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- **KIM, Sangjin**
Suwon-si Gyeonggi-do 16677 (KR)
- **SEO, Eungryeol**
Suwon-si Gyeonggi-do 16677 (KR)
- **OH, Changhoon**
Suwon-si Gyeonggi-do 16677 (KR)
- **LEE, Sangjin**
Suwon-si Gyeonggi-do 16677 (KR)
- **KHAN, Qasim**
Suwon-si Gyeonggi-do 16677 (KR)

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

(74) Representative: **Gulde & Partner**
Patent- und Rechtsanwaltskanzlei mbB
Wallstraße 58/59
10179 Berlin (DE)

(72) Inventors:
• **KWON, Myoungkeun**
Suwon-si Gyeonggi-do 16677 (KR)

(54) **HOOD SYSTEM AND CONTROL METHOD THEREFOR**

(57) A hood system according to one embodiment comprises: a main body having an exhaust duct, a fan configured to generate airflow in the exhaust duct, an arm including an intake port and configured to allow air to be sucked into the intake port so as to pass through the arm and thereafter in the exhaust duct, a driving unit

configured to be driven to move the arm, a sensor module configured to sense an environmental state of the hood system, and at least one processor configured to control driving of the driving unit based on the sensed environmental state to move the arm and thereby position the intake port based on the sensed state.

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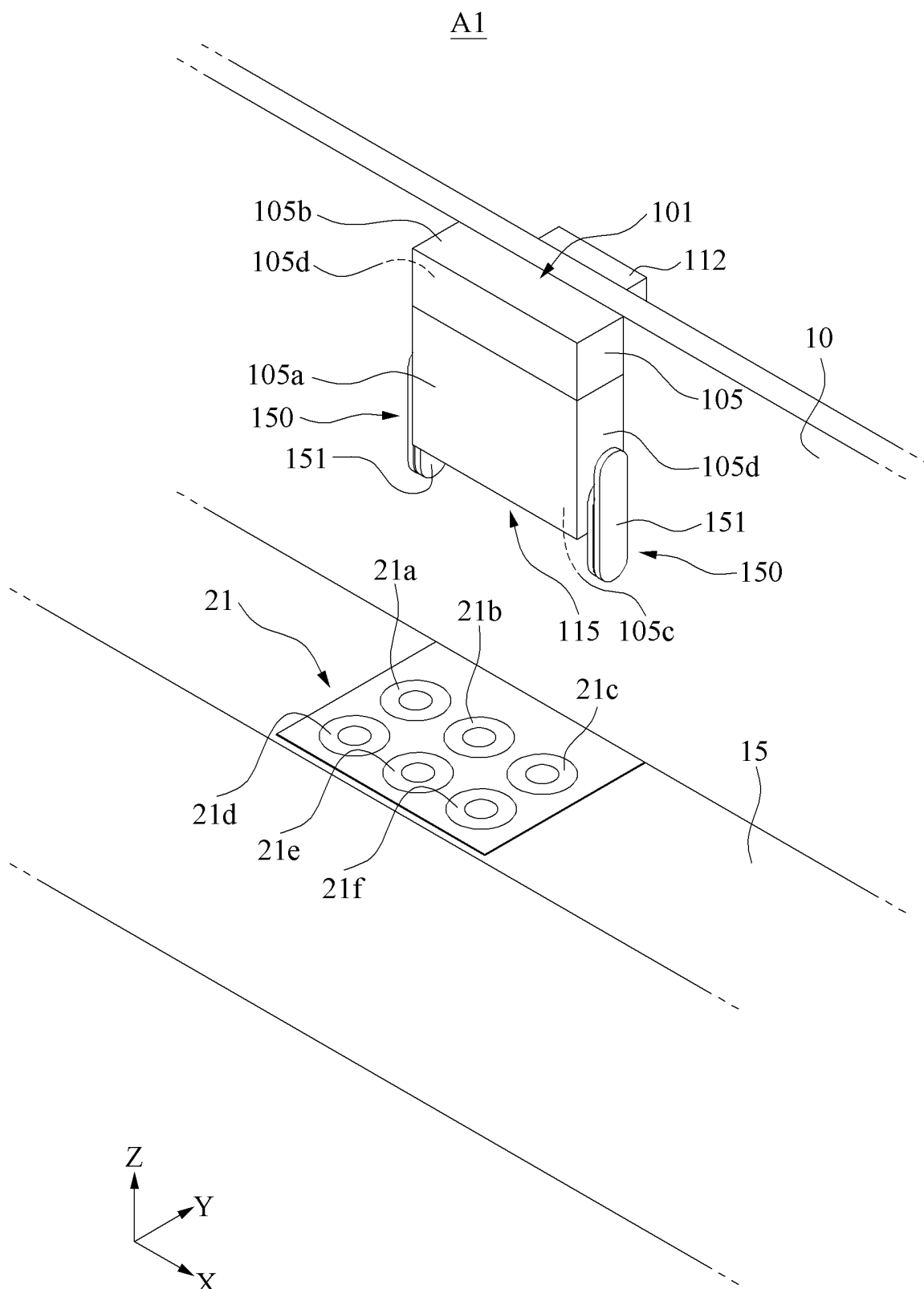


FIG. 3A

Description

BACKGROUND

1. Field

[0001] The disclosure relates to a hood system and a method of controlling the same.

2. Description of Related Art

[0002] A hood system is a device installed in a place where smoke, odor, dust or pollutants in a surrounding environment are generated. The hood system exhausts air to prevent the smoke, odor, dust or pollutants from spreading. For example, a household hood system is generally installed above a cooktop in a kitchen and sucks odors and smoke generated from a cooking vessel under a hood.

SUMMARY

[0003] According to an embodiment, a hood system comprise a main body comprising an exhaust duct, a fan configured to generate airflow in the exhaust duct, an arm comprising an intake port, the arm configured to allow air to be sucked into the intake port so as to pass through the arm and thereafter into the exhaust duct, a driving unit configured to be driven to move the arm, a sensor module configured to sense an environmental state of the hood system and a processor configured to control driving of the driving unit based on the sensed environmental state to move the arm and thereby position the intake port based on the sensed environmental state.

[0004] According to an embodiment, a method of controlling a hood system including a main body comprising an exhaust duct, a movable arm including an intake port, and a sensor module configured to sense an environmental state of the hood system, the method comprise recognizing a position of a cooking vessel by a sensor module, moving the arm based on the sensed position of the cooking vessel, to thereby position the intake port based on the sensed position of the cooking vessel, causing air to be sucked into the intake port, so that the air sucked into the intake port passes through the arm and into the exhaust duct, sensing a change in an environmental state of the hood system by a sensor module, and moving the arm based on the sensed change in the environmental state, to thereby position the intake port based on the sensed change in the environmental state.

[0005] Embodiments and effects of the hood system are not limited to the above-mentioned embodiments and effects, and other unmentioned embodiments and effects may be clearly understood from the above description by those having ordinary skill in the technical field to which the present disclosure pertains.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The above and other aspects, features, and advantages of certain embodiments of the present disclosure will be more apparent from the following detailed description, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a hood system, according to one embodiment;

FIG. 2 is a block diagram of a hood system, according to one embodiment;

FIG. 3A is a perspective view of a hood system, according to one embodiment;

FIG. 3B is a perspective view of a hood system, according to one embodiment;

FIG. 3C is a front view of a hood system, according to one embodiment;

FIG. 4A is a perspective view of a hood system assembly, according to one embodiment;

FIG. 4B is a perspective view of a hood system, according to one embodiment;

FIG. 4C is a perspective view of a hood system, according to one embodiment;

FIG. 5 is a perspective view of a hood system, according to one embodiment;

FIG. 6 is a flowchart of a method of controlling a hood system, according to one embodiment;

FIG. 7 is a flowchart of a method of controlling a hood system, according to one embodiment of the present disclosure; and

FIG. 8 is a flowchart of a method of controlling a hood system, according to one embodiment.

DETAILED DESCRIPTION

[0007] Hereinafter, embodiments will be described in detail with reference to the accompanying drawings. When describing the embodiments with reference to the accompanying drawings, like reference numerals refer to like components and a repeated description related thereto will be omitted.

[0008] It should be appreciated that various embodiments of the present disclosure and the terms used therein are not intended to limit the technical features set forth herein to particular embodiments and include various changes, equivalents, or replacements for a corresponding embodiment. In connection with the description of the drawings, like reference numerals may be used for similar or related components.

[0009] It is to be understood that a singular form of a noun corresponding to an item may include one or more of the things, unless the relevant context clearly indicates otherwise.

[0010] As used herein, "A or B", "at least one of A and B", "at least one of A or B", "A, B or C", "at least one of A, B and C", and "at least one of A, B, or C," each of which may include any one of the items listed together

in the corresponding one of the phrases, or all possible combinations thereof. As an example, terminology such as "at least one of A and B", as used herein, includes any of the following: A, B, A and B. As an example, terminology such as "at least one of A, B, and C", as used herein, includes any of the following: A, B, C, A and B, A and C, B and C, A and B and C.

[0011] Terms such as "first", "second", or "first" or "second" may simply be used to distinguish the component from other components in question, and do not limit the components in other aspects (e.g., importance or order). It is to be understood that if an element (e.g., a first element) is referred to, with or without the term "operatively" or "communicatively", as "coupled with," "coupled to," "connected with," or "connected to" another element (e.g., a second element), it means that the element may be coupled with the other element directly (e.g., by wire), wirelessly, or via a third element.

[0012] As used in connection with various embodiments of the disclosure, the term "module" may include a unit implemented in hardware, software, or firmware, and may interchangeably be used with other terms, for example, "logic," "logic block," "part," or "circuitry". A module may be a single integral component, or a minimum unit or part thereof, adapted to perform one or more functions. For example, according to one embodiment, the module may be implemented in a form of an application-specific integrated circuit (ASIC).

[0013] Various embodiments as set forth herein may be implemented as software (e.g., a program) including one or more instructions that are stored in a storage medium (e.g., an internal memory or an external memory) that is readable by a machine (e.g., the electronic device). For example, a processor of the machine (e.g., an electronic device) may invoke at least one of the one or more instructions stored in the storage medium and execute it. This allows the machine to be operated to perform at least one function according to the at least one instruction invoked. The one or more instructions may include code generated by a compiler or code executable by an interpreter. The machine-readable storage medium may be provided in the form of a non-transitory storage medium. Here, the term "non-transitory" simply means that the storage medium is a tangible device, and does not include a signal (e.g., an electromagnetic wave), but this term does not differentiate between where data is semi-permanently stored in the storage medium and where the data is temporarily stored in the storage medium.

[0014] A method according to various embodiments of the disclosure may be included and provided in a computer program product. The computer program product may be traded as a product between a seller and a buyer. The computer program product may be distributed in the form of a machine-readable storage medium (e.g., compact disc read-only memory (CD-ROM)), or be distributed (e.g., downloaded or uploaded) online via an application store (e.g., PlayStore™), or between two user devices (e.g., smartphones) directly. If distributed online, at least

part of the computer program product may be temporarily generated or at least temporarily stored in the machine-readable storage medium, such as memory of the manufacturer's server, a server of the application store, or a relay server.

[0015] According to various embodiments, each component (e.g., a module or a program) of the above-described components may include a single entity or multiple entities, and some of the multiple entities may be separately disposed in different components. According to various embodiments, one or more of the above-described components may be omitted, or one or more other components may be added. Alternatively or additionally, a plurality of components (e.g., modules or programs) may be integrated into a single component. In such a case, according to various embodiments, the integrated component may still perform one or more functions of each of the plurality of components in the same or similar manner as they are performed by a corresponding one of the plurality of components before the integration. According to various embodiments, operations performed by the module, the program, or another component may be carried out sequentially, in parallel, repeatedly, or heuristically, or one or more of the operations may be executed in a different order or omitted, or one or more other operations may be added.

[0016] Since a household hood system is disposed at a predetermined distance from a cooktop, there is a predetermined distance from a suction target which generates odors or smoke, such as a cooking vessel. As a result, some odors and/or smoke generating from a cooking vessel may spread out from the cooktop area, which may discomfort a user and a hood system motor with a greater driving force may be required, which may increase energy consumption or make excessive noise during operation. In order to improve such inconvenience, there is a technical demand for a hood system that effectively sucks air of a suction object in a localized area.

[0017] The technical goals to be achieved through various embodiments of the present disclosure are not limited to those described above, and other technical goals not mentioned above are clearly understood by one of ordinary skill in the art from the following description.

[0018] FIG. 1 is a perspective view of a hood system 101, according to one embodiment.

[0019] Referring to FIG. 1, the hood system 101 of one embodiment may be on the upper side (e.g., the + Z direction of FIG. 1) of a cooktop-type cooking appliance 20, such as a gas range or an induction cooker and be spaced apart from the cooking appliance 20 by a predetermined distance.

[0020] In one embodiment, the cooking appliance 20 may include at least one of a cooktop including a heater configured to heat food with electricity or gas in an upper portion (e.g., a - Z direction) and/or an oven or an electric range including a main body 22 and a door portion 23 in a lower portion (e.g., in a - z direction).

[0021] In one embodiment, the hood system 101 may

be on the upper side of the cooking appliance 20 (e.g., the +Z direction in FIG. 1). The hood system 101 may be a kitchen hood device for discharging smoke and heat generating from the cooking appliance 20 while the cooking appliance 20 is operating to the outside. The hood system 101 may suck polluted air, smoke, and odors generating from the cooking appliance 20 and discharge them to the outside.

[0022] In addition to a form shown in FIG. 1, the hood system 101 may be provided in various forms such as a sliding-type hood, a tube-type hood, a chimney-type hood, an island-type hood, a canopy-type hood, and the like. The hood system 101 may be fixed on a wall of a building or a ceiling of the building.

[0023] FIG. 2 is a block diagram of a hood system 101, according to one embodiment.

[0024] Referring to FIG. 2, the hood system 101, according to one embodiment, may include an exhaust module 110, a hood module 150, a processor 120, and a sensor module 160.

[0025] In one embodiment, the hood system 101 may include a plurality of components to suck and exhaust air. FIG. 2 illustrates some of the plurality of components which may be included in the hood system 101, according to one embodiment. All or some of the components may be included in an actual implementation of a hood system, or may be replaced within the scope of components simply replaceable by those skilled in the art.

[0026] In one embodiment, the exhaust module 110 may collect the air sucked in by the hood system 101 and discharge the air to the outside. The hood system 101 may be an exhaust system, and the exhaust module 110 may be a main body 105 (e.g., the main body 105 in FIG. 3A) or one configuration inside the main body 105. In one embodiment, the exhaust module 110 may include an exhaust duct 111, an exhaust port 112, a fan 113, and a fixed intake port 115.

[0027] In one embodiment, the exhaust duct 111 may be a flow path through which the air and dust sucked in by the hood system 101 pass. One end of the exhaust duct 111 may connect to at least one of an intake port 153 and the fixed intake port 115, and the other end may connect to the exhaust port 112 so that air may be sucked in by the intake port 153 and the fixed intake port 115 and discharged by the exhaust port 112.

[0028] In one embodiment, the fan 113 may be in the exhaust duct 111 to generate an air flow in the exhaust duct 111. The fan 113 may be inside a fan housing accommodating and protecting the fan 113 (e.g., the fan housing 114 in FIG. 3C). In one embodiment, the driving force of the fan 113 may be controlled by the processor 120.

[0029] In one embodiment, the hood module 150 may connect to one surface of the main body 105 of the hood system 101 and may communicate with the exhaust duct 111 to suck air. In one embodiment, the hood module 150 may include an arm 151, the intake port 153, and a driving unit 155. The hood module 150 may change a

position of the intake port 153 by the arm 151 being moved by a user or the driving unit 155, and the hood system 101 may control a suction position and a suction target to correspond to a driving environment through the hood module 150.

[0030] In one embodiment, the arm 151 may serve as a flow path. The arm 151 may have the intake port 153 on one surface and communicate with the exhaust duct 111 to allow air to pass therethrough. The arm 151 may connect to the main body 105 to have a structure extending in a direction outside the main body 105. For example, the main body 105 may be fixed on an external support (e.g., the wall surface 10 of FIG. 3A), and the arm 151 may extend in a direction from the main body 105 to a cooking appliance (e.g., the cooking appliance 20 of FIG. 1).

[0031] In one embodiment, the hood module 150 may include a door 157 selectively opening and closing the intake port 153. For example, in one embodiment in which the exhaust module 110 includes the fixed intake port 115, the door 157 may close the intake port 153 of the hood module 150 with the fixed intake port 115 open, so that the hood system 101 may suck air only through the fixed intake port 115. Alternatively, the door 157 may close the intake port 153 in order to prevent foreign substances from flowing in or out through the hood module 150 and may again open the intake port 153 when the fixed intake port 115 needs to suck air. In one embodiment, the door 157 may selectively open the intake port 153, at least partially, and the hood module 150 may provide a stronger suction force at a localized area. In one embodiment, the driving unit 155 or a user may open or close the door 157.

[0032] In one embodiment, the hood module 150 may change a position of the intake port 153 as the arm 151 moves and rotates and selectively open and close the intake port 153 of the hood module 150 through the door 157. The hood module 150 may control detailed driving conditions, such as an air suction position, a suction target, and a suction force, to correspond to a driving environment.

[0033] In one embodiment, the processor 120 may control the driving of the hood system 101. The processor 120 may execute, for example, software to control at least one other component of the hood system 101 connected to the processor 120 (e.g., the driving unit 155) or the fan 113 and perform various types of data processing or computation.

[0034] The memory 125 may store various data used by at least one component (e.g., the processor 120 or the sensor module 160) of the hood system 101. The variety of data may include, for example, software and input data or output data for instructions related thereto. The memory 125 may include a volatile memory and/or a non-volatile memory.

[0035] According to one embodiment, as at least a part of data processing or computation, the processor 120 may store a command or data received from another

component (e.g., the sensor module 160 or the communication interface 140) in a volatile memory 125, process the command or the data stored in the volatile memory 125, and store result data in a non-volatile memory. According to one embodiment, the processor 120 may include a main processor (e.g., a central processing unit or an application processor) or an auxiliary processor (e.g., a sensor hub processor or a communication processor) that may be operated independently or together. The auxiliary processor, according to one embodiment, may control at least some of functions or states related to at least one (e.g., the sensor module 160, or the communication interface 140) of the components of the hood system 101, instead of the main processor while the main processor is in an inactive state or along with the main processor while the main processor is in an active state. According to one embodiment, the auxiliary processor (e.g., an image signal processor or a communication processor) may be implemented as a portion of another component (e.g., the sensor module 160 or the communication interface 140) that is functionally related to the auxiliary processor.

[0036] According to one embodiment, the processor 120 and/or the memory 125 may include a hardware structure specified for artificial intelligence model processing. An artificial intelligence model may be generated by machine learning. Such learning may be performed by, for example, the hood system 101 in which artificial intelligence is performed, or may be performed by a separate server. Learning algorithms may include, but are not limited to, for example, supervised learning, unsupervised learning, semi-supervised learning, or reinforcement learning. The AI model may include a plurality of artificial neural network layers. An artificial neural network may include, for example, a deep neural network (DNN), a convolutional neural network (CNN), a recurrent neural network (RNN), a restricted Boltzmann machine (RBM), a deep belief network (DBN), and a bidirectional recurrent deep neural network (BRDNN), a deep Q-network, or a combination of two or more thereof, but is not limited thereto. The AI model may additionally or alternatively include a software structure other than the hardware structure.

[0037] In one embodiment, an input interface 130 may receive a command or data to be used by a component of the hood system 101 (e.g., the processor 120) from the outside of the hood system 101 (e.g., a user or a network 50). The input interface 130 may be implemented as, for example, a knob, a button, a key, or a capacitive or pressure-sensitive touch pad.

[0038] The input interface 130 may support one or more specified protocols for the hood system 101 to couple to an external electronic device directly (e.g., wiredly) or wirelessly. According to one embodiment, the input interface 130 may include, for example, a high-definition multimedia interface (HDMI), a universal serial bus (USB) interface, a secure digital (SD) card interface, or an audio interface.

[0039] In one embodiment, a communication interface 140 may establish a direct (e.g., wired) communication channel or a wireless communication channel between the hood system 101 and an external device 70 or a server 60 and support communications based on the established communication channel. The communication interface 140 may include one or more communication processors 120 that are operable independently from the processor 120 (e.g., an application processor) and that support a direct (e.g., wired) communication or a wireless communication.

[0040] According to one embodiment, the communication interface 140 may include a wireless communication module (e.g., a cellular communication module, a short-range wireless communication module, or a global navigation satellite system (GNSS) communication module) or a wired communication module (e.g., a local region network (LAN) communication module, or a power line communication (PLC) module).

[0041] In one embodiment, a network 50 may include a first network (e.g., a short-range communication network, such as Bluetooth™, wireless-fidelity (Wi-Fi) direct, or infrared data association (IrDA)) or the second network (e.g., a long-range communication network, such as a legacy cellular network, a 5G network, a next-generation communication network, the Internet, or a computer network (e.g., a LAN or a wide region network (WAN))). The communication interface 140 may communicate with the external device 70 or the server 60 through the network 50. Various types of communication interfaces 140 may be implemented as a single component (e.g., a single chip), or may be implemented as multiple components (e.g., multiple chips) separate from each other. In one embodiment, the communication interface 140 may use subscriber information stored in the memory 125 to identify or authenticate the hood system 101 in the communication network 50, such as the network 50.

[0042] In one embodiment, the communication interface 140 may include an antenna transmitting or receiving signals to or from the outside (e.g., the external device 70), and the antenna may include an electric conductor on a substrate (e.g., a PCB) or a radiator in a conductive pattern. According to one embodiment, the communication interface 140 may include a plurality of antennas (e.g., an array antenna), and the communication interface 140 may, for example, select at least one antenna suitable for a communication method used in the various networks 50 described herein, among the plurality of antennas. The communication interface 140 may be connected to each other and exchange signals (e.g., commands or data) each other via an inter-peripheral communication scheme (e.g., a bus, general purpose input and output (GPIO), serial peripheral interface (SPI), or mobile industry processor interface (MIPI)).

[0043] According to one embodiment, commands or data may be transmitted or received between the hood system 101 and the external devices 70 via the network 50 connecting to the network 50. Each of the external

devices 70 may be the same as or different from the hood system 101. According to one embodiment, all or some of operations to be executed by the hood system 101 may be executed by one or more of external electronic devices 70.

[0044] In one embodiment, the external devices 70 may include a plurality of Internet-of-things (IoT) devices 71, 72, and 73 (hereinafter, referred to as "IoT devices"). The network 50 may be an intelligent server 60 using machine learning and/or a neural network. According to one embodiment, the external devices 70 or the server 60 may connect to the server 60. The hood system 101 may be applicable to intelligent services (e.g., smart home, smart city, smart car, or healthcare) based on communication technology and IoT-related technology.

[0045] For example, the first IoT device 71 may be one of a cooktop, an oven, and an electric range of a cooking appliance (e.g., the cooking appliance 20 of FIG. 1). Alternatively, at least one of the first IoT device 71, the second IoT device 72, and the third IoT device 73 may be a home electronic appliance, such as a cooking appliance, an air conditioner, a robot cleaner, an air conditioner, a refrigerator, a toaster, a water purifier, and a TV, or a personal communication device, such as a smartphone, tablet, notebook, or desktop.

[0046] For example, when the hood system 101 performs a function or a service automatically, or in response to a request from a user or another device, the hood system 101, instead of, or in addition to, executing the function or the service, may send a request to one or more external devices 70 to perform the function or the service or at least part thereof. The one or more external devices 70 receiving the request may perform the at least part of the function or the service requested, or an additional function or an additional service related to the request, and may transfer an outcome of the performance to the hood system 101. The hood system 101 may provide the outcome, further processing or not further processing the outcome, as at least part of a reply to the request. To that end, a connection method via the network 50 may, for example, use a cloud computing, distributed computing, mobile edge computing (MEC), or client-server 60 computing technology.

[0047] In one embodiment, the sensor module 160 may sense at least one of an operational state of the hood system 101 and an environmental state of the hood system 101. The terminology of "at least one of" an operational state of the hood system 101 and an environmental state of the hood system 101 includes any of the following: (i) an operational state of the hood system 101, (ii) an environmental state of the hood system, (iii) an operational state of the hood system 101 and an environmental state of the hood system 101.

[0048] The "operational state" of the hood system 101 may include, but is not limited to, power of the hood system 101, temperature of the hood system, air volume of a fan of the hood system 101, etc. The environmental state of the hood system 101 may include, but is not

limited to, a position of a user, motion of the user, an operation performed by the user, an ambient temperature of the hood system 101, a temperature of an external device, a degree of air quality in the vicinity of the hood system 101, an air volume in the vicinity of the hood system 101, etc. Based on the sensed at least one of the operational state and the environmental state, the sensor module 160 may generate an electric signal or data value corresponding to the detected state.

[0049] In an embodiment in which the hood system 101 is for a cooking appliance, the environmental state may include, but is not limited to, a position of a user of the cooking appliance, motion of the user, an operation performed by the user, an ambient temperature of the hood system 101, a temperature of a heater of the cooking appliance, a temperature of a cooking vessel on a cooktop of the cooking appliance, a position of the cooking vessel, a degree of air quality in the vicinity of the hood system 101, an air volume in the vicinity of the hood system 101, etc. Based on the sensed at least one of the operational state and the environmental state, the sensor module 160 may generate an electric signal or data value corresponding to the detected state.

[0050] In one embodiment, to perform various sensor functions, the sensor module 160 may include at least one of a gesture sensor, a gyro sensor, an atmospheric pressure sensor, a magnetic sensor, an acceleration sensor, a grip sensor, a proximity sensor, a color sensor, an infrared (IR) sensor, a biometric sensor, a humidity sensor, or an illuminance sensor.

[0051] In one embodiment, a temperature sensor 161 measures an ambient temperature of the hood system 101, or a temperature of a heater of the cooking appliance 20 (e.g., the heater 21 of FIG. 1) or a cooking vessel (e.g., the cooking appliance of FIG. 3B).

[0052] In one embodiment, a motion sensor 163 may measure a user's position or motion. For example, the motion sensor 163 may measure a distance between the user and the hood system 101 or the cooking appliance. Alternatively, the motion sensor 163 may sense the user's motion, and the processor 120 may receive the sensed user's motion and determine whether the user is performing a cooking preparation motion or an ending motion. Alternatively, the motion sensor 163 may sense the user's motion to determine a position of a cooking vessel 25. The present disclosure is not limited thereto, and the motion sensor 163, according to one embodiment, may sense a variety of a user's motions related to the hood system 101 and the cooking appliance 20.

[0053] In one embodiment, a dust sensor 165 and a VOCs sensor 167 may measure a degree of air pollution. For example, the dust sensor 165 may measure a concentration of fine dust and ultrafine dust in harmful air generating from cooking, and the VOCs sensor 167 may measure a concentration of gas, such as hydrogen, hydrogen sulfide, and ammonia 151, ethanol, carbon monoxide, methane, and propane.

[0054] In one embodiment, an air volume sensor 169

may measure an air volume of the fan 113, and the processor 120 may receive the measured air volume to control the driving force of the fan 113 by increasing or decreasing the driving force of the fan 113. Alternatively, the air volume sensor 169 may measure an air volume of a surrounding environment of the hood system 101, and the hood system 101 may control driving elements, such as a position of the hood module 150 and driving force of the fan 113, based on the measured air volume.

[0055] In one embodiment, the sensor module 160 measures a level of fine dust concentration or gas contamination in surrounding air even when the hood system 101 is not being driven or the cooking appliance is not being driven. When it is determined that air quality is bad, the processor 120 may notify a user that air quality is bad or drive the hood system 101 automatically.

[0056] FIG. 3A is a perspective view of a hood system 101 according to one embodiment, FIG. 3B is a perspective view of the hood system 101 according to one embodiment, and FIG. 3C is a front view of the hood system 101 according to one embodiment.

[0057] Referring to FIGS. 3A to 3C, the hood system 101 according to one embodiment may include a main body 105 and a hood module 150, which may move.

[0058] In one embodiment, the hood system 101 may be in a first state A1 as illustrated in FIG. 3A, where the hood system 101 is in a standby state or the hood system 101 is in operation but the hood module 150 is in a standby state, and may be in a second state A2 as illustrated in FIG. 3B, where the hood system 101 is in operation and the hood module 150 is moved and in operation. FIG. 3C illustrates an internal structure of the main body 105 of the hood system 101.

[0059] In one embodiment, the hood system 101 may include a main body 105 defining an exterior and receiving internal components, and the main body 105 may be secured to a wall surface 10, which is an external support. In one embodiment, the main body 105 may include a first surface 105A facing a direction that the wall surface 10 is facing (e.g., -Y direction), a second surface 105B facing a direction (e.g., +Z direction) opposite to a direction of a cooking appliance (e.g., -Z direction) from the first surface 105A, a third surface 105C facing a direction of the cooking appliance (e.g., -Z direction) based on the first surface 105A, and a pair of a fourth surfaces 105D facing both directions (e.g., +/-X directions) excluding the directions of the second surface 105B and the third surface 105C, based on the first surface 105A.

[0060] In one embodiment, a sensor module 160 may be adjacent to one surface, for example, the second surface 105B of the main body 105, to sense at least one of external conditions of the main body 105 (e.g., environment change of a user, a cooking appliance, and a cooking space). A processor (e.g., the processor 120 of FIG. 2) may receive a sensing result from the sensor module 160 and control driving of the hood system 101 based on the received sensing result.

[0061] In one embodiment, a fixed intake port 115 may

be on the second surface 105B facing a heater 21 of the cooking appliance, and the hood module 150 may be adjacent to the second surface 105B and on a pair of the fourth surfaces 105D. In one embodiment, the hood system 101 may include a plurality (e.g., two) of hood modules 150, and each of the plurality of hood modules 150 may include an arm 151 and an intake port 153. A plurality of arms 151 may be spaced apart from each other in both directions with respect to the second surface 105B and respectively disposed on the pair of fourth surfaces 105D.

[0062] In one embodiment, an exhaust duct 111 may be in the inner space of the main body 105. The main body 105 may include an exhaust port 112 that passes through the wall surface 10 or extends to the outside of a cooking space to discharge sucked air to the outside of the cooking space, and the exhaust port 112 may connect to the exhaust duct 111. In one embodiment, the exhaust duct 111 may connect to at least one of the intake port 153 of the arm 151 and the fixed intake port 115 of the arm 151.

[0063] For example, the arm 151 may connect to the pair of fourth surfaces 105D of the main body 105 to communicate with the exhaust duct 111, and the fixed intake port 115 may connect to the third surface 105C of the main body 105. The exhaust duct 111 may include a first duct 111A, which communicates with the intake port 153 of the hood module 150 through the arm 151 and a second duct 111B, which communicate with the fixed intake port 115.

[0064] In one embodiment, the main body 105 may include a fan housing 114 communicating with the exhaust port 112 and having a fan 113 therein. The fan housing 114 may respectively connect to a first duct 111A and a second duct 111B to induce an air flow in the first duct 111A and the second duct 111B. The main body 105 may communicate with the fan housing 114 and include a wall 119 partitioning the interior of the exhaust duct 111 to separate the first duct 111A from the second duct 111B. By the wall 119, the first duct 111A and the second duct 111B may be separated and suck and discharge air, respectively. In one embodiment, the wall 119 may connect to the fan housing 114.

[0065] In one embodiment, the cooking appliance may include a plurality of heaters 21. For example, the plurality of heaters 21 may be on the upper surface (e.g., a plane in the +Z direction) of a countertop 15, and may be defined based on a position on the countertop 15.

[0066] For example, the heaters 21 may include internal heaters (e.g., first, second, third heaters 21A, 21B, and 21C) in a direction adjacent to the wall surface 10 or the hood system 101 in a countertop 15 (e.g., +Y direction) and external heaters (e.g., fourth, fifth, sixth heaters 21D, 21E, and 21F) in a direction away from the wall surface 10 or the hood system 101 (e.g., -Y direction).

[0067] For example, the heaters 21 may include the first heater 21A and the fourth heater 21D in one of the directions of the pair of fourth surfaces 105D of the hood system 101 (e.g., -X direction) in the countertop 15, and

may include the third heater 21C and the sixth heater 21F in the other direction of the pair of fourth surfaces 105D of the hood system 101 (e.g., +X direction) in the countertop 15. In one embodiment, the heaters 21 may include the second heater 21B between the first heater 21A and the third heater 21C and the fifth heater 21E between the fourth heater 21D and the sixth heater 21F.

[0068] In one embodiment, cooking vessels 25 may be on the upper surface (e.g., +X direction) of the heaters 21 to be heated by the heaters 21, and more than one cooking vessel 25 may be used at the same time in the cooking appliance, the cooking vessels 25 corresponding to the heaters 21.

[0069] For example, the first cooking vessel 25A may be on the first heater 21A, the second cooking vessel 25B may be on the second heater 21B, and the third cooking vessel 25C may be on the third heater 21C, the fourth cooking vessel 25D may be on the fourth heater 21D, the fifth cooking vessel 25E may be on the fifth heater 21E, and the sixth cooking vessel 25F may be on the sixth heater 21F. However, the present disclosure is not limited thereto, and one cooking vessel 25 may be on the plurality of heaters 21.

[0070] In one embodiment, the arm 151 may include a first arm 171 and a second arm 172, and joints (e.g., first and second joints 181 and 182) to allow the first arm 171 and the second arm 172 to rotate and/or move based on the main body 105, so that the arm 151 may be multi-articulated and driven. The arm 151 may include the first arm 171 which may be rotatably connected to the main body 105 through the first joint 181 and the second arm 172 which may be rotatably connected to the first arm 171 through the second joint 182. The intake port 153 may be on one surface of the second arm 172 and a position of the intake port 153 may change by the rotation of the first arm 171 and the second arm 172.

[0071] For example, the arm 151 may include a first arm 171 including a first end portion 171A connecting to the main body 105 and a second end portion 171B opposite to the first end portion 171A; and a second arm 172 including a third end portion 172A connecting to the second end portion 171B of the first arm 171 and a fourth end portion 172B opposite to the third end portion 172A. The arm 151 may include the first joint 181 connecting the main body 105 to the first end portion 171A to allow the first arm 171 to rotate within a predetermined angle range and a second joint 182 connecting the second end portion 171B to the third end portion 172A to allow the second arm 172 to rotate within a predetermined angle range. In one embodiment, the intake port 153 of the plurality of arms 151 may be on one surface facing the cooking appliance or the cooking vessel 25 among the outer surfaces of the first arm 171 and/or the second arm 172.

[0072] Referring to FIG. 3A, the first state A1 may be a standby state in which the fan 113 is not driven, or the first state A1, according to one embodiment, may be a 'weak driving' state in which the hood system 101 drives

weakly. Alternatively, the first state A1 of one embodiment may be a state in which only some of the heaters 21 (e.g., the internal heaters 21A, 21B, 21C or the second heater 21B) are driven among the plurality of heaters 21 so that only the fixed intake port 115 sucks in air.

[0073] In one embodiment, in the first state A1, the first arm 171 and the second arm 172 may be fixed adjacent to the main body 105, and the intake port 153 may be closed or substantially closed by a door 157. In one embodiment, the first state may be a state in which air is sucked only by the fixed intake port 115.

[0074] Referring to FIG. 3B, the second state A2 may be a state in which the arm 151 of the hood module 150 moves to suck air, or the second state A2, according to one embodiment, may be a 'strong driving' state in which the hood system 101 drives strongly. Alternatively, the second state A2 of one embodiment may be a state in which some of the plurality of heaters 21, for example, at least one of the external heaters 21D, 21E, and 21F, the first heater 21A, and the third heater 21C, are being driven so that the intake port 153 of the hood module 150 is sucking air.

[0075] In one embodiment, the processor 120 may control driving of the hood system 101, for example, controlling a driving force of the fan 113 or controlling a driving unit 155 to move the hood module 150. In one embodiment, the processor 120 may receive a sensing result from the sensor module 160, move the hood module 150 adjacent to a suction target based on the sensing result and control a position of the intake port 153 to suck air.

[0076] For example, a state progresses from the first state A1 to the second state A2, and the hood system 101 may move the first arm 171 at a predetermined angle from the main body 105 and move the second arm 172 at a predetermined angle from the first arm 171. The hood system 101 may recognize a position where air suction is needed through the processor 120 and move the intake port 153 to the position to suck air. However, the present disclosure is not limited thereto, and the hood system 101 may allow a user or a user and a program to move the first arm 171 and the second arm 172.

[0077] In one embodiment, the second state A2 may be a state in which the intake port 153 of the hood module 150 moves to a position where air suction is needed, for example, a position adjacent to heaters 21 being driven or adjacent to the cooking vessel 25 generating smoke, so that air may be sucked strongly in a localized area.

[0078] In one embodiment, when the intake port 153 of the hood module 150 does not suck air and the fixed intake port 115 sucks air, the hood system 101 may not completely suck dust and gases generating from the external heaters 21D, 21E, and 21F, or the heaters in both lateral directions (e.g., +/- X directions) 21A, 21C, 21D, and 21F so that the hood system 101 may increase a driving force of the fan 113 to provide a greater suction force, thus increasing power consumption and generating noise.

[0079] The hood system 101 of one embodiment may

include the hood module 150, which is movable, to move the intake port 153 adjacent to a position where air suction is needed. The arm 151 of the hood module 150 may be flexibly moved to and fixed at a place adjacent to a suction target through a multi-articulated structure and may suck air while being practically close to the suction target, thus improving performance of sucking in dust and harmful gases.

[0080] The hood system 101, according to one embodiment, may identify an optimal position to effectively suck air while not interfering with a user's cooking, based on various factors, for example, type of the cooking container 25, a cooking target, and a user's tendency (e.g., left-handed or right-handed and physical factors, such as height) through the processor 120 and/or the sensor module 160. The hood module 150 may practically move the intake port 153 to an optimal position in a free and stable manner through the arm 151, which is multi-articulated, to improve the user's convenience and comfort.

[0081] The hood system 101 of one embodiment may efficiently suck air in a localized area even when the fan 113 provides relatively less driving force, compared to the fixed intake port 115, so that the hood system 101 of one embodiment herein may consume less power and produce less noise.

[0082] In one embodiment, the processor 120 may compile a sensing result into data and transmit the data to a network 50 through a communication interface (e.g., the communication interface 140 of FIG. 2), or notify a user of a driving state of the hood system 101 through an output interface (not shown).

[0083] FIG. 4A is a perspective view of a hood system 101 according to one embodiment, FIG. 4B is a perspective view of the hood system 101 according to one embodiment, and FIG. 4C is a perspective view of the hood system 101 according to one embodiment.

[0084] Referring to FIGS. 4A to 4C, the hood system 101, according to one embodiment, may include a main body 105 and a hood module 150, which is movable.

[0085] In one embodiment, the hood system 101 may be in a state B1 as illustrated in FIG. 4A where the hood system 101 is in a standby state or sucks less air, compared to other states B2 and B3, and may be in a second state B2 as illustrated in FIG. 4B in which a fixed intake port 115 of the hood system 101 mainly sucks air. FIG. 4C illustrates a third state B3 in which the fixed intake port 115 and the hood module 150 of the hood system 101 suck air.

[0086] Referring to the description of the hood system 101 of FIGS. 4A to 4C, any redundant description of the hood system 101 of FIGS. 1 to 3C above has been omitted, and different structures are mainly described.

[0087] Illustrating a cooking vessel (e.g., the cooking vessel 25 of FIG. 3B), FIGS. 4A to 4C show, as an example, a first cooking vessel 25A and a third cooking vessel 25C facing in an inner direction (e.g., +Y direction) of two lateral directions (e.g., +/-X direction) based on a direction in which the heater 21 is viewed from the main

body 105, and a fourth cooking vessel 25D and a sixth cooking vessel 25F facing in an outer direction (e.g., -Y direction) of the two lateral directions (e.g., +/-X direction). However, the actual implementation is not limited thereto and the cooking vessel 25 may be disposed at various positions, corresponding to a structure of the heater 21.

[0088] In one embodiment, the hood system 101 may include a support groove 116 that receives and supports the arm 151 in a state in which the arm 151 is in close contact with the main body 105. In one embodiment, the fixed intake port 115 may be inside the support groove 116. The support groove 116 may be at a position adjacent to the cooking vessel 25 among a plurality of surfaces of the main body 105 (first, second, and fourth surfaces of the main body 105A, 105B, and 105D), for example, a first surface 105A or a second surface 105B of the main body 105.

[0089] In one embodiment, when the arm 151 closes at least a portion of the fixed intake port 115 or the arm is seated in the support groove 116, air flow in the fixed intake port 115 may be partially restricted.

[0090] For example, as in the first state B1 of FIG. 4A, a pair of the arms 151 may be seated in the support groove 116. In one embodiment, the first state B1 may be a standby state in which the fan 113 of the hood system 101 stops driving, or may be a 'weak driving' state in which the hood system 101 drives weakly.

[0091] In one embodiment, in a state in which the arm 151 is in close contact with the main body 105, the intake port 153 may be inside the support groove 116 and form a clearance area 161 between the support groove 116 and the arm 151. A clearance space 116A may be an open space where at least a portion of the arm 151 is spaced apart from the support groove 116 with the arm 151 in the support groove 116.

[0092] In one embodiment, in the first state B1, the intake port 153 or the fixed intake port 115 may communicate with the outside of the hood system 101 through the clearance space 116A, and the hood system 101 may suck air from the outside.

[0093] For example, some areas of the arm 151 (e.g., the first arm 171) may have a shape corresponding to a shape of the support groove 116 and closely couple to the support groove 116. The other areas of the arm 151 (e.g., the second arm 172) may have a shape different from that of the support groove 116 at least in part, and at least some of the other areas may be spaced apart from the support groove 116 and be couplable to the support groove 116. In one embodiment, the clearance space 116A between the arm 151 and the support groove 116 may form a flow path to suck air.

[0094] In one embodiment, in the first state B1, air may be sucked through the clearance space 116A relatively restrictedly, compared to other states (e.g., the second state B2 or the third state B3) in which the arm 151 is separated from the support groove 116.

[0095] In one embodiment, the first state B1 may be a

state when heating of the cooking vessel 25 has started or cooking generating little air pollution has started. In one embodiment, assuming the same driving force of the fan 113, the air suction force may be stronger in a localized area in the first state B1, than in the second state B2 and the third state B3.

[0096] In one embodiment, the arm 151 may include the first arm 171, the second arm 172, a first joint 181, and a second joint 182. The first joint 181 may connect a first end portion 171A of the first arm 171 to the main body 105 such that the first arm 171 may rotate.

[0097] In one embodiment, in the second state B2, as shown in FIG. 4B, the first joint 181 may connect the first arm 171 to the main body 105 to allow the first arm 171 to rotate at a predetermined angle in the vertical direction (e.g., the + Z direction) from the support groove 116.

[0098] In one embodiment, the second state B2, as shown in FIG. 4B, may be a state in which the fixed intake port 115 is completely open and the intake port 153 of the hood module 150 is closed. In one embodiment, the second state B2 may be a state in which the arm 151 opens the fixed intake port 115, and the arm 151 moves upward allowing air to be sucked mainly through the fixed intake port 115.

[0099] For example, the second state B2 may be a state in which the arm 151 moves away from the cooking vessel 25 (e.g., + Y direction and/or + Z direction) to prevent the arm 151 from interfering with a user using the cooking appliance. Alternatively, for example, the second state B2 may be a state in which the cooking vessels (e.g., the first cooking vessel 25A and/or the third cooking vessel 25C) of the heaters 21 adjacent to the fixed intake port 115 are being heated.

[0100] In one embodiment, in the third state B3, as shown in FIG. 4C, the first joint 181 may connect the first arm 171 to the main body 105 to allow the first arm 171 to rotate at a predetermined angle in a horizontal direction (e.g., - Y direction) from the support groove 116.

[0101] In one embodiment, the third state B3, as shown in FIG. 4C, may be a state in which the fixed intake port 115 and the intake port 153 of the hood module 150 are open so that both are sucking air respectively, or the fixed intake port 115 is closed and the intake port 153 of the hood module 150 is open, so that the hood module 150 is sucking air. In one embodiment, the third state B3 may be a state in which the arm 151 moves to a position adjacent to the cooking vessel 25 and air is sucked strongly in a localized area.

[0102] In one embodiment, the third state B3 may be a driving state in which a relatively large amount of air needs to be sucked while a user is using a cooking appliance, and the cooking vessels 25 are being heated on the plurality of heaters 25.

[0103] For example, the third state B3 may be a state in which the arm 151 moves to a position adjacent to the cooking vessel 25. Alternatively, for example, the third state B3 may be a state in which a cooking vessel (e.g., the fourth cooking vessel 25D and the sixth cooking ves-

sel 25F), which is relatively far from the fixed intake port 115, is being heated.

[0104] In one embodiment, the hood module 150 in the third state B3 may be in a cooking state to suck air from around cooking vessels (e.g., the fourth cooking vessel 25D and the sixth cooking vessel 25F) spaced apart from the fixed intake port 115 in a direction of a position of a user (e.g., + Y direction) or cooking vessels (e.g., the first cooking vessel 25, the third cooking vessel 25C, the fourth cooking vessel 25D, and the sixth cooking vessel 25F) spaced apart from the fixed intake port 115 in a direction of a countertop 15 (e.g., +/- X direction). Alternatively, the third state may be a 'strong driving' state in which the hood system 101 drives strongly.

[0105] In one embodiment, in the second state B2, as shown in FIG. 4B, and in the third state B3, as shown in FIG. 4C, the first joint 181 may connect the first arm 171 to the main body 105 to allow the arm 171 to rotate from the support groove 116 at a predetermined angle in a horizontal direction and a vertical direction, respectively. The first arm 171 may rotate in various directions from the main body 105 and form an appropriate driving state according to a driving environment and a user.

[0106] For example, in the first state B1, the hood system 101 may suck air at a position adjacent to the fixed intake port 115 with a weak driving force. In the second state B2, the hood system 101 may open the fixed intake port 115 so that air may be sucked based on a position of the fixed intake port 115 with a strong driving force, and may dispose the arm 151 so that a user's cooking is not interfered with. In the third state B3, the hood system 101 may move the hood module 150 so that air may be sucked efficiently in a localized area.

[0107] In one embodiment, the second joint 182 may connect the second end portion 171B of the first arm 171 and the third end portion 172A of the second arm 172 so that the second arm 172 may rotate. In another embodiment, the second joint 182 may connect the second arm 172 and the first arm 171 to allow the second arm 172 to be inserted in or withdrawn from the first arm 171, an overall length of the arm 151 may be extended or reduced by the second joint 182, and the arm 151 may adjust a position of the intake port 153. In one embodiment, a plurality of intake ports 153 may be provided on the second arm 172, and the plurality of intake ports 153 may be spaced apart from each other in a direction from the third end portion 172A of the second arm 172 to the fourth end portion 172B.

[0108] FIG. 5 is a perspective view of a hood system 101, according to one embodiment.

[0109] Referring to FIG. 5, the hood system 101, according to one embodiment, may include a third arm 173 and a plurality of intake ports 153A, 153B, and 153C.

[0110] Referring to the hood system 101 of FIG. 5, any redundant description of the hood system 101 of FIGS. 1 to 4C above has been omitted and different structures are mainly described.

[0111] FIG. 5 illustrating cooking vessels (e.g., the

cooking vessel 25 of FIG. 3B) shows, as an example, a third cooking vessel 25C disposed at an inner position (e.g., + Y direction) on one side (e.g., +X direction) and a fourth cooking vessel 25D disposed at an outer position (e.g., - Y direction) on other side (e.g., - X direction) opposite to the side on which 25C is disposed, based on a direction in which a heater 21 is viewed from a main body 105. However, the actual implementation is not limited thereto and the cooking vessels 25 may be at various positions, corresponding to a structure of the heater 21.

[0112] In one embodiment, an arm 151 may include a fifth end portion 173A connecting to a fourth end portion 172B of the second arm 172, a third arm 173 including a sixth end portion 173B opposite to the fifth end portion 173A, and a third joint 183 connecting the fourth end portion 172B and the fifth end portion 173A to allow the third arm 173 to rotate at a predetermined angle range. In one embodiment, the arm 151 may include a plurality of arms 171, 172, and 173, and the plurality of arms 171, 172 and 173 are rotatably connected to through plurality of joints 181, 182, and 183 and may each be a multi-articulated arm, providing greater freedom of movement.

[0113] In one embodiment, the arm 151 may include a plurality of intake ports (e.g., first, second and third intake ports 153A, 153B, and 153C) in at least one of the plurality of arms 171, 172, and 173, and the plurality of intake ports 153A, 153B, and 153C may include at least one of the first intake port 153A on the first arm 171, the second intake port 153B on the second arm 172, and the third intake port 153C on the third arm 173.

[0114] In one embodiment, the plurality of intake ports 153A, 153B, and 153C may extend from the main body 105 in a direction of the heaters 21, and at least a portion may be moved and fixed while being bent or folded. For example, a sensor module 160 may sense various factors, such as a position, a type, a height of the cooking vessels 25, and based on such factors, the processor 120 may move the arm 151 to an optimal position at which the intake port 153 may suck smoke or dust generating from the cooking vessel 25.

[0115] For example, the arm 151 may be parallel to one direction (e.g., - Y direction) so that the plurality of intake ports 153A, 153B, and 153C may be arranged in one direction (e.g., - Y direction) and be adjacent to each of the cooking vessels 25 arranged in the same direction. Alternatively, at least a portion of the arm 151 may be bent at a predetermined angle so that the plurality of intake ports 153 may suck air from around the cooking vessel 25 from a relatively high position, or effectively suck air moving in an upward direction (e.g., + Z direction).

[0116] FIG. 6 is a flowchart of a method of controlling a hood system, hood system control method S100, according to one embodiment.

[0117] Referring to FIG. 6, the hood system control method S100 of one embodiment may include at least some of sensing cooking in operation S110, driving a fan 113 in operation S120, recognizing a cooking position in

operation S130, moving an arm 151 in operation S135, and sucking air in operation S140.

[0118] In one embodiment, the hood system control method S 100 may be the hood system control method S100 described in FIGS. 1 to 5, or, without being limited thereto, may be applicable to various hood systems 101 capable of performing the following operations. In addition, at least some of operations in the hood system control method S100 may be performed by a processor (e.g., the processor 120 of FIG. 2) and a sensor module (e.g., the sensor module 160 of FIG. 2) of the hood system 101, or by a user. At least some operations may be omitted or modified within a range easily modifiable by those skilled in the art.

[0119] In one embodiment, sensing cooking in operation S110 may include sensing when cooking starts. The sensor module 160 may sense cooking start information, for example, a temperature change of a heater 21, a temperature change of a cooking vessel 25, and a user's movement and transmit the sensed information to the processor 120. Alternatively, the processor 120 may receive driving information about a cooking appliance from an external device (e.g., the external device 70 of FIG. 2) through a communication interface (e.g., the communication interface 140 of FIG. 2) and thereby recognize cooking has started. In one embodiment, driving the fan 113 in operation S 120 may include driving the fan 113 to suck air by an exhaust duct 111.

[0120] In one embodiment, recognizing a cooking position in operation S130 may include recognizing a position of the cooking vessel 25 for which air suction is needed by the sensor module 160. For example, in a cooking appliance including the plurality of heaters 21, the sensor module 160 may sense at least one of factors, such as a position, a type, and a size of the cooking vessel 25. In one embodiment, moving the arm 151 in operation S135 may include moving the arm 151 to a position adjacent to the cooking vessel 25 based on the sensing result of the sensor module 160.

[0121] In one embodiment, sucking air in operation S140 may include sucking air adjacent to the cooking vessel 25 by an intake port 153 communicating with the exhaust duct 111 and provided on one surface of the arm 151. In one embodiment, sucking air in operation S140 may include initiating and performing sucking air by the intake port 153 of the arm 151, in connection with driving the fan in operation S120 and moving the arm in operation S135, or may include initiating sucking air by the intake port 153 of the arm 151 by moving a door 157 of the intake port 153 to open the intake port 153.

[0122] In one embodiment, the hood system control method S100 may recognize a cooking position, move the arm 151 to allow the intake port 153 to be adjacent to the cooking vessel 25, and suck air in a localized area where air suction is needed so the fan 113 may be driven more efficiently and enhance the air suction of the hood system 101.

[0123] In one embodiment, the hood system control

method S 100 may perform additional control in operation S150 to control driving of the hood system 101 based on a change in driving system of the hood system 101 after performing sucking air in operation S140.

[0124] FIG. 7 is a flowchart of a method of controlling a hood system, the hood system control method S100, according to one embodiment.

[0125] Referring to FIG. 7, the hood system control method S100 may further include at least some of sensing an environment change in operation S160, moving an arm position in operation S170 and controlling fan driving in operation S180.

[0126] In one embodiment, sensing the environment change in operation S160 may include sensing a change in cooking environment, in which a hood system 101 is driving, when the hood system 101 starts sucking air after initiating sucking air in operation S140. For example, an amount of smoke and dust may change as cooking proceeds in stages after sucking air is initiated, a cooking vessel may be added, or air suction may be mainly needed only for one cooking vessel among a plurality of cooking vessel 25. Sensing the environment change in operation S160 may include sensing at least one of a plurality of factors, such as a user, the cooking vessel 25, and a surrounding environment.

[0127] In one embodiment, performing additional control in operation S150 may include changing a position of the arm 151 in operation S160 based on a sensing result from sensing the environment change in operation S160 and/or controlling a driving force of the fan in operation S180. Changing the position of the arm 151 in operation S170 may include selectively performing at least one of moving the arm 151 in a direction of the cooking vessel 25 in operation S171 and moving the arm 151 in a direction away from the cooking vessel 25 in operation S175, which may be done when there is need to change a position of the intake port 153. Controlling the fan driving in operation S180 may include selectively performing at least one of increasing a driving force of the fan 113 in operation S181 and decreasing a driving force of the fan 113 in operation S185, which may be done when there is need to change an amount of air suction in the hood system 101.

[0128] In one embodiment, sensing the environmental change in operation S160 may include sensing at least one of a position and operation of a user of the hood system 101, a temperature and a state of the cooking vessel 25, and air quality of a cooking environment. Described hereinafter are performing additional control in operation S150, which includes changing a position of the arm 151 in operation S170, based on a plurality of factors recognized through recognizing the environment change in operation S160, and controlling a driving force of the fan 113 in operation S170, which includes changing a position of a hood module 150 in operation S170 and controlling driving of the fan 113 in operation S180.

[0129] In one embodiment, sensing the environmental change in operation S160 may include at least one of

sensing a position of a user of the hood system 101 in operation S161 and sensing an operation of a user of the hood system 101 in operation S162.

[0130] In one embodiment, performing additional control in operation S150 may include moving the arm 151 adjacent to the cooking vessel 25 in response to sensing that a user is moving away from a cooking appliance by the sensing of an environment change in operation S160. Alternatively, performing additional control in operation S150 may include moving the arm 151 in an opposition direction away from the cooking vessel 25 in operation S175 in response to sensing that a user is approaching the cooking appliance by the sensing of an environment change in operation S160.

[0131] In one embodiment, when a user is adjacent to the cooking vessel 25, the hood system 101 may recognize that the user is performing a cooking operation in the cooking vessel 25. The arm 151 adjacent to the cooking vessel 25 may interfere with the user putting ingredients in the cooking vessel 25 or touching ingredients. Performing additional control in operation S150, according to one embodiment, may include moving the arm 151 away from the cooking vessel 25 when a user is adjacent to the cooking vessel 25, so that the user may perform the cooking operation in a comfortable environment and moving the arm 151 adjacent to the cooking vessel 25 when the user is away from the cooking vessel 25, so that air may be sucked more effectively.

[0132] In one embodiment, performing the additional control in operation S150 may include increasing a driving force of the fan 113 in operation S181 in response to sensing that a user is moving away from the cooking appliance by the sensing of the environment change in operation S160. Alternatively, performing the additional control in operation S150 may include decreasing a driving force of the fan 113 in operation S185 in response to sensing that a user is approaching the cooking appliance by the sensing of the environment change in operation S160.

[0133] In one embodiment, when a user is adjacent to the cooking vessel 25, the hood system 101 may recognize that the user is performing a cooking operation in the cooking vessel 25. When the arm 151 is adjacent to the cooking vessel 25, driving noise or strong air flow from the fan 113 may interfere with the user's cooking operation and discomfort the user. Performing the additional control in operation S150, according to one embodiment, may include reducing a driving force of the fan 113 when a user is adjacent to the cooking vessel 25 so that the user may perform the cooking operation in a comfortable environment and increasing a driving force of the fan 113 when the user moves away from the fan 113 so that air may be sucked more efficiently.

[0134] In one embodiment, sensing the environment change in operation S160 may include at least one of sensing a temperature in operation S163 and sensing a state of cooking in operation S164.

[0135] In one embodiment, performing the additional

control in operation S150 may include moving the arm 151 adjacent to the cooking vessel 25 in operation S171 in response to sensing that the contents of the cooking vessel 25 are boiling by the sensing of the environment change in operation S160. Alternatively, performing the additional control in operation S150 may include moving the arm 151 in an opposite direction away from the cooking container 25 in operation S175 in response to sensing that the contents of the cooking container 25 have not started boiling, by the sensing of the environmental change in operation S160.

[0136] In one embodiment, when the contents of the cooking vessel 25 are boiling, to efficiently suck smoke or dust generating from the cooking vessel 25, the hood system 101 may suck strongly. Performing the additional control in operation S150, according to one embodiment, may include moving the arm 151 away from the cooking vessel 25 before the contents of the cooking vessel 25 start boiling so that the arm 151 does not interfere with a user's cooking operation, providing a comfortable environment for the cooking operation. Alternatively, performing the additional control in operation S150 may include moving the arm 151 adjacent to the cooking vessel 25 when the contents of the cooking vessel 25 start boiling, so that the air may be sucked more efficiently.

[0137] In one embodiment, performing the additional control in operation S150 may include increasing a driving force of the fan 113 in operation S181 in response to sensing that the contents of the cooking vessel 25 are boiling by the sensing of the environment change in operation S160. Alternatively, performing the additional control in operation S150 may include reducing a driving force of the fan 113 in operation S185 in response to sensing that the contents of the cooking container 25 have not started boiling by the sensing of the environment change in operation S160.

[0138] In one embodiment, when the contents of the cooking vessel 25 start boiling, the hood system 101 may increase a driving force of the fan 113 to increase an amount of air suction. Performing additional control in operation S150, according to one embodiment, may include reducing a driving force of the fan 113 before the contents of the cooking vessel 25 start boiling so that a user may perform the cooking operation in a comfortable environment and increasing a driving force of the fan 113 when the contents of the cooking vessel 25 start boiling, so that air may be sucked more efficiently.

[0139] In one embodiment, sensing the environmental change in operation S160 may include sensing quality of air adjacent to the hood system 101 in operation S165 or sensing the environmental change in operation S160 may include sensing air volume of the hood system 101 and/or a volume of air adjacent to the hood system 101 in operation S166.

[0140] In one embodiment, performing the additional control in operation S150 may include moving the arm 151 adjacent to the cooking vessel 25 in operation S171 in response to sensing that air quality around the hood

system 101 is deteriorating or ventilation around the hood system 101 is insufficient by the sensing of the environment change in operation S160. Alternatively, performing the additional control in operation S150 may include moving the arm 151 in an opposite direction away from the cooking vessel 25 in operation S175 in response to sensing that the air quality is good or ventilation around the hood system 101 is sufficient by the sensing of the environment change in operation S160.

[0141] Performing the additional control in operation S150 according to one embodiment, may include moving the arm 151 adjacent to the cooking vessel 25 to increase air suction performance of the hood system 101 when strong air suction is needed and moving the arm 151 away from the cooking vessel 25 when the surrounding air quality has improved so that a user's cooking operation is not interfered with, and so that the user may perform the cooking operation in a comfortable environment.

[0142] In one embodiment, performing the additional control in operation S150 may include increasing a driving force of the fan 113 in operation S181 in response to sensing that more ventilation is needed around the hood system 101 by the sensing of the environmental change in operation S160. Alternatively, performing the additional control in operation S150 may include reducing a driving force of the fan 113 in response to sensing that ventilation around the hood system 101 is sufficient by the sensing of the environment change in operation S160.

[0143] In one embodiment, the hood system 101 may increase or decrease the amount of air suction based on ambient air quality. Performing the additional control in operation S150, according to one embodiment, may include reducing a driving force of the fan 113 when the surrounding air quality is appropriate within a preset value, so that a user may perform the cooking operation in a comfortable environment, and increasing a driving force of the fan 113 to suck air more efficiently when surrounding air quality deteriorates.

[0144] In one embodiment, sensing the environment change in operation S160 may include receiving a driving state of IoT devices (e.g., first, second, and third IoT devices 71, 72, and 73) through a network 50 in operation S167. Controlling a position of the arm 151 in operation S170 may include controlling a position of the arm 151 based on a driving state of the IoT devices 71, 72, and 73.

[0145] In one embodiment, information from the various IoT devices 71, 72, and 73 is acquired by performing sensing the environment change in operation S160 and, based thereon, performing the additional control in operation S150 may include moving the arm 151 adjacent to the cooking vessel 25 in operation S 171 or moving the arm 151 in an opposite direction away from the cooking vessel 25 in operation S175. Alternatively, information is acquired from the various IoT devices 71, 72, and 73 by performing sensing of the environment change in operation S160 and, based thereon, performing the additional control in operation S150 may include increasing a driving force of the fan 113 in operation S181 or de-

creasing a driving force of the fan 113 in operation S185.

[0146] For example, the first IoT device 71, which is one of external devices 70, may be a cooking appliance, and the hood system control method S100 may receive a driving state of the first IoT device 71 and, based thereon, control a position of the arm 151 and a driving force of the fan 113.

[0147] For example, the second IoT device 72, which is one of the external devices 70, may be an air conditioner or a robot cleaner capable of sensing indoor or outdoor air quality, and the hood system control method S100 may receive a state of surrounding air from the second IoT device 72 and, based thereon, control a position of the arm 151 and a driving force of the fan 113.

[0148] For example, the third IoT device 73, which is one of the external devices 70, may be a personal communication device, such as a smartphone, a tablet, a notebook, or a desktop, and the hood system control method S100 may receive a driving command from the communication device and, based thereon, control a position of the arm 151 and a driving force of the fan 113.

[0149] FIG. 8 is a flowchart of a method of controlling a hood system, the hood system control method S100, according to one embodiment.

[0150] Referring to FIG. 8, the hood system control method S100 may include machine learning in operation S190.

[0151] In one embodiment, performing additional control in operation S150 may include controlling a hood system 101 to be driven in various ways in response to environmental changes, and the machine learning in operation S190 may interwork with a server 60 to update a learning model.

[0152] In one embodiment, the machine learning in operation S190 may acquire additional data on a driving environment of the hood system 101 in operation S191 based on a sensing result acquired by the hood system 101. For example, the additional data may be numerical values related to ventilation performance of the hood system 101 or a result of controlling the arm 151 of the hood system 101 in operation S170 and controlling the fan 113 in operation S180, based on the sensing of the environment change in operation S160.

[0153] In one embodiment, the machine learning in operation S190 may include comparing the additional data to pre-stored data in operation S910 and detecting a data area, which changes as a result of the comparison, in operation S195. When there is no difference between the additional data and the pre-stored data, the machine learning in operation S190 may end the machine learning in operation S190 and, when there is a difference between the additional data and the pre-stored data, the machine learning in operation S190 may detect the difference and transfer the changed data to the server 60 in operation S196.

[0154] In one embodiment, the server 60 may have already been formed through establishing a local model or a global model in operation S201 before receiving the

changed data in operation S196. The server 60 may perform acquiring information received from the hood system 101 in operation S203 and, based thereon, perform modeling in operation S205.

[0155] In one embodiment, the server 60 may perform the machine learning to update an established model based on a result of the modeling. The server 60 may feed the modeling result back to the hood system 101 again in operation S198, and the hood system 101 may receive the new data fed back from the server 60 to update existing data in operation S197.

[0156] In one embodiment, the hood system control method S100 may connect to the server 60 through the network 50, acquire information about various situations, a driving state, and a surrounding environment of the hood system 101 in real time, and share the information with the server 60. In the hood system control method S100, as efficient control information may change over time, there may be a demand for a more effective driving method to deal with various variables. The hood system control method S100, according to one embodiment, may continue to update a model of the server 60 according to changed situation information, combine various variables in a driving environment to acquire the most effective driving control method and continue to update the method.

[0157] According to one embodiment, a hood system may comprise a main body comprising an exhaust duct, a fan configured to generate airflow in the exhaust duct, an arm comprising an intake port, the arm configured to allow air to be sucked into the intake port so as to pass through the arm and thereafter into the exhaust duct, a driving unit configured to be driven to move the arm, a sensor module configured to sense an environmental state of the hood system and a processor configured to control driving of the driving unit based on the sensed environmental state to move the arm and thereby position the intake port based on the sensed environmental state.

[0158] According to one embodiment, the main body may comprise a fixed intake port on a surface of the main body. According to one embodiment, the exhaust duct may comprise a first duct communicating with the intake port of the arm and a second duct communicating with the fixed intake port.

[0159] According to one embodiment, the main body may comprise an exhaust port to discharge the air passing into the exhaust duct to outside of the hood system, a fan housing communicating with the exhaust port and housing the fan, and a wall partitioning an interior of the exhaust duct into the first duct from the second duct.

[0160] According to one embodiment, the hood system may further comprise a door configured to selectively open and close the intake port of the arm in a state in which the fixed intake port is open.

[0161] According to one embodiment, the arm may comprise a first arm comprising a first end portion connected to the main body and a second end portion opposite to the first end portion, a second arm comprising

a third end portion connected to the second end portion of the first arm and a fourth end portion opposite to the third end portion, a first joint configured to connect the main body and the first end portion to allow the first arm to rotate within a predetermined angle range, and a second joint configured to connect the second end portion and the third end portion to allow the second arm to rotate within a predetermined angle range.

[0162] According to one embodiment, the intake port may comprise a first intake port on the first arm and a second intake port on the second arm.

[0163] According to one embodiment, the intake port may be on a side surface of the arm extending from the third end portion to the fourth end portion and longitudinally extends in a direction from the third end portion to the fourth end portion.

[0164] According to one embodiment, the arm may comprise a third arm comprising a fifth end portion connected to the fourth end portion of the second arm and a sixth end portion opposite to the fifth end portion, and a third joint configured to connect the fourth end portion and the fifth end portion to allow the third arm to rotate within a predetermined angle range.

[0165] According to one embodiment, the main body may comprise a support groove configured to receive and support the arm in a state in which the arm is in close contact with the main body.

[0166] According to one embodiment, the processor may be configured to open the intake port so that air is sucked into the input port through a clearance space between the support groove and the arm, in a state in which the arm is in close contact with the main body and the intake port is positioned inside the support groove.

[0167] According to one embodiment, the hood system may be for a cooking appliance, and the environmental state includes at least one of: a position of a user of the cooking appliance, motion of the user, an operation performed by the user, an ambient temperature of the hood system, a temperature of a heater of the cooking appliance, a temperature of a cooking vessel on a cooktop of the cooking appliance, a position of the cooking vessel, air quality in a vicinity of the hood system, and air volume in the vicinity of the hood system.

[0168] According to one embodiment, a method of controlling a hood system including a main body comprising an exhaust duct, a movable arm including an intake port, and a sensor module configured to sense an environmental state of the hood system, the method may comprise recognizing a position of a cooking vessel by a sensor module, moving the arm based on the sensed position of the cooking vessel, to thereby position the intake port based on the sensed position of the cooking vessel, causing air to be sucked into the intake port, so that the air sucked into the intake port passes through the arm and into the exhaust duct, sensing a change in an environmental state of the hood system by a sensor module and moving the arm based on the sensed change in the environmental state, to thereby position the intake port

based on the sensed change in the environmental state.

[0169] According to one embodiment, the hood system may be for a cooking appliance, and the environmental state sensed by the sensor module may include at least one of a position of a user of the cooking appliance, a motion of the user, an operation performed by the user, an ambient temperature of the hood system, a temperature of a heater of the cooking appliance, a temperature of the cooking vessel on a cooktop of the cooking appliance, a position of the cooking vessel, air quality in a vicinity of the hood system, and air volume in the vicinity of the hood system.

[0170] According to one embodiment, the hood system may be for a cooking appliance, and the sensed change in the environmental state may be a movement of a user of the cooking appliance away from the cooking appliance, and the moving of the arm based on the sensed change in the environmental state may be a moving of the arm toward a cooking vessel on a cooktop of the cooking appliance.

[0171] According to one embodiment, the hood system may be for a cooking appliance, the sensed change in the environmental state may be a movement of a user of the cooking appliance toward the cooking appliance, and the moving of the arm based on the sensed change in the environmental state may be a moving of the arm away from a cooking vessel on a cooktop of the cooking appliance.

[0172] According to one embodiment, the hood system may be for a cooking appliance, the sensed change in the environmental state may be a boiling of contents in a cooking vessel on a cooktop of the cooking appliance, and the moving of the arm based on the sensed change in the environmental state may be a moving of the arm toward the cooking vessel.

[0173] According to one embodiment, the hood system may be for a cooking appliance, the sensed change in the environmental state may be a deterioration of air quality in the vicinity of the hood system, and the moving of the arm based on the sensed change in the environmental state may be a moving of the arm toward a cooking vessel on a cooktop of the cooking appliance.

[0174] According to one embodiment, the hood system may be for a cooking appliance, the hood system may include a fan configured to generate airflow in the exhaust duct, the method may further comprise controlling a driving force of the fan based on the sensed change in the environmental state.

[0175] According to one embodiment, the method may further comprise, acquiring additional data on the environmental state of the hood system based on a sensing result, comparing the additional data to pre-stored data and detecting a change, updating the pre-stored data, transmitting the change to a server and receiving new data from the server and updating the pre-stored data.

[0176] According to one embodiment, the method may further comprise receiving information indicating a driving state of an Internet-of things (IoT) device through a

network, and moving the arm based on the received information indicating the driving state of the IoT device.

[0177] While this disclosure includes specific examples, it will be apparent to one of ordinary skill in the art that various changes in form and details may be made in these examples without departing from the spirit and scope of the claims and their equivalents. The examples described herein are to be considered in a descriptive sense only, and not for purposes of limitation. Descriptions of features or aspects in each example are to be considered as being applicable to similar features or aspects in other examples. Suitable results may be achieved if the described techniques are performed in a different order, and/or if components in a described system, architecture, device, or circuit are combined in a different manner, and/or replaced or supplemented by other components or their equivalents. Therefore, the scope of the disclosure is defined not by the detailed description, but by the claims and their equivalents, and all variations within the scope of the claims and their equivalents are to be construed as being included in the disclosure.

Claims

1. A hood system comprising:

a main body comprising an exhaust duct;
a fan configured to generate airflow in the exhaust duct;
an arm comprising an intake port, the arm configured to allow air to be sucked into the intake port so as to pass through the arm and thereafter into the exhaust duct;
a driving unit configured to be driven to move the arm;
a sensor module configured to sense an environmental state of the hood system; and
a processor configured to control driving of the driving unit based on the sensed environmental state to move the arm and thereby position the intake port based on the sensed environmental state.

2. The hood system of claim 1, wherein

the main body comprises a fixed intake port on a surface of the main body, and
the exhaust duct comprises a first duct communicating with the intake port of the arm and a second duct communicating with the fixed intake port.

3. The hood system of any one of claims 1 or 2, wherein the main body comprises:

an exhaust port to discharge the air passing into

the exhaust duct to outside of the hood system, a fan housing communicating with the exhaust port and housing the fan, and
a wall partitioning an interior of the exhaust duct into the first duct from the second duct.

4. The hood system of any one of claims 1 to 3, wherein the arm comprises:

a first arm comprising a first end portion connected to the main body and a second end portion opposite to the first end portion,
a second arm comprising a third end portion connected to the second end portion of the first arm and a fourth end portion opposite to the third end portion,
a first joint configured to connect the main body and the first end portion to allow the first arm to rotate within a predetermined angle range, and
a second joint configured to connect the second end portion and the third end portion to allow the second arm to rotate within a predetermined angle range.

5. The hood system of any one of claims 1 to 4, wherein the intake port comprises a first intake port on the first arm and a second intake port on the second arm.

6. The hood system of any one of claims 1 to 5, wherein the arm comprises:

a third arm comprising a fifth end portion connected to the fourth end portion of the second arm and a sixth end portion opposite to the fifth end portion, and
a third joint configured to connect the fourth end portion and the fifth end portion to allow the third arm to rotate within a predetermined angle range.

7. The hood system of any one of claims 1 to 6, wherein the main body comprises a support groove configured to receive and support the arm in a state in which the arm is in close contact with the main body, and

wherein the at least one processor is configured to open the intake port so that air is sucked into the input port through a clearance space between the support groove and the arm, in a state in which the arm is in close contact with the main body and the intake port is positioned inside the support groove.

8. The hood system of any one of claims 1 to 7, wherein the hood system is for a cooking appliance, and the environmental state includes at least one of:

a position of a user of the cooking appliance, motion of the user,

- an operation performed by the user,
 an ambient temperature of the hood system,
 a temperature of a heater of the cooking appliance,
 a temperature of a cooking vessel on a cooktop of the cooking appliance,
 a position of the cooking vessel,
 air quality in a vicinity of the hood system, and
 air volume in the vicinity of the hood system.
9. A method of controlling a hood system including a main body comprising an exhaust duct, a movable arm including an intake port, and a sensor module configured to sense an environmental state of the hood system, the method comprising:
- recognizing a position of a cooking vessel by a sensor module;
 moving the arm based on the sensed position of the cooking vessel, to thereby position the intake port based on the sensed position of the cooking vessel;
 causing air to be sucked into the intake port, so that the air sucked into the intake port passes through the arm and into the exhaust duct;
 sensing a change in an environmental state of the hood system by a sensor module; and
 moving the arm based on the sensed change in the environmental state, to thereby position the intake port based on the sensed change in the environmental state.
10. The method of claim 9, wherein the hood system is for a cooking appliance, and the environmental state sensed by the sensor module includes at least one of:
- a position of a user of the cooking appliance,
 a motion of the user,
 an operation performed by the user,
 an ambient temperature of the hood system,
 a temperature of a heater of the cooking appliance,
 a temperature of the cooking vessel on a cooktop of the cooking appliance,
 a position of the cooking vessel,
 air quality in a vicinity of the hood system, and
 air volume in the vicinity of the hood system.
11. The method of any one of claims 9 or 10, wherein
- the hood system is for a cooking appliance,
 the sensed change in the environmental state is a movement of a user of the cooking appliance toward the cooking appliance, and
 the moving of the arm based on the sensed change in the environmental state is a moving of the arm away from a cooking vessel on a cook-
- top of the cooking appliance.
12. The method of any one of claims 9 to 11, wherein
- the hood system is for a cooking appliance,
 the sensed change in the environmental state is a boiling of contents in a cooking vessel on a cooktop of the cooking appliance, and
 the moving of the arm based on the sensed change in the environmental state is a moving of the arm toward the cooking vessel.
13. The method of any one of claims 9 to 12, wherein
- the hood system is for a cooking appliance,
 the sensed change in the environmental state is a deterioration of air quality in the vicinity of the hood system, and
 the moving of the arm based on the sensed change in the environmental state is a moving of the arm toward a cooking vessel on a cooktop of the cooking appliance.
14. The method of any one of claims 9 to 13, wherein
- the hood system is for a cooking appliance,
 the hood system includes a fan configured to generate airflow in the exhaust duct,
 the method further comprising:
 controlling a driving force of the fan based on the sensed change in the environmental state.
15. The method of any one of claims 9 to 14 further comprising,
- acquiring additional data on the environment state of the hood system based on a sensing result;
 comparing the additional data to pre-stored data and detecting a change;
 updating the pre-stored data;
 transmitting the change to a server; and
 receiving new data from the server and updating the pre-stored data.

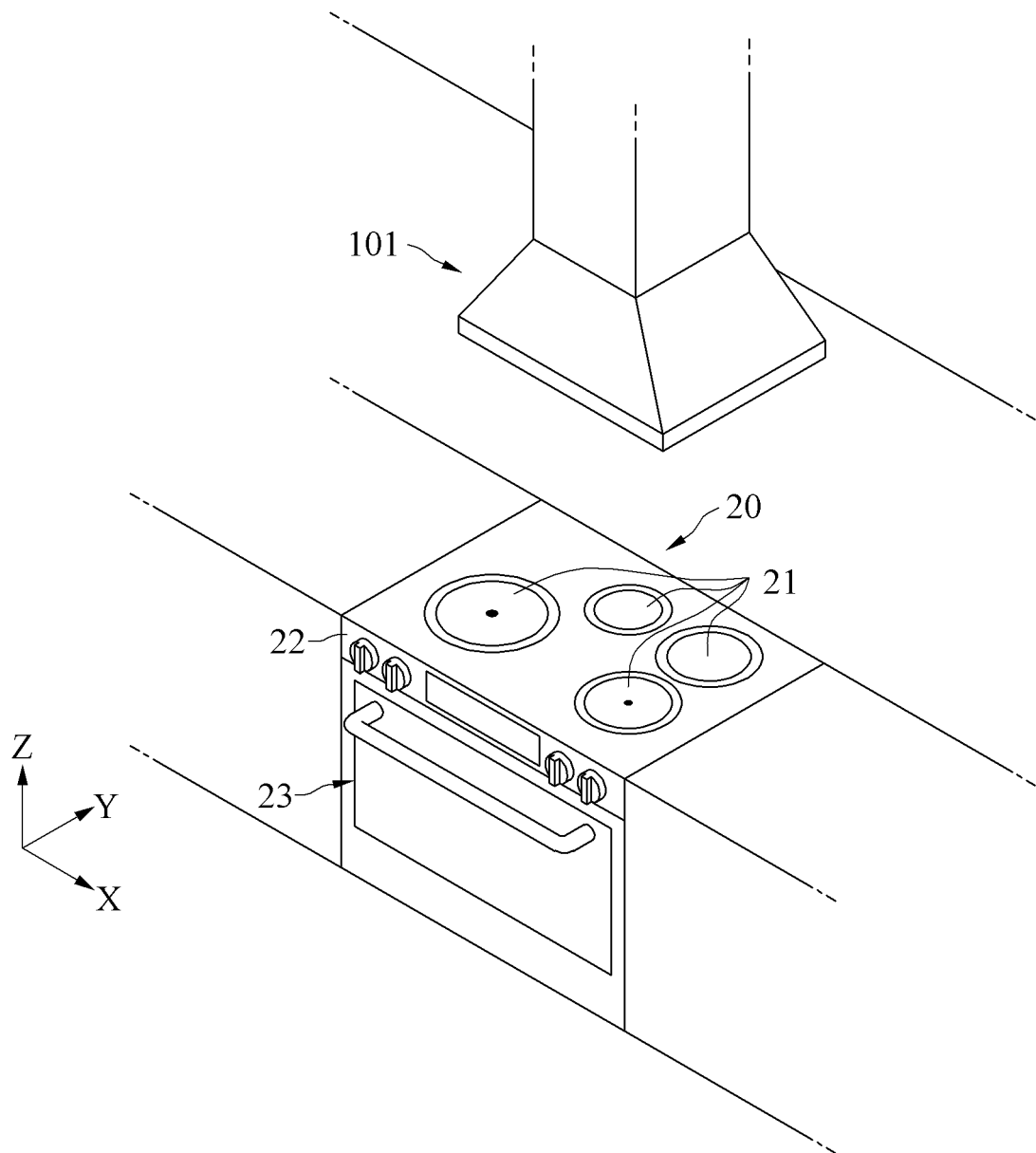


FIG. 1

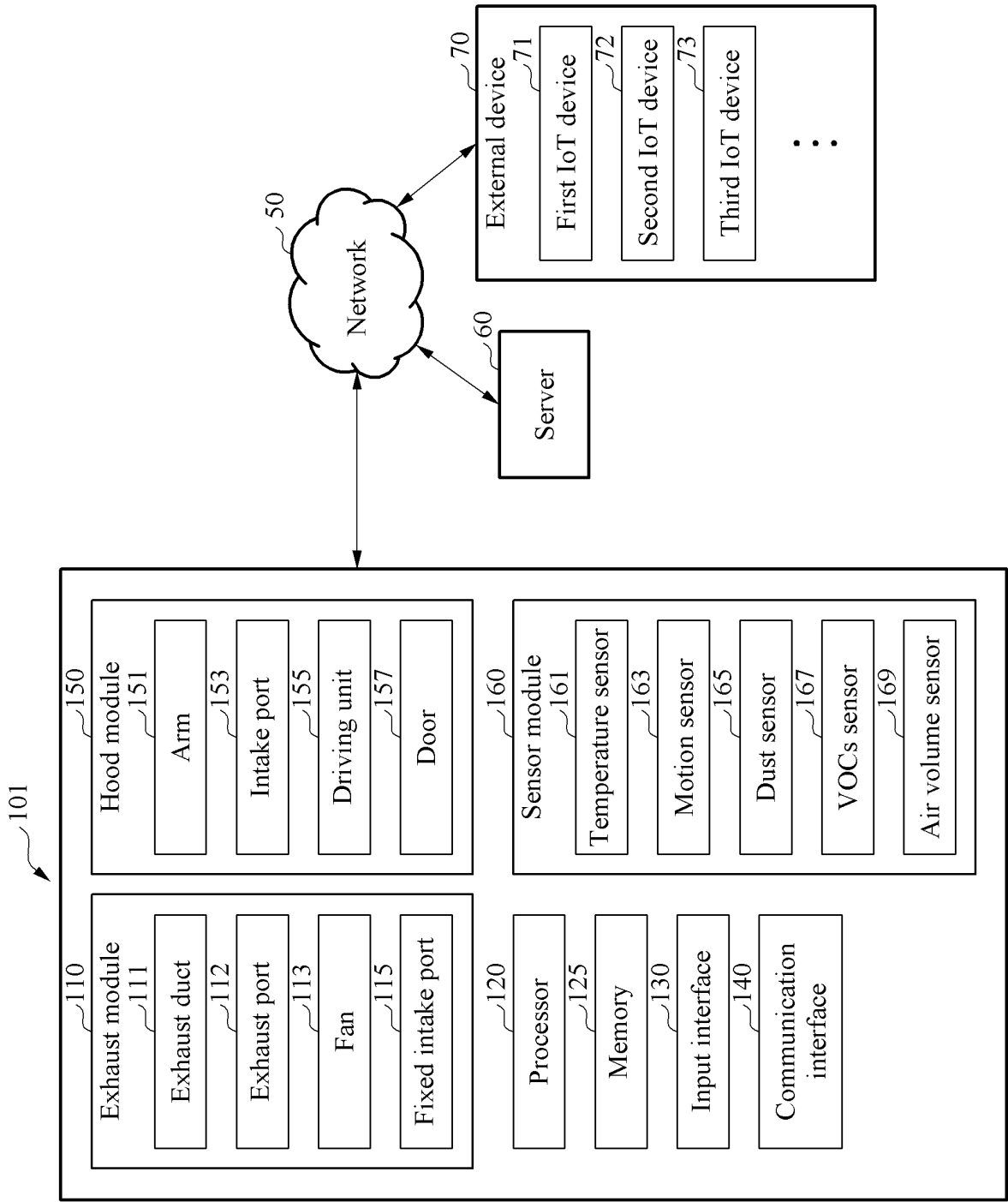


FIG. 2

A1

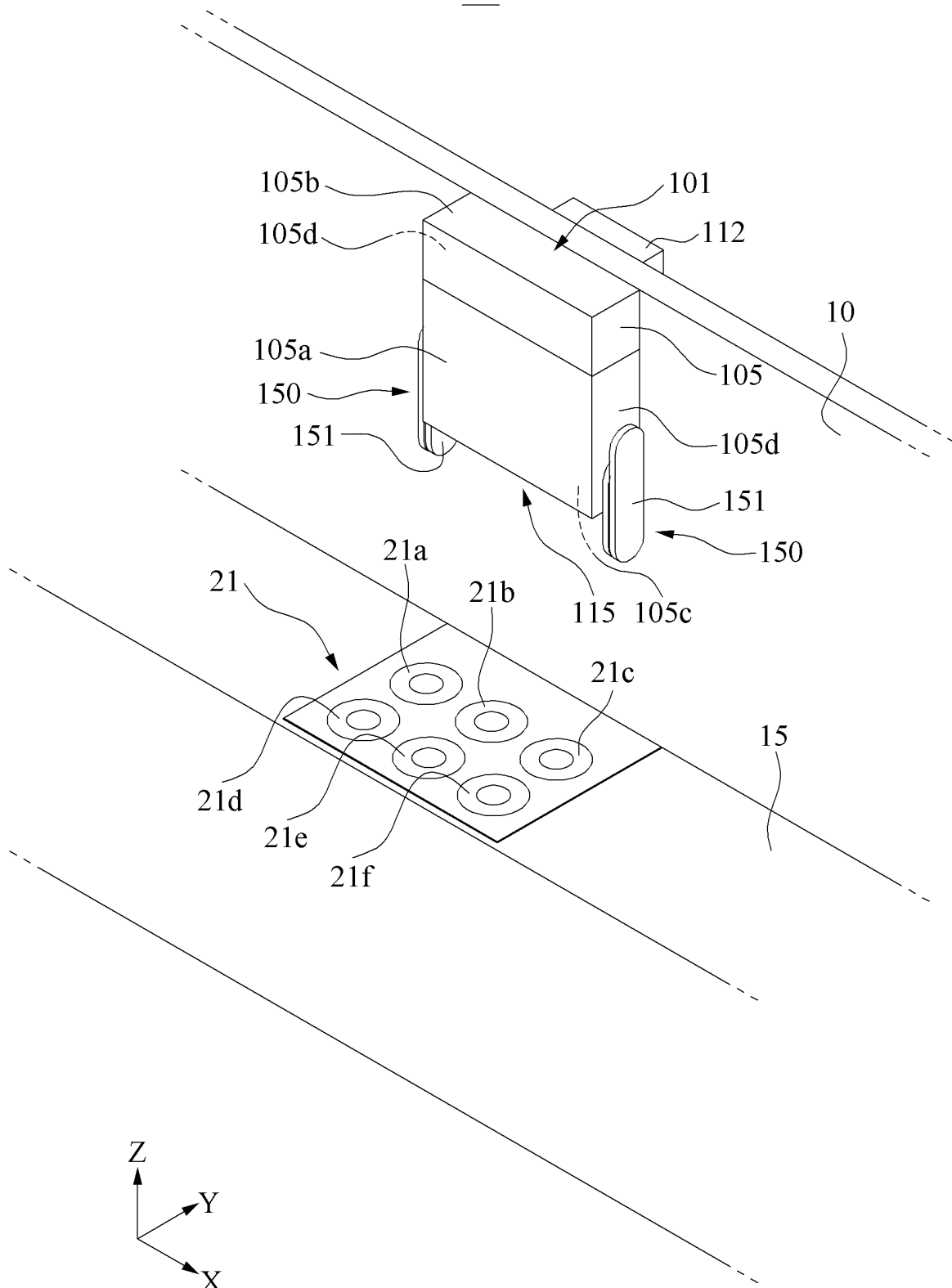


FIG. 3A

A2

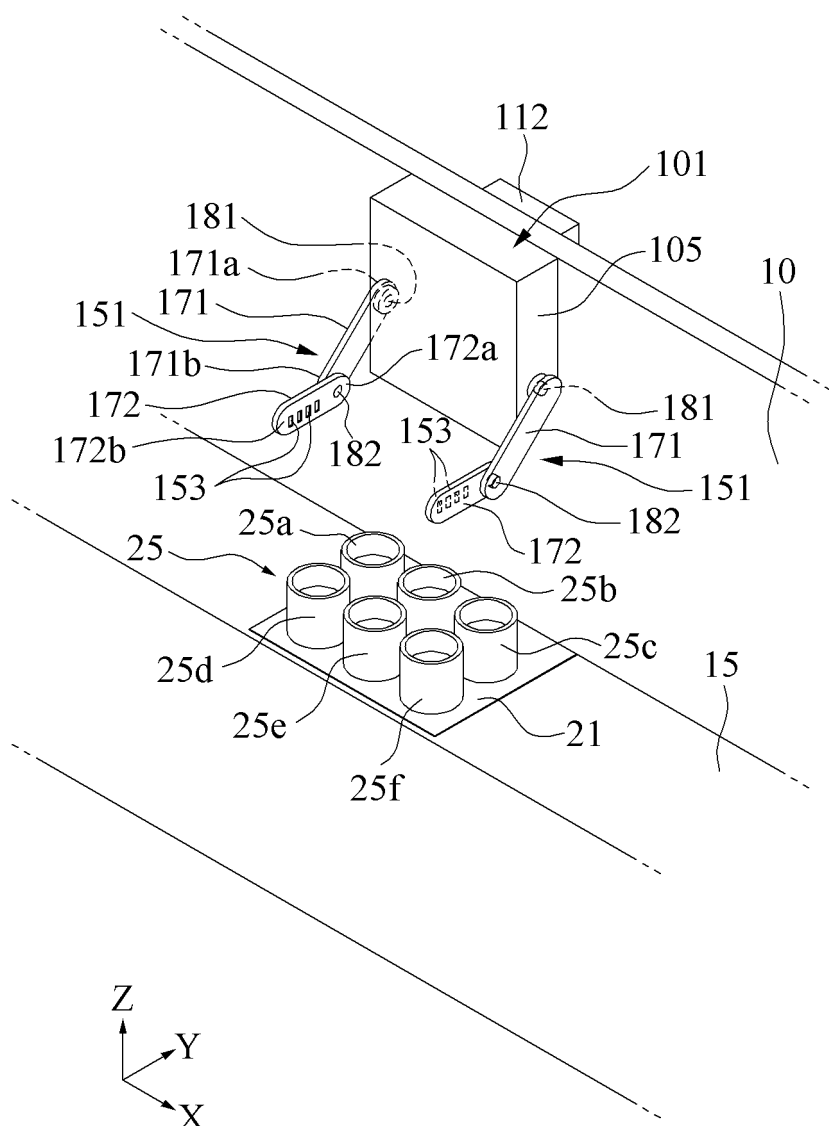


FIG. 3B

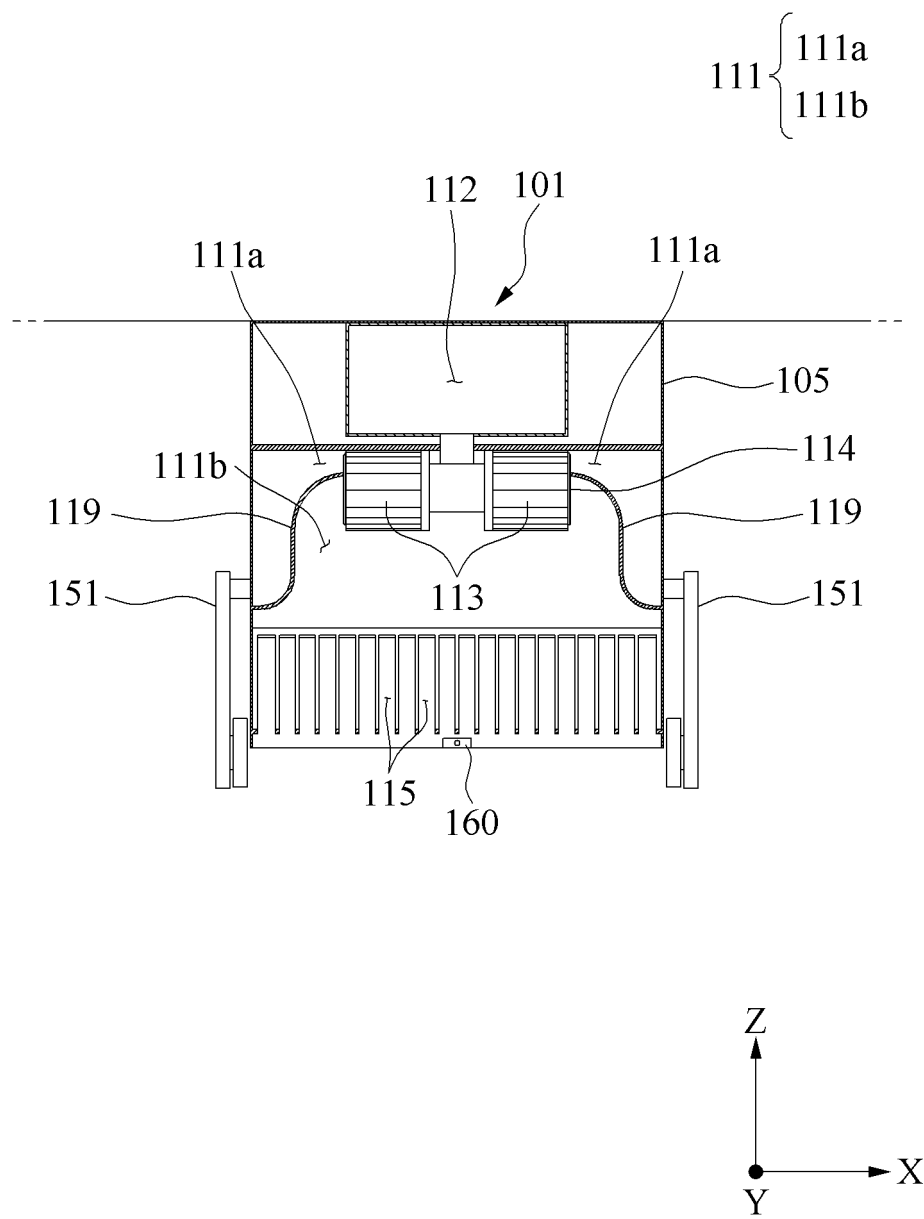


FIG. 3C

B1

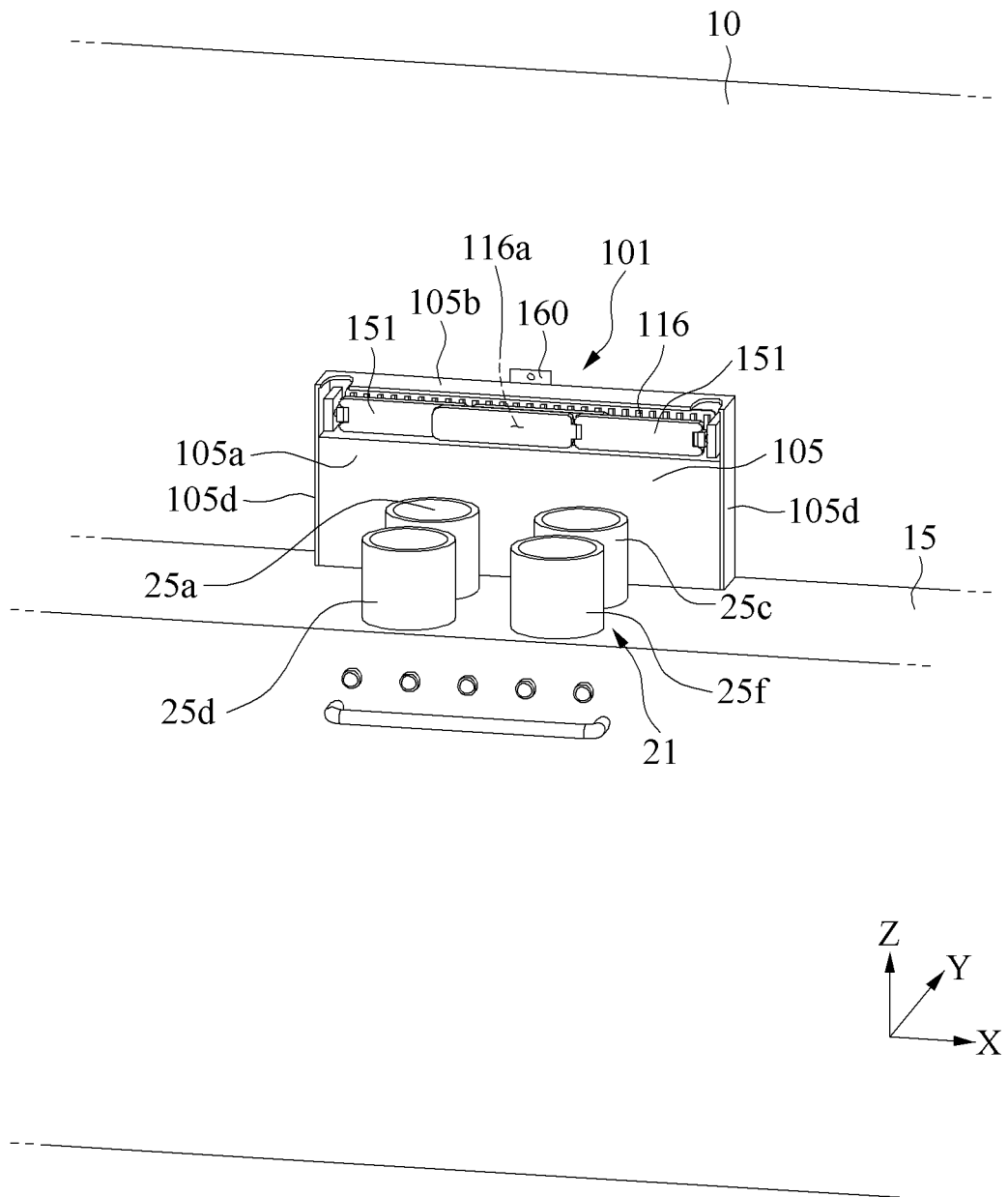


FIG. 4A

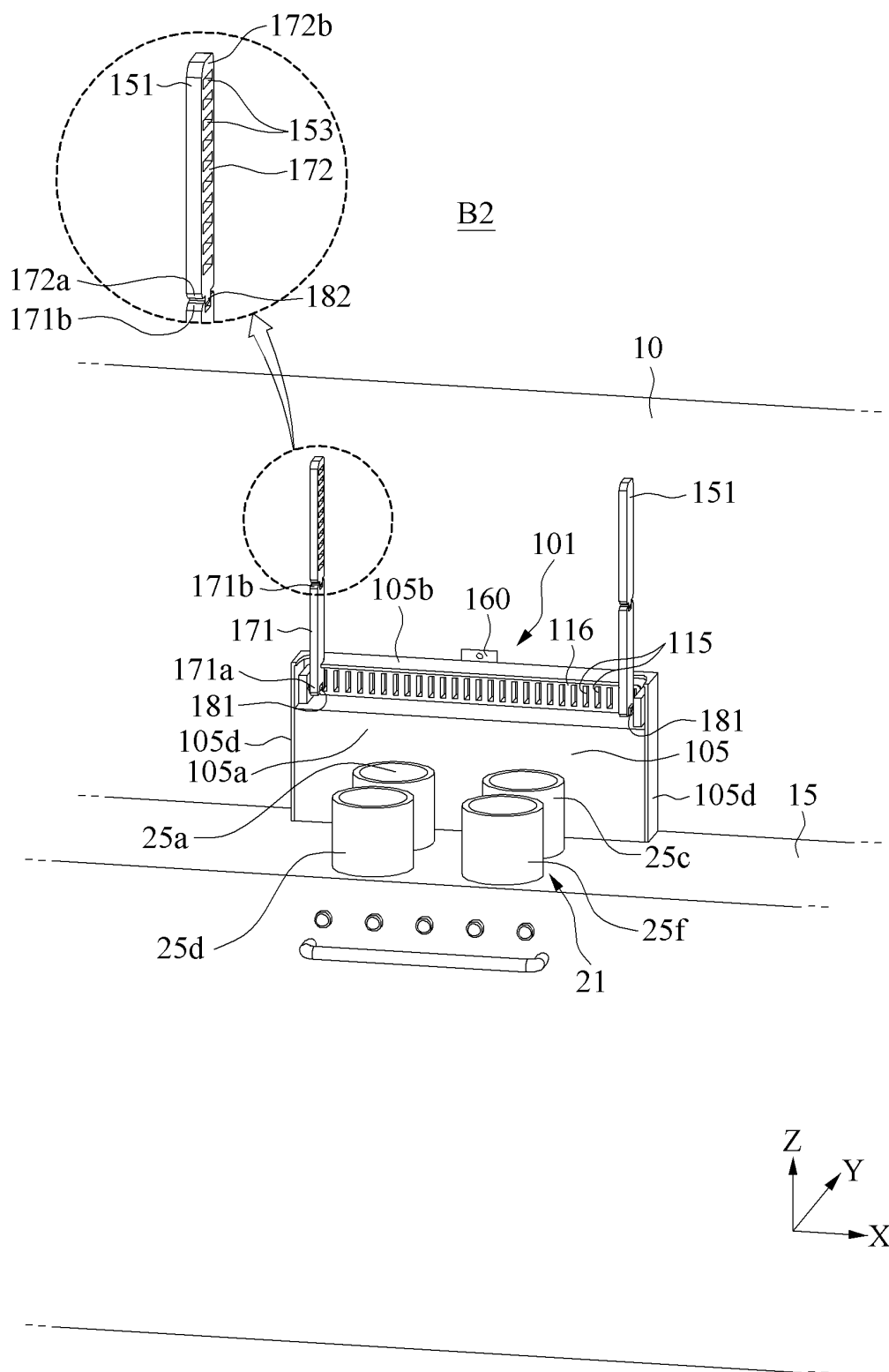


FIG. 4B

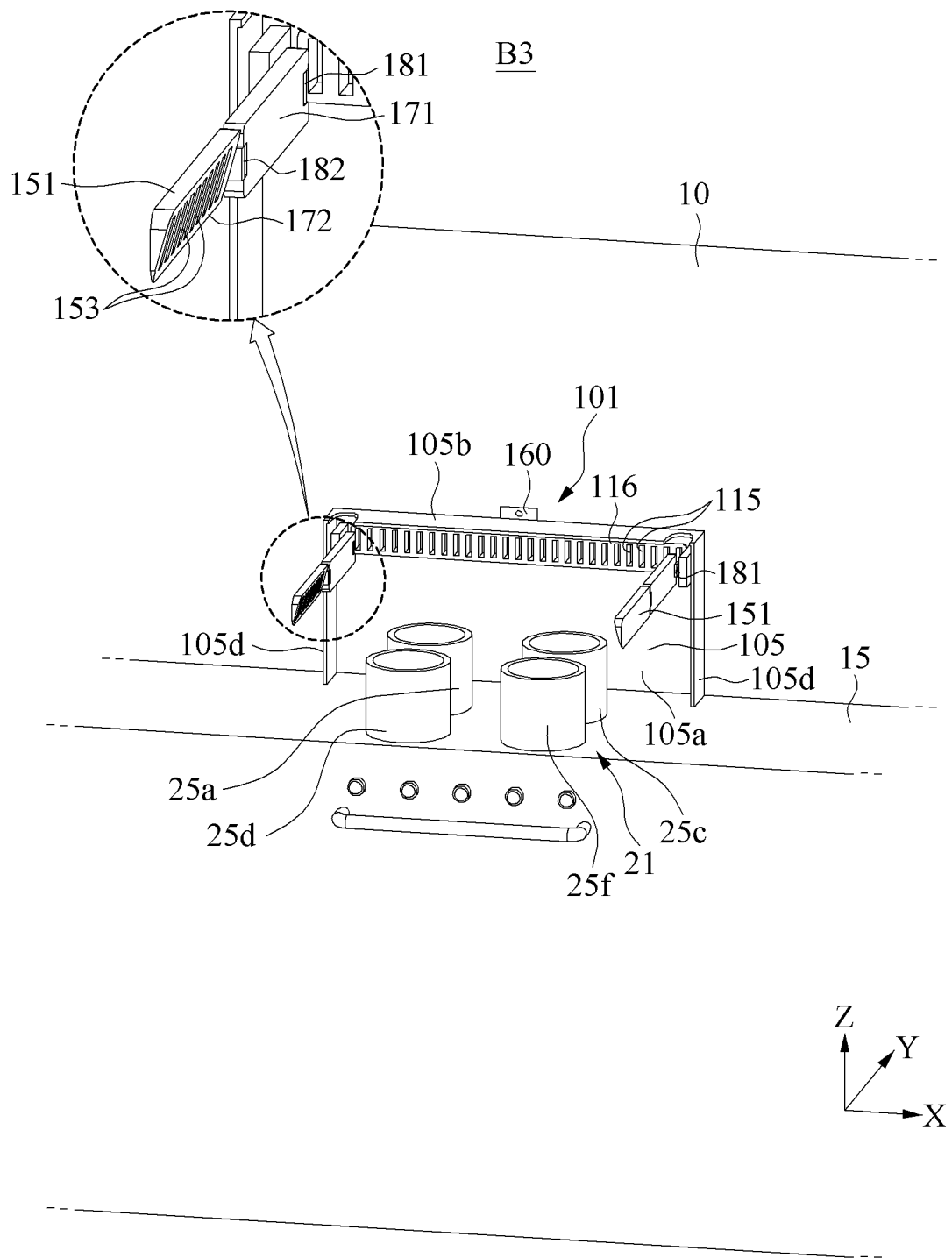


FIG. 4C

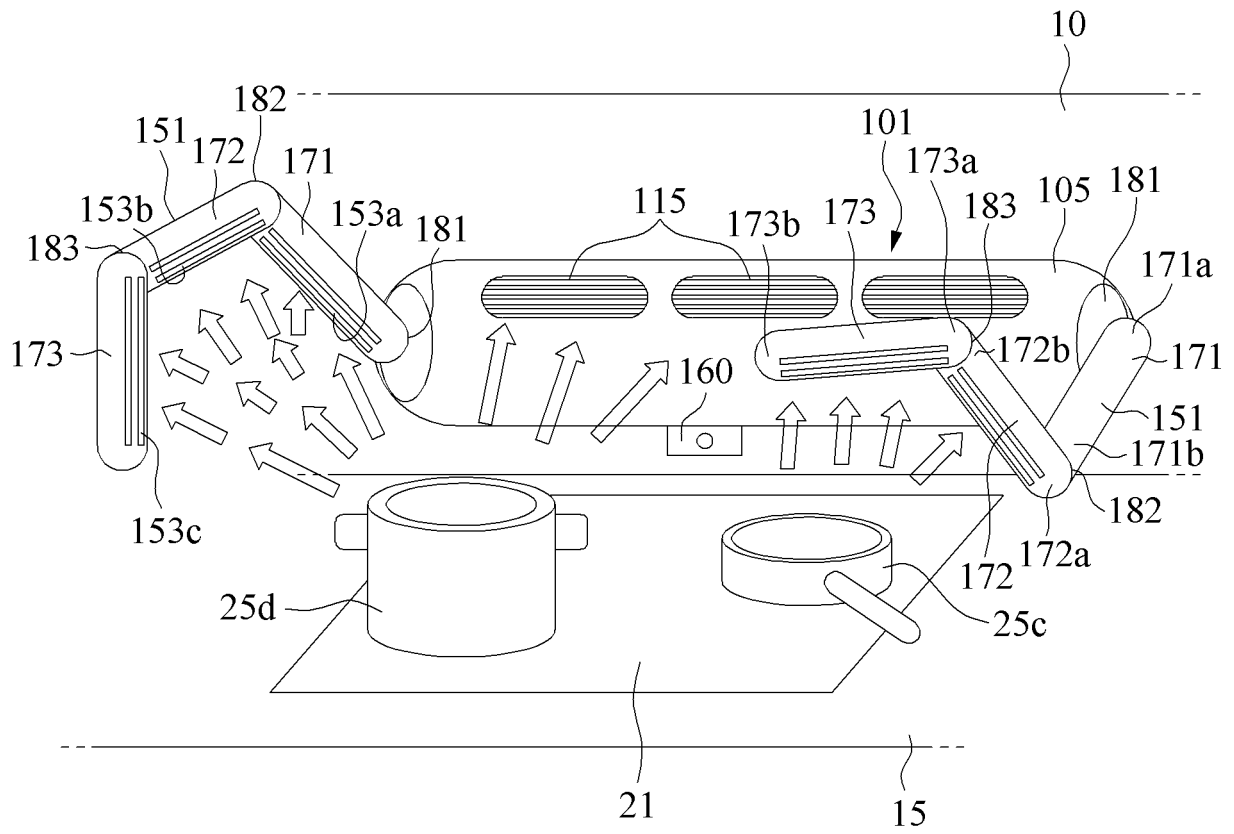


FIG. 5

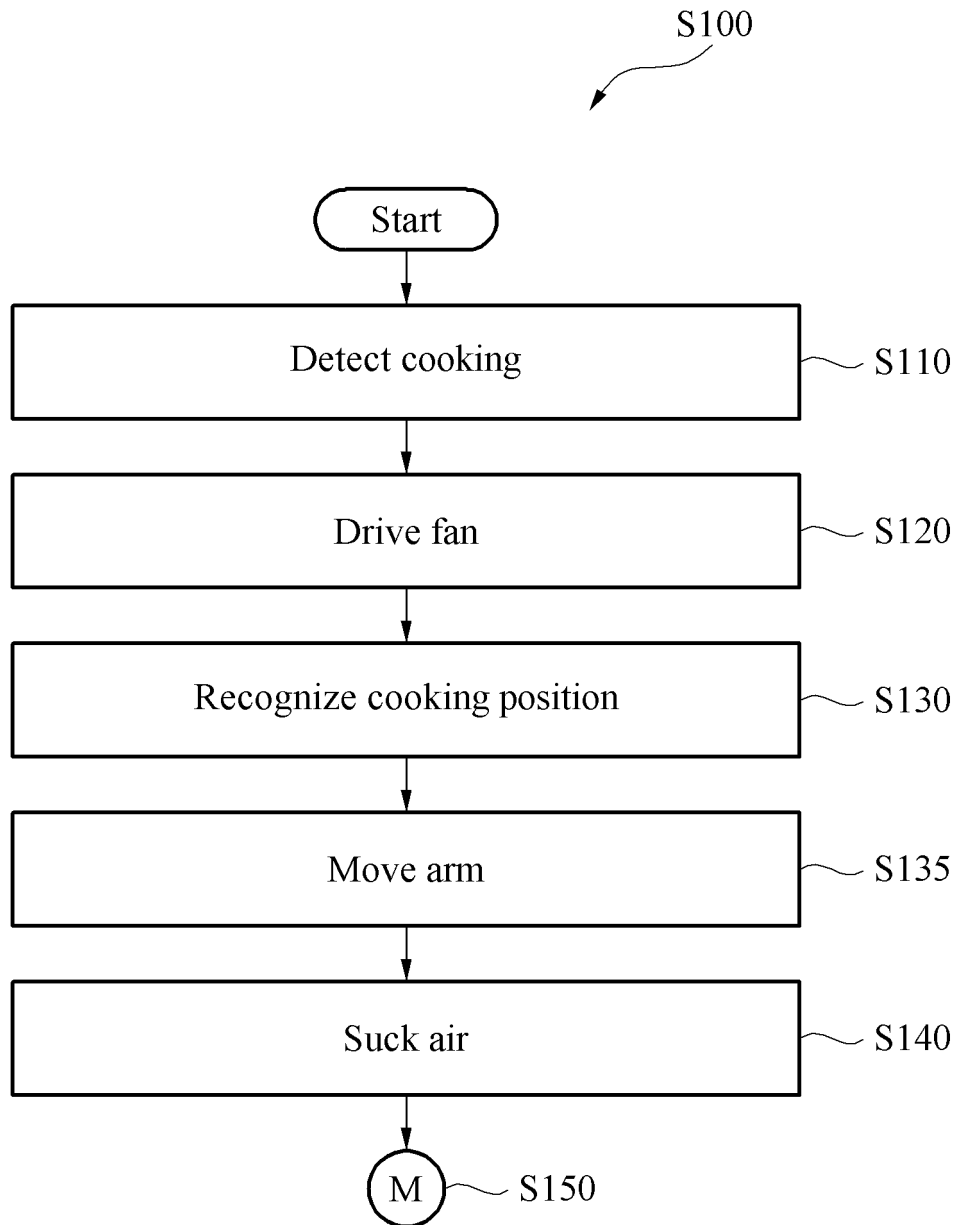


FIG. 6

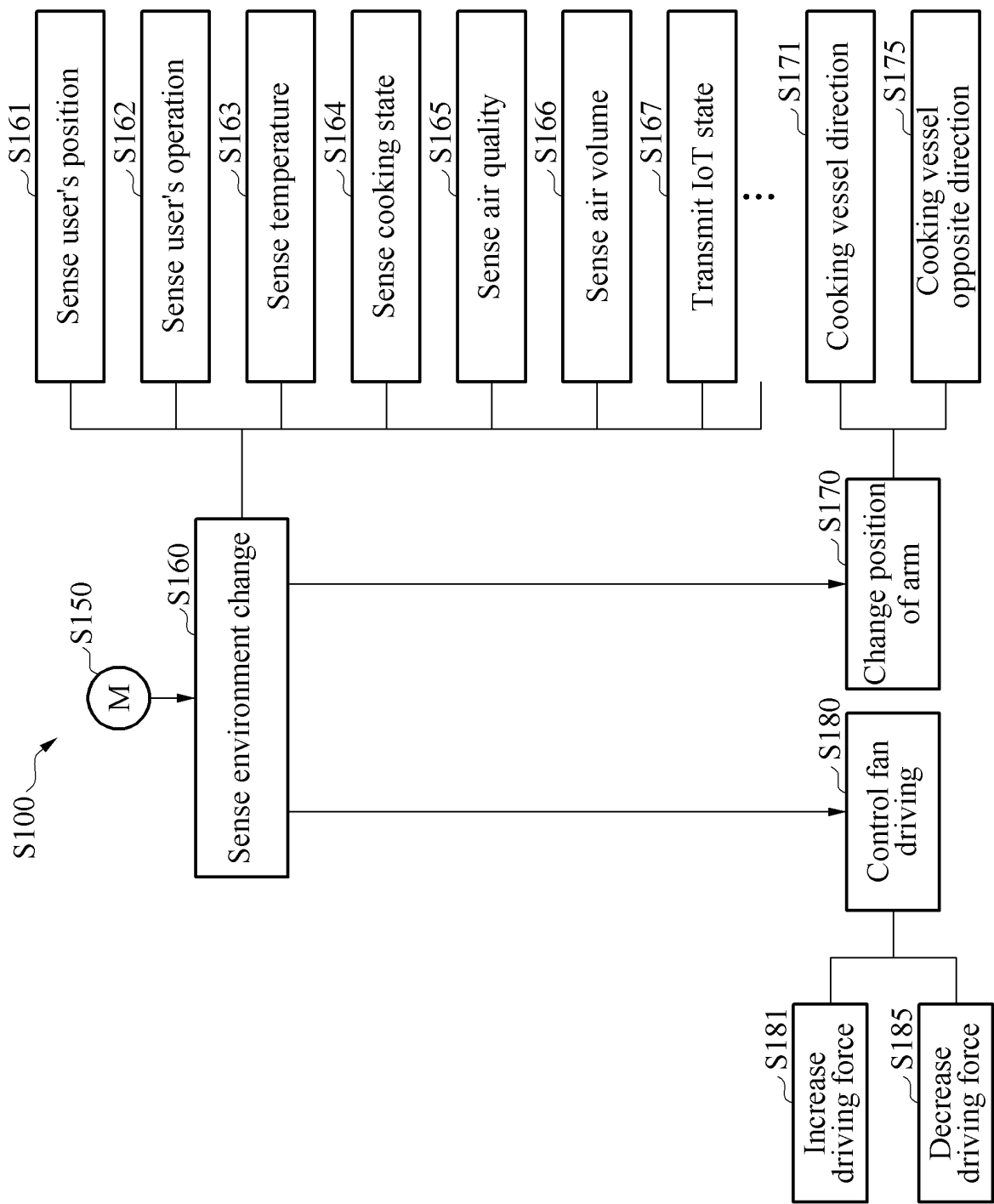


FIG. 7

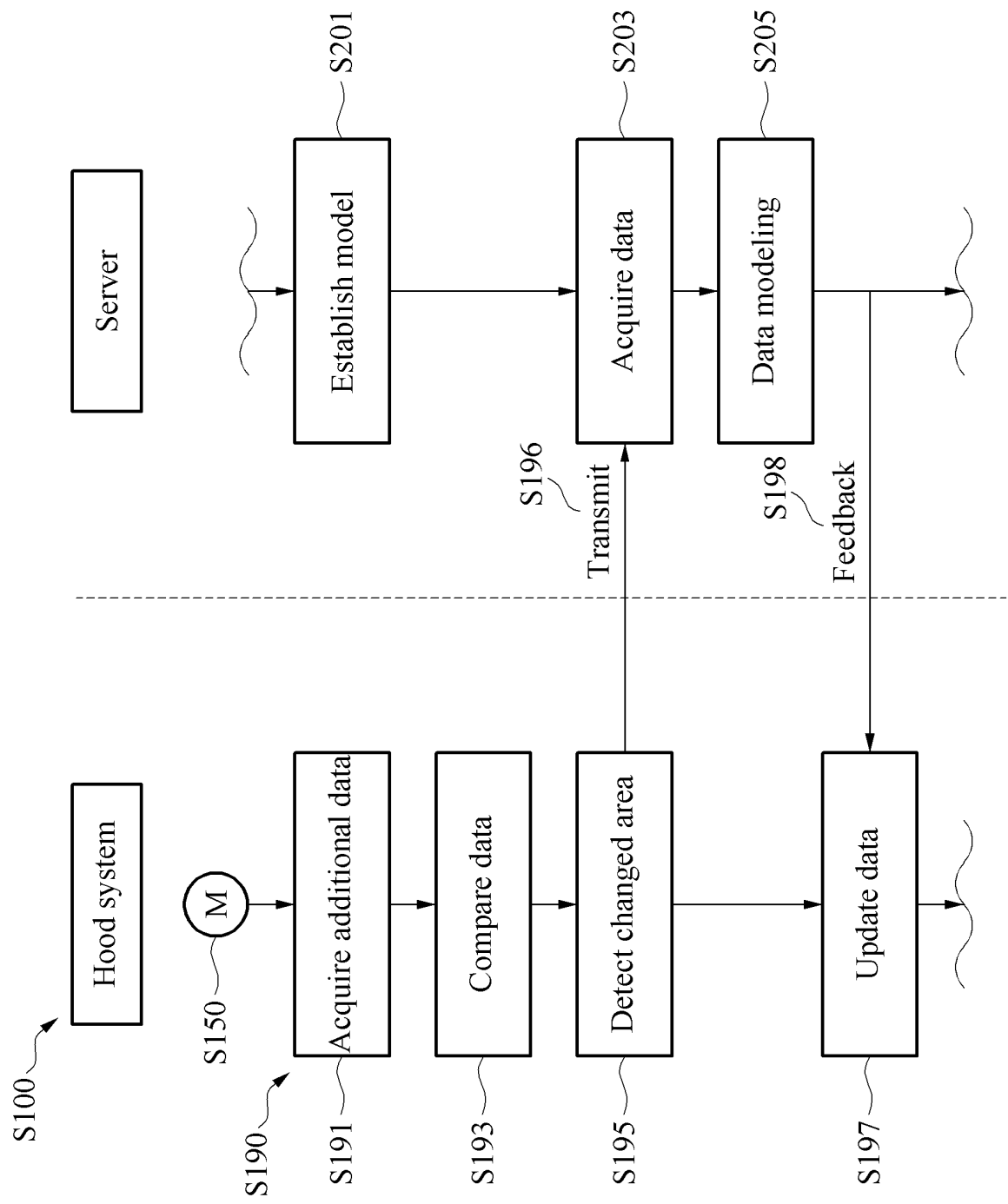


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2022/013001

5	A. CLASSIFICATION OF SUBJECT MATTER F24C 15/20(2006.01)i; F24F 7/06(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC		
10	B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) F24C 15/20(2006.01); F24F 11/61(2018.01); F24F 110/60(2018.01); F24F 7/06(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		
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) eKOMPASS (KIPO internal) & keywords: 후드(hood), 배기(exhaust), 조리 기구(cooking appliance), 암(arm), 로봇(robot), 센서(sensor)		
20	C. DOCUMENTS CONSIDERED TO BE RELEVANT		
25	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
30	Y	KR 10-2021-0052176 A (LG ELECTRONICS INC.) 10 May 2021 (2021-05-10) See paragraphs [0110]-[0111], [0131], [0133], [0135], [0138], [0155], [0200]-[0201], [0221] and [0230], claim 1 and figures 4b-5, 11, 19 and 23a.	1-15
35	Y	JP 2001-074287 A (OSAKA GAS CO., LTD.) 23 March 2001 (2001-03-23) See paragraphs [0017]-[0018] and [0020] and figures 2-4.	1-15
40	A	CN 111457433 A (FOSHAN SHUNDE MIDEA WASHING APPLIANCES MFG. CO., LTD.) 28 July 2020 (2020-07-28) See claims 1 and 5-7 and figures 3 and 5.	1-15
45	A	US 2020-0333019 A1 (MIDEA GROUP CO., LTD.) 22 October 2020 (2020-10-22) See paragraph [0032] and figure 2.	1-15
50	A	CN 111271745 A (CHINABEST HOME APPLIANCES CO., LTD.) 12 June 2020 (2020-06-12) See claims 6-8 and figures 3-4.	1-15
55	☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
60	* 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		
65	Date of the actual completion of the international search 05 December 2022		Date of mailing of the international search report 05 December 2022
70	Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon Building 4, 189 Cheongsaro, Seo-gu, Daejeon 35208 Facsimile No. +82-42-481-8578		Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2022/013001

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		US 2021-0123603 A1	29 April 2021
		US 2021-0123604 A1	29 April 2021
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		US 11255549 B2	22 February 2022
		US 2020-0191410 A1	18 June 2020
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