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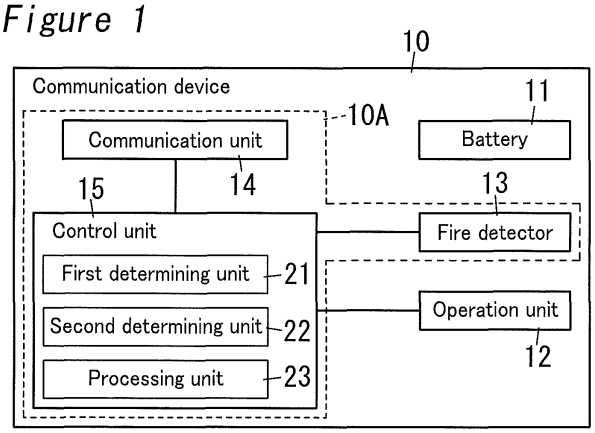
(54) COMMUNICATION DEVICE

(57) A communication device capable of extending the life of a battery is provided. A communication device (10) includes a main unit (10A) and an operation unit (12), a processing unit (23), a first determining unit (21) and a second determining unit (22). The main unit (10A) includes a communication unit (14) and is supplied with electric power from a battery (11) to be activated. While an operation mode is a second operation mode, power consumption in which is smaller than that in a first operation mode, the processing unit (23) changes the operation mode from the second operation mode to the first operation mode when the first determining unit (21) determines receipt of a changeover instruction to the first operation mode, and when the second determining unit (22) determines fulfilment of a changeover condition of the operation mode from the second operation mode to the first operation mode.

Figure 1



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Description

Technical Field

[0001] The invention relates generally to communication devices and, more particularly, to a communication device whose power supply is a battery.

Background Art

[0002] For example, a fire alarm device has so far been provided as a communication device configured to be supplied with electric power from a battery and perform wireless communication (see Patent Literature 1).

[0003] The fire alarm device is installed in a building such as a dwelling and configured to alert people inside the building to a fire when detecting the fire. Therefore, in order to avoid battery exhaustion when alerting the fire, the fire alarm device periodically detects voltage of the battery to notify that when the voltage of the battery is less than or equal to a threshold, the battery needs to be replaced. The fire alarm device accordingly enables a user of the fire alarm device to replace the battery.

[0004] In recent years there has been a communication device (e.g., fire alarm device) that prohibits removal of a battery in order to avoid an unusable state in an emergency as a result of the battery being removed from the communication device. As soon as such a communication device has been produced, it starts to consume a battery thereof. It is therefore necessary to more extend the life of the battery than those of other conventional communication devices.

Citation List

[0005] Patent Literature 1: JPH05-174265 A

Summary of Invention

[0006] The present invention has been achieved in view of the above circumstances, and an object thereof is to provide a communication device capable of extending the life of a battery.

[0007] A communication device according to an aspect of the present invention includes a main unit and an operation unit. The main unit includes a communication unit and is configured to be supplied with electric power from a battery to be activated. The communication device further includes a processing unit, a first determining unit and a second determining unit. The processing unit is configured to cause the main unit to operate in an operation mode as any one of a first operation mode for performing a normal operation and a second operation mode for performing a stand-by operation, power consumption in which is smaller than that in the first operation mode. The first determining unit is configured to, when the operation mode is the second operation mode, determine whether or not the operation unit receives a changeover instruction to the first operation mode. The second determining unit is configured to, when the first determining unit determines receipt of the changeover instruction, determine whether or not a changeover condition of the operation mode from the second operation mode to the first operation mode is fulfilled. The processing unit is configured to, when the second determining unit determines fulfilment of the changeover condition, change the operation mode from the second operation mode to the first operation mode.

[0008] The communication device can extend the life of the battery.

Brief Description of Drawings

[0009]

Figure 1 is a block diagram of a communication device according to Embodiment 1,

Figure 2 illustrates a configuration of a communication system including the communication device according to Embodiment 1,

Figure 3 is a flowchart showing an operation, of the communication device 10 according to Embodiment 1, about changeover from a second operation mode to a first operation mode,

Figure 4 is a flowchart showing an operation, of the communication device 10 according to Embodiment 1, about changeover from the first operation mode to the second operation mode,

Figure 5 is a block diagram of a communication device according to Embodiment 2,

Figure 6 is a flowchart showing an operation, of the communication device 10 according to Embodiment 2, about changeover from a second operation mode to a first operation mode, and

Figure 7 is a flowchart showing an operation, of a communication device 10 according to Embodiment 3, about changeover from a first operation mode to a second operation mode.

Description of Embodiments

(Embodiment 1)

[0010] A communication device 10 according to the present embodiment will be explained with reference to Figures 1 to 4. The communication device 10 is, for example a fire detector. As shown in Figure 2, communication devices 10 and a management device 100 (external device) constitute a wireless communication system 1. Note that the communication devices 10 and the management device 100 are installed in the same dwelling. Each of the communication devices 10 is configured to, when detecting fire, wirelessly transmit a fire detection signal representing detection of the fire to the management device 100. The management device 100 is configured to, responsive to receipt of the fire detection sig-

nal, notify the detection of the fire to another device via the Internet or the like.

[0011] Each of the communication devices 10 is configured to be supplied with electric power from a battery 11 to be described later to operate in an operation mode as any one of a first operation mode for performing a normal operation including a communication operation with the management device 100 and a second operation mode for performing a stand-by operation, power consumption in which is smaller than that in the first operation mode. Each communication device 10 is to operate in the second operation mode at the time of shipment.

[0012] Each communication device 10 is configured to, while supplied with the electric power from the battery 11 and operating in the second operation mode, change its own operation mode from the second operation mode to the first operation mode responsive to receipt of a changeover instruction from the second operation mode to the first operation mode from a user and to fulfilment of a predetermined changeover condition.

[0013] As shown in Figure 2, the wireless communication system 1 includes a maintenance device 101. The maintenance device 101 is, for example a device provided for a service engineer (maintainer) requested to repair a communication device(s) 10, and configured to perform wireless communication with each communication device 10.

[0014] Each communication device 10 is configured to, while operating in the first operation mode, change its own operation mode from the first operation mode to the second operation mode responsive to receipt of a changeover message representing a changeover instruction to the second operation mode from the maintenance device 101.

[0015] A configuration of each communication device 10 will hereinafter be explained. As shown in Figure 1, a communication device 10 includes a main unit 10A, a battery 11 and an operation unit 12. The main unit 10A is configured to be supplied with electric power from the battery 11 to operate in an operation mode as any one of a first operation mode and a second operation mode. As shown in Figure 1, the main unit 10A includes a fire detector 13, a communication unit 14 and a controller 15.

[0016] The battery 11 is a power supply configured to energize and activate the communication device 10 and, for example a lithium battery. The battery 11 is provided so as to prohibit removal of the battery 11 from the communication device 10. In the embodiment, the battery 11 is configured to supply the electric power to the operation unit 12 and the main unit 10A in the first operation mode. Specifically, the battery 11 will supply the electric power to the operation unit 12, the fire detector 13, the communication unit 14 and the controller 15. The battery 11 is also configured to supply the electric power to the operation unit 12 and part of the main unit 10A in the second operation mode. Specifically, the battery 11 will supply the electric power to the operation unit 12 and the controller 15. In the embodiment, an operation state of the communication unit 14 while the communication unit 14 is supplied with the electric power is called a communication enabled state. An operation state of the communication unit 14 while supplied with no electric power (deactivated state of communication unit 14) is called a communication disabled state. In addition, an operation state of the fire detector 13 while the fire detector 13 is supplied with the electric power is called a fire detection enabled state. An operation state of the fire detector 13 while supplied with no electric power (deactivated state of fire detector 13) is called a fire detection disabled state.

[0017] The operation unit 12 includes an operation button that allows the operation unit 12 to receive an operation from a user through. The operation unit 12 includes a circuit (operation circuit) that is configured to be supplied with the electric power from the battery 11 to provide a signal to the controller 15 to be described later when the operation button is pushed. The operation unit 12 is configured to, while the main unit 10A is supplied with the electric power from the battery 11 and is operating in the second operation mode, receive a changeover instruction as a result of a long push of the operation button by a user. In this case, the operation circuit of the operation unit 12 will provide the signal to the controller 15 during the long push of the operation button. Here, the long push means that the operation button of the operation unit 12 is pushed for, e.g. one second or more. Note that the value is merely one example and the embodiment is not limited thereto.

[0018] The fire detector 13 is configured to detect fire, and examples thereof include a thermal detector, a smoke detector and a flame sensor. The fire detector 13 is configured to be in the fire detection enable state during the first operation mode, and in the fire detection disable state during the second operation mode. The fire detector 13 is configured to, when the operation mode is changed from the second operation mode to the first operation mode, be controlled with a processing unit 23 to be described later to change an operation state thereof from the fire detection disable state to the fire detection enable state.

[0019] The communication unit 14 is a communication circuit configured to perform wireless communication-for example short-range wireless communication. The communication unit 14 is configured to, while operating in the first operation mode, communicate with a management device 100 at regular intervals. This enables the management device 100 to confirm the presence of the communication device 10. The communication unit 14 is also configured to transmit a fire detection signal to the management device 100 responsive to detection of fire by the fire detector 13. Here, the processing unit 23 to be described later is configured to, responsive to receipt of a changeover instruction by the operation unit 12 while the main unit 10A is operating in the second operation mode, activate the communication unit 14 to change an operation state of the communication unit 14 from the communication disabled state to the communication en-

abled state. The communication unit 14 is configured to then be controlled with the processing unit 23 to transmit to the management device 100 a communication start signal that represents starting communication. After the communication start signal is transmitted, the communication unit 14 is to wait a response signal representing receipt of the communication start signal-be in a waiting state.

[0020] The controller 15 includes, for example a microcomputer (microcontroller) as a main component and is configured to include predetermined functions by executing a program stored in a memory. The program may be stored in the memory in advance or provided through a storage medium such as a memory card.

[0021] As shown in Figure 1, the controller 15 includes a first determining unit 21, a second determining unit 22 and the processing unit 23.

[0022] The first determining unit 21 is configured to, while the main unit 10A is supplied with the electric power from the battery 11 and is operating in the second operation mode, determine whether or not the operation unit 12 receives a changeover instruction (long push of operation button of operation unit 12 is detected). Specifically, when receiving a signal from the operation circuit of the operation unit 12 for one second more with the main unit 10A operating in the second operation mode, the first determining unit 21 may determine receipt of the changeover instruction by the operation unit 12.

[0023] The second determining unit 22 is configured to, when the first determining unit 21 determines receipt of the changeover instruction by the operation unit 12, determine whether or not a changeover condition from the second operation mode to the first operation mode is fulfilled within a predetermined time period. Specifically, after the communication unit 14 transmits the communication start signal to the management device 100, the second determining unit 22 may determine whether or not the communication unit 14 receives the response signal from the management device 100 within the predetermined time period. The second determining unit 22 is configured to, when the response signal is received within the predetermined time period beginning at time of the transmission of the communication start signal, determine fulfilment of the changeover condition. The second determining unit 22 is configured to, when the response signal is not received within the predetermined time period beginning at time of the transmission of the communication start signal, determine that the changeover condition is not fulfilled. Here, the predetermined time period is, for example 30 seconds. Note that the value is merely one example and the embodiment is not limited to this.

[0024] The processing unit 23 is configured to control and cause the main unit 10A to operate in an operation mode as any one of the first operation mode and the second operation mode. Specifically, the processing unit 23 is to cause the main unit 10A to operate in the second operation mode until the predetermined changeover condition is fulfilled with the changeover instruction received by the operation unit 12.

[0025] The processing unit 23 is configured to, when the first determining unit 21 determines receipt of the changeover instruction by the operation unit 12, change the operation state of the communication unit 14 from the communication disabled state to the communication enabled state. Specifically, the processing unit 23 is to start supplying the communication unit 14 with electric power from the battery 11 to activate and control the communication unit 14 so that the communication unit 14 transmits a communication start signal to the management device 100. According to this control, the communication unit 14 will transmit the communication start signal to the management device 100.

[0026] The processing unit 23 is configured to, when the second determining unit 22 determines fulfilment of the predetermined changeover condition, change the operation mode of the main unit 10A from the second operation mode to the first operation mode, and subsequently control so that the main unit 10A operates in the first operation. At this moment, the processing unit 23 is to activate the fire detector 13. Specifically, the processing unit 23 will start supplying the fire detector 13 with electric power from the battery 11. This allows the operation unit 12, the fire detector 13, the communication unit 14 and the controller 15 to be supplied with electric power from the battery 11. Thus, the operation state of the fire detector 13 will be changed from the fire detection disabled state to the fire detection enabled state.

[0027] The processing unit 23 is configured to, when the second determining unit 22 determines unfulfilment of the predetermined changeover condition, cause the communication unit 14 to operate in the communication disabled state. Specifically, the processing unit 23 is to stop the supply of electric power from the battery 11 to the communication unit 14 to deactivate the communication unit 14, and maintain the main unit 10A operating in the second operation mode.

[0028] The processing unit 23 is also configured to, when the communication unit 14 receives a changeover message from a maintenance device 101 with the main unit 10A operating in the first operation mode, change the operation mode of the main unit 10A from the first operation mode to the second operation mode. In this case, the processing unit 23 is to stop the supply of electric power from the battery 11 to the fire detector 13 and the communication unit 14 of the main unit 10A. Thus, the operation state of the communication unit 14 will be changed from the communication enabled state to the communication disabled state.

[0029] The processing unit 23 is configured to, when the fire detector 13 detects fire, control and cause the communication unit 14 to transmit a fire detection signal to the management device 100.

[0030] For example, the communication device 10 may operate in the second operation mode at the time of shipment, and change the operation mode from the second operation mode to the first operation mode in response

to a request from a purchaser (user) of the communication device 10 for causing the communication device 10 to detect fire.

[0031] An operation of the communication device 10 when the operation mode is changed from the second operation mode to the first operation mode will hereinafter be explained with reference to the flowchart of Figure 3.

[0032] While the main unit 10A is provided with electric power from the battery 11 and operating in the second operation mode, the first determining unit 21 determines whether or not the operation unit 12 receives a changeover instruction (step S1). Specifically, the first determining unit 21 determines whether or not a long push of the operation button in the operation unit 12 is performed.

[0033] The first determining unit 21 determines that the operation unit 12 receives no changeover instruction ("No" at step S1), and then proceeds to process of waiting the changeover instruction.

[0034] When the first determining unit 21 determines receipt of the changeover instruction by the operation unit 12 ("Yes" at step S1), the second determining unit 22 determines whether or not communication is successful or established within the predetermined time period (step S2). Specifically, the second determining unit 22 determines whether or not the communication unit 14 receives a response signal within the predetermined time period after the communication unit 14 transmits a communication start signal to the management device 100. In this case, the processing unit 23 changes the operation state of the communication unit 14 from the communication disabled state to the communication enabled state, and controls and causes the communication unit 14 to transmit the communication start signal to the management device 100.

[0035] When the second determining unit 22 determines success in the communication ("Yes" at step S2), the processing unit 23 changes the operation mode from the second operation mode to the first operation mode (step S3). Specifically, when the communication unit 14 receives a response signal within the predetermined time period beginning at time of the transmission of the communication start signal, the second determining unit 22 determines success in the communication-fulfilment of the changeover condition. When the second determining unit 22 determines the fulfilment of the changeover condition, the processing unit 23 activates the fire detector 13.

[0036] When the second determining unit 22 determines unsuccess-failure of the communication ("No" at step S2), the processing unit 23 maintains the second operation mode (step S4). Specifically, when the communication unit 14 does not receive the response signal within the predetermined time period beginning at time of the transmission of the communication start signal, the second determining unit 22 determines failure of the communication-unfulfilment of the changeover condition. In this case, the processing unit 23 changes the operation state of the communication unit 14 from the communication enabled state to the communication disabled state. Specifically, the processing unit 23 stops the supply of electric power from the battery 11 to the communication unit 14 to deactivate the communication device 10, and then proceeds to process of waiting the changeover instruction.

[0037] An operation of the communication device 10 when the operation mode is changed from the first operation mode to the second operation mode will hereinafter be explained with reference to the flowchart of Figure 4.

[0038] While the main unit 10A is operating in the first operation mode, the processing unit 23 determines whether or not the communication unit 14 receives a changeover message from the maintenance device 101 (step S10). When determining receipt of the changeover message by the communication unit 14 ("Yes" at step S10), the processing unit 23 changes the operation mode from the first operation mode to the second operation mode (step S11). When determining that the changeover message is not received by the communication unit 14 ("No" at step S10), the processing unit 23 maintains the main unit 10A operating in the first operation mode, and waits to receive the changeover message.

[0039] In the embodiment, the communication device 10 is the fire detector, but not limited to this. The communication device 10 may be a device that is configured to detect intrusion (of an intruder(s)) into a dwelling when nobody is in, or a device configured to notify abnormality in a dwelling to a device outside the dwelling via the management device 100. That is, the communication device 10 needs to be a security device configured to be activated by the battery 11 to perform wireless communication with the management device 100.

[0040] Note that the battery 11 in the embodiment may be included as a component of the communication device 10 or needn't be included as the component of the communication device 10. The battery 11 may have a removable configuration, or be provided outside the communication device 10.

[0041] In the embodiment, the communication device 10 receives the changeover instruction by a long push of the operation button in the operation unit 12, but is not limited to this. The communication device 10 may receive the changeover instruction when the operation button of the operation unit 12 is continuously pushed a predetermined number of times. When the operation unit 12 is provided with operation buttons, the changeover instruction may be received when at least two operation buttons are pushed at the same time.

[0042] In the embodiment, the communication device 10 changes the operation mode from the first operation mode to the second operation mode responsive to receipt of the changeover message from the maintenance device 101 while operating in the first operation mode, but is not limited to this. While operating in the first operation mode, the communication device 10 may change the operation mode from the first operation mode to the second

operation mode when the changeover message from the maintenance device 101 is received with a predetermined operation being received. Here, the predetermined operation means, for example the operation button of the operation unit 12 being pushed. When the operation unit 12 is provided with operation buttons, the predetermined operation may be at least two operation buttons being pushed at the same time.

[0043] In the embodiment, the communication device 10 receives the changeover message from the maintenance device 101, but is not limited to this. The communication device 10 may receive the changeover message from the management device 100.

(Embodiment 2)

[0044] In the present embodiment, a predetermined changeover condition is different from that in Embodiment 1. Here, different points from Embodiment 1 will be mainly described. Like components are assigned the same reference numerals as depicted in Embodiment 1 and explanation thereof will be omitted.

[0045] As shown in Figure 5, a main unit 10A of a communication device 10 according to the present embodiment includes an installation detector 16 in addition to the same components as those of the main unit 10A in Embodiment 1. In addition, the components included in the communication device 10 (battery 11, operation unit 12, fire detector 13, communication unit 14, controller 15 and installation detector 16) are housed in an enclosure 10B of the communication device 10.

[0046] In the present embodiment, the battery 11 is configured to supply electric power to the operation unit 12 and the main unit 10A in a first operation mode. Specifically, the battery 11 is to supply the electric power to the fire detector 13, the communication unit 14, the controller 15 and the installation detector 16. The battery 11 is also configured to supply electric power to the operation unit 12 and a part of the main unit 10A in a second operation mode. Specifically, the battery 11 is to supply the electric power to the operation unit 12 and the controller 15. In the present embodiment, an operation state of the installation detector 16 when the installation detector 16 is supplied with the electric power is called an installation detection enabled state, while the operation state of the installation detector 16 when supplied with no electric power (when installation detector 16 is deactivated) is called an installation detection disabled state.

[0047] The installation detector 16 is, for example a magnetism detector circuit and configured to detect installation of the enclosure 10B in the communication device 10 on a wall or the like in a dwelling, where the enclosure 10B accommodates at least the main unit 10A and a processing unit 23. The installation detector 16 is to detect the installation of the enclosure 10B in the communication device 10 by detecting magnetism from a mounting base (base) that is equipped with a magnet and provided at an installation place such as a wall. The processing unit 23 is configured to, responsive to receipt of a changeover instruction by the operation unit 12 while operating in the second operation mode, activate the installation detector 16 to change the operation state from the installation detection disabled state to the installation detection enabled state.

[0048] A second determining unit 22 in the present embodiment is configured to, when the first determining unit 21 determines the receipt of the changeover instruction, determine whether or not a changeover condition from the second operation mode to the first operation mode is fulfilled within a predetermined time period. Specifically, the second determining unit 22 is to determine whether or not the installation detector 16 detects the installation of the enclosure 10B in the communication device 10 within the predetermined time period beginning at the start of the operation of the installation detector 16 in the installation detection enabled state under control of the processing unit 23. The second determining unit 22 is configured to, when the installation detector 16 detects the installation of the enclosure 10B in the communication device 10 within the predetermined time period beginning at the start of the operation of the installation detector 16 in the detection enabled state, determine fulfilment of the changeover condition. The second determining unit 22 is also configured to, when the installation detector 16 does not detect the installation of the enclosure 10B in the communication device 10 within the predetermined time period beginning at the start of the operation of the installation detector 16 in the detection enabled state, determine unfulfilment of the changeover condition. Here, the predetermined time period is, for example 60 seconds. Note that the value is merely one example and the present embodiment is not limited to this.

[0049] The processing unit 23 is configured to, when the first determining unit 21 determines receipt of the changeover instruction by the operation unit 12, change the operation state of the installation detector 16 from the installation detection disabled state to the installation detection enabled state. Specifically, the processing unit 23 is to start supplying the installation detector 16 with electric power from the battery 11 to activate the installation detector 16.

[0050] The processing unit 23 is configured to, when the second determining unit 22 determines fulfilment of a predetermined changeover condition, change an operation mode of the main unit 10A from the second operation mode to the first operation mode, and subsequently perform operation control according to the first operation. Specifically, the processing unit 23 is to activate the fire detector 13 and the communication unit 14 by starting supplying the fire detector 13 and the communication unit 14 with electric power from the battery 11. The battery 11 will supply the electric power to the operation unit 12, the fire detector 13, the communication unit 14, the controller 15 and the installation detector 16. Thus, an operation state of the fire detector 13 will be

changed from a fire detection disabled state to a fire detection enabled state.

[0051] The processing unit 23 is configured to, when the second determining unit 22 determines unfulfilment of the predetermined changeover condition, stop the supply of the electric power from the battery 11 to the installation detector 16 to deactivate the installation detector 16, and maintain the main unit 10A operating in the second operation mode.

[0052] An operation of the communication device 10 in the present embodiment when the operation mode is changed from the second operation mode to the first operation mode will hereinafter be explained with reference to the flowchart of Figure 6.

[0053] While the main unit 10A is supplied with electric power from the battery 11 and operating in the second operation mode, the first determining unit 21 determines whether or not the operation unit 12 receives a changeover instruction (step S20). Specifically, the first determining unit 21 determines whether or not a long push of the operation button in the operation unit 12 is performed.

[0054] The first determining unit 21 determines that the operation unit 12 does not receive the changeover instruction ("No" at step S20), and then maintains the main unit 10A operating in the second operation mode to proceed to process of waiting the changeover instruction.

[0055] When the first determining unit 21 determines receipt of a changeover instruction by the operation unit 12 ("Yes" at step S20), the second determining unit 22 determines whether or not the installation of the enclosure 10B in the communication device 10 is detected within the predetermined time period (step S21). Specifically, the second determining unit 22 determines whether or not the installation detector 16 detects the magnetism of the magnet provided for the base within the predetermined time period beginning at the activation of a detection function of the installation detector 16. In this case, the processing unit 23 changes the operation state of the installation detector 16 from the installation detection disabled state to the installation detection enabled state.

[0056] When the second determining unit 22 determines that the installation of the enclosure 10B in the communication device 10 is detected ("Yes" at step S21), the processing unit 23 changes the operation mode from the second operation mode to the first operation mode (step S22). Specifically, when the installation detector 16 detects the magnetism of the magnet provided for the base within the predetermined time period beginning at the start of the operation of the installation detector 16 in the installation detection enabled state, the second determining unit 22 determines that the installation of the enclosure 10B in the communication device 10 is detected (changeover condition is fulfilled). When the determining unit 22 determines fulfilment of the changeover condition, the processing unit 23 activates the fire detector 13.

[0057] When the determining unit 22 determines that the installation of the enclosure 10B in the communication device 10 is not detected ("No" in step S21), the processing unit 23 maintains the second operation mode (step S23). Specifically, when the installation detector 16 does not detect the magnetism of the magnet provided for the base within the predetermined time period beginning at the start of the operation of the installation detector 16 in the installation detection enabled state, the second determining unit 22 determines that the installation of the enclosure 10B in the communication device 10 is not detected (changeover condition is not fulfilled). In this case, the processing unit 23 changes the operation state of the installation detector 16 from the installation detection enabled state to the installation detection disabled state. Specifically, the processing unit 23 stops the supply of the electric power from the battery 11 to the installation detector 16, and then proceeds to process of waiting the changeover instruction.

(Embodiment 3)

[0058] In Embodiment 2, the second determining unit 22 determines whether or not the changeover condition is fulfilled based on a detection result by the installation detector 16. In the present embodiment, a second determining unit 22 is configured to determine whether or not a changeover condition is fulfilled, based on a successful or unsuccessful result of communication as explained in Embodiment 1 and a detection result by an installation detector 16 as explained in Embodiment 2. In the explanation below, different points from Embodiment 2 will be mainly described. Like components are assigned the same reference numerals as depicted in Embodiment 2 and explanation thereof will be omitted. Also, in the explanation below, like Embodiment 1, an operation state of a communication unit 14 when the communication unit 14 is supplied with electric power is called a communication enabled state, while the operation state of the communication unit 14 when supplied with no electric power is called a communication disabled state

[0059] A processing unit 23 in the present embodiment is configured to, when a first determining unit 21 determines receipt of a changeover instruction, change the operation state of the communication unit 14 from the communication disabled state to the communication enabled state and also change an operation state of the installation detector 16 from a detection disabled state to a detection enabled state. Specifically, the processing unit 23 is to start supplying the communication unit 14 and the installation detector 16 with electric power from a battery 11 to activate the communication unit 14 and the installation detector 16.

[0060] The second determining unit 22 is configured to determine whether or not communication with a management device 100 is successful within a predetermined time period (first predetermined time period), and also determine whether or not a communication device 10 is installed within a predetermined time period (second pre-

determined time period). Here, the first predetermined time period is, for example 30 seconds, while the second predetermined time period is, for example 60 seconds. Not that these values are merely examples, but the present embodiment is not limited thereto.

[0061] The processing unit 23 is configured to, when the communication is successful within the first predetermined time period and the installation of the communication device 10 is detected within the second predetermined time period, changes an operation mode from a second operation mode to a first operation mode, and subsequently performs operation control according to the first operation mode. Specifically, the processing unit 23 is to start supplying a fire detector 13 with electric power from the battery 11 to activate the fire detector 13. The battery 11 will supply the electric power to the fire detector 13, an operation unit 12, the communication unit 14, a controller 15 and an installation detector 16. Thus, an operation state of the fire detector 13 will be changed from a fire detection disabled state to a fire detection enabled state.

[0062] The processing unit 23 is configured to, when the communication is unsuccessful within the first predetermined time period, or when the installation of the communication device 10 is not detected within the second predetermined time period, deactivate the communication unit 14 and the installation detector 16 and maintain a main unit 10A operating in the second operation mode. Specifically, the processing unit 23 is to stop the supply of the electric power from the battery 11 to the communication unit 14 and the installation detector 16 to deactivate the communication unit 14 and the installation detector 16.

[0063] An operation of the communication device 10 in this case will be explained with reference to Figure 7.

[0064] While supplied with electric power from the battery 11 and operating in the second operation mode, the first determining unit 21 determines. whether or not the operation unit 12 receives a changeover instruction (step S30). Specifically, the first determining unit 21 is to determine whether or not a long push of an operation button in the operation unit 12 is performed.

[0065] When the first determining unit 21 determines that the operation unit 12 does not receive the changeover instruction ("No" at step S30), the processing unit 23 maintains the main unit 10A operating in the second operation mode and then proceeds to process of waiting the changeover instruction.

[0066] When the first determining unit 21 determines receipt of the changeover instruction by the operation unit 12 ("Yes" at step S30), the second determining unit 22 determines whether or not the communication is successful within the first predetermined time period (step S31). Specifically, the second determining unit 22 is to determine whether or not the communication unit 14 receives a response signal within the first predetermined time period after the communication unit 14 transmits a communication start signal to the management device 100. In this case, the processing unit 23 changes the operation state from the communication disabled state to the communication enabled state, and controls and causes the communication unit 14 to transmit the communication start signal to the management device 100.

[0067] When the communication is successful ("Yes" at step S31), the second determining unit 22 determines whether or not the installation detector 16 detects installation of an enclosure 10B in the communication device 10 within the second predetermined time period (step S32). Specifically, the second determining unit 22 determines whether or not the installation detector 16 detects magnetism of a magnet provided for a base within the second predetermined time period beginning at the start of the operation of the installation detector 16 in the installation detection enabled state. Note that when the second determining unit determines success in the communication, the processing unit 23 changes the operation state of the installation detector 16 from the detection disabled state to the detection enabled state.

[0068] When the second determining unit 22 determines that the installation detector 16 detects the installation of the enclosure 10B in the communication device 10 ("Yes" at step S32), the processing unit 23 changes the operation mode from the second operation mode to the first operation mode (step S33).

[0069] When the second determining unit 22 determines unsuccess-failure of the communication ("No" at step S31), the processing unit 23 maintains the second operation mode (step S34). When the second determining unit 22 determines that the installation of the communication device 10 is not detected ("No" at step S32), the processing unit 23 also maintains the second operation mode (step S34). In these cases, the processing unit 23 changes the operation state of the communication unit 14 from the communication enabled state to the communication disabled state, and changes the operation state of the installation detector 16 from the detection enabled state to the detection disabled state. Specifically, the processing unit 23 stops the supply of the electric power from the battery 11 to the communication unit 14 and the installation detector 16, and then proceeds to process of waiting the changeover instruction.

[0070] Note that in the operation of the communication device 10 shown in Figure 7, the second determining unit 22 determines whether or not the communication is successful, and then determines whether or not the installation is performed, but the present embodiment is not limited to this. The order of the determination may be reverse.

[0071] In the present embodiment, when the communication is successful, the operation state of the installation detector 16 becomes the installation detection enabled state, but the present embodiment is not limited to this. Timing for causing the installation detector 16 to operate in the installation detection enabled state needs to be timing after the first determining unit 21 determines receipt of the changeover instruction and before the sec-

ond determining unit makes a determination.

(Schema)

[0072] As stated above, a communication device 10 according to a first aspect of the present invention includes a main unit 10A that includes a communication unit 14 and is configured to be supplied with electric power from a battery 11 to be activated, and an operation unit 12. The communication device further includes a processing unit 23, a first determining unit 21 and a second determining unit 22. The processing unit 23 is configured to control and cause the main unit 10A to operate in an operation mode as any one of a first operation mode for performing a normal operation and a second operation mode for performing a stand-by operation, power consumption in which is smaller than that in the first operation mode. The first determining unit 21 is configured to, when the operation mode is the second operation mode, determine whether or not the operation unit 12 receives a changeover instruction to the first operation mode. The second determining unit 22 is configured to, when the first determining unit 21 determines receipt of the changeover instruction, determine whether or not a changeover condition of the operation mode from the second operation mode to the first operation mode is fulfilled. The processing unit 23 is configured to, when the second determining unit 22 determines fulfilment of the changeover condition, change the operation mode from the second operation mode to the first operation mode.

[0073] With this configuration, the communication device 10 operates in the second operation mode until it receives the changeover instruction and the changeover condition is fulfilled. It is accordingly possible to extend battery's life in comparison with the communication device 10 operating in the first operation mode. In addition, the communication device 10 changes the operation mode from the second operation mode to the first operation mode responsive to a determination by the first determining unit and a determination by the second determining unit-two step determination. It is therefore possible to prevent changeover of the operation mode caused by a wrong operation such that a changeover instruction is entered by, for example a user operating the operation unit 12 in error. Note that removal of the battery 11 is not necessarily prohibited. Even if the battery 11 is removable, the communication device 10 includes the components described above, thereby capable of extension of the life of the battery 11 and prevention of the changeover of the operation mode caused by the wrong operation. In case the removal of the battery 11 is prohibited, electricity of the battery 11 will be consumed from the time of shipment. Therefore, the components described above are provided, and it is thereby possible to obtain a remarkable effect in comparison with a removable battery 11.

[0074] In the first aspect, as a communication device 10 according to a second aspect of the present invention, the processing unit 23 is configured to, when the first determining unit determines the receipt of the changeover instruction by the operation unit 12, cause the communication unit 14 to operate in a communication enabled state, and control and cause the communication unit 14 to transmit a signal (communication start signal) to a management device 100. The second determining unit 22 is configured to, responsive to receipt, by the communication unit 14 within a predetermined time period beginning at time of the transmission of the communication start signal, of a response signal to the communication start signal from the management device 100, determine the fulfilment of the changeover condition. The second determining unit 22 is configured to determine unfulfilment of the changeover condition when the communication unit 14 does not receive the response signal from the external device within the predetermined time period. The processing unit 23 is configured to deactivate the communication unit 14 when the second determining unit 22 determines the unfulfilment of the changeover condition.

[0075] Even if the changeover instruction is received with communication with the management device 100 not available and then the operation mode is changed from the second operation mode to the first operation mode, it is impossible to communicate with the management device 100. As a result, the battery will be consumed wastefully. In the present configuration, the communication device 10 determines the fulfilment of the changeover condition when the response signal is received within the predetermined time period beginning at time of the transmission of the communication start signal. Therefore, even if the changeover instruction is received with the communication with the management device 100 not available, the operation mode is not changed from the second operation mode to the first operation mode. Thus, the communication device 10 is able to prevent the changeover from the second operation mode to the first operation mode caused by a wrong operation and extend the battery's life.

[0076] In the first aspect, as a communication device 10 according to a third aspect of the present invention, the main unit 10A includes an installation detector 16 that is configured to detect installation of an enclosure 10B accommodating at least the main unit 10A and the processing unit 23. The processing unit 23 is configured to cause the installation detector 16 to operate in an installation detection enabled state when the first determining unit 21 determines the receipt of the changeover instruction by the operation unit 12. The second determining unit 22 is configured to determine the fulfilment of the changeover condition when the installation detector 16 detects the installation of the enclosure 10B within a predetermined time period beginning at the start of the operation of the installation detector 16 in the installation detection enabled state. The second determining unit 22 is configured to determine unfulfilment of the changeover

condition when the installation detector 16 does not detect the installation of the enclosure 10B within the predetermined time period. The processing unit is configured to deactivate the installation detector 16 when the second determining unit 22 determines the unfulfilment of the changeover condition.

[0077] The communication device 10 is employed with the communication device fixed (installed) on a wall or the like in a dwelling. With the present configuration, the communication device 10 determines the fulfilment of the changeover condition when the installation detector 16 detects the completion of the installation within the predetermined time period beginning at the start of the operation of the installation detector 16 in the installation detection enabled state. Therefore, even if the changeover instruction is received with the communication device 10 not intended to be employed (with communication device 10 not intended to be installed), the operation mode is not changed from the second operation mode to the first operation mode. Thus, the communication device 10 is able to prevent the changeover of the operation mode caused by a wrong operation and extend the battery's life.

[0078] In the first aspect, as a communication device 10 according a fourth aspect of the present invention, the main unit 10A includes an installation detector 16 that is configured to detect installation of an enclosure 10B accommodating at least the main unit 10A and the processing unit 23. The processing unit 23 is configured to, when the first determining unit 21 determines the receipt of the changeover instruction by the operation unit 12, cause the communication unit 14 to operate in a communication enabled state, and control and cause the communication unit 14 to transmit a signal (communication start signal) to a management device 100 (external device). The processing unit 23 is further configured to cause the installation detector 16 to operate in an installation detection enabled state. The second determining unit 22 is configured to determine the fulfilment of the changeover condition responsive to receipt, by the communication unit 14 within a first predetermined time period beginning at time of the transmission of the signal, of a response signal to the signal transmitted from the management device 100, and to the installation of the enclosure 10B detected by the installation detector 16 within a second predetermined time period beginning at the start of the operation of the installation detector 16 in the installation detection enabled state. The second determining unit 22 is configured to determine unfulfilment of the changeover condition when the communication unit 14 does not receive the response signal from the management device 100 within the first predetermined time period or when the installation detector 16 does not detect the installation of the enclosure 10B within the second predetermined time period. The processing unit 23 is configured to deactivate the communication unit 14 and the installation detector 16 when the second determining unit 22 determines the unfulfilment of the changeover condition.

[0079] The communication device 10 is employed with the communication device fixed (installed) on a wall or the like in a dwelling. Even if the changeover instruction is received with communication with the management device 100 not available and then the operation mode is changed from the second operation mode to the first operation mode, it is impossible to communicate with the management device 100. As a result, the battery will be consumed wastefully. In the present configuration, the communication device 10 determines the fulfilment of the changeover condition responsive to receipt of the response signal within the first predetermined time period beginning at time of the transmission of the communication start signal and to the completion of the installation detected within the second predetermined time period beginning at the start of the operation of the installation detector 16 in the detection enabled state. Therefore, even if the changeover instruction is received with the communication with the communication device 10 not available, the operation mode is not changed from the second operation mode to the first operation mode. In addition, even if the changeover instruction is received with the communication device 10 not intended to be employed (with communication device 10 not intended to be installed), the operation mode is not changed from the second operation mode to the first operation mode. Thus, the communication device 10 is able to prevent the changeover of the operation mode caused by a wrong operation and extend the battery's life.

[0080] In any one of the first to fourth aspects, as a communication device 10 according to a fifth aspect of the present invention, the main unit 10A includes a fire detector 13 that is configured to detect fire. The processing unit 23 is configured to cause the fire detector 13 to operate in a fire detection enable state when the second determining unit 22 determines the fulfilment of the changeover condition. With this configuration, the fire detector 13 will operate in the fire detection enabled state responsive to the two step determination. It is therefore possible to reduce a possibility that the fire detector 13 will operate in the fire detection enabled state responsive to a wrong operation.

[0081] In any one of the first to fifth aspects, as a communication device 10 according to a sixth aspect of the present invention, the communication unit 14 is configured to receive a changeover message representing an instruction to change the operation mode to the second operation when the operation mode is the first operation mode. In this case, processing unit 23 is configured to change the operation mode from the first operation mode to the second operation mode. This configuration enables the communication device 10 to change the operation mode from the first operation mode to the second operation mode. It is therefore possible to extend the battery's life because when the communication device 10 is not employed temporarily due to, for example house-moving or the like, power consumption of the battery 11 is to be suppressed meanwhile.

[0082] In the sixth aspect, as a communication device 10 according to a seventh aspect of the present invention, the processing unit 23 is configured to change the operation mode from the first operation mode to the second operation mode when the communication unit 14 receives the changeover message while the operation unit 12 receives a specific operation. With this configuration, even if the message is received from a specific device with the specific operation not received, the communication device 10 does not change the operation mode from the first operation mode to the second operation mode. As a result, even if the changeover message is transmitted in error, the operation mode is not changed from the first operation mode to the second operation mode. It is therefore possible to prevent the communication device 10 from changing the operation mode caused by a wrong operation.

Reference Signs List

[0083]

10	Communication device
10A	Main unit
11	Battery
12	Operation unit
13	Fire detector
14	Communication unit
16	Installation detector
21	First determining unit
22	Second determining unit
23	Processing unit
100	Management device (External device)

Claims

1. A communication device, comprising a main unit that includes a communication unit and is configured to be supplied with electric power from a battery to be activated, and an operation unit, wherein the communication device further comprises
a processing unit that is configured to cause the main unit to operate in an operation mode as any one of a first operation mode for performing a normal operation and a second operation mode for performing a stand-by operation, power consumption in which is smaller than that in the first operation mode,
a first determining unit that is configured to, when the operation mode is the second operation mode, determine whether or not the operation unit receives a changeover instruction to the first operation mode, and
a second determining unit that is configured to, when the first determining unit determines receipt of the changeover instruction, determine whether or not a changeover condition of the operation mode from the second operation mode to the first operation mode is fulfilled,
wherein the processing unit is configured to, when the second determining unit determines fulfilment of the changeover condition, change the operation mode from the second operation mode to the first operation mode.

2. The communication device of claim 1, wherein
the processing unit is configured to, when the first determining unit determines the receipt of the changeover instruction by the operation unit, cause the communication unit to operate in a communication enabled state, and control and cause the communication unit to transmit a signal to an external device,
the second determining unit is configured to, responsive to receipt, by the communication unit within a predetermined time period beginning at time of the transmission of the signal, of a response signal to the signal transmitted from the external device, determine the fulfilment of the changeover condition,
the second determining unit is configured to determine unfulfilment of the changeover condition when the communication unit does not receive the response signal from the external device within the predetermined time period, and
the processing unit is configured to deactivate the communication unit when the second determining unit determines the unfulfilment of the changeover condition.

3. The communication device of claim 1, wherein
the main unit comprises an installation detector that is configured to detect installation of an enclosure accommodating at least the main unit and the processing unit,
the processing unit is configured to cause the installation detector to operate in an installation detection enabled state when the first determining unit determines the receipt of the changeover instruction by the operation unit,
the second determining unit is configured to

determine the fulfilment of the changeover condition when the installation detector detects the installation of the enclosure within a predetermined time period beginning at start of operation of the installation detector in the installation detection enabled state, and
determine unfulfilment of the changeover condition when the installation detector does not detect the installation of the enclosure within the predetermined time period, and

the processing unit is configured to deactivate the installation detector when the second determining unit determines the unfulfilment of the changeover condition.

4. The communication device of claim 1, wherein
the main unit comprises an installation detector that is configured to detect installation of an enclosure accommodating at least the main unit and the processing unit,
the processing unit is configured to, when the first determining unit determines the receipt of the changeover instruction by the operation unit,

cause the communication unit to operate in a communication enabled state, and control and cause the communication unit to transmit a signal to an external device, and
cause the installation detector to operate in an installation detection enabled state,

the second determining unit is configured to

determine the fulfilment of the changeover condition responsive to receipt, by the communication unit within a first predetermined time period beginning at time of the transmission of the signal, of a response signal to the signal transmitted from the external device, and to the installation of the enclosure detected by the installation detector within a second predetermined time period beginning at start of operation of the installation detector in the installation detection enabled state, and
determine unfulfilment of the changeover condition when the communication unit does not receive the response signal from the external device within the first predetermined time period or when the installation detector does not detect the installation of the enclosure within the second predetermined time period, and

the processing unit is configured to deactivate the communication unit and the installation detector when the second determining unit determines the unfulfilment of the changeover condition.

5. A communication device of any one of claims 1 to 4, wherein
the main unit comprises a fire detector that is configured to detect fire, and
the processing unit is configured to cause the fire detector to operate in a fire detection enabled state when the second determining unit determines the fulfilment of the changeover condition.

6. A communication device of any one of claims 1 to 5, wherein the processing unit is configured to change the operation mode from the first operation mode to the second operation mode when the communication unit receives a changeover message representing an instruction to change the operation mode to the second operation with the operation mode being the first operation mode.

7. The communication device of claim 6, wherein the processing unit is configured to change the operation mode from the first operation mode to the second operation mode when the communication unit receives the changeover message while the operation unit receives a specific operation.

Figure 1

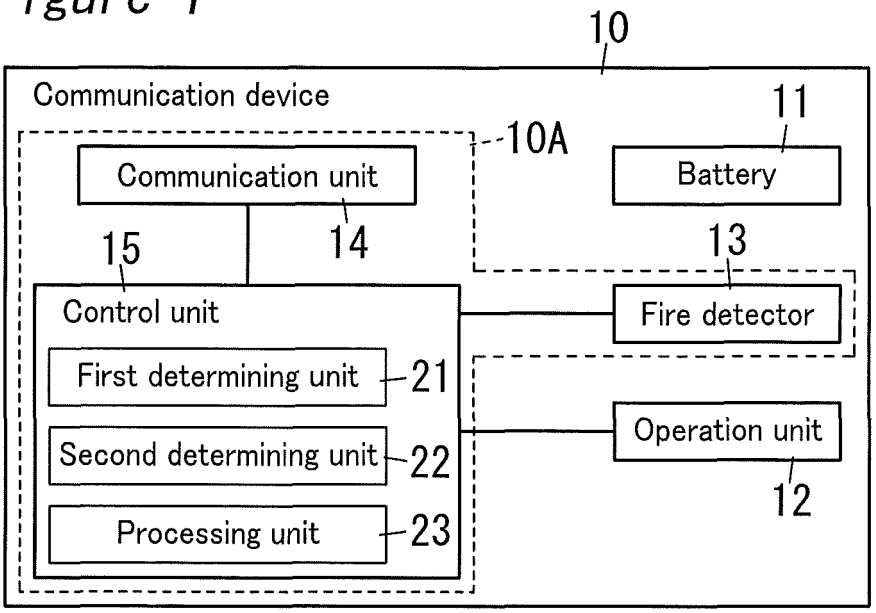


Figure 2

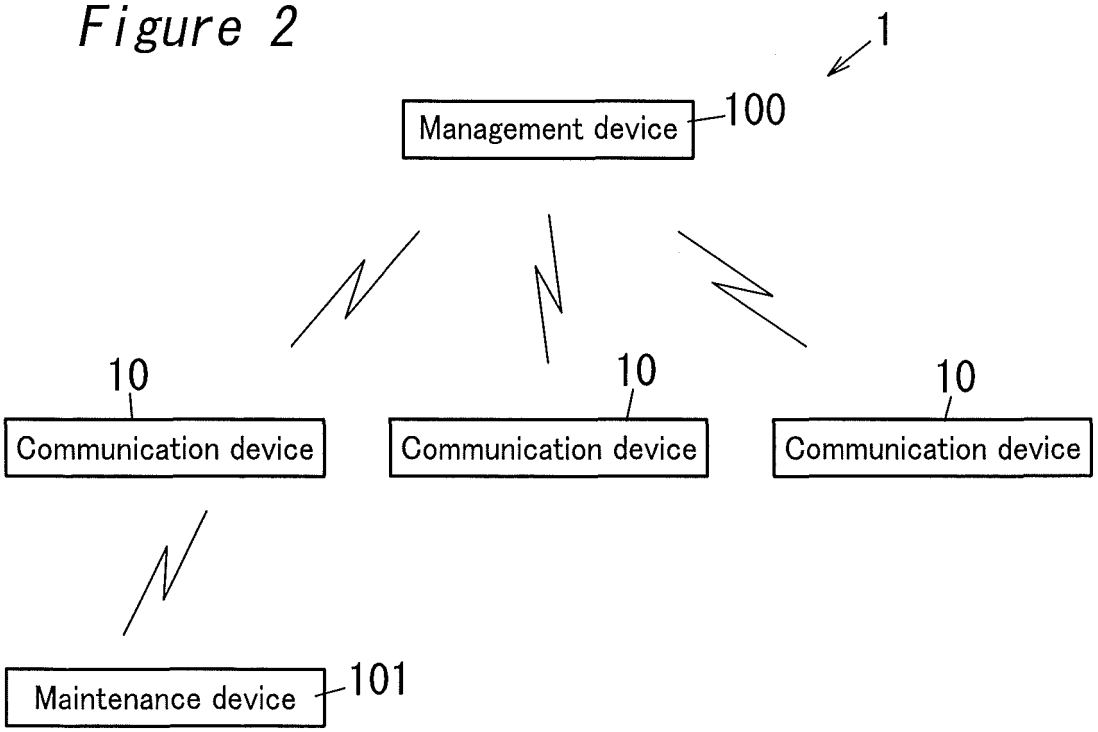


Figure 3

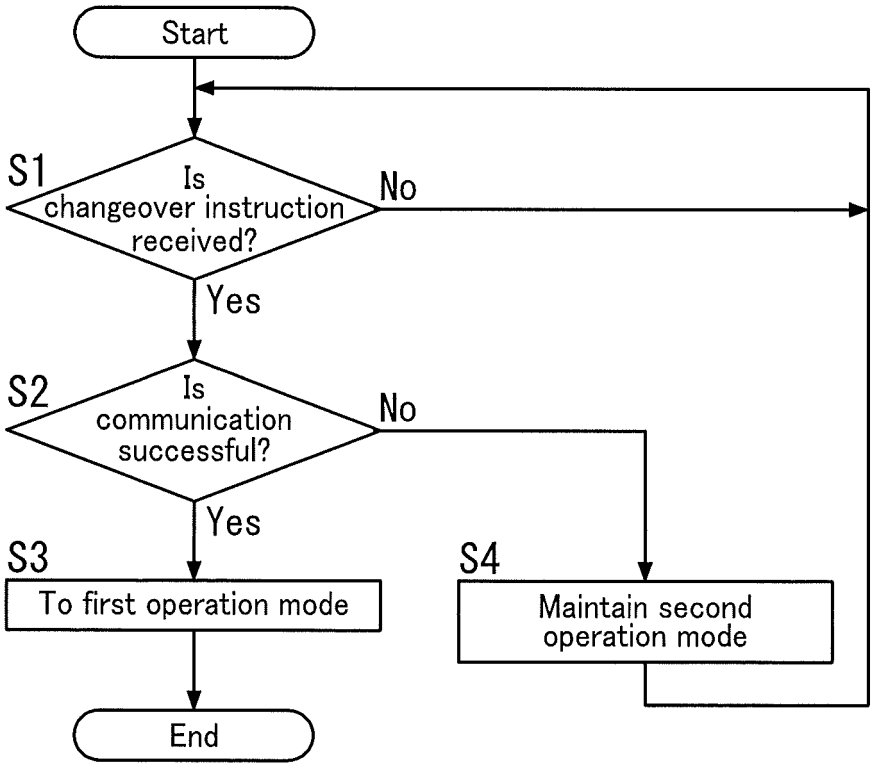


Figure 4

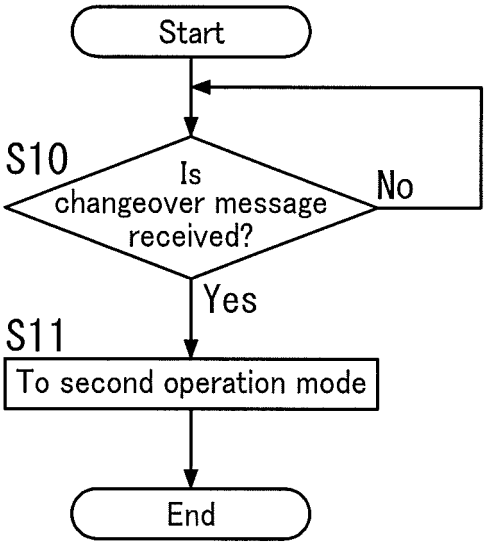


Figure 5

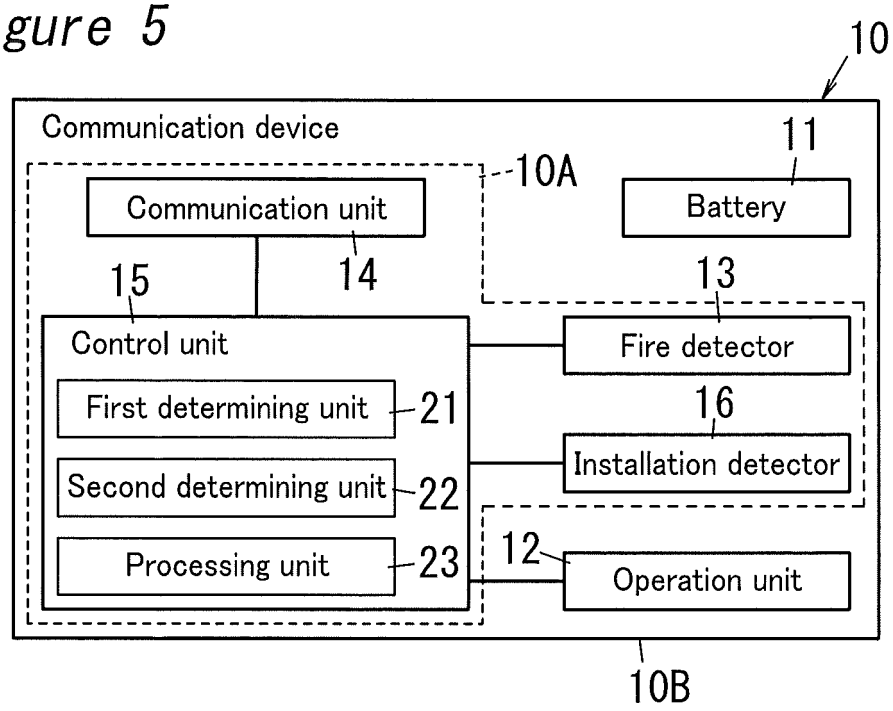


Figure 6

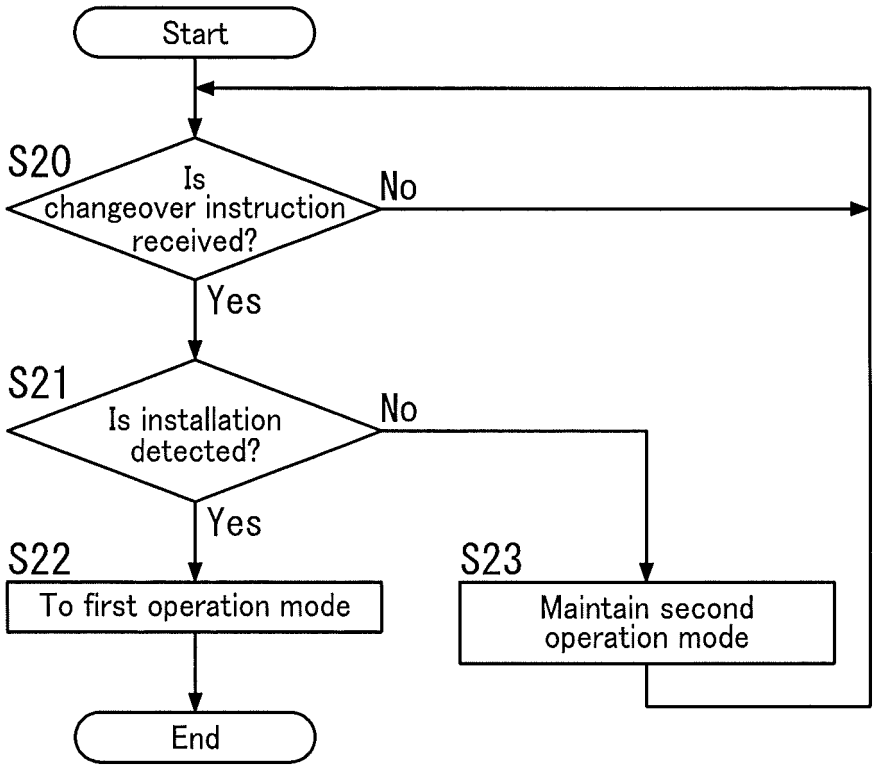
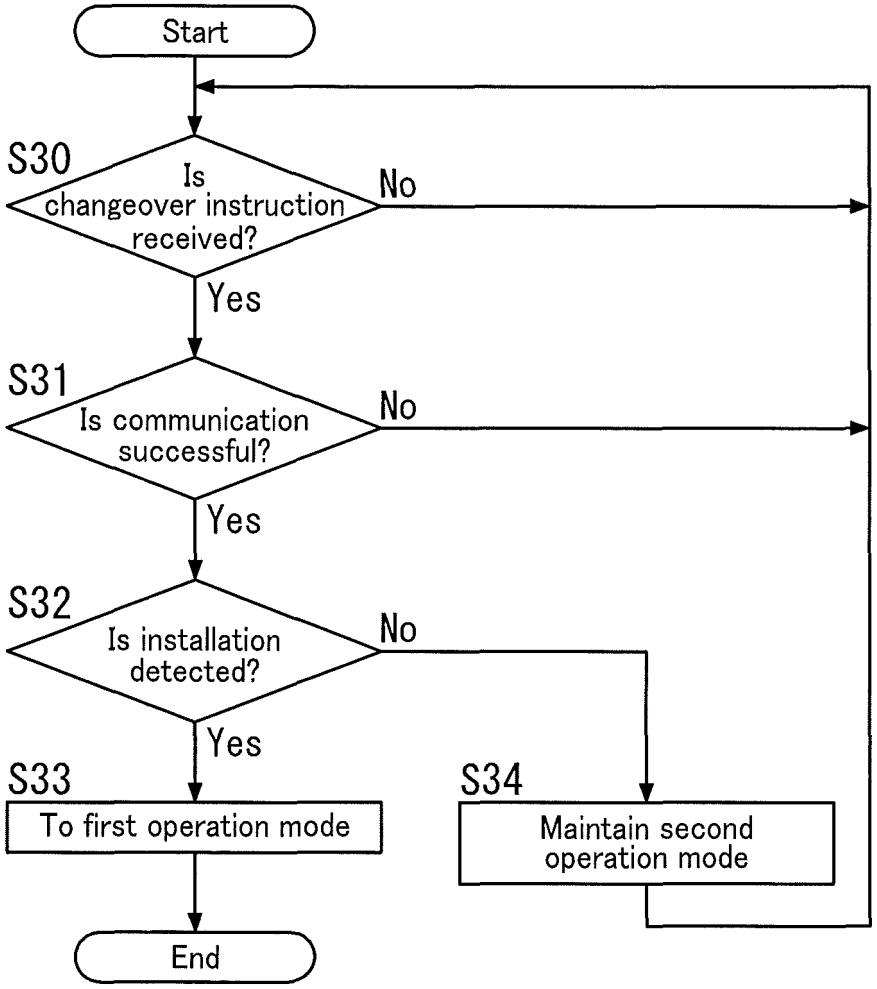


Figure 7


Start
S30
Is changeover instruction received?
No
Yes
S31
Is communication successful?
No
Yes
S32
Is installation detected?
No
Yes
S33
To first operation mode
S34
Maintain second operation mode
End

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/003467

A. CLASSIFICATION OF SUBJECT MATTER
G08B17/00(2006.01)i, *G08B17/06*(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G08B17/00, G08B17/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 9-128665 A (Secom Co., Ltd.), 16 May 1997 (16.05.1997), claim 1; paragraphs [0002], [0010] to [0015]; fig. 1 (Family: none)	1,5,6 2-4,7
Y	JP 11-345381 A (Apollo Fire Detectors Ltd.), 14 December 1999 (14.12.1999), paragraph [0010] & US 6040769 A & GB 2336455 A & EP 951001 A2 paragraph [0003]	1,5,6

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 October 2016 (07.10.16)	18 October 2016 (18.10.16)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/003467

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2003-523028 A (Martin Terence Cole), 29 July 2003 (29.07.2003), & US 2003/0011770 A1 paragraph [0104] & WO 2001/059737 A1 & EP 1261953 A1 & CN 1418358 A1	1,5,6
Y	JP 2012-239137 A (Fujitsu Telecom Networks Ltd.), 06 December 2012 (06.12.2012), abstract (Family: none)	6

Form PCT/ISA/210 (continuation of second sheet) (January 2015)