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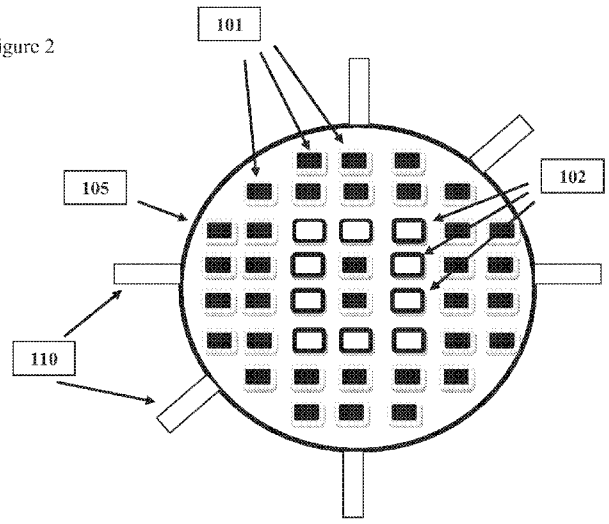
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(54) Title: AN LED LIGHT FIXTURE

Figure 2



(57) Abstract: The present invention describes an LED light device which includes a plurality of light emitting diode units providing daylight illumination or nightlight illumination and a motion sensor where motion within a target area determines the active status of nightlight illumination. In addition, a photodetector provides a means to alternate between daylight and nightlight illumination. A battery power source provides an alternative power supply during periods of limited energy demand. Further, a plurality of LED devices as disclosed in the present invention are each equipped with a wireless communication module in communication with a smart device, configured for control by a user.

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 62/275,334, filed January 06, 2016 and incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

l. Field of the Invention

The present invention relates to an LED-based light and light system capable of automatically switching from a daylight source to a nightlight source; in particular the present invention provides embodiments directed to an improved light-emitting diode illumination lamp incorporating a motion sensor, or photocell which further incorporates a wireless control system to regulate illumination in specific areas of a structure.

2. Description of the Prior Art

Lamps for illumination have evolved from the conventional incandescent lamps and fluorescent lamps to the use of light-emitting diodes (LED) lamps which use LEDs as a light source. Residential and commercial structures are replacing older lamps with LED lamps, capable of providing either day or night illumination from a power source within the structure or through a battery.

Further, illumination sources such as an LED lamp have been coupled to motion sensors for transient illumination. These systems are used as a deterrent for intruders or as a means to save energy.

Conventional wireless LED lighting control systems have been incorporated in illumination systems, but are limited to the control of on/off and brightness of LED lamps.

The present invention incorporates these concepts in a single LED lamp and LED lamp system. A daylight illumination source requiring a higher wattage is contained within the LED lamp also having a nightlight illumination source with a lower wattage load and optionally incorporating red LED units. The LED lamp and lamp system is controlled through a wireless communication device.

SUMMARY OF THE INVENTION

The present disclosure provides several embodiments of an LED lamp device that functions to provide daylight and nightlight illumination within the same device. The device contains a series of light-emitting diodes arranged on an emission surface to provide both daylight and nightlight illumination as determined through an integrated circuit and sensor means. Different embodiments of the present invention offer different integrated levels of control for daylight illumination and/or nightlight illumination. The device is suitable for replacing a currently-installed fixture or can be mounted during new construction to provide the optimum illumination designed in a targeted area and having the further advantage that the same lighting fixture provides a source for daylight or nightlight illumination.

According to one embodiment of the present disclosure, an LED lamp device contains two groups of LED (light-emitting diodes) units, one group acts as a daylight source while another group acts as a nightlight source with all LED units located in front of the emission surface of the device. A motion detector is incorporated as one sensor means to activate the nightlight units in stand-by mode when motion is detected. The present invention considers optical, microwave, or acoustic sensors or other sensor means commonly known in the art. One embodiment of the present invention incorporates a passive sensor to sense a signal emitted by a moving object or human such passive sensors include passive infrared (PIR), microwave, ultrasonic or tomographic motion detection. The present

invention also considers dual-technology motion detectors where one sensor such as a PIR sensor is combined with another sensor, such as a microwave sensor, into one device to maximize accuracy and reduce energy usage.

In some embodiments, the nightlight group of LED units is comprised of red LED units. The red LED units allows visibility without sacrificing night vision unlike white light or other colors when illuminating a dark environment.

In some embodiments, a battery source is incorporated within the device to serve as a power supply when the main power supply is off. A battery source provides a power source which is independent from a general power supply found in a residential or commercial structure and thereby can act as an independent source for illuminating the structure during power outages or minimizing the general use of energy by the structure.

In some embodiments, a photocell is incorporated into the device as a light sensor to activate or deactivate a group of LED units. Accordingly, these sensors acts as an ambient light trigger to turn off the daylight LED group and/or turn on the nightlight LED group.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view showing an LED lamp according to a first embodiment of the present disclosure.

FIG. 2 is a front view showing the LED lamp showing the individual LED units arranged on the emission surface. The solid black units represent the daylight LED group source. The white units represent the night light source.

FIG. 3 is a front view showing one orientation of 4 windows for sensors on the device to detect motion within a predetermined area.

FIG. 4 is a flow chart illustrating one embodiment for the operation of an LED lamp device with a battery power source.

FIG. 5 is a front view showing one of several typical positions within the window of the device for placement of a photocell in detecting changes in light.

FIG. 6 is a flow chart illustrating one embodiment for the operation of an LED lamp device with a battery power source and further having a photocell.

FIG. 7 is a flow chart of one embodiment incorporating a wireless communication with the LED device.

FIG. 8 is a flow chart depicting the use of a wireless communication

DETAILED DESCRIPTION

Reference will be made in detail to various embodiments, examples of which are illustrated in the accompanying figures. In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, well-known methods, procedures, systems, and components have not been described in detail so as not to unnecessarily obscure aspects of the various embodiments.

Embodiments of the present disclosure are described in detail with reference to the drawings.

The present invention incorporates within a single LED lamp and LED lamp system a daylight LED illumination source having a higher wattage and a nightlight source with lower wattage load, optionally incorporating red LED units. The nightlight source is activated through a switch or photo cell. At dusk, the photo cell switches the nightlight illumination source to stand-by mode, powered through an optional battery power source. When an object or human enters the detection area of the passive infrared motion detector, the motion sensor instantly turns on the light source and the system, thus creating a device having a dual illumination within the same illuminating device. At dawn the photo cell turns off the battery power supply and the daylight illumination is engage.

FIGS. 1 and 2 show an LED lamp device according to a first embodiment of the present disclosure. FIG. 1 shows the device in a perspective view with the emission surface (105) containing the LED lamp units. The outer housing (108) and rear section (108a) house the sensors, related integrated circuits, and power supply such

as a battery. The LED device includes two separate groups of LED units, each having the same or a plurality of LED units. LED lamp units (101) provide the daylight source while the LED lamp units (102) provide the nightlight source. Both groups are positioned across the emission surface (105) of the device to provide both daylight and nightlight illumination. Optionally a support member (110) provides for an installation means for either adapting to a currently installed fixture or incorporating in new construction.

LED units are arranged in groups to form specific arrays along the emission surface (105). An LED unit or lamp consists in part of a two-lead semiconductor light source which is a p-n junction diode that emits light when activated. Each LED unit contains a lens designed to achieve a specific radiation pattern which results in a combined radiation pattern for the group of LED units. A group of LED units may contain all the same type lens or may contain any combination thereof. A Lambertain radiation pattern is formed from each LED unit by placing a chip in a hemispheric encapsulation, resulting in the maximum light intensity at 0 degrees from the lamp axis. Another radiation pattern for an LED unit forms a Batwing radiation pattern where light intensity is almost half the maximum at the center of the emitter and attains a maximum at about 55 degrees on either side of the lamp center axis. Finally, a side-emitter radiation pattern is used to provide maximum light intensity at about 75 degrees which falls rapidly as the angular displacement increases or decreases. Accordingly, all possible combinations of LED units and the lens for each are considered in the present invention. More specifically, the appropriate combination is associated with the type of fixture. For example, a ceiling fixture would have a preferred lambertain distribution where a wall sconce could use a side emitter. Given design and cost considerations, 120 degree LEDs are preferred. This would also allow the use of secondary optics for specific fixture beam patterns (i.e. 15, 30, and 60 degree lighting patterns).

Each LED unit is fixed onto an emission surface and integrated with other LED units and selected components such as, but not limited to, a photocell or motion detector to form a group of LED units, capable of providing a combined radiation

pattern emanating from the emission surface. The LED group providing the daylight source contain a number of LEDs appropriate to the supply voltage of the fixture, arranged in concentric rings, along the emission surface while the LED group providing the nightlight source contain a number of LEDs appropriate for the power source for the nightlight function, arranged in an inner ring array within the daylight LED units, however all possible arrangements are considered in the present invention, appreciating that the LED layout should be designed so that LED placement reduces shadowing from the PCB components and fixture housing while still maintaining the desired lighting patterns.

The motion detector incorporates a sensor to detect a signal emitted by a moving object or human. Sensors such as, but not limited to, passive infrared (PIR sensor), microwave, ultrasonic or tomographic motion detection are considered. A PIR sensor does not generate or radiate energy, but rather detects energy given off by objects or humans which has been emitted or reflected from the object. A PIR sensor detects changes in the amount of infrared radiation received by the sensor. When an object or human passes in front of a background energy level, the temperature at that point in the sensor's field will rise from room temperature to body temperature. This change in incoming infrared radiation is interpreted as a change in output voltage to trigger a detection. PIR sensor considered in the present invention have a Fresnal-type lense or mirror segments to create an effective range of about thirty feet with a field of view of less than 180 degrees but other PIR sensors with a field of view up to 380 degrees are also considered. The PIR sensor is mounted on a circuit board containing the necessary electronics to interpret the signals received from the sensor. The sensor and circuit board are positioned within the device such that a plastic window structure allows coverage of the area to be monitored.

A plastic window is transparent to infrared radiation to allow detection. The plastic window reduces the chances of dust or insects from obscuring the sensor's field of view. FIG. 3 shows one possible orientation of multiple motion sensors (200), each with a plastic window along the emission surface (105), however all possible

locations within the device for the window are considered in the present invention and depend upon the area selected for monitoring with the preferred location for most sensors at approximately the center of the fixture.

The present invention further considers the use of an alternative power supply for illumination as a nightlight source. A battery is incorporated within the device to serve as a power supply when the main power supply is off. A battery acts as a power source which is independent from a general power supply to provide continued power during a power outage or reducing the amount of energy supplied from a central power supply. A battery source is also considered in the present invention as the primary power source for nightlight use, providing a separate independent power source when there is a limited nightlight demand. An integrated circuit design within the device alternates the power source from a central power supply to a battery.

The flow chart in FIG.4 illustrates one embodiment for the operation of the LED Lamp device, incorporating the system components within an integrated circuit design. A power supply provides a high wattage source for daylight illumination. When the daylight illumination is switched off, a battery power source is activated and nightlight illumination is engaged in stand-by mode until a motion sensor detects appropriate movement from an object or human. When motion is detected, the nightlight LED group actively illuminates, optionally emitting red light during this period. When motion is no longer detected or a preset time period expires, the motion detector returns to stand-by mode. The motion detector can be any means known in the art. The switching means returns to daylight illumination.

In one further embodiment, a group of red illuminating LED units provide the nightlight source. Red light is the optimum light for the ability to see in low light conditions without sacrificing night vision and consequently would be the preferred illumination source as a nightlight source.

Similar to the motion detector on the emission surface, all possible orientations are considered, one location for the photocell contemplated is shown in FIG. 5 where a photocell (300) is positioned at the center of the emission surface (105).

A photocell is incorporated into the device as a light sensor to activate or deactivate a group of LED units. The flow chart in FIG. 6 depicts the photocell as the switching means between daylight illumination and nightlight illumination. Accordingly, the photocell acts as an ambient light trigger that regulates the flow of current in an integrated circuit to either turn on the daylight LED group while turning off the nightlight LED group. Also considered is a system that enables the nightlight LED group to turn on and the daylight LED group to turn off.

A further embodiment incorporates a system for wireless control of multiple LED lighting devices within a residential or commercial structure. A plurality of LED devices are each equipped with a processing unit in communication with a wireless communication device which is configured to be controlled by a user.

The flow chart in FIG. 7 depicts one of several configurations for controlling each individual LED device. This configuration incorporates a photocell component as previously described. Each LED device is controlled through a wireless communication system having a user interface such as, but not limited to, a smart phone configured to generate a unique lamp ID for each LED device. The unique lamp ID provides a signal for controlling illumination of that specific device. Through a processor and memory component, the device is programed to operate from either the main power supply for daylight illumination or from a battery power source for nightlight illumination. In one embodiment, the main power supply can be programed to operate directly through a motion detector, thus providing daylight illumination when the motion detector is activated.

Accordingly, a single smart device controls the local/regional illumination within a residential or commercial structure by the user. With a wireless communication system, the user can not only control daylight or nightlight illumination within each LED device, but the nightlight mode may be set for those devices which are located

within or near the bedrooms or bathroom, restricting other devices throughout the structure to not provide nightlight or red illumination. These other devices may be located on the first floor in a residential structure which alternatively may be set to "security mode" where the red LED units for nightlight illumination are not programed to illuminate with activation of the motion detector, but rather the daylight LED units become activated with movement. FIG.8 shows a flow chart of multiple devices in a residential structure controlled through a smart phone. In addition when in security mode, the smart device may be programed to alert the user or contact the appropriate authorities.

As would be understood by a person of ordinary skill in the art, the alternative embodiments of the present invention described above incorporating the primary components, comprising the daylight illumination, nightlight illumination and motion detection, may be independently incorporated in the LED lamp device in accordance to the present invention. Alternatively, any two or more of the embodiments can be combined into a single LED lamp device. At least for certain applications, such combinations may be expected to achieve the desired illumination.

Although illustrated and described above with reference to certain specific embodiments, the present invention nevertheless is not intended to be limited to the details shown. Rather, various modifications may be made in the details within the scope and range of equivalents of the claims and without departing from the spirit of the invention.

I claim,

1- **An LED illumination device comprising:**
   a. **a first group of LED units to provide daylight illumination on an emission surface within the device; and**
   b. **a second group of LED units to provide nightlight illumination on the emission surface; and**
   c. **an integrated circuit having at least one sensor means wherein the integrated circuit illuminates the first group of LED units or the second group of LED units to provide daylight or nightlight illumination respectively.**

2- **The LED device of claim 1 where the second group of LED units has a lower wattage load than the first group of LED units.**

3- **The LED device of claim 1 wherein the second group of LED units are comprised of red LED units to allow visibility when illuminating a dark environment.**

4- **The LED device of claim 1 where the first group of LED units and second group of LED units are arranged in specific arrays on the emission surface.**

5- **The LED device of claim 1 where each LED unit contains a lens designed to emit a specific radiation pattern to form a combined radiation pattern for the first group of LED units or the second group of LED units.**

6- **The LED device of claim 5 where the combined radiation pattern is a Lambertain radiation pattern, a Batwing radiation pattern, or a side-emitter radiation pattern.**

7- **The LED device of claim 5 where the combined radiation pattern is formed from concentric rings of the first group of LED units along the emission surface for daylight illumination and a minimum number of the second group of LED units for the power source for nightlight illumination within the concentric rings.**

8- **The LED device of claim 1 wherein the sensor is selected from a group consisting of optical detector, motion detector, acoustic detector, and combinations thereof.**

9- The LED device of claim 8 where the sensor is a motion detector to activate the first group of LED units or the second group of LED units.

10- The LED device of claim 9 where the motion detector is selected from a group consisting of a passive infrared sensor, microwave sensor, ultrasonic sensor, a tomographic sensor and combinations thereof.

11- The LED device of claim 10 where the passive infrared sensor has a Fresnal-type lense.

12- The LED device of claim 10 where the passive infrared sensor is protected by a plastic window.

13- The LED device of claim 1 where the sensor is a photocell.

14- The LED device of claim 13 where the photocell controls illumination of the first group of LED units.

15- The LED device of claim 13 where the photocell controls illumination of the second group of LED units.

16- The LED device of claim 1 having a battery source as a power supply when the main power is off.

17- The LED device of claim 1 is a replacement for an installed fixture

18- The LED device of claim 1 is a new construction fixture for targeting a specific area.

19- A wireless controlled LED illumination system comprising:

a. at least one LED device of claim 1;

b. a processing unit for each LED device wherein each processing unit is in communication with a wireless communication device; and

c. at least one wireless communication device configured to be controlled by a user wherein the user controls the individual LED devices through each processing unit.

Figure 1

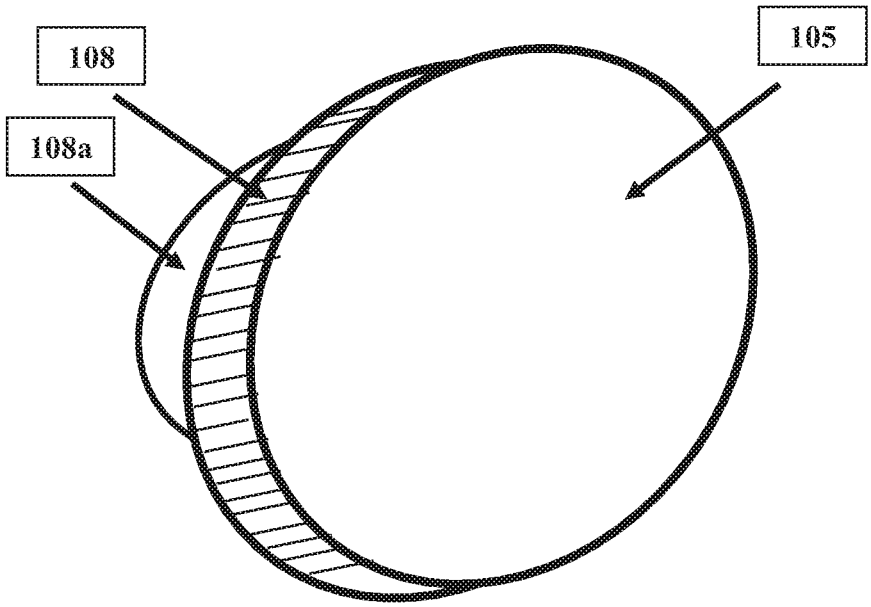


Figure 2

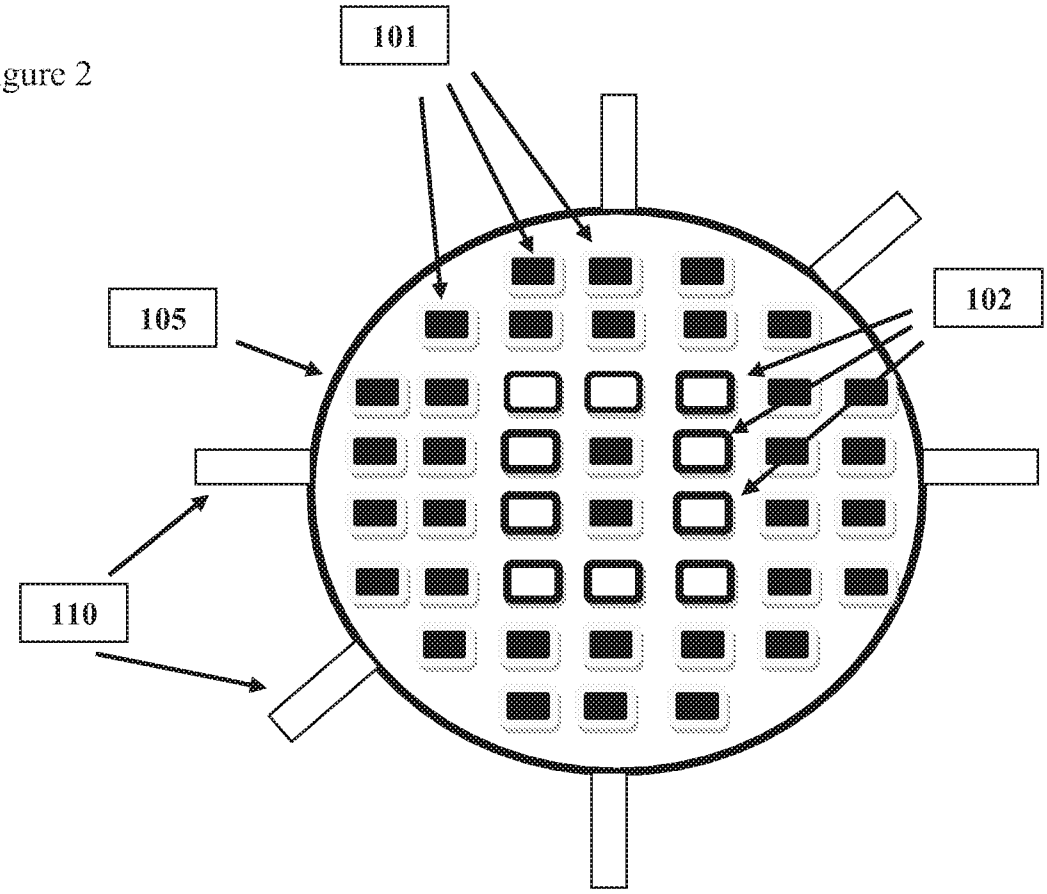


Figure 3

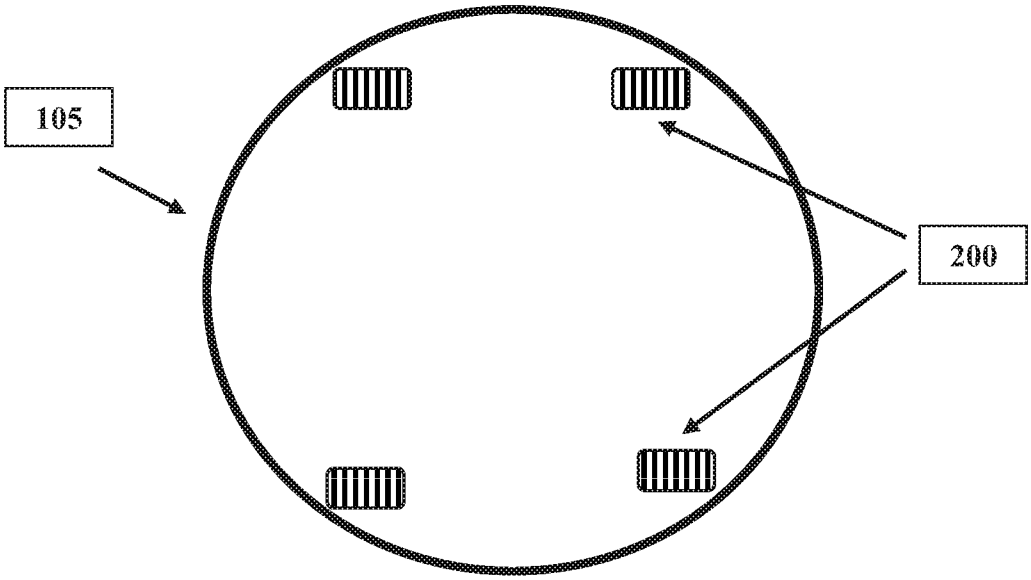


Figure 4

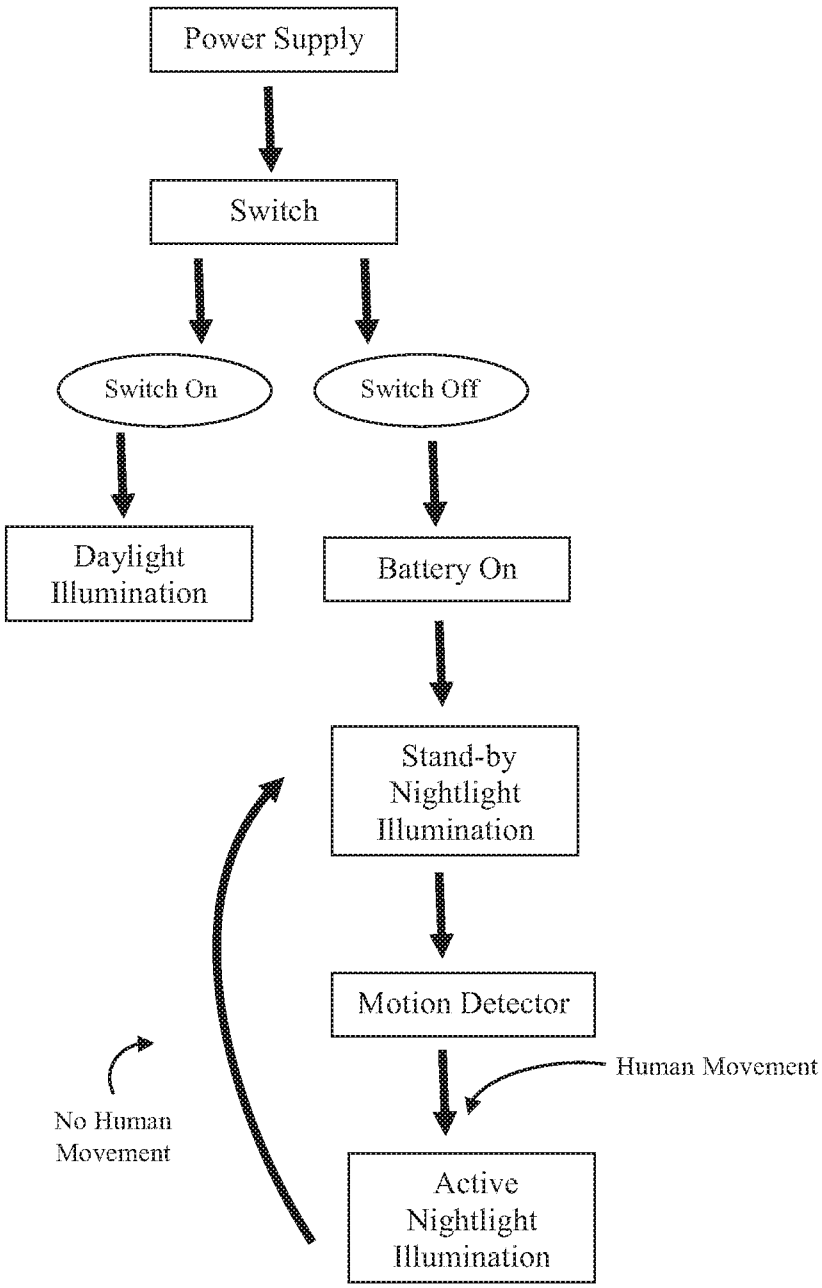

Power Supply
Switch
Switch On
Switch Off
Daylight Illumination
Battery On
Stand-by Nightlight Illumination
Motion Detector
Human Movement
No Human Movement
Active Nightlight Illumination

Figure 5

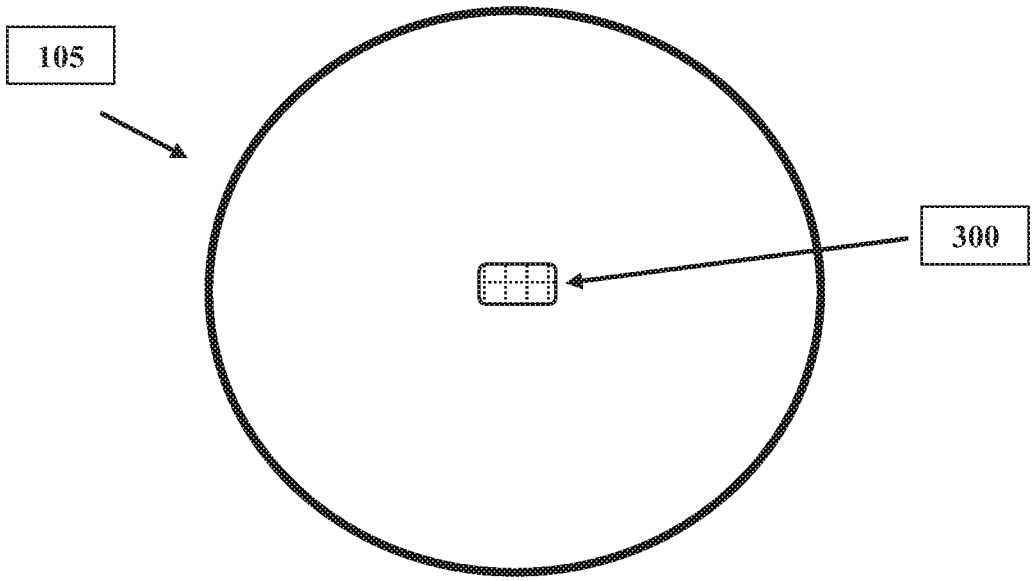


Figure 6

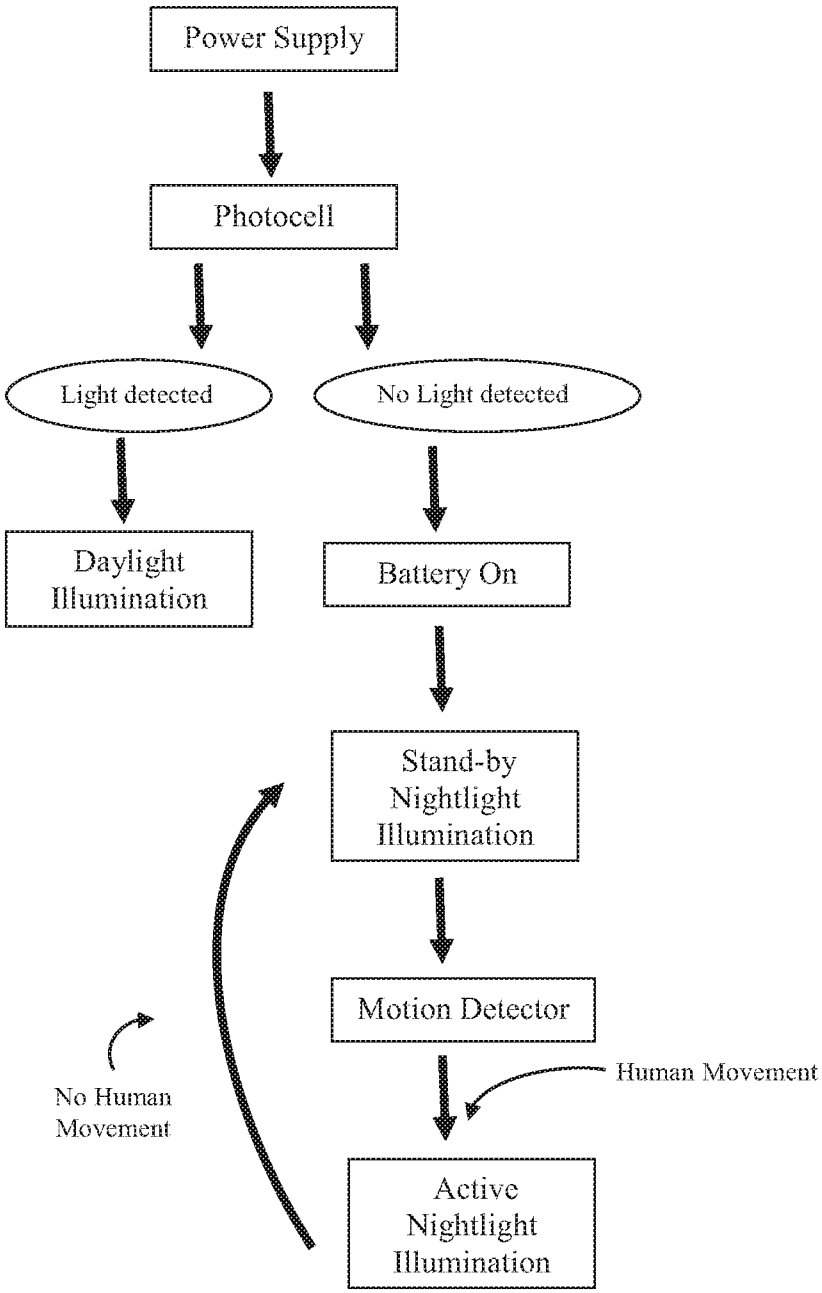

Power Supply
Photocell
Light detected
No Light detected
Daylight Illumination
Battery On
Stand-by Nightlight Illumination
Motion Detector
Human Movement
No Human Movement
Active Nightlight Illumination

Figure 7

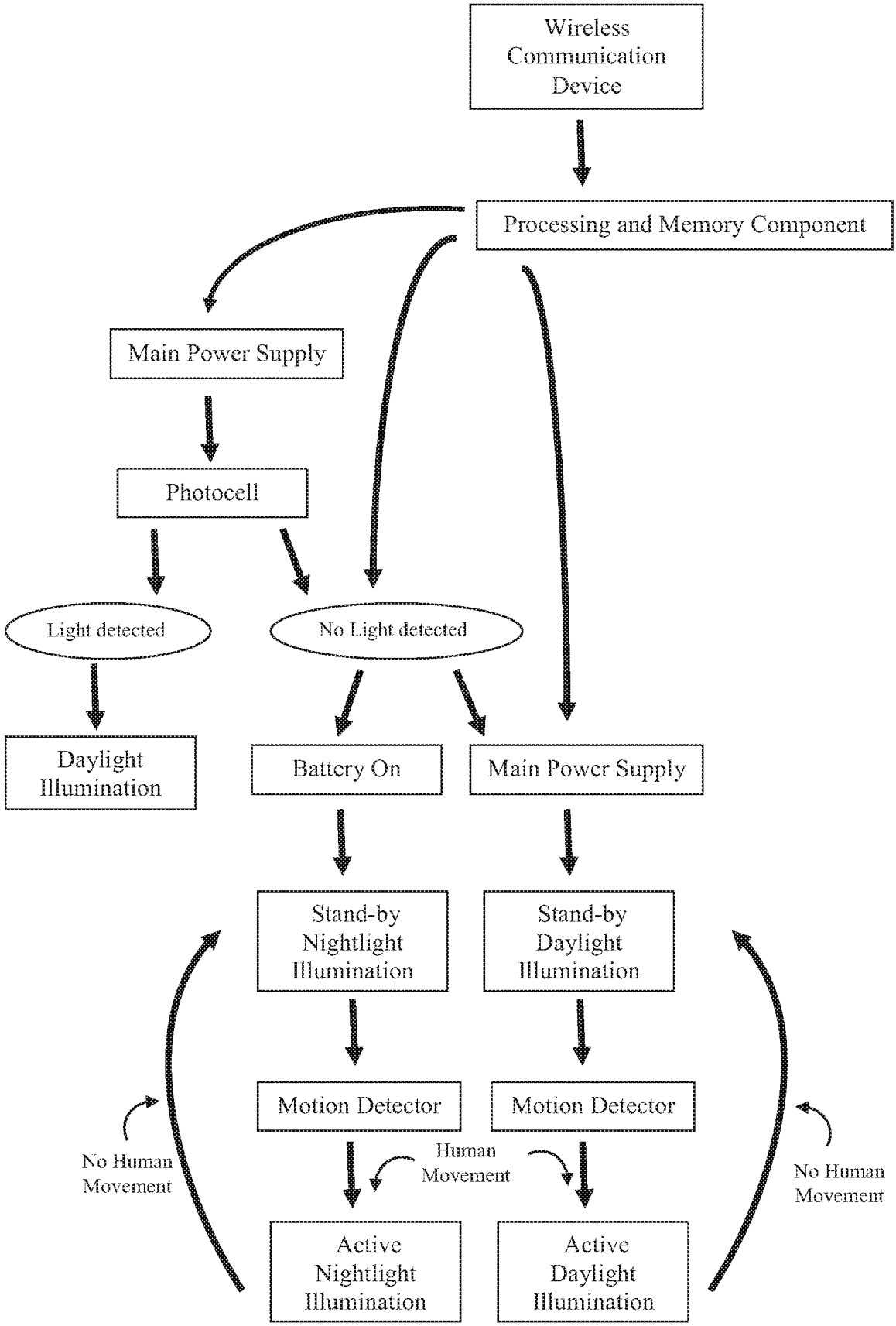
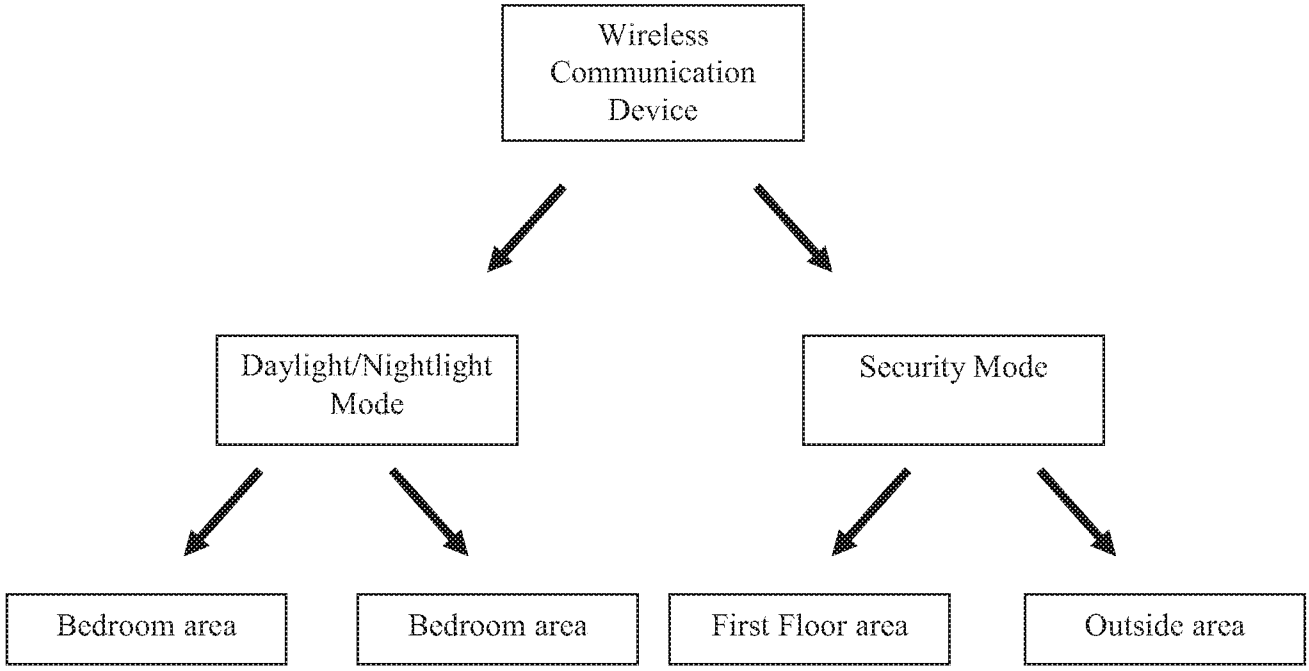

Wireless Communication Device
Processing and Memory Component
Main Power Supply
Photocell
Light detected
No Light detected
Daylight Illumination
Battery On
Main Power Supply
Stand-by Nightlight Illumination
Stand-by Daylight Illumination
Motion Detector
Motion Detector
No Human Movement
Human Movement
No Human Movement
Active Nightlight Illumination
Active Daylight Illumination

Figure 8


Wireless Communication Device
Daylight/Nightlight Mode
Security Mode
Bedroom area
Bedroom area
First Floor area
Outside area

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/012426

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H05B 37/02; F21V 13/00; F21V 14/00; H05B 37/00 (2017.01)

CPC - H05B 37/0218; F21V 13/00; F21V 14/00; H05B 37/02; H05B 37/00; H05B 37/0227; H05B 37/029 (2017.02)

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)

See Search History document

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

USPC - 315/153; 315/152; 362/231; 362/237 (keyword delimited)

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

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/0207605 A1 (FIELDS) 20 August 2009 (20.08.2009) entire document	1, 3-8, 17, 18
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Y		2, 9-16, 19
Y	US 2015/0028750 A1 (CHEN) 29 January 2015 (29.01.2015) entire document	2
Y	US 5,128,654 A (GRIFFIN et al) 07 July 1992 (07.07.1992) entire document	9-15
Y	US 2010/0141153 A1 (RECKER et al) 10 June 2010 (10.06.2010) entire document	16, 19

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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"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
18 February 2017	13 MAR 2017
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774