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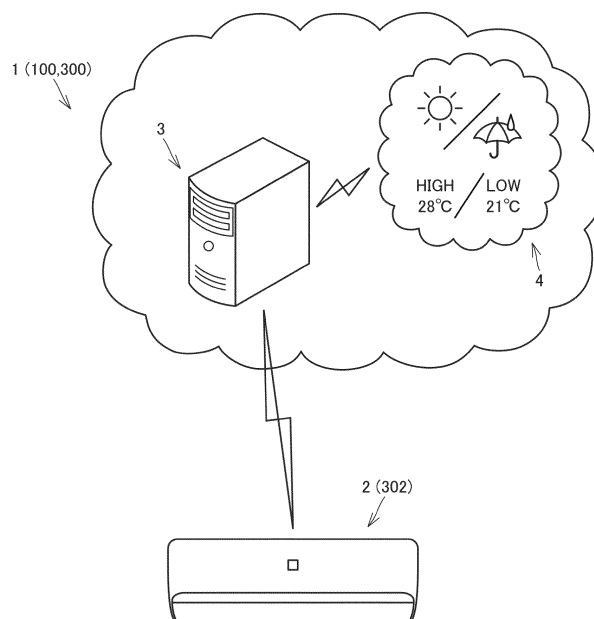
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(54) **AIR-CONDITIONING CONTROL SYSTEM**

(57) An air-conditioning control system (1) has a server (3). The server (3) is capable of communicating with an air conditioner (2) via a network such as the Internet. The server (3) can obtain weather report data (4) via a network such as the Internet. The server (3) includes a memory (storage unit) storing a plurality of operation

control tables for determining a method of operation of the air conditioner (2); a control unit that selects an operation control table by using the weather report data (4); and a transmission unit (communication interface) that sends the operation control table selected by the control unit to the air conditioner (2).

[FIG. 1]



Description

Technical Field

[0001] The present invention relates to an air-conditioning control system that controls the operation of an air conditioner.

Background Art

[0002] An air conditioner that has different operation modes such as cooling operation and heating operation can operate in an operation mode called automatic operation. In an automatic operation mode, the air conditioner obtains information such as the temperature outside of a room (outside temperature), and the inside temperature (room temperature), and selects settings, such as the optimum method of operation, and a set temperature, using such information.

[0003] Various studies are made with regard to methods for controlling the automatic operation of an air conditioner, including selection of a cooling operation and a heating operation in in-between seasons, and optimization of the set temperature. As an example of a control method that takes into consideration in-between seasons, a method is available that controls the operation mode and the set temperature according to the calendar, using the calendar information obtained by an air conditioner.

[0004] PTL 1 proposes an air conditioner that allows selection of an operation mode that provides a comfortable feel, and more delicate selection of a set temperature in automatic operation. The air conditioner proposed by this related art generates automatic operation information for controlling the automatic operation of the air conditioner, using environment information obtained by sensors such as an inside temperature sensor and an outside temperature sensor, regional information of the area where the air conditioner is installed, and calendar information to which the current date and time belong.

Citation List

Patent Literature

[0005] PTL 1: JP-A-2014-9932

Summary of Invention

Technical Problem

[0006] However, a drawback of the traditional method in which parameters such as the operation mode and the set temperature are determined according to the calendar is that the automatic operation may fail to reflect the actual situations when the climate does not follow the usual seasonal patterns, such as when the cold weather returns, or the summer is long.

[0007] Accordingly, the present invention is intended to provide an air-conditioning control system that can control an air conditioning operation in a way that more accurately reflects the location and the changing environment of the place where the air conditioner is installed.

Solution to Problem

[0008] According to an aspect of the present invention, there is provided an air-conditioning control system that includes:

a storage unit storing a plurality of operation control tables for determining a method of operation of an air conditioner;
a control unit that selects one of the operation control tables by using prediction data concerning weather; and
a transmission unit that sends the operation control table selected by the control unit to the air conditioner.

[0009] According to another aspect of the present invention, there is provided an air-conditioning control system that includes:

a storage unit storing a plurality of operation control tables for determining a method of operation of an air conditioner;
a receiving unit that receives information of an outside temperature and a room temperature of a place where the air conditioner is installed;
a control unit that selects one of the operation control tables by using prediction data concerning weather, and produces a control signal for controlling a method of operation of the air conditioner, the control signal being produced according to the selected operation control table and the information of the outside temperature and the room temperature; and
a transmission unit that sends the control signal to the air conditioner.

[0010] According to yet another aspect of the present invention, there is provided an air-conditioning control system that includes:

a receiving unit that receives prediction data concerning weather information;
a heat pump cycle that includes a compressor for compressing a heat carrier, an inside heat exchanger, an expansion valve for decompressing the heat carrier, and an outside heat exchanger;
a storage unit storing a plurality of operation control tables for determining a method of operation of the heat pump cycle; and
a control unit that selects an operation control table stored in the storage unit by using the prediction data, and controls operation of the heat pump cycle by

using the selected operation control table.

[0011] In the air-conditioning control system according to the aspect of the present invention, the prediction data may contain data of predicted lowest temperature and predicted highest temperature.

[0012] In the air-conditioning control system according to the aspect of the present invention, the prediction data may further contain sky condition prediction data, and the control unit may correct the operation control table by using the sky condition prediction data.

[0013] In the air-conditioning control system according to the aspect of the present invention, the control unit may obtain data of an atmospheric pressure of a place where the air conditioner or the air-conditioning control system is installed, and may select an operation control table stored in the storage unit by further taking into account the atmospheric pressure data.

[0014] In the air-conditioning control system according to the aspect of the present invention, the control unit may obtain seasonal data concerning a current season, and may select an operation control table stored in the storage unit by further taking into account the seasonal data.

[0015] In the air-conditioning control system according to the aspect of the present invention, the control unit may obtain local data concerning an area where the air conditioner or the air-conditioning control system is installed, and may correct the operation control table by using the local data.

[0016] In the air-conditioning control system according to the aspect of the present invention, the plurality of operation control tables may include a summer table, a winter table, and a basic table.

[0017] In the air-conditioning control system according to the aspect of the present invention, the operation control table may be a table in which an outside temperature, a room temperature, and an operation method determined by using an outside temperature and a room temperature are related to one another. The operation control table may contain information in which an outside temperature, a room temperature, and a set temperature of the air conditioner determined by using an outside temperature and a room temperature are related to one another.

Advantageous Effects of Invention

[0018] As stated above, the air-conditioning control system of the aspect of the present invention has enabled control of an air conditioning operation in a way that more accurately reflects the location and the changing environment of the place where the air conditioner is installed.

Brief Description of Drawings

[0019]

FIG. 1 is a schematic view showing an overall configuration of an air-conditioning control system according to First Embodiment of the present invention. FIG. 2 is a block diagram showing an inner configuration of an air conditioner constituting the air-conditioning control system shown in FIG. 1.

FIG. 3 is a schematic view showing an overall configuration of the air conditioner constituting the air-conditioning control system shown in FIG. 1.

FIG. 4 is a block diagram showing an inner configuration of a server constituting the air-conditioning control system shown in FIG. 1.

FIG. 5 is a diagram representing the relationship between forecast temperature (highest temperature/lowest temperature) and tables used in the air-conditioning control system shown in FIG. 1.

FIG. 6 is a diagram representing an example of a summer table used for operation control of the air conditioner in the air-conditioning control system shown in FIG. 1.

FIG. 7 is a diagram representing an example of a winter table used for operation control of the air conditioner in the air-conditioning control system shown in FIG. 1.

FIG. 8 is a diagram representing an example of a basic table or a spring table used for operation control of the air conditioner in the air-conditioning control system shown in FIG. 1.

FIG. 9 is a diagram representing an example of a fall table used for operation control of the air conditioner in the air-conditioning control system shown in FIG. 1.

FIG. 10 is a flowchart representing the procedures of operation control of the air conditioner in the air-conditioning control system shown in FIG. 1, in which FIG. 10(a) shows the procedures of operation control on the server side, and FIG. 10 (b) shows the procedures of operation control on the air conditioner side.

FIG. 11 is a flowchart representing the procedures of operation control of an air conditioner in an air-conditioning control system according to Second Embodiment of the present invention.

FIG. 12 is a flowchart representing the procedures of operation control of an air conditioner in an air-conditioning control system according to Third Embodiment of the present invention.

FIG. 13 is a schematic view showing a schematic structure of an air-conditioning control system according to Fourth Embodiment of the present invention.

FIG. 14 is a block diagram showing an inner configuration of a smartphone constituting the air-conditioning control system shown in FIG. 13.

FIG. 15 is a block diagram showing an inner configuration of an air conditioner constituting an air-conditioning control system according to Fifth Embodiment of the present invention.

FIG. 16 is a block diagram showing a configuration of an air conditioner according to Sixth Embodiment of the present invention.

Description of Embodiments

[0020] Embodiments of the present invention are described below with reference to the accompanying drawings. In the following descriptions, like elements are given like reference numerals. Such like elements will be referred to by the same names, and have the same functions. Accordingly, detailed descriptions of such elements will not be repeated.

First Embodiment

[0021] First Embodiment describes an example in which an air-conditioning control system of an aspect of the present invention is applied to a network system that is configured to include a server and an air conditioner that can communicate with each other via a network such as the Internet. Specifically, the following describes an example of an air-conditioning control system in which an air conditioner, and a server that provides services for controlling operations of the air conditioner are connected to each other via a network (the Internet).

[0022] FIG. 1 shows an overall configuration of an air-conditioning control system 1 according to First Embodiment (hereinafter, also referred to simply as "system"). The air-conditioning control system 1 is configured mainly from an air conditioner 2 and a server 3. The air conditioner 2 and the server 3 can communicate with each other via a network such as the Internet. As shown FIG. 1, the server 3 can obtain weather report data (prediction data concerning weather) 4 via a network such as the Internet.

[0023] As used herein, "weather" refers to weather conditions at a specific location at a specific time. The term "weather" as used herein is also used to refer to temperature, humidity, sky conditions (e.g., sunny, rainy, or cloudy), wind speed, cloudiness, amount of sunlight, and atmospheric pressure, either individually or as a combination. As used herein, "weather report data (prediction data concerning weather)" means data predicting the future weather by, for example, week, day, or hour.

Configuration of Air Conditioner

[0024] The following describes an overall configuration of an air conditioner 2 constituting the air-conditioning control system 1, along with an overview of its basic operations. The air conditioner 2 according to the present embodiment can operate in more than one operation mode, for example, cooling, heating, dehumidifying, and fan modes. The air conditioner 2 according to the present embodiment can also operate in automatic operation mode according to instructions from the server 3 communicably connected via the Internet.

[0025] Here, the automatic operation means an operation mode in which various methods of operation of the air conditioner 2, including cooling, heating, dehumidifying, and fan modes, are automatically determined by the air-conditioning control system 1, instead of being selected by a user. That is, the air conditioner 2 can operate, broadly, in two operation modes: automatic operation mode, and manual operation mode in which a user manually selects the type of operation. The manual operation mode includes more than one operation mode (operation method), for example, cooling, heating, dehumidifying, and fan modes.

[0026] In the automatic operation, the server 3 obtains the weather report data 4 on the cloud, and, by using the weather report data 4, selects an operation control table for determining parameters of the air conditioner 2, such as a method of operation, and a set temperature. The operation control table selected in the server 3 is sent to the air conditioner 2. By using the operation control table sent from the server 3, the air conditioner 2 determines the method of operation. Specifically, the air conditioner 2 refers to the operation control table, and selects a suitable method of operation, using information of the current outside temperature and the current room temperature of the environment in which the air conditioner 2 is installed.

[0027] FIG. 2 shows an inner configuration of the air conditioner 2. FIG. 3 shows an overall configuration of the air conditioner 2. In FIG. 3, the flow of a refrigerant (heat carrier) is indicated by solid arrow in a cooling operation of the air conditioner 2, and by broken arrow in a heating operation of the air conditioner 2. In a dehumidifying operation, the humidity inside a room is reduced by circulating the refrigerant in a heat pump cycle in the same manner as in a cooling operation. In fan mode, the heat pump cycle stops its operation, and only an inside fan 13 comes into operation.

[0028] As shown in FIGS. 2 and 3, the air conditioner 2 according to the present embodiment is a separate-type air conditioner, and is configured mainly from an indoor unit 10 and an outdoor unit 50. The air conditioner 2 is configured by connecting the indoor unit 10 and the outdoor unit 50 via refrigerant pipes 57 and 58. The outdoor unit 50, the indoor unit 10, and the refrigerant pipes 57 and 58 are described below in detail.

(1) Outdoor Unit

[0029] The outdoor unit 50 is configured mainly from a cabinet 51, a compressor 52, a four-way switching valve 53, an outdoor heat exchanger 54, an expansion valve 55, an outside fan 56, a two-way valve 59, a three-way valve 60, and an outside thermometer 62. The outdoor unit 50 is installed outside.

[0030] The cabinet 51 houses the compressor 52, the four-way valve 53, the outdoor heat exchanger (outside heat exchanger) 54, the expansion valve 55, the outside fan 56, the two-way valve 59, and the three-way valve

60, among others.

[0031] The compressor 52 has an exhaust pipe 52a and an intake pipe 52b. The exhaust pipe 52a and the intake pipe 52b are connected to different connection ports of the four-way switching valve 53. During its operation, the compressor 52 takes in a low-pressure refrigerant gas through the intake pipe 52b, and compresses the refrigerant gas to produce a high-pressure refrigerant gas. The high-pressure refrigerant gas discharges through the exhaust pipe 52a.

[0032] The four-way switching valve 53 is connected to the exhaust pipe 52a and the intake pipe 52b of the compressor 52, and to the outdoor heat exchanger 54 and an indoor heat exchanger 12 via refrigerant pipes. During its operation, the four-way switching valve 53 switches the route of the refrigeration cycle according to a control signal sent from the control unit 20 (see FIG. 2) of the air conditioner 2. That is, the four-way valve 53 switches the route between a cooling operation state and a heating operation state.

[0033] Specifically, in a cooling operation state, the four-way valve 53 connects the exhaust pipe 52a of the compressor 52 to the outdoor heat exchanger 54, and connects the intake pipe 52b of the compressor 52 to the indoor heat exchanger 12 (see the solid arrow in FIG. 3). In a heating operation state, the four-way valve 53 connects the exhaust pipe 52a of the compressor 52 to the indoor heat exchanger 12, and connects the intake pipe 52b of the compressor 52 to the outdoor heat exchanger 54 (see the broken arrow in FIG. 3).

[0034] The outdoor heat exchanger 54 is of a structure in which large numbers of heat dissipating fins (not illustrated) are attached to a heat exchanger tube (not illustrated) that is horizontally folded back and forth multiple times. The outdoor heat exchanger 54 functions as a condenser in a cooling operation, and as an evaporator in a heating operation.

[0035] The expansion valve 55 is connected at one end to the two-way valve 59 via the refrigerant pipe. The other end is connected to the outdoor heat exchanger 54. In its operation, the expansion valve 55 serves to reduce pressure so that the high-temperature and high-pressure liquid refrigerant flowing out of the condenser (the indoor heat exchanger 12 in a heating operation, and the outdoor heat exchanger 54 in a cooling operation) can be brought to an easily evaporable state, and to adjust the amount of the refrigerant supplied to the evaporator (the outdoor heat exchanger 54 in a heating operation, and the indoor heat exchanger 12 in a cooling operation).

[0036] The outside fan 56 is configured mainly from a propeller fan and a motor. The propeller fan is driven to rotate by the motor, and supplies the outside air to the outdoor heat exchanger 54. The motor operates according to control signals sent from the control unit 20 of the air conditioner 2.

[0037] The two-way valve 59 is connected to the refrigerant pipe 57. The refrigerant pipe 57 connects the

outdoor unit and the indoor unit to each other. The two-way valve 59 is closed when removing the refrigerant pipe 57 from the outdoor unit 50, so that the refrigerant is prevented from leaking out of the outdoor unit 50.

[0038] The three-way valve 60 is connected at one end to the four-way valve 53 via the refrigerant pipe. The other end is connected to the refrigerant pipe 58. This connects the outdoor unit and the indoor unit to each other. The three-way valve 60 is closed when removing the refrigerant pipe 58 from the outdoor unit 50, so that the refrigerant is prevented from leaking out of the outdoor unit 50. When there is a need to collect the refrigerant from the outdoor unit 50, or from the whole refrigeration cycle (cooling mechanism) including the indoor unit 10, the refrigerant is collected through the three-way valve 60.

[0039] The outside thermometer 62 measures the outside temperature of the place the outdoor unit 50 is installed.

20 (2) Indoor Unit

[0040] The main constituting members of the indoor unit 10 include a cabinet 11, the indoor heat exchanger (inside heat exchanger) 12, the inside fan 13, a room thermometer 15, a room hygrometer 16, a speaker 18, a display unit 21, and a communication interface 22. As shown in FIG. 2, the air conditioner 2 has a remote controller 26, separately from the indoor unit 10.

[0041] The cabinet 11 houses the indoor heat exchanger 12, the inside fan 13, the room thermometer 15, the room hygrometer 16, and the control unit 20, among others.

[0042] As shown in FIG. 3, the indoor heat exchanger 12 combines three heat exchangers in the form of a roof (an inverted V shape) over the inside fan 13. These heat exchangers each have a structure in which large numbers of heat dissipating fins (not illustrated) are attached to a heat exchanger tube (not illustrated) that is horizontally folded back and forth multiple times. The heat exchangers function as condensers in a heating operation, and as evaporators in a cooling operation.

[0043] The inside fan 13 is configured mainly from a crossflow fan and a motor. The crossflow fan is driven to rotate by the motor. The crossflow fan takes room air into the cabinet 11, and supplies it to the indoor heat exchanger 12. The crossflow fan sends air into a room after the heat exchange in the indoor heat exchanger 12.

[0044] The room thermometer 15 measures the temperature of the room where the indoor unit 10 is installed. The room thermometer 15 is disposed, for example, in the vicinity of the room air intake opening of the cabinet 11.

[0045] The room hygrometer 16 measures the humidity of the room where the indoor unit 10 is installed. The room hygrometer 16 is disposed, for example, in the vicinity of the room air intake opening of the cabinet 11.

[0046] The speaker 18 provides information such as today's weather forecast, chances of rain, and forecast

temperatures in the form of sounds, for example, when the air conditioner 2 stops operating, using the instructions (for example, sound data produced based on the weather report data 4) sent from the server 3. The speaker 18 may be adapted so that it aurally notifies occupants that the air conditioner 2 has started or ended its operation, or the operation mode has changed, when these events take place. The speaker 18 also may be configured so that it notifies occupants of the current method of operation when the air conditioner 2 is operating in automatic operation mode.

[0047] The control unit 20 is connected to the components of the air conditioner 2, and controls these members. The control unit 20 includes a memory 23, and a timer 24, among others. In the present embodiment, the control unit 20 refers to the operation control table sent from the server 3, and determines the method of operation of the air conditioner 2. The control unit 20 then controls the components of the air conditioner 2 according to the method of operation so determined.

[0048] The memory 23 includes ROM (read only memory) and RAM (Random Access Memory). The memory 23 stores operating programs and settings data for the air conditioner 2. The memory 23 also serves as a temporary storage of the results of calculations made by the control unit 20. The timer 24 counts time, for example, the time of a process performed by the control unit 20, and the operation time of the constituting members of the air conditioner 2, as needed.

[0049] The display unit 21 includes a liquid crystal display panel, and an LED light, among others. The display unit 21 displays information such as the operation status of the air conditioner 2, and warnings, using signals from the control unit 20.

[0050] The communication interface 22 is realized by an antenna and connectors. The communication interface 22 allows data exchange with other devices by means of cable or wireless communications. Specifically, the communication interface 22 receives an infrared signal sent when the remote controller (operation controller) 26 is operated. The communication interface 22 also receives information from the server 3, including various signals, various data (for example, an operation control table), and various instructions. The communication interface 22 also can send the server 3 information such as outside temperature, room temperature, and room humidity.

[0051] The remote controller (operation controller) 26 functions as an operation controller which a user uses to operate the air conditioner 2. By operating the remote controller 26, a user can select, for example, an operation mode and a set temperature for the air conditioner 2.

(3) Refrigerant Pipes

[0052] The refrigerant pipe 57 is a pipe narrower than the refrigerant pipe 58, and through which a liquid refrigerant flows during operation. The refrigerant pipe 58 is a

pipe thicker than the refrigerant pipe 57, and through which a gas refrigerant flows during operation. The heat carrier (refrigerant) may be, for example, HFC R410A, or R32.

[0053] In the air conditioner 2 of the configuration described above, the indoor heat exchanger 12 of the indoor unit 10, and the compressor 52, the four-way valve 53, the outdoor heat exchanger 54, and the expansion valve 55 of the outdoor unit 50 are connected in series via the refrigerant pipes 57 and 58. This constitutes the refrigeration cycle (heat pump cycle).

Configuration of Server

[0054] The following describes the server 3 constituting the air-conditioning control system 1. FIG. 4 shows an inner configuration of the server 3 constituting the air-conditioning control system 1.

[0055] The server 3 is connected to the air conditioner 2 via a network such as the Internet. As shown in FIG. 4, the server 3 includes a control unit 31, a memory 32, and a communication interface 33, among others.

[0056] The control unit 31 controls the components of the server 3 by executing the programs stored in the memory 32 or in an external storage medium. Specifically, the control unit 31 enables the various processes below by executing the programs stored in the memory 32.

[0057] The memory 32 is realized by, for example, various types of RAM and ROM, and flash memory. The memory 32 stores various types of data, including programs to be executed by the control unit 31, data generated by execution of programs by the control unit 31, input data from switches and a keyboard, data received from the air conditioner 2, and operation control tables for controlling the operation of the air conditioner 2 (see, for example, FIGS. 6 to 9).

[0058] The communication interface 33 enables data exchange with other devices by means of cable or wireless communications.

Control of Automatic Operation of Air Conditioner

[0059] The following describes a method for controlling the automatic operation of the air conditioner 2 in the system 1 according to the present embodiment, with reference to FIGS. 1, 2, 4, 5 to 8, and 10. FIG. 5 represents an example of the relationship between forecast temperatures from weather report data, and the operation control tables used, explaining how the operation control table is determined. FIGS. 6 to 9 represent examples of operation control tables. Specifically, FIG. 6 shows an example of a summer table, FIG. 7 shows an example of a winter table, and FIG. 8 shows an example of a basic table. The procedures of the operation control of the air conditioner 2 of the system 1 are as follows.

[0060] The descriptions below are based on the air conditioner 2 operating in three operation modes, specifically, heating, cooling, and fan modes. However, the

operation method of the air conditioner is not limited to these three modes in the air-conditioning control system of an aspect of the present invention. The present invention is also applicable to an air conditioner adapted to operate in, for example, dehumidifying mode.

[0061] In the system 1 of the present embodiment, the three operation control tables shown in FIGS. 6 to 8 are stored in the memory (storage unit) 32 of the server 3. By using the weather report data 4 supplied by a weather information server provided on the cloud, the control unit 31 of the server 3 selects one of the three operation control tables. The weather information server may be, for example, a server run by a company providing weather forecast services.

[0062] The weather report data contains information such as a weekly weather forecast, the predicted lowest temperature and the predicted highest temperature of a day, and other forecast information such as hourly weather (sky conditions), wind speeds, and chances of rain. In the present embodiment, an operation control table is selected according to the predicted lowest temperature and the predicted highest temperature of a day in the weather report data. The weather report data 4 sent from the weather information server is stored in the memory 32 of the server 3.

[0063] The server 3 may obtain the weather report data 4 from the weather information server at any intervals, and the data may be obtained, for example, once a day. Information of the predicted lowest temperature and the predicted highest temperature of a day may be obtained from, for example, tomorrow's weather report data provided on the day before the day of operation. When the weather report data 4 is obtained more frequently (several times a day, or every few hours), the control unit 31 updates the data in the memory 32 every time new weather report data is obtained. An operation control table may then be selected preferably on the basis of the newest weather report data.

[0064] The following describes how the operation control table is determined, with reference to FIG. 5. As described above, the server 3 selects an operation control table by using information of the predicted lowest temperature and the predicted highest temperature of a day (the day of operation) contained in the weather report data 4.

[0065] FIG. 5 shows an example of the predicted lowest temperature and the predicted highest temperature of when selecting a winter table, a summer table, or a basic table. In FIG. 5, the temperature pointed by upward arrow ($\uparrow$) indicates the predicted highest temperature, and the temperature pointed by downward arrow ($\downarrow$) indicates the predicted lowest temperature.

[0066] As an example, the summer table (see FIG. 6) is selected when the predicted lowest temperature is 15°C or more. The winter table (see FIG. 7) is selected when the predicted highest temperature is 15°C or less. The basic table (see FIG. 8) is selected when neither of these conditions are met (i.e., the predicted lowest tem-

perature is less than 15°C, and the predicted highest temperature exceeds 15°C). In other words, there is a higher chance of the basic table being selected in moderate temperature seasons such as fall and spring.

[0067] The summer table and the winter table may be selected by taking into account both the predicted lowest temperature and the predicted highest temperature. This enables more delicate control. For example, more delicate control is possible when the reference temperature line used for the selection of a table is set in smaller units. Specifically, the temperature line at 15°C shown in FIG. 5 is set as a middle temperature line, and other temperature lines may additionally be provided, in addition to the middle temperature line. In this way, a table can be selected using more complex conditions. As an example, the additional temperature lines may be a high temperature line having a higher threshold than the middle temperature line, and a low temperature line having a lower threshold than the middle temperature line. For example, a table can be selected according to the following conditions.

[0068] In this example, a summer high-temperature table and a winter low-temperature table are used, in addition to the basic table, the summer table, and the winter table. The summer high-temperature table is intended for use in, for example, extremely hot days. The winter low-temperature table is intended for use in, for example, cold regions or extremely cold days.

- Basic table is selected when: the predicted lowest temperature and the predicted highest temperature both fall between the high temperature line and the low temperature line.
- Summer table is selected when: the predicted lowest temperature is above the middle temperature line and below the high temperature line.
- Summer high-temperature table is selected when: the predicted lowest temperature is at or above the high temperature line.
- Winter table is selected when: the predicted highest temperature is at or below the middle temperature line, and is above the low temperature line.
- Winter low-temperature table is selected when: the predicted highest temperature is at or below the low temperature line.

[0069] In the present embodiment, the temperature of the middle temperature line is not necessarily limited to 15°C. The temperature of the middle temperature line may be appropriately set according to, for example, experimental results. Likewise, the temperature of the high temperature line, and the temperature of the low temperature line may be appropriately set according to, for example, experimental results.

[0070] FIGS. 6 to 8 show examples of the operation control tables. In the operation control tables, the horizontal axis represents outside temperature, and the vertical axis represents room temperature. The air conditioner 2 determines the method of operation and the set temperature according to the operation control table sent from the server 3. Specifically, the control unit 20 of the air conditioner 2 refers to the operation control table stored in the memory 23, and determines the method of operation and the set temperature, using the room temperature data obtained from the room thermometer 15, and the outside temperature data obtained from the outside thermometer 62.

[0071] For example, when the room temperature data is 27°C, and the outside temperature data is 33°C in controlling the operation using the summer table of FIG. 6, the method of operation and the set temperature are selected from the region in which these room temperature and outside temperature cross. Specifically, as indicated by broken arrow in FIG. 6, "cooling operation" is selected as the method of operation, and "27°C" is selected as the set temperature.

[0072] As can be seen from a comparison of the tables shown in FIGS. 6 to 8, different methods of operation, and different set temperature are selected from the summer table, the winter table, and the basic table even when the outside temperatures or the room temperatures are the same. For example, there is a higher probability of the fan mode being selected as the method of operation in the basic table, which typically has a higher chance of being selected in in-between seasons such as spring and fall (see FIG. 8). This is to control the operation of the air conditioner 2 by a method that is more suited to the current climate conditions of the location the air conditioner 2 is installed. That is, the selected method of operation control can more accurately take into account the characteristics of the season when a table corresponding to the season is selected using the forecast temperatures contained in the weather report data 4.

[0073] For example, the server 3 selects the summer table in a mid-summer day with the predicted lowest temperature of 26°C, and the predicted highest temperature of 35°C. By referring to the summer table, the air conditioner 2 can determine the method of operation, and the set temperature.

[0074] For example, the month of May is spring in Japan. However, when the predicted lowest temperature is 21°C, and the predicted highest temperature is 28°C in the information of predicted lowest temperature and predicted highest temperature contained in the weather report data 4, the summer table is selected because the predicted lowest temperature is 15°C or more. On the actual day of operation for which the temperature was predicted to reach a low of 21°C and a high of 28°C by the weather report data 4, the air conditioner 2 can determine the method of operation and the set temperature by referring to the summer table. In this way, the selected method of operation and the selected set temperature

can be more suited to the current climate conditions of the location the air conditioner 2 is installed.

[0075] The following describes the procedures of the operation control of the air conditioner 2 in the system 1, with reference to FIG. 10. FIG. 10 (a) represents the procedure of the control by the server 3 (specifically, the control unit 31) of the system 1. FIG. 10(b) represents the procedure of the control by the air conditioner 2 (specifically, the control unit 20) of the system 1.

[0076] As shown in FIG. 10(a), the server 3 first registers the location (area) where the air conditioner 2 is installed (step S11). The installation location is registered when, for example, incorporating the air conditioner 2 to the system 1 via, for example, the Internet. Specifically, this can be achieved by, for example, sending information of the postal code of the installation address, from the air conditioner 2 to the server 3. More specifically, for example, a user (or a person installing the air conditioner 2) chooses a postal code in the remote controller 26, and sends the selected postal code to the air conditioner 2. The air conditioner 2 sends the received postal code to the server 3.

[0077] Once the installation location is registered, the control unit 31 of the server 3 can obtain local weather report data 4 of the area where the air conditioner 2 is installed (step S12). The control unit 31 of the server 3 then selects one of the operation control tables stored in the memory 32, using the weather report data 4 (specifically, information of predicted highest temperature, and information of predicted lowest temperature) provided by the weather information server on the cloud (step S13).

[0078] The information of the operation control table selected by the control unit 31 of the server 3 is sent to the air conditioner 2 via the communication interface 33 (step S14).

[0079] In response, as shown in FIG. 10(b), the communication interface 22 of the air conditioner 2 receives data of the operation control table sent from the server 3 (step S21). The received data of the operation control table is stored in the memory 23 of the control unit 20.

[0080] A user then sends an instruction for starting the air conditioner 2 in automatic operation mode, using, for example, the remote controller 26. That is, the control unit 20 receives an automatic operation mode ON signal (step S22). An automatic operation mode starting instruction may be sent from a smartphone 5 when a portable terminal such as a smartphone 5 is provided in a system 200 as in the Fourth Embodiment described below.

[0081] The control unit 20 obtains room temperature data from the room thermometer 15, and outside temperature data from the outside thermometer 62 (step S23). By referring to the operation control table stored in the memory 23, the control unit 20 determines the method of operation and the set temperature (step S24). The control unit 20 then starts the air conditioner 2 in automatic operation mode according to the method of operation method and the set temperature so determined (step S25).

[0082] The automatic operation of the air conditioner 2 is controlled according to these procedures. As described above, in the air-conditioning control system 1 according to the present embodiment, an operation control table to be used on the day of operation (or a time of day) is selected according to the forecast temperatures contained in the weather report data 4 and predicting the temperatures of the place the air conditioner 2 is installed. By using the selected operation control table, the air conditioner 2 controls the automatic operation. This enables control of an air conditioning operation in a way that more accurately reflects the location and the current conditions of the place the air conditioner 2 is installed.

[0083] The example described above is based on control of the automatic operation of the air conditioner 2 that operates in the three operation modes of heating, cooling, and fan modes. However, this is merely an example of the present invention. In an aspect of the present invention, the invention is also applicable to an automatic operation of an air conditioner that can operate in dehumidifying mode, in addition to these three operation modes. In this case, it is preferable to add a room humidity parameter in the operation control table, and whether to operate the air conditioner in dehumidifying mode instead of cooling mode is determined according to the result of the detection by the room hygrometer 16 provided for the air conditioner 2.

[0084] In the air-conditioning control system 1 according to the present embodiment, the roles of the constituting devices (for example, the air conditioner 2) of the system may be served by other devices (for example, the server 3 on the cloud), either in part or as a whole. Here, the cloud is configured from a group of servers, including a plurality of servers capable of communicating with the air conditioner on a regular basis. Each server is able to collect, accumulate, and send various types of data, and create tables or other data forms by processing these data.

Variation

[0085] A variation of the automatic operation control method of the air conditioner 2 performed in the system 1 is described below, with reference to FIGS. 6 to 9. In First Embodiment, the automatic operation of the air conditioner 2 is controlled by using the three operation control tables shown in FIGS. 6 to 8. In the variation, the automatic operation of the air conditioner 2 is controlled by using the four operation control tables shown in FIGS. 6 to 9.

[0086] The summer table of FIG. 6, and the winter table of FIG. 7 may be selected using the same method described in First Embodiment. FIG. 8 represents an example of a spring table used in the variation. FIG. 9 represents an example of a fall table used in the variation.

[0087] In this variation, the summer table (see FIG. 6) is selected when the predicted lowest temperature is 15°C or more. The winter table (see FIG. 7) is selected

when the highest temperature is 15°C or less. The spring table (see FIG. 8) or the fall table (see FIG. 9) is selected when neither of these conditions are met (i.e., the predicted lowest temperature is below 15°C, and the predicted highest temperature exceeds 15°C).

[0088] Whether to select the spring table or the fall table may be determined according to, for example, the calendar information (date information for the day of operation) contained in the weather report data 4. For example, when the calendar information contained in the weather report data 4 received by the server 3 is of the date of a day between April and September, the control unit of the server 3 selects the spring table. The control unit of the server 3 selects the fall table when the calendar information contained in the weather report data 4 received by the server 3 is of the date of a day between January and March, or between October and December.

[0089] As described above, the automatic operation of the air conditioner 2 can be controlled in a more delicate fashion with the use of the four operation control tables as in this variation. Specifically, in contrast to First Embodiment in which only the basic table is used when the weather report data corresponds to the climate conditions of in-between seasons such as spring and fall, the spring table or the fall table can be used for these seasons as appropriate in the variation.

Other Applications

[0090] The present invention also can be implemented by supplying programs to a system or a device. One can also benefit from the effect of the aspect of the present invention when a storage medium (or memory) storing programs represented by software for achieving the aspect of the present invention is supplied to a system or a device, and the program code stored in the storage medium is executed by a computer (or a CPU or an MPU) of the system or device.

[0091] In this case, the functions of the embodiment above are realized by the program code itself read from the storage medium, and the storage medium storing the program code constitutes the aspect of the present invention.

[0092] It is to be noted that the functions of the embodiment above can be realized not only by a computer executing the program code, but by an operating system (OS) or other software of a computer performing a part or all of the actual processes according to instructions of the program code.

[0093] The functions of the embodiment above also can be realized by a CPU of an expanded capability board or an expanded capability unit performing a part or all of the actual processes according to instructions of the program code read from a storage medium and written into another storage medium provided for an expanded capability board inserted in a computer, or an expanded capability unit connected to a computer.

Second Embodiment

[0094] The foregoing First Embodiment was described through the case of the system 1 in which the air conditioner 2 determines the method of operation and the set temperature using the operation control table sent from the server 3. However, the air-conditioning control system of the aspect of the present invention may be adapted so that the server 3 determines the method of operation and the set temperature of the air conditioner 2. Second Embodiment describes an example of an air-conditioning control system in which the server 3 determines the method of operation and the set temperature of the air conditioner 2 according to the operation control table, using information sent from the air conditioner 2, including an outside temperature, and a room temperature.

[0095] FIG. 1 shows an overall configuration of an air-conditioning control system 100 (hereinafter, also referred to simply as "system") according to Second Embodiment. The air-conditioning control system 100 is configured mainly from an air conditioner 2 and a server 3. The overall configuration of the system 100 according to Second Embodiment may have the same configuration as the system according to First Embodiment. Accordingly, Second Embodiment describes only the differences from First Embodiment.

[0096] The following describes a method for controlling the automatic operation of the air conditioner 2 in the system 100 according to Second Embodiment, with reference to FIGS. 1, 2, 4, 5 to 8, and 11. FIG. 11 represents the procedure of the operation control of the air conditioner 2 in the system 100 when the air conditioner 2 is operating in automatic operation mode. The control procedures shown in FIG. 11 are mainly procedures on the side of the server 3 (specifically, the control unit 31) constituting the system 100.

[0097] As shown in FIG. 11, the server 3 first registers the location (area) where the air conditioner 2 is installed (step S31). The installation location may be registered in the same manner as in First Embodiment.

[0098] Once the installation location is registered, the control unit 31 of the server 3 can obtain local weather report data 4 of the area where the air conditioner 2 is installed (step S32).

[0099] The control unit 31 of the server 3 then selects one of the operation control tables stored in the memory (storage unit) 32, using the weather report data 4 provided by the weather information server on the cloud (step S33). The operation control tables stored in the memory 32 are, for example, the operation control tables shown in FIGS. 6 to 9, as in First Embodiment. The operation control table may be selected in the same manner as in First Embodiment.

[0100] From the air conditioner 2, the server 3 receives information of the outside temperature and the room temperature of the place the air conditioner 2 is installed (step S34). Specifically, the room temperature data obtained by the room thermometer 15 of the air conditioner 2, and

the outside temperature data obtained by the outside thermometer 62 are sent to the communication interface (receiving unit) 33 of the server 3 via the communication interface 22 of the air conditioner 2.

[0101] By referring to the operation control table stored in the memory 32, the control unit 31 of the server 3 determines the method of operation and the set temperature of the air conditioner 2, using the room temperature data and the outside temperature data obtained from the air conditioner 2 (step S35). The control unit 31 then produces an operation control signal containing information of the operation method and the set temperature it determined.

[0102] The operation control signal is sent to the control unit 20 of the air conditioner 2 via the communication interface (transmission unit) 32 of the server 3, and the communication interface 22 of the air conditioner 2 (step S36). In response, the control unit 20 of the air conditioner 2 starts the air conditioner 2 in automatic operation mode according to the information of the operation method and the set temperature contained in the received operation control signal.

[0103] The automatic operation of the air conditioner 2 is controlled according to these procedures. As described above, in the air-conditioning control system 100 according to the present embodiment, an operation control table to be used on the day of operation (or a time of day) is selected according to the forecast temperatures contained in the weather report data 4 and predicting the temperatures of the place the air conditioner 2 is installed. By using the selected operation control table, the server 3 produces an operation control signal for controlling the automatic operation of the air conditioner 2. The air conditioner 2 controls the automatic operation according to the operation control signal sent from the server 3. This enables control of an air conditioning operation in a way that more accurately reflects the location and the current conditions of the place the air conditioner 2 is installed.

Third Embodiment

[0104] Third Embodiment describes an example in which the operation control table is corrected in the air-conditioning control system 1 according to First Embodiment. The air-conditioning control system according to the present embodiment may have the same configuration as the air-conditioning control system according to First Embodiment. Accordingly, Third Embodiment describes only the differences from First Embodiment.

[0105] FIG. 12 represents the procedure of the operation control of the air conditioner 2 in the system 1 when the air conditioner 2 is operating in automatic operation mode. The control procedures shown in FIG. 12 are mainly procedures on the side of the server 3 (specifically, the control unit 31) constituting the system 1.

[0106] As shown in FIG. 12, the server 3 first registers the location (area) where the air conditioner 2 is installed (step S41). The installation location may be registered in

the same manner as in First Embodiment.

[0107] Once the installation location is registered, the control unit 31 of the server 3 can obtain local weather report data 4 of the area where the air conditioner 2 is installed (step S42).

[0108] The control unit 31 of the server 3 then selects one of the operation control tables stored in the memory (storage unit) 32, using the weather report data 4 provided by the weather information server on the cloud (step S43). The operation control tables stored in the memory 32 are, for example, the operation control tables shown in FIGS. 6 to 9, as in First Embodiment. The operation control table may be selected in the same manner as in First Embodiment.

[0109] The control unit 31 of the server 3 corrects the operation control table, using the weather report data 4 obtained from the weather information server (step S44). Here, the weather report data 4 contains information concerning sky conditions, such as sunny, rainy, or cloudy (sky condition prediction data), in addition to information of predicted lowest temperature and predicted highest temperature. By using the sky condition information, the control unit 31 corrects the content of the selected operation control table.

[0110] Specifically, when the sky condition information in the weather report data 4 obtained by the server 3 forecasts "rain" for the day of operation, "cooling operation" is changed to "dehumidifying operation" as a method of operation in the selected operation control table. The correction may be made only when, for example, the summer table (see FIG. 6) and the basic table (see FIG. 8) are selected in step S43. Alternatively, the correction may be made regardless of the type of the selected table.

[0111] For example, when the weather report data 4 contains wind speed forecast data, the following correction may be made when the winter table (see FIG. 7) is selected in step S43. Specifically, the set temperature is always raised by one degree (" + 1°C") in the selected operation control table when the forecast wind speed in the weather report data 4 obtained by the server 3 is equal to or greater than a predetermined value (for example, 10 m/s).

[0112] As another example, when the weather report data 4 obtained by the server 3 forecasts "extremely hot weather" for the day of operation, the set temperature is always lowered by one degree (" - 1°C") in the selected operation control table. The correction may be made only when, for example, the summer table (see FIG. 6) is selected in step S43.

[0113] Information of the operation control table corrected in the control unit 31 of the server 3 is sent to the air conditioner 2 via the communication interface 33 (step S45). The air conditioner 2 receives the corrected operation control table, and controls the automatic operation using the operation control table. The control on the air conditioner 2 side may follow the procedures described in First Embodiment (see, for example, FIG. 10 (b)).

[0114] The automatic operation of the air conditioner

2 is controlled according to these procedures. With the system 1 of Third Embodiment, the operation control table can be corrected using information of weather report data containing forecast data such as data predicting sky conditions. This makes it possible to create a more appropriate operation control table that is more in line with the weather report data of the place the air conditioner 2 is installed.

[0115] Third Embodiment described an example of a system in which the air conditioner 2 determines the method of operation and the set temperature using the operation control table sent from the server, as in First Embodiment. However, the correction of an operation control table described in Third Embodiment is also applicable to the air-conditioning control system 100 of Second Embodiment.

Fourth Embodiment

[0116] Third Embodiment described an example in which an operation control table is corrected by using information of weather report data containing sky condition prediction data. However, the method of correction of an operation control table is not limited to this. Fourth Embodiment describes an example in which an operation control table is corrected by using data of an area (a more local area) where the air conditioner 2 is installed.

[0117] FIG. 13 shows an overall configuration of an air-conditioning control system 200 according to Fourth Embodiment (hereinafter, also referred to simply as "system"). The air-conditioning control system 200 is configured mainly from an air conditioner 2, a server 3, and a smartphone (portable terminal) 5. The air conditioner 2 and the server 3 may have the same configurations as the air conditioner 2 and the server 3 of the system 1 according to First Embodiment.

[0118] As in First Embodiment, the server 3 and the devices (the air conditioner 2, and the smartphone 5) can communicate with each other via a network such as the Internet. As shown in FIG. 13, the server 3 can obtain weather report data (prediction data concerning weather) 4 via a network such as the Internet.

[0119] In the present embodiment, the server 3 can obtain local data 6 - data concerning the area where the air conditioner is installed - via a network such as the Internet. The local data 6 contains data concerning characteristic features of the area where the air conditioner 2 is installed, including the address. Specifically, the local data 6 contains data concerning characteristic features of smaller areas or zones, as compared to the weather report data 4 which is provided as information of districts such as prefectures, cities, wards, towns, and villages. For example, the local data 6 contains information indicating whether the area including the installation address of the air conditioner 2 is an urban area or a rural area, and information such as the population density of the area, and the average seasonal insolation of the area.

[0120] In FIG. 13, the server 3 receiving the local data

6, and the server 3 receiving the weather report data 4 are the same server. However, in an aspect of the present invention, the server 3 receiving the local data 6, and the server 3 receiving the weather report data 4 may be configured as different servers. In the system 200 of the present embodiment, the server 3 may be a group of servers.

[0121] FIG. 14 shows an inner configuration of the smartphone 5. As shown in FIG. 14, the smartphone 5 includes a control unit 251, an operation controller 252, a memory 253, a communication interface 254, a display unit 255, and a speaker 256, among others.

[0122] The control unit 251 controls different parts of the smartphone 5 by executing the programs stored in the memory 253 or in an external storage medium.

[0123] The operation controller 252 receives instructions from a user, and sends the instructions to the control unit 251.

[0124] The memory 253 is realized by, for example, various types of RAM and ROM, and flash memory. The memory 253 stores various types of data, including programs to be executed by the control unit 251, data generated by execution of programs by the control unit 251, input data through the operation controller 252, and data associated with tasks received from the server 3.

[0125] The communication interface 254 is realized by an antenna and connectors. The communication interface 254 allows data exchange with other devices by means of cable or wireless communications.

[0126] The display unit 255 displays information such as texts and images according to signals from the control unit 251. In the present embodiment, the smartphone 5 has a touch panel that combines the display unit 255 with the operation controller 252.

[0127] The speaker 256 outputs various sounds, including voice associated with sound signals from the control unit 251, phone conversations, and music.

[0128] The smartphone 5 can be incorporated in the system 200 by, for example, downloading application software offering services for controlling the operation of the air conditioner 2, from the server 3. For example, the smartphone 5 may be incorporated in the system 200 upon a person entering a room with the smartphone 5.

[0129] The smartphone 5 may download application software for obtaining the weather report data 4, and application software for obtaining the local data 6. This allows the smartphone 5 to obtain weather forecast information of the area of interest (for example, the address of the place the air conditioner 2 is installed), and information concerning characteristic features of an area.

[0130] In the system 200 according to the present embodiment, the operation control of the air conditioner 2 operating in automatic operation mode may follow the method described in Third Embodiment with reference to FIG. 12.

[0131] Specifically, the procedures shown in FIG. 12 differ from Third Embodiment only in step S44. That is, in the present embodiment, the control unit 31 of the serv-

er 3, in step S44, corrects the operation control table using the received local data 6.

[0132] For example, when the local data 6 containing the installation address of the air conditioner 2 and obtained by the server 3 contains information "urban area", the set temperature is always lowered by one degree ("−1°C") in the selected operation control table. The correction may be made only when, for example, the summer table (see FIG. 6) is selected in step S43.

[0133] In the system 200 according to the present embodiment, the speaker 18 of the air conditioner 2 may produce sound information, for example, today's weather forecast, chances of rain, and forecast temperatures, when the air conditioner 2 stops operating.

[0134] The content of the sound information is determined according to, for example, sound data sent from the server 3. The memory 32 of the server 3 stores the weather report data 4 obtained, for example, every few hours. When the air conditioner 2 stops operating, sound data is generated according to the weather report data 4 corresponding to the time after when the air conditioner 2 stopped operating. The sound data produced in the server 3 is sent to the air conditioner 2, and the speaker 18 outputs it in the form of sound.

[0135] The system 200 according to the present embodiment may be adapted so that the speaker 256 of the smartphone 5 produces the same sound information.

[0136] In the system 200 according to the present embodiment, the local data 6 obtained by the server 3 may contain information of other areas, in addition to the information of the area where the air conditioner 2 is installed. The weather report data 4 obtained by the server 3 may contain weather report data of different regions, in addition to the weather report data of the region including the installation area of the air conditioner 2. In this case, the operation of the air conditioner 2 may be controlled so that, when a specific region (for example, a prefecture) is selected through, for example, the smartphone 5 or the remote controller 26 of the air conditioner 2 in the system 200, the same temperature and humidity are created in the room as in the selected region, using the weather report data of the region.

Fifth Embodiment

[0137] Fifth Embodiment of the present invention is described below. Fifth Embodiment describes a configuration in which the air conditioner is equipped with a barometer. FIG. 1 shows an overall configuration of an air-conditioning control system 300 (hereinafter, also referred to simply as "system") according to Fifth Embodiment. The air-conditioning control system 300 is configured mainly from an air conditioner 302 and a server 3. The system 300 according to Fifth Embodiment differs from First Embodiment in the configuration of an air conditioner 302. Accordingly, the following descriptions of Fifth Embodiment focus on the configuration of the air conditioner 302. Other configurations may basically be

the same as in First Embodiment.

[0138] FIG. 15 shows an inner configuration of the air conditioner 302. The air conditioner 302 is a separate-type air conditioner, and is configured mainly from an indoor unit 10 and an outdoor unit 50. The outdoor unit 50 of the air conditioner 302 is equipped with a barometer 363. Other configurations may be the same as in the air conditioner 2 of First Embodiment, and will not be described.

[0139] The barometer 363 measures the atmospheric pressure of the environment in which the air conditioner 302 is installed. The atmospheric pressure data measured by the barometer 363 is sent to the control unit 20. From the atmospheric pressure data, the control unit 20 estimates the altitude of the place the air conditioner 302 is installed. Information of the altitude estimated by the control unit 20 is sent to the server 3.

[0140] From the received altitude information, the control unit 31 of the server 3 varies the forecast temperature of the weather report data 4 it obtained (at least one of the predicted lowest temperature and the predicted highest temperature), if need be. For example, the forecast temperature of the weather report data 4 is lowered when the altitude of the installation place of the air conditioner 302 is higher than the altitude used as a reference for the weather report data 4 of the region of interest. The control unit 31 of the server 3 then selects an operation control table by using the new forecast temperature.

[0141] The automatic operation control method of the air conditioner 302, except for the selection of an operation control table, may be the same as the method described in First Embodiment.

[0142] In the foregoing description, the altitude is estimated by the control unit 20 of the air conditioner 302. However, the altitude may be estimated by the control unit 31 of the server 3 by sending the measured atmospheric pressure data from the barometer 363 to the server 3.

[0143] In the foregoing description, the altitude of the installation place of the air conditioner 302 is estimated from the atmospheric pressure data measured by the barometer 363. In another aspect, the forecast temperature may be directly varied according to the measured atmospheric pressure data, using information such as a table associating atmospheric pressure data with forecast temperature values to be changed.

[0144] As described above, in the system 300 according to the present embodiment, the air conditioner 302 or the server 3 obtain data of the atmospheric pressure of the installation place of the air conditioner 302. By taking into account the obtained atmospheric pressure data, the server 3 selects one of the operation control tables stored in the memory 32. Specifically, the server 3 predicts the altitude of the installation place of the air conditioner 302 from the obtained atmospheric pressure data.

[0145] When the predicted altitude is equal to or greater than a predetermined value (for example, + 100 m),

the forecast temperature (at least one of the predicted lowest temperature and the predicted highest temperature) of the weather report data 4 obtained is lowered by a predetermined temperature (for example, 1°C or 0.5°C). An operation control table can then be selected by using the new temperature as the forecast temperature. As a rule, a temperature decreases as the altitude increases. Accordingly, the forecast temperature of the weather report data 4 may be lowered as the altitude increases. For example, the temperature may be lowered at a rate of 0.5°C per + 100 m. It is, however, desirable not to change the forecast temperature of the weather report data 4 when the obtained weather report data already takes into account the altitude.

[0146] With the system 300 according to the present embodiment, the automatic operation of the air conditioner 302 can be controlled by taking into account the altitude of the place where the air conditioner 302 is installed.

Sixth Embodiment

[0147] The foregoing First to Fifth Embodiments described examples of systems in which the air conditioner and the server are connected to each other via the Internet. However, the air-conditioning control system of the aspect of the present invention may be implemented as a configuration of solely an air conditioner. Sixth Embodiment describes an example of an air conditioner according to an aspect of the present invention.

[0148] FIG. 16 shows an inner configuration of an air conditioner 402 according to the present embodiment. The air conditioner 402 according to the present embodiment is a separate-type air conditioner, and is configured mainly from an indoor unit 10 and an outdoor unit 50. The inner configuration of the air conditioner 402 may have the same configuration as the air conditioner 2 according to First Embodiment.

[0149] In First Embodiment, the weather report data 4 is obtained by the server 3 communicably connected to the air conditioner 2 via the Internet. In the air conditioner 402 according to the present embodiment, the weather report data 4 is obtained by the air conditioner 2, directly from, for example, the weather information server. The weather report data 4 is received through the communication interface 22.

[0150] In the air conditioner 402 of the present embodiment, the operation control tables are stored in the memory (storage unit) 23 of the air conditioner 402. The control unit 20 of the air conditioner 402 selects one of the operation control tables by using the weather report data 4 supplied by the weather information server on the cloud.

[0151] The control unit 20 then obtains room temperature data from the room thermometer 15, and outside temperature data from the outside thermometer 62. By referring to the selected operation control table, the control unit 20 determines the method of operation and the set temperature, using the room temperature data and

the outside temperature data. The control unit 20 then starts operating the air conditioner 402 in automatic mode according to the operation method and the set temperature it determined.

[0152] The types of the operation control tables stored in the memory 23, the method of selection of an operation control table, and the automatic operation control method of the air conditioner 402 may be the same as in First Embodiment described with reference to FIGS. 1, 2, 4, 5 to 8, and 10.

[0153] The embodiments disclosed herein are to be considered in all aspects only as illustrative and not restrictive. The scope of the present invention is to be determined by the scope of the appended claims, not by the foregoing descriptions, and the invention is intended to cover all modifications falling within the equivalent meaning and scope of the claims set forth below. A configuration based on a combination of different configurations of the embodiments described in this specification is also intended to fall within the scope of the present invention.

Reference Signs List

[0154]

- 1: Air-conditioning control system
- 2: Air conditioner
- 3: Server
- 4: Weather report data
- 5: Smartphone
- 6: Local data
- 20: Control unit (of air conditioner)
- 22: Communication interface (transmission unit, receiving unit) (of air conditioner)
- 23: Memory (storage unit) (of air conditioner)
- 31: Control unit (of server)
- 32: Memory (storage unit) (of server)
- 33: communication interface (transmission unit, receiving unit) (of server)
- 100: Air-conditioning control system
- 200: Air-conditioning control system
- 300: Air-conditioning control system
- 302: Air conditioner
- 402: Air conditioner

Claims

1. An air-conditioning control system comprising:

a storage unit storing a plurality of operation control tables for determining a method of operation of an air conditioner;
 a control unit that selects one of the operation control tables by using prediction data concerning weather; and
 a transmission unit that sends the operation con-

trol table selected by the control unit to the air conditioner.

2. An air-conditioning control system comprising:

a storage unit storing a plurality of operation control tables for determining a method of operation of an air conditioner;
 a receiving unit that receives information of an outside temperature and a room temperature of a place where the air conditioner is installed;
 a control unit that selects one of the operation control tables by using prediction data concerning weather, and produces a control signal for controlling a method of operation of the air conditioner, the control signal being produced according to the selected operation control table and the information of the outside temperature and the room temperature; and
 a transmission unit that sends the control signal to the air conditioner.

3. An air-conditioning control system comprising:

a receiving unit that receives prediction data concerning weather information;
 a heat pump cycle that includes a compressor for compressing a heat carrier, an inside heat exchanger, an expansion valve for decompressing the heat carrier, and an outside heat exchanger;
 a storage unit storing a plurality of operation control tables for determining a method of operation of the heat pump cycle; and
 a control unit that selects an operation control table stored in the storage unit by using the prediction data, and controls operation of the heat pump cycle by using the selected operation control table.

4. The air-conditioning control system according to any one of claims 1 to 3, wherein the prediction data contains data of predicted lowest temperature and predicted highest temperature.

5. The air-conditioning control system according to claim 4, wherein the prediction data further contains sky condition prediction data, and the control unit corrects the operation control table by using the sky condition prediction data.

6. The air-conditioning control system according to any one of claims 1 to 5, wherein the control unit obtains data of an atmospheric pressure of a place where the air conditioner or the air-conditioning control system is installed, and selects an operation control table stored in the storage unit by further taking into account the atmos-

pheric pressure data.

7. The air-conditioning control system according to any one of claims 1 to 6, wherein the control unit obtains seasonal data concerning a current season, and selects an operation control table stored in the storage unit by further taking into account the seasonal data. 5
8. The air-conditioning control system according to any one of claims 1 to 7, wherein the control unit obtains local data concerning an area where the air conditioner or the air-conditioning control system is installed, and corrects the operation control table by using the local data. 10 15

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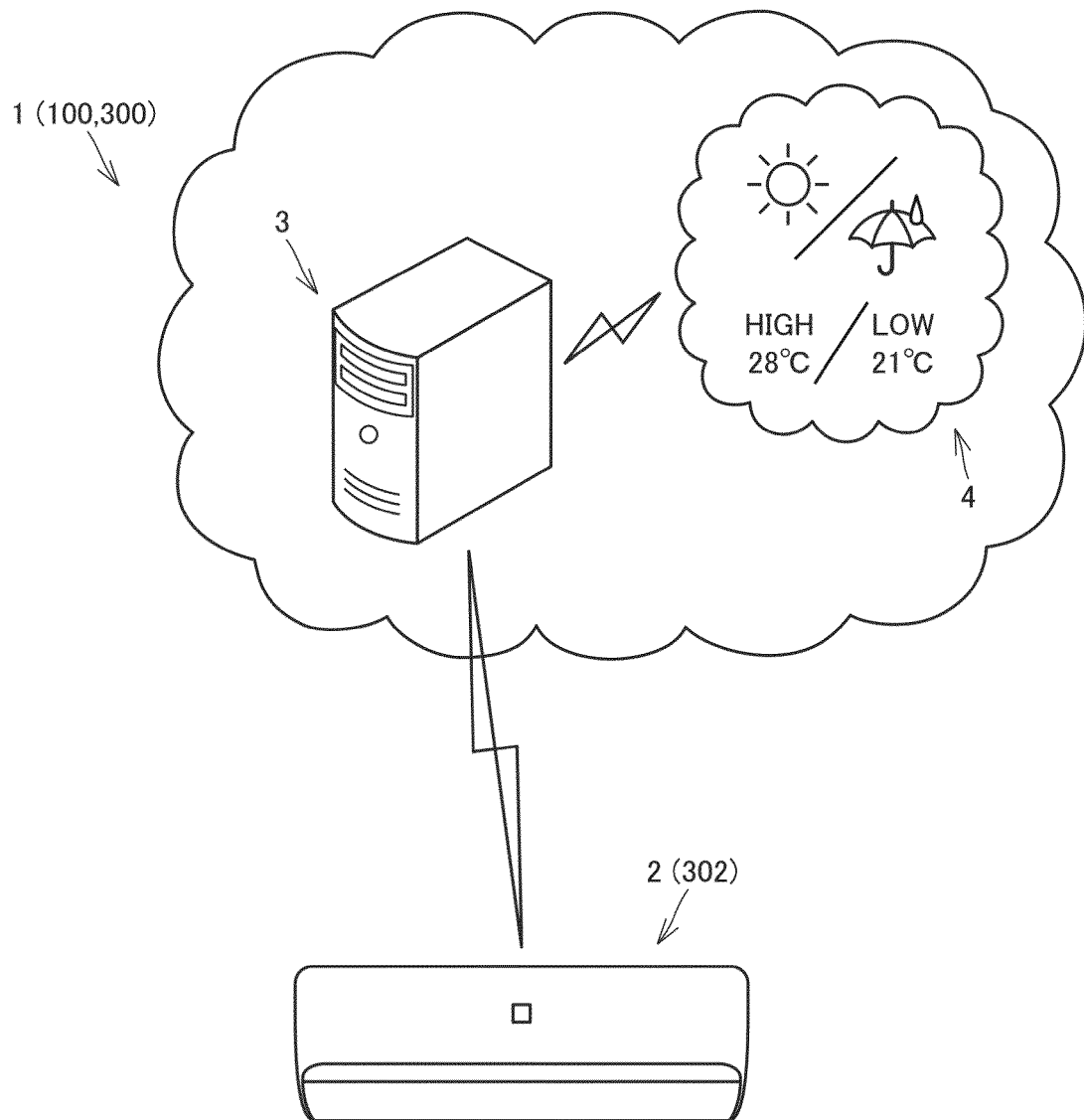
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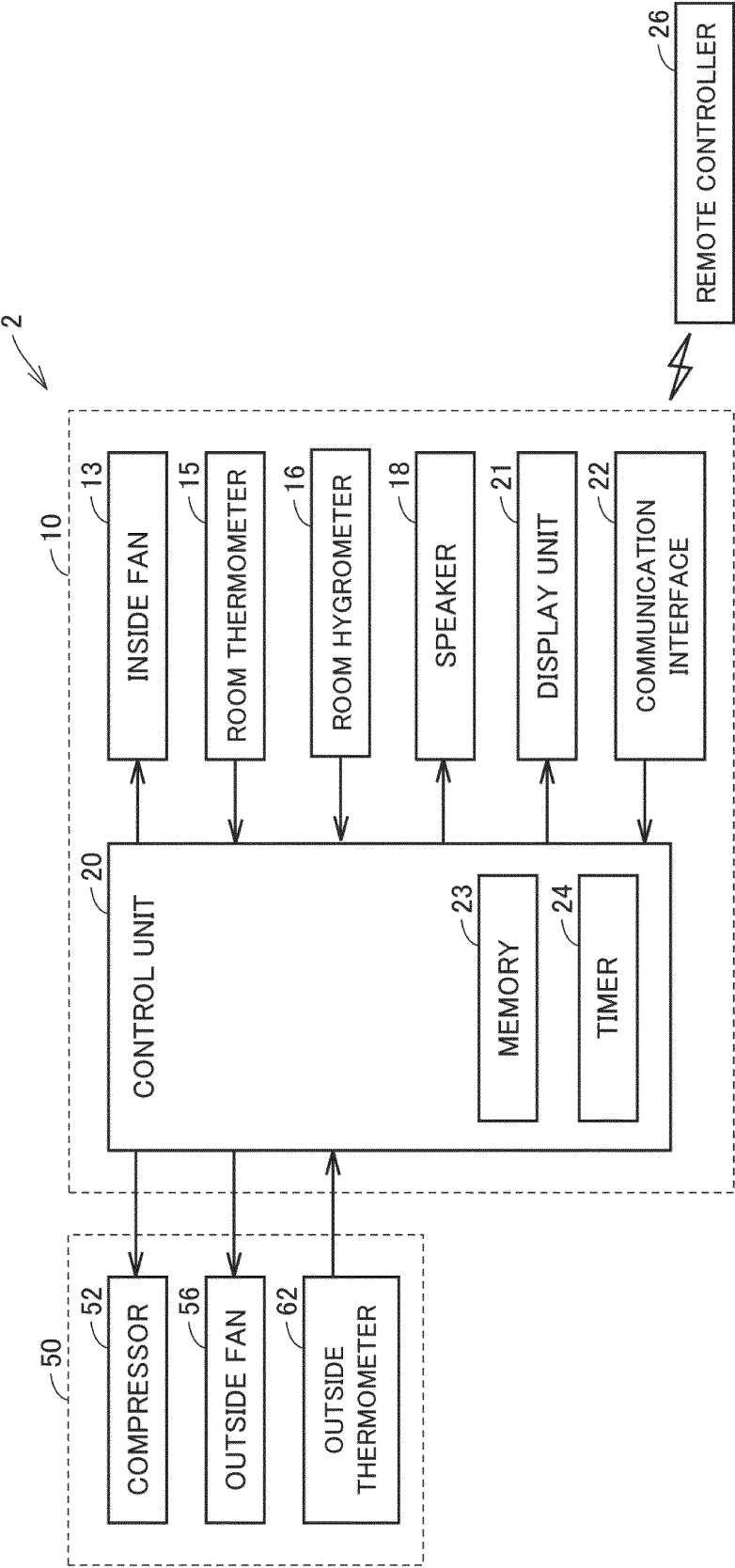
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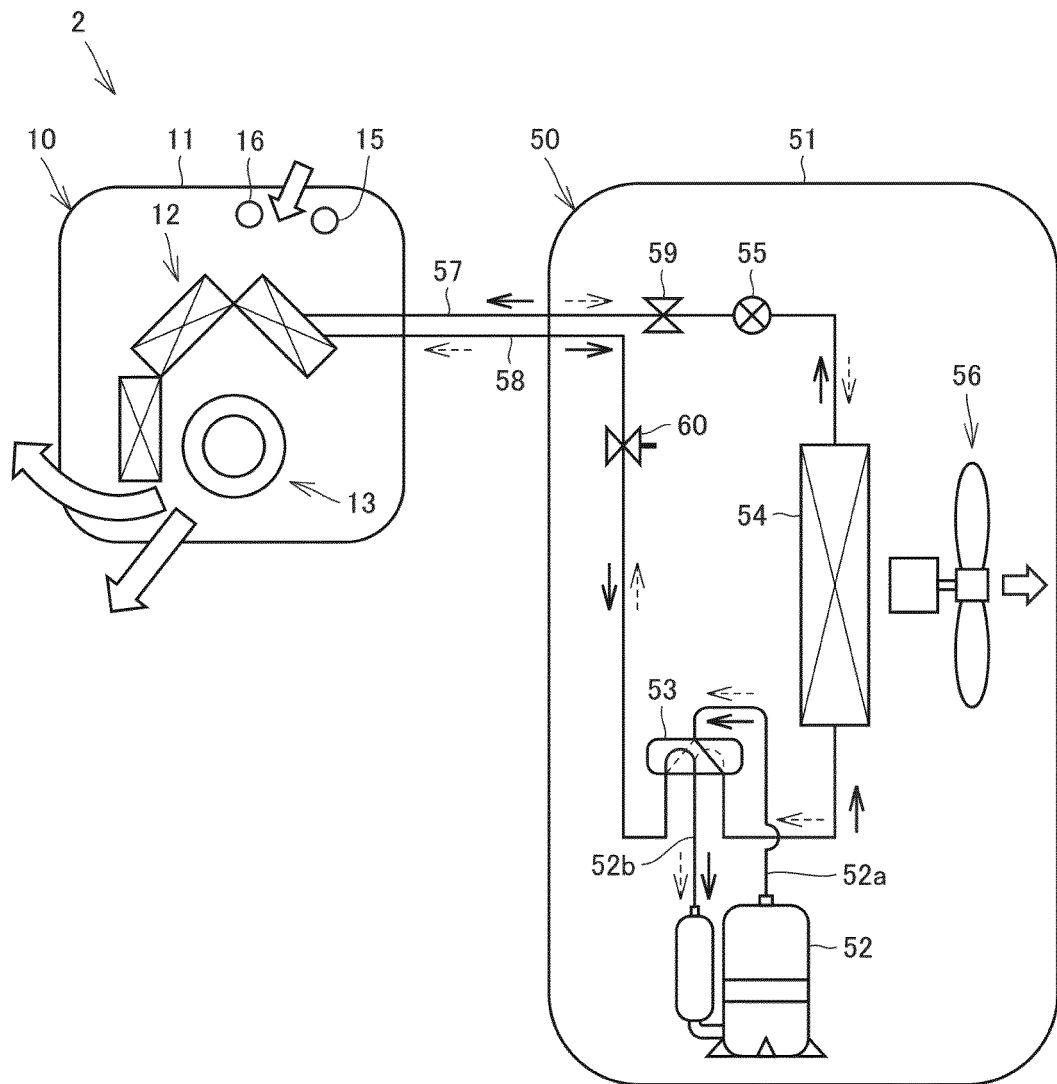
【FIG. 1】



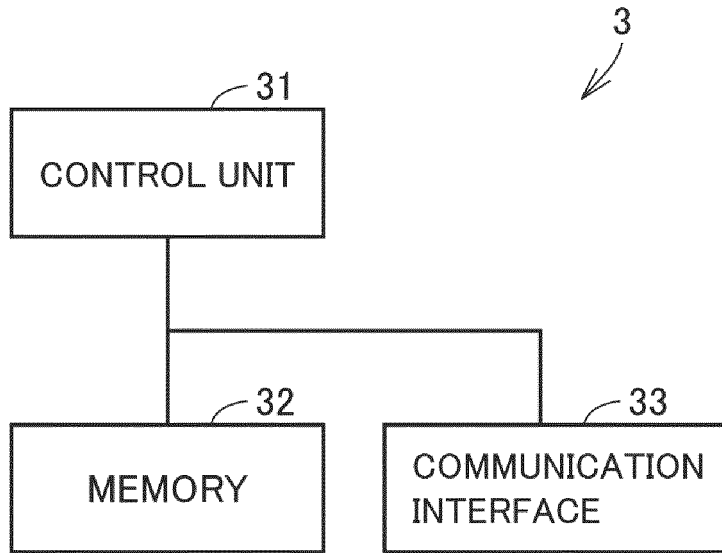
【FIG. 2】



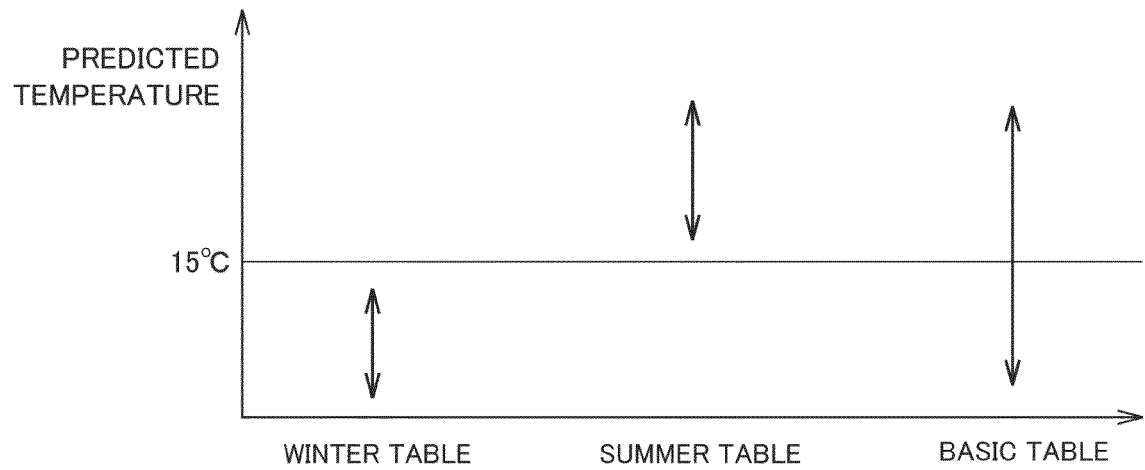
【FIG. 3】



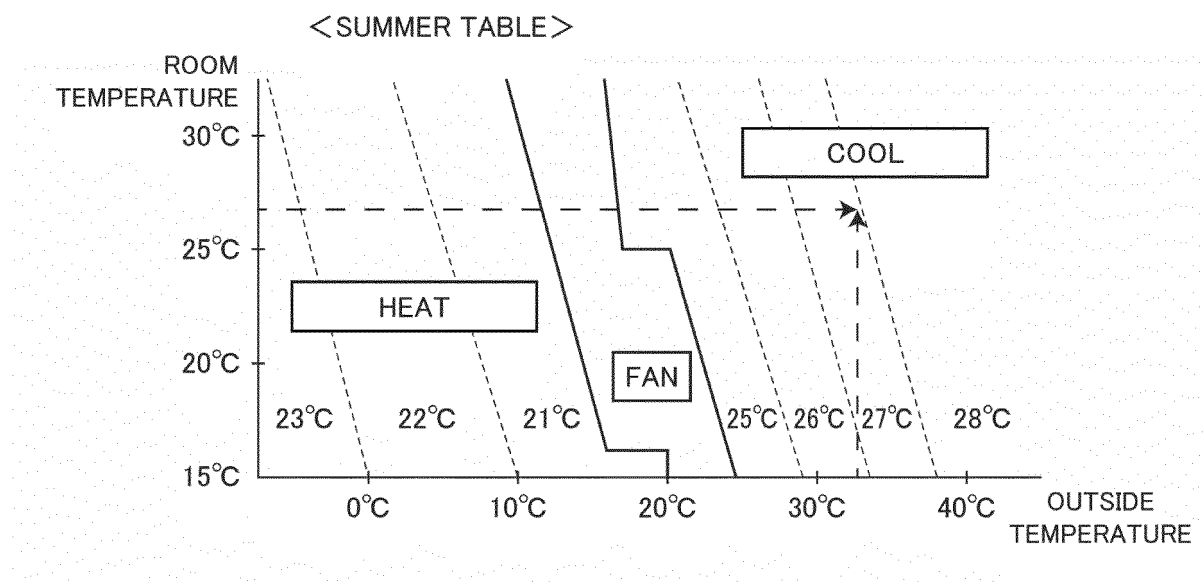
【FIG. 4】



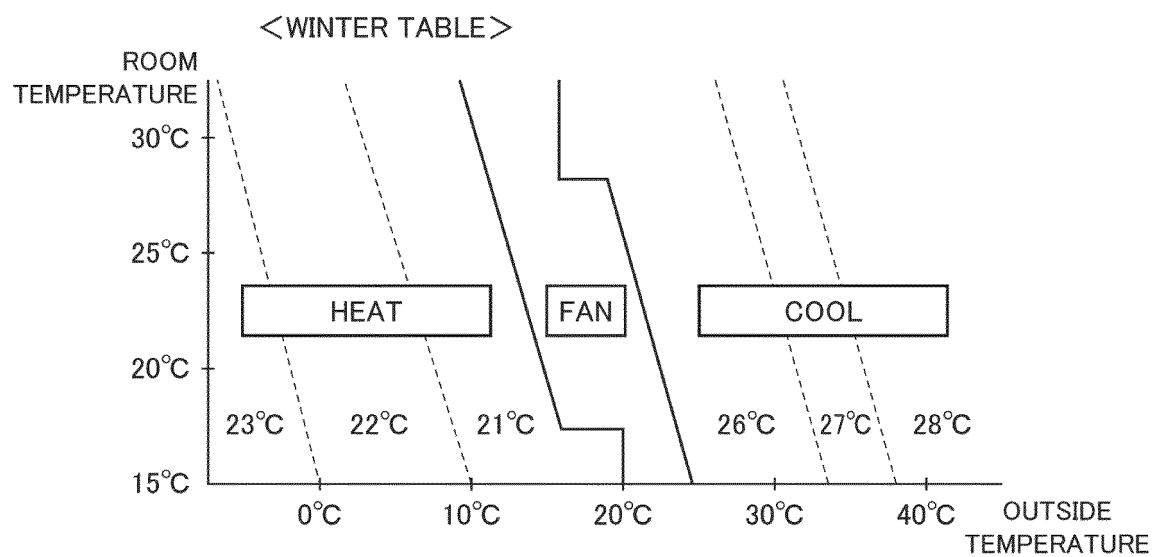
【FIG. 5】



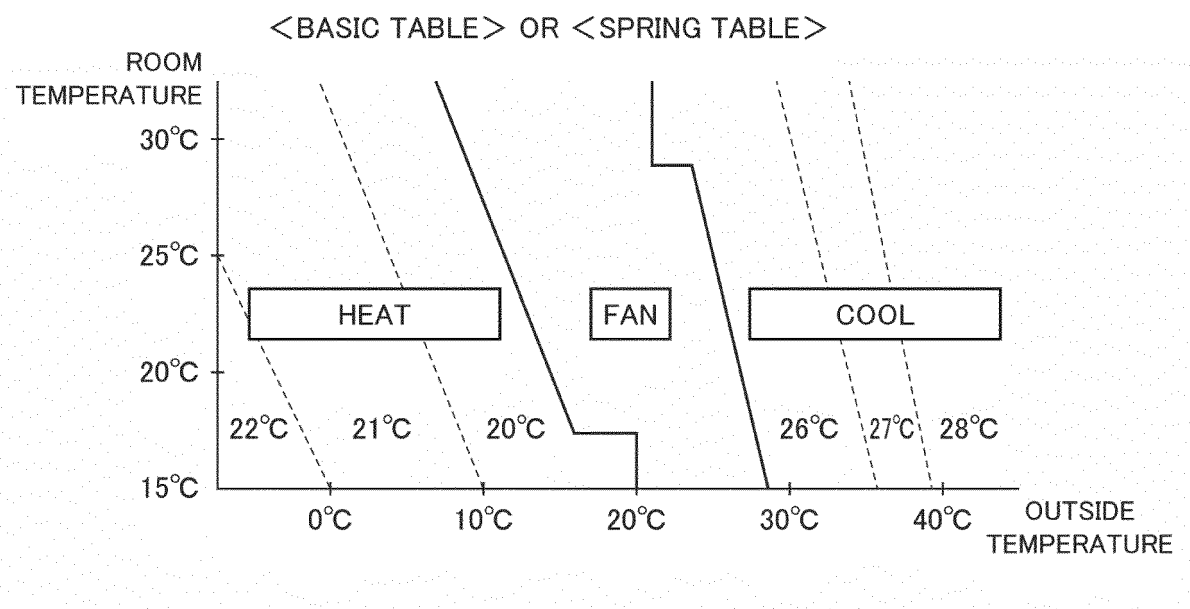
【FIG. 6】



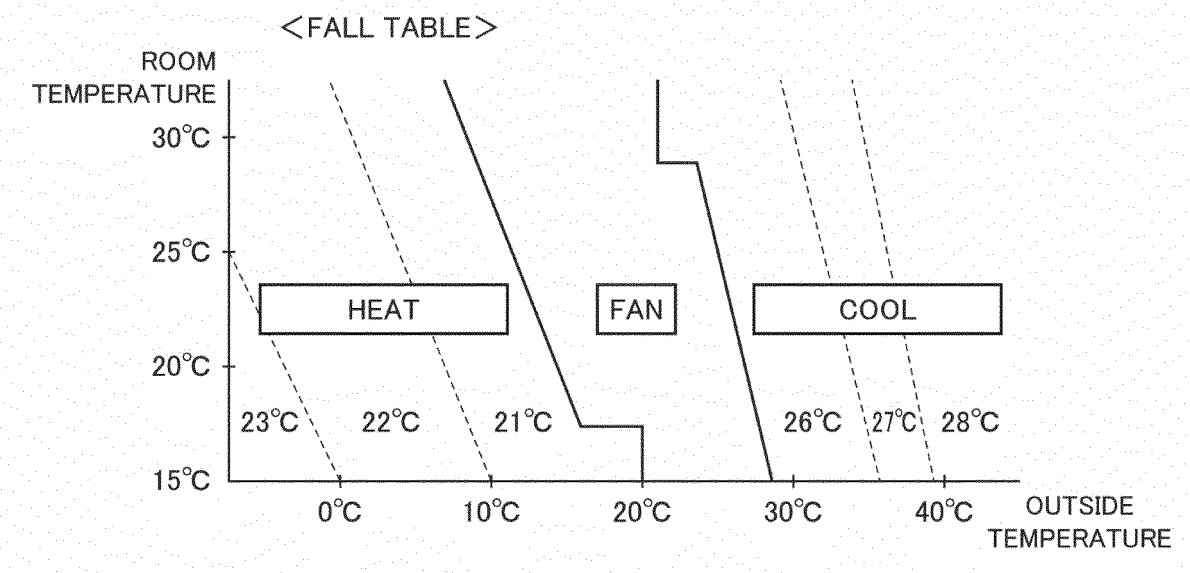
【FIG. 7】



【FIG. 8】

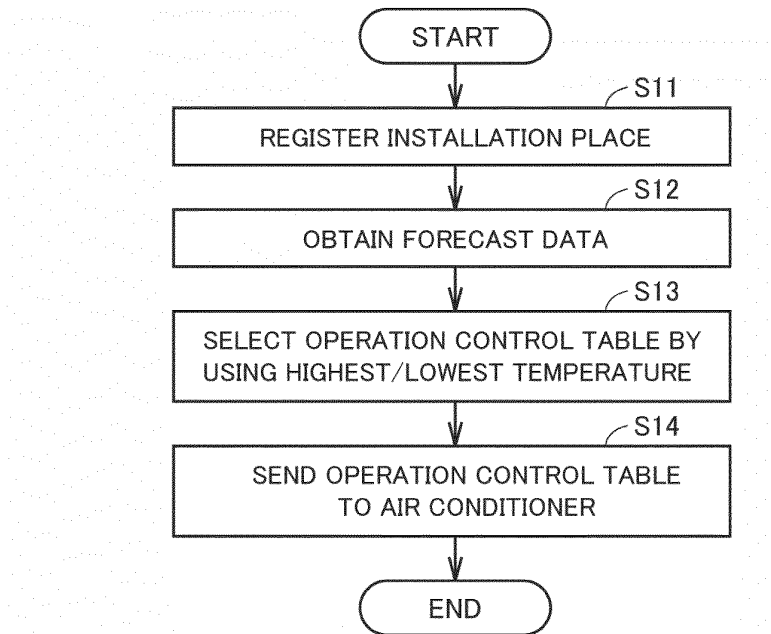


【FIG. 9】

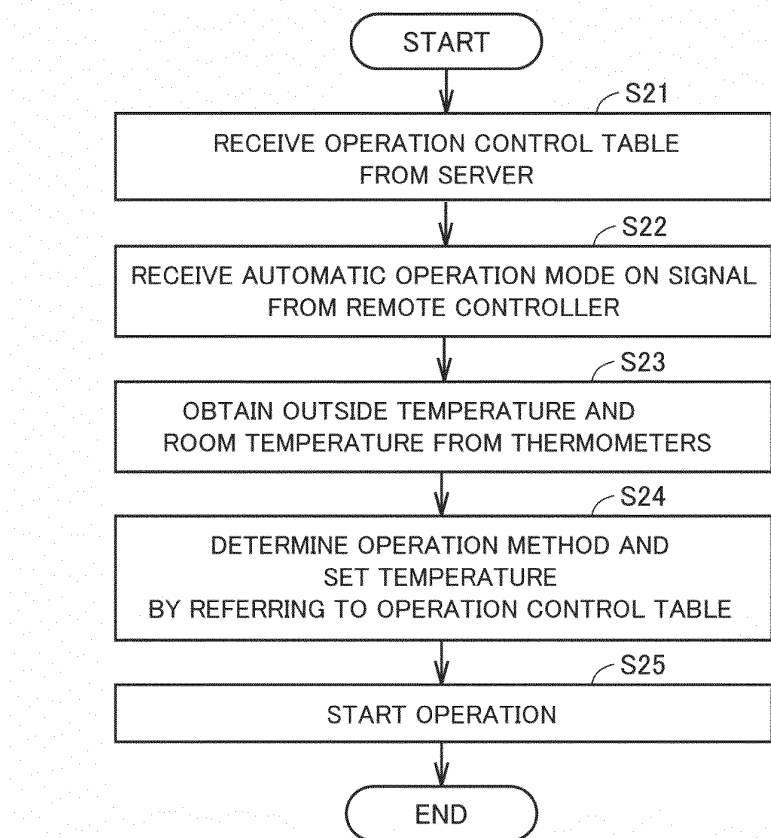


【FIG. 10】

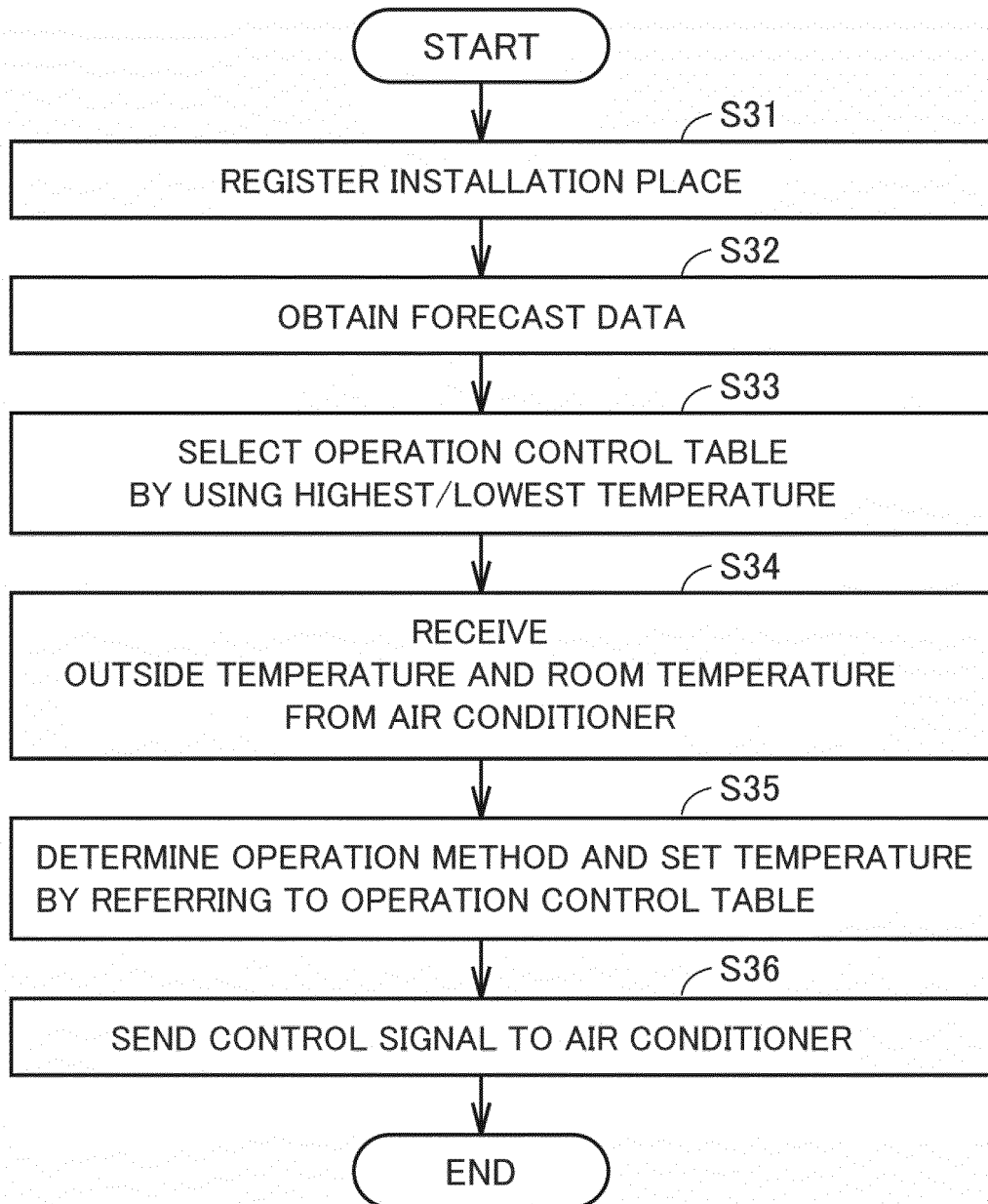
(a)



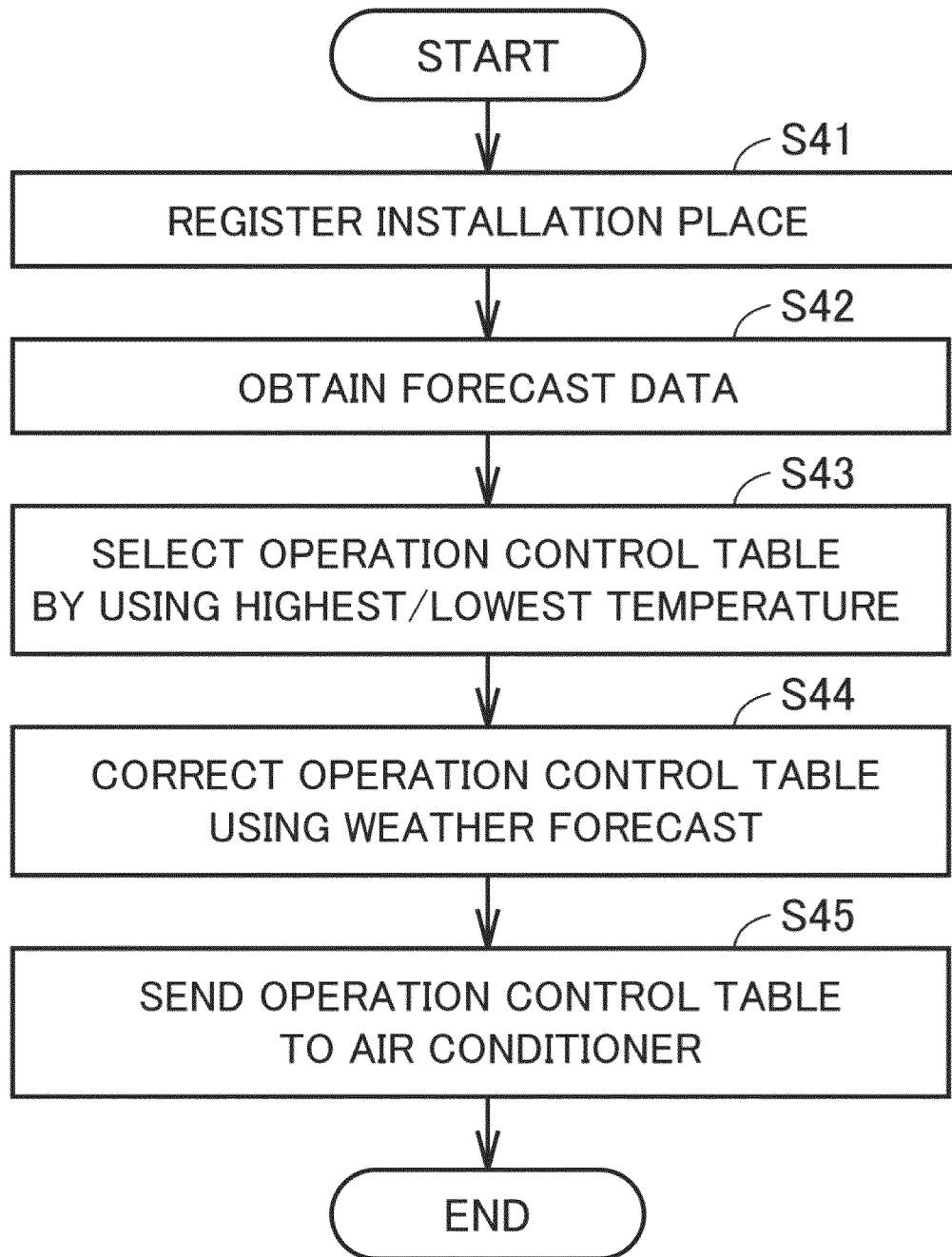
(b)



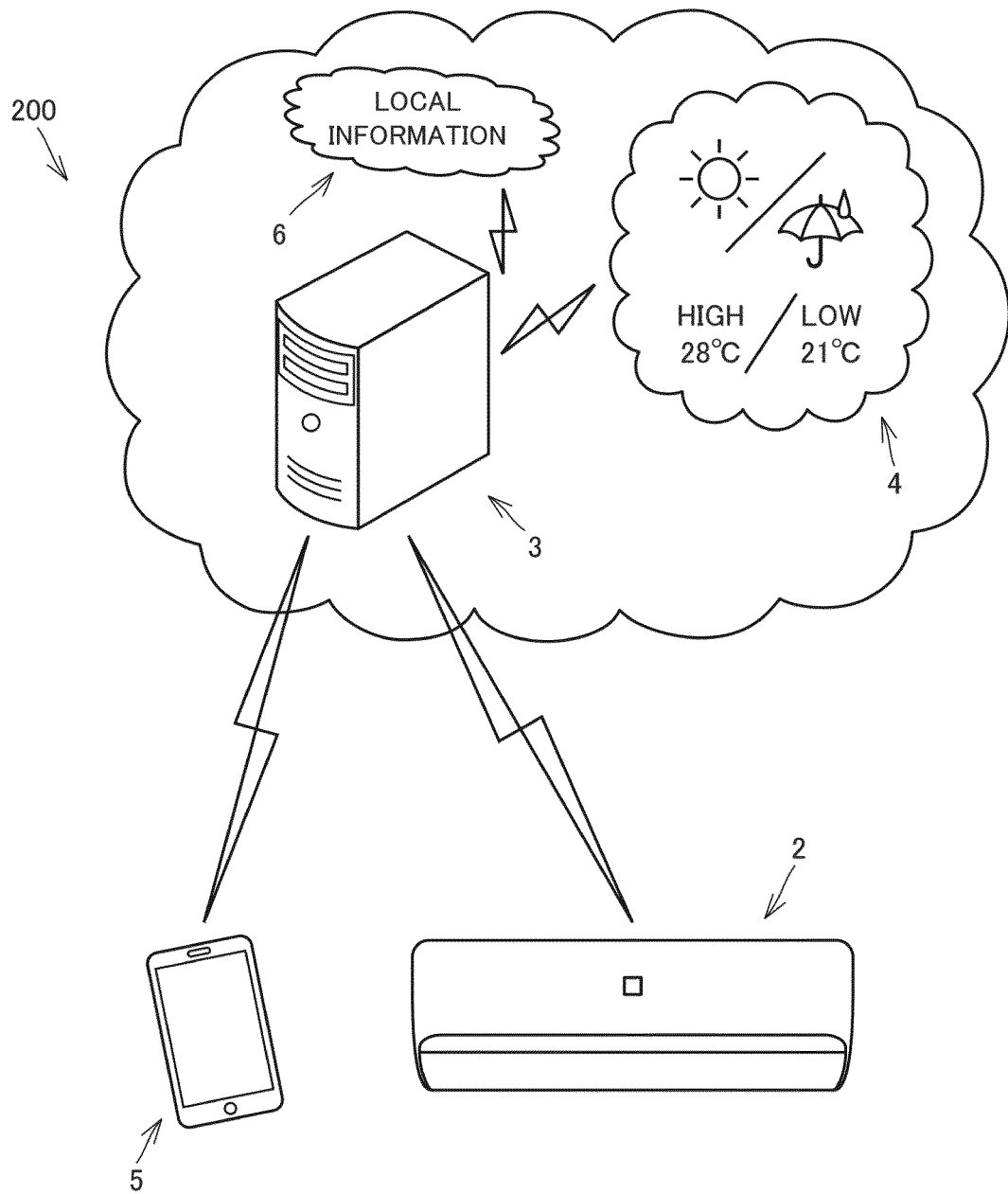
【FIG. 11】



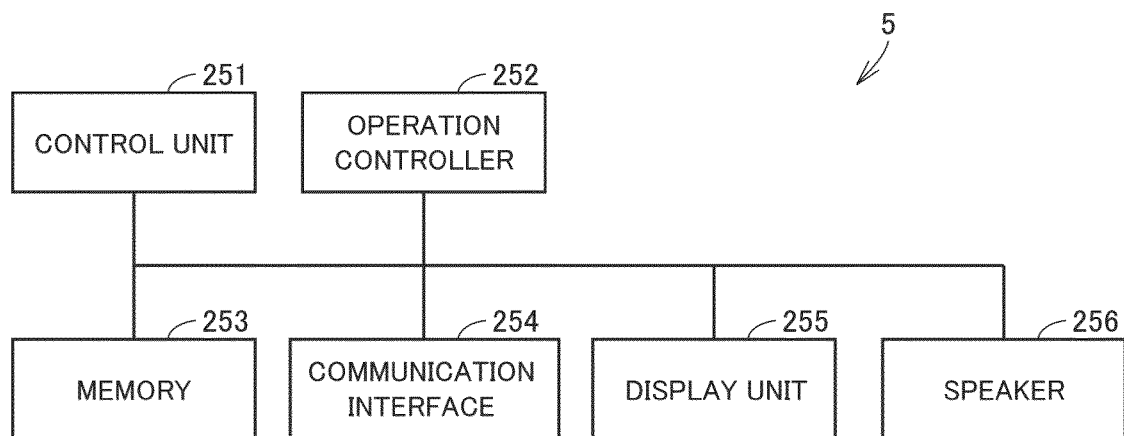
【FIG. 12】



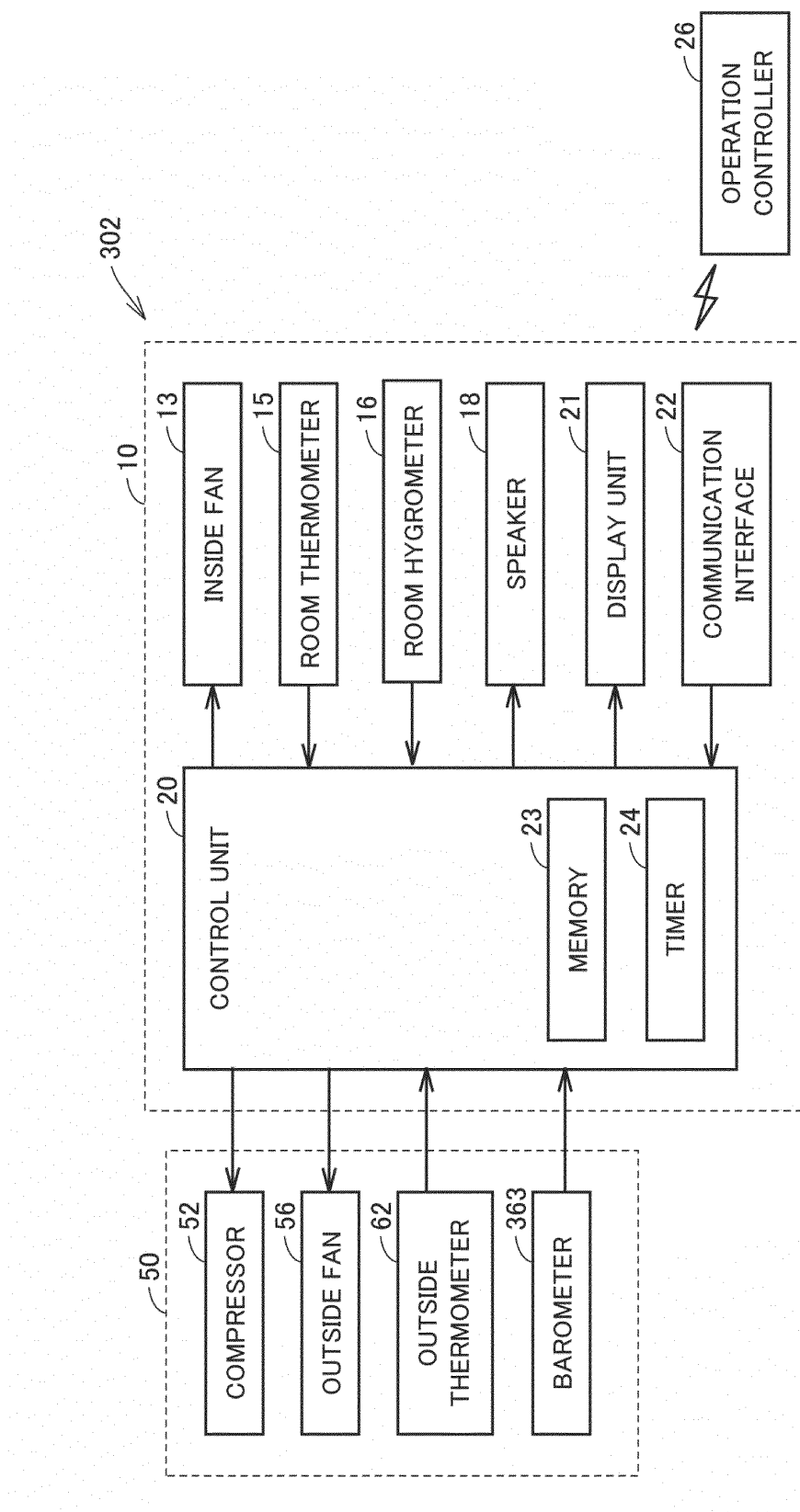
【FIG. 13】



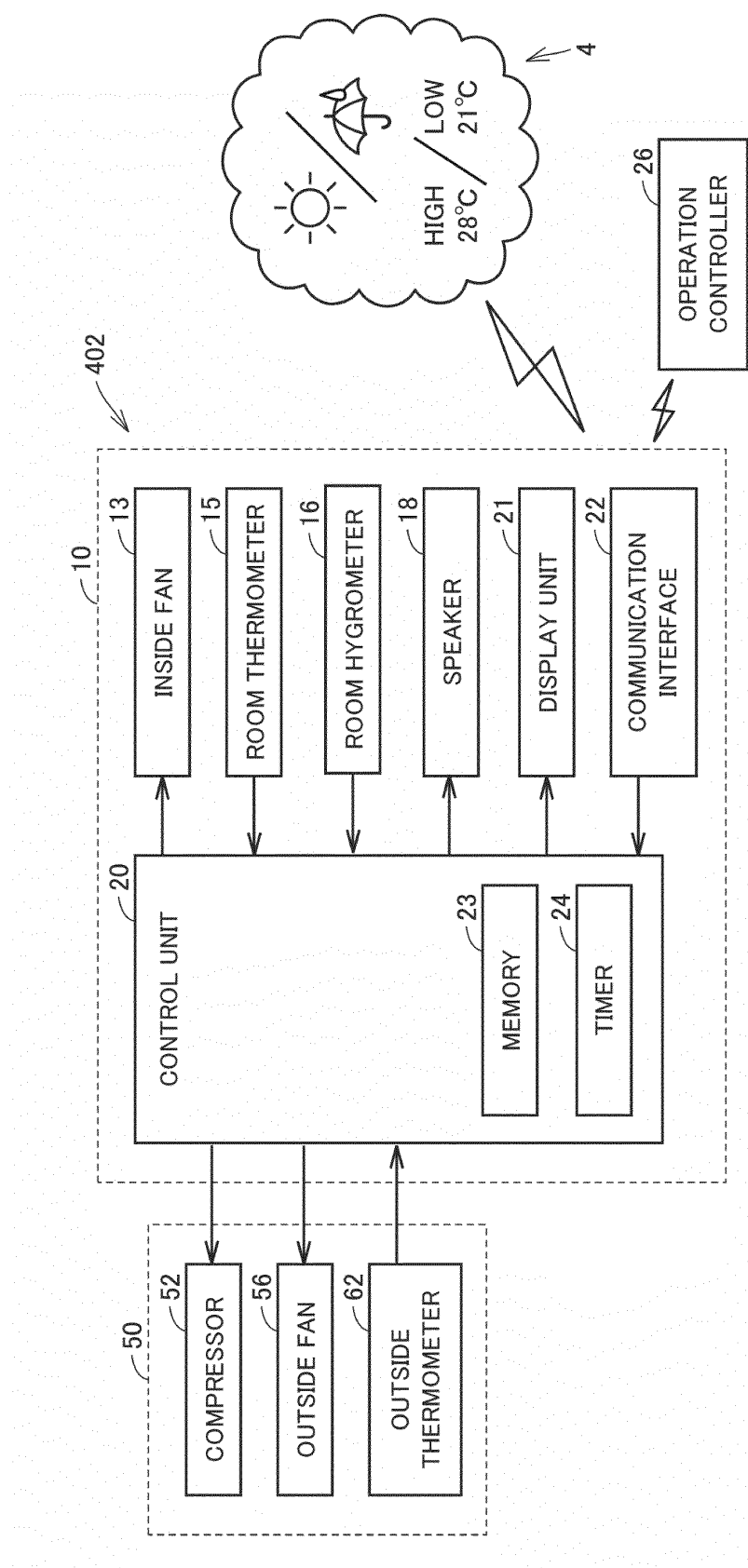
【FIG. 14】



【FIG. 15】



【FIG. 16】



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/000574

A. CLASSIFICATION OF SUBJECT MATTER

F24F11/02(2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F11/02

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2017

Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 6-34177 A (Fujitsu Ltd.), 08 February 1994 (08.02.1994), paragraphs [0029] to [0039]; fig. 6 (Family: none)	1-8
Y	JP 2010-175229 A (Mitsubishi Electric Corp.), 12 August 2010 (12.08.2010), paragraph [0018] (Family: none)	1-8
Y	JP 2008-126765 A (Toshiba Corp.), 05 June 2008 (05.06.2008), claims (Family: none)	5-6, 8

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Date of the actual completion of the international search
22 March 2017 (22.03.17)Date of mailing of the international search report
04 April 2017 (04.04.17)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/000574

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2014-40978 A (Toshiba Corp.), 06 March 2014 (06.03.2014), claims (Family: none)	5-6, 8
Y	JP 2014-9932 A (Sharp Corp.), 20 January 2014 (20.01.2014), claims; paragraph [0025] (Family: none)	5-6, 8
A	JP 2003-83586 A (Matsushita Electric Industrial Co., Ltd.), 19 March 2003 (19.03.2003), claims; paragraph [0035] (Family: none)	1-8
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A	JP 6-185785 A (Mitsubishi Electric Corp.), 08 July 1994 (08.07.1994), paragraphs [0034] to [0046] (Family: none)	1-8
A	JP 63-306344 A (Mitsubishi Electric Corp.), 14 December 1988 (14.12.1988), page 3, upper left column, lines 4 to 19 (Family: none)	1-8

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Patent documents cited in the description

- JP 2014009932 A [0005]