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(71) Applicant(s)
Mitsubishi Heavy Industries Thermal Systems, Ltd.

(72) Inventor(s)
Masutani, Akihiro;Yoshida, Kenji

(74) Agent / Attorney
Phillips Ormonde Fitzpatrick, PO Box 323, Collins Street West, VIC, 8007, AU

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ABSTRACT OF THE DISCLOSURE

A control device (2) includes a radio wave detection unit (211) configured to detect radio waves radiated from a transmitter (4) through at least two reception units (33) provided in the air conditioning indoor unit (3), a direction estimation unit (212) configured to estimate a transmitter direction indicating a direction in which the transmitter (4) is disposed on the basis of the radio waves received by each of the reception units (33), an environment information acquisition unit (213) configured to acquire environment information indicating an air conditioning environment in the transmitter direction, which is included in the radio waves, a required environment acquisition unit (214) configured to acquire a required environment setting requested by a user, and a driving control unit (215) configured to control the air conditioning indoor unit (3) so that the air conditioning environment in the transmitter direction satisfies the required environment setting.

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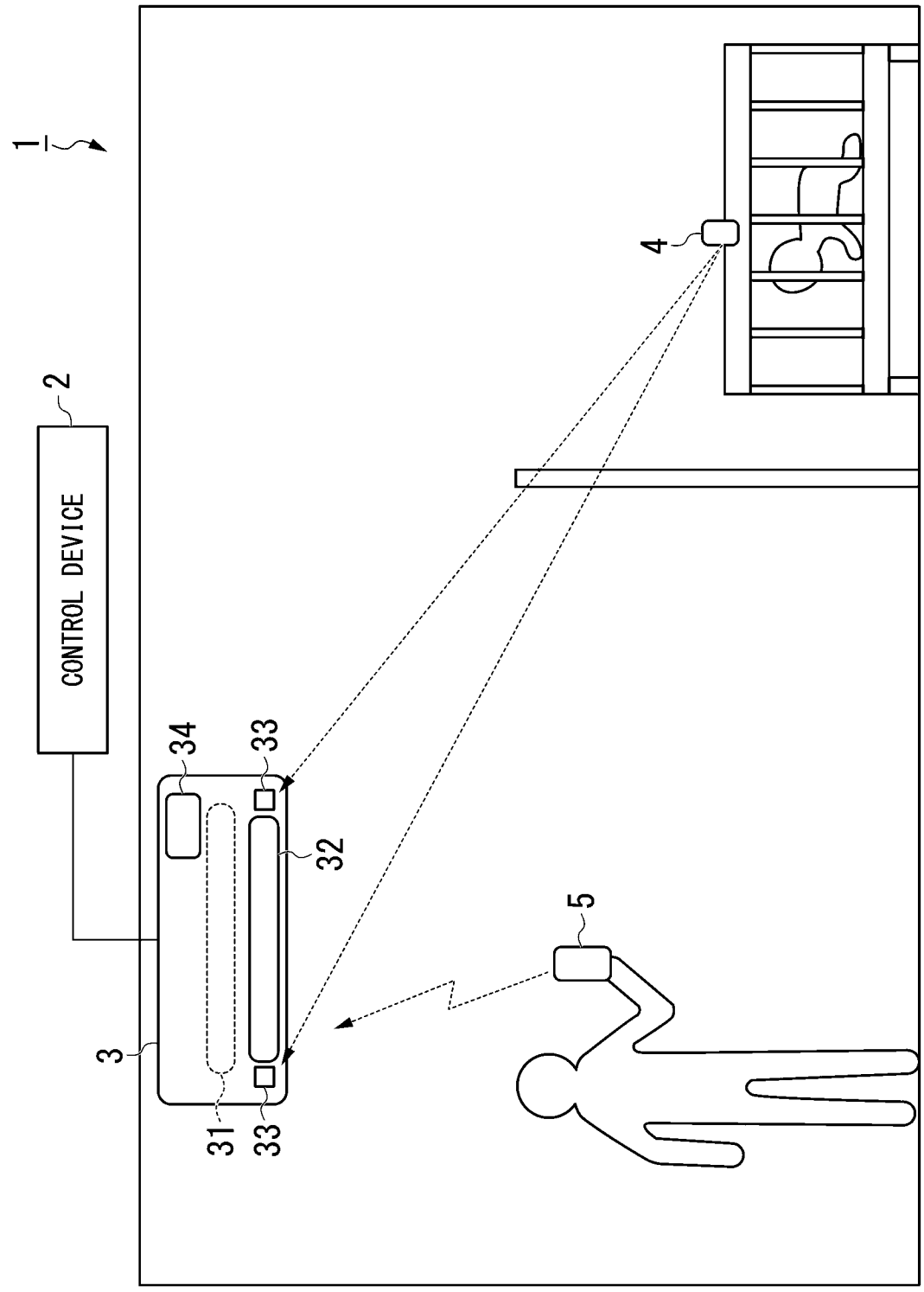
FIG. 1



CONTROL DEVICE, AIR CONDITIONING SYSTEM, CONTROL METHOD, AND PROGRAM

This application claims priority from Japanese Application No. 2018-067835 filed on 30 March 2018, the contents of which are to be taken as incorporated herein by this reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0001]

The present invention relates to a control device, an air conditioning system, a control method, and a program.

Description of Related Art

[0002]

An air conditioning system of the related art, which controls a temperature, a humidity, an airflow direction, and the like of a room according to characteristics of a user in order to improve comfort, is known (refer to, for example, Japanese Unexamined Patent Application, First Publication No. 2003-50040).

[0003]

In addition, for the purpose of further improving comfort, an air conditioning system that detects a position of the user in a room and utilizes the position of the user for output control of an indoor unit and airflow direction control is conceivable.

[0004]

In the air conditioning system of the related art, the position of the user is detected by using a sensor (human sensor, temperature sensor, and the like) built into the

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indoor unit. However, according to the related art, in a case where an obstacle is present between the indoor unit and the user, or in a case where it is recognized that a plurality of users overlap, the position of the user may not be able to be correctly recognized, and it may be difficult to control the air conditioning system such that there is an air conditioning environment intended by the user.

[0005]

The present invention provides a control device, an air conditioning system, a control method, and a program capable of allowing adjustment of an air conditioning environment in a specific place to that intended by a user even in a case where an obstacle is present.

SUMMARY OF THE INVENTION

[0006]

According to a first aspect of the present invention, a control device that controls an air conditioning indoor unit includes a radio wave detection unit configured to detect radio waves radiated from a transmitter through at least two reception units provided in the air conditioning indoor unit, a direction estimation unit configured to estimate a transmitter direction indicating a direction in which the transmitter is disposed on the basis of the radio waves received by each of the reception units, an environment information acquisition unit configured to acquire environment information indicating an air conditioning environment in the transmitter direction, which is included in the radio waves, a required environment acquisition unit configured to acquire a required environment setting requested by a user, and a driving control unit configured to control the air conditioning indoor unit so that the air conditioning environment in the transmitter direction satisfies the required environment setting.

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According to the above configuration, for example, even in a case where an obstacle is present between the air conditioning indoor unit and the transmitter, it is possible to estimate the transmitter direction in which the transmitter is disposed. Thus, since the control device is capable of adjusting the air conditioning environment in the direction in which the transmitter is disposed according to an intention of the user by disposing the transmitter in a place where the user preferentially wishes to adjust the air conditioning environment, it is possible to greatly improve comfort of the user.

[0007]

According to a second aspect of the present invention, in the control device of the first aspect, the reception units are disposed at different positions in a horizontal direction, and the direction estimation unit estimates the transmitter direction on the basis of intensities of the radio waves received by each of the reception units from the transmitter.

According to the above configuration, the direction estimation unit is capable of accurately estimating the direction in which the transmitter is disposed.

[0008]

According to a third aspect of the present invention, in the control device of the first or second aspect, the air conditioning indoor unit is provided with three or more reception units, and the direction estimation unit further estimates a transmitter position indicating a position of the transmitter on the basis of intensities of the radio waves received by each of the three or more reception units from the transmitter.

According to the above configuration, the control device is capable of estimating the position where the transmitter is disposed and adjust the air conditioning environment in the vicinity of the transmitter position according to the intention of the user. Thus, the control device is capable of further improving the comfort of the user.

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[0009]

According to a fourth aspect of the present invention, in the control device of the first to third aspects, the direction estimation unit estimates the transmitter direction indicating a direction in which each of a plurality of transmitters is disposed, the required environment acquisition unit acquires different required environment settings for each of the transmitters, and the driving control unit controls the air conditioning indoor unit so that the air conditioning environment in the transmitter direction of each of the plurality of transmitters satisfies the required environment settings for each of the transmitters.

According to the above configuration, by disposing the transmitter in each of a plurality of places where the user wishes to adjust the air conditioning environment, the control device is capable of appropriately adjusting a range where the airflow blows, for example, the airflow blows in a certain direction and the airflow does not blow in another direction, etc., according to a preference of each of a plurality of users. Accordingly, the control device is capable of improving the comfort of each of the plurality of users.

[0010]

According to a fifth aspect of the present invention, the control device of any one of the first to fourth aspects further includes an error detection unit configured to detect the occurrence of an error in the transmitter in a case where the radio wave from the transmitter is not received even after a predetermined waiting time has elapsed.

According to the above configuration, the control device is capable of detecting that the radio wave is not capable of being radiated due to, for example, a failure of the transmitter or battery exhaustion.

[0011]

According to a sixth aspect of the present invention, an air conditioning system includes a transmitter configured to radiate a radio wave, an air conditioning indoor unit

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having at least two reception units that receive the radio waves radiated from the transmitter, and a control device of any one of the first to fifth aspects.

[0012]

According to a seventh aspect of the present invention, a control method for controlling an air conditioning indoor unit includes a radio wave detection step of detecting radio waves radiated from a transmitter through at least two reception units provided in the air conditioning indoor unit, a direction estimation step of estimating a transmitter direction indicating a direction in which the transmitter is disposed on the basis of the radio waves received by each of the reception units, an environment information acquisition step of acquiring environment information indicating an air conditioning environment in the transmitter direction, which is included in the radio waves, a required environment acquisition step of acquiring a required environment setting requested by a user, and an operation control step of controlling the air conditioning indoor unit so that the air conditioning environment in the transmitter direction satisfies the required environment setting.

[0013]

According to an eighth aspect of the present invention, a program causes a computer of a control device that controls an air conditioning indoor unit to function and execute a radio wave detection step of detecting radio waves radiated from a transmitter through at least two reception units provided in the air conditioning indoor unit, a direction estimation step of estimating a transmitter direction indicating a direction in which the transmitter is disposed on the basis of the radio waves received by each of the reception units, an environment information acquisition step of acquiring environment information indicating an air conditioning environment in the transmitter direction, which is included in the radio waves, a required environment acquisition step of

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acquiring a required environment setting requested by a user, and an operation control step of controlling the air conditioning indoor unit so that the air conditioning environment in the transmitter direction satisfies the required environment setting.

[0014]

According to the control device, the air conditioning system, the control method, and the program as described above, it is possible to adjust a specific place to the air conditioning environment intended by the user even in a case where an obstacle is present.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

FIG. 1 is a schematic diagram showing an overall configuration of an air conditioning system according to an embodiment of the present invention.

FIG. 2 is a diagram showing a functional configuration of the air conditioning system according to the embodiment of the present invention.

FIG. 3 is a diagram showing a functional configuration of a transmitter according to the embodiment of the present invention.

FIG. 4 is a flowchart showing an example of a process of a control device according to the embodiment of the present invention.

FIG. 5 is a diagram showing an example of transmitter information according to the embodiment of the present invention.

FIG. 6 is a flowchart showing an example of a process of the transmitter according to the embodiment of the present invention.

FIG. 7 is a diagram showing an example of a hardware configuration of the control device and the transmitter according to the embodiment of the present invention.

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DETAILED DESCRIPTION OF THE INVENTION

[0016]

Hereinafter, an air conditioning system 1 according to a first embodiment of the present invention will be described with reference to FIGS. 1 to 7.

In the present embodiment, an aspect in which the air conditioning system 1 is a home room air conditioner will be described as an example, but the present invention is not limited thereto. In alternative embodiment, the air conditioning system 1 may be a system provided in a space such as a large store, a factory, or the like where a large number of users are present.

[0017]

(Overall configuration of air conditioning system)

FIG. 1 is a schematic diagram showing an overall configuration of an air conditioning system according to an embodiment of the present invention.

As shown in FIG. 1, the air conditioning system 1 includes a control device 2, an air conditioning indoor unit 3, a transmitter 4, and a remote controller 5.

[0018]

The control device 2 receives a request for an air conditioning environment (temperature, humidity, air volume, airflow direction, and the like) (hereinafter also referred to as "required environment setting") from the user and controls the air conditioning indoor unit 3 such that the request is satisfied.

[0019]

The air conditioning indoor unit 3 is installed on a wall surface, a ceiling, or the like of a space (room) in which the user is present, and performs various operations for adjusting the air conditioning environment in the space according to a control command

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by the control device 2. Although FIG. 1 shows an example in which the air conditioning system 1 includes one air conditioning indoor unit 3, the present invention is not limited thereto. In alternative embodiments, the air conditioning system 1 may include a plurality of air conditioning indoor units 3, and one control unit 2 may control the plurality of air conditioning indoor units 3. As shown in FIG. 1, the air conditioning indoor unit 3 includes a fan 31 capable of adjusting the air volume, a louver 32 capable of adjusting the airflow direction, at least two reception units 33 capable of receiving radio waves from the transmitter 4, and a notification unit 34 that notifies the user of the occurrence of an error.

The reception units 33 are each disposed at different positions in a horizontal direction. For example, as shown in FIG. 1, two reception units 33 are each disposed at opposite ends in the horizontal direction of the air conditioning indoor unit 3. Although FIG. 1 shows an example in which the air conditioning indoor unit 3 includes two of the reception units 33, the present invention is not limited thereto. In alternative embodiments, the air conditioning indoor unit 3 may include three or more reception units 33.

The notification unit 34 is a display device such as a liquid crystal display or an LED. When the notification unit 34 detects an error such that the reception unit 33 is not capable of receiving the radio wave from the transmitter 4, the notification unit 34 notifies the user of the detection of the error. In addition, the notification unit 34 may be an output device that notifies detection of the error by voice. In addition, in the present embodiment, an aspect in which the notification unit 34 is provided in the air conditioning indoor unit 3 is described as an example, but the present invention is not limited thereto. In alternative embodiments, the notification unit 34 may be provided in the remote controller 5.

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[0020]

The transmitter 4 is a terminal device disposed at a place where the user prefers to adjust the air conditioning environment. For example, as shown in FIG. 1, in a case where a plurality of users (adult and baby) are present in one space, it is conceivable that the user may request an air conditioning environment in which the baby is able to remain in comfort. In this case, the user is able to preferentially adjust the air conditioning environment in the vicinity of a baby bed by disposing the transmitter 4 in the baby bed where the baby is present.

In addition, the transmitter 4 radiates radio waves including the air conditioning environment (temperature, humidity, and the like) at the position where the transmitter 4 is disposed at every predetermined transmission time.

The transmitter 4 radiates a radio wave having a frequency band of at least 300 GHz or less such that the radio wave transmits through an obstacle disposed between the receiver 33 provided in the air conditioning indoor unit 3 and the transmitter 4. More preferably, the transmitter 4 radiates a radio wave of a frequency band of 300 MHz to 300 GHz (so-called microwave). In the present embodiment, an aspect in which the transmitter 4 radiates a radio wave of a frequency band of 2.4 GHz using Bluetooth (registered trademark) technology, particularly Bluetooth Low Energy will be described as an example.

Although FIG. 1 shows an example in which only one transmitter 4 is disposed in the space, the present invention is not limited thereto. In another embodiment, a plurality of transmitters 4 may be disposed.

[0021]

The remote controller 5 receives an input operation of the "required environment setting" from the user and transmits the input operation to the control device 2. The

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"required environment setting" is a setting value of the air conditioning environment requested by the user, and includes, for example, a temperature, humidity, air volume, airflow direction, and the like. In addition, in a case where a plurality of transmitters 4 are disposed, the remote controller 5 may receive different "required environment settings" for each of the transmitters 4.

For example, the remote controller 5 transmits the "required environment setting" to the control device 2 through a light reception unit (not shown) provided in the air conditioning indoor unit 3 by infrared communication similarly to the air conditioning system of the related art. In addition, in alternative embodiments, the remote controller 5 may be wired to the air conditioning indoor unit 3.

[0022]

(Functional configuration of air conditioning system)

FIG. 2 is a diagram showing a functional configuration of the air conditioning system according to an embodiment of the present invention.

As shown in FIG. 2, the control device 2 of the air conditioning system 1 has a CPU 21 and a storage medium 22.

The CPU 21 is a processor that is responsible for the overall operation of the control device 2 and operates according to a predetermined program, to function as a radio wave detection unit 211, a direction estimation unit 212, an environment information acquisition unit 213, a required environment acquisition unit 214, a driving control unit 215, and an error detection unit 216.

[0023]

The radio wave detection unit 211 detects the radio wave radiated from the transmitter 4 through the reception unit 33 provided in the air conditioning indoor unit 3.

Note that the radio wave radiated from the transmitter 4 includes a "transmitter

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ID" capable of specifying the transmitter 4 and "environment information" indicating the air conditioning environment (temperature, humidity, and the like) at the position of the transmitter 4.

[0024]

The direction estimation unit 212 estimates a "transmitter direction" indicating a direction in which the transmitter 4 is disposed (a two-dimensional position in the horizontal direction) or "transmitter position" indicating a three-dimensional position, on the basis of the radio waves received by each of the reception units 33 provided in the air conditioning indoor unit 3.

In a case where a plurality of transmitters 4 are disposed in the space, the direction estimation unit 212 specifies the transmitter 4 associated with the radio wave by the "transmitter ID" included in the radio wave, and estimates the "transmitter direction" or the "transmitter position" of each of the transmitters 4.

[0025]

The environmental information acquisition unit 213 acquires "environment information" included in the radio wave radiated from the transmitter 4. Therefore, the environment information acquisition unit 213 acquires the environmental information indicating the air conditioning environment (temperature, humidity, and the like) in the "transmitter direction (two-dimensional position)" or the "transmitter position (three-dimensional position)" of the transmitter 4.

[0026]

The required environment acquisition unit 214 acquires the "required environment setting" requested by the user.

[0027]

The driving control unit 215 controls the air conditioning indoor unit 3 so that

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the air conditioning environment in the "transmitter direction" or the "transmitter position" of the transmitter 4 satisfies the "required environment setting".

In addition, in a case where a plurality of transmitters 4 are disposed, the driving control unit 215 controls the air conditioning indoor unit 3 so that the air conditioning environment in the "transmitter direction" or the "transmitter position" of each of the plurality of transmitters 4 satisfies the "required environment setting" for each of the transmitters 4.

[0028]

The error detection unit 216 detects the occurrence of an error in the transmitter 4 in a case where a period during which the radio wave is not received from the transmitter 4 continues for a predetermined waiting time (for example, three minutes) or more.

In addition, the error detection unit 216 notifies the user of the occurrence of the error through the notification unit 34 of the air conditioning indoor unit 3. Therefore, for example, it is possible to notify the user that the radio wave is not able to be radiated by detecting that the radio wave is not able to be radiated due to failure of the transmitter 4, battery exhaustion, or the like.

[0029]

The "required environment setting" acquired by the required environment acquisition unit 214 is stored in the storage medium 22. In addition, the "transmitter direction" or the "transmitter position" of the transmitter 4 estimated by the direction estimation unit 212 and the "environment information" acquired by the environment information acquisition unit 213 may be stored in the storage medium 22.

[0030]

FIG. 3 is a diagram showing a functional configuration of the transmitter

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according to an embodiment of the present invention.

As shown in FIG. 3, the transmitter 4 includes a sensor 41, a wireless communication unit 42, and a CPU 43.

[0031]

The sensor 41 is a sensor group for measuring the air conditioning environment (temperature, humidity, and the like) in the vicinity of the transmitter 4 and includes, for example, a temperature sensor, a humidity sensor, and the like.

[0032]

The wireless communication unit 42 is a dedicated IC chip mounted for performing wireless communication using a radio wave of a predetermined frequency band. In the present embodiment, as described above, the wireless communication unit 42 is an IC chip for transmitting and receiving the radio wave using Bluetooth (registered trademark) technology.

[0033]

The CPU 43 is a processor that is responsible for the overall operation of the transmitter 4, and is operated according to a predetermined program to function as a sensor information acquisition unit 431 and a radio wave transmission-processing unit 432.

[0034]

The sensor information acquisition unit 431 acquires the "environment information" indicating the air conditioning environment (temperature, humidity) in the vicinity of the transmitter 4 from the sensor 41 at every predetermined measurement time (for example, one minute).

[0035]

The radio wave transmission-processing unit 432 radiates the radio wave in

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which the "transmitter ID" that is set in the transmitter 4 in advance and the "environment information" acquired by the sensor information acquisition unit 431 are superimposed at every predetermined transmission time (for example, one minute).

[0036]

(Process flow of air conditioning system)

FIG. 4 is a flowchart showing an example of a process of the control device according to an embodiment of the present invention.

As shown in FIG. 4, the radio wave detection unit 211 of the control device 2 determines whether or not the reception unit 33 provided in the air conditioning indoor unit 3 has received the radio wave radiated from the transmitter 4 (step S10)

[0037]

In a case where the radio wave detection unit 211 detects that the radio wave from the transmitter 4 is received (step S10: YES), the direction estimation unit 212 estimates the "transmitter direction" or the "transmitter position" of the transmitter 4 that is a transmission source of the radio wave (step S11).

As shown in FIG. 1, in a case where the two reception units 33 are provided in the air conditioning indoor unit 3, the direction estimation unit 212 calculates distances between each of the reception units 33 and the transmitter 4, on the basis of intensities of the radio waves received by each of the two reception units 33. In addition, the direction estimation unit 212 estimates the two-dimensional position (horizontal direction position) that satisfies the two distances in space, that is, the "transmitter direction" indicating the direction in which the transmitter 4 is disposed.

In addition, in a case where three or more reception units 33 are provided in the air conditioning indoor unit, the direction estimation unit 212 is able to further estimate the position in a height direction of the transmitter 4 on the basis of the intensities of the

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radio waves received by each of the reception units 33. That is, the direction estimation unit 212 further estimates the "transmitter position" that is the three-dimensional position of the transmitter 4 in the space, on the basis of the intensities of the radio waves received by each of the three or more reception units 33.

In the present embodiment, the radio wave detection unit 211 sequentially detects the radio wave radiated from the transmitter 4 at every predetermined transmission time, but the present invention is not limited thereto. In alternative embodiments, when the radio wave detection unit 211 detects that the position of the transmitter 4 is changed, the radio wave detection unit 211 may detect the radio wave. A time when detecting that the position of the transmitter 4 is changed means, for example, a time when the radio wave intensity of the received radio wave is changed.

[0038]

Next, the environment information acquisition unit 213 acquires the "transmitter ID" and the "environment information" included in the radio wave detected by the radio wave detection unit 211 (step S12).

At this time, the environment information acquisition unit 213 stores the acquired "transmitter ID" and "environment information" in the storage medium 22 as "transmitter information D10 (FIG. 5)".

FIG. 5 is a diagram showing an example of the transmitter information according to an embodiment of the present invention.

As shown in FIG. 5, the transmitter information D10 is information in which the "transmitter ID" capable of specifying the transmitter 4 that is the transmission source of the radio wave, the "environment information" indicating the air conditioning environment (temperature, humidity, and the like) in the vicinity of the transmitter 4, and the "transmitter direction" or the "transmitter position" of the transmitter 4 estimated by

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the direction estimation unit 212 are associated with each other.

In a case where a plurality of transmitters 4 are disposed, the transmitter information D10 is stored in the storage medium 22 for each of the transmitters.

[0039]

Next, the required environment acquisition unit 214 acquires the "required environment setting" indicating the air conditioning environment requested by the user.

At this time, the required environment acquisition unit 214 stores the "required environment setting" that is input by the user in advance through the remote controller 5 in the storage medium 22, and reads and acquires the latest "required environment setting" from the storage medium 22.

[0040]

Next, the driving control unit 215 performs driving control of the air conditioning indoor unit 3 so that the air conditioning environment ("environment information") in the "transmitter direction" or the "transmitter position" of the transmitter 4 satisfies the "required environment setting" (step S14).

For example, it is assumed that the user has disposed the transmitter 4 in a baby bed where a baby is present as in the example of FIG. 1. At this time, the user inputs the "required environment setting" that specifies temperature, humidity, and the like, which allow the baby to comfortably stay through the remote controller 5. Then, the driving control unit 215 transmits a control command for changing a control amount of the fan 31 to the air conditioning indoor unit 3 so that the temperature, the humidity, and the like in the vicinity of the baby bed where the transmitter 4 is disposed is close to the "required environment setting" as much as possible. In addition, there is a possibility that the user may think that the user does not want an airflow to directly blow towards the baby. In this case, the user may dispose different transmitters 4 to each of a position where the

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baby is present (baby bed) and a position where the adult is present and may input the "required environment setting" in which the airflow direction is designated so that the airflow only directly blows towards the adult. In this case, the driving control unit 215 transmits a control command for controlling the louver 32 to the air conditioning indoor unit 3 so that the airflow is not transmitted toward the transmitter 4 disposed at the baby bed and the airflow is transmitted toward the transmitter 4 disposed at the position where the adult is present.

Therefore, the driving control unit 215 is able to allow the air conditioning environment in the "transmitter direction" or the "transmitter position" of the transmitter 4 to be close to the environment according to the "required environment setting" requested by the user.

[0041]

In addition, in a case where the reception unit 33 has not detected the reception of the radio wave from the transmitter 4 (step S10: NO), the radio wave detection unit 211 determines whether or not a predetermined waiting time (for example, three minutes) has elapsed (step S15).

In a case where the radio wave detection unit 211 has not detected the reception of the radio wave even after the predetermined waiting time has elapsed since a reception of a previous radio wave (step S15: YES), the radio wave detection unit 211 determines that the error in which the radio wave is not able to be radiated has occurred in the transmitter 4, and transmits a control command for notifying the air conditioning indoor unit 3 of the error (step S16). Then, the air conditioning indoor unit 3 notifies the user through the notification unit 34 that the error has occurred in the transmitter 4.

On the other hand, in a case where the predetermined waiting time has not elapsed (step S15: NO), the radio wave detection unit 211 returns to step S10.

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[0042]

FIG. 6 is a flowchart showing an example of a process of the transmitter according to an embodiment of the present invention. As shown in FIG. 6, the transmitter 4 determines whether or not a predetermined transmission time (for example, one minute) has passed (step S20).

[0043]

In a case where the predetermined transmission time has elapsed (step S20: YES), the transmitter 4 acquires the "environment information" indicating the air conditioning environment (temperature, humidity, and the like) in the vicinity of the transmitter 4 from the sensor 41 (step S21).

[0044]

Next, the transmitter 4 radiates the radio wave in which the "transmitter ID" that is set in the transmitter 4 in advance and the "environment information" acquired in step S21 are superimposed (step S22).

[0045]

In addition, in a case where the predetermined transmission time has elapsed (step S20: NO), the transmitter 4 returns to step S20.

[0046]

The transmitter 4 periodically radiates the radio wave capable of estimating the "transmitter direction" or the "transmitter position" of the transmitter 4 and capable of acquiring the "environment information" in the vicinity of the transmitter 4, by repeatedly executing the above-described processes during operation.

FIG. 6 shows an example in which the transmitter 4 radiates the radio wave every time the predetermined transmission time elapses, but the present invention is not limited thereto. In another embodiment, the transmitter 4 may radiate the radio wave

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when the position of the transmitter 4 changes. In this case, for example, the sensor 41 of the transmitter 4 may have an acceleration sensor, and the radio wave transmission-processing unit 432 may radiate the radio wave when the acceleration sensor detects a movement of the transmitter 4.

[0047]

(Hardware configuration)

FIG. 7 is a diagram showing an example of a hardware configuration of the control device and the transmitter according to an embodiment of the present invention.

Hereinafter, an example of the hardware configuration of the control device 2 and the transmitter 4 will be described with reference to FIG. 7.

As shown in FIG. 7, a computer 900 includes a CPU 901, a main storage device 902, an auxiliary storage device 903, and an interface 904.

The control device 2 and the transmitter 4 described above are mounted on the computer 900. In addition, the operations of each of the processing units described above are stored in the auxiliary storage device 903 in a form of a program. The CPU 901 reads the program from the auxiliary storage device 903, develops the program in the main storage device 902, and executes the above-described process according to the program. In addition, in accordance with the program, the CPU 901 secures a storage region used by the control device 2 and the transmitter 4 for various processes in the main storage device 902. In addition, in accordance with the program, the CPU 901 secures a storage region for storing data under a process in the auxiliary storage device 903.

[0048]

Examples of the auxiliary storage device 903 may include a hard disk drive (HDD), a solid-state drive (SSD), a magnetic disk, a magneto-optical disk, a compact

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disc read-only memory (CD-ROM), a digital versatile disc read-only memory (DVD-ROM), a semiconductor memory, and the like. The auxiliary storage device 903 may be an internal medium directly connected to a bus of the computer 900 or may be an external medium connected to the computer 900 through an interface 904 or a communication line. In addition, in a case where the program is delivered to the computer 900 through the communication line, the computer 900 receiving the delivery may develop the program in the main storage device 902 and execute the process described above. In at least one embodiment, the auxiliary storage device 903 is a non-transitory tangible storage medium.

[0049]

In addition, the program may be for realizing a part of the above-described function. Furthermore, the program may be a so-called difference file (difference program) that realizes the above-described function by a combination with another program that is stored in the auxiliary storage device 903 in advance.

[0050]

(Advantageous effects)

As described above, the control device 2 of the air conditioning system 1 of the present embodiment is the control device 2 that controls the air conditioning indoor unit 3. The control device 2 includes the radio wave detection unit 211 configured to detect the radio waves radiated from the transmitter 4 through at least two reception units 33 provided in the air conditioning indoor unit 3, the direction estimation unit 212 configured to estimate the "transmitter direction" indicating the direction in which the transmitter 4 is disposed on the basis of the radio waves received by each of the reception units 33, the environment information acquisition unit 213 configured to acquire the "environment information" indicating the air conditioning environment in the

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"transmitter direction", which is included in the radio waves, the required environment acquisition unit 214 configured to acquire the "required environment setting" requested by the user, and the driving control unit 215 configured to control the air conditioning indoor unit 3 so that the air conditioning environment in the "transmitter direction" satisfies the "required environment setting". According to the above configuration, for example, even in a case where an obstacle is present between the air conditioning indoor unit 3 and the transmitter 4, it is possible to estimate the "transmitter direction" in which the transmitter 4 is disposed. Thus, since the control device 2 is capable of adjusting the air conditioning environment in the direction in which the transmitter 4 is disposed according to an intention of the user by disposing the transmitter 4 in a place where the user preferentially wishes to adjust the air conditioning environment, it is possible to greatly improve comfort of the user.

[0051]

In addition, the reception units 33 are disposed at different positions in the horizontal direction, and the direction estimation unit 212 estimates the "transmitter direction" on the basis of the intensities of the radio waves received by each of the reception units 33 from the transmitter 4.

Therefore, the direction estimation unit 212 is capable of accurately estimating the direction in which the transmitter 4 is disposed (two-dimensional position).

[0052]

In addition, the air conditioning indoor unit 3 is provided with three or more reception units 33, and the direction estimation unit 212 further estimates the "transmitter position" indicating the position of the transmitter 4 on the basis of the intensities of the radio waves received by each of the three or more reception units 33 from the transmitter 4.

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According to the above configuration, the control device 2 is capable of estimating the "transmitter position" indicating the three-dimensional position where the transmitter 4 is disposed and adjust the air conditioning environment in the vicinity of the "transmitter position" according to the intention of the user. Thus, the control device 2 is capable of further improve the comfort of the user.

[0053]

In addition, the direction estimation unit 212 estimates the "transmitter direction" or the "transmitter position" of each of the plurality of transmitter 4, the required environment acquisition unit 214 acquires the different "required environment settings" for each of the transmitters, and the driving control unit 215 controls the air conditioning indoor unit 3 so that the air conditioning environment in "transmitter direction" or the "transmitter position" of each of the plurality of transmitter 4 satisfies the "required environment settings" for each of the transmitters.

According to the above configuration, by disposing the transmitter 4 in each of a plurality of places where the user wishes to adjust the air conditioning environment, the control device 2 is capable of appropriately adjusting a range where the airflow blows, for example, the airflow blows in a certain direction (position) and the airflow does not blow in another direction (position), etc., according to a preference of each of a plurality of users. Accordingly, the control device 2 is capable of improving the comfort of each of the plurality of users.

[0054]

In addition, the control device 2 further includes the error detection unit 216 configured to detect the occurrence of the error in the transmitter 4 in a case where the radio wave from the transmitter 4 is not received even after a predetermined waiting time has elapsed.

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According to the above configuration, the control device 2 is capable of detecting that the radio wave is not able to be radiated due to, for example, a failure of the transmitter 4 or battery exhaustion.

In addition, in a case where the failure of the transmitter 4 or the battery exhaustion has occurred, the control device 2 is able to quickly allow the user to recognize the failure of the transmitter 4 or the battery exhaustion by notifying the user of the detected error through the notification unit 34 of the air conditioning indoor unit 3.

[0055]

In addition, since the environment information acquisition unit 213 periodically acquires the "environment information" in the vicinity of the transmitter 4, the driving control unit 215 is capable of performing the driving control of the air conditioning indoor unit 3 while sequentially checking whether the air conditioning environment in the vicinity of the transmitter 4 is close to the "required environment setting". According to the above configuration, the driving control unit 215 is capable of adjusting the air conditioning environment in the vicinity of the transmitter 4 with high precision so that the air conditioning environment satisfies the "required environment setting" as much as possible. Thus, the control device 2 is capable of providing a more comfortable air conditioning environment closer to the request of the user.

[0056]

In the embodiments, an example in which the transmitter 4 and the remote controller 5 are different devices has been described, but the present invention is not limited thereto. In alternative embodiments, the remote controller 5 may include each functional part of the transmitter 4.

In this case, similarly to the transmitter 4, the remote controller 5 radiates the radio wave in which the "required environment setting" received from the user is

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superimposed to the reception unit 33 of the air conditioning indoor unit 3, by using the technology such as Bluetooth (registered trademark).

Even with such an aspect, it is possible to obtain the same advantageous effects as the above-described embodiment.

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What is claimed is:

1. A control device that controls an air conditioning indoor unit, the control device comprising:

a radio wave detection unit configured to detect radio waves radiated from a transmitter through at least two reception units provided in the air conditioning indoor unit;

a direction estimation unit configured to estimate a transmitter direction indicating a direction in which the transmitter is disposed on the basis of the radio waves received by each of the reception units;

an environment information acquisition unit configured to acquire environment information indicating an air conditioning environment in the transmitter direction, which is included in the radio waves;

a required environment acquisition unit configured to acquire a required environment setting requested by a user; and

a driving control unit configured to control the air conditioning indoor unit so that the air conditioning environment in the transmitter direction satisfies the required environment setting.

2. The control device according to Claim 1,

wherein the reception units are disposed at different positions in a horizontal direction, respectively, and

the direction estimation unit estimates the transmitter direction on the basis of intensities of the radio waves received by each of the reception units from the transmitter.

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3. The control device according to claim 1 or 2,

wherein the air conditioning indoor unit is provided with three or more reception units, and

the direction estimation unit further estimates a transmitter position indicating a position of the transmitter on the basis of intensities of the radio waves received by each of the three or more reception units from the transmitter.

4. The control device according to any one of claims 1 to 3,

wherein the direction estimation unit estimates the transmitter direction indicating a direction in which each of a plurality of transmitters is disposed,

the required environment acquisition unit acquires different required environment settings for each of the transmitters, and

the driving control unit controls the air conditioning indoor unit so that the air conditioning environment in the transmitter direction of each of the plurality of transmitters satisfies the required environment settings for each of the transmitters.

5. The control device according to any one of claims 1 to 4, further comprising:

an error detection unit configured to detect the occurrence of an error in the transmitter in a case where the radio wave from the transmitter is not received even after a predetermined waiting time has elapsed.

6. An air conditioning system comprising:

a transmitter configured to radiate a radio wave;

an air conditioning indoor unit having at least two reception units that receive the radio waves radiated from the transmitter; and

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a control device according to any one of claims 1 to 5.

7. A control method for controlling an air conditioning indoor unit, the control method comprising:

a radio wave detection step of detecting radio waves radiated from a transmitter through at least two reception units provided in the air conditioning indoor unit;

a direction estimation step of estimating a transmitter direction indicating a direction in which the transmitter is disposed on the basis of the radio waves received by each of the reception units;

an environment information acquisition step of acquiring environment information indicating an air conditioning environment in the transmitter direction, which is included in the radio waves;

a required environment acquisition step of acquiring a required environment setting requested by a user; and

an operation control step of controlling the air conditioning indoor unit so that the air conditioning environment in the transmitter direction satisfies the required environment setting.

8. A program for causing a computer of a control device that controls an air conditioning indoor unit to function and execute:

a radio wave detection step of detecting radio waves radiated from a transmitter through at least two reception units provided in the air conditioning indoor unit;

a direction estimation step of estimating a transmitter direction indicating a direction in which the transmitter is disposed on the basis of the radio waves received by each of the reception units;

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an environment information acquisition step of acquiring environment information indicating an air conditioning environment in the transmitter direction, which is included in the radio waves;

a required environment acquisition step of acquiring a required environment setting requested by a user; and

an operation control step of controlling the air conditioning indoor unit so that the air conditioning environment in the transmitter direction satisfies the required environment setting.

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FIG. 1

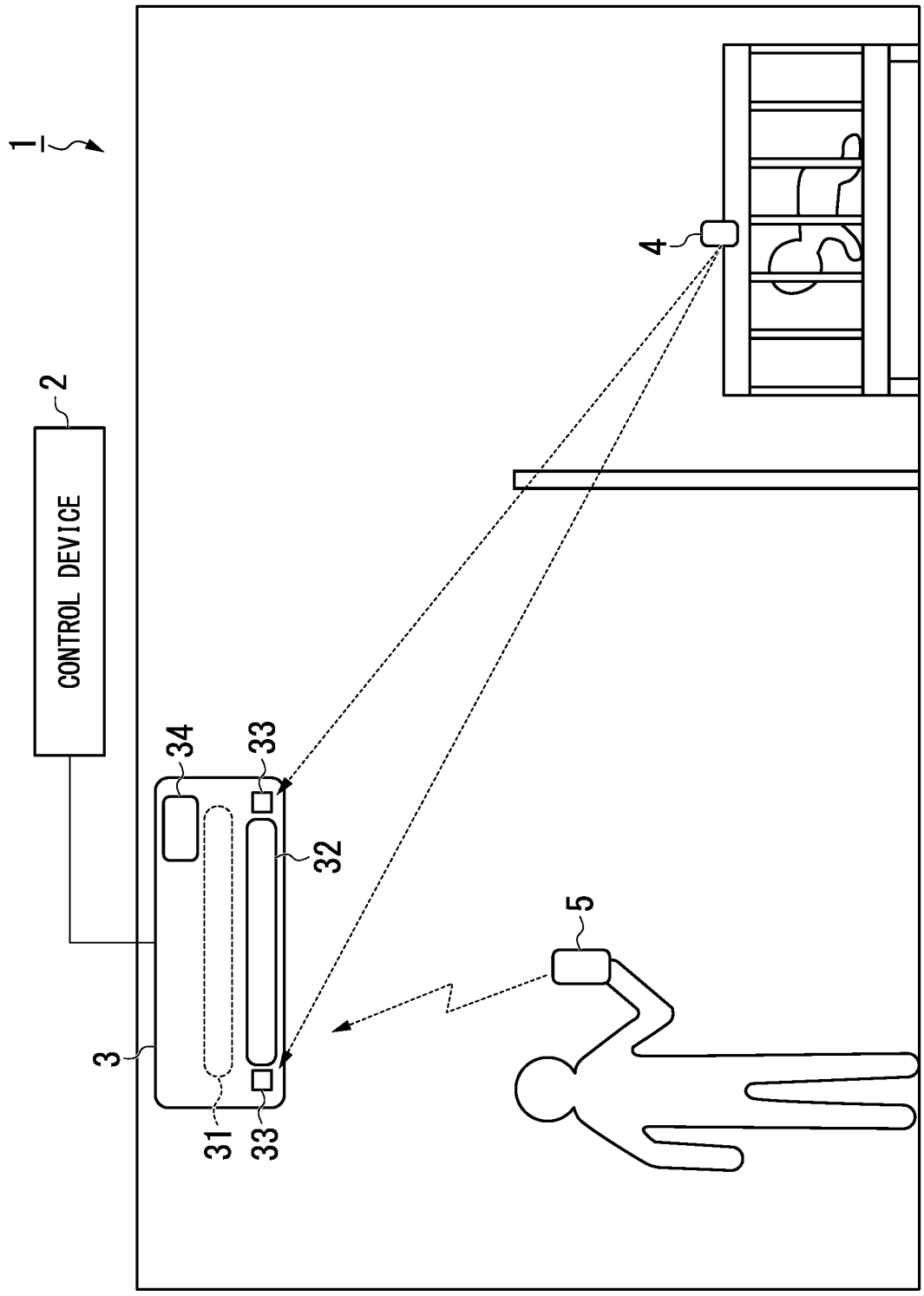

FIG. 2

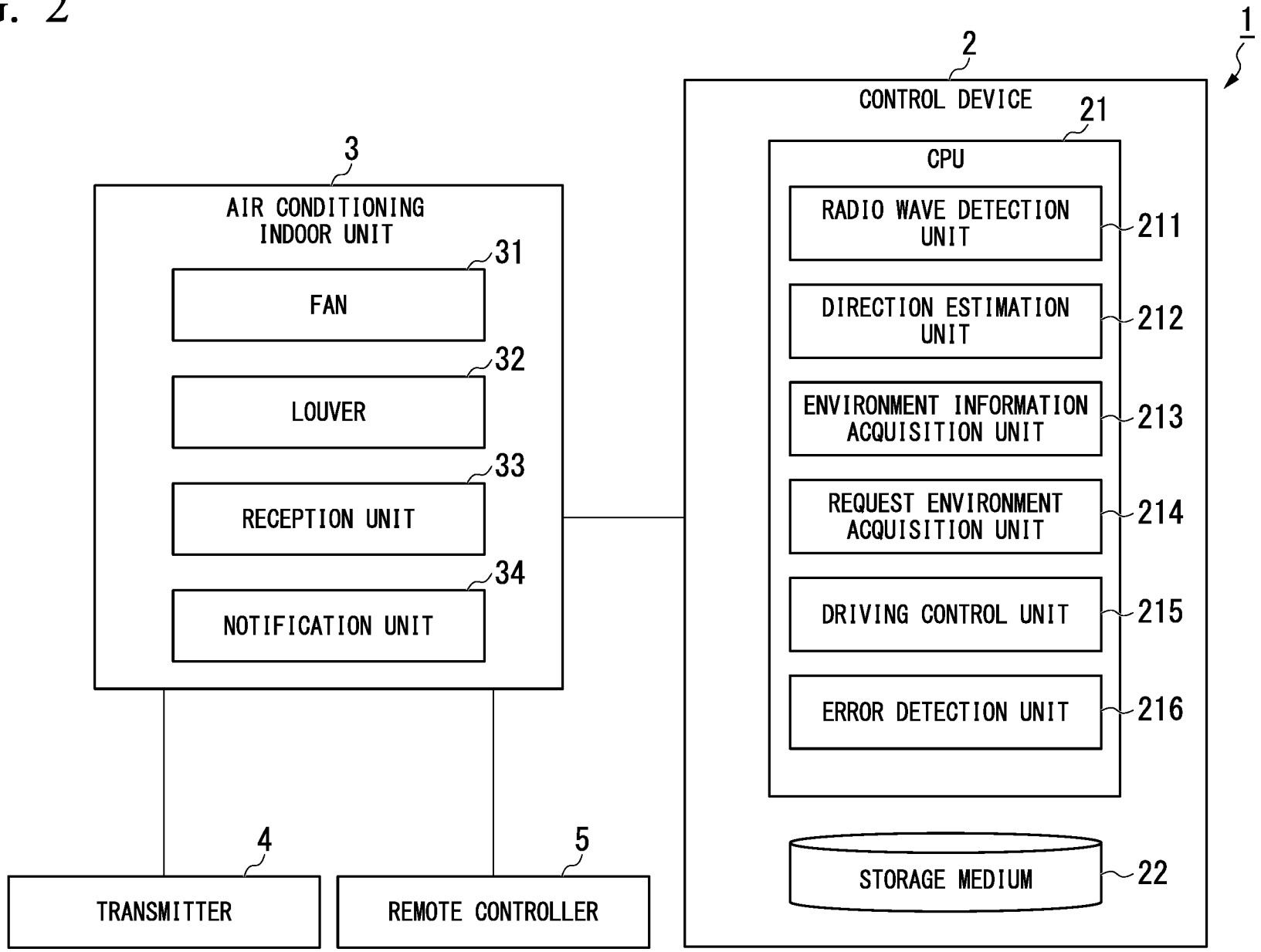
1
2
CONTROL DEVICE
21
CPU
RADIO WAVE DETECTION UNIT
211
DIRECTION ESTIMATION UNIT
212
ENVIRONMENT INFORMATION ACQUISITION UNIT
213
REQUEST ENVIRONMENT ACQUISITION UNIT
214
DRIVING CONTROL UNIT
215
ERROR DETECTION UNIT
216
STORAGE MEDIUM
22
3
AIR CONDITIONING INDOOR UNIT
31
FAN
32
LOUVER
33
RECEPTION UNIT
34
NOTIFICATION UNIT
4
TRANSMITTER
5
REMOTE CONTROLLER

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FIG. 3

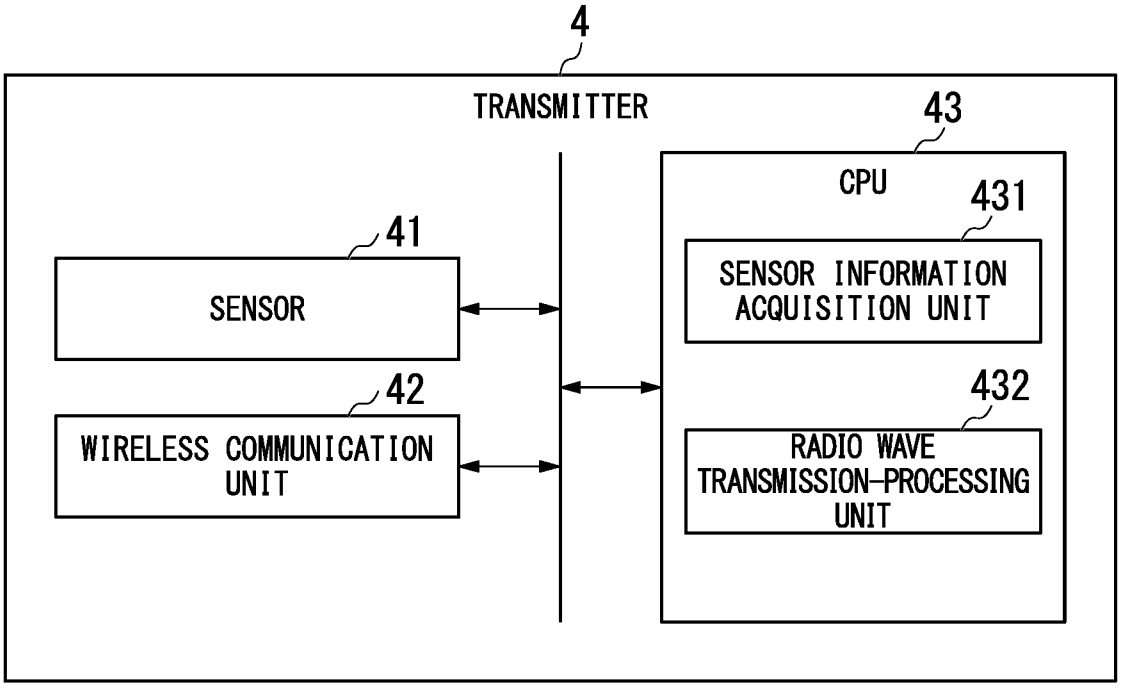

FIG. 4

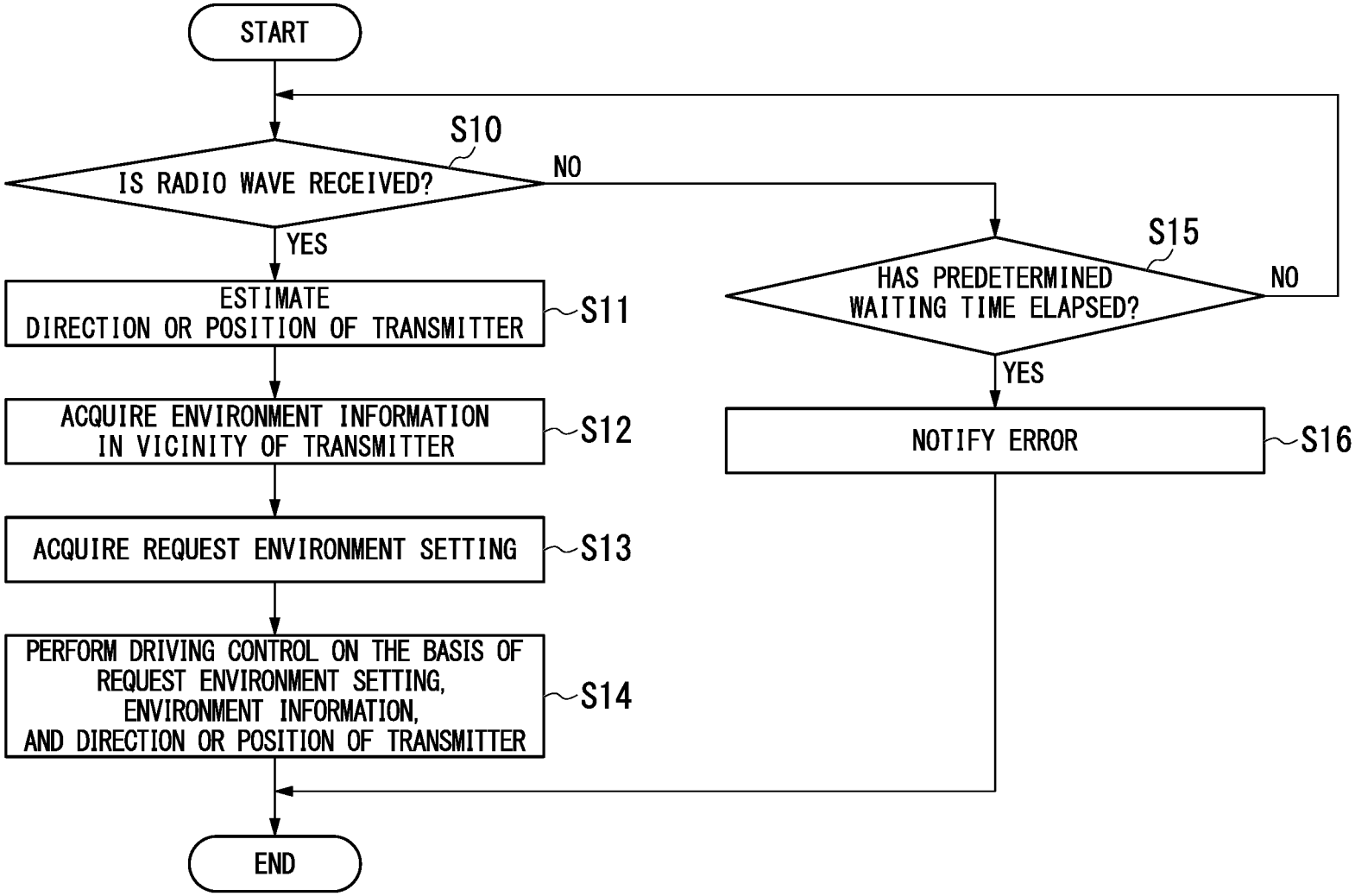
START
S10
IS RADIO WAVE RECEIVED?
NO
YES
ESTIMATE DIRECTION OR POSITION OF TRANSMITTER
S11
ACQUIRE ENVIRONMENT INFORMATION IN VICINITY OF TRANSMITTER
S12
ACQUIRE REQUEST ENVIRONMENT SETTING
S13
PERFORM DRIVING CONTROL ON THE BASIS OF REQUEST ENVIRONMENT SETTING, ENVIRONMENT INFORMATION, AND DIRECTION OR POSITION OF TRANSMITTER
S14
END
S15
HAS PREDETERMINED WAITING TIME ELAPSED?
NO
YES
NOTIFY ERROR
S16

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FIG. 5

D10

TRANSMITTER INFORMATION

TRANSMITTER ID	ENVIRONMENT INFORMATION (TEMPERATURE, HUMIDITY)	TRANSMITTER DIRECTION/ TRANSMITTER POSITION
ID0001	25℃、30%	*****

FIG. 6

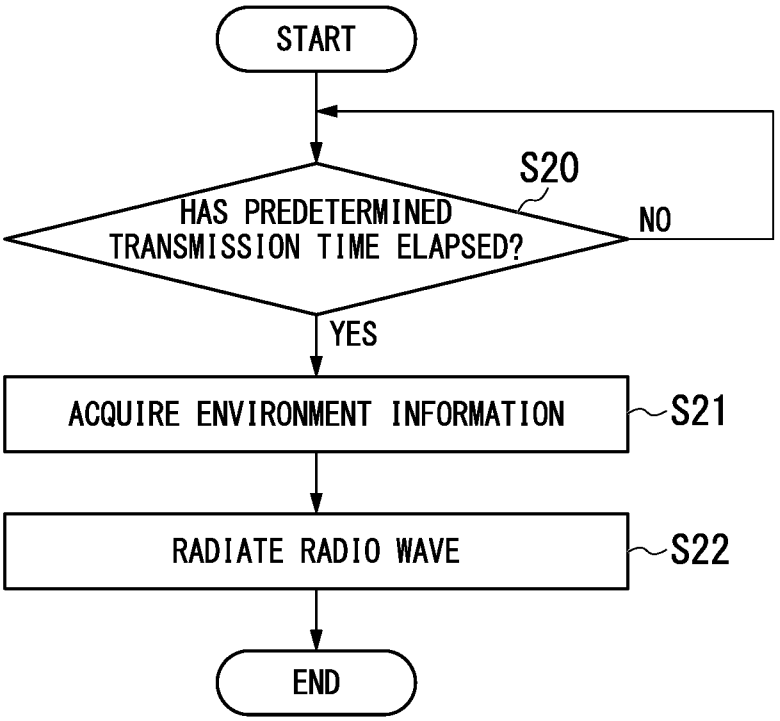
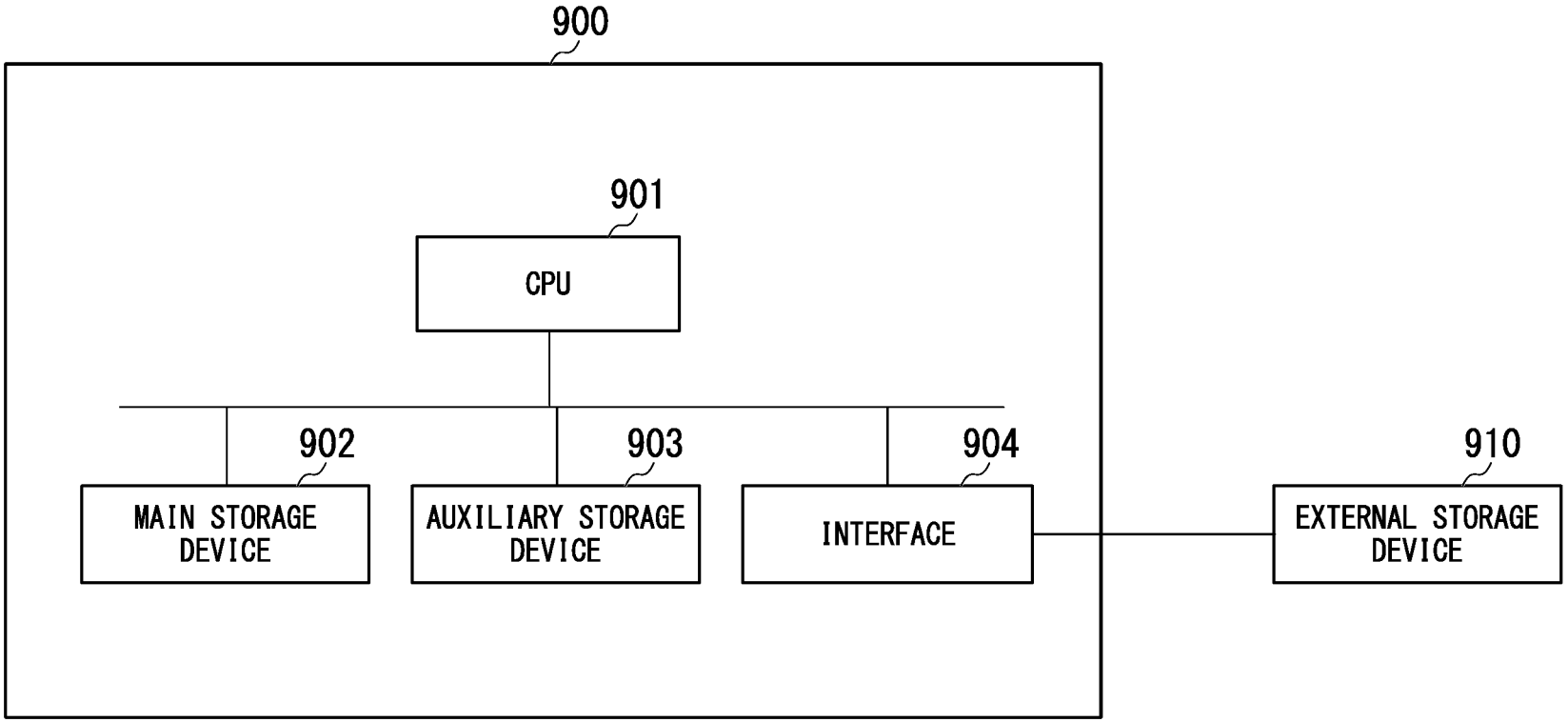


FIG. 7


900
901
CPU
902
MAIN STORAGE DEVICE
903
AUXILIARY STORAGE DEVICE
904
INTERFACE
910
EXTERNAL STORAGE DEVICE