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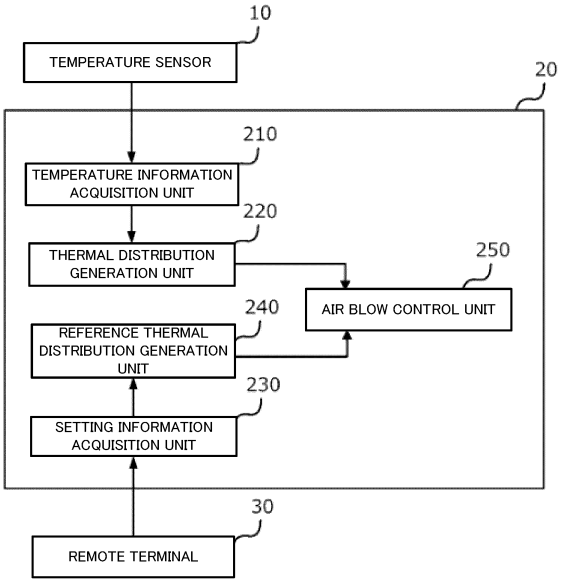
(54) AIR CONDITIONER

(57) In regard to an air conditioner and an air conditioning system controlling a plurality of air conditioners, an object of the present disclosure is to provide an air conditioner capable of continuously controlling the operating status in consideration of the temperature conditions at the position for which a setting is made and in the vicinity of the position in a case where a setting has been made so as to locally provide a set temperature difference in a region, for example. The air conditioner includes a temperature information acquisition unit (210) to acquire a result of detecting temperature information in a region, a thermal distribution generation unit (220) to generate thermal distribution information in the region from the temperature information, a reference thermal distribution generation unit (240) to generate reference thermal distribution information in the region, and an air blow control unit (250) to control an air blow setting so that a difference between the thermal distribution information and the reference thermal distribution information decreases.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The present disclosure relates to an air conditioner.

BACKGROUND ART

[0002] In recent years, in regard to an air conditioner and an air conditioning system controlling a plurality of air conditioners, there has been provided an air conditioning technology of acquiring information on the presence or absence of a person in a region equipped with the air conditioner and information on the number of people in the region from a human detection sensor and controlling operating status of the air conditioner based on those items of information.

[0003] For example, Patent Reference 1 discloses a technology of controlling the operating status of the air conditioner by dividing the region into a plurality of areas.

PRIOR ART REFERENCE

PATENT REFERENCE

[0004] Patent Reference 1: Japanese Patent Application Publication No. 2011-94965 (Pages 6 to 13, Fig. 2)

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0005] In the aforementioned Patent Reference 1, no description is given of continuously controlling the operating status in consideration of temperature conditions at a position for which a setting is made and in the vicinity of the position in cases where a setting has been made so as to locally provide a set temperature difference in the region, for example.

[0006] An object of the present disclosure is to provide an air conditioner capable of continuously controlling the operating status in consideration of the temperature conditions at the position for which a setting is made and in the vicinity of the position in cases where a setting has been made so as to locally provide a set temperature difference in the region, for example.

MEANS FOR SOLVING THE PROBLEM

[0007] An air conditioner according to the present disclosure includes a temperature information acquisition unit to acquire a result of detecting temperature information in a region; a thermal distribution generation unit to generate thermal distribution information in the region from the temperature information; a reference thermal distribution generation unit to generate reference thermal distribution information in the region; an air blow control unit to control an air blow setting so that a difference between the thermal distribution information and the reference thermal distribution information decreases; a setting information acquisition unit to acquire setting information in each of positions in the region; a storage unit to store user position information in which the user information and a staying position of the user in the region are associated with each other; and a reception unit to receive user setting information including the user information and the setting information specified by the user, wherein the setting information includes temperature setting information or relative temperature setting information, the reference thermal distribution generation unit generates the reference thermal distribution information based on the temperature setting information or the relative temperature setting information regarding each position acquired by the setting information acquisition unit, and the setting information acquisition unit estimates a setting position in the region based on the user information included in the user setting information received by the reception unit and the user position information and acquires the setting information included in the user setting information while associating the setting information with the setting position.

EFFECT OF THE INVENTION

[0008] According to the present disclosure, by generating the thermal distribution information in the region from the result of detecting the temperature information in the region and controlling the operating status so that the difference between the thermal distribution information in the region and the reference thermal distribution information in the region decreases, it is possible to continuously control the operating status in consideration of the temperature conditions at the position for which a setting is made and in the vicinity of the position in cases where a setting has been made so as to locally provide a set temperature difference in the region, for example.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a block diagram schematically showing a configuration of an air conditioner according to a first embodiment.

Figs. 2(a) and 2(b) are diagrams showing examples of thermal distribution information and reference thermal distribution information according to the first embodiment.

Figs. 3(a) to 3(d) are diagrams showing transition of the thermal distribution information according to the first embodiment.

Fig. 4 is a block diagram schematically showing a configuration of an air conditioner according to a second embodiment.

Fig. 5 is a block diagram schematically showing a

configuration of an air conditioner according to a third embodiment.

Figs. 6(a) and 6(b) are diagrams showing user position information.

Fig. 7 is a diagram showing an example of data stored in a storage unit 270.

Fig. 8 is a block diagram schematically showing an air conditioning system according to a fourth embodiment.

Fig. 9 is a diagram showing a centralized control device 70 according to the fourth embodiment by using a processor.

MODE FOR CARRYING OUT THE INVENTION

First Embodiment

[0010] Embodiments will be described below with reference to the drawings. In the drawings described below, identical or similar parts are assigned the same or similar reference characters. However, it should be noted that the drawings are schematic and ratios of dimensions and the like differ from the actual ones. Accordingly, specific dimensions and the like should be determined in consideration of the following description. Further, dimensional relationships and ratios can of course vary partially from drawing to drawing.

[0011] Fig. 1 is a block diagram schematically showing a configuration of an air conditioner according to the present embodiment.

[0012] The air conditioner 20 according to the present embodiment includes a temperature information acquisition unit 210, a thermal distribution generation unit 220, a setting information acquisition unit 230, a reference thermal distribution generation unit 240 and an air blow control unit 250. Further, the air conditioner 20 is communicatively connected to a temperature sensor 10 and a remote terminal 30. While the temperature sensor 10 is configured outside the air conditioner 20 in Fig. 1, it is permissible even if the air conditioner 20 includes the temperature sensor 10 or is configured to be connected to a plurality of temperature sensors 10. Further, the connection between the temperature sensor 10 and the air conditioner 20 and the connection between the remote terminal 30 and the air conditioner 20 may also be implemented by wireless communication such as infrared communication or 5G communication or via a LAN network or the like.

[0013] The temperature sensor 10 detects temperature information in a region and supplies the detected temperature information in the region to the temperature information acquisition unit 210. Here, the region represents a spatial region equipped with the air conditioner 20 in which temperature and humidity are expected to be controlled by the air conditioner 20. For example, when the air conditioner 20 is provided in a living room, the living room is the region. If the living room and a kitchen room spatially connect to each other and the temperature sensor 10 has been provided to be able to detect the temperature information in the kitchen room, the region may include the kitchen room.

[0014] The temperature information acquisition unit 210 acquires the temperature information in the region from the temperature sensor 10.

[0015] The thermal distribution generation unit 220 generates thermal distribution information in the region from the temperature information in the region acquired by the temperature information acquisition unit 210. For example, position information indicating detection target positions in the region as viewed from the temperature sensor 10 is converted into detection target positions in a virtual region representing a space in the region based on the temperature information detected at the detection target positions, and data obtained by plotting the detected temperature information at the positions in the virtual region is generated as the thermal distribution information. Further, from the data obtained by the plotting, it is also possible to execute interpolation in regard to other positions in the virtual region by using temperature information detected in the vicinity and use the data obtained by the interpolation as the thermal distribution information.

[0016] The setting information acquisition unit 230 acquires setting information regarding the inside of the region during the operation of the air conditioner 20 from the remote terminal 30 or the like. The setting information includes set a temperature at a position in the region. Further, the setting information may include set humidity at a position in the region, set air volume, a setting for avoiding direct airflow, an eco mode setting for holding down the electric energy consumption, and so forth.

[0017] The reference thermal distribution generation unit 240 generates reference thermal distribution information in the region from set temperature information in the region acquired by the setting information acquisition unit 230.

[0018] Figs. 2(a) and 2(b) are diagrams showing examples of the thermal distribution information and the reference thermal distribution information. Fig. 2(a) shows an example of the thermal distribution information 40. The thermal distribution information and the reference thermal distribution information respectively represent temperature information in regard to each point represented by two-dimensional coordinates in the region. For example, in a case where the temperature sensor 10 executes temperature detection (sampling) in the region at n points at even intervals along the horizontal axis and at m points at even intervals along the vertical axis, thermal distribution information having temperature information at each hollow circle position shown in Fig. 2(a) can be generated by converting a positional relationship in the virtual region determined based on the region by using the temperature information regarding $m \times n$ positions acquired from the temperature sensor 10. While the temperature information is indicated by a hollow circle at every position in Fig. 2(a), the temperature information

is represented by changing the color of each hollow circle based on the temperature. For example, when an image in which the blue color is intensified for lower temperature and the red color is intensified for higher temperature like a so-called thermography image, is presented to the user, it is possible to generate thermal distribution information facilitating a user to visually imagine the thermal distribution.

[0019] Further, when the temperature sensor 10 has not successfully obtained the result of the temperature detection (sampling) in the region at all of the m × n positions, the thermal distribution generation unit 220 is capable of generating the thermal distribution information 40 by executing an interpolation process by using a temperature detection result in the vicinity. Similarly, also for positions where the temperature sensor 10 has not executed the temperature detection (sampling), the thermal distribution generation unit 220 is capable of generating the thermal distribution information 40 by executing the interpolation process by using a temperature detection result in the vicinity.

[0020] Similarly, also for a position where the temperature sensor 10 failed to directly detect the temperature information, the thermal distribution generation unit 220 may be configured to execute the interpolation by using the temperature information from the temperature sensor 10 regarding the vicinity of the position. With such a configuration, even in cases where the temperature sensor 10 is a sensor that detects the temperature information at constant intervals, the thermal distribution generation unit 220 is capable of interpolating the temperature information in between by using a detection result in the vicinity.

[0021] Fig. 2(b) shows an example of the reference thermal distribution information 50. In this example, in regard to each point represented by two-dimensional coordinates in the region, the temperature information is indicated by a hollow circle. In Fig. 2(b), it is assumed that a local temperature setting has been made to the position of the coordinates (x2, y2), and the temperature information regarding the position is indicated not as a hollow circle but as a filled circle. For example, when the user does not particularly make a local setting, the set temperature at the time when the user started up the operation of the air conditioner 20 is specified as an initial value, and reference thermal distribution information in which the inside of the region is at the same temperature is generated. Further, for example, when the user has set a certain set temperature for the position of the coordinates (x2, y2) as shown in Fig. 2(b), the reference thermal distribution information is generated by updating the information to reference thermal distribution information in which the temperature at the position of the coordinates (x2, y2) is the set temperature set by the user. By generating the reference thermal distribution information while executing the interpolation in regard to the vicinity of the position for which the setting has been made, the reference thermal distribution information can be generated so as to have thermal distribution in which the temperature gets closer to the set temperature as the position approaches the position for which the user made the setting. The generation of the reference thermal distribution information may be executed by acquiring information such as the floor plan of the region and modifying the method of the interpolation based on the information, for example. Further, in consideration of limitation on the local temperature setting due to the performance of the air conditioner, when the user requests a setting beyond the performance of the air conditioner, the reference thermal distribution information is adjusted to implementable reference thermal distribution information.

[0022] The air blow control unit 250 receives the thermal distribution information from the thermal distribution generation unit 220 and the reference thermal distribution information from the reference thermal distribution generation unit 240 as inputs and controls an air blow setting so that a difference between the thermal distribution information and the reference thermal distribution information decreases. The air blow setting includes the direction of the air blown out, and may include a temperature setting and a humidity setting of the air to be blown out. Based on the air blow setting, the air conditioner 20 executes control of the air blown out and control of a louver (not shown) arranged at the air outlet port of the air conditioner 20 to vary the air direction vertically and horizontally.

[0023] For example, a sum total is calculated regarding the error between the thermal distribution information and the reference thermal distribution information at a plurality of positions in the region, and the control is executed until the error decreases below a prescribed threshold value. Alternatively, in regard to a position where the error is the maximum error among the errors at a plurality of positions, the control is executed in a direction for reducing the error. If the calculation result of the error between the thermal distribution information and the reference thermal distribution information has become not noticeably different from the previous calculation result, it can be judged that the control of the air blow setting is in progress stably or control close to the limitation on the setting controllable by the air conditioner 20 is in progress successfully.

[0024] For example, when the thermal distribution information indicates the same temperature (e.g., 28 °C in Celsius) in the whole of the region as shown in Fig. 2(a) and the reference thermal distribution information indicates a local set temperature (e.g., 26 °C in Celsius) at the coordinate position (x2, y2) alone as shown in Fig. 2(b), the air direction or the like of the air conditioner is adjusted so that the temperature at the coordinate position (x2, y2) locally approaches 26 °C in Celsius.

[0025] Figs. 3(a) to 3(d) are diagrams showing transition of the thermal distribution information due to the control by the air blow control unit 250, illustrating transition of the thermal distribution information from Fig. 3(a) successively to Fig. 3(b), Fig. 3(c) and Fig. 3(d) since the

start of the control by the air blow control unit 250 as an example.

[0026] It is assumed that the thermal distribution information before the start of the operation of the air blow control unit 250 indicated the same temperature (e.g., 28 °C in Celsius) in the whole of the region as shown in Fig. 2(a) and the reference thermal distribution information 50 shown in Fig. 2(b) has been generated due to the user's command for a local temperature setting (e.g., 26 °C in Celsius) for the coordinate position (x2, y2). In this case, the air blow control unit 250 executes the control so that the thermal distribution information becomes closer to the reference thermal distribution information 50, the whole of the region reaches 28 °C in Celsius and the coordinate position (x2, y2) reaches 26 °C in Celsius as the local temperature setting, and the air blow direction of the air after undergoing the temperature setting by the air conditioner is pointed at the coordinate position (x2, y2). By this control, the coordinate position (x2, y2) gradually approaches 26 °C in Celsius as shown in Fig. 3(a) and the coordinate position (x2, y1) also gradually approaches 26 °C in Celsius along with the approach of the coordinate position (x2, y2) to 26 °C in Celsius as shown in Fig. 3(b), for example. In this case, the setting of the air blow direction is updated slightly towards the coordinate position (x2, y3) in comparison with the first setting.

[0027] Thereafter, when thermal distribution information 41c in which the coordinate position (x1, y2) approaches 26 °C in Celsius as shown in Fig. 3(c) has been generated, the setting of the air blow direction is further updated slightly towards the coordinate position (x3, y2).

[0028] As above, the difference between the thermal distribution information 41d and the reference thermal distribution information 50 can be reduced. Incidentally, for the air blow control unit 250, the thermal distribution information and the reference thermal distribution information do not necessarily have to be information facilitating visual recognition like a so-called thermography image since information indicating a positional relationship and temperature information at the position can work well. Thus, when there is no function of presenting a display to the user, an operation achieving similar effects is possible even if information like a table list regarding positional information indicating a positional relationship with the vicinity and temperature information at the position is used as the thermal distribution information and the reference thermal distribution information.

[0029] In reality, various objects such as tall furniture, a wall or a partition may be arranged in the region, and thus even if the air conditioner 20 changes the air blow direction towards the coordinate position (x2, y2) as intended, there are cases where the tall furniture, the partition or the like causes reflection or blockage of the airflow and the reference thermal distribution information desired by the user is not necessarily implemented. Further, there is also an object serving as a heat source, such as a cooking appliance in a house or a computer in an office, and there is also an object moving in the region that can serve as a heat source such as a human or a pet. Influence of the sunlight coming in through a window also fluctuates. Thus, there arise situations where the optimum setting of the air direction by the air conditioner 20 corresponding to the reference thermal distribution information 50 needs to be continuously adjusted due to not only the structure in the region but also fluctuation in the heat source temperature or fluctuation in the heat source position. In such situations, in the present invention, the air blow direction is adjusted so that the difference between the thermal distribution information generated from the result of actually detecting the temperature information in the region and the reference thermal distribution information set by the user decreases, by which the situation can be dealt with properly while detecting the fluctuating influence in the region.

[0030] Furthermore, by providing the air conditioner 20 with a second air outlet port realizing a local air blow in addition to the regular air outlet port, the air blow control unit 250 is enabled to widen its range of dealing with the local temperature setting through the utilization of the second air outlet port. Moreover, in an air conditioner capable of blowing out air after undergoing multiple types of temperature settings, the range of dealing with the local temperature setting can be widened further by sending air after undergoing different temperature settings to the respective air outlet ports.

Second Embodiment

[0031] Fig. 4 is a block diagram schematically showing the configuration of an air conditioner 21 according to a second embodiment. The second embodiment differs from the first embodiment in that the system includes a remote terminal 31 capable of communicating with the air conditioner 21 and displaying thermal distribution information acquired from the air conditioner 21, the air conditioner 21 includes a transmission reception unit 261 that communicates with the remote terminal 31 and transmits the generated thermal distribution information, and the air conditioner 21 includes a setting information acquisition unit 231 that acquires setting information in the region during the operation of the air conditioner 21 via the transmission reception unit 261.

[0032] The transmission reception unit 261 acquires the thermal distribution information generated by the thermal distribution generation unit 220 and transmits the thermal distribution information to the remote terminal 31. Further, the transmission reception unit 261 receives a signal from the remote terminal 31 including information on the set temperature in the region during the operation of the air conditioner 21.

[0033] The remote terminal 31 acquires the thermal distribution information transmitted from the transmission reception unit 261 and displays the thermal distribution information to the user. Further, the remote terminal 31 acquires the setting information in the region during the operation of the air conditioner 21 from the user and

transmits the setting information to the transmission reception unit 261. For example, the remote terminal 31 acquires the setting information in the region specified by the user by displaying the acquired thermal distribution information on a touch panel display unit of the remote terminal 31, acquiring a region, where the setting is desired to be made, from the user by means of a touch input, inquiring of the user about information such as temperature, humidity, airflow strength or the like in the touched region, and making the user input the information. The temperature setting may be made not only by a setting by use of the absolute temperature but also a setting by use of relative temperature setting information indicating information regarding a relative temperature setting relative to the present temperature. The same goes for the humidity and the airflow strength.

[0034] Here, an example of the flow of the operation will be described below in regard to the air conditioner 21 in the present embodiment. The user starts up the air conditioner 21 via the remote terminal 31.

[0035] Subsequently, the air conditioner 21 after the startup acquires the temperature information from the temperature sensor 10.

[0036] Subsequently, the thermal distribution generation unit 220 generates the thermal distribution information in the present region based on the acquired temperature information.

[0037] Subsequently, the transmission reception unit 261 transmits a signal including the generated thermal distribution information to the remote terminal 31.

[0038] Subsequently, the remote terminal 31 displays the thermal distribution information acquired from the received signal on a display unit (not shown) of the remote terminal 31.

[0039] Subsequently, the user selects a region where the setting is desired to be made, from the displayed thermal distribution information.

[0040] Subsequently, the remote terminal 31 presents a display indicating an inquiry about the temperature, the humidity, the air direction, the air volume and so forth to be set for the region selected by the user.

[0041] Subsequently, in response to the display on the remote terminal 31, the user sets the temperature, the humidity, the air direction, the air volume and so forth to be set.

[0042] Subsequently, the remote terminal 31 transmits a signal including setting information regarding the temperature, the humidity, the air direction, the air volume and so forth to be set, associated with information regarding the selected region, to the air conditioner 21.

[0043] Subsequently, the transmission reception unit 261 receives the signal transmitted from the remote terminal 31 including the setting information associated with the information regarding the selected region, and the reference thermal distribution generation unit 240 generates the reference thermal distribution information by using the setting information.

[0044] Then, based on the thermal distribution information and the reference thermal distribution information, the air blow control unit 250 executes the air blow control so that the difference between the thermal distribution information and the reference thermal distribution information decreases.

[0045] While the procedure in which the air conditioner 21 at the startup of the operation automatically transmits the thermal distribution information has been described above, it is also possible to let the user transmit a transmission signal indicating a request for the present thermal distribution information from the remote terminal 31 and make the air conditioner 21 transmit the requested thermal distribution information from the transmission reception unit 261 after the reception of the transmission signal by the transmission reception unit 261.

[0046] Displaying the present thermal distribution information to the user as above enables the user to grasp the present thermal distribution. Incidentally, it is possible to let the user check a temporal change in the thermal distribution information if past thermal distribution information generated for a plurality of times is transmitted and the past thermal distribution information is continuously displayed together with information indicating the time of generating each piece of thermal distribution information.

[0047] Further, the reference thermal distribution information generated by the reference thermal distribution generation unit 240 based on the setting information may also be transmitted to the remote terminal 31 via the transmission reception unit 261. In this case, the remote terminal 31 is enabled to display also the reference thermal distribution information transmitted from the transmission reception unit 261 to the user, and the user is enabled to grasp the present settings. Further, by converting the thermal distribution information and the reference thermal distribution information into an image of the thermal distribution information and the reference thermal distribution information superimposed together and displaying the image, it is possible to facilitate the user to grasp the present thermal distribution information and the reference thermal distribution information targeted by the setting.

[0048] It goes without saying that the remote terminal 31 is not limited to the remote control specifically for the air conditioner and similar effects can be achieved even if the remote terminal 31 is a smartphone, a tablet, a PC or the like in which an application capable of dealing with the above-described display and setting has been installed.

[0049] Further, it is also possible to acquire respective setting information from a plurality of remote terminals 31. In that case, the reference thermal distribution generation unit 240 generates the reference thermal distribution by integrating the plurality of pieces of setting information. When different settings are received for the same position, the situation is dealt with by employing a method of prioritizing the setting by the setting information acquired earlier, a method of transmitting information

indicating that different settings have been received to the remote terminal 31 and thereafter prioritizing a setting received latter when different settings are received anew for the same position, a method of displaying the reference thermal distribution information after undergoing an intermediate setting between the different settings for the same position, or the like.

Third Embodiment

[0050] Fig. 5 is a block diagram schematically showing the configuration of an air conditioner 22 according to a third embodiment. The third embodiment differs from the above-described embodiment in including a storage unit 270.

[0051] The storage unit 270 previously stores user position information in which user information and a staying position of each user in the region are associated with each other.

[0052] Figs. 6(a) and 6(b) are diagrams showing the staying position of each user in the region. Fig. 6(a) is a seat layout diagram 42 indicating each coordinate position in the region where there is a seat, and Fig. 6(b) shows a table 60 in which each user and a staying position (seat) are associated with each other. Fig. 6(b) indicates that a coordinate position representing a seat position of a person whose user ID is 50a is (x1, y1), a coordinate position representing a seat position of a person whose user ID is 50b is (x1, y2), a coordinate position representing a seat position of a person whose user ID is 50c is (x1, y3), and a coordinate position representing a seat position of a person whose user ID is 50z is (xm, ym) .

[0053] In a situation where employees work at predetermined seats in an office as the workplace, for example, there are cases where who uses which seat has previously been determined. In such cases, data in which a user ID as information associated with each user and coordinate position information representing the seat position of the user are associated with each other is previously stored in the storage unit 270.

[0054] In Fig. 5, the illustration is given on the assumption that each user carries a remote terminal 32. Each remote terminal 32 transmits information including the user ID for identifying the user using the remote terminal 32. In this case, it is permissible even if the user just specifies setting information such as the set temperature for the user's staying position without selecting the position in the region for which the setting is desired to be made.

[0055] A reception unit 262 receives a signal including the setting information and information on the user ID from each remote terminal 32 and outputs the signal to a setting information acquisition unit 232.

[0056] Based on the information on the user ID acquired together with the setting information acquired from the reception unit 262 and the data stored in the storage unit 270 while being associated with the coordinate position information representing the seat position regarding the user ID, the setting information acquisition unit 232 regards the coordinate position associated with the user ID of the user who transmitted the setting information acquired from the reception unit 262 as the position for which the setting is desired to be made by use of the setting information, and supplies the reference thermal distribution generation unit 240 with the position for which the setting is desired to be made and the setting information.

[0057] As above, in the present embodiment, even if the remote terminal 32 has no user interface for specifying the setting information after specifying the setting position, similar effects can be achieved even by use of a simple application that just transmits setting information such as temperature and humidity at the user's own seating position.

[0058] Further, the reception unit 262 may also work as a transmission reception unit and transmit the thermal distribution information and the generated reference thermal distribution information to each remote terminal as in the second embodiment.

[0059] Furthermore, while the storage unit 270 stores the data in which each user ID and the staying position (seat) are associated with each other, the storage unit 270 may further store transmission history records indicating what kinds of settings each user transmitted in the past. Then, it is possible to acquire information indicating that a user is heading for a room equipped with the air conditioner 23 and previously generate reference thermal distribution information based on the transmission history records and incorporate the generated reference thermal distribution information into the reference thermal distribution information before the user enters the region. For example, a comparison is made between a setting made in the past by the user about to enter the region and the present thermal distribution information at the seat position of the user, the control is executed by incorporate the generated reference thermal distribution information into the reference thermal distribution from a time point before the user after entering the room transmits the setting if the difference is greater than a prescribed threshold value, and the generated reference thermal distribution information is not incorporated into the reference thermal distribution until the user after entering the room transmits the setting if the difference is less than or equal to the prescribed threshold value. In this case, similar effects can be achieved even if the storage unit 270 stores not the transmission history records but setting history records.

[0060] Fig. 7 shows an example of data stored in the storage unit 270 according to the present embodiment as a table 61. In Fig. 7, the seat position of each user, premises entry/exit information on the user, and information representing a transmission history record indicating what kind of setting the user transmitted the previous time are stored while being associated with the user ID.

[0061] If the doorway to a building or floor including the

room equipped with the air conditioner 23 has been equipped with an entry/exit management system that opens and closes the doorway according to user authentication, for example, information obtained by the entry/exit management system is utilized as the premises entry/exit information. If the doorway to the building premises including the room equipped with the air conditioner 23 has been equipped with a premises entry/exit management system that opens and closes the doorway according to the user authentication, information obtained by the premises entry/exit management system is utilized as the premises entry/exit information.

[0062] With this configuration, it becomes possible to make a setting adapted to the user's preference at a time point before the user enters the room equipped with the air conditioner 23.

Fourth Embodiment

[0063] Fig. 8 is a block diagram schematically showing the configuration of an air conditioning system according to the present embodiment. In the present embodiment, a description will be given of an air conditioning system including a plurality of air conditioners 23 and a centralized control device 70 communicatively connected to the plurality of air conditioners 23.

[0064] While the description in the above embodiments has been given by taking a configuration in which the air conditioner includes the control unit as an example, the present embodiment is implemented by independently providing the centralized control device 70 as a device corresponding to the control unit and transmitting control information respectively to each air conditioner 23.

[0065] The centralized control device 70 in Fig. 8 is shown in correspondence with the air conditioner 20 shown in Fig. 1. In Fig. 8, the centralized control device 70 is communicatively connected to three air conditioners 23a, 23b and 23c. This connection is not limited to wired connection; even a condition of having been communicatively connected by radio works.

[0066] Based on the thermal distribution information supplied from the thermal distribution generation unit 220 and the reference thermal distribution information supplied from the reference thermal distribution generation unit 240, a control information generation unit 710 generates control information for controlling each air conditioner 23 so that the difference between the thermal distribution information and the reference thermal distribution information decreases. Here, the control information generation unit 710 is assumed to have grasped position information indicating the position where each air conditioner 23 has been installed.

[0067] A communication unit 720 transmits the control information generated by the control information generation unit 710 to each air conditioner 23. In this case, it is permissible even if the control information is transmitted to each air conditioner 23. Further, it is permissible even if a device ID is previously assigned to each air conditioner 23 and the control information is transmitted together with the device ID.

[0068] Each air conditioner 23 receives a transmission signal from the centralized control device 70 including the control information, and when the received control information includes control information relevant to the air conditioner 23 itself, carries out the air blow by adjusting the temperature, the humidity, the air direction and the air volume of the air blown out according to the control information.

[0069] As above, even in a region equipped with the plurality of air conditioners 23, the effects can be achieved in the whole of the region equipped with the plurality of air conditioners 23 if the centralized control device 70 communicatively connected to the air conditioners 23 generates the thermal distribution information and the reference thermal distribution information in the region and executes the control of each air conditioner 23 so that the difference between the thermal distribution information and the reference thermal distribution information decreases.

[0070] The communication unit 720 may also be configured to receive information supplied from a temperature sensor 10 communicatively connected to each air conditioner 23 and send the information to the temperature information acquisition unit 210. By such a method, the centralized control device 70 is capable of acquiring the temperature information in the region even if there is no temperature sensor 10 directly and communicatively connected to the centralized control device 70.

[0071] Further, the communication unit 720 may also be configured to receive information supplied from a remote terminal 30 communicatively connected to each air conditioner 23 and send the information to the setting information acquisition unit 230. By such a method, the centralized control device 70 is capable of acquiring the setting information from a user in the region even if there is no remote terminal 30 directly and communicatively connected to the centralized control device 70.

[0072] In such a situation where the centralized control device 70 is directly connected to no temperature sensor 10 or remote terminal 30, the centralized control device 70 does not need to be provided in the pertinent region, and the centralized control device 70 is capable of executing its functions not only in an edge server inside the premises but also in a cloud server or the like outside the premises that is communicatively connected to each air conditioner 23 via the Internet.

[0073] While the centralized control device 70 in Fig. 8 is shown in correspondence with the air conditioner 20 shown in Fig. 1, it goes without saying that the effects of each embodiment can be achieved even if the centralized control device 70 is configured in correspondence with the air conditioner 21 in Fig. 4 or the air conditioner 22 in Fig. 5.

[0074] The centralized control device 70 is capable of executing its functions in a computer server or the like.

[0075] Fig. 9 is a diagram showing the centralized control device 70 by using a processor. The processor 711 is connected to a memory 712, a key input-output interface (hereinafter represented to as I/F) 713, a data input-output I/F 715 and a display output I/F 714.

[0076] The processor 711 is hardware that operates when a program for executing a process in the present disclosure is executed by using the memory 712. The key input-output I/F 713 is connected to a keyboard, a touch key device such as the remote terminal 30, or the like, and is used when a threshold value from the user is set. The data input-output I/F 715 is connected to the temperature sensor 10 and is used when the temperature information is acquired. The data input-output I/F 715 is used also when the premises entry/exit information is acquired.

[0077] It is also possible to connect the data input-output I/F 715 to an external storage device and record the user position information, the previous setting information regarding each user, installation position information regarding each air conditioner 23, and so forth by making access to the external storage device (not shown). The display output I/F 714 is used for purposes such as displaying the thermal distribution information.

[0078] When there is a program executing the above-described method, even such a centralized control device 70 using a processor achieves the effects by executing the program.

[0079] Dislosed are, in particular, air conditioners and air conditioning systems, which are related to the invention, according to the following aspects:

1. An air conditioner comprising:

a temperature information acquisition unit to acquire a result of detecting temperature information in a region;
a thermal distribution generation unit to generate thermal distribution information in the region from the temperature information;
a reference thermal distribution generation unit to generate reference thermal distribution information in the region; and
an air blow control unit to control an air blow setting so that a difference between the thermal distribution information and the reference thermal distribution information decreases.

2. The air conditioner according to aspect 1, wherein the air blow control unit adjusts the air blow setting by using a temporal change in the difference between the thermal distribution information and the reference thermal distribution information in accordance with the control of the air blow setting.

3. The air conditioner according to aspect 1 or 2, comprising a setting information acquisition unit to acquire setting information regarding a position in the region, wherein

the setting information includes temperature setting information or relative temperature setting information, and
the reference thermal distribution generation unit generates the reference thermal distribution information based on the temperature setting information or the relative temperature setting information regarding each position acquired by the setting information acquisition unit.

4. The air conditioner according to aspect 3, wherein

the setting information includes air volume setting information, and
the air blow control unit controls the air blow setting corresponding to the air volume setting information regarding each position acquired by the setting information acquisition unit.

5. The air conditioner according to aspect 3 or 4, further comprising a transmission reception unit to transmit the thermal distribution information in the region generated by the thermal distribution generation unit and to receive user setting information including position information specifying a certain position in the region and the setting information regarding the specified position,
wherein the setting information acquisition unit acquires the setting information corresponding to the position information received by the transmission reception unit.

6. The air conditioner according to aspect 5, wherein

the transmission reception unit receives a plurality of pieces of the user setting information, and
the setting information acquisition unit acquires the setting information corresponding to each piece of the position information received by the transmission reception unit.

7. The air conditioner according to aspect 3 or 4, comprising:

a storage unit to store user position information in which user information previously assigned to a user and a staying position of the user in the region are associated with each other; and
a reception unit to receive second user setting information including the user information and the setting information specified by the user,
wherein the setting information acquisition unit estimates a setting position in the region based on the user information included in the second user setting information received by the recep-

tion unit and the user position information and acquires the setting information included in the second user setting information while associating the setting information with the setting position.

8. The air conditioner according to aspect 7, comprising an entry/exit information acquisition unit to acquire site entry/exit information indicating entry/exit information regarding each piece of the user information in a site including the region, wherein

the storage unit stores the user information and transmission history records of the setting information regarding each user, and
the reference thermal distribution generation unit identifies a user about to enter the region or having exited from the region based on the site entry/exit information and generates the reference thermal distribution information by using the transmission history records regarding each identified user.

9. An air conditioning system comprising:

a plurality of air conditioners to acquire control information and to control an air blow setting based on the acquired control information;
a temperature information acquisition unit to acquire a result of detecting temperature information in a region equipped with the plurality of air conditioners;
a thermal distribution generation unit to generate thermal distribution information in the region from the temperature information;
a reference thermal distribution generation unit to generate reference thermal distribution information in the region;
a control information generation unit to generate the control information for controlling each of the air conditioners so that a difference between the thermal distribution information and the reference thermal distribution information decreases; and
a transmission unit to transmit the control information to each of the air conditioners.

DESCRIPTION OF REFERENCE CHARACTERS

[0080] 10: temperature sensor, 20: air conditioner, 30: remote terminal, 210: temperature information acquisition unit, 220: thermal distribution generation unit, 230: setting information acquisition unit, 240: reference thermal distribution generation unit, 250: air blow control unit.

Claims

1. An air conditioner (20-22) comprising:

a temperature information acquisition unit (210) to acquire a result of detecting temperature information in a region;
a thermal distribution generation unit (220) to generate thermal distribution information in the region from the temperature information;
a reference thermal distribution generation unit (240) to generate reference thermal distribution information in the region;
an air blow control unit (250) to control an air blow setting so that a difference between the thermal distribution information and the reference thermal distribution information decreases;
a setting information acquisition unit (230) to acquire setting information in each of positions in the region;
a storage unit (270) to store user position information in which the user information and a staying position of the user in the region are associated with each other; and
a reception unit (262) to receive user setting information including the user information and the setting information specified by the user, wherein
the setting information includes temperature setting information or relative temperature setting information,
the reference thermal distribution generation unit (240) generates the reference thermal distribution information based on the temperature setting information or the relative temperature setting information regarding each position acquired by the setting information acquisition unit (230), and
the setting information acquisition unit (230) estimates a setting position in the region based on the user information included in the user setting information received by the reception unit (262) and the user position information and acquires the setting information included in the user setting information while associating the setting information with the setting position.

FIG. 1

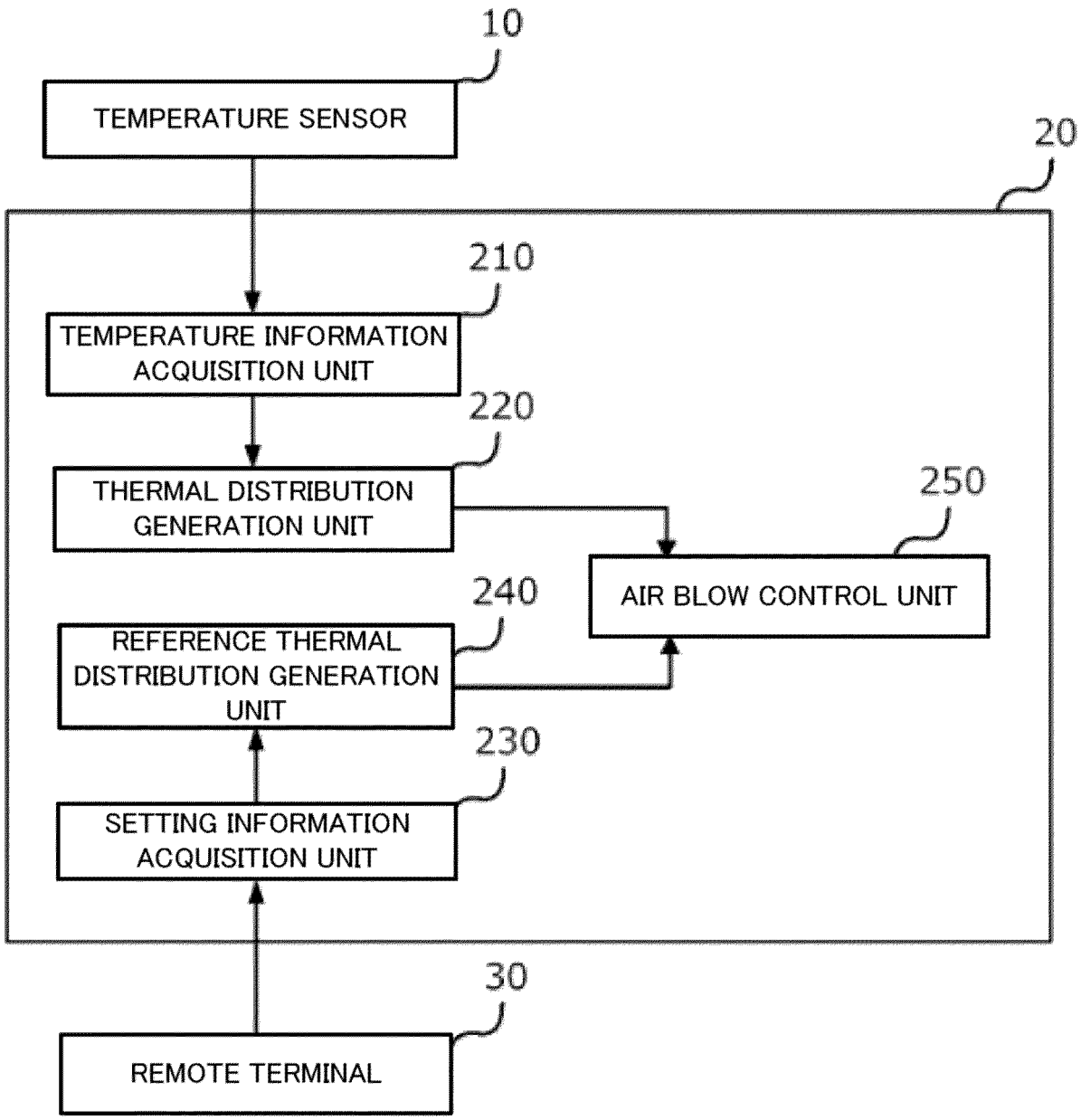

10
TEMPERATURE SENSOR
20
210
TEMPERATURE INFORMATION ACQUISITION UNIT
220
THERMAL DISTRIBUTION GENERATION UNIT
250
AIR BLOW CONTROL UNIT
240
REFERENCE THERMAL DISTRIBUTION GENERATION UNIT
230
SETTING INFORMATION ACQUISITION UNIT
30
REMOTE TERMINAL

FIG. 2(a)

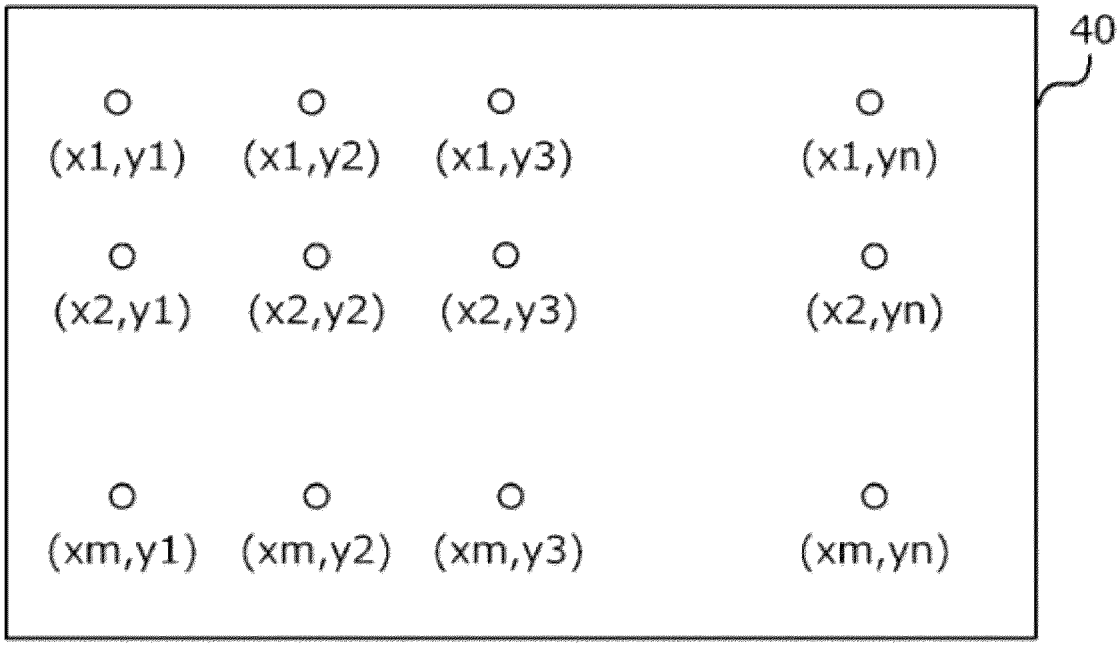

40
(x1,y1)
(x1,y2)
(x1,y3)
(x1,yn)
(x2,y1)
(x2,y2)
(x2,y3)
(x2,yn)
(xm,y1)
(xm,y2)
(xm,y3)
(xm,yn)

FIG. 2(b)

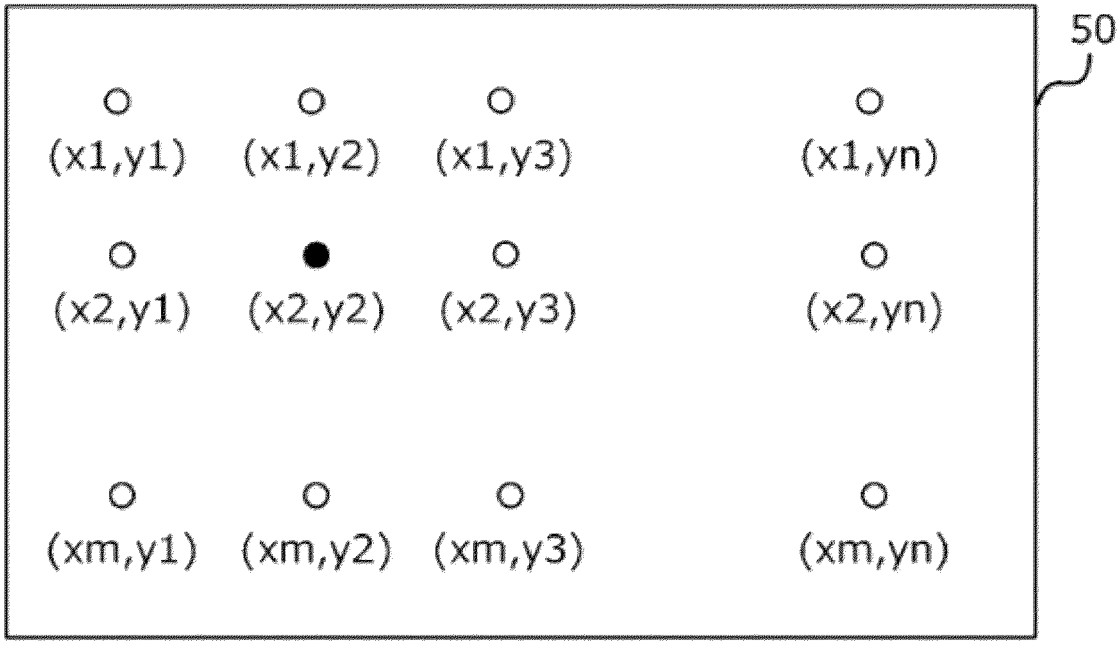

50
(x1,y1)
(x1,y2)
(x1,y3)
(x1,yn)
(x2,y1)
(x2,y2)
(x2,y3)
(x2,yn)
(xm,y1)
(xm,y2)
(xm,y3)
(xm,yn)

FIG. 3(a)

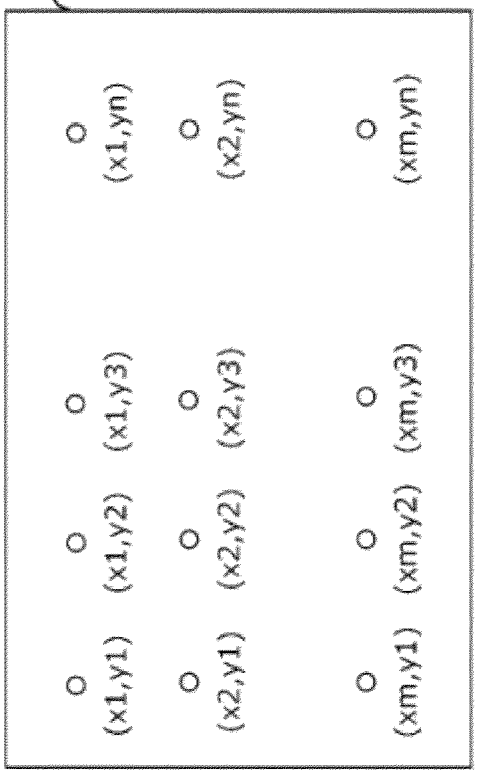


FIG. 3(b)

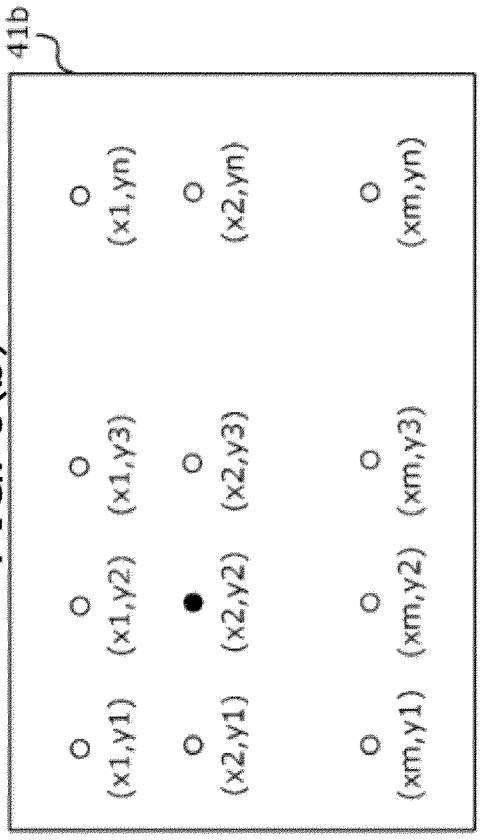


FIG. 3(c)

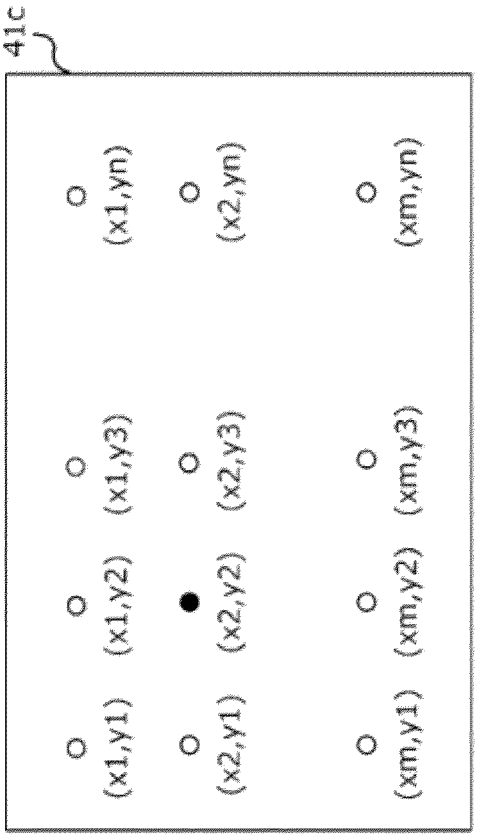


FIG. 3(d)

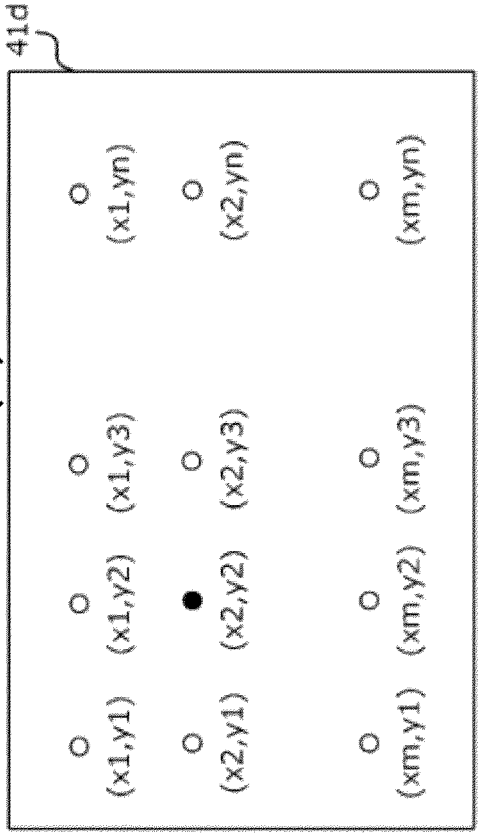


FIG. 4

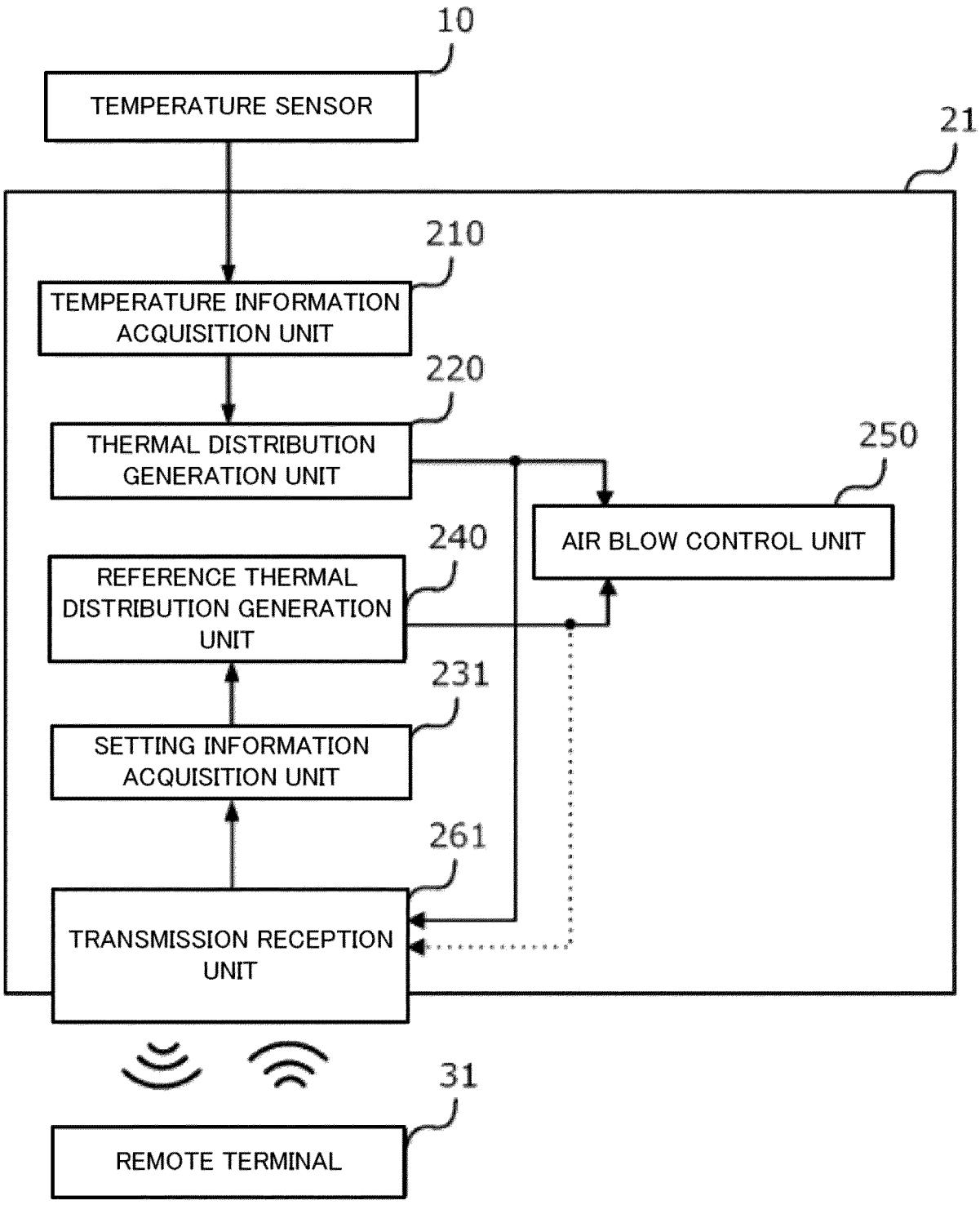

10
TEMPERATURE SENSOR
21
210
TEMPERATURE INFORMATION ACQUISITION UNIT
220
THERMAL DISTRIBUTION GENERATION UNIT
250
AIR BLOW CONTROL UNIT
240
REFERENCE THERMAL DISTRIBUTION GENERATION UNIT
231
SETTING INFORMATION ACQUISITION UNIT
261
TRANSMISSION RECEPTION UNIT
31
REMOTE TERMINAL

FIG. 5

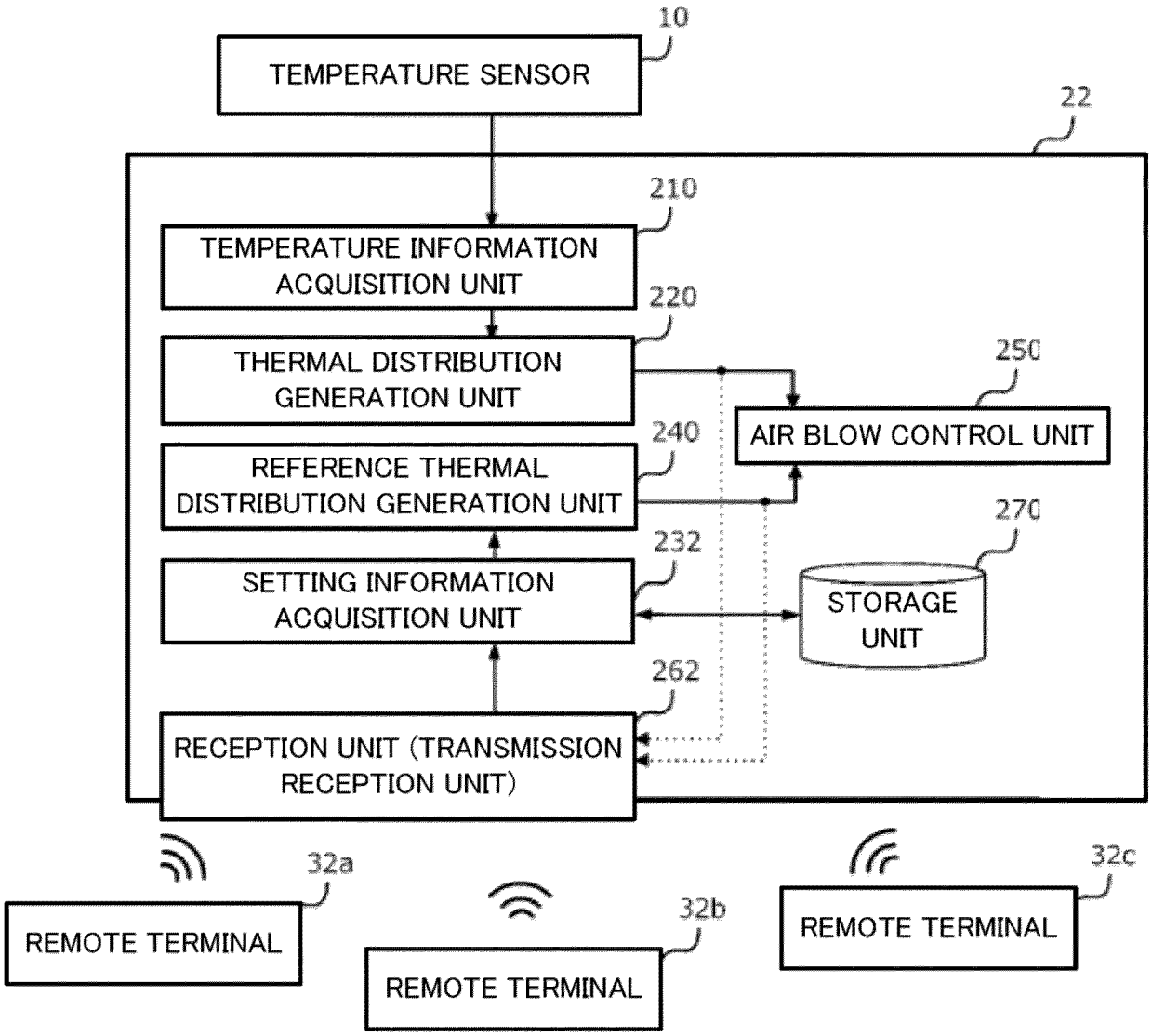

10
TEMPERATURE SENSOR
22
210
TEMPERATURE INFORMATION ACQUISITION UNIT
220
THERMAL DISTRIBUTION GENERATION UNIT
250
AIR BLOW CONTROL UNIT
240
REFERENCE THERMAL DISTRIBUTION GENERATION UNIT
270
232
SETTING INFORMATION ACQUISITION UNIT
STORAGE UNIT
262
RECEPTION UNIT (TRANSMISSION RECEPTION UNIT)
32a
REMOTE TERMINAL
32b
REMOTE TERMINAL
32c
REMOTE TERMINAL

FIG. 6(a)

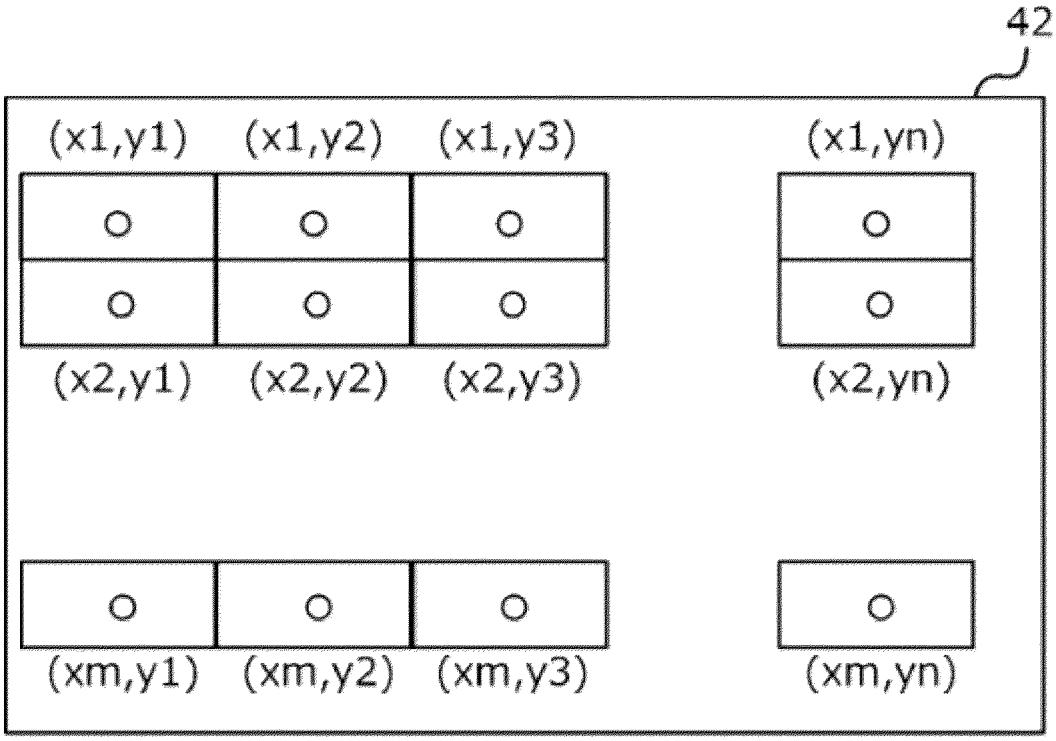


FIG. 6(b)

60

USER ID	SEAT POSITION
50a	(x1,y1)
50b	(x1,y2)
50c	(x1,y3)
—	—
50z	(xm,yn)

FIG. 7

61

USER ID	SEAT POSITION	PREMISES ENTRY/ EXIT INFORMATION	PREVIOUS SETTING INFO.
50a	(x1,y1)	In	26°C, 60%, AIR VOLUME: LOW
50b	(x1,y2)	In	27°C, 60%, AIR VOLUME: LOW
50c	(x1,y3)	Out	26°C, 60%, AIR VOLUME: HIGH
:	:	:	:
50z	(xm,yn)	In	27°C, 70%, AIR VOLUME: LOW

FIG. 8

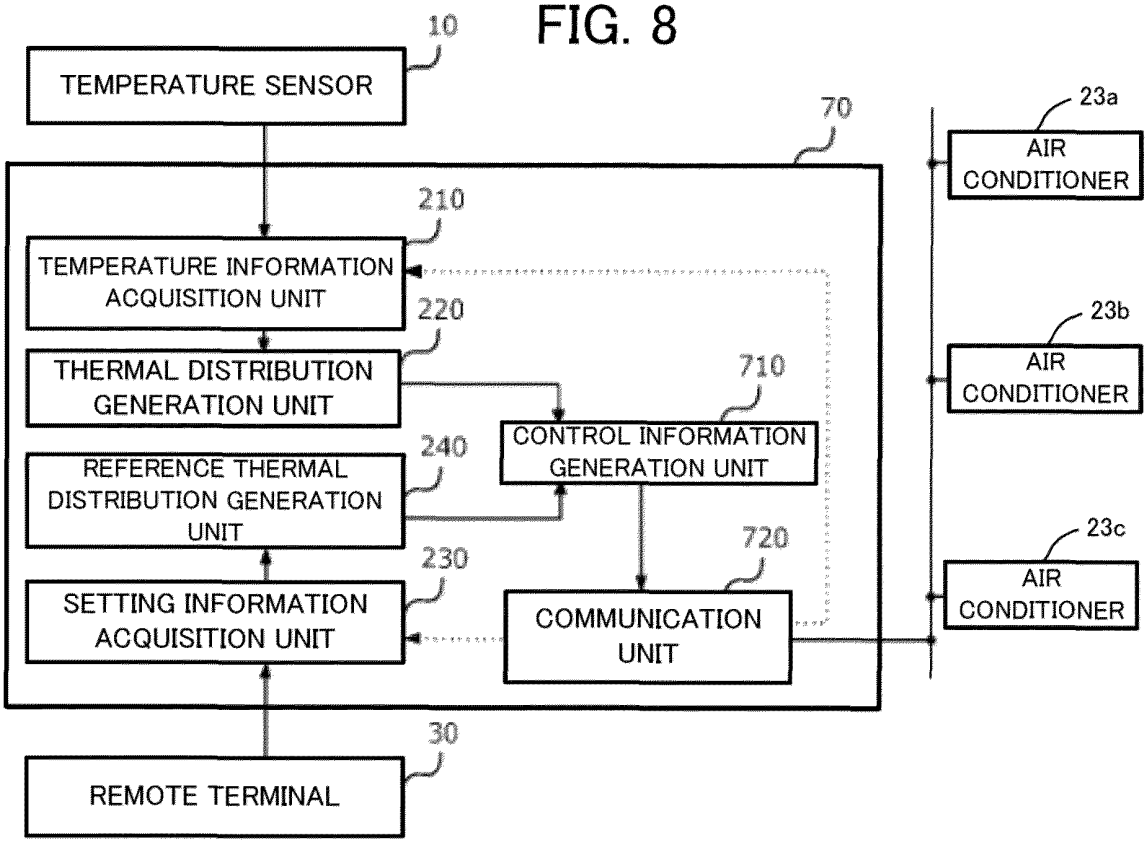
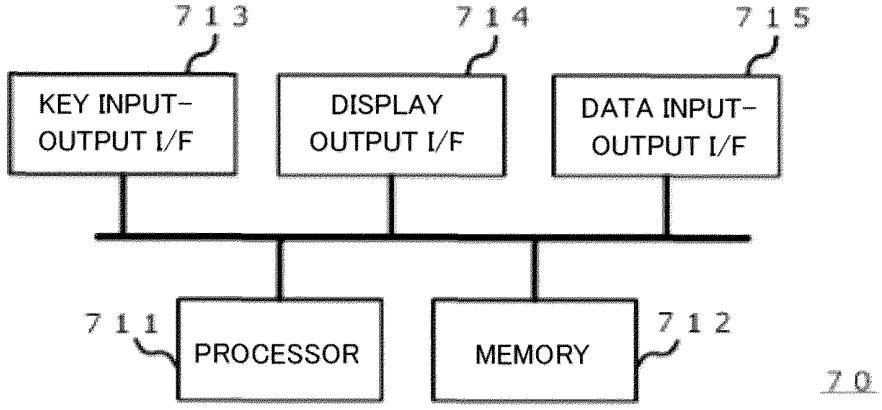


FIG. 9



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Patent documents cited in the description

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