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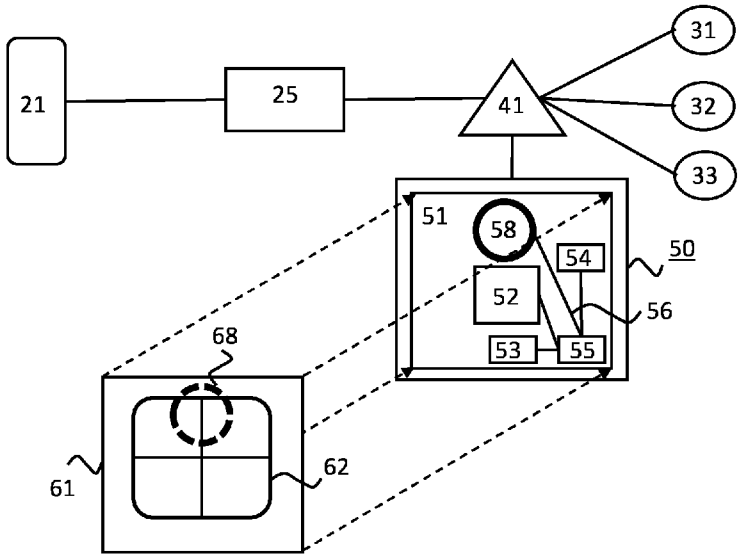

Fig. 2

(57) Abstract: A system (50) for controlling or facilitating control of a lighting unit (31-33) is configured to detect attachment of a second lighting control unit (61) to a first lighting control unit (51), enable control of the lighting unit by the second lighting control unit responsive to detecting the attachment, and disable control of the lighting unit by the first lighting control unit responsive to detecting the attachment. The first lighting control unit comprises first user input means (52) and/or first sensor means. The second lighting control unit comprises second user input means (62) and/or second sensor means. Disabling control of the lighting unit by the first lighting control unit (51) comprises: removing an identifier of the first lighting control unit (51) from a set of identifiers of active devices stored in a memory (7) of said system (50) and/or ignoring input signals generated by the first lighting control unit (51) and/or configuring the first lighting control unit (51) not to generate any signals related to lighting control.

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Upgradeable lighting control

FIELD OF THE INVENTION

The invention relates to a system for controlling or facilitating control of a lighting unit.

The invention further relates to a method of controlling or facilitating control of a lighting unit.

The invention also relates to a computer program product enabling a computer system to perform such a method.

BACKGROUND OF THE INVENTION

A new or renovated home typically comes with standard wall-switches for lighting control. It would be convenient for users if they would be able to add new lighting control functionality to these wall-switches instead of having to replace these wall-switches, which may require the help of an electrician.

US 2017/0271921 A1 discloses a modular lighting control system which includes a switch module having one or more magnets, a wireless power transmission coil, an infrared light transmitter, and an infrared light receiver and further includes a user interface module having one or more wireless power reception coils, one or more magnets, an infrared light emitter and an infrared light detector. The user interface module can be removably attached to and powered by one or more of the switch modules and communicate with one or more of the switch modules without any mechanical attachment or electrical connection on either the switch module or the user interface module. The switch module may include a tactile switch configured to trigger different lighting events and/or one or more temperature sensors.

It is a drawback of this modular lighting control system that the new lighting control functionality may interfere with the old lighting control functionality. For example, a temperature sensor on a switch module may not register the temperature correctly anymore when a user interface module is attached the switch module.

SUMMARY OF THE INVENTION

It is a first object of the invention to provide a system, which can prevent new lighting control functionality from interfering with old lighting control functionality.

It is a second object of the invention to provide a method, which can be used to prevent new lighting control functionality from interfering with old lighting control functionality.

In a first aspect of the invention, a system for controlling or facilitating control of a lighting unit comprises at least one input interface and at least one processor configured to detect, via said at least one input interface, attachment of a second lighting control unit to a first lighting control unit, said first lighting control unit comprising first user input means and/or first sensor means and said second lighting control unit comprising second user input means and/or second sensor means, enable control of said lighting unit by said second lighting control unit responsive to detecting said attachment, and disable control of said lighting unit by said first lighting control unit responsive to detecting said attachment.

Thus, the second lighting control unit does not merely add new lighting control functionality but replaces the old lighting control functionality offered by the first lighting control unit. If the first lighting control unit comprises user input means, the second lighting control unit preferably hides and/or covers these user input means when it is attached to the first lighting control unit. By automatically disabling control of the lighting unit by the first lighting control unit, it may be prevented, for example, that the lighting unit is controlled based on an unreliable measurement of sensor means of the first lighting control unit or that user input is provided via user input means of the first lighting control unit by accident. Furthermore, by disabling sensor means of the first lighting control unit, energy may be saved. The user input means may comprise sensor means. For example, the first user input means may be a simple touch sensor and may not have any moveable parts.

The first lighting control unit may comprise, for example, only basic lighting control elements which provide only basic lighting functions, such as a basic on/off switch or a basic light or motion sensor. The first lighting control unit may comprise a non-mechanical light switch or a simple mechanical switch, for example. The second lighting control unit may provide more lighting control functionality and/or more advanced lighting control functionality than the first lighting control unit. Alternatively, the second lighting control unit may offer the same or similar functionality but may have a more attractive appearance or finishing.

Said system may comprise a lighting control bridge, a lighting control device, and/or a luminaire. Said system may comprise said first lighting control unit. Disabling control of said lighting unit by said first lighting control unit may not require the first lighting control unit to be disabled entirely.

Said first lighting control unit or a device into which said first lighting control unit is integrated may comprise a wall mount for mounting said first lighting control unit or said device to a wall and/or said first lighting control unit may be integrated into a luminaire, for example. Said first lighting control unit or said device into which said first lighting control unit is integrated may have a wired power connection at a backside for receiving mains power, for example.

Said at least one processor may be configured to associate at least part of configuration data associated with said first lighting control unit with said second lighting control unit responsive to detecting said attachment, and to configure said second lighting control unit based on the at least part of configuration data. Said configuration data may be indicative of one or more of: a name (e.g. assigned to the lighting control unit), one or more control settings, one or more light routines, one or more light scenes, a position (e.g. of the lighting control unit), and an orientation (e.g. of the lighting control unit).

By re-using the configuration data associated with the first lighting control unit for the second lighting control unit, the user may be able to configure the second lighting control unit with less effort. Since the second lighting control unit replaces the first lighting control unit, this re-use may be especially substantial. Since the first lighting control unit will no longer be used, the name assigned to the first lighting control unit (e.g. light switch living room) may be assigned to the second lighting control unit instead.

Said at least one processor may be configured to disable control of said lighting unit by said first lighting control unit by removing an identifier of said first lighting control unit from a set of identifiers of active devices stored in a memory of said system and/or by ignoring input signals generated by said first lighting control unit and/or by configuring said first lighting control unit not to generate any signals related to lighting control.

For example, said system may be a light control bridge which maintains the set of identifiers of active devices in its memory. By removing an identifier from this set, the light control bridge could later determine that it should ignore input signals generated by a light control unit associated with this identifier or the light control unit associated with this

identifier could determine that it should not send any signals related to lighting control to this light control bridge.

Instead of a light control bridge, the system may be a lighting unit. The lighting unit may store a set of identifiers of active (lighting control) devices which are allowed to control it. Control of the lighting unit by the first lighting control unit may be disabled by removing an identifier of the first lighting control unit from this set of identifiers. Instead of a light control bridge, the system may be a lighting control device. The lighting control device may store a set of identifiers of lighting units that the lighting control device is allowed to control.

Said at least one processor may be further configured to enable configuration of said second lighting control unit via a user interface and disabling configuration of said first lighting control unit via said user interface in response to detecting said attachment. This may be used to make it possible for the user(s) to configure new lighting control unit via the user interface, e.g. of a mobile device, and prevent the user(s) from accidentally configuring the old, disabled lighting control unit or at least prevent confusion.

Said first lighting control unit may comprise one or more wireless power coils and/or one or more electrodes for transferring energy and/or data from said first lighting control unit to said second lighting control unit. The second control unit would therefore not need to includes own batteries. For example, the second lighting control unit may be able to use the same power source, e.g. a battery or mains power, as the first lighting control unit. The electrodes may be surface electrodes or holes and pins, for example. Data may (alternatively) be transferred via light. For example, the second lighting control unit may comprise a LED and the first lighting control unit may comprise a light receiver and/or vice versa. The LED may shine through thin plastic so a hole in first lighting control unit would not be visible when the second lighting control unit is not attached to the first lighting control unit.

Said first lighting control unit may comprise one or more parts which enable attachment of said second lighting control unit to said first lighting control unit and alignment of said one or more wireless power coils and/or said one or more electrodes of said first lighting control unit with one or more corresponding wireless power coils and/or one or more corresponding electrodes of said second lighting control unit. This makes attachment of the second lighting control unit to the first lighting control unit relatively easy. The alignment optimizes the energy transfer and charging efficiency. The one or more parts may be magnetic or metal parts or may be mechanical or other kinds of parts (e.g. plastic clips or the

corresponding slots; or the housing of the second lighting control unit may fit nicely over the housing of the first lighting control unit), for example. Said first lighting unit may comprise a magnetic wireless power dock, for example. Said magnetic wireless power dock may be similar to Apple's magnetic MagSafe connector, for example. A benefit of surface electrodes is that they do not only have a high power transfer efficiency, but high-bandwidth data communication could further be enabled by adding a data line connector.

Said first lighting control unit may be configured to forward input signals received from said second lighting control unit to said at least one processor while said second lighting control unit is attached to said first lighting control unit. This may allow an RF transceiver, e.g. for transmitting the input signals to a lighting control bridge, to be omitted from the second lighting control unit, thereby saving costs.

Said at least one processor may be configured to detect, via said at least one input interface, detachment of said second lighting control unit from said first lighting control unit, enable control of said lighting unit by said first lighting control unit responsive to detecting said detachment, and disable control of said lighting unit by said second lighting control unit responsive to detecting said detachment. For example, if the second lighting control unit does not provide the expected benefit or is of better use elsewhere, then control of the lighting unit by the first lighting control may be enabled again. Configuration data previously associated with the first lighting control unit may still be associated with the first lighting control unit and may then be used again as soon as the first lighting control unit is enabled again.

Alternatively, control of the lighting unit by the second lighting control unit may remain enabled after detachment of the second lighting control unit from the first lighting control unit. For example, the second lighting control unit may remain linked to the lighting unit until the second lighting control unit is attached to another lighting control unit.

In a second aspect of the invention, a method of controlling or facilitating control of a lighting unit comprises detecting attachment of a second lighting control unit to a first lighting control unit, said first lighting control unit comprising first user input means and/or first sensor means and said second lighting control unit comprising second user input means and/or second sensor means, enabling control of said lighting unit by said second lighting control unit responsive to detecting said attachment, and disabling control of said lighting unit by said first lighting control unit responsive to detecting said attachment. Said method may be performed by software running on a programmable device. This software may be provided as a computer program product.

Moreover, a computer program for carrying out the methods described herein, as well as a non-transitory computer readable storage-medium storing the computer program are provided. A computer program may, for example, be downloaded by or uploaded to an existing device or be stored upon manufacturing of these systems.

A non-transitory computer-readable storage medium stores at least one software code portion, the software code portion, when executed or processed by a computer, being configured to perform executable operations for controlling or facilitating control of a lighting unit.

The executable operations comprise detecting attachment of a second lighting control unit to a first lighting control unit, said first lighting control unit comprising first user input means and/or first sensor means and said second lighting control unit comprising second user input means and/or second sensor means, enabling control of said lighting unit by said second lighting control unit responsive to detecting said attachment, and disabling control of said lighting unit by said first lighting control unit responsive to detecting said attachment.

As will be appreciated by one skilled in the art, aspects of the present invention may be embodied as a device, a method or a computer program product. Accordingly, aspects of the present invention may take the form of an entirely hardware embodiment, an entirely software embodiment (including firmware, resident software, micro-code, etc.) or an embodiment combining software and hardware aspects that may all generally be referred to herein as a "circuit", "module" or "system." Functions described in this disclosure may be implemented as an algorithm executed by a processor/microprocessor of a computer. Furthermore, aspects of the present invention may take the form of a computer program product embodied in one or more computer readable medium(s) having computer readable program code embodied, e.g., stored, thereon.

Any combination of one or more computer readable medium(s) may be utilized. The computer readable medium may be a computer readable signal medium or a computer readable storage medium. A computer readable storage medium may be, for example, but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing. More specific examples of a computer readable storage medium may include, but are not limited to, the following: an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical

fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing. In the context of the present invention, a computer readable storage medium may be any tangible medium that can contain, or store, a program for use by or in connection with an instruction execution system, apparatus, or device.

A computer readable signal medium may include a propagated data signal with computer readable program code embodied therein, for example, in baseband or as part of a carrier wave. Such a propagated signal may take any of a variety of forms, including, but not limited to, electro-magnetic, optical, or any suitable combination thereof. A computer readable signal medium may be any computer readable medium that is not a computer readable storage medium and that can communicate, propagate, or transport a program for use by or in connection with an instruction execution system, apparatus, or device.

Program code embodied on a computer readable medium may be transmitted using any appropriate medium, including but not limited to wireless, wireline, optical fiber, cable, RF, etc., or any suitable combination of the foregoing. Computer program code for carrying out operations for aspects of the present invention may be written in any combination of one or more programming languages, including an object oriented programming language such as Java(TM), Smalltalk, C++ or the like and conventional procedural programming languages, such as the "C" programming language or similar programming languages. The program code may execute entirely on the user's computer, partly on the user's computer, as a stand-alone software package, partly on the user's computer and partly on a remote computer, or entirely on the remote computer or server. In the latter scenario, the remote computer may be connected to the user's computer through any type of network, including a local area network (LAN) or a wide area network (WAN), or the connection may be made to an external computer (for example, through the Internet using an Internet Service Provider).

Aspects of the present invention are described below with reference to flowchart illustrations and/or block diagrams of methods, apparatus (systems), and computer program products according to embodiments of the present invention. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, can be implemented by computer program instructions. These computer program instructions may be provided to a processor, in particular a microprocessor or a central processing unit (CPU), of a general purpose

computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer, other programmable data processing apparatus, or other devices create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

These computer program instructions may also be stored in a computer readable medium that can direct a computer, other programmable data processing apparatus, or other devices to function in a particular manner, such that the instructions stored in the computer readable medium produce an article of manufacture including instructions which implement the function/act specified in the flowchart and/or block diagram block or blocks.

The computer program instructions may also be loaded onto a computer, other programmable data processing apparatus, or other devices to cause a series of operational steps to be performed on the computer, other programmable apparatus or other devices to produce a computer implemented process such that the instructions which execute on the computer or other programmable apparatus provide processes for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

The flowchart and block diagrams in the figures illustrate the architecture, functionality, and operation of possible implementations of devices, methods and computer program products according to various embodiments of the present invention. In this regard, each block in the flowchart or block diagrams may represent a module, segment, or portion of code, which comprises one or more executable instructions for implementing the specified logical function(s). It should also be noted that, in some alternative implementations, the functions noted in the blocks may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. It will also be noted that each block of the block diagrams and/or flowchart illustrations, and combinations of blocks in the block diagrams and/or flowchart illustrations, can be implemented by special purpose hardware-based systems that perform the specified functions or acts, or combinations of special purpose hardware and computer instructions.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects of the invention are apparent from and will be further elucidated, by way of example, with reference to the drawings, in which:

Fig. 1 is a block diagram of a first embodiment of the system;

Fig. 2 is a block diagram of a second embodiment of the system;

Fig. 3 is a block diagram of a third embodiment of the system;

Fig. 4 depicts a fourth embodiment of the system

Fig. 5 is a flow diagram of a first embodiment of the method;

Fig. 6 is a flow diagram of a second embodiment of the method;

Fig. 7 is a flow diagram of a third embodiment of the method;

Fig. 8 is a flow diagram of a fourth embodiment of the method;

Fig. 9 is a flow diagram of a fifth embodiment of the method; and

Fig. 10 is a block diagram of an exemplary data processing system for performing the method of the invention.

Corresponding elements in the drawings are denoted by the same reference numeral.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Fig. 1 shows a first embodiment of the system for controlling or facilitating control of a lighting unit. In this first embodiment, the system is a lighting control bridge 1. The lighting unit may be a lighting device or a light element/pixel of a pixelated lighting device. The bridge 1 controls lighting devices 31-33, e.g. using Zigbee technology. The bridge 1 may be a Philips Hue bridge, for example.

The bridge 1 is connected to a wireless LAN access point 25, e.g. via Ethernet or Wi-Fi. A mobile device 21 is also connected to the wireless LAN access point 25, e.g. via Wi-Fi. Mobile device 21 may be a mobile phone, a tablet or a smart watch, for example. A user may be able to use an app running on mobile device 21 to control lighting devices 31-33 via the wireless LAN access point 25 and the bridge 1.

The bridge 1 comprises a receiver 3, a transmitter 4, a processor 5, and memory 7. The processor 5 is configured to detect, via the receiver 3, attachment of a second lighting control unit 37 to a first lighting control unit 36. For example, the processor 5 may be configured to detect attachment of the second lighting control unit 37 to the first lighting control unit 36 upon receiving a certain message from the first lighting control unit 36, from the lighting control device which comprises the first lighting control unit 36, or from the second lighting control unit 37.

The first lighting control unit 36 comprises first user input means and/or first sensor means. The second lighting control unit 37 comprises second user input means and/or second sensor means. Typically, the second lighting control unit 37 provides more lighting

control functionality and/or more advanced lighting control functionality than the first lighting control unit 36. In the example of Fig. 1, the first lighting control unit 36 comprises a basic light switch (on/off) and the second light control unit 37 comprises a scene selector with four buttons. Each button of the scene selector can be associated with a light scene.

The processor 5 is further configured to enable control of a lighting unit, e.g. one or more of lighting devices 31-33, by the second lighting control unit 37 responsive to detecting the attachment and disable control of the lighting unit by the first lighting control unit 36 responsive to detecting the attachment.

The second lighting control unit 37 may be a (thin) magnetic planar lighting control unit that provides a functionality and finishing that the user prefers, for example. A user may attach this second control unit 37 to the first lighting control unit 36 to easily upgrade the lighting control device which comprises the first lighting control unit 36. In this way, the installation part in a home or office building may be decoupled from the many design and functionality choices for light switches and other lighting controls – allowing the user to select and interchange those without the need for professional help (which is mandated in some regions when working on the electricity wiring).

The second lighting control unit 37 may either comprise its own RF transceiver and/or lighting control processor or it may only communicate detected sensor or user inputs to the first lighting control unit 36. The first lighting control unit 36 or the device that comprises the first lighting control unit 36 then takes care of the communication and lighting control. The first lighting control unit 36 may detect, e.g. via a Hall sensor, that the second lighting control unit 37 has been attached to it, for example. Alternatively, if both lighting control units 36 and 37 are connected to the bridge 1, the bridge 1 may detect that both lighting control units are co-located and then disable the first lighting control unit 36 while auto-configuring/commissioning the second lighting control unit 37 to control the same lighting unit(s) as associated with the first lighting control unit 36.

Besides lighting control, the lighting control unit(s) may provide controls which go beyond lighting, such as, for instance, controls for an audio system or for a climate control system. Also, the lighting control unit(s) may additionally comprise one or more actuators, e.g. a night guidance light or a speaker for music and/or voice interaction.

In the embodiment of the bridge 1 shown in Fig. 1, the bridge 1 comprises one processor 5. In an alternative embodiment, the bridge 1 comprises multiple processors. The processor 5 of the bridge 1 may be a general-purpose processor, e.g. ARM-based, or an application-specific processor. The processor 5 of the bridge 1 may run a Unix-based

operating system for example. The memory 7 may comprise one or more memory units. The memory 7 may comprise one or more hard disks and/or solid-state memory, for example.

The receiver 3 and the transmitter 4 may use one or more wired or wireless communication technologies such as Zigbee to communicate with the lighting devices 31-33 and Ethernet to communicate with the wireless LAN access point 25, for example. In an alternative embodiment, multiple receivers and/or multiple transmitters are used instead of a single receiver and a single transmitter. In the embodiment shown in Fig. 1, a separate receiver and a separate transmitter are used. In an alternative embodiment, the receiver 3 and the transmitter 4 are combined into a transceiver. The bridge 1 may comprise other components typical for a bridge such as a power connector. The invention may be implemented using a computer program running on one or more processors.

In the embodiment of Fig. 1, the system of the invention is a lighting control bridge. In an alternative embodiment, the system of the invention is a different device, e.g. a lighting control device or a luminaire. In the embodiment of Fig. 1, the system of the invention comprises a single device. In an alternative embodiment, the system of the invention comprises a plurality of devices.

Fig. 2 shows a second embodiment of the system for controlling or facilitating control of a lighting unit. In this second embodiment, the system is a lighting control device 50. In the example of Fig. 2, the lighting devices 31-33 and the lighting control device 50 communicate with a bridge 41 instead of bridge 1 of Fig. 1. The bridge 41 is connected to the wireless LAN access point 25, e.g. via Ethernet or Wi-Fi. As described in relation to Fig. 1, the mobile device 21 is also connected to the wireless LAN access point 25, e.g. via Wi-Fi. In an alternative embodiment, the lighting devices 31-33 are controlled without a bridge, e.g. directly via Bluetooth or via the cloud.

The lighting control device 50 comprises a first lighting control unit 51. The first lighting control unit 51 comprises a basic light switch (on/off) 52, a receiver 53, a transmitter 54, a processor 55, a magnetic wireless power dock 58, and an interface 56 between the processor 55 and the magnetic wireless power dock 58. The lighting control device 50, into which the first lighting control unit 51 is integrated, may further comprise a wall mount for mounting the lighting control device 50 to a wall.

In the embodiment of Fig. 2, the magnetic wireless power dock 58 comprises one or more wireless power coils and a second lighting control unit 62 comprises a magnetic power connector 68 with one or more corresponding wireless power coils. In an alternative embodiment, the magnetic wireless power dock 58 comprises one or more (e.g. surface)

electrodes and the magnetic power connector 68 comprises one or more corresponding (e.g. surface) electrodes. The magnetic wireless power dock 58 is used for transferring energy from the first lighting control unit 51 to the second lighting control unit 61. In the example of Fig. 2, the second light control unit 61 comprises a scene selector 62 with four buttons. Each button of the scene selector can be associated with a light scene.

The magnetic wireless power dock 58 further comprises one or more magnetic parts which enable attachment of the second lighting control unit 61 to the first lighting control unit 51 and alignment of the one or more wireless power coils and of the first lighting control unit 51 with the one or more corresponding wireless power coils of the second lighting control unit 61. In the above-mentioned alternative embodiment, one or more magnetic parts enable alignment of the one or more (e.g. surface) electrodes of the first lighting control unit 51 with the one or more corresponding (e.g. surface) electrodes of the second lighting control unit 61.

In another embodiment, one or more mechanical parts provide the alignment for the one or more wireless power coils and/or the one or more (e.g. surface) electrodes. For instance, lighting control unit 61 may fit tight on top of lighting control device 50 to guarantee alignment.

In the embodiment of Fig. 2, the one or more wireless power coils are located in the top-middle part of the first lighting control unit 51 and the one or more magnetic parts are located in the center of the one or more wireless power coils. In an alternative embodiment, the one or more wireless power coils surround the basic light switch 52. Optionally, the lighting control unit 51 may further have one or more notches (e.g. a circular notch) to provide additional stability to the magnetic attachment. In the above-mentioned alternative embodiment with surface electrodes, one or more of these surface electrodes may be integrated into the one or more notches.

The wireless power connector 68 comprises one or more corresponding magnetic or metal parts. The magnetic wireless power dock 58 is configured to provide a signal to the processor 55 via the interface 56 indicative of whether a second lighting control unit is attached to the first lighting control unit 51. The magnetic wireless power dock 58 may detect attachment of the second lighting control unit 61 to the first lighting control unit 51, for example. For instance, wireless charging may detect if a client is drawing power or a separate Hall sensor may be used. In the embodiment of Fig. 2, the lighting control units do not comprise an environmental sensor. In an alternative embodiment, the lighting control unit

51 and/or the lighting control unit 61 alternatively or additionally comprises one or more environmental sensors such as an ambient light sensor or presence sensor.

The processor 55 is configured to detect, via the interface 56, attachment of the second lighting control unit 61 to the first lighting control unit 51 and enable control of a lighting unit, e.g. one or more of lighting devices 31-33, by the second lighting control unit 61 responsive to detecting the attachment and disable control of the lighting unit by the first lighting control unit 51 responsive to detecting the attachment.

In the embodiment of the light control device 50 shown in Fig. 2, the lighting control device 50 comprises one processor 55. In an alternative embodiment, the lighting control device 50 comprises multiple processors. The processor 55 of the lighting control device 50 may be a general-purpose processor, e.g. ARM-based, or an application-specific processor. The lighting control device 50 may further comprise a memory (not shown in Fig. 2). The memory may comprise one or more memory units. The memory may comprise solid-state memory, for example.

The receiver 53 and the transmitter 54 may use one or more wireless communication technologies, e.g. Zigbee, for communicating with the bridge 41, for example. In an alternative embodiment, multiple receivers and/or multiple transmitters are used instead of a single receiver and a single transmitter. In the embodiment shown in Fig. 2, a separate receiver and a separate transmitter are used. In an alternative embodiment, the receiver 53 and the transmitter 54 are combined into a transceiver. The lighting control device 50 may comprise other components typical for a connected lighting control device such as a power connector and/or a battery. The invention may be implemented using a computer program running on one or more processors.

In the embodiment of Fig. 2, the lighting devices 31-33 are controlled by the lighting control device 50 and the mobile device 21 via the bridge 41. In an alternative embodiment, one or more of the lighting devices 31-33 are controlled by one or more of these devices without a bridge, e.g. directly via Bluetooth.

Fig. 3 shows a third embodiment of the system for controlling or facilitating control of a lighting unit. In this third embodiment, the system is a luminaire 70. In the embodiment of Fig. 3, the luminaire 70 is a ceiling luminaire. The luminaire 70 comprises a receiver 73, a transmitter 74, a processor 74, a first lighting control unit 71, an interface 76 between the first lighting control 71 and the processor 75, and an array of light sources 79, e.g. LEDs. The first lighting control unit 71 comprises a magnetic wireless power dock 78

and a simple sensor 72, e.g. a light and/or presence sensor. The magnetic wireless power dock 78 may be similar to the magnetic wireless power dock 58 of Fig. 2, for example.

The magnetic wireless power dock 78 is configured to provide a signal, to the processor 75 via the interface 76, indicative of whether a second lighting control unit is attached to the first lighting control unit 71. The second lighting control unit 71 comprises a magnetic power connector 88 and an advanced sensor 82, e.g. a multi-sensor bundle and/or a (depth) camera. The magnetic power connector 88 may be similar to the magnetic power connector 68 of Fig. 2, for example. In the embodiment of Fig. 3, the magnetic wireless power dock 78 is rotation symmetric and enables the second lighting control unit 81, and therefore the sensor 82, to be rotated such that the sensor 82 can be oriented in the desired direction.

The processor 75 is configured to detect, via the interface 76, attachment of the second lighting control unit 81 to the first lighting control unit 71, enable control of the light array 79 by the second lighting control unit 81 responsive to detecting the attachment, e.g. by activating advanced sensor 82, and disable control of the light array 79 unit by the first lighting control unit 71 responsive to detecting the attachment, e.g. by de-activating simple sensor 72.

In the embodiment of Fig. 3, the processor 75 may be able to communicate with the second lighting control unit 81 via the receiver 73 and the transmitter 74. The second lighting control 81 may comprise a (e.g. RF) transmitter for transmitting input signals to the processor 75 via the receiver 73. Optionally, the first lighting control unit 71 may be configured to forward input signals received from the second lighting control unit 81 (e.g. via the magnetic field, or via surface electrodes in an alternative embodiment) to the processor 75 while the second lighting control unit 81 is attached to the first lighting control unit 71. In an alternative embodiment, the receiver 73 and the transmitter 74 may be omitted.

In the embodiment of the luminaire 70 shown in Fig. 3, the luminaire 70 comprises one processor 75. In an alternative embodiment, the luminaire 70 comprises multiple processors. The processor 75 of the luminaire 70 may be a general-purpose processor or an application-specific processor. The receiver 73 and the transmitter 74 may use one or more wireless communication technologies. e.g. Zigbee. In an alternative embodiment, multiple receivers and/or multiple transmitters are used instead of a single receiver and a single transmitter.

In the embodiment shown in Fig. 3, a separate receiver and a separate transmitter are used. In an alternative embodiment, the receiver 73 and the transmitter 74 are

combined into a transceiver. The luminaire 70 may comprise other components typical for a luminaire such as a power connector. The invention may be implemented using a computer program running on one or more processors.

Fig. 4 shows a fourth embodiment of the system for controlling or facilitating control of a lighting unit. Like in the embodiment of Fig. 3, the first lighting control unit is integrated into a luminaire. However, in the embodiment of Fig. 4, the first lighting control unit 96 is integrated into a desk lamp 94 instead of into a ceiling luminaire. The first lighting control unit 96 comprises a basic on/off switch and a magnetic wireless power dock and is integrated into the base of the desk lamp 94. This enables a user to use the magnetic wireless power dock to charge an electronic device such as a smartphone. In addition, the user could use it to upgrade the lighting control functionality of the desk lamp, e.g. by adding a rotary dimmer knob or by adding a light and presence sensor to enable the desk lamp to automatically switch on and off dependent on detected lighting conditions and user presence.

At a first moment 91, the first lighting control unit 96 is enabled and at a second moment 92, the second lighting control unit 97 is attached to the first lighting control unit 96, the first lighting control unit 96 is disabled, and the second lighting control unit 97 is enabled. The desk lamp 94 may optionally comprise multiple wireless power docks such that a user does not have to choose between charging a phone, adding a sensor, or having the dimming ability. For example, a second wireless power dock may be comprised in the first lighting control unit 96, in a further lighting control unit integrated into the base of the desk lamp 94, or in another part of the desk lamp 94.

It may be possible to attach the second lighting control unit 97 to different parts of the first lighting control unit 96 or to different lighting control units integrated into the desk lamp 94 and have the user input means and/or sensor means of the second lighting control unit 97 behave differently depending on where the second lighting control unit 97 is placed.

A first embodiment of the method of controlling or facilitating control of a lighting unit is shown in Fig. 5. The method may be performed by the lighting control bridge 1 of Fig. 1, the lighting control device 50 of Fig. 2, or the luminaire 70 of Fig. 3, for example.

A step 101 comprises detecting attachment of a second lighting control unit to a first lighting control unit. The first lighting control unit comprises first user input means and/or first sensor means. The second lighting control unit comprises second user input means and/or second sensor means. Typically, the second lighting control unit provides more

lighting control functionality and/or more advanced lighting control functionality than the first lighting control unit.

A step 103 comprises enabling control of the lighting unit by the second lighting control unit responsive to detecting the attachment. A step 105 comprises disabling control of the lighting unit by the first lighting control unit responsive to detecting the attachment. Additionally, one or more steps of one or more of the embodiments of Figs. 6-9 may be added to the embodiment of Fig. 5.

A second embodiment of the method of controlling or facilitating control of a lighting unit is shown in Fig. 6. The method may be performed by the lighting control bridge 1 of Fig. 1, the lighting control device 50 of Fig. 2, or the luminaire 70 of Fig. 3, for example. The second embodiment of Fig. 6 is an extension of the first embodiment of Fig. 5. In the embodiment of Fig. 6, steps 121 and 123 are performed after steps 103 and 105 of Fig. 4 have been performed.

Step 121 comprises associating at least part of configuration data associated with the first lighting control unit with the second lighting control unit. The configuration data may be indicative of one or more of: a name, one or more control settings, one or more light routines, one or more light scenes, a position, and an orientation. Step 123 comprises configuring the second lighting control unit based on the at least part of configuration data associated with the second lighting control unit in step 121. Additionally, one or more steps of one or more of the embodiments of Figs. 7-9 may be added to the embodiment of Fig. 6.

A third embodiment of the method of controlling or facilitating control of a lighting unit is shown in Fig. 7. The method may be performed by the lighting control bridge 1 of Fig. 1, the lighting control device 50 of Fig. 2, or the luminaire 70 of Fig. 3, for example. The third embodiment of Fig. 7 is an extension of the first embodiment of Fig. 5. In the embodiment of Fig. 7, step 105 of Fig. 5 is implemented by a step 141.

Step 141 comprises disabling control of the lighting unit by the first lighting control unit by removing an identifier of the first lighting control unit from a set of identifiers of active devices stored in a memory of the system and/or by ignoring input signals generated by the first lighting control unit and/or by configuring the first lighting control unit not to generate any signals related to lighting control. By removing the identifier from the set of identifiers of active devices, the first lighting control unit may no longer be visible to any device in the lighting system. Additionally, one or more steps of one or more of the embodiments of Figs. 6, 8-9 may be added to the embodiment of Fig. 7.

A fourth embodiment of the method of controlling or facilitating control of a lighting unit is shown in Fig. 8. The method may be performed by the lighting control bridge 1 of Fig. 1, the lighting control device 50 of Fig. 2, or the luminaire 70 of Fig. 3, for example. The fourth embodiment of Fig. 8 is an extension of the first embodiment of Fig. 5. In the embodiment of Fig. 8, a step 161 is performed after step 103 of Fig. 5 and a step 163 is performed after step 105 of Fig. 5.

Step 161 comprises enabling configuration of the second lighting control unit via a user interface. Step 163 comprises disabling configuration of the first lighting control unit via the user interface and/or via another user interface. Additionally, one or more steps of one or more of the embodiments of Figs. 6-7, 9 may be added to the embodiment of Fig. 8.

A fifth embodiment of the method of controlling or facilitating control of a lighting unit is shown in Fig. 9. The method may be performed by the lighting control bridge 1 of Fig. 1, the lighting control device 50 of Fig. 2, or the luminaire 70 of Fig. 3, for example. The fifth embodiment of Fig. 9 is an extension of the first embodiment of Fig. 5. In the embodiment of Fig. 9, steps 181-185 are performed at a later moment.

Step 181 comprises detecting detachment of the second lighting control unit from the first lighting control unit. Step 183 comprises enabling control of the lighting unit by the first lighting control unit responsive to detecting the detachment. Step 185 comprises disabling control of the lighting unit by the second lighting control unit responsive to detecting the detachment.

The second lighting control unit may later be re-attached to the first lighting control unit. Steps 101-105 are then repeated. Additionally, one or more steps of one or more of the embodiments of Figs. 6-8 may be added to the embodiment of Fig. 9.

Fig. 10 depicts a block diagram illustrating an exemplary data processing system that may perform the method as described with reference to Figs. 5-9.

As shown in Fig. 10, the data processing system 300 may include at least one processor 302 coupled to memory elements 304 through a system bus 306. As such, the data processing system may store program code within memory elements 304. Further, the processor 302 may execute the program code accessed from the memory elements 304 via a system bus 306. In one aspect, the data processing system may be implemented as a computer that is suitable for storing and/or executing program code. It should be appreciated, however, that the data processing system 300 may be implemented in the form of any system including a processor and a memory that is capable of performing the functions described within this specification.

The memory elements 304 may include one or more physical memory devices such as, for example, local memory 308 and one or more bulk storage devices 310. The local memory may refer to random access memory or other non-persistent memory device(s) generally used during actual execution of the program code. A bulk storage device may be implemented as a hard drive or other persistent data storage device. The processing system 300 may also include one or more cache memories (not shown) that provide temporary storage of at least some program code in order to reduce the quantity of times program code must be retrieved from the bulk storage device 310 during execution. The processing system 300 may also be able to use memory elements of another processing system, e.g. if the processing system 300 is part of a cloud-computing platform.

Input/output (I/O) devices depicted as an input device 312 and an output device 314 optionally can be coupled to the data processing system. Examples of input devices may include, but are not limited to, a keyboard, a pointing device such as a mouse, a microphone (e.g. for voice and/or speech recognition), or the like. Examples of output devices may include, but are not limited to, a monitor or a display, speakers, or the like. Input and/or output devices may be coupled to the data processing system either directly or through intervening I/O controllers.

In an embodiment, the input and the output devices may be implemented as a combined input/output device (illustrated in Fig. 10 with a dashed line surrounding the input device 312 and the output device 314). An example of such a combined device is a touch sensitive display, also sometimes referred to as a “touch screen display” or simply “touch screen”. In such an embodiment, input to the device may be provided by a movement of a physical object, such as e.g. a stylus or a finger of a user, on or near the touch screen display.

A network adapter 316 may also be coupled to the data processing system to enable it to become coupled to other systems, computer systems, remote network devices, and/or remote storage devices through intervening private or public networks. The network adapter may comprise a data receiver for receiving data that is transmitted by said systems, devices and/or networks to the data processing system 300, and a data transmitter for transmitting data from the data processing system 300 to said systems, devices and/or networks. Modems, cable modems, and Ethernet cards are examples of different types of network adapter that may be used with the data processing system 300.

As pictured in Fig. 10, the memory elements 304 may store an application 318. In various embodiments, the application 318 may be stored in the local memory 308, the one or more bulk storage devices 310, or separate from the local memory and the bulk

storage devices. It should be appreciated that the data processing system 300 may further execute an operating system (not shown in Fig. 10) that can facilitate execution of the application 318. The application 318, being implemented in the form of executable program code, can be executed by the data processing system 300, e.g., by the processor 302. Responsive to executing the application, the data processing system 300 may be configured to perform one or more operations or method steps described herein.

Fig. 10 shows the input device 312 and the output device 314 as being separate from the network adapter 316. However, additionally or alternatively, input may be received via the network adapter 316 and output be transmitted via the network adapter 316. For example, the data processing system 300 may be a cloud server. In this case, the input may be received from and the output may be transmitted to a user device that acts as a terminal.

Various embodiments of the invention may be implemented as a program product for use with a computer system, where the program(s) of the program product define functions of the embodiments (including the methods described herein). In one embodiment, the program(s) can be contained on a variety of non-transitory computer-readable storage media, where, as used herein, the expression “non-transitory computer readable storage media” comprises all computer-readable media, with the sole exception being a transitory, propagating signal. In another embodiment, the program(s) can be contained on a variety of transitory computer-readable storage media. Illustrative computer-readable storage media include, but are not limited to: (i) non-writable storage media (e.g., read-only memory devices within a computer such as CD-ROM disks readable by a CD-ROM drive, ROM chips or any type of solid-state non-volatile semiconductor memory) on which information is permanently stored; and (ii) writable storage media (e.g., flash memory, floppy disks within a diskette drive or hard-disk drive or any type of solid-state random-access semiconductor memory) on which alterable information is stored. The computer program may be run on the processor 302 described herein.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

The corresponding structures, materials, acts, and equivalents of all means or step plus function elements in the claims below are intended to include any structure, material, or act for performing the function in combination with other claimed elements as specifically claimed. The description of embodiments of the present invention has been presented for purposes of illustration, but is not intended to be exhaustive or limited to the implementations in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope of the present invention. The embodiments were chosen and described in order to best explain the principles and some practical applications of the present invention, and to enable others of ordinary skill in the art to understand the present invention for various embodiments with various modifications as are suited to the particular use contemplated.

CLAIMS:

1. A system (1,50,70,94) for controlling or facilitating control of a lighting unit (31-33), said system (1,50,70,94) comprising:

at least one input interface (3,56,76); and

at least one processor (5, 55,75) configured to:

- detect, via said at least one input interface (3,56,76), attachment of a second lighting control unit (37,61,81,97) to a first lighting control unit (36,51,71,96), said first lighting control (36,51,71,96) unit comprising first user input means (52) and/or first sensor means (72) and said second lighting control unit (37,61,81,97) comprising second user input means (62) and/or second sensor means (82),

- enable control of said lighting unit (31-33) by said second lighting control unit (37,61,81,97) responsive to detecting said attachment, and

- disable control of said lighting unit (31-33) by said first lighting control unit (36,51,71,96) responsive to detecting said attachment,

wherein said at least one processor (5, 55,75) is configured to disable control of said lighting unit (31-33) by said first lighting control unit (36,51,71,96) by removing an identifier of said first lighting control unit (36,51,71,96) from a set of identifiers of active devices stored in a memory (7) of said system (1,50,70,94) and/or by ignoring input signals generated by said first lighting control unit (36,51,71,96) and/or by configuring said first lighting control unit (36,51,71,96) not to generate any signals related to lighting control.

2. A system (1,50,70,94) as claimed in claim 1, wherein said at least one processor (5, 55,75) is configured to associate at least part of configuration data associated with said first lighting control unit (36,51,71,96) with said second lighting control unit (37,61,81,97) responsive to detecting said attachment, and to configure said second lighting control unit (37,61,81,97) based on the at least part of configuration data.

3. A system (1,50,70,94) as claimed in claim 2, wherein said configuration data is indicative of at least one of: a name, one or more control settings, one or more light routines, one or more light scenes, a position, and an orientation.

4. A system (1,50,70,94) as claimed in any one of the preceding claims, wherein said at least one processor (5, 55,75) is further configured to enable configuration of said second lighting control unit (37,61,81,97) via a user interface and disabling configuration of said first lighting control (36,51,71,96) unit via said user interface in response to detecting said attachment.

5. A system (1,50,70,94) as claimed in any one of the preceding claims, wherein said second lighting control unit (37,61,81,97) provides more lighting control functionality and/or more advanced lighting control functionality than said first lighting control unit (36,51,71,96).

6. A system (1,50,70,94) as claimed in any one of the preceding claims, further comprising said first lighting control unit (36,51,71,96).

7. A system (1,50,70,94) as claimed in claim 6, wherein said first lighting control unit (36,51,71,96) comprises one or more wireless power coils and/or one or more electrodes for transferring energy and/or data from said first lighting control unit (36,51,71,96) to said second lighting control unit (37,61,81,97).

8. A system (1,50,70,94) as claimed in claim 7, wherein said first lighting control unit (36,51,71,96) comprises one or more parts which enable attachment of said second lighting control unit (37,61,81,97) to said first lighting control unit (36,51,71,96) and alignment of said one or more wireless power coils and/or said one or more electrodes of said first lighting control unit (36,51,71,96) with one or more corresponding wireless power coils and/or one or more corresponding electrodes of said second lighting control unit (37,61,81,97).

9. A system (1,50,70,94) as claimed in any one of claims 6 to 8, wherein said first lighting control unit (36,51,71,96) or a device into which said first lighting control unit (36,51,71,96) is integrated comprises a wall mount for mounting said first lighting control unit (36,51,71,96) or said device to a wall and/or wherein said first lighting control unit (36,51,71,96) is integrated into a luminaire (70,94).

10. A system (1,50,70,94) as claimed in any one of claims 6 to 9, wherein said first lighting control unit (36,51,71,96) is configured to forward input signals received from said second lighting control unit (37,61,81,97) to said at least one processor (5, 55,75) while said second lighting control unit (37,61,81,97) is attached to said first lighting control unit (36,51,71,96).

11. A system (1,50,70,94) as claimed in any one of the preceding claims, wherein said at least one processor (5, 55,75) is configured to:

- detect, via said at least one input interface (3,56,76), detachment of said second lighting control unit (37,61,81,97) from said first lighting control unit (36,51,71,96),
- enable control of said lighting unit (31-33) by said first lighting control unit (36,51,71,96) responsive to detecting said detachment, and
- disable control of said lighting unit (31-33) by said second lighting control unit (37,61,81,97) responsive to detecting said detachment.

12. A system (1,50,70,94) as claimed in any one of the preceding claims, wherein said system comprises a lighting control bridge (1), a lighting control device (50), and/or a luminaire (70,94).

13. A method of controlling or facilitating control of a lighting unit, said method comprising:

- detecting (101) attachment of a second lighting control unit to a first lighting control unit, said first lighting control unit comprising first user input means and/or first sensor means and said second lighting control unit comprising second user input means and/or second sensor means;
- enabling (103) control of said lighting unit by said second lighting control unit responsive to detecting said attachment; and
- disabling (105) control of said lighting unit by said first lighting control unit responsive to detecting said attachment by removing an identifier of said first lighting control unit (36,51,71,96) from a set of identifiers of active devices stored in a memory (7) of said system (1,50,70,94) and/or by ignoring input signals generated by said first lighting control unit (36,51,71,96) and/or by configuring said first lighting control unit (36,51,71,96) not to generate any signals related to lighting control.

14. A computer program product for a computing device, the computer program product comprising computer program code to perform the method of claim 13 when the computer program product is run on a processing unit of the computing device.

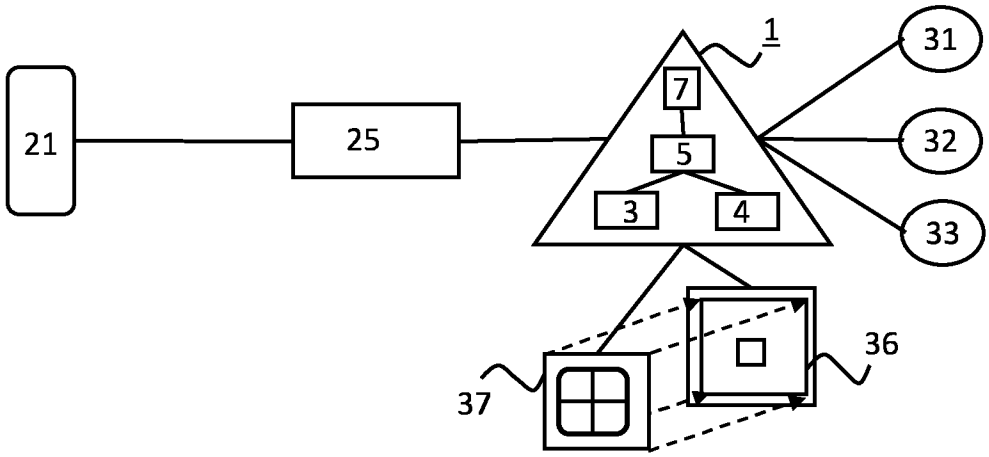
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Fig. 1

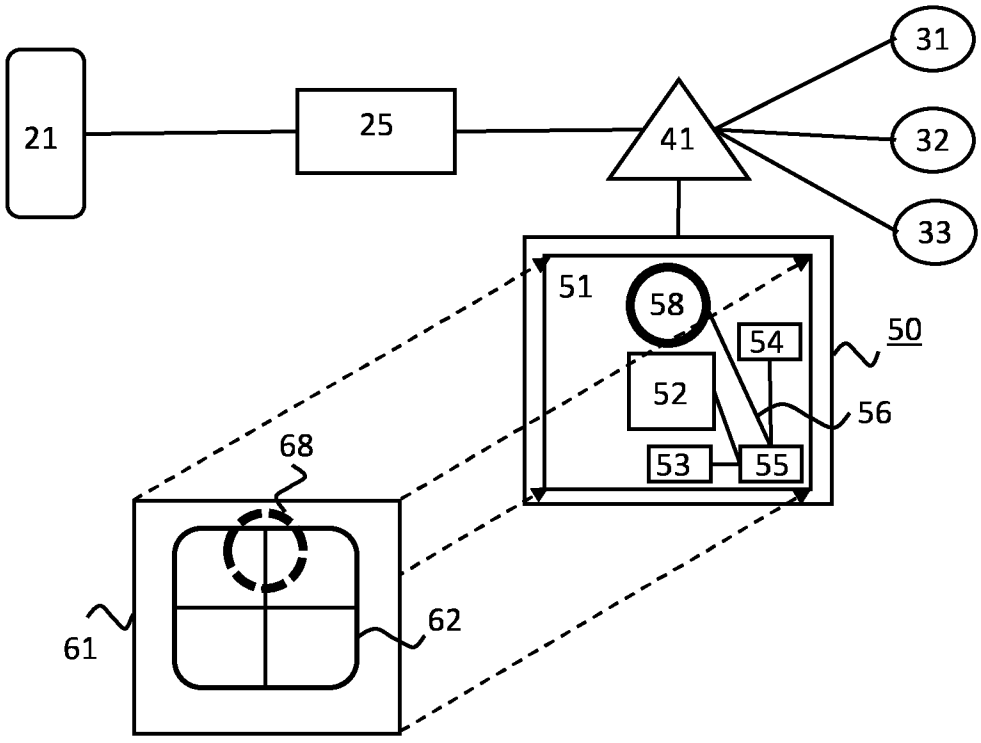
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Fig. 2

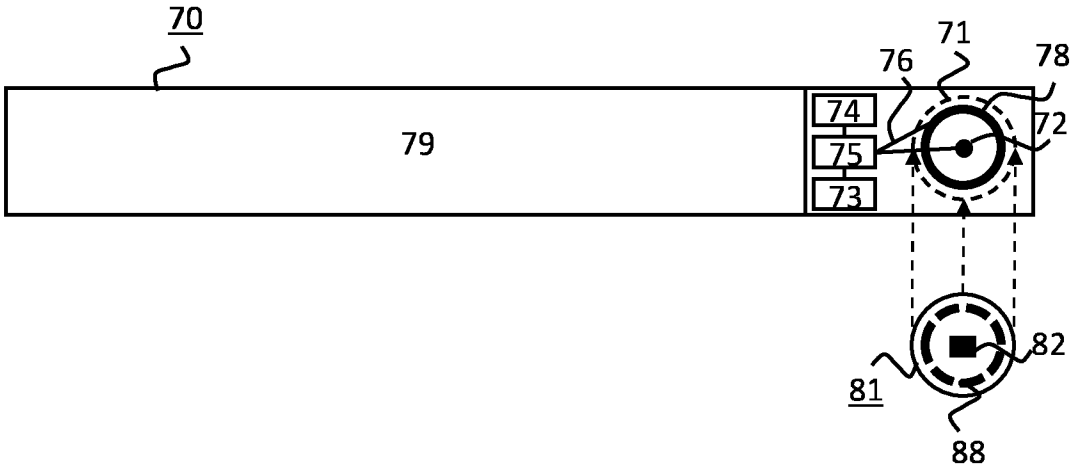

Fig. 3

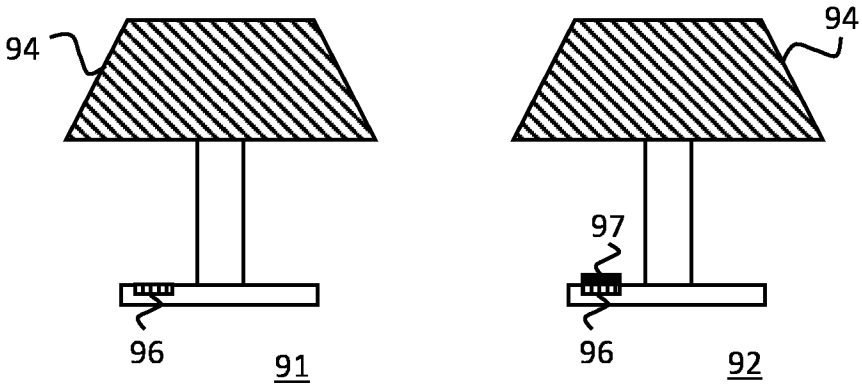

Fig. 4

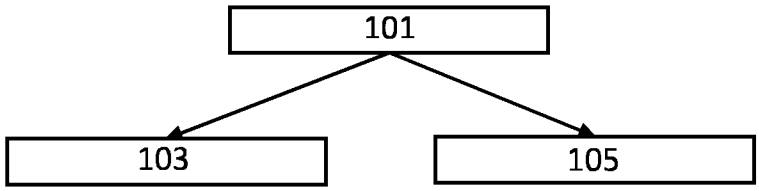

Fig. 5

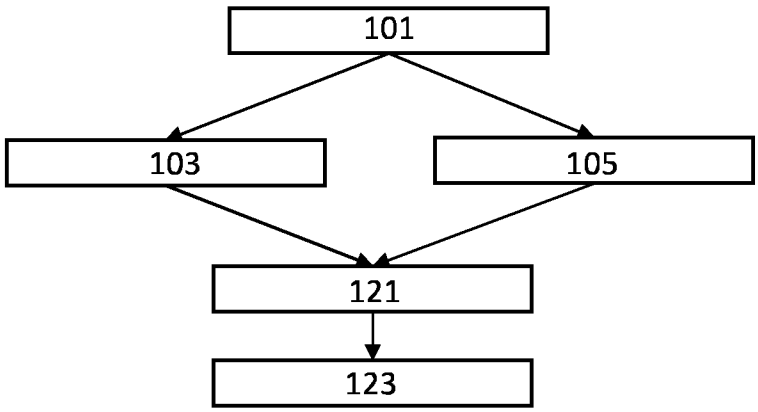

Fig. 6

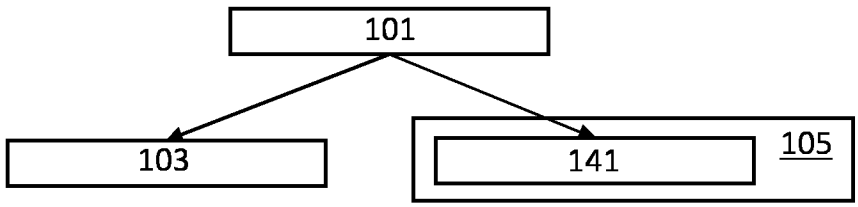

Fig. 7

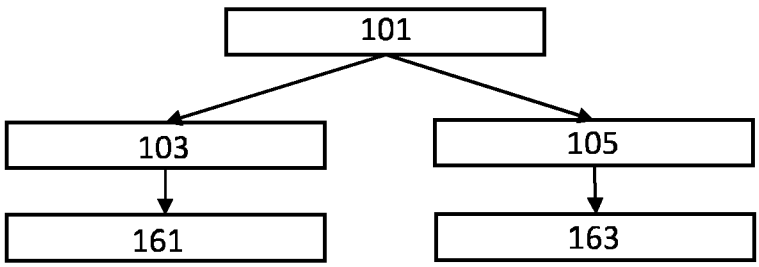

Fig. 8

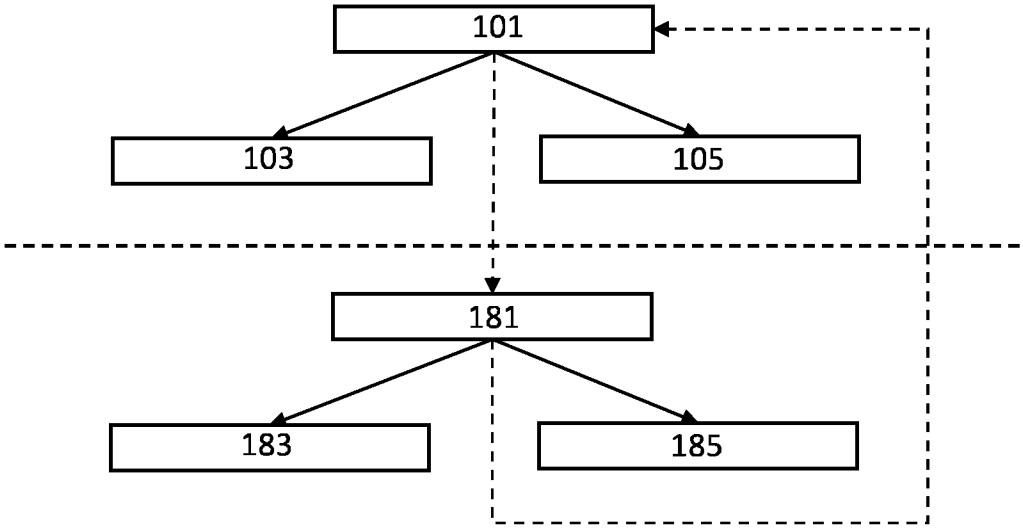

Fig. 9

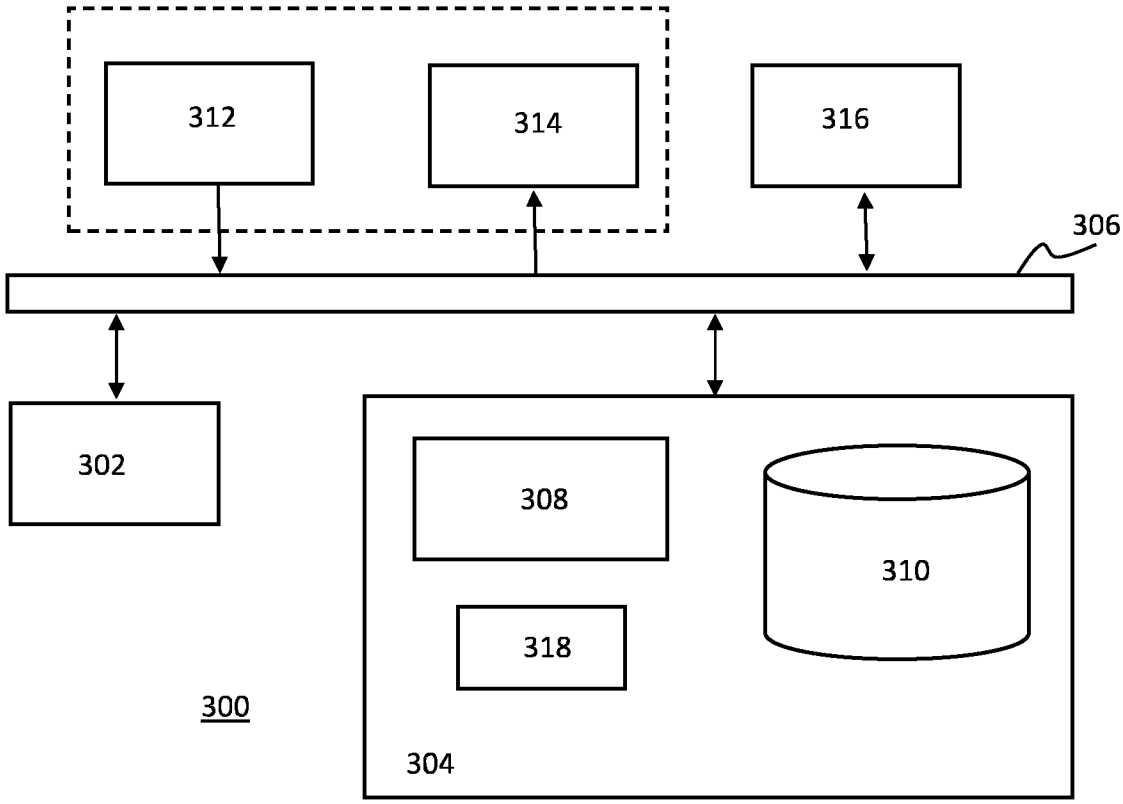

Fig. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/053538

A. CLASSIFICATION OF SUBJECT MATTER
INV. H05B47/17
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H05B

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 10 917 956 B1 (KING JOHN J [US] ET AL) 9 February 2021 (2021-02-09) column 1, lines 27-36 column 41, line 14 - column 45, line 63 column 82, lines 62-65 column 91, line 62 - column 99, line 31; figures 1-12, 37, 126, 129, 130, 143, 144	1-14
A	US 2010/294915 A1 (WILLIAMS JONATHAN D [US] ET AL) 25 November 2010 (2010-11-25) paragraphs [0044] - [0048], [0052], [0057] - [0069]; figures 1-12, 15-17	1-14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 April 2024	25/04/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Waters, Duncan

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2024/053538

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 10917956 B1	09-02-2021	NONE	
US 2010294915 A1	25-11-2010	CA 2666785 A1	22-11-2010
		US 2010294915 A1	25-11-2010
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