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(71) Applicant: **Beijing Xiaomi Mobile Software Co., Ltd.**
Beijing 100085 (CN)

(72) Inventor: **WANG, Yukun**
Beijing, 100085 (CN)

(74) Representative: **dompatent von Kreisler Selting Werner -**
Partnerschaft von Patent- und Rechtsanwälten mbB
Deichmannhaus am Dom
Bahnhofsvorplatz 1
50667 Köln (DE)

(54) CLEANING EQUIPMENT CONTROL METHOD AND ELECTRONIC DEVICE, AND STORAGE MEDIUM

(57) The disclosure provides a cleaning equipment control method and an electronic device, and a storage medium, and relates to the technical field of cleaning equipment. The cleaning equipment includes laundry treating equipment (110) and a cleaning robot (120) arranged below a drum (111) of the laundry treating equipment (110), where the cleaning robot (120) can be moved out from a position below the drum (111). The method includes: detecting whether the drum (111) satisfies a touch condition in the case that the cleaning robot (120) is located below the drum; and controlling the cleaning robot (120) to move out from the position below the drum (111) if the drum (111) satisfies the touch condition.

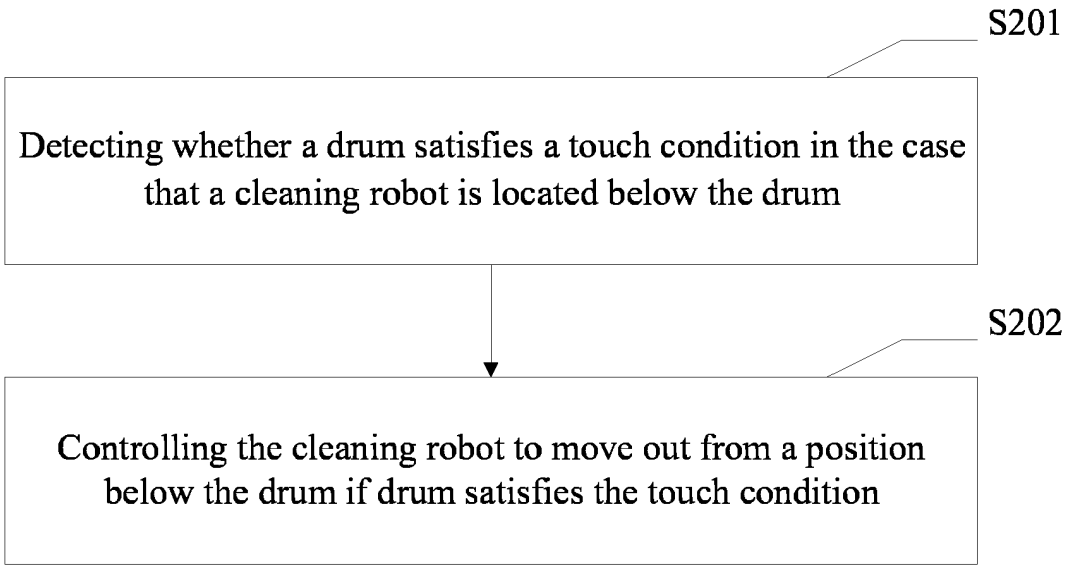

Fig. 2

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Description

TECHNICAL FIELD

[0001] The disclosure relates to the technical field of cleaning equipment, in particular to a cleaning equipment control method and an electronic equipment, and a storage medium.

BACKGROUND

[0002] With the development of cleaning equipment, the "double washing station" which integrates laundry treating equipment and a cleaning robot has gradually attracted people's attention. By integrating the cleaning robot below the traditional laundry treating equipment, the double washing station can reduce the space occupied by the cleaning equipment to some extent.

SUMMARY

[0003] To overcome the problems existing in the related art, the disclosure provides a cleaning equipment control method and an electronic device, and a storage medium.

[0004] According to a first aspect of examples of the disclosure, there is provided a cleaning equipment control method, where cleaning equipment includes laundry treating equipment and a cleaning robot arranged below a drum of the laundry treating equipment, where the cleaning robot can be moved out from a position below the drum;
the method includes:

detecting whether the drum satisfies a touch condition in the case that the cleaning robot is located below the drum; and
controlling the cleaning robot to move out from a position below the drum if the drum satisfies the touch condition.

[0005] In some examples, detecting whether the drum satisfies a touch condition includes:
determining that the drum satisfies the touch condition if the distance between the drum and the cleaning robot is less than a preset distance threshold.

[0006] In some examples, detecting whether the drum satisfies a touch condition includes:
determining that the drum satisfies the touch condition if the weight of laundry in the drum is greater than a preset weight threshold.

[0007] In some examples, detecting whether the drum satisfies a touch condition includes:
determining that the drum satisfies the touch condition if the laundry treating equipment is in a spinning instruction execution state.

[0008] In some examples, controlling the cleaning robot to move out from a position below the drum includes:

detecting a spinning rotation speed of the drum in a spinning process in real time if the laundry treating equipment is in a spinning instruction execution state; and
controlling the cleaning robot to move out from a position below the drum if it is detected that the spinning rotation speed is within a resonance rotation speed interval, where the resonance rotation speed interval is a rotation speed interval in which the whole cleaning equipment can resonate.

[0009] In some examples, the method further includes:
controlling the cleaning robot to return to the position below the drum if it is detected that the spinning rotation speed is outside the resonance rotation speed interval, and the cleaning robot is in a standby state.

[0010] In some examples, the method further includes:

predicting a completion time of a cleaning task if the cleaning robot is performing the cleaning task; and
extending the completion time of the cleaning task to a time after the time at which the laundry treating equipment stops operating if the completion time is before the time at which the laundry treating equipment stops operating; where
the cleaning robot moves out from the position below the drum when performing the cleaning task, and returns to the position below the drum after completing the cleaning task.

[0011] According to a second aspect of examples of the disclosure, there is provided a cleaning equipment control device, where cleaning equipment includes laundry treating equipment and a cleaning robot arranged below a drum of the laundry treating equipment, where the cleaning robot can be moved out from a position below the drum;
the device includes:

a judging module, configured to detect whether the drum satisfies a touch condition in the case that the cleaning robot is located below the drum; and
a control module, configured to control the cleaning robot to move out from the position below the drum if the drum satisfies the touch condition.

[0012] According to a third aspect of examples of the disclosure, there is provided an electronic device, including: a processor; and a memory, configured to store instructions executable by the processor; where the processor is configured to perform the method of the first aspect of examples of the disclosure by executing the executable instructions.

[0013] According to a fourth aspect of examples of the disclosure, there is provided a non-transitory computer-readable storage medium storing a computer program, where the computer program, when executed by a processor, implements the method of the first aspect of

examples of the disclosure.

[0014] According to the cleaning equipment control method provided by the examples of the disclosure, it can be judged whether the drum will come into contact with the cleaning robot during operation of the laundry treating equipment under the condition that the cleaning robot is located below the drum. When it is determined that the drum will come into contact with the cleaning robot during operation of the laundry treating equipment, the cleaning robot is controlled to move out from a position below the drum to avoid abnormal sound or damage of the cleaning robot caused by the collision between the drum and the cleaning robot during the operation of the laundry treating equipment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 shows a structural schematic diagram of cleaning equipment in an example of the disclosure.

Fig. 2 shows a flowchart of a cleaning equipment control method in an example of the disclosure.

Fig. 3 shows a flowchart of another cleaning equipment control method in an example of the disclosure.

Fig. 4 shows a structural schematic diagram of a cleaning equipment control device in an example of the disclosure.

Fig. 5 shows a structural schematic diagram of an electronic device in an example of the disclosure.

DETAILED DESCRIPTION

[0016] Reference will now be made in detail to examples, instances of which are illustrated in the accompanying drawings. Where the following description refers to the drawings, unless otherwise indicated, the same numbers in different drawings refer to the same or similar elements. The embodiments described in the following examples do not represent all embodiments consistent with the disclosure. Rather, the following examples are merely examples of devices and methods consistent with some aspects of this disclosure as detailed in the appended claims.

[0017] The terminology used in this disclosure is for the purpose of describing specific examples merely and is not intended to be limiting of the disclosure. As used in this disclosure and the appended claims, the singular forms "a," "the," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will also be understood that the term "and/or" as used here refers to and encompasses any and all possible combinations of one or more of the associated listed items.

[0018] It needs to be understood that although the terms such as first, second and third may be employed in this disclosure to describe various information, these pieces of information are not limited to these terms. These terms are merely used to distinguish the same type of information from one another. For example, first information may also be referred to as second information, and, similarly, second information may also be referred to as first information, without departing from the scope of the disclosure. The word "if" as used here may be interpreted as "upon "or" when" or "in response to determining", depending on the context.

[0019] In the related art, since the cleaning robot is integrated below the laundry treating equipment in the double washing station, when the drum of the laundry treating equipment is loaded with a large amount of laundry or filled with water, the drum will sink, causing the drum to vibrate during the rotation, which will lead to collision between the drum and the cleaning robot, thus causing abnormal sound of the equipment and even damaging the cleaning robot.

[0020] For the "double washing station" which integrates laundry treating equipment and a cleaning robot, since the cleaning robot is integrated below the laundry treating equipment in the double washing station, when the drum of the laundry treating equipment is loaded with a large amount of laundry or filled with water, the drum will sink, causing the drum to vibrate during the rotation, which will lead to collision between the drum and the cleaning robot, thus causing abnormal sound of the equipment and even damaging the cleaning robot.

[0021] In view of this, an example of the disclosure provides a solution that it can be judged whether the drum will come into contact with the cleaning robot during operation of the laundry treating equipment under the condition that the cleaning robot is located below the drum. When it is determined that the drum will come into contact with the cleaning robot during operation of the laundry treating equipment, the cleaning robot is controlled to move out from a position below the drum to avoid abnormal sound or damage of the cleaning robot caused by the collision between the drum and the cleaning robot during the operation of the laundry treating equipment.

[0022] The application scenarios of the examples of the disclosure will be introduced below.

[0023] Referring to Fig. 1, which shows a structural schematic diagram of cleaning equipment in an example of the disclosure. As shown in Fig. 1, the cleaning equipment 100 includes laundry treating equipment 110 and a cleaning robot 120 arranged below the laundry treating equipment 110.

[0024] A rotatable drum 111 is arranged in the laundry treating equipment 110. By controlling the rotation of the drum 111, the laundry treating equipment 110 may realize a washing function or a spinning function. The laundry treating equipment 110 may also have other functions, for example, a drying function, a laundry disinfection function, etc., and starting of these functions may likewise cause the rotation of the drum 111, and examples of the disclosure will not make limitations to these.

[0025] The cleaning robot 120 may be arranged below

the drum 111 and may freely move out from the position below the drum 111 or return to the position below the drum 111. For example, the cleaning robot 120 may be a freely movable robot such as a sweeping robot, a mopping robot, or a sweeping and mopping robot, and examples of the disclosure will not make limitations to these.

[0026] In some examples, the cleaning robot 120 may share the same set of water supply and drain hoses with the laundry treating equipment 110, and a charging module adapted for the cleaning robot may be integrated inside the laundry treating equipment 110, thus saving the space occupied by the cleaning robot 120.

[0027] In addition, in order to further save the space occupied by the cleaning equipment, the spacing between the cleaning robot 120 and the drum 111 may be narrowed, thus reducing the height of the cleaning equipment. When the spacing between the cleaning robot 120 and the drum 111 is small, control may be performed by the cleaning equipment control method provided by an example of the disclosure to avoid the collision between the cleaning robot 120 and the drum 111.

[0028] Examples of the disclosure will be explained in detail below in conjunction with the above application scenarios.

[0029] First, an example of the disclosure provides a cleaning equipment control method, which can be performed by any electronic device. Cleaning equipment may be a "double washing station" including laundry treating equipment and a cleaning robot, where the cleaning robot is arranged below a drum of the laundry treating equipment.

[0030] Fig. 2 shows a flowchart of a cleaning equipment control method in an example of the disclosure, and as shown in Fig. 2, the cleaning equipment control method provided in an example of the disclosure includes steps S201 and S202.

[0031] S201, detecting whether a drum satisfies a touch condition in the case that a cleaning robot is located below the drum.

[0032] It needs to be noted that the position of the cleaning robot may be obtained by a position sensor mounted on the robot or by calculating a movement trajectory by a moving distance of the cleaning robot in combination with steering data. Since an example of the disclosure focuses on whether the cleaning robot is located below the drum, it is also possible to judge whether the cleaning robot is located below the drum by installing a corresponding object detection sensor below the drum.

[0033] The touch condition may be understood as a condition that enables contact or collision between the drum and the cleaning robot. In the case that it is detected that the drum satisfies the touch condition, the drum will come into contact with or collide with the cleaning robot during rotation. The touch condition may be a predefined operational state of the laundry treating equipment or a specific positional or environmental scenario, under which the cleaning robot is prompted to move out from its position below the drum for reasons including, but not limited to, proximity, load capacity, and operational dynamics of the equipment.

[0034] It needs to be noted that when the cleaning robot is located below the drum, the drum will sink after being loaded with laundry or filled with water, which will cause the drum to vibrate during the rotation, thus greatly reducing the distance between the drum and the cleaning robot. Accordingly, it can be judged in advance whether the drum will come into contact with the cleaning robot during operation before the starting instruction for the laundry treating equipment is executed. After it is confirmed that there is no contact, the starting instruction is executed.

[0035] For example, a sensor may be arranged between the drum and the cleaning robot for detecting the distance between the drum in a non-moving state and the cleaning robot so as to detect whether the drum satisfies the touch condition. If the distance between the drum and the cleaning robot is less than a preset distance threshold, it is considered that the drum satisfies the touch condition. That is, it can be predicted whether the drum will come into contact with the cleaning robot while rotating according to the amount of sinking of the drum after being loaded with laundry.

[0036] The distance threshold may be measured by experimental calibration. Since different starting instructions of the laundry treating equipment are different for the treatment process of laundry, the corresponding distance thresholds may be set according to the different starting instructions. For example, after the washing instruction is started, the laundry in the drum will be soaked in water, which further exacerbates the sinking of the drum. Thus, the amount of sinking after water filling needs to be reserved for the distance threshold set for the washing instruction. After the spinning instruction is started, the amount of sinking caused by the laundry initially containing a lot of water in the drum is already the maximum amount of sinking during the execution of the instruction, and the corresponding distance threshold can be set directly according to the measured amount of sinking.

[0037] For example, it can be detected whether the drum satisfies the touch condition by detecting the weight of the laundry in the drum. It can be understood that in order to achieve a better washing effect of the laundry treating equipment, a weight sensor is generally arranged in the drum of the laundry treating equipment, so that the laundry treating equipment can automatically adjust parameters of various laundry treatment processes such as a water filling amount and spinning time in a washing process according to the weight of the laundry loaded. In the examples of the disclosure, the weight of the laundry in the drum may be detected by means of the weight sensor. If the weight of the laundry in the drum is greater than a preset weight threshold, it is considered that the drum satisfies the touch condition.

That is, it is possible to indirectly evaluate the amount of sinking of the drum according to the weight of the laundry, thus predicting whether the drum will come into contact with the cleaning robot while rotating.

[0038] Similar to the distance threshold, the weight threshold may also be measured by experimental calibration. Since different starting instructions of the laundry treating equipment are different for the treatment process of laundry, the corresponding weight thresholds may be set according to the different starting instructions. For example, after a washing instruction is started, the laundry in the drum will be soaked in water, at this time, which will further aggravate the weight borne by the drum and make the drum sink more seriously. Thus, the weight of the water needs to be reserved for the weight threshold set for the washing instruction. After the spinning instruction is started, the weight of the laundry initially containing a lot of water in the drum is already the maximum weight borne by the drum during the execution of the instruction, and at this time, the corresponding weight threshold can be set directly according to the measured weight.

[0039] It will be appreciated that the above-described manner of judging according to the distance threshold and the weight threshold may be used separately or simultaneously. In the simultaneous use, measurement errors due to an excessively concentrated placement of the laundry in the drum can be eliminated. That is, when it is judged that the drum satisfies the touch condition by any of the judgment manners, it is considered that the drum will come into contact with the cleaning robot during rotation, thus avoiding as much as possible a false judgment due to an error.

[0040] In some examples, the cleaning robot may not be located below the drum when a starting instruction of the laundry treating equipment is received. For example, the cleaning robot may be performing a cleaning task, for example, cleaning the floor of a specified area. It can be appreciated that the cleaning robot will move out from a position below the drum when performing the cleaning task, and returns to the position below the drum after completing the cleaning task.

[0041] At this time, although the cleaning robot is not currently below the drum, and will not come into contact with the drum regardless of how the drum rotates, the cleaning robot may return during the rotation of the drum, thus causing contact or collision with the drum.

[0042] In some examples, the cleaning robot may be caused to return to the position below the drum after the rotation of the drum is finished.

[0043] For example, if the cleaning robot is performing a cleaning task, the completion time of the cleaning task may be predicted. If the completion time is before the time at which the laundry treating equipment stops operating, the completion time of the cleaning task may be extended to a time after the time at which the laundry treating equipment stops operating.

[0044] Thus, the cleaning robot may be prevented from returning to the position below the drum during the rotation of the drum by extending the cleaning time of the cleaning robot, thus preventing the cleaning robot from coming into contact with or colliding with the drum.

[0045] S202, controlling the cleaning robot to move out from a position below the drum if the drum satisfies the touch condition.

[0046] In some examples, if it is determined that the drum satisfies the touch condition, the cleaning robot may be controlled to move out from a position below the drum to avoid occurrence of collision.

[0047] It is worth noting that "controlling the cleaning robot to move out from a position below the drum" described in the example of the disclosure means that the cleaning robot can be moved to any position other than the position below the drum, and the cleaning robot moved out may be in a stationary standby state or in a moving state. For example, the cleaning robot may be moved to a position preset by the user that does not affect the daily life of the user, or may be caused to perform a cleaning task, that is, to move in a space where the cleaning equipment is located according to a planned cleaning route, and examples of the disclosure will not make limitations to this.

[0048] In addition, it may be understood that after the cleaning robot is moved out, the cleaning robot may be controlled to return to the position below the drum after the laundry treating equipment stops operating, thus automatically restoring the original state.

[0049] Accordingly, examples of the disclosure provide a solution that can effectively prevent the drum from coming into contact with or colliding with the cleaning robot during rotation. By moving the cleaning robot out from a position below the drum after detecting a possible contact, it can be ensured that the drum will certainly not come into contact with or collide with the cleaning robot during rotation. Thus, by using the method provided by the example of the disclosure to control the cleaning equipment, the amount of interference between the cleaning robot and the drum does not need to be reserved in design, so that the height of the cleaning equipment can be greatly reduced, thus saving more space for the user.

[0050] In some examples, the rotation speed of the drum when the laundry treating equipment executes the spinning instruction is significantly higher than the rotation speed of the drum when the laundry treating equipment executes other instructions, for example, when the laundry treating equipment executes the spinning instruction, the rotation speed of the drum may reach 1200 rmp or above, and a higher rotation speed will aggravate the vibration amplitude of the drum, so in order to effectively prevent the drum from coming into contact with or colliding with the cleaning robot at a high rotation speed, it may be considered that the drum satisfies the touch condition detected in S201 when the laundry treating equipment is in a spinning instruction execution state, thus controlling the cleaning robot to be moved out from a position below the drum. That is, regardless of the result

of the above-described judgment according to the weight threshold and/or judgment according to the distance threshold, the cleaning robot is moved out from a position below the drum when the laundry treating equipment is in a spinning instruction execution state, thus ensuring that the cleaning robot and the drum will certainly not come into contact or collision.

[0051] In some examples, when the drum resonates with the cleaning whole equipment, the vibration amplitude of the drum is the largest. In order to shorten the time when the cleaning robot is moved out and increase the user experience, the cleaning robot may be controlled to move out from a position below the drum in the case that the rotation speed of the drum is within the resonance rotation speed interval. The resonant rotation speed interval is the rotation speed interval in which the whole cleaning equipment can resonate, and may be measured by experimental calibration.

[0052] Specifically, Fig. 3 shows a flowchart of another cleaning equipment control method in an example of the disclosure, as shown in Fig. 3, another cleaning equipment control method provided in an example of the disclosure includes steps S301 and S302.

[0053] S301, detecting a spinning rotation speed of the drum in a spinning process in real time if the laundry treating equipment is in a spinning instruction execution state.

[0054] The spinning rotation speed may be obtained by detecting a motor driving signal or by arranging a corresponding sensor, and examples of the disclosure will not make limitations to this.

[0055] S302, controlling the cleaning robot to move out from a position below the drum if it is detected that the spinning rotation speed is within the resonance rotation speed interval.

[0056] The inventors have found that, in practical applications, the upper limit value of the resonant rotation speed spinning will be much smaller than the spinning rotation speed maintained when the drum executes the spinning instruction, for example, the resonant rotation speed interval may be 150 to 400 rmp, while the spinning rotation speed of the drum may be maintained at 1200 rmp when the laundry treating equipment normally performs spinning. That is, the spinning rotation speed of the drum passes through the resonance rotation speed interval merely during the initial rotation speed increase and during the rotation speed decrease after the spinning is finished.

[0057] Thus, if it is detected that the spinning rotation speed is outside the resonance rotation speed interval, and the cleaning robot is in a standby state (i.e., no cleaning task is performed), the cleaning robot may be controlled to return to the position below the drum. At this time, since the drum does not resonate with the whole cleaning equipment, it can be considered that the vibration amplitude of the drum is insufficient to enable the drum to collide with the cleaning robot, so that the cleaning robot can be enabled to return to the position below the drum.

[0058] Accordingly, by configuring that the cleaning robot is moved out from a position below the drum when it is detected that the spinning rotation speed is in the resonance rotation speed interval, the time for the cleaning robot to be moved out can be greatly shortened, thus reducing the hindrance caused by the moving-out of the cleaning robot to the user.

[0059] Based on the same inventive concept, the example of the disclosure also provides a cleaning equipment control device, such as the following example. Since the problem solving principle of the device example is similar to the problem solving principle of the method example described above, the embodiment of the device example may be referred to the embodiment of the method example described above, and will not be repeated.

[0060] Fig. 4 shows a structural schematic diagram of a cleaning equipment control device in an example of the disclosure. Cleaning equipment may include laundry treating equipment and a cleaning robot arranged below a drum of the laundry treating equipment, where the cleaning robot can be moved out from a position below the drum. As shown in Fig. 4, the cleaning equipment control device 400 includes a judgment module 401 and a control module 402.

[0061] The judgment module 401 is configured to detect whether the drum satisfies a touch condition in the case that the cleaning robot is located below the drum.

[0062] The control module 402 is configured to control the cleaning robot to be moved out from a position below the drum if the drum satisfies the touch condition.

[0063] In some examples, the judgment module 401 is configured to determine that the drum satisfies the touch condition if the distance between the drum and the cleaning robot is less than a preset distance threshold.

[0064] In some examples, the judgment module 401 is configured to determine that the drum satisfies the touch condition if the weight of laundry in the drum is greater than a preset weight threshold.

[0065] In some examples, the control module 402 is further configured to determine that the drum satisfies the touch condition if the laundry treating equipment is in a spinning instruction execution state.

[0066] In some examples, the control module 402 is configured to detect a spinning rotation speed of the drum in a spinning process in real time if the laundry treating equipment is in a spinning instruction execution state. controlling the cleaning robot to move out from the position below the drum if it is detected that the spinning rotation speed is within a resonance rotation speed interval, where the resonance rotation speed interval is a rotation speed interval in which the whole cleaning equipment can resonate.

[0067] In some examples, the control module 402 is configured to control the cleaning robot to return to the position below the drum if it is detected that the spinning rotation speed is outside the resonance rotation speed

interval, and the cleaning robot is in a standby state.

[0068] In some examples, the control module 402 is configured to predict the completion time of a cleaning task if the cleaning robot is performing the cleaning task. If the completion time is before the time at which the laundry treating equipment stops operating, the completion time of the cleaning task is extended to a time after the time at which the laundry treating equipment stops operating. the cleaning robot moves out the position below the drum when performing the cleaning task, and returns to the position below the drum after completing the cleaning task.

[0069] It needs to be noted that when the cleaning equipment control device provided in the above example is used for cleaning equipment control, the cleaning equipment control device is merely illustrated by the division of the above-mentioned functional modules. In practical application, the above-mentioned function allocation can be completed by different functional modules as needed, that is, the internal structure of the device is divided into different functional modules to complete all or part of the above-mentioned functions. In addition, the cleaning equipment control device provided by the above examples belongs to the same concept as the cleaning equipment control method example, and its specific implementation process is detailed in the method example, which will not be described in detail here.

[0070] As will be appreciated by one skilled in the art, aspects of the disclosure may be implemented as a system, method or program product. Accordingly, aspects of the disclosure may take the form of an entirely hardware embodiment, an entirely software embodiment (including firmware, micro-code, etc.) or an embodiment combining hardware and software aspects that may all generally be referred to here as a "circuit," "module" or "system."

[0071] An electronic device 500 capable of implementing an example of the disclosure is described below with reference to Fig. 5. The electronic device 500 shown in Fig. 5 is merely one example and does not bring any limitation to the functionality and scope of applicability of examples of the disclosure.

[0072] As shown in Fig. 5, the electronic device 500 is represented in the form of a general-purpose computing device. Components of the electronic device 500 may include, but are not limited to, at least one processing unit 510, at least one memory unit 520, and a bus 530 that connects various system components including the memory unit 520 and the processing unit 510.

[0073] The memory unit stores a program code, the program code can be executed by the processing unit 510 to cause the processing unit 510 to perform steps according to various examples of the disclosure described in the above "Method Example" section of the disclosure.

[0074] In some examples, the processing unit 510 may perform the following steps of the above-described method example: if the cleaning robot is located below the drum, detecting whether the drum satisfies a touch condition; if the drum satisfies the touch condition, controlling the cleaning robot to move out from a position below the drum.

[0075] The memory unit 520 may include readable media in the form of a volatile memory unit, such as a random-access memory unit (RAM) 5201 and/or a cache memory unit 5202, and may further include a read-only memory units (ROM) 5203.

[0076] The memory unit 520 may further include a program/utility 5204 having a set of (at least one) program modules 5205 including, but not limited to, an operating system, one or more applications, other program modules, and program data, each or some combination of which may include implementations in a networking environment.

[0077] The bus 530 may represent one or more of several types of bus structures, including a memory unit bus or memory unit controller, a peripheral bus, an accelerated graphics port, a processing unit, or local bus using any of a variety of bus architectures.

[0078] The electronic device 500 may also communicate with one or more external devices 540 (e.g., a keyboard, a pointing device, a Bluetooth device, etc.), and may also communicate with one or more devices that enable a user to interact with the electronic device 500, and/or communicate with any device (e.g., router, modem, etc.) that enables the electronic device 500 to communicate with one or more other computing devices. Such communication can occur via an input/output (I/O) interface 550. Moreover, the electronic device 500 can also communicate with one or more networks, such as a local area network (LAN), a wide area network (WAN), and/or a public network, such as the Internet, via a network adapter 560. As shown in Fig. 5, the network adapter 560 communicates with other modules of the electronic device 500 via the bus 530. It needs to be understood that although not shown, other hardware and/or software modules may be used in conjunction with the electronic device 500, including but not limited to microcode, device drivers, redundant processing units, external disk drive arrays, RAID systems, tape drives, and data backup storage systems, etc.

[0079] From the above description of the embodiments, those skilled in the art will readily appreciate that the embodiments described here may be implemented in software or software in combination with necessary hardware. Thus, the technical solution according to an embodiment of the disclosure may be embodied in the form of a software product, the software product may be stored in a non-volatile storage medium (which may be a CD-ROM, a USB flash drive, a mobile hard disk, or the like) or on a network, and includes several instructions for causing a computing device (which may be a personal computer, a server, a terminal device, a network device, or the like) to perform the method according to the embodiments of the disclosure.

[0080] In an example of the disclosure, a non-transitory

computer-readable storage medium is also provided, which may be a readable signal medium or a readable storage medium. The computer-readable storage medium stores a program product capable of implementing the above-described method of the disclosure. In some possible embodiments, various aspects of the disclosure may also be implemented in the form of a program product including a program code for causing a terminal device to perform steps according to various examples of the disclosure described in the above "Method Example" section of the disclosure, when the program product runs on the terminal device.

[0081] More specific examples of non-transitory computer-readable storage media in the disclosure may include, but are not limited to: an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing.

[0082] In the disclosure, the non-transitory computer-readable storage medium may include a data signal propagating in baseband or as part of a carrier wave, and a readable program code is carried in the data signal. Such a propagated data signal may take a variety of forms, including, but not limited to, an electromagnetic signal, an optical signal, or any suitable combination of the foregoing. The readable signal medium may also be any readable medium other than the readable storage medium that can send, propagate, or transmit a program for use by or in connection with an instruction execution system, apparatus, or device.

[0083] Optionally, the program code contained in the non-transitory computer-readable storage medium may be transmitted by any appropriate medium, including but not limited to wireless medium, wired medium, optical fiber cable, RF, etc., or any suitable combination of the foregoing.

[0084] During specific embodiment, the program code for carrying out operations of the disclosure may be written in any combination of one or more programming languages, including an object-oriented programming language such as Java, C++ or the like and conventional procedural programming languages, such as the "C" language or similar programming languages. The program code may be executed entirely on the user computing device, partly on the user device, as a stand-alone software package, partly on the user computing device and partly on a remote computing device or entirely on the remote computing device or server. In the scenario involving a remote computing device, the remote computing device may be connected to the user computing device through any type of network, including a local area network (LAN) or a wide area network (WAN), or may be connected to an external computing device (for example, through the Internet using an Internet service provider).

[0085] It needs to be noted that although several modules or units of a device for action execution are mentioned in the above detailed description, this division is not mandatory. Indeed, according to embodiments of the disclosure, the features and functions of two or more modules or units described above may be embodied in one module or unit. Conversely, the features and functions of one module or unit described above may be further divided into a plurality of modules or units to be embodied.

[0086] Moreover, although the various steps of the method of the disclosure are depicted in the figures in a particular order, this does not require or imply that the steps need to be performed in that particular order, or that all illustrated steps need to be performed to achieve desirable results. Additionally or alternatively, certain steps may be omitted, multiple steps may be combined into one step for execution, and/or one step may be decomposed into multiple steps for execution, etc.

[0087] From the above description of the embodiments, those skilled in the art will readily appreciate that the embodiments described here may be implemented by software or by combining software with necessary hardware. Thus, the technical solution according to an embodiment of the disclosure may be embodied in the form of a software product, the software product may be stored in a non-volatile storage medium (which may be a CD-ROM, a USB flash drive, a mobile hard disk, or the like) or on a network, and includes several instructions to cause a computing device (which may be a personal computer, a server, a mobile terminal, or a network device, or the like) to perform the method according to the embodiments of the disclosure.

Claims

1. A cleaning equipment (100) control method, wherein cleaning equipment (100) comprises laundry treating equipment (110) and a cleaning robot (120) arranged below a drum (111) of the laundry treating equipment (110), wherein the cleaning robot (120) can be moved out from a position below the drum (111);
   the method comprises:

   detecting (S201) whether the drum (111) satisfies a touch condition in the case that the cleaning robot (120) is located below the drum (111); and
   controlling (S202) the cleaning robot (120) to move out from the position below the drum (111) under the condition that the drum (111) satisfies the touch condition.

2. The method according to claim 1, wherein detecting whether the drum (111) satisfies a touch condition comprises:

determining that the drum (111) satisfies the touch condition in a case of determining that a distance between the drum (111) and the cleaning robot (120) is less than a preset distance threshold.

3. The method according to claim 1, wherein detecting whether the drum (111) satisfies a touch condition comprises:
determining that the drum (111) satisfies the touch condition in a case of determining that a weight of laundry in the drum (111) is greater than a preset weight threshold.

4. The method according to claim 1, wherein detecting whether the drum (111) satisfies a touch condition comprises:
determining that the drum (111) satisfies the touch condition in a case of determining that the laundry treating equipment (110) is in a spinning instruction execution state.

5. The method according to claim 4, wherein controlling the cleaning robot (120) to move out from the position below the drum (111) comprises:

detecting (S301) a spinning rotation speed of the drum (111) in a spinning process in real time in a case of determining that the laundry treating equipment (110) is in the spinning instruction execution state; and
controlling (S302) the cleaning robot (120) to move out from the position below the drum (111) in a case of determining that it is detected that the spinning rotation speed is within a resonance rotation speed interval, wherein the resonance rotation speed interval is a rotation speed interval in which the whole cleaning equipment (100) can resonate.

6. The method according to claim 5, further comprising:
controlling the cleaning robot (120) to return to the position below the drum (111) in a case of determining that it is detected that the spinning rotation speed is outside the resonance rotation speed interval, and the cleaning robot (120) is in a standby state.

7. The method according to any one of claims 1 to 6, further comprising:

predicting a completion time of a cleaning task in response to determining that the cleaning robot (120) is performing the cleaning task; and
extending the completion time of the cleaning task to a time after a time at which the laundry treating equipment stops operating in a case of determining that the completion time is before the time at which the laundry treating equipment stops operating; wherein
the cleaning robot (120) moves out the position below the drum (111) when performing the cleaning task, and returns to the position below the drum (111) after completing the cleaning task.

8. An electronic device (500), comprising:

a processor (510); and
a memory (520), configured to store instructions executable by the processor (510); wherein
the processor (510) is configured to execute the following a cleaning equipment (100) control method by executing the executable instructions, wherein cleaning equipment (100) comprises laundry treating equipment (110) and a cleaning robot (120) arranged below a drum (111) of the laundry treating equipment (110), and the cleaning robot (120) can be moved out from a position below the drum (111):

detecting (S201) whether the drum (111) satisfies a touch condition in the case that the cleaning robot (120) is located below the drum (111); and
controlling (S202) the cleaning robot (120) to move out from the position below the drum (111) under the condition that the drum (111) satisfies the touch condition.

9. The electronic device (500) according to claim 8, wherein the processor (510) is configured to:
determine that the drum (111) satisfies the touch condition in a case of determining that a distance between the drum (111) and the cleaning robot (120) is less than a preset distance threshold.

10. The electronic device (500) according to claim 8, wherein the processor (510) is configured to:
determine that the drum (111) satisfies the touch condition in a case of determining that a weight of laundry in the drum (111) is greater than a preset weight threshold.

11. The electronic device (500) according to claim 8, wherein the processor (510) is configured to:
determine that the drum (111) satisfies the touch condition in a case of determining that the laundry treating equipment (110) is in a spinning instruction execution state.

12. The electronic device (500) according to claim 11, wherein the processor (510) is configured to:

detect (S301) a spinning rotation speed of the drum (111) in a spinning process in real time in a case of determining that the laundry treating equipment (110) is in the spinning instruction

execution state; and
control (S302) the cleaning robot (120) to move out from the position below the drum (111) in a case of determining that it is detected that the spinning rotation speed is within a resonance rotation speed interval, wherein the resonance rotation speed interval is a rotation speed interval in which the whole cleaning equipment (100) can resonate.

13. The electronic device (500) according to claim 12, wherein the processor (510) is further configured to:
control the cleaning robot (120) to return to the position below the drum (111) in a case of determining that it is detected that the spinning rotation speed is outside the resonance rotation speed interval, and the cleaning robot (120) is in a standby state.

14. The electronic device (500) according to any one of claims 8 to 13, wherein the processor (510) is further configured to:

predict a completion time of a cleaning task in response to determining that the cleaning robot (120) is performing the cleaning task; and
extend the completion time of the cleaning task to a time after a time at which the laundry treating equipment stops operating in a case of determining that the completion time is before the time at which the laundry treating equipment stops operating; wherein
the cleaning robot (120) moves out the position below the drum (111) when performing the cleaning task, and returns to the position below the drum (111) after completing the cleaning task.

15. A non-transitory computer-readable storage medium, storing a computer program, wherein the computer program, when executed by a processor, implements the method according to any one of claims 1 to 7.

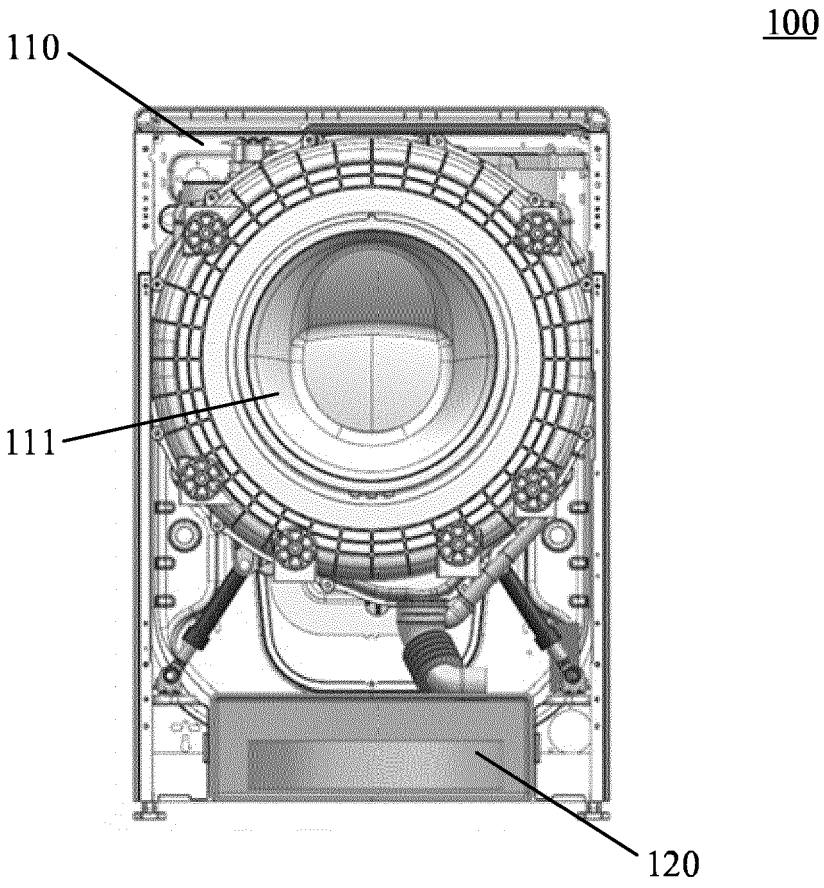
100
110
111
120

Fig. 1

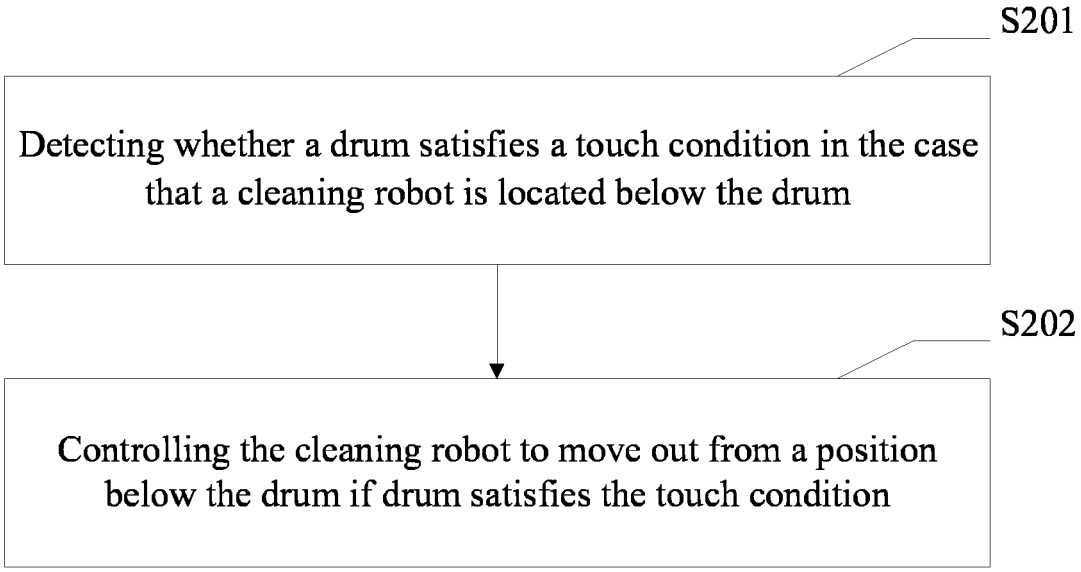
S201
Detecting whether a drum satisfies a touch condition in the case that a cleaning robot is located below the drum
S202
Controlling the cleaning robot to move out from a position below the drum if drum satisfies the touch condition

Fig. 2

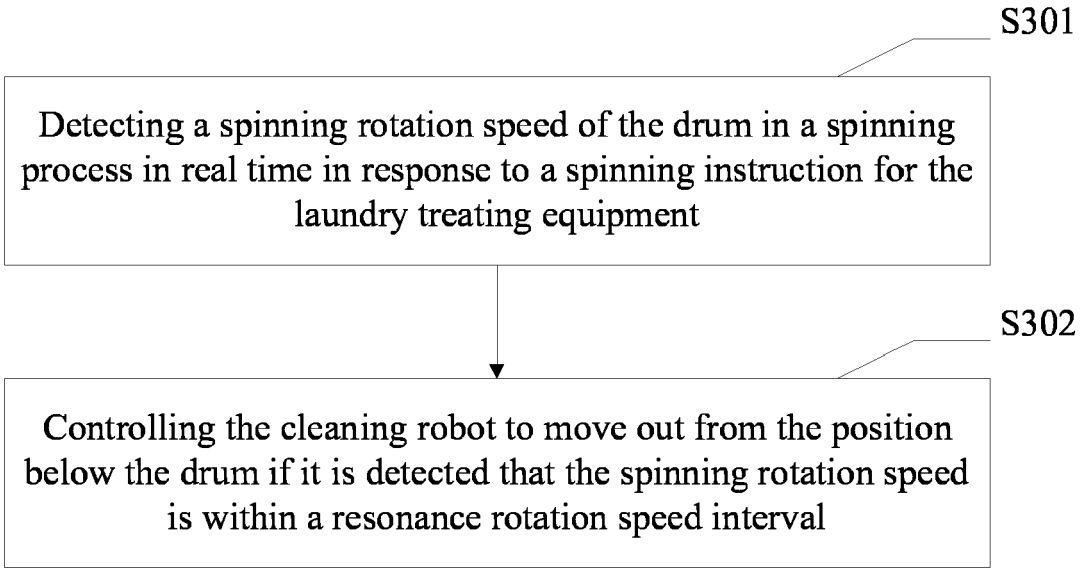
S301
Detecting a spinning rotation speed of the drum in a spinning process in real time in response to a spinning instruction for the laundry treating equipment
S302
Controlling the cleaning robot to move out from the position below the drum if it is detected that the spinning rotation speed is within a resonance rotation speed interval

Fig. 3

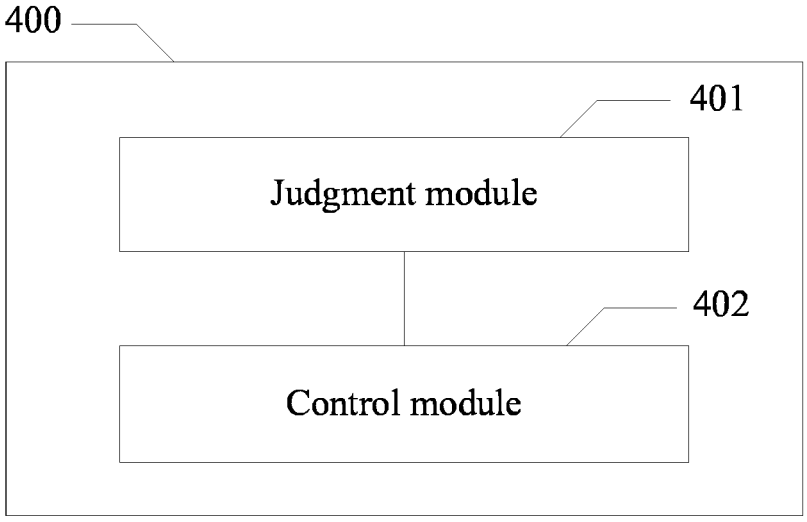
400
401
Judgment module
402
Control module

Fig. 4

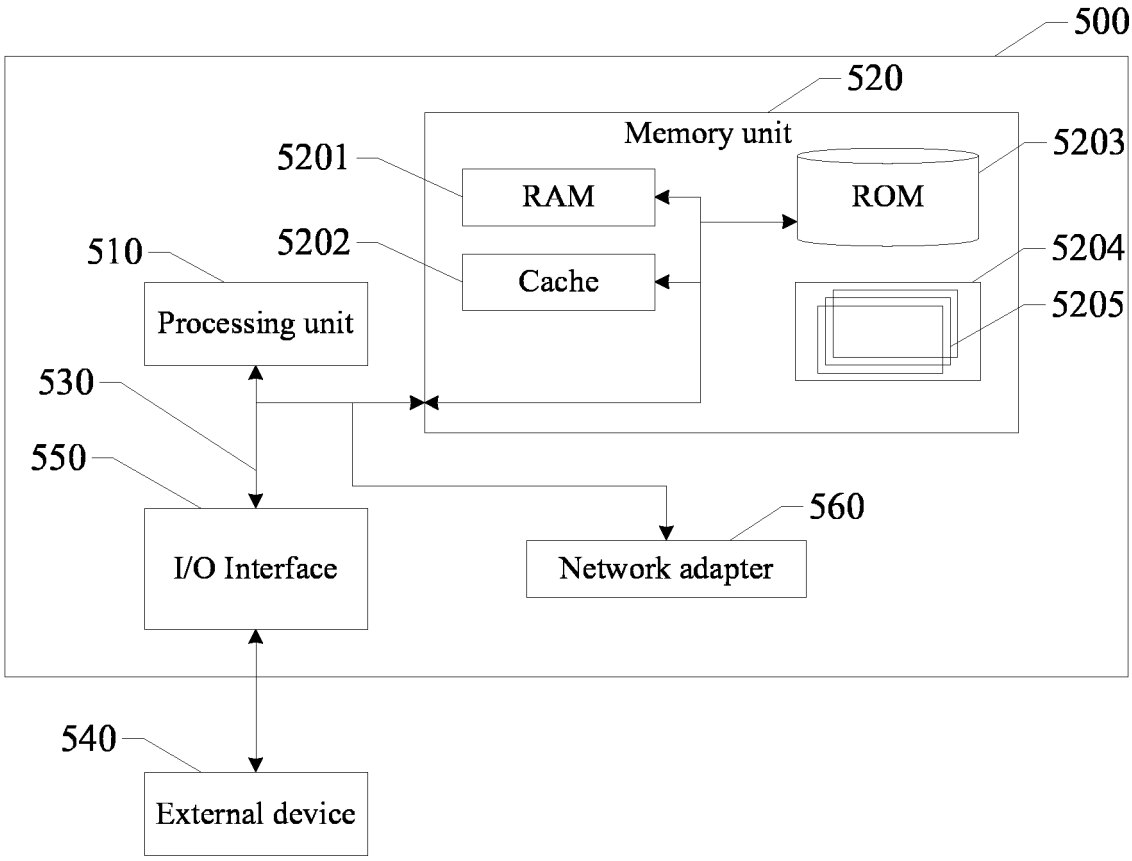
500
520
Memory unit
5201
RAM
5203
ROM
5202
Cache
510
5204
Processing unit
5205
530
550
560
I/O Interface
Network adapter
540
External device

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 24 15 4442

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 113 440 075 A (SICHUAN QIRUIKE TECHNOLOGY CO LTD) 28 September 2021 (2021-09-28) * claims; figures *	1-15	INV. D06F29/00 A47L11/40
A	CN 116 509 271 A (WUXI FEILING ELECTRONIC CO LTD) 1 August 2023 (2023-08-01) * paragraph [0096]; figures *	1-15	
A	CN 116 536 879 A (GUANGDONG WONJAR INTELLIGENT ROBOT CO LTD) 4 August 2023 (2023-08-04) * claim 1; figure 1 *	1-15	
A	CN 112 429 538 A (QINGDAO HAIER DRUM WASHING MACHINE CO LTD; HAIER SMART HOME CO LTD) 2 March 2021 (2021-03-02) * paragraph [0077]; claim 1; figure 1 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

D06F
A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 July 2024	Popara, Velimir

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 15 4442

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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08-07-2024

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