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(54) CONTROL SYSTEM AND CONTROL METHOD

(57) A control system (information terminal 30) includes a processing unit, a receiver, and a storage. The processing unit displays, on a display (32), a setting image (32s) for control setting performed for each of at least one device (light fixture). The receiver receives, for each of the at least one device, input of the control setting of the device among the at least one device. The storage stores, for each of the at least one device, control setting information including the control setting received by the receiver. The control setting information is the latest control setting information transmitted to the device. If the control setting information on a target device which is to be set among the at least one device includes a change from the latest control setting information stored in the storage, the processing unit puts a mark (M1) to a setting item (I1) related to the change in the setting image (32s).

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Description

Field

[0001] The present invention relates to a control system and a control method that are used for control setting of a communication system.

Background

[0002] Patent Literature (PTL) 1 discloses a technology of creating a mesh network with a plurality of lighting devices.

Citation List

Patent Literature

[0003] PTL 1: Japanese Unexamined Patent Application Publication No. 2021-163573

Summary

Technical Problem

[0004] The present invention provides a control system that enables easy confirmation on whether control setting of a target device is completed.

Solution to Problem

[0005] In accordance with an aspect of the present disclosure, a control system includes: a processing unit that displays, on a display, a setting image for control setting performed for each of at least one device; a receiver that receives, for each of the at least one device, input of the control setting of the device among the at least one device; and a storage that stores, for each of the at least one device, control setting information including the control setting received by the receiver, the control setting information being latest control setting information transmitted to the device. If the control setting information on a target device which is to be set among the at least one device includes a change from the latest control setting information stored in the storage, the processing unit puts a mark to a setting item related to the change in the setting image.

[0006] In accordance with another aspect of the present disclosure, a control method includes: displaying, on a display, a setting image for control setting performed for each of at least one device; receiving, for each of the at least one device, input of the control setting of the device; storing, for each of the at least one device, into a storage, control setting information including the control setting received in the receiving, the control setting information being latest control setting information transmitted to the device. If the control setting information on a target device which is to be set among the at least one device includes a change from the latest control setting information stored in the storage, putting a mark to a setting item related to the change in the setting image.

Advantageous Effects

[0007] The control system according to the present invention has an advantage of enabling easy confirmation on whether control setting of a target device is completed.

Brief Description of Drawings

[0008]

[FIG. 1]
FIG. 1 is a block diagram illustrating a functional configuration of a communication system that includes a control system according to Embodiment.

[FIG. 2]
FIG. 2 is a conceptual diagram illustrating a mesh network.

[FIG. 3]
FIG. 3 is a sequence diagram illustrating an example of an initial setting operation.

[FIG. 4]
FIG. 4 is a diagram illustrating an example of an initial setting screen.

[FIG. 5]
FIG. 5 is a diagram illustrating an example of a setting screen.

[FIG. 6]
FIG. 6 is a flowchart illustrating an example of a control setting operation.

[FIG. 7]
FIG. 7 is a flowchart illustrating an example of an operation performed by a control system according to Embodiment.

Description of Embodiment

[0009] Hereinafter, embodiments will be described in detail with re ference to the accompanying Drawings. The following embodimen ts are general or specific examples of the present disclosure. Th e numerical values, shapes, materials, constituent elements, arran gement and connection configuration of the constituent elements, steps, the order of the steps, etc., described in the following emb odiments are merely examples, and are not intended to limit the present disclosure. Among constituent elements in the following embodiments, those not described in any one of the independent claims indicating the broadest concept of the present disclosure ar e described as optional constituent elements.

[0010] Note that the respective figures are schematic diagrams an d are not necessarily precise illustrations. In the drawings, eleme nts regarding substantially identical structures are assigned with a same reference sign, and explanation of such substantially identi cal elements

is not repeated or is simplified.

Embodiment

[Configuration]

[0011] The configuration of a communication system according to Embodiment is firstly described. FIG. 1 is a block diagram illustrating the functional configuration of the communication system that includes a control system according to Embodiment. As illustrated in FIG. 1, communication system 10 includes a plurality of devices 20 and information terminal 30. Device 20 is a light fixture in Embodiment. In the following description, device 20 is referred to as "light fixture 20" unless otherwise specified. Furthermore, information terminal 30 corresponds to the control system in Embodiment.

[0012] Each of the plurality of light fixtures 20 included in communication system 10 has a wireless communication function. The plurality of light fixtures 20 make up a wireless mesh network (hereafter, also referred to simply as a "mesh network"). FIG. 2 is a conceptual diagram illustrating the mesh network. A circle illustrated in FIG. 2 corresponds to one light fixture 20 (or more specifically, a communication node). For transmission of information from one communication node (also referred to as a first communication node) to another communication node (also referred to as a second communication node) in the mesh network, a flooding technique is used.

[0013] To be more specific, when the first communication node broadcasts information that includes address information (destination information) on the second communication node, each of other communication nodes belonging to the same mesh network as the first communication node receives this information and in turn broadcasts the received information. In other words, each of the other communication nodes relays the information. Such repetition of relay of the information in one mesh network allows the information transmitted by the first communication node to reach all the communication nodes belonging to the same mesh network as the first communication node. Thus, the second communication node is able to receive the information transmitted by the first communication node.

[0014] The information transmitted via the mesh network is control information used for turning-on control, turning-off control, and dimming control of light fixture 20, for example. In the mesh network that includes an environmental sensor, a measurement value (sensing information) obtained by the environmental sensor may be transmitted.

[0015] Firstly, light fixture 20 is described. Light fixture 20 is, for example, a base light fixture attached to the ceiling of an indoor space to illuminate the indoor space. As described above, each of the plurality of light fixtures 20 has the wireless communication function and makes up the mesh network. Note that the type of light fixture 20 is not intended to be limiting. Light fixture 20 may be a ceiling light fixture, a downlight fixture, or a spotlight fixture. Specifically, light fixture 20 includes communicator 21 and light source 22.

[0016] Communicator 21 is a wireless communication circuit that enables light fixture 20 to perform wireless communication (or more specifically, radio communication) with another light fixture 20 and information terminal 30. After light fixture 20 joins the mesh network, communicator 21 performs communication via the mesh network described above. Before light fixture 20 joins the mesh network, communicator 21 periodically transmits a beacon signal (also known as an advertising signal) and performs wireless communication individually with information terminal 30 that received the beacon signal. Specifically, communicator 21 performs wireless communication according to a communication standard, such as Bluetooth (registered trademark) Low Energy (BLE) or Wi-Fi (registered trademark).

[0017] Light source 22 emits white light into the indoor space to enable light fixture 20 to illuminate the indoor space. For example, light source 22 is implemented by a light emitting diode (LED) device. However, light source 22 may be implemented by a different light emitting device, such as a semiconductor laser, an organic electroluminescent (organic EL) device, or an inorganic EL device.

[0018] Next, the configuration of information terminal 30 is described. Information terminal 30 performs: an initial setting operation to allow the plurality of light fixtures 20 to join the mesh network; and a control setting operation for various controls over the plurality of light fixtures 20. For example, information terminal 30 is a mobile terminal, such as a smartphone, a tablet, or a personal digital assistant (PDA). Information terminal 30 may be a laptop personal computer, for example. Alternatively, information terminal 30 may be a remote controller dedicated to communication system 10. Information terminal 30 is used by a user that performs initial setting for instance. Here, the user is an installer that installs the plurality of light fixtures 20 to the ceiling, for example. However, the user may be a different person other than the installer. Specifically, information terminal 30 includes receiver 31, display 32, communicator 33, processing unit 34, and storage 35.

[0019] Receiver 31 receives input of various kinds by receiving an operation performed by the user. In Embodiment, receiver 31 receives input of control setting of a target device among at least one device 20 (the plurality of light fixtures 20 in this case). Specifically, receiver 31 is implemented by a touch panel, for example.

[0020] Display 32 displays an image necessary for the aforementioned initial setting. In Embodiment, display 32 also displays setting image 32s (see FIG. 5) for control setting for each of the at least one device 20 (the plurality of light fixtures 20 in this case). Display 32 is implemented by a display panel, such as a liquid crystal panel or an organic EL panel.

[0021] Communicator 33 is a wireless communication

circuit that enables information terminal 30 to perform wireless communication (or more specifically, radio communication) with each of the plurality of light fixtures 20. Specifically, communicator 33 performs wireless communication according to a communication standard, such as BLE or Wi-Fi (registered trademark).

[0022] Processing unit 34 performs information processing related to the initial setting operation and the control setting operation, in response to an operation performed by the user and received by receiver 31. Processing unit 34 is implemented by a microcomputer, for example. However, processing unit 34 may be implemented by a processor or a dedicated circuit. A function of processing unit 34 is achieved by hardware of processing unit 34, such as the microcomputer or the processor, executing a computer program (software) stored in storage 35.

[0023] Storage 35 stores information, such as the computer program executed by processing unit 34, necessary for the information processing related to the initial setting operation and the control setting operation. Storage 35 is implemented by a semiconductor memory, for example.

[Initial Setting Operation]

[0024] Next, the initial setting operation performed to create a mesh network is described. The initial setting operation includes a detection phase, a setting phase, and an identification-registration phase, in this order. A specific process performed in each of these phases is described with reference to a sequence diagram. FIG. 3 is a sequence diagram illustrating an example of the initial setting operation. The initial setting operation illustrated in FIG. 3 is performed after the user, such as an installer, installs the plurality of light fixtures 20 to the ceiling.

[0025] Firstly, the process performed in the detection phase is described. Receiver 31 of information terminal 30 receives a start operation performed by the user to start the initial setting operation (S10a). Before joining the mesh network, each of the plurality of light fixtures 20 periodically transmits a beacon signal (also known as an advertising signal) (SlOb). Upon the receipt of the start operation in Step S10a, communicator 33 of information terminal 30 receives the beacon signal. The beacon signal transmitted from light fixture 20 includes identification information that identifies light fixture 20. Although a media access control (MAC) address is used as the identification information for example, this is not intended to be limiting. Any information that uniquely identifies light fixture 20 can be used as the identification information.

[0026] Steps S10a and SlOb described above correspond to the process performed in the detection phase. Next, the process performed in the setting phase is described. The process of the setting phase is also known as provisioning, for example.

[0027] Processing unit 34 establishes a communication connection between communicator 33 and any given one of the plurality of light fixtures 20 that are the transmission sources of the beacon signals received in Step SlOb (S20a), and then starts individual communication with this light fixture 20. Processing unit 34 causes communicator 33 to transmit setting information to this light fixture 20 (S20b). Receiving the setting information, light fixture 20 stores this setting information into a storage included in light fixture 20 (S20c). After storing the setting information into the storage, light fixture 20 is allowed to join the mesh network.

[0028] The setting information allows light fixture 20 to join the mesh network. The setting information includes: a network ID of the mesh network where light fixture 20 belongs; and address information (a unicast address) on light fixture 20 that is used for communication in the mesh network. The setting information may also include, as appropriate, a security passcode used for communication in the mesh network and information related to information terminal 30 (information related to a device that manages the mesh network). After storing the setting information into the storage, light fixture 20 is allowed to join the mesh network.

[0029] After storing the setting information, light fixture 20 transmits a setting completion notification to information terminal 30 (S20d). Upon receipt of the setting completion notification by communicator 33, processing unit 34 of information terminal 30 disconnects the communication connection established with light fixture 20 in Step S20a (S20e).

[0030] Steps S20a to S20e are repeated until all light fixtures 20, each of which is the transmission source of the beacon signal received in Step SlOb, join the mesh network. More specifically, processing unit 34 of information terminal 30 performs the setting process by establishing an individual communication connection for each of the plurality of light fixtures 20 from which the beacon signal was received in Step SlOb. After joining the mesh network, light fixture 20 stops, as appropriate, the beacon signal transmission that is periodically performed before joining the mesh network.

[0031] Steps S20a to S20e described above correspond to the process performed in the setting phase. Next, the process performed in the identification-registration phase is described.

[0032] Processing unit 34 establishes a communication connection between communicator 33 and one of the plurality of light fixtures 20 joining the mesh network (S30a). Step S30a may be omitted by not disconnecting (that is, by maintaining) the communication connection with light fixture 20 that is the last light fixture to receive the setting information in the setting phase. Furthermore, Step S30a may also be omitted if information terminal 30 joins the mesh network (that is, if information terminal 30 is a communication node in the mesh network).

[0033] Next, processing unit 34 displays icons of the plurality of light fixtures 20 joining the mesh network, on display 32 (S30b). FIG. 4 is a diagram illustrating an example of a display screen displaying the icons of the plu-

rality of light fixtures 20 (that is, an initial setting screen). As illustrated in FIG. 4, the initial setting screen displays a plurality of icons 32a in a single row, corresponding to the plurality of light fixtures 20 that are the transmission sources of the beacon signals.

[0034] Furthermore, the display screen illustrated in FIG. 4 also displays map image 32m. Map image 32m is a top view of the area where the plurality of light fixtures 20 are installed. In the example illustrated in FIG. 4, installation positions P1 to P6 of light fixtures 20 are indicated by enclosed alphanumerics representing these installation positions. More specifically, map image 32m is an image showing the installation positions of the plurality of light fixtures 20. In Embodiment, the map image is previously stored in storage 35.

[0035] Receiver 31 receives a selection operation performed on the plurality of icons 32a by the user (S30c). The selection operation is a tap on one of the plurality of icons 32a, for example. Processing unit 34 transmits a blink command via the mesh network to light fixture 20 (that is, target light fixture 20) corresponding to icon 32a selected (S30d). To be more specific, after transmitted to light fixture 20 communicatively connected to communicator 33 of information terminal 30 in Step S30a, the blink command is transmitted via the mesh network to target light fixture 20. For example, after the selection operation, the blink command is transmitted upon the receipt of the tap on blink icon 32b.

[0036] The blink command is a signal selectively causing target light fixture 20 to blink. Receiving the blink command, target light fixture 20 blinks (S30e). This allows the user to identify target light fixture 20.

[0037] The user visually confirms the actual installation position of blinking target light fixture 20 (S30f). Then, the user designates the installation position (one of installation positions P1 to P6 for example) of blinking target light fixture 20 on map image 32m. Receiver 31 receives the designation operation performed on the installation position of light fixture 20 by the user on map image 32m (S30g). This causes processing unit 34 to store the identification information indicated by icon 32a selected in Step S30c, corresponding to the installation position (that is, coordinates) designated in Step S30g (S30h). Furthermore, processing unit 34 removes icon 32a from the display screen after the correspondence of icon 32a with the installation position is defined (S30i). As a result, the number of icons 32a displayed in Step S30b is reduced by one.

[0038] Steps S30c to S30i are repeated until establishment of correspondence between icon 32a (that is, the identification information) and the installation position is completed for all icons 32a displayed in Step S30b. As a result of this, storage 35 stores correspondence information indicating a correspondence between identification information and installation position for each of the plurality of light fixtures 20. More specifically, the plurality of light fixtures 20 are registered with information terminal 30.

[0039] Steps S30a to S30i described above correspond to the process performed in the identification-registration phase.

[Control Setting Operation]

[0040] Next, the control setting operation performed for control setting for each of the at least one device 20 (the plurality of light fixtures 20 in this case) is described. The control setting operation is performed by the user, such as an installer, after the initial setting operation. The control setting operation is performed at any given time by the user (and manager) that actually uses a place where the plurality of light fixtures 20 are installed, for example. Examples of control setting possible through the control setting operation may include group setting, scene setting, schedule setting, and remote-controller setting.

[0041] By the group setting, a group where light fixture 20 belongs is set. At least one light fixture 20 belonging to the same group performs the same operation. For example, when receiving a control command issued to any given group, a plurality of light fixtures 20 belonging to this group are turned on at the same time and turned off at the same time.

[0042] By the scene setting, the brightness or color appearance of light fixture 20 is set for instance. For example, when receiving a control command to start creation of any given scene, each of the plurality of light fixtures 20 for creating this scene emits light with the brightness or color appearance set for this light fixture 20.

[0043] By the schedule setting, a lighting-up period of light fixture 20 is set for instance. For example, when receiving a control command to perform control according to a schedule that is set by the schedule setting, light fixture 20 having this schedule is turned on in the lighting-up period according to the schedule and turned off in a period other than the lighting-up period. Note that the schedule setting is useful if a scheduler, described later as an external device, is registered with information terminal 30 (that is, the control system).

[0044] By the remote-controller setting, light fixture 20 operable by a remote controller is set. For example, when receiving a control command from the remote controller, light fixture 20 allowed to be operated by the remote controller is turned on or off. Note that the remote-controller setting is useful if a remote controller, described later as an external device, is registered with information terminal 30 (the control system).

[0045] The user performs the control setting operation while looking at a setting screen displayed on display 32 of information terminal 30. FIG. 5 is a diagram illustrating an example of the setting screen. As illustrated in FIG. 5, the setting screen displays setting image 32s for control setting performed for each of the at least one device 20 (the plurality of light fixtures 20 in this case). Setting image 32s mainly shows list 32c of setting items I1 related to setting of light fixture 20 and detailed image 32d of

setting items I1 selected by the user.

[0046] Detailed image 32d in turn includes setting items I1 that are narrower concepts of setting items I1 selected by the user. In the example illustrated in FIG. 5, setting items I1 included in detailed image 32d are: "Area/zone" (corresponding to the group setting); "Scene" (corresponding to the scene setting); "Schedule" (corresponding to the schedule setting); and "Remote controller" (corresponding to the remote-controller setting). The example in FIG. 5 illustrates detailed image 32d displayed on display 32 when the user selects setting item I1 of "Area/zone". Detailed image 32d shows setting items I1 including: "Device" indicating the target device as a setting target; "Zone" indicating the zone where the target device belongs; and "Area" indicating the area including the zone where the target device belongs. In Embodiment, setting items I1 include the target device, the zone where the target device belongs, and the area where the zone belongs, as described above.

[0047] While looking at setting image 32s, the user performs control setting for the target device. In the example illustrated in FIG. 5, the user performs input to set up light fixture 20 belonging to "Zone 1" of "Area 1" in the group setting. For example, by selecting the checkbox of "L1" as the target device, the user performs input to register "L1" with "Zone 1" of "Area 1". After the inputting for the target device, the user selects transmission icon 32e corresponding to "Transmit setting". This causes communicator 33 to transmit the control setting information including the setting received by receiver 31 to the target device. In the above example, communicator 33 transmits, to target device "L1", the control setting information including the setting of the registration with "Zone 1" of "Area 1".

[0048] FIG. 6 is a flowchart illustrating an example of the control setting operation. When receiver 31 receives input directing to start the control setting operation, processing unit 34 displays setting image 32s on display 32 (S40). While looking at setting image 32s, the user inputs control setting of light fixture 20. Thus, receiver 31 receives input of the control setting for each of the at least one device 20 (the plurality of light fixtures 20 in this case) (S41).

[0049] After inputting the setting, the user selects transmission icon 32e. This allows processing unit 34 to cause communicator 33 to transmit the control setting information to light fixture 20 (that is, the target device) corresponding to the inputted setting (S42). After storing the received control setting information, light fixture 20, which is the target device, transmits a control setting completion notification to information terminal 30.

[0050] Upon receipt of the control setting completion notification by communicator 33, processing unit 34 stores the latest control setting information transmitted to the target device into the storage 35 (S43). More specifically, storage 35 stores the latest control setting information for each of the at least one device 20 (the plurality of light fixtures 20 in this case).

[0051] FIG. 7 is a flowchart illustrating an example of an operation performed by information terminal 30 (the control system) according to Embodiment. FIG. 7 illustrates an example of an operation performed by processing unit 34 in the control setting operation. Processing unit 34 firstly determines whether the control setting information includes any change (S51). To be more specific, processing unit 34 reads the latest control setting information on the target device from storage 35. Then, processing unit 34 determines whether at least a part of the control setting information on the target device has been changed from the latest control setting information as a result of the setting inputted by the user.

[0052] For example, suppose that the target device is "L1" and that "L1" does not belong to any group in the latest control setting information stored in storage 35. In this case, if "L1" is registered with "Zone 1" as a result of the setting inputted by the user, processing unit 34 determines that the control setting information on "L1" includes a change.

[0053] If determining that the control setting information includes a change) (Yes in S51), processing unit 34 puts mark M1 to setting item I1 related to the change in setting image 32s (S52). In the example illustrated in FIG. 5, because the information on the target devices "L1" and "L3" includes changes, each of "L1" and "L3" is marked with mark M1 of an exclamation point. Furthermore, because "L1" and "L3" belong to "Zone 1", setting item I1 of "Zone 1" is also marked with mark M1 of an exclamation point. Moreover, because "L1" and "L3" belong to "Area 1", setting item I1 of "Area 1" is also marked with mark M1 of an exclamation point. Furthermore, because the setting of "L1" and "L3" relates to "Area/zone" and "Remote controller", each of setting items I1 of "Area/zone" and "Remote controller" is also marked with mark M1 of an asterisk.

[0054] In Embodiment, mark M1 is put not only to setting item I1 indicating the target device having the control setting information that includes a change, but also to setting item I1 indicating a broader concept of the target device. Note that mark M1 is not limited to the exclamation point or the asterisk. Any mark that attracts the attention of the user to the change in the control setting information may be used.

[0055] Referring back to FIG. 7, after inputting the setting, the user selects transmission icon 32e. This allows processing unit 34 to cause communicator 33 to transmit the control setting information including the change to light fixture 20 corresponding to the setting inputted (that is, to the target device) (S53). If the transmission of the control setting information including the change to the target device is successful (Yes in F54), processing unit 34 deletes mark M1 from setting image 32s (S55). For example, suppose that the target device is "L1" and that communicator 33 receives the control setting completion notification from "L1". In this case, processing unit 34 determines that the transmission of the control setting information including the change to "L1" is successful

and then deletes mark M1 put to setting item I1 related to "L1" in setting image 32s.

[0056] Note that, in the example illustrated in FIG. 5, although mark M1 put to "L1" is deleted, marks M1 put to "Zone 1", "Area 1", "Area/zone", and "Remote controller" are not deleted until the transmission of the control setting information including the change to "L3" is successful.

[0057] In contrast, if the transmission of the control setting information including the change to the target device is unsuccessful (No in S54), processing unit 34 does not delete mark M1 from setting image 32s and thus keeps mark M1 displayed (S56). For example, suppose that the target device is "L1" and that a predetermined period of time has passed but communicator 33 does not yet receive the control setting completion notification. In this case, processing unit 34 determines that the transmission of the control setting information including the change to "L1" is unsuccessful and thus does not delete mark M1 put to "L1" in setting image 32s.

[Advantages]

[0058] Hereafter, the advantages of information terminal 30 (the control system) according to Embodiment are described in comparison with an information terminal according to a comparison example. The information terminal according to the comparison example is different from information terminal 30 according to Embodiment in that setting item I1 is not marked with mark M1 even if the control setting information includes a change from the latest control setting information stored in storage 35.

[0059] By using only the information terminal according to the comparison example, the user is unable to confirm whether the control setting information on the target device includes a change or whether the control setting information including the change is already transmitted to the target device. To confirm this, the user has to perform an operation to transmit a signal requesting the target device to send the control setting information in response. This takes time and effort to obtain the confirmation.

[0060] In contrast, information terminal 30 according to Embodiment allows the user to visually confirm, by looking at setting item I1 marked with mark M1, that the control setting information on the target device includes a change and that the control setting information including the change is not yet transmitted to the target device. Thus, information terminal 30 according to Embodiment has an advantage of allowing the user to easily confirm whether the control setting of the target device is completed. In particular, the confirmation on whether the control setting of the target device is completed can be obtained by using only information terminal 30 according to Embodiment. This eliminates the necessity to request the target device to send the control setting information in response. Hence, information terminal 30 according to Embodiment has another advantage of saving time and effort to obtain the confirmation.

[Variations]

[0061] Although Embodiment has been described thus far, the present invention is not limited to Embodiment described above.

[0062] For example, when the control setting is performed for the at least one device 20 (the plurality of light fixtures 20 in this case) for the first time, processing unit 34 according to Embodiment may put mark M1 to all setting items I1 of the at least one device 20 in setting image 32s. For example, the control setting operation that is performed after the initial setting operation is firstly performed after light fixture 20 joins the mesh network. For this reason, storage 35 stores no control setting information on light fixture 20, or stores default control setting information. Thus, processing unit 34 puts mark M1 to all setting items I1 of light fixture 20 in this case. This has an advantage of allowing the user to visually confirm with ease that the control setting is not yet performed for light fixture 20.

[0063] For example, if an external device is not registered, processing unit 34 according to Embodiment need not put mark M1 to setting item I1 that requires a connection with the external device. Here, for setting items I1 of "Schedule" for example, the external device is a scheduler. For setting item I1 of "Remote controller" for example, the external device is a remote controller.

[0064] The schedule setting performed for target device "L3" is described as an example. Suppose that a scheduler is registered with information terminal 30 (the control system). In this case, if the control setting information on "L3" includes a change from the latest control setting information stored in storage 35, processing unit 34 puts mark M1 to setting item I1 related to "L3". Suppose, in contrast, that a scheduler is not registered with information terminal 30. In this case, even if the control setting information on "L3" includes a change from the latest control setting information stored in storage 35, processing unit 34 does not put mark M1 to setting item I1 related to "L3".

[0065] As described, if no external device is registered, mark M1 is not put to setting item I1 that requires setting only when an external device is registered. This has an advantage of saving the user from needlessly having to transmit the control setting information including the change.

[0066] For example, processing unit 34 according to Embodiment may put mark M1 to setting item I1 of a specific device among the at least one device 20 (the plurality of light fixtures 20 in this case). The specific device refers to device 20 having the latest control setting information stored in storage 35 that is different from the control setting information obtained by information terminal 30 in synchronization with device 20. Such a situation takes place when, for example, information terminal 30 mistakenly reads previous control setting information on

any given light fixture 20 instead of the latest control setting information on this light fixture 20 and then stores this previous control setting information into storage 35. In this case, mark M1 put to the specific device allows the user to visually confirm with ease that the control setting information stored in the specific device is different from the control setting information stored in information terminal 30. This has an advantage that the user is able to easily take action to cause the specific device and information terminal 30 to store the same control setting information.

[0067] For example, processing unit 34 according to Embodiment may transmit a control command to device 20 (light fixture 20) marked with mark M1 in setting image 32s or device 20 not marked with mark M1 in setting image 32s so that device 20 receiving this control command operates differently from other devices 20. For example, suppose that, while each of light fixtures 20 is turned on, processing unit 34 transmits a blink command as the control command to all light fixtures 20 that are marked with mark M1 in setting image 32s. As a result, each of light sources 22 of all light fixtures 20 marked with mark M1 in setting image 32s blinks. This allows the user to visually confirm with ease the position of light fixture 20 that does not yet receive the control setting information including the change. Alternatively, processing unit 34 transmits the blink command as the control command to all light fixtures 20 that are not marked with mark M1 in setting image 32s. As a result, each of light sources 22 of all light fixtures 20 that are not marked with mark M1 in setting image 32s blinks. This allows the user to visually confirm with ease each of the positions of light fixtures 20 that already receive the control setting information including the change or that have no change in the setting.

[0068] Note that the control command is not limited to the blink command and may be a turning-off command. To be more specific, the control command may be any command that turns on or off light source 22 of target light fixture 20 differently from light source 22 of other light fixtures 20.

[0069] For example, in response to the input received by receiver 31, processing unit 34 according to Embodiment may deregister device 20 (light fixture 20) marked with mark M1 in setting image 32s. For example, even after the control setting information including the change is transmitted to light fixture 20 marked with mark M1 in setting image 32s, no control setting completion notification may be received from this light fixture 20. This is because this light fixture 20 may have been removed and thus may no longer exist. In such a case, input performed by the user to deregister this light fixture 20 allows processing unit 34 to deregister this light fixture 20 without any operation to initialize this light fixture 20. This has an advantage of reducing the burden on the user.

[0070] Processing unit 34 according to Embodiment deletes mark M1 from setting image 32s after the successful transmission of the control setting information including the change to the target device. However, this is not intended to be limiting. For example, upon transmitting the control setting information including the change to the target device, processing unit 34 may delete mark M1 from setting image 32s.

[0071] For example, the mesh network in Embodiment above is made up of the plurality of light fixtures 20. However, this is not intended to be limiting. For example, the mesh network may be made up of information terminal 30 and the plurality of light fixtures 20. Alternatively, the mesh network may be made up of a plurality of devices 20 of different kind (devices 20 that are not light fixtures 20). Alternatively, the mesh network may include different device 20 in addition of the plurality of light fixtures 20.

[0072] Different device 20 described above may be a lighting remote controller operated by the user to control light fixture 20, or an alternating-current (AC) relay, for example. Note that the AC relay refers to a device that is mounted to a wiring duct and capable of turning on and off a light fixture mounted to the wiring duct by switching on and off the supply of AC power to the wiring duct. The AC relay may be a device that is capable of turning on and off all light fixtures mounted to a wiring duct by switching on and off the supply of AC power to the wiring duct.

[0073] Different device 20 described above may be a device that is not directly related to lighting. Examples of such include an air conditioner, a ventilator, a camera, a human detecting sensor, and an environmental sensor. Note that the environmental sensor includes a temperature sensor, a humidity sensor, a carbon dioxide concentration sensor, or a particle matter (PM) sensor, for example.

[0074] In Embodiment above, light source 22 of light fixture 20 is a state presenter that allows the user to visually confirm the installation position of light fixture 20. However, since device 20 making up the mesh network is not limited to light fixture 20, various kinds of component may be used as a state presenter included in device 20.

[0075] For example, device 20 may include a light source as the state presenter (or include an LED indicator for instance if device 20 is not light fixture 20). Device 20 may include a loudspeaker as the state presenter and present the state by outputting a sound. Alternatively, device 20 may use an exclusive feature of device 20 (such as a blower function if device 20 is an air conditioner) as the state presenter. Note that, based on a control command transmitted from information terminal 30, the state presenter may operate differently from a state presenter included in another device 20.

[0076] In Embodiment above, the identification information on light fixture 20 is stored corresponding to the installation position of light fixture 20 when light fixture 20 is registered with information terminal 30, for example. However, the registration of light fixture 20 need not necessarily include establishment of correspondence between identification information and installation position. For example, to display light fixtures 20 joining the mesh

network on display 32 in list form instead of map form, establishment of correspondence between identification information and installation position of light fixture 20 is unnecessary.

[0077] For example, it is possible in the above-described embodiments that the process performed by a certain processing unit may be performed by another processing unit, that an order of a plurality of processes is changed, or that a plurality of processes are performed in parallel.

[0078] For example, each of the constituent elements such as processing units in the above embodiment may be realized by executing a software program suitable for the constituent element. Each of the constituent elements may be realized by means of a program executing unit, such as a Central Processing Unit (CPU) or a processor, reading and executing the software program recorded on a recording medium such as a hard disk or a semiconductor memory.

[0079] Each of the constituent elements such as the processing units may be configured in the form of a hardware product. For example, the constituent elements such as the processing units may be implemented to circuits (or integrated circuits). These circuits may form a single circuit, or serve as separate circuits. Each circuit may be may be a general-purpose circuit or a dedicated circuit.

[0080] It should be noted that general or specific aspects of the pr esent disclosure may be implemented to a system, a device, a m ethod, an integrated circuit, a computer program, a non-transitory computer-readable recording medium such as a Compact Disc-Re ad Only Memory (CD-ROM), or any given combination thereof.

[0081] For example, the present invention may be implemented to a control system or an information terminal according to the above-described embodiment, or may be implemented to a method (control method etc.) executed by the information terminal. The present invention may be implemented to a program causing a computer to execute such a method, or a non-transitory computer-readable recording medium on which the program is recorded. Such programs include an application program that causes a computer such as a general-purpose information terminal to function as the information terminal according to the above-described embodiment.

[0082] In addition, the present disclosure may include embodiments obtained by making various modifications on the above embodiments which those skilled in the art will arrive at, or embodiments obtained by selectively combining the constituent elements and functions disclosed in the above embodiment, without materially departing from the scope of the present disclosure.

(Summary)

[0083] In accordance with a first aspect of the present disclosure, a control system (information terminal 30) includes: processing unit 34, receiver 31, and storage 35. Processing unit 34 displays, on a display, setting image 34 for control setting performed for each of at least one device 20 (light fixture 20). Receiver 31 receives, for each of the at least one device 20, input of the control setting of device 20 among the at least one device 20. Storage 35 that stores, for each of the at least one device 20, control setting information including the control setting received by receiver 31. The control setting information is the latest control setting information transmitted to device 20. If the control setting information on a target device which is to be set among the at least one device 20 includes a change from the latest control setting information stored in storage 35, processing unit 34 puts mark M1 to setting item I1 related to the change in setting image 32s.

[0084] The control system described above allows the user to visually confirm, by looking at setting item I1 marked with mark M1, that the control setting information on the target device includes a change and that the control setting information including the change is not yet transmitted to the target device. Thus, the control system has an advantage of allowing the user to easily confirm whether the control setting of the target device is completed.

[0085] For example, in the control system according to a second aspect, it is possible, in the first aspect, that the setting item includes the target device, a zone where the target device belongs, and an area where the zone belongs.

[0086] The control system described above puts mark M1 not only to the target device but also to the zone and the area where the target device belongs. Thus, the control system has an advantage that a failure to confirm whether the control setting of the target device is completed is less likely to occur.

[0087] For example, in the control system according to a third aspect, it is possible, in the first aspect or the second aspect, that when the control setting is performed for the at least one device 20 for a first time, processing unit 34 puts mark M1 to the setting item of all of the at least one device 20 in setting image 32s.

[0088] The control system described above puts mark M1 to all setting items I1 of device 20 before the control setting operation is performed for the first time. Thus, the control system has an advantage of allowing the user to visually confirm with ease that the control setting is not yet performed for device 20.

[0089] For example, in the control system according to a fourth aspect, it is possible, in any one of the first to third aspects, that if transmission of the control setting information including the change to the target device is successful, processing unit 34 deletes mark M1 from setting image 32s.

[0090] The control system described above deletes mark M1 upon the receipt of the control setting information including the change by the target device. Thus, the control system has an advantage of allowing the user to visually confirm with ease whether the control setting of

the target device is completed.

[0091] For example, in the control system according to a fifth aspect, it is possible, in one of the first to fourth aspects, that if transmission of the control setting information including the change to the target device is unsuccessful, processing unit 34 does not delete mark M1 from setting image 32s.

[0092] The control system described above keeps mark M1 displayed until the target device receives the control setting information including the change. Thus, the control system has an advantage of allowing the user to more easily confirm whether the control setting of the target device is completed.

[0093] For example, in the control system according to a sixth aspect, it is possible, in one of the first to fifth aspects, that if an external device is not registered, processing unit 34 does not put mark M1 to the setting item that requires a connection with the external device.

[0094] If no external device is registered, the control system described above does not put mark M1 to setting item I1 that requires setting only when an external device is registered. Thus, the control system has an advantage of saving the user from needlessly having to transmit the control setting information including the change.

[0095] For example, in the control system according to a seventh aspect, it is possible, in one of the first to sixth aspects, that processing unit 34 puts mark M1 to the setting item of a specific device, among the at least one device 20, having the latest control setting information stored in storage 35 that is different from the control setting information obtained by synchronization.

[0096] The control system described above allows the user to visually confirm with ease, by looking at mark M1 put to the specific device, that the control setting information stored in the specific device is different from the control setting information stored in the control system. This has an advantage that the user is able to easily take action to cause the specific device and the control system to store the same control setting information.

[0097] For example, in the control system according to an eighth a spect, it is possible, in one of the first to seventh aspects, that p rocessing unit 34 transmits to, among the at least one device 20, one of device 20 marked with mark M1 in setting image 32s or device 20 not marked with mark M1 in setting image 32s, a contr ol command for causing device 20 to which the control command is transmitted to operate differently from another device 20 to wh ich the control command is not transmitted.

[0098] The control system described above causes device 20 marked with M1 in setting image 32 to operate differently from other devices 20, for example. Thus, the control system has an advantage of allowing the user to visually confirm with ease the position of device 20 that does not yet receive the control setting information including the change.

[0099] For example, in the control system according to a night aspect, it is possible, in one of the first to eighth aspects, that in response to the input received by receiver 31, processing unit 34 deregisters device 20, among the at least one device 20, that is marked with mark M1 in setting image 32s.

[0100] If, for example, light fixture 20 may have been removed and thus may no longer exist in the control system described above, input performed by the user to deregister this light fixture 20 enables deregistration of this light fixture 20 without any operation to initialize this light fixture 20. Thus, the control system has an advantage of easily reducing the burden on the user.

[0101] For example, a control method according to a tenth aspect includes: displaying, on a display, setting image 32s for control setting performed for each of at least one device 20 (S40); receiving, for each of the at least one device 20, input of the control setting of device 20 (S41); storing, for each of the at least one device 20, into storage 35, control setting information including the control setting received in the receiving, the control setting information being latest control setting information transmitted to device 20 (S43). If the control setting information on a target device which is to be set among the at least one device 20 includes a change from the latest control setting information stored in storage 35 (S51: Yes), putting mark M1 to setting item I1 related to the change in setting image 32s (S52).

[0102] The control method described above allows the user to visually confirm, by looking at setting item I1 marked with mark M1, that the control setting information on the target device includes a change and that the control setting information including the change is not yet transmitted to the target device. Thus, the control method has an advantage of allowing the user to easily confirm whether the control setting of the target device is completed.

[0103] Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of example only and is not to be taken by way of limitation, the scope of the present invention being limited only by the terms of the appended claims.

Reference Signs List

[0104]

20	light fixture (device)
30	information terminal (control system)
31	receiver
32	display
32s	setting image
34	processing unit
35	storage
I1	setting item
M1	mark

Claims

1. A control system comprising:

   a processing unit that displays, on a display, a setting image for control setting performed for each of at least one device;
   a receiver that receives, for each of the at least one device, input of the control setting of the device among the at least one device; and
   a storage that stores, for each of the at least one device, control setting information including the control setting received by the receiver, the control setting information being latest control setting information transmitted to the device,
   wherein if the control setting information on a target device which is to be set among the at least one device includes a change from the latest control setting information stored in the storage, the processing unit puts a mark to a setting item related to the change in the setting image.

2. The control system according to claim 1,
   wherein the setting item includes the target device, a zone where the target device belongs, and an area where the zone belongs.

3. The control system according to claim 1 or claim 2,
   wherein when the control setting is performed for the at least one device for a first time, the processing unit puts the mark to the setting item of all of the at least one device in the setting image.

4. The control system according to one of the preceding claims,
   wherein if transmission of the control setting information including the change to the target device is successful, the processing unit deletes the mark from the setting image.

5. The control system according to one of the preceding claims,
   wherein if transmission of the control setting information including the change to the target device is unsuccessful, the processing unit does not delete the mark from the setting image.

6. The control system according to one of the preceding claims,
   wherein if an external device is not registered, the processing unit does not put the mark to the setting item that requires a connection with the external device.

7. The control system according to one of the preceding claims,
   wherein the processing unit puts the mark to the setting item of a specific device, among the at least one device, having the latest control setting information stored in the storage that is different from the control setting information obtained by synchronization.

8. The control system according to one of the preceding claims,
   wherein the processing unit transmits to, among the at least one device, one of a device marked with the mark in the setting image or a device not marked with the mark in the setting image, a control command for causing the device to which the control command is transmitted to operate differently from another device to which the control command is not transmitted.

9. The control system according to one of the preceding claims,
   wherein in response to the input received by the receiver, the processing unit deregisters a device, among the at least one device, that is marked with the mark in the setting image.

10. A control method comprising:

    displaying, on a display, a setting image for control setting performed for each of at least one device;
    receiving, for each of the at least one device, input of the control setting of the device;
    storing, for each of the at least one device, into a storage, control setting information including the control setting received in the receiving, the control setting information being latest control setting information transmitted to the device; and
    if the control setting information on a target device which is to be set among the at least one device includes a change from the latest control setting information stored in the storage, putting a mark to a setting item related to the change in the setting image.

FIG. 1

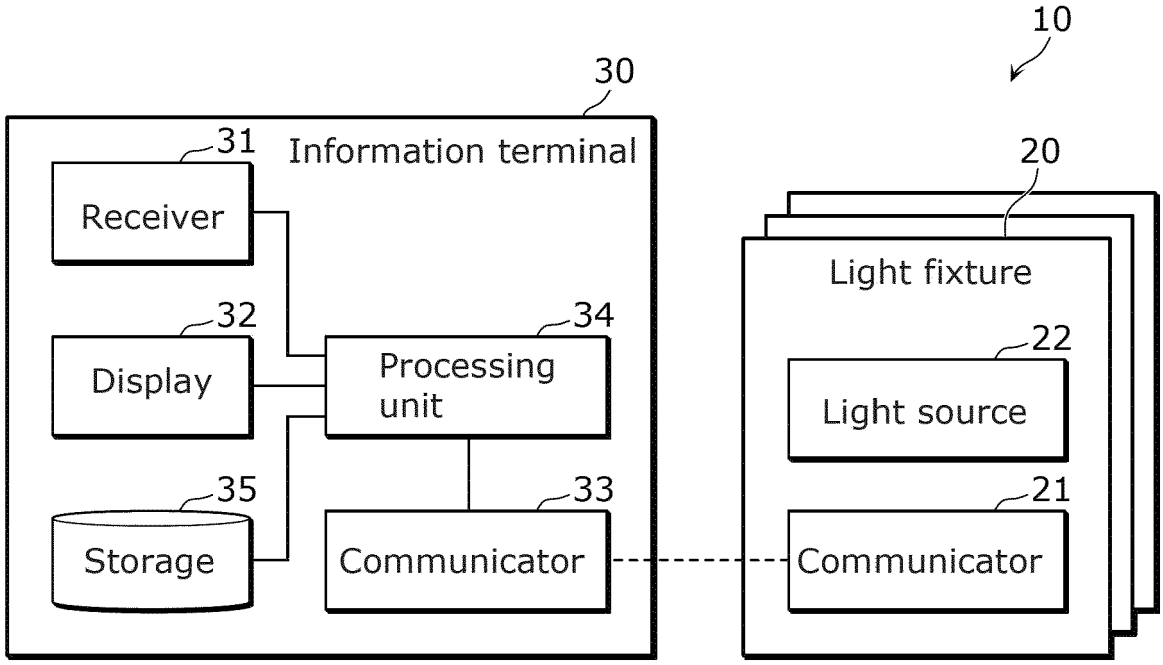

10
30
31
Information terminal
Receiver
32
Display
34
Processing unit
35
Storage
33
Communicator
20
Light fixture
22
Light source
21
Communicator

FIG. 2

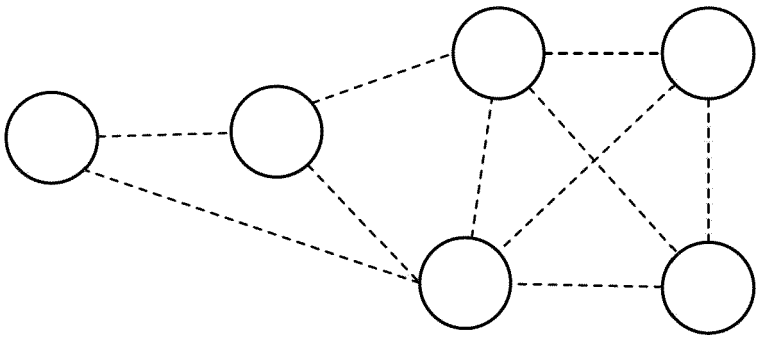


FIG. 3

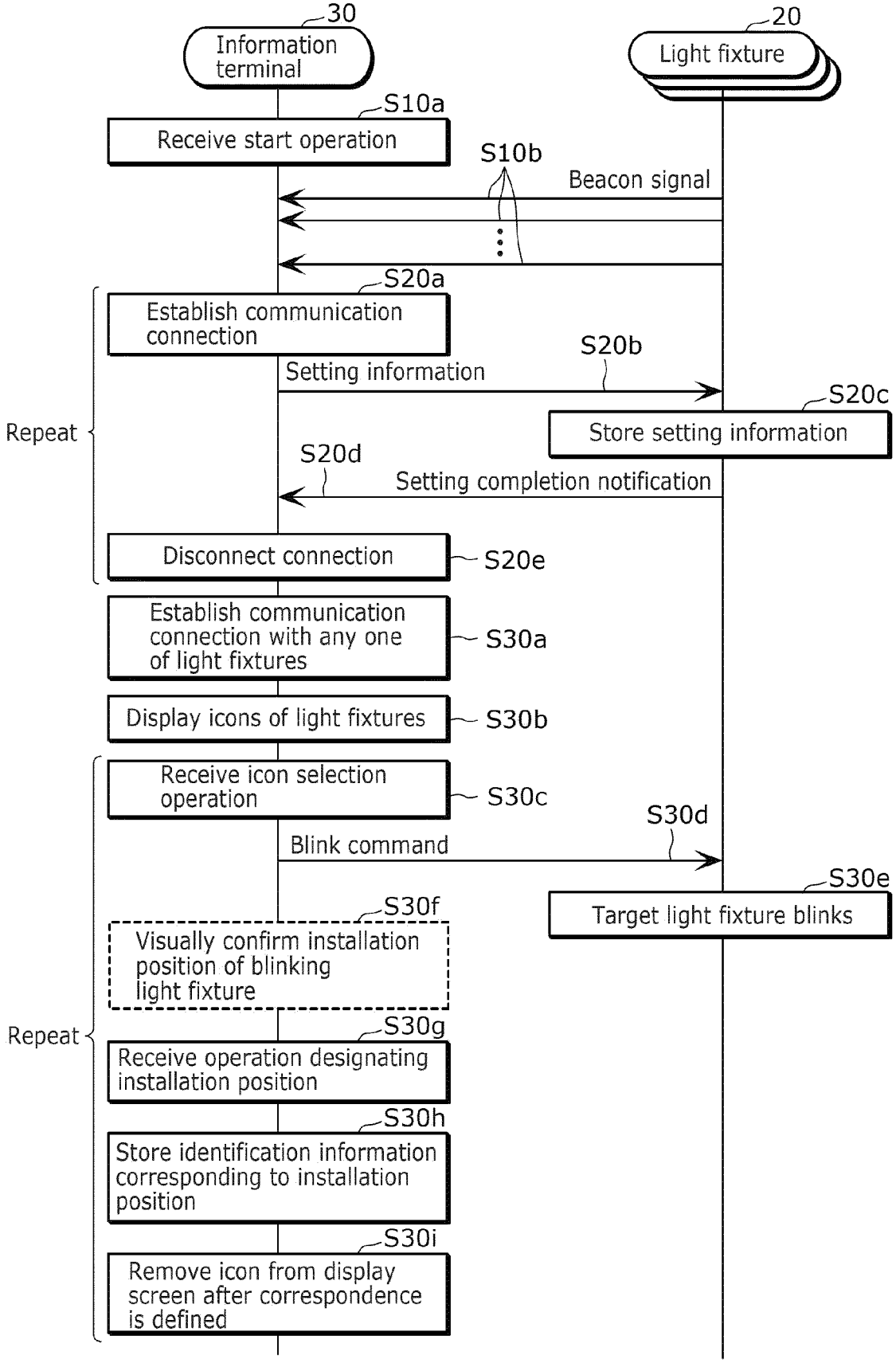

30
Information terminal
20
Light fixture
S10a
Receive start operation
S10b
Beacon signal
S20a
Establish communication connection
S20b
Setting information
S20c
Store setting information
Repeat
S20d
Setting completion notification
Disconnect connection
S20e
Establish communication connection with any one of light fixtures
S30a
Display icons of light fixtures
S30b
Receive icon selection operation
S30c
S30d
Blink command
S30e
Target light fixture blinks
S30f
Visually confirm installation position of blinking light fixture
Repeat
S30g
Receive operation designating installation position
S30h
Store identification information corresponding to installation position
S30i
Remove icon from display screen after correspondence is defined

FIG. 4

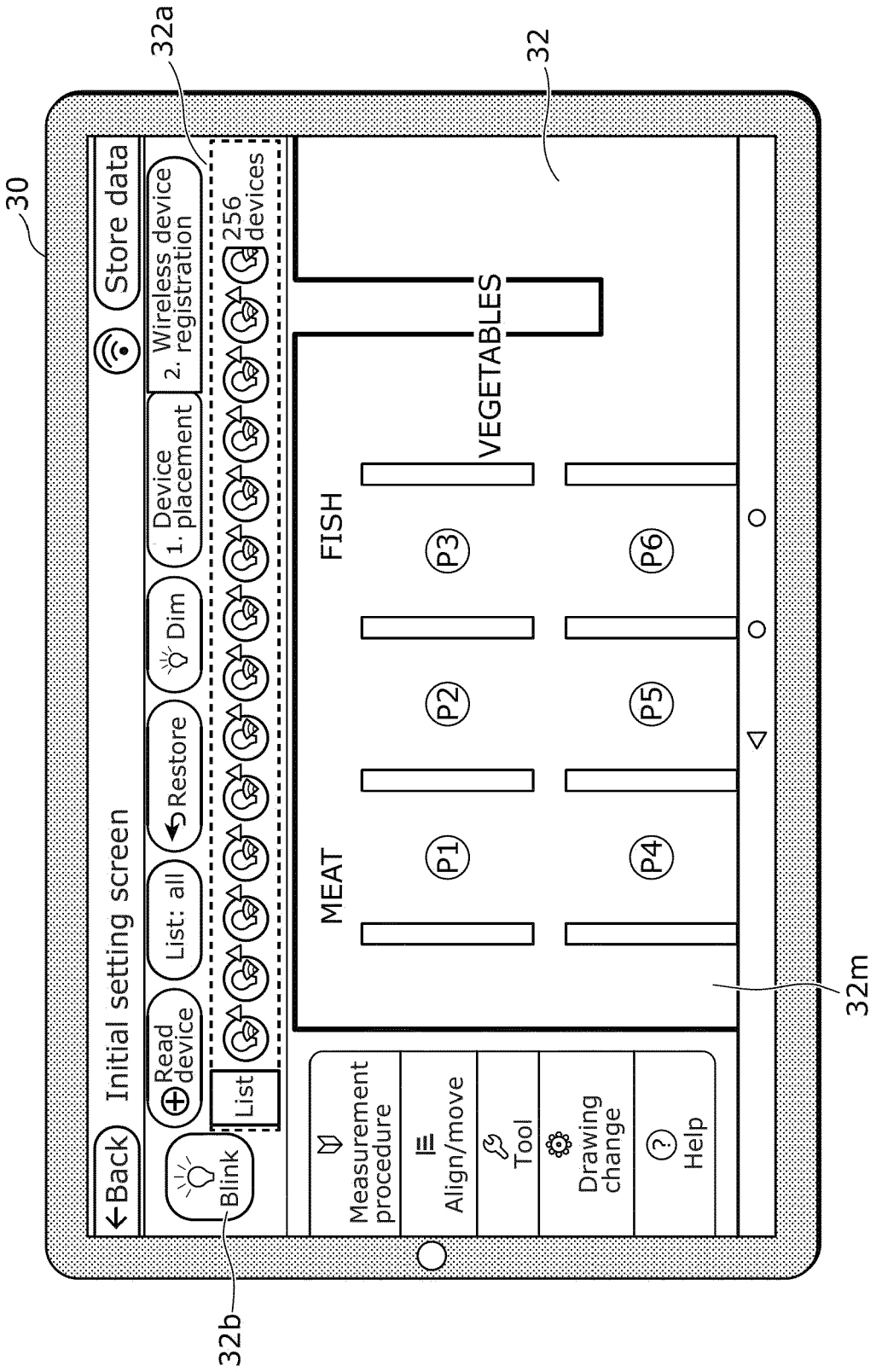

30
32a
32
32b
32m
Back
Initial setting screen
Store data
Read device
List: all
Restore
Dim
1. Device placement
2. Wireless device registration
256 devices
List
Blink
Measurement procedure
Align/move
Tool
Drawing change
Help
MEAT
FISH
VEGETABLES
P1
P2
P3
P4
P5
P6

FIG. 5

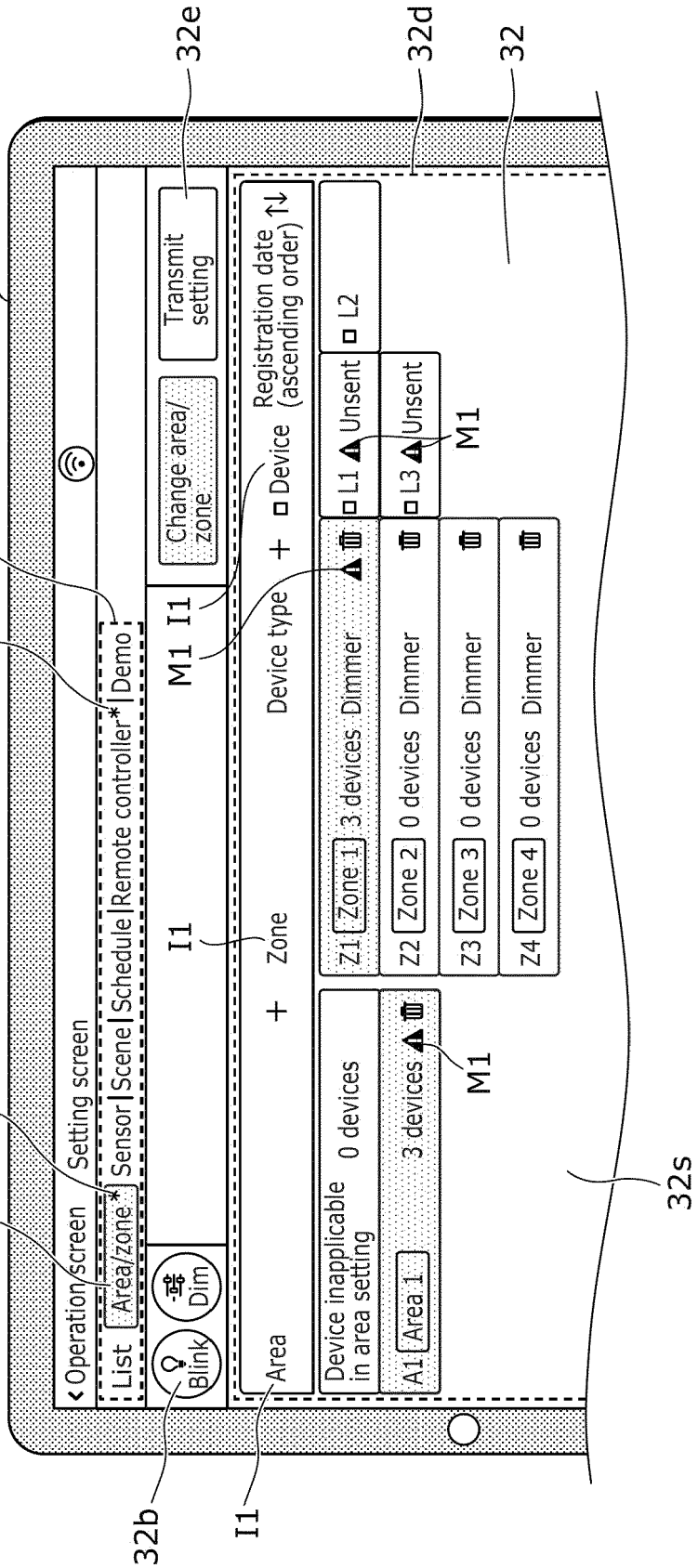

30
32e
32d
32
32c
M1
I1
32b
32s
Operation screen
Setting screen
List
Area/zone*
Sensor
Scene
Schedule
Remote controller*
Demo
Blink
Dim
Change area/ zone
Transmit setting
Area
Zone
Device
Device type
Registration date (ascending order)
Device inapplicable in area setting
0 devices
A1
Area 1
3 devices
Z1
Zone 1
3 devices
Dimmer
L1
Unsent
L2
Z2
Zone 2
0 devices
Dimmer
L3
Unsent
Z3
Zone 3
0 devices
Dimmer
Z4
Zone 4
0 devices
Dimmer

FIG. 6

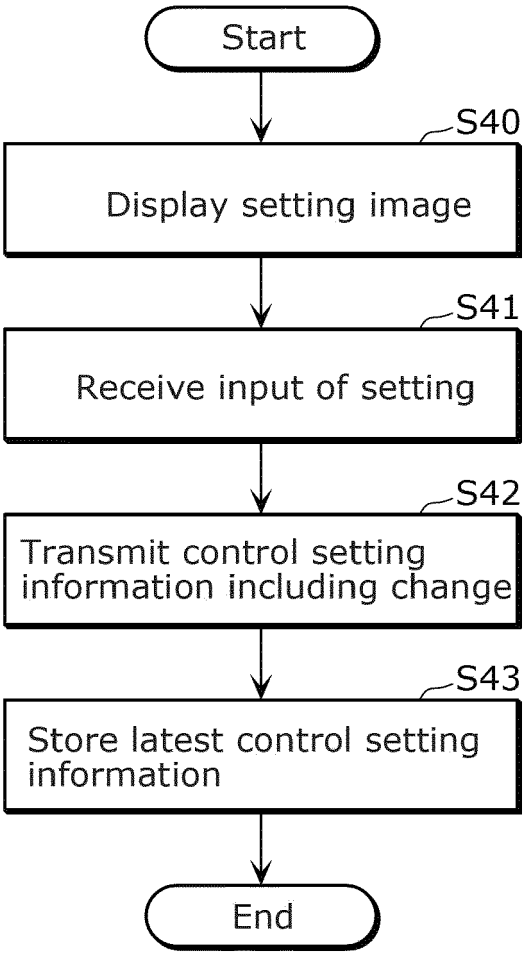
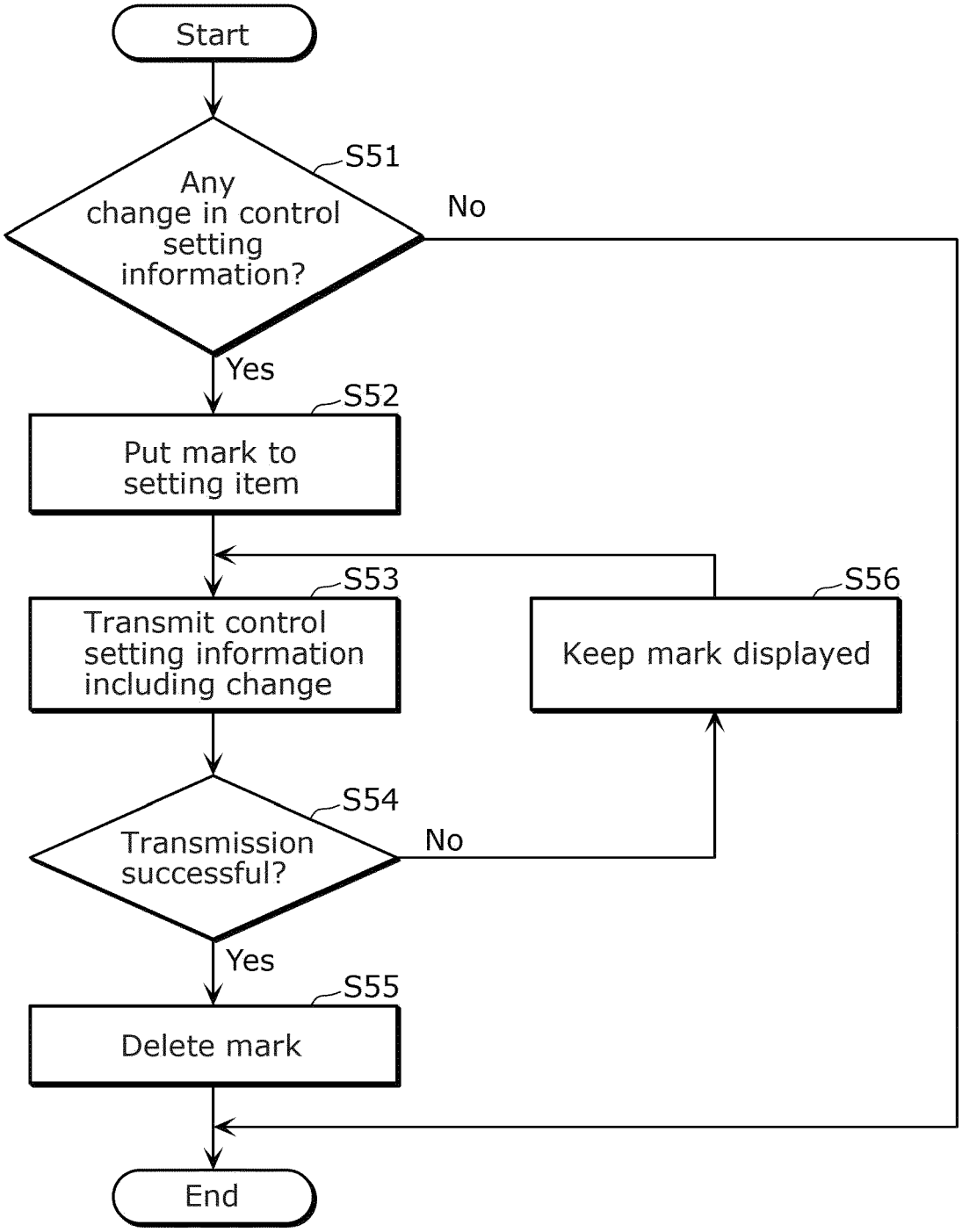

Start
S40
Display setting image
S41
Receive input of setting
S42
Transmit control setting information including change
S43
Store latest control setting information
End

FIG. 7


Start
S51
Any change in control setting information?
No
Yes
S52
Put mark to setting item
S53
Transmit control setting information including change
S56
Keep mark displayed
S54
Transmission successful?
No
Yes
S55
Delete mark
End

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EUROPEAN SEARCH REPORT

Application Number
EP 24 16 9702

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	US 2008/163058 A1 (TANAKA YOSHIHISA [JP] ET AL) 3 July 2008 (2008-07-03)	1-7,9,10	INV. H05B47/175
Y	* paragraphs [0025] - [0037], [0053], [0058], [0076], [0081], [0088], [0117]; claims 1,2; figures 1,2,5 *	8	H05B47/19
Y,D	JP 2021 163573 A (TOSHIBA LIGHTING & TECHNOLOGY) 11 October 2021 (2021-10-11)	8	
A	* paragraphs [0002], [0016] - [0025], [0065]; figures 1,2,4 *	1,10	

TECHNICAL FIELDS SEARCHED (IPC)
H05B
G06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 September 2024	Henderson, Richard

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 16 9702

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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17-09-2024

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US 2008163058 A1	03-07-2008	JP 4860459 B2	25-01-2012
		JP 2008165397 A	17-07-2008
		US 2008163058 A1	03-07-2008
JP 2021163573 A	11-10-2021	NONE	

REFERENCES CITED IN THE DESCRIPTION

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