Array, PLA). The processor can integrate one or a combination of a central processing unit (Central Processing Unit, CPU), a graphics processing unit (Graphics Processing Unit, GPU), a modem, etc. The central processing unit mainly handles the operating system, user interface and application programs. The graphics processing unit is configured to render and draw the display content. The modem is configured to process wireless communications. It should be understood that the above-mentioned modem may not be integrated into the processor and may be implemented solely through a communication chip.

[0047] The control assembly 500 may be integrated into the housing 100. In other embodiments, the control assembly 500 may be provided on a server, and the server remotely receives the detection information provided by the detection assembly 400, processes the detection information, and makes corresponding responses and executions.

[0048] The following is an exemplary description of a method for controlling a sweeping device provided by the present application with reference to FIGS. 10 to 15. It should be understood that the sweeping device in FIGS. 10 to 15 is only an example of the structure, and it does not mean that the control method provided in the present application can only be limited to the sweeping device with these structures.

[0049] As shown in FIG. 10, when the sweeping device is in a normal traveling state, rotation directions of the driving assembly 200 and the crawler-type cleaning cloth 300 are opposite. It should be understood that the driving assembly 200 and the crawler-type cleaning cloth 300 are each powered by a respective power member to generate rotation. An arrow located in an upper left of the sweeping device indicates a movement direction of the sweeping device, and a direction pointing to the left is defined as a forward direction, that is, the sweeping device moves forward relative to the surface to be cleaned. An arrow located on the driving assembly 200 indicates the rotation direction of the driving assembly 200. An arrow located on the crawler-type cleaning cloth 300 indicates the rotation direction of the crawler-type cleaning cloth 300. An arrow F 1 located between the driving assembly 200 and the surface to be cleaned indicates a forward force provided by the surface to be cleaned to the driving assembly 200. An arrow F2 located between the crawler-type cleaning cloth 300 and the surface to be cleaned indicates a backward force provided by the surface to be cleaned to the crawler-type cleaning cloth 300. Unless otherwise specified, the arrows in the following figures have the same meaning as the above description. It should be understood that at this time, the forward force F 1 provided by the surface to be cleaned to the driving assembly 200 is greater than the backward force F2 provided by the surface to be cleaned to the crawler-type cleaning cloth 300, that is, the sum of the force vectors provided by the driving assembly 200 and the crawler-type cleaning cloth 300 to the surface to be cleaned points forward, so that the sweeping device can move forward relative to the surface to be cleaned.

[0050] Compared with the driving assembly 200 and the crawler-type cleaning cloth 300 rotating in the same direction, when the driving assembly 200 and the crawler-type cleaning cloth 300 rotate in opposite directions, the crawler-type cleaning cloth 300 has a stronger cleaning ability on the surface to be cleaned. The specific reasons are analyzed as follows. The driving assembly 200 drives the sweeping device to move at a speed V1 relative to the surface to be cleaned. The crawler-type cleaning cloth 300 rotates autonomously and a side of the crawler-type cleaning cloth 300 that is in contact with the surface to be cleaned moves at a speed V0 relative to the surface to be cleaned. Since the crawler-type cleaning cloth 300 moves relative to the surface to be cleaned simultaneously with the sweeping device, a moving speed of the side of the crawler-type cleaning cloth 300 that is in contact with the surface to be cleaned relative to the surface to be cleaned is that V0 plus V1. Compared with the situation where the driving assembly 200 and the crawler-type cleaning cloth 300 rotate in the same direction, the reverse rotation of the two increases the rotation speed of the crawler-type cleaning cloth 300 relative to the surface to be cleaned, thereby achieving a better cleaning effect.

[0051] In an embodiment with two crawler-type cleaning clothes 300, the rotation directions of the two crawler-type cleaning clothes 300 can be opposite. As shown in FIG. 11, the rotation directions of the two crawler-type cleaning clothes 300 at the front and rear are opposite. It should be pointed out that each of the two crawler-type cleaning clothes 300 are powered by a respective power member to generate autonomous rotation in opposite directions. Therefore, the surface to be cleaned provides a backward force F2 to the crawler-type cleaning cloth 300 located at the rear and a forward force F3 to the crawler-type cleaning cloth 300 located in the front. The sweeping device moves forward relative to the surface to be cleaned under the resultant force of the three vectors of forward force F 1, backward force F2 and forward force F3.

[0052] During the normal traveling process of the sweeping device as shown in FIG. 10, it is possible that the normal traveling cannot continue due to environmental changes on the surface to be cleaned or some conditions of the sweeping device itself. These situations that lead to the inability to continue normal traveling include the sweeping device being blocked by obstacles, the driving assembly 200 being stuck, the driving assembly 200 being suspended, the driving assembly 200 slip-

ping, etc. When the detection assembly 400 detects detection information that directly or indirectly indicates that the sweeping device may be traveling abnormally or is already traveling abnormally, the control assembly 500 receives the detection information and controls the driving assembly 200 or the crawler-type cleaning cloth 300 to change the movement mode to increase the force vector provided by driving assembly 200 and the crawler-type cleaning cloth 300 to the surface to be cleaned. Since the forces are mutual, the force vector provided by the surface to be cleaned to the sweeping device also increases. When the force vector between the driving assembly 200, the crawler-type cleaning cloth 300 and the surface to be cleaned is increased, the sweeping device can have greater obstacle-crossing capability, or have a varied travel strategy, so that the sweeping device can autonomously get rid of abnormal traveling or avoid factors that will cause abnormal traveling, and facilitate restoring or maintaining normal traveling states, in order to produce the expected sweeping effect on the surface to be cleaned.

[0053] There are many ways to change the movement mode of the driving assembly 200 or the crawler-type cleaning cloth 300 to increase the force vector between the driving assembly 200, the crawler-type cleaning cloth 300 and the surface to be cleaned, and the appropriate movement mode can be determined according to different situations causing abnormal traveling, so that the sweeping device can autonomously get rid of abnormal traveling or avoid factors that will cause abnormal traveling. This is illustrated below in conjunction with FIGS. 12, 13, 14, and 15, respectively.

[0054] In an embodiment, as shown in FIG. 12, the crawler-type cleaning cloth 300 is stopped from rotating autonomously to increase the force vector between the driving assembly 200, the crawler-type cleaning cloth 300 and the surface to be cleaned. Since the backward force F2 provided by the surface to be cleaned to the crawler-type cleaning cloth 300 removes after the crawler-type cleaning cloth 300 stops rotating, the force vector between the driving assembly 200, the crawler-type cleaning cloth 300 and the surface to be cleaned is the forward force F 1. The forward force F 1 becomes larger than the resultant force of the forward force F 1 and the backward force F2 in the operating mode shown in FIG. 10. When the detection assembly 400 detects that there is an obstacle on a path of the sweeping device, and it belongs to the first and second situations of being blocked by the obstacle mentioned above, the crawler-type cleaning cloth 300 can stop rotating autonomously to cross the obstacle. When the obstacle disappears, the normal traveling state can be restored, and the rotation directions of the driving assembly 200 and the crawler-type cleaning cloth 300 are opposite again.

[0055] It should be noted that when the crawler-type cleaning cloth 300 stops rotating autonomously, it means that the first power member 303 in the crawler-type cleaning cloth 300 stops outputting power. Whether the crawler-type cleaning cloth 300 still rotates relative to the surface to be cleaned is determined by the resultant force between the surface to be cleaned and the crawler-type cleaning cloth 300. This force includes at least a static friction force between the surface to be cleaned and the crawler-type cleaning cloth 300 and a braking force of the crawler-type cleaning cloth 300. For example, in the case that the crawler-type cleaning cloth 300 adopts a braking mode, the crawler-type cleaning cloth 300 itself has a braking force to inhibit rotation. The crawler-type cleaning cloth 300 does not rotate, but moves relative to the surface to be cleaned as the sweeping device continues to move forward. When the crawler-type cleaning cloth 300 itself is not braked, in the case that the static friction between the surface to be cleaned and the crawler-type cleaning cloth 300 is not large enough, the crawler-type cleaning cloth 300 will also stop rotating, and will move relative to the surface to be cleaned as the sweeping device continues to move forward. In the case that the static friction between the surface to be cleaned and the crawler-type cleaning cloth 300 is large enough, the sweeping device will passively follow the driving assembly 200 to rotate in the same direction while continuing to move forward. However, as long as the crawler-type cleaning cloth 300 stops rotating autonomously, whether the crawler-type cleaning cloth 300 moves relative to the surface to be cleaned or the crawler-type cleaning cloth 300 passively follows the driving assembly 200 to rotate in the same direction, the force vector between the crawler-type cleaning cloth 300 and the surface to be cleaned is greater than that when the driving assembly 200 and the crawler-type cleaning cloth 300 rotate in opposite directions.

[0056] In an embodiment, as shown in FIG. 13, the crawler-type cleaning cloth 300 may be lifted to be separated from the surface to be cleaned to increase the force vector between the driving assembly 200, the crawler-type cleaning cloth 300 and the surface to be cleaned. Since the backward force F2 provided by the surface to be cleaned to the crawler-type cleaning cloth 300 disappears after the crawler-type cleaning cloth 300 is separated from the surface to be cleaned, the force vector between the driving assembly 200, the crawler-type cleaning cloth 300 and the surface to be cleaned is the forward force F1, This forward force F1 becomes larger than the resultant force of the forward force F 1 and the backward force F2 in the operating mode shown in FIG. 10. In this case, whether the crawler-type cleaning cloth 300 still rotates autonomously can be flexibly determined based on other factors.

[0057] When the detection assembly 400 detects that there is an obstacle on the path of the sweeping device, and it belongs to the first and second situations of being blocked by the obstacle mentioned above, the crawler-type cleaning cloth 300 can be lifted to be separated from the surface to be cleaned to cross the obstacle. When the obstacle is crossed, the normal traveling state can be restored, and the crawler-type cleaning cloth 300 can

be in contact with the surface to be cleaned again.

[0058] In an embodiment, as shown in FIG. 14, the rotation direction of the driving assembly 200 can be the same as the rotation direction of the crawler-type cleaning cloth 300 to increase the force vector between the driving assembly 200, the crawler-type cleaning cloth 300 and the surface to be cleaned. Compared with the operating mode shown in FIG. 10, in FIG. 14, the rotation direction of the crawler-type cleaning cloth 300 is changed, so that the rotation direction of the driving assembly 200 is the same as the rotation direction of the crawler-type cleaning cloth 300. After the rotation direction of the crawler-type cleaning cloth 300 is changed, the backward force F2 provided by the surface to be cleaned to the crawler-type cleaning cloth 300 becomes the forward force F2. Therefore, the force vector between the driving assembly 200, the crawler-type cleaning cloth 300 and the surface to be cleaned is the sum of the forward force F 1 and the forward force F2, which becomes larger compared to that in the operating mode in FIG. 10.

[0059] When the detection assembly 400 detects that there is an obstacle on the traveling path of the sweeping device, and it belong to the first and second situations of being blocked by the obstacle mentioned above, or it detects that the driving assembly 200 is about to be or has been stuck, when the driving assembly 200 is about to or has been suspended or the driving assembly 200 is about to slip or has slipped, the crawler-type cleaning cloth 300 can be caused to change the rotation direction to be the same as the rotation direction of the driving assembly 200, so that the sweeping device can get rid of or avoid abnormal traveling.

[0060] In an embodiment, as shown in FIG. 15, compared with the operating mode in FIG. 10, the rotation direction of the driving assembly 200 may be changed, so that the rotation direction of the driving assembly 200 is the same as the rotation direction of the crawler-type cleaning cloth 300. After the rotation direction of the driving assembly 200 changes, the forward force F 1 provided by the surface to be cleaned to the driving assembly 200 becomes the backward force F1. Therefore, the force vector between the driving assembly 200, the crawler-type cleaning cloth 300 and the surface to be cleaned is the sum of the backward force F1 and the backward force F2. Compared with the operating mode in FIG. 10, this force vector becomes larger and in the opposite direction, so that the sweeping device can be moved backward relative to the surface to be cleaned.

[0061] When the detection assembly 400 detects that there is an obstacle on the path of the sweeping device and it belongs to the third situation of being blocked by the obstacle mentioned above, or it detects that the driving assembly 200 is about to be or has been stuck, when the driving assembly 200 is about to or has been suspended or the driving assembly 200 is about to slip or has slipped, the driving device 200 can be caused to change the rotation direction to be the same as the rotation direction of the crawler-type cleaning cloth 300, so that the sweeping device can get rid of or avoid abnormal traveling.

[0062] In some embodiments, when the detection assembly 400 detects detection information indicating that the sweeping device may travel abnormally, or already travels abnormally, and the driving assembly 200 is deflected within the preset range, the force vector between both the driving assembly 200 and the crawler-type cleaning cloth 300 and the surface to be cleaned may also be increased by reducing the deflection angle. Since the deflection angle is reduced, the component force along the front-to-back direction parallel to the housing 100 of the sweeping device will become larger, thereby increasing the force vector between the driving assembly 200, the crawler-type cleaning cloth 300 and the surface to be cleaned, so that the sweeping device can move forward or backward. It should be understood that this method of changing the movement mode of the driving assembly 200 by changing the deflection angle can be combined with the other methods of changing the movement mode of the driving assembly 200 or the crawler-type cleaning cloth 300 as needed.

[0063] In each of the above movement modes, the force vectors between the driving assembly 200, the crawler-type cleaning cloth 300 and the surface to be cleaned are different. For example, the force vector in the movement mode shown in FIG. 12 is less than that in the movement mode shown in FIG. 14. Therefore, in some embodiments, different abnormality levels can also be preset according to a height of the obstacle. Different abnormality levels require the sweeping device to have different obstacle-crossing capability. According to the corresponding abnormality level, the corresponding change in the movement mode of the driving assembly 200 or the crawler-type cleaning cloth 300 is adapted to adjust the magnitude of the force vector between the sweeping device and the surface to be cleaned, so as to have different obstacle-crossing capabilities.

[0064] For example, a first abnormality level and a second abnormality level are preset according to the height of the obstacle, and the height of the obstacle at the first abnormality level is lower than the height of the obstacle at the second abnormality level. When detecting that the sweeping device is about to be at the first abnormality level, the movement mode of the driving assembly or the crawler-type cleaning cloth is changed to provide a first force vector to the surface to be cleaned, such as the force vector of the movement mode shown in FIG. 12. When it is detected that the sweeping device is about to be at the second abnormality level, the movement mode of the driving assembly or the crawler-type cleaning cloth is changed to provide a second force vector to the surface to be cleaned, such as the force vector of the movement mode shown in FIG. 14.

[0065] In the embodiment with the scraping strip 305 and the cleaning pump 101, during normal traveling, the cleaning pump 101 sprays cleaning liquid to the surface to be cleaned through the spraying port 103. The surface

to be cleaned is first wetted and impregnated by the cleaning liquid, and then cleaned by the crawler-type cleaning cloth 300. The crawler-type cleaning cloth 300 mixes cleaning fluid with stains and debris on the surface to be cleaned to form sewage. The scraping strip 305 scrapes and separates the sewage attached to the crawler-type cleaning cloth 300 to the sewage tank 107 to be collected and temporarily stored. The crawler-type cleaning cloth 300 needs to rotate in a specific direction, such as the movement mode shown in FIG. 10, so that the scraping strip 305 can scrape and separate the sewage on the crawler-type cleaning cloth 300 to the sewage tank 107. When the crawler-type cleaning cloth 300 changes direction, such as the movement mode shown in FIG. 14, the sewage on the crawler-type cleaning cloth 300 will be scraped off by the scraping strip 305 and remain on the surface to be cleaned, which will affect the cleaning effect. In order to prevent the generated sewage from remaining on the surface to be cleaned, the cleaning pump 101 can be turned off to stop spraying cleaning fluid on the surface to be cleaned. It should be pointed out that in other movement modes, in the case that the scraping strip 305 does not scrape the sewage on the crawler-type cleaning cloth 300 to the surface to be cleaned, the cleaning pump 101 does not need to be turned off. For example, in the movement mode shown in FIG. 12, in the case that the crawler-type cleaning cloth 300 does not rotate, the scraping strip 305 will not scrape the sewage on the crawler-type cleaning cloth 300 to the surface to be cleaned, and the cleaning pump 101 does not need to be turned off. For another example, in the movement mode shown in FIG. 15, the crawler-type cleaning cloth 300 does not change due to a steering direction, and there is no need to turn off the cleaning pump 101.

[0066] In addition, in an embodiment in which the scraping strip 305 is configured to be telescopic relative to the crawler-type cleaning cloth 300, when the movement mode of the crawler-type cleaning cloth 300 is changed, in order to prevent the sewage on the crawler-type cleaning cloth 300 from being scraped off by the scraping strip 305 and left on the surface to be cleaned, the scraping strip 305 may be controlled to retract and be separated from the crawler-type cleaning cloth 300. For example, in the movement mode as shown in FIG. 10, the scraping strip 305 may be controlled to extend out to scrape the sewage on the crawler-type cleaning cloth 300. In the movement mode as shown in FIG. 14, the scraping strip 305 may be controlled to retract and be separated from the crawler-type cleaning cloth 300.

Claims

1. A method for controlling a sweeping device, the sweeping device comprising a driving assembly and a crawler-type cleaning cloth, the driving assembly being configured to enable the sweeping device to move on a surface to be cleaned, the crawler-type cleaning cloth being configured to sweep the surface to be cleaned, the method comprising:

   providing independent power members for the driving assembly and the crawler-type cleaning cloth, respectively; and
   enabling rotation directions of the driving assembly and the crawler-type cleaning cloth that are driven by the corresponding power members to be opposite during normal traveling, so as to improve cleaning efficiency.

2. The method according to claim 1, wherein when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, a movement mode of the driving assembly or the crawler-type cleaning cloth is changed to increase a force vector provided by the driving assembly and the crawler-type cleaning cloth to the surface to be cleaned.

3. The method according to claim 2, wherein the sweeping device being about to travel abnormally or being traveling abnormally comprises any one of being blocked by an obstacle, the driving assembly being stuck, the driving assembly being suspended, or the driving assembly slipping.

4. The method according to claim 3, wherein a first abnormality level and a second abnormality level are preset according to a height of the obstacle, the height of the obstacle at the first abnormality level is lower than the height of the obstacle at the second abnormality level, when detecting that the sweeping device is about to be at the first abnormality level, the movement mode of the driving assembly or the crawler-type cleaning cloth is changed to provide a first force vector to the surface to be cleaned, when detecting that the sweeping device is about to be at the second abnormality level, the movement mode of the driving assembly or the crawler wiper is changed to provide a second force vector to the surface to be cleaned, and the first force vector is less than the second force vector.

5. The method according to claim 2, wherein when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, the crawler-type cleaning cloth stops rotating autonomously.

6. The method according to claim 2, wherein when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, the rotation direction of the driving assembly is the same as the rotation direction of the crawler-type cleaning cloth.

7. The method according to claim 2, wherein the crawler-type cleaning cloth is configured to be lifted and

lowered, when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, the crawler-type cleaning cloth is lifted to be separated from the surface to be cleaned.

8. The method according to claim 2, wherein the sweeping device further comprises a scraping strip arranged telescopically relative to the crawler-type cleaning cloth, during normal traveling, the scraping strip extends out to scrape the crawler-type cleaning cloth, when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, the scraping strip retracts and is separated from the crawler-type cleaning cloth.

9. The method according to claim 2, wherein the sweeping device further comprises a housing and a cleaning pump, the crawler-type cleaning cloth and the cleaning pump are mounted in the housing, the housing is provided with a spraying port in communication with the cleaning pump, during normal traveling, the cleaning pump is turned on to spray cleaning liquid to the surface to be cleaned through the spraying port, when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, the cleaning pump is turned off.

10. The method according to claim 2, wherein the driving assembly is capable of deflecting within a preset range of deflection angle, when detecting that the sweeping device is about to travel abnormally or is traveling abnormally, the deflection angle is reduced compared with traveling normally to increase the force vector provided by the driving assembly and the crawler-type cleaning cloth to the surface to be cleaned.

11. A method for controlling a sweeping device, the sweeping device comprising a power member, a first crawler-type cleaning cloth, and a second crawler-type cleaning cloth, wherein the power member drives the first crawler-type cleaning cloth and the second crawler-type cleaning cloth to rotate in opposite directions, so as to sweep a surface to be cleaned.

12. The method according to claim 11, wherein the power member comprises a first power member and a second power member, the first power member drives the first crawler-type cleaning cloth to rotate in a forward direction, and the second power member drives the second crawler-type cleaning cloth to rotate in a reverse direction, so as to improve cleaning efficiency.

13. A sweeping device, comprising a detection assembly, a driving assembly, and a crawler-type cleaning cloth, wherein the detection assembly is configured to provide detection information that determines a movement mode of the driving assembly and the crawler-type cleaning cloth, so as to implement the method for controlling the sweeping device according to any one of claims 1 to 12.

14. The device according to claim 13, further comprising a control assembly configured to receive detection information provided by the detection assembly and control the movement mode of the driving assembly and the crawler-type cleaning cloth.

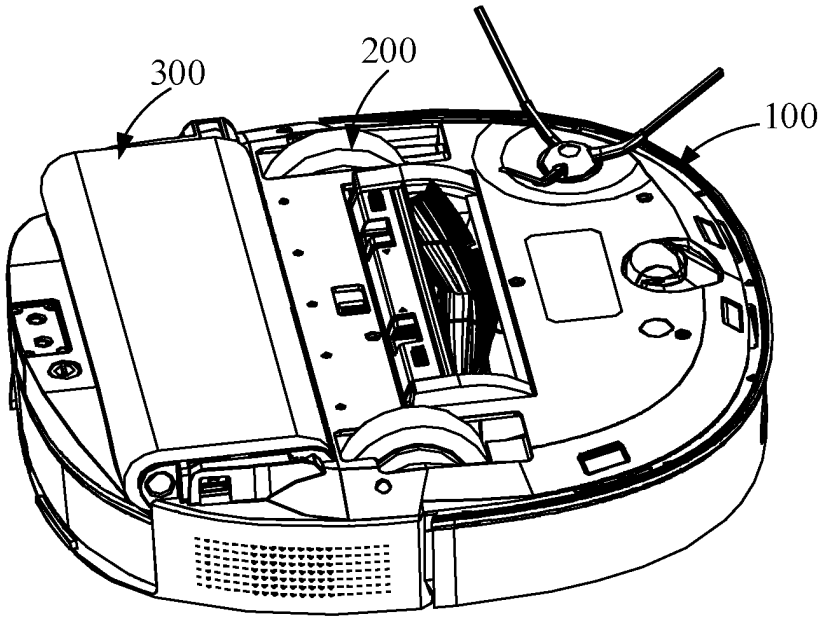

FIG. 1

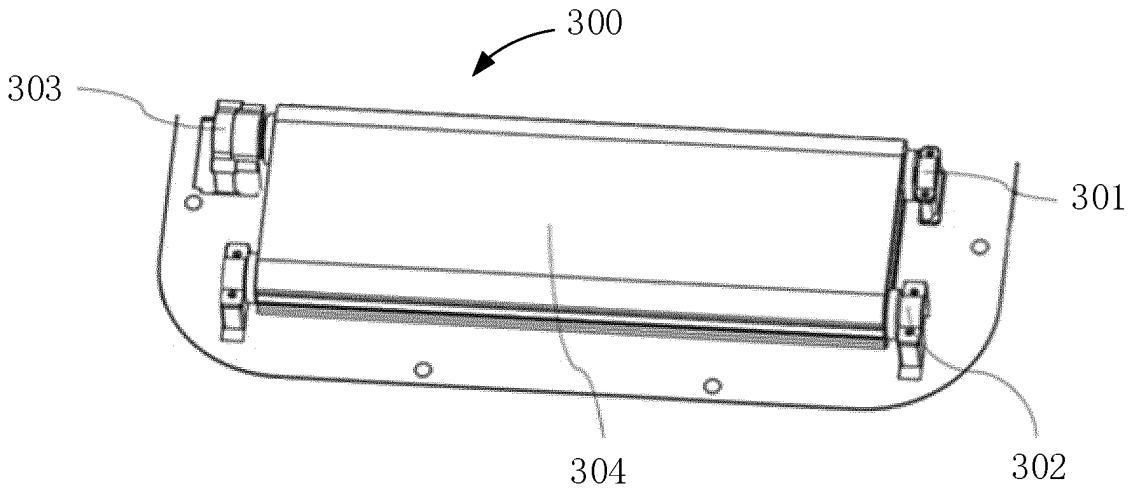

FIG. 2

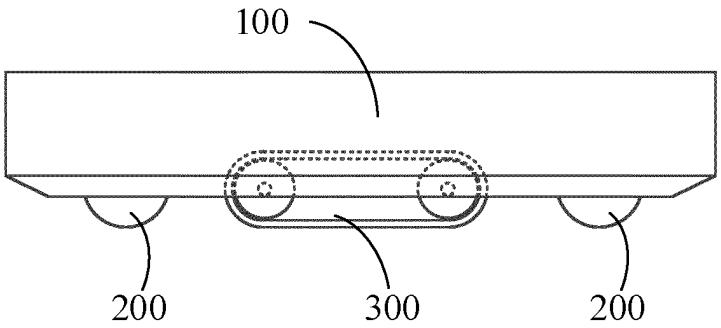

FIG. 3

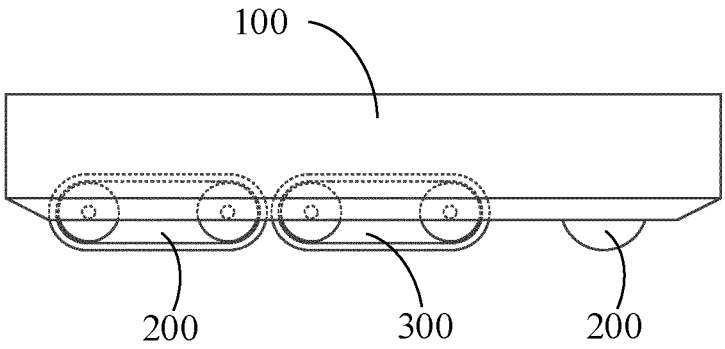

FIG. 4

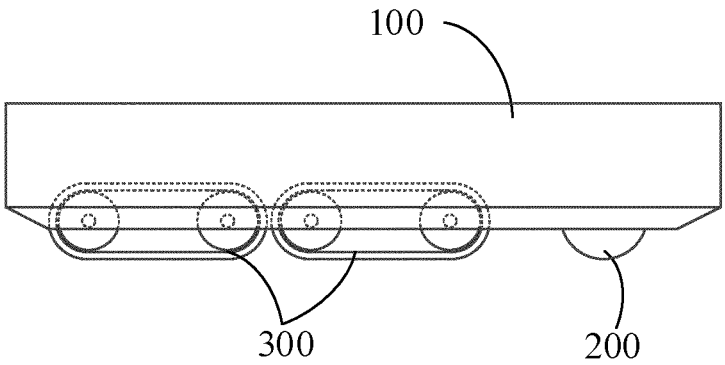

FIG. 5

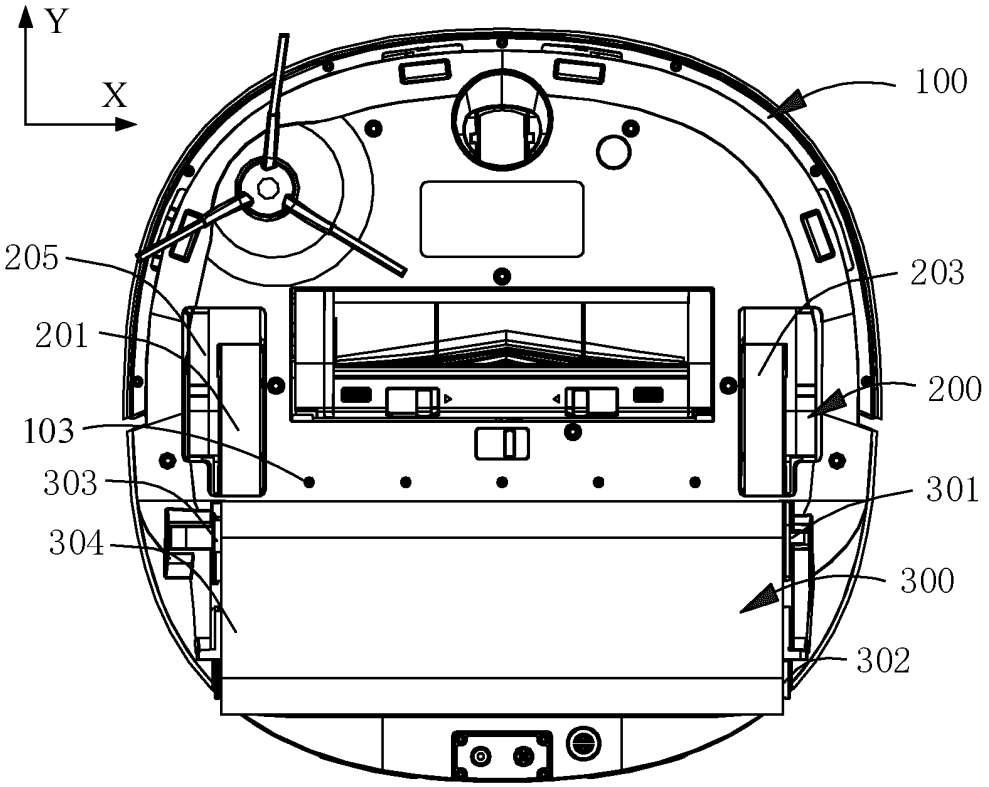

FIG. 6

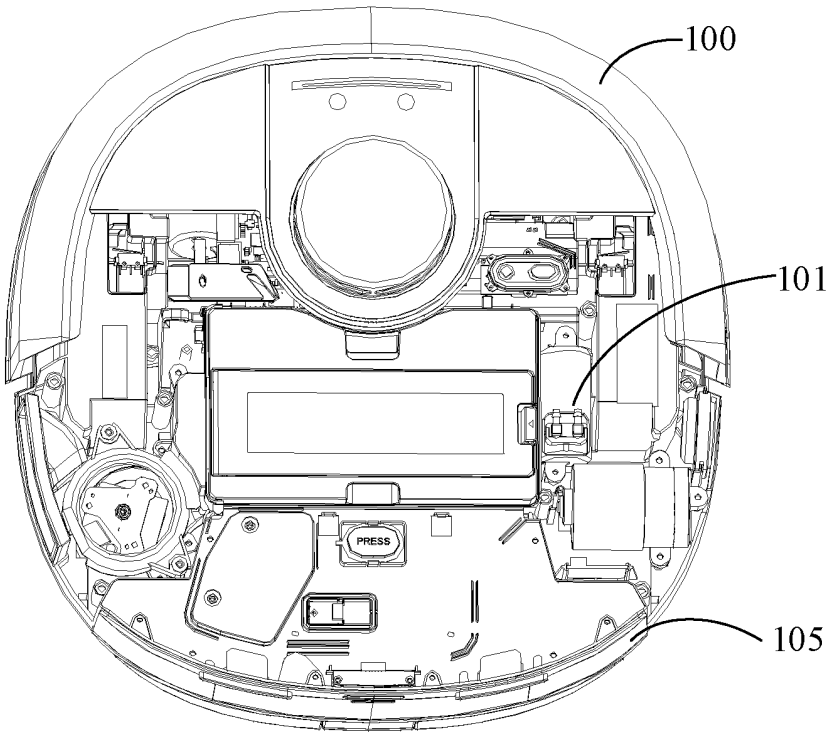

FIG. 7

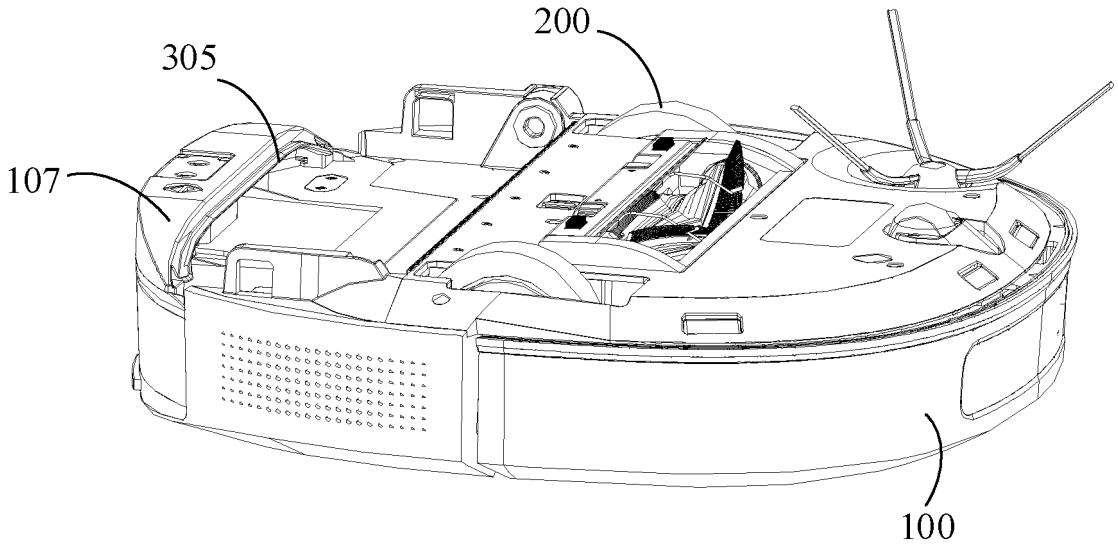

FIG. 8

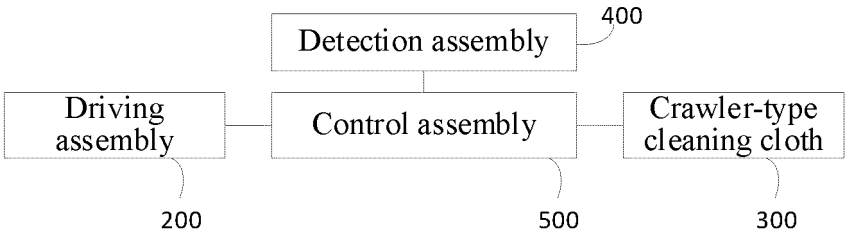

FIG. 9

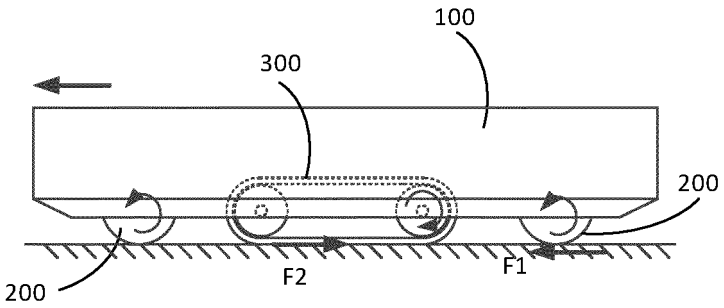

FIG. 10

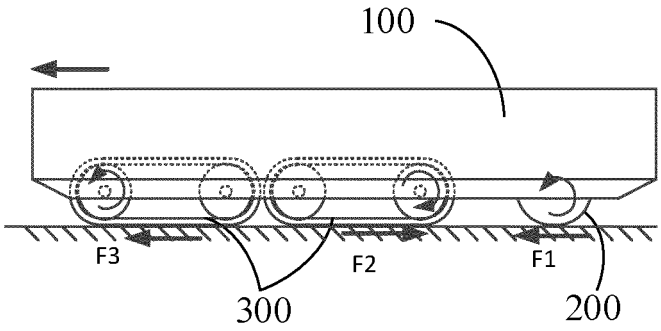

FIG. 11

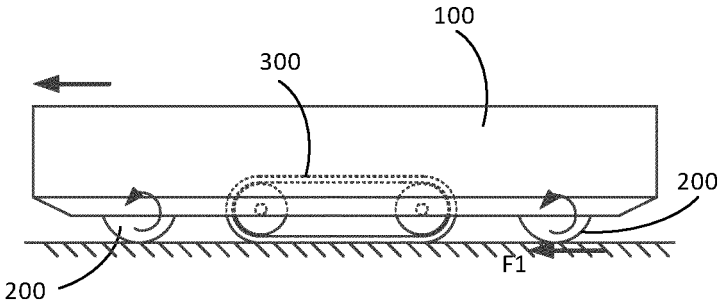

FIG. 12

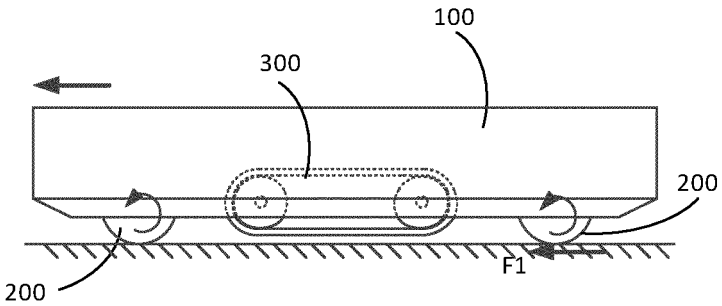

FIG. 13

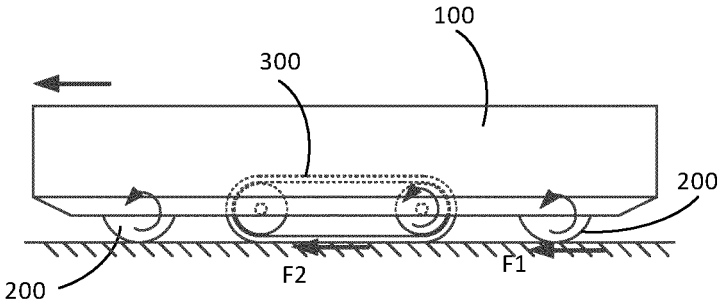

FIG. 14

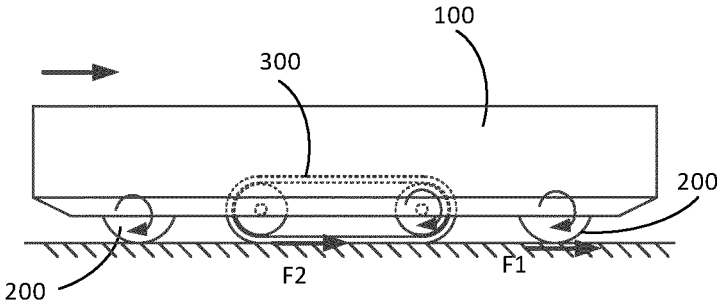

FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/090349

A. CLASSIFICATION OF SUBJECT MATTER

A47L 11/24(2006.01)i; A47L 11/28(2006.01)i; A47L 11/40(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47L11; A47L5; A47L9

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS; CNTXT; VEN; USTXT; EPTXT; CNKI: 反向, 方向相反, 增大, 摩擦, 作用力, 履带, 传送带, 传送带, 拖布, 抹布, 悬空, 障碍物, 卡住, 打滑, 异常, 模式, 等级, 抬升, 升起, pedrail, track, direction, orient+, opposition, reverse, dishcloth, dishclout, rag, obstacle, detect+, lift+, model, control+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 114027748 A (SHENZHEN BEATLES INTELLIGENT CO., LTD.) 11 February 2022 (2022-02-11) description, paragraphs 24-64	1-4, 6, 10, 13-14
PX	CN 113208507 A (SHENZHEN BEATLES INTELLIGENT CO., LTD.) 06 August 2021 (2021-08-06) description, paragraphs 19-58 and 82	1-9, 13-14
PX	CN 112806924 A (NANJING SURERTECH CO., LTD.) 18 May 2021 (2021-05-18) description, paragraph 35	1-4, 13-14
X	CN 106821152 A (ZHENG MINGZHU) 13 June 2017 (2017-06-13) description, paragraphs 41-45	1-4, 13-14
X	CN 203234684 U (GAO SHUAIBO) 16 October 2013 (2013-10-16) description, paragraphs [0037]-[0040]	1-4, 13-14
X	KR 20160008855 A (LG ELECTRONICS INC.) 25 January 2016 (2016-01-25) description, paragraphs 32-73	1-4, 13-14

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"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)
"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
"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
"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
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 June 2022	**06 July 2022**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/090349

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 112535440 A (HANGZHOU CRAFTSMAN DRAGON ROBOT TECHNOLOGY CO., LTD.) 23 March 2021 (2021-03-23) description, paragraphs 91-97	11-14
X	CN 110693403 A (NIU GUISEN) 17 January 2020 (2020-01-17) description, paragraph 2, and figure 2	11-14
X	CN 212996284 U (ECOVACS ROBOT CO., LTD.) 20 April 2021 (2021-04-20) description, paragraphs 77, 138-139, and 163	1-4, 6, 13-14
Y	CN 212996284 U (ECOVACS ROBOT CO., LTD.) 20 April 2021 (2021-04-20) description, paragraphs 77, 138-139, and 163	5, 7-10
Y	CN 110403539 A (YUNJING INTELLIGENT TECHNOLOGY (DONGGUAN) CO., LTD.) 05 November 2019 (2019-11-05) description, paragraphs 119-192	5, 10
Y	CN 111601534 A (POSITEC POWER TOOLS (SUZHOU) CO., LTD.) 28 August 2020 (2020-08-28) description, paragraphs 207-208	7-9
X	CN 112535432 A (HANGZHOU CRAFTSMAN DRAGON ROBOT TECHNOLOGY CO., LTD.) 23 March 2021 (2021-03-23) description, paragraphs 93-99	11-14
A	JP 2018099293 A (MAKITA CORPORATION) 28 June 2018 (2018-06-28) entire document	1-14
A	WO 2021060663 A1 (LG ELECTRONICS INC.) 01 April 2021 (2021-04-01) entire document	1-14

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/090349

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

[1] The same or corresponding technical feature between independent claim 1 and independent claim 11 is "a method for controlling a cleaning device, the cleaning device comprising a power member", and the feature is well known in the art. Therefore, independent claim 1 and independent claim 11 do not share a same or corresponding special technical feature, are not technically linked, do not belong to a single general inventive concept, and therefore do not comply with the requirement of unity of invention as defined in PCT Rule 13.1.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☑ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/090349

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