(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 April 2020 (23.04.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/078831 A1

(51) International Patent Classification:
H05B 37/02 (2006.01)

(21) International Application Number:
PCT/EP2019/077518

(22) International Filing Date:
10 October 2019 (10.10.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
18201471.2 19 October 2018 (19.10.2018) EP

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

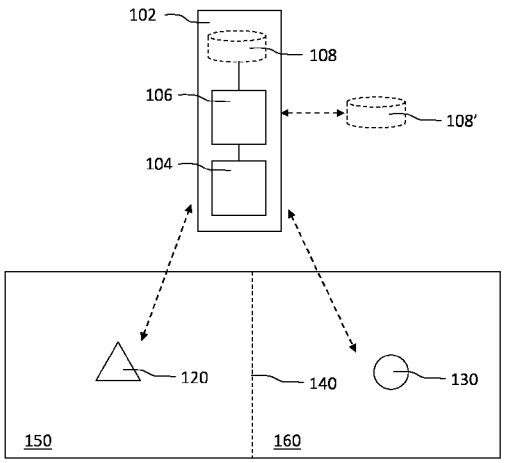
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

(54) Title: A METHOD AND A CONTROLLER FOR CONFIGURING A LIGHTING SYSTEM



100

Fig. 1

(57) Abstract: A method 400 of configuring a lighting system 100 is disclosed. The lighting system 100 comprising a first lighting device 120 located in a first area 150 and a light sensor 130 located in a second area 160. The method 400 comprises: receiving first position information of the first lighting device 120, wherein the first position information is indicative of the first area 150 wherein the first lighting device 120 is located, receiving 5 second position information of the light sensor 130, wherein the second position information is indicative of the second area 160 wherein the light sensor 130 is located, temporally controlling the light output of the first lighting device 120, receiving sensor data from the light sensor 130, analyzing the sensor data, determining that, if the sensor data corresponds to the temporal control of the first lighting device 120, the first area 150 is visible from the 10 second area 160, determining that, based on that the first area 150 is visible from the second area 160, the first area 150 is adjacent to the second area 160, and storing information indicative of the adjacency between the first area 150 and the second area in a memory 108, 108'.

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Published:
— *with international search report (Art. 21(3))*

A METHOD AND A CONTROLLER FOR CONFIGURING A LIGHTING SYSTEM

FIELD OF THE INVENTION

The invention relates to a method of configuring a lighting system and to a computer program product for executing the method. The invention further relates to a controller for configuring a lighting system.

BACKGROUND

Home and office lighting control systems enable users to control lamps that are distributed throughout a space. A user can assign lighting devices to different areas of the space via a user interface of, for example, a smart device such as a smartphone. A user may, for instance, assign a first lighting device to the living room and assign a second lighting device to the kitchen. This enables a user to set light scenes (lighting control settings for one or more lighting devices) for lighting devices assigned to a certain area. These light scenes may, for example, be activated when a (presence) sensor is triggered, when a light scene is selected via a user interface (e.g. a light switch, a user interface on a smart device, etc.), when a (user-defined) routine is activated, etc.

A user interface may be used to manually create a floorplan of a building, wherein a user can indicate where the different rooms are located. This process can be cumbersome. Furthermore, most lighting control software applications do not offer this functionality.

U.S. patent application 2014/0354161 A1 discloses commissioning of a lighting system. Logical associations into sub-networks may be created based on element locations and/or proximity. Relative proximity of lighting devices may entail detection by light transmission and light sensing. Various system elements within each of rooms are grouped or associated to form a logical sub-network in the respective room. If two rooms are parts of a conference room separated by a moveable partition, the two groups might work together (via a third grouping that encompasses elements in both rooms), e.g. when the partition is open to join the two rooms into one large conference space. The opening of the partition may be recognized by sensing of appropriately modulated light emitted from a

lighting device in one room by a sensor in the other room. The lighting devices may be informed of an occupancy state and be turned off if a user is no longer present.

SUMMARY OF THE INVENTION

It is an object of the present invention to automatically determine a layout of rooms in a building. It is a further object of the present invention to control lighting devices based on the layout of a building.

According to a first aspect of the present invention, the object is achieved by a method of configuring a lighting system, the lighting system comprising a first lighting device located in a first area and a light sensor located in a second area, the method comprising:

- receiving first position information of the first lighting device, wherein the first position information is indicative of the first area wherein the first lighting device is located,
- receiving second position information of the light sensor, wherein the second position information is indicative of the second area wherein the light sensor is located,
- temporally controlling the light output of the first lighting device,
- receiving sensor data from the light sensor,
- analyzing the sensor data,
- determining that, if the sensor data corresponds to the temporal control of the first lighting device, the first area is visible from the second area,
- determining that, based on that the first area is visible from the second area, the first area is adjacent to the second area, and
- storing information indicative of the adjacency between the first area and the second area in a memory.

The sensor data from the light sensor located in the second area is analyzed to determine if the sensor detects light that is emitted by the first lighting device located in the first area. The light output of the first lighting device in the first area is temporally controlled which enables this determination. The light output of the first lighting device may, for example, be modulated such that it comprises an identifier, which may be detected by the light sensor. Alternatively, the light output may be changed at a certain moment in time, which change may be detected by the light sensor. This enables determining that the light emitted by the first lighting device corresponds to the sensor reading of the light sensor. This means that the lighting device and/or its light effect is in the field of view of the light sensor,

and that there is a (semi-)transparent boundary (e.g. a window or an opening) between the first area and the second area. In other words, this means that the first area is visible from the second area. By determining that the light sensor detects light emitted by the first lighting device, it can be determined that the first area (e.g. a living room) is adjacent to the second area (e.g. a garden). This enables automatically determining adjacency between rooms, and therewith a layout of a building. It is to be understood that there may be a gap between the first and the second area.

The lighting system may further comprise a second lighting device located in the second area. The method may further comprise: detecting, by a presence sensor, presence of one or more users in the first and/or second area, and controlling the light output of the first lighting device and the second lighting device as a function of the presence (only) if the first area is visible from the second area.

The method may further comprise: detecting, by a presence sensor, presence of one or more users the first and/or the second area, and controlling, if a user is present in one of the first and the second area, the light output of a respective lighting device located in the area wherein the user is located according to a first light setting and the light output of a respective lighting device located in the other area according to a second light setting. For instance, a user may be present in the first area, whereupon the first lighting device may be controlled according to a first light setting (e.g. a functional light setting), and the second lighting device may be controlled according to a second light setting (e.g. an ambient light setting). Due to the presence of a (semi-)transparent boundary between the first area and the second area, the second light setting is visible from the first area. This is beneficial because it creates (ambient) light in the second area visible to the user in the first area. If, for example, the first area is not visible from the second area, the lighting device in the other area may be switched off.

The second light setting may be based on a previous second light setting of the respective lighting device located in the other area. The previous second light setting may for example be a default light setting, a previous ambient light setting, a user defined light setting, etc. The new light setting which is activated in the other area (i.e. the area where the user is not present) may be (automatically) derived from a previous (functional) light setting that was already activated in that area. For instance, a default (functional) light setting may have been applied to a lighting device in the second area, and upon detecting presence in the first area an ambient light setting is activated in the second area which is based on the default light setting. For example, the ambient light setting may have different brightness (e.g. a

lower brightess), saturation (e.g. a higher saturation) or color values compared to the default (functional) light setting.

The method may comprise: controlling, if a first user is present in the first area and a second user is present in the second area, the light output of the second lighting device according to a third light setting. If users are present in both areas, the light settings for the areas may be different compared to when only one user is present in one of the first and the second area. For example, both the first and the second lighting device may be controlled according to functional light settings rather than ambient light settings.

The method may further comprise: receiving information about types of the first and second areas, and determining light settings for lighting devices in the first and second area based on the type of the respective area. Different types of areas may require different light settings. For instance, a dining room requires different light settings than a garden. It is therefore beneficial to determine/select light settings for the areas based on their type.

The method may further comprise repeating, at a second moment in time, the steps of: temporally controlling the light output of the first lighting device, receiving sensor data from the light sensor and analyzing the sensor data. The method may further comprise: determining that, if the sensor data does not correspond to the temporal control of the first lighting device, a light blocking element is located between the first area and the second area at the second moment in time, and storing information indicative of presence of the light blocking element in the memory. In other words, these steps of the method may be executed at the second moment in time to determine if the first lighting device (or its light effect) is still in the field of view of the light sensor to determine if a light blocking element (e.g. a closed door, curtains, etc.) is present between the first area and the second area. These steps may be repeated (e.g. continuously, every predetermined time period, upon detection of user presence, etc.) in order to determine the presence of the light blocking element. The method may further comprise: controlling the light output of the first lighting device (and, optionally, the light output of a second lighting device located in the second area) based on the presence of the light blocking element and, optionally, based on user presence in one of the first and second area. Thus, if a light blocking element is (temporarily) present between the first area and the second area, the lighting may be controlled accordingly. If, for example, a user is present in the first area and no user is present in the second area, and a light blocking element (such as a closed door) is present between the first and second area, the second lighting device in the second area may be turned off because it may not be visible from the first area.

The position information may be indicative of a room or a part of a room to which the respective lighting device or light sensor has been assigned.

The method may further comprise the step of: receiving user input via a user interface, wherein the user input is indicative of the first and second position information. A user may, for example, assign the first lighting device to the first area (e.g. a first room in a house) and assign the light sensor to the second area (e.g. a second room in a house) via a user interface of a (portable) personal device such as a smartphone or a central (home) control system.

The step of temporally controlling the light output of the first lighting device may comprise controlling the light output of the first lighting device such that the light output comprises an embedded code. The step of determining that, if the sensor data corresponds to the temporal control of the first lighting device, the first area is visible from the second area may comprise: analyzing the sensor data to identify a code in the sensor data that corresponds to the embedded code, and determining that the first area is visible from the second area if the code corresponds to the embedded code. In other words, the first lighting device may be controlled such that it emits modulated light comprising a code, and if the light sensor detects the code, it may be concluded that the first lighting device or its light effect is in the field of view of the sensor device, and that the first area is therefore visible from and adjacent to the second area.

The step of temporally controlling the light output of the first lighting device may comprise changing the light output of the first lighting device at a defined moment in time. The step of determining that, if the sensor data corresponds to the temporal control of the first lighting device, the first area is visible from the second area may comprise: analyzing the sensor data to identify a change in a detected light level, and determining that the first area is visible from the second area if the moment of the change in the detected light level corresponds to the change of the light output at the moment defined in time. In other words, the first lighting device may be controlled such that it is switched on (or that its light output is changed) at a certain moment in time, and if the light sensor detects the change at the same moment in time, it may be concluded that the first lighting device or its light effect is in the field of view of the sensor device, and that the first area is therefore visible from and adjacent to the second area.

According to a second aspect of the present invention, the object is achieved by a computer program product for a computing device, the computer program product

comprising computer program code to perform any one of the preceding methods when the computer program product is run on a processing unit of the computing device.

According to a second aspect of the present invention, the object is achieved by a controller for configuring a lighting system, the lighting system comprising a first lighting device located in a first area and a light sensor located in a second area, the controller comprising:

- a receiver configured to receive first position information of the first lighting device, wherein the first position information is indicative of the first area wherein the first lighting device is located, and to receive second position information of the light sensor, wherein the second position information is indicative of the second area wherein the light sensor is located,
- a processor configured to temporally control the light output of the first lighting device, receive sensor data from the light sensor, analyze the sensor data, determine that, if the sensor data corresponds to the temporal control of the first lighting device, the first area is visible from the second area, determine that, based on that the first area is visible from the second area, the first area is adjacent to the second area, and store information indicative of the adjacency between the first area and the second area in a memory.

According to a fourth aspect of the present invention, the object is achieved by a lighting system comprising:

- the controller,
- the first lighting device located in the first area, wherein the first lighting device is configured to receive lighting control commands from the controller, and
- the light sensor located in the second area, wherein the light sensor is configured to communicate sensor data to the controller. In embodiments of the system, the light sensor may be comprised in a second lighting device located in the second area. Additionally, a second light sensor for detecting light emitted by the second lighting device may be comprised in the first lighting device.

It should be understood that the computer program product, the controller and the system may have similar and/or identical embodiments and advantages as the above-mentioned methods.

BRIEF DESCRIPTION OF THE DRAWINGS

The above, as well as additional objects, features and advantages of the disclosed systems, devices and methods will be better understood through the following

illustrative and non-limiting detailed description of embodiments of devices and methods, with reference to the appended drawings, in which:

Fig. 1 shows schematically an embodiment of a lighting system comprising a lighting device located in a first area, a light sensor located in a second area and a controller for configuring the lighting system;

Fig. 2a shows schematically an embodiment of a lighting system comprising a lighting device located in a first area, a light sensor located in a second area, wherein the lighting device emits light comprising an embedded code;

Fig. 2b shows schematically an embodiment of a lighting system comprising a lighting device located in a first area, a light sensor located in a second area, wherein the lighting device is switched on at a certain moment in time;

Fig. 3a, 3b and 3c show schematically embodiments of a lighting system comprising presence sensors for detecting presence in first and second areas and controlling the lights based on the presence;

Fig. 4 shows schematically a method of configuring a lighting system; and

Fig. 5 shows schematically a method of configuring a lighting system.

All the figures are schematic, not necessarily to scale, and generally only show parts which are necessary to elucidate the invention, wherein other parts may be omitted or merely suggested.

DETAILED DESCRIPTION OF EMBODIMENTS

Fig. 1 shows schematically an embodiment of a lighting system 100 comprising a lighting device 120 located in a first area 150, a light sensor 130 located in a second area 160 and a controller 102 for configuring the lighting system 100. The controller 102 comprises a receiver 104 configured to receive first position information of the first lighting device 120, wherein the first position information is indicative of the first area 150 wherein the first lighting device 120 is located, and to receive second position information of the light sensor 130, wherein the second position information is indicative of the second area 160 wherein the light sensor 130 is located. The controller 102 further comprises a processor 106 (e.g. a microcontroller, a microchip, circuitry, etc.) configured to temporally control the light output of the first lighting device 120, receive sensor data from the light sensor 130 and analyze the sensor data to determine if the sensor data corresponds to the temporal control of the first lighting device 120, and to determine that the first area is visible from the second area. The processor 106 is further configured to determine that the first area 150 is adjacent

to the second area 160 if the sensor data corresponds to the temporal control of the first lighting device 120, and to store information indicative of the adjacency between the first area 150 and the second area 160 in a memory 108, 108'.

The controller 102 may be configured to communicate with devices, such as the first lighting device 120 and the light sensor 130, of the lighting system 100. The controller 102 may comprise a transmitter and a receiver 104 or a transceiver to communicate with lighting devices and/or sensor devices of the lighting system 100 via any suitable communication protocol. Various wired and wireless communication protocols may be used, for example Ethernet, DMX, DALI, USB, Bluetooth, Wi-Fi, Li-Fi, 3G, 4G, 5G or ZigBee. The controller 102 may for example be comprised in a bridge device, a central home/office control system, a personal user device such as a smartphone, a tablet pc, etc. Alternatively, the controller 102 may be comprised in a lighting device or a sensor device, such as the first lighting device 120 or the light sensor 130.

The receiver 104 is configured to receive/obtain first position information of the first lighting device 120 and second position information of the light sensor 130. The receiver 104 may be an input of the processor 106. The receiver 104 may receive/retrieve the position information from a memory, for example memory 108, 108', receive the position information from a lighting control software application running on, for example, a smartphone or a bridge device, receive the position information from a remote server via, for example, the internet, receive the position information from an (indoor) positioning system, determine the position information by analyzing RF signal strengths from wireless RF signals received from the first lighting device 120 and/or the light sensor 130, etc.

The position information is indicative of respective areas wherein respective devices of the lighting system 100 are located. The position information may, for instance, be indicative of a room in a building (e.g. 'living room', 'dining room', 'kitchen', 'office 1', etc.) or an indoor/outdoor space (e.g. 'garden', 'corridor', 'cross section', etc.). Additionally, the position information may be indicative of a position of a device relative to the area (e.g. a set of coordinates relative to the area).

The processor 106 is configured to temporally control the light output of the first lighting device 120. The processor 106 may transmit lighting control commands to the first lighting device 120 via, for example, a transmitter/transceiver. Examples of temporal control of the first lighting device 120 are illustrated in Figs. 2a and 2b. Figs. 2a and 2b further illustrate the beam 122 of light of the first lighting device 120 and the field of view 132 of the light sensor 130. In the examples of Fig. 2a and 2b, the footprint of the light

emitted by the first lighting device 120 is located within the field of view 132 of the light sensor 130. Therefore, the light sensor 130 may detect light emitted by the first lighting device 120. In other embodiments the first lighting device 120 (and not only its light effect/footprint) may be located in the field of view of the light sensor 130.

In a first example, as illustrated in Fig. 2a, the processor 106 may instruct the first lighting device 120 to emit light comprising an embedded code 124. The code 124 may be created by any known principle of embedding a code in light, for example by controlling a time-varying, modulated current to the one or more light sources to produce variations in the light output, by modulating the amplitude and/or the duty-cycle of the light pulses, etc. The code 124 may be any code identifiable by the processor 106, for instance an identifier of the first lighting device 120. The processor 106 may analyze the sensor data of the light sensor 130 and, if the sensor data comprises the same code 124, determine that the light emitted by the first lighting device 120 in the first area 150 is visible from the second area 160, and determine that the first area 150 is therefore adjacent to the second area 160.

In a second example, as illustrated in Fig. 2b, the processor 106 may instruct the first lighting device 120 to change its light output from a first light setting (Fig. 2b, lower image) to a second light setting (Fig. 2b, upper image) at a certain moment in time. The processor 106 may, for example, switch the first lighting device 120 on, change its brightness, color, etc. The processor 106 may analyze the sensor data of the light sensor 130 and, if the sensor data has detected the change in light at substantially the same moment in time, determine that the light emitted by the first lighting device 120 in the first area 150 is visible from the second area 160, and determine that the first area 150 is therefore adjacent to the second area 160.

The processor 106 may be configured to repeat the process of determining that the first area 150 is adjacent to the second area 160 multiple times. This may improve the accuracy of the determination. Additionally, this may be used to determine if a light blocking element, such as a door, curtains, etc., temporarily blocks light between the first area 150 and the second area 160. The process of determining that the first area 150 is visible from and adjacent to the second area 160 may, for example, be repeated every predefined time period, or every time one or more lighting devices in the first and/or second area are to be controlled. This is beneficial, because it enables the processor 106 to stay up to date about the visibility of the light emitted by the first lighting device 120 from the second area 160.

The processor 106 may determine that if the sensor data corresponds to the temporal control of the first lighting device, the first area is visible from and adjacent to the

second area. Fig. 1 illustrates an (at least semi-)transparent boundary 140 between the first area 150 and the second area 160. This boundary may, for example, be a window, an open door, a window equipped with curtains or blinds, or a 'virtual' (non-physical) boundary between the first area 150 and the second area 160 which are both part of one larger area. The latter may occur in embodiments wherein a larger area is divided into subareas 150 and 160, for instance a living 'room' and a dining 'room', which are physically the same room. It should be understood that the term "adjacent" should be understood such that the second area 160 may be located next to or nearby the first area 150, and/or that there may be a gap between the first and the second area. There may, for example, be a corridor or an open space between the areas.

The processor 106 is further configured to store information indicative of the adjacency between the first area 150 and the second area 160 in a memory 108, 108'. The memory may be comprised in the controller 102, or the memory 108' may be located remotely and be accessible via a network and/or the internet. The adjacency information may later be retrievable by the controller 102, or for example by a lighting or building control system.

The processor 106 may be a single processor 106 or a distributed processor. For example, a first sub-processor may be configured to control the first lighting device temporally. The first sub-processor may for example be located in a lighting control device such as a bridge, or in a smartphone. A second sub-processor may receive information regarding the temporal control of the first lighting device from the first sub-processor, receive sensor data from the light sensor 130 and analyze the sensor data to determine that the first area 150 is visible from and adjacent to the second area 160, and store the information indicative of the adjacency between the first area 150 and the second area 160 in the memory 108, 108'. The second sub-processor may, for example, be comprised in a second device (e.g. a bridge or a central home/office control system).

The light sensor 130 may be any type of light sensor for detecting light emitted by the first lighting device 120. The light sensor may, for example, be a photodiode or a camera. The first lighting device 120 may comprise one or more LED light sources configured to emit visible light. Additionally or alternatively, the first lighting device 120 may comprise LED light sources configured to emit non-visible light (e.g. infrared or ultraviolet light), and the light sensor 130 may be configured to detect this non-visible light.

The first area 150 may comprise a lighting device and a light sensor, and the second area 160 may also comprise a lighting device and a light sensor. The processor 106

may be configured to control the lighting devices temporally in both areas and analyze the sensor data from both light sensors. This may increase the robustness of determining the adjacency between the first area 150 and the second area 160. The light sensors may be comprised in respective lighting devices in the respective areas.

The processor 106 may be further configured for controlling the first lighting device 120 (and, optionally, additional lighting devices located in the first and/or second area), after the adjacency between the first area 150 and the second area 160 has been determined. The lighting system 100 may further comprise one or more presence sensors (e.g. one or more cameras, one or more PIR sensors, one or more radar sensors, acoustic presence sensors, network presence sensing (using network diagnostic data), RF beacons, etc.) for detecting presence in the first and/or the second area. In embodiments, the light sensor 130 sensor may function as the presence sensor (e.g. a camera, a PIR sensor, etc.). The processor 106 may be further configured to control lighting devices in the first and/or second areas as a function of the detected presence. Figs. 3a, 3b and 3c illustrate examples of lighting control based on presence of users in the first, second and both areas, respectively. These figures show a lighting system comprising a first lighting device 120 and a first presence sensor 302 in a first area 150, and a second lighting device 320, a second presence sensor 304 and a light sensor 130 in a second area 160, and a transparent boundary 304 (e.g. a wall comprising a window) between the first area 150 and the second area 160. In these figures, the first area 150 may, for example, be a living room and the second area may, for example, be a garden.

In a first example, as illustrated in Fig. 3a, a user 312 is present in the first area 150. First presence sensor 302 may detect the presence of the user 312, and communicate this to the processor 106 and second presence sensor 304 may not detect presence. The processor 106 may therefore control the light output of the first lighting device 120 in the first area 150 (the living room) according to a first light setting, for example a reading light setting (e.g. a light setting with a high brightness). Since no user is present in the second area 160 (the garden), and since the first area 150 is visible from the second area 160, the processor 106 may control the second lighting device 320 located in the second area 160 according to a second light setting, different from the first light setting, for example an ambient light setting (e.g. a colored light setting with low brightness). As a result, the user 312 can see his garden illuminated while sitting inside.

In a second example, as illustrated in Fig. 3b, a user 314 is present in the second area 150. Second presence sensor 304 may detect the presence of the user 314, and

communicate this to the processor 106, while first presence sensor 302 may not detect presence. The processor 106 may therefore control the light output of the second lighting device 320 in the second area 160 (the garden) according to a first light setting, for example a 'welcome home' light setting (e.g. a light setting with a high brightness). Since no user is present in the first area 150 (the living room), and since the first area 150 is visible from the second area 160, the processor 106 may control the first lighting device 120 located in the first area 150 according to a second light setting, different from the first light setting, for example an ambient light setting (e.g. a colored light setting with low brightness). As a result, the user 314 can see his living room illuminated while walking through his garden.

In a third example, as illustrated in Fig. 3c, a first user 316 is present in the first area 150, and a second user 318 is present in the second area 160. This may be detected by the presence sensors 302, 304, and be communicated to the processor 106. The processor 106 may therefore control the light output of the first lighting device 120 in the first area according to a first light setting, for example a reading light setting, and the second lighting device 320 in the second area 160 (the garden) according to a second light setting, for example a 'welcome home' light setting. As a result, the lighting devices in both areas are controlled based on the presence of the users 316, 318.

The processor 106 may be further configured to receive/obtain information about a first type of the first area 150 and a second type of the second area 160, and select/determine light settings for lighting devices in these areas based on the respective type of the area. The processor 106 may receive the information about the types of the areas from a from a lighting control software application running on, for example, a smartphone or a bridge device, or receive the information from a remote server via, for example, the internet, etc. The processor 106 may, for example, receive data indicative of that the first area 150 is a living room, and that the second area 160 is a garden. The processor 106 may therefore select respective light settings for these types of areas.

The lighting system 100 may further comprise a user interface device for receiving user input indicative of the first and second position information. The user interface device may, for example, be a smartphone comprising a user interface (e.g. a touch screen or a voice-controlled user interface) for receiving the user input. A user may for example assign the first lighting device 120 to the first area 150 (e.g. the living room) and assign the light sensor 130 to the second area 160 (e.g. a garden).

Fig. 4 shows schematically a method 400 of configuring a lighting system 100. The method 400 comprises: receiving 402 first position information of a first lighting device

120, wherein the first position information is indicative of a first area 150 wherein the first lighting device 120 is located, receiving 404 second position information of the light sensor 130, wherein the second position information is indicative of a second area 160 wherein the light sensor 130 is located, temporally controlling 406 the light output of the first lighting device 120, receiving 408 sensor data from the light sensor 130, analyzing 410 the sensor data, determining 412 that, if the sensor data corresponds to the temporal control of the first lighting device 120, the first area is visible from the second area, determining 414 that, based on that the first area 150 is visible from the second area 160, the first area 150 is adjacent to the second area 160, and storing 416 information indicative of the adjacency between the first area 150 and the second area 160 in a memory 108, 108'.

Fig. 5 shows schematically a method 500 of configuring a lighting system 100. The method 500 comprises the steps of the method 400 of Fig. 4, further including repeating, at a second moment in time, the steps of temporally controlling 406 the light output of the first lighting device 120, receiving 408 sensor data from the light sensor 130, analyzing 410 the sensor data. The method further comprises the step of determining 502 that, if the sensor data does not correspond to the temporal control of the first lighting device 120, a light blocking element is located between the first area 150 and the second area 160 at the second moment in time, and the step of storing 504 information indicative of presence of the light blocking element in the memory 108, 108'. After this last step, the steps 406 and onwards may be repeated over time to determine if and when the light blocking element is located between the first area 150 and the second area 160.

The methods 400, 500 may be executed by computer program code of a computer program product when the computer program product is run on a processing unit of a computing device, such as the processor 106 of the controller 102.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims.

In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention may be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer or processing unit. In the device claim enumerating several means, several of these means may be embodied by one and the same

item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

Aspects of the invention may be implemented in a computer program product, which may be a collection of computer program instructions stored on a computer readable storage device which may be executed by a computer. The instructions of the present invention may be in any interpretable or executable code mechanism, including but not limited to scripts, interpretable programs, dynamic link libraries (DLLs) or Java classes. The instructions can be provided as complete executable programs, partial executable programs, as modifications to existing programs (e.g. updates) or extensions for existing programs (e.g. plugins). Moreover, parts of the processing of the present invention may be distributed over multiple computers or processors or even the 'cloud'.

Storage media suitable for storing computer program instructions include all forms of nonvolatile memory, including but not limited to EPROM, EEPROM and flash memory devices, magnetic disks such as the internal and external hard disk drives, removable disks and CD-ROM disks. The computer program product may be distributed on such a storage medium, or may be offered for download through HTTP, FTP, email or through a server connected to a network such as the Internet.

CLAIMS:

1. A method (400) of configuring a lighting system (100), the lighting system (100) comprising a first lighting device (120) located in a first area (150), a second lighting device and a light sensor (130) located in a second area (160), and one or more presence sensors (302, 304) for detecting presence of one or more users the first and/or the second area (160), the method (400) comprising:

- receiving first position information of the first lighting device (120), wherein the first position information is indicative of the first area (150) wherein the first lighting device (120) is located,
- receiving second position information of the light sensor (130), wherein the second position information is indicative of the second area (160) wherein the light sensor (130) is located,
- temporally controlling the light output of the first lighting device (120),
- receiving sensor data from the light sensor (130),
- analyzing the sensor data,
- determining that, if the sensor data corresponds to the temporal control of the first lighting device (120), the first area (150) is visible from the second area (160),
- determining that, based on that the first area (150) is visible from the second area (160), the first area (150) is adjacent to the second area (160), and
- storing information indicative of the adjacency between the first area (150) and the second area in a memory (108, 108').

wherein the method (400) further comprises:

- detecting, by the one or more presence sensors (302, 304), presence of one or more users in the first and/or the second area (160), and
- controlling the first and/or second lighting device as a function of detected presence if the first area (150) is visible from the second area (160), by controlling, if a user is present in one of the first and the second area, the light output of a respective lighting device located in the area wherein the user is located according to a first light setting and the light output of a respective lighting device located in the other area according to a second light setting different from the first light setting.

2. The method (400) of claim 1, wherein the second light setting is an ambient light setting.

3. The method of any preceding claim, wherein the second light setting is based on a previous second light setting of the respective lighting device located in the other area.

4. The method (400) of any preceding claim, comprising:
- controlling, if a first user is present in the first area (150) and a second user is present in the second area (160), the light output of the second lighting device according to a third light setting.

5. The method (400) of any preceding claim, further comprising:
- receiving information about types of the first and second areas, and
- determining light settings for lighting devices in the first and second area based on the type of the respective area.

6. The method (400) of any preceding claim, further comprising repeating, at a second moment in time, the steps of:
- temporally controlling the light output of the first lighting device (120), and
- receiving sensor data from the light sensor (130),
- analyzing the sensor data,
and wherein the method (400) further comprises:
- determining (502) that, if the sensor data does not correspond to the temporal control of the first lighting device (120), a light blocking element is located between the first area (150) and the second area at the second moment in time, and
- storing (504) information indicative of presence of the light blocking element in the memory (108, 108').

7. The method (400) of any preceding claim, further comprising the step of
- receiving user input via a user interface, wherein the user input is indicative of the first and second position information.

8. The method (400) of any one of claims 1 to 7, wherein the step of temporally controlling the light output of the first lighting device (120) comprises controlling the light output of the first lighting device (120) such that the light output comprises an embedded code (124), and wherein the step of determining that, if the sensor data corresponds to the temporal control of the first lighting device (120), the first area (150) is visible from the second area (160) comprises: analyzing the sensor data to identify a code in the sensor data that corresponds to the embedded code (124), and determining that the first area (150) is visible from the second area (160) if the code corresponds to the embedded code (124).

9. The method (400) of any one of claims 1 to 7, wherein the step of temporally controlling the light output of the first lighting device (120) comprises changing the light output of the first lighting device (120) at a defined moment in time, and wherein the step of determining that, if the sensor data corresponds to the temporal control of the first lighting device (120), the first area (150) is visible from the second area (160) comprises: analyzing the sensor data to identify a change in a detected light level, and determining that the first area (150) is visible from the second area (160) if a moment of the change in the detected light level corresponds to the change of the light output at the defined moment in time.

10. A computer program product for a computing device, the computer program product comprising computer program code to perform the method (400) of any preceding claim when the computer program product is run on a processing unit of the computing device.

11. A controller (102) for configuring a lighting system (100), the lighting system (100) comprising a first lighting device (120) located in a first area (150), a second lighting device and a light sensor (130) located in a second area (160), and one or more presence sensors (302, 304) for detecting presence of one or more users in the first and/or the second area (160), the controller (102) comprising:

- a receiver (104) configured to receive first position information of the first lighting device (120), wherein the first position information is indicative of the first area (150) wherein the first lighting device (120) is located, and to receive second position

information of the light sensor (130), wherein the second position information is indicative of the second area (160) wherein the light sensor (130) is located,

- a processor (106) configured to temporally control the light output of the first lighting device (120), receive sensor data from the light sensor (130), analyze the sensor data, determine that, if the sensor data corresponds to the temporal control of the first lighting device (120), the first area (150) is visible from the second area (160), determine that, based on that the first area (150) is visible from the second area (160), the first area (150) is adjacent to the second area (160), and store information indicative of the adjacency between the first area (150) and the second area in a memory (108, 108'), and to control the first and/or second lighting device as a function of detected presence if the first area (150) is visible from the second area (160), by controlling, if a user is present in one of the first and the second area, the light output of a respective lighting device located in the area wherein the user is located according to a first light setting and the light output of a respective lighting device located in the other area according to a second light setting different from the first light setting.

12. A lighting system (100) comprising:

- the controller (102) of claim 12,
- the first lighting device (120) located in the first area (150), wherein the first lighting device (120) is configured to receive lighting control commands from the controller (102), and
- the light sensor (130) located in the second area (160), wherein the light sensor (130) is configured to communicate sensor data to the controller (102).

13. The system of claim 12, wherein the light sensor (130) is comprised in a second lighting device located in the second area (160).

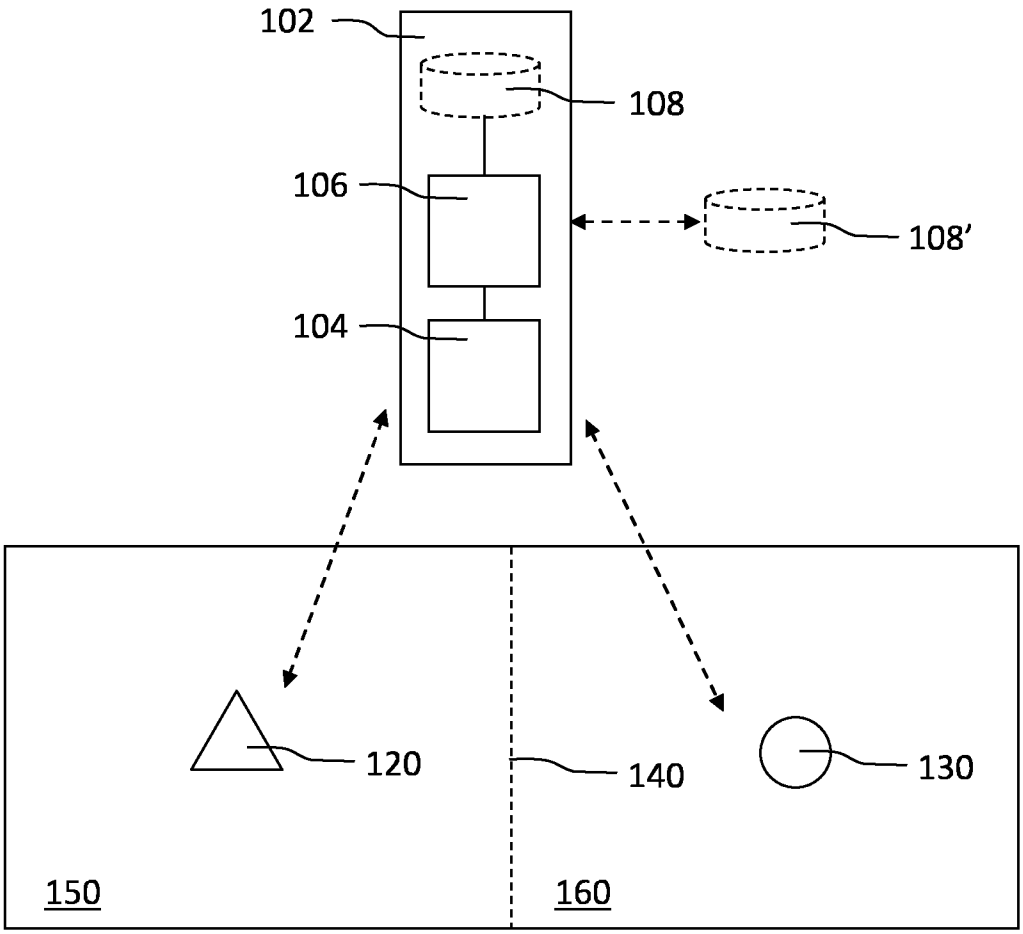


Fig. 1

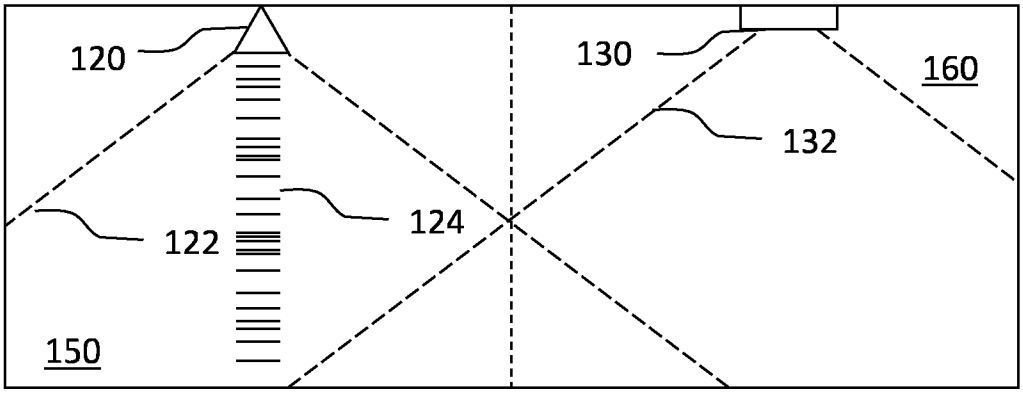

120
130
160
132
124
122
150

Fig. 2a

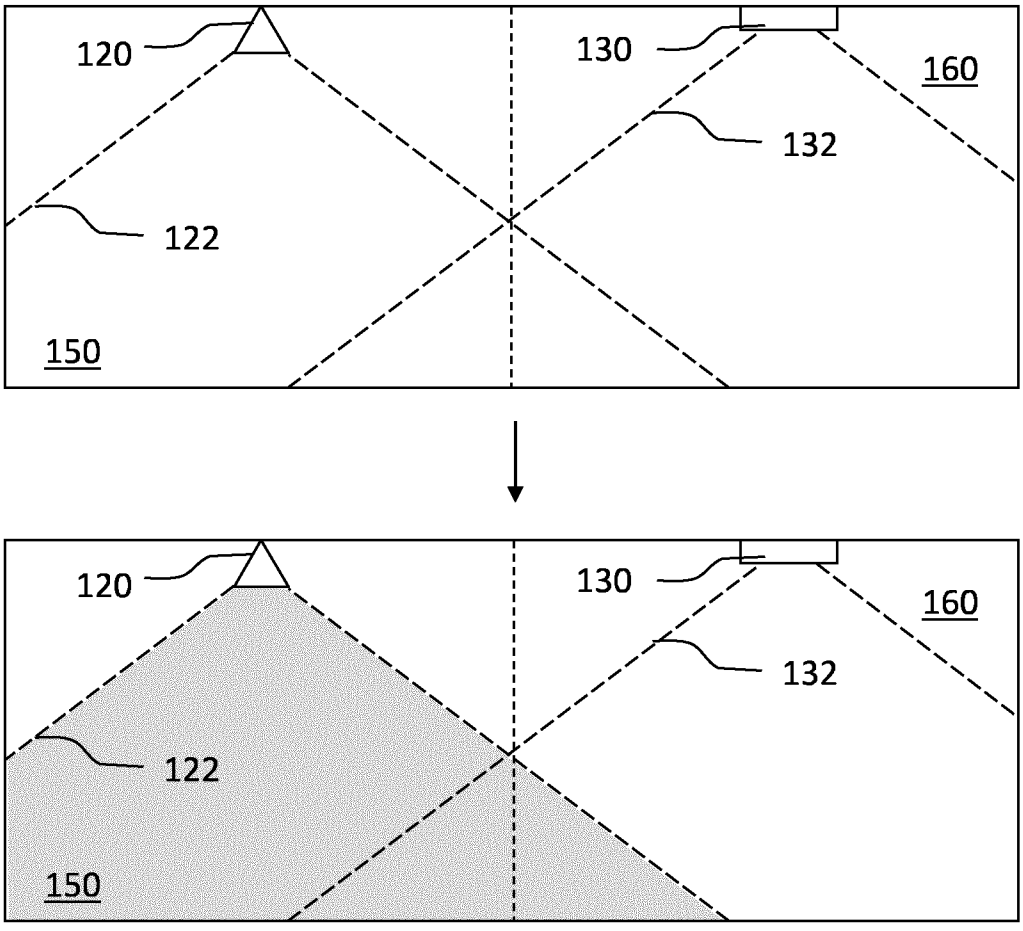

120
130
160
132
122
150
120
130
160
132
122
150

Fig. 2b

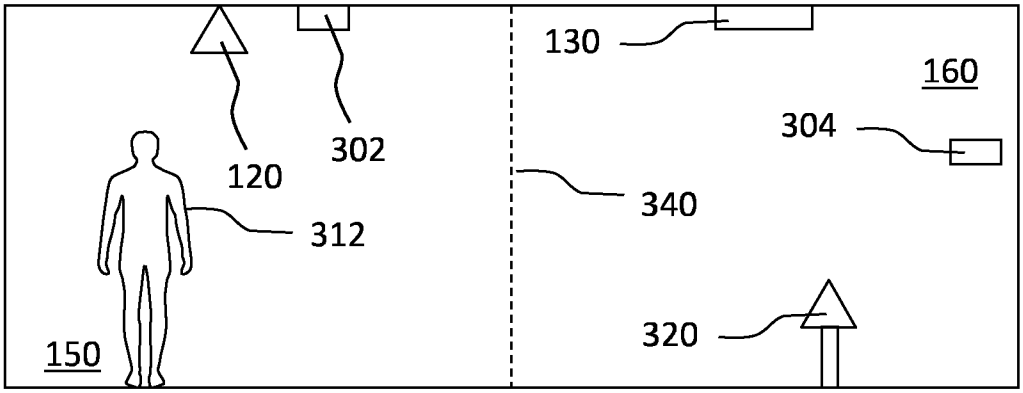


Fig. 3a

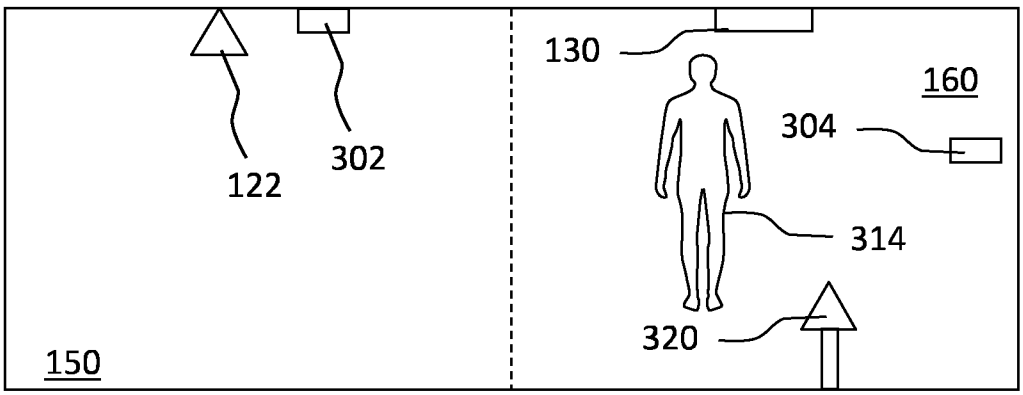


Fig. 3b

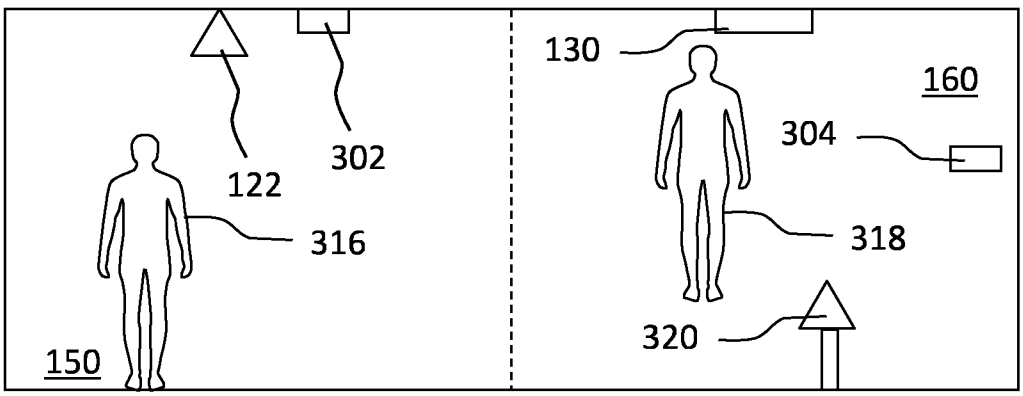
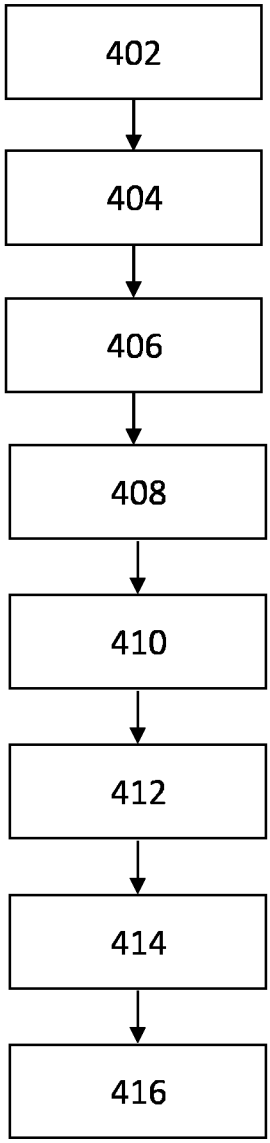


Fig. 3c



400

Fig. 4

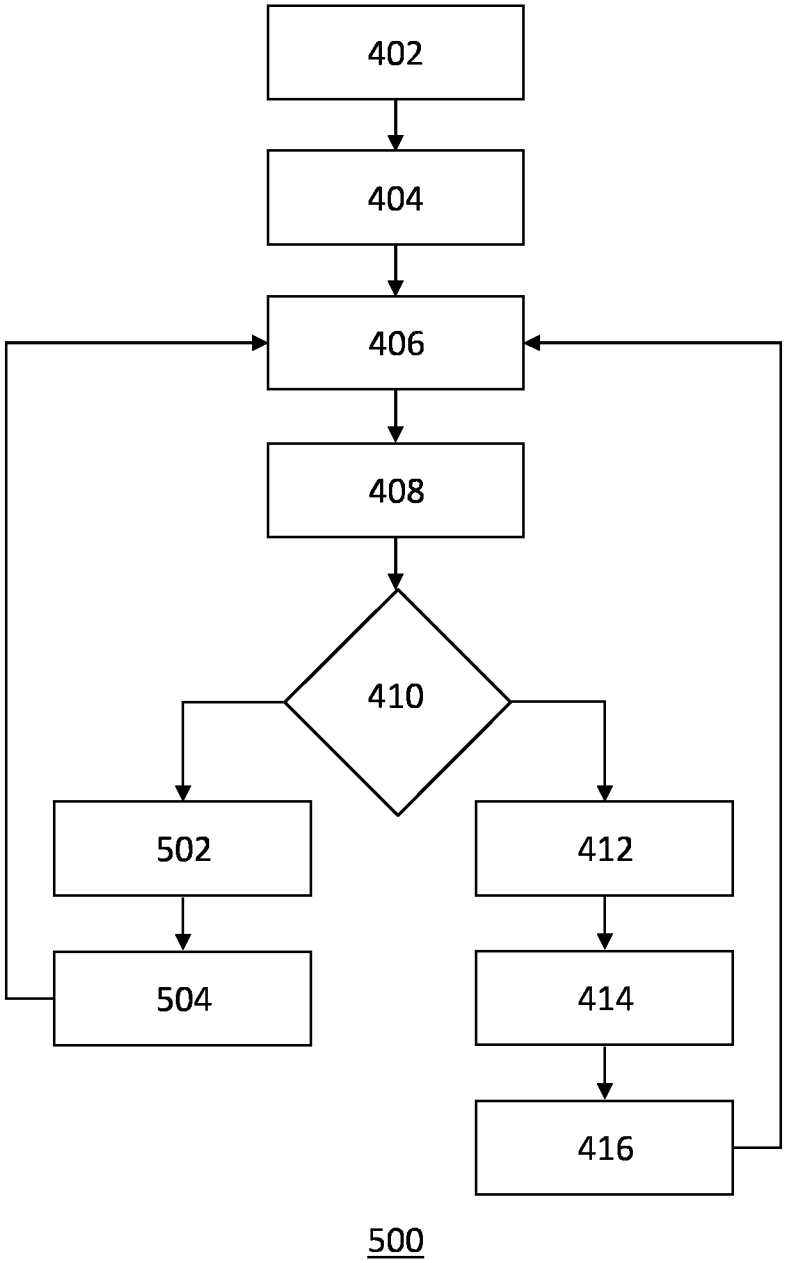


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/077518

A. CLASSIFICATION OF SUBJECT MATTER
INV. H05B37/02
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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2014/354161 A1 (AGGARWAL JANUK [US] ET AL) 4 December 2014 (2014-12-04) the whole document	1-13
A	US 2018/063927 A1 (ABRAHAM ARYA [US] ET AL) 1 March 2018 (2018-03-01) the whole document	1-13

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

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"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
24 October 2019	12/11/2019

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	Morrish, Ian

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2019/077518

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2014354161 A1	04-12-2014	US 2014354161 A1	04-12-2014
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US 2018063927 A1	01-03-2018	NONE	