

TITLE OF INVENTION: SWAPPABLE CLEANING MODULE FOR AN AUTONOMOUS CLEANING ROBOT

FIELD

[0001] The present invention relates to a swappable cleaning module for an autonomous cleaning robot.

BACKGROUND

[0002] The following discussion of the background to the invention is intended to facilitate an understanding of the present invention only. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was published, known or part of the common general knowledge of the person skilled in the art in any jurisdiction as at the priority date of the invention.

[0003] Current autonomous cleaning robots comes with various types of cleaning mechanisms. These cleaning mechanisms can be designed to carry out various types of cleaning such as, but not limited to floor scrubbing, sweeping, vacuuming, dust mopping, and wet mopping. However, each cleaning mechanism needs to be mounted and calibrated to a specific robot to perform the operation. In a scenario, where the user wants to scrub and mop a floor, currently the user must have a scrubbing robot as well as a mopping robot. This decreases the ROI value for the customers as they must buy two robots instead of one.

[0004] An object of the invention is to ameliorate one or more of the above-mentioned difficulties.

SUMMARY

According to an aspect of the present disclosure, there is provided a cleaning mechanism for an autonomous cleaning robot comprising:

a mount assembly;

at least one swappable cleaning module having a securing arrangement for releasably securing the swappable cleaning module to the mount assembly; and

a displacement actuator for lowering and raising the mount assembly to allow for engagement of the swappable cleaning module with a floor surface, the swappable cleaning module(s) conducting a surface maintenance operation on the underlying floor surface when in contact with the floor surface;

wherein cleaning modules of different types can be mounted on the mount assembly depending on the maintenance operation to be conducted on the floor surface.

[0005] In some embodiments, the securing arrangement comprises at least one engagement member supported on the swappable cleaning module, the engagement member(s) including a rotatably mounted knob, wherein the knob can pass through a corresponding aperture provided in the mount assembly when in at least one rotational position, and wherein the knob can be rotated into at least one other rotational position to engage the mount assembly thereby preventing the knob from passing back through the aperture to thereby lock in position the swappable cleaning module on the mount assembly.

[0006] In some embodiments, the aperture is generally slot shaped, and the knob includes a pair of opposing lateral wings.

[0007] In some embodiments, the securing arrangement further comprises a magnetic engagement assembly including one or more magnets and cooperating ferromagnetic material respectively provided on the mount assembly and the swappable cleaning module.

[0008] In some embodiments, the swappable cleaning module is in the form of a squeegee module supporting a rubber squeegee blade for collecting water on the floor surface.

[0009] In some embodiments, the swappable cleaning module is in the form of a dust mop module supporting a dust mop for removing dust from the floor surface.

[0010] In some embodiments, the swappable cleaning module is in the form of a wet mop module supporting a wet mop for wet cleaning of the floor surface.

[0011] According to another aspect of the present disclosure, there is provided a swappable cleaning module for a cleaning mechanism as described above.

[0012] According to a further aspect of the present disclosure, there is provided an autonomous cleaning robot having a cleaning mechanism as described above.

[0013] Other aspects and features will become apparent to those of ordinary skill in the art upon review of the following description of specific embodiments in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] In the figures, which illustrate, by way of example only, embodiments of the present invention,

[0015] [Figure 1] is a top perspective view of a cleaning mechanism for an autonomous cleaning robot having a swappable cleaning module in the form of a squeegee module according to the present disclosure;

[0016] [Figures 2a and 2b] are top partial perspective views of the connection arrangement of a swappable cleaning module according to the present disclosure respectively in a locked and unlocked configuration;

[0017] [Figure 3] is a top perspective view of a cleaning mechanism for an autonomous cleaning robot having a swappable dust mop module according to the present disclosure; and

[0018] [Figure 4] is a top perspective view of a cleaning mechanism for an autonomous cleaning robot having a swappable wet mop module according to the present disclosure;

[0019] Other arrangements of the invention are possible and, consequently, the accompanying drawings are not to be understood as superseding the generality of the preceding description of the invention.

DETAILED DESCRIPTION

[0020] Throughout this document, unless otherwise indicated to the contrary, the terms “comprising”, “consisting of”, “having” and the like, are to be construed as non-exhaustive, or in other words, as meaning “including, but not limited to”.

[0021] Furthermore, throughout the specification, unless the context requires otherwise, the word “include” or variations such as “includes” or “including” will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

[0022] Example embodiments of the present invention will now be described with reference to the accompanying drawings. The terminology used herein is for the purpose of describing particular embodiments only and is not intended to limit the scope of the present invention. Other definitions for selected terms used herein may be found within the detailed description of the invention and apply throughout the description. Additionally, unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one of ordinary skill in the art to which this invention belongs. Where possible, the same reference numerals are used throughout the figures for clarity and consistency.

[0023] The present disclosure is directed to a cleaning mechanism locatable at the rear end of an autonomous cleaning robot such as a floor scrubbing robot. The cleaning mechanism is provided with swappable cleaning modules for the autonomous cleaning robot. The floor scrubbing robots generally comes with a scrubbing brush and a squeegee blade at the rear that sucks the water from the floor using a vacuum motor. The present disclosure presents ways of replacing the squeegee blade with swappable cleaning modules that can be used to mount different devices including, but not restricted to a squeegee blade, dust mop or a wet mop (which can be either a re-usable type or disposable type).

[0024] [Fig. 1] shows a cleaning mechanism 3 for an autonomous cleaning robot (not shown) according to the present disclosure. The autonomous cleaning robot may typically include a cylindrical or other form of scrubbing brush for scrubbing an underlying floor surface. The cleaning mechanism 3 can be mounted on the rear of the autonomous cleaning robot and may work in conjunction with the scrubbing brush

to perform a surface maintenance operation on the underlying floor surface. The cleaning mechanism has a mount assembly 5 having a main body 6 for securing thereon different types of swappable cleaning modules 7. The mount assembly 5 further comprises a series of weighted plates 13 positioned over and secured to the main body 6 to assist in maintaining the swappable cleaning module 7 in contact with the underlying floor surface.

[0025] The cleaning mechanism 3 further comprises a displacement actuator 9 secured to a support bracket 11. That support bracket 11 can act to secure in place the cleaning mechanism 3 to the rear of the autonomous cleaning robot. The displacement actuator 9 has a lower end 10 secured to the mount assembly main body 6. Therefore, actuation of the displacement actuator 9 can result in the lowering and raising of the mount assembly 5 relative to the underlying floor surface. The actuator 9 may be directly connected to the mount assembly main body 6. It is however also envisaged that the actuator 9 may be connected to the main body 6 via other means such as one or more cables formed from steel, composite, nylon or other material. The displacement of the actuator 9 can apply or release tension on the cable(s) to raise and lower the main body 6.

[0026] The swappable cleaning module 7 shown in [fig. 1] is in the form of a squeegee module 15 having a bow shaped body 17 to which is secured a rubber squeegee blade 19. The squeegee module 15 also has a back wheel assembly 21 for supporting a positioning the squeegee module 15 during its traverse over the floor surface. At least one securing arrangement 23 is provided on the squeegee module 15 to facilitate the installation and removal of the squeegee module 15 from the mount assembly 5. Two such securing arrangements 23 are shown in [figs. 1, 3 and 4]. The squeegee module 15 can also be swapped with other types of cleaning modules 7 which will be subsequently described. Similar or identical securing arrangements 23 may also be provided on these other cleaning modules 7 to facilitate removal and replacement of these cleaning modules 7 for different surface maintenance requirements.

[0027] The mount assembly 5 may be connected to the wastewater tank of the autonomous cleaning robot via a hose (not shown). When the vacuum motor of the autonomous cleaning robot turns on, it creates a suction inside the wastewater tank

causing the water to be lifted off from the floor surface via the squeegee module 15. When the autonomous cleaning robot is scrubbing the floor surface, the cylindrical brushes and squeegee module 15 can be lowered down together with the vacuum motor switched on. The cylindrical brushes can scrub the floor together with the water that is sprayed at regular intervals from the autonomous cleaning robot. The dirty water is then collected from the floor surface by the squeegee module 15, and the water sucked from the squeegee module 15 via the squeegee hose. This action leaves the floor dry. To perform daily maintenance, the swappable squeegee module 15 can be unmounted from the mount assembly 6 to facilitate convenient cleaning of the rubber squeegee blade 19.

[0028] [Figs. 2a and 2b] show in more detail the operation of the securing arrangement 23 which includes a rotatably mounted knob 25 which can be rotated into different rotational positions. The mount assembly main body 6 has at least one generally slot shaped aperture 27 passing therethrough, with two such apertures 27 shown in [figs. 1, 3 and 4]. The knob 27 has a pair of opposing laterally extending wings 26. The knob 25 is shown in a locked position in [fig. 2a], with the opposing wings 26 of the knob 25 engaging an upper surface 8 of the main body 6. This locks in position the swappable cleaning module 7 on the mount assembly 5. The knob 25 is shown in an unlocked position in [fig. 2b], where the knob 25 is rotated in an anticlockwise direction as shown by arrow 29 so that the opposing wings 26 of the knob 25 are aligned with the generally slot-shaped aperture 27. This thereby allows the knob 25 to pass through the aperture 27 thereby releasing the swappable cleaning module 7 from the mount assembly main body 6. It is also envisaged that the securing arrangement 23 further includes a magnetic engagement assembly (not shown) respectively provided on the mount assembly 5 and the swappable cleaning module 7. The magnetic engagement assembly may include one or more magnets and cooperating ferromagnetic material respectively provided on the mount assembly 5 and the swappable cleaning module 7. The magnetic attraction of the magnets to the ferromagnetic material will engage together and prevent the cleaning module 7 from dropping downwardly off the mount assembly 5, while the knob 25 when engaged with the corresponding aperture 27 will prevent or minimise lateral displacement of the cleaning module 7 relative to the mount assembly 5. The use of

other engagement assemblies such as hook and loop fasteners for example is also envisaged.

[0029] [Figs. 3 and 4] respectively show a cleaning mechanism 3 according to the present disclosure similar to the cleaning mechanism 3 shown in [fig. 1]. However, a dust mop module 31 is secured to the mount assembly 5 in [fig. 3], while a wet mop module 33 is secured to the mount assembly 5 in [fig. 4].

[0030] In General, floor cleaning can be categorized into (but not limited to)

- Wet Floor Scrubbing using disc brushes
- Wet Floor Scrubbing using cylindrical brushes
- Sweeping into a debris tray
- Sweeping into an active suction hose (leading into a debris tank/container)
- Dry dust mopping
- Wet Mopping – with water spray and mopping pad
- Disposable Wet Mopping (using disposable wet pads)
- Sweeping with dust mopping
- Sweeping with wet mopping

[0031] The cleaning mechanism 3 according to the present disclosure allows an autonomous cleaning robot with this cleaning mechanism 3 installed to have multiple cleaning modes using the same robot. The swappable cleaning modules 7 potentially allows the user to have the following cleaning options:

- Config. 1: Dry Sweeping into a debris tray
- Config. 2: Wet Scrubbing with sweeping, and suction of dirty water using squeegee module 15
- Config. 3: Dry Sweeping into a debris tray, and dust mopping at the rear of the robot using a dust mop module 31
- Config. 4: Dry Sweeping into a debris tray, wet mopping at the rear of the robot using a wet mop module 33
- Config. 5: Dust Mopping only using a dust mop module 31
- Config. 6: Wet Mopping only (using disposable wet pads) using a wet mop module 33

[0032] It should be appreciated by the person skilled in the art that the above invention is not limited to the embodiment described. It is to be appreciated that modifications and improvements may be made without departing from the scope of the present invention.

[0033] It should be further appreciated by the person skilled in the art that one or more of the above modifications or improvements, not being mutually exclusive, may be further combined to form yet further embodiments of the present invention.

CLAIMS

[Claim 1] A cleaning mechanism for an autonomous cleaning robot comprising:

a mount assembly;

at least one swappable cleaning module having a securing arrangement for releasably securing the swappable cleaning module to the mount assembly; and

a displacement actuator for lowering and raising the mount assembly to allow for engagement of the swappable cleaning module with a floor surface, the swappable cleaning module(s) conducting a maintenance operation on the underlying floor surface when in contact with the floor surface;

wherein cleaning modules of different types can be mounted on the mount assembly depending on the maintenance operation to be conducted on the floor surface.

[Claim 2] A cleaning mechanism for an autonomous cleaning robot according to claim 1, wherein the securing arrangement comprises at least one engagement member supported on the swappable cleaning module, the engagement member(s) including a rotatably mounted knob, wherein the knob can pass through a corresponding aperture provided in the mount assembly when in at least one rotational position, and wherein the knob can be rotated into at least one other rotational position to engage the mount assembly thereby preventing the knob from passing back through the aperture to thereby lock in position the swappable cleaning module on the mount assembly.

[Claim 3] A cleaning mechanism for an autonomous cleaning robot, according to claim 2, wherein the aperture is generally slot shaped, and the knob includes a pair of opposing lateral wings.

[Claim 4] A cleaning mechanism for an autonomous cleaning robot, according to claim 2 or 3, the securing arrangement further comprising a magnetic engagement assembly including one or more magnets and cooperating ferromagnetic material respectively provided on the mount assembly and the swappable cleaning module.

[Claim 5] A cleaning mechanism for an autonomous cleaning robot according to claim 1, wherein the swappable cleaning module is in the form of a squeegee module supporting a rubber squeegee blade for collecting water on the floor surface.

[Claim 6] A cleaning mechanism for an autonomous cleaning robot, wherein the swappable cleaning module is in the form of a dust mop module supporting a dust mop for removing dust from the floor surface.

[Claim 7] A cleaning mechanism for an autonomous cleaning robot, wherein the swappable cleaning module is in the form of a wet mop module supporting a wet mop for wet cleaning of the floor surface.

[Claim 8] A swappable cleaning module for a cleaning mechanism according to any one of claims 1 to 4.

[Claim 9] A swappable module according to claim 8, wherein the swappable cleaning module is in the form of a squeegee module supporting a rubber squeegee blade for collecting water on the floor surface.

[Claim 10] A swappable cleaning module according to claim 8, wherein the swappable cleaning module is in the form of a dust mop module supporting a dust mop for removing dust from the floor surface.

[Claim 11] A swappable cleaning module according to claim 8, wherein the swappable cleaning module is in the form of a wet mop module supporting a wet mop for wet cleaning of the floor surface.

[Claim 12] An autonomous cleaning robot having a cleaning mechanism according to any one of claims 1 to 7.