

TITLE

ENVIRONMENTAL CONTROL SYSTEM AND ENVIRONMENTAL CONTROL METHOD

TECHNICAL FIELD

5 [0001] The present invention relates to an environmental control system
and an environmental control method that control a thermal environment
of a space.

BACKGROUND

10 [0002] In an air conditioning system for an open office (an office in
which many people share a large room with no partitions) that is currently
widespread, air conditioning is performed in each of air conditioning
zones obtained by virtually partitioning a space. For example, a sensor
and an air conditioning control device (terminal unit) are provided in each
air conditioning zone, and the air conditioning control device adjusts the
15 amount of heat supplied such that a value of the sensor is a set value.

[0003] An example of a system that is commonly used as this air
conditioning system is a single-duct variable air volume system (VAV
system) (see, for example, Japanese Unexamined Patent Publication No.
2020-76508 (Patent Literature 1)). In the VAV system, a temperature
20 sensor is provided in each air conditioning zone, and the amount of
conditioned air supplied (air volume) by a VAV unit is adjusted such that
a measured value of the sensor is a preset temperature set value.

SUMMARY

25 [0004] In the open office, a plurality of air conditioning zones are present
to be adjacent to each other. However, in the VAV system, in general,
each air conditioning zone is independently controlled from the

viewpoint of control stability and simplicity. For example, temperature set values are set independently for each air conditioning zone, and control is performed on the basis of the temperature set values. Therefore, for example, an irrational situation in which the temperature is extremely higher or lower than in an adjacent air conditioning zone occurs. In this situation, an unbalanced load occurs between a plurality of terminal units (for example, the VAV units of the VAV system). This has an adverse effect on an indoor environment and energy efficiency. For example, in an air conditioning zone in which an unbalance occurs, the supply air temperature is too low, resulting in excessive cooling, or the supply air temperature is too high, resulting in excessive fan power.

[0005] An embodiment of the present invention has been made in view of the above circumstances, and the objective of the embodiment of the present invention is to provide an environmental control system and an environmental control method that can appropriately control thermal environments of a plurality of areas related to each other.

[0006] In order to achieve the objective, according to an embodiment of the present invention, there is provided an environmental control system for controlling thermal environments of a plurality of areas related to each other. The environmental control system includes: acquisition means for acquiring control information related to the thermal environment of each of the plurality of areas; and setting means for comparing the control information of the plurality of areas acquired by the acquisition means and setting a set value related to control of the thermal environment for at least one of the plurality of areas.

[0007] In the environmental control system according to an embodiment

of the present invention, the control information of the plurality of areas is compared, and the set value related to the control of the thermal environment is set for at least one of the plurality of areas. Therefore, the thermal environment of each area is controlled according to a situation
5 related to the thermal environments of different areas related to each other. As a result, according to the environmental control system of an embodiment of the present invention, it is possible to appropriately control the thermal environments of the plurality of areas related to each other.

10 [0008] The acquisition means may acquire, as the control information, a set value that is related to the control of the thermal environment and has been set by a user of the area. According to this configuration, it is possible to appropriately control the thermal environments of the plurality of areas related to each other according to the set value set by
15 the user of the area.

[0009] The setting means may set the set values for the plurality of areas such that the set values are included in a range with a preset size. According to this configuration, it is possible to reliably and appropriately control the thermal environments of the plurality of areas related to each
20 other.

[0010] The setting means may set the set values in stages according to the control information. According to this configuration, it is possible to more appropriately control the thermal environments of the plurality of areas related to each other.

25 [0011] The acquisition means may acquire, as the control information, information indicating a thermal environment preference of a user of the

area. According to this configuration, it is possible to appropriately control the thermal environments of the plurality of areas related to each other according to the thermal environment preference of the user of the area.

5 [0012] The setting means may set a temperature of a space as the set value. According to this configuration, it is possible to appropriately control the temperature of the space in the plurality of areas related to each other.

10 [0013] However, an embodiment of the present invention can be described not only as an invention of the environmental control system as described above, but also as an invention of an environmental control method as described below. These are just different in categories, but are substantially the same inventions. Therefore, these have similar operations and effects.

15 [0014] That is, according to an embodiment of the present invention, there is provided an environmental control method that is a method for operating an environmental control system for controlling thermal environments of a plurality of areas related to each other. The environmental control method includes: an acquisition step of acquiring
20 control information related to the thermal environment of each of the plurality of areas; and a setting step of comparing the control information of the plurality of areas acquired in the acquisition step and setting a set value related to control of the thermal environment for at least one of the plurality of areas.

25 [0015] According to an embodiment of the present invention, it is possible to appropriately control the thermal environments of the

plurality of areas related to each other.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. 1 is a diagram showing a configuration of an environmental control system according to an embodiment of the present invention.

5 FIG. 2 is a graph showing an example of a comfort probability curve.

 FIGS. 3(a) and 3(b) are graphs showing an example in which a new set value is determined using a set value of room temperature set by a user of an air conditioning zone.

10 FIG. 4 is a graph showing an example in which a new set value is determined using information indicating a room temperature preference of the user of the air conditioning zone.

 FIGS. 5(a), 5(b) and 5(c) are graphs showing another example in which a new set value is determined using the information indicating the room temperature preference of the user of the air conditioning zone.

15 FIG. 6 is a flowchart showing an environmental control method that is a process executed by the environmental control system according to the embodiment of the present invention.

DETAILED DESCRIPTION

20 [0017] Hereinafter, an embodiment of an environmental control system and an environmental control method according to the present invention will be described in detail with reference to the drawings. In addition, in the description of the drawings, the same elements are denoted by the same reference numerals, and a duplicate description thereof will be omitted.

25 [0018] FIG. 1 shows an environmental control system 10 according to

this embodiment. The environmental control system 10 is a system (device) that controls a thermal environment of a space. The space to be controlled is a space including a plurality of areas that are related to each other. The plurality of areas are used by respective users (occupants). The space to be controlled is, for example, an open office (an office in which many people share a large room without partitions). The space to be controlled may be a plurality of areas that are spatially continuous as described above. In this embodiment, each of the plurality of areas included in the space to be controlled is called an air conditioning zone. In addition, the space to be controlled is not necessarily the above-described space as long as it includes a plurality of areas related to each other, which will be described below.

[0019] The thermal environment to be controlled is, for example, room temperature (indoor air temperature). In the following description, for example, the environmental control system 10 will be described as a system controlling the room temperature of the space. Further, the thermal environment to be controlled does not need to be room temperature, but may be anything that affects thermal sensation felt by the user when the user uses the space. Examples of the thermal environment to be controlled may include the surface temperature of a wall, a floor, and a ceiling, radiant temperature, operative temperature, and standard new effective temperature (SET*) and predicted mean vote (PMV) which are comprehensive thermal evaluation indexes.

[0020] An air conditioning system 20 is provided in the space to be controlled. The environmental control system 10 controls the air conditioning system 20 to control the room temperature. In addition,

the environmental control system 10 may be a portion of the function of the air conditioning system 20.

[0021] Specifically, the environmental control system 10 is a computer including hardware such as a central processing unit (CPU) and a memory. These components are operated by programs and the like to implement each function of the environmental control system 10 which will be described below. In addition, the environmental control system 10 may be implemented by one computer or may be implemented by a computer system configured by connecting a plurality of computers via a network. The environmental control system 10 may have a communication function for the acquisition of information required for controlling the thermal environment, the control of the thermal environment, and the like, which will be described below.

[0022] The air conditioning system 20 is a system that performs air conditioning for the space to be controlled. The air conditioning system 20 performs air conditioning for each of the plurality of air conditioning zones included in the space to be controlled. The air conditioning system 20 is, for example, a VAV system. In the VAV system, a set value of the room temperature is set for each air conditioning zone, and air conditioning is performed according to the set value. For example, a temperature sensor is provided for each air conditioning zone, and air conditioning is performed such that a measured value of the temperature sensor is the set value. The set value is set, for example, by the user of the air conditioning zone. In addition, the control of the air conditioning system 20 by the environmental control system 10 is performed by setting the set value, which will be described below.

[0023] In the VAV system, a terminal unit (VAV unit) is provided in each air conditioning zone, and all terminal units are connected to a single duct. That is, the plurality of air conditioning zones in the VAV system are related to each other in this respect. As described above, the plurality of air conditioning zones may be related to each other such that they are spatially continuous or may be related to each other such that air conditioning is performed from the same air conditioning system as described above. In addition, when the plurality of air conditioning zones are related to each other such that air conditioning is performed (that is, they receive heat) from the same air conditioning system, the plurality of air conditioning zones are not necessarily spatially continuous. For example, the plurality of air conditioning zones may be spaces in which air conditioning is performed and which are physically separated from each other by partitions or the like and are not continuous.

[0024] Further, the air conditioning system 20 does not need to be the VAV system, but may be any system that performs air conditioning for the plurality of air conditioning zones, which are related to each other and are to be controlled by the environmental control system 10, according to the set value. For example, the air conditioning system 20 may be a system that is other than the VAV system and has the same air conditioning system and a plurality of terminal units corresponding to each air conditioning zone. Examples of this system include a constant air volume system (CAV system), a radiant heating and cooling system, and a variable refrigerant flow (VRF) system including a plurality of terminal units (CAV units, radiant heating and cooling panels + motorized valves and VRF indoor units). Furthermore, the control of the thermal

environment by the environmental control system 10 may be performed by means other than the air conditioning system 20.

[0025] Next, the functions of the environmental control system 10 according to this embodiment will be described. As shown in FIG. 1, the environmental control system 10 is configured to include an acquisition unit 11 and a setting unit 12.

[0026] The acquisition unit 11 is acquisition means for acquiring control information related to the thermal environment of each of a plurality of areas. The acquisition unit 11 may acquire the set value, which is related to the control of the thermal environment and has been set by the user of the area, as the control information. The acquisition unit 11 may acquire, as the control information, information indicating a thermal environment preference of a user of the area.

[0027] The control information acquired by the acquisition unit 11 is information used for the control by the environmental control system 10. The control information is information related to the thermal environment of each air conditioning zone. The control information is, for example, the set value of the room temperature set by the user of the air conditioning zone. For example, the acquisition unit 11 receives the set value of the room temperature transmitted from the air conditioning system 20 to acquire the set value of the room temperature. For example, the air conditioning system 20 is configured to transmit the set values of the room temperatures of all of the air conditioning zones to the environmental control system 10 when the set value of the room temperature is set (changed) by the user of any of the air conditioning zones, when the air conditioning system 20 is started up, or the like.

[0028] In addition, the set value set by the user of the air conditioning zone may be related to any of the air conditioning zones to be controlled. That is, in any of the air conditioning zones other than the air conditioning zone in which the set value has been set by the user, the set value may not be the set value set by the user of the air conditioning zone. For example, in any of the other air conditioning zones, the set value may be a set value set by the environmental control system 10. Even in this case, the acquisition unit 11 acquires information related to all of the air conditioning zones to be controlled.

[0029] Further, the control information may also be, for example, information indicating the room temperature preference (thermal comfort) of the user of the air conditioning zone. The user of the air conditioning zone may be a user who is using the air conditioning zone at the time of the control by the environmental control system 10, for example, at the time when the acquisition unit 11 acquires the control information. In this case, specifically, the control information is a room temperature range (temperature range) in which the user of the air conditioning zone feels comfortable. The acquisition unit 11 may acquire information for each user.

[0030] In this case, for example, information of the room temperature range in which the user feels comfortable is prepared for each potential user of the air conditioning zone in advance and is then stored in the environmental control system 10. For example, the room temperature range in which the user feels comfortable can be ascertained from a questionnaire conducted in advance. Specifically, a comfort probability curve shown in FIG. 2 is created from data of the questionnaire, and a

room temperature range (temperature range) with a comfort probability of 80% or higher is calculated for each individual. In addition, the comfort probability curves shown in FIG. 2 are for eight subjects. This method is disclosed in, for example, Ono, E., Lei, Y., Mihara, K., & Chong, A. (2022), The impact of resolution of occupancy data on personal comfort model-based HVAC control performance, In The 9th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys '22). Alternatively, the temperature range may be determined by a conventional model that predicts average human comfort, such as PMV or SET*.

[0031] The acquisition unit 11 acquires information indicating the user of the air conditioning zone, reads information indicating the room temperature preference of the user stored in the environmental control system 10, and acquires the information. The information indicating the user of the air conditioning zone may be acquired by a conventional method that detects individuals in a space (for example, a method using a video obtained by imaging the air conditioning zone with a camera or a method using a beacon). Furthermore, the user of the air conditioning zone may be preset and stored in the environmental control system 10, and the acquisition unit 11 may acquire the stored information. In addition, when there is a user whose thermal environment preference is not known (a user whose thermal environment preference is not stored in the environmental control system 10), the acquisition unit 11 may use a standard temperature range (an average value for all of the users or a range that can be estimated from PMV or SET*) as the thermal environment preference of the user.

[0032] The acquisition unit 11 may acquire one or both of the set values of the room temperature set by the user of the air conditioning zone and the information indicating the room temperature preference of the user of the air conditioning zone. In addition, the acquisition unit 11 may acquire, as the control information, information other than the above as long as the information is related to the thermal environment of each air conditioning zone and is used for the control by the environmental control system 10. Further, the acquisition unit 11 may acquire the control information using any method other than the above. The acquisition unit 11 outputs the acquired control information to the setting unit 12.

[0033] The setting unit 12 is setting means that compares the control information of the plurality of areas acquired by the acquisition unit 11 and sets a set value related to the control of the thermal environment for at least one of the plurality of areas. The setting unit 12 may set the set values for the plurality of areas such that the set values are included in a range with a preset size. The setting unit 12 may set the set values in stages according to the control information. The setting unit 12 may set the temperature of the space as the set value. For example, the setting unit 12 sets the set values as follows.

[0034] The setting unit 12 receives the input of the control information from the acquisition unit 11. The setting unit 12 newly sets a set value related to the control of the thermal environment from the input control information on the basis of the criteria stored in advance as follows and controls the thermal environment. For example, the setting unit 12 newly sets the set value of the room temperature (the temperature of the space) as the set value related to the control of the thermal environment.

The control by the setting unit 12 is performed according to the type of the control information acquired by the acquisition unit 11. Hereinafter, the control by the setting unit 12 for each type of control information will be described.

5 [0035] For the set value of the room temperature, from the viewpoint of energy saving, it is better that a temperature difference between the air conditioning zones is small and the set value is higher for cooling and is lower for heating. From the viewpoint of comfort, it is better that the room temperature is the preferred temperature of the user of each air
10 conditioning zone. However, the preferred temperature inherently has a range and is not pinpointed. Further, the preferred temperature also changes depending on the past activities of the user of the air conditioning zone. For this reason, there is a possibility that the user of the air conditioning zone may not truly know his or her own preferred
15 temperature. Therefore, it is assumed that, in a case where the set value of the room temperature is extremely high or low (for example, the temperature is not included in the range of $25\pm 2^{\circ}\text{C}$), even when the set value of the room temperature is corrected to a normal value after a predetermined period of time has passed, it does not adversely affect the
20 comfort of the majority of users. For example, the control of the thermal environment by the setting unit 12 may be performed considering the above.

[0036] When the control information acquired by the acquisition unit 11 is the set value of the room temperature set by the user of the air
25 conditioning zone, the setting unit 12 determines the set value to be newly set (changed) as follows. The setting unit 12 compares the set values of

all of the air conditioning zones indicated by the control information and determines new set values of the air conditioning zones such that the set values of all of the air conditioning zones fall within a preset temperature difference range. In addition, the temperature difference range indicates the width of the temperature (the range of the magnitudes of the set values (specifically, the difference between the set temperatures)). The set value of the air conditioning zone may be changed in any of the air conditioning zones to be controlled. Further, when the comparison between the control information items shows that change conditions are not satisfied in any of the air conditioning zones, the setting unit 12 does not change the set value in any of the air conditioning zones.

[0037] When the set values of all of the air conditioning zones fall within the preset temperature difference range, it is possible to prevent the occurrence of an unbalanced load between the plurality of terminal units of the air conditioning system 20 provided in each air conditioning zone. This makes it possible to prevent an adverse effect on the indoor environment and energy efficiency. For example, it is possible to prevent excessive cooling caused by extremely low supply air temperature or excessive fan power caused by extremely high supply air temperature in a specific air conditioning zone. In addition, this also makes it possible to achieve energy saving.

[0038] The temperature difference range is preset to meet the above-mentioned purpose and is set to, for example, a value within a range of 1°C to 2°C. Furthermore, the temperature difference range may be set after the influence of the difference between the set values in each air conditioning zone of the air conditioning system 20 to be controlled on

the load of each terminal unit or the like is investigated by, for example, simulation evaluation. The temperature difference range may be set to a different value for each season. The temperature difference range may be tuned during the testing of the environmental control system 10 or operation phase. In addition, other parameters used in the environmental control system 10 may be set in the same manner as the temperature difference range.

[0039] For example, the setting unit 12 sets a temperature range corresponding to the temperature difference range having, as the upper limit, the highest temperature among the set values of all of the air conditioning zones indicated by the control information. In addition, the temperature range is a range having the upper and lower limits which are absolute values of the temperature. For example, the temperature range is from 24°C to 26°C. In this case, the temperature difference range is 2°C (= 26°C - 24°C). When there are three air conditioning zones of zone 1, zone 2, and zone 3 as shown in FIG. 3(a), the setting unit 12 sets a temperature range R1 corresponding to the temperature difference range having, as the upper limit, a set value A1 of zone 1 which is the set value of the highest temperature.

[0040] The setting unit 12 determines new set values for the set values, which are not included in the temperature range R1, among the set values of all of the air conditioning zones indicated by the control information, that is, for the set values below the lower limit of the temperature range R1. For example, the setting unit 12 determines the lower limit value of the temperature range R1 as a new set value for the set value that is not included in the temperature range R1. For example, as shown in FIG.

3(a), for a set value A2 of zone 2 that is not included in the temperature range R1, a set value B2, which is the lower limit of the temperature range R1, is determined to be a new set value. In addition, new set values may not be determined (changed) for the set values included in the temperature range R1 (for example, the set values A1 and A3 of zones 1 and 3 in FIG. 3(a)) among the set values of all of the air conditioning zones indicated by the control information.

[0041] Alternatively, the setting unit 12 sets a temperature range corresponding to the temperature difference range having, as the lower limit, the lowest temperature among the set values of all of the air conditioning zones indicated by the control information. For example, as shown in FIG. 3(b), the setting unit 12 sets a temperature range R1 corresponding to the temperature difference range having, as the lower limit, a set value A2 of zone 2 which is the set value of the lowest temperature.

[0042] The setting unit 12 determines new set values for the set values, which are not included in the temperature range R1, among the set values of all of the air conditioning zones indicated by the control information, that is, for the set values exceeding the upper limit of the temperature range R1. For example, the setting unit 12 determines the upper limit value of the temperature range R1 as a new set value for the set value that is not included in the temperature range R1. For example, as shown in FIG. 3(b), for a set value A1 of zone 1 and a set value A3 of zone 3 that are not included in the temperature range R1, set values B1 and B3, which are the lower limit of the temperature range R1, are determined to be new set values. In addition, new set values may not be determined (changed)

for the set values included in the temperature range R1 (for example, the set value A2 of zone 2 in FIG. 3(b)) among the set values of all of the air conditioning zones indicated by the control information.

[0043] Alternatively, the setting unit 12 may determine a temperature range including all of the set values and a new set value of each air conditioning zone such that the total value of correction widths of the set values for making the set values of all of the air conditioning zones indicated by the control information fall within the temperature difference range is minimized. When the new set values are determined in this manner, it is possible to minimize the influence of the control by the environmental control system 10 across all of the air conditioning zones.

[0044] When the control information acquired by the acquisition unit 11 is information indicating the room temperature preference of the user of the air conditioning zone, the setting unit 12 determines the set value to be newly set (changed) as follows. In this case, the setting unit 12 also acquires the set value of the room temperature of the air conditioning zone. The acquisition of the set value may be performed in the same manner as when the control information is the set value of the room temperature set by the user of the air conditioning zone.

[0045] As shown in FIG. 4, the setting unit 12 calculates a maximum temperature range R2, in which the number of persons who feel comfortable is equal to or greater than a preset percentage (for example, 80%), from the range of the room temperature (temperature range), in which the user feels comfortable, indicated by the control information for each air conditioning zone. In addition, by adjusting this percentage, the operation can be geared towards energy saving or towards comfort.

This adjustment can be performed according to the preference of the owner or the facility manager of the space to be controlled. Then, the setting unit 12 compares the temperature ranges R2 of the respective air conditioning zones and sets a temperature range R3 that is included in all of the temperature ranges R2.

[0046] The setting unit 12 determines new set values for the set values that are not included in the temperature range R3, that is, the set values exceeding the upper limit or below the lower limit of the temperature range R3, among the set values of all of the air conditioning zones. For example, for the set values exceeding the upper limit of the temperature range R3, the setting unit 12 determines the upper limit value of the temperature range R3 to be a new set value. In addition, for the set values below the lower limit of the temperature range R3, the setting unit 12 determines the lower limit value of the temperature range R3 to be a new set value.

[0047] For example, as shown in FIG. 4, for a set value A1 of zone 1 that exceeds the upper limit of the temperature range R3, a set value B1, which is the upper limit of the temperature range R3, is determined to be a new set value. In addition, for a set value A2 of zone 2 that is below the lower limit of the temperature range R3, a set value B2, which is the lower limit of the temperature range R3, is determined to be a new set value. In addition, new set values may not be determined (changed) for the set values included in the temperature range R3 (for example, the set value A3 of zone 3 in FIG. 4) among the set values of all of the air conditioning zones.

[0048] This setting of the set values makes it possible to keep the set

values within a predetermined temperature difference range and to ensure the comfort of the user in each air conditioning zone. In addition, there may be a trade-off between comfort and energy saving. The percentage of the number of persons who feel comfortable for calculating the temperature range R2 can be changed to adjust which of comfort and energy saving more emphasis is placed on.

[0049] Further, when information indicating the room temperature preference of the user of the air conditioning zone is used as the control information, the setting unit 12 may determine a new set value using a preset temperature difference range used to determine the new set value when the set value of the room temperature set by the user of the air conditioning zone has been used as the control information. The use of this makes it possible to set more appropriate set values in terms of both comfort and energy saving. In this case, for example, the setting unit 12 determines new set values as follows.

[0050] The setting unit 12 sets the temperature range R3 in the same manner as described above on the basis of the information indicating the room temperature preference of the user of the air conditioning zone. Further, the setting unit 12 acquires information indicating whether the current air conditioning by the air conditioning system 20 is cooling or heating.

[0051] The setting unit 12 compares the set temperature range R3 with the above-described preset temperature difference range. As shown in FIG. 5(a), when the temperature range R3 based on the preference is narrower than a preset temperature difference range D1, the setting unit 12 determines the set value on the basis of the temperature range R3 based

on the preference in the same manner as described above.

[0052] As shown in FIG. 5(b), when the temperature range R3 based on the preference is wider than the preset temperature difference range D1 and the current air conditioning by the air conditioning system 20 is cooling, the setting unit 12 sets a temperature range that corresponds to the preset temperature difference range D1 and has the upper limit of the temperature range R3 based on the preference as an upper limit. That is, in this case, the setting unit 12 sets the temperature range corresponding to the preset temperature difference range D1 on the high-temperature side of the temperature range R3 based on the preference. The setting unit 12 determines the set value on the basis of the set temperature range in the same manner as described above.

[0053] As shown in FIG. 5(c), when the temperature range R3 based on the preference is wider than the preset temperature difference range D1 and the current air conditioning by the air conditioning system 20 is heating, the setting unit 12 sets a temperature range that corresponds to the preset temperature difference range D1 and has the lower limit of the temperature range R3 based on the preference as a lower limit. That is, in this case, the setting unit 12 sets the temperature range corresponding to the preset temperature difference range D1 on the low-temperature side of the temperature range R3 based on the preference. The setting unit 12 determines the set value on the basis of the set temperature range in the same manner as described above.

[0054] In the above-described examples, the control information is the set value of the room temperature set by the user of the air conditioning zone or the information indicating the room temperature preference of the

user of the air conditioning zone. However, the setting unit 12 may determine a new set value using both of them. The use of both of them also makes it possible to set a more appropriate set value in terms of both comfort and energy saving.

5 [0055] For example, the setting unit 12 may set an overlapping temperature range between the temperature range R1 based on the set value and the temperature range R3 based on the preference and determine the set value on the basis of the set temperature range in the same manner as described above. For example, when the temperature
10 range R1 based on the set value is from 26.0°C to 27.0°C and the temperature range R3 based on the preference is 25.5°C to 26.5°C, the setting unit 12 may determine the set value so as to fall within a common range of 26.0°C to 26.5°C.

[0056] Furthermore, the setting unit 12 may determine a new set value
15 using any method other than the above as long as the method compares the control information of a plurality of areas to perform the determination.

[0057] The setting unit 12 notifies the air conditioning system 20 of the set values newly determined as described above and sets the set values
20 such that air conditioning is performed for each air conditioning zone according to the set values. The air conditioning system 20 performs air conditioning for the corresponding air conditioning zones according to the set values.

[0058] The setting unit 12 may perform the above-described control after
25 a preset period of time has elapsed (for example, after 30 minutes to 1 hour) from the timing when the set value before the newly determined set

value was set (for example, the timing when the set value was changed by the user). In addition, the setting unit 12 may newly determine the set value at the timing after the preset period of time has elapsed. This is based on the fact that previous studies have reported that it takes about 15 to 20 minutes for the human body to adapt and reach thermal neutrality after being exposed to a different temperature environment. For example, assuming that the user comes in from outside, feels hot temporarily, and reduces the set temperature, and generally reaches a steady state after 30 minutes, it is reasonable to change the settings after 30 minutes.

[0059] When the difference between the newly set value and the previous set value is higher than a preset value, the setting unit 12 may set the set values in stages to perform the above control. For example, when the difference exceeds 1°C, the setting unit 12 may set the set value at a gradient of 1°C every 30 minutes to 1 hour such that the set value is finally the newly set value. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards stipulate that temperature (working temperature) changes need to be within 2.2°C per hour. This is the function of the environmental control system 10 in the present embodiment.

[0060] Next, an environmental control method which is a process executed by the environmental control system 10 according to this embodiment (an operation method performed by the environmental control system 10) will be described with reference to a flowchart shown in FIG. 6. In this process, the acquisition unit 11 acquires control information related to the thermal environment of each of a plurality of

air conditioning zones (S01, an acquisition step). Then, the setting unit 12 compares the control information of the plurality of air conditioning zones and calculates a new set value related to the control of the thermal environment of at least one of the plurality of air conditioning zones (S02, a setting step). Then, the setting unit 12 notifies the air conditioning system 20 of the new set value and sets the new set value as the set value used for air conditioning (S03). Then, the air conditioning system 20 uses the new set value to perform air conditioning in the corresponding air conditioning zone. The above is the environmental control method according to this embodiment.

[0061] In this embodiment, the control information of a plurality of areas is compared, and the set value related to the control of the thermal environment is set for at least one of the plurality of areas. Therefore, the thermal environment of each area is controlled according to the situation related to the thermal environments of different areas related to each other. As a result, according to this embodiment, it is possible to appropriately control the thermal environments of a plurality of areas related to each other.

[0062] As described above, in the related art, an unbalanced load between a plurality of terminal units occurs depending on the set values of the room temperatures of a plurality of air conditioning zones. The set value set by the user is likely to be influenced by the preferences of some persons, and a comfortable situation is not necessarily provided to the majority of users. In addition, even when the set value is changed to an extremely high or low value, the extreme set value be used until someone changes the set value. As a result, in many cases, air

conditioning that is not comfortable for the majority of people and does not save energy is performed. According to this embodiment, control is performed with a focus on the relationship between the situations related to the thermal environments of the air conditioning zones related to each other. Therefore, it is possible to perform appropriate control that solves the above-mentioned problems and achieves both comfort and energy saving for a plurality of air conditioning zones.

[0063] As in this embodiment, the control information may be the set value (for example, the set value of the room temperature) that is related to control of the thermal environment and has been set by the user of the area. According to this configuration, it is possible to appropriately control the thermal environments of a plurality of areas related to each other according to the set value set by the user of the area. However, the control information is not necessarily the above-described information as long as it is related to the thermal environment of each of the plurality of areas.

[0064] As in this embodiment, the set values for the plurality of areas may be set such that the set values are included in a range with a preset size (for example, the above-mentioned preset temperature difference range). According to this configuration, it is possible to reliably and appropriately control the thermal environments of the plurality of areas related to each other. However, the set values are not necessarily set as described above.

[0065] As in this embodiment, the setting unit 12 may set the set values in stages according to the control information. According to this configuration, it is possible to more appropriately control the thermal

environments of the plurality of areas related to each other.

[0066] As in this embodiment, the control information may be information indicating the thermal environment preference of the user of the area (for example, the range of the room temperature in which the user feels comfortable). According to this configuration, it is possible to appropriately control the thermal environments of the plurality of areas related to each other according to the thermal environment preference of the user of the area. However, the control information is not necessarily the above information as long as it is related to the thermal environment of each of the plurality of areas.

[0067] As in this embodiment, the setting unit 12 may set the temperature of a space as the set value. According to this configuration, it is possible to appropriately control the temperature of the space in the plurality of areas related to each other. However, the set value related to the thermal environment, that is, the thermal environment to be controlled, is not necessarily the temperature of the space and may be anything.

[0068] The environmental control system and the environmental control method according to the present disclosure have the following configurations.

[1] An environmental control system for controlling thermal environments of a plurality of areas related to each other, the environmental control system including:

acquisition means for acquiring control information related to the thermal environment of each of the plurality of areas; and

setting means for comparing the control information of the plurality of areas acquired by the acquisition means and setting a set value

related to control of the thermal environment for at least one of the plurality of areas.

[2] The environmental control system according to [1],

wherein the acquisition means acquires, as the control information, a set value that is related to the control of the thermal environment and has been set by a user of the area.

[3] The environmental control system according to [1] or [2],

wherein the setting means sets the set values for the plurality of areas such that the set values are included in a range with a preset size.

[4] The environmental control system according to any one of [1]

to [3],

wherein the setting means sets the set values in stages according to the control information.

[5] The environmental control system according to any one of [1]

to [4],

wherein the acquisition means acquires, as the control information, information indicating a thermal environment preference of a user of the area.

[6] The environmental control system according to any one of [1]

to [5],

wherein the setting means sets a temperature of a space as the set value.

[7] An environmental control method that is a method for

operating an environmental control system for controlling thermal environments of a plurality of areas related to each other, the environmental control method including:

an acquisition step of acquiring control information related to the thermal environment of each of the plurality of areas; and

- 5 a setting step of comparing the control information of the plurality of areas acquired in the acquisition step and setting a set value related to control of the thermal environment for at least one of the plurality of areas.

WHAT IS CLAIMED IS:

1. An environmental control system for controlling thermal environments of a plurality of areas related to each other, the environmental control system comprising:

5 acquisition means for acquiring control information related to the thermal environment of each of the plurality of areas; and

setting means for comparing the control information of the plurality of areas acquired by the acquisition means and setting a set value related to control of the thermal environment for at least one of the plurality of areas,

10 wherein the acquisition means acquires, as the control information, a set value that is related to the control of the thermal environment and has been set by a user of the area, and

15 the setting means sets the set values in stages according to the control information.

2. The environmental control system according to claim 1, wherein the setting means sets the set values for the plurality of areas such that the set values are included in a range with a preset size.

3. The environmental control system according to claim 1 or 2, wherein the acquisition means acquires, as the control information, information indicating a thermal environment preference of a user of the area.

4. The environmental control system according to claim 1 or 2, wherein the setting means sets a temperature of a space as the set value.

5. An environmental control method that is a method for operating

an environmental control system for controlling thermal environments of a plurality of areas related to each other, the environmental control method comprising:

an acquisition step of acquiring control information related to the thermal environment of each of the plurality of areas; and

a setting step of comparing the control information of the plurality of areas acquired in the acquisition step and setting a set value related to control of the thermal environment for at least one of the plurality of areas,

wherein, in the acquisition step, a set value that is related to the control of the thermal environment and has been set by a user of the area is acquired, as the control information, and,

in the setting step, the set values are set in stages according to the control information.