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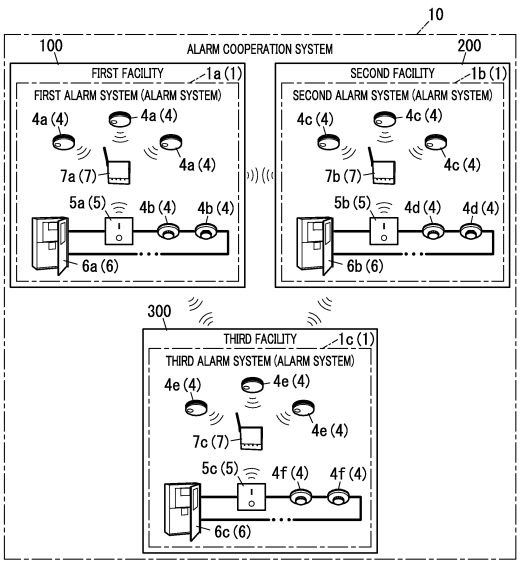
(54) ALARM SYSTEM, ALARM COOPERATION SYSTEM, COOPERATION METHOD, AND PROGRAM

(57) An object of the present disclosure is to reduce damage in the vicinity of a fire site. An alarm system (1a) is a system including a first detector (4a). The first detector (4a) is installed in a first facility (100) which is a non-dwelling house. The first detector (4a) is configured to detect a fire in the first facility (100). The alarm system (1a) includes an external communication unit (52). The external communication unit (52) is configured to transmit fire information on the fire detected by the first detector (4a) to an external system without using another network. The external system includes a second detector (4c). The second detector (4c) is installed in a second facility (200) different from the first facility (100). The second detector (4c) is configured to detect a fire in the second facility (200).

FIG. 1



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Description

Technical Field

[0001] The present disclosure generally relates to alarm systems, alarm cooperation systems, cooperation methods, and programs and more specifically relates to an alarm system, an alarm cooperation system, a cooperation method, and a program which relate to a fire in a facility.

Background Art

[0002] Patent Literature 1 describes a wireless disaster protection system. The wireless disaster protection system described in Patent Literature 1 includes a wireless detector configured to wirelessly transmit an alarm activation event signal, a wireless reception relay configured to receive the alarm activation event signal and transmit an alarm activation signal to a P-type receiver, and a radio wave relay configured to relay the alarm activation event signal received from the wireless detector to the wireless reception relay.

Citation List

Patent Literature

[0003] Patent Literature 1: JP 2021-068666 A

Summary of Invention

[0004] In such a wireless disaster protection system (alarm system) as described in Patent Literature 1, a reduction in damage in the vicinity of a fire site is desired.

[0005] In view of the foregoing, it is an object of the present disclosure to provide an alarm system, an alarm cooperation system, a cooperation method, and a program which are configured to reduce damage in the vicinity of a fire site.

[0006] An alarm system according to an aspect of the present disclosure is a system including a first detector. The first detector is installed in a first facility which is a non-dwelling house. The first detector is configured to detect a fire in the first facility. The alarm system includes an external communication unit. The external communication unit is configured to transmit fire information on the fire detected by the first detector to an external system without using another network. The external system includes a second detector. The second detector is installed in a second facility different from the first facility. The second detector is configured to detect a fire in the second facility.

[0007] An alarm system according to an aspect of the present disclosure is a system including a second detector. The second detector is installed in a second facility and is configured to detect a fire. The alarm system includes an external communication unit. The external communication unit is configured to receive fire information from an external system without using another network. The fire information is information on a fire detected by a first detector installed in a first facility different from the second facility. The first detector is configured to detect a fire. The external system is a system including the first detector.

[0008] An alarm cooperation system according to an aspect of the present disclosure includes a first alarm system and a second alarm system. The first alarm system includes a first detector. The first detector is installed in a first facility which is a non-dwelling house. The first detector is configured to detect a fire. The second alarm system includes a second detector. The second detector is installed in a second facility different from the first facility. The second detector is configured to detect a fire. The first alarm system includes a first external communication unit. The first external communication unit is configured to transmit fire information on the fire detected by the first detector to the second alarm system without using another network. The second alarm system includes a second external communication unit. The second external communication unit is configured to receive the fire information from the first alarm system without using the another network.

[0009] A cooperation method according to an aspect of the present disclosure is a method to be used in an alarm system. The alarm system includes a first detector installed in a first facility which is a non-dwelling house. The first detector is configured to detect a fire. The cooperation method includes a transmission step. The transmission step includes transmitting fire information on the fire detected by the first detector to an external system without using another network. The external system includes a second detector installed in a second facility different from the first facility. The second detector is configured to detect a fire.

[0010] A cooperation method according to an aspect of the present disclosure is a method to be used in an alarm system. The alarm system includes a second detector installed in a second facility and configured to detect a fire. The cooperation method includes a reception step. The reception step includes receiving fire information from an external system without using another network. The fire information is information on a fire detected by a first detector installed in a first facility different from the second facility, the first detector being configured to detect a fire. The external system is a system including the first detector.

[0011] A program according to an aspect of the present disclosure is a program configured to cause one or more processors to execute the cooperation method.

Brief Description of Drawings

[0012]

FIG. 1 is a schematic diagram of an alarm coopera-

tion system according to a first embodiment;
FIG. 2 is a block diagram of a first alarm system included in the alarm cooperation system;
FIG. 3 is a sequence diagram of operation of the alarm cooperation system; and
FIG. 4 is a block diagram of an alarm cooperation system according to a second embodiment.

Description of Embodiments

[0013] A preferable embodiment relating to the present disclosure will be described in detail below with reference to the drawings. Note that common elements in the embodiments described below are denoted by the same reference signs, and the redundant description of the common elements is omitted. The embodiments described below are mere examples of various embodiments of the present disclosure. Various modifications may be made to the embodiments depending on design and the like as long as the object of the present disclosure is achieved.

(First Embodiment)

(1) Overview

[0014] First of all, the overview of an alarm cooperation system 10 according to a first embodiment will be described with reference to FIGS. 1 and 2.

[0015] As shown in FIG. 1, the alarm cooperation system 10 according to the first embodiment includes a plurality of (in the example shown in FIG. 1, three) alarm systems 1. Specifically, the alarm cooperation system 10 according to the first embodiment includes a first alarm system 1a, a second alarm system 1b, and a third alarm system 1c. Each of the first alarm system 1a, the second alarm system 1b, and the third alarm system 1c is an alarm system 1 configured to detect a fire in a facility. The first alarm system 1a of the first embodiment is disposed in a first facility 100. Moreover, the second alarm system 1b is disposed in a second facility 200, and the third alarm system 1c is disposed in a third facility 300.

[0016] The "facility" as used in the present disclosure includes a dwelling house facility used for residual purposes and a non-dwelling house facility such as a retail establishment (establishment for lease), an office, a welfare facility, an educational facility, a hospital, and a factory. Examples of the non-dwelling house facility also include restaurants, recreation halls, hotels, inns, kindergarten, nursery centers, and citizens' public halls. In the first embodiment, the first facility 100, the second facility 200, and the third facility 300 are, for example, non-dwelling house facilities such as office buildings. Note that in the first embodiment, an example is shown in which the first facility 100, the second facility 200, and the third facility 300 are in the vicinity of each other. The "vicinity" as used in the present disclosure is an area within which the alarm system 1 can transmit fire information by wireless communication without using another network such as the Internet other than a network formed by the wireless communication. Moreover, the "vicinity" may include an area within which a fire can spread when the fire breaks out in a facility and an area which smoke or ashes resulting from the fire can reach.

[0017] As shown in FIG. 1, the first alarm system 1a includes a plurality of first detectors 4a. The plurality of first detectors 4a are detectors 4, such as alarms, installed in the first facility 100 (facility) which is a non-dwelling house, and each detector 4 is configured to detect a fire in the first facility 100 (facility). Note that in the following description, each of the plurality of first detectors 4a may be referred to as a "first detector 4a".

[0018] Moreover, the second alarm system 1b (external system) includes a plurality of second detectors 4c. The plurality of second detectors 4c are detectors 4, such as alarms, installed in the second facility 200 (facility) different from the first facility 100, and each detector 4 is configured to detect a fire in the second facility 200 (facility). Note that in the following description, each of the plurality of second detectors 4c may be referred to as a "second detector 4c".

[0019] As shown in FIG. 2, the first alarm system 1a includes an external communication unit 52 (first external communication unit). The external communication unit 52 transmits fire information on a fire detected by one of the first detectors 4a to the second alarm system 1b which is another alarm system 1 (external system) without using another network such as the Internet. That is, the first alarm system 1a transmits the fire information to the second alarm system 1b without using another network such as the Internet other than a network formed by an appropriate communication which is wired communication or wireless communication between the first alarm system 1a and the second alarm system 1b.

[0020] The "fire information" as used in the present disclosure may include facility information on a facility in which a fire is present, scale information on a scale of the fire, and meteorological information on meteorological phenomena such as wind directions and humidity.

[0021] Moreover, the second alarm system 1b of the first embodiment has a similar configuration to the first alarm system 1a. That is, the second alarm system 1b includes an external communication unit 52 (second external communication unit). The external communication unit 52 receives, without using the another network, the fire information on the fire detected by the one of the first detectors 4a from the first alarm system 1a which is an external system.

[0022] According to the alarm cooperation system 10 of the first embodiment, the first alarm system 1a transmits the fire information to the second alarm system 1b installed in the second facility 200 located in the vicinity of the first facility 100, thereby reducing damage in the vicinity (the second facility 200) of a fire site. Moreover, the first alarm system 1a directly transmits the fire information to the second alarm system 1b without using another network such as the Internet, thereby providing the

advantage that the chances of being affected by a communication failure in the another network are low. That is, the first alarm system 1a can more securely transmit the fire information, which is desired to be quickly transmitted to the second alarm system 1b, to the second alarm system 1b. Moreover, the second alarm system 1b can, for example, issue an announcement about the fire present in the first facility 100, thereby reducing damage to the second facility 200.

(2) Details

[0023] Next, the details of the alarm cooperation system 10 according to the first embodiment will be described with reference to FIGS. 1 to 3.

(2.1) Alarm Cooperation System

[0024] As shown in FIG. 1, the alarm cooperation system 10 includes the first alarm system 1a, the second alarm system 1b, and the third alarm system 1c.

(2.2) First Alarm System

[0025] The first alarm system 1a according to the first embodiment is disposed in the first facility 100. The first alarm system 1a includes the plurality of first detectors 4a, a plurality of first detectors 4b, a first master device 5a, a first receiver 6a, and a first relay 7a.

[0026] Note that in the following description, each of the plurality of first detectors 4b may be referred to as a "first detector 4b". Moreover, each of the first detectors 4a or the first detectors 4b may be referred to simply as a "detector 4". Moreover, the first master device 5a may be referred to simply as a "master device 5". Further, the first receiver 6a may be referred to simply as a "receiver 6". Furthermore, the first relay 7a may be referred to simply as a "relay 7".

(2.2.1) Detector

[0027] The first detectors 4a and the first detectors 4b are detectors 4 included in the first alarm system 1a. For example, the detectors 4 are fire detectors. That is, each of the first detectors 4a and the first detectors 4b is configured to detect a fire in the first facility 100. The first detectors 4a and the first detectors 4b of the first embodiment function as slave devices of the first master device 5a. The first detectors 4a communicate with the first master device 5a by wireless communication compliant with the standard of, for example, Wi-Fi (registered trademark), Bluetooth (registered trademark), ZigBee (registered trademark), or low power radio (specified low power radio) requiring no license. In contrast, the first detectors 4b are connected to the first master device 5a via wires and communicate with the first master device 5a by wired communication. Note that the first detectors 4b may be connected to the first receiver 6a via wires to communicate with the first receiver 6a by wired communication.

[0028] As shown in FIG. 2, each detector 4 includes a communication unit 41, a controller 42, a detecting unit 43, and an announcement unit 44.

[0029] Each detector 4 includes, for example, a microcomputer including a processor and memory. The processor executes an appropriate program, and thereby, a computer system functions as the controller 42. That is, the controller 42 is implemented by a computer system including a processor and memory. The program may be stored in the memory in advance, may be provided over a telecommunications network such as the Internet, or may be provided as a non-transitory recording medium, such as a memory card, in which the program has been stored.

[0030] The communication unit 41 includes a communication interface configured to communicate with another device such as the master device 5. Note that "be configured to communicate" as used in the present disclosure means that information can be transmitted and received directly by appropriate communication which is wired or wireless communication, or indirectly via a network or a relay.

[0031] The communication unit 41 of each first detector 4a is configured to directly communicate with the master device 5 by wireless communication. Moreover, the communication unit 41 of each first detector 4a is configured to indirectly communicate with the master device 5 via the relay 7 by wireless communication.

[0032] The communication unit 41 of each first detector 4b is configured to directly communicate with the master device 5 by wired communication. Moreover, the communication unit 41 of each first detector 4b is configured to indirectly communicate with the master device 5 via another device, such as another first detector 4b, by wired communication.

[0033] Note that the communication unit 41 of each first detector 4b may be configured to directly communicate with the receiver 6 by wired communication. Moreover, the communication unit 41 of each first detector 4b may be configured to indirectly communicate with the receiver 6 via another device, such as another first detector 4b, by wired communication.

[0034] The communication unit 41 transmits, to the master device 5, a detection result by the detecting unit 43 together with information representing the identifier of the first detector 4 in which the communication unit 41 is included. Moreover, the communication unit 41 receives an announcement instruction from the master device 5. Note that the communication unit 41 of each first detector 4b may be configured to transmit, to the receiver 6, the detection result by the detecting unit 43 together with information representing the identifier of the first detector 4b in which the communication unit 41 is included.

[0035] The detecting unit 43 has a function of detecting a fire (detection function). In this embodiment, the detecting unit 43 is, for example, a photoelectric sensor which senses smoke. The detecting unit 43 includes a

light emitting part such as a light emitting diode (LED) and a light receiving part.

[0036] The light emitting part and the light receiving part are, in a labyrinth of a housing of the detector 4 in which the light emitting part and the light receiving part are included, arranged such that a light receiving surface of the light receiving part is not on an optical axis of irradiation light of the light emitting part. When a fire breaks out, smoke can be introduced into the labyrinth through a hole formed in the housing.

[0037] When no smoke is present in the labyrinth of the housing, almost no irradiation light of the light emitting part reaches the light receiving surface of the light receiving part. In contrast, when smoke is present in the labyrinth of the housing, the irradiation light of the light emitting part is scattered by the smoke, and part of scattered light reaches the light receiving surface of the light receiving part. That is, the detecting unit 43 receives, by the light receiving part, the irradiation light, which has been scattered by the smoke, of the light emitting part.

[0038] The detecting unit 43 outputs, to the controller, an electric signal (the detection result) representing a voltage level according to the quantity of light received by the light receiving part.

[0039] The announcement unit 44 has a function (announcement function) of issuing an announcement about the outbreak of a fire. The announcement unit 44 according to the first embodiment includes a light emitting part such as an LED and a loudspeaker to issue an announcement by light or a sound in response to an instruction from the controller 42.

[0040] The controller 42 controls the communication unit 41 and the announcement unit 44.

[0041] The controller 42 controls the communication unit 41 such that the communication unit 41 transmits a detection result of a fire by the detecting unit 43 to the master device 5. Moreover, the controller 42 controls, based on the announcement instruction received from the master device 5, the announcement unit 44 such that the announcement unit 44 issues an announcement. Note that the controller 42 of each first detector 4b may control the communication unit 41 such that the communication unit 41 transmits the detection result of the fire by the detecting unit 43 to the receiver 6. Moreover, the controller 42 of each first detector 4b may control, based on an announcement instruction received from the receiver 6, the announcement unit 44 such that the announcement unit 44 issues an announcement.

(2.2.2) Master Device

[0042] The first master device 5a is a master device 5 included in the first alarm system 1a. The master device 5 transmits a detection result received from one of the detectors 4 to the receiver 6.

[0043] The master device 5 includes a communication unit 51, the external communication unit 52 (first external communication unit), a controller 53, and a storage 54.

[0044] The master device 5 includes, for example, a microcomputer including a processor and memory. The processor executes an appropriate program, and thereby, a computer system functions as the controller 53. That is, the controller 53 is implemented by a computer system including a processor and memory. The program may be stored in the memory in advance, may be provided over a telecommunications network such as the Internet, or may be provided as a non-transitory recording medium, such as a memory card, in which the program has been stored.

[0045] The communication unit 51 includes a communication interface configured to communicate with the detectors 4, the receiver 6, and the relay 7.

[0046] The communication unit 51 receives the detection result from the one of the detectors 4 directly or indirectly via the relay 7. Moreover, the communication unit 51 transmits the detection result received from the one of detectors 4 to the receiver 6. The communication unit 51 receives an announcement instruction from the receiver 6. Moreover, the communication unit 51 transmits the announcement instruction received from the receiver 6 to the one of the detectors 4.

[0047] The external communication unit 52 is configured to communicate with a plurality of alarm systems 1 (external systems) disposed in a plurality of respective other facilities without using another network. The external communication unit 52 of the first alarm system 1a is configured to communicate with the second alarm system 1b disposed in the second facility 200 and the third alarm system 1c disposed in the third facility 300. The external communication unit 52 includes a transmission unit 521 and a reception unit 522.

[0048] The transmission unit 521 transmits fire information to another alarm system 1 (external system) by wireless communication compliant with the standard of, for example, Wi-Fi (registered trademark), Bluetooth (registered trademark), ZigBee (registered trademark), or low power radio (specified low power radio) requiring no license without using another network such as the Internet other than a network formed by the wireless communication.

[0049] The transmission unit 521 of the first alarm system 1a has a function of transmitting fire information on a fire detected by one of the first detectors 4a (4b) to at least one (external system) of the second alarm system 1b or the third alarm system 1c without using another network. Moreover, the transmission unit 521 transmits fire information received by the reception unit 522 from an external system to another external system without using another network. For example, the transmission unit 521 of the first alarm system 1a transmits fire information received by the reception unit 522 from the second alarm system 1b including the second detectors 4c (4d) to another third alarm system 1c other than the second alarm system 1b including the second detectors 4c (4d) without using another network. Moreover, the transmission unit 521 of the first alarm system 1a transmits

fire information received by the reception unit 522 from the third alarm system 1c to the second alarm system 1b.

[0050] Moreover, the transmission unit 521 according to the first embodiment transmits, based on an estimation result by an estimator 621 which is included in the receiver 6 and which will be escribed later, fire information to another alarm system 1 (external system) without using another network.

[0051] The first alarm system 1a of the first embodiment transmits fire information received from another alarm system 1 (the second alarm system 1b) to still another alarm system 1 (the third alarm system 1c), thereby reducing damage in the vicinity (the third facility 300) of the first facility 100. Moreover, in the first alarm system 1a, the master device 5 configured to communication with the receiver 6 includes the external communication unit 52, thereby stably and quickly transmitting fire information to another alarm system 1.

[0052] The reception unit 522 receives, from another alarm system 1, fire information on a fire detected by one of the detectors 4 included in another alarm system 1 without using another network. The reception unit 522 receives the fire information from another alarm system 1 by wireless communication compliant with the standard of, for example, Wi-Fi (registered trademark), Bluetooth (registered trademark), ZigBee (registered trademark), or low power radio (specified low power radio) requiring no license without using another network, such as the Internet, other than a network formed by the wireless communication.

[0053] For example, the reception unit 522 of the first alarm system 1a receives information on a fire detected by one of the second detectors 4c (4d) from the second alarm system 1b including the second detectors 4c (4d) without using another network. Moreover, the reception unit 522 of the first alarm system 1a may receive the information on the fire detected by the one of the second detectors 4c (4d) from the third alarm system 1c without using another network.

[0054] The storage 54 is semiconductor memory such as read only memory (ROM), random access memory (RAM), or electrically erasable programmable read only memory (EEPROM). Note that the storage 54 is not limited to the semiconductor memory but may be, for example, a hard disk drive.

[0055] The storage 54 stores transmission destination information on another alarm system 1 (external system) which is to be a target to which the external communication unit 52 (the transmission unit 521) transmits fire information. Since the storage 54 stores the transmission destination information, the external communication unit 52 can transmit the fire information to the alarm system 1 registered in advance, as a transmission destination. Moreover, the storage 54 stores the identifier of each of the plurality of detectors 4 included in the alarm system 1. Note that the alarm system 1 registered in advance does not have to be the transmission destination, but the external communication unit 52 may employ a method of randomly transmitting the fire information to the plurality of alarm systems 1 therearound.

[0056] The controller 53 controls the communication unit 51. The controller 53 controls the communication unit 51 such that the communication unit 51 transmits the detection result received from the one of the detectors 4 to the receiver 6. Moreover, the controller 53 controls the communication unit 51 such that the communication unit 51 transmits the announcement instruction received from the receiver 6 to the one of the detectors 4 which are slave devices. Moreover, the controller 53 controls the communication unit 51 such that the communication unit 51 transmits fire information received from another alarm system 1 (external system) to the receiver 6.

[0057] The controller 53 controls the external communication unit 52. The controller 53 controls the external communication unit 52 such that the external communication unit 52 transmits, based on a communication instruction from the receiver 6, fire information detected by one of the detectors 4 to another alarm system 1 (external system). Moreover, the controller 53 controls the external communication unit 52 such that the external communication unit 52 transmits, based on the communication instruction from the receiver 6, fire information received from another alarm system 1 (e.g., the second alarm system 1b) to still another alarm system 1 (e.g., the third alarm system 1c).

(2.2.3) Relay

[0058] The first relay 7a is a relay 7 included in the first alarm system 1a. The first relay 7a of the first embodiment includes a communication interface configured to communicate with the plurality of first detectors 4a and the master device 5 by wireless communication. The first relay 7a relays communication between the plurality of first detectors 4a. Moreover, the first relay 7a relays communication between each first detector 4a and the master device 5.

(2.2.4) Receiver

[0059] The first receiver 6a is a receiver 6 included in the first alarm system 1a. The receiver 6 receives a detection result of a fire detected by one of the detectors 4 in the alarm system 1 including the receiver 6. For example, the first receiver 6a receives a detection result of a fire detected by one of the first detectors 4a (4b). The receiver 6 of the first embodiment functions as a control device in the alarm system 1.

[0060] The receiver 6 includes a communication unit 61, a controller 62, a storage 63, a display unit 64, and an operating unit 65.

[0061] The receiver 6 includes, for example, a microcomputer including a processor and memory. The processor executes an appropriate program, and thereby, a computer system functions as the controller 62. That is, the controller 62 is implemented by a computer system

including a processor and memory. The program may be stored in the memory in advance, may be provided over a telecommunications network such as the Internet, or may be provided as a non-transitory recording medium, such as a memory card, in which the program has been stored.

[0062] The communication unit 61 includes a communication interface configured to communicate with the master device 5. Moreover, the communication unit 61 may be configured to communicate with the first detectors 4b connected via wires.

[0063] The storage 63 is semiconductor memory such as ROM, RAM, or EEPROM. Note that the storage 63 is not limited to the semiconductor memory but may be, for example, a hard disk drive.

[0064] The storage 63 of the first embodiment stores map information on the facility in which the alarm system 1 is installed and map information on the vicinity of the facility in which the alarm system 1 is installed. The map information of the facility includes information on installation place of each of the plurality of detectors 4. Moreover, the storage 63 stores the identifier of each of the plurality of detectors 4 included in the alarm system 1.

[0065] The display unit 64 includes a display device such as a liquid crystal panel display. The display unit 64 is configured to display various types of information. The display unit 64 can display, for example, information on the installation place of one of the detectors 4 which has transmitted a detection result to the receiver 6, information for selecting the one of the detectors 4 which is to be a transmission destination of the announcement instruction, and information on an amount of time elapsed since first detection of a fire by the one of the detectors 4. Moreover, the display unit 64 can display information on fire information received by the external communication unit 52 included in the master device 5.

[0066] The operating unit 65 receives operation inputs given by a user which are, for example, various settings of the alarm system 1 and selection of one of the detectors 4 which is to be a transmission destination of the announcement instruction. In the present disclosure, the user is, for example, a manager of the facility. The receiver 6 of the first embodiment includes, for example, a touch-panel liquid crystal display as an operation display device including the display unit 64 and the operating unit 65. The operation display device functions as a user interface (graphic user interface (GUI)).

[0067] The controller 62 controls the communication unit 61, the display unit 64, and the operating unit 65. For example, the controller 62 controls the communication unit 61 such that the communication unit 61 transmits an announcement instruction based on the operation input received by the operating unit 65 to the master device 5. Note that the controller 62 may control the communication unit 61 such that the communication unit 61 transmits the announcement instruction based on the operation input received by the operating unit 65 to one of the first detectors 4b.

[0068] Moreover, the controller 62 of the first embodiment includes an estimator 621 and a decider 622.

[0069] The estimator 621 performs an estimation process of estimating a situation of a fire on the basis of the detection result of the fire detected by one of the detectors 4 in the alarm system 1 including the estimator 621. For example, the estimator 621 included in the first alarm system 1a estimates, based on a detection result of a fire detected by one of the first detectors 4a (4b), a situation of the fire present in the first facility 100. Moreover, the estimator 621 may estimate the situation of the fire on the basis of, for example, meteorological information in addition to the detection result output from the one of the detectors 4. The meteorological information is obtainable from a server of a business operator which offers meteorological service of providing meteorological data about current weather and forecast data about future weather. The meteorological information may include information on current and future weather (air temperature, humidity, precipitation, wind direction, wind-force, etc.) in an area including the facility in which the fire is present.

[0070] The estimator 621 estimates a situation of a fire on the basis of, for example, the number of detection results received by the communication unit 61, the installation place of the detector 4 which has transmitted the detection result, an amount of time elapsed since first detection of a fire by the detector 4, and the concentration of smoke (the magnitude of a voltage level) detected by the detector 4. The estimator 621 outputs an estimation result of the situation of the fire to the decider 622.

[0071] The decider 622 makes a decision on fire information. The decider 622 generates the fire information on the basis of the estimation result by the estimator 621. As described above, the fire information may include facility information on a facility in which a fire is present, scale information on a scale of the fire, and meteorological information.

[0072] The facility information may include, for example, information on the location, including the address and the like, of a facility in which a fire is present, information on a fire site, such as a room or a floor, where the fire is present in the facility, information on the type (specification) and name of the facility, and information on the stock (storage) of hazardous materials under the Fire Services Act.

[0073] The decider 622 controls the communication unit 61 such that the communication unit 61 transmits, to the master device 5, a transmission instruction that causes the fire information generated based on the estimation result by the estimator 621 to be transmitted to another alarm system 1 (external system). The estimation result by the estimator 621 is based on a detection result of a fire. In other words, the receiver 6 causes the external communication unit 52 to transmit, based on the detection result of the fire, the fire information. In the first embodiment, the transmission instruction includes the fire information. When the master device 5 receives the transmission instruction, the external communication unit

52 of the master device 5 transmits the fire information based on the estimation result by the estimator 621 to the external system.

[0074] According to the alarm system 1 of the first embodiment, the fire information is transmitted based on the instructions given by the receiver 6 which receives the detection result from the detector 4, thereby reducing, for example, wrong transmission of the fire information. Transmitting the fire information generated based on the estimation result by the estimator 621 to the external system enables the external system to be informed of the situation of the fire, for example, the scale of the fire.

[0075] The scale information may include, for example, information on an area in which a fire is present and information on, for example, a time of an outbreak of the fire and an amount of time elapsed since the outbreak of the fire.

[0076] The decider 622 decides, based on the estimation result by the estimator 621, to transmit the fire information to at least one external system of the plurality of external systems. The decider 622 of the first alarm system 1a decides to transmit the fire information to at least one alarm system 1 of the second alarm system 1b or the third alarm system 1c.

[0077] The decider 622 controls the communication unit 61 such that the communication unit 61 transmits, to the master device 5, a transmission instruction that causes the fire information to be transmitted to another alarm system 1 (external system) determined to be the transmission destination of the fire information. When the master device 5 receives the transmission instruction, the external communication unit 52 of the master device 5 transmits, based on the transmission instruction, the fire information to the at least one external system of the plurality of external systems. The transmission instruction is based on the estimation result by the estimator 621. In other words, the external communication unit 52 of the master device 5 transmits, based on the estimation result by the estimator 621, the fire information to the at least one external system of the plurality of external systems.

[0078] The alarm system 1 of the first embodiment enables the fire information to be transmitted, based on the estimation result by the estimator 621, to another alarm system 1 installed in a facility for which it has been estimated that the chances of being affected by the fire are high, for example.

[0079] Moreover, when the fire information is to be transmitted to two or more external systems of the plurality of external systems, the decider 622 decides, based on the estimation result by the estimator 621, on a transmission order. For example, the decider 622 of the first alarm system 1a decides, based on the estimation result by the estimator 621, that the transmission order of the second alarm system 1b be 1 (first) and the transmission order of the third alarm system 1c be 2.

[0080] The decider 622 controls the communication unit 61 such that the communication unit 61 transmits, to the master device 5, a transmission instruction that causes the fire information to be transmitted to the alarm systems 1 determined to be the transmission destinations of the fire information in the transmission order determined by the decider 622. When the master device 5 receives the transmission instruction, the external communication unit 52 of the master device 5 transmits, in the case of transmitting the fire information to two or more external systems of the plurality of external systems, the fire information to the two or more external systems in the order based on the transmission instruction. The transmission instruction is based on the estimation result by the estimator 621, and therefore, in the case of transmitting the fire information to two or more external systems of the plurality of external systems, the external communication unit 52 of the master device 5 transmits the fire information to the two or more external systems in the order based on the estimation result by the estimator 621.

[0081] The alarm system 1 of the first embodiment enables the fire information to be transmitted, based on the estimation result by the estimator 621, to other alarm systems 1 installed in facilities on a priority basis for which it has been estimated that the chances of being affected by the fire are relatively high, for example.

(2.3) Second Alarm System

[0082] As shown in FIG. 1, the second alarm system 1b is disposed in the second facility 200.

[0083] The second alarm system 1b includes the plurality of second detectors 4c, the plurality of second detectors 4d, a second master device 5b, a second receiver 6b, and a second relay 7b. Note that in the following description, each of the plurality of second detectors 4c may be referred to as a "second detector 4c". Moreover, each of the plurality of second detectors 4d may be referred to as a "second detector 4d".

[0084] The second alarm system 1b is an alarm system 1. That is, the second detectors 4c, the second detectors 4d, the second master device 5b, the second receiver 6b, and the second relay 7b included in the second alarm system 1b respectively correspond to the first detectors 4a, the first detectors 4b, the first master device 5a, the first receiver 6a, and the first relay 7a included in the first alarm system 1a. Thus, the detailed description of the second alarm system 1b is omitted.

[0085] Note that the second alarm system 1b transmits fire information received from the first alarm system 1a to the third alarm system 1c, for example. Moreover, the second alarm system 1b transmits fire information on a fire detected by one of the second detectors 4c (4d) to the first alarm system 1a and the third alarm system 1c in transmission order determined by the second alarm system 1b.

(2.4) Third Alarm System

[0086] As shown in FIG. 1, the third alarm system 1c is disposed in the third facility 300.

[0087] The third alarm system 1c includes a plurality of third detectors 4e, a plurality of third detectors 4f, a third master device 5c, a third receiver 6c, and a third relay 7c. Note that in the following description, each of the plurality of third detectors 4e may be referred to as a "third detector 4e". Moreover, each of the plurality of third detectors 4f may be referred to as a "third detector 4f".

[0088] The third alarm system 1c is an alarm system 1. That is, the third detectors 4e, the third detectors 4f, the third master device 5c, the third receiver 6c, and the third relay 7c included in the third alarm system 1c respectively correspond to the first detectors 4a, the first detectors 4b, the first master device 5a, the first receiver 6a, and the first relay 7a included in the first alarm system 1a. Thus, the detailed description of the third alarm system 1c is omitted.

[0089] Note that the third alarm system 1c transmits fire information received from the first alarm system 1a to the second alarm system 1b, for example. Moreover, the third alarm system 1c transmits fire information on a fire detected by one of the third detectors 4e (4f) to the first alarm system 1a and the second alarm system 1b in transmission order determined by the third alarm system 1c.

(3) Operation

[0090] Next, an operation example of the alarm cooperation system 10 according to the first embodiment will be described with reference to FIG. 3. Note that FIG. 3 shows an example in which a fire is present in the first facility 100 in which the first alarm system 1a is installed.

[0091] First of all, one of the detectors 4 of the first alarm system 1a detects a fire (S1). The one of the first detectors 4a (4b) which has detected the fire transmits a detection result to the first master device 5a (S2). The first master device 5a which has received the detection result transmits the detection result thus received to the first receiver 6a (S3).

[0092] When the first receiver 6a receives the detection result of the fire, the first receiver 6a performs an estimation process of estimating a situation of the fire on the basis of the detection result (S4). The first receiver 6a transmits a transmission instruction including fire information to the first master device 5a (S5).

[0093] The first master device 5a which has received the transmission instruction transmits, based on the transmission instruction, the fire information to another alarm system 1 (external system). In the example shown in FIG. 4, the transmission instruction is an instruction that causes the fire information to be transmitted to the second alarm system 1b installed in the second facility 200 and the third alarm system 1c installed in the third facility 300. Moreover, the transmission instruction is an instruction that causes the fire information to be transmitted to the second alarm system 1b and the third alarm system 1c in this order.

[0094] The first master device 5a of the first alarm system 1a transmits the fire information to the second master device 5b of the second alarm system 1b without using another network (S6). Then, the second master device 5b of the second alarm system 1b receives the fire information without using the another network (S7). Moreover, the first master device 5a of the first alarm system 1a transmits the fire information to the third master device 5c of the third alarm system 1c without using another network (S8). Then, the third master device 5c of the third alarm system 1c receives the fire information without using the another network (S9). Each of the second alarm system 1b and the third alarm system 1c issues, based on the fire information thus received, an announcement about the fire present in the first facility 100, for example.

[0095] Note that the sequence diagram shown in FIG. 3 is a mere example, and the order of the steps may accordingly be changed, or a step(s) may accordingly be added or omitted.

[0096] For example, the first alarm system 1a may transmit the fire information on the fire detected by the one of the first detectors 4a (4b) to the second alarm system 1b and the third alarm system 1c at the same time.

[0097] Moreover, the one of the first detectors 4b which has detected the fire may transmit the detection result directly to the first receiver 6a by wired communication without transmitting the detection result to the first master device 5a.

(4) Variations

[0098] The first embodiment is a mere example of various embodiments of the present disclosure. Various modifications may be made to the first embodiment depending on design and the like as long as the object of the present disclosure is achieved

[0099] Moreover, a function equivalent to the alarm system 1 according to the first embodiment may be implemented by, for example, a cooperation method, a (computer) program, or a non-transitory recording medium storing the program. A cooperation method according to an aspect is a method to be used in a first alarm system 1a (an alarm system 1). The alarm system 1 includes first detectors 4a (4b) installed in a first facility 100 which is a non-dwelling house, each first detector 4a (4b) being configured to detect a fire. The cooperation method includes a transmission step. The transmission step includes transmitting fire information on the fire detected by one of the first detectors 4a (4b) to an external system (a second alarm system 1b) without using another network. The external system includes second detectors 4c (4d) installed in a second facility 200 different from the first facility 100. Each second detector 4c (4d) is configured to detect a fire. Moreover, a cooperation method according to an aspect is a method to be used in a second

alarm system 1b (an alarm system 1). The alarm system 1 includes second detectors 4c (4d) installed in a second facility 200 which is a non-dwelling house. Each second detectors 4c (4d) is configured to detect a fire. The cooperation method includes a reception step. The reception step includes receiving fire information from an external system (a first alarm system 1a) without using another network. The fire information is information on a fire detected by one of first detectors 4a (4b) installed in a first facility 100 different from the second facility 200. Each first detector 4a (4b) is configured to detect a fire. The external system is a system including the first detectors 4a (4b). A program according to an aspect is a program configured to cause one or more processors to execute the cooperation method.

[0100] The alarm system 1 in the present disclosure includes, for example, a computer system. The computer system may include a processor and memory as principal hardware components thereof. The functions of the alarm system 1 according to the present disclosure may be realized by making the processor execute a program stored in the memory of the computer system. The program may be stored in advance in the memory of the computer system. Alternatively, the program may also be downloaded through a telecommunications line or be distributed after having been recorded in some non-transitory storage medium such as a memory card, an optical disc, or a hard disk drive, any of which is readable for the computer system. The processor of the computer system may be implemented as a single or a plurality of electronic circuits including a semiconductor integrated circuit (IC) or a large-scale integrated circuit (LSI). As used herein, the "integrated circuit" such as an IC or an LSI is called by a different name depending on the degree of integration thereof. Examples of the integrated circuits include a system LSI, a very-large-scale integrated circuit (VLSI), and an ultra-large-scale integrated circuit (ULSI). Optionally, a field-programmable gate array (FPGA) to be programmed after an LSI has been fabricated or a reconfigurable logic device allowing the connections or circuit sections inside of an LSI to be reconfigured may also be adopted as the processor. Those electronic circuits may be either integrated together on a single chip or distributed on multiple chips, whichever is appropriate. Those multiple chips may be integrated together in a single device or distributed in multiple devices without limitation. As used herein, the "computer system" includes a microcontroller including one or more processors and one or more memory elements. Thus, the microcontroller may also be implemented as a single or a plurality of electronic circuits including a semiconductor integrated circuit or a large-scale integrated circuit.

[0101] At least part of a plurality of functions of the alarm system 1 may be implemented as a cloud computing system as well.

[0102] Moreover, the estimator 621 of the alarm system 1 may use a learned model generated by machine learning to estimate a situation of a fire present in a facility. The learned model is generated, for example, by supervised learning using a plurality of pieces of training data showing a relationship between a detection result of a fire detected by one of the detectors 4 and a situation of the fire. The estimator 621 receives the detection result of the fire detected by the one of the detectors 4 as an input of the learned model, thereby obtaining information representing the situation of the fire as an output of the learned model.

[0103] Note that the algorithm of the machine learning is, for example, a neural network. However, the algorithm of the machine learning is not limited to the neural network but may be, for example, extreme gradient boosting (XGB) regression, random forest, decision tree, logistic regression, support vector machine (SVM), naive Bayes classifiers, or k-nearest neighbors. Moreover, the algorithm of the machine learning may be, for example, Gaussian mixture model (GMM) or k-means clustering.

[0104] Moreover, the learning method in the first embodiment is, for example, supervised learning. However, the learning method is not limited to the supervised learning but may be unsupervised learning or reinforcement learning.

[0105] Moreover, the learned model may be updated by additional learning.

[0106] Not all of components of the first alarm system 1a have to be disposed in the first facility 100. It suffices that at least the detectors 4 included in the first alarm system 1a are disposed in the first facility 100. Moreover, not all of components of the second alarm system 1b have to be disposed in the second facility 200. It suffices that at least the detectors 4 included in the second alarm system 1b are disposed in the second facility 200.

[0107] A transmission route for the fire information between the plurality of alarm systems 1 may be determined in advance. For example, a transmission route may be determined in advance along which the fire information is transmitted from the first alarm system 1a to the second alarm system 1b, and then, the fire information is transmitted from the second alarm system 1b to the third alarm system 1c. Moreover, a transmission route for fire information on a fire detected by one of the detectors 4 in a system including the one of the detectors 4 may be different from a transmission route for fire information on a fire detected by one of the detectors 4 in another alarm system 1. Note that the transmission destination information may include information on the transmission route.

[0108] The alarm system 1 may include a plurality of relays 7.

[0109] In the first embodiment, an example is described in which the receiver 6 receives the detection result from one of the detectors 4 and then estimates the situation of the fire to decide on the transmission destinations and the transmission order of the fire information. However, it is not essential that the receiver 6 estimates the situation of the fire, that is, it is not essential that the receiver 6 includes the estimator 621. For example,

based on an operation input given by a user who has confirmed the detection result received by the receiver 6, the receiver 6 may decide on the transmission destination(s) of the fire information and transmit the fire information.

[0110] In the first embodiment, an example is described in which the receiver 6 includes the estimator 621 and the decider 622, but alternatively to the receiver 6, any of the detectors 4; the master device 5; and the relay 7 may include the estimator 621 and the decider 622. For example, the first master device 5a may include the estimator 621 and the decider 622. When the first master device 5a includes the estimator 621, the first master device 5a estimates the situation of a fire present in the first facility 100 on the basis of a detection result of a fire detected by one of the first detectors 4a (4b). Moreover, when the first master device 5a includes the decider 622, the first master device 5a transmits fire information generated based on an estimation result by the estimator 621 to another alarm system 1 (external system). In other words, the first master device 5a causes the external communication unit 52 to transmit, based on the detection result of the fire, the fire information. The fire information is transmitted based on an instruction given by the master device 5 which relays the detection result of the fire detected by the one of the first detectors 4a (4b) to the receiver 6, thereby reducing, for example, wrong transmission of the fire information.

[0111] In the first alarm system 1a, an example in which the first master device 5a includes the external communication unit 52 is shown, but alternatively to the first master device 5a, any of the first detectors 4a, the first receiver 6a, and the first relay 7a may include the external communication unit 52. Similarly, in the second alarm system 1b, an example in which the second master device 5b includes the external communication unit 52 is shown, but alternatively to the second master device 5b, any of the second detectors 4c, the second receiver 6b, and the second relay 7b may include the external communication unit 52. Moreover, which one of the detectors 4, the master device 5, the receiver 6, and the relay 7 includes the external communication unit 52 may be different depending on the alarm systems 1.

[0112] For example, when the first master device 5a of the first alarm system 1a includes the external communication unit 52, the first master device 5a transmits the fire information to the second alarm system 1b without using another network. The second alarm system 1b may receive the fire information transmitted from the first master device 5a by any one of the second detectors 4c, the second master device 5b, the second receiver 6b, and the second relay 7b. The second alarm system 1b which has received the fire information by any of the second detectors 4c, the second master device 5b, the second receiver 6b, and the second relay 7b issues an announcement about the fire present in the first facility 100 on the basis of the operation input given by the user who has confirmed the fire information thus received, for example.

[0113] Moreover, when one of the first detectors 4a of the first alarm system 1a includes the external communication unit 52, the one of the first detectors 4a transmits the fire information to the second alarm system 1b without using another network. The second alarm system 1b may receive the fire information transmitted from the one of the first detectors 4a by any one of the second detectors 4c, the second master device 5b, the second receiver 6b, and the second relay 7b.

[0114] Moreover, when the first relay 7a of the first alarm system 1a includes the external communication unit 52, the first relay 7a transmits the fire information to the second alarm system 1b without using the another network. The second alarm system 1b may receive the fire information transmitted from the first relay 7a by any one of the second detectors 4c, the second master device 5b, the second receiver 6b, and the second relay 7b.

[0115] Moreover, when the first receiver 6a of the first alarm system 1a includes the external communication unit 52, the first receiver 6a transmits the fire information to the second alarm system 1b without using the another network. The second alarm system 1b may receive the fire information transmitted from the first receiver 6a by any one of the second detectors 4c, the second master device 5b, the second receiver 6b, and the second relay 7b. Note that when the fire information is transmitted from the first receiver 6a to the second receiver 6b, the first receiver 6a and the second receiver 6b may be connected to each other by a communication cable. When the first receiver 6a and the second receiver 6b are connected to each other by the communication cable, the first receiver 6a may transmit the fire information to the second receiver 6b without using another network other than a wired communication network formed by the communication cable.

(Second Embodiment)

(1) Overview

[0116] As shown in FIG. 4, an alarm cooperation system 10 according to a second embodiment is different from the alarm cooperation system 10 according to the first embodiment in that a second alarm system 1b (alarm system 1) is disposed in a second facility 200 which is a dwelling house facility.

(2) Details

[0117] Next, the details of the second alarm system 1b according to the second embodiment will be described with reference to FIG. 4.

(2.1) Second Alarm System

[0118] The second alarm system 1b according to the second embodiment includes a plurality of second detectors 8, a control device 9, and a second relay 7b.

(2.2) Detector

[0119] The plurality of second detectors 8 include a second detector 8a which is a master device and a plurality of second detectors 8b which are slave devices. In the following description, each of the plurality of second detectors 8 may be referred to as a "second detector 8". Moreover, each of the plurality of second detectors 8b may be referred to as a "second detector 8b".

(2.2.1) Slave Device

[0120] Each of the second detectors 8b includes a communication unit 81b, a controller 82b, a detecting unit 83, and an announcement unit 84.

[0121] Each second detector 8b includes, for example, a microcomputer including a processor and memory. The processor executes an appropriate program, and thereby, a computer system functions as the controller 82b. That is, the controller 82b is implemented by a computer system including a processor and memory. The program may be stored in the memory in advance, may be provided over a telecommunications network such as the Internet, or may be provided as a non-transitory recording medium, such as a memory card, in which the program has been stored.

[0122] The communication unit 81b is configured to directly communicate with the second detector 8a, which is the master device, by wireless communication. Moreover, the communication unit 81b is configured to indirectly communicate with the second detector 8a which is the master device via the second relay 7b (relay 7) by wireless communication.

[0123] The communication unit 81b transmits, to the second detector 8a, which is the master device, a detection result by the detecting unit 83 together with information representing the identifier of the second detector 8b in which the communication unit 81b is included. Moreover, the communication unit 81b receives an announcement instruction from the second detector 8a, which is the master device.

[0124] The detecting unit 83 has a function of detecting a fire (detection function). In this embodiment, the detecting unit 43 is, for example, a photoelectric sensor which senses smoke. The configuration of the detecting unit 83 is similar to that of the detecting unit 43 described in the first embodiment, and the description thereof is thus omitted.

[0125] The announcement unit 84 has a function (announcement function) of issuing an announcement about the outbreak of a fire. The configuration of the announcement unit 84 is similar to that of the announcement unit 44 described in the first embodiment, and the description thereof is omitted.

[0126] The controller 82b controls the communication unit 81b and the announcement unit 84. The controller 82b controls the communication unit 81b such that the communication unit 81b transmits the detection result of a fire by the detecting unit 83 to the second detector 8a, which is the master device. Moreover, the controller 82b controls the announcement unit 84 such that the announcement unit 84 issues an announcement based on the announcement instruction received from the second detector 8a, which is the master device.

(2.2.2) Master Device

[0127] The second detector 8a, which is the master device includes a communication unit 81a, a controller 82a, a detecting unit 83, an announcement unit 84, a storage 85, and an external communication unit 86.

[0128] The second detector 8a includes, for example, a microcomputer including a processor and memory. The processor executes an appropriate program, and thereby, a computer system functions as the controller 82a. That is, the controller 82a is implemented by a computer system including a processor and memory. The program may be stored in the memory in advance, may be provided over a telecommunications network such as the Internet, or may be provided as a non-transitory recording medium, such as a memory card, in which the program has been stored.

[0129] The communication unit 81a is configured to directly communicate with the control device 9 and the second detectors 8b, which are slave devices, by wireless communication. Moreover, the communication unit 81a is configured to indirectly communicate with the control device 9 and the second detectors 8b, which are the slave devices, via the second relay 7b by wireless communication.

[0130] The communication unit 81a receives a detection result from one of the second detectors 8b directly, or indirectly via the second relay 7b. Moreover, the communication unit 81a transmits the detection result received from the one of the second detectors 8b to the control device 9. The communication unit 81a receives an announcement instruction from the control device 9. Moreover, the communication unit 81a transmits the announcement instruction received from the control device 9 to the one of the second detectors 8b.

[0131] The external communication unit 86 is configured to communicate with a plurality of alarm systems 1 (external systems) disposed in a plurality of respective other facilities without using another network. The external communication unit 86 is configured to communicate with a first alarm system 1a disposed in a first facility 100 and a third alarm system 1c disposed in a third facility 300.

[0132] The external communication unit 86 receives fire information on a fire detected by one of detectors 4 included in another alarm system 1 from the another alarm system 1 without using another network. The external communication unit 86 receives the fire information from the another alarm system 1 by wireless communication compliant with the standard of, for example, Wi-Fi (registered trademark), Bluetooth (registered trademark), ZigBee (registered trademark), or low power radio

(specified low power radio) requiring no license without using another network.

[0133] Moreover, the external communication unit 86 transmits the fire information received from the external system to another external system without using another network. For example, the external communication unit 86 transmits fire information received from the first alarm system 1a to the third alarm system 1c different from the first alarm system 1a without using another network.

[0134] The storage 85 is semiconductor memory such as ROM, RAM, or EEPROM. Note that the storage 85 is not limited to the semiconductor memory but may be, for example, a hard disk drive.

[0135] The storage 85 stores transmission destination information on another alarm system 1 (external system) which is to be a target to which the external communication unit 86 transmits fire information. Moreover, the storage 85 stores an identifier of each of the plurality of second detectors 8b included in the second alarm system 1b.

[0136] The controller 82a controls the communication unit 81a. The controller 82a controls the communication unit 81a such that the communication unit 81a transmits a detection result received from one of the second detector 8b to the control device 9. Moreover, the controller 82a controls the communication unit 81a such that the communication unit 81a transmits the announcement instruction received from the control device 9 to the one of the second detectors 8b, which are the slave devices. Moreover, the controller 82a controls the communication unit 81a such that the communication unit 81a transmits the fire information received from another alarm system 1 (external system) to the control device 9.

[0137] The controller 82a controls the external communication unit 86. For example, controller 82a controls the external communication unit 86 such that the external communication unit 86 transmits fire information received from another alarm system 1 (e.g., the first alarm system 1a) to still another alarm system 1 (e.g., the third alarm system 1c).

(2.3) Relay

[0138] The second relay 7b is a relay 7 included in the second alarm system 1b. The second relay 7b of the second embodiment includes a communication interface configured to communicate with the second detector 8a, which is the master device, and the plurality of second detectors 8b, which are the slave devices, by wireless communication. The second relay 7b relays communication between the second detector 8a and each second detector 8b.

(2.4) Control Device

[0139] The control device 9 is, for example, a controller of a home energy management system (HEMS) and is configured to communicate with a plurality of devices disposed in the second facility 200. The plurality of devices include the plurality of second detectors 8 described above. Moreover, the control device 9 is configured to communicate with a plurality of devices, such as illumination devices and air conditioners, disposed in the second facility 200.

[0140] The control device 9 receives a detection result of a fire detected by one of the second detectors 8 in the second alarm system 1b.

[0141] The control device 9 includes a communication unit 91, a controller 92, and a storage 93.

[0142] The control device 9 includes, for example, a microcomputer including a processor and memory. The processor executes an appropriate program, and thereby, a computer system functions as the controller 92. That is, the controller 92 is implemented by a computer system including a processor and memory. The program may be stored in the memory in advance, may be provided over a telecommunications network such as the Internet, or may be provided as a non-transitory recording medium, such as a memory card, in which the program has been stored.

[0143] The communication unit 91 includes a communication interface configured to communicate with the second detector 8a, which is the master device.

[0144] The storage 93 is semiconductor memory such as ROM, RAM, or EEPROM. Note that the storage 93 is not limited to the semiconductor memory but may be, for example, a hard disk drive.

[0145] The storage 93 stores an identifier of each of the plurality of second detectors 8 included in the second alarm system 1b.

[0146] The controller 92 controls the communication unit 91. For example, the controller 92 controls the communication unit 91 such that the communication unit 91 transmits the announcement instruction to the second detector 8a.

[0147] The second embodiment is a mere example of various embodiments of the present disclosure. Various modifications may be made to the second embodiment depending on design and the like as long as the object of the present disclosure is achieved

[0148] An example in which the second detector 8a, which is the master device includes the external communication unit 86 has been described, but alternatively to the second detector 8a, any of the second detectors 8b, which are the slave devices, the second relay 7b, and the control device 9 may include the external communication unit 86.

[0149] Various configurations (including variations) described in the second embodiment may be employed accordingly in combination with various configurations (including variations) described in the first embodiment.

(Summary)

[0150] As described above, an alarm system (a first alarm system 1a) of a first aspect is an alarm system (1) including a first detector (4a; 4b). The first detector (4A;

4B) is installed in a first facility (100) which is a non-dwelling house. The first detector (4A; 4B) is configured to detect a fire in the first facility (100). The alarm system (1) includes an external communication unit (52). The external communication unit (52) is configured to transmit fire information on the fire detected by the first detector (4a; 4b) to an external system (a second alarm system 1b) without using another network. The external system includes a second detector (4c; 4d; 8). The second detector (4c; 4d; 8) is installed in a second facility (200) different from the first facility (100). The second detector (4c; 4d; 8) is configured to detect a fire in the second facility (200).

[0151] With this aspect, the alarm system (the first alarm system 1a) transmits the fire information to the second alarm system (1b) disposed in the second facility (200), thereby reducing damage in the vicinity (the second facility 200) of a fire site. Moreover, the alarm system (1) directly transmits the fire information to the external system without using another network such as the Internet, thereby providing the advantage that the chances of being affected by a communication failure in the another network are low.

[0152] An alarm system (a first alarm system 1a) of a second aspect referring to the first aspect further includes an estimator (621). The estimator (621) is configured to estimate, based on a detection result of the fire detected by the first detector (4a; 4b), a situation of the fire. The external communication unit (52) is configured to communicate with a plurality of the external systems (the second alarm system 1b; a third alarm system 1c) each disposed in a corresponding one of a plurality of the second facilities (the second facility 200; a third facility 300) without using the another network. The external communication unit (52) is configured to transmit, based on an estimation result by the estimator (621), the fire information to at least one external system of the external systems.

[0153] This aspect enables the fire information to be transmitted, based on the estimation result by the estimator (621), to an external system (the second alarm system 1b; the third alarm system 1c) installed in a facility (the second facility 200; the third facility 300) for which it has been estimated that the chances of being affected by the fire are high, for example.

[0154] In an alarm system (a first alarm system 1a) of a third aspect referring to the second aspect, the external communication unit (52) is configured to, when the fire information is to be transmitted to two or more external systems of the external systems (the second alarm system 1b; the third alarm system 1c), transmit the fire information to the two or more external systems in an order based on the estimation result by the estimator (621).

[0155] This aspect enables the fire information to be transmitted, based on the estimation result by the estimator (621), to external systems (the second alarm system 1b; the third alarm system 1c) installed in facilities (the second facility 200; the third facility 300) on a priority basis for which it has been estimated that the chances of being affected by the fire are relatively high, for example.

[0156] An alarm system (a first alarm system 1a) of a fourth aspect referring to any one of the first to third aspects further includes an estimator (621). The estimator (621) is configured to estimate, based on a detection result of the fire detected by the first detector (4a; 4b), a situation of the fire. The external communication unit (52) is configured to transmit the fire information based on an estimation result by the estimator (621) to the external system (the second alarm system 1b; a third alarm system 1c).

[0157] With this aspect, transmitting the fire information generated based on the estimation result by the estimator (621) to the external system (the second alarm system 1b; the third alarm system 1c) enables the external system to be informed of the situation of the fire, for example, the scale of the fire.

[0158] An alarm system (a first alarm system 1a) of a fifth aspect referring to any one of the first to fourth aspects further includes a receiver (6). The receiver (6) is configured to receive a detection result of the fire detected by the first detector (4a; 4b). The receiver (6) is configured to cause the external communication unit (52) to transmit, based on the detection result of the fire, the fire information.

[0159] With this aspect, the fire information is transmitted based on an instruction given by the receiver (6) configured to receive the detection result from the first detector (4a; 4b), thereby reducing, for example, wrong transmission of the fire information.

[0160] An alarm system (a first alarm system 1a) of a sixth aspect referring to any one of the first to fourth aspects further includes a master device (5). The master device (5) is configured to transmit a detection result received from the first detector (4a; 4b) to a receiver (6). The receiver (6) is configured to receive the detection result of the fire detected by the first detector (4a; 4b). The master device (5) is configured to cause the external communication unit (52) to transmit, based on the detection result of the fire, the fire information.

[0161] With this aspect, the fire information is transmitted based on an instruction given by the master device (5) configured to relay the detection result of the fire detected by the first detector (4a; 4b) to the receiver (6), thereby reducing, for example, wrong transmission of the fire information.

[0162] The alarm system (a first alarm system 1a) of a seventh aspect referring to any one of the first to sixth aspects further includes a storage (63). The storage (63) is configured to store transmission destination information on the external system (the second alarm system 1b; a third alarm system 1c) which is to be a target to which the external communication unit (52) transmits the fire information.

[0163] With this aspect, the storage (63) stores the transmission destination information, and therefore, the

external communication unit (52) can transmit the fire information to the external system (the second alarm system 1b; the third alarm system 1c), registered in advance, as a transmission destination.

[0164] An alarm system (a second alarm system 1b) of an eighth aspect is an alarm system (1) including a second detector (4c; 4d; 8). The second detector (4c; 4d; 8) is installed in a second facility (200). The second detector (4c; 4d; 8) is configured to detect a fire. The alarm system (1) includes an external communication unit (52;86). The external communication unit (52;86) is configured to receive fire information from an external system (a first alarm system 1a) without using another network. The fire information is information on a fire detected by a first detector (4a; 4b) installed in a first facility (100) different from the second facility (200). The first detector (4a; 4b) is configured to detect a fire. The external system is a system including the first detector (4a; 4b).

[0165] With this aspect, the alarm system (the second alarm system 1b) issues, for example, an announcement about the fire present in the first facility (100), thereby reducing damage to the second facility (200).

[0166] In an alarm system (a second alarm system 1b) of a ninth aspect referring to the eighth aspect, the external communication unit (52;86) is configured to transmit, without using another network, the fire information thus received to an external system (a third alarm system 1c) which is installed in a third facility (300) different from the first facility (100) and which is different from the external system (the first alarm system 1a) including the first detector (4a; 4b).

[0167] With this aspect, the alarm system (the second alarm system 1b) transmits the fire information received from the external system (the first alarm system 1a) to still another external system (the third alarm system 1c), thereby reducing damage in the vicinity (the third facility 300) of the first facility (100).

[0168] An alarm system (a first alarm system 1a) of a tenth aspect referring to any one of the first to ninth aspects further includes a master device (5). The master device (5) is configured to transmit a detection result received from the first detector (4a; 4b) to a receiver (6). The receiver (6) is configured to receive the detection result of the fire detected by the first detector (4a; 4b). The master device (5) includes the external communication unit (52).

[0169] With this aspect, the master device (5) configured to communicate with the receiver (6) includes the external communication unit (52), thereby stably and promptly transmitting the fire information to the external system (the second alarm system 1b; the third alarm system 1c).

[0170] The configurations except for the configuration of the first aspect are not essential configurations for the alarm system (the first alarm system 1a) and may thus accordingly be omitted.

[0171] An alarm cooperation system (10) of an eleventh aspect includes a first alarm system (1a) and a second alarm system (1b). The first alarm system (1a) includes a first detector (4a; 4b). The first detector (4a; 4b) is installed in a first facility (100) which is a non-dwelling house. The first detector (4a; 4b) is configured to detect a fire. The second alarm system (1b) includes a second detector (4c; 4d). The second detector (4c; 4d) is installed in a second facility (200) different from the first facility (100). The second detector (4c; 4d) is configured to detect a fire. The first alarm system (1a) includes a first external communication unit (an external communication unit 52). The first external communication unit is configured to transmit fire information on the fire detected by the first detector (4a; 4b) to the second alarm system (1b) without using another network. The second alarm system (1b) includes a second external communication unit (an external communication unit 52). The second external communication unit is configured to receive the fire information from the first alarm system (1a) without using another network.

[0172] With this aspect, the first alarm system (1a) transmits the fire information to the second alarm system (1b) disposed in the second facility (200), thereby reducing damage in the vicinity (the second facility 200) of a fire site. Moreover, the first alarm system (1a) directly transmits the fire information to the second alarm system (1b) without using another network such as the Internet, thereby providing the advantage that the chances of being affected by a communication failure in the another network are low. Moreover, the second alarm system (1b) issues, for example, an announcement about the fire present in the first facility (100), thereby reducing damage to the second facility (200).

[0173] A cooperation method of a twelfth aspect is a method to be used in an alarm system (a first alarm system 1a). The alarm system (1) includes a first detector (4a; 4b) installed in a first facility (100) which is a non-dwelling house. The first detector (4a; 4b) is configured to detect a fire. The cooperation method includes a transmission step. The transmission step includes transmitting fire information on the fire detected by the first detector (4a; 4b) to an external system (a second alarm system 1b) without using another network. The external system includes a second detector (4c; 4d) installed in a second facility (200) different from the first facility (100). The second detector (4c; 4d) is configured to detect a fire.

[0174] With this aspect, the alarm system (the first alarm system 1a) transmits the fire information to the second alarm system (1b) disposed in the second facility (200), thereby reducing damage in the vicinity (the second facility 200) of a fire site. Moreover, the alarm system (1) directly transmits the fire information to the external system without using another network such as the Internet, thereby providing the advantage that the chances of being affected by a communication failure in the another network are low.

[0175] A cooperation method of a thirteenth aspect is a method to be used in an alarm system (a second alarm system 1b). The alarm system (1) includes a second de-

tector (4c; 4d) installed in a second facility (200). The second detector (4c; 4d) is configured to detect a fire. The cooperation method includes a reception step. The reception step includes receiving fire information from an external system (a first alarm system 1a) without using another network. The fire information is information on a fire detected by a first detector (4a; 4b) installed in a first facility (100) different from the second facility (200). The first detector (4a; 4b) is configured to detect a fire. The external system is a system including the first detector (4a; 4b).

[0176] With this aspect, the alarm system (the second alarm system 1b) issues, for example, an announcement about the fire present in the first facility (100), thereby reducing damage to the second facility (200).

[0177] A program of a fourteenth aspect is a program configured to cause one or more processors to execute the cooperation method of the twelfth aspect.

[0178] The alarm system (the first alarm system 1a) transmits the fire information to the second alarm system (1b) disposed in the second facility (200), thereby reducing damage in the vicinity (the second facility 200) of a fire site. Moreover, the alarm system (1) directly transmits the fire information to the external system without using another network such as the Internet, thereby providing the advantage that the chances of being affected by a communication failure in the another network are low.

[0179] A program according to a fifteenth aspect is a program configured to cause one or more processor to execute the cooperation method of the thirteenth aspect.

[0180] With this aspect, the alarm system (first alarm system 1a) issues, for example, an announcement about the fire present in the first facility (100), thereby reducing damage to the second facility (200).

Reference Signs List

[0181]

1	Alarm System
1a	First Alarm System (Alarm System)
1b	Second Alarm System (External System)
1c	Third Alarm System (Another External System)
10	Alarm Cooperation System
100	First Facility
200	Second Facility
300	Third Facility
4a; 4b	First Detector
4c; 4d	Second Detector
5	Master
52	External Communication Unit (First External Communication Unit, Second External Communication Unit)
6	Receiver
621	Estimator
8	Second Detector
86	External Communication Unit (Second External Communication Unit)

Claims

1. An alarm system comprising

a first detector installed in a first facility which is a non-dwelling house, the first detector being configured to detect a fire in the first facility; and an external communication unit configured to transmit fire information on the fire detected by the first detector to an external system without using another network, the external system including a second detector installed in a second facility different from the first facility, the second detector being configured to detect a fire in the second facility.

2. The alarm system of claim 1, further comprising an estimator configured to estimate, based on a detection result of the fire detected by the first detector, a situation of the fire, wherein

the external communication unit is configured to communicate with a plurality of the external systems each disposed in a corresponding one of a plurality of the second facilities without using the another network, and
the external communication unit is configured to transmit, based on an estimation result by the estimator, the fire information to at least one external system of the external systems.

3. The alarm system of claim 2, wherein
the external communication unit is configured to, when the fire information is to be transmitted to two or more external systems of the external systems, transmit the fire information to the two or more external systems in an order based on the estimation result by the estimator.

4. The alarm system of any one of claims 1 to 3, further

comprising an estimator configured to estimate, based on a detection result of the fire detected by the first detector, a situation of the fire, wherein
the external communication unit is configured to transmit the fire information based on an estimation result by the estimator to the external system.

5. The alarm system of any one of claims 1 to 4, further comprising a receiver configured to receive a detection result of the fire detected by the first detector, wherein
the receiver is configured to cause the external communication unit to transmit, based on the detection result of the fire, the fire information.

6. The alarm system of any one of claims 1 to 4, further comprising a master device configured to transmit a detection result received from the first detector to a receiver configured to receive the detection result of the fire detected by the first detector, wherein
the master device is configured to cause the external communication unit to transmit, based on the detection result of the fire, the fire information.

7. The alarm system of any one of claims 1 to 6, further comprising a storage configured to store transmission destination information on the external system which is to be a target to which the external communication unit transmits the fire information.

8. An alarm system comprising:

a second detector installed in a second facility, the second detector being configured to detect a fire; and
an external communication unit configured to receive fire information from an external system without using another network, the fire information being information on a fire detected by a first detector included in the external system, the first detector being installed in a first facility different from the second facility, the first detector being configured to detect a fire.

9. The alarm system of claim 8, wherein
the external communication unit is configured to transmit, without using another network, the fire information thus received to an external system which is installed in a third facility different from the first facility and which is different from the external system including the first detector.

10. The alarm system of any one of claims 1 to 9, further comprising a master device configured to transmit a detection result received from the first detector to a receiver configured to receive the detection result of the fire detected by the first detector, wherein
the master device includes the external communication unit.

11. An alarm cooperation system comprising:

a first alarm system including a first detector installed in a first facility which is a non-dwelling house, the first detector being configured to detect a fire; and
a second alarm system including a second detector installed in a second facility different from the first facility, the second detector being configured to detect a fire,
the first alarm system including a first external communication unit configured to transmit fire information on the fire detected by the first detector to the second alarm system without using another network,
the second alarm system including a second external communication unit configured to receive the fire information from the first alarm system without using another network.

12. A cooperation method to be used in an alarm system including a first detector installed in a first facility which is a non-dwelling house, the first detector being configured to detect a fire, the cooperation method comprising a transmission step of transmitting fire information on the fire detected by the first detector to an external system without using another network, the external system including a second detector installed in a second facility different from the first facility, the second detector being configured to detect a fire.

13. A cooperation method to be used in an alarm system including a second detector installed in a second facility, the second detector being configured to detect a fire, the cooperation method comprising a reception step of receiving fire information from an external system without using another network, the fire information being information on a fire detected by a first detector included in the external system, the first detector being installed in a first facility different from the second facility, the first detector being configured to detect a fire.

14. A program configured to cause one or more processors to execute the cooperation method of claim 12.

15. A program configured to cause one or more processors to execute the cooperation method of claim 13.

FIG. 1

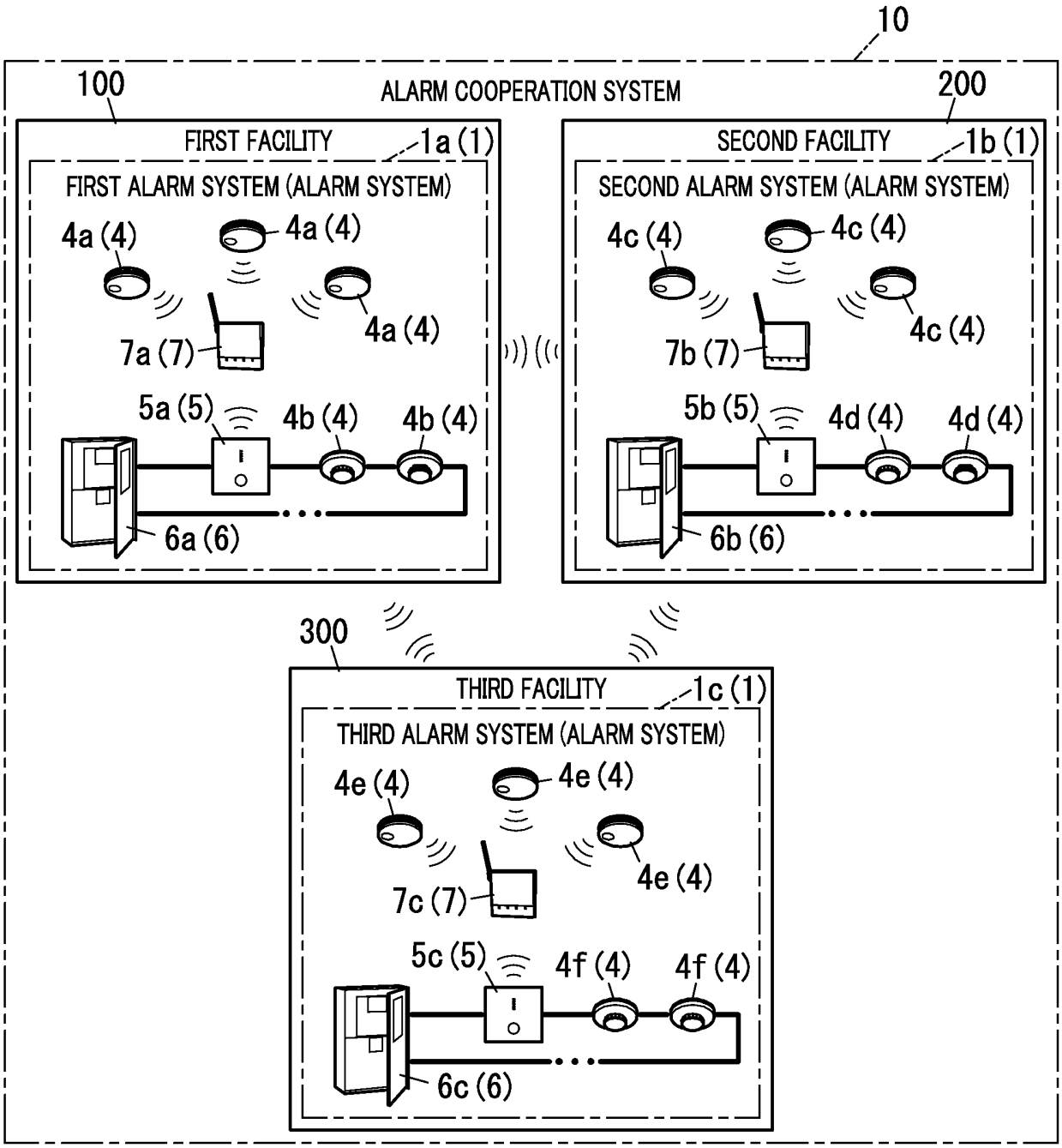

10
100
ALARM COOPERATION SYSTEM
200
FIRST FACILITY
1a (1)
FIRST ALARM SYSTEM (ALARM SYSTEM)
4a (4)
4a (4)
4a (4)
7a (7)
5a (5)
4b (4)
4b (4)
6a (6)
SECOND FACILITY
1b (1)
SECOND ALARM SYSTEM (ALARM SYSTEM)
4c (4)
4c (4)
4c (4)
7b (7)
5b (5)
4d (4)
4d (4)
6b (6)
300
THIRD FACILITY
1c (1)
THIRD ALARM SYSTEM (ALARM SYSTEM)
4e (4)
4e (4)
4e (4)
7c (7)
5c (5)
4f (4)
4f (4)
6c (6)

FIG. 2

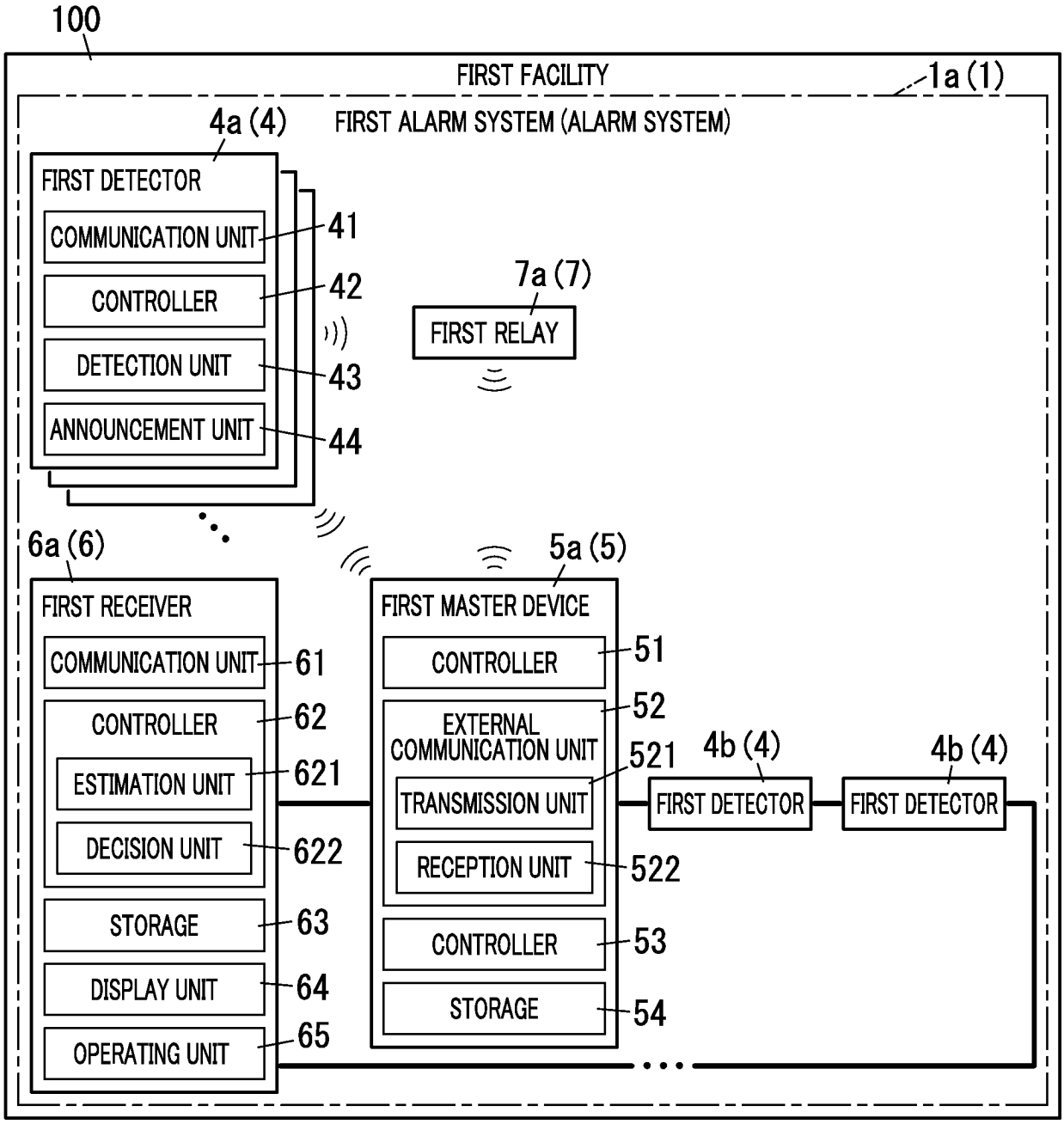

100
FIRST FACILITY
1a (1)
4a (4)
FIRST ALARM SYSTEM (ALARM SYSTEM)
FIRST DETECTOR
COMMUNICATION UNIT
41
CONTROLLER
42
DETECTION UNIT
43
ANNOUNCEMENT UNIT
44
7a (7)
FIRST RELAY
6a (6)
5a (5)
FIRST RECEIVER
COMMUNICATION UNIT
61
CONTROLLER
62
ESTIMATION UNIT
621
DECISION UNIT
622
STORAGE
63
DISPLAY UNIT
64
OPERATING UNIT
65
FIRST MASTER DEVICE
CONTROLLER
51
EXTERNAL COMMUNICATION UNIT
52
TRANSMISSION UNIT
521
RECEPTION UNIT
522
CONTROLLER
53
STORAGE
54
4b (4)
FIRST DETECTOR
4b (4)
FIRST DETECTOR

FIG. 3

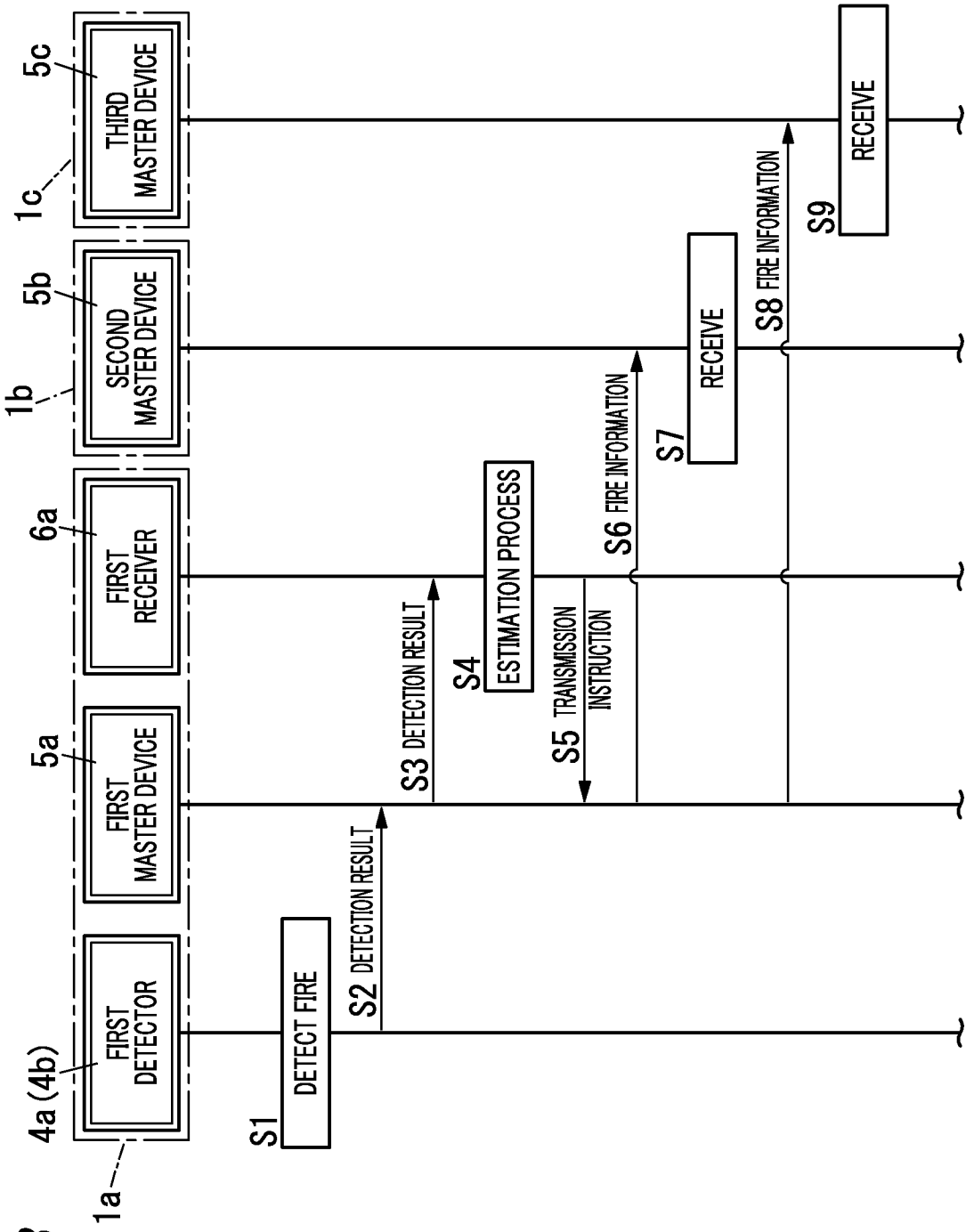
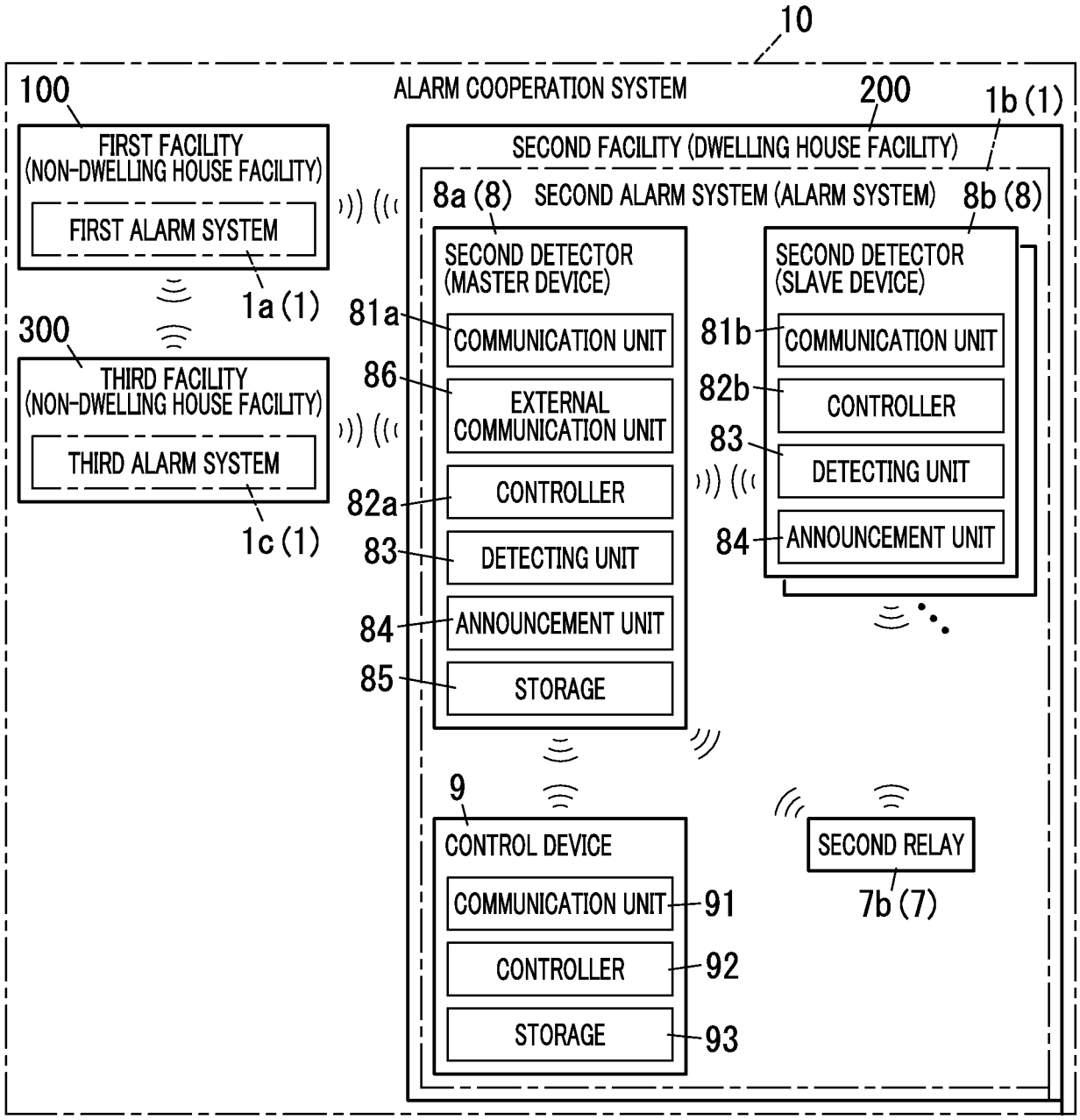

1a
4a (4b)
FIRST DETECTOR
5a
FIRST MASTER DEVICE
6a
FIRST RECEIVER
1b
5b
SECOND MASTER DEVICE
1c
5c
THIRD MASTER DEVICE
S1 DETECT FIRE
S2 DETECTION RESULT
S3 DETECTION RESULT
S4 ESTIMATION PROCESS
S5 TRANSMISSION INSTRUCTION
S6 FIRE INFORMATION
S7 RECEIVE
S8 FIRE INFORMATION
S9 RECEIVE

FIG. 4


10
ALARM COOPERATION SYSTEM
100
FIRST FACILITY
(NON-DWELLING HOUSE FACILITY)
FIRST ALARM SYSTEM
1a (1)
300
THIRD FACILITY
(NON-DWELLING HOUSE FACILITY)
THIRD ALARM SYSTEM
1c (1)
200
1b (1)
SECOND FACILITY (DWELLING HOUSE FACILITY)
8a (8)
SECOND ALARM SYSTEM (ALARM SYSTEM)
8b (8)
SECOND DETECTOR
(MASTER DEVICE)
81a
COMMUNICATION UNIT
86
EXTERNAL
COMMUNICATION UNIT
82a
CONTROLLER
83
DETECTING UNIT
84
ANNOUNCEMENT UNIT
85
STORAGE
SECOND DETECTOR
(SLAVE DEVICE)
81b
COMMUNICATION UNIT
82b
CONTROLLER
83
DETECTING UNIT
84
ANNOUNCEMENT UNIT
9
CONTROL DEVICE
COMMUNICATION UNIT
91
CONTROLLER
92
STORAGE
93
SECOND RELAY
7b (7)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/043472

A. CLASSIFICATION OF SUBJECT MATTER

G08B 25/04(2006.01)i; ***G08B 17/00***(2006.01)i
FI: G08B25/04 A; G08B17/00 C

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)

G08B17/00-31/00; H04M11/00

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

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.
X	JP 2020-087369 A (PANASONIC IP MAN CORP) 04 June 2020 (2020-06-04) paragraphs [0014]-[0020], [0026], [0031], [0037], [0060]-[0061], [0073], [0096], [0102], [0105], fig. 1, 6	8-10, 13, 15
Y		1-7, 11-12, 14
Y	JP 2021-144445 A (PANASONIC IP MAN CORP) 24 September 2021 (2021-09-24) paragraphs [0015], [0019], [0021], [0033]-[0037], [0056], fig. 1	1-7, 11-12, 14
A	JP 2016-021732 A (BUFFALO INC) 04 February 2016 (2016-02-04) paragraphs [0025]-[0035], [0053]	1-15

☐ 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
09 December 2022	**27 December 2022**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/043472

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2020-087369 A	04 June 2020	WO 2020/110569 A1	
JP 2021-144445 A	24 September 2021	(Family: none)	
JP 2016-021732 A	04 February 2016	US 2015/0373553 A1 paragraphs [0024]-[0034], [0052]	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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