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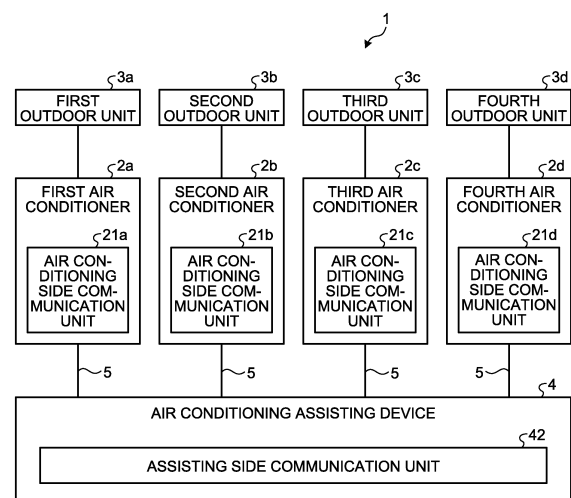
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(54) **AIR-CONDITIONING SYSTEM**

(57) An air conditioning system (1) includes a plurality of air conditioners (2a, 2b, 2c, 2d) installed on a wall or a ceiling, and an air conditioning assisting device (4) installed at a position at an equal distance from each of the air conditioners (2a, 2b, 2c, 2d) on the wall or the ceiling. The air conditioning assisting device (4) includes a thermal image sensor (41), an assisting side communication unit (42) that receives information relating to operating states of some or all of the air conditioners (2a, 2b, 2c, 2d) from some or all of the air conditioners (2a, 2b, 2c, 2d), and transmits commands for air conditioning to some or all of the air conditioners (2a, 2b, 2c, 2d), a storage unit (43) that stores information obtained by the thermal image sensor (41) and information received by the assisting side communication unit (42), and a processing unit (44) that analyzes the information obtained by the thermal image sensor (41) and the information received by the assisting side communication unit (42), and generates the commands.

FIG.1



Description

Field

[0001] The present disclosure relates to an air conditioning system for air conditioning of a room.

Background

[0002] In related art, air conditioners including a thermal image sensor that is attached to a main unit and detects the temperature in a room have been proposed (refer to Patent Literature 1, for example). In addition, air conditioning systems including a plurality of air conditioners connected to a communication network have also been proposed (refer to Patent Literature 2, for example). In an air conditioning system of the related art, a sensor transmits thermal image data generated by detecting temperature to a device such as a personal computer, for example, and the device determines control content to be performed by each of air conditioners and instructs each of the air conditioners to perform the content. In the air conditioning system of the related art, a space and an object are recognized by a camera, and each of the air conditioners is thus associated with a space in which the air conditioner performs control.

Citation List

Patent Literature

[0003]

Patent Literature 1: Japanese Patent Application Laidopen No. 2012-42197
Patent Literature 2: International Publication No. WO 2018/051479

Summary

Technical Problem

[0004] With the technology of the related art, for controlling an air conditioner on the basis of a result of temperature detection obtained by a sensor for detecting temperature, the sensor needs to be mounted on each air conditioner. Thus, with the technology of the related art, it is difficult to control an air conditioner that does not support attachment of the sensor on the basis of a result obtained by the sensor.

[0005] The present disclosure has been made in view of the above, and an object thereof is to provide an air conditioning system that controls each of a plurality of air conditioners, which do not support attachment of a sensor for detecting temperature, on the basis of results obtained by the sensor.

Solution to Problem

[0006] In order to solve the above-described problems and achieve the object, an air conditioning system according to the present disclosure includes: a plurality of air conditioners each installed on a wall or a ceiling; and an air conditioning assisting device installed at a position at an equal distance from each of the air conditioners on the wall or the ceiling. The air conditioning assisting device includes: a thermal image sensor that detects temperature; an assisting side communication unit that receives information relating to operation states of some or all of the air conditioners from some or all of the air conditioners, and transmits commands for air conditioning to some or all of the air conditioners; a storage unit that stores information obtained by the thermal image sensor and information received by the assisting side communication unit; and a processing unit that analyzes the information obtained by the thermal image sensor and the information received by the assisting side communication unit, and generates the commands.

Advantageous Effects of Invention

[0007] An air conditioning system according to the present disclosure produces an effect of enabling control of each of a plurality of air conditioners, which do not support attachment of a sensor for detecting temperature, on the basis of a result obtained by the sensor.

Brief Description of Drawings

[0008]

FIG. 1 is a diagram illustrating a configuration of an air conditioning system according to an embodiment. FIG. 2 is a diagram illustrating an example in which a first air conditioner, a second air conditioner, a third air conditioner, and a fourth air conditioner included in the air conditioning system according to the embodiment are installed on a ceiling.

FIG. 3 is a diagram illustrating a configuration of an air conditioning assisting device included in the air conditioning system according to the embodiment. FIG. 4 is a diagram schematically illustrating an example of a floor surface of a room to be air-conditioned by the air conditioning system according to the embodiment.

FIG. 5 is a flowchart illustrating part of an example of procedures of one operation of the air conditioning assisting device included in the air conditioning system according to the embodiment.

FIG. 6 is a flowchart illustrating part of an example of procedures of another operation of the air conditioning assisting device included in the air conditioning system according to the embodiment.

FIG. 7 is a flowchart illustrating part of an example of procedures of still another operation of the air con-

ditioning assisting device included in the air conditioning system according to the embodiment.

FIG. 8 is a flowchart illustrating part of an example of procedures of still another operation of the air conditioning assisting device included in the air conditioning system according to the embodiment.

FIG. 9 is a diagram illustrating a processor in a case where a thermal image sensor, an assisting side communication unit, and a processing unit included in the air conditioning assisting device of the air conditioning system according to the embodiment are at least partially implemented by the processor.

FIG. 10 is a diagram illustrating processing circuitry in a case where the thermal image sensor, the assisting side communication unit, and the processing unit included in the air conditioning assisting device of the air conditioning system according to the embodiment are at least partially implemented by the processing circuitry.

Description of Embodiments

[0009] An air conditioning system according to an embodiment will be described in detail below with reference to the drawings.

Embodiment.

[0010] First, a configuration of an air conditioning system 1 according to the embodiment will be described. FIG. 1 is a diagram illustrating a configuration of the air conditioning system 1 according to the embodiment. The air conditioning system 1 includes a first air conditioner 2a, a second air conditioner 2b, a third air conditioner 2c, and a fourth air conditioner 2d installed on a ceiling of a room to be air-conditioned. The first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d are examples of a plurality of air conditioners. The first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d are each an indoor unit.

[0011] FIG. 2 is a diagram illustrating an example in which the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d included in the air conditioning system 1 according to the embodiment are installed on a ceiling C. As illustrated in FIG. 2, when the ceiling C is divided into four regions of the same size, the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d are each installed in any one of the four regions. The individual four regions are regions defined by solid lines on the ceiling C in FIG. 2. The number of air conditioners installed in each of the four regions is not more than one. Each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d is installed at the center of one of the four regions.

[0012] Some or all of the first air conditioner 2a, the

second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d may be installed on a wall of the room to be air-conditioned. The wall is an inner wall of the room.

[0013] For example, the wind direction of each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d is set to vertically downward. For example, the air volume of each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d is set to a maximum volume of its capacity.

[0014] The air conditioning system 1 further includes a first outdoor unit 3a associated with the first air conditioner 2a, a second outdoor unit 3b associated with the second air conditioner 2b, a third outdoor unit 3c associated with the third air conditioner 2c, and a fourth outdoor unit 3d associated with the fourth air conditioner 2d. The first outdoor unit 3a, the second outdoor unit 3b, the third outdoor unit 3c, and the fourth outdoor unit 3d are installed outside of the room to be air-conditioned. The first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, the fourth air conditioner 2d, the first outdoor unit 3a, the second outdoor unit 3b, the third outdoor unit 3c, and the fourth outdoor unit 3d perform air conditioning of the room.

[0015] The air conditioning system 1 further includes an air conditioning assisting device 4 on the ceiling C of the room to be air-conditioned. Thus, the air conditioning assisting device 4 installed in one room. In the room, no air conditioning assisting device other than the air conditioning assisting device 4 is installed. In the room, the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, the fourth air conditioner 2d, and the air conditioning assisting device 4 are arranged. The air conditioning assisting device 4 is a device for controlling the operations of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d. The air conditioning assisting device 4 is connected with each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d via a communication network 5.

[0016] As illustrated in FIG. 2, the air conditioning assisting device 4 is installed at a position at an equal distance from each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d. Specifically, the air conditioning assisting device 4 is installed at the center of the ceiling C. The air conditioning assisting device 4 may be located on a wall. The wall is an inner wall of the room to be air-conditioned. In any case, the air conditioning assisting device 4 is installed at an equal distance from each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d.

[0017] The first air conditioner 2a includes an air conditioning side communication unit 21a that communicates with the air conditioning assisting device 4. The

second air conditioner 2b includes an air conditioning side communication unit 21b that communicates with the air conditioning assisting device 4. The third air conditioner 2c includes an air conditioning side communication unit 21c that communicates with the air conditioning assisting device 4. The fourth air conditioner 2d includes an air conditioning side communication unit 21d that communicates with the air conditioning assisting device 4.

[0018] FIG. 3 is a diagram illustrating a configuration of the air conditioning assisting device 4 included in the air conditioning system 1 according to the embodiment. The air conditioning assisting device 4 includes a thermal image sensor 41 that detects temperature. Specifically, the thermal image sensor 41 detects the temperature of the room in which the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d are installed. The air conditioning assisting device 4 further includes an assisting side communication unit 42 that communicates with each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d.

[0019] Specifically, the assisting side communication unit 42 communicates with each of the air conditioning side communication unit 21a, the air conditioning side communication unit 21b, the air conditioning side communication unit 21c, and the air conditioning side communication unit 21d. Furthermore, the assisting side communication unit 42 is connected with each of the air conditioning side communication unit 21a, the air conditioning side communication unit 21b, the air conditioning side communication unit 21c, and the air conditioning side communication unit 21d via the communication network 5, and communicates with the air conditioning side communication unit 21a, the air conditioning side communication unit 21b, the air conditioning side communication unit 21c, and the air conditioning side communication unit 21d via the communication network 5.

[0020] The assisting side communication unit 42 communicates at least one of the air conditioning side communication unit 21a, the air conditioning side communication unit 21b, the air conditioning side communication unit 21c, and the air conditioning side communication unit 21d to receive information relating to operation states of some or all of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d from some or all of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d. An operation state includes some or all of the temperature of the room in which the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d are installed, the humidity of the room, and the air volume of each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d. The assisting side communication unit 42 also has a function of transmitting commands for air conditioning to some or all of the first air conditioner 2a, the second air conditioner 2b, the third

air conditioner 2c, and the fourth air conditioner 2d.

[0021] The air conditioning assisting device 4 further includes a storage unit 43 for storing information obtained by the thermal image sensor 41 and information received by the assisting side communication unit 42. An example of the storage unit 43 is a semiconductor memory. The air conditioning assisting device 4 further includes a processing unit 44 for analyzing information obtained by the thermal image sensor 41 and information received by the assisting side communication unit 42, and generating the commands. The processing unit 44 also has a function of detecting a human on the basis of heat distribution on a thermal image obtained by the thermal image sensor 41. The processing unit 44 also has a function of determining which part of the room is to be controlled by each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d.

[0022] For example, the air conditioning assisting device 4 causes one of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d to perform cooling operation. In this case, the storage unit 43 stores information associating an area in which the temperature detected by the thermal image sensor 41 is a predetermined cooling reference temperature with the air conditioner that is performing the cooling operation.

[0023] The thermal image sensor 41 may detect the temperature of the room before the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d operate. In this case, the air conditioning assisting device 4 causes one of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d to perform heating operation on the basis of the temperature detected by the thermal image sensor 41. The storage unit 43 stores information associating an area in which the temperature detected by the thermal image sensor 41 is a predetermined heating reference temperature with the air conditioner that is performing the heating operation.

[0024] In the case where the thermal image sensor 41 detects the temperature of the room before the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d operate, the air conditioning assisting device 4 may determine whether to cause each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d to perform cooling operation or heating operation on the basis of the temperature detected by the thermal image sensor 41.

[0025] The storage unit 43 may store calendar information indicating monthly details of operations of an air conditioner. In this case, the air conditioning assisting device 4 may determine whether to cause each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d to perform cooling operation or heating operation on the

basis of the calendar information stored in the storage unit 43 and the current month.

[0026] In a case where the air conditioning assisting device 4 associates one area in which the thermal image sensor 41 has detected the temperature with the one air conditioner, and then associates another air conditioner different from the one air conditioner among the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with another area different from the one area in the room, the following operations may be performed. Specifically, the air conditioning assisting device 4 may cause the another air conditioner to perform operation different from that of the one air conditioner. Furthermore, each time the air conditioner with which any one area in the room is associated changes among the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d, the air conditioning assisting device 4 may cause the air conditioner that is newly associated to perform operation different from that of the air conditioner that was last associated.

[0027] After associating one area in which the thermal image sensor 41 has detected the temperature with the one air conditioner and before associating another air conditioner different from the one air conditioner among the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with another area different from the one area in the room, the air conditioning assisting device 4 may stop the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d for a predetermined time period.

[0028] After associating one area in which the thermal image sensor 41 has detected the temperature with the one air conditioner and before associating another air conditioner different from the one air conditioner among the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with another area different from the one area in the room, the air conditioning assisting device 4 may cause the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d to perform fan operation for a predetermined time period.

[0029] Next, the operation of the air conditioning system 1 according to the embodiment will be explained. FIG. 4 is a diagram schematically illustrating an example of a floor surface of the room to be air-conditioned by the air conditioning system 1 according to the embodiment. The room is a room in which the air conditioning assisting device 4 is installed. As illustrated in FIG. 4, assume a situation in which the floor surface has a square shape, and is divided into 64 blocks 401,..., 464. The 64 blocks 401,..., 464 each have a square shape, and each have the same size as the other blocks. The air conditioning assisting device 4 recognizes the floor surface in the 64 blocks 401,..., 464.

[0030] When the air conditioning assisting device 4 has

detected a human in any of the 64 blocks 401,..., 464, the air conditioning assisting device 4 generates commands to cause some or all of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d to perform one or more of starting operation, changing temperature, and changing air volume, for example. For example, in the air conditioning assisting device 4, information indicating operations to be performed by each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d is set in advance for each of a plurality of situations.

[0031] Next, an operation of the air conditioning assisting device 4 to associate each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with any of the 64 blocks 401,..., 464 will be explained. FIG. 5 is a flowchart illustrating part of an example of procedures of one operation of the air conditioning assisting device 4 included in the air conditioning system 1 according to the embodiment. The air conditioning assisting device 4 instructs only the first air conditioner 2a to perform cooling operation via the communication network 5. Only the first air conditioner 2a performs cooling operation (S1). In FIG. 5, the operation in step S1 is described as the following wording: "only one air conditioner performs cooling operation".

[0032] The air conditioning assisting device 4 determines whether or not a predetermined time has elapsed since the air conditioning assisting device 4 instructed the first air conditioner 2a to perform cooling operation (S2). If it is determined that the predetermined time has not elapsed (No in S2), the air conditioning assisting device 4 performs the operation in step S2.

[0033] If it is determined that the predetermined time has elapsed (Yes in S2), the air conditioning assisting device 4 detects the temperature of the room by the thermal image sensor 41, and recognizes, as a control area of the first air conditioner 2a, a block in which the temperature is a preset cooling reference temperature among the 64 blocks 401,..., 464 (S3). Specifically, in step S3, the air conditioning assisting device 4 associates a block in which the detected temperature is the cooling reference temperature among the 64 blocks 401,..., 464 with the first air conditioner 2a. A block is an example of an area. In FIG. 5, the operation in step S3 is described as the following wording: "recognize block in which temperature is cooling reference temperature as control area of one air conditioner". The air conditioning assisting device 4 stores the recognized matter in the storage unit 43.

[0034] After performing the operation in step S3, the air conditioning assisting device 4 instructs the first air conditioner 2a to stop operating. The first air conditioner 2a stops operating (S4). In FIG. 5, the operation in step S4 is described as the following wording: "one air conditioner stops operating". As a result, the operation of associating the first air conditioner 2a with the block to be controlled by the first air conditioner 2a is terminated.

[0035] When the operation of associating the first air conditioner 2a with the block to be controlled by the first air conditioner 2a is terminated, the air conditioning assisting device 4 performs an operation of associating the second air conditioner 2b with a block to be controlled by the second air conditioner 2b in accordance with the procedures in the flowchart of FIG. 5. In this case, the first air conditioner 2a in the description above with reference to FIG. 5 is replaced with the second air conditioner 2b.

[0036] Similarly, the air conditioning assisting device 4 sequentially performs an operation of associating the third air conditioner 2c with a block to be controlled by the third air conditioner 2c, and an operation of associating the fourth air conditioner 2d with a block to be controlled by the fourth air conditioner 2d. In this manner, the air conditioning assisting device 4 associates each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with one of the 64 blocks 401,..., 464.

[0037] When cooling operation is performed in winter-time, for example, a difference between the temperature in any one block of the 64 blocks 401,..., 464 and the temperature in another block thereof may not be appropriately determined. In this case, if the air conditioning assisting device 4 operates in accordance with the procedures of the flowchart in FIG. 5, each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d cannot be appropriately associated with one of the 64 blocks 401,..., 464.

[0038] Thus, the air conditioning assisting device 4 may associate each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with one of the 64 blocks 401,..., 464 in accordance with procedures of a flowchart in FIG. 6. FIG. 6 is a flowchart illustrating part of an example of procedures of another operation of the air conditioning assisting device 4 included in the air conditioning system 1 according to the embodiment. The air conditioning assisting device 4 detects the temperature of the room by the thermal image sensor 41 before causing the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d to operate (S11).

[0039] The air conditioning assisting device 4 determines whether or not the temperature detected by the thermal image sensor 41 is equal to or higher than a preset reference room air temperature (S12). If the temperature detected by the thermal image sensor 41 is determined to be equal to or higher than the reference room air temperature (Yes in S12), the air conditioning assisting device 4 instructs only the first air conditioner 2a to perform cooling operation via the communication network 5. Only the first air conditioner 2a performs cooling operation (S13). In FIG. 6, the operation in step S13 is described as the following wording: "only one air conditioner performs cooling operation".

[0040] The air conditioning assisting device 4 determines whether or not a predetermined time has elapsed since the air conditioning assisting device 4 instructed the first air conditioner 2a to perform cooling operation (S14). If it is determined that the predetermined time has not elapsed (No in S14), the air conditioning assisting device 4 performs the operation in step S14.

[0041] If it is determined that the predetermined time has elapsed (Yes in S14), the air conditioning assisting device 4 detects the temperature of the room by the thermal image sensor 41, and recognizes, as a control area of the first air conditioner 2a, a block in which the temperature is a preset cooling reference temperature among the 64 blocks 401,..., 464 (S15). Specifically, in step S15, the air conditioning assisting device 4 associates a block in which the detected temperature is the cooling reference temperature among the 64 blocks 401,..., 464 with the first air conditioner 2a. In FIG. 6, the operation in step S15 is described as the following wording: "recognize block in which temperature is cooling reference temperature as control area of one air conditioner". The air conditioning assisting device 4 stores the recognized matter in the storage unit 43.

[0042] After performing the operation in step S15, the air conditioning assisting device 4 instructs the first air conditioner 2a to stop operating. The first air conditioner 2a stops operating (S16). In FIG. 6, the operation in step S16 is described as the following wording: "one air conditioner stops operating". As a result, the operation of associating the first air conditioner 2a with the block to be controlled by the first air conditioner 2a is terminated.

[0043] If the temperature detected by the thermal image sensor 41 is determined to be lower than the reference room air temperature (No in S12), the air conditioning assisting device 4 instructs only the first air conditioner 2a to perform heating operation via the communication network 5. Only the first air conditioner 2a performs heating operation (S17). In FIG. 6, the operation in step S17 is described as the following wording: "only one air conditioner performs heating operation".

[0044] The air conditioning assisting device 4 determines whether or not a predetermined time has elapsed since the air conditioning assisting device 4 instructed the first air conditioner 2a to perform heating operation (S18). If it is determined that the predetermined time has not elapsed (No in S18), the air conditioning assisting device 4 performs the operation in step S18.

[0045] If it is determined that the predetermined time has elapsed (Yes in S18), the air conditioning assisting device 4 detects the temperature of the room by the thermal image sensor 41, and recognizes, as a control area of the first air conditioner 2a, a block in which the temperature is a preset heating reference temperature among the 64 blocks 401,..., 464 (S19). Specifically, in step S19, the air conditioning assisting device 4 associates a block in which the detected temperature is the heating reference temperature among the 64 blocks 401,..., 464 with the first air conditioner 2a. In FIG. 6, the

operation in step S19 is described as the following wording: "recognize block in which temperature is heating reference temperature as control area of one air conditioner". The air conditioning assisting device 4 stores the recognized matter in the storage unit 43.

[0046] After performing the operation in step S19, the air conditioning assisting device 4 instructs the first air conditioner 2a to stop operating. The first air conditioner 2a stops operating (S20). In FIG. 6, the operation in step S20 is described as the following wording: "one air conditioner stops operating". As a result, the operation of associating the first air conditioner 2a with the block to be controlled by the first air conditioner 2a is terminated.

[0047] When the operation of associating the first air conditioner 2a with the block to be controlled by the first air conditioner 2a is terminated, the air conditioning assisting device 4 performs an operation of associating the second air conditioner 2b with a block to be controlled by the second air conditioner 2b in accordance with the procedures in the flowchart of FIG. 6. In this case, the first air conditioner 2a in the description above with reference to FIG. 6 is replaced with the second air conditioner 2b. If it is determined by the air conditioning assisting device 4 that the temperature detected by the thermal image sensor 41 is equal to or higher than the reference room air temperature (Yes in S12), the operations in step S13 and subsequent steps are performed. If it is determined by the air conditioning assisting device 4 that the temperature detected by the thermal image sensor 41 is lower than the reference room air temperature (No in S12), the operations in step S17 and subsequent steps are performed.

[0048] Similarly, the air conditioning assisting device 4 sequentially performs an operation of associating the third air conditioner 2c with a block to be controlled by the third air conditioner 2c, and an operation of associating the fourth air conditioner 2d with a block to be controlled by the fourth air conditioner 2d. In this manner, the air conditioning assisting device 4 associates each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with one of the 64 blocks 401,..., 464.

[0049] The air conditioning assisting device 4 may associate each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with one of the 64 blocks 401,..., 464 in accordance with procedures of a flowchart in FIG. 7. FIG. 7 is a flowchart illustrating part of an example of procedures of still another operation of the air conditioning assisting device 4 included in the air conditioning system 1 according to the embodiment.

[0050] The air conditioning assisting device 4 determines whether or not the current month is any one of May to September (S21). If the current month is determined to be any of May to September (Yes in S21), the air conditioning assisting device 4 instructs only the first air conditioner 2a to perform cooling operation via the communication network 5. Only the first air conditioner

2a performs cooling operation (S22). In FIG. 7, the operation in step S22 is described as the following wording: "only one air conditioner performs cooling operation".

[0051] The air conditioning assisting device 4 determines whether or not a predetermined time has elapsed since the air conditioning assisting device 4 instructed the first air conditioner 2a to perform cooling operation (S23). If it is determined that the predetermined time has not elapsed (No in S23), the air conditioning assisting device 4 performs the operation in step S23.

[0052] If it is determined that the predetermined time has elapsed (Yes in S23), the air conditioning assisting device 4 detects the temperature of the room by the thermal image sensor 41, and recognizes, as a control area of the first air conditioner 2a, a block in which the temperature is a preset cooling reference temperature among the 64 blocks 401,..., 464 (S24). Specifically, in step S24, the air conditioning assisting device 4 associates a block in which the detected temperature is the cooling reference temperature among the 64 blocks 401,..., 464 with the first air conditioner 2a. In FIG. 7, the operation in step S24 is described as the following wording: "recognize block in which temperature is cooling reference temperature as control area of one air conditioner". The air conditioning assisting device 4 stores the recognized matter in the storage unit 43.

[0053] After performing the operation in step S24, the air conditioning assisting device 4 instructs the first air conditioner 2a to stop operating. The first air conditioner 2a stops operating (S25). In FIG. 7, the operation in step S25 is described as the following wording: "one air conditioner stops operating". As a result, the operation of associating the first air conditioner 2a with the block to be controlled by the first air conditioner 2a is terminated.

[0054] If the current month is determined to be none of May to September (No in S21), the air conditioning assisting device 4 instructs only the first air conditioner 2a to perform heating operation via the communication network 5. Only the first air conditioner 2a performs heating operation (S26). In FIG. 7, the operation in step S26 is described as the following wording: "only one air conditioner performs heating operation".

[0055] The air conditioning assisting device 4 determines whether or not a predetermined time has elapsed since the air conditioning assisting device 4 instructed the first air conditioner 2a to perform heating operation (S27). If it is determined that the predetermined time has not elapsed (No in S27), the air conditioning assisting device 4 performs the operation in step S27.

[0056] If it is determined that the predetermined time has elapsed (Yes in S27), the air conditioning assisting device 4 detects the temperature of the room by the thermal image sensor 41, and recognizes, as a control area of the first air conditioner 2a, a block in which the temperature is a preset heating reference temperature among the 64 blocks 401,..., 464 (S28). Specifically, in step S28, the air conditioning assisting device 4 associates a block in which the detected temperature is the

heating reference temperature among the 64 blocks 401,..., 464 with the first air conditioner 2a. In FIG. 7, the operation in step S28 is described as the following wording: "recognize block in which temperature is heating reference temperature as control area of one air conditioner". The air conditioning assisting device 4 stores the recognized matter in the storage unit 43.

[0057] After performing the operation in step S28, the air conditioning assisting device 4 instructs the first air conditioner 2a to stop operating. The first air conditioner 2a stops operating (S29). In FIG. 7, the operation in step S29 is described as the following wording: "one air conditioner stops operating". As a result, the operation of associating the first air conditioner 2a with the block to be controlled by the first air conditioner 2a is terminated.

[0058] When the operation of associating the first air conditioner 2a with the block to be controlled by the first air conditioner 2a is terminated, the air conditioning assisting device 4 performs an operation of associating the second air conditioner 2b with a block to be controlled by the second air conditioner 2b in accordance with the procedures in the flowchart of FIG. 7. In this case, the first air conditioner 2a in the description above with reference to FIG. 7 is replaced with the second air conditioner 2b. If it is determined by the air conditioning assisting device 4 that the current month is any of May to September (Yes in S21), the operations in step S22 and subsequent steps are performed. If it is determined by the air conditioning assisting device 4 that the current month is none of May to September (No in S21), the operations in step S26 and subsequent steps are performed.

[0059] Similarly, the air conditioning assisting device 4 sequentially performs an operation of associating the third air conditioner 2c with a block to be controlled by the third air conditioner 2c, and an operation of associating the fourth air conditioner 2d with a block to be controlled by the fourth air conditioner 2d. In this manner, the air conditioning assisting device 4 associates each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with one of the 64 blocks 401,..., 464.

[0060] In accordance with the procedures of any of the flowcharts in FIGS. 5 to 7, after the first air conditioner 2a has performed cooling operation and the first air conditioner 2a is associated with the block to be controlled by the first air conditioner 2a, the first air conditioner 2a stops, and the second air conditioner 2b performs cooling operation. In this case, there may be no difference between the temperature in the block to be controlled by the first air conditioner 2a and the temperature in the block to be controlled by the second air conditioner 2b, and the air conditioning assisting device 4 may recognize a wrong block as a block to be controlled by the second air conditioner 2b.

[0061] Thus, the air conditioning assisting device 4 may associate each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c,

and the fourth air conditioner 2d with any one of the 64 blocks 401,..., 464 in accordance with procedures of a flowchart in FIG. 8. FIG. 8 is a flowchart illustrating part of an example of procedures of still another operation of the air conditioning assisting device 4 included in the air conditioning system 1 according to the embodiment. The air conditioning assisting device 4 detects the temperature of the room by the thermal image sensor 41 before causing the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d to operate (S31).

[0062] The air conditioning assisting device 4 determines whether or not the temperature detected by the thermal image sensor 41 is equal to or higher than a preset reference room air temperature (S32). If the temperature detected by the thermal image sensor 41 is determined to be equal to or higher than the reference room air temperature (Yes in S32), the air conditioning assisting device 4 instructs only the first air conditioner 2a to perform cooling operation via the communication network 5. Only the first air conditioner 2a performs cooling operation (S33). In FIG. 8, the operation in step S33 is described as the following wording: "only one air conditioner performs cooling operation".

[0063] The air conditioning assisting device 4 determines whether or not a predetermined time has elapsed since the air conditioning assisting device 4 instructed the first air conditioner 2a to perform cooling operation (S34). If it is determined that the predetermined time has not elapsed (No in S34), the air conditioning assisting device 4 performs the operation in step S34.

[0064] If it is determined that the predetermined time has elapsed (Yes in S34), the air conditioning assisting device 4 detects the temperature of the room by the thermal image sensor 41, and recognizes, as a control area of the first air conditioner 2a, a block in which the temperature is a preset cooling reference temperature among the 64 blocks 401,..., 464 (S35). Specifically, in step S35, the air conditioning assisting device 4 associates a block in which the detected temperature is the cooling reference temperature among the 64 blocks 401,..., 464 with the first air conditioner 2a. In FIG. 8, the operation in step S35 is described as the following wording: "recognize block in which temperature is cooling reference temperature as control area of one air conditioner". The air conditioning assisting device 4 stores the recognized matter in the storage unit 43.

[0065] After performing the operation in step S35, the air conditioning assisting device 4 instructs the first air conditioner 2a to stop operating. The first air conditioner 2a stops operating (S36). In FIG. 8, the operation in step S36 is described as the following wording: "one air conditioner stops operating". As a result, the operation of associating the first air conditioner 2a with the block to be controlled by the first air conditioner 2a is terminated.

[0066] After performing the operation in step S36, the air conditioning assisting device 4 instructs only the second air conditioner 2b to perform heating operation via

the communication network 5. Only the second air conditioner 2b performs heating operation (S37). In FIG. 8, the operation in step S37 is described as the following wording: "only another air conditioner performs heating operation".

[0067] The air conditioning assisting device 4 determines whether or not a predetermined time has elapsed since the air conditioning assisting device 4 instructed the second air conditioner 2b to perform heating operation (S38). If it is determined that the predetermined time has not elapsed (No in S38), the air conditioning assisting device 4 performs the operation in step S38.

[0068] If it is determined that the predetermined time has elapsed (Yes in S38), the air conditioning assisting device 4 detects the temperature of the room by the thermal image sensor 41, and recognizes, as a control area of the second air conditioner 2b, a block in which the temperature is a preset heating reference temperature among the 64 blocks 401,..., 464 (S39). Specifically, in step S39, the air conditioning assisting device 4 associates a block in which the detected temperature is the heating reference temperature among the 64 blocks 401,..., 464 with the second air conditioner 2b. In FIG. 8, the operation in step S39 is described as the following wording: "recognize block in which temperature is heating reference temperature as control area of another air conditioner". The air conditioning assisting device 4 stores the recognized matter in the storage unit 43.

[0069] After performing the operation in step S39, the air conditioning assisting device 4 instructs the second air conditioner 2b to stop operating. The second air conditioner 2b stops operating (S40). In FIG. 8, the operation in step S40 is described as the following wording: "another air conditioner stops operating". As a result, the operation of associating the second air conditioner 2b with the block to be controlled by the second air conditioner 2b is terminated.

[0070] Although not illustrated in FIG. 8, after performing the operation in step S40, the air conditioning assisting device 4 instructs only the third air conditioner 2c to perform cooling operation via the communication network 5. Specifically, after the operation in step S40 is performed, the air conditioning system 1 performs the operations from step S33 to step S40. In this case, the first air conditioner 2a in the description above with reference to FIG. 8 is replaced with the third air conditioner 2c, and the second air conditioner 2b in the description above with reference to FIG. 8 is replaced with the fourth air conditioner 2d.

[0071] If the temperature detected by the thermal image sensor 41 is determined to be lower than the reference room air temperature (No in S32), the air conditioning assisting device 4 instructs only the first air conditioner 2a to perform heating operation via the communication network 5. Only the first air conditioner 2a performs heating operation (S41). In FIG. 8, the operation in step S41 is described as the following wording: "only one air conditioner performs heating operation".

[0072] The air conditioning assisting device 4 determines whether or not a predetermined time has elapsed since the air conditioning assisting device 4 instructed the first air conditioner 2a to perform heating operation (S42). If it is determined that the predetermined time has not elapsed (No in S42), the air conditioning assisting device 4 performs the operation in step S42.

[0073] If it is determined that the predetermined time has elapsed (Yes in S42), the air conditioning assisting device 4 detects the temperature of the room by the thermal image sensor 41, and recognizes, as a control area of the first air conditioner 2a, a block in which the temperature is a preset heating reference temperature among the 64 blocks 401,..., 464 (S43). Specifically, in step S43, the air conditioning assisting device 4 associates a block in which the detected temperature is the heating reference temperature among the 64 blocks 401,..., 464 with the first air conditioner 2a. In FIG. 8, the operation in step S43 is described as the following wording: "recognize block in which temperature is heating reference temperature as control area of one air conditioner". The air conditioning assisting device 4 stores the recognized matter in the storage unit 43.

[0074] After performing the operation in step S43, the air conditioning assisting device 4 instructs the first air conditioner 2a to stop operating. The first air conditioner 2a stops operating (S44). In FIG. 8, the operation in step S44 is described as the following wording: "one air conditioner stops operating". As a result, the operation of associating the first air conditioner 2a with the block to be controlled by the first air conditioner 2a is terminated.

[0075] After performing the operation in step S44, the air conditioning assisting device 4 instructs only the second air conditioner 2b to perform cooling operation via the communication network 5. Only the second air conditioner 2b performs cooling operation (S45). In FIG. 8, the operation in step S45 is described as the following wording: "only another air conditioner performs cooling operation".

[0076] The air conditioning assisting device 4 determines whether or not a predetermined time has elapsed since the air conditioning assisting device 4 instructed the second air conditioner 2b to perform cooling operation (S46). If it is determined that the predetermined time has not elapsed (No in S46), the air conditioning assisting device 4 performs the operation in step S46.

[0077] If it is determined that the predetermined time has elapsed (Yes in S46), the air conditioning assisting device 4 detects the temperature of the room by the thermal image sensor 41, and recognizes, as a control area of the second air conditioner 2b, a block in which the temperature is a preset cooling reference temperature among the 64 blocks 401,..., 464 (S47). Specifically, in step S47, the air conditioning assisting device 4 associates a block in which the detected temperature is the cooling reference temperature among the 64 blocks 401,..., 464 with the second air conditioner 2b. In FIG. 8, the operation in step S47 is described as the following

wording: "recognize block in which temperature is cooling reference temperature as control area of another air conditioner". The air conditioning assisting device 4 stores the recognized matter in the storage unit 43.

[0078] After performing the operation in step S47, the air conditioning assisting device 4 instructs the second air conditioner 2b to stop operating. The second air conditioner 2b stops operating (S48). In FIG. 8, the operation in step S48 is described as the following wording: "another air conditioner stops operating". As a result, the operation of associating the second air conditioner 2b with the block to be controlled by the second air conditioner 2b is terminated.

[0079] Although not illustrated in FIG. 8, after performing the operation in step S48, the air conditioning assisting device 4 instructs only the third air conditioner 2c to perform heating operation via the communication network 5. Specifically, after the operation in step S48 is performed, the air conditioning system 1 performs the operations from step S41 to step S48. In this case, the first air conditioner 2a in the description above with reference to FIG. 8 is replaced with the third air conditioner 2c, and the second air conditioner 2b in the description above with reference to FIG. 8 is replaced with the fourth air conditioner 2d. In this manner, the air conditioning assisting device 4 associates each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with one of the 64 blocks 401,..., 464.

[0080] When the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d sequentially operate, the wind direction of each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d during operation may be set to vertically downward so as to prevent cool air or warm air from spreading to cause a temperature difference in the room before each operation is performed. For example, in a case where the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d are installed on a ceiling, the wind direction of each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d during operation may be set to vertically downward so as to prevent cool air or warm air from spreading to cause a temperature difference in the room before each operation is performed. The air volume of each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d during operation may be set to a maximum volume of its capacity.

[0081] When the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d sequentially operate, the air conditioning assisting device 4 may stop the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d for a predetermined time period each time association of any of the first air

conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with one of the 64 blocks 401,..., 464 is terminated, so as to make the temperature of the room uniform in advance for the purpose of appropriately determining a temperature difference.

[0082] When the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d sequentially operate, the air conditioning assisting device 4 may cause the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d to perform fan operation for a predetermined time period each time association of any of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with one of the 64 blocks 401,..., 464 is terminated, so as to make the temperature of the room uniform in advance for the purpose of appropriately determining a temperature difference.

[0083] As described above, the air conditioning system 1 according to the embodiment includes the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d, and also includes the air conditioning assisting device 4. The air conditioning assisting device 4 includes the thermal image sensor 41 for detecting temperature, and controls the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d on the basis of results obtained by the thermal image sensor 41. Specifically, even when each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d is an air conditioner that does not support attachment of a sensor for detecting temperature, the air conditioning assisting device 4, which includes the thermal image sensor 41 for detecting temperature, can control the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d on the basis of results obtained by the thermal image sensor 41. The air conditioning system 1 can thus control each of a plurality of air conditioners, which do not support attachment of a sensor for detecting temperature, on the basis of a result obtained by the sensor.

[0084] The air conditioning system 1 can associate each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d with a space to be controlled by the air conditioner without using an external device such as a personal computer. The air conditioning system 1 can analyze operation states of and determine control of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d without using an external device such as a personal computer. As described above, an operation state includes some or all of the temperature of the room in which the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d are installed, the humidity of the room, and the air volume

of each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d.

[0085] FIG. 9 is a diagram illustrating a processor 91 in a case where the thermal image sensor 41, the assisting side communication unit 42, and the processing unit 44 included in the air conditioning assisting device 4 of the air conditioning system 1 according to the embodiment are at least partially implemented by the processor 91. In other words, at least some of the functions of the thermal image sensor 41, the assisting side communication unit 42, and the processing unit 44 may be implemented by the processor 91 executing programs stored in a memory 92.

[0086] The processor 91 is a central processing unit (CPU), a processing device, a computing device, a microprocessor, or a digital signal processor (DSP). FIG. 9 also illustrates the memory 92.

[0087] In the case where at least some of the functions of the thermal image sensor 41, the assisting side communication unit 42, and the processing unit 44 are implemented by the processor 91, the at least some of the functions are implemented by the processor 91 and software, firmware, or combination of software and firmware. The software or firmware is described in the form of programs and stored in the memory 92. The processor 91 reads and executes programs stored in the memory 92 to implement at least some of the functions of the thermal image sensor 41, the assisting side communication unit 42, and the processing unit 44.

[0088] In the case where at least some of the functions of the thermal image sensor 41, the assisting side communication unit 42, and the processing unit 44 are implemented by the processor 91, the air conditioning assisting device 4 includes the memory 92 for storing programs that result in execution of at least some of the steps performed by the thermal image sensor 41, the assisting side communication unit 42, and the processing unit 44. In other words, the programs stored in the memory 92 cause a computer to execute at least part of the thermal image sensor 41, the assisting side communication unit 42, and the processing unit 44.

[0089] The memory 92 is a nonvolatile or volatile semiconductor memory such as a random access memory (RAM), a read only memory (ROM), a flash memory, and an erasable programmable read only memory (EPROM), an electrically erasable programmable read-only memory (EEPROM) (registered trademark); a magnetic disk; a flexible disk; an optical disk; a compact disc; a mini disc; a digital versatile disk (DVD); or the like, for example.

[0090] FIG. 10 is a diagram illustrating processing circuitry 93 in a case where the thermal image sensor 41, the assisting side communication unit 42, and the processing unit 44 included in the air conditioning assisting device 4 of the air conditioning system 1 according to the embodiment are at least partially implemented by the processing circuitry 93. In other words, the thermal

image sensor 41, the assisting side communication unit 42, and the processing unit 44 may be at least partially implemented by the processing circuitry 93.

[0091] The processing circuitry 93 is dedicated hardware. The processing circuitry 93 is a single circuit, a composite circuit, a programmed processor, a parallel-programmed processor, an application specific integrated circuit (ASIC), a field programmable gate array (FPGA), or a combination thereof, for example.

[0092] Part of the thermal image sensor 41, the assisting side communication unit 42, and the processing unit 44 may be dedicated hardware separate from the remaining part thereof.

[0093] A plurality of functions of the thermal image sensor 41, the assisting side communication unit 42, and the processing unit 44 may be implemented by software or firmware, and the remaining functions may be implemented by dedicated hardware. As described above, a plurality of functions of the thermal image sensor 41, the assisting side communication unit 42, and the processing unit 44 can be implemented by hardware, software, firmware, or a combination thereof.

[0094] At least part of the air conditioning side communication unit included by each of the first air conditioner 2a, the second air conditioner 2b, the third air conditioner 2c, and the fourth air conditioner 2d may be implemented by a processor, or may be implemented by processing circuitry. In other word, each of the air conditioning side communication unit 21a, the air conditioning side communication unit 21b, the air conditioning side communication unit 21c, and the air conditioning side communication unit 21d may be at least partially implemented by a processor or processing circuitry.

[0095] The configurations presented in the embodiment above are examples, and can be combined with other known technologies or can be partly omitted or modified without departing from the gist thereof.

Reference Signs List

[0096] 1 air conditioning system; 2a first air conditioner; 2b second air conditioner; 2c third air conditioner; 2d fourth air conditioner; 3a first outdoor unit; 3b second outdoor unit; 3c third outdoor unit; 3d fourth outdoor unit; 4 air conditioning assisting device; 5 communication network; 21a, 21b, 21c, 21d air conditioning side communication unit; 41 thermal image sensor; 42 assisting side communication unit; 43 storage unit; 44 processing unit; 91 processor; 92 memory; 93 processing circuitry.

Claims

1. An air conditioning system comprising:

a plurality of air conditioners each installed on a wall or a ceiling; and
an air conditioning assisting device installed at

a position at an equal distance from each of the air conditioners on the wall or the ceiling, wherein the air conditioning assisting device includes:

a thermal image sensor to detect temperature;
an assisting side communication unit to receive information relating to operation states of some or all of the air conditioners from some or all of the air conditioners, and transmit commands for air conditioning to some or all of the air conditioners;
a storage unit to store information obtained by the thermal image sensor and information received by the assisting side communication unit; and
a processing unit to analyze the information obtained by the thermal image sensor and the information received by the assisting side communication unit, and generate the commands.

2. The air conditioning system according to claim 1, wherein

each of the air conditioners includes an air conditioning side communication unit to communicate with the assisting side communication unit, and
the assisting side communication unit is connected with air conditioning side communication units of the air conditioners via a communication network, and communicates with at least one of the air conditioning side communication units.

3. The air conditioning system according to claim 2, wherein

the air conditioning assisting device is installed in one room,
no air conditioning assisting device other than the air conditioning assisting device is installed in the room, and
the processing unit detects a human on the basis of heat distribution on a thermal image obtained by the thermal image sensor.

4. The air conditioning system according to claim 3, wherein

the processing unit determines which part of the room each of the air conditioners controls.

5. The air conditioning system according to claim 4, wherein

the air conditioning assisting device causes one of the air conditioners to perform cooling operation,

and

the storage unit stores information associating an area in which temperature detected by the thermal image sensor is a predetermined cooling reference temperature with the one of the air conditioners that is performing the cooling operation.

6. The air conditioning system according to claim 4, wherein

the thermal image sensor detects temperature of the room before the air conditioners operate, the air conditioning assisting device causes one of the air conditioners to perform heating operation on the basis of the temperature detected by the thermal image sensor, and
the storage unit stores information associating an area in which the temperature detected by the thermal image sensor is a predetermined heating reference temperature with the one of the air conditioners that is performing the heating operation.

7. The air conditioning system according to claim 4, wherein

the thermal image sensor detects temperature of the room before the air conditioners operate, and
the air conditioning assisting device determines whether to cause each of the air conditioners to perform cooling operation or to perform heating operation on the basis of the temperature detected by the thermal image sensor.

8. The air conditioning system according to claim 4, wherein

the storage unit stores calendar information indicating monthly details of operations of an air conditioner, and
the air conditioning assisting device determines whether to cause each of the air conditioners to perform cooling operation or to perform heating operation on the basis of the calendar information stored in the storage unit and the current month.

9. The air conditioning system according to claim 5 or 6, wherein

when one area of the room in which the thermal image sensor has detected temperature is associated with the one of the air conditioners and thereafter another area of the room is associated with another of the air conditioners, the air conditioning assisting device causes the another of

the air conditioners to perform operation different from operation of the one of the air conditioners, and
each time an air conditioner to be associated with one area of the room changes among the air conditioners, the air conditioning assisting device causes an air conditioner that is newly associated to perform operation different from operation performed by an air conditioner that is last associated.

10. The air conditioning system according to claim 4 wherein
wind direction of each of the air conditioners is set to vertically downward.
11. The air conditioning system according to claim 4, wherein
an air volume of each of the air conditioners is set to a maximum volume of capacity thereof.
12. The air conditioning system according to claim 5 or 6, wherein
after associating the area of the room in which the thermal image sensor has detected temperature with the one of the air conditioners and before associating another of the air conditioners with another area of the room, the air conditioning assisting device causes the air conditioners to stop for a predetermined time period.
13. The air conditioning system according to claim 5 or 6, wherein
after associating the area of the room in which the thermal image sensor has detected temperature with the one of the air conditioners and before associating another of the air conditioners with another area of the room, the air conditioning assisting device causes the air conditioners to perform fan operation for a predetermined time period.

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FIG.1

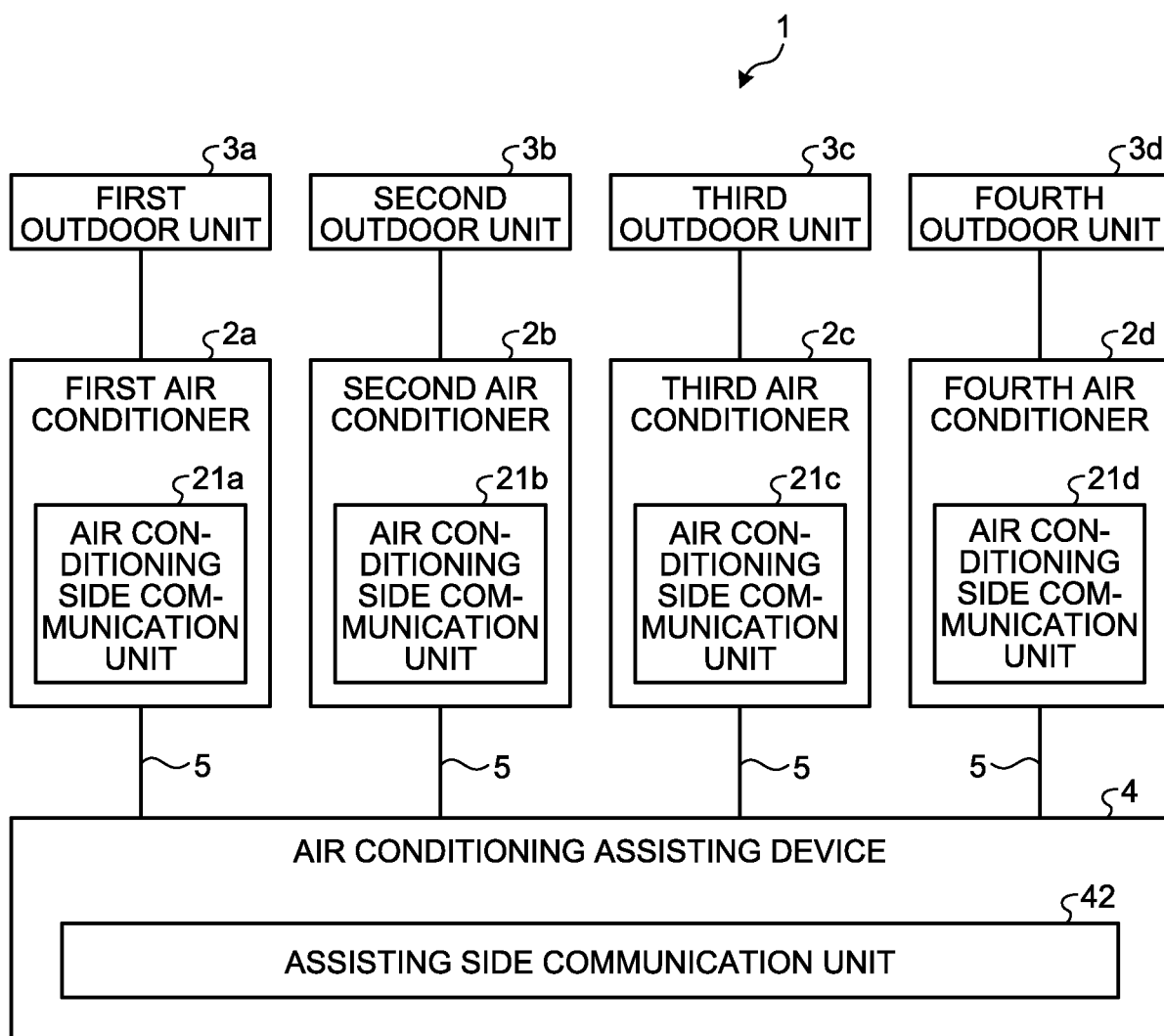


FIG.2

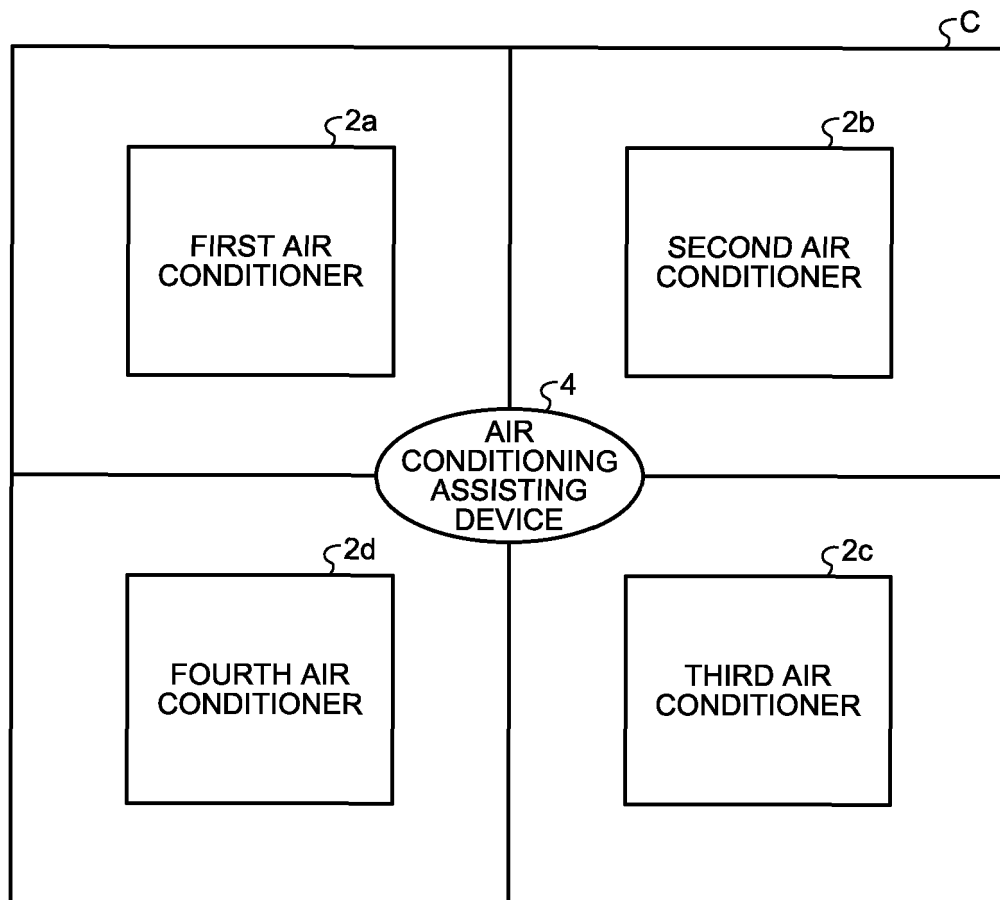


FIG.3

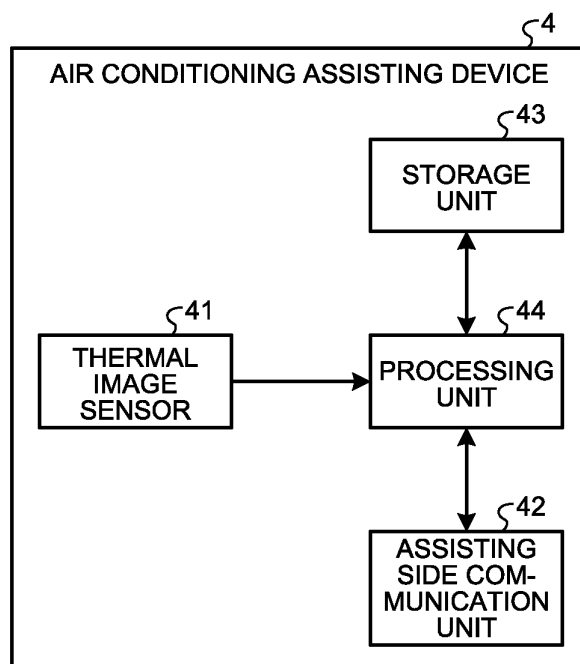


FIG.4

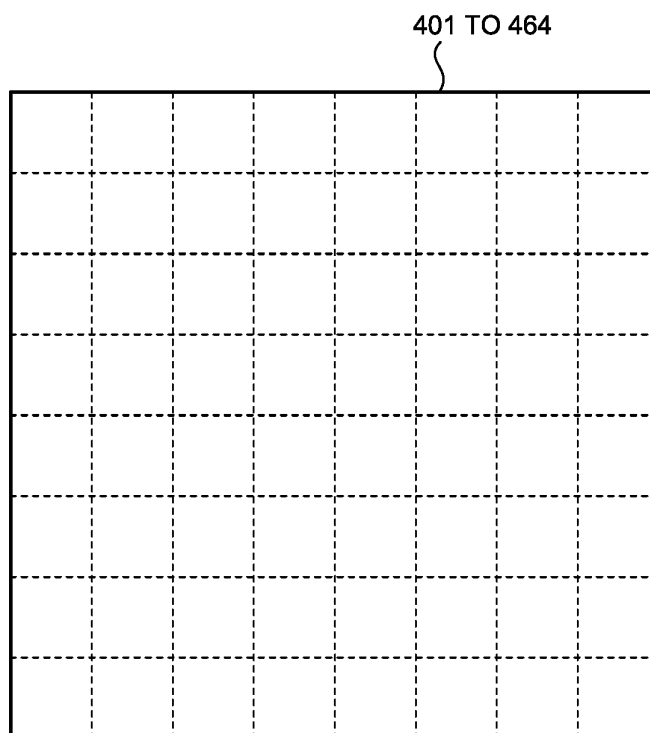


FIG.5

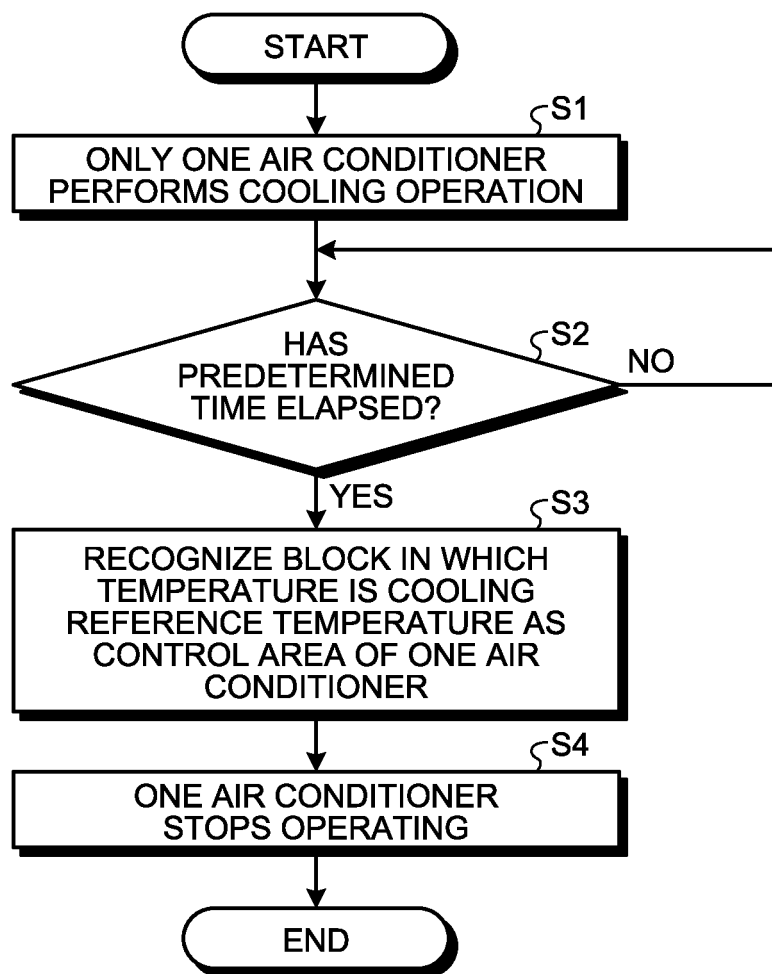


FIG.6

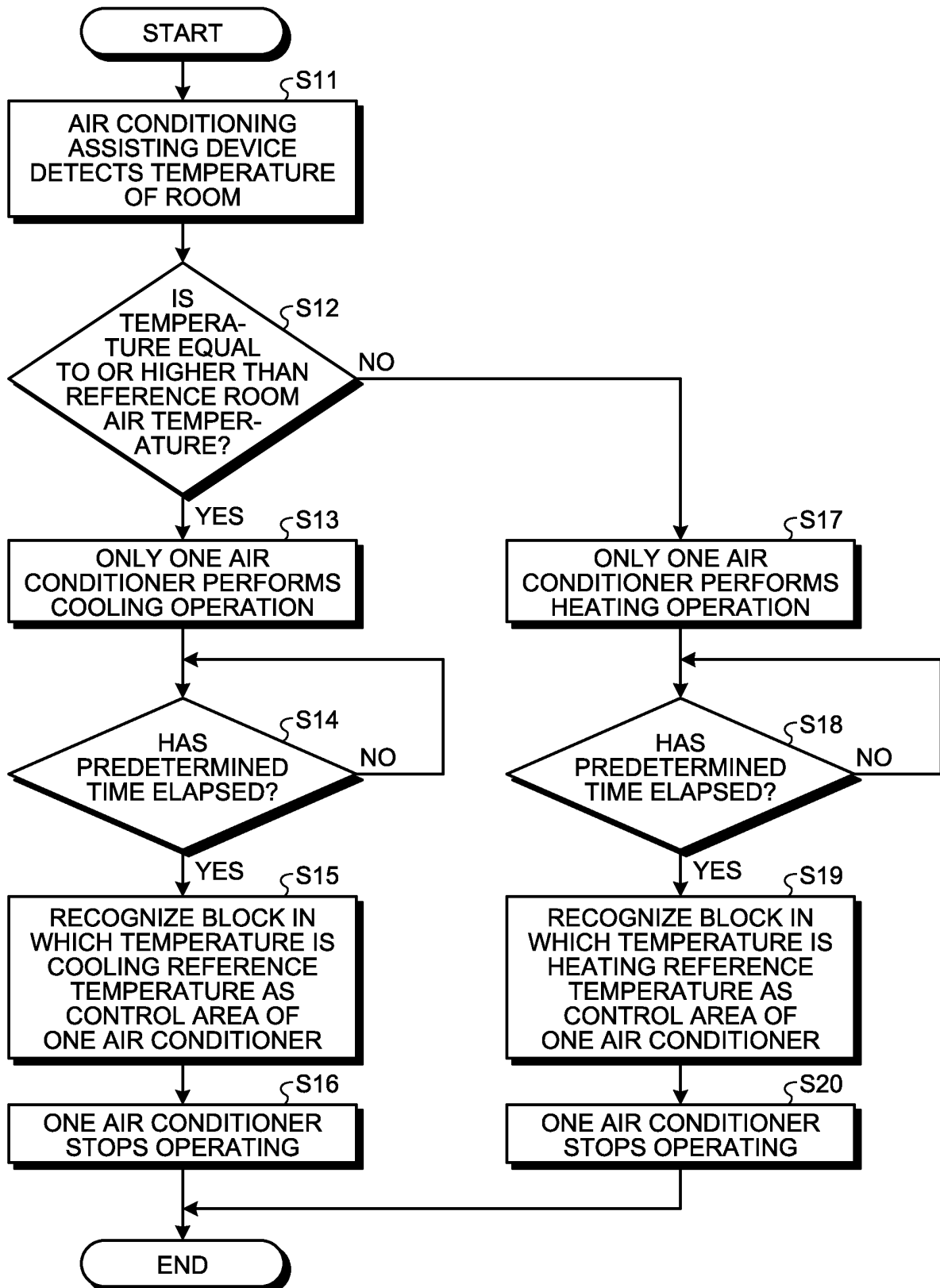


FIG.7

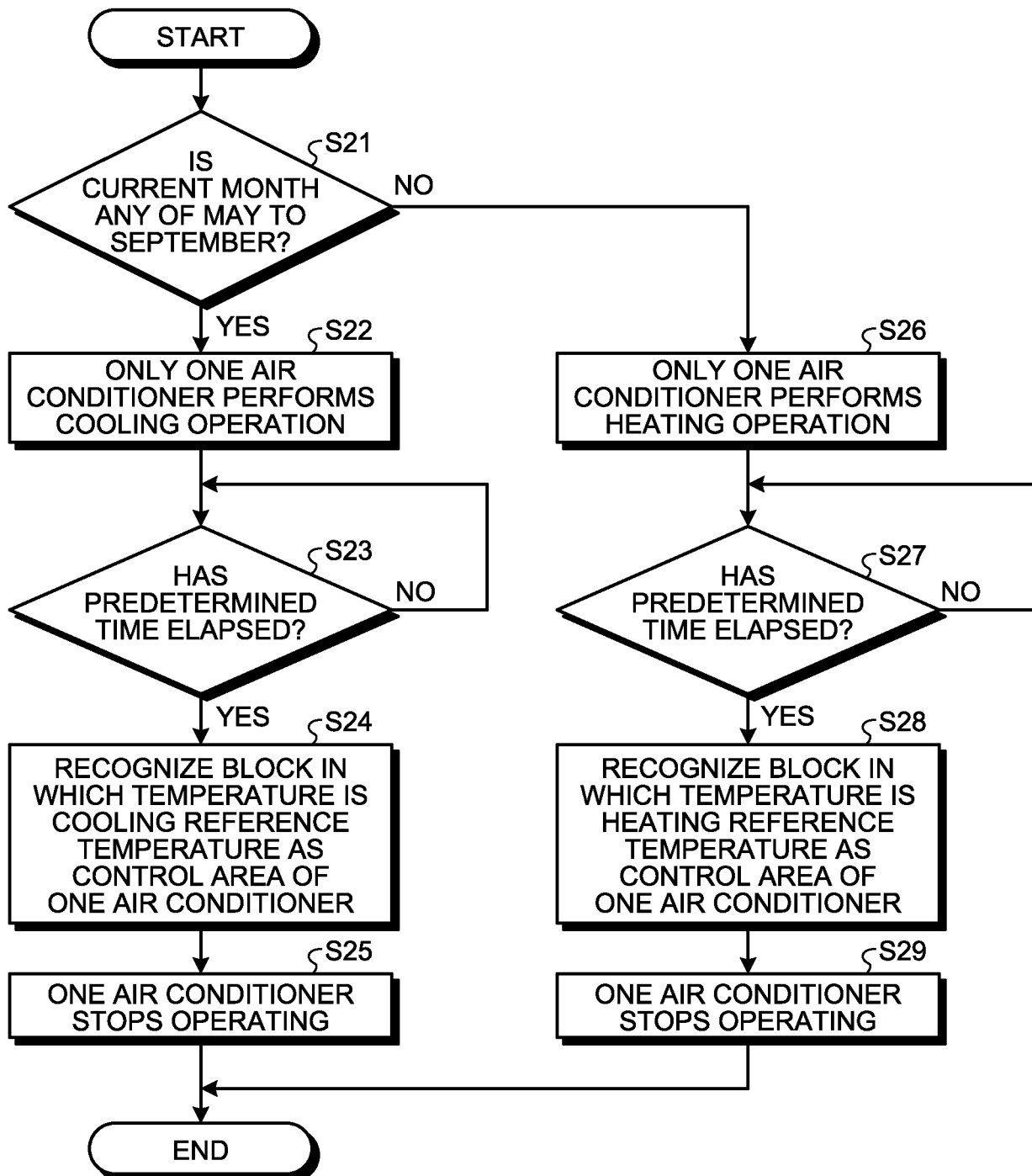


FIG.8

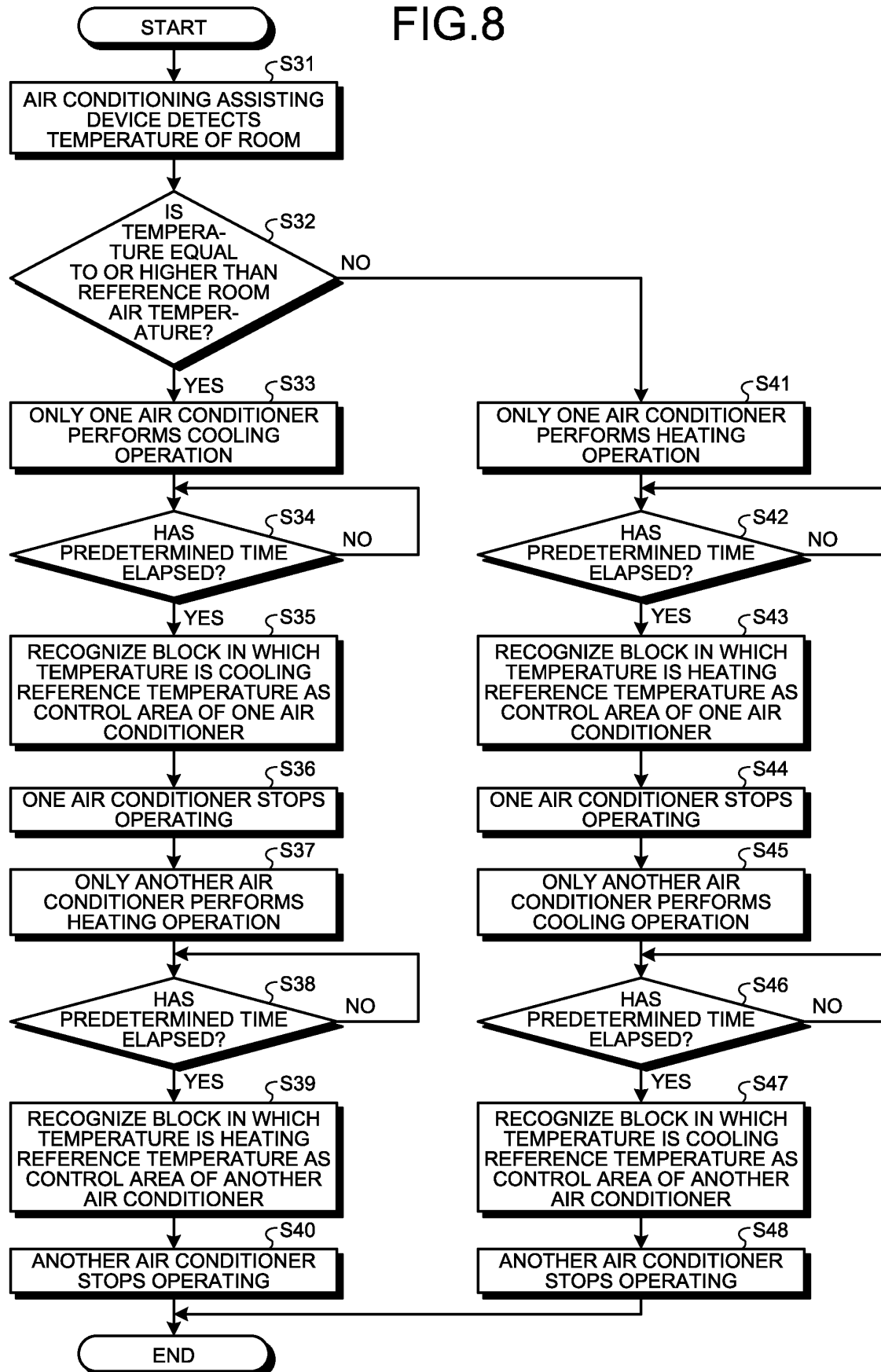


FIG.9

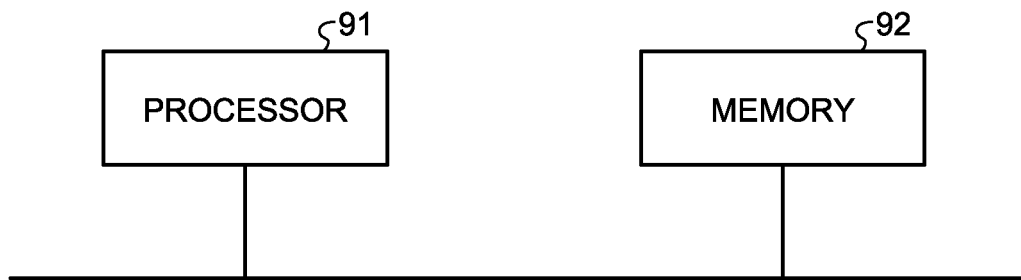
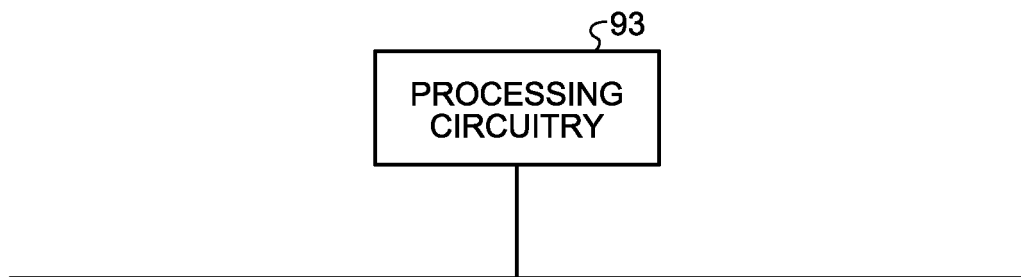


FIG.10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/010589

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. F24F11/54(2018.01)i, F24F11/56(2018.01)i, F24F11/64(2018.01)i,
F24F11/67(2018.01)i, F24F110/10(2018.01)n, F24F120/10(2018.01)n
FI: F24F11/56, F24F11/64, F24F11/54, F24F11/67, F24F110:10, F24F120:10

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)

Int. Cl. F24F11/54, F24F11/56, F24F11/64, F24F11/67, F24F110/10,
F24F120/10

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2020
Registered utility model specifications of Japan 1996-2020
Published registered utility model applications of Japan 1994-2020

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.
A	JP 2006-105487 A (HITACHI, LTD.) 20 April 2006	1-13
A	WO 2015/079548 A1 (MITSUBISHI ELECTRIC CORP.) 04 June 2015	1-13
A	JP 2011-106724 A (MITSUBISHI ELECTRIC CORP.) 02 June 2011	1-13
A	WO 2012/123989 A1 (MITSUBISHI ELECTRIC CORP.) 20 September 2012	1-13
A	WO 2018/051479 A1 (MITSUBISHI ELECTRIC CORP.) 22 March 2018	4-13



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search
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Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/010589

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2014/084145 A1 (MITSUBISHI ELECTRIC CORP.) 05 June 2014	4-13

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2020/010589

Patent Documents referred to in the Report	Publication Date	Patent Family	Publication Date
JP 2006-105487 A	20.04.2006	(Family: none)	
WO 2015/079548 A1	04.06.2015	(Family: none)	
JP 2011-106724 A	02.06.2011	(Family: none)	
WO 2012/123989 A1	20.09.2012	US 2014/0005838 A1	
		EP 2687790 A1	
		CN 103429965 A	
WO 2018/051479 A1	22.03.2018	(Family: none)	
WO 2014/084145 A1	05.06.2014	US 2015/0293540 A1	
		EP 2927613 A1	
		CN 104823000 A	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2012042197 A [0003]
- WO 2018051479 A [0003]