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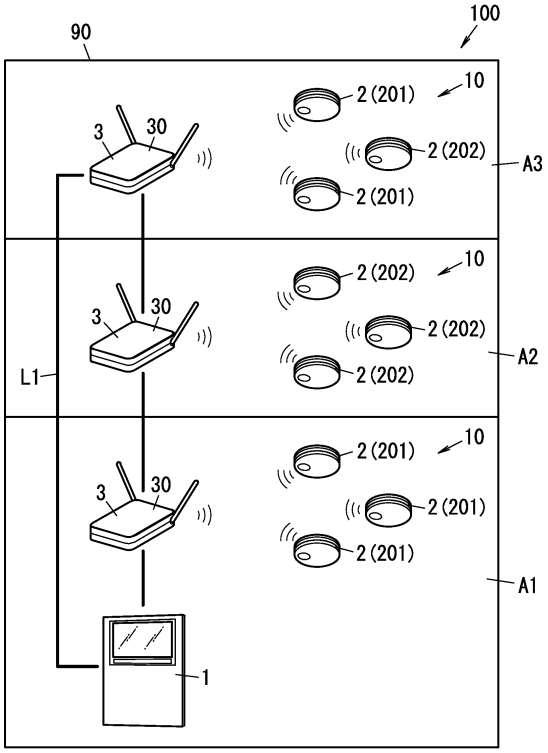
(54) **RELAY, CONTROL METHOD, AND PROGRAM**

(57) An object of the present disclosure is to improve convenience. A relay (3) is configured to relay communication between each of a plurality of detectors (2) and a receiver (1). The relay (3) includes a first communication unit (31) and a registration processor (363). The communication unit (31) is configured to perform communication with the plurality of detectors (2) which have been registered with the storage (33). The registration processor (363) is configured to perform a registration process of registering the plurality of detectors (2) with the storage (33). The registration processor (363) registers each of the plurality of detectors (2) with the storage (33) such that the plurality of detectors (2) are sorted according to whether each of the plurality of detectors (2) is a first detector (201) or a second detector (202). The second detector (202) is different from the first detector (201) in terms of a communication protocol.

FIG. 1



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Description

Technical Field

[0001] The present disclosure generally relates to relays, control methods, and programs and specifically relates to a relay for relaying communication between a disaster protection receiver and a detector, and a method and a program for controlling the relay.

Background Art

[0002] JP 2010-41545 A (hereinafter referred to as "Document 1") describes a wireless disaster protection system. In the wireless disaster protection system of Document 1, an uplink radio signal from a wireless detector is relayed by a radio wave relay, and the uplink radio signal is received by a wireless reception relay. With the radio wave relay, slave node ID of another radio wave relay and/or wireless detector compatible with a prescribed network tree-structure is registered. The radio wave relay relays the received uplink radio signal when transmission source ID of the uplink radio signal thus received matches the slave node ID registered with the radio wave relay.

[0003] In the case of a relay such as the wireless reception relay or the radio wave relay described in Document 1, a plurality of types of devices (detectors) compliant with different communication protocols cannot be registered. Therefore, the relay is still susceptible to an improvement in convenience.

Summary of Invention

[0004] In view of the foregoing, an object of the present disclosure is to improve convenience.

[0005] A relay according to an aspect of the present disclosure is configured to relay communication between a receiver and a plurality of detectors. The relay includes a communication unit and a registration processor. The communication unit is configured to communicate with the plurality of detectors which have been registered with a storage. The registration processor is configured to perform a registration process of registering the plurality of detectors with the storage. The registration processor registers each of the plurality of detectors with the storage such that the plurality of detectors are sorted according to whether each of the plurality of detectors is a first detector or a second detector different from the first detector in terms of a communication protocol.

[0006] A control method according to an aspect of the present disclosure is a method for controlling a relay configured to relay communication between a receiver and a plurality of detectors. The relay includes a communication unit configured to communicate with the plurality of detectors which have been registered with a storage. The control method includes a registration process of registering the plurality of detectors with the storage. The registration process includes registering each of the plurality of detectors with the storage such that the plurality of detectors are sorted according to whether each of the plurality of detector is a first detector or a second detector different from the first detector in terms of a communication protocol.

[0007] A program according to an aspect of the present disclosure is configured to cause one or more processors to execute the control method.

Brief Description of Drawings

[0008]

FIG. 1 is a schematic diagram of a configuration of a disaster protection system according to an embodiment;

FIG. 2 is a block diagram of a detector included in the disaster protection system;

FIG. 3 is a block diagram of a receiver included in the disaster protection system;

FIG. 4 is a block diagram of a relay included in the disaster protection system;

FIG. 5 is an example of a list stored in a storage of the relay;

FIG. 6 is an example of a registration number table showing an upper limit of the number of detectors registrable on the list; and

FIG. 7 is a flowchart illustrating operation of the relay included in the disaster protection system.

Description of Embodiments

[0009] A preferable embodiment of the present disclosure will be described in detail below with reference to the drawings. Note that components common in the embodiment described below are denoted by the same reference signs, and duplicate description thereof may be omitted. The embodiment described below is a mere example of various embodiments of the present disclosure. The embodiment may be modified variously depending on design and the like as long as the object of the present disclosure is achieved. The drawings to be referred to in the following description of the embodiment are all schematic representations. That is to say, the ratio of the dimensions (including thicknesses) of respective constituent elements illustrated on the drawings does not always reflect their actual dimensional ratio.

(1) Overview

[0010] As shown in FIG. 1, a relay 3 of the present embodiment is applied to a disaster protection system 100. The disaster protection system 100 is a system for coping with an abnormality (e.g., a disaster) in a facility 90 such as an office building. As used in the present disclosure, "disaster protection" includes, for example, prevention of damage by a disaster such as a fire from

spreading, prevention of a disaster such as a fire, restoration from the disaster, or the like. As used in the present disclosure, "disaster" may include, for example, a fire, gas leakage, earthquake, and water immersion.

[0011] The disaster protection system 100 of the present embodiment is configured as an automatic fire alarm system to be introduced into, in particular, the facility 90. When, for example, detecting the presence of a fire, the automatic fire alarm system notifies a user or the like in the facility 90 of the presence of the fire. The facility 90 may be a theater, a movie theater, a public assembly hall, a recreation hall, a complex facility, a restaurant, a department store, a school, a hotel, an inn, a hospital, a nursing home, a kindergarten, a library, a museum, an art museum, a underground mall, a station, an airport, or a multiple dwelling house, or the like other than the office building.

[0012] As shown in FIG. 1, the disaster protection system 100 includes a receiver (a control panel) 1 and a plurality of detectors 2 in addition to the relay 3.

[0013] Each of the plurality of detectors 2 is installed in the facility 90. The plurality of detectors 2 are installed in different places in the facility 90.

[0014] Each of the plurality of detectors 2 includes a sensor 20 (see FIG. 2) configured to detect a specific physical quantity regarding an abnormality in the facility 90. The specific physical quantity detected by the sensor 20 is, for example, a physical quantity regarding a fire as the abnormality in the facility 90. That is, each of the plurality of detectors 2 is a fire detector.

[0015] Each of the plurality of detectors 2 senses, based on the physical quantity detected by the sensor 20, the presence of a fire, for example, when the magnitude or the change amount (change amount per unit time) of the physical quantity thus detected exceeds a prescribed threshold. Each of the plurality of detectors 2 transmits a fire signal (a signal notifying of the presence of a fire) to the receiver 1 when sensing the presence of the fire.

[0016] Each of the plurality of detectors 2 is either a first detector 201 or a second detector 202. The first detector 201 and the second detector 202 are different from each other in terms of a communication protocol. Each of the plurality of detectors 2 communicates with the receiver 1. Here, each of the plurality of detectors 2 communicates with the receiver 1 via the relay 3. That is, the relay 3 relays communication between the receiver 1 and the plurality of detectors 2. Each of the plurality of detectors 2 transmits the fire signal to the receiver 1 by the communication.

[0017] As shown in FIG. 4, the relay 3 includes a communication unit (a first communication unit) 31 and a registration processor 363.

[0018] The first communication unit 31 communicates with the plurality of detectors 2 which have been registered with a storage 33. The first communication unit 31 is configured to communicate with both the first detector(s) 201 and the second detector(s) 202.

[0019] The registration processor 363 performs a registration process of registering the plurality of detectors 2 with the storage 33. The registration processor 363 registers each of the plurality of detectors 2 with the storage 33 such that the plurality of detectors 2 are sorted according to whether each of the plurality of detectors 2 is the first detector 201 or the second detector 202.

[0020] In the relay 3 of the present embodiment, both the first detector 201 and the second detector 202 which are different from each other in terms of the communication protocol are registrable. This enables convenience (user-friendliness) to be improved.

[0021] Moreover, in the relay 3 of the present embodiment, each of the plurality of detectors 2 is registered such that the plurality of detectors 2 are sorted according to whether each of the plurality of detectors 2 is the first detector 201 or the second detector 202, and therefore, the first detectors 201 and the second detectors 202 are registered while distinguished from each other. Therefore, in the relay 3 of the present embodiment, a registrable number of detectors 2 (registration upper limit) can be increased as compared with the case where the first detectors 201 and the second detectors 202 are registered without being distinguished from each other, which will be described later in detail. This enables the convenience to be further improved.

(2) Details

[0022] A detailed configuration of the disaster protection system 100 including the relay 3 according to the present embodiment will be described below with reference to FIGS. 1 to 6.

(2.1) Overall Structure

[0023] As shown in FIG. 1, the disaster protection system 100 includes the receiver 1, the detectors 2, and the relay 3.

[0024] The receiver 1 and the relay 3 are connected via a transmission line L1 which is of a twowire type. The receiver 1 and the relay 3 perform wired communication via the transmission line L1. The relay 3 and the detector 2 perform wireless communication via a radio wave.

[0025] As shown in FIG. 1, the disaster protection system 100 of the present embodiment includes a plurality of (in the example in FIG. 1, three) relays 3. Moreover, the relays 3 and the plurality of detectors 2 are arranged such that each of the plurality of detectors 2 can wirelessly communicate with a corresponding one of the relays 3.

[0026] The plurality of relays 3 are arranged in a distributed manner, for example, on different floors of the facility 90. In the example in FIG. 1, in an area A1 of a first floor (ground floor) of the facility 90, one (first) relay 3 of the plurality of relays 3 and a plurality of (three) detectors 2 which wirelessly communicate with the first relay 3 are arranged. In the area A1 of the first floor, all of

the three detectors 2 are first detectors 201. Moreover, in the example in FIG. 1, in an area A2 of a second floor of the facility 90, another (second) relay 3 of the plurality of relays 3 and a plurality of (three) detectors 2 which wirelessly communicate with the second relay 3 are disposed. In the area A2 of the second floor, all the three detectors 2 are second detectors 202. Further, in the example in FIG. 1, in an area A3 of a third floor of the facility 90, still another (third) relay 3 of the plurality of relays 3 and a plurality of (three) detectors 2 which wirelessly communicate with the third relay 3 are disposed. In the area A3, two of the three detectors 2 are first detectors 201 and one of the three detectors 2 is a second detector 202.

[0027] The plurality of relays 3 use respective channels different from each other to wirelessly communicate with the detectors 2. Thus, each detector 2 wirelessly communicates with only a corresponding relay 3 of the plurality of relays 3.

[0028] In the following description, of the plurality of relays 3 and the plurality of detectors 2 included in the disaster protection system 100, one relay 3 and a plurality of detectors 2 which wirelessly communicate with the one relay 3 are referred to as a "communication system 10", and description is given focusing on one communication system 10. In the example in FIG. 1, the disaster protection system 100 includes three communication systems 10.

[0029] Note that although not shown in the figure, the disaster protection system 100 further includes, for example, a transmitter, notification devices (regional acoustic devices, light warning devices, emergency broadcasting devices), and an emergency call system. Moreover, the disaster protection system 100 may further include a wired detector configured to perform wired communication with the relay 3.

(2.2) Detector

[0030] As shown in FIG. 2, each detector 2 includes the sensor 20, a communication unit 21, a storage 22, an operating unit 23, and a processor 24.

[0031] The sensor 20 detects a specific physical quantity regarding an abnormality (a fire) in the facility 90. The sensor 20 is, for example, a heat sensor, a smoke sensor, an infrared sensor, or an ultraviolet sensor. The specific physical quantity detected by the sensor 20 is, for example, heat (temperature), smoke (fine particle) concentration, ultraviolet intensity, or infrared intensity. That is, the detector 2 may be a so-called heat detector in which the sensor 20 includes a heat sensor to sense heat (a temperature rise) caused by a fire. The detector 2 may be a so-called smoke detector in which the sensor 20 includes a smoke sensor to sense smoke or a fine burned product caused by a fire. The detector 2 may be a so-called flame detector in which the sensor 20 includes an infrared sensor or an ultraviolet sensor and is configured to sense a flame caused by a fire. The detector 2 may be a so-called complex detector including two or more types of sensors 20, for example, a heat sensor and a smoke sensor each configured to detect a physical quantity. Note that the detector 2 may further include a sensor 20 for sensing an abnormality in the facility other than the fire, such as a gas leakage, earthquake, water immersion or the like.

[0032] The communication unit 21 includes a communication interface for wireless communication with an external device (the relay 3 or another detector 2). The communication unit 21 includes an antenna, a communication circuit, and the like.

[0033] The storage 22 stores various pieces of information. The storage 22 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 22 is not limited to the semiconductor memory but may be, for example, a hard disk drive. The storage 22 may also be used as memory of the processor 24. The storage 22 stores, for example, identification information on the detector 2.

[0034] The operating unit 23 receives an operation input given by a user. The operating unit 23 includes, for example, an operation button to be operated by the user. The operation button includes a registration button for requesting the relay 3 to do registration.

[0035] The processor 24 may be implemented by, for example, a computer system including one or more processors (microprocessors) and one or more memory elements. The one or more processors execute one or more programs stored in the one or more memory elements, thereby functioning as the processor 24. Here, the program(s) is stored in the memory element(s) of the processor 24 in advance but 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 storing the program(s).

[0036] The processor 24 controls operation of the detector 2. As shown in FIG. 2, the processor 24 includes a determination processor 241, a communication processor 242, and a request processor 243. The determination processor 241, the communication processor 242, and the request processor 243 represent functions implemented by the processor 24.

[0037] The determination processor 241 determines, based on the physical quantity (or change amount of the physical quantity) detected by the sensor 20, whether or not an abnormality (fire) has occurred. The determination processor 241 compares the physical quantity thus detected with a threshold, and if the physical quantity is greater than the threshold, the determination processor 241 determines that the abnormality (fire) has occurred.

[0038] When the determination processor 241 determines that the abnormality (fire) has occurred, the communication processor 242 wirelessly transmits a fire signal (a signal notifying of the presence of the fire) from the communication unit 21. The fire signal includes the identification information on the detector 2.

[0039] The request processor 243 performs a process

for requesting the relay 3 to do the registration of the detector 2. For example, when the registration button of the operating unit 23 is pressed, the request processor 243 causes the communication unit 21 to wirelessly transmit a signal (registration request) which requests the registration. The registration request includes the identification information on the detector 2. Moreover, the registration request includes device information on the detector 2 (e.g., information representing whether the detector 2 is a heat detector, a smoke detector, a flame detector, or a complex detector).

[0040] As described above, each detector 2 is either the first detector 201 or the second detector 202. For example, the first detector 201 may be a "new type" detector, and the second detector 202 may be an "old type" detector. The first detector 201 and the second detector 202 are different from each other in terms of, at least, a communication protocol for wireless communication by the communication unit 21. In the following description, for the sake of convenience, a communication protocol in accordance with which the first detector 201 performs wireless communication via the communication unit 21 is referred to also as a "first communication protocol", and a communication protocol in accordance with which the second detector 202 performs wireless communication via the communication unit 21 is referred to also as a "second communication protocol".

[0041] In the disaster protection system 100 of the present embodiment, data traffic per unit time of the communication in accordance with the first communication protocol is lower than data traffic per unit time of the communication in accordance with the second communication protocol. Therefore, the first detector 201 can communicate with the relay 3 at a higher speed than the second detector 202.

[0042] The first detector 201 and the second detector 202 may have the same configuration except for the communication protocol or may include different components. For example, the first detector 201 may have a function which the second detector 202 does not have. In the present embodiment, the first detector 201 has a multi-hop communication function as the function which the second detector 202 does not have. For example, when the detectors 2 included in the communication system 10 are all first detectors 201 (see the area A1 of the first floor in FIG. 1), a mesh-type network is configured in the communication system 10. On the other hand, when the communication system 10 includes one or more second detectors 202 (see the area A2 of the second floor and the area A3 of the third floor of FIG. 1), a star-type network in which the relay 3 serves as a hub is configured in the communication system 10.

(2.3) Receiver

[0043] As shown in FIG. 3, the receiver 1 includes a communication unit 11, a display unit 12, an operating unit 13, a voice input 14, a sound output 15, and a processor 16.

[0044] The communication unit 11 includes a communication interface for wired communication, and the communication interface is connected to the transmission line L1. The communication unit 11 is connected to the plurality of relays 3 via the transmission line L1. The receiver 1 may include a communication interface for wired or wireless communication, and the communication interface is connected to, for example, an external server.

[0045] The display unit 12 includes, for example, a liquid crystal panel display, an indicator, or a 7-segment display. The display unit 12 is configured to display various pieces of information. The display unit 12 displays, for example, a place in a facility 90 where a detector 2 which has transmitted a fire signal to the receiver 1 is installed, and information regarding the fire signal.

[0046] The operating unit 13 includes various devices for receiving the input operations given by a user (an administrator of the facility 90) of the disaster protection system 100. The operating unit 13 includes, for example, various switches (button switches, dip switches, etc.) and a touch panel integrated with the display of the display unit 12.

[0047] The voice input 14 receives an input of a sound of a surrounding environment. The voice input 14 includes, for example, a microphone and receives an input of a voice of a user (an administrator of the facility 90) of the disaster protection system 100. The voice input to the voice input 14 is output, for example, from a loudspeaker of the emergency broadcasting devices installed in various places in the facility 90.

[0048] The sound output 15 includes, for example, a loudspeaker and outputs various sounds. The sound output 15 outputs, for example, an artificial voice, a beep, or the like stored in memory in response to reception of the fire signal from a detector 2.

[0049] The processor 16 controls operation of the receiver 1. The processor 16 controls operation of the communication unit 11, the display unit 12, the operating unit 13, the voice input 14, and the sound output 15. The processor 16 may be implemented by, for example, a computer system including one or more processors (microprocessors) and one or more memory elements. The one or more processors execute one or more programs stored in the one or more memory elements, thereby functioning as the processor 16. Here, the program(s) is stored in the memory element(s) of the processor 16 in advance but 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 storing the program(s).

(2.4) Relay

[0050] As shown in FIG. 4, the relay 3 includes a housing 30 (see FIG. 1), the first communication unit 31, a second communication unit 32, the storage 33, an operating unit 34, a presentation unit 35, and a processor 36.

[0051] The housing 30 holds the first communication unit 31, the second communication unit 32, the storage 33, the operating unit 34, the presentation unit 35, and the processor 36.

[0052] The first communication unit 31 includes a communication interface for wireless communication with the external device (detector 2). The first communication unit 31 includes an antenna, a communication circuit, and the like.

[0053] The second communication unit 32 includes a communication interface for wired communication, and the communication interface is connected to the transmission line L1. The second communication unit 32 is connected to the receiver 1 via the transmission line L1.

[0054] The storage 33 stores various pieces of information. The storage 33 is semiconductor memory such as ROM, RAM, or EEPROM. Note that the storage 33 is not limited to the semiconductor memory but may be, for example, a hard disk drive. The storage 33 may be used also as memory of the processor 36.

[0055] The storage 33 includes an area (registration area) for storing pieces of information on the detectors 2 which have been registered. In the registration area, pieces of registration information on a plurality of detectors 2 are registrable. In the relay 3 of the present embodiment, pieces of registration information on 32 detectors 2 at maximum are registrable in the registration area.

[0056] As shown in FIG. 5, the storage 33 of the relay 3 stores, in the registration area, pieces of information (registration information) on the plurality of detectors 2 in the form of a list 300. That is, in the relay 3, both the first detector 201 and the second detector 202 are registered on one list 300 included in a single storage 33. This enables the proportion of the registration area in the storage 33 to be reduced.

[0057] In the example shown in FIG. 5, a plurality of (five) first detectors 201 and a plurality of (four) second detectors 202 have been registered on the list 300 on which 32 detectors 2 are registrable at maximum. Note that in FIG. 5, the plurality of (five) first detectors 201 which have been registered on the list 300 are distinguished from each other by symbols "Ax (x is an integer greater than or equal to 1)" added thereto. Moreover, the plurality of (four) second detectors 202 which have been registered on the list 300 are distinguished from each other by symbols "By (y is an integer greater than or equal to 1)" added thereto.

[0058] The operating unit 34 receives an operation input given by a user. The operating unit 34 includes, for example, an operation switch to which an operation is given by a user. The operation switch includes a changeover switch for switching the operation mode of the processor 36 between a registration mode and a normal mode.

[0059] The presentation unit 35 presents information to a user. The presentation unit 35 may include at least one of, for example, a light emission part (e.g., LED) configured to present the information to the user by light, a sound output (e.g., a loudspeaker) configured to present the information to the user by voice, or a display unit (e.g., a display) configured to present the information to the user by displaying a character or diagram.

[0060] The processor 36 may be implemented by, for example, a computer system including one or more processors (microprocessors) and one or more memory elements. The one or more processors execute one or more programs stored in the one or more memory elements, thereby functioning as the processor 36. Here, the program(s) is stored in the memory element(s) of the processor 36 in advance but 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 storing the program(s).

[0061] The processor 36 controls operation of the relay 3. As shown in FIG. 4, the processor 36 includes a switching processor 361, a normal mode processor 362, the registration processor 363, an identification processor 364, a decision processor 365, an announcement processor 366, a setting processor 367, and a confirmation processor 368. The switching processor 361, the normal mode processor 362, the registration processor 363, the identification processor 364, the decision processor 365, the announcement processor 366, the setting processor 367, and the confirmation processor 368 represent functions implemented by the processor 36.

[0062] The switching processor 361 performs a switching process of switching the processor 36 between operation modes. The switching processor 361 switches the operation mode of the processor 36 between the registration mode and the normal mode in accordance with an operation given to the changeover switch by a user. The registration mode is a mode for registering the detectors 2 with the relay 3. The normal mode is a mode for performing wireless communication with the detectors 2 thus registered to transfer, to the receiver 1, a fire signal transmitted from one of the detectors 2 when detecting the occurrence of an abnormality (disaster) in the facility 90, thereby providing disaster protection. Of the functions of the processor 36, the normal mode processor 362 is a function which operates in the normal mode of the processor 36. Of the functions of the processor 36, the functions of the registration processor 363, the identification processor 364, the decision processor 365, the announcement processor 366, and the setting processor 367 are functions which operate in the registration mode of the processor 36. Of the functions of the processor 36, the confirmation processor 368 is a function which operates at the time of switching from the registration mode to the normal mode.

[0063] The normal mode processor 362 controls the operation of the relay 3 in the normal mode. For example, the normal mode processor 362 causes the first communication unit 31 to receive a fire signal from one of the detectors 2 which have been registered, and the normal mode processor 362 causes the second communication unit 32 to transmit the fire signal to the receiver 1. The

normal mode processor 362 causes, regularly, or in response to a request from the receiver 1, the first communication unit 31 to transmit a confirmation signal as an alive check signal to each detector 2, and the normal mode processor 362 causes the first communication unit 31 to receive a response signal from each detector 2.

[0064] The registration processor 363 performs a registration process of registering the detectors 2 with the storage 33 (registration area). In the relay 3, in response to the reception of a registration request from a detector 2 in the registration mode, the decision processor 365 decides whether or not registering the detector 2 be possible. If the decision processor 365 decides that the registering of the detector 2 be possible, the registration processor 363 performs the registration process of the detector 2. Note that if the decision processor 365 decides that the registering of the detector 2 be impossible, the registration processor 363 forgoes the registration process. Moreover, the registration processor 363 forgoes the registration process also when the registration processor 363 receives the registration request from the detector 2 in the normal mode.

[0065] The registration processor 363 stores the registration information on the detector 2 in the storage 33 (registration area), thereby registering the detector 2. The registration information includes identification information and device information on the detector 2 which are included in the registration request, a registration date, and the like. The registration date includes the date, the month, and the year when the detector 2 is registered with the storage 33. Moreover, when the registration processor 363 registers the registration information, the registration processor 363 transmits a signal (registration acceptance) representing acceptance of the registration from the first communication unit 31 to the detector 2. The registration acceptance may include information on the registration number in the list 300 (see FIG. 5) on which the detector 2 has been registered.

[0066] As described above, the registration processor 363 registers detectors 2 with the storage 33 by distinguishing whether each of the detectors 2 is the first detectors 201 or the second detectors 202. When the registration processor 363 performs the registration process of a detector 2, the registration processor 363 registers the detector 2 such that whether the detector 2 is the first detector 201 or the second detector 202 is distinguishable.

[0067] Moreover, the registration processor 363 registers each of the plurality of detectors 2 with the storage 33 in the registration process such that the plurality of detectors 2 are sorted according to whether a detector in question 2 is the first detectors 201 or the second detectors 202. That is, the registration processor 363 registers the plurality of detectors 2 such that a group of the first detectors 201 and a group of the second detectors 202 are separated from each other in the registration area of the storage 33 (e.g., area(s) in which the first detectors 201 are registered and area(s) in which the second detectors 202 are registered are not mixed with each other).

[0068] In particular, for the detectors 2 used in the disaster protection system 100, the second detectors 202 which are of old-type are assumed to eventually be replaced with the first detectors 201 which are of new type. In such a case, registering the detectors such that the detectors are sorted according to whether a detector in question is the first detectors 201 or the second detectors 202 in advance facilitates a replacement process.

[0069] In the relay 3 of the present embodiment, the registration processor 363 causes the pieces of information (registration information) on the first detectors 201 to be stored in order from one end (first end) of the list 300 (see FIG. 5) and the pieces of information (registration information) on the second detectors 202 to be stored in order from the other end (second end) of the list 300 in the registration process. This enables the first detectors 201 and the second detectors 202 to be registered on the one list 300 while they are sorted.

[0070] Referring to the example shown in FIG. 5, a further detailed description will be given. The registration processor 363 registers the first detectors 201 in order from the last (32nd) field of the list 300. Moreover, the registration processor 363 registers the second detectors 202 in order from the first (1st) field of the list 300. In a registration state shown in FIG. 5, if the registration processor 363 receives a registration request newly given by a first detector 201 which has not registered, the registration processor 363 registers the first detector 201 in a 27th field of the list 300. Further, in the registration state shown in FIG. 5, if the registration processor 363 receives a registration request newly given by a second detector 202 which has not registered, the registration processor 363 registers the second detector 202 in a 5th field of the list 300.

[0071] The registration processor 363 further performs a deletion process of a detector 2 which has been registered. For example, when the registration processor 363 receives a signal (deletion request) requesting deletion of the registration from the detector 2 which has been registered in the registration mode, the registration processor 363 deletes the registration information on the detector 2 from the registration area (the list 300) of the storage 33. Thus, the field of the detector 2 which has been deleted from the list 300 enters a "null" state. In particular, deleting the registration of a first detector 201, other than a first detector 201 which has last been registered, of the plurality of first detectors 201 (e.g., deleting the first detector 201 denoted by "A3" in the example shown in FIG. 5) leaves an "empty space" in an area in which first detectors 201 are registered on the list 300. In this case, to eliminate the empty space, the registration processor 363 may shift, in terms of the registration number, first detector(s) 201 which have been registered. For example, when the first detector 201 denoted by "A3" in the example shown in FIG. 5 is deleted and thus the field of the registration number "30" enters the "null" state,

the registration processor 363 may move the registration information on the first detector 201 denoted by "A4" to the field of the registration number "30" and then move the registration information on the first detector 201 denoted by "A5" to the field of the registration number "29". The same applies to the case of the deletion process of the second detector 202.

[0072] The identification processor 364 performs an identification process. In the identification process, the identification processor 364 identifies the number of first detectors 201 registered with the storage 33 and the number of second detectors 202 registered with the storage 33. The identification processor 364 identifies, based on the list 300 of the storage 33, the number of first detectors 201 which have been registered and the number of second detectors 202 which have been registered. In the relay 3 of the present embodiment, the registered number of first detectors 201 is easily identifiable based on a boundary between a field in which a first detector 201 has been registered and a column which is "null" in the list 300, except for the case of registration up to the registration upper limit (i.e., except for the case where 32 detectors have been registered). Moreover, based on a boundary between a field in which a second detector 202 has been registered and a column which is "null" in the list 300, the registered number of second detectors 202 is easily identifiable. That is, in the relay 3 of the present embodiment, even when the storage 33 includes no storage area dedicated for storing the registered number of first detectors 201 and the registered number of second detectors 202, the number of first detectors 201 which have been registered and the number of second detectors 202 which have been registered are easily identifiable. However, this should not be construed as limiting, but the storage 33 may include a storage area dedicated for storing the registered number of first detectors 201 and the registered number of second detectors 202 (storage area for the number of detectors), and based on information stored in the storage area for the number of detectors, the identification processor 364 may identify the registered number of first detectors 201 and the registered number of second detectors 202.

[0073] The decision processor 365 decides whether or not further registering a detector 2 be possible. The decision processor 365 decides, based on the registered number of detectors 2, whether or not the further registering of the detector 2 be possible. As used herein, "the registered number" is the number of detectors 2 registered with the storage 33 and is the sum of the number of first detectors 201 registered with the storage 33 and the number of second detectors 202 registered with the storage 33.

[0074] Specifically, the decision processor 365 performs a decision process (first decision process). In the first decision process, the decision processor 365 decides, based on the number of first detectors 201 registered with the storage 33 and the number of second detectors 202 registered with the storage 33, whether or not the registered number have reached the registration upper limit. As used in the present disclosure, the "registration upper limit" is an upper limit of the number of detectors 2 registrable with the storage 33 of the relay 3. In the first decision process, the decision processor 365 decides, based on the registered number of first detectors 201 and the registered number of second detectors 202 identified by the identification processor 364, whether or not the registered number have reached the registration upper limit. The decision processor 365 performs the first decision process, for example, each time the registration of a new detector 2 is completed.

[0075] Here, in the relay 3 of the present embodiment, the registration upper limit changes in accordance with the number of second detectors 202 registered with the storage 33 (list 300). This is because data traffic per unit time of communication with the second detector 202 in accordance with the second communication protocol is higher than data traffic per unit time of communication with the first detector 201 in accordance with the first communication protocol, and an increased number of second detectors 202 compresses an available communication capacity per unit time (the amount of data transmittable and receivable per unit time) of the first communication unit 31. FIG. 6 shows an example of a registration number table 310 showing the relationship of the number (registrable number) of first detectors 201 which are registrable to the number (registered number) of second detectors 202 which have been registered. In the example shown in FIG. 6, when the registered number of second detectors 202 is 10 or less, a total of up to 32 detectors 2 are registrable. On the other hand, when the registered number of second detectors 202 exceeds 10, the registration upper limit decreases, as the registered number of the second detectors 202 increases. Note that in the example shown in FIG. 6, it is not possible to register 17 or more second detectors 202. In sum, the processor 36 includes the setting processor 367 configured to perform a setting process of setting the registration upper limit. In the setting process, the setting processor 367 changes the registration upper limit in accordance with the number of second detectors 202 registered with the storage 33. The setting processor 367 changes, with reference to the registration number table 310 in FIG. 6, the registration upper limit in accordance with the number of second detectors 202 which have been registered.

[0076] The decision processor 365 decides, in the first decision process, for example, whether or not a combination of the registered number of first detectors 201 and the registered number of second detectors 202 correspond to any of rows in the registration number table 310 in FIG. 6, and if the combination corresponds to one of the rows, the decision processor 365 decides that the registered number have reached the registration upper limit.

[0077] The decision processor 365 performs the first decision process, thereby suppressing a larger number of detectors 2 than the registration upper limit from being

registered, and, for example, the return of registration (reregistration) can be prevented.

[0078] Moreover, the decision processor 365 performs a decision process (second decision process). In the second decision process, when registration of a new detector 2 is requested, the decision processor 365 decides whether or not the registered number exceed the registration upper limit if the new detector 2 is registered. The decision processor 365 performs the second decision process, for example, each time registration is newly requested by a detector 2.

[0079] In the example shown in FIG. 6, for example, when registration is requested by a new detector 2 in a state where two second detectors 202 and 30 first detectors 201 have been registered, the decision processor 365 decides that the registered number (33 devices) exceed the registration upper limit (32 devices) in each case where the new detector 2 is the first detector 201 and the second detector 202. In another example, when registration is requested by a second detector 202 in a state where 12 second detectors 202 and 14 first detectors 201 have been registered, the decision processor 365 decide that the registered number will exceed the registration upper limit because if the second detector 202 were newly registered, the registered number would exceed the registration upper limit (23 devices) for the case where 13 second detectors 202 be registered. In contrast, for example, when registration is requested by a first detector 201 in the state where 12 second detectors 202 and 14 first detectors 201 have been registered, the decision processor 365 decide that the registered number should not exceed the registration upper limit because even when the first detector 201 is newly registered, the registered number does not exceed the registration upper limit (27 devices) for the case where 12 second detectors 202 be registered.

[0080] The decision processor 365 performs the second decision process, thereby suppressing a larger number of detectors 2 than the registration upper limit from being registered, and, for example, return of registration (reregistration) can be prevented.

[0081] Note that the decision processor 365 may decide, further based on information other than the registered number of detectors 2, whether or not further registering a detector 2 be possible. For example, when receiving a registration request from a detector 2 which has already been registered with the storage 33, the decision processor 365 may decide that the registering of the detector 2 be impossible. Moreover, when reception signal strength is less than or equal to a threshold, the decision processor 365 may decide that the registering of the detector 2 be impossible. Moreover when the decision processor 365 communicates with another relay 3 and finds that the detector 2 has been registered with this another relay 3, the decision processor 365 may decide that the registering of the detector 2 be impossible.

[0082] When it is decided that further registering a detector 2 be impossible, the announcement processor 366 performs an announcement process. Specifically, the announcement processor 366 performs the announcement process when it is decided by the decision processor 365 (in the first decision process) that the registered number have reached the registration upper limit. Moreover, the announcement processor 366 performs the announcement process when it is decided by the decision processor 365 (in the second decision process) that the registered number exceed the registration upper limit.

[0083] The announcement processor 366 controls the presentation unit 35 included in the relay 3 to cause the presentation unit 35 to present, to a user, that the registered number has reached the registration upper limit or that the registered number exceeds the registration upper limit. In other words, the presentation unit 35 presents prescribed information (that the registered number has reached the registration upper limit or that the registered number exceeds the registration upper limit) to a user in accordance with the announcement process performed by the announcement processor 366. For example, the notification processor 366 may turn on any of a plurality of light emission parts included in the presentation unit 35, thereby causing the presentation unit 35 to present, to a user, that the registered number has reached the registration upper limit or that the registered number exceeds the registration upper limit. The announcement processor 366 may cause, for example, a loudspeaker of the presentation unit 35 to output that the registered number has reached the registration upper limit or that the registered number exceeds the registration upper limit by voice (e.g., messages such as "the registered number has reached the upper limit", or "this detector cannot be registered"). The announcement processor 366 may cause, for example, a display of the presentation unit 35 to display that the registered number has reached the registration upper limit or that the registered number exceeds the registration upper limit. Since the relay 3 presents, to a user, that the registered number has reached the registration upper limit or that the registered number exceeds the registration upper limit, the user can immediately deal with a situation.

[0084] Moreover, the announcement process may include a transmission process of transmitting a signal for causing another device to announce the prescribed information (that the registered number has reached the registration upper limit or that the registered number exceeds the registration upper limit). That is, the announcement processor 366 performs a transmission process of transmitting a signal for causing another device to announce the prescribed information. The another device may be, for example, the receiver 1 or a detector 2. However, this should not be construed as limiting, but the another device may be, for example, an information appliance (a smartphone, a laptop computer, etc.) which a user carries or, a server. Since the another device presents, to a user, that the registered number has reached the registration upper limit or that the registered number exceeds the registration upper limit, the user can

immediately deal with a situation.

[0085] The confirmation processor 368 performs a confirmation of communication with detectors 2 registered with the storage 33 when the registration mode is switched to the normal mode. In the relay 3 of the present embodiment, when the detectors 2 registered with the storage 33 include at least one second detector 202, the confirmation processor 368 confirms that direct wireless communication (with a hop count of 0) is possible with all the detectors 2 which have been registered. When the detectors 2 registered with the storage 33 are all first detectors 201, the confirmation processor 368 causes the plurality of detectors 2 (first detectors 201) to perform a route search to confirm that wireless communication is possible with all the detectors 2 by multi-hop communication.

[0086] Thus, in the relay 3 of the present embodiment, both the first detectors 201 and the second detectors 202 which are different from the first detectors 201 in terms of the communication protocol can be registered. This enables convenience to be improved.

[0087] Moreover, in the relay 3 of the present embodiment, both the first detectors 201 and the second detectors 202 are registered on a single list 300, and therefore, the proportion of the registration area occupying the storage 33 can be reduced. This enables convenience to be further improved.

[0088] Moreover, in the relay 3 of the present embodiment, the plurality of detectors 2 are sorted according to whether each of the detectors 2 is the first detector 201 or the second detector 202, and thereby, the first detectors 201 and the second detectors 202 are registered while distinguished from each other. Here, in a relay of a comparative example in which the first detectors 201 and the second detectors 202 are registered without being distinguished from each other, the registration upper limit of the detectors 2 is limited to the registrable number of second detectors 202 (in the example shown in FIG. 6, 16). In contrast, in the relay 3 of the present embodiment, the first detectors 201 and the second detectors 202 are registered while distinguished from each other, thereby increasing the registration upper limit of the detectors 2 as compared with the relay of the comparative example. This enables convenience to be further improved.

(3) Operation Example

[0089] Operation of the relay 3 of the present embodiment at the time of registering a detector 2 will be described with reference to FIG. 7.

[0090] When the processor 36 of the relay 3 transitions to the registration mode in response to an operation given to a changeover switch (ST1), the processor 36 waits for a registration request from a detector 2 (ST2).

[0091] In the registration mode, when receiving the registration request from the detector 2 (ST2: Yes), the processor 36 decides whether the detector 2 which has transmitted the registration request be the first detector 201 or the second detector 202 (ST3).

[0092] If the detector 2 is the first detector 201 (ST3: Yes), the processor 36 (decision processor 365) decides whether or not the registered number exceed the registration upper limit if the first detector 201 is newly registered (ST4). If the registered number does not exceed the registration upper limit (ST4: No), the processor 36 (registration processor 363) registers the first detector 201 in a "null" field closest to the first end (in the example shown in FIG. 5, the lower end) in the list 300 (ST5) and transmits a registration acceptance to the first detector 201. After the registration, the processor 36 (decision processor 365) decides whether or not the registered number have reached the registration upper limit (ST6). If the registered number has not reached the registration upper limit (ST6: No), the processor 36 proceeds to step ST13. In contrast, if the registered number has reached the registration upper limit (ST6: Yes), the processor 36 announce that the registered number has reached the registration upper limit (ST7) and proceeds to step ST13. Note that in step ST4, if the registered number exceeds the registration upper limit (ST4: Yes), the processor 36 announces that the registration is impossible (ST8) without registering the first detector 201, and the processor 36 proceeds to step ST13.

[0093] In step ST3, if the detector 2 is the second detector 202 (ST3: No), the processor 36 (decision processor 365) decides whether or not the registered number exceed the registration upper limit if the second detector 202 is newly registered (ST9). If the registered number does not exceed the registration upper limit (ST9: No), the processor 36 (registration processor 363) registers the second detector 202 in a "null" column closest to the second end (in the example shown in FIG. 5, the upper end) in the list 300 (ST10) and transmits a registration acceptance to the second detector 202. After the registration, the processor 36 (decision processor 365) decides whether or not the registered number have reached the registration upper limit (ST11). If the registered number has not reached the registration upper limit (ST11: No), the processor 36 proceeds to step ST13. In contrast, if the registered number has reached the registration upper limit (ST11: Yes), the processor 36 announces that the registered number has reached the registration upper limit (ST12) and proceeds to step ST13. Note that in step ST9, if the registered number exceeds the registration upper limit (ST9: Yes), the processor 36 announces that the registration is impossible (ST8) without registering the second detector 202 and proceeds to step ST13.

[0094] In step ST13, the processor 36 decides whether or not an operation have been given to the changeover switch, and if no operation has been given (ST13: No), the processor 36 continues operating in the registration mode, returns to step ST2, and waits for a registration request.

[0095] If the operation has been given to the change-

over switch (ST13: Yes), the processor 36 switches the operation mode from the registration mode to the normal mode and confirms that communication with all the detectors 2 which have been registered is possible (ST14). When the detectors 2 which have been registered include at least one second detector 202, the processor 36 (confirmation processor 368) confirms that direct wireless communication is possible with all the detectors 2. When the detectors 2 which have been registered are all first detectors 201, the processor 36 (confirmation processor 368) confirms that wireless communication is possible with all the detectors 2 by multi-hop communication. Note that if communication with one or more detectors 2 is impossible in step ST14, the relay 3 may notify a user that the communication is impossible with one or more detectors 2.

[0096] Note that the flowchart shown in FIG. 7 is a mere example, and the order of steps may accordingly be changed, or a process(es) may accordingly be added or deleted.

[0097] For example, the processor 36 may give any announcement even when the registered number has not reached the registration upper limit in step ST6 or ST11 (ST6: No, ST11: No). Examples of the announcement include an audio output or display of information (e.g., a message saying that "X more devices can be registered if the devices are new type detectors, and Y more devices can be registered if the devices are old type detectors") representing the remaining registrable number of detectors.

(4) Variations

[0098] The above-described embodiment is a mere example of various embodiments of the present disclosure. The above-described embodiment may be modified variously depending on design and the like as long as the object of the present disclosure is achieved. Variations of the above-described embodiment will be described below. Any of the variations to be described below may be combined as appropriate.

[0099] Each of the processor 16 of the receiver 1, the processor 24 of the detector 2, and the processor 36 of the relay 3 of the present disclosure includes a computer system. The computer system may include a processor and a memory as principal hardware components thereof. The processor executes a program stored in the memory of the computer system, thereby implementing a function as each of the processors 16, 24, and 36 in the present disclosure. The program may be stored in advance in the memory of the computer system. Alternatively, the program may also be downloaded over a telecommunications network 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 made up of 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.

[0100] Also, in the embodiment described above, the plurality of functions of each of the processors 16, 24, and 36 are aggregated together in a single housing. However, this is not an essential configuration for each of the processors 16, 24, and 36. Alternatively, those constituent elements of each of the processors 16, 24, and 36 may be distributed in multiple different housings. Conversely, the plurality of functions of each of the processors 16, 24, and 36 may be aggregated together in a single housing. Still alternatively, at least some functions of each of the processors 16, 24, and 36 may be implemented as a cloud computing system, for example.

[0101] In a variation, the processor 24 of the detector 2 does not have to include the determination processor 241. In this case, for example, the receiver 1 may have a function as the determination processor 241, the detector 2 may transmit a physical quantity detected by the sensor 20 to the receiver 1 via the relay 3, and the receiver 1 may determine, based on the physical quantity thus received, the occurrence of an abnormality (e.g., a fire).

[0102] In a variation, the detector 2 may include a notifier configured to give notification when an abnormality (fire) occurs. The notifier may include, for example, a light emission part, such as an LED, and/or a loudspeaker, and based on an instruction from the processor 24, notification of the occurrence of an abnormality (fire) may be given by light and/or sound.

[0103] In a variation, the receiver 1 and the relay 3 may be configured to perform wireless communication via a radio wave.

[0104] In a variation, when the relay 3 receives a registration request from a detector 2 in the normal mode, the relay 3 may perform the announcement process.

[0105] In a variation, even when an "empty space" results from the deletion process, the registration processor 363 may leave the empty space as it is. In this case,

when the registration processor 363 next receives a registration request from a new detector 2, the registration processor 363 may register the registration information on the new detector 2 in the "empty space" portion. For example, in the example shown in FIG. 5, deleting the first detector 201 denoted by "A3" results in the column of the registration number "30" being in the "null" state, the registration processor 363 maintains the column of the registration number "30" in the "null" state. Then, in response to a registration request from a new first detector 201 (referred to as a first detector 201 denoted by "AX"), registration information on the first detector 201 denoted by "AX" may be registered in the column of the registration number "30".

(4) Aspects

[0106] As described above, a relay (3) of a first aspect of the present disclosure is configured to relay communication between a receiver (1) and a plurality of detectors (2). The relay (3) includes a communication unit (31) and a registration processor (363). The communication unit (31) is configured to communicate with the plurality of detectors (2) which have been registered with a storage (33). The registration processor (363) is configured to perform a registration process of registering the plurality of detectors (2) with the storage (33). The registration processor (363) registers each of the plurality of detectors (2) with the storage (33) such that the plurality of detectors (2) are sorted according to whether each of the plurality of detectors (2) is a first detector (201) or a second detector (202). The second detector (202) is different from the first detector (201) in terms of a communication protocol.

[0107] This aspect enables convenience to be improved.

[0108] A relay (3) of a second aspect of the present disclosure referring to the first aspect further includes an identification processor (364). The identification processor (364) is configured to identify the number of first detectors (201) which have been registered with the storage (33) and the number of second detectors (202) which have been registered with the storage (33).

[0109] With this aspect, the number of the first detectors (201) which have been registered and the number of the second detectors (202) which have been registered can be identified, thereby enabling convenience to be improved.

[0110] A relay (3) of a third aspect of the present disclosure referring to the first or second aspect further includes a decision processor (365). The decision processor (365) is configured to decide, based on the number of first detectors (201) which have been registered with the storage (33) and the number of second detectors (202) which have been registered with the storage (33), whether or not a registered number have reached a registration upper limit (first decision process). The registered number is the number of plurality of detectors (2) registered with the storage (33).

[0111] This aspect suppresses a larger number of detectors (2) than the registration upper limit from being registered, thereby enabling convenience to be improved.

[0112] A relay (3) of a fourth aspect of the present disclosure referring to the third aspect further includes an announcement processor (366). The announcement processor (366) is configured to perform an announcement process when the decision processor (365) decides that the registered number have reached the registration upper limit.

[0113] With this aspect, a user can immediately deal with a situation, thereby enabling convenience to be improved.

[0114] A relay (3) of a fifth aspect of the present disclosure referring to any one of the first to fourth aspects further includes a decision processor (365) and an announcement processor (366). The decision processor (365) is configured to decide, when registration of a new detector (2) is requested, whether or not registering of the new detector (2) result in a registered number exceeding a registration upper limit (second decision process). The registered number is the number of detectors (2) registered with the storage (33). The announcement processor (366) is configured to perform an announcement process when the decision processor (365) decides that the registered number exceed the registration upper limit.

[0115] This aspect suppresses a larger number of detectors (2) than the registration upper limit from being registered, thereby enabling convenience to be improved.

[0116] A relay (3) of a sixth aspect of the present disclosure referring to the fourth or fifth aspect further includes a presentation unit (35). The presentation unit (35) is configured to present prescribed information to a user in accordance with the announcement process performed by the announcement processor (366).

[0117] With this aspect, a user can immediately deal with a situation, thereby enabling convenience to be improved.

[0118] In a relay (3) of a seventh aspect of the present disclosure referring to any one of the fourth to sixth aspects, the announcement process includes a transmission process of transmitting a signal for causing another device to announce prescribed information.

[0119] With this aspect, a user can immediately deal with a situation, thereby enabling convenience to be improved.

[0120] A relay (3) of an eighth aspect of the present disclosure referring to any one of the third to seventh aspects further includes a setting processor (367). The setting processor (367) is configured to set the registration upper limit. The setting processor (367) is configured to change the registration upper limit in accordance with the number of the second detectors (202) which have been registered with the storage (33).

[0121] This aspect enables convenience to be improved.

[0122] In a relay (3) of a ninth aspect of the present disclosure referring to any one of the first to eighth aspects, the storage (33) is configured to store pieces of information on the plurality of detectors (2) in a form of a list (300). The registration processor (363) is configured to, in the registration process, store pieces of information on the first detectors (201) in order from a first end (one end) of the list (300) and store pieces of information on the second detectors (202) in order from a second end (the other end) of the list (300).

[0123] This aspect enables the first detectors (201) and the second detectors (202) to be distinguished from each other while both the first detectors (201) and the second detectors (202) are registered on the one list (300).

[0124] A control method of a tenth aspect is a method for controlling a relay (3) configured to relay communication between a receiver (1) and a plurality of detectors (2). The relay (3) includes a communication unit (31) configured to communicate with the plurality of detectors (2) which have been registered with a storage (33). The control method includes a registration process of registering the plurality of detectors (2) with the storage (33). The registration process includes registering each of the plurality of detectors (2) with the storage (33) such that the plurality of detectors (2) are sorted according to whether each of the plurality of detectors (2) is a first detector (201) or a second detector (202). The second detector (202) is different from the first detector (201) in terms of a communication protocol.

[0125] This aspect enables convenience to be improved.

[0126] A program of an eleventh aspect is configured to cause one or more processors to execute the control method of the tenth aspect.

Reference Signs List

[0127]

1	Receiver
2	Detector
201	First Detector
202	Second Detector
3	Relay
31	Communication Unit (First Communication Unit)
33	Storage
35	Presentation Unit
363	Registration Processor
364	Identification Processor
365	Decision processor
366	Announcement Processor
367	Setting Processor
300	List

Claims

1. A relay (3) configured to relay communication between a receiver (1) and a plurality of detectors (2), the relay (3) comprising:

a communication unit (31) configured to communicate with the plurality of detectors (2) which have been registered with a storage (33); and
a registration processor (363) configured to perform a registration process of registering the plurality of detectors (2) with the storage (33),
the registration processor (363) registering each of the plurality of detectors (2) with the storage (33) such that the plurality of detectors (2) are sorted according to whether each of the plurality of detectors (2) is a first detector (201) or a second detector (202) different from the first detector (201) in terms of a communication protocol.

2. The relay (3) of claim 1, further comprising an identification processor (364) configured to identify a number of the first detectors (201) which have been registered with the storage (33) and a number of the second detectors (202) which have been registered with the storage (33).

3. The relay (3) of claim 1 or 2, further comprising a decision processor (365) configured to decide, based on a number of the first detectors (201) which have been registered with the storage (33) and a number of the second detectors (202) which have been registered with the storage (33), whether or not a registered number have reached a registration upper limit, the registered number being a number of the plurality of detectors (2) registered with the storage (33).

4. The relay (3) of claim 3, further comprising an announcement processor (366) configured to perform an announcement process when the decision processor (365) decides that the registered number have reached the registration upper limit.

5. The relay (3) of any one of claims 1 to 4, further comprising:

a decision processor (365) configured to decide, when registration of a new detector (2) is requested, whether or not registering of the new detector (2) result in a registered number exceeding a registration upper limit, the registered number being a number of detectors (2) registered with the storage (33); and
an announcement processor (366) configured to perform an announcement process when the decision processor (365) decides that the registered number exceed the registration upper

limit.

6. The relay (3) of claim 4 or 5, further comprising a presentation unit (35) configured to present prescribed information to a user in accordance with the announcement process performed by the announcement processor (366).

7. The relay (3) of any one of claims 4 to 6, wherein
the announcement process includes a transmission process of transmitting a signal for causing another device to announce prescribed information.

8. The relay (3) of any one of claims 3 to 7, further comprising a setting processor (367) configured to set the registration upper limit, wherein
the setting processor (367) is configured to change the registration upper limit in accordance with the number of the second detectors (202) which have been registered with the storage (33).

9. The relay (3) of any one of claims 1 to 8, wherein

the storage (33) is configured to store pieces of information on the plurality of detectors (2) in a form of a list (300),
the registration processor (363) is configured to, in the registration process,

store pieces of information on the first detectors (201) in order from a first end of the list (300) and
store pieces of information on the second detectors (202) in order from a second end of the list (300).

10. A control method of a relay (3) configured to relay communication between a receiver (1) and a plurality of detectors (2), the relay (3) including a communication unit (31) configured to communicate with the plurality of detectors (2) which have been registered with a storage (33), the control method comprising

a registration process of registering the plurality of detectors (2) with the storage (33),
the registration process including registering each of the plurality of detectors (2) with the storage (33) such that the plurality of detectors (2) are sorted according to whether each of the plurality of detectors (2) is a first detector (201) or a second detector (202) different from the first detector (201) in terms of a communication protocol.

11. A program configured to cause one or more processors to execute the control method of claim 10.

FIG. 1

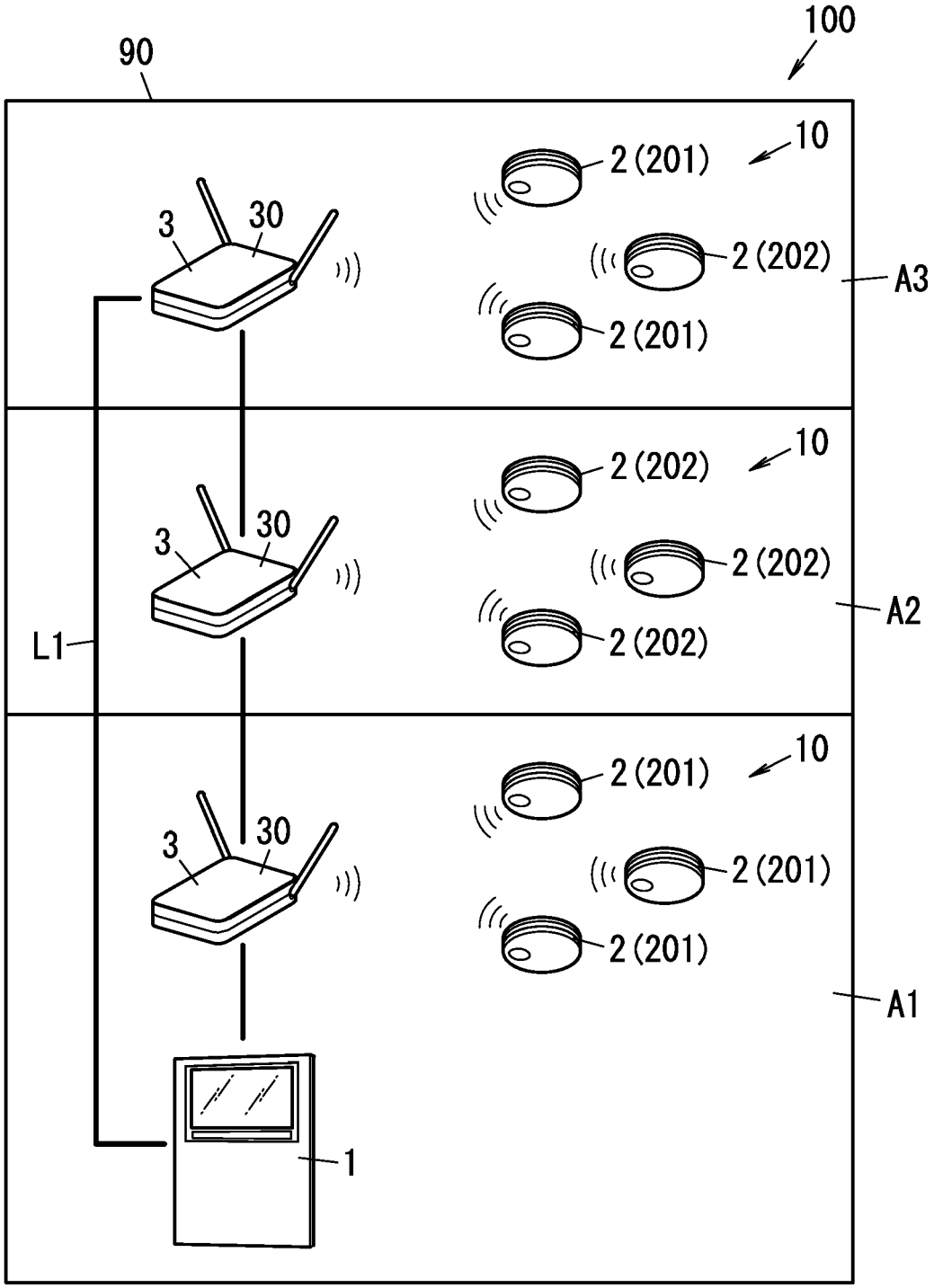
100
90
10
2 (201)
2 (202)
2 (201)
A3
3
30
10
2 (202)
2 (202)
2 (202)
A2
L1
3
30
10
2 (201)
2 (201)
2 (201)
A1
3
30
1

FIG. 2

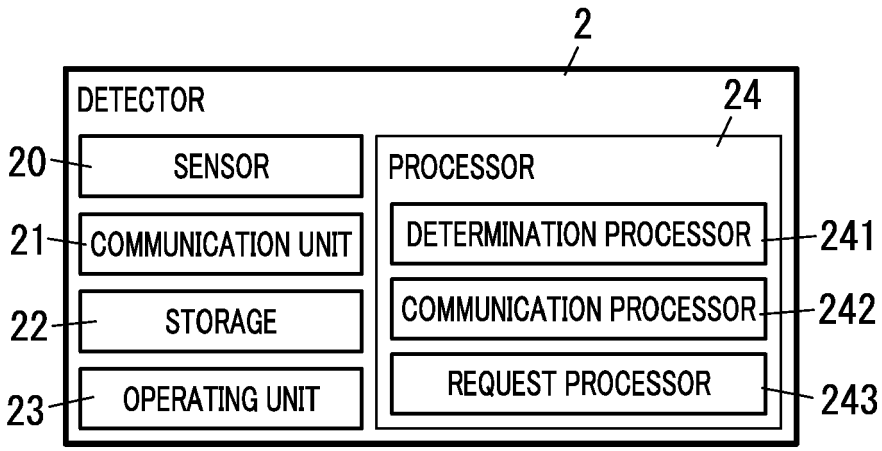
2
DETECTOR
24
20
SENSOR
PROCESSOR
21
COMMUNICATION UNIT
DETERMINATION PROCESSOR
241
22
STORAGE
COMMUNICATION PROCESSOR
242
23
OPERATING UNIT
REQUEST PROCESSOR
243

FIG. 3

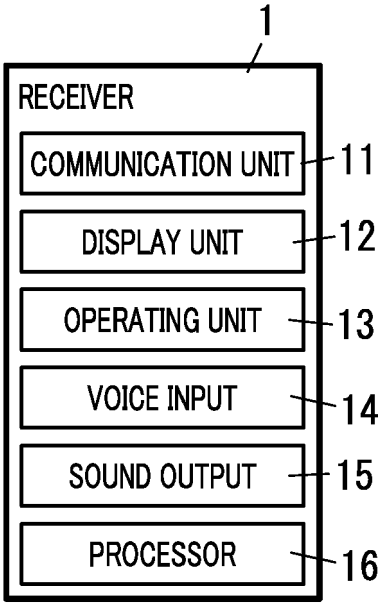
1
RECEIVER
COMMUNICATION UNIT
11
DISPLAY UNIT
12
OPERATING UNIT
13
VOICE INPUT
14
SOUND OUTPUT
15
PROCESSOR
16

FIG. 4

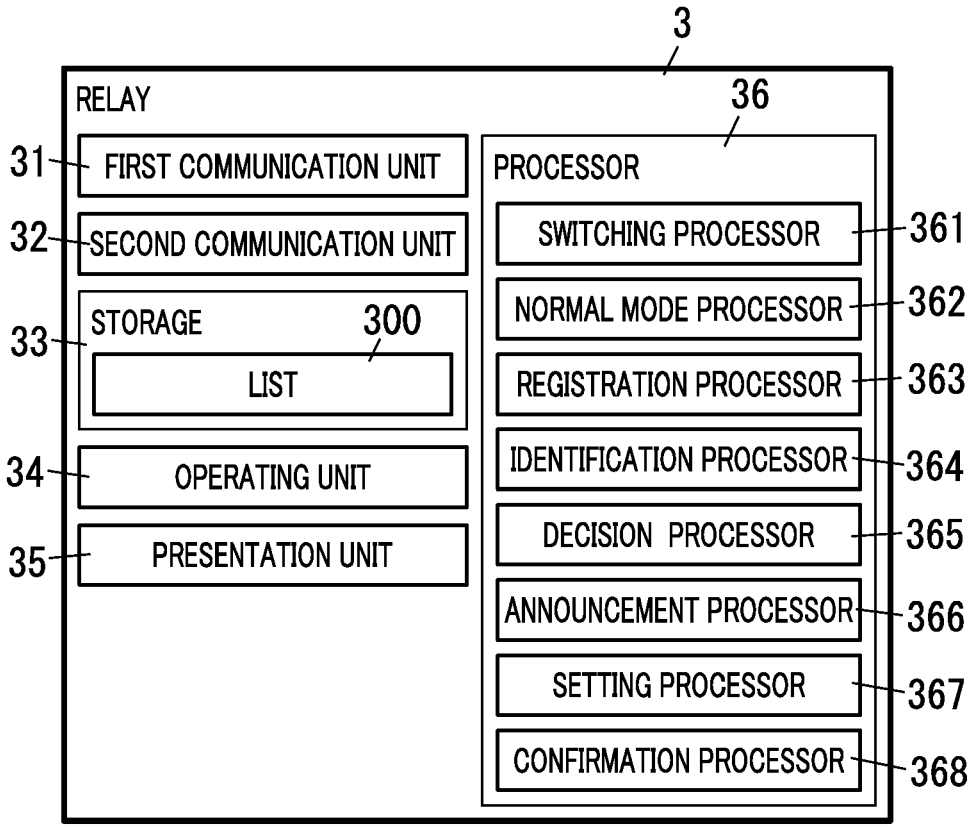
3
RELAY
36
31
FIRST COMMUNICATION UNIT
32
SECOND COMMUNICATION UNIT
33
STORAGE
300
LIST
34
OPERATING UNIT
35
PRESENTATION UNIT
PROCESSOR
SWITCHING PROCESSOR
361
NORMAL MODE PROCESSOR
362
REGISTRATION PROCESSOR
363
IDENTIFICATION PROCESSOR
364
DECISION PROCESSOR
365
ANNOUNCEMENT PROCESSOR
366
SETTING PROCESSOR
367
CONFIRMATION PROCESSOR
368

FIG. 5

300

REGISTRATION NUMBER	
1	REGISTRATION INFORMATION ON SECOND DETECTOR B1
2	REGISTRATION INFORMATION ON SECOND DETECTOR B2
3	REGISTRATION INFORMATION ON SECOND DETECTOR B3
4	REGISTRATION INFORMATION ON SECOND DETECTOR B4
5	NULL
6	NULL
⋮	
27	NULL
28	REGISTRATION INFORMATION ON FIRST DETECTOR A5
29	REGISTRATION INFORMATION ON FIRST DETECTOR A4
30	REGISTRATION INFORMATION ON FIRST DETECTOR A3
31	REGISTRATION INFORMATION ON FIRST DETECTOR A2
32	REGISTRATION INFORMATION ON FIRST DETECTOR A1

FIG. 6

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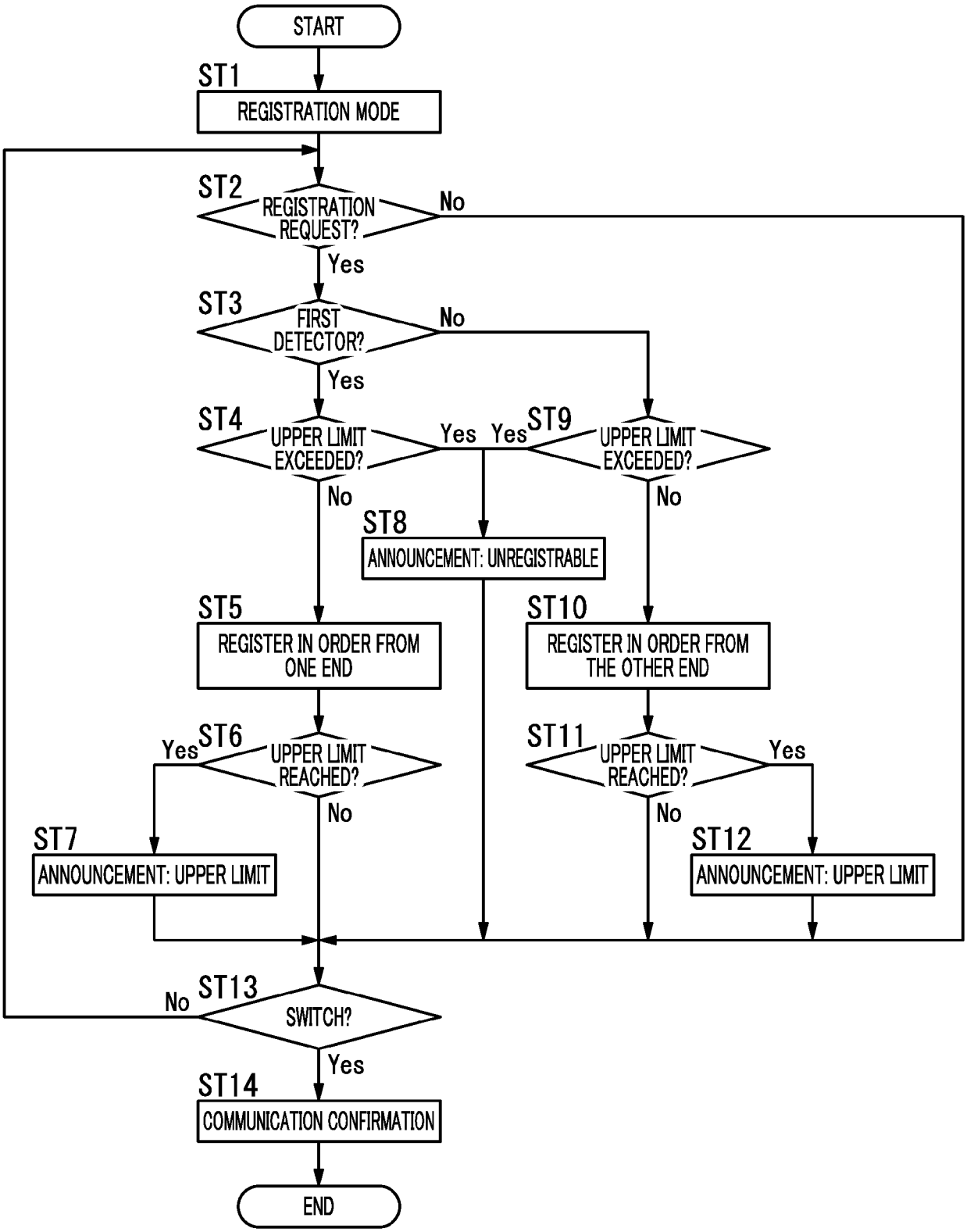
REGISTERED NUMBER OF SECOND DETECTOR	REGISTRABLE NUMBER OF FIRST DETECTOR	REGISTRATION UPPER LIMIT
0	32	32
1	31	32
2	30	32
3	29	32
4	28	32
5	27	32
6	26	32
7	25	32
8	24	32
9	23	32
10	22	32
11	20	31
12	15	27
13	10	23
14	5	19
15	1	16
16	0	16

FIG. 7


START
ST1
REGISTRATION MODE
ST2
REGISTRATION REQUEST?
No
Yes
ST3
FIRST DETECTOR?
No
Yes
ST4
UPPER LIMIT EXCEEDED?
Yes
Yes
ST9
UPPER LIMIT EXCEEDED?
No
No
ST8
ANNOUNCEMENT: UNREGISTRABLE
ST5
REGISTER IN ORDER FROM ONE END
ST10
REGISTER IN ORDER FROM THE OTHER END
Yes
ST6
UPPER LIMIT REACHED?
No
ST11
UPPER LIMIT REACHED?
Yes
No
ST7
ANNOUNCEMENT: UPPER LIMIT
ST12
ANNOUNCEMENT: UPPER LIMIT
No
ST13
SWITCH?
Yes
ST14
COMMUNICATION CONFIRMATION
END

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EUROPEAN SEARCH REPORT

Application Number
EP 24 15 8055

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 6 028073 B2 (NOHMI BOSAI LTD) 16 November 2016 (2016-11-16)	1-7,9-11	INV. G08B25/00
A	* paragraph [0013] - paragraph [0015]; figures 1-3 * * paragraph [0034] - paragraph [0039] * * paragraph [0023] - paragraph [0027] *	8	
A	JP 2016 062371 A (HOCHIKI CO) 25 April 2016 (2016-04-25) * paragraph [0041] - paragraph [0046]; figures 1-4 *	1-11	
			TECHNICAL FIELDS SEARCHED (IPC)
			G08B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 July 2024	Kurzbauer, Werner

CATEGORY OF CITED DOCUMENTS

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04-07-2024

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