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(54) COMMISSIONING OF ELECTRICAL DEVICES IN AN AUTOMATED HOME ENVIRONMENT

(57) A method of commissioning a lighting system in a house or building includes linking a plurality of peripheral interfaces with a plurality of lighting devices in a network. The method includes generating a set of patterns with at least as many different patterns as the number of lighting devices, retrieving the plurality of lighting devices and assigning each pattern to a unique lighting device of the plurality, activating each lighting device following its assigned pattern as a sequence of powering pulses, and replicating the pattern of a particular lighting device by actuating a peripheral interface to be linked with that particular lighting device. Upon detecting actuation of the peripheral interface following an assigned pattern of the set of patterns, the actuated peripheral interface is linked with the lighting device with that pattern assigned.

A corresponding control unit and lighting system are also provided.

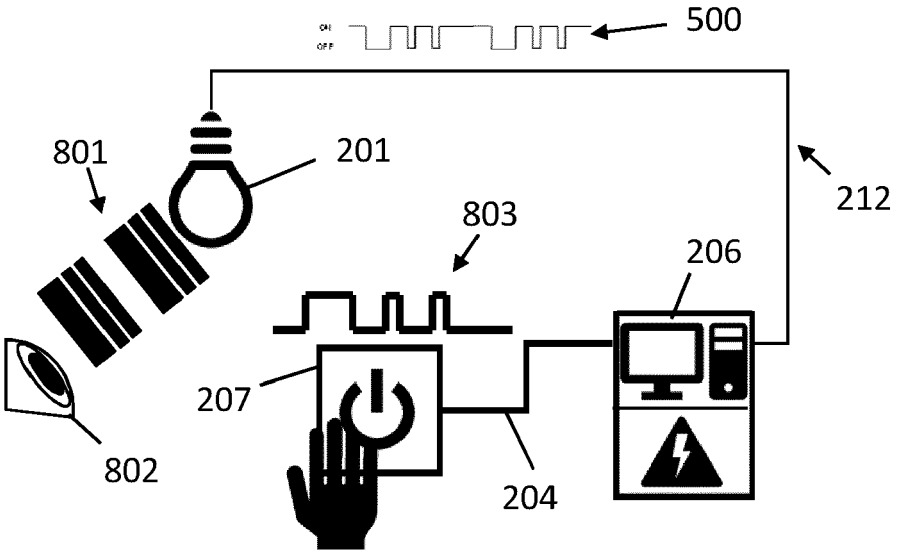

FIG 8

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Description

Field of the invention

[0001] The present invention relates to commissioning of electrical devices in an automated home environment. More specifically it relates to methods of installation and commissioning of lighting devices in an automated home environment, to control units programmed to perform such methods, and to such systems.

Background of the invention

[0002] Smart home and smart building technologies are based on the concept of automation and remote control. For example, several functions of the building are automatized, programmable, and/or can be controlled remotely. This improves energy efficiency, comfort, and security. Usually, a programmable control unit stores all the settings of the building, and controls all the slave nodes connected to it, such as electrical devices, e.g. lighting devices, and appliances. In case of smart lighting devices or systems, sensing functions, dimming options and programmed activation and deactivation can be included and controlled by the control unit, which may be also controlled or monitored remotely, e.g. via internet.

[0003] Smart home systems often require a high level of expertise and knowledge to fully configure them, including configuring basic on/off behavior of lighting devices. It is often cumbersome and expensive to proceed to a full installation of the smart system technology before the actual works in the building have finished and/or other systems (e.g. telecommunication systems) are enabled. The alternative is not having enabled the lighting system until a late or last step, which is not desirable, because commissioning and tests that the system works properly should be done at an early stage, to avoid later re-works.

[0004] Document WO 2014/046477 A2 discloses reconfigurable elements for providing power distribution, interconnection and integration of functional components. For example, the system can be manually programmed by a user to transfer signals to a controlled apparatus and a controlling apparatus. Although the system is easy to use, the apparatuses should include sensing means responsive to the signals (which may be IR signals sent by a user with a further device) for establishing the relationship, increasing the costs.

[0005] Document WO 2014/108817 A1 discloses a system including presence sensors and lighting devices. A user interaction element and a control unit allow associating one or a group of lighting devices with at least one presence sensor. Different groups of lighting devices may share one or more lighting devices. In this case, a presence sensor is required, which increases costs.

[0006] Document WO 2010/035192 A1 includes a lighting control system for commissioning light sources, in particular for wallwasher light sources. The controller controls light sources with a spatial light coding, which code attributes of the light sources, thus creating a light pattern on a wall. A light capturing device (camera, etc.) can capture the light pattern, which can be decoded, so information relevant to the sources (position, sequence, spacing, etc.) can be stored in the controller. The controller can map a commanded lighting scene data to the real lighting installation based on the detected code. This system is limited to particular lighting installations which can provide a meaningful spatial light coding, and a light capturing device is required.

Summary of the invention

[0007] It is an object of embodiments of the present invention to provide a fast and easy commissioning of electrical devices and more particularly lighting devices in an automated building with no need of complex or lengthy programming of a control unit which controls the lighting system.

[0008] In a first aspect, the present invention provides a method of commissioning a lighting system in a house or building, by linking a plurality of peripheral interfaces with a plurality of lighting devices in an electrical network. The method comprises:

- generating a set of patterns with at least as many different patterns as the number of lighting devices in the plurality thereof, each pattern being unique and differentiating,
- detecting the plurality of lighting devices in the electrical network,
- assigning each pattern of the set to a unique lighting device of the plurality thereof, or in other words, assigning one pattern of the set to each unique lighting device so each lighting device has assigned a pattern different and distinguishable from each other,
- activating each lighting device in accordance with its assigned pattern, the pattern comprising a sequence of powering pulses,
- replicating the pattern of a particular lighting device by actuating, e.g. pushing, a peripheral interface to be linked with that particular lighting device, and
- upon detecting actuation of the peripheral interface in accordance with a pattern of the set of patterns, linking the actuated peripheral interface with the lighting device which has that pattern assigned.

[0009] In some embodiments, the peripheral interfaces may be also retrieved (e.g. by detecting them, and retrieving their address). The retrieval allows the identification of the peripheral interface, e.g. identification of the address thereof, and the possibility of addressing and control it when required.

[0010] It is an advantage of embodiments of the present invention that commissioning of lighting devices in a lighting system can easily be done, without the need to program the control unit itself, and in the early stage of the building process, when no data connectivity is yet

existing, e.g. no WiFi is present. This is done by matching each lighting device flickering in accordance with a train of pulses with one or more chosen peripheral interfaces, by actuating the peripheral interface with the corresponding sequence in the pattern. A further advantage of embodiments of the present invention is that this can be done by a low skilled installer.

[0011] A method in accordance with embodiments of the present invention may further comprise emitting a perceptible signal when a particular lighting device is linked to at least one peripheral interface. The method may still further comprise emitting a further perceptible signal when all lighting devices are linked to at least one peripheral interface. The perceptible signal emitted when a lighting device is linked to at least one peripheral interface may be different from the perceptible signal emitted when all lighting devices are linked to at least one peripheral interface.

[0012] It is an advantage of embodiments of the present invention that it is ensured that no lighting device is left without matched peripheral interface, so each lighting device is addressable. It is a further advantage that every peripheral interface may have functionality. By emitting a further perceptible signal when all lighting devices are linked, the process may automatically end when an installer or a user wants it to. However, an installer or a user can still determine to link a lighting device, already linked to one peripheral interface, to another peripheral interface. So, one lighting device can be linked to different peripheral interfaces located at different locations.

[0013] In a method in accordance with embodiments of the present invention, the step of generating a set of patterns may comprise generating patterns including a fixed number of pulses and a variable duration of each pulse, wherein the variable duration of each pulse is a short or a long duration. In such a way, the step of generating a set of patterns may comprise generating a set of unique and differentiating patterns.

[0014] It is an advantage that pulses can be generated which are easy to replicate and which are sufficiently different from other pulses, so that the control unit can (with low error marge) assign the right lighting device to the actuated peripheral interface, e.g. the pressed button or switch. In an example, for N pulses in each pattern which may be either short or long, a number of lighting devices of 2^N can be programmed.

[0015] In a second aspect, the present invention provides a control unit for commissioning a lighting system including a plurality of lighting devices and a plurality of peripheral interfaces in an electrical network. The control unit comprises an input port for receiving input signals from the plurality of peripheral interfaces and an output for powering the lighting devices. The control unit is programmed to carry out the steps of generating a set of patterns with at least as many different patterns as the number of lighting devices in the plurality thereof, detecting the plurality of lighting devices in the electrical network, assigning each pattern of the set to a unique lighting device of the plurality thereof, activating each lighting device in accordance with its assigned pattern, the pattern comprising a sequence of powering pulses, and upon detecting actuation of the peripheral interface in accordance with a pattern of the set of patterns, linking the actuated peripheral interface with the lighting device which has that pattern assigned, for linking the plurality of lighting devices with respective peripheral interfaces. In some embodiments of the present invention, the control unit may be programmed to retrieve also the peripheral interfaces. In some embodiments the lighting devices and/or the peripheral interfaces are retrieved by scanning the output respectively input ports, and obtaining the address sent by them in response to the scan.

[0016] It is an advantage of embodiments of the present invention that a modular control unit can be obtained, with no need of programming for commissioning

[0017] In a third aspect, the present invention provides a lighting system for a house or building, including

- a plurality of lighting devices for emitting continuous light when powered,
- a plurality of peripheral interfaces for actuating the powering of the lighting devices,
- a control unit in accordance with embodiments of the second aspect of the present invention, the control unit being electrically connected to each of the plurality of lighting devices and to each of the plurality of peripheral interfaces.

[0018] It is an advantage of embodiments of the present invention that a house or building including such lighting system can be commissioned and can have functioning lights in early building stage.

[0019] In a lighting system in accordance with embodiments of the present invention, the peripheral interfaces and/or the lighting devices may be connected to the control unit via wired buses.

[0020] It is an advantage of such embodiments of the present invention that no wireless connection and/or internet is required.

[0021] Particular and preferred aspects of the invention are set out in the accompanying independent and dependent claims. Features from the dependent claims may be combined with features of the independent claims and with features of other dependent claims as appropriate and not merely as explicitly set out in the claims.

[0022] These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

Brief description of the drawings

[0023]

FIG 1 illustrates a prior art lighting system without control unit.

FIG 2 illustrates a lighting system with a control unit

where the lighting devices are controlled by peripheral interfaces via a control unit.

FIG 3 is a flowchart including steps and optional steps of a method in accordance with embodiments of the present invention.

FIG 4, FIG 5 and FIG 6 illustrate three alternative patterns implemented as sequences of "off" pulses in accordance with embodiments of the present invention.

FIG 7 illustrates a house with lighting devices in different areas being powered with different pulse trains.

FIG 8 shows an example of commissioning using light flickering and replication of the flickering sequence on a button or switch, in accordance with embodiments of the present invention.

[0024] The drawings are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn on scale for illustrative purposes.

[0025] Any reference signs in the claims shall not be construed as limiting the scope.

[0026] In the different drawings, the same reference signs refer to the same or analogous elements.

Detailed description of illustrative embodiments

[0027] The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto but only by the claims. The dimensions and the relative dimensions do not correspond to actual reductions to practice of the invention.

[0028] The terms first, second and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequence, either temporally, spatially, in ranking or in any other manner.

[0029] Moreover, the terms top, under and the like in the description and the claims are used for descriptive purposes and not necessarily for describing relative positions.

[0030] It is to be noticed that the term "comprising", used in the claims, should not be interpreted as being restricted to the means listed thereafter; it does not exclude other elements or steps. It is thus to be interpreted as specifying the presence of the stated features, integers, steps or components as referred to, but does not preclude the presence or addition of one or more other features, integers, steps or components, or groups thereof. The term "comprising" therefore covers the situation where only the stated features are present and the situation where these features and one or more other features are present. Thus, the scope of the expression "a device comprising means A and B" should not be interpreted as being limited to devices consisting only of components A and B. It means that with respect to the present invention, the only relevant components of the device are A and B.

[0031] Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment, but may.

[0032] Similarly it should be appreciated that in the description of exemplary embodiments of the invention, various features of the invention are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of one or more of the various inventive aspects. This method of disclosure, however, is not to be interpreted as reflecting an intention that the claimed invention requires more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less than all features of a single foregoing disclosed embodiment. Thus, the claims following the detailed description are hereby expressly incorporated into this detailed description, with each claim standing on its own as a separate embodiment of this invention.

[0033] In the description provided herein, numerous specific details are set forth. However, it is understood that embodiments of the invention may be practiced without these specific details. In other instances, well-known methods, structures and techniques have not been shown in detail in order not to obscure an understanding of this description.

[0034] Typically, when the electrical network of a building (including lighting devices, switches, and other electrical elements) are installed, the electrical connections and wiring are laid out, during construction of the building. The electrical network, including the lighting system, needs to be tested and brought to a condition to work, with predetermined minimum requirements (commissioning) before configuring them with the options and functionalities tailored to the preferences of the end user. While commissioning takes place after installing, configuration usually takes place at the last stages of construction or after the construction is finished. The present invention provides commissioning of electrical devices such as lighting devices, before configuring the system, in a simple way and in an early stage, for example immediately after installation.

[0035] In traditional houses and buildings, and as represented in FIG 1, one or more lighting devices 101 are wired and electrically connected to the electrical network 102 via switches 103 physically installed on power wires 104. The network 102 may be connected to the external network or to a generator via an electrical cabinet 105. The switch 103 opens or shorts the wire 104, turning the lighting devices 101 off or on, respectively. Commission-

ing of such traditional lighting devices 101 is very simple: the wires 104 should be connected to the switches 103 and the lighting devices 101, and to the electrical cabinet 105. If no mistakes or wrong connections are made, actuating (e.g. toggling, e.g. activating and deactivating) the switch 103 will turn the corresponding lighting device 101 respectively on and off. Once the switch 103 is linked to a lighting device 101, in order to make changes and provide another or additional, different lighting device 106 responsive to that switch 103, it is necessary to hardwire the switch 103 to the other lighting device 106, which is more complex.

[0036] Automated systems, on the other hand, follow a different scheme. An example of such scheme is shown in FIG 2. They usually include peripheral interfaces 203, 207. Where in embodiments of the present invention reference is made to "peripheral interface", or simply "peripheral", reference is made to any actuatable device which can control other device or devices when being actuated. For example it may be a user interface which can turn one or more lighting devices on and off when a user interacts with it. These peripheral interfaces include an input with which a user can interact (in other words, an input that a user can actuate). Thus, the peripheral interface may be simply a button or switch which can power a device, e.g. turn on and off a device. Commissioning can advantageously be applied to standard installations using buttons or switches as peripheral interfaces. However, the present invention is not limited thereto, and it may include dimmers or dimming units, touchscreen switches or the like, as long as they can be actively actuated for at least powering and turning off a device. The peripheral interface may even include a sensor, e.g. a sound or motion sensor, as an input. In such case the peripheral can be actively actuated by sending an appropriate signal to the sensor, e.g. a gesture, voice command or programmed sound, which would allow activating and deactivating a lighting source.

[0037] These peripherals send signals via a bus system 202 (which may include data wires 204 and/or a wireless system with e.g. a transceiver 205) upon actuation, to a control unit 206. Further, they include a lighting system with lighting devices 201 that activate according to instructions sent as signals via a power wire, by the control unit 206, which may include also a transceiver or receiver 216. Communication between transceivers 205, 216 may be based on any suitable protocol, e.g. WIFI, radio communication, infrared, Bluetooth, Zigbee, etc. This is different from directly cutting or shorting a power line for allowing current through that wire, as in FIG 1. In the automated system of FIG 2, the link between the lighting devices 201 and the peripherals 203, 207 is not physical, but programmed in the control unit 206. The control unit 206 controls the powering of the lighting devices 201 via a power line network 212, for example via switching and/or dimming units (not pictured) connected to the lighting devices 201 via wires 213. The lighting devices 201 may be connected to the control unit 206 via output ports, for example via a bus interface. When the passing of current to a lighting device 201 is controlled by the control unit 206, it is said that the lighting device is connected to the control unit 206, because the switching and dimming units may be integral part of the control unit 206, or connected thereto. The power is obtained also from the external network or a generator, e.g. via an electrical cabinet 105 as was described with respect to FIG 1.

[0038] The functional link between lighting devices 201 and peripherals 203, 207 which is programmed in the control unit 206 allows (de)activating the lighting devices 201 by suitably actuating the peripherals (for example, by toggling a button, by flipping or tapping a switch, by pushing an on/off button...).

[0039] If a peripheral interface, e.g. a switch, is linked to a lighting device 201, in order to make another or additional, different lighting device 201' responsive to that peripheral interface, it is necessary to only re-program the control unit 206 in an automated system. This requires less effort than hardwiring as it was described with respect to FIG 1.

[0040] On the other hand, commissioning is more difficult in an automated system than in the system of FIG 1. While the link peripheral interface-lighting device 201 can be programmed remotely, this is usually not possible in early stages of construction, because usually the telecommunication system (phone line, internet) is not installed at that point. Optionally, the control unit 206 itself can be programmed in situ, e.g. while laying out the electrical installation of the building, by for example an installer such as an electrician. However, programming usually requires a level of expertise which is out of the scope of what is expected from an installer. This leads to expensive, time consuming and sometimes unreliable commissioning.

[0041] The present invention provides a simple and basic, commissioning-level, functionality of the lighting system, in which all the lighting devices 201 can be reliably switched on and off, and all the buttons or peripherals 203, 207 are responsive, with no need to carry out complex programming, even with no need of knowledge of informatics. Because this can be performed and reset by an end user, it already allows personalization to some degree, before full-fledged configuration. The commissioning of the lighting system can be done at early stages of building, for example immediately after installation, and before further works such as flooring, wall painting, or installing phone or data lines. This is especially advantageous in case of automated home environments, where the present invention provides a basic functionality of the lighting system in an automated home without the need of modems or other connections to data networks (such as the internet), which are rarely installed in early building stages. The basic functionality may allow testing the lighting system early, and the ability of turning on and off the lights may assist in further stages of the building process, such as installing furniture or painting walls or the like, which is usually subject to unreliable

sunlight if the lighting system is not operative.

[0042] In the present invention, the control unit 206 generates digital patterns, and assigns a different pattern to each lighting device 201 of a plurality of lighting devices 201 present in a home or building. Then the control unit 206 retrieves, e.g. detects, the plurality of lighting devices in the network and powers each lighting device 201 of the plurality of lighting devices 201 in a specific, unique, way, corresponding to the pattern assigned to the lighting device 201. The installer receives (sees) the pattern assigned to the lighting device 201 as input from the control unit 206, and replicates the assigned pattern by actuating a peripheral interface 203, 207 (e.g. button) chosen by the installer for controlling that particular lighting device 201, in accordance with that pattern. The control unit 206 then automatically generates the link between the peripheral 203, 207 that was actuated in accordance with the pattern, and the lighting device 201 with the assigned pattern. Only one person is needed, and the process can be done fast.

[0043] Lighting devices, during commissioning, are automatically activated following a pattern by the control unit. The actuation of the peripheral interface, during commissioning, serves to communicate to the control unit the information regarding which peripheral interface or interfaces should be linked to the corresponding lighting unit. After commissioning, during normal use, the activation of the lighting unit is performed by actuating the corresponding peripheral interface, which signalizes the control unit that the corresponding lighting unit should be activated, as usual.

[0044] In some embodiments of the present invention, the input is sent to the user through the powering of lighting devices 201 themselves. The control unit 206 powers the lighting devices 201 with a train of pulses following the assigned pattern, as a coded signal, which is visible by the installer. In a practical non limiting example, the installer presses a button intermittently, switching between the on and off positions, replicating the pattern under which the lighting device turns on and off.

[0045] This will further be discussed in detail further in embodiments below.

[0046] The present invention provides a method of commissioning a lighting system comprising a plurality of lighting devices 201 in a home or building. Commissioning the lighting system is done by linking a plurality of lighting devices 201 to at least one peripheral interface 203, 207, e.g. a button, for commissioning functionality to a building or home automation system. The method, outlined in FIG 3, first comprises starting 300 commissioning, e.g. by putting the control unit 206 in commissioning mode by, for example, pushing a button on that control unit 206. Then, a set of patterns is generated 301. A pattern may comprise a train of successive powering pulses in a particular sequence. Each pattern is unique and differentiates itself from the other patterns of the set. The control unit 206 then retrieves all lighting devices 201 connected to the network. For example, the control unit 206 may be pre-programmed already with the number of lighting devices, e.g. in a lookup table, and the devices are retrieved from a memory. In some embodiments, the control unit 206 may detect all lighting devices 201 in the network. For example, when set into commissioning mode, the control unit 206 may boot up and detect all connected lighting devices 201. It may additionally detect all connected peripheral interfaces 203, 207. For example, the control unit may be programmed to detect how many lighting devices 201 are connected thereto, as well as peripheral interfaces 203, 207. The detection can be made for example by sending signals through each wire 213 of the network 212 (e.g. broadcasting signals) and detecting which wire has a connection to a lighting device, and/or to a peripheral. For example, the bus interface (or output ports where the lighting devices connect the control unit) may be scanned, for instance with or in an analogous way to a "ping" utility. Connected devices respond to the scan typically with their unique address, e.g. a media access control (MAC) address or similar. The connected devices may be the peripherals, and/or the lighting devices (e.g. the controller which is part of the lighting device, e.g. the dimmer or relay connected to the source of light, e.g. a LED). Any other existing method of detection of devices connected to the control unit, e.g. connected via buses or the like, could be used.

[0047] One pattern is then assigned 302 to each of a plurality of lighting devices 201, so that each lighting device 201 has a unique pattern. The control unit 206 then sends the right pattern to the right lighting device 201 to activate 303 it with its pattern. The train of powering pulses used to activate a given lighting device corresponds on a one-to-one basis to the pattern assigned to that lighting device 201. The train of powering pulses may be sent from the control unit 206 to the devices via e.g. the power line network 212, reducing the need of wireless internet network or presence of other wireless protocols.

[0048] At that time, when all lighting devices 201 are activated 303 or, in other words have received their assigned pattern, they all start "flickering" according to that assigned pattern. This sequence of powering pulses may be a visual sequence which can be observed by the human eye, so the pulses can be counted, and for example the duration and/or spacing between them estimated. An installer, electrician or other user than walks around the building or house and notices this flickering. He or she determines which peripheral 203, 207 (e.g. button or switch) he or she wants to use to control a particular lighting device 201. After determining which peripheral 203, 207 should control which lighting device 201, the installer, electrician or user then imitates or replicates the flickering pattern of a particular lighting device 201 by actuating the peripheral 203, 207 with which he or she wants to control that particular lighting device 201. Imitation or replication of the flickering pattern should be as close as possible, e.g. identical with respect to the number of pulses, the duration of the pulses, the time

between two subsequent pulses, and so on.

[0049] For example, two buttons 203, 207 in a hall next to stairs can be programmed one after another, linking a first button with the lighting device 201 of the present floor where the buttons 203, 207 are situated, and linking a second button 203, 207 with a lighting device 201 of a floor higher up, the sequence of which can be seen through the stairwell (or can be remembered or noted by the installer, electrician or user). A peripheral 203, 207 at the upper floor may also be programmed to activate that same lighting device 201 of that floor. Thus, several peripherals 203, 207 may act on a same lighting device 201. Analogously, a user could apply different sequences of different lighting devices 201 to the same peripheral 203, 207, so several lighting devices 201 may be linked to the same peripheral 203, 207.

[0050] The control unit 206 then detects 304 the input of sequence of pulses from that button 203, 207. Detecting 304 the sequence of pulses may include detecting the number of pulses, their relative duration, the timing between the subsequent pulses, etc. For example, in case of patterns with different number of flickerings, the control unit 206 may read how many inputs (or flickering imitations) are introduced in a period of time (for example five seconds), and/or may compare the duration of one pulse with the others within a predetermined range, if the pattern includes short and long pulses. If the detected sequence is recognized by the control unit 206 as being a pulse sequence that was assigned to a lighting device 201, the control unit 206 functionally matches or links 305 the peripheral 203, 207 to that lighting device 201 and will assign that button 203, 207 to that lighting device 201. The control unit may accept a threshold error with respect to the duration of pulses and time between them.

[0051] In a next step, in accordance with embodiments of the invention, the established combination lighting device/peripheral may be stored in a memory unit.

[0052] In accordance with embodiments of the invention, the control unit 206 can give some kind of feedback to the installer, electrician or user to confirm that assignment of the button 203, 207 to the lighting device 201 is finished. This feedback may, for example, be a visual sign such as, for example, stopping the flickering to indicate that the match has been made or flicker in a different, shorter pattern. In that way, all buttons 203, 207 in the building or house can be assigned to at least one of the plurality of lighting devices 201. The above process may continue until at least one termination condition takes place, thereby ending 306 the process. Otherwise, the control unit 206 just waits to receive a signal of actuation of a peripheral 203, 207.

[0053] In embodiments of the present invention, one pattern is generated for each lighting device 201 connected to the network. As described above, this is done by the control unit 206. Thus, each pattern is linked to a single lighting device 201. When all the lighting devices 201 are linked to at least one peripheral 203, 207, and optionally all peripherals 203, 207 have been assigned to a lighting device, and thus when advantageously all lighting devices 201 are operable and optionally also all peripherals 203, 207 are operable, the process may automatically end 306. To indicate to the installer or user that the process is ended, again a visual sign or perceptible signal may be given as feedback. This visual sign or perceptible signal may be different from the visual sign for indicating that one lighting device is linked to a peripheral 203, 207, e.g. to a button or switch. When receiving the visual signal that all lighting devices 201 are linked to at least one peripheral 203, 207, the installer or user may then decide whether he or she still wants to link additional buttons 203, 207 to one or more lighting devices 201 already linked to one other button 203, 207.

[0054] Further examples of termination conditions may be (indicated in FIG 3 by the dashed lines):

- a predetermined time passes (time-out) 307, and/or
- a special pattern, preassigned by the control unit 206, is used on any peripheral (e.g. pushing continuously a button during one cycle or more), thus allowing forcing 308 off the process.

[0055] In accordance with embodiments of the invention, the length of the pattern assigned to the lighting devices 201 and its type may be chosen in accordance with the number of lighting devices 201 present in the network and thus in the lighting system which need to be programmed. In other words, the length of the pattern and its type may be chosen in accordance with the total number of patterns required to commission all lighting devices 201 in the lighting system. FIGs 4 to 6 illustrate exemplary patterns to be used with embodiments of the present invention. The examples of FIGs 4 to 6 all include three bits or "flickers", and each flicker may include either a long pulse or a short pulse. With three flickers, each flicker having one of two values (e.g. long or short), 2^3=8 patterns can be formed, which allows addressing 8 different lighting devices 201. With four flickers, up to 16 lighting devices 201 could be addressed. For commissioning a higher number of lighting devices 201, different patterns can be used, for example similar to a Morse code.

[0056] For example, the pattern of FIG 4 includes three OFF pulses 401 of a predetermined duration separated by ON periods 402. The pattern is introduced as a powering sequence following the pattern, by turning off and on the light three times. The sequence may repeat cyclically, for example every 5 seconds. This pattern can be assigned to a lighting device 201. To link the lighting device 201 to a given peripheral 203, 207, the installer, electrician, or user actuates the chosen device three times, thereby taking into account the time in between the pulses and the time in between the cycles of three pulses.

[0057] In some embodiments, the sequences include OFF pulses of different duration, for example with short pulses (fast flickering) and with long pulses (longer off-periods).

[0058] For example, FIG 5 and FIG 6 show two different patterns 500, 600 (which can be assigned to two different lighting devices 201) including a mixture of short and long off periods. The pattern 500 of FIG 5 has a long off period 501 before two short off periods 502, every 5 second cycle. The pattern 600 of FIG 6 shows a long off-period 601 between two flickers or short off periods 602. These patterns repeat every cycle. The long off-period may be for example two or three times longer than a flicker. For example, the flicker may last 0.4 seconds, while the long off-period may last 1.2 seconds. The present invention is not limited by these exemplary periods, and they can be adapted considering the number of lighting devices and the number of patterns needed, so the period may be shorter than 5 seconds if the number of lighting devices is low.

[0059] The skilled person could divide a cycle in equal periods of time and apply different on and off sequences, although it is preferred that the patterns can be distinguished by the order of long and short off pulses, where the long pulses have the same duration and the short pulses have the same duration in the cycle, rather than by having to distinguish between short, medium and long pulses. This allows the patterns to be easily replicated by a user: it is easier to actuate a peripheral interface by a sequence of pulses of two different lengths, than to actuate a peripheral interface by trying to replicate the duration of a pulse. A typical example would be a button, switch or the like, pressed or toggled analogously as with Morse code.

[0060] In embodiments of the present invention, the cycle leaves a constant period long enough in between cycles so the start of one pattern is not confused with the end of the previous pattern. For example, there may be a 2 or 3 second pause between repetition of cycles (where the lighting device 201 may be preferably on), e.g. in case the cycle lasts 5 seconds, thus ensuring enough break between sequences.

[0061] In some embodiments, all the lighting devices 201 in a building are powered by sequences during the commissioning. FIG 7 shows a house in which the lighting devices 201 are powered in accordance with their assigned sequences.

[0062] Similar as described earlier, the installer, electrician or user roams around the different rooms and areas of the building, actuating the peripherals 203, 207 (e.g. pushing the buttons or tapping the switches) in accordance to, or replicating, the observed pulse sequence of the lighting devices 201 in the building that needs to be controlled with that peripheral 203, 207.

[0063] In a second aspect, the present invention provides a program which, when run in a control unit 206, is capable of performing steps of the method of the first aspect. In particular, the program can generate a set of unique and differentiating patterns and assign each pattern to one of a plurality of lighting devices 201. It can also link or match each lighting device 201 to at least one peripheral interface 203, 207, when the peripheral interface is actuated following the pattern assigned to the lighting device 201.

[0064] In some embodiments, the present invention provides a pattern for each address representing a lighting device, the addresses being stored in a memory. The program may include a list of lighting devices, and/or instructions to detect lighting devices in the network.

[0065] The control unit, via an input, may detect actuations done on a peripheral interface, e.g. pushing of a button. In some embodiments of the present invention, the algorithm includes instructions for discerning short actuation from long actuation of a peripheral interface with a predetermined or adaptable tolerance. For example, it can compare one pulse with another and consider that they are the same if the difference of actuation is within a fault tolerance programmed in the control unit. The program may also obtain all the addresses of the lighting devices 201 and prepare the pattern in accordance with the number of lighting devices 201. The program may also obtain all address of the peripheral interfaces.

[0066] The program may include instructions to emit a signal or execute an action when a lighting device 201 is linked to at least one peripheral interface 203, 207. The program may further include instructions to emit a further signal or execute an action when all lighting devices 201 are linked to at least one peripheral 203, 207. The actions may include stop the flickering, turning the lighting devices off, emitting an acoustic signal, sending a message to a communication device, etc. Preferably, the signal for indicating that all lighting devices 201 are linked to at least one peripheral 203, 207 may be different from the signal indicating that one lighting device is linked to a peripheral 203, 207. For example, the program may include instructions to stop flickering the lighting devices 201 for a few cycles, to signalize that all the lighting devices 201 have been linked, and then to continue the process (resume flickering) if there are still peripherals that need to be linked. When all lighting devices 201 are linked to at least one peripheral 203, 207 an installer, electrician or other user can decide to link at least one lighting device 201 to a further peripheral 203, 207. Then, when all lighting devices 201 are linked to all required peripherals 203, 207, the program may include instructions to take further action, e.g. to turn off the lighting devices 201 and/or to emit an acoustic signal, or in general to emit a further perceptible signal. This way, it is ensured that all lighting devices 201 are linked to at least one peripheral 203, 207.

[0067] In a third aspect, the present invention provides a control unit 206, e.g. a controller, including the program of the present invention. The control unit 206 may be included in the building, and it may adapted to control powering lines, for example by including or by controlling switches, dimmers or the like connected to a power line of a lighting device 201. The control unit 206 may be adapted also to receive signals from peripherals 203, 207, in a wired way, or wirelessly. For example the control

unit 206 may include inputs from the peripherals 203, 207. It does not need external connection to a data network in order to execute the program. An advantage of a central control unit 206 in accordance with embodiments of the present invention is that the commissioning can be performed, so all lighting devices 201 and peripherals 203, 207 in a building have at least a required basic functionality (they all can be used and can turn on and off), without need of having a connection to a remote unit, or to internet, established. However, the present invention is not limited to an in-situ central control unit 206 of the building or house, and it may have external connection to a data network or be connectable thereto, e.g. to internet, e.g. it may include a remote control. The control unit may include lookup tables, memory, a processing unit and such.

[0068] The control unit 206 may include means to manually start the process, and optionally to interrupt it. This way, it can be reset at any time, e.g. if redecoration or redistribution of the building or house is needed, or in case of change of inhabitant or proprietor. This can be done advantageously easily with no need of rewiring, even by the end user.

[0069] In a fourth aspect, the present invention provides a lighting system including a control unit 206 in accordance with embodiments of the third aspect, further including a plurality of lighting devices 201 being connected to elements directly controlled by, or integral to, the control unit 206. The control unit (following instructions received from peripherals 203, 207) directly regulates the powering of the lighting unit by controlling these elements.

[0070] The power may be obtained from a generator, or from an external network. Fuses, connections to buses, and power lines, etc. may also be provided. The control unit 206 may be included or connected to an electrical cabinet 105, to connect the external network (or generator) to the power network of the house or building.

[0071] The system further includes a plurality of peripheral interfaces 203, 207, e.g. buttons. These are connected to the control unit 206 via communication protocols, e.g. via data buses, via wireless connection, etc. Input and output for the buses, and transmitters, receivers and/or transceivers can be included to enable this communication. Wired connections 204 are preferred as they do not need any special setup or programming.

[0072] In embodiments of the present invention, every lighting device 201 connected to the control unit 206 can be linked to at least one peripheral interface 203, 207. This way, after the commissioning, each lighting device 201 can be turned on and off, and each peripheral interface can have a function.

[0073] The peripheral interfaces 203, 207 may include buttons, switches, etc., for example any actuatable device which can be used to actively send a signal to the control unit.

[0074] The control unit 206 may be pre-programmed, and all devices (lighting devices 201 and peripheral interfaces 203, 207) connected to the control unit 206 may be identified and/or programmed and stored in a memory, so no device is left without a function.

[0075] The present invention provides an easy way of commissioning a lighting system comprising a plurality of lighting devices 201, by matching each lighting device 201 (e.g. lamp) with at least one chosen peripheral interface 203, 207(e.g. button), by actuating the chosen peripheral interface 203, 207 in accordance with a sequence of pulses emitted by the lighting device 201.

[0076] An example of commissioning is shown in FIG 8, where only one lighting device 201 is illustrated. It gives a basic and easily reconfigurable functionality to the lighting devices and peripheral interfaces at an early stage of building. The control unit 206 assigns a pattern to each lighting device, which in the case of shown lighting device 201 may be for example the pattern 500 of FIG 5 (including a long off period followed by two short off periods). The pattern 500 is introduced as a powering sequence 801 through the power line network 212, the sequence 801 being a long off period followed by two short off periods, separated by on periods (which preferably have the same duration, to avoid excessive complexity in the sequences and lighting control). The sequence may repeat cyclically, leaving the lighting device on for few seconds in order to indicate where the sequence starts, as explained with reference to FIG 5. The installer 802 sees the lighting device 201 turning on and off cyclically with sequence 801 "long off-flicker-flicker" (or, more accurately, "long on - long off - on - short off - on - short off - long on"). The skilled person decides which peripheral interface 207 (e.g. button) will be assigned to the lighting device 201, and performs a first long pressing followed by two short pressing of the button 207. The control unit 206 detects the actuation sequence 803 (for example, it detects the length, number and/or order of pressings, for example) via its input, which may be a wired input (e.g. data wire 204), identifies the sequence 500 assigned to the lighting device 201 from the actuation sequence 803 pressed in that particular button, and establishes the link between the button 207 and the lighting device 201. This information can be kept in an internal memory, thus enabling a basic control of the lighting device 201 through the button 207. The installer can move to a different lighting device 201 and/or peripheral interface 207 and repeat the operation until all the lighting devices 201 of the building are functional and can be turned on and off. Optionally, all the peripheral interfaces 207 of the building can also be made functional (thus, each of them can turn on or off a lighting device 201). All this can be done by a single installer only, not needing help of a colleague, and it can be done as soon as the wiring, peripheral interfaces, lighting devices, and control unit are installed and connected to the power network, with no need of any data network connection, wireless connection, wi-fi signal, modems or the like.

[0077] In a later building stage, when the control unit 206 has access to external networks (for example when

the building is connected to data lines such as phone lines or fiber-optic communication providing connection to e.g. internet), it can link all the information of the external database (address, each room including the lighting devices 201 linked to peripheral interfaces 207) with the information stored in the control unit 206. Thus, the configuration of the lighting system, with all the user preferences, or at least part thereof can be finished remotely, from a central unit with access to the database and to the control unit 206. Additionally, this allows an external support center to obtain information for technical support or the like, with no need to send a specialist to the physical lighting system (e.g. the house with such system).

Claims

1. A method of commissioning a lighting system in a house or building by linking a plurality of peripheral interfaces (203, 207) with a plurality of lighting devices (201) in an electrical network, the method comprising:

   - generating (301) a set of patterns with at least as many different patterns as the number of lighting devices (201) in the plurality thereof,
   - retrieving the plurality of lighting devices (201) in the electrical network,
   - assigning (302) each pattern of the set to a unique lighting device (201) of the plurality thereof,
   - activating (303) each lighting device (201) in accordance with its assigned pattern, the pattern comprising a sequence of powering pulses,
   - replicating the pattern of a particular lighting device (201) by actuating a peripheral interface (203, 207) to be linked with that particular lighting device (201), and
   - upon detecting (304) actuation of the peripheral interface (203, 207) in accordance with the assigned pattern of the set of patterns, linking (305) the actuated peripheral interface (203, 207) with the lighting device (201) which has that pattern assigned.

2. The method of the previous claim, further comprising emitting a perceptible signal when a lighting device (201) is linked to at least one peripheral interface (203, 207).

3. The method of claim 2, further comprising emitting a further perceptible signal when all lighting devices (201) are linked to at least one peripheral interface (203, 207).

4. The method of any of the previous claims, wherein the step of generating (301) a set of patterns comprises generating patterns including a fixed number of pulses and a variable duration of each pulse, wherein the variable duration of each pulse is a short or a long duration.

5. The method of any of the previous claims, further comprising retrieving at least one peripheral interface (203, 207).

6. A control unit (206) for commissioning a lighting system including a plurality of lighting devices (201) and a plurality of peripheral interfaces (203, 207) in an electrical network, the control unit comprising an input port for receiving input signals from the plurality of peripheral interfaces (203, 207) and an output for powering the lighting devices (201), the control unit being programmed to carry out the steps of generating (301) a set of patterns with at least as many different patterns as the number of lighting devices (201) in the plurality thereof, retrieving the plurality of lighting device (201) connected to the electrical network, assigning (302) each pattern of the set to a unique lighting device (201) of the plurality thereof, activating (303) each lighting device (201) in accordance with its assigned pattern, the pattern comprising a sequence of powering pulses, and upon detecting (304) signals received through the input port indicating actuation of the peripheral interface (203, 207) in accordance with a pattern of the set of patterns, linking (305) the actuated peripheral interface (203, 207) with the lighting device (201) which has that pattern assigned, for linking the plurality of lighting devices (201) with respective peripheral interfaces (203, 207).

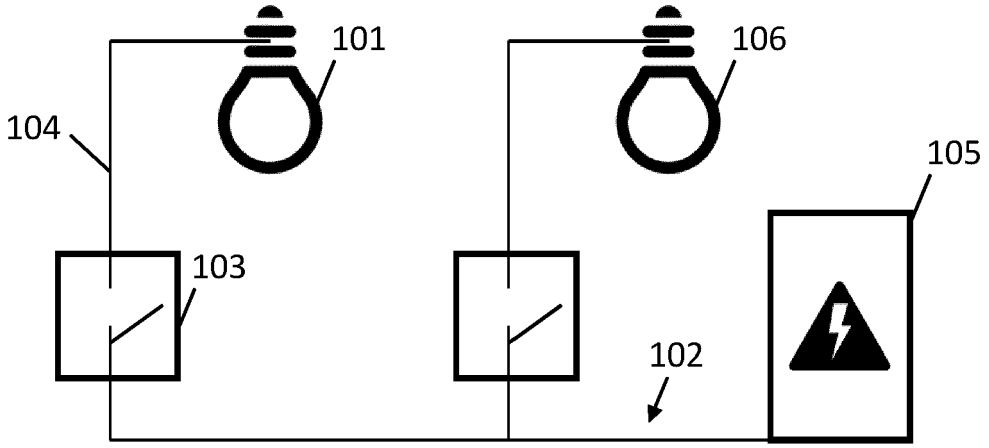
7. The control unit (206) of the previous claim wherein being programmed to carry out the step of retrieving the plurality of lighting devices (201) comprises being programmed to scan the output for powering the lighting devices (201) thus detecting said lighting devices.

8. The control unit (206) of the claims 6 or 7 further comprising retrieving the plurality of peripheral interfaces (203, 207).

9. A lighting system for a house or building including

   - a plurality of lighting devices (201) for emitting continuous light when powered,
   - a plurality of peripheral interfaces (203, 207) for actuating the powering of the lighting devices (201),
   - a control unit (206) in accordance with any one of claims 6 to 8, the control unit (206) being electrically connected to each of the plurality of lighting devices (201) and to each of the plurality of peripheral interfaces (203, 207).

10. The lighting system of claim 9, wherein the peripheral interfaces (203, 207) and/or the lighting devices (201) are connected to the control unit (206) via wired buses (204).



(Prior art)

FIG 1

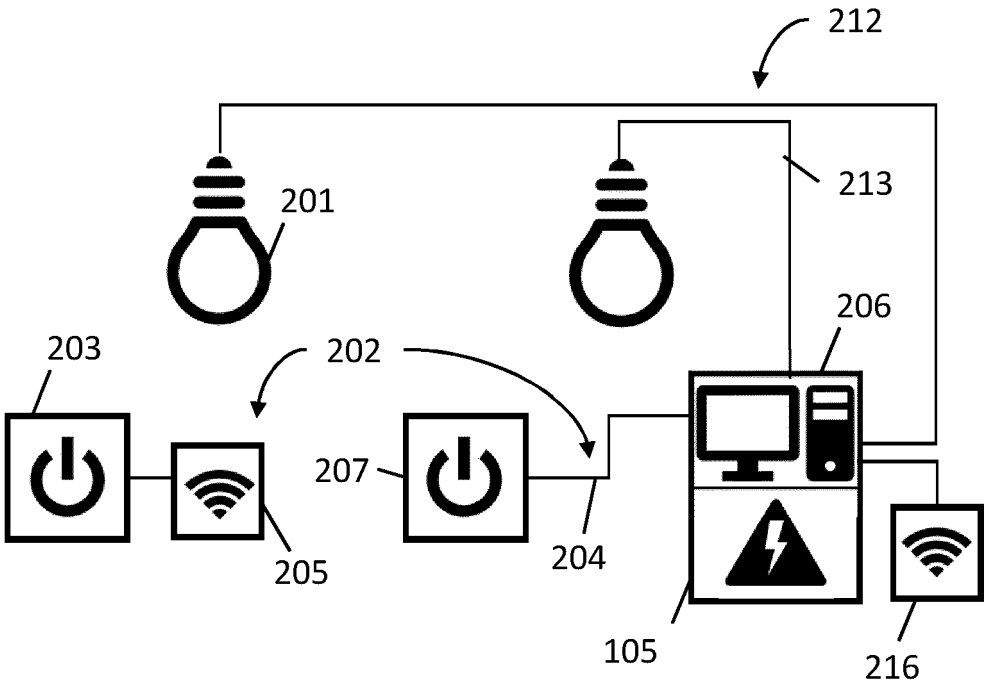


FIG 2

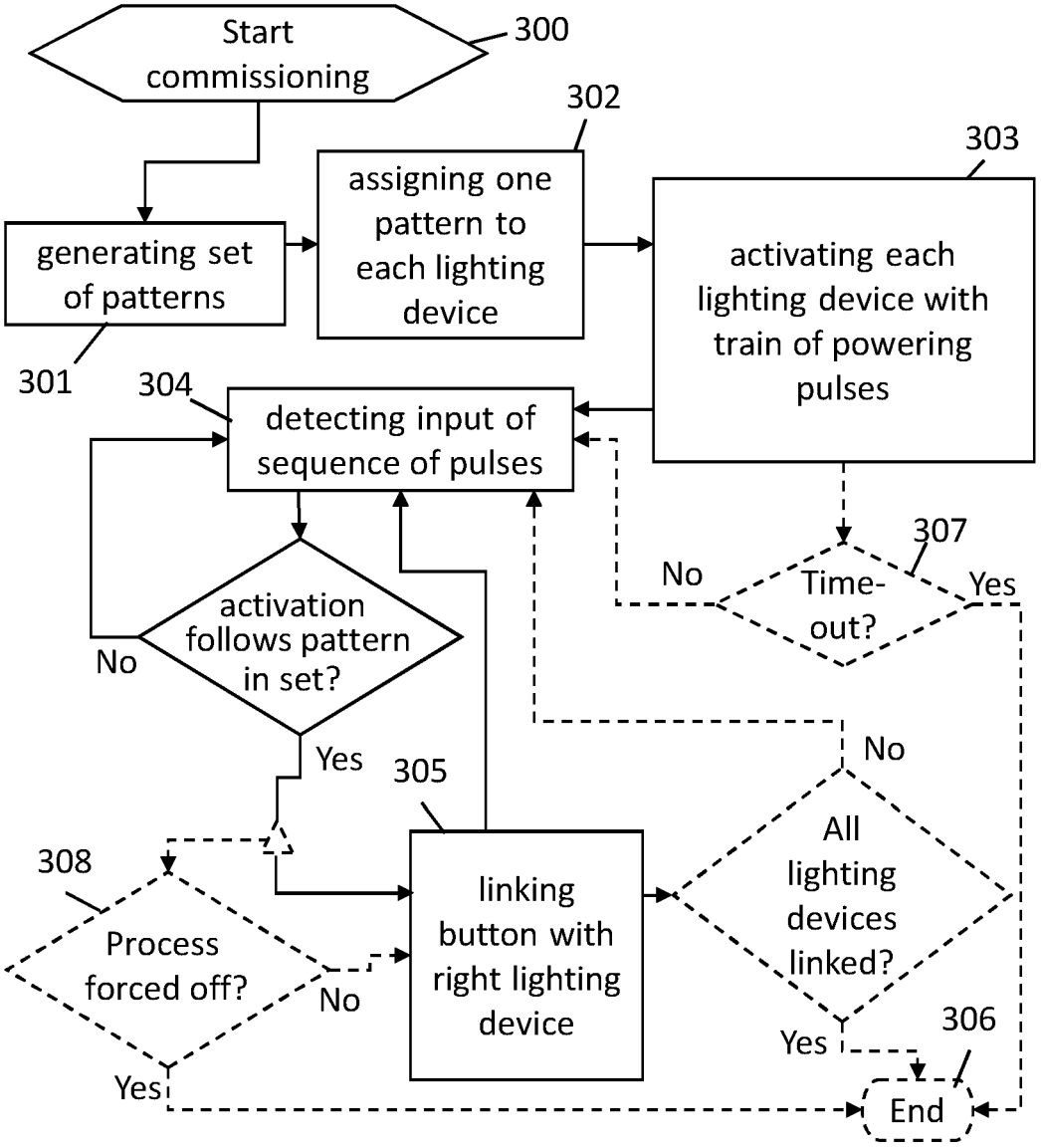

Start commissioning
300
302
303
assigning one pattern to each lighting device
generating set of patterns
activating each lighting device with train of powering pulses
301
304
detecting input of sequence of pulses
307
No
Time-out?
Yes
activation follows pattern in set?
No
Yes
305
No
All lighting devices linked?
308
Process forced off?
No
linking button with right lighting device
Yes
306
Yes
End

FIG 3

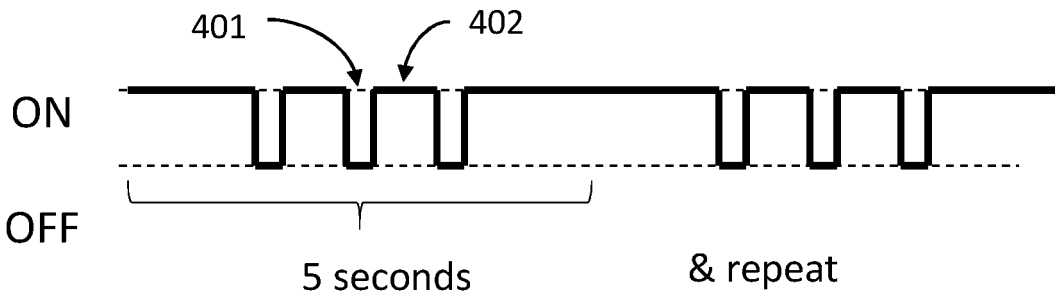

401
402
ON
OFF
5 seconds
& repeat

FIG 4

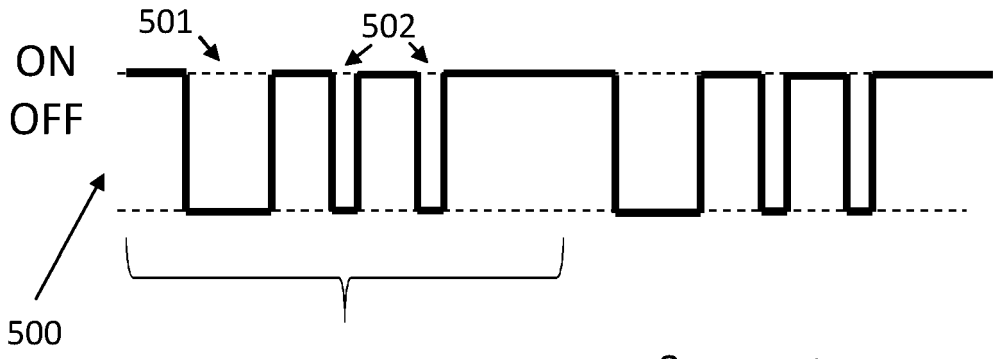


FIG 5

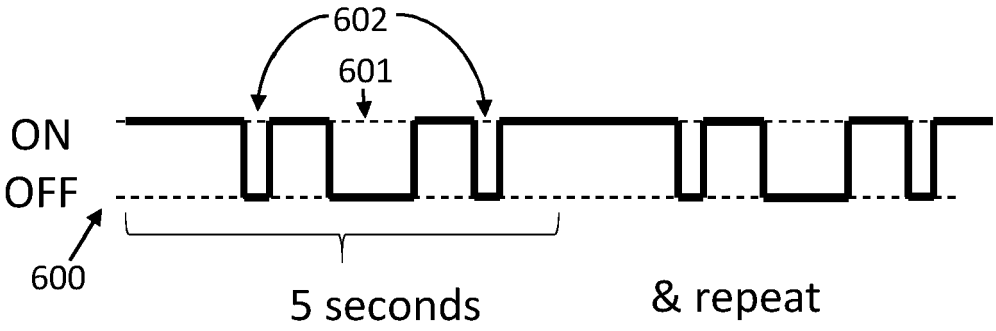


FIG 6

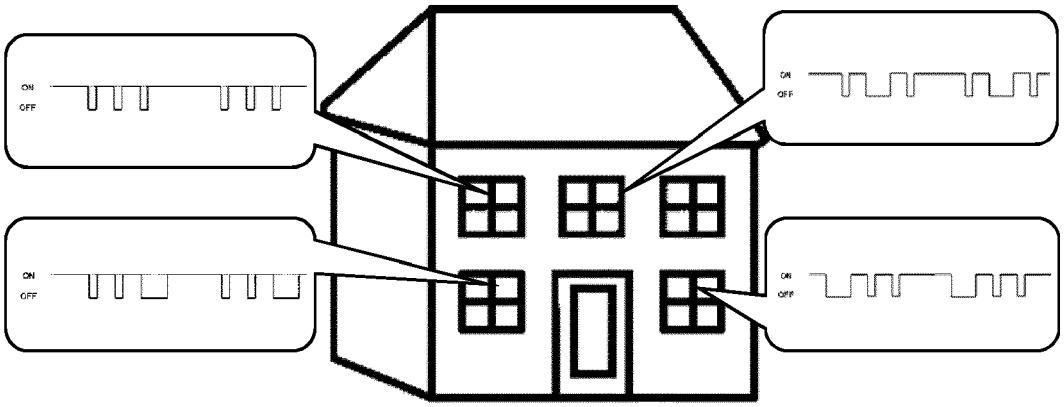


FIG 7

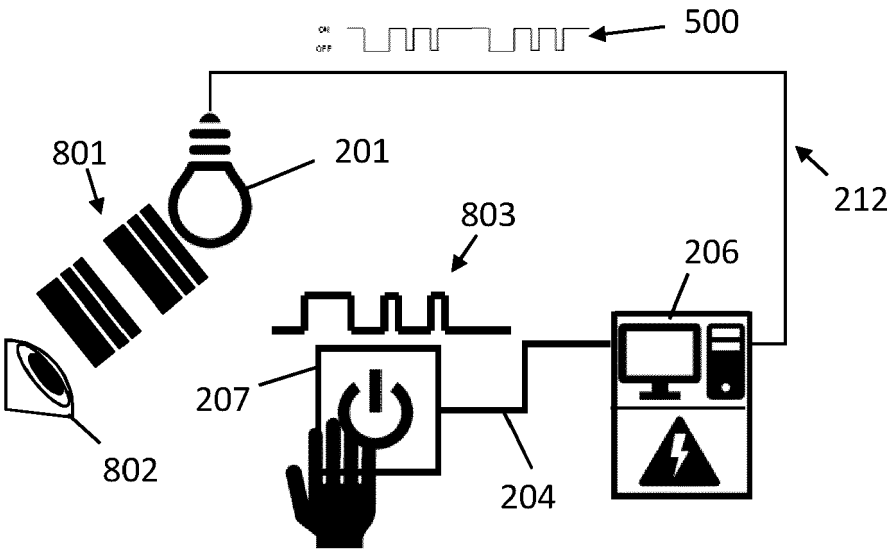


FIG 8

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EUROPEAN SEARCH REPORT

Application Number
EP 20 16 6939

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2004/046477 A2 (MILLER HERMAN INC [US]; KENNEDY SHEILA [US] ET AL.) 3 June 2004 (2004-06-03) * page 1, lines 10-14; figures 1-123 * * page 9, line 22 - page 16, line 17 * * page 31, line 2 - page 140, line 9 * * in het bijzonder, van pagina 9, regel 22 tot pagina 13, regel 23; van pagina 31, regel 2 tot pagina 41, regel 21; Figuren 1, 2 *	1-10	INV. H05B47/10 H05B47/19
A	WO 2014/108817 A1 (KONINKL PHILIPS NV [NL]) 17 July 2014 (2014-07-17) * page 1, paragraph 1; figures 1-3 * * page 1, paragraph 3 - page 8, paragraph 1 * * page 9, paragraph 4 - page 15, paragraph 2 *	1-10	
A	WO 2010/035192 A1 (PHILIPS INTELLECTUAL PROPERTY [DE] ET AL.) 1 April 2010 (2010-04-01) * page 1, lines 7-10; figures 1-11 * * page 2, line 18 - page 6, line 21 * * page 8, line 24 - page 24, line 5; claims 1-3 *	1-10	TECHNICAL FIELDS SEARCHED (IPC) H05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 April 2020	Brosa, Anna-Maria

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 16 6939

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29-04-2020

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		ES 2425079 T3	11-10-2013
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- WO 2014108817 A1 **[0005]**
- WO 2010035192 A1 **[0006]**