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(54) CONTROL METHOD AND APPARATUS FOR AIR CONDITIONER, AND COMPUTER READABLE STORAGE MEDIUM

(57) A control method and apparatus for an air conditioner, and a computer readable storage medium. The control method for the air conditioner comprises: when a current time is within a time period when a user is not at home, detecting a current running state of the air conditioner, said time period being determined according to historical usage data of the air conditioner, and the historical usage data comprising at least one of historical usage time periods of the air conditioner and time periods of historical connection between the air conditioner and a terminal application; and when the air conditioner is in a power-on state, determining that the user forgets to turn off the air conditioner, and outputting prompt information or reducing energy consumption of the air conditioner.

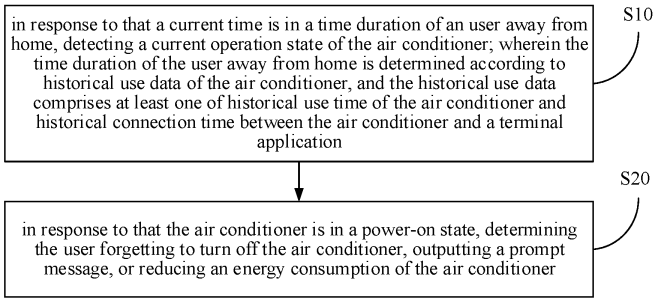

FIG. 2

EP 4 354 037 A1

Description

[0001] The present application claims priority to Chinese Patent Application No. 202110879423.5, filed on July 30, 2021, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present application relates to the technical field of air conditioners, in particular to a method and a device for controlling an air conditioner, and a computer-readable storage medium.

BACKGROUND

[0003] At present, as an important part of smart home, air conditioners have brought a lot of convenience to people's daily life and improved the comfort of the living environment. However, many users will forget to turn off the air conditioner after leaving home, which will easily cause the loss of air conditioner and the waste of electric energy. Based on this problem, the existing solution is to install a human body detection sensor on the air conditioner to detect whether there is anyone in the room. If there is no one, it is determined that the current user is away from home. If the air conditioner is on at this time, it is determined that the user forgot to turn the air conditioner off. With this method, an additional sensor needs to be installed, thereby resulting in an increase in cost. At the same time, because the sensor cannot adapt to the user's work needs, there will be misjudged, resulting in a wrong determination that the user has forgotten to turn off the air conditioner, thereby reducing the user's experience. Therefore, the accuracy of the existing determining method for forgetting to turn off the air conditioner is low.

SUMMARY

TECHNICAL PROBLEM

[0004] By providing a method and a device for controlling an air conditioner, and a computer-readable storage medium, embodiments of the present application aim to solve the problem of low accuracy in the existing air conditioner forgetting to turn off determination method.

TECHNICAL SOLUTION

[0005] In order to achieve the above objectives, on the one hand, the present application provides a method for controlling an air conditioner, and the method includes:

if a current time is in a time duration when an user is away from home, detecting a current operation state of the air conditioner; the time duration when the user is away from home is determined according to historical use data of the air conditioner, and the historical use data includes at least one of historical use time of the air conditioner and historical connection time between the air conditioner and a terminal application; and

if the air conditioner is in an on state, determining that the user forgot to turn off the air conditioner, outputting a prompt message, or reducing energy consumption of the air conditioner.

[0006] In an embodiment, after the detecting the current operation state of the air conditioner, the method further includes:

if the time duration when the user is away from home is greater than or equal to a first preset duration, obtaining an operation duration of the air conditioner; and

if the operation duration is greater than or equal to a second preset duration and the air conditioner is in the on state, determining that the user forgot to turn off the air conditioner; the first preset duration is less than the second preset duration.

[0007] In an embodiment, before the obtaining the operation duration of the air conditioner, the method further includes:

determining a time point when the user leaves home according to the time duration when the user is away from home; and

obtaining a time difference between the current time and the time point to obtain the time duration of the user away from home.

[0008] In an embodiment, the reducing the energy consumption of the air conditioner includes:

adjusting a current operation mode of the air conditioner; or

performing a shutdown operation.

[0009] In an embodiment, before the detecting the current operation state of the air conditioner, the method further includes:

obtaining a working time of the user according to the historical use data; and

determining the time duration when the user is away from home during the working time according to the historical use data during the working time of the user; the time duration when the user is away from home does not overlap with the historical use time and the historical connection time.

[0010] In an embodiment, the obtaining the working time of the user according to the historical use data includes:

obtaining each fourth preset duration of historical unused data within a third preset duration; the historical unused data is determined according to the historical use data, and the third preset duration is divided into a preset number of fourth preset duration;
determining an unused time duration in each of the fourth preset duration according to the historical use data of each of the fourth preset duration; and
configuring the fourth preset duration overlapping the unused time duration as the working time.

[0011] In an embodiment, the configuring the fourth preset duration overlapping the unused time duration as the working time includes:

obtaining the fourth preset duration of each target if the unused time duration is greater than or equal to a fifth preset duration; the fifth preset duration is less than the fourth preset duration; and
configuring the fourth preset duration of the target overlapping the unused time duration as the working time.

[0012] In an embodiment, the determining the time duration when the user is away from home during the working time according to the historical use data during the working time of the user includes:

obtaining a historical unused time and/or a historical unconnected time with a highest frequency during the working time according to the historical use data during the working time of the user; and
configuring a time duration corresponding to the historical unused time and/or the historical unconnected time with the highest frequency as the time duration when the user is away from home.

[0013] In addition, in order to achieve the above objectives, the present application also provides a device for controlling an air conditioner, including a memory, a processor, and a program for controlling the air conditioner stored on the memory and run on the processor, and when the program for controlling the air conditioner is executed by the processor, the steps of the method for controlling the air conditioner are realized.

[0014] In addition, in order to achieve the above objectives, the present application also provides a computer-readable storage medium, a program for controlling an air conditioner is stored on the computer-readable storage medium, and when the program for controlling the air conditioner is executed by a processor, the steps of the method for controlling the air conditioner are realized.

BENEFICIAL EFFECT

[0015] The present application provides a method for controlling an air conditioner, which detects the current operation state of the air conditioner if the current time is in the time duration when the user is away from home. The time duration when the user is away from home is determined according to the historical use data of the air conditioner. The historical use data includes at least one of the historical use time of the air conditioner and the historical connection time between the air conditioner and the terminal application; when the air conditioner is turned on, it is determined that the user has forgotten to turn off the air conditioner, and a prompt message is output or the energy consumption of the air conditioner is reduced. The present application determines whether the user has left home based on the historical use data of the air conditioner and the current time. After the user leaves home, if it is detected that the air conditioner is turned on, it is determined that the user has forgotten to turn off the air conditioner, and the leaving home control is executed. In this way, the accuracy of forgetting to turn off the air conditioner is improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1 is a schematic diagram of a terminal structure of a hardware operation environment according to an embodiment of the present application.
FIG. 2 is a schematic flowchart of a method for controlling an air conditioner according to a first embodiment of the present application.
FIG. 3 is a schematic flowchart of the method for controlling the air conditioner according to a second embodiment of the present application.
FIG. 4 is a schematic flowchart before the step of detecting the current operation state of the air conditioner in the method for controlling the air conditioner according to the present application.
FIG. 5 is a schematic flowchart of an operation of the method for controlling the air conditioner according to the present application.
FIG. 6 is a block diagram of the method for controlling the air conditioner according to the present application.

[0017] The realization, functional features and advantages of the present application will be further described in conjunction with the embodiments and with reference to the accompanying drawings.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0018] It should be understood that the specific embodiments described herein are only used to explain the present application, and not to limit the present application.

[0019] In order to better understand the above-mentioned technical solutions, exemplary embodiments of the present application will be described in more detail below with reference to the accompanying drawings. Al-

though exemplary embodiments of the present application are shown in the drawings, it should be understood that the present application may be embodied in various forms and should not be limited by the embodiments set forth herein. Rather, these embodiments are provided for more thorough understanding of the present application and to fully convey the scope of the present application to those skilled in the art.

[0020] Due to the existing use of sensors to determine whether the user has forgotten to turn off the air conditioner, the sensor cannot adapt to the user's work needs, and there will be misdetermination, resulting in a wrong determination that the user has forgotten to turn off the air conditioner, thereby reducing the accuracy of determining that the air conditioner has forgotten to turn off. Therefore, the accuracy of the existing determining method for forgetting to turn off the air conditioner is low. However, the present application detects the current operation state of the air conditioner when the current time is in the duration when the user is away from home. The time duration when the user is away from home is determined according to the historical use data of the air conditioner. The historical use data includes at least one of the historical use time of the air conditioner and the historical connection time between the air conditioner and the terminal application; when the air conditioner is turned on, it is determined that the user has forgotten to turn off the air conditioner, and a prompt message is output or the energy consumption of the air conditioner is reduced. The present application judges whether the user has left home based on the historical use data of the air conditioner and the current time. After the user leaves home, if it is detected that the air conditioner is turned on, it is determined that the user has forgotten to turn off the air conditioner, and the leaving home control is executed. In this way, the accuracy of forgetting to turn off the air conditioner is improved.

[0021] As shown in FIG. 1, FIG. 1 is a schematic diagram of a terminal structure of a hardware operation environment according to an embodiment of the present application.

[0022] As shown in FIG. 1, the terminal may include: a processor 1001, such as a central processing unit (CPU), a network interface 1004, a user interface 1003, a memory 1005, and a communication bus 1002. The communication bus 1002 is used to realize connection and communication between these components. The user interface 1003 may include a display screen, an input unit such as a keyboard, and the optional user interface 1003 may also include a standard wired interface and a wireless interface. Optionally, the network interface 1004 may include a standard wired interface and a wireless interface (such as a wireless fidelity (WI-FI) interface). The memory 1005 can be a high-speed random access memory (RAM) memory, or a stable memory (non-volatile memory), such as a disk memory. Optionally, the memory 1005 may also be a storage device independent of the aforementioned processor 1001.

[0023] Those skilled in the art can understand that the terminal structure shown in FIG. 1 does not constitute a limitation on the terminal device, and may include more or less components than those shown in the figure, or a combination of some components, or different arranged components.

[0024] As shown in FIG. 1, the memory 1005 as a computer-readable storage medium may include an operating system, a network communication module, a user interface module, and a program for controlling an air conditioner.

[0025] In the terminal shown in FIG. 1, the network interface 1004 is mainly used for data communication with the background server; the user interface 1003 is mainly used for data communication with the client terminal (user terminal); and when the terminal is an air conditioner, the processor 1001 can be used to call the program for controlling the air conditioner in the memory 1005, and perform the following operations:

When the current time is in the time duration when the user is away from home, the current operation state of the air conditioner is detected. The time duration when the user is away from home is determined according to the historical use data of the air conditioner, and the historical use data includes at least one of the historical use time of the air conditioner and the historical connection time between the air conditioner and the terminal application;

[0026] When the air conditioner is turned on, it is determined that the user has forgotten to turn off the air conditioner, and a prompt message is output or energy consumption of the air conditioner is reduced.

[0027] Referring to FIG. 3, FIG. 3 is a schematic flowchart of the method for controlling the air conditioner according to a first embodiment of the present application.

[0028] The embodiment of the present application provides the method for controlling the air conditioner. It should be noted that although the logic sequence is shown in the flow chart, in some cases, the steps shown or described can be performed in a different sequence than here.

[0029] The method for controlling the air conditioner includes:

Step S10, if the current time is in the time duration when the user is away from home, detecting the current operation state of the air conditioner. The time duration when the user is away from home is determined according to the historical use data of the air conditioner, and the historical use data includes at least one of the historical use time of the air conditioner and the historical connection time between the air conditioner and the terminal application;

[0030] It should be noted that a storage module is provided in the air conditioner, and the storage module is used for storing historical use data of the air conditioner, and the historical use data includes at least one of the historical use time of the air conditioner and the historical connection time of the air conditioner and the terminal

application. The historical use time can include the start-up time, shutdown time, start-stop time, use duration, and use time duration of the air conditioner; the historical connection time can include the connection time, disconnection time, connection duration and connection time duration, etc. In an embodiment, the historical use data may also include: the operation environment data of the air conditioner (including indoor and outdoor ambient temperature, ambient humidity, etc.), air supply parameters of the air conditioner (including air supply angle, air supply intensity, etc.), the load power of the air conditioner (including compressor frequency, fan speed, etc.), and the heat transfer parameters of the air conditioner (including target temperature and humidity, operation mode, etc.), the historical use data reflects the operation characteristics of the air conditioner.

[0031] In this embodiment, if the user presets the smart control function of forgetting to turn off the air conditioner by default, or, during the process of starting and running the air conditioner, the user turns on the smart control function of forgetting to turn off through the remote control or the air conditioner application (APP). At this time, the air conditioner automatically obtains the historical use data of the air conditioner from the storage module through the data acquisition module, then obtains the user's working time according to the historical use data, and finally determines the time duration when the user is away from home in the working time according to the historical use data of the user's working time.

[0032] If the current time is in the time duration when the user is away from home, the current operation state of the air conditioner is detected, and the operation state includes the on state and off state of the air conditioner, and the connection state and disconnection state between the air conditioner and the terminal application. For example, the sensor detects the current and voltage of the air conditioner. If the current and voltage of the air conditioner are both 0, it means that the air conditioner is in the off state. If the voltage of the air conditioner is greater than or equal to the preset value when the air conditioner is running, it means that the air conditioner is in the on state. Secondly, since the air conditioner and the terminal application can be connected to the same router at home, the network information of the air conditioner and the terminal application can be obtained from the router, and the connection status of the air conditioner and the terminal application can be determined according to the network information. For example, if the air conditioner and the terminal are connected to the same router IP, it is indicated that the air conditioner and the terminal are in a connection state.

[0033] Step S20, if the air conditioner is in the on state, it is determined that the user has forgotten to turn off the air conditioner, and a prompt message is output or energy consumption of the air conditioner is reduced.

[0034] After it is determined that the user leaves home, if it is detected that the current operation state of the air conditioner is in the on state, it means that the user forgot to turn off the air conditioner after leaving home. At this time, the forget-to-shut-off control of the air conditioner is automatically executed. The forget-to-shut-off control includes but is not limited to outputting prompt message or reducing the energy consumption of the air conditioner. Reducing the energy consumption of the air conditioner includes but is not limited to adjusting the current operation mode of the air conditioner and performing a shutdown operation. In order to facilitate sending the prompt message to the user, the air conditioner is pre-associated with the mobile terminal, for example, associated with the air conditioner APP, WeChat, and the user's mobile phone number of the mobile terminal. When pushing prompt message, the information can be sent to the air conditioner APP or WeChat in the mobile terminal, and at the same time, the prompt message can also be sent in the form of short message service (SMS).

[0035] In an embodiment, in order to avoid the loss of the air conditioner and the waste of electricity, after the user leaves home, it is necessary to adjust the current operation mode of the air conditioner in time, the user has set the corresponding operation mode in the air conditioner in advance, such as sleep mode, energy-saving mode, economical mode, etc. When it is detected that the user is away from home and the air conditioner is turned on, the current operation mode is adjusted according to the preset operation mode. For example, if the current operation mode is cooling mode, the cooling operation mode is adjusted to the preset sleep mode, so that the air conditioner operates at low power, so as to achieve the effect of saving energy and electricity.

[0036] In an embodiment, when it is detected that the user is away from home and the air conditioner is turned on, the air conditioner is directly turned off.

[0037] In this embodiment, it is determined whether the user has left home based on the historical use data and current time of the air conditioner. After the user leaves home, if it is detected that the air conditioner is in the on state, it is determined that the user has forgotten to turn off the air conditioner, and the control of leaving home is performed. In this way, the accuracy of forgetting to turn off the air conditioner is improved.

[0038] Further, referring to FIG. 3, a second embodiment of the method for controlling the air conditioner of the present application is provided.

[0039] The method for controlling the air conditioner is applied to an air conditioner. The difference between the second embodiment of the method for controlling the air conditioner and the first embodiment is that after the step of detecting the current operation state of the air conditioner, the method further includes:

Step S21, f the time duration when the user is away from home is greater than or equal to the first preset duration, obtaining the operation duration of the air conditioner;

Step S22, if the operation duration is greater than or equal to the second preset duration and the air con-

ditioner is in the on state, it is determined that the user forgot to turn off the air conditioner, and the first preset duration is less than the second preset duration.

[0040] It should be noted that if the operation state of the air conditioner is detected immediately after the user leaves home, misdetermination may occur, because the user may forget to turn off the air conditioner after going out for a few minutes, and then return home to turn off the air conditioner again. Therefore, in order to improve the accuracy of determining that the air conditioner is forgotten to be turned off, it is necessary to detect the operation state of the air conditioner after the user leaves home for a duration of time (such as 1 hour).

[0041] In this embodiment, the time point when the user leaves home is obtained based on the time duration when the user is away from home, and then the time difference between the current time and the time point is continuously detected during the operation of the air conditioner, and the time difference is how long the user is away from home. If the user is away from home for the preset first operation duration (such as 1 hour), at this time, the operation state of the air conditioner will be automatically detected, and the current operation duration of the air conditioner will be obtained. Therefore, the operation time duration of the air conditioner at the current time is longer than the time away from home, that is, the second preset time duration is longer than the first preset time duration. When the current operation duration of the air conditioner reaches the second preset time (such as 2 hours), and the operation state of the air conditioner is in the on state, it means that the user forgot to turn off the air conditioner after leaving home.

[0042] In this embodiment, it is determined that the user forgot to turn off the air conditioner after leaving home through how long the user is away from home, the operation duration of the air conditioner, and the operation state. In this way, the accuracy of determining that the air conditioner is forgotten to turn off is improved.

[0043] Further, referring to FIG. 4, a third embodiment of the method for controlling the air conditioner of the present application is provided.

[0044] The method for controlling the air conditioner is applied to an air conditioner. The difference between the third embodiment of the method for controlling the air conditioner and the second embodiment is that before the step of detecting the current operation state of the air conditioner, the method includes:

Step S 11, obtaining the working time of the user according to the historical use data;

[0045] It should be noted that since each user's occupation is different, each user's working time will also be different, and the working time correspond to the user's time away from home, so it can be determined the time duration when the user is away from home based on the user's working time.

[0046] The working time of the user is obtained based on the historical use data of the air conditioner. In an embodiment, the historical unused data of the air conditioner is obtained according to the historical use time data of the air conditioner, and then, each fourth preset time duration (such as extracting the last 10 natural days within 30 natural days) for which historical unused data exists within the fifth preset time duration (such as the last 30 natural days) is obtained; the unused time duration in each fourth preset duration is determined based on the historical use data of each fourth preset duration. Finally, the fourth preset time duration overlapping the unused time duration is used as the working time. For example, the on/off time of the air conditioner and/or the connection time of the air conditioner APP in the last 30 natural days are obtained, and then working days (Monday to Friday) of the last 10 historical unused data from the 30 natural days (that is, the air conditioner is off and/or the air conditioner APP is disconnected) are extracted, in other words, the last 10 working days when the air conditioner is not used all day in the 30 natural days are extracted. Further the on/off time and/or connection time of the air conditioner APP on each working day are obtained, and the time duration when the air conditioner is not used in each working day based on the on/off time and/or the connection time of the air conditioner APP is determined, for example, the power-on time duration of the air conditioner is from 17:00 of today to 8:00 of the next day, and the non-use time duration of the air conditioner is from 8 am to 17:00. If in 10 working days, it is detected that the unused time duration of the previous 8 working days overlap, if the unused time duration is all from 8:00 am to 17:00 pm, it means that the user leaves home for work from 8:00 am to 17:00 pm. Therefore, the first 8 working days are taken as the user's working time.

[0047] In an embodiment, the user's working time can also be determined by week, for example, the on-off time of the air conditioner and/or the connection time of the air conditioner APP in the last 30 natural days are obtained, and then the weekly Monday from the 30 natural days is extracted, for example, the extracted Monday has 4 days, namely the 5th, the 12th, the 19th and the 26th. The on-off time and/or air conditioner APP connection time of each Monday is obtained respectively, and the time duration when the air-conditioner is not used in each Monday based on the on-off time and/or air-conditioning APP connection time is determined; if the air conditioner is not used in the four Mondays during the duration from 8:00 am to 17:00 pm, it means that Monday is the user's working time; if there is only one Monday that does not use the air conditioner during the time duration from 8:00 am to 17:00 pm, it means that Monday is not the user's working time. Based on this method, it can be independently determined whether Monday to Sunday is the user's working time within 30 natural days. At the same time, the method can determine whether the user needs to work on weekends.

[0048] In an embodiment, for a part-time user, the user's working time can also be determined by counting the

on-off time of the air conditioner and/or the connection time of the air conditioner APP. For example, the on/off time of the air conditioner and/or the connection time of the air conditioner APP in the last 30 natural days are obtained, and then the last 10 natural days with air conditioner use records from the 30 natural days are extracted, and in the 10 natural days, the air conditioner use data in each time duration of each natural day is obtained, and based on the use data to determine the user's working time. For example, if the unused time duration of the first natural day in 10 natural days is from 8:00 to 15:00, this time duration is described as the user's working time; if the unused time duration of the second natural day out of 10 natural days is from 19:00 to 23:00, it means that this time duration is the user's working time.

[0049] It should be noted that if the air conditioner is not used for a short duration of time, such as 15 minutes, it may be caused by the user turning off the air conditioner by mistake, or the connection of the air conditioner APP is abnormal. If the unused time duration is directly used to statistically analyze the user's working time, misdetermination may occur, thereby reducing the accuracy of the user's decision to leave home. Therefore, it is necessary to obtain a natural day with a long unused time duration to determine the working time of the user.

[0050] In an embodiment, the fourth preset duration of each target corresponding to the unused time duration greater than or equal to the fifth preset duration (such as 2 hours) is obtained, and then the fourth preset duration of the target overlapped by the unused time duration is determined as the user's working time. For example, the on/off time of the air conditioner and/or the connection time of the air conditioner APP in the last 30 natural days are obtained, and then 10 natural days in which the unused time duration of the air conditioner is greater than or equal to 2 hours from the 30 natural days are extracted. The unused time duration of each natural day in the natural day is obtained, and the unused time duration with the same occurrence time (that is, overlapping) is used as the user's working time.

[0051] Step S12, according to the user's historical use data during working time, determining the time duration when the user is away from home during the working time, and the time duration when the user is away from home does not overlap with the historical use time and the historical connection time.

[0052] After determining the user's working time, the historical use data of the air conditioner during the working time is obtained (that is, the historical use time and/or the historical connection time), and the time duration when the user is away from home during the working time is determined based on the historical use data, the time duration when the user is away from home does not overlap with the historical use time and historical connection time. In an embodiment, the historical unused time and/or historical unconnected time with the highest frequency during working time are obtained according to the historical use time and/or historical connection time during the working time of the user, and then the time duration corresponding to the highest frequency historical unused time and/or historical unconnected time is used as the time duration when the user is away from home. For example, from Monday to Friday, 8:00 am to 17:00 pm is the time duration when the air conditioner is not used, and the number of days that this time duration occurs is 5 days, that is, this time duration occurs every day, and the probability of occurrence is 100%, and then 8:00 am to 17:00 pm is used as the time duration when the user is away from home.

[0053] In this embodiment, the working time of the user is determined according to the on/off data of the air conditioner and the connection data of the air conditioner APP, and then time duration when the user is away from home is determined during the working time, thus improving the accuracy of the determination of leaving home.

[0054] In order to better illustrate the method for controlling the air conditioner of the present application, referring to FIG. 5, which is a schematic diagram of the operation flow of the method for controlling the air conditioner of the present application.

[0055] In this embodiment, if the user presets the smart control function of forgetting to turn off the air conditioner by default, or, during the process of starting and running the air conditioner, the user turns on the smart control function of forgetting to turn off through the remote control or the air conditioner APP. At this time, the data acquisition module of the air conditioner automatically obtains the historical use records of the air conditioner from the storage module, for example, start-up time, shutdown time, start-stop time, use duration, and use time duration, etc., and then, it is determined that whether the user is an office worker according to the historical use record of the air conditioner. For example, the time duration when the user is away from home is determined according to the historical use records, and the user who leaves home during this time duration is determined as an office worker. After determining that the user is an office worker, the current operation state of the air conditioner is detected after the user leaves home for a duration of time (such as 1 hour). When the operation state of the air conditioner is in the on state and the operation time is greater than or equal to the preset time (such as 2 hours), it is determined that the user forgot to turn it off. At this time, the control of forgetting to turn off the air conditioner is executed. The control includes but is not limited to outputting prompt message or reducing the energy consumption of the air conditioner. However, reducing the energy consumption of the air conditioner includes, but is not limited to, adjusting the current operation mode of the air conditioner and performing a shutdown operation.

[0056] In this embodiment, it is determined whether the user has left home based on the historical use data and current time of the air conditioner. After the user leaves home, if it is detected that the air conditioner is in the on state, it is determined that the user has forgotten

to turn off the air conditioner, and the control of leaving home is performed. In this way, the accuracy of forgetting to turn off the air conditioner is improved.

[0057] Further, referring to FIG. 6, FIG. 6 is a block diagram of the control method of the air conditioner of the present application.

[0058] In this embodiment, the air conditioner includes five modules, which are respectively a storage module, a data acquisition module, an office worker determination module, a forgetting to turn off the power determination module, and a control module.

[0059] The storage module is used to store the user's historical air conditioner use records, including on/off, use time, use duration, etc..

[0060] The data acquisition module is used to obtain use records from the air conditioner, and store the collected data in the storage module.

[0061] The office worker determination module is used to determine whether the air conditioner user is an office worker according to the historical air conditioner use records in the storage module.

[0062] The forgetting to turn off the power determination module is used to determine whether the air conditioner is forgotten to turn off according to the current operation state of the air conditioner, including on/off, use time, current duration, etc..

[0063] The control module is used to execute the control operation of forgetting to turn off the air conditioner when it is determined that the user using the air conditioner is an office worker and forgets to turn it off, including but not limited to push prompt, energy-saving mode, and turning off the air conditioner.

[0064] Among them, the air conditioner is pre-associated with the terminal, for example, the air conditioner APP, WeChat, and the mobile phone number of the user, etc. When pushing the prompt message, the information can be sent to the air conditioner APP or WeChat in the terminal. A prompt message is sent in the form of a text message, the content of the prompt message can be "master, according to the shutdown time of your air conditioner in the past month, you may have forgotten to turn off the air conditioner today-".

[0065] In addition, the present application also provides a device for controlling an air conditioner, the device includes a memory, a processor, and a program for controlling an air conditioner stored in the memory and run on the processor; the device determines whether the user is away from home through the historical use data and the current time of the air conditioner. After the user leaves home, if it is detected that the air conditioner is in the on state, it is determined that the user has forgotten to turn off the air conditioner, and the control of leaving home is executed. In this way, the accuracy of forgetting to turn off the air conditioner is improved.

[0066] In addition, the present application also provides a computer-readable storage medium, the computer-readable storage medium stores the program for controlling the air conditioner, and when the program for controlling the air conditioner is executed by the processor, the steps of the method for controlling the air conditioner as described above is realized.

[0067] Those skilled in the art should understand that the embodiments of the present application may be provided as methods, systems, or computer program products. Accordingly, the present application may take the form of an entirely hardware embodiment, an entirely software embodiment, or an embodiment combining software and hardware aspects. Furthermore, the present application may take the form of a computer program product embodied on one or more computer-usable storage media (including but not limited to disk storage, CD-ROM, optical storage, etc.) having computer-usable program code embodied therein.

[0068] The present application is described with reference to flowcharts and/or block diagrams of methods, devices (systems), and computer program products according to embodiments of the present application. It should be understood that each procedure and/or block in the flowchart and/or block diagram, and combinations of procedures and/or blocks in the flowchart and/or block diagram can be realized by computer program instructions. These computer program instructions may be provided to a general purpose computer, special purpose computer, embedded processor, or processor of other programmable data processing device to produce a machine such that the instructions executed by the processor of the computer or other programmable data processing device produce a device for realizing the functions specified in one or more steps of the flowchart and/or one or more blocks of the block diagram.

[0069] These computer program instructions may also be stored in a computer-readable memory capable of directing a computer or other programmable data processing device to operate in a specific manner, such that the instructions stored in the computer-readable memory produce a manufacturing article including instruction device. The instruction device realizes the function specified in one or more procedures of the flowchart and/or one or more blocks of the block diagram.

[0070] These computer program instructions can also be loaded onto a computer or other programmable data processing device, causing a series of operational steps to be performed on the computer or other programmable device to produce a computer-implemented process. Thus, the instructions executed on a computer or other programmable device provide steps for implementing the functions specified in the process or processes of the flow diagrams and/or the block or blocks of the block diagrams.

[0071] It should be noted that, in the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word "comprising" does not exclude the presence of elements or steps not listed in a claim. The word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The present application can be implemented by

means of hardware including several distinct elements, and by means of a suitably programmed computer. In a unit claim enumerating several devices, several of these devices can be embodied by one and the same item of hardware. The use of the words first, second, and third, etc. does not indicate any order. These words can be interpreted as names.

[0072] While alternative embodiments of the present application have been described, additional changes and modifications to these embodiments may be made by those skilled in the art once the basic inventive concept is appreciated. Therefore, it is intended that the appended claims be interpreted to cover alternative embodiments and all changes and modifications that fall within the scope of the present application.

[0073] Obviously, those skilled in the art can make various changes and modifications to the present application without departing from the scope of the present application. In this way, if these modifications and variations of the present application fall within the scope of the claims of the present application and their equivalent technologies, the present application is also intended to include these modifications and variations.

Claims

1. A method for controlling an air conditioner, **characterized by**:

   if a current time is in a time duration when an user is away from home, detecting a current operation state of the air conditioner, wherein the time duration when the user is away from home is determined according to historical use data of the air conditioner, and the historical use data comprises at least one of historical use time of the air conditioner and historical connection time between the air conditioner and a terminal application; and
   if the air conditioner is in an on state, determining that the user forgot to turn off the air conditioner, outputting a prompt message, or reducing energy consumption of the air conditioner.

2. The method for controlling the air conditioner according to claim 1, wherein after the detecting the current operation state of the air conditioner, the method further comprises:

   if the time duration when the user is away from home is greater than or equal to a first preset duration, obtaining an operation duration of the air conditioner; and
   if the operation duration is greater than or equal to a second preset duration and the air conditioner is in the on state, determining that the user forgot to turn off the air conditioner, wherein the first preset duration is less than the second preset duration.

3. The method for controlling the air conditioner according to claim 2, wherein before the obtaining the operation duration of the air conditioner, the method further comprises:

   determining a time point when the user leaves home according to the time duration when the user is away from home; and
   obtaining a time difference between the current time and the time point to obtain the time duration of the user away from home.

4. The method for controlling the air conditioner according to claim 1, wherein the reducing the energy consumption of the air conditioner comprises:

   adjusting a current operation mode of the air conditioner; or
   performing a shutdown operation.

5. The method for controlling the air conditioner according to claim 1, wherein before the detecting the current operation state of the air conditioner, the method further comprises:

   obtaining a working time of the user according to the historical use data; and
   determining the time duration when the user is away from home during the working time according to the historical use data during the working time of the user, wherein the time duration when the user is away from home does not overlap with the historical use time and the historical connection time.

6. The method for controlling the air conditioner according to claim 5, wherein the obtaining the working time of the user according to the historical use data comprises:

   obtaining each fourth preset duration of historical unused data within a third preset duration, wherein the historical unused data is determined according to the historical use data, and the third preset duration is divided into a preset number of fourth preset duration;
   determining an unused time duration in each of the fourth preset duration according to the historical use data of each of the fourth preset duration; and
   configuring the fourth preset duration overlapping the unused time duration as the working time.

7. The method for controlling the air conditioner accord-

ing to claim 6, wherein the configuring the fourth preset duration overlapping the unused time duration as the working time comprises:

obtaining the fourth preset duration of each target if the unused time duration is greater than or equal to a fifth preset duration; wherein the fifth preset duration is less than the fourth preset duration; and
configuring the fourth preset duration of the target overlapping the unused time duration as the working time.

8. The method for controlling the air conditioner according to claim 5, wherein the determining the time duration when the user is away from home during the working time according to the historical use data during the working time of the user comprises:

obtaining a historical unused time and/or a historical unconnected time with a highest frequency during the working time according to the historical use data during the working time of the user; and
configuring a time duration corresponding to the historical unused time and/or the historical unconnected time with the highest frequency as the time duration when the user is away from home.

9. A device for controlling an air conditioner, comprising a memory, a processor, and a program for controlling the air conditioner stored on the memory and run on the processor, wherein when the program for controlling the air conditioner is executed by the processor, the steps of the method according to any one of claims 1 to 8 are realized.

10. A computer-readable storage medium, wherein a program for controlling an air conditioner is stored on the computer-readable storage medium, and when the program for controlling the air conditioner is executed by a processor, the steps of the method according to any one of claims 1 to 8 are realized.

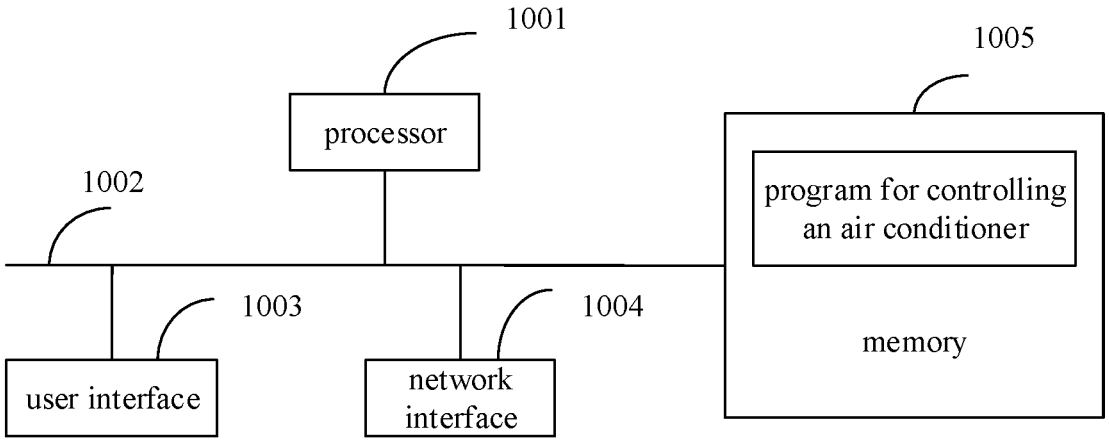
1001
processor
1005
1002
program for controlling an air conditioner
1003
1004
memory
user interface
network interface

FIG. 1

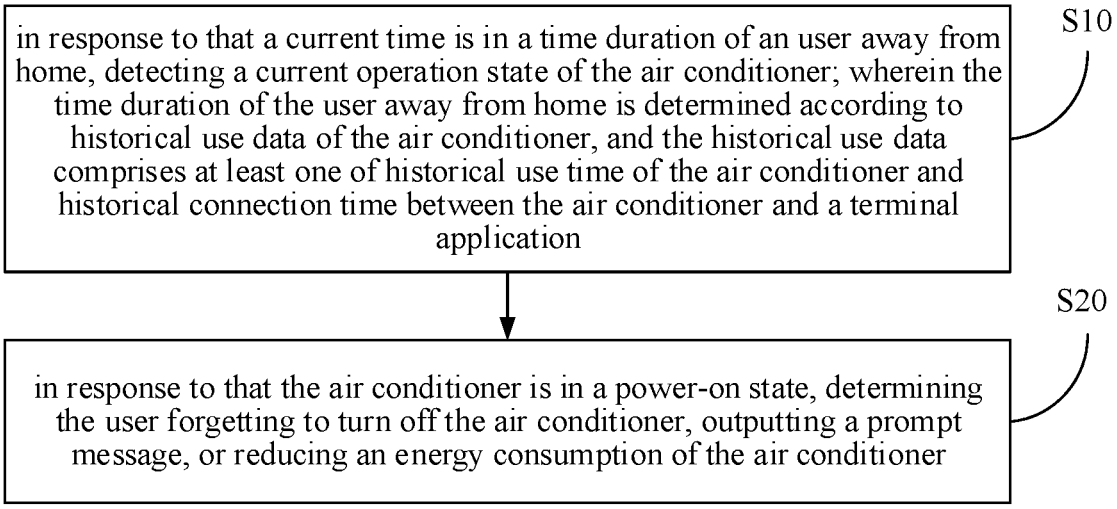
in response to that a current time is in a time duration of an user away from home, detecting a current operation state of the air conditioner; wherein the time duration of the user away from home is determined according to historical use data of the air conditioner, and the historical use data comprises at least one of historical use time of the air conditioner and historical connection time between the air conditioner and a terminal application
S10
in response to that the air conditioner is in a power-on state, determining the user forgetting to turn off the air conditioner, outputting a prompt message, or reducing an energy consumption of the air conditioner
S20

FIG. 2

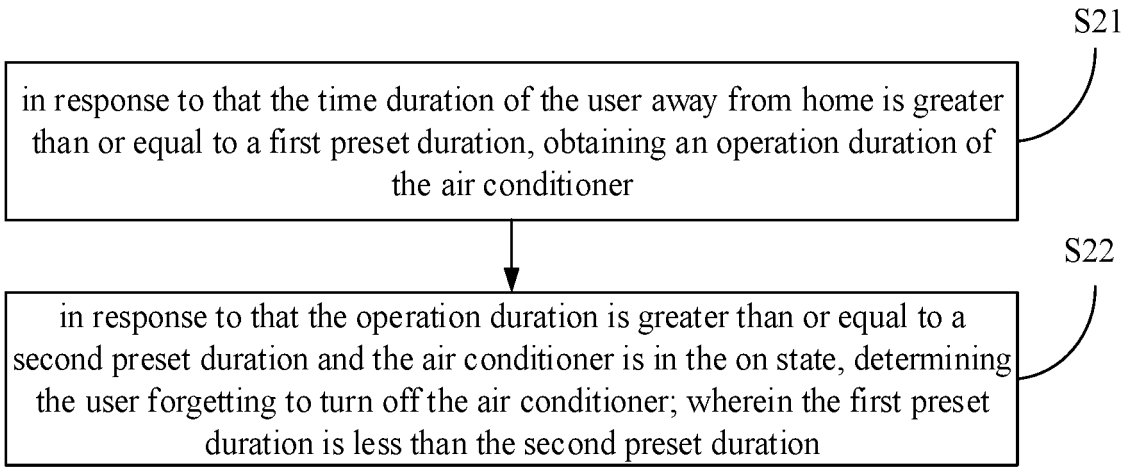
S21
in response to that the time duration of the user away from home is greater than or equal to a first preset duration, obtaining an operation duration of the air conditioner
S22
in response to that the operation duration is greater than or equal to a second preset duration and the air conditioner is in the on state, determining the user forgetting to turn off the air conditioner; wherein the first preset duration is less than the second preset duration

FIG. 3

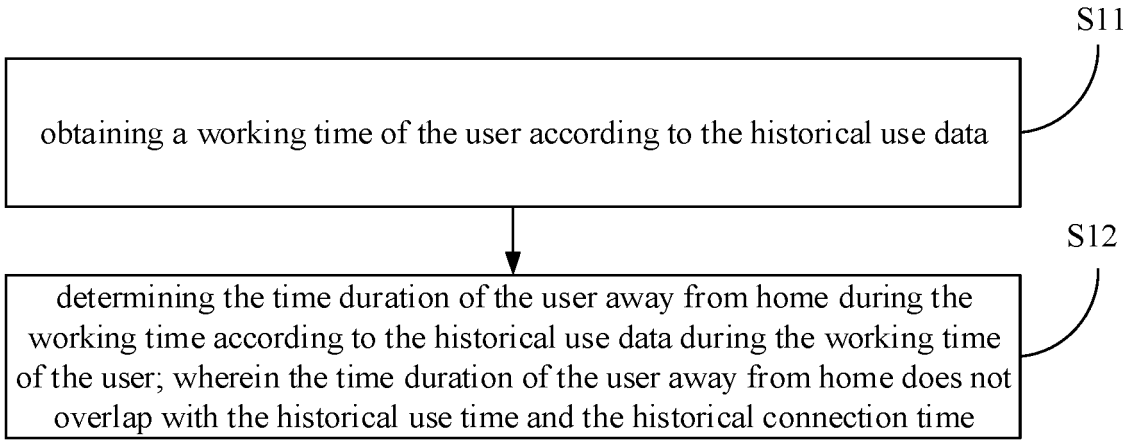
S11
obtaining a working time of the user according to the historical use data
S12
determining the time duration of the user away from home during the working time according to the historical use data during the working time of the user; wherein the time duration of the user away from home does not overlap with the historical use time and the historical connection time

FIG. 4

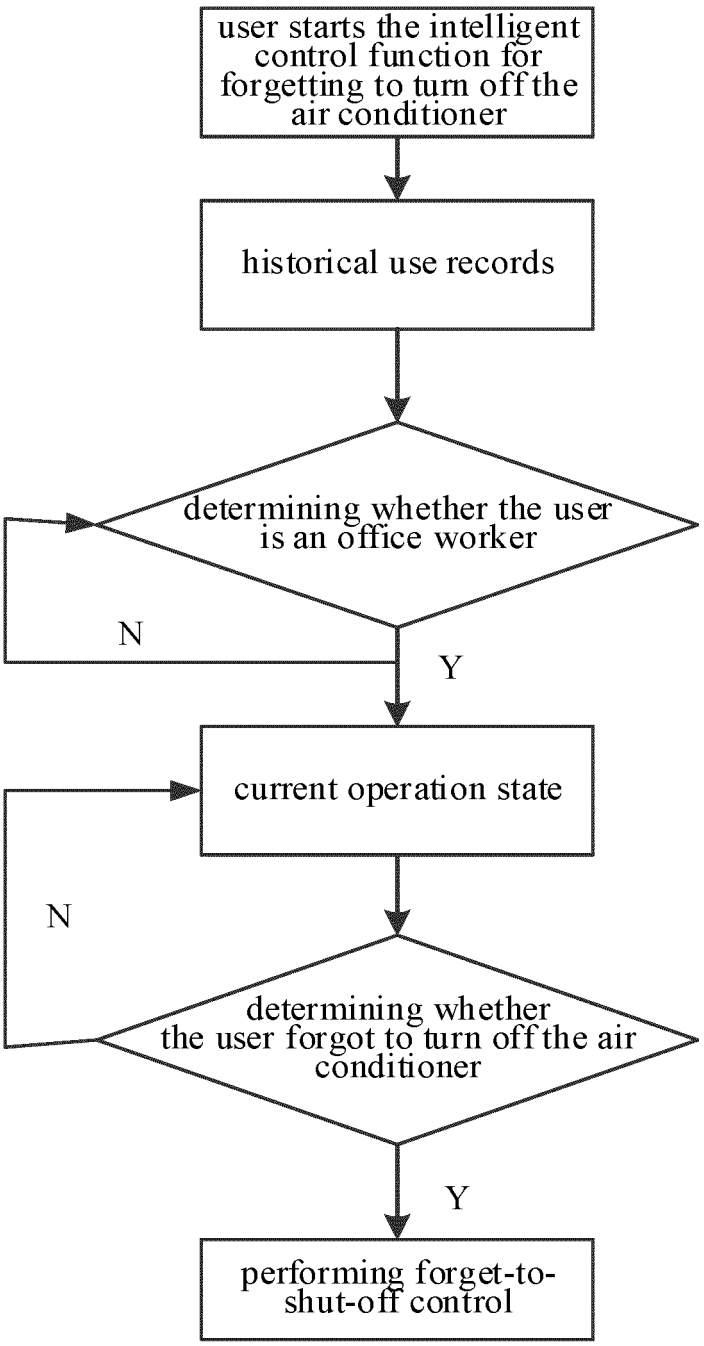
user starts the intelligent control function for forgetting to turn off the air conditioner
historical use records
determining whether the user is an office worker
N
Y
current operation state
N
determining whether the user forgot to turn off the air conditioner
Y
performing forget-to-shut-off control

FIG. 5

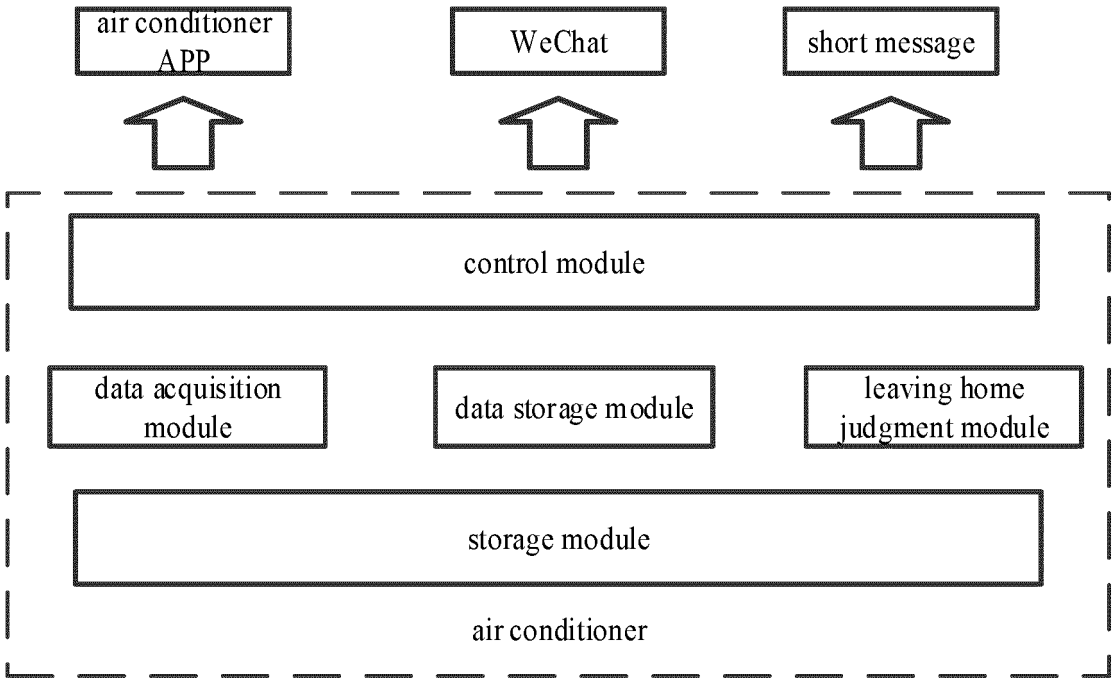
air conditioner APP
WeChat
short message
control module
data acquisition module
data storage module
leaving home judgment module
storage module
air conditioner

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/136149

A. CLASSIFICATION OF SUBJECT MATTER

F24F 11/64(2018.01)i; G01R 11/00(2006.01)i; F24F 120/12(2018.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F; ; G01R

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

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

DWPI, CJFD, CNABS, SIPOABS, CNTXT, USTXT: 美的, 海尔, 格力, 樊其锋, 刘莹, 空调, 离家, 离开家, 出门, 不在家, 外出, 时段, 时长, 历史, 统计, 忘记, 检测, 监测, 获得; MIDEA, MEDE, HIER, GREE, air, conditioner, home, absent, away, leav+, outgo+, duration, period?, time+, history, statistic+, forget+, detect+, monitor+, measur+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 103782479 A (TOSHIBA K. K. et al.) 07 May 2014 (2014-05-07) description, paragraphs 0031-0084, and figures 1-14	1-10
A	CN 109709815 A (AUX AIR CONDITIONER CO., LTD.) 03 May 2019 (2019-05-03) entire document	1-10
A	CN 107271764 A (NINGBO SANXING ELECTRIC CO., LTD.) 20 October 2017 (2017-10-20) entire document	1-10
A	CN 112013520 A (GUANGDONG MIDEA REFRIGERATION EQUIPMENT CO., LTD. et al.) 01 December 2020 (2020-12-01) entire document	1-10
A	CN 106440217 A (GUANGDONG MIDEA REFRIGERATION EQUIPMENT CO., LTD) 22 February 2017 (2017-02-22) entire document	1-10
A	JP 2007-132804 A (PURE, S. K. K. et al.) 31 May 2007 (2007-05-31) entire document	1-10

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 April 2022	**26 April 2022**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/136149

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 103782479 A	07 May 2014	WO 2013031886 A1	07 March 2013
		JP 5526238 B2	18 June 2014
		US 2015178630 A1	25 June 2015
		EP 2752968 A1	09 July 2014
		US 9230217 B2	05 January 2016
		CN 103782479 B	20 April 2016
		EP 2752968 B1	21 September 2016
CN 109709815 A	03 May 2019	None	
CN 107271764 A	20 October 2017	CN 107271764 B	12 May 2020
CN 112013520 A	01 December 2020	None	
CN 106440217 A	22 February 2017	None	
JP 特开2007-132804 A	31 May 2007	None	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202110879423 **[0001]**