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(54) **AIR CONDITIONER, CONTROL METHOD AND DEVICE THEREOF, STORAGE MEDIUM, AND PROCESSOR**

(57) The disclosure relates to an air conditioner, control method and device Thereof, storage medium and processor, and relates to the technical field of air conditioners. The method of the present disclosure includes: detecting a current ambient temperature; determining a control parameter related to each of at least two outlets

of the air conditioner according to the current ambient temperature; and controlling each of the outlets to output airflow in a pattern corresponding to the control parameter.

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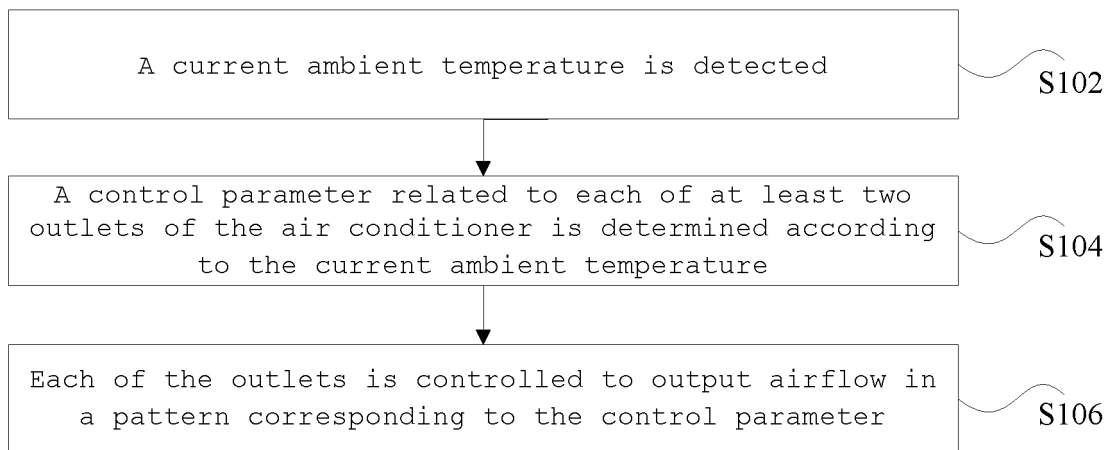


Fig. 1

Description**CROSS-REFERENCE TO RELATED APPLICATIONS**

5 **[0001]** The application claims priority to Chinese Patent Application with Priority No. 2017103626608, filed to the Patent Office of the PRC on May 19, 2017, entitled "Air Conditioner, Control Method and Device Thereof, Storage Medium and Processor", the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

10 **[0002]** Embodiments of the present application relate to the field of air conditioners, and more particularly, to an air conditioner, a control method and a control device thereof, a storage medium and a processor.

BACKGROUND

15 **[0003]** In an indoor thermal environment, researches on human body reaction to heat are mainly concentrated in a uniform thermal environment. The researches seek evenly-distributed indoor environmental parameters to meet the demand for human body comfort. The unevenly-distributed indoor environmental parameters are negatively considered to be the source of human body discomfort, and generally, such parameters are eliminated or limited.

20 **[0004]** When an air conditioner is controlled, the control objective is always to regulate the steady-state thermal environment. However, there is rarely a research on how to make people to quickly reach the heat reaction in the thermal comfort demand during the process of thermal environment conditioning. For example, the household room air conditioner is not provided with the design and response strategies which are based on the human physiological reaction and related to dynamic thermal comfort, so that it cannot effectively provide users with the comfort in the process of using the air conditioner, and the user experience is reduced, and the effect and efficiency of the temperature regulation of the air conditioner is lowered.

25 **[0005]** Effective solutions have not been proposed yet to solve the problem that the effect and efficiency of the temperature regulation of the air conditioner are poor in the prior art.

SUMMARY

30 **[0006]** An object of the embodiments of the present application is to provide an air conditioner and a control method and a device thereof, a storage medium and a processor so as to improve the effect and efficiency of the temperature regulation of the air conditioner.

35 **[0007]** According to one aspect of the present application, there is provided a control method of an air conditioner comprising: detecting a current ambient temperature; determining a control parameter related to each of at least two outlets of the air conditioner according to the current ambient temperature; and controlling each of the outlets to output airflow in a pattern corresponding to the control parameter.

40 **[0008]** In some embodiments, determining the control parameter related to each of the at least two outlets of the air conditioner according to the current ambient temperature comprises: determining a preset temperature range to which the current ambient temperature belongs; and determining a state of air supply corresponding to the preset temperature range at each of the at least two outlets, as the control parameter related to each of the at least two outlets, wherein the at least two outlets are arranged at different heights of the air conditioner.

45 **[0009]** In some embodiments, the method further comprises: determining an operating mode corresponding to the preset temperature range and controlling the air conditioner to operate according to the determined operating mode, before determining the state of air supply corresponding to the preset temperature range at each of the at least two outlets, wherein the operating mode comprises a refrigeration mode and/or a heating mode.

50 **[0010]** In some embodiments, determining the state of air supply corresponding to the preset temperature range at each of the outlets comprises: determining a state of air supply corresponding to a first temperature range at a first outlet, in a case that the preset temperature range is the first temperature range, wherein the minimum value of the first temperature range is greater than a first threshold value.

[0011] In some embodiments, the method further comprises: controlling the air conditioner to operate according to a refrigeration mode, in a case of determining the state of air supply corresponding to the first temperature range at the first outlet.

55 **[0012]** In some embodiments, determining the state of air supply corresponding to the first temperature range at the first outlet comprises: determining an outlet to which a distance from a preset plane is within a first preset distance range as the first outlet, wherein the first preset distance range is at least determined by a first parameter and a warm air buoyancy, the first parameter is the average height of a group of target objects, and the target objects are objects to

which the air conditioner supplies air for temperature regulation.

[0013] In some embodiments, determining the state of air supply corresponding to the preset temperature range at each of the at least two outlets comprises: determining a state of air supply corresponding to a second temperature range at each of the first outlet and a second outlet respectively, in a case that the preset temperature range is a second temperature range, wherein the maximum value of the second temperature range is less than a second threshold value.

[0014] In some embodiments, the method further comprises: controlling the air conditioner to operate according to a heating mode, when the state of air supply corresponding to the second temperature range is determined at each of the first outlet and the second outlet respectively.

[0015] In some embodiments, determining the state of air supply corresponding to the second temperature range at each of the first outlet and the second outlet respectively comprises: determining an outlet to which a distance from a preset plane is within a first preset distance range as the first outlet; and determining an outlet to which a distance from the preset plane is within a second preset distance range, as the second outlet, wherein the minimum value of the first preset distance range is greater than the maximum value of the second preset distance range, the first preset distance range is at least determined by a first parameter and a warm air buoyancy, the second preset distance range is at least determined by a second parameter and the warm air buoyancy, wherein the first parameter is the average height of a group of first target objects and the second parameter is the average height of a group of second target objects, and the first target objects and the second objects are objects to which the air conditioner supplies air for temperature regulation.

[0016] In some embodiments, the state of air supply at each of the at least two outlets comprises at least one of: a velocity of air supply of each of the at least two outlets; a temperature of air supply of each of the at least two outlets; a direction of air supply of each of the at least two outlets; or an ON/OFF state of each of the at least two outlets.

[0017] According to another aspect of the embodiments of the present application, there is provided a control device. The device comprises: a detection unit configured to detect a current ambient temperature; a determination unit configured to determine a control parameter related to each of at least two outlets of the air conditioner according to the current ambient temperature; and a control unit configured to control each of the outlets to output airflow in a pattern corresponding to the control parameter.

[0018] According to another aspect of the embodiments of the present application, there is provided a non-transitory computer readable storage medium, storing a computer program, when executed by a processor, cause the processor to execute the control method of the air conditioner according to any one of the above embodiments.

[0019] According to another aspect of the embodiment of the present application, there is provided a processor. The processor is configured to operate a program, wherein the control method of the air conditioner according to any one of the above embodiments is executed when the program operates.

[0020] According to another aspect of the embodiments of the present application, there is provided an air conditioner. The air conditioner comprises: a sensor, configured to detect the current ambient temperature; a processor configured to determine a control parameter related to each of at least two outlets of the air conditioner according to the current ambient temperature, and generate control commands used for controlling each of the outlets to output airflow in a pattern corresponding to the control parameter; and at least two outlets configured to output airflow according to the control parameter.

[0021] In the embodiments of the present application, the current ambient temperature is detected; the control parameter related to each of the at least two outlets of the air conditioner is determined according to the current ambient temperature and each of the outlets is controlled to output airflow in the pattern corresponding to the control parameter. Thereby, the thermal comfort of the human body is improved by the airflow output from the outlets, so that the human body comfort can be efficiently obtained during the process of using the air conditioner. Then effect and efficiency of the temperature regulation of the air conditioner is improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The drawings constituting a part of the present application are used for further understanding of the present application. The exemplary embodiments of the present application and the description thereof are used to explain the present application, but not improperly limit the present application.

FIG. 1 illustrates a schematic flow diagram of a control method of an air conditioner according to some embodiments of the present application.

FIG. 2 illustrates a schematic view of an air conditioner according to some embodiments of the present application.

FIG. 3 illustrates a schematic view of a design height of each outlet of an air conditioner according to some embodiments of the present application.

FIG. 4 illustrates a schematic view of a human body model according to some embodiments of the present application.

FIG. 5 illustrates a schematic view of a pattern of airflow output from an air conditioner when it operates in the

refrigeration mode in a high-temperature environment according to some embodiments of the present application.
 FIG. 6 illustrates a schematic view of a pattern of airflow output from an air conditioner when it operates in the refrigeration mode in a natural steady-state environment according to some embodiments of the present application.
 FIG. 7 illustrates a schematic view of a pattern of airflow output from an air conditioner when it operates in the heating mode according to some embodiments of the present application.
 FIG. 8 illustrates a schematic view of a non-isothermal jet curve of airflow according to some embodiments of the present application.
 FIG. 9 illustrates a schematic view of a control device of an air conditioner according to some embodiments of the present application.
 FIG. 10 illustrates a schematic view of an air conditioner according to some embodiments of the present application.

DETAILED DESCRIPTION

[0023] It should be noted that the embodiments of the present application and the features thereof can be combined without conflicts. The present application will be described hereinafter in detail by reference to the drawings and the embodiments.

[0024] In order to provide a better understanding of the solutions of the present application to those skilled in the art, the technical solutions in the embodiments of the present application will be clearly and completely described below in conjunction with the accompanying drawings in the embodiments of the present application. Apparently, the embodiments described are merely part of the embodiments of the present application, rather than all of the embodiments. All other embodiments obtained by those of ordinary skill in the art based on the embodiments in the present application without creative efforts should fall within the protection scope of the present application.

[0025] It should be stated that the terms "first", "second" and the like in the description and claims of the present application are used to distinguish similar objects, and are not necessarily used to describe a specific order or sequence. It should be understood that the data so used may be interchanged where appropriate, so as to describe the embodiments of the present application herein. In addition, the terms "comprise" and "have" and any variations thereof are intended to cover a non-exclusive inclusion. For example, a process, method, system, product or device that comprises a series of steps or units is not necessarily limited to those steps or units explicitly listed, but may include other steps or units not explicitly listed or inherent to such process, method, product or device.

EMBODIMENT 1

[0026] In some embodiments of the present application, a control method of an air conditioner is provided.

[0027] FIG. 1 illustrates a schematic flow diagram of a control method of an air conditioner according to some embodiments of the present application. As illustrated in FIG. 1, the method comprises the following steps: steps S102 to S106.

[0028] In step S102, a current ambient temperature is detected.

[0029] In the technical scheme provided in step S102 of the present application, the current ambient temperature is detected.

[0030] During the process of the control of an air conditioner, the current ambient temperature is detected; namely, the current temperature of the environment where the air conditioner is located is detected, and the current temperature in a non-uniform thermal environment can be detected. For example, as for a household air conditioner, the ambient temperature in the room is detected. The current ambient temperature can be detected and a preset temperature range where the air conditioner is located can be determined by using a sensor arranged on the air conditioner. For example, the preset temperature range where the air conditioner is located is a high-temperature range in a high-temperature environment, or the preset temperature range is a low-temperature range in a low-temperature environment.

[0031] In different current ambient temperatures within different preset temperature ranges, various human body parts have different degrees of response to cold stimulus and heat stimulus. Since thermoreceptors exist in the layer of human skin, a change in the temperature of external environment can be sensed by the thermoreceptors to provide human body with an overall temperature sense. The thermoreceptors can be divided into cold receptors and warm receptors according to the characteristics of thermoreceptors in terms of response to dynamic stimuli of cold stimulus and heat stimulus. The cold receptors are also known as the cold points and the warm receptors as the heat points. The distribution densities of the cold receptors in human skin vary from that of the warm receptors. Table 1 shows the distribution densities of cold and heat points in different human body parts (number of points/cm²) according to some embodiments of the present application.

Table 1 Distribution Densities of Cold and Heat Points in Different Human Body Parts (number of points/cm²)

Part	Cold point	Heat point	Part	Cold point	Heat point
Forehead	5.4-8.0		Dorsum of hand	7.4	0.5
Nose	8.0	1.0	Palm	1.0-5.0	0.4
Lip	16.0-19.0		Dorsum of finger	7.0-9.0	1.7
Other parts of the face	8.4-9.0	1.7	Pulp of thumb	2.0-4.0	1.6
Chest	9.0-10.2	0.3	Thigh	4.4-5.2	0.4
Abdomen	8.0-12.5		Shank	4.3-5.7	
Back	7.8		Instep	5.6	
Upper arm	5.0-6.5		Sole of the foot	3.4	
Forearm	6.0-7.5	0.3-0.4			

[0032] It can be seen from Table 1 that the distribution densities of the cold receptors in human skin vary from that of the warm receptors. More specifically, the number of the cold receptors distributed in human skin is higher than that of the warm receptors. Both the location distribution and the density distribution of the cold and warm receptors also determine that the response of human body to cold is more sensitive than that to heat. Due to different degrees of response of different human body parts to cold and heat stimuli, the most sensitive parts comprise roughly head, back and pit of the stomach in a high-temperature environment by cold and heat stimuli. Namely, in a high-temperature environment, weights of influence of local thermal sensations of human head, back and pit of the stomach on the overall thermal sensation are relatively large. In a low-temperature environment, the most sensitive parts comprise four parts: head, thighs, shanks and hands. Namely, in a low-temperature environment, weights of influence of the local thermal sensations of human head, thighs, shanks and hands on the overall thermal sensation are great.

[0033] In the above embodiments the current ambient temperature which can be detected, and the thermal comfort provided for human body by an air conditioner is improved by local heat stimuli in combination with different degrees of response of various human body parts to cold and heat stimuli. The human in the following embodiments can be a common adult without specification.

[0034] In step S104, a control parameter related to each of at least two outlets of the air conditioner is determined according to the current ambient temperature.

[0035] In the technical scheme provided in Step S104 of the present application, the control parameter related to each of the at least two outlets of the air conditioner is determined according to the current ambient temperature.

[0036] The control parameter related to each of the at least two outlets of the air conditioner is determined according to the current ambient temperature, after the current ambient temperature is detected. The control parameter comprises at least one related parameter of each of the outlets. The related parameter can be, but not be limited to, at least one of a turbulent coefficient, a temperature of air supply, a velocity of air supply, an angle of air supply or a state of air supply. The control parameter related to each of the outlets of the embodiments can be used to reflect a buoyancy/falling force and control each of the outlets of the air conditioner to output airflow in a pattern corresponding to the control parameter. For example, the airflow of each of the outlets can be controlled to output in an inclined downward pattern or an inclined upward pattern or the like.

[0037] The at least two outlets are disposed on an air conditioner. The at least one control parameter of each of the outlets is influenced by a location of each of the outlets on the air conditioner. According to the distribution of local parts of human body which are sensitive to cold and heat stimuli, the at least two outlets of the air conditioner are disposed in a form of layered layout. Namely, the at least two outlets are arranged at different heights of the air conditioner.

[0038] The human body's response to a thermal environment reflects the physiological characteristics of heat adaptation and heat regulation of human body, and the embodiments provide the design and control strategies of the pattern of the airflow output from the air conditioner in combination with the characteristics of human body's special response to heat in a temperature-changing environment. With the action of cold and heat stimuli, the most sensitive human body parts comprise roughly head, back and pit of the stomach, all of which belong to the upper part of human body, when the current ambient temperature belongs to a high-temperature range. The most sensitive human body parts comprise head, thighs, shanks and hands, which are separately located on the upper and lower parts of human body, when the current ambient temperature belongs to a low-temperature range. The at least two outlets of the embodiments can comprise an upper outlet and a lower outlet.

[0039] When the current ambient temperature belongs to the high-temperature range, the air conditioner will dynamically lower the temperature in a refrigeration mode and supply air via the upper outlet, so that the temperature of some

upper parts of the human body can be reduced by air supply. For example, cold air is at least supplied for human head, back, pit of the stomach and the like for cooling so as to improve the overall thermal sensation of the human body quickly by local cold stimuli and make human body feel cooling and comfortable. When the current ambient temperature belongs to the low-temperature range, the air conditioner will dynamically increase the temperature in a heating mode and supply air via the upper and lower outlets, so that the temperature of the uppermost parts and lower parts of the human body can be raised by air supply. For example, warm air is at least supplied for human head and lower limbs for heating so as to improve the overall cold sensation of the human body quickly by local heat stimuli and make human body feel warm and comfortable.

[0040] In some embodiments, a height of each of the outlets from a preset plane can be determined according to human body parameters, air buoyancy, an average velocity of air from the outlets and the like. For example, the average height of target population is obtained. With the action of cold and heat stimuli, the most sensitive human body parts comprise roughly head, back and pit of the stomach in a high-temperature environment; the most sensitive human body parts comprise head, thighs, shanks and hands in a low-temperature environment. The average velocity of air from the outlets of the household air conditioner is determined. In addition, due to changes in the density caused by changes in the air temperature, the impact of an air buoyancy or falling force should be taken into account. In some embodiments, during the heating process of the air conditioner, according to an object that lower warm air within a preset distance range from the air conditioner can cover at least the shanks and thighs of the relatively high users (for example, common adults) and basically cover the whole body of the relatively short users (for example, common children); combined with calculations of flow and heat transfer, the center height from the lower outlet of the air conditioner to the ground shall be located within a first preset distance range. For example, if the first preset distance range is less than 50cm; preferably, the first preset distance range varies from 30cm to 50cm. The height from the center of the upper outlet to the ground shall be located within a second preset distance range. For example, the second preset distance range varies from 150cm to 170cm.

[0041] In step S106, each of the outlets is controlled to output airflow in a pattern corresponding to the control parameter.

[0042] In the technical scheme provided in step S106 of the present application, each of the outlets is controlled to output airflow in a pattern corresponding to the control parameter.

[0043] After the control parameter related to each of the at least two outlets of the air conditioner is determined according to the current ambient temperature, each of the outlets of the air conditioner is controlled to output airflow in a pattern corresponding to the control parameter. In the refrigeration mode, due to an influence of gravity and buoyancy of cold air and for the gravity of the cold air is greater than its buoyancy, the cold air is output in an inclined downward pattern from the upper outlet of the at least two outlets which are disposed on the air conditioner and the cold air flows in a direction toward the lower part of the air conditioner to form a curve that protrudes away from the air conditioner. The degree of bending of the curve can be determined by a coefficient of turbulence, an outlet size and a velocity, a temperature, an angle of cold air from the upper outlet and the like. Air from the at least two outlets which are disposed on the air conditioner can be supplied for cooling the upper parts of human body, so as to improve the overall thermal sensation of the human body quickly by local cold stimuli, efficiently bring comfort to the human body and improve effect and efficiency of the temperature regulation of the air conditioner.

[0044] In the heating mode, due to an influence of gravity and buoyancy of warm air and for the gravity of the warm air is lower than its buoyancy, the warm air is output in an inclined upward pattern from each of the upper outlet and lower outlet of the at least two outlets which are disposed on the air conditioner and the warm air flows in an upward direction to form a curve that protrudes downward. The degree of bending of the curve can be determined by a coefficient of turbulence, an outlet size and a velocity, a temperature, an angle of the warm air from each outlet and the like. Air from the at least two outlets which are disposed on the air conditioner can be supplied for heating human head and lower limbs, so as to improve the overall cold sensation of the human body by local heat stimuli quickly, efficiently bring comfort to the human body and improve effect and efficiency of the temperature regulation of the air conditioner.

[0045] In the embodiments of the present application, the current ambient temperature is detected; the control parameter related to each of the at least two outlets of the air conditioner is determined according to the current ambient temperature and each of the outlets is controlled to output airflow in the pattern corresponding to the control parameter. Thereby, the thermal comfort of the human body is improved by the airflow output from the outlets, and the process that the temperature is regulated dynamically in a non-uniform thermal is completed, so that the human body comfort can be efficiently obtained during the process of using the air conditioner. Then effect and efficiency of the temperature regulation of the air conditioner is improved.

[0046] As an optional mode of carrying out the application, in step S104, determining the control parameter related to each of the at least two outlets of the air conditioner according to the current ambient temperature comprises: determining a preset temperature range to which the current ambient temperature belongs; and determining a state of air supply corresponding to the preset temperature range at each of the at least two outlets, as the control parameter related to each of the at least two outlets, wherein the at least two outlets are arranged at different heights of the air conditioner.

[0047] Thermal environments can be distinguished according to temperature ranges, and the states of air supply of

the outlets of the air conditioner vary in different thermal environments. After the current ambient temperature is detected and in a case that the control parameter related to each of the at least two outlets of the air conditioner is determined according to the current ambient temperature, the preset temperature range which the current ambient temperature belongs to is determined. The preset temperature range can comprise at least a high-temperature range and a low-temperature range, wherein the high-temperature range corresponds to a high-temperature environment and the low-temperature range corresponds to a low-temperature environment.

[0048] The at least two outlets of the air conditioner in the embodiments are arranged at different heights of the air conditioner, which are disposed on the air conditioner layer by layer, comprising an upper outlet and a lower outlet of the air conditioner. The upper outlet is arranged on the top of the air conditioner and the lower outlet is arranged on the bottom thereof. In some embodiments, an outlet can be disposed in the middle part of the air conditioner to adjust the direction of air supply. In order to efficiently bring comfort to the human body during a dynamical adjustment, the factors, including a height of each outlet on the air conditioner, an a velocity of air supply, an outlet size, an angle of air supply of each outlet and the like, are configured. Preferably, if comfort can be brought to users efficiently through the upper and lower outlets and the outlet disposed in the middle part of the air conditioner has a bad effect of convection and cannot be well received by users; an outlet may not be arranged in the middle part of the air conditioner.

[0049] After the preset temperature range which the current ambient temperature pertains to is determined, the state of air supply corresponding to the preset temperature range is determined at each of the outlets. The state of air supply determined at each of the outlets comprises, but is not limited to, at least one of a velocity of air supply of each of the outlets; a temperature of air supply of each of the outlets; a direction of air supply of each of the outlets; or a ON/OFF state of each of the outlets .

[0050] As an optional mode of carrying out the application, the method further comprises: determining an operating mode corresponding to the preset temperature range, and controlling the air conditioner to operate according to the operating mode, before determining the state of air supply corresponding to the preset temperature range at each of the outlets, wherein the operating mode comprises a refrigeration mode and/or a heating mode.

[0051] The operating mode is determined according to the current ambient temperature so as to regulate the temperature, when the air conditioner operates. The operating mode of air conditioner comprises a refrigeration mode and a heating mode. The air conditioner, in the refrigeration mode, can supply cold air for the upper parts of human body for cooling so as to improve the overall thermal sensation of the human body quickly by local cold stimuli. The air conditioner, in the heating mode, can supply warm air for human head and lower limbs so as to improve the overall cold sensation quickly by local heat stimuli. In some embodiments, an operation mode suitable for the current ambient temperature is determined according to the preset temperature range which the current ambient temperature belongs to. The operating mode corresponding to the preset temperature range is determined, before determining the state of air supply corresponding to the preset temperature range at each of the outlets. For example, the operating mode of the air conditioner is determined as the refrigeration mode, in a case that the current ambient temperature is in the high-temperature range and determined as the heating mode, in a case that the current ambient temperature is in the low-temperature range. After the operating mode corresponding to the preset temperature range is determined, the air conditioner is controlled to operate according to the operating mode determined.

[0052] As an optional mode of carrying out the application, the determining the state of air supply corresponding to the preset temperature range at each of the outlets comprises: determining a state of air supply corresponding to a first temperature range at a first outlet, in a case that the preset temperature range is the first temperature range, wherein the minimum value of the first temperature range is greater than a first threshold value.

[0053] Whether the preset temperature range is a first temperature range is judged, in a case that the state of air supply corresponding to the preset temperature range at each of the outlets is determined. The first temperature range can correspond to the high-temperature range in the high-temperature environment, the minimum value of the first temperature range is greater than a first threshold value and the first threshold value is a temperature value in the high-temperature environment. Namely, when the current ambient temperature is greater than the first threshold value, the current ambient temperature is considered to be a temperature in the high-temperature environment. The at least two outlets of the air conditioner comprise a first outlet. The first outlet can be the upper outlet arranged on the upper part of the air conditioner, and the first outlet can be a circular outlet or a rectangular outlet. In a case of the current ambient temperature within the first temperature range, weights of influence of local thermal sensations of sensitive parts such as human head, back and pit of the stomach on the overall thermal sensation are relatively large. The air from the first outlet can be supplied to the sensitive parts such as human head, back and pit of the stomach at least for cooling. The air output can bent downward from the first outlet according to a temperature, a velocity and an angle of air supply and a coefficient of turbulence.

[0054] Whether the preset temperature range is the first temperature range is judged, and then if the preset temperature range is the first temperature range, the state of air supply corresponding to a first temperature range at the first outlet will be determined, so as to achieve the effect of improving the overall thermal sensation of human body quickly by local cold stimuli.

[0055] As an optional mode of carrying out the application, the method further comprises: controlling the air conditioner to operate according to a refrigeration mode, in a case of determining the state of air supply corresponding to the first temperature range at the first outlet.

[0056] After the first temperature range which the current ambient temperature belongs to is determined, the current environment can be determined to be a high-temperature environment. Then the weights of influence of the local thermal sensations of human head, back and pit of the stomach and the like on the overall thermal sensation are relatively large, while the weights of influence of the local thermal sensations of thighs, shanks and hands and the like on the overall thermal sensation are relatively small. If a human body is in a high-temperature environment for a long time, the human body will feel hot and uncomfortable, so removal of heat from human body should be accelerated in the thermal state. The air conditioner is controlled to operate in the refrigeration mode to supply cold air for the current environment, and the first outlet can operate according to the state of air supply corresponding to the first temperature range to supply cold air for human head, back and pit of the stomach at least and not for thighs, shanks and hands having small weights of influence of the local thermal sensations on the overall thermal sensation, so that other outlets in the at least two outlets can be kept closed. In addition, cold air having an extremely low temperature and a high density can bypass the lower parts of human body and flow through the upper parts of human so that cold air will not directly affect the lower parts of human body, with the aim to achieve the purpose of supply cold air for the upper parts of human body, efficiently bring comfort to the human body and improve the effect and efficiency of the temperature regulation of the air conditioner.

[0057] In some embodiments, when the current ambient temperature is relatively high, only the first outlet is controlled to operate according to the state of air supply corresponding to the first temperature range so as to supply air for the upper parts of human body for cooling, and if comfort cannot be brought to the overall human body quickly, another state of air supply corresponding to the first temperature range can be determined at the second outlet arranged below the first outlet, and the second outlet can be controlled to operate according to the another state of air supply corresponding to the first temperature range so as to supply air for the lower parts of human body for cooling.

[0058] As an optional mode of carrying out the application, the determining the state of air supply corresponding to the first temperature range at the first outlet comprises: determining an outlet to which a distance from a preset plane is within a first preset distance range as the first outlet, wherein the first preset distance range is at least determined by a first parameter and a warm air buoyancy, the first parameter is the average height of a group of target objects, and the target objects are objects to which the air conditioner supplies air for temperature regulation.

[0059] After the first temperature range which the current ambient temperature belongs to is determined, the state of air supply corresponding to the first temperature range at the first outlet is determined. The distance from the location of the first outlet disposed on the air conditioner to the preset plane is located within the first preset distance range. In some embodiments, the distance from the central height of the first outlet to the preset plane is within the first preset distance range, wherein the preset plane is the datum plane used to measure the height of the at least two outlets disposed on the air conditioner. For example, if the ground is set as the preset plane, the distance from the first outlet to the ground will be located within the first preset distance range. The first preset distance range is at least determined by the first parameter and the warm air buoyancy, the target objects are objects that the air conditioner supplies air for temperature regulation in the current environment. For example, users are the target objects and the first parameter is the average height of a group of target objects. By combining the average height, and an influence of the warm air buoyancy, a set velocity of air supply of the air conditioner and the like, the height of the first outlet on the air conditioner is determined. In some embodiments, the recommended central height of the first outlet from the ground ranges from 150cm to 170cm. The warm air buoyancy can be determined by a coefficient of turbulence, an outlet size and a temperature and an angle of air supply and the like. Thus, in the refrigeration mode, cold air from the first outlet can be supplied for some upper parts of human body for cooling so as to quickly improve the overall thermal sensation of human body by local cold stimuli and efficiently increase the comfort level of users.

[0060] As an optional mode of carrying out the application, the determining the state of air supply corresponding to the preset temperature range at each of the outlets comprises: determining a state of air supply corresponding to a second temperature range at each of the first outlet and a second outlet respectively, in a case that the preset temperature range is a second temperature range, wherein the maximum value of the second temperature range is less than the second threshold value.

[0061] Whether the preset temperature range is the second temperature range is judged, in a case of determining the state of air supply corresponding to the preset temperature range at each of the outlets. The second temperature range can correspond to the low-temperature range in the low-temperature environment, the maximum value of the second temperature range is less than a second threshold value and the second threshold value is a temperature value in the low-temperature environment. Namely, when the current ambient temperature is less than the first threshold value, the current ambient temperature is considered to be a temperature in the low-temperature environment. The at least two outlets of the air conditioner comprise the first outlet and the second outlet, and the second outlet can be the lower outlet arranged on the upper part of the air conditioner, and the second outlet can be a circular outlet or a square outlet. In a case of the current ambient temperature within the second temperature range, weights of influence of the local cold

sensation of sensitive parts such as human head, thighs and shanks on the overall cold sensation is relatively large. The air from the first outlet can be supplied to human head at least for heating and air from the second outlet can be supplied to the sensitive parts such as human thighs and shanks at least for heating. The air output can bent upward from the first outlet and the second outlet respectively, according to a temperature, a velocity and an angle of air supply of each of the outlets and a coefficient of turbulence.

[0062] Whether the preset temperature range is the second temperature range is judged, and then if the preset temperature range is the second temperature range, the state of air supply corresponding to a first temperature range at each of the first outlet and the second outlet will be determined respectively, so as to achieve the effect of improving the overall cold sensation of human body quickly by local heat stimuli.

[0063] As an optional mode of carrying out the application, the method further comprises: controlling the air conditioner to operate according to the heating mode, in a case of determining the state of air supply corresponding to the second temperature range at each of the first outlet and the second outlet respectively.

[0064] After the second temperature range which the current ambient temperature belongs to is determined, the current environment can be a low-temperature environment. The weights of influence of the local thermal sensations of human head, hands, thighs and shanks and the like on the overall thermal sensation are relatively large, while the weights of influence of the local thermal sensations of back, pit of the stomach and the like on the overall thermal sensation are relatively small. If a human body is in a low-temperature environment for a long time, the human body will shiver and feel uncomfortable, so heat shall be absorbed by the human body. The air conditioner is controlled to operate in the heating mode to supply warm air for the current environment, and the first outlet can operate according to the state of air supply corresponding to the second temperature range to supply warm air for human head at least and the second outlet can operate according to another state of air supply corresponding to the second temperature range to supply warm air for human hands, thighs and shanks at least and bring to the human body the comfort like that from radiant floor heating, with the aim to achieve the purpose of supplying warm air for the uppermost part and lower part of human body for heating and increase the effect and efficiency of the temperature regulation of the air conditioner.

[0065] As an optional mode of carrying out the application, the determining the state of air supply corresponding to the second temperature range at each of the first outlet and the second outlet respectively comprises: determining an outlet to which a distance from a preset plane is within a first preset distance range as the first outlet and determining an outlet to which a distance from the preset plane is within a second preset distance range as the second outlet, wherein the minimum value of the first preset distance range is greater than the maximum value of the second preset distance range, the first preset distance range is at least determined by a first parameter and a warm air buoyancy, the second preset distance range is at least determined by a second parameter and the warm air buoyancy, wherein the first parameter is the average height of a group of first target objects and the second parameter is the average height of a group of second target objects, and the first target objects and the second objects are objects to which the air conditioner supplies air for temperature regulation.

[0066] After the second temperature range which the current ambient temperature belongs to is determined, the state of air supply corresponding to the second temperature range at each of the first outlet and the second outlet is determined respectively. The distance from the location of the first outlet disposed on the air conditioner to the preset plane is located within the first preset distance range and the distance from the location of the second outlet disposed on the air conditioner to the preset plane is located within the second preset distance range. In some embodiments, the distance from the central height of the first outlet to the preset plane is located within the first preset distance range and the distance from the central height of the second outlet to the preset plane is within the second preset distance range, wherein the preset plane is the datum plane used to measure the height of the at least two outlets disposed on the air conditioner. For example, if the ground is set as the preset plane, the distance from the first outlet to the ground will be located within the first preset distance range and the distance from the second outlet to the ground will be located within the second preset distance range.

[0067] The first preset distance range is at least determined by the first parameter and the warm air buoyancy and the second preset distance range is at least determined by the second parameter and the warm air buoyancy. The first target objects and the second objects are objects that the air conditioner supplies air for temperature regulation in the current environment. For example, the relatively high users (for example, common adults) are the first target objects and the first parameter is the average height of a group of the first target objects. By combining the average height, and an influence of the warm air buoyancy, a set velocity of air supply of the air conditioner and the like, the height of the first outlet on the air conditioner is determined. In some embodiments, the recommended central height of the first outlet from the ground ranges from 150cm to 170cm. The warm air buoyancy can be determined by a coefficient of turbulence, an outlet size and a temperature and an angle of air supply and the like. Thus, in the heating mode, warm air from the first outlet can be supplied for some upper parts of human body for heating so as to quickly improve the overall thermal sensation of human body by local heat stimuli. The second parameter can be the average height of the shanks and thighs of the relatively high users (for example, common adults) and also can be determined according to the average height of the relatively short users (for example, common children). In some embodiments, the central height of the

second outlet from the ground is less than 50cm, and preferably, the central height of the second outlet from the ground ranges from 30cm to 50cm. Thus, when the air conditioner operates in the heating mode, warm air which is supplied for the lower parts of human body can cover human shanks and thighs and basically cover the whole body of children, so as to efficiently improve the comfort of users and increase the effect and efficiency of the temperature regulation of the air conditioner.

[0068] As an optional mode of carrying out the application, the state of air supply determined at each of the outlets comprises at least one of: a velocity of air supply of each of the outlets; a temperature of air supply of each of the outlets; a direction of air supply of each of the outlets; or an ON/OFF state of each of the outlets.

[0069] In the above embodiments, the current ambient temperature is detected; after the current ambient temperature is detected, the control parameter related to each of the at least two outlets of the air conditioner is determined according to the current ambient temperature. The control parameter related to each of the outlets can comprise the state of air supply of each of the outlets. The state of air supply of each of the outlets can comprise the relevant air supply parameters of each of the outlets in the current ambient temperature and also comprise the parameters and operating states of each of the outlets, such as a temperature of air supply, an outlet size, and an ON/OFF state of each of each of the outlets. Then each of the outlets of the air conditioner is controlled to output airflow in a pattern corresponding to the control parameter, so as to efficiently bring comfort to users and increase the effect and efficiency of the temperature regulation of the air conditioner.

EMBODIMENT 2

[0070] It should be noted that the steps shown in the flow chart of the drawings can be executed in a computer system containing a set of executable computer instructions, and the logic sequence is illustrated in the flow chart, but in some cases, the steps listed or described can be executed in a different sequence.

[0071] The technical solution of the present application will be described hereinafter in combination with some preferred embodiments.

[0072] According to different degrees of response of different human body parts to cold and heat stimuli, in the embodiments an air conditioner and a pattern of airflow output that can improve the comfort of human body by local cold and heat stimuli are designed, so that the human body can receive comfort better and quickly during the process of using the air conditioner and the effect and efficiency of the temperature regulation of the air conditioner can be increased.

[0073] FIG. 2 illustrates a schematic view of an air conditioner according to some embodiments of the present application. As illustrated in FIG. 2, the air conditioner comprises: an upper outlet 1 and a lower outlet 2.

[0074] In a high-temperature environment, when the air conditioner dynamically reduces the temperature in the refrigeration mode, air will be supplied from the upper outlet 1 so as to supply cold air for the upper parts of human body for cooling, and the overall cold sensation of human body can be quickly improved by local cold stimuli to make human body feel comfortable as quickly as possible. In the low-temperature environment, when the air conditioner dynamically raises the temperature in the heating mode, air will be supplied from the upper outlet 1 and the lower outlet 2 so as to supply warm air to human head, hands, thighs and shanks for heating, and the overall thermal sensation of human body can be quickly improved by local heat stimuli so as to make human body feel warm and comfortable as quickly as possible and enhance the effect and efficiency of the temperature regulation of the air conditioner.

[0075] FIG. 3 illustrates a schematic view of a design height of each outlet of an air conditioner according to some embodiments of the present application. As illustrated in FIG. 3, the ground is used as the datum plane for the outlet design, and the preferred height from the upper outlet 1 to the ground is 150-170cm and the preferred height from the lower outlet 2 to the ground is 30-50cm. For example, taking the average height of Chinese adults as the reference object, the average height of female is 158cm and the average height of male is 168cm. Then 165cm is taken as the average height of human body. With the action of cold and heat stimuli, the most sensitive human body parts comprise roughly head, back and pit of the stomach in a high-temperature environment, while the most sensitive human body parts comprise head, thighs, shanks and hands in a low-temperature environment. The design value of average velocity of air from the outlets of household air conditioner is generally 5.5m/s. For the density varies due to the changes in the air temperature after the processing of the air conditioner, an influence of air buoyancy or a falling force after processing should be considered. And when the air conditioner operates in a heating process, warm air from the lower outlet 2 can cover the shanks and thighs of the relatively high users (for example, common adults) and basically cover the whole body of the relatively short users (for example, common children) within the range of 5m from the air conditioner. Based on the above conditions and combined with the calculations of flow and heat transfer, the preferred central height from the upper outlet 1 to the ground is 150-170cm and the central height from the lower outlet 2 to the ground is less than 50cm (preferred height: 30-50cm).

[0076] FIG. 4 illustrates a schematic view of a human body model according to some embodiments of the present application. As illustrated in FIG. 4, the human body parts comprise: head, neck, pit of the stomach, back, upper arm, lower arm, hands, thighs, anterior part of shank, posterior part of shank and feet and so on. In a high-temperature

environment, the most sensitive parts comprise head, back and pit of the stomach. Namely, in a high-temperature environment, weights of influence of the local thermal sensations of human head, back and pit of stomach on the overall thermal sensation are relatively large; in a low-temperature environment, the most sensitive parts comprise head, thighs, shanks and hands. Namely, in a low-temperature environment, the weights of influence of the local thermal sensations

of human head, thighs, shanks and hands on the overall thermal sensation are relatively large.

[0077] In a case that the height from the upper outlet of the air conditioner to the ground ranges from 150cm to 170cm and the height from the lower outlet to the ground varies from 30cm to 50cm, in the high-temperature environment, air will be supplied from the upper outlet to the upper parts of human body 160cm high for cooling during the process that the air conditioner dynamically reduces the temperature in the refrigeration mode, and the overall thermal sensation of human body can be quickly improved by local cold stimuli to make human body feel comfortable as quickly as possible.

In a low-temperature environment, air will be supplied from the upper outlet and the lower outlet so as to supply warm air to the head of human body 160cm high and the legs with the distance of 50cm from the ground for heating, during the process that the air conditioner dynamically raises the temperature in the heating mode, and the overall thermal sensation of human body can be quickly improved by local heat stimuli to make human body feel warm and comfortable as quickly as possible and enhance the effect and efficiency of the temperature regulation of the air conditioner.

[0078] FIG. 5 illustrates a schematic view of a pattern of airflow output from an air conditioner when it operates in the refrigeration mode in a high-temperature environment according to some embodiments of the present application. As illustrated in FIG. 5, the most sensitive human body parts comprise head, back and pit of the stomach, which belong to the upper part of human body, in a high-temperature environment, and in this case, the upper outlet 1 of the air conditioner is kept open, while the lower outlet 2 of the air conditioner is kept closed when the temperature is not very high. When the air conditioner dynamically lowers the temperature in the refrigeration mode, the upper outlet 1 will supply cold air for the upper parts of human body for cooling. The control parameter related to the upper outlet 1 of the air conditioner is determined according to the current ambient temperature. The cold air is output in an inclined downward pattern determined according to the control parameter related to the upper outlet 1 and the cold air flows in a direction toward the lower part of the air conditioner to form a curve that protrudes away from the air conditioner. The cold air flows in a direction as indicated by the curve arrow in FIG. 5, so as to quickly improve the overall thermal sensation of human body by local cold stimuli, bring comfort to human body as quickly as possible and increase the effect and efficiency of the temperature regulation of the air conditioner.

[0079] FIG. 6 illustrates a schematic view of a pattern of airflow output from an air conditioner when it operates in the refrigeration mode in a natural steady-state environment according to some embodiments of the present application. As illustrated in FIG. 6, the human body can feel comfortable in a natural steady-state environment. The human body can produce heat naturally, and the air flow of an air conditioner is not required to blow too much air into the human body and not directly impact the human skin. When the air conditioner operates in the refrigeration mode, in order to avoid the case that the overall thermal sensation of human body is relatively cold due to local cold stimuli to cause discomfort, the upper outlet can be started, and the control parameter related to the upper outlet 1 of the air conditioner is determined according to the current ambient temperature. The airflow is output in an inclined upward pattern determined according to the control parameter related to the upper outlet 1 and the air flows in a direction toward the lower part of the air conditioner to form a curve that protrudes obliquely upward. The air flows in a direction as indicated by the curve arrow in FIG. 6, so that air from the air conditioner can bypass the human body, the ambient temperature can be regulated and discomfort can be avoided.

[0080] FIG. 7 illustrates a schematic view of a pattern of airflow output from an air conditioner when it operates in the heating mode according to some embodiments of the present application. As illustrated in FIG. 7, the most sensitive human body parts comprise head, hands, thighs and shanks in a low-temperature environment. In this case, both the upper outlet 1 and the lower outlet 2 of the air conditioner are kept open. When the air conditioner dynamically raises the temperature in the heating mode, the upper outlet 1 will supply warm air for human head for heating, and at least one control parameter related to the upper outlet 1 of the air conditioner is determined according to the current ambient temperature. The warm air is output in an inclined upward pattern determined according to the control parameter related to the upper outlet 1 and the warm air flows in an upward direction to form a curve that protrudes downward. The warm air flows in a direction as indicated by the upper curve arrow in FIG. 7. The lower outlet 2 will supply warm air to human hands, thighs and shanks for heating, and at least one control parameter related to the lower outlet 2 of the air conditioner are determined according to the current ambient temperature. The warm air is output in an inclined upward determined according to the control parameter related to the upper outlet 2 and the warm air flows in an upward direction to form a curve that protrudes downward. The warm air flows in a direction as indicated by the lower curve arrow direction in FIG. 7, so as to quickly improve the overall thermal sensation of human body by local cold stimuli, bring comfort to human body as quickly as possible and increase the effect and efficiency of the temperature regulation of the air conditioner.

[0081] FIG. 8 illustrates a schematic view of a non-isothermal jet curve of airflow according to some embodiments of the present application. As illustrated in FIG. 8, the non-isothermal jet curve in this embodiment corresponds to the pattern of airflow output from an air conditioner when it operates in the heating mode, as shown in FIG. 7. When the

temperature of air supply is higher than the ambient temperature, due to an influence of buoyancy, the jet axis deviates from the dotted line without considering buoyancy, forming a trajectory curve which bends upward. The corresponding jet axis trajectory equation is shown in the following Equation (1):

$$\frac{y}{d_0} = \frac{x}{d_0} \tan \alpha + \left(\frac{g d_0 \Delta T_0}{v_0^2 T_e} \right) \left(\frac{x}{d_0 \cos \alpha} \right)^2 \left(0.51 \frac{ax}{d_0 \cos \alpha} + 0.35 \right) \quad (1)$$

y is a longitudinal deviation distance of the trajectory curve, d_0 is the diameter of an outlet, x is a transverse deviation distance of the trajectory curve, α is an angle of air supply, g is the acceleration of gravity, ΔT_0 is a temperature difference of outlet section, v_0 is a velocity of air supply, T_e is the ambient temperature, a is a coefficient of turbulence, y' is a longitudinal distance of the jet trajectory curve deviating from Point A, and A' is the point after A deviates from y' , as shown in the following Equation (2):

$$y' = \frac{g \bullet \Delta T_0}{v_0^2 T_e} \left(0.51 \frac{a}{2r_0} + 0.35s^2 \right) \quad (2)$$

[0082] $\Delta T_0 = T_0 - T_e$, T_0 is a temperature of air supply, r_0 is a radius of the outlet, $s = \frac{x}{\cos \alpha}$, is a jet axis distance (upper distance of the dotted line as shown in FIG. 8). For example, when the coordinate of Point A is $(x, x \tan \alpha)$, s refers to a distance of the dotted line from the origin of coordinates to Point A. The greater ΔT_0 is, the higher the buoyancy corresponding to Point A is, and the buoyancy refers to $\rho_e \cdot g$, and $\rho_m \cdot g$ is the gravity of air.

[0083] It can be seen from the jet calculation equations (1) and (2) that the key factors influencing the jet axis trajectory are the temperature of air supply T_0 , the ambient temperature T_e , the coefficient of turbulences a , the radius of the outlet r_0 , the velocity of air supply v_0 and the angle of air supply α .

[0084] The air conditioner of the embodiments is designed based on the influence of local heat stimuli on the comfort level of human body, and both the amenity of dynamic environment and the amenity of static environment are taken into account. The human body's response to cold stimuli is more sensitive than that to heat stimuli. Namely, in a high-temperature environment, local cold stimuli to human body will be conducive to the improvement of the overall thermal sensation of human body. But in a comfortable, steady-state environment and local cold stimuli to human body will cause that the overall thermal sensation of human body is relatively cold and cause discomfort. Thus, the pattern of airflow output from the air conditioner in the refrigeration or heating mode can be adopted, as shown in FIG. 5 to FIG. 7.

[0085] The embodiments provide an air conditioner and a control method that can improve the thermal comfort of human body by local cold and heat stimuli. Based on the combination of different degrees of response of different human body parts to cold and heat stimuli, average height as well as various influencing factors such as warm air buoyancy and air velocity and the like, the air conditioner and the pattern of airflow output from the air conditioner that can improve the thermal comfort of human body by local cold and heat stimuli are designed, so that the human body can receive thermal comfort better and quickly during the process of using the air conditioner and the effect and efficiency of the temperature regulation of the air conditioner can be increased.

EMBODIMENT 3

[0086] An embodiment of the present application further provides a device for controlling an air conditioner. It should be noted that the control device in this embodiment can execute the control method of the air conditioner in the embodiments of the present application.

[0087] FIG. 9 illustrates a schematic view of a control device of an air conditioner according to some embodiments of the present application. As illustrated in FIG. 9, the control device comprises: a detection unit 10, a determination unit 20 and a control unit 30.

[0088] The detection unit 10 is configured to detect a current ambient temperature.

[0089] The determination unit 20 is configured to determine a control parameter related to each of at least two outlets of the air conditioner according to the current ambient temperature.

[0090] The control unit 30 is configured to control each of the outlets to output airflow in a pattern corresponding to the control parameter.

[0091] It should be noted that the detection unit 10, the determination unit 20 and the control unit 30 can be used as

a part of the device to operate in the air conditioner, and the functions of the units can be executed by using the processor in the air conditioner.

[0092] It should be noted that detection unit 10 in this embodiment can be used to execute Step S102 in Embodiment 1 of the present application, the determination unit 20 in this embodiment can be used to execute Step S104 in Embodiment 1 of the present application, and the control unit 30 in this embodiment can be used to execute Step 106 in Embodiment 1 of the present application.

[0093] In some embodiments, the determination unit 20 comprises: a determination module and a control module, wherein the determination module is configured to determine a preset temperature range to which the current ambient temperature belongs; and the control module is configured to determine a state of air supply corresponding to the preset temperature range at each of the at least two outlets, as the control parameter related to each of the at least two outlets, wherein the at least two outlets are arranged at different heights of the air conditioner.

[0094] It should be noted that the determination module and the control module can be used as a part of the device to operate in the air conditioner, and the functions of the units can be executed by using the processor in the air conditioner.

[0095] In some embodiments, the device further comprises: the first determination unit. The first determination unit is configured to determine an operating mode corresponding to the preset temperature range and controlling the air conditioner to operate according to the determined operating mode, before determining the state of air supply corresponding to the preset temperature range at each of the at least two outlets.

[0096] It should be noted that the first determination unit can be used as a part of the device to operate in the air conditioner, and the functions of the units can be executed by using the processor in the air conditioner.

[0097] In some embodiments, the control module comprises: a first control submodule, which is configured to determine a state of air supply corresponding to a first temperature range at a first outlet, in a case that the preset temperature range is the first temperature range, wherein the minimum value of the first temperature range is greater than a first threshold value.

[0098] It should be noted that the first control submodule can be used as a part of the device to operate in the air conditioner, and the functions of the units can be executed by using the processor in the air conditioner.

[0099] In some embodiments, the control module comprises: a second control submodule, which is configured to the air conditioner to operate according to a refrigeration mode, in a case of determining the state of air supply corresponding to the first temperature range at the first outlet.

[0100] It should be noted that the second control submodule can be used as a part of the device to operate in the air conditioner, and the functions of the units can be executed by using the processor in the air conditioner.

[0101] In some embodiments, the first control submodule is further configured to determine an outlet to which a distance from a preset plane is within a first preset distance range as the first outlet, wherein the first preset distance range is at least determined by a first parameter and a warm air buoyancy, the first parameter is the average height of a group of target objects, and the target objects are objects to which the air conditioner supplies air for temperature regulation.

[0102] In some embodiments, the control module comprises: a third control submodule, which is configured to determine a state of air supply corresponding to a second temperature range at each of the first outlet and a second outlet respectively, in a case that the preset temperature range is a second temperature range, wherein the maximum value of the second temperature range is less than a second threshold value.

[0103] It should be noted that the third control submodule can be used as a part of the device to operate in the air conditioner, and the functions of the units can be executed by using the processor in the air conditioner.

[0104] In some embodiments, the control module comprises: a fourth control submodule, which is configured to the air conditioner to operate according to a heating mode, when the state of air supply corresponding to the second temperature range is determined at each of the first outlet and the second outlet respectively.

[0105] It should be noted that the fourth control submodule can be used as a part of the device to operate in the air conditioner, and the functions of the units can be executed by using the processor in the air conditioner.

[0106] In some embodiments, the fourth control submodule is further configured to determine an outlet to which a distance from a preset plane is within a first preset distance range as the first outlet; and determine an outlet to which a distance from the preset plane is within a second preset distance range, as the second outlet, wherein the minimum value of the first preset distance range is greater than the maximum value of the second preset distance range, the first preset distance range is at least determined by a first parameter and a warm air buoyancy, the second preset distance range is at least determined by a second parameter and the warm air buoyancy, wherein the first parameter is the average height of a group of first target objects and the second parameter is the average height of a group of second target objects, and the first target objects and the second objects are objects to which the air conditioner supplies air for temperature regulation.

[0107] In some embodiments, the state of air supply at each of the at least two outlets comprises at least one of: a velocity of air supply of each of the at least two outlets; a temperature of air supply of each of the at least two outlets; a direction of air supply of each of the at least two outlets; or an ON/OFF state of each of the at least two outlets.

[0108] In this embodiment, the detection unit 10 is used to detect the current ambient temperature, the determination

unit 20 is used to determine a control parameter related to each of at least two outlets of the air conditioner according to the current ambient temperature, and the control unit 30 is used to control each of the outlets to output airflow in a pattern corresponding to the control parameter to improve the human body comfort by the air distribution pattern output by the control parameters for the at least two outlets, so that the human body comfort can be efficiently obtained during the process of using the air conditioner, the effect and efficiency of the temperature regulation of the air conditioner is improved.

EMBODIMENT 4

[0109] The embodiments of the present application provide a non-transitory computer readable storage medium, storing a computer program, when executed by a processor, cause the processor to execute the control method of the air conditioner according to any one of the above embodiments.

[0110] Various functional modules provided in the embodiment of the present application can operate in an air conditioner or similar arithmetic devices and also can be used as a part of the storage medium for storage.

[0111] In some embodiments, the storage medium can be used to store the program codes to be executed by the control method of the air conditioner provided in the method embodiments and device embodiments.

[0112] In some embodiments, the storage medium is set to store the program codes for executing the following steps : detecting the current ambient temperature; determining a control parameter related to each of at least two outlets of the air conditioner according to the current ambient temperature; and controlling each of the outlets to output airflow in a pattern corresponding to the control parameter.

[0113] In some embodiments, the storage medium further can be used to store the program codes for a variety of preferred or optional methods and steps provided by the control method of the air conditioner.

EMBODIMENT 5

[0114] The embodiment of the present application further provides a processor which is used to operate programs, wherein the control method of the embodiment of the present application is executed when the programs operate.

[0115] In the embodiment of the present application, the processor can invoke the program for running the control method of the air conditioner.

[0116] In some embodiments, the processor can be set to execute the following steps: detecting the current ambient temperature; determining a control parameter related to each of at least two outlets of the air conditioner according to the current ambient temperature; and controlling each of the outlets to output airflow in a pattern corresponding to the control parameter.

[0117] The processor can run various software applications and modules stored in the memory to execute various functional applications and data processing, i.e. to realize the control method of the air conditioner.

EMBODIMENT 6

[0118] The embodiment of the present application further provides an air conditioner.

[0119] FIG. 10 illustrates a schematic view of an air conditioner according to some embodiments of the present application. As illustrated in FIG. 10, the air conditioner comprises: a sensor 40, a processor 50 and at least two outlets 60.

[0120] The sensor 40, which is used to detect the current ambient temperature;

[0121] The processor 50, which is used to obtain the current ambient temperature from the sensor 40, determine a control parameter related to each of at least two outlets of the air conditioner according to the current ambient temperature, and generate control commands used for controlling each of the outlets to output airflow in a pattern corresponding to the control parameter;

[0122] The at least two outlets configured to output airflow according to the control parameter.

[0123] It should be noted that the sensor 40 in this embodiment can be used to execute Step S102 in Embodiment 1 of the present application, the processor 50 in this embodiment can be used to execute Step S104 in Embodiment 1 of the present application, and the 60 in this embodiment can be used to execute Step 106 in Embodiment 1 of the present application.

[0124] In this embodiment, the control method executed by the air conditioner comprises the program codes of the following steps: detecting the current ambient temperature; determining a control parameter related to each of at least two outlets of the air conditioner according to the current ambient temperature; and controlling each of the outlets to output airflow in a pattern corresponding to the control parameter.

[0125] In some embodiments, the air conditioner can comprise: one or more processors, a memory and a transmitting device.

[0126] The memory can be used to store software programs and modules, such as the air conditioner and the control

method thereof in the embodiment of the present application and program instructions/modules corresponding to the device, and the processor can run various software applications and modules stored in the memory to execute various functional applications and data processing, i.e. to realize the control method of the air conditioner. The memory may include a high-speed random access memory (RAM) and a non-volatile memory (NVM), such as one or more magnetic disk storage devices, flash memory devices, or other non-volatile solid-state memories. In some embodiments, the memories which are remotely disposed relative to the processor can be included, and these remote memories can be connected to a terminal via a network. The network embodiments include, but are not limited to, the Internet, intranet, local area network (LAN) and mobile communication network and a combination thereof.

[0127] The transmitting device is used to receive or transmit data via a network. The network embodiments may comprise wired network and wireless network. In an embodiment, a transmitting device comprises a network interface controller (NIC), which can be connected with other network equipment and a router via a network cable to communicate with the Internet or LAN. In an embodiment, a transmitting device is a radio frequency (RF) module, which is used to communicate with the Internet in the wireless mode.

[0128] More specifically, the memory is used to store the application programs in the air conditioner.

[0129] The processor can invoke the information and application programs stored in the memory via the transmitting device to execute the program codes of methods and steps in various optional or preferred embodiments in the method embodiment.

[0130] Those of ordinary skill in the art can understand that all or part of steps in various methods in the embodiments can be completed by using a program to instruct the relevant hardware of an air conditioner, and the program can be stored in a readable storage medium of the air conditioner, and the storage medium may comprise: a flash disk, a Read-Only Memory (ROM), a Random Access Memory (RAM), a magnetic disk, an optical disk or the like.

[0131] The control method and control device of the air conditioner according to the present application are described by example with reference to the drawings. However, it should be understood by those skilled in the art that the control method and control device of the air conditioner as disclosed in the present application can be subject to various improvements without departing from the contents of the present application. Therefore, the scope of protection of the present application should be defined by the attached claims.

[0132] Obviously, it should be understood by those skilled in the art that various modules or steps in the present application can be realized by using the general-purpose computing device, which can be concentrated in a single computing device or distributed in the network consisting of several computing devices; In some embodiments, the modules or steps can be realized by using the program codes to be executed by computing devices, so that they can be stored in the storage device and executed by computing devices, or they can be made in different integrated circuit modules, or several modules or steps are made in a single integrated circuit module for execution. In this way, the present application is not limited to any particular combination of hardware and software.

[0133] The embodiments are only preferred embodiments of the application, but not limit thereto. For a person skilled in the art, various variations and changes can be made to the application. Any modification, equivalent substitution and improvement made within the spirit and rule of the application shall be incorporated in the protection scope of the application.

INDUSTRIAL APPLICABILITY

[0134] The technical solution provided in the embodiment of the present application can be applied to the control process of an air conditioner to detect the current ambient temperature, determine a control parameter related to each of at least two outlets of the air conditioner according to the current ambient temperature; and control each of the outlets to output airflow in a pattern corresponding to the control parameter to improve the human body comfort by the air distribution pattern output by the control parameters for the at least two outlets, so that the human body comfort can be efficiently obtained during the process of using the air conditioner, and the effect and efficiency of the temperature regulation of the air conditioner is improved..

Claims

1. A control method of an air conditioner, **characterized by**, comprising:

detecting a current ambient temperature;

determining a control parameter related to each of at least two outlets of the air conditioner according to the current ambient temperature; and

controlling each of the outlets to output airflow in a pattern corresponding to the control parameter.

2. The method according to Claim 1, **characterized in that**, determining the control parameter related to each of the at least two outlets of the air conditioner according to the current ambient temperature comprises:

determining a preset temperature range to which the current ambient temperature belongs; and
determining a state of air supply corresponding to the preset temperature range at each of the at least two outlets, as the control parameter related to each of the at least two outlets, wherein the at least two outlets are arranged at different heights of the air conditioner.

3. The method according to Claim 2, **characterized by**, further comprising:

determining an operating mode corresponding to the preset temperature range and controlling the air conditioner to operate according to the determined operating mode, before determining the state of air supply corresponding to the preset temperature range at each of the at least two outlets,
wherein the operating mode comprises a refrigeration mode and/or a heating mode.

4. The method according to Claim 2, **characterized in that**, determining the state of air supply corresponding to the preset temperature range at each of the outlets comprises:

determining a state of air supply corresponding to a first temperature range at a first outlet, in a case that the preset temperature range is the first temperature range, wherein the minimum value of the first temperature range is greater than a first threshold value.

5. The method according to Claim 4, **characterized by**, further comprising:

controlling the air conditioner to operate according to a refrigeration mode, in a case of determining the state of air supply corresponding to the first temperature range at the first outlet.

6. The method according to Claim 4, **characterized in that**, determining the state of air supply corresponding to the first temperature range at the first outlet comprises:

determining an outlet to which a distance from a preset plane is within a first preset distance range as the first outlet, wherein the first preset distance range is at least determined by a first parameter and a warm air buoyancy, the first parameter is the average height of a group of target objects, and the target objects are objects to which the air conditioner supplies air for temperature regulation.

7. The method according to Claim 4, **characterized in that**, determining the state of air supply corresponding to the preset temperature range at each of the at least two outlets comprises:

determining a state of air supply corresponding to a second temperature range at each of the first outlet and a second outlet respectively, in a case that the preset temperature range is a second temperature range, wherein the maximum value of the second temperature range is less than a second threshold value.

8. The method according to Claim 7, **characterized by**, further comprising:

controlling the air conditioner to operate according to a heating mode, when the state of air supply corresponding to the second temperature range is determined at each of the first outlet and the second outlet respectively.

9. The method according to Claim 7, **characterized in that**, determining the state of air supply corresponding to the second temperature range at each of the first outlet and the second outlet respectively comprises:

determining an outlet to which a distance from a preset plane is within a first preset distance range as the first outlet; and

determining an outlet to which a distance from the preset plane is within a second preset distance range, as the second outlet,

wherein the minimum value of the first preset distance range is greater than the maximum value of the second preset distance range, the first preset distance range is at least determined by a first parameter and a warm air buoyancy, the second preset distance range is at least determined by a second parameter and the warm air buoyancy, wherein the first parameter is the average height of a group of first target objects and the second parameter is the average height of a group of second target objects, and the first target objects and the second objects are objects to which the air conditioner supplies air for temperature regulation.

10. The method as claimed as any one of Claims 2 to 9, wherein the state of air supply at each of the at least two outlets comprises at least one of:

a velocity of air supply of each of the at least two outlets;
a temperature of air supply of each of the at least two outlets;
a direction of air supply of each of the at least two outlets; or
an ON/OFF state of each of the at least two outlets.

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11. A control device, comprising:

a detection unit configured to detect a current ambient temperature;
a determination unit configured to determine a control parameter related to each of at least two outlets of the
air conditioner according to the current ambient temperature; and
a control unit configured to control each of the outlets to output airflow in a pattern corresponding to the control
parameter.

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12. A non-transitory computer readable storage medium, **characterized by**, storing a computer program, when executed
by a processor, cause the processor to execute the control method of the air conditioner according to any one of
Claims 1 to 10.

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13. A processor **characterized in that**, the processor is configured to operate a program, wherein the control method
of the air conditioner according to any one of Claims 1 to 10 is executed when the program operates.

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14. An air conditioner, **characterized by**, comprising:

a sensor configured to detect a current ambient temperature;
a processor configured to determine a control parameter related to each of at least two outlets of the air conditioner
according to the current ambient temperature, and generate control commands used for controlling each of the
outlets to output airflow in a pattern corresponding to the control parameter; and
at least two outlets configured to output airflow according to the control parameter.

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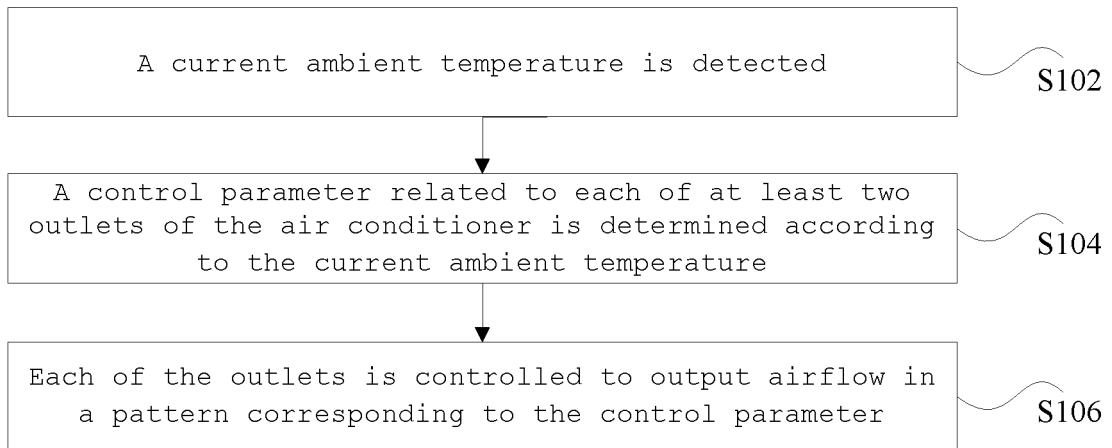


Fig. 1

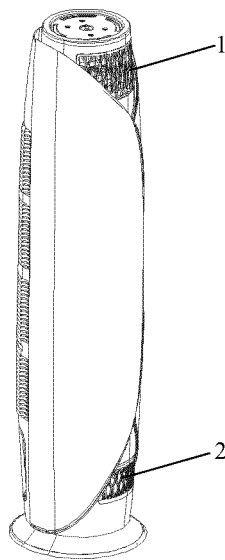


Fig. 2

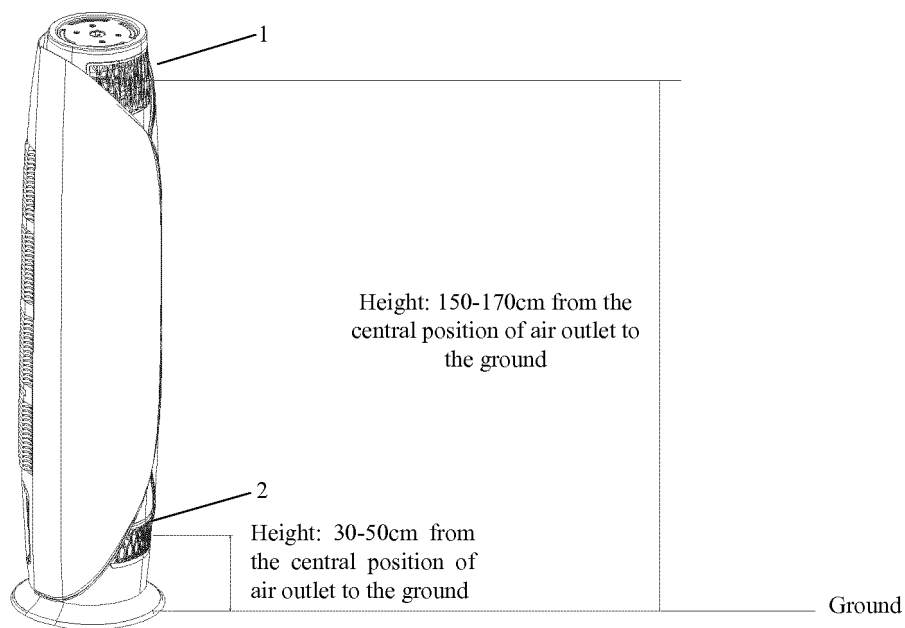


Fig. 3

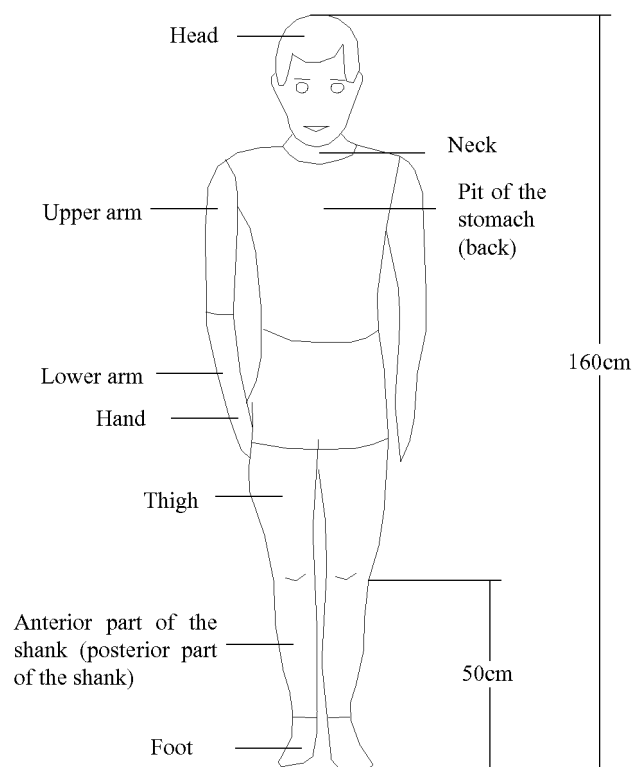


Fig. 4

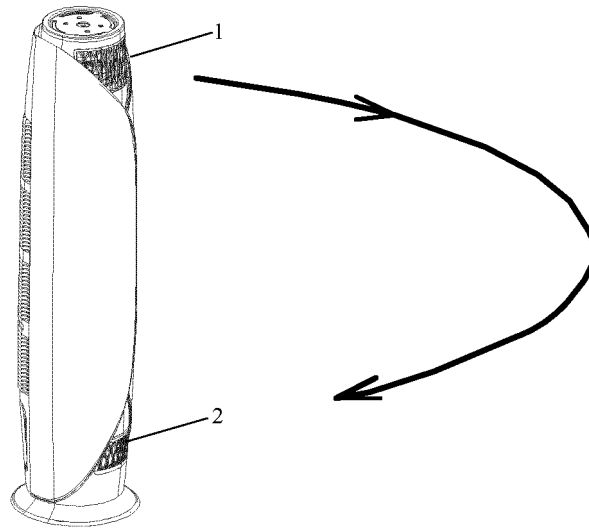


Fig. 5

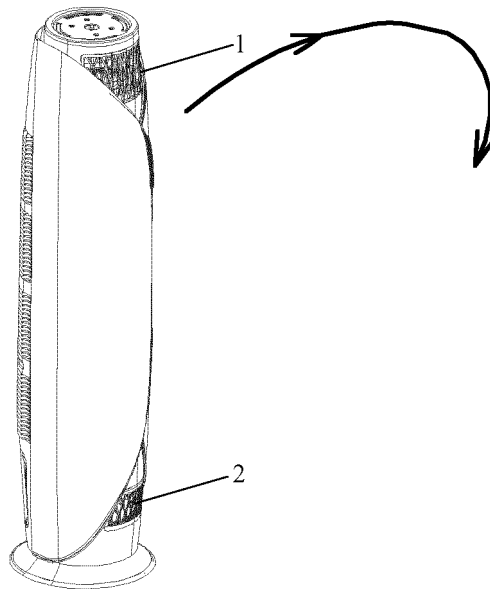


Fig. 6

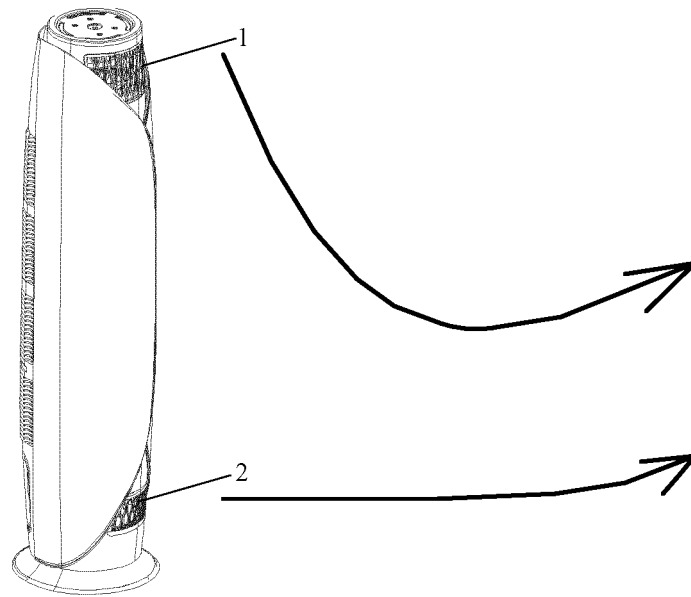


Fig. 7

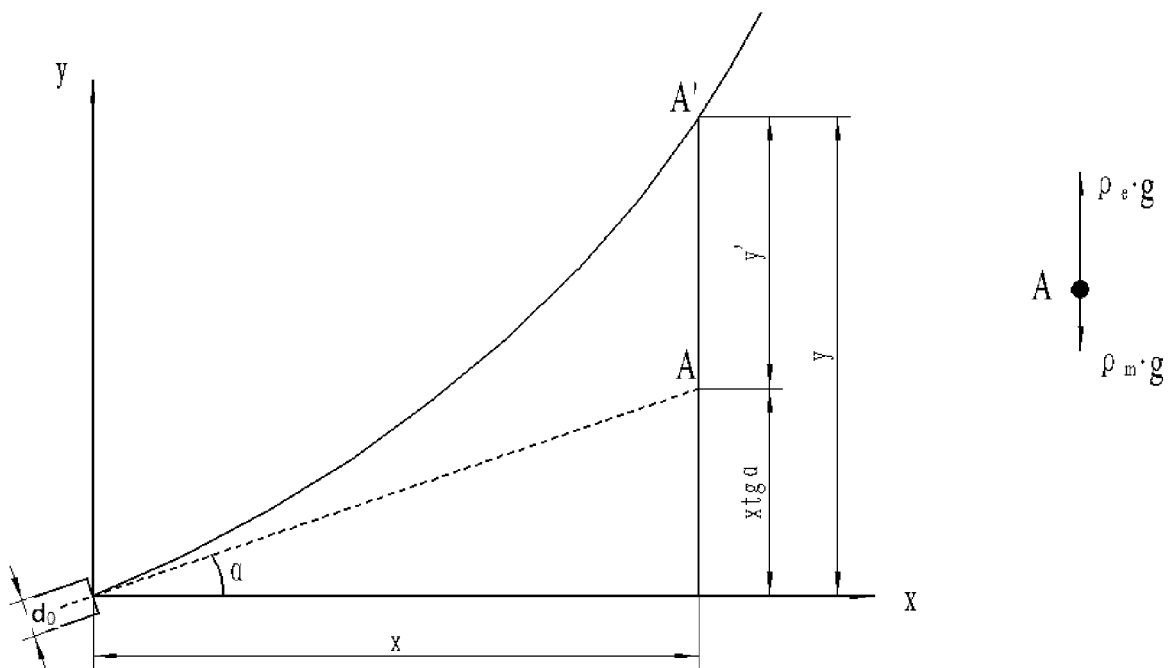


Fig. 8

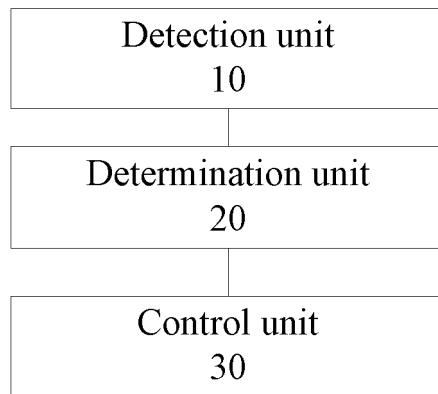


Fig. 9

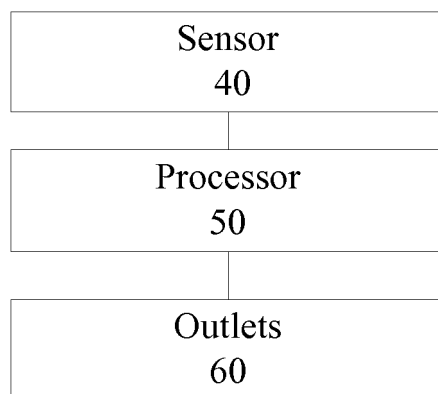


Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2017/087811

A. CLASSIFICATION OF SUBJECT MATTER F24F 11/00(2018.01)i; F24F 1/00(2011.01)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 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) CNABS, CNTXT, CNKI, VEN: 空调, 空气调节, 空调和, 热泵, 环境温度, 室内温度, 制冷, 降温, 冷却, 制热, 加热, 取暖, 升温, 出风口, 排风口, 送风口, 吹出口, 控制, air condition, heat pump, ambient temperature, indoor temperature, refrigerate, cool, heat, warm, outlet, opening, control																		
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>CN 106440043 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 22 February 2017 (2017-02-22) description, paragraphs [0034]-[0060], and figures 1-9</td> <td>1-2, 10-14</td> </tr> <tr> <td>Y</td> <td>CN 106440043 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 22 February 2017 (2017-02-22) description, paragraphs [0034]-[0060], and figures 1-9</td> <td>3-9</td> </tr> <tr> <td>Y</td> <td>CN 101256017 A (NINGBO AUX AIR-CONDITION CO., LTD.) 03 September 2008 (2008-09-03) description, page 3, and figure 1</td> <td>3-9</td> </tr> <tr> <td>X</td> <td>CN 106052040 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 26 October 2016 (2016-10-26) description, paragraphs [0025]-[0070], and figures 1-4(b)</td> <td>1-2, 10-14</td> </tr> <tr> <td>Y</td> <td>CN 106052040 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 26 October 2016 (2016-10-26) description, paragraphs [0025]-[0070], and figures 1-4(b)</td> <td>3-9</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	CN 106440043 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 22 February 2017 (2017-02-22) description, paragraphs [0034]-[0060], and figures 1-9	1-2, 10-14	Y	CN 106440043 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 22 February 2017 (2017-02-22) description, paragraphs [0034]-[0060], and figures 1-9	3-9	Y	CN 101256017 A (NINGBO AUX AIR-CONDITION CO., LTD.) 03 September 2008 (2008-09-03) description, page 3, and figure 1	3-9	X	CN 106052040 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 26 October 2016 (2016-10-26) description, paragraphs [0025]-[0070], and figures 1-4(b)	1-2, 10-14	Y	CN 106052040 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 26 October 2016 (2016-10-26) description, paragraphs [0025]-[0070], and figures 1-4(b)	3-9
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Date of the actual completion of the international search 22 January 2018	Date of mailing of the international search report 07 February 2018																	
Name and mailing address of the ISA/CN State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088 China Facsimile No. (86-10)62019451	Authorized officer Telephone No.																	

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2017/087811

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	CN 204611979 U (GUANGDONG MIDEA AIR-CONDITIONING EQUIPMENT CO., LTD. ET AL.) 02 September 2015 (2015-09-02) entire document	1-14
A	JP H1054576 A (TOSHIBA KK) 24 February 1998 (1998-02-24) entire document	1-14
A	JP H08178344 A (TOSHIBA KK) 12 July 1996 (1996-07-12) entire document	1-14

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Information on patent family members

International application No.

PCT/CN2017/087811

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Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	106440043	A	22 February 2017	None			
CN	101256017	A	03 September 2008	CN	100582592	C	20 January 2010
CN	106052040	A	26 October 2016	None			
CN	103673203	A	26 March 2014	CN	103673203	B	27 October 2017
CN	204611979	U	02 September 2015	None			
JP	H1054576	A	24 February 1998	None			
JP	H08178344	A	12 July 1996	None			

Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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