(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 501 194 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
05.02.2025 Bulletin 2025/06

(21) Application number: **23860849.1**

(22) Date of filing: **29.08.2023**

(51) International Patent Classification (IPC):
A47L 9/28 *(2006.01)* ***A47L 5/24*** *(2006.01)*
A47L 7/00 *(2006.01)* ***A47L 9/32*** *(2006.01)*
A47L 9/24 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A47L 5/24; A47L 7/00; A47L 9/24; A47L 9/28; A47L 9/32

(86) International application number:
PCT/KR2023/012814

(87) International publication number:
WO 2024/049173 (07.03.2024 Gazette 2024/10)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **30.08.2022 KR 20220109493**
19.01.2023 KR 20230008104

(71) Applicant: **Samsung Electronics Co., Ltd.**
Suwon-si, Gyeonggi-do 16677 (KR)

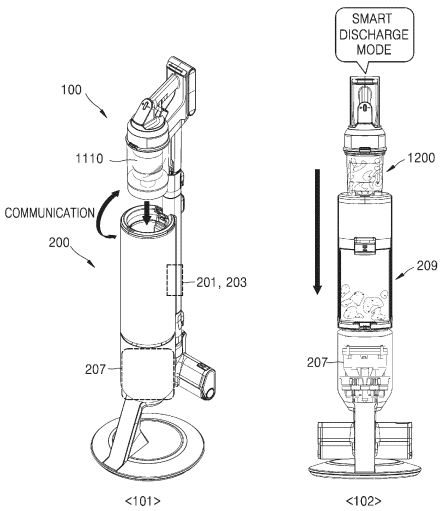
(72) Inventors:
- **LEE, Seongu**
  Suwon-si, Gyeonggi-do 16677 (KR)
- **CHO, Jeonghee**
  Suwon-si, Gyeonggi-do 16677 (KR)
- **LEE, Ahyoung**
  Suwon-si, Gyeonggi-do 16677 (KR)
- **LEE, Yeongju**
  Suwon-si, Gyeonggi-do 16677 (KR)
- **JEONG, Jaeshik**
  Suwon-si, Gyeonggi-do 16677 (KR)
- **CHO, Yoonkyung**
  Suwon-si, Gyeonggi-do 16677 (KR)

(74) Representative: **Walaski, Jan Filip et al**
Venner Shipley LLP
200 Aldersgate
London EC1A 4HD (GB)

(54) **STATION DEVICE AND METHOD FOR OPERATING STATION DEVICE**

(57) A station apparatus performs a dust discharging operation when it is identified that a suction power decrease amount of a cordless vacuum cleaner is equal to or greater than a pre-set threshold suction power decrease amount, based on information about the suction power decrease amount of the cordless vacuum cleaner received from the cordless vacuum cleaner.

FIG. 1



EP 4 501 194 A1

Description

TECHNICAL FIELD

[0001] An embodiment of the disclosure relates to a station apparatus for performing a dust discharging operation, and an operating method of the station apparatus.

BACKGROUND ART

[0002] A cordless vacuum cleaner is a type of cleaner that is used by charging a battery included in the vacuum cleaner itself without having to connect a line to an outlet. The cordless vacuum cleaner includes a suction motor that generates suction power, and thus may suck up or absorb foreign materials, such as dust, together with the air, from a cleaner head (e.g., brush) through the suction power generated in the suction motor, and collect the sucked up foreign materials by separating the sucked up foreign materials from the air.

[0003] A size of a dust container of the cordless vacuum cleaner is limited, and thus the cordless vacuum cleaner itself is hard to collect a lot of dust. Also, when the cordless vacuum cleaner is continuously operated while the dust container is completely filled with dust, a flow path within the cordless vacuum cleaner may be blocked and thus cleaning performance may largely decrease. The cleaning performance may not be recovered only by emptying the dust in the dust container, and the dust container may need to be disassembled and the inside of the dust container may need to be cleaned. Accordingly, it is desired to empty the dust in the dust container of the cordless vacuum cleaner at an appropriate time.

[0004] Recently, functions of a station for storing the cordless vacuum cleaner, together with the cordless vacuum cleaner, are being updated. The station provides a function of manually or automatically discharging dust collected in the dust container of the cordless vacuum cleaner, in addition to functions of storing the cordless vacuum cleaner and charging a battery of the cordless vacuum cleaner.

DESCRIPTION OF EMBODIMENTS

SOLUTION TO PROBLEM

[0005] In an embodiment of the disclosure, a station apparatus includes a communication interface configured to communicate with a cordless vacuum cleaner including a dust container for containing dust, a suction motor configured to generate suction power for sucking up the dust from the dust container included in the cordless vacuum cleaner, a collecting portion through which the dust from the dust container is collected, a memory storing information about a pre-set threshold suction power decrease amount, and at least one processor. The at least one processor is configured to receive information about a suction power decrease amount of the cordless vacuum cleaner from the cordless vacuum cleaner through the communication interface. The at least one processor is further configured to, when it is identified that the suction power decrease amount of the cordless vacuum cleaner is equal to or greater than the pre-set threshold suction power decrease amount, based on the received information about the suction power decrease amount, perform a dust discharging operation of discharging the dust from the dust container to the collecting portion by driving the suction motor.

[0006] In an embodiment of the disclosure, an operating method of a station apparatus for discharging dust from a cordless vacuum cleaner including a dust container includes receiving information about a suction power decrease amount of the cordless vacuum cleaner from the cordless vacuum cleaner through a communication interface of the station apparatus, comparing the suction power decrease amount of the cordless vacuum cleaner with a pre-set threshold suction power decrease amount, based on the received information about the suction power decrease amount, and performing a dust discharging operation of discharging the dust from the dust container of the cordless vacuum cleaner to a collecting portion of the station apparatus by driving a suction motor of the station apparatus, when it is identified that the suction power decrease amount of the cordless vacuum cleaner is equal to or greater than the pre-set threshold suction power decrease amount, based on a result of the comparing.

BRIEF DESCRIPTION OF DRAWINGS

[0007] The above and other exemplary embodiments, advantages and features of this disclosure will become more apparent by describing in further detail exemplary embodiments thereof with reference to the accompanying drawings, in which:

FIG. 1 is a diagram for describing an embodiment of a cleaning system according to the disclosure.
FIG. 2 is a diagram for describing an embodiment of a station apparatus and a cordless vacuum cleaner, according to the disclosure.

FIG. 3 is a diagram for describing an embodiment of a cleaner body according to the disclosure.

FIG. 4 is a diagram for describing an embodiment of operations of processors of a cordless vacuum cleaner, according to the disclosure.

FIG. 5 is a diagram for describing an embodiment of a brush device according to the disclosure.

FIG. 6 is a diagram for describing an embodiment of an operation by which a cleaner body identifies a type of a brush device, according to the disclosure.

FIG. 7 is a diagram for describing an embodiment of a cleaning system according to the disclosure.

FIG. 8 is a flowchart of an embodiment of a method by which a station apparatus performs a dust discharging operation in association with a suction power decrease amount of a cordless vacuum cleaner, according to the disclosure.

FIG. 9 is a diagram for describing an embodiment of an operation of identifying a lifted state of a brush device, according to the disclosure.

FIG. 10 is a diagram for describing an embodiment of an operation of identifying a state in which a cordless vacuum cleaner is docked to a station apparatus as a lifted state of a brush device, according to the disclosure.

FIG. 11 is a diagram for describing an embodiment of an operation by which a cordless vacuum cleaner identifies a suction power decrease amount while a brush device is in a lifted state, according to the disclosure.

FIG. 12 is a flowchart of an embodiment of a method by which a cordless vacuum cleaner identifies a usage environment state of a brush device, according to the disclosure.

FIG. 13 is a diagram for describing an embodiment of an artificial intelligence (AI) model for inferring a usage environment state of a brush device, according to the disclosure.

FIG. 14 is a diagram for describing an embodiment of an operation by which a cleaner body identifies a lifted state of a brush device by a support vector machine (SVM) model, according to the disclosure.

FIG. 15 is a flowchart of an embodiment of a method by which a station apparatus identifies a discharge mode, according to the disclosure.

FIG. 16 is a diagram showing an embodiment of a graphics user interface (GUI) for setting a discharge mode of a station apparatus, according to the disclosure.

FIG. 17 is a diagram for describing an embodiment of an operation of setting a discharge mode through an input interface of a station apparatus, according to the disclosure.

FIG. 18 is a flowchart of an embodiment of a method by which a station apparatus performs a dust discharging operation according to a type of a user input of selecting a dust discharge button, according to the disclosure.

FIG. 19 is a flowchart of an embodiment of a method by which a station apparatus sets a threshold suction power decrease amount for a smart discharge mode, according to the disclosure.

FIG. 20 is a diagram showing an embodiment of a GUI for setting a threshold suction power decrease amount, according to the disclosure.

FIG. 21 is a flowchart of an embodiment of a method of performing a dust discharging operation, based on a discharge strength or discharge duration time set by a user, according to the disclosure.

FIG. 22 is a diagram showing an embodiment of a GUI for setting a discharge strength or discharge duration time, according to the disclosure.

FIG. 23 is a flowchart of an embodiment of a method of performing a dust discharging operation when a discharge timing condition set by a user is satisfied, according to the disclosure.

FIG. 24 is a diagram showing an embodiment of a GUI for setting a discharge timing condition, according to the disclosure.

FIG. 25 is a flowchart of an embodiment of a method of performing a dust discharging operation in association with a mainly used cleaning mode of a cordless vacuum cleaner, according to the disclosure.

FIG. 26 is a diagram for describing an embodiment of a threshold suction power decrease amount and a discharging operation condition corresponding to a mainly used cleaning mode, according to the disclosure.

MODE OF DISCLOSURE

[0008] The terms used in the disclosure will be briefly defined, and embodiment of the disclosure will be described in detail.

[0009] All terms including descriptive or technical terms which are used herein should be construed as having meanings that are obvious to one of ordinary skill in the art. However, the terms may have different meanings according to the intention of one of ordinary skill in the art, precedent cases, or the appearance of new technologies. Also, some terms may be arbitrarily selected by the applicant, and in this case, the meaning of the selected terms will be described in detail in the detailed description of embodiments of the disclosure. Thus, the terms used herein have to be defined based on the meaning of the terms together with the description throughout the specification.

[0010] Throughout the disclosure, the expression "at least one of a, b or c" indicates only a, only b, only c, both a and b, both a and c, both b and c, all of a, b, and c, or variations thereof.

[0011] When a part "includes" or "comprises" an element, unless there is a particular description contrary thereto, the part may further include other elements, not excluding the other elements. In addition, terms such as "unit", "-er/or", and "module" described in the specification denote a unit that processes at least one function or operation, which may be implemented in hardware or software, or implemented in a combination of hardware and software.

[0012] Hereinafter, embodiments of the disclosure will be described in detail with reference to the accompanying drawings such that one of ordinary skill in the art may easily implement the embodiments of the disclosure. However, the disclosure may be implemented in various different forms and is not limited to the embodiments of the disclosure described herein. Also, in the drawings, parts irrelevant to the description are omitted in order to clearly describe embodiments of the disclosure, and like reference numerals designate like elements throughout the specification.

[0013] FIG. 1 is a diagram for describing an embodiment of a cleaning system according to the disclosure.

[0014] Referring to FIG. 1, the cleaning system in an embodiment of the disclosure may include a cordless vacuum cleaner 100 and a station apparatus 200. However, not all of the components shown in FIG. 1 are essential components. The cleaning system may be implemented by more components than those illustrated in FIG 1 or by fewer components than those illustrated in FIG. 1. In an embodiment, the cleaning system may be implemented to further include a server device (300 shown in FIG. 7) and a user terminal (400 shown in FIG. 7), for example. The cleaning system further including the server device and the user terminal will be described in more detail with reference to FIG. 7.

[0015] The cordless vacuum cleaner 100 includes a chargeable battery and may denote a vacuum cleaner that does not need to connect a power cord to an outlet during cleaning. A user may use a handle provided in a cleaner body to move the cordless vacuum cleaner 100 back and forth such that a brush device (cleaner head) sucks up foreign materials (e.g., dust, hair, and trash) from a surface to be cleaned. The foreign materials sucked up from the surface to be cleaned through the brush device may be collected in a dust container 1200 (also referred to as a dust collecting container) of the cleaner body. The cordless vacuum cleaner 100 may include a suction motor 1110 forming vacuum inside the cordless vacuum cleaner 100. Hereinafter, for convenience of descriptions, the suction motor 1110 of the cordless vacuum cleaner 100 may also be referred to as a first suction motor 1110. The cordless vacuum cleaner 100 may include a communication interface for communicating with the station apparatus 200. In an embodiment, the cordless vacuum cleaner 100 may transmit/receive data to/from the station apparatus 200 through a wireless personal area network (WPAN), for example. A configuration of the cordless vacuum cleaner 100 will be described in detail below with reference to FIGS. 2 through 4.

[0016] The station apparatus 200 may be an apparatus for discharging dust, charging a battery, or storing the cordless vacuum cleaner 100. The station apparatus 200 may also be referred to as a cleaning station. In an embodiment of the disclosure, the station apparatus 200 may communicate with the cordless vacuum cleaner 100 or the server device through a network. In an embodiment, the station apparatus 200 may transmit/receive data to/from the cordless vacuum cleaner 100 through the WPAN that does not pass through an access point (AP), for example. The station apparatus 200 may transmit/receive data to/from the server device through an AP that connects a local area network (LAN) to which the station apparatus 200 is connected to a wide area network (WAN) to which the server device is connected. In an embodiment, the station apparatus 200 may be connected to the cordless vacuum cleaner 100 through Bluetooth low energy (BLE) communication and connected to the server device through Wi-Fi™ communication (IEEE 802.11), for example, but is not limited thereto.

[0017] In an embodiment of the disclosure, the station apparatus 200 may include a communication interface 201, at least one processor 203, a suction motor 207 (hereinafter, also referred to as a second suction motor 207), and a collecting portion 209, but is not limited thereto. The second suction motor 207 may be a device generating suction power for discharging foreign materials collected in the dust container 1200 of the cordless vacuum cleaner 100 from the cordless vacuum cleaner 100. In an embodiment, the second suction motor 207 may generate a pressure difference inside the dust container 1200, for example. The second suction motor 207 may be disposed lower than the collecting portion 209 while the station apparatus 200 is erected.

[0018] Referring to a reference numeral 101 of FIG. 1, the user may dock the cordless vacuum cleaner 100 to the station apparatus 200 after using the cordless vacuum cleaner 100. When a distance between the cordless vacuum cleaner 100 and the station apparatus 200 is decreased, the cordless vacuum cleaner 100 and the station apparatus 200 may establish a near field communication (NFC) channel and transmit/receive data. In an embodiment, the cordless vacuum cleaner 100 may transmit, to the station apparatus 200 through NFC, information about a suction power decrease amount of the cordless vacuum cleaner 100, information about a mainly used cleaning mode, and information about error occurrence, for example, but the disclosure is not limited thereto.

[0019] Referring to a reference numeral 102 of FIG. 1, the station apparatus 200 in an embodiment of the disclosure may operate in a smart discharge mode, other than a manual discharge mode or an automatic discharge mode, when the cordless vacuum cleaner 100 is docked to the station apparatus 200. The manual discharge mode may denote a mode in which the station apparatus 200 performs a dust discharging operation according to a manual input of the user selecting a dust discharge button. In the disclosure, the dust discharging operation indicate operating the second suction motor 207 of the station apparatus 200 such that the dust in the dust container 1200 of the cordless vacuum cleaner 100 is discharged to the collecting portion 209 of the station apparatus 200. According to the manual discharge mode, when the user does not

select the dust discharge button for a relatively long time, suction power (cleaning performance) of the cordless vacuum cleaner 100 may largely decrease due to dust accumulated in the dust container 1200.

[0020] The automatic discharge mode may be a mode in which the station apparatus 200 automatically performs the dust discharging operation whenever there is an event of docking the cordless vacuum cleaner 100 to the station apparatus 200. According to the automatic discharge mode, the station apparatus 200 may perform the dust discharging operation once the cordless vacuum cleaner 100 is docked to the station apparatus 200 again, even in a situation where there is no practical benefit in dust discharge (e.g., when there is almost no dust in the dust container 1200). Thus, according to the automatic discharge mode, energy may be unnecessarily wasted due to the dust discharging operation, and the dust discharging operation may be performed even in a situation sensitive to noise occurrence, such as a night time.

[0021] The smart discharge mode may be a mode in which the station apparatus 200 automatically performs the dust discharging operation when the cordless vacuum cleaner 100 is docked to the station apparatus 200 and a predetermined condition for dust discharge is satisfied. The predetermined condition for dust discharge may be related to at least one of the suction power decrease amount of the cordless vacuum cleaner 100, the mainly used cleaning mode of the cordless vacuum cleaner 100, or a discharge timing condition set by the user, but is not limited thereto.

[0022] In an embodiment of the disclosure, when the station apparatus 200 operates in the smart discharge mode, the station apparatus 200 may perform the dust discharging operation in association with a suction power decrease level of the cordless vacuum cleaner 100. In an embodiment, the station apparatus 200 may perform the dust discharging operation when suction power of the cordless vacuum cleaner 100 is decreased to a threshold suction power decrease amount or greater, for example. When the suction power of the cordless vacuum cleaner 100 is largely decreased due to dust or the like of the dust container 1200, the cleaning performance of the cordless vacuum cleaner 100 may also be largely decreased. Accordingly, when the suction power of the cordless vacuum cleaner 100 is decreased to the threshold suction power decrease amount or greater, the station apparatus 200 may perform the dust discharging operation to recover the suction power (cleaning performance) of the cordless vacuum cleaner 100. Also, the station apparatus 200 may prevent power from being unnecessarily wasted by not performing the dust discharging operation in a situation where there is almost no suction power decrease in the cordless vacuum cleaner 100.

[0023] In an embodiment of the disclosure, the station apparatus 200 may perform the dust discharging operation in association with a dust amount of the dust container 1200. In an embodiment, the station apparatus 200 may perform the dust discharging operation when the dust amount of the dust container 1200 has increased to a threshold level or greater, for example. However, the suction power of the cordless vacuum cleaner 100 may often decrease regardless of the dust amount of the dust container 1200. Also, fine dust may greatly decrease the suction power of the cordless vacuum cleaner 100 by blocking a pre-motor filter inside the dust container 1200 or blocking a high efficiency particulate air (HEPA) filter, thereby rapidly raising a flow path internal pressure, even when a relatively small amount of fine dust is sucked up. Suction power may barely decrease even when a relatively large amount of foreign materials having relatively large volume is sucked up. Accordingly, when the station apparatus 200 performs the dust discharging operation in association with the dust amount of the dust container 1200, the station apparatus 200 may be unable to appropriately prepare for a situation where suction power of the cordless vacuum cleaner 100 is decreased before the dust container 1200 is filled with dust. Also, even when an optical sensor is provided inside the dust container 1200 to measure the dust amount of the dust container 1200, a light emitter or a light receiver of the optical sensor may be covered by dust, and thus it is difficult for the cordless vacuum cleaner 100 to accurately measure the dust amount of the dust container 1200. Accordingly, the cleaning performance (suction power) of the cordless vacuum cleaner 100 may be maintained easier when the station apparatus 200 performs the dust discharging operation in association with the suction power decrease level instead of the dust amount of the dust container 1200.

[0024] In an embodiment of the disclosure, the station apparatus 200 may perform the dust discharging operation in association with the mainly used cleaning mode of the cordless vacuum cleaner 100. The mainly used cleaning mode of the cordless vacuum cleaner 100 may denote a cleaning mode that is used for a longest time. The cleaning mode relates to suction power strength of the cordless vacuum cleaner 100, and may include a super-power suction mode, a power suction mode, a medium suction mode, and a weak suction mode, but is not limited thereto. When the station apparatus 200 performs the dust discharging operation in association with the mainly used cleaning mode of the cordless vacuum cleaner 100, a cleaning environment or individual inclination of the user may be reflected. In an embodiment, in a cleaning environment that desires relatively strong suction power or when the user prefers the power suction mode, even a slight suction power decrease needs to be immediately processed, and thus the station apparatus 200 may perform the dust discharging operation even when there is less suction power decrease amount, for example. In an environment where cleaning is relatively easy or when the user prefers energy saving, relatively low noise, or a relatively long usage duration of time rather than relatively strong suction power, the station apparatus 200 may allow a slight suction power decrease and set a dust discharge cycle to be relatively long. A method by which the station apparatus 200 performs the dust discharging operation in association with the mainly used cleaning mode of the cordless vacuum cleaner 100 will be described in detail below with reference to FIG. 25.

[0025] In an embodiment of the disclosure, the station apparatus 200 may perform the dust discharging operation in association with the discharge timing condition set by the user. In other words, when the user has set the discharge timing condition (a discharge cycle or a discharge timing), the station apparatus 200 may perform the dust discharging operation when the dust discharging operation is satisfied. In an embodiment, the user may set the discharge timing to a case where an accumulated operating duration time of the cordless vacuum cleaner 100 is 10 minutes, for example. In this case, the station apparatus 200 may not perform the dust discharging operation when the accumulated operating duration time of the cordless vacuum cleaner 100 is less than 10 minutes, and may perform the dust discharging operation when the accumulated operating duration time of the cordless vacuum cleaner 100 is equal to or greater than 10 minutes. A method by which the station apparatus 200 performs the dust discharging operation in association with the discharge timing condition set by the user will be described in detail below with reference to FIG. 23.

[0026] In an embodiment of the disclosure, the station apparatus 200 may perform the dust discharging operation according to a discharge strength or a discharge duration of time (also referred to a discharge duration time) set by the user. In an embodiment, the station apparatus 200 may adjust power consumption or operating time of the second suction motor 207 during the dust discharging operation, according to the discharge strength or discharge duration time set by the user, for example. When the second suction motor 207 of the station apparatus 200 is always operated in a maximum suction level, amounts of energy used and noise occurred may increase. Thus, in an embodiment according to the disclosure, the user may adjust the discharge strength or discharge duration time according to his/her preference. A method by which the station apparatus 200 performs the dust discharging operation according to the discharge strength or discharge duration time set by the user will be described in detail below with reference to FIG. 21.

[0027] In an embodiment of the disclosure, the station apparatus 200 provides the smart discharge mode in addition to the manual discharge mode and the automatic discharge mode, so as to reflect preference of the user during the dust discharging operation, prevent energy from being unnecessarily wasted, and efficiently manage the suction power (cleaning performance) of the cordless vacuum cleaner 100. A method by which the station apparatus 200 performs the dust discharging operation in the smart discharge mode will be described in detail below with reference to FIG. 8, and hereinafter, a configuration of the station apparatus 200 will be described in more detail with reference to FIG. 2.

[0028] FIG. 2 is a diagram for describing an embodiment of the station apparatus 200 and the cordless vacuum cleaner 100, according to the disclosure.

[0029] Referring to FIG. 2, the station apparatus 200 in an embodiment of the disclosure may include the communication interface 201, a memory 202, and the at least one processor 203. Also, the station apparatus 200 may further include a user interface 204, a wired connector 205 (e.g., a home appliance smart service (HASS) connector for updating the at least one processor 203 or providing a smart service (examination, self-diagnosis, history check, or the like)), a pressure sensor 206 (also referred to as a second pressure sensor 206), the suction motor 207 (also referred to as the second suction motor 207), a power supply device 208, a dust collecting container combining portion, the collecting portion 209, and a filter portion. However, not all of the components shown in FIG. 2 are essential components. The station apparatus 200 may be implemented by more components than those shown in FIG. 2 or by fewer components than those illustrated in FIG. 2. Each component will now be described below.

[0030] The station apparatus 200 may include the communication interface 201 for performing communication with an external device. In an embodiment, the station apparatus 200 may perform communication with a cleaner body 1000 of the cordless vacuum cleaner 100 or the server device through the communication interface 201, for example. Here, the communication interface 201 may communicate with the server device through a first communication method (e.g., a Wi-Fi communication method) and communicate with the cordless vacuum cleaner 100 through a second communication method (e.g., a BLE communication method).

[0031] The communication interface 201 may include a short-range wireless communication interface and a long-range wireless communication interface. The short-range wireless communication interface may include a Bluetooth communication interface, a BLE communication interface, an NFC interface, a wireless LAN (WLAN) (Wi-Fi) communication interface, a Zigbee communication interface, an infrared data association (IrDA) communication interface, a Wi-Fi direct (WFD) communication interface, an ultra-wideband (UWB) communication interface, or an Ant+ communication interface, but is not limited thereto. The long-range wireless communication interface may be used by the station apparatus 200 to remotely communicate with the server device. The long-range wireless communication interface may include the Internet, a computer network (e.g., LAN or WAN), and a mobile communicator. The mobile communicator may include a 3rd generation (3G) module, a 4th generation (4G) module, a 5th generation (5G) module, a long-tern evolution (LTE) module, a node B (NB)-Internet of things (IoT) module, an LTE-machine type communication (LTE-M) module, but is not limited thereto.

[0032] The communication interface 201 may transmit data to the at least one processor 203 through a universal synchronous receiver/transmitter (UART), but is not limited thereto.

[0033] The memory 202 of the station apparatus 200 may store a program (e.g., one or more instructions) for processing and control by the at least one processor 203, or store pieces of input/output data. In an embodiment, the memory 202 of the station apparatus 200 may store software related to control by the station apparatus 200, state data of the suction motor

207, a measurement value of the pressure sensor 206, error occurrence data (malfunction history data), information about an operating mode for dust discharge (e.g., an operating time of the suction motor 207 for each operating mode and a suction power generation pattern for each operating mode), a pre-set threshold suction power decrease amount for the smart discharge mode, and the discharge timing condition, for example, but the disclosure is not limited thereto. The memory 202 of the station apparatus 200 may store data received from the cleaner body 1000. In an embodiment, the station apparatus 200 may store product information (e.g., identification information and model information) of the cordless vacuum cleaner 100 docked to the station apparatus 200, information about a software version installed in the cordless vacuum cleaner 100, error occurrence data (malfunction history data) of the cordless vacuum cleaner 100, information about the mainly used cleaning mode, information about a suction power decrease amount calculated while the brush device 2000 is in a lifted state, information about an accumulated cleaning time after dust discharge, and information about an accumulated number of cleanings after dust discharge, for example.

[0034] The memory 202 may include at least one type of storage medium among a flash memory type, a hard disk type, a multimedia card micro type, a card type memory (e.g., a secure digital (SD) or an extreme digital (XD) memory), random access memory (RAM), static RAM (SRAM), read-only memory (ROM), electrically erasable programmable ROM (EEPROM), programmable ROM (PROM), a magnetic memory, a magnetic disk, and an optical disk. Programs stored in the memory 202 may be classified into a plurality of modules depending on functions.

[0035] The station apparatus 200 may include the at least one processor 203. The station apparatus 200 may include one processor or a plurality of processors. The at least one processor 203 in an embodiment of the disclosure may include at least one of a central processing unit (CPU), a graphics processing unit (GPU), an accelerated processing unit (APU), a many integrated core (MIC), a digital signal processor (DSP), or a neural processing unit (NPU). The at least one processor 203 may be implemented in the form of an integrated system-on-chip (SoC) including one or more electronic components. The at least one processor 203 may each be implemented as individual hardware. The at least one processor 203 may be also referred to as a micro-computer, microprocessor computer, or microprocessor controller (MICOM), a micro processor unit (MPU), or a micro controller unit (MCU).

[0036] The at least one processor 203 in an embodiment of the disclosure may be implemented as a single core processor or a multicore processor.

[0037] In an embodiment of the disclosure, the at least one processor 203 may receive the information about the suction power decrease amount of the cordless vacuum cleaner 100 from the cordless vacuum cleaner 100 through the communication interface 201. When it is identified that the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount, the at least one processor 203 may perform the dust discharging operation of discharging the dust from the dust container 1200 of the cordless vacuum cleaner 100 to the collecting portion 209 by driving the suction motor 207. In an embodiment, the at least one processor 203 may set the discharge mode of the station apparatus 200 to the smart discharge mode by receiving a user input of selecting the smart discharge mode, and perform the dust discharging operation when it is identified that the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount in the smart discharge mode, for example.

[0038] In an embodiment of the disclosure, the at least one processor 203 may receive the information about the threshold suction power decrease amount, which is set by the user, from the server device. In an embodiment, the at least one processor 203 may receive a user input of selecting one operating mode from among a plurality of operating modes of the station apparatus 200 and select a decrease amount corresponding to the selected operating mode as the threshold suction power decrease amount, for example.

[0039] The at least one processor 203 may obtain user setting information about at least one of the discharge strength or discharge duration time, and control the operating time of the suction motor 207 or power consumption of the suction motor 207 during the dust discharging operation, based on the user setting information.

[0040] The at least one processor 203 may obtain information related to the discharge timing condition set by the user, compare the suction power decrease amount of the cordless vacuum cleaner 100 with the pre-set threshold suction power decrease amount when the discharge timing condition set by the user is satisfied, and perform the dust discharging operation by driving the suction motor 207 when the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount. The information related to the discharge timing condition set by the user may include at least one of a discharge cycle, a discharge duration time, an accumulated operating duration time of the cordless vacuum cleaner 100, or an accumulated number of operations of the cordless vacuum cleaner 100, but is not limited thereto.

[0041] The at least one processor 203 may receive the information about the mainly used cleaning mode of the cordless vacuum cleaner 100 from the cordless vacuum cleaner 100, and determine at least one of the pre-set threshold suction power decrease amount, the discharge strength, or the discharge duration time, based on the mainly used cleaning mode of the cordless vacuum cleaner 100.

[0042] The at least one processor 203 may perform the dust discharging operation by controlling the suction motor 207 according to the discharge strength or discharge duration time set by the user, when an input of pressing the dust discharge

button for a first time is detected. The at least one processor 203 may perform the dust discharging operation by controlling the suction motor 207 according to a default discharge strength or default discharge duration time, when an input of pressing the dust discharge button for a second time different from the first time is detected.

[0043] The user interface 204 of the station apparatus 200 may include an input interface and an output interface. The input interface may include a discharge start button, a discharge end button, and a mode selecting button. The output interface may include a light-emitting diode (LED) display, a liquid crystal display (LCD), a touch screen, and a sound output module for audio guidance, but is not limited thereto. The output interface may display a battery charge amount of the cleaner body 1000 or software update progress information, but is not limited thereto.

[0044] The station apparatus 200 may include the wired connector 205. The wired connector 205 may include a terminal for connecting a computing device of a system manager (e.g., a service engineer). The system manager may connect the computing device storing a new version of software to the wired connector 205, and transfer the new version of software to the memory 202 of the station apparatus 200. Here, when the new version of software is software related to control by the station apparatus 200, pre-installed software of the station apparatus 200 may be updated. When the new version of software is software related to control by the cordless vacuum cleaner 100, the station apparatus 200 may transfer the new version of software to the cordless vacuum cleaner 100 depending on whether a pre-set condition is satisfied. In an embodiment, when the cordless vacuum cleaner 100 is docked to the station apparatus 200 and the station apparatus 200 is able to perform BLE communication with the cordless vacuum cleaner 100, the station apparatus 200 may transfer the new version of software to the cordless vacuum cleaner 100, for example. Here, the cordless vacuum cleaner 100 may update pre-installed software.

[0045] The pressure sensor 206 (second pressure sensor 206) of the station apparatus 200 may be a sensor for measuring internal pressure of the station apparatus 200. The pressure sensor 206 may measure a pressure value before dust discharge, measure a pressure value during dust discharge, or measure a pressure value after dust discharge. The pressure sensor 206 may transmit the measured pressure value to the at least one processor 203 through inter-integrated circuit (I2C) communication or UART communication. The pressure sensor 206 may be provided between the collecting portion 209 and the suction motor 207, but is not limited thereto. When the pressure sensor 206 is provided between the collecting portion 209 and the suction motor 207, the pressure sensor 206 is disposed at a front end of the suction motor 207, and thus the pressure sensor 206 may be implemented as a negative pressure sensor.

[0046] The suction motor 207 (second suction motor 207) may be a device generating suction power for discharging foreign materials collected in the dust container 1200 of the cleaner body 1000 from the cleaner body 1000. The suction motor 207 may rotate a suction fan moving the air. The suction fan may include an impeller.

[0047] The power supply device 208 may include a switching mode power supply (SMPS) configured to receive alternating current power from a power source and change the alternating current power to direct current power. When the cordless vacuum cleaner 100 is docked to the station apparatus 200, the direct current power obtained by the power supply device 208 is supplied to the battery of the cleaner body 1000 through a charging terminal, thereby charging the battery.

[0048] The dust collecting container combining portion may be provided such that the dust collecting container (the dust container 1200) of the cleaner body 1000 is docked thereto. When the dust container 1200 is disposed (e.g., mounted) on the dust collecting container combining portion, docking of the cleaner body 1000 and the station apparatus 200 may be completed. A docking detecting sensor for detecting docking of the cleaner body 1000 may be included in the dust collecting container combining portion. The docking detecting sensor may be a tunnel magneto-resistance (TMR) sensor, but is not limited thereto. The TMR sensor may sense whether the cleaner body 1000 is docked by detecting a magnetic body attached to the dust container 1200. The station apparatus 200 may include a step motor (also referred to as a first step motor) for pressing one side of a cover (also referred to as a door) of the dust container 1200 such that the cover is opened when the dust container 1200 is docked to the station apparatus 200. The station apparatus 200 may further include a step motor (also referred to as a second step motor) for pressing one side of the cover of the dust container 1200 such that the cover is closed after dust discharge is completed.

[0049] The collecting portion 209 is a space where the foreign materials discharged from the dust container 1200 of the cleaner body 1000 may be collected. The collecting portion 209 may include a dust bag where the foreign materials discharged from the dust container 1200 are collected. The dust bag may include a material through which the air is penetrated but the foreign materials are not penetrated, such that the foreign materials introduced from the dust container 1200 to the collecting portion 209 are collected. The dust bag may be provided to be detachable from the collecting portion 209. The station apparatus 200 may include an ultraviolet (UV) irradiator that irradiates UV rays to the collecting portion 209. The UV irradiator may include a plurality of UV lamps. The UV irradiator may suppress proliferation of germs in the collecting portion 209 including the dust bag. In an embodiment, the UV irradiator may suppress proliferation of germs from dust in the dust bag, for example.

[0050] The filter portion may filter out fine particulate matters that are not collected in the collecting portion 209. The filter portion may include a discharge port for discharging the air that passed through a filter to the outside of the station apparatus 200. The filter portion may include a motor filter or a high-efficiency particulate air (HEPA) filter, but is not limited thereto.

[0051] The cordless vacuum cleaner 100 according an embodiment of the disclosure may be a stick type vacuum cleaner including the cleaner body 1000, a brush device 2000, and an extension pipe 3000. However, not all of the components shown in FIG. 2 are essential components. The cordless vacuum cleaner 100 may be implemented by more components than those illustrated in FIG. 2 or by fewer components than those illustrated in FIG. 2. In an embodiment, the cordless vacuum cleaner 100 may include the cleaner body 1000 and the brush device 2000 without the extension pipe 3000, for example.

[0052] The cleaner body 1000 is a portion where the user may hold and move during cleaning, and may include the suction motor 1110 (first suction motor 1110) forming vacuum inside the cordless vacuum cleaner 100. The suction motor 1110 may be disposed inside the dust container 1200 where foreign materials sucked up from a surface to be cleaned (e.g., a floor, bedding, or a sofa) are accommodated. The cleaner body 1000 may further include, in addition to the suction motor 1110, at least one processor, a battery, and a memory storing software related to control by the cordless vacuum cleaner 100, but is not limited thereto. The cleaner body 1000 will be described in detail below with reference to FIG. 3.

[0053] The brush device 2000 is a device configured to suck up the air and foreign materials of the surface to be cleaned by being pressed against the surface to be cleaned. The brush device 2000 may also be referred to as a cleaner head. The brush device 2000 may be rotatably combined to the extension pipe 3000. The brush device 2000 may include a motor and a drum to which a rotating brush is attached, but is not limited thereto. In an embodiment of the disclosure, the brush device 2000 may further include at least one processor configured to control communication with the cleaner body 1000. A type of the brush device 2000 may vary, and types of the brush device 2000 will be described in detail below with reference to FIG. 5.

[0054] The extension pipe 3000 may be formed as a pipe having predetermined rigidity or a flexible hose. The extension pipe 3000 may be configured to transmit suction power generated through the suction motor 1110 of the cleaner body 1000 to the brush device 2000, and transfer the air and foreign material sucked up through the brush device 2000 to the cleaner body 1000. The extension pipe 3000 may be detachably connected to the brush device 2000. The extension pipe 3000 may be formed in multiple stages between the cleaner body 1000 and the brush device 2000. There may be two or more extension pipes 3000.

[0055] In an embodiment of the disclosure, each of the cleaner body 1000, the brush device 2000, and the extension pipe 3000 included in the cordless vacuum cleaner 100 may include power lines (e.g., a + power line and a - power line) and a signal line.

[0056] The power lines may be lines for transmitting power supplied from the battery to the cleaner body 1000 and the brush device 2000 connected to the cleaner body 1000. The signal line is different from the power line and may be a line for transmitting/receiving signals between the cleaner body 1000 and the brush device 2000. The signal line may be implemented to be connected to the power lines inside the brush device 2000.

[0057] In an embodiment of the disclosure, each of at least one processor 1001 of the cleaner body 1000 and a processor of the brush device 2000 may be configured to control operations of a switching device connected to the signal line for bi-directional communication between the cleaner body 1000 and the brush device 2000. Hereinafter, communication between the cleaner body 1000 and the brush device 2000 will be defined as signal line communication when the cleaner body 1000 and the brush device 2000 communicate with each other through the signal line. The cleaner body 1000 and the brush device 2000 may communicate with each other through I2C communication or UART communication.

[0058] In an embodiment of the disclosure, the cleaner body 1000 may identify a type of the brush device 2000, in addition to detecting detachment of the brush device 2000, and adaptively control an operation of the brush device 2000 (e.g., drum revolution per minute (RPM)) according to a usage environment state of the brush device 2000 (e.g., a hard floor, a carpet, a mat, a corner, or a state of being lifted from a surface to be cleaned). In an embodiment, the cleaner body 1000 may periodically communicate with the brush device 2000 to transmit a signal for controlling operations of the brush device 2000 to the brush device 2000, for example. Hereinafter, a configuration of the cleaner body 1000 will be described in more detail with reference to FIG. 3.

[0059] FIG. 3 is a diagram for describing an embodiment of the cleaner body 1000 according to the disclosure.

[0060] Referring to FIG. 3, the cleaner body 1000 may include a suction power generating device (hereinafter, also referred to as a motor assembly 1100) for generating suction power desired to suck up foreign materials on the surface to be cleaned, a dust collecting container 1200 (also referred to as the dust container 1200) in which the foreign materials sucked up from the surface to be cleaned are accommodated, a filter portion 1300, the pressure sensor 1400, a battery 1500 supplying power to the motor assembly 1100, a communication interface 1600, a user interface 1700, the at least one processor 1001 (e.g., a main processor 1800), and a memory 1900. However, not all of the components shown in FIG. 3 are essential components. The cleaner body 1000 may be implemented by more components than those illustrated in FIG. 1 or by fewer components than those illustrated in FIG. 3.

[0061] Each component will now be described below.

[0062] The motor assembly 1100 may include the suction motor 1110 configured to switch electric force to mechanical rotating force, a fan 1120 rotating by being connected to the suction motor 1110, and a printed circuit board (PCB) 1130 connected to the suction motor 1110. The suction motor 1110 may form vacuum inside the cordless vacuum cleaner 100.

Here, the vacuum denotes a state lower than the atmospheric pressure. The suction motor 1110 may include a brushless direct current (BLDC) motor, but is not limited thereto.

[0063] The PCB 1130 may include a processor (hereinafter, a first processor 1131) configured to control the suction motor 1110 and control communication with the brush device 2000, a first switching device 1132 connected to a signal line, a switching device (hereinafter, a pulse width modulation (PWM) control switching device 1133) (e.g., a field-effect transistor (FET), a transistor, or an insulated gate bipolar transistor (IGBT)) configured to control power supply to the brush device 2000, and a load detecting sensor 1134 (e.g., a shunt resistor, a shunt resistor and an amplification circuit (operational amplifier (OP-AMP)), a current detecting sensor, or a magnetic field detecting sensor (non-contact manner)) configured to detect a load of the brush device 2000. Hereinafter, for convenience of descriptions, an FET may be described as an embodiment of the PWM control switching device 1133, and a shunt resistor may be described as an embodiment of the load detecting sensor 1134.

[0064] The first processor 1131 may obtain data (hereinafter, also referred to as state data) related to a state of the suction motor 1110, and transmit the state data of the suction motor 1110 to the main processor 1800. Also, the first processor 1131 may transmit a signal (hereinafter, a first signal) to the brush device 2000 through the signal line by controlling (e.g., turning on or off) an operation of the first switching device 1132 connected to the signal line. The first switching device 1132 is a device that enables a state of the signal line to become low. In an embodiment, the first switching device 1132 is a device that enables a voltage of the signal line to be 0 volt (V). The first signal may include data indicating at least one of target RPM of a rotating brush of the brush device 2000 (hereinafter, also referred to as a target drum RPM), a target trip level of the brush device 2000, or power consumption of the suction motor 1110, for example, but is not limited thereto. In an embodiment, the first signal may include data for controlling a lighting device included in the brush device 2000, for example. The first signal may be realized in a pre-set number of bits. In an embodiment, the first signal may be realized in 5 bits or 8 bits, and have a transmission cycle of 10 milliseconds (ms) per bit, for example, but is not limited thereto.

[0065] The first processor 1131 may detect a signal (hereinafter, a second signal) transmitted from the brush device 2000 through the signal line. The second signal may include data indicating a current state of the brush device 2000, but is not limited thereto. In an embodiment, the second signal may include data related to a condition being currently operated (e.g., current drum RPM, a current trip level, or a current lighting device setting value), for example. Also, the second signal may further include data indicating a type of the brush device 2000. The first processor 1131 may transmit, to the main processor 1800, the data indicating the current state of the brush device 2000 or the data indicating the type of the brush device 2000, included in the second signal.

[0066] The motor assembly 1100 may be disposed in the dust collecting container 1200 (the dust container 1200). The dust collecting container 1200 may filter out dust or dirt in the air introduced through the brush device 2000, and collect the same. The dust collecting container 1200 may be provided to be attached to or detached from the cleaner body 1000.

[0067] The dust collecting container 1200 may collect foreign materials through a cyclone method of separating the foreign material by centrifugal force. The air from which the foreign materials are removed through the cyclone method may be discharged out of the cleaner body 1000, and the foreign materials may be contained in the dust collecting container 1200. A multi-cyclone may be arranged inside the dust collecting container 1200. The dust collecting container 1200 may be provided such that the foreign materials are collected below the multi-cyclone. The dust collecting container 1200 may include a dust collecting container door (also referred to as the cover of the dust container 1200) provided such that the dust collecting container 1200 is opened when connected to the station apparatus 200. The dust collecting container 1200 may include a first dust collecting portion where relatively large foreign materials collected primarily are collected, and a second dust collecting portion where relatively small foreign materials collected by the multi-cyclone are collected. The first dust collecting portion and the second dust collecting portion may both be provided to be externally opened when the dust collecting container door is opened.

[0068] The filter portion 1300 may filter out fine particulate matters or the like, which are not filtered out by the dust collecting container 1200. The filter portion 1300 may include the discharge port for discharging the air that passed through a filter to the outside of the cordless vacuum cleaner 100. The filter portion 1300 may include a motor filter or a HEPA filter, but is not limited thereto.

[0069] The pressure sensor 1400 may measure pressure inside a flow path (hereinafter, also referred to as flow path pressure). The pressure sensor 1400 provided at a suction end (e.g., a suction duct 40) may measure a flow rate change at a corresponding location by measuring static pressure. The pressure sensor 1400 may be an absolute pressure sensor or a relative pressure sensor. When the pressure sensor 1400 is an absolute pressure sensor, the main processor 1800 may sense a first pressure value before the suction motor 1110 is operated, by the pressure sensor 1400. Then, the main processor 1800 may sense a second pressure value after the suction motor 1110 is operated at the target RPM, and use a difference between the first pressure value and the second pressure value as a pressure value inside the flow path. Here, the first pressure value may be a pressure value according to internal/external influences, such as the weather, an altitude, a state of the cordless vacuum cleaner 100, and an amount of dust inflow, the second pressure value may be a pressure value according to an operation of the suction motor 1110 and the pressure value according to the internal/external

influences, such as the altitude, the state of the cordless vacuum cleaner 100, and the amount of dust inflow, and the difference between the first pressure value and the second pressure value may be the pressure value according to an operation of the suction motor 1110. Accordingly, when the difference between the first pressure value and the second pressure value is used as the pressure value inside the flow path, the internal/external influence other than the suction motor 1110 may be reduced.

[0070] The flow path pressure measured by the pressure sensor 1400 may be used to identify a current usage environment state of the brush device 2000 (e.g., a state of the surface to be cleaned (a hard floor, a carpet, a mat, or a corner) or a state of being lifted from the surface to be cleaned), and may be used to measure suction power that changes according to a contamination degree or a dust collected degree of the dust collecting container 1200.

[0071] The pressure sensor 1400 may be disposed at the suction end (e.g., the suction duct 40). The suction duct 40 may be a structure that connects the dust collecting container 1200 and the extension pipe 3000 to each other or the dust collecting container 1200 and the brush device 2000 to each other such that a fluid including the foreign materials may move to the dust collecting container 1200. Considering contamination of dirt/dust, the pressure sensor 1400 may be disposed at an end of a straight portion (or an inflection point of the straight portion and a curved portion) of the suction duct 40, but is not limited thereto. The pressure sensor 1400 may be disposed at a center of the straight portion of the suction duct 40. When the pressure sensor 1400 is disposed at the suction duct 40, the pressure sensor 1400 is disposed at a front end of the suction motor 1110 that generates suction power, and thus the pressure sensor 1400 may be implemented as a negative pressure sensor.

[0072] In the disclosure, the pressure sensor 1400 is disposed at the suction duct 40, but the disclosure is not limited thereto. The pressure sensor 1400 may be disposed at a discharge end (e.g., inside the motor assembly 1100). When the pressure sensor 1400 is disposed at the discharge end, the pressure sensor 1400 is disposed at a rear end of the suction motor 1110, and thus the pressure sensor 1400 may be implemented as a positive pressure sensor. Also, a plurality of the pressure sensors 1400 may be provided in the cordless vacuum cleaner 100.

[0073] In an embodiment of the disclosure, the cleaner body 1000 may include a flow sensor (not shown). In an embodiment, the flow sensor may be provided at the suction duct 40 or discharge end (e.g., inside the motor assembly 1100), for example. The flow sensor may include a heat wire flowmeter, an ultrasonic flowmeter, a turbine type flowmeter, or a differential flowmeter, but is not limited thereto.

[0074] The battery 1500 may be detachably disposed (e.g., mounted) on the cleaner body 1000. The battery 1500 may be electrically connected to a charging terminal provided at the station apparatus 200. The battery 1500 may be charged by receiving power from the charging terminal.

[0075] The cleaner body 1000 may include the communication interface 1600 for performing communication with an external device. In an embodiment, the cleaner body 1000 may communicate with the station apparatus 200 (or a server device 300) through the communication interface 1600, for example. The communication interface 1600 may include a short-range wireless communication interface and a long-range wireless communication interface. The short-range wireless communication interface may include a Bluetooth communication interface, a BLE communication interface, an NFC interface, a Wi-Fi communication interface, a Zigbee communication interface, an IrDA communication interface, a WFD communication interface, a UWB communication interface, or an Ant+ communication interface, but is not limited thereto.

[0076] The user interface 1700 may be provided at the handle. The user interface 1700 may include an input interface and an output interface. The cleaner body 1000 may receive a user input related to an operation of the cordless vacuum cleaner 100 or output information related to an operation of the cordless vacuum cleaner 100, through the user interface 1700. The cleaner body 1000 may output, through the user interface 1700, information about a docking state, information about a state of the dust container 1200, and information about a state of a dust bag. The input interface may include a power button, a suction power strength adjusting button, or the like. The output interface may include an LED display, an LCD, or a touch screen, but is not limited thereto.

[0077] The cleaner body 1000 may include the at least one processor 1001. The cleaner body 1000 may include one processor or a plurality of processors. In an embodiment, the cleaner body 1000 may include the main processor 1800 connected to the user interface 1700 and the first processor 1131 connected to the suction motor 1110, for example. The at least one processor 1001 may control all operations of the cordless vacuum cleaner 100. In an embodiment, the at least one processor 1001 may determine the power consumption (suction power strength) of the suction motor 1110, a drum RPM of the brush device 2000, and a trip level of the brush device 2000, for example. The at least one processor 1001 may operate the suction motor 1110 for dust discharge, based on a control signal received from the station apparatus 200.

[0078] The at least one processor 1001 in an embodiment of the disclosure may include at least one of a CPU, a GPU an APU, an MIC, a DSP, or an NPU. The at least one processor 1001 may be implemented in the form of an SoC including one or more electronic components. The at least one processor 1001 may each be implemented as individual hardware. The at least one processor 1001 may be also referred to as a micro-computer, microprocessor computer, or MICOM, an MPU, or an MCU.

[0079] The at least one processor 1001 in an embodiment of the disclosure may be implemented as a single core

processor or a multicore processor.

[0080] The memory 1900 may store a program for processing and control by the at least one processor 1001, and may store pieces of input/output data. In an embodiment, the memory 1900 may store a pre-trained artificial intelligence (AI) model (e.g., a support vector machine (SVM) algorithm), a state data of the suction motor 1110, a measurement value of the pressure sensor 1400, state data of the battery 1500, state data of the brush device 2000, error occurrence data (malfunction history data), power consumption of the suction motor 1110 corresponding to an operating condition, RPM of a drum with a rotating brush, a trip level, and an operating sequence of the suction motor 1110 corresponding to a suction power generation pattern, for example. The trip level is for preventing overload of the brush device 2000, and may denote a reference load value (e.g., a reference current value) for stopping an operation of the brush device 2000.

[0081] The memory 1900 may include an external memory 1910 and an internal memory 1920. In an embodiment, the memory 1900 may include at least one type of storage medium among a flash memory type, a hard disk type, a multimedia card micro type, a card type memory (e.g., an SD or an XD memory), an RAM, an SRAM, a ROM, an EEPROM, a PROM, a magnetic memory, a magnetic disk, and an optical disk, for example. Programs stored in the memory 1900 may be classified into a plurality of modules depending on functions.

[0082] Hereinafter, operations of processors of the cordless vacuum cleaner 100 will be described in detail with reference to FIG. 4.

[0083] FIG. 4 is a diagram for describing an embodiment of operations of processors of the cordless vacuum cleaner 100, according to the disclosure.

[0084] Referring to FIG. 4, the main processor 1800 may identify states of components in the cordless vacuum cleaner 100 by communicating with the battery 1500, the pressure sensor 1400, and the first processor 1131 in the motor assembly 1100. Here, the main processor 1800 may communicate with each component by universal asynchronous receiver/-transmitter (UART) communication or I2C communication, but is not limited thereto. In an embodiment, the main processor 1800 may obtain, from the battery 1500 by UART, data related to a voltage state (e.g., normal, abnormal, fully charged, or fully discharged) of the battery 1500, for example. The main processor 1800 may obtain, from the pressure sensor 1400, data related to flow path pressure by the I2C communication.

[0085] Also, the main processor 1800 may obtain, from the first processor 1131 connected to the suction motor 1110 by the UART, data related to suction power strength, RPM of the suction motor 1110, and a state (e.g., normal or abnormal) of the suction motor 1110. Suction power is electric force consumed to operate the cordless vacuum cleaner 100, and may be also referred to as power consumption. The main processor 1800 may obtain, from the first processor 1131, data related to load of the brush device 2000 and data about a type of the brush device 2000.

[0086] The first processor 1131 may obtain, from the brush device 2000 through signal line communication with a second processor 2410 of the brush device 2000, state data (e.g., drum RPM, a trip level, normal, or abnormal) of the brush device 2000. Here, the first processor 1131 may transmit the state data of the brush device 2000 to the main processor 1800 through the UART. In an embodiment of the disclosure, the first processor 1131 may transmit, to the main processor 1800, state data of the suction motor 1110 and the state data of the brush device 2000 at different intervals. In an embodiment, the first processor 1131 may transmit the state data of the suction motor 1110 to the main processor 1800 every 0.02 second, and transmit the state data of the brush device 2000 to the main processor 1800 every 0.2 second, for example, but is not limited thereto.

[0087] The main processor 1800 may determine whether an error has occurred, based on states of components in the cordless vacuum cleaner 100, a state of the suction motor 1110, and a state of the brush device 2000, and periodically transmit data related to error occurrence to the station apparatus 200 through NFC (e.g., BLE communication).

[0088] When the first processor 1131 of the cleaner body 1000 and the second processor 2410 of the brush device 2000 are connected to each other through the UART communication or I2C communication, a relatively high impedance effect caused by an internal line of the extension pipe 3000, and damaging of a circuit device (e.g., a maximum value excess of a MICOM AD port) caused by ESD and/or an over voltage may become issues. Thus, in an embodiment according to the disclosure, the first processor 1131 of the cleaner body 1000 and the second processor 2410 of the brush device 2000 communicate with each other through the signal line communication instead of the UART communication or I2C communication. Here, a circuit for the signal line communication may include a voltage distributing circuit (hereinafter, also referred to as a voltage distributer) to prevent the damaging of the circuit device caused by over voltage, power noise, surge, electrical overstress (ESD), or electrical discharge (EOS). The communication between the first processor 1131 of the cleaner body 1000 and the second processor 2410 of the brush device 2000 is not limited to the signal line communication.

[0089] In an embodiment of the disclosure, when a noise reduction circuit is applied to the cleaner body 1000 and brush device 2000, the first processor 1131 of the cleaner body 1000 and the second processor 2410 of the brush device 2000 may communicate with each other by the UART communication or I2C communication. The noise reduction circuit may include at least one of a low pass filter, a high pass filter, a band pass filter, a damping resistor, or a distribution resistor, but is not limited thereto. In an embodiment of the disclosure, when a level shifter circuit is applied to the cleaner body 1000 or brush device 2000, the first processor 1131 of the cleaner body 1000 and the second processor 2410 of the brush device

2000 may communicate with each other by the UART communication or I2C communication. Hereinafter, for convenience of description, a case in which the cleaner body 1000 and the brush device 2000 communicate with each other through a signal line communication will be described as a main example.

[0090] The main processor 1800 may receive a user input on a setting button (e.g., an on/off button or a +/- setting button) included in the user interface 1700 or control an output of an LCD. The main processor 1800 may identify a usage environment state of the brush device 2000 (e.g., a state of a surface to be cleaned (a hard floor, a carpet, a mat, or a corner) or a state of being lifted from a surface to be cleaned), by a pre-trained AI model (e.g., an SVM algorithm), and determine operating information of the cordless vacuum cleaner 100 suitable to the usage environment state of the brush device 2000 (e.g., power consumption, drum RPM, or trip level of the suction motor 1110). Here, the main processor 1800 may transmit, to the first processor 1131, the operating information of the cordless vacuum cleaner 100 suitable to the usage environment state of the brush device 2000. The first processor 1131 may adjust the strength of suction power (power consumption or RPM) of the suction motor 1110 according to the operating information of the cordless vacuum cleaner 100, and transmit the operating information of the cordless vacuum cleaner 100 suitable to the usage environment state of the brush device 2000, to the second processor 2410 through the signal line communication. In this case, the second processor 2410 may adjust the drum RPM, trip level, and lighting device (e.g., an LED display) according to the operating information of the cordless vacuum cleaner 100. Hereinafter, the brush device 2000 will be described in detail with reference to FIG. 5.

[0091] FIG. 5 is a diagram for describing an embodiment of the brush device 2000 according to the disclosure.

[0092] Referring to FIG. 5, the brush device 2000 may include a motor 2100, a drum 2200 to which a rotating brush is attached, and a lighting device 2300, but is not limited thereto. The motor 2100 of the brush device 2000 may be provided inside the drum 2200 or outside the drum 2200. When the motor 2100 is provided outside the drum 2200, the drum 2200 may receive power from the motor 2100 through a belt.

[0093] Referring to a reference numeral 510 of FIG. 5, the motor 2100 may be a planet geared motor. The planet geared motor may have a form in which a planet gear 2101 is combined to a direct current (DC) motor. The planet gear 2101 adjusts RPM of the drum 2200 according to a gear ratio. In the planet geared motor, RPM of the motor 2100 and RPM of the drum 2200 may have a constant ratio. Referring to a reference numeral 520 of FIG. 5, the motor 2100 may be a brushless direct current (BLDC) motor, but is not limited thereto. When the motor 2100 is the BLDC motor, the RPM of the motor 2100 and the RPM of the drum 2200 may be the same.

[0094] The lighting device 2300 lights up a dark surface to be cleaned, lights up dust or foreign materials of the surface to be cleaned to be easily identified, or indicates a state of the brush device 2000, and may be provided in front of or at the top of the brush device 2000. The lighting device 2300 may include an LED display, but is not limited thereto. In an embodiment, the lighting device 2300 may be a laser, for example. The lighting device 2300 may automatically operate when the motor 2100 operates, or may operate according to control by the second processor 2410. In an embodiment of the disclosure, the lighting device 2300 may change a color or brightness according to control by the second processor 2410.

[0095] Referring to the reference numeral 520 of FIG. 5, the brush device 2000 may further include a PCB 2400. The PCB 2400 may include a circuit for the signal line communication with the cleaner body 1000. In an embodiment, the PCB 2400 may include the second processor 2410, a switching device (hereinafter, also referred to as a second switching device) (not shown) connected to a signal line, and an identification (ID) resistor (not shown) indicating a type of the brush device 2000, for example, but is not limited thereto.

[0096] A type of the brush device 2000 may vary. In an embodiment, the brush device 2000 may include a multi-brush 501, a hard floor brush 502, a damp cloth brush 503, a turbo (carpet) brush 504, a bedding brush 505, a bristle brush (not shown), a gap brush (not shown), and a pet brush (not shown), for example, but is not limited thereto.

[0097] In an embodiment of the disclosure, the type of the brush device 2000 may be distinguished by the ID resistor included in the brush device 2000. An operations by which the cleaner body 1000 identifies a type of the brush device 2000 combined to the cordless vacuum cleaner 100 will be described with reference to FIG. 6.

[0098] FIG. 6 is a diagram for describing an embodiment of an operation by which the cleaner body 1000 identifies a type of the brush device 2000, according to the disclosure.

[0099] Referring to FIG. 6, the motor assembly 1100 (refer to FIG. 3 and 4) of the cleaner body 1000 may include the first processor 1131 and the load detecting sensor 1134 (e.g., a shunt resistor), and the brush device 2000 may include an ID resistor 2500. The ID resistor 2500 may be disposed between power lines 10 and 20 and a signal line 30. The ID resistor 2500 indicates a type of the brush device 2000 and may vary according to the type of brush device 2000. In an embodiment, a resistance of the ID resistor 2500 of the multi-brush 501 may be 330 kiloohms (KΩ), a resistance of the ID resistor 2500 of the hard floor brush 502 may be 2.2 megaohms (MΩ), and a resistance of the ID resistor 2500 of the turbo (carpet) brush 504 may be 910 KΩ, for example, but the ID resistor 2500 is not limited thereto.

[0100] The first processor 1131 may detect detachment of the brush device 2000 by the load detecting sensor 1134. In an embodiment, when the brush device 2000 is not combined to the cordless vacuum cleaner 100 (e.g., a handy mode), an operating current of the brush device 2000, detected by the load detecting sensor 1134, may be 0 (zero), for example.

When the brush device 2000 is combined to the cordless vacuum cleaner 100 (e.g., a brush mode), the operating current of the brush device 2000, detected by the load detecting sensor 1134, may be equal to or greater than 50 milliamperes (mA). Accordingly, the first processor 1131 may determine that the brush device 2000 is detached when the operating current of the brush device 2000, detected by the load detecting sensor 1134, is 0, and that the brush device 2000 is combined when the operating current of the brush device 2000, detected by the load detecting sensor 1134, is equal to or greater than 50 mA. A value of a reference operating current for determining that the brush device 2000 is combined is not limited to 50 mA, and may vary.

[0101] When it is determined that the brush device 2000 is combined to the cordless vacuum cleaner 100, the first processor 1131 may identify a type of the brush device 2000, based on a voltage value input to an input port of the first processor 1131. In an embodiment, when the brush device 2000 includes an ID resistor A, and the PCB 1130 of the cleaner body 1000 includes voltage distributers (a resistor B and a resistor C) connected to the signal line 30, a voltage input to the input port of the first processor 1131 may be as follows, for example.

$$\text{AD Port Input Voltage} = \text{Battery Supply Voltage} * \frac{C}{A + B + C}$$

[0102] The voltage value input to the input port of the first processor 1131 may decrease when a value of the ID resistor 2500 increases. When the resistance of the resistor B and the resistance of the resistor C are constant, the voltage value input to the input port varies according to a value of the ID resistor A, and thus the first processor 1131 may identify a type of the brush device 2000 corresponding to the ID resistor 2500, based on the voltage value input to the input port.

[0103] In an embodiment, the ID resistor 2500 of the multi-brush 501 may be 330 KΩ, the ID resistor 2500 of the hard floor brush 502 may be 2.2 MΩ, and the ID resistor 2500 of the turbo (carpet) brush 504 may be 910 KΩ, for example. When a voltage of the battery 1500 is 25.2 V, the voltage value input to the input port of the first processor 1131 is 2.785 V when the multi-brush 501 is combined to the cordless vacuum cleaner 100, the voltage value input to the input port of the first processor 1131 is 0.791 V when the hard floor brush 502 is combined to the cordless vacuum cleaner 100, and the voltage value input to the input port of the first processor 1131 is 1.563 V when the turbo (carpet) brush 504 is combined to the cordless vacuum cleaner 100. Accordingly, when it is determined that the brush device 2000 is combined to the cordless vacuum cleaner 100 and the voltage of the battery 1500 is 25.2 V, the first processor 1131 identifies that the multi-brush 501 is combined when the voltage value input to the input port is 2.785 V, identifies that the hard floor brush 502 is combined when the voltage value input to the input port is 0.791 V, and identifies that the turbo (carpet) brush 504 is combined when the voltage value input to the input port is 1.563 V.

[0104] A case where a type of the brush device 2000 is distinguished by the ID resistor 2500 included in the brush device 2000 has been described as an example in FIG. 6, but the disclosure is not limited thereto. In an embodiment of the disclosure, the brush device 2000 may distinguish a type of the brush device 2000, based on a data signal transmitted by the brush device 2000. In an embodiment, the brush device 2000 may transmit, to the cleaner body 1000, the data signal including information indicating a type of the brush device 2000, for example. In an embodiment, a resistor having a resistance of 100 KΩ may be connected between the first processor 1131 and a node connected between the resistor B and the resistor C, for example.

[0105] Hereinafter, a cleaning system further including a server device and a user terminal, in addition to the cordless vacuum cleaner 100 and the station apparatus 200, will be described in detail with reference to FIG. 7.

[0106] FIG. 7 is a diagram for describing an embodiment of a cleaning system according to the disclosure.

[0107] Referring to FIG. 7, the cleaning system in an embodiment of the disclosure may further include the server device 300 and a user terminal 400, in addition to the cordless vacuum cleaner 100 and the station apparatus 200. The cleaning system including the cordless vacuum cleaner 100 and the station apparatus 200 has been described with reference to FIG. 1, and thus the server device 300 and the user terminal 400 will be described hereinafter.

[0108] The server device 300 in an embodiment of the disclosure may be a device for managing the station apparatus 200 and the cordless vacuum cleaner 100. In an embodiment, the server device 300 may be a home appliance management server, for example. The server device 300 may manage user account information and information of home appliances connected to a user account. In an embodiment, a user may generate the user account by accessing the server device 300 through the user terminal 400. The user account may be identified by an ID and a password set by the user, for example. The server device 300 may register the station apparatus 200 and the cordless vacuum cleaner 100 to the user account according to a determined procedure. In an embodiment, the server device 300 may connect ID information of the station apparatus 200 (e.g., a serial number or a medium access control (MAC) address) and ID information of the cordless vacuum cleaner 100 to the user account to register the station apparatus 200 and the cordless vacuum cleaner 100, for example. When the station apparatus 200 and the cordless vacuum cleaner 100 are registered in the server device 300, the server device 300 may periodically receive state information of the station apparatus 200 or state information of the cordless vacuum cleaner 100 from the station apparatus 200 to manage a state of the station apparatus

200 or a state of the cordless vacuum cleaner 100.

[0109] The user terminal 400 may be a device registered in the server device 300 under a same account as the station apparatus 200 or cordless vacuum cleaner 100. In embodiments, the user terminal 400 include a smartphone, a laptop computer, a tablet personal computer (PC), a digital camera, an electronic book terminal, a digital broadcasting terminal, a personal digital assistant (PDA), a portable multimedia player (PMP), a wearable device, and a device including a display, but are not limited thereto. Hereinafter, for convenience of descriptions, an embodiment in which the user terminal 400 is a smartphone will be described.

[0110] In an embodiment of the disclosure, the user terminal 400 may communicate with at least one of the server device 300, the station apparatus 200, or the cordless vacuum cleaner 100. The user terminal 400 may directly communicate with the station apparatus 200 or cordless vacuum cleaner 100 through NFC, or indirectly communicate with the station apparatus 200 or cordless vacuum cleaner 100 through the server device 300.

[0111] In an embodiment of the disclosure, the user terminal 400 may execute a predetermined application (e.g., a home appliance management application) provided by the server device 300, based on a user input. In this case, the user may identify the state of the cordless vacuum cleaner 100 or the state of the station apparatus 200 through an application execution window. In an embodiment, the user terminal 400 may provide, through the application execution window, information related to an operation of a UV irradiator (e.g., UV LED operating) and information related to dust discharge of the station apparatus 200 (e.g., dust container last emptied - 1 minute ago), for example, but the disclosure is not limited thereto.

[0112] Also, the user terminal 400 may provide an icon related to dust discharge (e.g., empty dust container), a graphics user interface (GUI) for setting a discharge mode (e.g., a manual discharge mode button, an automatic discharge mode button, and a smart discharge mode button), a GUI for setting a threshold suction power decrease amount for a smart discharge mode, a GUI for setting a discharge strength or discharge duration time, and a GUI for setting a discharge timing condition. The user may set, through the user terminal 400, at least one of the discharge mode, the threshold suction power decrease amount for the smart discharge mode, the discharge strength, the discharge duration time, or the discharge timing condition. In this case, the station apparatus 200 may perform a dust discharging operation, based on at least one of the discharge mode, the threshold suction power decrease amount, the discharge strength, the discharge duration time, or the discharge timing condition set by the user.

[0113] Hereinafter, a method by which the station apparatus 200 performs the dust discharging operation in the smart discharge mode will be described in detail with reference to FIG. 8.

[0114] FIG. 8 is a flowchart of an embodiment of a method by which the station apparatus 200 performs a dust discharging operation in association with a suction power decrease amount of the cordless vacuum cleaner 100, according to the disclosure.

[0115] In operation S810, in an embodiment according to the disclosure, the cordless vacuum cleaner 100 may identify a state in which the brush device 2000 is lifted from a surface to be cleaned (hereinafter, also referred to as a lifted state of the brush device 2000). The lifted state of the brush device 2000 may include a state in which the brush device 2000 is lifted from the surface to be cleaned by a predetermined height or greater, or a state in which a flow path of the cordless vacuum cleaner 100 is opened. In an embodiment, the lifted state of the brush device 2000 may include a state in which a user moves holding the cordless vacuum cleaner 100 while the cordless vacuum cleaner 100 is turned on (also referred to as an idle state or moving state), a state in which the user docked the cordless vacuum cleaner 100 to the station apparatus 200, or the like, for example, but is not limited thereto.

[0116] In an embodiment of the disclosure, the cordless vacuum cleaner 100 may identify the lifted state of the brush device 2000, based on a sensor measurement value measured through the pressure sensor 1400 of the cordless vacuum cleaner 100 or the flow sensor of the cordless vacuum cleaner 100.

[0117] Referring to FIG. 9, the cordless vacuum cleaner 100 may identify the lifted state of the brush device 2000, based on a pressure value inside a flow path, measured by the pressure sensor 1400. In an embodiment, when the user is cleaning a hard floor with the cordless vacuum cleaner 100, the pressure value measured by the pressure sensor 1400 of the cordless vacuum cleaner 100 may be about 980 pascals (Pa) to 984 Pa, as indicated by a reference numeral 910, for example. When the user lifts the cordless vacuum cleaner 100 during cleaning (the lifted state of the brush device 2000), the pressure value measured by the pressure sensor 1400 of the cordless vacuum cleaner 100 may be rapidly decreased to 500 Pa or less (e.g., 381 Pa to 383 Pa), as indicated by a reference numeral 920.

[0118] Accordingly, when the pressure value measured by the pressure sensor 1400 is rapidly decreased or when the pressure value measured by the pressure sensor 1400 is equal to or less than a reference value (e.g., 500 Pa), the cordless vacuum cleaner 100 may determine that the brush device 2000 is currently lifted from the surface to be cleaned (the lifted state of the brush device 2000).

[0119] Referring to FIG. 10, when the cordless vacuum cleaner 100 is docked to the station apparatus 200, the cordless vacuum cleaner 100 may determine that a current usage environment state of the brush device 2000 is the lifted state.

[0120] In an embodiment of the disclosure, when the battery 1500 of the cleaner body 1000 contacts a charging terminal of the station apparatus 200, the at least one processor 1001 of the cleaner body 1000 may periodically communicate with

the battery 1500 to detect a charging start of the battery 1500. Accordingly, when the charging of the battery 1500 included in the cleaner body 1000 starts, the cleaner body 1000 is docked to the station apparatus 200, and thus the cordless vacuum cleaner 100 may determine that the current usage environment state of the brush device 2000 is the lifted state.

[0121] Also, according to the disclosure, the cordless vacuum cleaner 100 may include a magnetic body 1450 and the station apparatus 200 may include a docking detecting sensor 210. The docking detecting sensor 210 may be a TMR sensor, but is not limited thereto. When the user docks the cleaner body 1000 to the station apparatus 200, a distance d between the magnetic body 1450 attached to the dust container 1200 of the cleaner body 1000 and the docking detecting sensor 210 draws near, and thus the docking detecting sensor 210 may detect the magnetic body 1450 attached to the dust container 1200. When the docking detecting sensor 210 detects the magnetic body 1450, the station apparatus 200 may identify that the cordless vacuum cleaner 100 has been docked. At this time, the station apparatus 200 may transmit, to the cordless vacuum cleaner 100 through NFC (e.g., BLE communication), information indicating that the cordless vacuum cleaner 100 has been docked to the station apparatus 200. Based on the information received from the station apparatus 200, the cordless vacuum cleaner 100 may detect that the cordless vacuum cleaner 100 has been docked to the station apparatus 200, and identify the current usage environment state of the brush device 2000 as the lifted state.

[0122] In FIG. 10, a case in which the cordless vacuum cleaner 100 includes the magnetic body 1450 and the station apparatus 200 includes the docking detecting sensor 210 is described in an embodiment, but the disclosure is not limited thereto. The cordless vacuum cleaner 100 may include the docking detecting sensor 210 and the station apparatus 200 may include the magnetic body 1450. In this case, the cordless vacuum cleaner 100 may directly detect the cordless vacuum cleaner 100 being docked to the station apparatus 200 through the docking detecting sensor 210.

[0123] In an embodiment of the disclosure, the cordless vacuum cleaner 100 may identify whether the usage environment state of the brush device 2000 is the lifted state, by an AI model trained to infer the usage environment state of the brush device 2000. In an embodiment, the cordless vacuum cleaner 100 may identify whether the current usage environment state of the brush device 2000 is the lifted state by applying, to the AI model, data related to flow path pressure measured by the pressure sensor 1400 (e.g., the pressure value) and data related to a load of the brush device 2000 obtained through the load detecting sensor 1134, for example. An operation by which the cordless vacuum cleaner 100 identifies the usage environment state of the brush device 2000 by the AI model will be described in detail below with reference to FIGS. 12 through 14.

[0124] In operation S820, the cordless vacuum cleaner 100 in an embodiment of the disclosure may obtain the suction power decrease amount of the cordless vacuum cleaner 100, based on the sensor measurement value of the pressure sensor 1400 or flow sensor while the brush device 2000 is in the lifted state.

[0125] In an embodiment of the disclosure, the cordless vacuum cleaner 100 may calculate the suction power decrease amount of the cordless vacuum cleaner 100 by comparing a pressure sensor value measured by the pressure sensor 1400 when the lifted state of the brush device 2000 is identified with an initial pressure value. The initial pressure value may be a pressure value measured by the pressure sensor 1400 when there is no foreign material in the dust container 1200 and the first suction motor 1110 operates in reference power consumption (reference RPM) (e.g., 58 watts (W)) while the brush device 2000 of the cordless vacuum cleaner 100 is in the lifted state. In an embodiment, the initial pressure value may be 500 Pa, for example, but is not limited thereto. The initial pressure value may be calibrated according to a state of the cordless vacuum cleaner 100. In an embodiment, when components are worn out as the cordless vacuum cleaner 100 is used, the cordless vacuum cleaner 100 may calibrate the initial pressure value according to the state of the cordless vacuum cleaner 100, for example. In an embodiment of the disclosure, the initial pressure value may vary depending on a type of the brush device 2000 or power consumption of the first suction motor 1110.

[0126] Referring to FIG. 11, when a dust amount of the dust container 1200 is increased, the pressure value measured by the pressure sensor 1400 may be gradually decreased lower than the initial pressure value. In an embodiment, when the pressure sensor 1400 is disposed at the suction duct 40, the dust container 1200 is disposed at a rear end than the pressure sensor 1400 in a flow path, and thus as dust piles up in the dust container 1200, the pressure value of the pressure sensor 1400 may be decreased, as indicated by a reference numeral 1101, for example. In other words, when the brush device 2000 is in the lifted state, the initial pressure value is highest, and the pressure value may be gradually decreased as the dust amount of the dust container 1200 is increased.

[0127] Thus, in an embodiment according to the disclosure, the cordless vacuum cleaner 100 may calculate the suction power decrease amount (suction power decrease rate) by comparing the initial pressure value with a current pressure value in the lifted state. In an embodiment, when the initial pressure value is 500 Pa and the current pressure value is 475 Pa, the cordless vacuum cleaner 100 may calculate the suction power decrease amount to be 5 %, for example. Also, when the initial pressure value is 500 Pa and the current pressure value is 450 Pa, the cordless vacuum cleaner 100 may calculate the suction power decrease amount to be 10 %.

[0128] In an embodiment of the disclosure, the cordless vacuum cleaner 100 may calculate the suction power decrease amount in real time, based on the current pressure value, or search a pre-stored table 1102 for the suction power decrease amount corresponding to the current pressure value. The pre-stored table 1102 may indicate a correlation between the pressure value of the pressure sensor 1400 and the suction power decrease amount.

[0129] In an embodiment of the disclosure, the cordless vacuum cleaner 100 may calculate the suction power decrease amount by comparing a pressure value at a point of time (also referred to as a time point) whenever the lifted state of the brush device 2000 is identified during cleaning with the initial pressure value. In an embodiment, when the lifted state of the brush device 2000 is identified several times during cleaning, the cordless vacuum cleaner 100 may calculate the suction power decrease amount several times, for example.

[0130] When the cordless vacuum cleaner 100 is docked to the station apparatus 200, the cordless vacuum cleaner 100 may determine the usage environment state of the brush device 2000 as the lifted state. Accordingly, the cordless vacuum cleaner 100 may measure the pressure value inside the flow path through the pressure sensor 1400 while driving the first suction motor 1110 in the reference power consumption (e.g., 58 W) for a relatively short duration of time. The cordless vacuum cleaner 100 may calculate the suction power decrease amount of the cordless vacuum cleaner 100 by comparing the pressure value measured while the cordless vacuum cleaner 100 is docked to the station apparatus 200 with the initial pressure value.

[0131] In an embodiment of the disclosure, the cordless vacuum cleaner 100 may identify the suction power decrease amount, based on a flow value measured by the flow sensor of the cordless vacuum cleaner 100. The flow value measured by the flow sensor may have a similar pattern as the pressure value measured by the pressure sensor 1400. In an embodiment, the flow value may be gradually decreased as dust in the dust container 1200 is increased, for example. Accordingly, when the usage environment state of the brush device 2000 is identified as the lifted state, the cordless vacuum cleaner 100 may calculate the suction power decrease amount of the cordless vacuum cleaner 100 by comparing the flow value at the corresponding time point with an initial flow value. The initial flow value may be a flow value measured by the flow sensor when there is no foreign material in the dust container 1200 and the first suction motor 1110 operates in the reference power consumption (reference RPM) (e.g., 58 W) while the brush device 2000 of the cordless vacuum cleaner 100 is in the lifted state.

[0132] In operation S830, the cordless vacuum cleaner 100 in an embodiment of the disclosure may transmit information about the suction power decrease amount to the station apparatus 200.

[0133] In an embodiment of the disclosure, the cordless vacuum cleaner 100 may establish an NFC channel (e.g., a BLE communication channel) with the station apparatus 200 when docked to the station apparatus 200. The cordless vacuum cleaner 100 may transmit the information about the suction power decrease amount of the cordless vacuum cleaner 100 to the station apparatus 200 through the NFC channel. When the suction power decrease amount is calculated several times by the cordless vacuum cleaner 100, the cordless vacuum cleaner 100 may transmit, to the station apparatus 200, the information about the suction power decrease amount calculated latest.

[0134] In an embodiment of the disclosure, the cordless vacuum cleaner 100 may transmit the information about the suction power decrease amount when a request is received from the station apparatus 200. Also, even when there is no request from the station apparatus 200, the cordless vacuum cleaner 100 may transmit the information about the suction power decrease amount to the station apparatus 200 when the cordless vacuum cleaner 100 is docked to the station apparatus 200 and communicably connected to the station apparatus 200.

[0135] In operation S840, the station apparatus 200 in an embodiment of the disclosure may receive the information about the suction power decrease amount of the cordless vacuum cleaner 100 from the cordless vacuum cleaner 100. The station apparatus 200 may receive the information about the suction power decrease amount of the cordless vacuum cleaner 100 from the cordless vacuum cleaner 100 through NFC (e.g., BLE communication). Here, the suction power decrease amount of the cordless vacuum cleaner 100 may be obtained based on the sensor measurement value measured using the flow sensor or the pressure sensor 1400 of the cordless vacuum cleaner 100. In an embodiment, the suction power decrease amount of the cordless vacuum cleaner 100 may be obtained based on the sensor measurement value measured using the flow sensor or the pressure sensor 1400 of the cordless vacuum cleaner 100 when the brush device 2000 connected to the cordless vacuum cleaner 100 is in the lifted state from the surface to be cleaned, for example. The lifted state may include at least one of the state in which the brush device 2000 is lifted from the surface to be cleaned by a predetermined height or more during the cleaning operation or the state in which the cordless vacuum cleaner 100 is docked to the station apparatus 200.

[0136] In operation S850, the station apparatus 200 in an embodiment of the disclosure may compare the suction power decrease amount of the cordless vacuum cleaner 100 with a pre-set threshold suction power decrease amount, based on the information about the suction power decrease amount received from the cordless vacuum cleaner 100.

[0137] In an embodiment of the disclosure, the threshold suction power decrease amount is a reference decrease level for determining whether to perform a dust discharging operation of the station apparatus 200, and may be pre-set by the user or system. In an embodiment of the disclosure, the pre-set threshold suction power decrease amount may be changed by setting of the user. The user may set the threshold suction power decrease amount through an input interface of the station apparatus 200, an input interface of the cordless vacuum cleaner 100, or an application execution window of the user terminal 400. In an embodiment, when the user regards a performance of the cordless vacuum cleaner 100 as important, the user may set the threshold suction power decrease amount to be relatively low, for example. When the user regards energy reduction as important, the user may set the threshold suction power decrease amount to be relatively

high. An operation of changing the pre-set threshold suction power decrease amount by the setting of the user will be described in detail below with reference to FIGS. 19 and 20.

[0138] In an embodiment of the disclosure, when information about the threshold suction power decrease amount set by the user is stored in the memory 202, the station apparatus 200 may compare the suction power decrease amount of the cordless vacuum cleaner 100 with the threshold suction power decrease amount set by the user. When the information about the threshold suction power decrease amount set by the user is not stored in the memory 202, the station apparatus 200 may compare the suction power decrease amount of the cordless vacuum cleaner 100 with a default threshold suction power decrease amount. The default threshold suction power decrease amount may be a threshold suction power decrease amount pre-set by the system.

[0139] In an embodiment of the disclosure, the station apparatus 200 may not perform the dust discharging operation when the suction power decrease amount of the cordless vacuum cleaner 100 is less than the pre-set threshold suction power decrease amount as a result of comparing the suction power decrease amount of the cordless vacuum cleaner 100 with the pre-set threshold suction power decrease amount (No in operation S850). In an embodiment, when the pre-set threshold suction power decrease amount is 30 % and the suction power decrease amount of the cordless vacuum cleaner 100 is 20 %, the station apparatus 200 may not perform the dust discharging operation even when the cordless vacuum cleaner 100 is docked to the station apparatus 200, for example.

[0140] In operation S860, the station apparatus 200 in an embodiment of the disclosure may perform the dust discharging operation of driving the suction motor 207 to discharge the dust in the dust container 1200 to the collecting portion 209, when the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount (Yes in operation S850).

[0141] In an embodiment, when the pre-set threshold suction power decrease amount is 30 % and the suction power decrease amount of the cordless vacuum cleaner 100 is 35 %, the station apparatus 200 may drive the suction motor 207 and perform the dust discharging operation because the suction power decrease amount (35 %) of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount (30 %), for example. When the dust in the dust container 1200 is discharged to the collecting portion 209 by the dust discharging operation, suction power (cleaning performance) of the cordless vacuum cleaner 100 may be recovered.

[0142] In an embodiment of the disclosure, when the discharge strength or discharge duration time is set by the user, the station apparatus 200 may perform the dust discharging operation according to the discharge strength or discharge duration time set by the user. In an embodiment, the station apparatus 200 may adjust the power consumption of the suction motor 207 during the dust discharging operation, based on the discharge strength set by the user, for example. The station apparatus 200 may adjust an operating time of the suction motor 207, based on the discharge duration time set by the user. An operation by which the user sets the discharge strength or discharge duration time will be described in detail below with reference to FIG. 21.

[0143] In an embodiment of the disclosure, when the user has not arbitrarily set the discharge strength or discharge duration time, the station apparatus 200 may perform the dust discharging operation according to a default discharge strength or default discharge duration time. The default discharge strength may be a discharge strength basically set by the system, and the default discharge duration time may be an operating time of the suction motor 207 basically set by the system.

[0144] In an embodiment of the disclosure, by performing the dust discharging operation in association with the suction power decrease amount of the cordless vacuum cleaner 100, the station apparatus 200 may prevent energy from being unnecessarily wasted and efficiently manage the suction power (cleaning performance) of the cordless vacuum cleaner 100 without involvement of the user.

[0145] Hereinafter, an operation by which the cordless vacuum cleaner 100 identifies that the usage environment state of the brush device 2000 is the lifted state by the AI model will be described with reference to FIGS. 12 through 14.

[0146] FIG. 12 is a flowchart of an embodiment of a method by which the cordless vacuum cleaner 100 identifies the usage environment state of the brush device 2000, according to the disclosure.

[0147] In operation S1210, the cordless vacuum cleaner 100 may obtain data related to flow path pressure measured by the pressure sensor 1400.

[0148] In an embodiment of the disclosure, the at least one processor 1001 of the cleaner body 1000 may obtain the pressure value measured by the pressure sensor 1400. In an embodiment, the main processor 1800 may receive, from the pressure sensor 1400 through I2C communication, the pressure value measured by the pressure sensor 1400, for example. The pressure sensor 1400 may be disposed inside the flow path and measure the pressure inside the flow path (flow path pressure). In an embodiment, the pressure sensor 1400 may be disposed inside the suction duct 40 or motor assembly 1100, for example, but is not limited thereto.

[0149] The pressure sensor 1400 may be an absolute pressure sensor or a relative pressure sensor. When the pressure sensor 1400 is an absolute pressure sensor, the main processor 1800 may use the pressure sensor 1400 to sense a first pressure value before the suction motor 1110 is operated and a second pressure value after the suction motor 1110 is operated at a target RPM, and use a difference between the first pressure value and the second pressure value as the

pressure value inside the flow path. When the difference between the first pressure value and the second pressure value is used as the pressure value inside the flow path, internal/external influences other than the suction motor 1110 may be reduced.

[0150] In operation S1220, the cordless vacuum cleaner 100 may obtain data related to the load of the brush device 2000, through the load detecting sensor 1134.

[0151] In an embodiment of the disclosure, the load detecting sensor 1134 may be disposed inside the PCB 1130 of the motor assembly 1100 and include a shunt resistor, a current detecting circuit, and a load detecting circuit, but is not limited thereto. The main processor 1800 of the cleaner body 1000 may receive the data related to the load of the brush device 2000 from the first processor 1131 inside the motor assembly 1100.

[0152] In an embodiment of the disclosure, the data related to the load of the brush device 2000 may include at least one of an operating current of the brush device 2000, a voltage applied to the brush device 2000, or power consumption of the brush device 2000, but is not limited thereto. The power consumption of the brush device 2000 may be power consumption of the motor 2100, and calculated by multiplying the operating current of the brush device 2000 and the voltage applied to the brush device 2000. When the brush device 2000 includes the lighting device 2300 (e.g., an LED display), the load of the brush device 2000 may be calculated by adding a load of the motor 2100 and a load of the lighting device 2300.

[0153] In operation S1230, the cleaner body 1000 may identify the current usage environment state of the brush device 2000 by applying, to the pre-trained AI model, the data related to the flow path pressure and the data related to the load of the brush device 2000.

[0154] In an embodiment of the disclosure, the AI model may be a machine learning algorithm trained to infer the usage environment state of the brush device 2000. The AI model may be trained or renewed (refined) by an external device (e.g., a server device or an external computing device), or may be trained or renewed (refined) by the cleaner body 1000. In an embodiment, the cleaner body 1000 may receive the trained AI model from the external device and store the same in the memory 1900, or at least one processor 1001 of the cleaner body 1000 may create the AI model for inferring the usage environment state of the brush device 2000 through learning, for example.

[0155] In an embodiment of the disclosure, the AI model may include at least one of an SVM model, a neural network model, a random forest model, or a graphical model, but is not limited thereto.

[0156] The SVM model may be an algorithm that generates a hyper plane of a maximum margin, which may classify data in a stereoscopic space by a kernel function. The random forest model may be an ensemble algorithm for training a plurality of decision trees and making prediction by combining results of the plurality of decision trees. The neural network model may be an algorithm that derives an output by combining a conversion function and a weight for each input value. The graphical model may be an algorithm for representing independency between probability variables in a graph. Here, the probability variable is represented as a node, and conditional independency between the probability values may be represented as an edge.

[0157] The SVM model has relatively high accuracy and a fast response speed, and thus operations of the cordless vacuum cleaner 100 may be quickly switched to an optimum specification. Thus, a case where the AI model is the SVM model will be mainly described as an example.

[0158] In an embodiment of the disclosure, the usage environment state of the brush device 2000 may be related to an environment in which the brush device 2000 is being used during cleaning. In an embodiment, the usage environment state of the brush device 2000 may include at least one of a state of a surface to be cleaned where the brush device 2000 is disposed, a relative location state of the brush device 2000 in the surface to be cleaned, or a state of the brush device 2000 being lifted from the surface to be cleaned, for example, but is not limited thereto. Here, the surface to be cleaned may denote a surface of a floor, bed, or sofa, which contacts the brush device 2000. The state of the surface to be cleaned may denote a material of the surface to be cleaned, e.g., a hard floor, a normal carpet (normal load), a high-density carpet (overload), or a mat. The relative location state may include a floor center, a floor side surface (wall), or a corner, but is not limited thereto. Hereinafter, for convenience of descriptions, a mat state, a hard floor state, a carpet state, and a lifted state from among various usage environment state will be described as examples.

[0159] In an embodiment of the disclosure, the main processor 1800 of the cleaner body 1000 may input, to the pre-stored AI model, the data related to the flow path pressure obtained from the pressure sensor 1400 and the data related to the load of the brush device 2000 obtained from the first processor 1131, and obtain the current usage environment state of the brush device 2000 as an inference result of the AI model.

[0160] In an embodiment of the disclosure, the AI model for inferring the usage environment state of the brush device 2000 may vary depending on a type of the brush device 2000. Accordingly, the cleaner body 1000 may store, in the memory 1900, a plurality of AI models according to types of brush device 2000, select an AI model corresponding to a type of the brush device 2000 after the type of the brush device 2000 is identified, and identify the current usage environment state of the brush device 2000. The main processor 1800 of the cleaner body 1000 may select a first AI model corresponding to a first type of the brush device 2000 from among the plurality of AI models, and identify the current usage environment state of the brush device 2000 by applying, to the selected first AI model, the data related to the flow path pressure and the data related to the load of the brush device 2000. In an embodiment, when the brush device 2000 is the multi-brush 501, the

main processor 1800 may select an AI model corresponding to the multi-brush 501, and identify the current usage environment state of the multi-brush 501 by applying, to the selected AI model, the data related to the flow path pressure and the data related to the load of the multi-brush 501, for example.

[0161] In an embodiment of the disclosure, a parameter value of the AI model may vary according to suction power strength of the suction motor 1110. Accordingly, the main processor 1800 of the cleaner body 1000 may modify the parameter value of the AI model by applying the suction power strength of the suction motor 1110 before inputting, to the AI model, the data related to the flow path pressure and the data related to the load of the brush device 2000. Also, the main processor 1800 may identify the current usage environment state of the brush device 2000 by applying, to the AI model in which the parameter value has been modified, the data related to the flow path pressure and the data related to the load of the brush device 2000.

[0162] In an embodiment of the disclosure, a value of the load of the brush device 2000, which is used as an input value of the AI model, may vary depending on a type of the brush device 2000. In an embodiment, when the brush device 2000 is the hard floor brush 502, the main processor 1800 may input operating current data of the hard floor brush 502 to an AI model corresponding to the hard floor brush 502, for example. When the brush device 2000 is the multi-brush 501, power consumption (or an operating current or applied voltage) of the multi-brush 501 may be input to an AI model corresponding to the multi-brush 501.

[0163] When a hard floor is cleaned, the flow path pressure and the load of the brush device 2000 are normal, but when a mat is cleaned, the flow path pressure and the load of the brush device 2000 may greatly increase, when a carpet is cleaned, the flow path pressure may be normal but the load of the brush device 2000 may greatly increase, and when the brush device 2000 is lifted, the flow path pressure and the load of the brush device 2000 may greatly decrease. Accordingly, the cleaner body 1000 may identify the current usage environment state of the brush device 2000 by applying, to the pre-trained AI model, the data related to the flow path pressure and the data related to the load of the brush device 2000. In an embodiment, when a normal first flow path pressure value and a normal first load value are applied to the AI model, the AI model may output "hard floor" as the usage environment state of the brush device 2000, and when a relatively low second flow path pressure value and a relatively low second load value are applied to the AI model, the AI model may output "lifted" as the usage environment state of the AI model, for example.

[0164] The usage environment state of the brush device 2000 may frequently change, and thus the cleaner body 1000 may apply the data related to the flow path pressure and the data related to the load of the brush device 2000 to the pre-trained AI model at predetermined intervals to continuously monitor the usage environment state of the brush device 2000.

[0165] In operation S1240, the cordless vacuum cleaner 100 in an embodiment of the disclosure may determine whether the current usage environment state of the brush device 2000 is a lifted state, based on the inference result of the AI model.

[0166] In operation S1250, the cordless vacuum cleaner 100 in an embodiment of the disclosure may calculate the suction power decrease amount, based on the pressure value measured by the pressure sensor 1400, when the current usage environment state of the brush device 2000 is the lifted state (Yes in operation S1240). In an embodiment, the cordless vacuum cleaner 100 may calculate the suction power decrease amount (suction power decrease rate) by comparing the pressure value in the lifted state with the initial pressure value, for example. Also, the cordless vacuum cleaner 100 may store the calculated suction power decrease amount in the memory 1900. In an embodiment of the disclosure, the cordless vacuum cleaner 100 may newly calculate the suction power decrease amount whenever the usage environment state of the brush device 2000 is the lifted state during cleaning.

[0167] When the cordless vacuum cleaner 100 is docked to the station apparatus 200, the cordless vacuum cleaner 100 may transmit, to the station apparatus 200, information about the suction power decrease amount that is most recently calculated. In an embodiment, when the cordless vacuum cleaner 100 is docked to the station apparatus 200, the cordless vacuum cleaner 100 may establish an NFC channel (e.g., BLE communication channel) with the station apparatus 200 and transmit, to the station apparatus 200, the information about the suction power decrease amount that is most recently calculated, through the NFC channel, for example.

[0168] Hereinafter, the SVM model will be described as an embodiment of the AI model for inferring the usage environment state of the brush device 2000, with reference to FIG. 13.

[0169] FIG. 13 is a diagram for describing an embodiment of the AI model for inferring the usage environment state of the brush device 2000, according to the disclosure.

[0170] Referring to a reference numeral 1310 of FIG. 13, an SVM model may be generated through supervised learning. The SVM model is a model configured to learn training data with labels, and then determine to which group, from among learned groups, newly input data belongs. In an embodiment of the disclosure, the SVM model may be trained by, as the training data, a load value of the brush device 2000 and a pressure value of the suction motor 1110, in a predetermined usage environment state.

[0171] In an embodiment, a first flow path pressure value and a first load value of the brush device 2000 obtained when a hard floor is cleaned, a second flow path pressure value and a second load value of the brush device 2000 obtained when a carpet is cleaned, a third flow path pressure value and a third load value of the brush device 2000 when a mat is cleaned,

and a fourth flow path pressure value and a fourth load value of the brush device 2000 when the brush device 2000 is lifted from a floor, may be used as the training data, for example. Also, the SVM model may be trained by, as a label (ground-truth), a usage environment state (e.g., a hard floor, a carpet, a mat, or a lifted state) when the load value of the brush device 2000 and the flow path pressure value are obtained.

[0172] In an embodiment of the disclosure, the SVM model may be trained by an external device (e.g., a server device or an external computing device), or may be trained by the cleaner body 1000.

[0173] Referring to a reference numeral 1320 of FIG. 13, the trained SVM model may be configured as at least one hyper plane for classifying usage environment states. In an embodiment, the SVM model for predicting a usage environment state may be configured as a hyper plane for classifying a hard floor and a carpet, and a hyper plane for classifying a hard floor and a mat, and a hyper plane for classifying a carpet and a lifted state, for example. Each hyper plane may be represented by a linear equation ($y = ax + b$). In the linear equation, a and b may be parameters, and the parameter may be modified according to the suction power strength of the suction motor 1110, the type of the brush device 2000, and the state (e.g., a dust amount) of the cordless vacuum cleaner 100. An equation of the hyper plane may be a higher order equation (e.g., $y = ax^2 + b$, $y = ax^3 + b$).

[0174] FIG. 14 is a diagram for describing an embodiment of an operation by which the cleaner body 1000 identifies a lifted state of the brush device 2000 by the SVM model, according to the disclosure.

[0175] In FIG. 14, a case, in which the usage environment states of the brush device 2000 are classified into four, i.e., a hard floor (hf) 1411, a carpet (plush, wilton and ultra soft) 1412, a mat (mat) 1413, and a lifted state (lift) 1414, will be described as an example.

[0176] When the hard floor 1411 is cleaned, the flow path pressure and the load of the brush device 2000 are normal, but when the mat 1413 is cleaned, the flow path pressure and the load of the brush device 2000 may greatly increase, when the carpet 1412 is cleaned, the flow path pressure may be normal but the load of the brush device 2000 may greatly increase, and when the brush device 2000 is in the lifted state 1414, the flow path pressure and the load of the brush device 2000 may greatly decrease. Accordingly, when a normal flow path pressure value and a normal load value are input to the SVM model, the SVM model may output "hard floor 1411" as the usage environment state of the brush device 2000. When a relatively high flow path pressure value and a relatively high load value are input to the SVM model, the SVM model may output "mat 1413" as the usage environment state of the brush device 2000. When a normal flow path pressure value and a relatively high load value are input to the SVM model, the SVM model may output "carpet 1412" as the usage environment state of the brush device 2000. When a relatively low flow path pressure value and a relatively low load value are input to the SVM model, the SVM model may output "lifted state 1414" as the usage environment state of the brush device 2000.

[0177] In an embodiment of the disclosure, the cordless vacuum cleaner 100 may calculate the suction power decrease amount by comparing the current pressure value of the pressure sensor 1400 with the initial pressure value, whenever the SVM model outputs "lifted state 1414" as the usage environment state of the brush device 2000. Also, when the cordless vacuum cleaner 100 is docked to the station apparatus 200, the cordless vacuum cleaner 100 may transmit the information about the suction power decrease amount that is most recently calculated to the station apparatus 200 through NFC (e.g., BLE communication).

[0178] Here, when the station apparatus 200 is operating in the smart discharge mode, the station apparatus 200 may determine whether to perform the dust discharging operation, based on the suction power decrease amount of the cordless vacuum cleaner 100, which is most recently calculated. When the station apparatus 200 is operating in the automatic discharge mode or manual discharge mode, the station apparatus 200 may not use the information about the suction power decrease amount of the cordless vacuum cleaner 100, which is most recently calculated, during the dust discharging operation. A method by which the station apparatus 200 performs the dust discharging operation in each discharge mode will be described in more detail with reference to FIG. 15.

[0179] FIG. 15 is a flowchart of an embodiment of a method by which the station apparatus 200 identifies the discharge mode, according to the disclosure.

[0180] In operation S1510, the station apparatus 200 in an embodiment of the disclosure may detect the cordless vacuum cleaner 100 being docked.

[0181] In an embodiment of the disclosure, the station apparatus 200 may determine whether the cordless vacuum cleaner 100 is docked to the station apparatus 200, by the docking detecting sensor 210. In an embodiment, referring to FIG. 10, when the user docks the cleaner body 1000 to the station apparatus 200, the distance d between the magnetic body 1450 attached to the dust container 1200 of the cleaner body 1000 and the docking detecting sensor 210 draws near, and thus the docking detecting sensor 210 may detect the magnetic body 1450 attached to the dust container 1200, for example. When the docking detecting sensor 210 detects the magnetic body 1450, the station apparatus 200 may identify that the cordless vacuum cleaner 100 has been docked.

[0182] In an embodiment of the disclosure, when the battery 1500 of the cleaner body 1000 is charged through the charging terminal of the station apparatus 200, the station apparatus 200 may detect power (or a current) charged in the battery 1500 of the cleaner body 1000 through the charging terminal. Accordingly, the station apparatus 200 may identify that the cordless vacuum cleaner 100 is docked when the power (or the current) charged in the battery 1500 is detected.

[0183] In an embodiment of the disclosure, when the battery 1500 of the cleaner body 1000 contacts the charging terminal of the station apparatus 200, the cleaner body 1000 may detect a charging start of the battery 1500. Accordingly, when the charging of the battery 1500 is started, the cleaner body 1000 may identify that the cleaner body 1000 is docked to the station apparatus 200. Here, the cleaner body 1000 may transmit information indicating the docking to the station apparatus 200 to the station apparatus 200 through NFC (e.g., BLE communication). The station apparatus 200 may detect that the cordless vacuum cleaner 100 is docked, based on the information received from the cleaner body 1000.

[0184] In operation S1520, the station apparatus 200 in an embodiment of the disclosure may identify a discharge mode currently set, as the docking of the cordless vacuum cleaner 100 is detected.

[0185] The discharge mode in an embodiment of the disclosure may include the manual discharge mode, the automatic discharge mode, and the smart discharge mode, but is not limited thereto. The user may select one of the manual discharge mode, the automatic discharge mode, and the smart discharge mode, according to a situation.

[0186] Referring to FIG. 16, the user may set the discharge mode of the station apparatus 200 through the user terminal 400 connected to the station apparatus 200. In an embodiment, the user terminal 400 may display a first screen 1610 of a predetermined application (e.g., a home appliance management application), for example. The first screen 1610 may include an icon 1601 for setting the discharge mode. When the user selects the icon 1601 for setting the discharge mode from the first screen 1610, the user terminal 400 may display a second screen 1620. The second screen 1620 may include a first icon 1602 for setting the automatic discharge mode, a second icon 1603 for setting the smart discharge mode, and a third icon 1604 for setting the manual discharge mode.

[0187] When the user selects one of the first icon 1602, the second icon 1603, and the third icon 1604, the user terminal 400 may transmit, to the station apparatus 200, information about a discharge mode corresponding to a selected icon. Here, the user terminal 400 may transmit the information about the discharge mode corresponding to the selected icon to the station apparatus 200 through the server device 300. In an embodiment, when the user terminal 400 receives a user input of selecting the second icon 1603, the user terminal 400 may transmit, to the server device 300, information indicating that the user input of setting the smart discharge mode has been received, for example. The server device 300 may transmit information to set the smart discharge mode to the station apparatus 200. The user terminal 400 may directly transmit, to the station apparatus 200 through NFC, information to operate in the discharge mode (e.g., the smart discharge mode) corresponding to the selected icon.

[0188] Referring to FIG. 17, the user may set the discharge mode of the station apparatus 200 through an input interface of the station apparatus 200. In an embodiment, the user may open a cover of the station apparatus 200 and set the discharge mode of the station apparatus 200 by a predetermined button 1710 (e.g., Auto Empty), for example. When the user presses the predetermined button 1710 to inactivate an auto empty function, the station apparatus 200 may set the manual discharge mode. Also, when the user may press the predetermined button 1710 again to activate the auto empty function, the station apparatus 200 may set the automatic discharge mode. Although not shown in FIG. 17, the input interface of the station apparatus 200 may include a button for setting the smart discharge mode.

[0189] In operations S1530 and S1540, the station apparatus 200 in an embodiment of the disclosure may obtain information about the suction power decrease amount of the cordless vacuum cleaner 100, when the currently set discharge mode is the smart discharge mode. In an embodiment, the information about the suction power decrease amount may be received from the cordless vacuum cleaner 100 through NFC (e.g., BLE communication), for example. Here, the suction power decrease amount of the cordless vacuum cleaner 100 may be obtained based on the sensor measurement value measured using the flow sensor or the pressure sensor 1400 of the cordless vacuum cleaner 100. In an embodiment, the suction power decrease amount of the cordless vacuum cleaner 100 may be obtained based on the sensor measurement value measured using the flow sensor or the pressure sensor 1400 of the cordless vacuum cleaner 100 when the brush device 2000 connected to the cordless vacuum cleaner 100 is in the lifted state from the surface to be cleaned, for example. The lifted state may include at least one of the state in which the brush device 2000 is lifted from the surface to be cleaned by a predetermined height or more during the cleaning operation or the state in which the cordless vacuum cleaner 100 is docked to the station apparatus 200.

[0190] In operation S1550, the station apparatus 200 in an embodiment of the disclosure may compare the suction power decrease amount of the cordless vacuum cleaner 100 with the pre-set threshold suction power decrease amount, based on the information about the suction power decrease amount obtained from the cordless vacuum cleaner 100.

[0191] In an embodiment of the disclosure, the station apparatus 200 may not perform the dust discharging operation when the suction power decrease amount of the cordless vacuum cleaner 100 is less than the pre-set threshold suction power decrease amount as a result of comparing the suction power decrease amount of the cordless vacuum cleaner 100 with the pre-set threshold suction power decrease amount (No in operation S1550). In an embodiment, when the pre-set threshold suction power decrease amount is 30 % and the suction power decrease amount of the cordless vacuum cleaner 100 is 20 %, the station apparatus 200 may not perform the dust discharging operation even when the cordless vacuum cleaner 100 is docked to the station apparatus 200, for example.

[0192] In operation S1560, the station apparatus 200 in an embodiment of the disclosure may perform the dust discharging operation of driving the suction motor 207 to discharge the dust in the dust container 1200 to the collecting

portion 209, when the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount (Yes in operation S1550).

[0193] In an embodiment, when the pre-set threshold suction power decrease amount is 30 % and the suction power decrease amount of the cordless vacuum cleaner 100 is 35 %, the station apparatus 200 may drive the suction motor 207 and perform the dust discharging operation because the suction power decrease amount (35 %) of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount (30 %), for example. When the dust in the dust container 1200 is discharged to the collecting portion 209 by the dust discharging operation, the suction power (cleaning performance) of the cordless vacuum cleaner 100 may be recovered.

[0194] Thus, according to the smart discharge mode, the station apparatus 200 performs the dust discharging operation in association with the suction power decrease amount of the cordless vacuum cleaner 100, thereby efficiently managing the suction power (cleaning performance) of the cordless vacuum cleaner 100 without involvement of the user.

[0195] In operations S1570 and S1560, the station apparatus 200 in an embodiment of the disclosure may automatically perform the dust discharging operation upon detecting the docking of the cordless vacuum cleaner 100, when the currently set discharge mode is the automatic discharge mode. In an embodiment, the station apparatus 200 may control the step motor to open the cover of the dust container 1200, when the docking of the cordless vacuum cleaner 100 is detected, for example.

[0196] Also, according to the disclosure, the station apparatus 200 may control the step motor to close the cover of the dust container 1200 as the dust discharging operation is completed, when an auto close mode for automatically closing the cover of the dust container 1200 is set.

[0197] When the discharge strength or discharge duration time is set by the user, the station apparatus 200 may perform the dust discharging operation, based on the discharge strength or discharge duration time set by the user, upon detecting the docking of the cordless vacuum cleaner 100.

[0198] In operations S1580 and S1590, the station apparatus 200 in an embodiment of the disclosure may determine whether an input of selecting the dust discharge button is received, when the currently set discharge mode is the manual discharge mode.

[0199] The dust discharge button in an embodiment of the disclosure may be on a surface of the station apparatus 200 or displayed on an execution window of an application executed in the user terminal 400.

[0200] In an embodiment of the disclosure, when the currently set discharge mode is the manual discharge mode, the station apparatus 200 may not perform the dust discharging operation even when the docking of the cordless vacuum cleaner 100 is detected, when the input of selecting the dust discharge button is not received from the user (No in operation S1590).

[0201] In operations S1590 and S1560, when the input of selecting the dust discharge button is received (Yes in operation S1590), the station apparatus 200 may perform the dust discharge button.

[0202] In an embodiment, when the station apparatus 200 detects the input of selecting the dust discharge button on the surface of the station apparatus 200, the station apparatus 200 may perform the dust discharging operation, for example. Also, referring to FIG. 16, when the user selects an "empty dust container" button from the first screen 1610, the user terminal 400 may transmit, to the server device 300, information indicating that the "empty dust container" button has been selected, and the server device 300 may transmit a control command for performing the dust discharging operation to the station apparatus 200. The station apparatus 200 may perform the dust discharging operation according to the control command received from the server device 300.

[0203] In an embodiment of the disclosure, the station apparatus 200 may differently adjust the discharge strength or the discharge duration time during the dust discharging operation, according to a type of a user input of selecting the dust discharge button. An operation by which the station apparatus 200 differently adjusts the discharge strength or the discharge duration time during the dust discharging operation will be described in detail with reference to FIG. 18.

[0204] FIG. 18 is a flowchart of a method by which the station apparatus 200 performs the dust discharging operation according to a type of the user input of selecting the dust discharge button, according to the disclosure.

[0205] In operation S1810, the station apparatus 200 in an embodiment of the disclosure may receive the user input of selecting the dust discharge button. In an embodiment, the station apparatus 200 may receive a user input of pressing a dust discharge start/end button 1810 while the cordless vacuum cleaner 100 is docked to the station apparatus 200, for example. The dust discharge start/end button 1810 may be provided at the top of the station apparatus 200. In an embodiment of the disclosure, the user input of selecting the dust discharge button may be received in the manual discharge mode, in the automatic discharge mode, or in the smart discharge mode.

[0206] In operation S1820, the station apparatus 200 in an embodiment of the disclosure may identify an operating mode according to a type of the user input of selecting the dust discharge button.

[0207] In an embodiment of the disclosure, the type of the user input may be distinguished according to a time the dust discharge button is pressed or the number of times the dust discharge button is pressed. In an embodiment, an input of the user pressing the dust discharge button for a predetermined time (e.g., 3 seconds) or more may be defined as a first type (long key) user input and an input of the user pressing the dust discharge button for less than the predetermined time (e.g.,

3 seconds) may be defined as a second type (short key) user input, for example. Also, an input of the user pressing the dust discharge button one time may be defined as a third type user input and an input of the user pressing the dust discharge button two times may be defined as a fourth type user input.

[0208] In an embodiment of the disclosure, the station apparatus 200 may identify the operating mode as a default mode when the first type user input (or the third type user input) is received. The default mode may be a mode in which the suction motor 207 is controlled according to a discharge strength or discharge duration time basically set in the station apparatus 200.

[0209] In an embodiment of the disclosure, the station apparatus 200 may identify the operating mode as a user setting mode when the second type user input (or the fourth type user input) is received. The user setting mode may be a mode in which the suction motor 207 is controlled according to a discharge strength or discharge duration time set by the user.

[0210] In operations S1830 and S1850, when the operating mode is the default mode, the station apparatus 200 in an embodiment of the disclosure may perform the dust discharging operation according to the discharge strength or discharge duration time basically set in the station apparatus 200. In an embodiment, the discharge strength basically set in the station apparatus 200 may be relatively strong (e.g., 1400 W) and the discharge duration time basically set in the station apparatus 200 may be 30 seconds. In this case, when the user presses the dust discharge button for a relatively long duration of time (the first type user input) while the cordless vacuum cleaner 100 is docked to the station apparatus 200, the station apparatus 200 may control the step motor to open the cover of the dust container 1200 and then drive the suction motor 207 for 30 seconds in power consumption of 1400 W, for example.

[0211] In operations S1840 and S1850, when the operating mode is the user setting mode, the station apparatus 200 in an embodiment of the disclosure may perform the dust discharging operation according to the discharge strength or discharge duration time set by the user. In an embodiment, the discharge strength set by the user may be medium (1190 W) and the discharge duration time set by the user may be 20 seconds, for example. In this case, when the user presses the dust discharge button for a relatively short duration of time (the second type user input) while the cordless vacuum cleaner 100 is docked to the station apparatus 200, the station apparatus 200 may control the step motor to open the cover of the dust container 1200 and then drive the suction motor 207 for 20 seconds in power consumption of 1190 W.

[0212] In an embodiment of the disclosure, when the user presses the dust discharge start/end button 1810 even before the discharge duration time set by the user or the basically set discharge duration time has passed, the station apparatus 200 may stop the dust discharging operation and control the step motor to close the cover of the dust container 1200.

[0213] Hereinafter, an operation of setting the threshold suction power decrease amount for the smart discharge mode will be described with reference to FIG. 19.

[0214] FIG. 19 is a flowchart of an embodiment of a method by which the station apparatus 200 sets the threshold suction power decrease amount for the smart discharge mode, according to the disclosure.

[0215] In operation S1910, the station apparatus 200 in an embodiment of the disclosure may set the smart discharge mode. In an embodiment, when the user selects the smart discharge mode of determining whether to perform the dust discharging operation in association with the suction power decrease amount of the cordless vacuum cleaner 100, from among a plurality of discharge modes, the station apparatus 200 may operate in the smart discharge mode, for example.

[0216] In operation S1920, the station apparatus 200 in an embodiment of the disclosure may obtain information about a threshold suction power decrease amount selected by the user for the smart discharge mode. Also, the station apparatus 200 may store the information about the threshold suction power decrease amount selected by the user in the memory 202.

[0217] Referring to FIG. 20, the user may set the threshold suction power decrease amount for the smart discharge mode through the user terminal 400 connected to the station apparatus 200. In an embodiment, the user terminal 400 may display a threshold suction power decrease amount setting screen 2001 on an execution window of a predetermined application (e.g., the home appliance management application), for example. When the user selects the threshold suction power decrease amount through the threshold suction power decrease amount setting screen 2001, the user terminal 400 may transmit, to the station apparatus 200, information about the selected threshold suction power decrease amount. Here, the user terminal 400 may transmit the information about the selected threshold suction power decrease amount to the station apparatus 200 through the server device 300. In an embodiment, when the user terminal 400 receives a user input of selecting "30 %" as the threshold suction power decrease amount, the user terminal 400 may transmit, to the server device 300, information indicating that the user input of selecting the threshold suction power decrease amount to be 30 % has been received, for example. The server device 300 may transmit information to set the threshold suction power decrease amount to 30 % for the smart discharge mode, to the station apparatus 200. The user terminal 400 may directly transmit the information to set the threshold suction power decrease amount for the smart discharge mode to "30 %" selected by the user, to the station apparatus 200 through NFC (e.g., BLE communication or WFD communication).

[0218] In an embodiment of the disclosure, the user may select the threshold suction power decrease amount to be relatively low when desires to maintain the suction power (cleaning performance) of the cordless vacuum cleaner 100 high. When the user regards energy reduction as important, the user may select the threshold suction power decrease amount to be relatively high.

[0219] In an embodiment of the disclosure, the station apparatus 200 may receive a user input of selecting one operating

mode from among the plurality of operating modes of the station apparatus 200 and select a decrease amount corresponding to the selected operating mode as the threshold suction power decrease amount set by the user. In an embodiment, referring to FIG. 20, the user may select one of a powerful cleaning mode, an economy mode, and an energy saving mode, for example. A decrease amount corresponding to the powerful cleaning mode may be 5 %, a decrease amount corresponding to the economy mode may be 30 %, and a decrease amount corresponding to the energy saving mode may be 50 %. Accordingly, when the user selects the powerful cleaning mode, the station apparatus 200 may set 5 % that is the decrease amount corresponding to the powerful cleaning mode as the threshold suction power decrease amount for the smart discharge mode. When the user selects the economy mode, the station apparatus 200 may set 30 % that is the decrease amount corresponding to the economy mode as the threshold suction power decrease amount for the smart discharge mode. When the user selects the energy saving mode, the station apparatus 200 may set 50 % that is the decrease amount corresponding to the energy saving mode as the threshold suction power decrease amount for the smart discharge mode.

[0220] In operation S1930, the station apparatus 200 in an embodiment of the disclosure may detect the docking of the cordless vacuum cleaner 100.

[0221] In an embodiment of the disclosure, the station apparatus 200 may determine whether the cordless vacuum cleaner 100 is docked to the station apparatus 200, by the docking detecting sensor 210.

[0222] In an embodiment of the disclosure, when the battery 1500 of the cleaner body 1000 is charged through the charging terminal of the station apparatus 200, the station apparatus 200 may detect power charged in the battery 1500 of the cleaner body 1000 through the charging terminal. Accordingly, the station apparatus 200 may identify that the cordless vacuum cleaner 100 is docked when the power (or a current) charged in the battery 1500 is detected.

[0223] In operation S1940, the cordless vacuum cleaner 100 in an embodiment of the disclosure may also detect that the docking to the station apparatus 200.

[0224] In an embodiment of the disclosure, when the battery 1500 of the cleaner body 1000 contacts the charging terminal of the station apparatus 200, the cleaner body 1000 may detect a charging start of the battery 1500. Accordingly, when the charging of the battery 1500 is started, the cleaner body 1000 may identify that the cleaner body 1000 is docked to the station apparatus 200.

[0225] In operation S1950, when the cordless vacuum cleaner 100 in an embodiment of the disclosure is docked to the station apparatus 200, the cordless vacuum cleaner 100 and the station apparatus 200 may perform communication connection. In an embodiment, the cordless vacuum cleaner 100 and the station apparatus 200 may establish an NFC channel (e.g., a BLE communication channel), for example.

[0226] In operation S1960, the cordless vacuum cleaner 100 in an embodiment of the disclosure may transmit the information about the suction power decrease amount of the cordless vacuum cleaner 100 when communicably connected to the station apparatus 200.

[0227] The suction power decrease amount of the cordless vacuum cleaner 100 may be obtained based on the sensor measurement value measured using the flow sensor or the pressure sensor 1400 of the cordless vacuum cleaner 100. In an embodiment, the suction power decrease amount of the cordless vacuum cleaner 100 may be obtained based on the sensor measurement value measured using the flow sensor or the pressure sensor 1400 of the cordless vacuum cleaner 100 when the brush device 2000 connected to the cordless vacuum cleaner 100 is in the lifted state from the surface to be cleaned, for example. The cordless vacuum cleaner 100 may transmit, to the station apparatus 200, the information about the suction power decrease amount that is most recently obtained.

[0228] In operation S1970, when the threshold suction power decrease amount selected by the user is stored in the memory 202, the station apparatus 200 in an embodiment of the disclosure may compare the suction power decrease amount of the cordless vacuum cleaner 100 with the threshold suction power decrease amount selected by the user.

[0229] When the suction power decrease amount of the cordless vacuum cleaner 100 is less than the threshold suction power decrease amount selected by the user (No in operation S1970), the station apparatus 200 in an embodiment of the disclosure may not perform the dust discharging operation but may operate in a standby mode, in operation S1980. The station apparatus 200 may not perform the dust discharging operation even when the cordless vacuum cleaner 100 is docked, until the user further uses the cordless vacuum cleaner 100 and the suction power decrease amount reaches the threshold suction power decrease amount selected by the user.

[0230] In an embodiment, when the threshold suction power decrease amount selected by the user is 30 % and the current suction power decrease amount of the cordless vacuum cleaner 100 is 10 %, the station apparatus 200 may not perform the dust discharging operation, for example. In other words, the station apparatus 200 may operate in the standby mode without performing the dust discharging operation until the suction power decrease amount of the cordless vacuum cleaner 100 reaches 30 %.

[0231] When the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the threshold suction power decrease amount selected by the user (Yes in operation S1970), the station apparatus 200 in an embodiment of the disclosure may perform the dust discharging operation, in operation S1990.

[0232] In an embodiment, the suction power decrease amount of the cordless vacuum cleaner 100 may be 20 %, for

example. In this case, when the threshold suction power decrease amount selected by the user is 10 %, the station apparatus 200 may perform the dust discharging operation, and when the threshold suction power decrease amount selected by the user is 30 %, the station apparatus 200 may not perform the dust discharging operation.

[0233] In an embodiment of the disclosure, the station apparatus 200 may frequently perform the dust discharging operation when the user selects the threshold suction power decrease amount to be relatively low. The station apparatus 200 may rarely perform the dust discharging operation when the user selects the threshold suction power decrease amount to be relatively high.

[0234] In an embodiment of the disclosure, when the user has set the discharge strength or discharge duration time, the station apparatus 200 may control the suction motor 207 according to the discharge strength or discharge duration time set by the user while performing the dust discharging operation. An operation by which the station apparatus 200 controls the suction motor 207 according to the discharge strength or discharge duration time set by the user will be described with reference to FIG. 21.

[0235] FIG. 21 is a flowchart of an embodiment of a method of performing the dust discharging operation, based on the discharge strength or discharge duration time set by the user, according to the disclosure.

[0236] In operation S2110, the station apparatus 200 in an embodiment of the disclosure may obtain the user setting information about at least one of the discharge strength or the discharge duration time. The discharge strength denotes suction strength of the suction motor 207 of the station apparatus 200 and may be proportional to power consumption of the suction motor 207. The discharge duration time may denote an operation duration time of the suction motor 207.

[0237] Referring to a reference numeral 2210 of FIG. 22, the user may set the discharge strength through the user terminal 400 connected to the station apparatus 200. In an embodiment, the user terminal 400 may display a first screen 2201 for setting the discharge strength, on an execution window of a predetermined application (e.g., the home appliance management application), for example. When the user selects the discharge strength through the first screen 2201, the user terminal 400 may transmit, to the station apparatus 200, information about the selected discharge strength. The user terminal 400 may transmit the information about the selected discharge strength to the station apparatus 200 through the server device 300. In an embodiment, when the user terminal 400 receives a user input of selecting the discharge strength to be 85 % (economy mode), the user terminal 400 may transmit, to the server device 300, information indicating that the user input of selecting the discharge strength to be 85 % (economy mode) has been received, for example. In this case, the server device 300 may transmit, to the station apparatus 200, information to set the discharge strength to 85 % (economy mode) during the dust discharging operation. The user terminal 400 may directly transmit the information to set the discharge strength to 85 % (economy mode) during the dust discharging operation, to the station apparatus 200 through NFC (e.g., BLE communication or WFD communication).

[0238] Referring to a reference numeral 2220 of FIG. 22, the user may set the discharge duration time through the user terminal 400 connected to the station apparatus 200. In an embodiment, the user terminal 400 may display a second screen 2202 for setting the discharge duration time, on an execution window of a predetermined application (e.g., the home appliance management application), for example. When the user selects the discharge duration time through the second screen 2202, the user terminal 400 may transmit, to the station apparatus 200, information about the selected discharge duration time. The user terminal 400 may transmit the information about the selected discharge duration time to the station apparatus 200 through the server device 300. In an embodiment, when the user terminal 400 receives a user input of selecting 30 seconds as the discharge duration time, the user terminal 400 may transmit, to the server device 300, information indicating that the user input of selecting the discharge duration time to be 30 seconds has been received, for example. In this case, the server device 300 may transmit, to the station apparatus 200, information to set the discharge duration time to 30 seconds during the dust discharging operation. The user terminal 400 may directly transmit the information to set the discharge duration time to 30 seconds during the dust discharging operation, to the station apparatus 200 through NFC (e.g., BLE communication or WFD communication).

[0239] In an embodiment of the disclosure, the user may adjust the discharge strength or discharge duration time according to a cleaning environment or preference. In an embodiment, when there are a lot of long hairs or dusts in a cleaning space, the user may set the discharge strength to be relatively strong and the discharge duration time to be relatively long. The user may set the discharge strength to be relatively weak and the discharge duration time to be relatively short so as to save energy, for example.

[0240] In operation S2120, the station apparatus 200 in an embodiment of the disclosure may receive, from the cordless vacuum cleaner 100, the information about the suction power decrease amount of the cordless vacuum cleaner 100.

[0241] The station apparatus 200 may receive the information about the suction power decrease amount of the cordless vacuum cleaner 100 from the cordless vacuum cleaner 100 through NFC (e.g., BLE communication). Here, the suction power decrease amount of the cordless vacuum cleaner 100 may be obtained based on the sensor measurement value measured using the flow sensor or the pressure sensor 1400 of the cordless vacuum cleaner 100. In an embodiment, the suction power decrease amount of the cordless vacuum cleaner 100 may be obtained based on the sensor measurement value measured using the flow sensor or the pressure sensor 1400 of the cordless vacuum cleaner 100 when the brush device 2000 connected to the cordless vacuum cleaner 100 is in the lifted state from the surface to be cleaned, for example.

[0242] In operation S2130, the station apparatus 200 in an embodiment of the disclosure may compare the suction power decrease amount of the cordless vacuum cleaner 100 with the pre-set threshold suction power decrease amount.

[0243] In an embodiment of the disclosure, the station apparatus 200 may not perform the dust discharging operation when the suction power decrease amount of the cordless vacuum cleaner 100 is less than the pre-set threshold suction power decrease amount as a result of comparing the suction power decrease amount of the cordless vacuum cleaner 100 with the pre-set threshold suction power decrease amount (No in operation S2130). In an embodiment, when the pre-set threshold suction power decrease amount is 30 % and the suction power decrease amount of the cordless vacuum cleaner 100 is 20 %, the station apparatus 200 may not perform the dust discharging operation even when the cordless vacuum cleaner 100 is docked to the station apparatus 200, for example.

[0244] In operation S2140, the station apparatus 200 in an embodiment of the disclosure may perform the dust discharging operation, based on the user setting information about at least one of the discharge strength or discharge duration time.

[0245] In an embodiment of the disclosure, the station apparatus 200 may control the power consumption of the suction motor 207 or the operating time of the suction motor 207 while the dust discharging operation is being performed, based on the user setting information.

[0246] In an embodiment, when the discharge strength set by the user is 85 % (economy mode) and the discharge duration time set by the user is 30 seconds, the station apparatus 200 may perform the dust discharging operation by adjusting the power consumption of the suction motor 207 to 1190 W and the operating time of the suction motor 207 to 30 seconds, for example.

[0247] In an embodiment of the disclosure, the station apparatus 200 may perform the dust discharging operation in association with the discharge timing condition set by the user. Referring to FIG. 23, a method by which the station apparatus 200 performs the dust discharging operation in association with the discharge timing condition will be described in detail.

[0248] FIG. 23 is a flowchart of an embodiment of a method of performing the dust discharging operation when the discharge timing condition set by the user is satisfied, according to the disclosure.

[0249] In operation S2310, the station apparatus 200 in an embodiment of the disclosure may obtain information related to the discharge timing condition set by the user. The discharge timing condition may denote a point in time when the station apparatus 200 is triggered to perform the dust discharging operation.

[0250] In an embodiment of the disclosure, the information related to the discharge timing condition set by the user may include at least one of a discharge cycle, a discharge duration time, an accumulated operating duration time of the cordless vacuum cleaner 100, or an accumulated number of operations of the cordless vacuum cleaner 100.

[0251] Referring to a reference numeral 2401 of FIG. 24, the user may set the discharge timing condition through the user terminal 400 connected to the station apparatus 200. In an embodiment, the user terminal 400 may display a first screen 2411 for setting the discharge timing condition, on an execution window of a predetermined application (e.g., the home appliance management application), for example. When the user sets the discharge timing condition through the first screen 2411, the user terminal 400 may transmit, to the station apparatus 200, information about the set discharge timing condition. The user terminal 400 may transmit the information about the discharge timing condition set by the user to the station apparatus 200 through the server device 300. In an embodiment, the user may set the discharge timing condition to once a week or set a predetermined time point (e.g., every noon or 11 AM), for example. In an alternative embodiment, the user may not set the discharge timing condition.

[0252] An embodiment in which the user desires the station apparatus 200 to perform the dust discharging operation during the day and thus sets 11 AM as the discharge timing condition will be described. When the user terminal 400 receives a user input of selecting 11 AM as the discharge timing condition, the user terminal 400 may transmit, to the server device 300, information indicating that the user input of setting the discharge timing condition to 11 AM has been received. In this case, the server device 300 may transmit, to the station apparatus 200, information to set the discharge timing condition to 11 AM. The user terminal 400 may directly transmit the information to set the discharge timing condition to 11 AM, to the station apparatus 200 through NFC (e.g., BLE communication or WFD communication).

[0253] Referring to a reference numeral 2402 of FIG. 24, the user may set the discharge timing condition in association with the accumulated operating duration time or accumulated number of operations of the cordless vacuum cleaner 100. In an embodiment, the user terminal 400 may display a second screen 2412 for setting the discharge timing condition, on an execution window of a predetermined application (e.g., the home appliance management application), for example. Through the second screen 2412, the user may set the discharge timing condition such that the dust discharging operation is performed when the accumulated operating duration time of the cordless vacuum cleaner 100 exceeds 30 minutes, or set the discharge timing condition such that the dust discharging operation is performed when the accumulated number of operations of the cordless vacuum cleaner 100 is 3 times or greater. The accumulated operating duration time or accumulated number of operations may be initialized when the station apparatus 200 performs the dust discharging operation. In an embodiment, when the station apparatus 200 transmits, to the cordless vacuum cleaner 100, information indicating that the dust discharging operation is completed through NFC (e.g., BLE communication), the cordless vacuum

cleaner 100 may initialize the accumulated operating duration time or accumulated number of operations to 0, for example.

[0254] In operation S2320, the station apparatus 200 in an embodiment of the disclosure may determine whether the discharge timing condition set by the user is satisfied.

[0255] In an embodiment of the disclosure, when the user has set the discharge timing condition to 11 AM, the station apparatus 200 may determine whether a current time point has reached 11 AM. Also, when the user has set the discharge timing condition to once a week, the station apparatus 200 may determine whether one week has passed from a time point when the dust discharging operation has been performed previously.

[0256] In an embodiment of the disclosure, when the user has set the discharge timing condition to a case in which the accumulated operating duration time of the cordless vacuum cleaner 100 exceeds 30 minutes, the station apparatus 200 may identify information about the accumulated operating duration time of the cordless vacuum cleaner 100, received from the cordless vacuum cleaner 100. In an embodiment of the disclosure, the cordless vacuum cleaner 100 may process accumulated operating duration time data and transmit, to the station apparatus 200, a flag (e.g., 1) indicating that the accumulated operating duration time exceeded 30 minutes, or may transmit the accumulated operating duration time data (e.g., 40 minutes 5 seconds) of the cordless vacuum cleaner 100 to the station apparatus 200 as it is.

[0257] In an embodiment of the disclosure, when the discharge timing condition set by the user is not satisfied, the station apparatus 200 may not perform the dust discharging operation but stand by until the discharge timing condition is satisfied. In an embodiment of the disclosure, when the user has not set the discharge timing condition, operation S2320 may be omitted.

[0258] In operation S2330, the station apparatus 200 in an embodiment of the disclosure may determine whether the cordless vacuum cleaner 100 is docked, when the discharge timing condition set by the user is satisfied (Yes in operation S2320).

[0259] In an embodiment of the disclosure, even when the discharge timing condition is satisfied (Yes in operation S2320), the dust discharging operation is not performed when the cordless vacuum cleaner 100 is not docked (No in operation S2330), and thus the station apparatus 200 may determine whether the cordless vacuum cleaner 100 is docked. When the discharge timing condition is satisfied but the cordless vacuum cleaner 100 is not docked, the station apparatus 200 may stand by until the cordless vacuum cleaner 100 is docked.

[0260] When the discharge timing condition is satisfied (Yes in operation S2320) and the cordless vacuum cleaner 100 is docked to the station apparatus 200 (Yes in operation S2330), the station apparatus 200 in an embodiment of the disclosure may compare the suction power decrease amount of the cordless vacuum cleaner 100 with the pre-set threshold suction power decrease amount in operation S2340.

[0261] In an embodiment of the disclosure, the station apparatus 200 may not perform the dust discharging operation when the suction power decrease amount of the cordless vacuum cleaner 100 is less than the pre-set threshold suction power decrease amount as a result of comparing the suction power decrease amount of the cordless vacuum cleaner 100 with the pre-set threshold suction power decrease amount (No in operation S2340). In an embodiment, when the pre-set threshold suction power decrease amount is 30 % and the suction power decrease amount of the cordless vacuum cleaner 100 is 20 %, the station apparatus 200 may not perform the dust discharging operation even when the discharge timing condition is satisfied and the cordless vacuum cleaner 100 is docked to the station apparatus 200, for example.

[0262] When the discharge timing condition is satisfied (Yes in operation S2320), the cordless vacuum cleaner 100 is docked to the station apparatus 200 (Yes in operation S2330), and the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount (Yes in operation S2340), the station apparatus 200 in an embodiment of the disclosure may perform the dust discharging operation in operation S2350.

[0263] In an embodiment of the disclosure, when the discharge strength or discharge duration time is set by the user, the station apparatus 200 may perform the dust discharging operation according to the discharge strength or discharge duration time set by the user.

[0264] In an embodiment of the disclosure, the user may set the discharge timing condition such that the dust discharging operation is not performed in a situation sensitive to noise, such as a night time. Also, the user may set the dust discharging operation to be performed after the cordless vacuum cleaner 100 operates for a predetermined duration of time (e.g., 30 minutes) or a predetermined number of times (e.g., 3 times), so as to save energy.

[0265] Not all operations of FIG. 23 are essential operations. In an embodiment, operation S2340 may be omitted, for example. In this case, the station apparatus 200 may perform the dust discharging operation when the discharge timing condition is satisfied and the cordless vacuum cleaner 100 is docked to the station apparatus 200, regardless of the suction power decrease amount of the cordless vacuum cleaner 100.

[0266] In an embodiment of the disclosure, the station apparatus 200 may perform the dust discharging operation in association with the mainly used cleaning mode of the cordless vacuum cleaner 100. Referring to FIG. 25, a method by which the station apparatus 200 performs the dust discharging operation in association with the mainly used cleaning mode of the cordless vacuum cleaner 100 will be described in detail.

[0267] FIG. 25 is a flowchart of an embodiment of a method of performing the dust discharging operation in association

with the mainly used cleaning mode of the cordless vacuum cleaner 100, according to the disclosure.

[0268] In operation S2510, the station apparatus 200 in an embodiment of the disclosure may detect the docking of the cordless vacuum cleaner 100.

[0269] In an embodiment of the disclosure, the station apparatus 200 may determine whether the cordless vacuum cleaner 100 is docked to the station apparatus 200, by the docking detecting sensor 210

[0270] In an embodiment of the disclosure, when the battery 1500 of the cleaner body 1000 is charged through the charging terminal of the station apparatus 200, the station apparatus 200 may detect power charged in the battery 1500 of the cleaner body 1000 through the charging terminal. Accordingly, the station apparatus 200 may identify that the cordless vacuum cleaner 100 is docked when the power (or a current) charged in the battery 1500 is detected.

[0271] In an embodiment of the disclosure, when the battery 1500 of the cleaner body 1000 contacts the charging terminal of the station apparatus 200, the cleaner body 1000 may detect a charging start of the battery 1500. Accordingly, when the charging of the battery 1500 is started, the cleaner body 1000 may identify that the cleaner body 1000 is docked to the station apparatus 200. Here, the cleaner body 1000 may transmit information indicating the docking to the station apparatus 200 to the station apparatus 200 through NFC (e.g., BLE communication). The station apparatus 200 may detect that the cordless vacuum cleaner 100 is docked, based on the information received from the cleaner body 1000.

[0272] In operation S2520, the cordless vacuum cleaner 100 in an embodiment of the disclosure may transmit, to the station apparatus 200, information about the suction power decrease amount of the cordless vacuum cleaner 100 and information about the mainly used cleaning mode, after being docked to the station apparatus 200.

[0273] In an embodiment of the disclosure, the cordless vacuum cleaner 100 may be communicably connected to the station apparatus 200 when docked to the station apparatus 200. In an embodiment, the cordless vacuum cleaner 100 and the station apparatus 200 may establish an NFC channel (e.g., a BLE communication channel), for example.

[0274] In an embodiment of the disclosure, the cordless vacuum cleaner 100 may transmit, to the station apparatus 200, the information about the suction power decrease amount of the cordless vacuum cleaner 100 and the information about the mainly used cleaning mode, through the NFC channel. The mainly used cleaning mode may denote a cleaning mode mostly used in the cordless vacuum cleaner 100. In an embodiment, when the user used the cordless vacuum cleaner 100 in the power suction mode for 15 minutes and in the medium suction mode for 5 minutes from among total 20 minutes of cleaning time, the mainly used cleaning mode may be the power suction mode, for example.

[0275] In operation S2530, the station apparatus 200 in an embodiment of the disclosure may compare the suction power decrease amount of the cordless vacuum cleaner 100 with a threshold suction power decrease amount corresponding to the mainly used cleaning mode.

[0276] In an embodiment of the disclosure, a threshold suction power decrease amount may be defined differently for each cleaning mode of the cordless vacuum cleaner 100. Referring to FIG. 26, a threshold suction power decrease amount corresponding to the power suction mode may be 5 %, a threshold suction power decrease amount corresponding to the medium suction mode may be 30 %, and a threshold suction power decrease amount corresponding to the weak suction mode may be 50 %. The numerical values in FIG. 26 are only examples and thus are not limited thereto.

[0277] Accordingly, when the mainly used cleaning mode of the cordless vacuum cleaner 100 is the power suction mode, the station apparatus 200 may determine whether the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than 5 %. When the mainly used cleaning mode of the cordless vacuum cleaner 100 is the medium suction mode, the station apparatus 200 may determine whether the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than 30 %. When the mainly used cleaning mode of the cordless vacuum cleaner 100 is the weak suction mode, the station apparatus 200 may determine whether the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than 50 %.

[0278] When the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the threshold suction power decrease amount corresponding to the mainly used cleaning mode (Yes in operation S2530, the station apparatus 200 in an embodiment of the disclosure may perform the dust discharging operation, based on a discharging operation condition corresponding to the mainly used cleaning mode, in operation S2540.

[0279] In an embodiment of the disclosure, a discharging operation condition may be defined differently for each cleaning mode of the cordless vacuum cleaner 100. Referring to FIG. 26, a first discharging operation condition corresponding to the power suction mode may be "discharge strength: 100 %, power consumption: 1400 W, discharge duration time: 30 seconds", a second discharging operation condition corresponding to the medium suction mode may be "discharge strength: 85 %, power consumption: 1190 W, discharge duration time: 20 seconds", and a third discharging operation condition corresponding to the weak suction mode may be "discharge strength: 70 %, power consumption: 980 W, discharge duration time: 10 seconds".

[0280] Accordingly, when the mainly used cleaning mode of the cordless vacuum cleaner 100 is the power suction mode and the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than 5 %, the station apparatus 200 may perform the dust discharging operation by driving the suction motor 207 according to the first discharging operation condition (discharge strength: 100 %, power consumption: 1400 W, discharge duration time: 30 seconds). When the mainly used cleaning mode of the cordless vacuum cleaner 100 is the medium suction mode and the

suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than 30 %, the station apparatus 200 may perform the dust discharging operation by driving the suction motor 207 according to the second discharging operation condition (discharge strength: 85 %, power consumption: 1190 W, discharge duration time: 20 seconds). When the mainly used cleaning mode of the cordless vacuum cleaner 100 is the weak suction mode and the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than 50 %, the station apparatus 200 may perform the dust discharging operation by driving the suction motor 207 according to the third discharging operation condition (discharge strength: 70 %, power consumption: 980 W, discharge duration time: 10 seconds).

[0281] In an embodiment of the disclosure, the station apparatus 200 may perform the dust discharging operation according to a pattern of the user using the cordless vacuum cleaner 100, by determining whether to perform the dust discharging operation and determining the discharging operation condition, in association with the mainly used cleaning mode of the cordless vacuum cleaner 100. In an embodiment, in a cleaning environment that desires relatively strong suction power or when the user prefers the power suction mode, even a slight suction power decrease needs to be immediately processed, for example, and thus the station apparatus 200 may perform the dust discharging operation even when there is less suction power decrease amount. In an environment where cleaning is relatively easy or when the user prefers energy saving, relatively low noise, or a relatively long usage duration of time rather than relatively strong suction power, the station apparatus 200 may allow a slight suction power decrease and set a dust discharge cycle to be relatively long.

[0282] In an embodiment of the disclosure, provided is the station apparatus 200 that suitably maintains the cleaning performance of the cordless vacuum cleaner 100 while reducing the amount of energy used according to dust discharge, by adaptively determining whether to perform the dust discharging operation, based on a degree of the suction power decrease of the cordless vacuum cleaner 100.

[0283] In an embodiment of the disclosure, provided is the station apparatus 200 that performs the dust discharging operation according to a pattern of the user using the cordless vacuum cleaner 100, by determining whether to perform the dust discharging operation and determining the discharge strength, in association with the mainly used cleaning mode of the cordless vacuum cleaner 100.

[0284] In an embodiment of the disclosure, provided is the station apparatus 200 that reflects an intention (preference) of the user and increases convenience of the user by performing the dust discharging operation according to the discharge timing, the discharge strength, or the discharge duration time selected by the user.

[0285] The station apparatus 200 in an embodiment of the disclosure may include the communication interface 201 for communicating with the cordless vacuum cleaner 100, the suction motor 207 configured to generate suction power for sucking up dust from the dust container 1200 included in the cordless vacuum cleaner 100, the collecting portion 209 for collecting the dust of the dust container 1200, the memory 202 storing information about a pre-set threshold suction power decrease amount, and the at least one processor 203. The at least one processor 203 may be configured to receive information about a suction power decrease amount of the cordless vacuum cleaner 100 from the cordless vacuum cleaner 100 through the communication interface 201. The at least one processor 203 may be further configured to, when it is identified that the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount, based on the received information about the suction power decrease amount, perform a dust discharging operation of discharging the dust from the dust container 1200 to the collecting portion 209 by driving the suction motor 207.

[0286] The suction power decrease amount of the cordless vacuum cleaner 100 may be obtained based on a sensor measurement value measured using the flow sensor or the pressure sensor 1400 of the cordless vacuum cleaner 100.

[0287] The suction power decrease amount of the cordless vacuum cleaner 100 may be obtained based on the sensor measurement value measured using the flow sensor or the pressure sensor 1400 of the cordless vacuum cleaner 100 when the brush device 2000 connected to the cordless vacuum cleaner 100 is in a lifted state from a surface to be cleaned.

[0288] The lifted state may include at least one of the state in which the brush device 2000 is lifted from the surface to be cleaned by a predetermined height or more during the cleaning operation or the state in which the cordless vacuum cleaner 100 is docked to the station apparatus 200.

[0289] The at least one processor 203 may be further configured to receive the user input of selecting the smart discharge mode in which whether to perform the dust discharging operation is determined based on the suction power decrease amount of the cordless vacuum cleaner 100. The at least one processor 203 may be further configured to set the discharge mode of the station apparatus 200 to the smart discharge mode, based on the received user input.

[0290] The at least one processor 203 may be further configured to perform the dust discharging operation when it is identified that the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount in the smart discharge mode.

[0291] The at least one processor 203 may be further configured to receive the information about the pre-set threshold suction power decrease amount, which is set by the user, from the server device 300 or the cordless vacuum cleaner 100.

[0292] The at least one processor 203 may be further configured to receive the user input of selecting one operating mode from among the plurality of operating modes of the station apparatus 200. The at least one processor 203 may be

further configured to select a decrease amount corresponding to the selected operating mode as the pre-set threshold suction power decrease amount.

[0293] The at least one processor 203 may be further configured to obtain the user setting information about at least one of the discharge strength or the discharge duration time. The at least one processor 203 may be further configured to control the power consumption of the suction motor 207 or the operating time of the suction motor 207 while the dust discharging operation is being performed, based on the user setting information.

[0294] The at least one processor 203 may be further configured to obtain the information related to the discharge timing condition set by the user. The at least one processor 203 may be further configured to compare the suction power decrease amount of the cordless vacuum cleaner 100 with the pre-set threshold suction power decrease amount when the discharge timing condition set by the user is satisfied. The at least one processor 203 may be further configured to perform the dust discharging operation by driving the suction motor 207 when the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount as the result of the comparing.

[0295] The information related to the discharge timing condition set by the user may include at least one of a discharge cycle, a discharge duration time, an accumulated operating duration time of the cordless vacuum cleaner 100, or an accumulated number of operations of the cordless vacuum cleaner 100.

[0296] The at least one processor 203 may be further configured to receive the information about the mainly used cleaning mode of the cordless vacuum cleaner 100 from the cordless vacuum cleaner 100. The at least one processor 203 may be further configured to determine at least one of the pre-set threshold suction power decrease amount, the discharge strength, or the discharge duration time, based on the mainly used cleaning mode of the cordless vacuum cleaner 100.

[0297] The at least one processor 203 may be further configured to perform the dust discharging operation by controlling the first step motor to open the door of the dust container 1200, when the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount.

[0298] The at least one processor 203 may be further configured to control the second step motor to close the door of the dust container 1200 when the performing of the dust discharging operation is completed.

[0299] The at least one processor 203 may be further configured to perform the dust discharging operation by controlling the suction motor 207 according to the discharge strength or discharge duration time set by the user, when the input of pressing the dust discharge button for the first time is detected. The at least one processor 203 may be further configured to perform the dust discharging operation by controlling the suction motor 207 according to the default discharge strength or the default discharge duration time, when the input of pressing the dust discharge button for the second time different from the first time is detected.

[0300] An operating method of the station apparatus 200, according to the disclosure, includes receiving the information about the suction power decrease amount of the cordless vacuum cleaner 100 from the cordless vacuum cleaner 100 through the communication interface 201 (operation S840), comparing the suction power decrease amount of the cordless vacuum cleaner 100 with the pre-set threshold suction power decrease amount, based on the received information about the suction power decrease amount (operation S850), and performing the dust discharging operation of discharging dust from the dust container 1200 of the cordless vacuum cleaner 100 to the collecting portion 209 of the station apparatus 200 by driving the suction motor 207, when it is identified that the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount, based on a result of the comparing (operation S860).

[0301] The suction power decrease amount of the cordless vacuum cleaner 100 may be obtained based on the sensor measurement value measured using the flow sensor or the pressure sensor 1400 of the cordless vacuum cleaner 100 when the brush device 2000 connected to the cordless vacuum cleaner 100 is in a lifted state from a floor surface.

[0302] The performing of the dust discharging operation may include receiving the user input of selecting the smart discharge mode in which whether to perform the dust discharging operation is determined based on the suction power decrease amount of the cordless vacuum cleaner 100, setting a discharge mode of the station apparatus 200 to the smart discharge mode, based on the received user input, and performing the dust discharging operation when it is identified that the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount in the smart discharge mode.

[0303] The operating method may further include receiving the information about the pre-set threshold suction power decrease amount, which is set by the user, from the server device 300 or the cordless vacuum cleaner 100, and storing the information about the pre-set threshold suction power decrease amount in the memory 202 of the station apparatus 200.

[0304] The performing of the dust discharging operation may further include obtaining the user setting information about at least one of the discharge strength or the discharge duration time, and controlling the power consumption of the suction motor 207 or the operating time of the suction motor 207 while the dust discharging operation is being performed, based on the user setting information.

[0305] The performing of the dust discharging operation may further include obtaining the information related to the discharge timing condition set by the user, comparing the suction power decrease amount of the cordless vacuum cleaner 100 with the pre-set threshold suction power decrease amount when the discharge timing condition set by the user is

satisfied, and performing the dust discharging operation by driving the suction motor 207 when the suction power decrease amount of the cordless vacuum cleaner 100 is equal to or greater than the pre-set threshold suction power decrease amount as the result of the comparing.

[0306] A machine-readable storage medium may be provided in the form of a non-transitory storage medium. Here, the "non-transitory storage medium" only denotes a tangible device and does not include or consist of a signal (e.g., electromagnetic waves). This term does not distinguish a case where data is stored in the storage medium semi-permanently and a case where the data is stored in the storage medium temporarily. In an embodiment, the "non-transitory storage medium" may include a buffer where data is temporarily stored, for example.

[0307] In an embodiment of the disclosure, a method according to various embodiments of the disclosure in the specification may be provided by being included in a computer program product. The computer program products are products that may be traded between sellers and buyers. The computer program product may be distributed in the form of a machine-readable storage medium (e.g., a compact disc read-only memory (CD-ROM) or a universal serial bus (USB) flash drive), or may be distributed (e.g., downloaded or uploaded) online through an application store or directly between two user devices (e.g., smart phones). In the case of online distribution, at least a part of the computer program product (e.g., a downloadable application) may be at least temporarily generated or temporarily stored in a machine-readable storage medium, such as a server of a manufacturer, a server of an application store, or a memory of a relay server.

Claims

1. A station apparatus (200) for discharging dust from a cordless vacuum cleaner including a dust container (100), the station apparatus (200) comprising:

   a communication interface (201) configured to communicate with the cordless vacuum cleaner (100);
   a suction motor (207) configured to generate suction power for sucking up the dust from the dust container (1200) included in the cordless vacuum cleaner (100);
   a collecting portion (209) through which the dust from the dust container (1200) is collected;
   a memory (202) which stores information about a pre-set threshold suction power decrease amount; and
   at least one processor (203),
   wherein the at least one processor (203) is configured to:

      receive information about a suction power decrease amount of the cordless vacuum cleaner (100) from the cordless vacuum cleaner (100) through the communication interface (201); and
      when it is identified that the suction power decrease amount of the cordless vacuum cleaner (100) is equal to or greater than the pre-set threshold suction power decrease amount, based on the received information about the suction power decrease amount, perform a dust discharging operation of discharging the dust from the dust container (1200) to the collecting portion (209) by driving the suction motor (207).

2. The station apparatus (200) of claim 1, wherein the suction power decrease amount of the cordless vacuum cleaner (100) is obtained based on a sensor measurement value measured using a flow sensor or a pressure sensor (1400) of the cordless vacuum cleaner (100).

3. The station apparatus (200) of claim 2, wherein the suction power decrease amount of the cordless vacuum cleaner (100) is obtained based on the sensor measurement value measured using the flow sensor or the pressure sensor (1400) of the cordless vacuum cleaner (100) when a brush device (2000) connected to the cordless vacuum cleaner (100) is in a lifted state from a surface to be cleaned.

4. The station apparatus (200) of claim 3, wherein the lifted state comprises at least one of a state in which the brush device (2000) is lifted from the surface to be cleaned by a predetermined height or more during a cleaning operation or a state in which the cordless vacuum cleaner (100) is docked to the station apparatus (200).

5. The station apparatus (200) of any one of claims 1 to 4, wherein the at least one processor (203) is further configured to:

   receive a user input of selecting a smart discharge mode in which whether to perform the dust discharging operation is determined based on the suction power decrease amount of the cordless vacuum cleaner (100);
   set a discharge mode of the station apparatus (200) to the smart discharge mode, based on the received user input; and

perform the dust discharging operation when it is identified that the suction power decrease amount of the cordless vacuum cleaner (100) is equal to or greater than the pre-set threshold suction power decrease amount in the smart discharge mode.

6. The station apparatus (200) of any one of claims 1 to 5, wherein the at least one processor (203) is further configured to receive the information about the pre-set threshold suction power decrease amount, which is set by a user, from a server device (300) or the cordless vacuum cleaner (100).

7. The station apparatus (200) of any one of claims 1 to 6, wherein the at least one processor (203) is further configured to:

receive a user input of selecting one operating mode from among a plurality of operating modes of the station apparatus (200); and
select a decrease amount corresponding to the selected operating mode as the pre-set threshold suction power decrease amount.

8. The station apparatus (200) of any one of claims 1 to 7, wherein the at least one processor (203) is further configured to:

obtain user setting information about at least one of a discharge strength or a discharge duration time; and
control power consumption of the suction motor (207) or an operating time of the suction motor (207) while the dust discharging operation is being performed, based on the user setting information.

9. The station apparatus (200) of any one of claims 1 to 8, wherein the at least one processor (203) is further configured to:

obtain information related to a discharge timing condition set by a user;
compare the suction power decrease amount of the cordless vacuum cleaner (100) with the pre-set threshold suction power decrease amount when the discharge timing condition set by the user is satisfied; and
perform the dust discharging operation by driving the suction motor (207) when the suction power decrease amount of the cordless vacuum cleaner (100) is equal to or greater than the pre-set threshold suction power decrease amount as a result of the comparing.

10. The station apparatus (200) of claim 9, wherein the information related to the discharge timing condition set by the user comprises at least one of a discharge cycle, a discharge duration time, an accumulated operating duration time of the cordless vacuum cleaner (100), or an accumulated number of operations of the cordless vacuum cleaner (100).

11. The station apparatus (200) of any one of claims 1 to 10, wherein the at least one processor (203) is further configured to:

receive information about a mainly used cleaning mode of the cordless vacuum cleaner (100) from the cordless vacuum cleaner (100); and
determine at least one of the pre-set threshold suction power decrease amount, a discharge strength, or a discharge duration time, based on the mainly used cleaning mode of the cordless vacuum cleaner (100).

12. The station apparatus (200) of any one of claims 1 to 11, wherein the at least one processor (203) is further configured to:

perform the dust discharging operation by controlling a first step motor to open a door of the dust container (1200), when the suction power decrease amount of the cordless vacuum cleaner (100) is equal to or greater than the pre-set threshold suction power decrease amount; and
control a second step motor to close the door of the dust container (1200) when the performing of the dust discharging operation is completed.

13. The station apparatus (200) of any one of claims 1 to 12, wherein the at least one processor (203) is further configured to:

perform the dust discharging operation by controlling the suction motor (207) according to a discharge strength or

a discharge duration time set by a user, when an input of pressing a dust discharge button for a first time is detected; and

perform the dust discharging operation by controlling the suction motor (207) according to a default discharge strength or a default discharge duration time, when an input of pressing the dust discharge button for a second time different from the first time is detected.

14. An operating method of a station apparatus (200) for discharging dust from a cordless vacuum cleaner including a dust container (100), the operating method comprising:

receiving information about a suction power decrease amount of the cordless vacuum cleaner (100) from the cordless vacuum cleaner (100) through a communication interface (201) of the station apparatus (200) (S840);

comparing the suction power decrease amount of the cordless vacuum cleaner (100) with a pre-set threshold suction power decrease amount, based on the received information about the suction power decrease amount (S850); and

performing a dust discharging operation of discharging the dust from the dust container (1200) of the cordless vacuum cleaner (100) to a collecting portion (209) of the station apparatus (200) by driving a suction motor (207) of the station apparatus (200), when it is identified that the suction power decrease amount of the cordless vacuum cleaner (100) is equal to or greater than the pre-set threshold suction power decrease amount, based on a result of the comparing (S860).

15. The operating method of claim 14, wherein the suction power decrease amount of the cordless vacuum cleaner (100) is obtained based on a sensor measurement value measured using a flow sensor or a pressure sensor (1400) of the cordless vacuum cleaner (100) when a brush device (2000) connected to the cordless vacuum cleaner (100) is in a lifted state from a floor surface.

FIG. 1

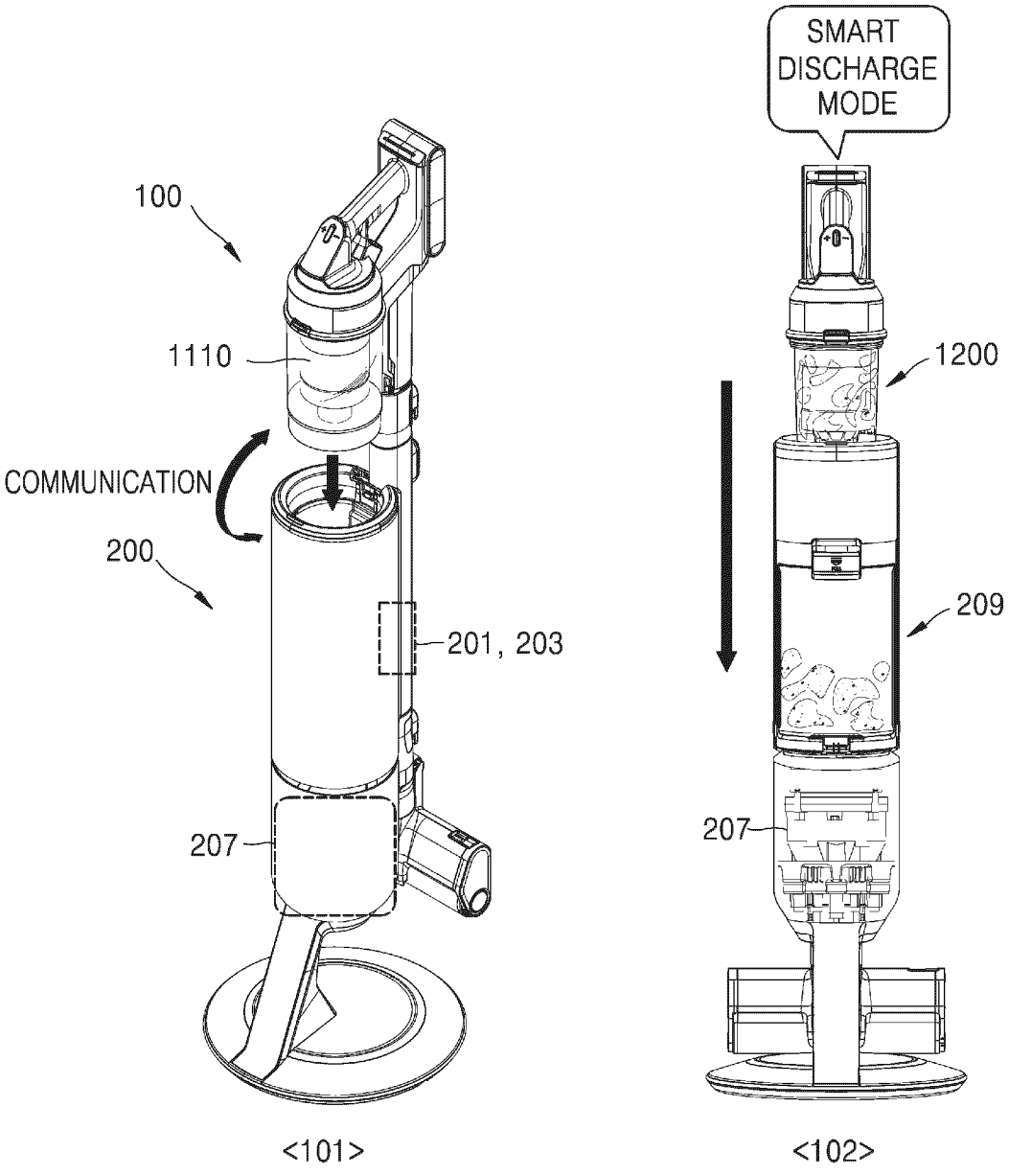

100
1110
COMMUNICATION
200
201, 203
207
<101>
SMART DISCHARGE MODE
1200
209
207
<102>

FIG. 2

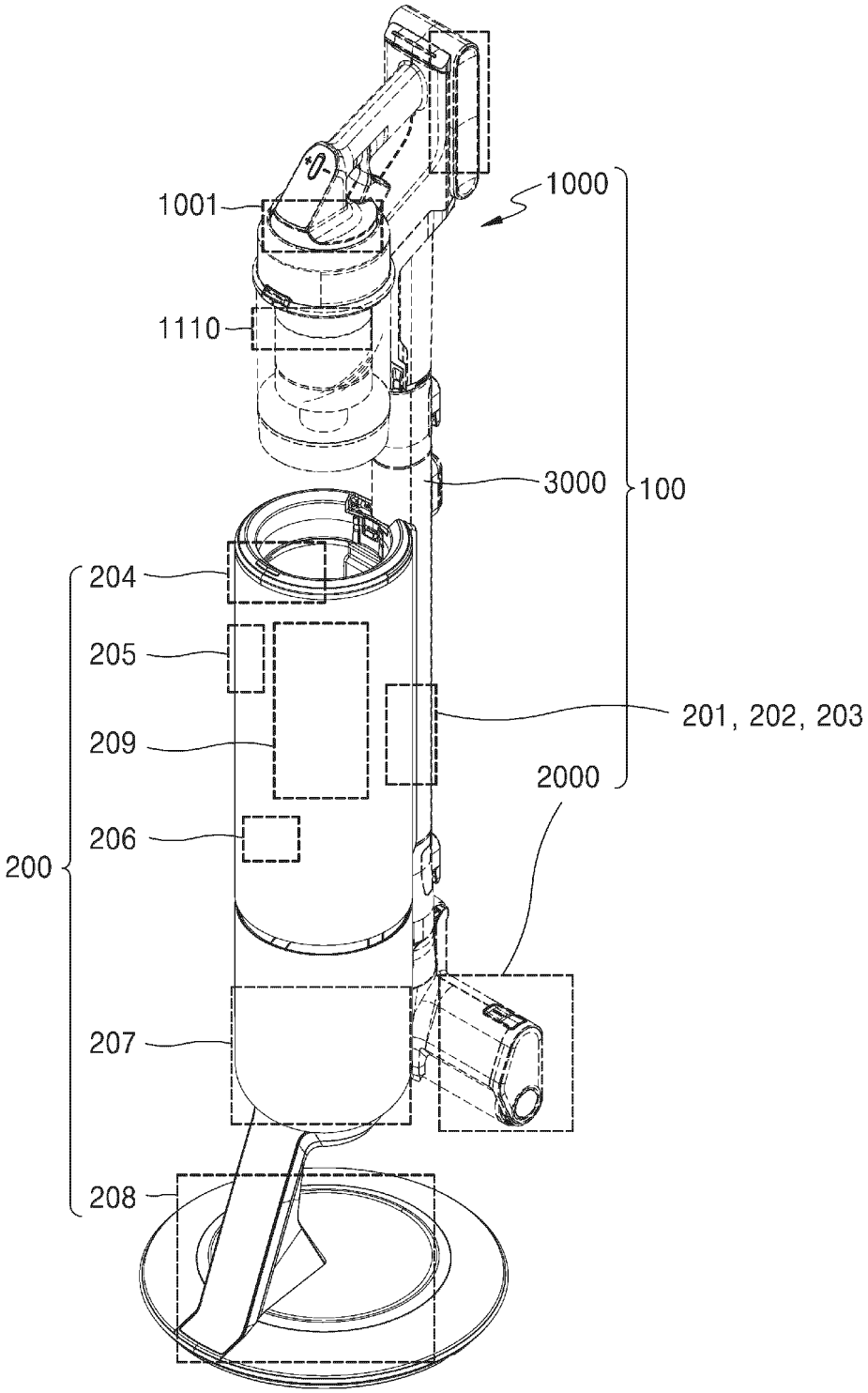

1001
1000
1110
3000
100
204
205
201, 202, 203
209
2000
206
200
207
208

FIG. 3

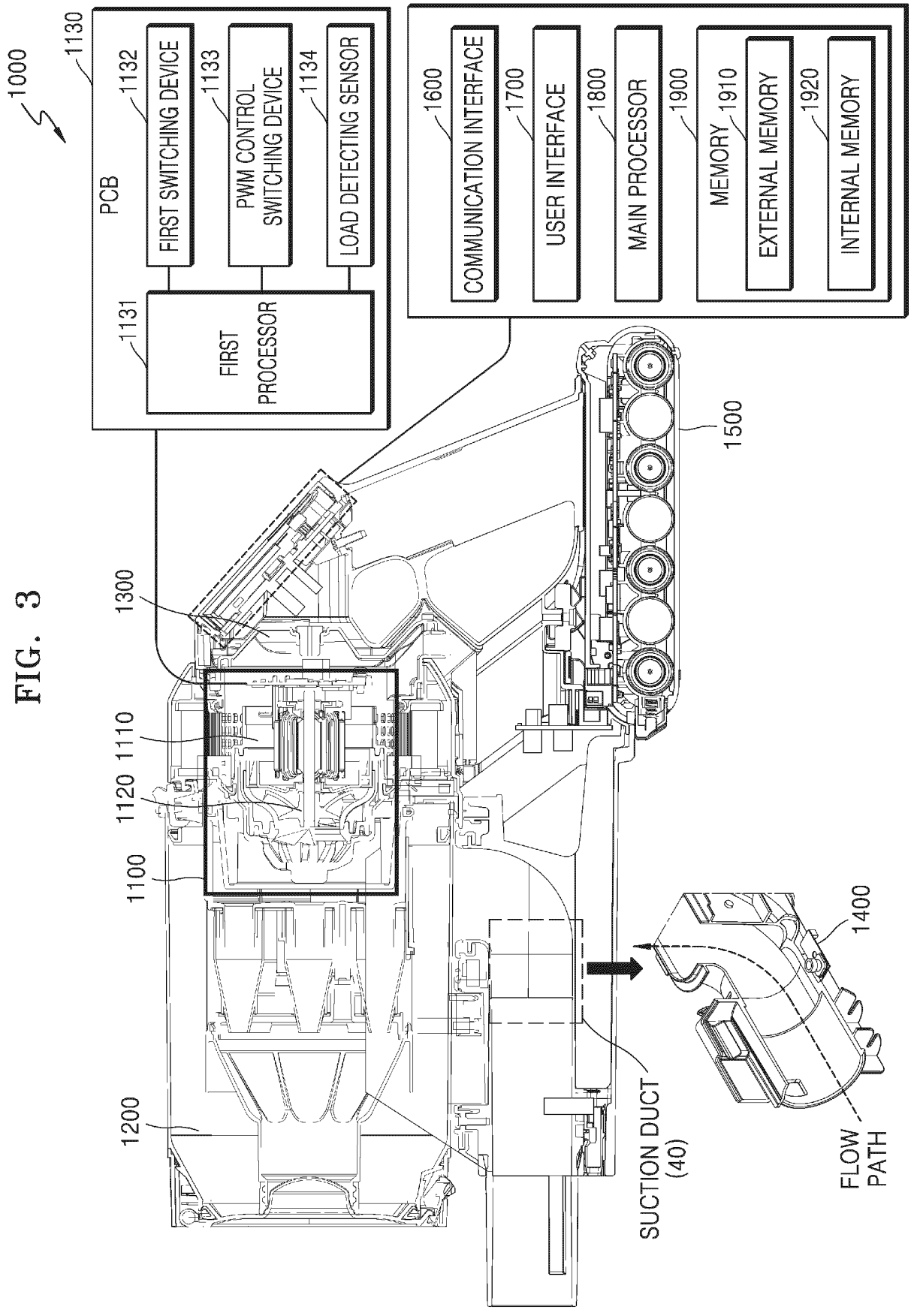

1000
1130
PCB
1131
FIRST PROCESSOR
1132
FIRST SWITCHING DEVICE
1133
PWM CONTROL SWITCHING DEVICE
1134
LOAD DETECTING SENSOR
1600
COMMUNICATION INTERFACE
1700
USER INTERFACE
1800
MAIN PROCESSOR
1900
MEMORY
1910
EXTERNAL MEMORY
1920
INTERNAL MEMORY
1500
1300
1120
1110
1100
1200
1400
SUCTION DUCT (40)
FLOW PATH

FIG. 4

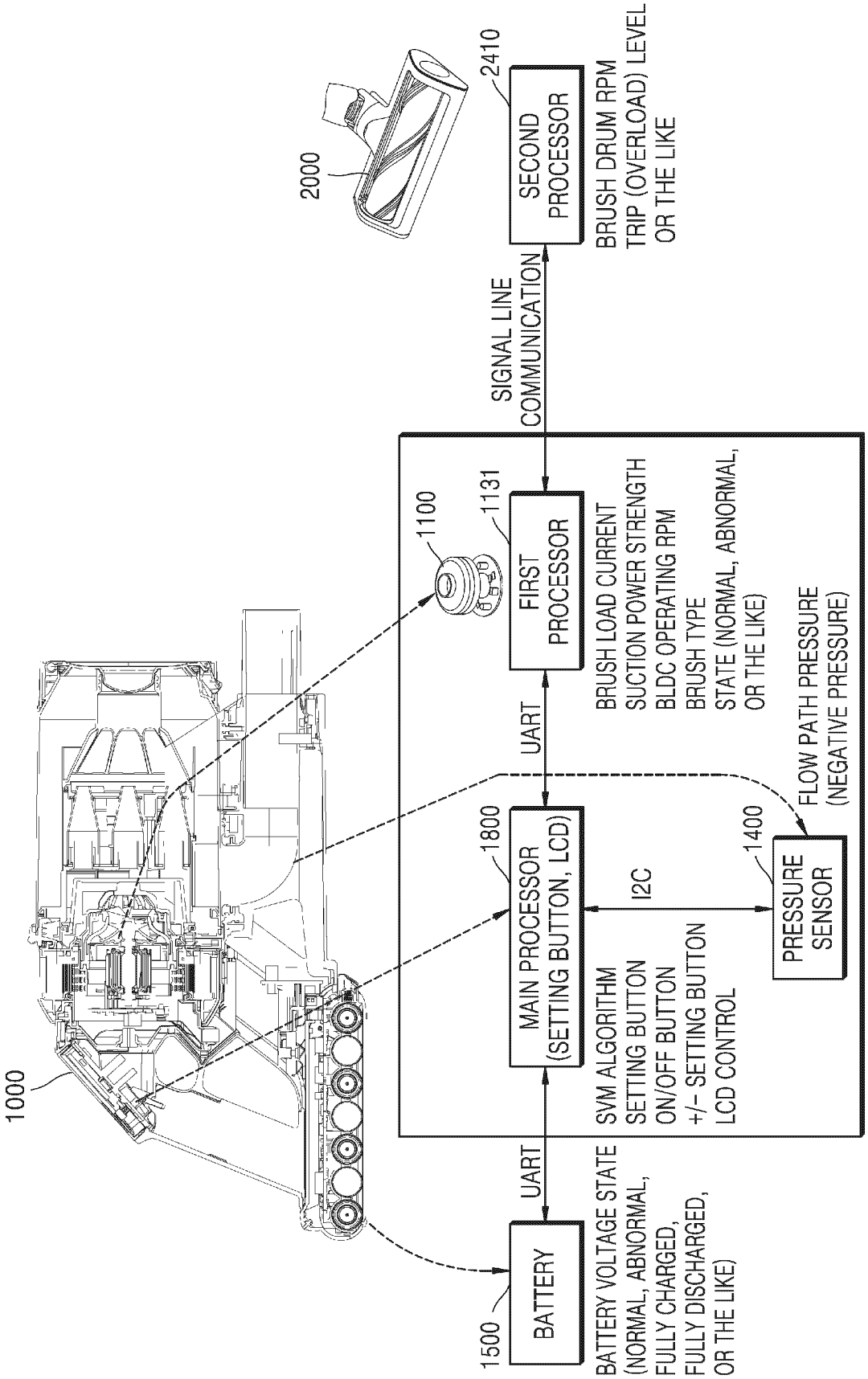

1000
2000
2410
SECOND PROCESSOR
BRUSH DRUM RPM
TRIP (OVERLOAD) LEVEL
OR THE LIKE
SIGNAL LINE COMMUNICATION
1100
1131
FIRST PROCESSOR
BRUSH LOAD CURRENT
SUCTION POWER STRENGTH
BLDC OPERATING RPM
BRUSH TYPE
STATE (NORMAL, ABNORMAL,
OR THE LIKE)
UART
1800
MAIN PROCESSOR
(SETTING BUTTON, LCD)
SVM ALGORITHM
SETTING BUTTON
ON/OFF BUTTON
+/- SETTING BUTTON
LCD CONTROL
I2C
1400
PRESSURE SENSOR
FLOW PATH PRESSURE
(NEGATIVE PRESSURE)
UART
1500
BATTERY
BATTERY VOLTAGE STATE
(NORMAL, ABNORMAL,
FULLY CHARGED,
FULLY DISCHARGED,
OR THE LIKE)

FIG. 5

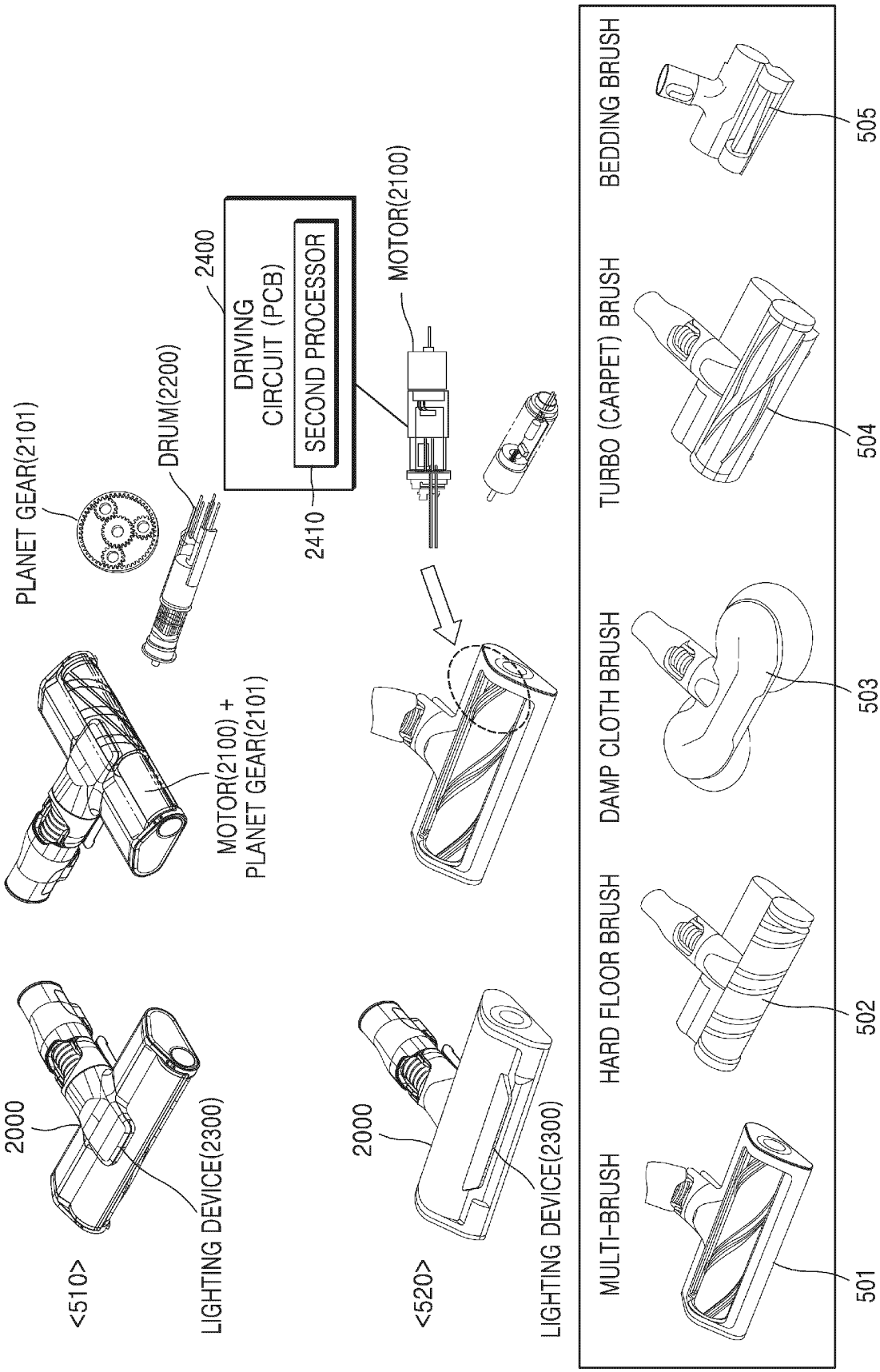

PLANET GEAR(2101)
DRUM(2200)
2400
DRIVING CIRCUIT (PCB)
SECOND PROCESSOR
2410
MOTOR(2100)
MOTOR(2100) + PLANET GEAR(2101)
2000
LIGHTING DEVICE(2300)
<510>
2000
LIGHTING DEVICE(2300)
<520>
MULTI-BRUSH
HARD FLOOR BRUSH
DAMP CLOTH BRUSH
TURBO (CARPET) BRUSH
BEDDING BRUSH
501
502
503
504
505

FIG. 6

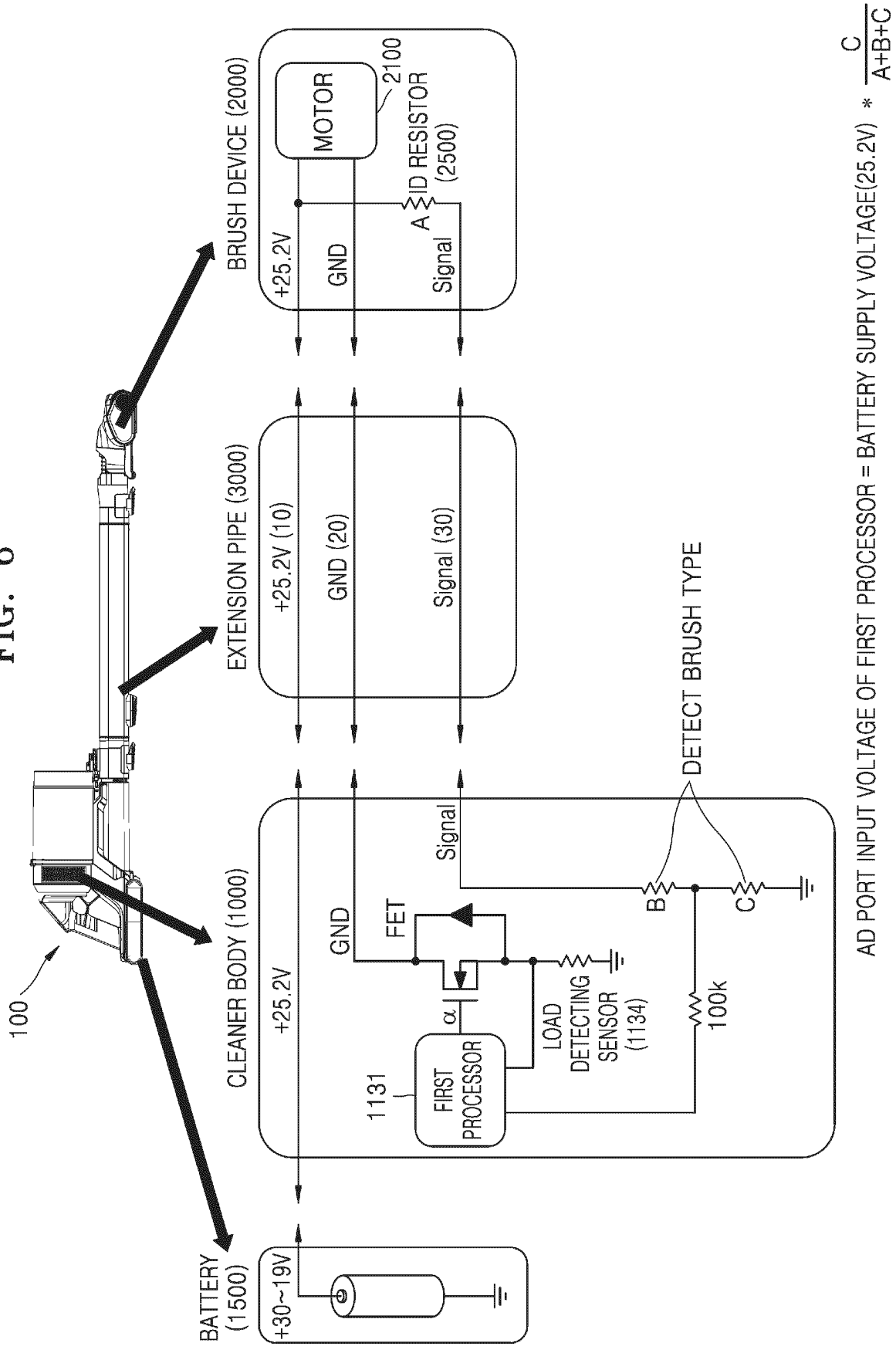

100
BRUSH DEVICE (2000)
MOTOR
2100
ID RESISTOR (2500)
A
+25.2V
GND
Signal
EXTENSION PIPE (3000)
+25.2V (10)
GND (20)
Signal (30)
CLEANER BODY (1000)
+25.2V
GND
Signal
FET
α
1131
FIRST PROCESSOR
LOAD DETECTING SENSOR (1134)
100k
B
C
DETECT BRUSH TYPE
BATTERY (1500)
+30~19V
AD PORT INPUT VOLTAGE OF FIRST PROCESSOR = BATTERY SUPPLY VOLTAGE(25.2V) * C/(A+B+C)

FIG. 7

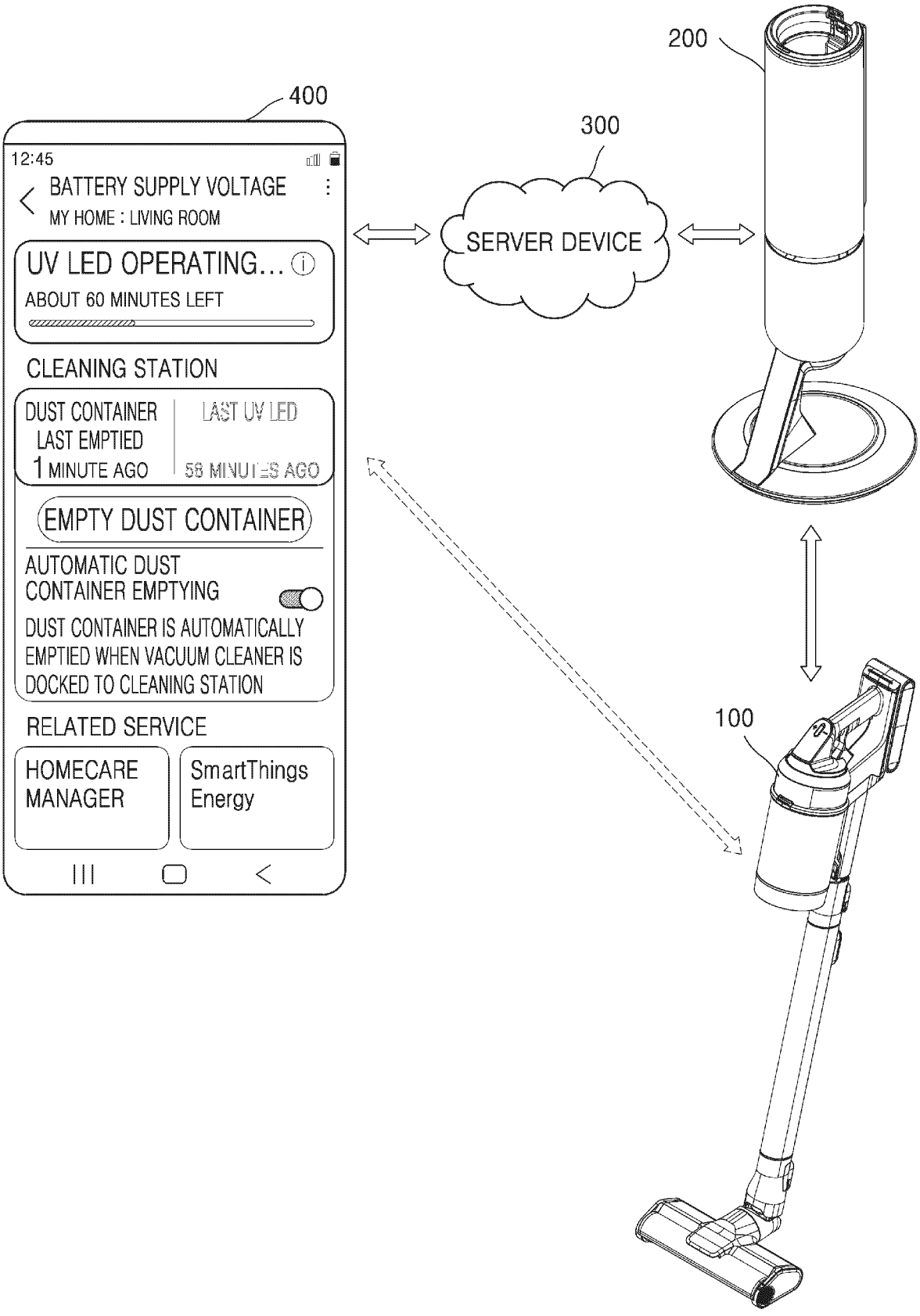

400
12:45
BATTERY SUPPLY VOLTAGE
MY HOME : LIVING ROOM
UV LED OPERATING...
ABOUT 60 MINUTES LEFT
CLEANING STATION
DUST CONTAINER LAST EMPTIED
1 MINUTE AGO
LAST UV LED
58 MINUTES AGO
EMPTY DUST CONTAINER
AUTOMATIC DUST CONTAINER EMPTYING
DUST CONTAINER IS AUTOMATICALLY EMPTIED WHEN VACUUM CLEANER IS DOCKED TO CLEANING STATION
RELATED SERVICE
HOMECARE MANAGER
SmartThings Energy
300
SERVER DEVICE
200
100

FIG. 8

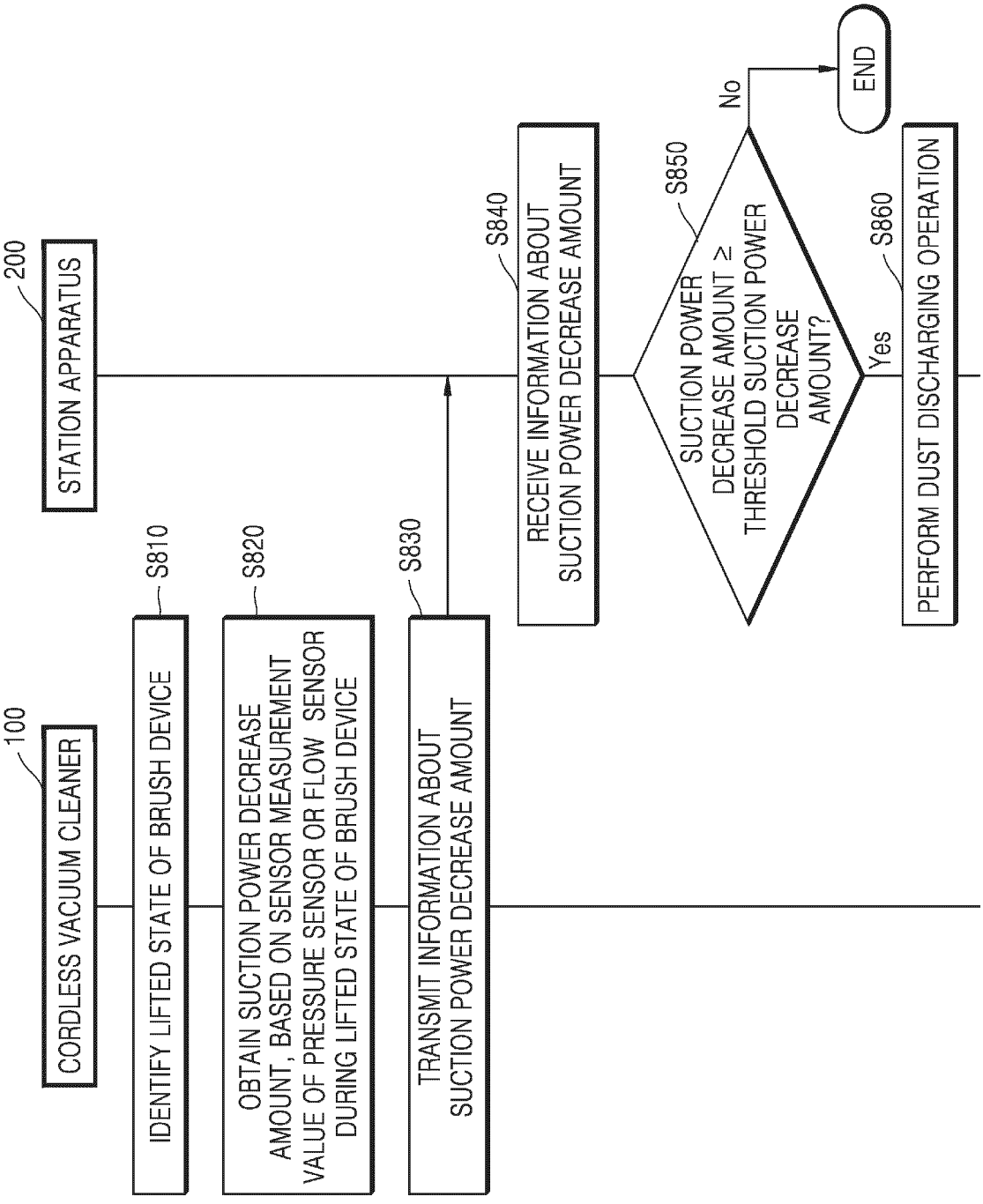

100
CORDLESS VACUUM CLEANER
200
STATION APPARATUS
S810
IDENTIFY LIFTED STATE OF BRUSH DEVICE
S820
OBTAIN SUCTION POWER DECREASE AMOUNT, BASED ON SENSOR MEASUREMENT VALUE OF PRESSURE SENSOR OR FLOW SENSOR DURING LIFTED STATE OF BRUSH DEVICE
S830
TRANSMIT INFORMATION ABOUT SUCTION POWER DECREASE AMOUNT
S840
RECEIVE INFORMATION ABOUT SUCTION POWER DECREASE AMOUNT
S850
SUCTION POWER DECREASE AMOUNT ≥ THRESHOLD SUCTION POWER DECREASE AMOUNT?
No
END
Yes
S860
PERFORM DUST DISCHARGING OPERATION

FIG. 9

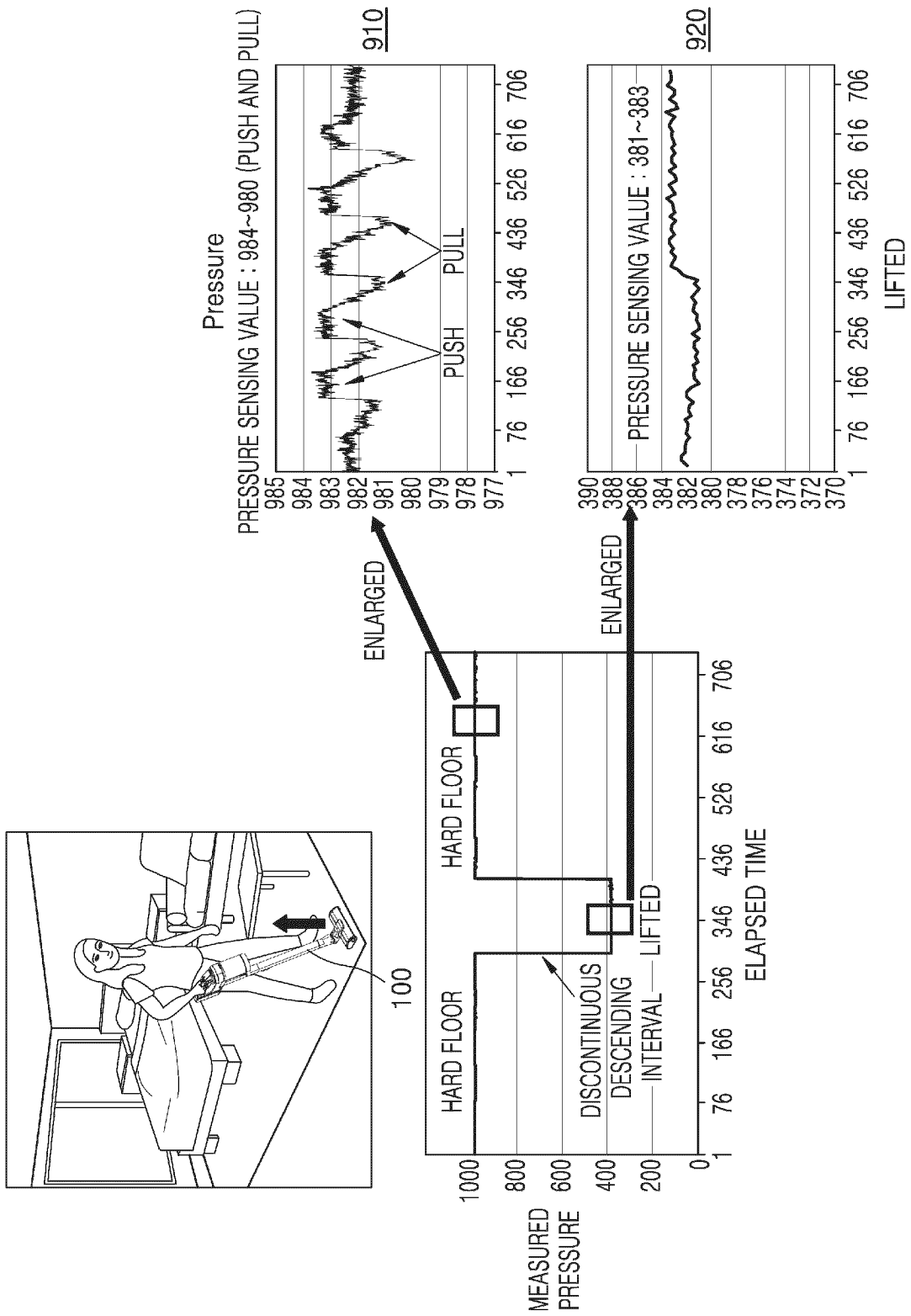

100
HARD FLOOR
HARD FLOOR
DISCONTINUOUS
DESCENDING
INTERVAL
LIFTED
MEASURED PRESSURE
ELAPSED TIME
ENLARGED
ENLARGED
Pressure
PRESSURE SENSING VALUE : 984~980 (PUSH AND PULL)
PUSH
PULL
910
PRESSURE SENSING VALUE : 381~383
920
LIFTED

FIG. 10

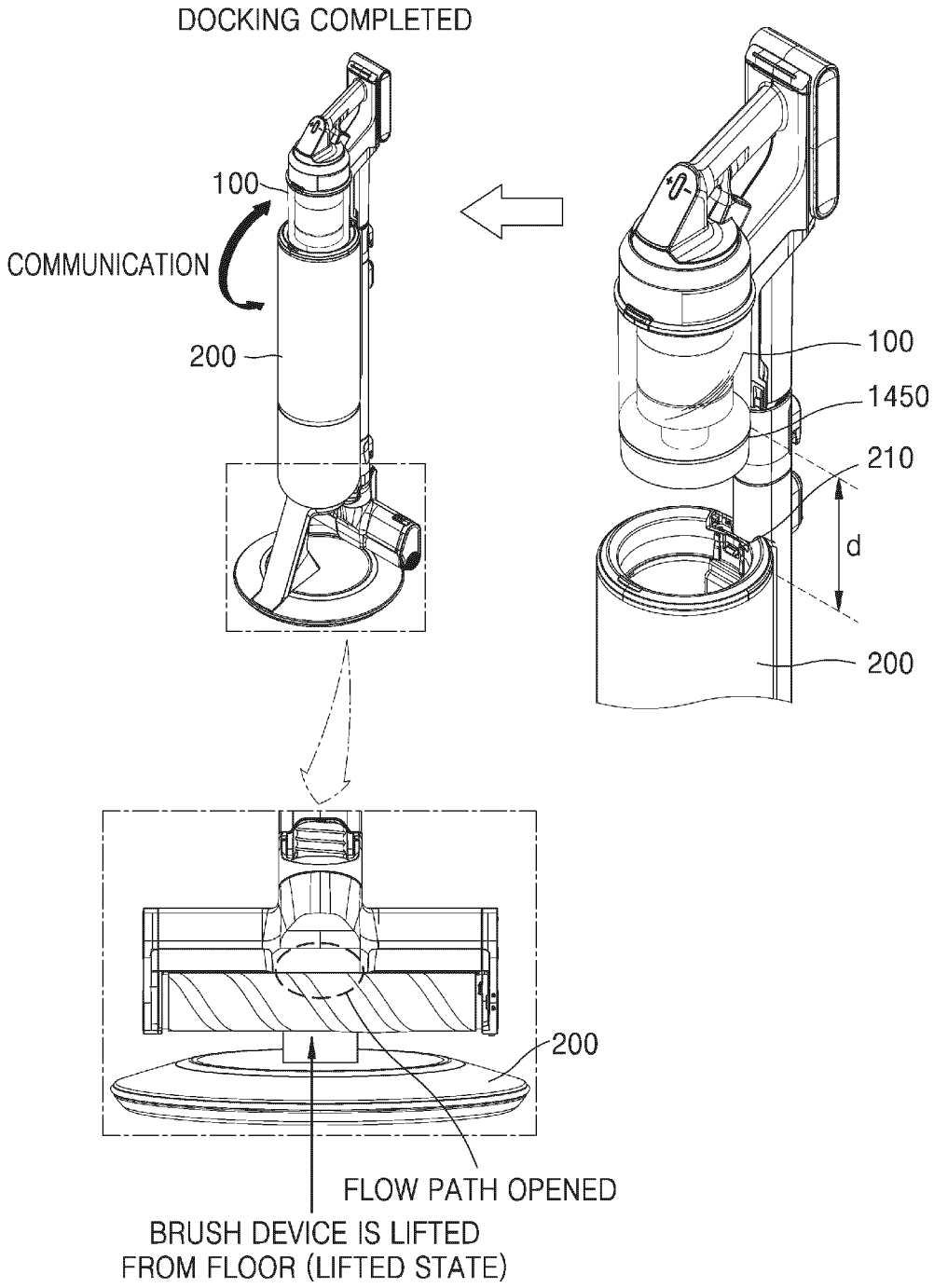
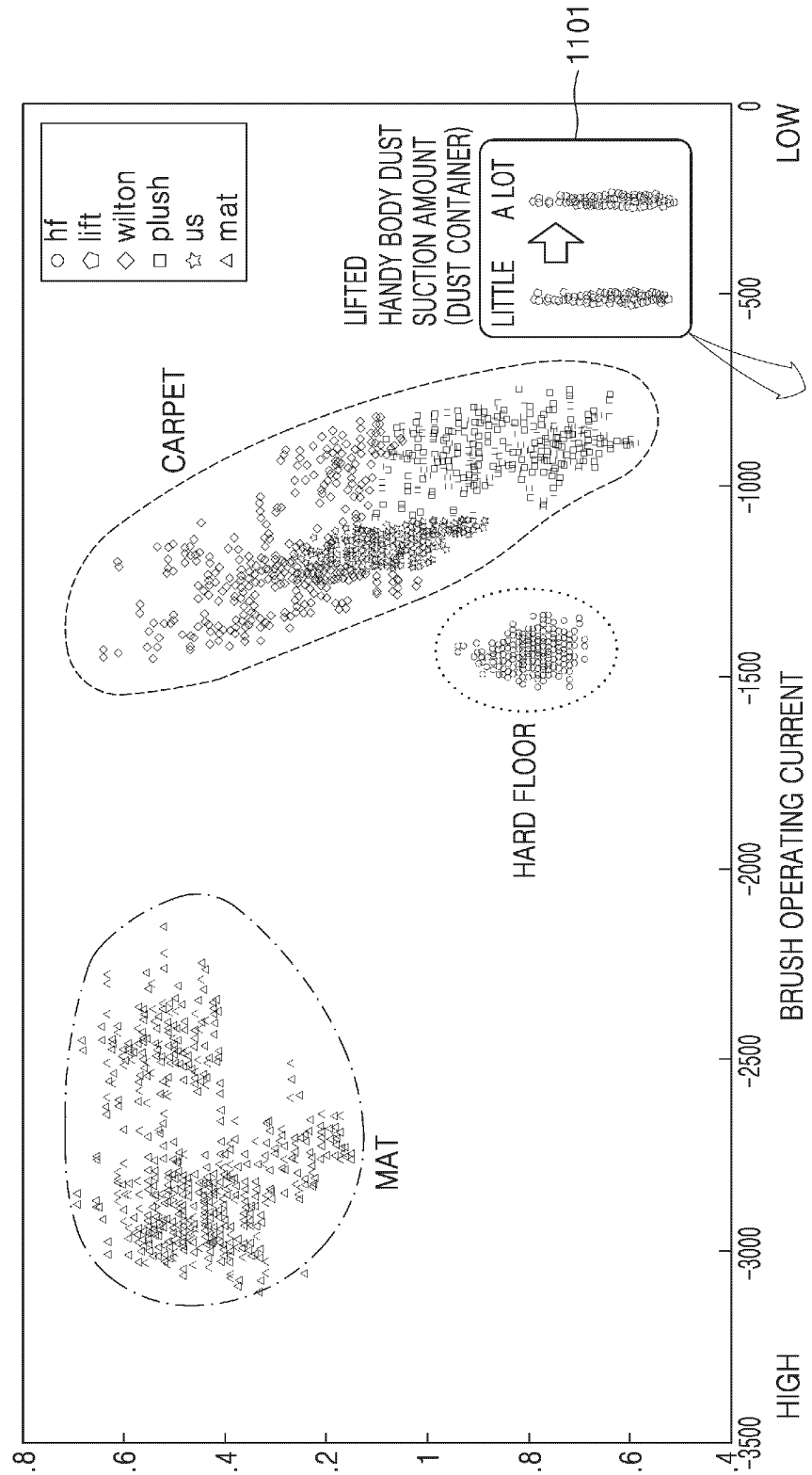

DOCKING COMPLETED
100
COMMUNICATION
200
100
1450
210
d
200
200
FLOW PATH OPENED
BRUSH DEVICE IS LIFTED
FROM FLOOR (LIFTED STATE)

FIG. 11



PRESSURE VALUE(Pa)	SUCTION POWER DECREASE AMOUNT(%)
500	0
475	5%
450	10%
350	30%
250	50%

1102

FIG. 12

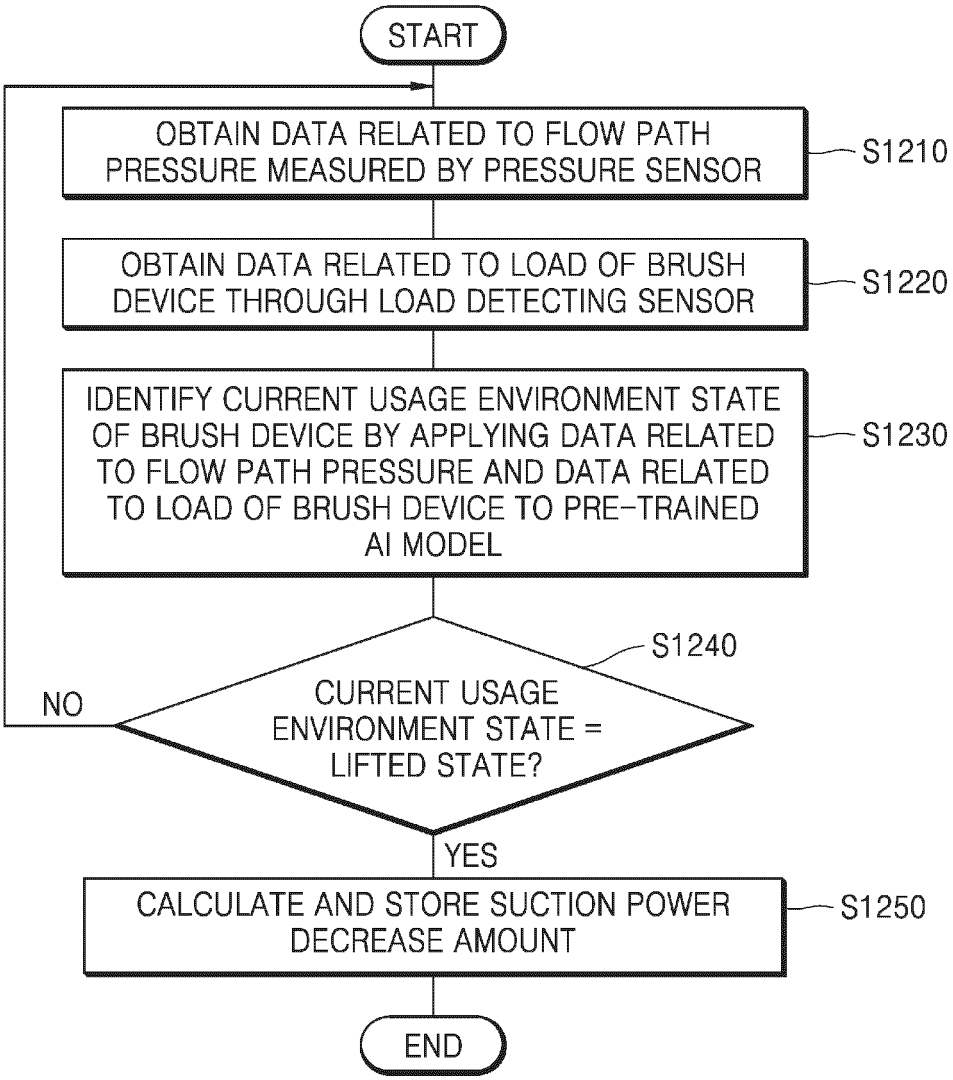

START
OBTAIN DATA RELATED TO FLOW PATH PRESSURE MEASURED BY PRESSURE SENSOR
S1210
OBTAIN DATA RELATED TO LOAD OF BRUSH DEVICE THROUGH LOAD DETECTING SENSOR
S1220
IDENTIFY CURRENT USAGE ENVIRONMENT STATE OF BRUSH DEVICE BY APPLYING DATA RELATED TO FLOW PATH PRESSURE AND DATA RELATED TO LOAD OF BRUSH DEVICE TO PRE-TRAINED AI MODEL
S1230
S1240
CURRENT USAGE ENVIRONMENT STATE = LIFTED STATE?
NO
YES
CALCULATE AND STORE SUCTION POWER DECREASE AMOUNT
S1250
END

FIG. 13

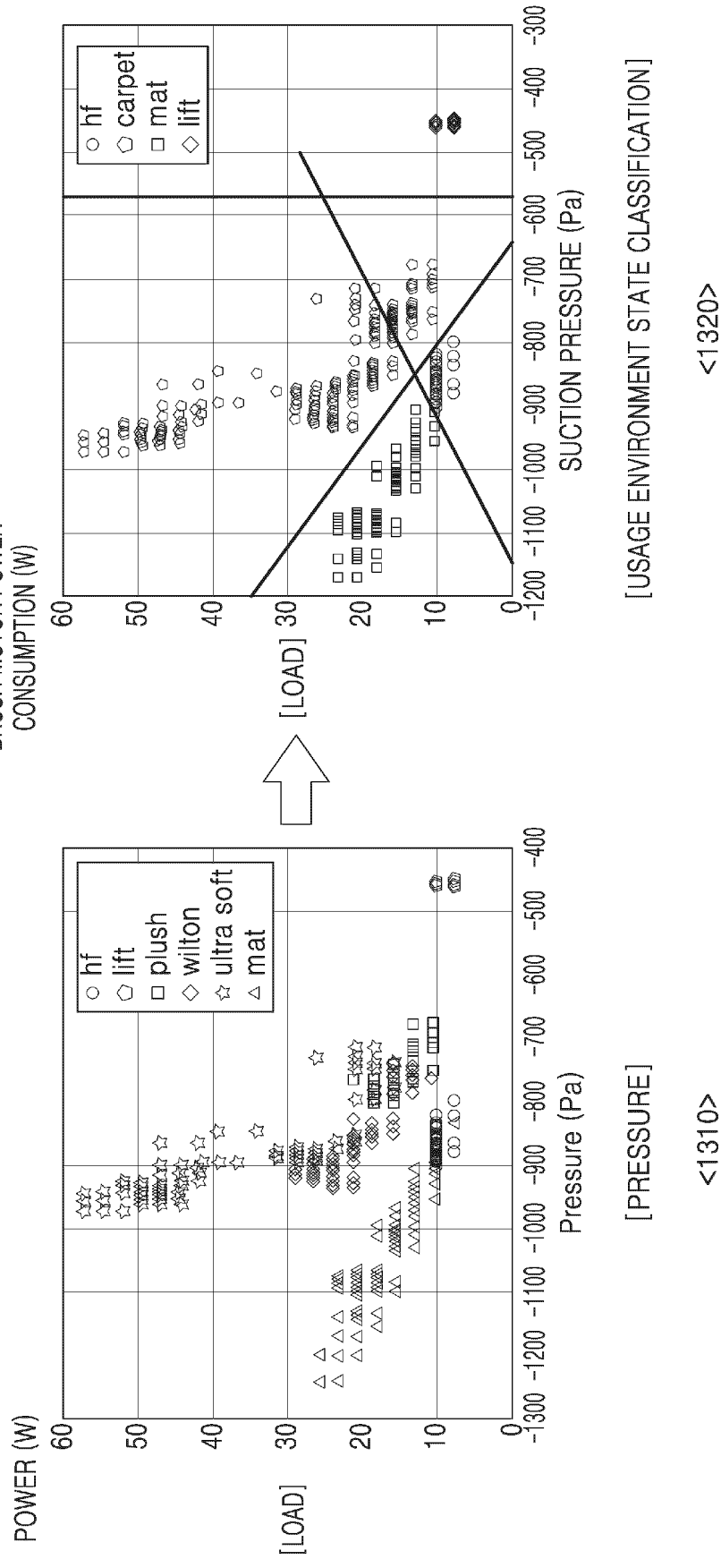

POWER (W)
60
50
40
30
20
10
0
[LOAD]
-1300 -1200 -1100 -1000 -900 -800 -700 -600 -500 -400
Pressure (Pa)
hf
lift
plush
wilton
ultra soft
mat
[PRESSURE]
<1310>
BRUSH MOTOR POWER CONSUMPTION (W)
60
50
40
30
20
10
0
[LOAD]
-1200 -1100 -1000 -900 -800 -700 -600 -500 -400 -300
SUCTION PRESSURE (Pa)
hf
carpet
mat
lift
[USAGE ENVIRONMENT STATE CLASSIFICATION]
<1320>

FIG. 14

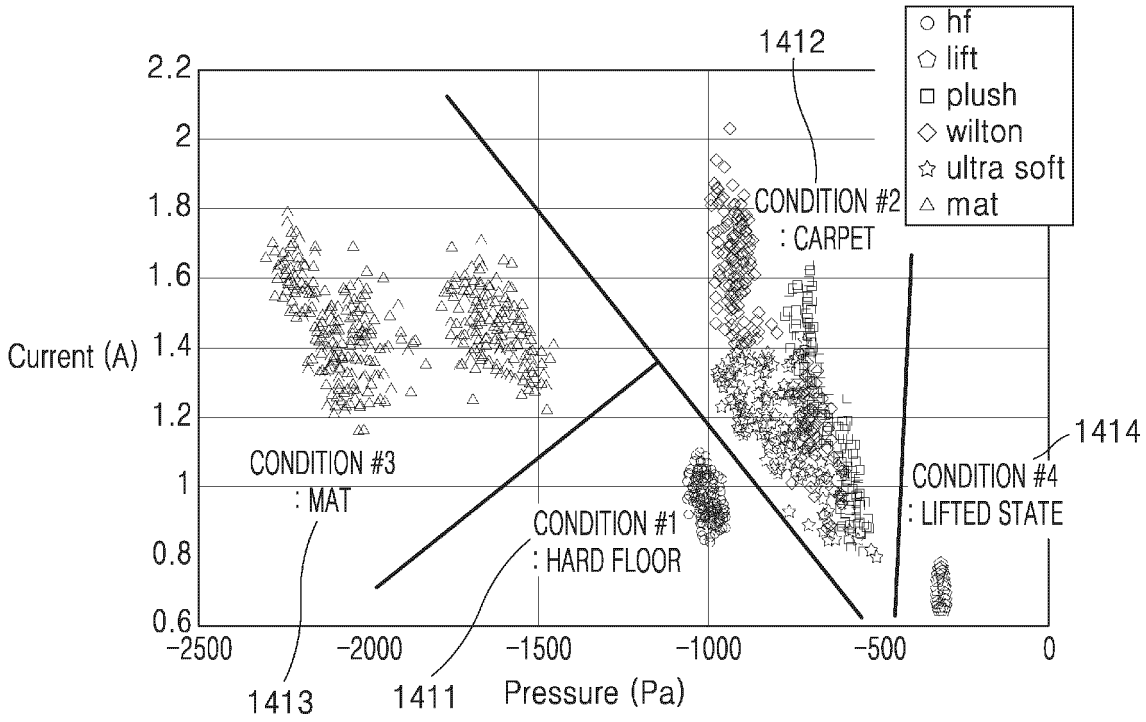

hf
lift
plush
wilton
ultra soft
mat
1412
CONDITION #2
: CARPET
1414
CONDITION #4
: LIFTED STATE
CONDITION #3
: MAT
CONDITION #1
: HARD FLOOR
1413
1411
Current (A)
Pressure (Pa)
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
-2500
-2000
-1500
-1000
-500
0

FIG. 15

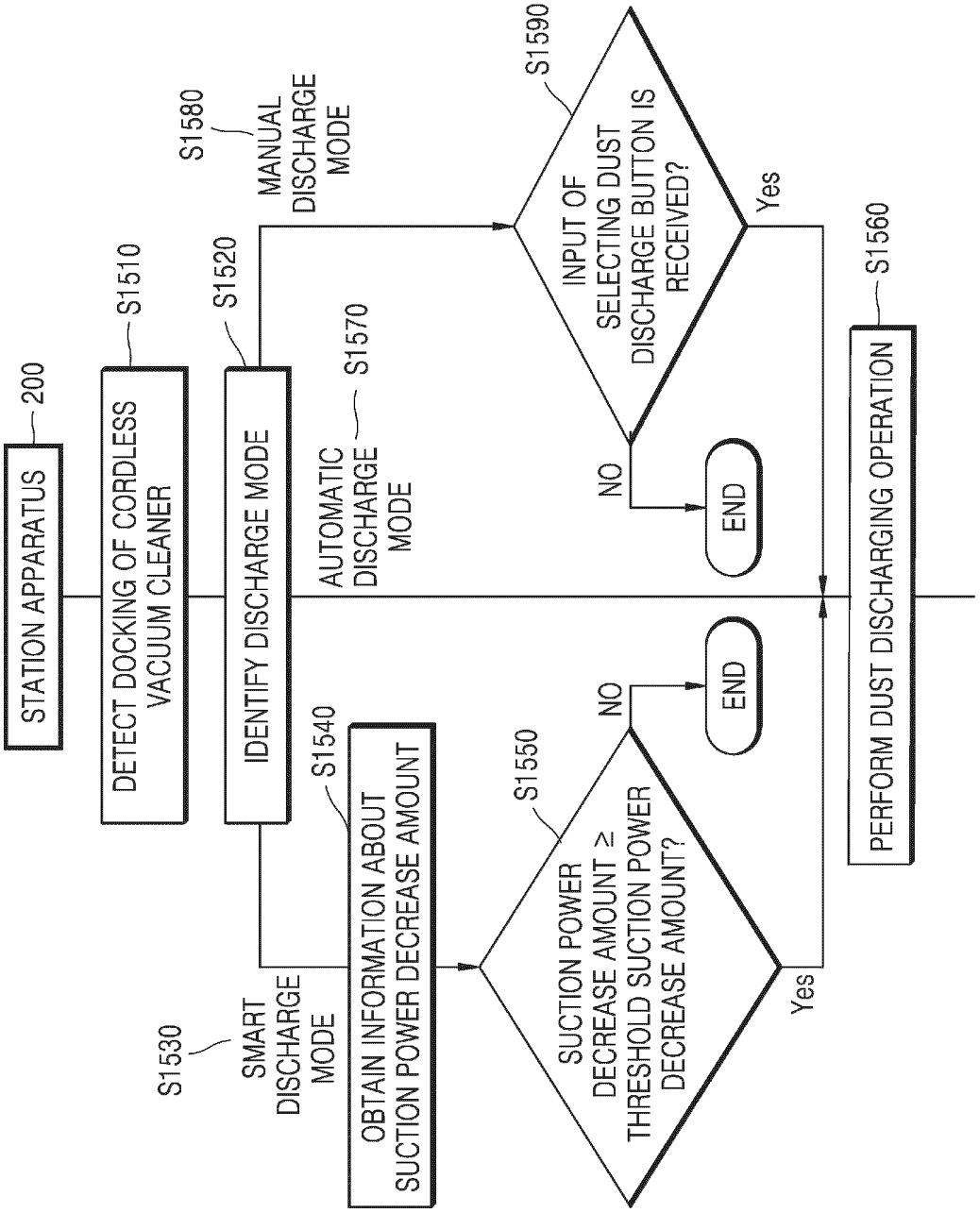

200
STATION APPARATUS
S1510
DETECT DOCKING OF CORDLESS VACUUM CLEANER
S1520
IDENTIFY DISCHARGE MODE
S1530
SMART DISCHARGE MODE
S1540
OBTAIN INFORMATION ABOUT SUCTION POWER DECREASE AMOUNT
S1550
SUCTION POWER DECREASE AMOUNT ≥ THRESHOLD SUCTION POWER DECREASE AMOUNT?
NO
END
Yes
S1560
PERFORM DUST DISCHARGING OPERATION
S1570
AUTOMATIC DISCHARGE MODE
S1580
MANUAL DISCHARGE MODE
S1590
INPUT OF SELECTING DUST DISCHARGE BUTTON IS RECEIVED?
NO
END
Yes

FIG. 16

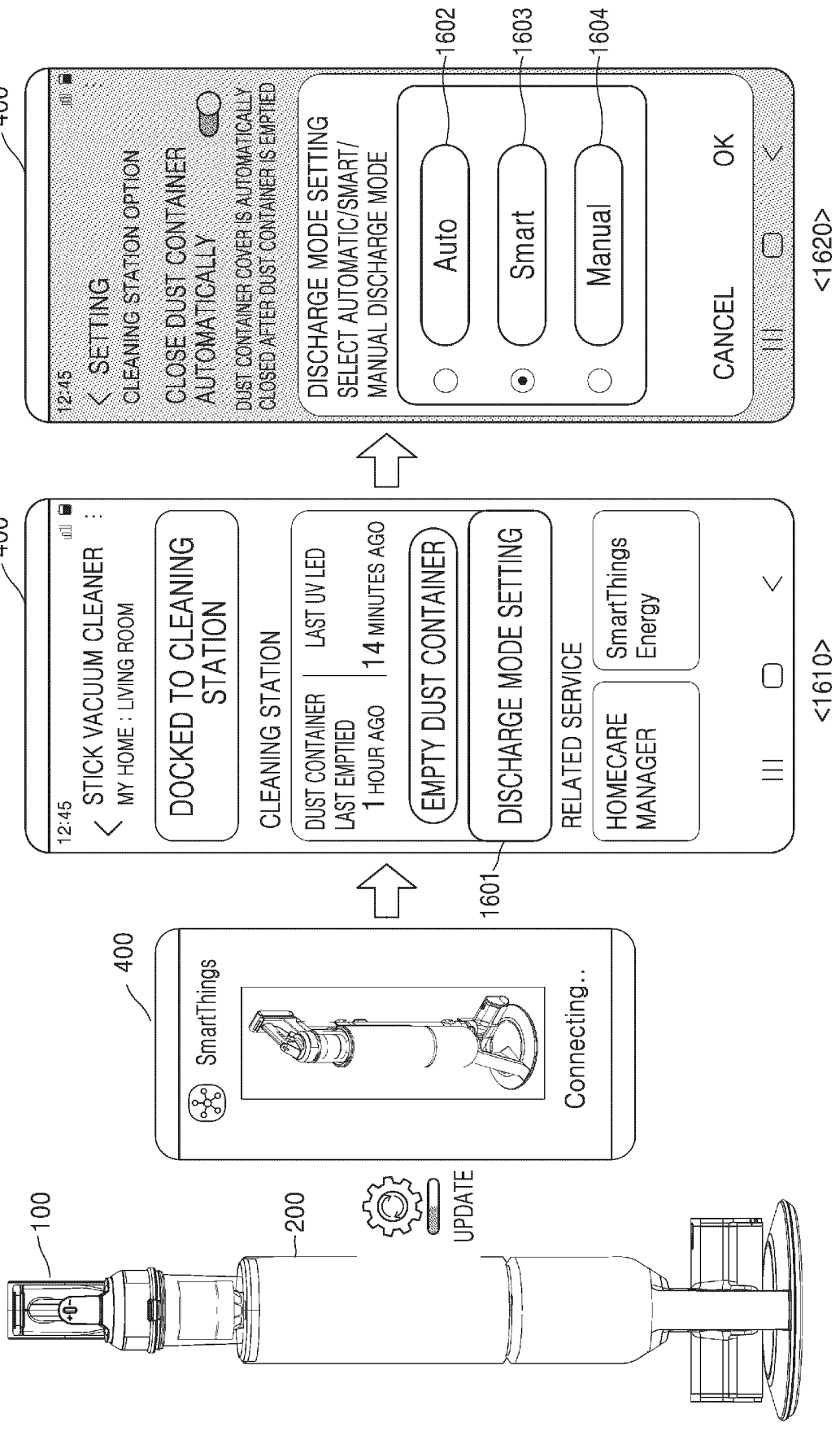

100
200
UPDATE
400
SmartThings
Connecting..
1601
STICK VACUUM CLEANER
MY HOME : LIVING ROOM
DOCKED TO CLEANING STATION
CLEANING STATION
DUST CONTAINER LAST EMPTIED 1 HOUR AGO
LAST UV LED 14 MINUTES AGO
EMPTY DUST CONTAINER
DISCHARGE MODE SETTING
RELATED SERVICE
HOMECARE MANAGER
SmartThings Energy
<1610>
SETTING
CLEANING STATION OPTION
CLOSE DUST CONTAINER AUTOMATICALLY
DUST CONTAINER COVER IS AUTOMATICALLY CLOSED AFTER DUST CONTAINER IS EMPTIED
DISCHARGE MODE SETTING
SELECT AUTOMATIC/SMART/MANUAL DISCHARGE MODE
1602
1603
1604
Auto
Smart
Manual
CANCEL
OK
<1620>

FIG. 17

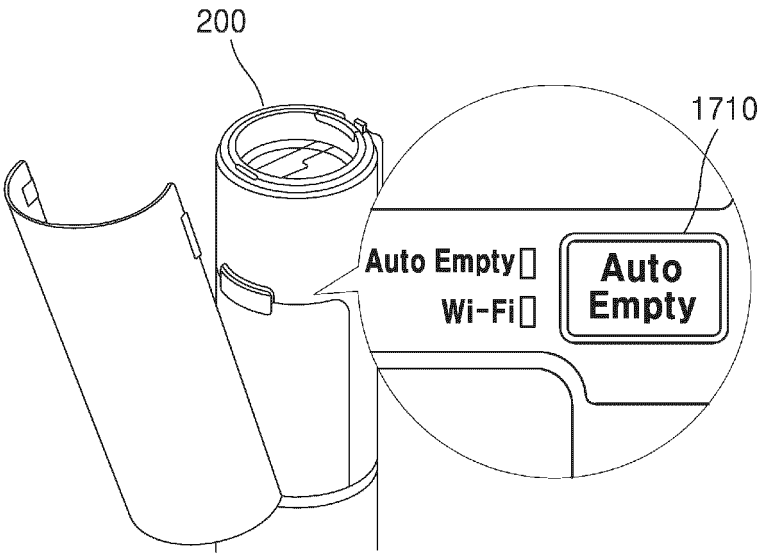


FIG. 18

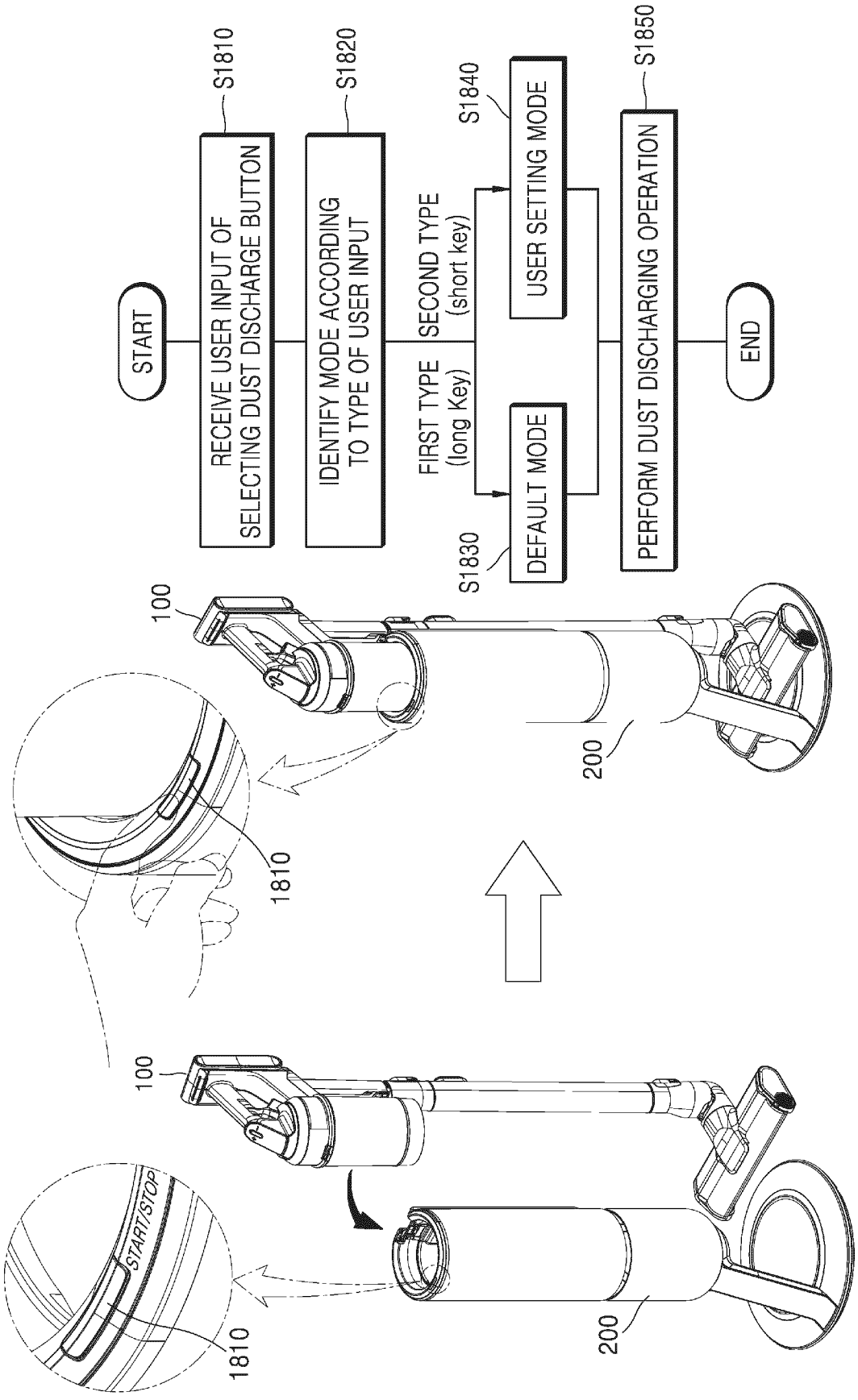

START
RECEIVE USER INPUT OF SELECTING DUST DISCHARGE BUTTON
S1810
IDENTIFY MODE ACCORDING TO TYPE OF USER INPUT
S1820
FIRST TYPE (long Key)
SECOND TYPE (short key)
DEFAULT MODE
S1830
USER SETTING MODE
S1840
PERFORM DUST DISCHARGING OPERATION
S1850
END
100
200
1810
START/STOP

FIG. 19

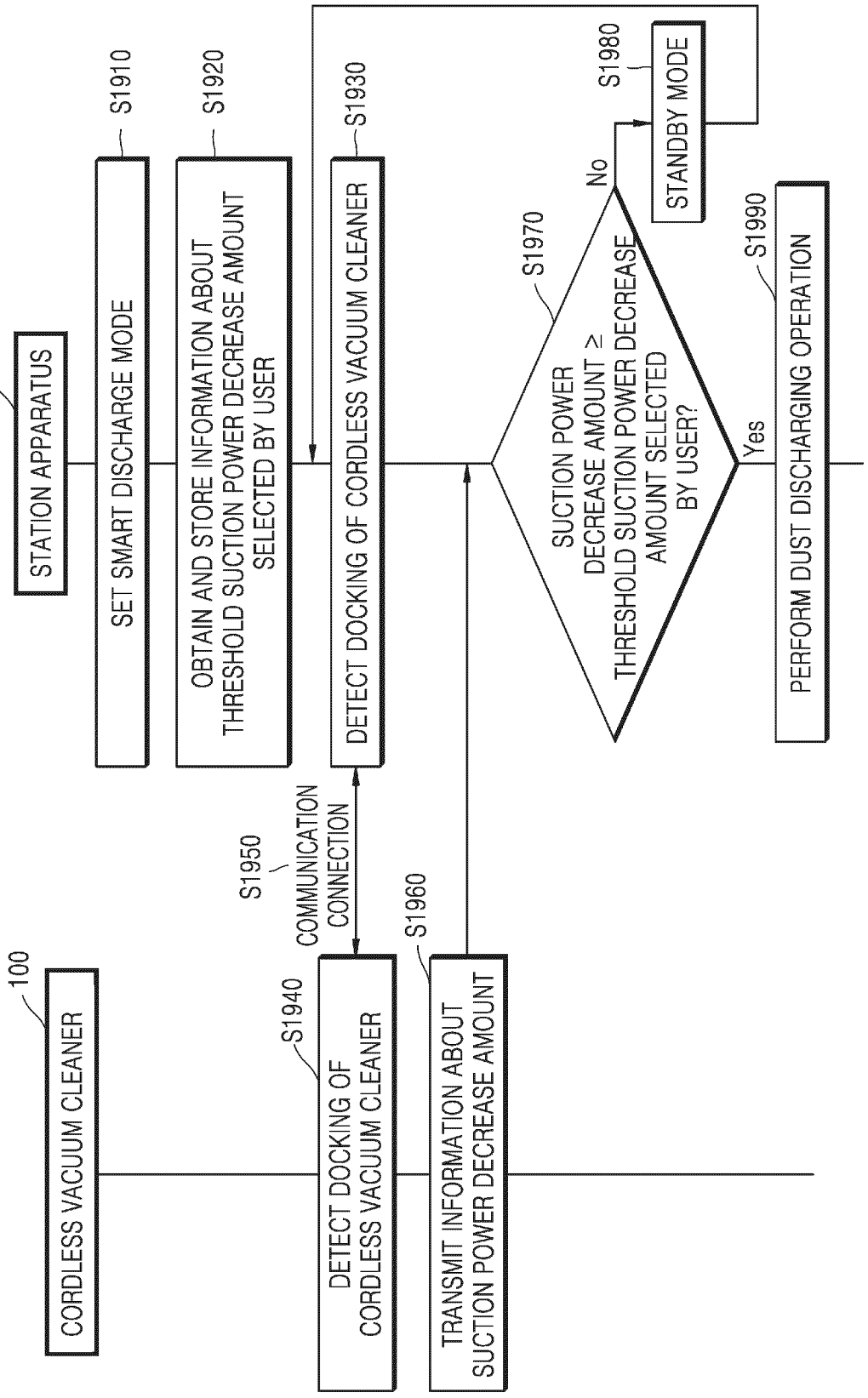

200
STATION APPARATUS
S1910
SET SMART DISCHARGE MODE
S1920
OBTAIN AND STORE INFORMATION ABOUT THRESHOLD SUCTION POWER DECREASE AMOUNT SELECTED BY USER
S1930
DETECT DOCKING OF CORDLESS VACUUM CLEANER
S1970
SUCTION POWER DECREASE AMOUNT ≥ THRESHOLD SUCTION POWER DECREASE AMOUNT SELECTED BY USER?
No
S1980
STANDBY MODE
Yes
S1990
PERFORM DUST DISCHARGING OPERATION
S1950
COMMUNICATION CONNECTION
100
CORDLESS VACUUM CLEANER
S1940
DETECT DOCKING OF CORDLESS VACUUM CLEANER
S1960
TRANSMIT INFORMATION ABOUT SUCTION POWER DECREASE AMOUNT

FIG. 20

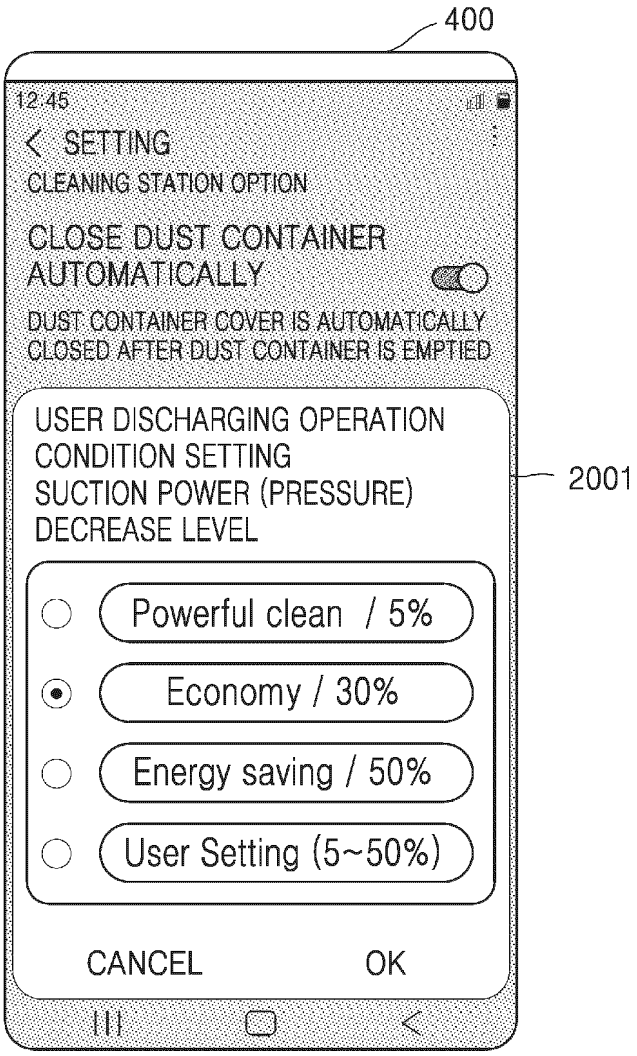

400
12:45
SETTING
CLEANING STATION OPTION
CLOSE DUST CONTAINER AUTOMATICALLY
DUST CONTAINER COVER IS AUTOMATICALLY CLOSED AFTER DUST CONTAINER IS EMPTIED
USER DISCHARGING OPERATION CONDITION SETTING
SUCTION POWER (PRESSURE) DECREASE LEVEL
2001
Powerful clean / 5%
Economy / 30%
Energy saving / 50%
User Setting (5~50%)
CANCEL
OK

FIG. 21

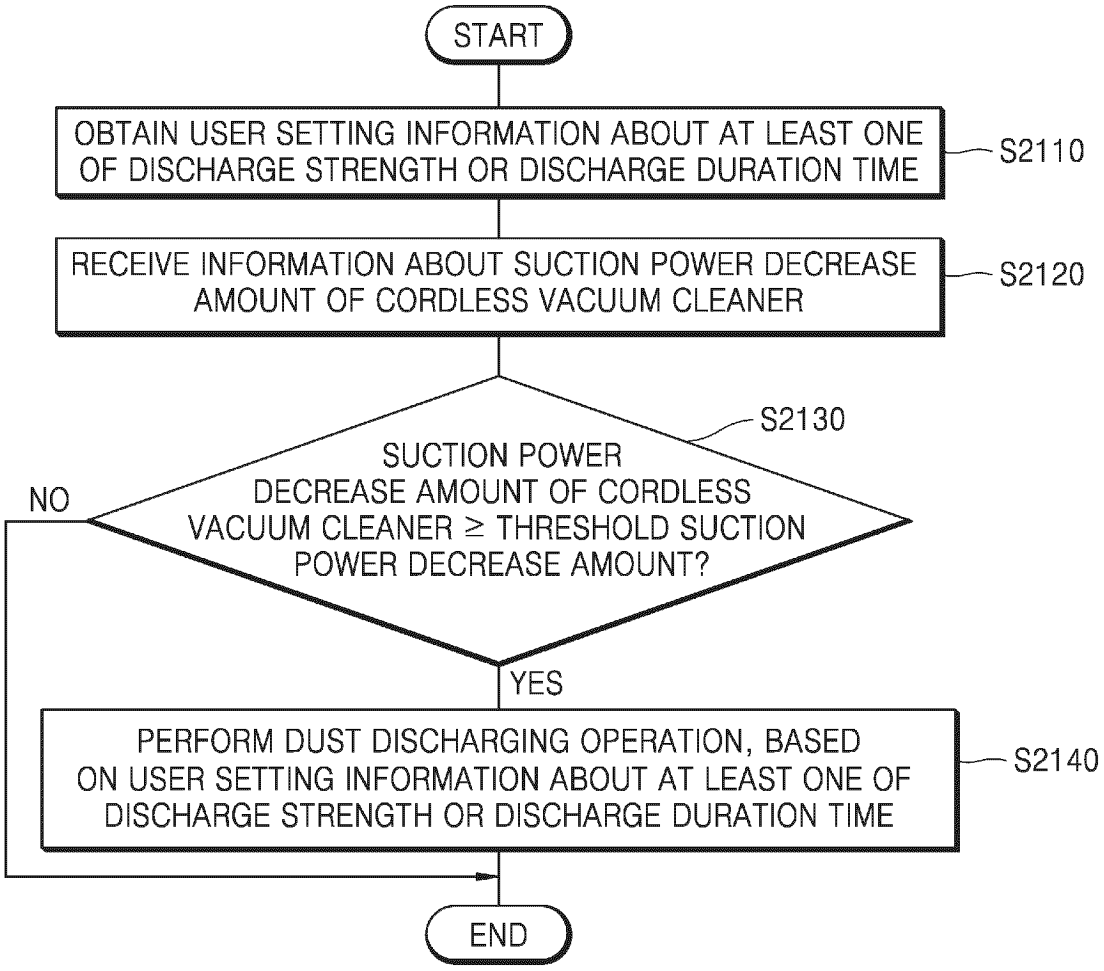

START
OBTAIN USER SETTING INFORMATION ABOUT AT LEAST ONE OF DISCHARGE STRENGTH OR DISCHARGE DURATION TIME
S2110
RECEIVE INFORMATION ABOUT SUCTION POWER DECREASE AMOUNT OF CORDLESS VACUUM CLEANER
S2120
S2130
SUCTION POWER DECREASE AMOUNT OF CORDLESS VACUUM CLEANER ≥ THRESHOLD SUCTION POWER DECREASE AMOUNT?
NO
YES
PERFORM DUST DISCHARGING OPERATION, BASED ON USER SETTING INFORMATION ABOUT AT LEAST ONE OF DISCHARGE STRENGTH OR DISCHARGE DURATION TIME
S2140
END

FIG. 22

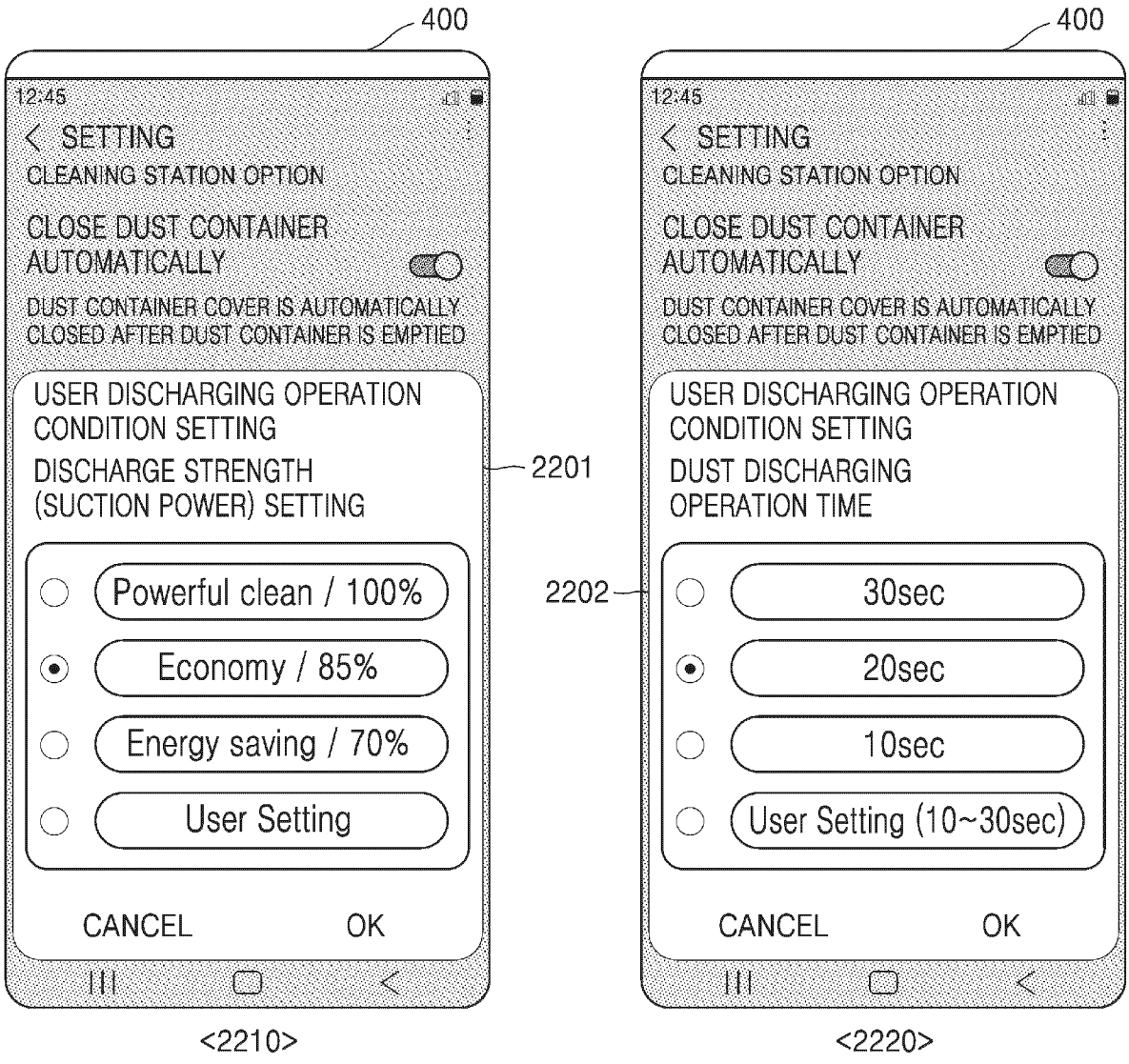

400
12:45
SETTING
CLEANING STATION OPTION
CLOSE DUST CONTAINER AUTOMATICALLY
DUST CONTAINER COVER IS AUTOMATICALLY CLOSED AFTER DUST CONTAINER IS EMPTIED
USER DISCHARGING OPERATION CONDITION SETTING
DISCHARGE STRENGTH (SUCTION POWER) SETTING
2201
Powerful clean / 100%
Economy / 85%
Energy saving / 70%
User Setting
2202
CANCEL
OK
<2210>
400
12:45
SETTING
CLEANING STATION OPTION
CLOSE DUST CONTAINER AUTOMATICALLY
DUST CONTAINER COVER IS AUTOMATICALLY CLOSED AFTER DUST CONTAINER IS EMPTIED
USER DISCHARGING OPERATION CONDITION SETTING
DUST DISCHARGING OPERATION TIME
30sec
20sec
10sec
User Setting (10~30sec)
CANCEL
OK
<2220>

FIG. 23

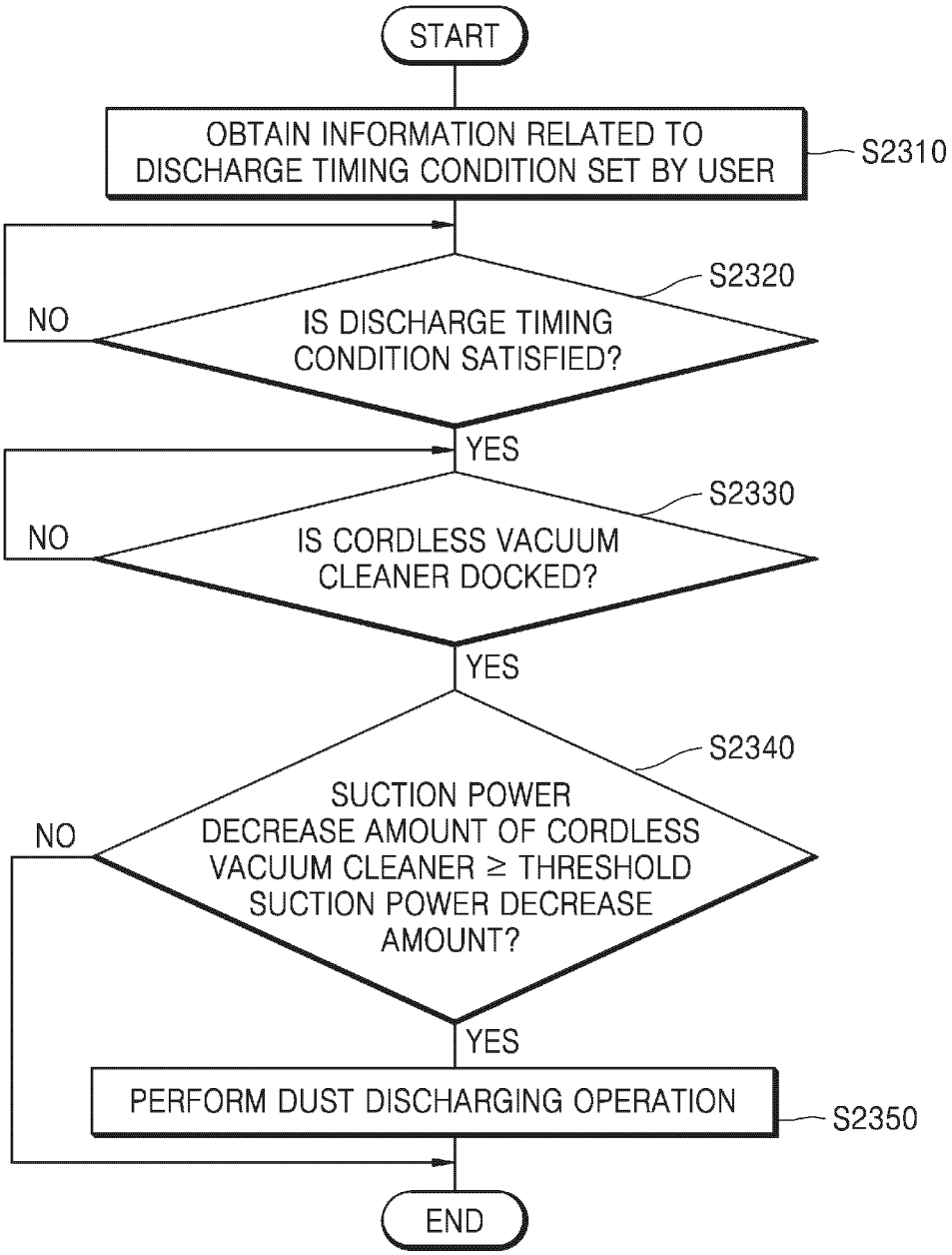

START
OBTAIN INFORMATION RELATED TO DISCHARGE TIMING CONDITION SET BY USER
S2310
S2320
IS DISCHARGE TIMING CONDITION SATISFIED?
NO
YES
S2330
IS CORDLESS VACUUM CLEANER DOCKED?
NO
YES
S2340
SUCTION POWER DECREASE AMOUNT OF CORDLESS VACUUM CLEANER ≥ THRESHOLD SUCTION POWER DECREASE AMOUNT?
NO
YES
PERFORM DUST DISCHARGING OPERATION
S2350
END

FIG. 24

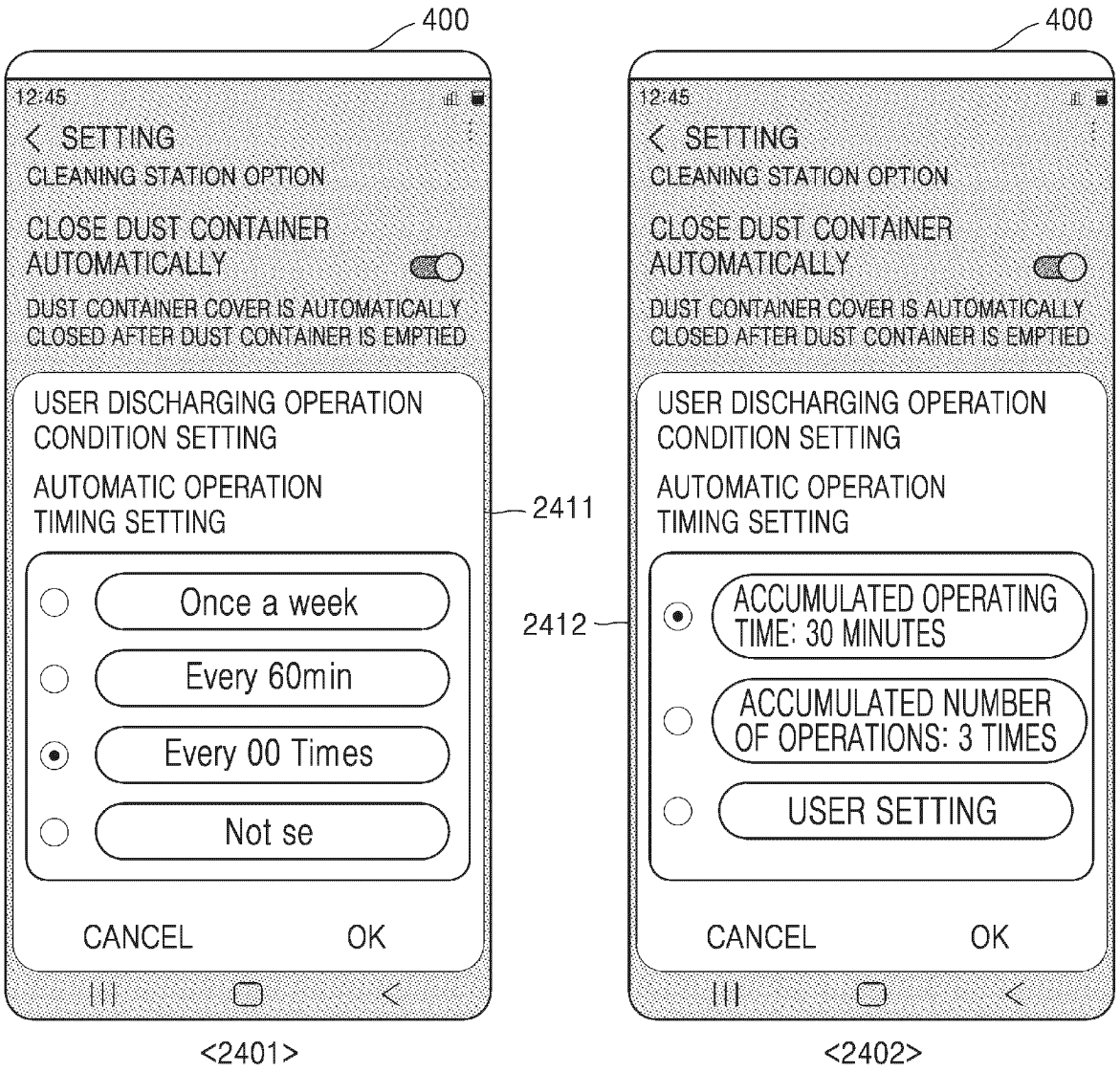

400
12:45
SETTING
CLEANING STATION OPTION
CLOSE DUST CONTAINER AUTOMATICALLY
DUST CONTAINER COVER IS AUTOMATICALLY CLOSED AFTER DUST CONTAINER IS EMPTIED
USER DISCHARGING OPERATION CONDITION SETTING
AUTOMATIC OPERATION TIMING SETTING
2411
Once a week
Every 60min
Every 00 Times
Not se
CANCEL
OK
<2401>
400
12:45
SETTING
CLEANING STATION OPTION
CLOSE DUST CONTAINER AUTOMATICALLY
DUST CONTAINER COVER IS AUTOMATICALLY CLOSED AFTER DUST CONTAINER IS EMPTIED
USER DISCHARGING OPERATION CONDITION SETTING
AUTOMATIC OPERATION TIMING SETTING
2412
ACCUMULATED OPERATING TIME: 30 MINUTES
ACCUMULATED NUMBER OF OPERATIONS: 3 TIMES
USER SETTING
CANCEL
OK
<2402>

FIG. 25

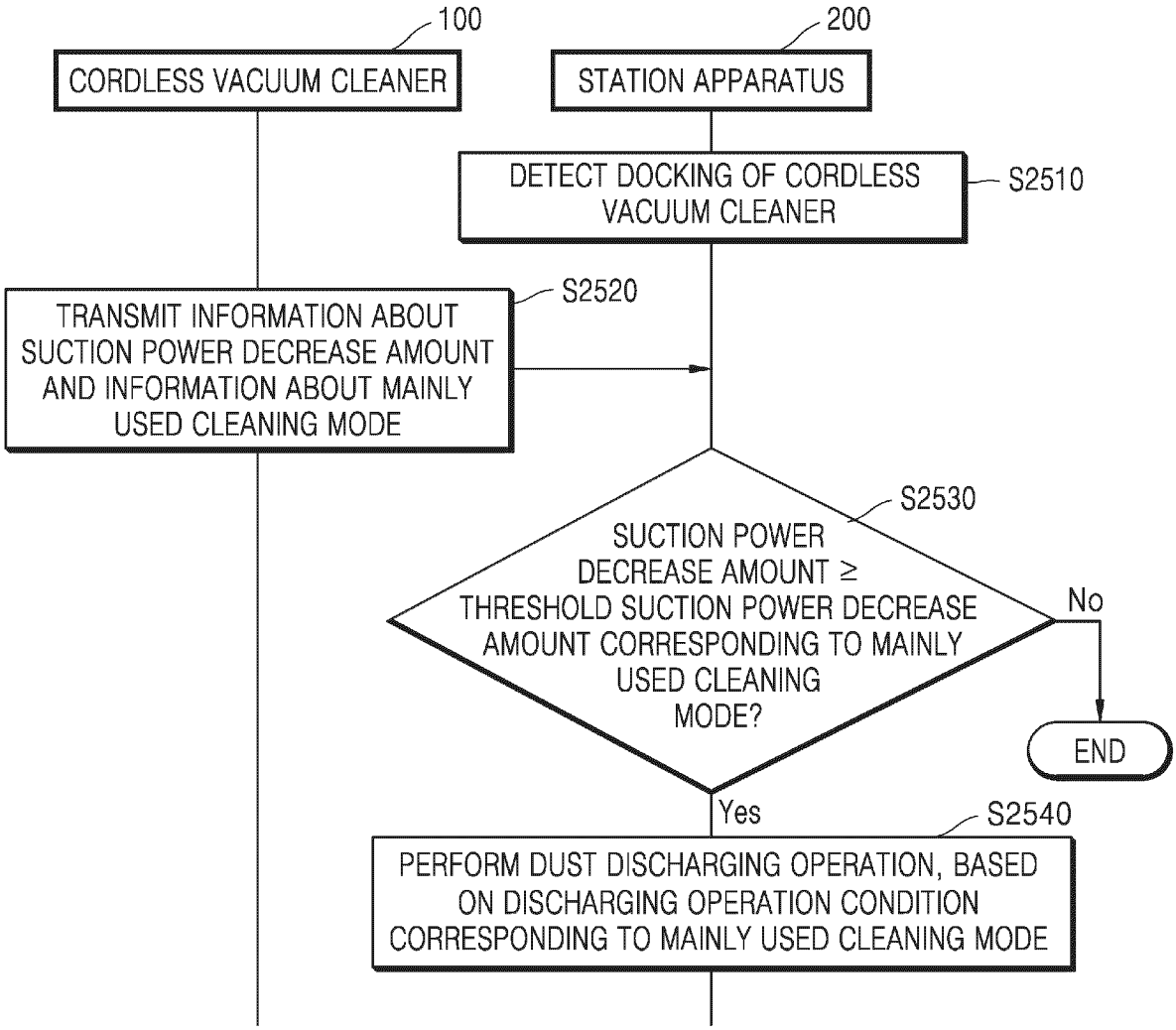

100
CORDLESS VACUUM CLEANER
200
STATION APPARATUS
DETECT DOCKING OF CORDLESS VACUUM CLEANER
S2510
TRANSMIT INFORMATION ABOUT SUCTION POWER DECREASE AMOUNT AND INFORMATION ABOUT MAINLY USED CLEANING MODE
S2520
S2530
SUCTION POWER DECREASE AMOUNT ≥ THRESHOLD SUCTION POWER DECREASE AMOUNT CORRESPONDING TO MAINLY USED CLEANING MODE?
No
END
Yes
S2540
PERFORM DUST DISCHARGING OPERATION, BASED ON DISCHARGING OPERATION CONDITION CORRESPONDING TO MAINLY USED CLEANING MODE

FIG. 26

SETTING / AND INFORMATION	THRESHOLD SUCTION POWER DECREASE AMOUNT	DISCHARGING OPERATING CONDITION		
		STRENGTH	POWER CONSUMPTION	TIME
POWER (MAX) SUCTION MODE	5%	100%	1400W	30 SECONDS
MEDIUM (MID) SUCTION MODE	30%	85%	1190W	20 SECONDS
WEAK (MIN) SUCTION MODE	50%	70%	980W	10 SECONDS

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2023/012814

A. CLASSIFICATION OF SUBJECT MATTER

A47L 9/28(2006.01)i; **A47L 5/24**(2006.01)i; **A47L 7/00**(2006.01)i; **A47L 9/32**(2006.01)i; **A47L 9/24**(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)

A47L 9/28(2006.01); A47L 9/00(2006.01); A47L 9/10(2006.01); B08B 5/04(2006.01); G01N 15/00(2006.01); H01L 21/677(2006.01)

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

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

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

eKOMPASS (KIPO internal) & keywords: 스테이션(station), 청소기(vacuum cleaner), 브러시(brush), 들림 상태(lifted state), 흡입력(suction power), 저하(decrease), 배출(discharge), 압력 센서(pressure sensor)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2022-0092056 A (LG ELECTRONICS INC.) 01 July 2022 (2022-07-01) See paragraphs [0131], [0264]-[0316] and [0352], claims 4-5 and figures 1-14.	1-2,5-12,14
A		3-4,13,15
Y	KR 10-2022-0000297 A (SAMSUNG ELECTRONICS CO., LTD.) 03 January 2022 (2022-01-03) See paragraphs [0049]-[0050], [0071]-[0083] and [0157] and figures 1-10.	1-2,5-12,14
A	KR 10-2022-0029361 A (DAIFUKU CO., LTD.) 08 March 2022 (2022-03-08) See claims 1-8 and figures 1-9.	1-15
A	JP 2020-142073 A (VORWERK & CO. INTERHOLDING GMBH) 10 September 2020 (2020-09-10) See claim 11 and figures 1-2.	1-15
A	JP 2018-522613 A (IROBOT CORPORATION) 16 August 2018 (2018-08-16) See paragraph [0038] and figures 1-2.	1-15

☐ 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
"D" document cited by the applicant in the international application
"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
28 November 2023	**29 November 2023**

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office **Government Complex-Daejeon Building 4, 189 Cheongsa-ro, Seo-gu, Daejeon 35208**	
Facsimile No. **+82-42-481-8578**	Telephone No.

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2023/012814

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
KR 10-2022-0092056 A	01 July 2022	None	
KR 10-2022-0000297 A	03 January 2022	CN 115734849 A	03 March 2023
		EP 4140380 A1	01 March 2023
		EP 4140380 A4	06 September 2023
		US 2023-0055824 A1	23 February 2023
		WO 2021-261716 A1	30 December 2021
KR 10-2022-0029361 A	08 March 2022	CN 114098507 A	01 March 2022
		JP 2022-040577 A	11 March 2022
		TW 202210395 A	16 March 2022
		US 2022-0061609 A1	03 March 2022
JP 2020-142073 A	10 September 2020	CN 111657785 A	15 September 2020
		CN 111657785 B	08 November 2022
		DE 102019105936 A1	10 September 2020
		EP 3705010 A1	09 September 2020
		EP 3705010 B1	24 November 2021
		ES 2904495 T3	05 April 2022
		TW 202038842 A	01 November 2020
		US 11357373 B2	14 June 2022
		US 2020-0281428 A1	10 September 2020
JP 2018-522613 A	16 August 2018	AU 2015-400076 A1	30 November 2017
		AU 2015-400076 B2	27 August 2020
		AU 2020-277235 A1	24 December 2020
		AU 2020-277235 B2	02 June 2022
		CN 107529930 A	02 January 2018
		CN 107529930 B	17 September 2021
		CN 109431376 A	08 March 2019
		CN 109431376 B	11 June 2021
		CN 109528088 A	29 March 2019
		CN 109528088 B	14 September 2021
		CN 113749582 A	07 December 2021
		EP 3313255 A1	02 May 2018
		EP 3313255 A4	20 February 2019
		EP 3313255 B1	17 June 2020
		EP 3777629 A1	17 February 2021
		ES 2818116 T3	09 April 2021
		JP 2021-0035519 A	04 March 2021
		JP 2021-0192849 A	23 December 2021
		JP 2022-0121458 A	19 August 2022
		JP 6786521 B2	18 November 2020
		JP 6953600 B2	27 October 2021
		JP 7087182 B2	20 June 2022
		JP 7297981 B2	26 June 2023
		US 10154768 B2	18 December 2018
		US 11445880 B2	20 September 2022
		US 2016-0374528 A1	29 December 2016
		US 2018-0235424 A1	23 August 2018
		US 2019-0133399 A1	09 May 2019
		US 2022-0409000 A1	29 December 2022
		US 9462920 B1	11 October 2016
		US 9924846 B2	27 March 2018

Form PCT/ISA/210 (patent family annex) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2023/012814

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
		WO 2016-209309 A1	29 December 2016

Form PCT/ISA/210 (patent family annex) (July 2022)