

(19)



(11)

EP 1 999 733 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
11.05.2016 Bulletin 2016/19

(51) Int Cl.:
G08B 13/191 ^(2006.01) **G08B 25/10** ^(2006.01)
G08B 13/196 ^(2006.01)

(21) Application number: **07867025.4**

(86) International application number:
PCT/US2007/006884

(22) Date of filing: **19.03.2007**

(87) International publication number:
WO 2008/054479 (08.05.2008 Gazette 2008/19)

(54) INTEGRATED MOTION-IMAGE MONITORING METHOD AND DEVICE

VERFAHREN UND VORRICHTUNG ZUR INTEGRIERTEN BEWEGUNGSBILDÜBERWACHUNG
PROCÉDÉ ET DISPOSITIF INTÉGRÉS DE SURVEILLANCE VIDÉO CAPABLE DE DÉTECTER TOUT
MOUVEMENT

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE
SI SK TR**

(30) Priority: **24.03.2006 US 785570 P**
24.03.2006 US 388764

(43) Date of publication of application:
10.12.2008 Bulletin 2008/50

(73) Proprietor: **Rsi Video Technologies, Inc.**
Vadnais Heights, MN 55110 (US)

(72) Inventors:
• **REIBEL, Jean-Michel**
67200 Strasbourg (FR)

• **JENTOFT, Keith**
Circle Pines, MN 55014 (US)

(74) Representative: **Chiva, Andrew Peter**
Dehns
St Bride's House
10 Salisbury Square
London
EC4Y 8JD (GB)

(56) References cited:
EP-A1- 1 575 009 EP-A2- 0 986 038
WO-A1-97/25696 US-A- 4 857 912
US-B1- 6 970 183

EP 1 999 733 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

FIELD OF THE INVENTION

[0001] The present invention is directed to a method and device for monitoring the inside of a facility or residence and, more specifically, to a method and device using an integrated motion detector and camera.

BACKGROUND

[0002] A variety of applications benefit from protection of residents, employees, personal property, and the like, by using security monitoring systems within facilities, e.g., to monitor and/or sense certain conditions such as a facility-operations problem or the presence of an unwanted intruder. Many such security systems are connected to a central control unit and monitored by an operator who can alert the appropriate emergency services in the event of an unwanted intruder. Often, a home monitoring security system includes a combination of sensing devices and alarm devices and some also include cameras. To achieve the maximum monitoring coverage, these devices are distributed throughout the interior of the facility.

[0003] Security systems that employ cameras are advantageous in that they are able to record any and all activity associated with a suspected breach of the facility. In some instances, however, the cameras record the regular activities of the facilities' residents and/or employees. The cameras also record activities that are falsely perceived to be security breaches such as pet behaviors and authorized users that have been accidentally locked out.

[0004] In specific situations, such as those having the potential to violate the privacy of authorized residents and/or employees of the facility, such comprehensive recordation by the security cameras may be undesirable. Since unwanted intruders could breach the security of a facility while the inhabitants are present, it is necessary for the security monitoring system to be functioning at all times. However, having cameras constantly being triggered to record inhabitants' daily living and working routines is a dramatic invasion of the inhabitants' privacy, especially considering false triggers. Further, the monitoring and recording of guests' activities can be just as invasive.

[0005] While numerous cameras and motion detectors are generally necessary to provide proper security coverage of a residence or facility, the size and frequent placement of the devices are burdensome to install and maintain and are aesthetically unpleasant. Each room or area in a facility typically requires both a motion detector and a camera, and large areas may require more combinations. The sizes of these devices render their presence in a facility obvious. Moreover a full-facility security system typically requires installation of several system components including wiring for communications and

power between cooperative units within the system.

[0006] Implementing small detectors and cameras presents a host of problems. For security reasons, ease of installation and flexibility of a system, it is a disadvantage to require the detectors and cameras to be electrically connected to other components. More specifically, detectors and cameras that operate using an external power source, such as an electrical outlet, can be circumvented by removing the power source. This presents a number of security weaknesses in the overall system. Moreover, reliance on an external power source often complicates the installation process because the installation requires a connection to the external power source. This may require routing of wires carrying power to the detectors and cameras. Small devices have the additional problem of not having space to include large independent power sources, such as batteries. Accordingly, the functionality and time between charging of the devices is often sacrificed for size. For example, many wireless communications protocols drain batteries and other power sources rapidly. Other power hungry portions of cameras and detectors include the camera, the detector, image processing and illumination devices. These and other problems have hampered the implementation of small, portable cameras and detectors used in security applications.

[0007] The above-discussed issues have presented challenges to developing a home and/or facility security monitoring system that provides maximum coverage while minimizing one or more of the above-identified issues.

[0008] EP 01575009 and WO 97/25696 disclose devices comprising both a camera and a motion detector.

SUMMARY

[0009] The present invention is directed to the above and related types of integrated security devices. These and other aspects of the present invention are exemplified in a number of illustrated implementations and applications, some of which are shown in the figures and characterized in the claims section that follows.

[0010] The present invention provides an integrated image-capture device as claimed in claim 1 and a method as claimed in claim 12.

[0011] Various aspects of the present invention are applicable to a security device that uses both motion detection and image-capture to detect a security breach.

[0012] The above summary of the present invention is not intended to describe each illustrated embodiment or every implementation of the present invention. The figures and detailed description that follow more particularly exemplify these embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention may be more completely understood in consideration of the detailed description of var-

ious embodiments of the invention in connection with the accompanying drawings, in which:

FIG. 1 shows a building-security system, according to an example embodiment of the present invention;
FIG. 2 illustrates a schematic of a security device mounted to a wall, according to an example embodiment of the present invention;

FIG. 3 is a side view of a motion-image security device, according to an example embodiment of the present invention;

FIG. 4A illustrates orientations of LEDs, according to an example embodiment of the present invention;
FIG. 4B is a bottom view of a motion-image security device showing LED orientation, according to an example embodiment of the present invention;

FIG. 5 is a perspective view of an internal support piece of a motion-image security device, according to an example embodiment of the present invention; and

FIG. 6 is a graph of filter responses, according to an example embodiment of the present invention.

[0014] While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not necessarily to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION

[0015] The present invention is believed to be applicable to a variety of different approaches for, and arrangements used in, monitoring a target area. The invention has been found to be particularly advantageous for addressing security-monitoring applications in a residence or office-facility environment where one or more peripheral devices communicate with another device and are used to monitor one or more respective target areas. While the present invention is not necessarily so limited, such a security-monitoring application is used in the following discussion to exemplify certain embodiments of the present invention.

[0016] Consistent with such an application, FIG. 1 depicts a security system according to an example embodiment of the present invention, as might be useful for monitoring a building (such as a home or workplace). FIG. 1 includes building 100, control panel 102, and peripheral devices 104-110. The security system is implemented in such a manner so as to reduce the power consumption of one or more of the control panel 102 and the peripheral devices 104-110 as related to the wireless communications between the devices. When implementing the wireless communications, the devices use multi-

ple frequencies (channels) as well as communication intervals. The devices are able to reduce the power consumption by utilizing information regarding a specific frequency from the multiple frequencies used and the communication interval. For example, if the transmitting devices modify their transmissions based upon the information, a receiving device may reduce the power consumption by decreasing the time the receiving device is listening for a transmission from another device. By reducing the power consumption, the system lends itself to implementing bi-directional communications between the devices, which typically require more power consumption than unidirectional communications.

[0017] The jagged lines and ellipses found between the control panel 102 and the peripheral devices 104-110 represent wireless communications between the control panel and the peripheral devices. The wireless communications may be implemented using suitable frequencies. For instance, wireless communications frequencies in industrial, scientific and medical (ISM) radio bands (900Mhz, 2.4Ghz and 5.8Ghz) have been found to be suitable for security systems; however, alternate frequencies may be implemented in accordance with the particulars of the system or its intended implementation. For example implementations related to communicative coupling and data transfer among the above-discussed devices in accordance with appropriate protocols, reference may be made to U.S. 7835343 filed on March 24, 2006, entitled "Calculating Transmission Anticipation Time Using Dwell and Blank Time in Spread Spectrum Communications for Security Systems", and to European Patent Application Publication No. EP 1 363 260 filed on May 6, 2003, entitled "Procédé De Communication Radiofréquence Entre Plusieurs Dispositifs Et Systeme De Surveillance Mettant En Ouvre Un Tel Procédé,".

[0018] The various elements of the peripheral devices 104-110 and the control panel 102 are implemented using one or more of electric circuit arrangements, processors, memory elements, software code, programmable logic devices, input/output interfaces or combinations thereof. In alternative (more specific) embodiments, the embodiments disclosed herein are implemented in combination with the embodiments described in US 7463145, entitled "Security Monitoring Arrangement And Method Using A Common Field Of View".

[0019] Building 100 represents a facility for which the building security system is implemented. Common implementations of building 100 include, but are not limited to, residential homes, retail stores, office buildings, government buildings, museums and other facilities. Typically, the security system will monitor several locations of building 100. Accordingly, FIG. 1 depicts various peripheral devices throughout the building.

[0020] Peripheral communications devices 104-110 may take the form of various different devices, a few of which are depicted in FIG. 1. For instance, device 104 depicts a window sensor that may, among other things, detect when the window has been opened or otherwise

compromised; device 106 depicts a camera for video capture; device 108 depicts an alarm; and device 110 depicts a mobile peripheral, such as a key fob for interfacing with the control panel 102 or another peripheral. These peripheral devices 104-110 communicate with control panel 102 using wireless communications.

[0021] Block 112 depicts several elements that may be implemented in the peripheral devices 104-110, including a transceiver block, a message protocol block, a synchronization block and a transmit (Tx) anticipation block. Various embodiments of the present invention use one or more of these blocks. In one such embodiment, a peripheral device wirelessly transmits a signal using the transceiver block. The peripheral device uses information regarding a transmission period and the listening channel of the control panel in the transmission process.

[0022] In one embodiment, the peripheral devices 104-110 transmit building security information to the control panel 102. For instance, device 106 might transmit video images or device-status information to the control panel 102, while device 104 might transmit information relating to the window sensor.

[0023] FIG. 1 depicts control panel 102 as including a transceiver block, a message protocol block, a synchronization block and a transmit (Tx) anticipation block. Various embodiments of the present invention use one or more of these blocks. In one such embodiment, the transceiver block is used for receiving signals from one of the peripheral devices 104-110 as a function of the communication intervals and the frequency the control panel 102 uses to listen for transmissions. The listening frequency is one of several potential frequencies available for communication between the peripheral devices and the control panel. For instance, the system may use a number of contiguous frequency slots (channels) within a suitable frequency band. One example of such a use includes 25 or more channels within the ISM frequency band from 902-928 MHz. Numerous other combinations of channels and frequency bands are possible using the present invention.

[0024] Typically, the control panel and peripherals are implemented using a similar set of elements as depicted by blocks 102 and 112; however, various components may be implemented differently. For instance, the synchronization block can be implemented differently in the control panel versus the peripheral devices where the control panel provides synchronization information to each of the peripherals and the peripherals must use the synchronization information to maintain synchronization using a local clock. In such an instance, the peripherals would compare the synchronization information with the local clock in order to compensate for any difference between the peripherals' time frames and the control panel's time frame.

[0025] The control panel 102 and the peripheral blocks 104-110 are depicted as having a transceiver; however, the system may be implemented using variations of receivers and transmitters. In some instances, the control

panel may be implemented with only a receiver and the peripherals with only a transmitter. In other instances, the control panel may be implemented with only a transmitter, while the peripherals are implemented with only a receiver. Other implementations allow for one or more of the control panels and peripherals to have both a transmitter and receiver (transceiver). Thus, transceiver is used herein to describe a receiver, transmitter or both a receiver and transmitter.

[0026] FIG. 2 illustrates a security device mounted to a wall, according to an example embodiment of the present invention. The present invention involves a monitoring device that includes an integrated motion detector and an image-capture device, although in order to more easily understand the preferred embodiment, the schematic of Fig. 2 does not show the components as being integrated. In certain implementations, the motion detector is designed with a passive infrared (PIR) detector 202. While other motion detectors may be used, the remaining discussion of the motion detector will refer to a PIR-type detector. The security device points the PIR detector at an angle 212. In a preferred implementation, the PIR detector 202 is positioned at an angle 212 of about five degrees to a horizontal axis (e.g., parallel to the ground). The monitoring device also includes an image sensor 204. For certain implementations, the lens of the image sensor is a wide angle lens (e.g., a Fresnel lens). In one instance, the security device directs the image sensor 204 in a direction 210. The image sensor 204 may be oriented such that the upper bound 206 of the viewing area 208 is at or near horizontal, one example being parallel to the ground. While maintaining this common upper bound 206, the two components (i.e., the PIR detector 202 and the image sensor 204) can be angled at different angles so as to form a common field of view. This can be useful for increasing the effective coverage of the components. For example, the devices can be easily installed because the installer knows the coverage (shown by field of view 208) will extend horizontally from the height the components are placed on the wall. Thus, the installation height is easily established by determining the highest point for which coverage is desired (e.g., head level). Moreover, such an alignment between components can be beneficial because the components can have a common field of view. More specifically, an indication of motion by a PIR sensor will directly correspond to the image captured by a camera.

[0027] FIG. 3 is a side view of a motion-image security device, according to an example embodiment of the present invention. In one implementation consistent with the example illustration shown in FIG. 3, the monitoring device includes a housing 302 that contains a single circuit board 310 for both components (motion sensor 312 and image-capture device 314). In a particular embodiment, circuit board 310 is one of a variety of commonly used solid printed-circuit-boards (PCB). For example, circuit board 310 may be implemented using a common 2 (or more) layer FR4 circuit board that has a rectangular

shape as shown by FIG. 3. Many standard circuit components (e.g., image detectors and PIR devices) are designed to mount flush with a circuit board. Accordingly, standard circuit components mounted on a common circuit board results in the circuit components having a common alignment (e.g., perpendicular to the circuit board), as shown by angle 306. Certain aspects of the present invention provide for the use of such a solid circuit board and standard components having different alignments. For instance, an angled support 502 (shown in FIG. 5) is used in connection with the single circuit board 310 to provide the PIR sensor angle depicted at 316. Wired legs 320 and 322 of the sensor 312 pass through and are used with "through holes" to package the PIR sensor 312 with the circuit board 310. The angle difference between the wired legs 320 and 322 and circuit board 310 can be accommodated using any number of techniques. A few example techniques include, without limitation, bending the wired legs 320 and 322, using holes in circuit board 310 sufficiently large to allow for angled entrance of wired legs 320 and 322, using angled holes in circuit board 310 and fastening the wired legs to one side of the circuit board using solder, screws or similar fastening techniques. Either side of the circuit board 310 includes areas 328 and 330 for mounting circuitry such as PIR signal-manipulation circuitry and radio frequency (RF) transceiver circuits (discrete and/or integrated components) and the antenna 331. Similarly, the circuit board 310 includes areas for mounting an image-capture related-device (e.g., lens) 332 and a video processor 334 programmed to process (manipulate) captured images.

[0028] In a more particular application, the RF and related circuits mounted on the board can be designed and programmed to implement the communication and related operations in a manner consistent with one or more embodiments disclosed in the above-referenced U.S. patent document US 7835343, filed on March 24, 2006, and entitled "Spread Spectrum Communications for Building-Security".

[0029] FIGS. 4A-4B and FIG. 5 illustrate various views of one embodiment of the monitoring device shown in FIG. 3. FIG. 4A illustrates IR-type LEDs (infrared emitting diodes or IREDs) 410 and 412 that emit light as used by the monitoring device for night-vision image capture. FIG. 4B is a bottom view of such a device that orients the LEDs 410 and 412 for motion-image security purposes. A sensor, such as image-capture 314 and PIR detector 312 captures the reflected IR. FIG. 4A shows two possible illumination patterns 420 and 430 for IREDs 410 and 412. 420 shows a first illumination pattern where the bases of the IREDs are parallel to each other. Such a pattern would result from standard mounting on a common PCB. 430 shows a second illumination pattern that has less overlap of illumination and provides a broader illumination angle. This is accomplished by angling the IREDs away from one another. Such an angled illumination pattern can be accomplished using techniques similar to those discussed in relation to PIR sensor 312 and as

further discussed herein.

[0030] FIG. 5 is a perspective view of an internal support piece 500 of a motion-image security device, according to an example embodiment of the present invention;

[0031] The PIR sensor support of FIG. 5 is connected with the body of the main plastic (structural) part 516 using strippable ribs 512. These ribs 512 may be cut to gain access to the circuit board 310, for example, to make repairs, without interfering with the PIR sensor 312. The ribs 512 allow for access to the circuitry without need to unsolder the PIR sensor or potentially disturb the PIR sensor's angle as depicted at 316 of FIG. 3. The image-capture device may be of surface-mounted device (SMD) type and soldered using a reflow process. The circuit board (310 of FIG. 3) is attached, e.g., clipped, to the main plastic part 516 and the board-support combination is inserted into the housing 302 of the motion-image security device with each of the sensing components angled so as to provide a common field of view. The housing 302 is generally shown in FIG. 3, and for a more particular view of such a housing, reference may be made to U.S. Design No. 555528, filed on March 24, 2006, entitled "Mountable Security Detector."

[0032] In one embodiment of the present invention, parasitic reflection of light can be reduced using a thin wall 510. In a preferred embodiment, this wall 510 has a cone shape that minimizes adverse effects to the view pattern of the PIR sensor.

[0033] Consistent with another embodiment of the present invention, keying of the various sensors and illumination devices can be incorporated into housing 302. More specifically, IRED supports 506 can include keying portions 504 and PIR support 502 can include keying portion 508. Various keying solutions can be implemented depending upon the component being used and the housing design.

[0034] Certain embodiments include a compact housing which involves miniaturization of the circuitry and components of the motion-image security device. To obtain a compact overall device, the electronic components are assembled on both sides of the circuit board. In certain implementations, the placement includes the image sensor located on a top side with the video processor located on the opposite side. Thus the length of the connections between the image sensor and the processor can be reduced so as to avoid signal noise. Moreover, to reduce electromagnetic interference (EMI), the "noisy" components (e.g., video components, image sensor, video processor, memory) are located near one portion of the board such as the bottom, while the RF and the PIR conditioning circuits are located near another portion such as the upper end.

[0035] The image sensor is used in connection with two infrared emitting diodes (IREDs) to provide night vision and image-capture in light-deficient environments. In certain implementations, they are located near the image sensor, in a symmetrical fashion, to evenly distribute the infrared energy. In certain other implementations the

IREDs are not positioned horizontally but instead have angled bases or supports to provide an infrared distribution that reduces the overlap between the two IREDs in the central axis and increases the angle of illumination. The IREDs also draw a high level of current, which limits the use of small SMD types, which cannot dissipate high power. Instead, the through hole-type is used. This is also advantageous for allowing flexibility in the angles of illumination provided by the IREDs.

[0036] Common through-hole footprints create difficulties in placing the video processor near (but on an opposite side of) the image sensor. In certain implementations, a plastic support piece is used to overcome these difficulties. For example, the IREDs are positioned by adapting IRED supports on the plastic support to orient the desired angles of the IREDs, and thereby avoiding the soldering of the thru hole IRED during the initial placement. The IRED (through-hole) legs can be bent and using a screw 404 to create pressure on the legs of each of the IREDs thereby forming an electrical contact with the circuit board. In one implementation, these two screws also serve to fastening the image sensor lens holder 514 tightly to the circuit board to reduce parasitic light due to gaps between the circuit board and the lens holder.

[0037] The above-discussed screws can be used for both tightening the support holder to the circuit board, to position the optical chamber between the image sensor and the lens, and for pressing the IRED legs to the circuit board to obtain a good contact. Soldering is then optionally avoided for the IRED attachment and the metalized holes usually required for a through hole footprint are also not needed. This frees space on the opposite side of the circuit board for positioning the video processor (e.g., a DSP).

[0038] According to another embodiment, the various components can be integrated independently from a single, non-adjustable circuit board. For instance, a flex board can be used to provide different angles for the IREDs, camera and motion detector. These and other embodiments include the use of a power control circuit that is used in conjunction with a battery circuit. The power control circuit responds to various control signals by reducing the power consumption of the device. This is particularly useful for implementing a self-powered device that operates for extended periods of time without replacing, recharging or otherwise supplementing power to the device.

[0039] In one instance, the power control circuit receives control signals from the central controller. In response to the control signals the power control circuit can implement any one of a number of different power saving techniques. One such technique involves placing the device in reduced power state by disabling or otherwise reducing power consumption by one or more of the motion detector, camera and IREDs. Thus, the power control circuit can maintain the reduced power state until a control signal is received that prompts the device to

leave the reduced power state. Such a control signal can be from the central controller or from other sources, such as a keyfob or an intrusion sensor. Additional logic can further control the various power states. For instance, the motion detector can be activated in response to a control signal, while keeping the camera disabled until motion is detected. This can also reduce the intrusiveness of the security system by minimizing the time during which images are captured. In another power reduction state, the image captures can be reduced in frequency. For example, instead of capturing an image every second, the device could be configured to capture and/or transmit an image every minute. This can significantly reduce the average power consumption over a period of time.

[0040] In another instance, the power control circuit controls the transmission of images from the camera to the central controller. Wireless transmission circuitry can require a significant amount of power to operate. Thus, the transmission of large amounts of data may require extensive periods of transmission activity and corresponding power draw. One technique employed by the device is performed by compression logic that reduces the size of the image data to be transferred. Another technique involves logic to limit the transmitted data to necessary images. For instance, the device may be enabled to capture images when a door or window sensor is triggered; however, the captured images need not be sent if a correct authorization code is provided by the person triggering the sensor. Various other logic implementations can be used to reduce unnecessary transmissions of captured images. Yet another technique involves the use of efficient handshake protocols between the devices. Many communication protocols require one or more of the devices to have extended periods of listening or sending in order to synchronize communications between devices. An efficient handshaking protocol can be used to reduce the synchronization times leading to significant power savings. For further details of one such protocol, reference can be made to U.S. 7835343 filed on March 24, 2006, entitled "Spread Spectrum Communications for Building-Security".

[0041] In other embodiments, the motion-image security device may be used to capture images both in daylight and using night vision technology. In environments with sufficient light, the image sensor may capture images in color. In addition, the image-capture device includes a camera that can also obtain black and white pictures in low-light environments such as at night using an infrared illuminator. This can be achieved with a black and white image sensor since color image sensors integrate a filter, which rejects the IR wavelength in order to keep the color fidelity. In certain implementations, a color image sensor is used with specific color filters. FIG. 6 shows a graph of filter responses (illustrated by lines representing green 604, red 602 and blue 606 colors), according to an example embodiment of the present invention. The illustrated filters' responses show that in the IR wavelength,

the sensitivity of each color is balanced, and is close to the sensitivity in the visible spectrum. This allows night vision with the IRED illuminators where the color signal is ignored, and only the luminescence signal is used to obtain black and white pictures.

[0042] Another embodiment allows for multiple image-capture possibilities in daylight environments. If the level of IR light is low (e.g., indoor light with fluorescent bulbs), the color fidelity will be good because the response to each color will not be overly effected by IR light and the camera can capture color images. If the level of IR is high (e.g., incandescent bulbs or direct sun exposure), the color fidelity of the image sensor may be adversely effected by the IR light, and the camera can deliver black and white images. In still other embodiments, all image acquisition operates using the color signals while a remote monitoring station (e.g., PC) determines if the black and white or color images will be displayed.

[0043] In certain implementations, the image-capture device is initialized with multiple operating modes. For example, in an auto mode, once the image-capture device is armed, the device will begin video image acquisition as soon as the motion detector detects motion. In another example, in a control panel mode the motion-image security device sends an intrusion notification to the control panel and waits for a video acquisition command from the panel. The video acquisition and video transfer to the control panel are two independent actions. This allows the image-capture device to obtain video images within a delayed zone, before the system is disarmed. If the disarming is done before the end of a delay, the video will be erased; otherwise the control panel will request the video data and send the video data to a remote monitoring station.

[0044] In certain instances, a video transfer requires several times more power than video acquisition. The image-capture device is able to transfer video data at a request of the control panel through a radio channel. The control panel can also request video erasing in memory. Since video data transfer can take more than two minutes, during the transfer time, a destruction of the image-capture device will result in the loss of the remaining video stored in RAM memory. A non volatile memory (e.g., Flash type) may be used to duplicate the video data immediately after the acquisition or during it. The small size of the Flash chip (e.g., SO8) makes it difficult to break, and thus, increases the likelihood of the video data being recovered in case of the device being damaged by an intruder.

[0045] The various circuits and logic describe herein can be implemented using a variety of devices including, but not limited to, discrete logic components, analog components, general purpose processors configured to execute software instructions, programmable logic devices and combinations thereof.

[0046] While certain aspects of the present invention have been described with reference to several particular example embodiments, those skilled in the art will rec-

ognize that many changes may be made thereto without departing from the scope of the present invention. Aspects of the invention are set forth in the following claims.

5

Claims

10

1. An integrated image-capture device (106) for a security system, the integrated image-capture device (106) comprising:

15

a battery circuit;
a circuit for receiving wireless control signals;
a power-control circuit, responsive to reception of the wireless control signals, to control use of the battery circuit;
a camera (314);
a motion detector (312);
a circuit board structure (310,502) that electrically integrates the camera (314) and the motion detector (312), wherein the circuit board structure (310,502) includes a circuit board (310) on which the camera (314) is mounted and an angled support (502) on which the motion detector (312) is mounted, the motion detector (312) being mounted on the angled support (502) such that the motion detector (312) points in a first direction and the camera (314) being mounted on the circuit board such that the camera (314) is directed in a second, different direction; and
logic for synchronizing transmission of data between the circuit for receiving wireless control signals and the controller (102).

25

30

35

2. The device of claim 1, further comprising a housing and wherein the at least one circuit board (310), the motion detector (312) and the camera (314) are secured within the housing such that the motion detector (312) and camera (314) provide a common field of view.

40

45

3. The device of claim 1, further comprising a ribbon cable to integrate the motion detector (312), the camera (314) and the circuit board upon which the motion detector (312) and the camera (314) are mounted.

50

4. The device of claim 1, wherein the power-control circuit is responsive to the controller (102), for limiting consumption of power from the battery circuit, wherein the device (16) includes a housing (302) that secures the at least one circuit board (310) and an independent power source, and that is adapted to direct the motion detector (312) at an angle along a substantially horizontal plane (206) and to direct the camera (314) in a downwardly direction to cover an area beneath the substantially horizontal plane.

55

5. The device of claim 1, further comprising:

- two infrared emitters (410,412) integrated with a surface of the at least one circuit board (310) using one or more wired connections (320,322); and
two supports that direct one of the infrared emitters at an angle different from an angle of the other infrared emitter, optionally wherein the infrared emitters (410,412) are directed away from one another, thereby increasing an angle of illumination from both emitters, relative to an angle of illumination for both emitters directed parallel to each other and wherein the infrared emitters are electrically connected to one of the at least one circuit boards (310) using a screw that also physically connects a video processor (334) to the circuit board; or wherein the infrared emitters (410,415) are directed away from one another, thereby increasing an angle of illumination from both emitters, relative to an angle of illumination for both emitters directed parallel to each other and wherein the infrared emitters are connected to one of the at least one circuit boards (310) using a screw.
6. The device of claim 1, wherein the angled support (502) directs the motion detector (312) in the first direction, and includes strippable ribs (512) for removal of the support.
7. The device of claim 1, wherein the at least one circuit board (310) includes an image processor (334) and wherein the image processor and at least part of a communication circuit are located on a side of the circuit board opposite a side of the circuit board from which the motion detector (312) and the camera (314) are directed.
8. The device of claim 1, wherein the device includes a housing (302) that holds the circuit board (310) and that includes a cone shaped portion (510) to reduce parasitic light from reaching the motion detector (312).
9. The device of claim 1, wherein the motion detector (312) is a passive infrared detector.
10. The device of claim 1, wherein the device is arranged to capture pictures in a black-and-white mode and a color mode.
11. The device of claim 10, wherein during low light conditions, the device operates in the black-and-white mode using light provided by infrared emitters (410,412) located on the circuit board (310) and wherein, during high light conditions, the device is selectable to operate in either the black-and-white mode or the color mode.
12. A method of using an integrated image-capture device (106) as claimed in claim 1 or 2.
13. A security system comprising a controller (102) for communicating with security monitoring devices (104-110) and comprising an integrated image-capture device (106) as claimed in claim 1, wherein the device operates in a first power mode and a second power mode under the control of the power-control circuit and wherein the first power mode reduces power consumption of one or more of the camera (314), the motion detector (312) and the circuit for receiving wireless control signals with respect to power consumption of said one or more of the camera, the motion detector and the circuit for receiving wireless control signals operating in the second power mode, the device optionally further including logic to compress image data captured by the camera, and optionally further including a temporary memory for storing captured images and logic to select a portion of the stored captured images to be transmitted to the controller (102) and a second portion of the stored captured images that is not transmitted to the controller.
14. A security system comprising a controller (102) for communicating with security monitoring devices (104-110) and comprising an integrated image-capture device (106) as claimed in claim 1, wherein the synchronization logic identifies periodic times during which communication occurs between the image-capture device (106) and the controller (102) and wherein the power-control circuit disables the circuit for receiving wireless control signals during time not identified as the periodic times.

Patentansprüche

1. Integrierte Bilderfassungsvorrichtung (106) für ein Sicherheitssystem, die integrierte Bilderfassungsvorrichtung (106) umfassend:
- einen Batteriekreis;
 - einen Kreis zum Empfangen von drahtlosen Steuersignalen;
 - einen Leistungssteuerkreis, der auf den Empfang der drahtlosen Steuersignale reagiert, zum Steuern der Benutzung des Batteriekreises;
 - eine Kamera (314);
 - einen Bewegungsdetektor (312);
 - eine Leiterplattenstruktur (310, 502), die die Kamera (314) und den Bewegungsdetektor (312) elektrisch integriert, wobei die Leiterplattenstruktur (310, 502) eine Leiterplatte (310), auf der die Kamera (314) angebracht ist, und eine winklige Stütze (502) enthält, auf der der Bewegungsdetektor (312) angebracht ist, wobei der

- Bewegungsdetektor (312) derart auf der winkligen Stütze (502) angebracht ist, dass der Bewegungsdetektor (312) in eine erste Richtung deutet, und die Kamera (314) derart auf der Leiterplatte angebracht ist, dass sie in eine zweite, andere Richtung gerichtet ist; und Logik zum Synchronisieren von Datenübertragung zwischen dem Kreis zum Empfangen von drahtlosen Steuersignalen und der Steuerung (102).
2. Vorrichtung nach Anspruch 1, ferner umfassend ein Gehäuse, und wobei die zumindest eine Leiterplatte (310), der Bewegungsdetektor (312) und die Kamera (314) derart innerhalb des Gehäuses befestigt sind, dass der Bewegungsdetektor (312) und die Kamera (314) ein gemeinsames Sehfeld vorsehen.
 3. Vorrichtung nach Anspruch 1, ferner umfassend ein Bandkabel zum Integrieren des Bewegungsdetektors (312), der Kamera (314) und der Leiterplatte, auf der der Bewegungsdetektor (312) und die Kamera (314) angebracht sind.
 4. Vorrichtung nach Anspruch 1, wobei der Leistungssteuerkreis auf die Steuerung (102) zum Begrenzen des Verbrauchs von Leistung aus dem Batteriekreis reagiert, wobei die Vorrichtung (16) ein Gehäuse (302) enthält, das die zumindest eine Leiterplatte (310) und eine unabhängige Leistungsquelle befestigt, und das zum Richten des Bewegungsdetektors (312) in einem Winkel entlang einer im Wesentlichen horizontalen Ebene (206) und zum Richten der Kamera (314) in einer Richtung nach unten zum Abdecken eines Bereichs unterhalb der im Wesentlichen horizontalen Ebene geeignet ist.
 5. Vorrichtung nach Anspruch 1, ferner umfassend:
 - zwei Infrarotemitter (410, 412), die mit einer Oberfläche der zumindest einen Leiterplatte (310) unter Benutzung von einer oder mehr verdrahteten Verbindungen (320, 322) integriert sind; und
 - zwei Stützen, die einen der Infrarotemitter in einem Winkel richten, der von einem Winkel des anderen Infrarotemitters abweicht, wobei die Infrarotemitter (410, 412) optional voneinander weg gerichtet sind, wodurch ein Beleuchtungswinkel von beiden Emittlern bezüglich eines Beleuchtungswinkels für beide Emittler, die parallel zueinander gerichtet sind, vergrößert ist, und wobei die Infrarotemitter elektrisch mit einer der zumindest einen Leiterplatten (310) unter Benutzung einer Schraube verbunden sind, die die außerdem einen Videoprozessor (334) physikalisch mit der Leiterplatte verbindet; oder wobei die Infrarotemitter (410, 415) voneinander weg gerichtet sind, wodurch ein Beleuchtungswinkel von beiden Emittlern bezüglich eines Beleuchtungswinkels für beide Emittler, die parallel zueinander gerichtet sind, vergrößert ist, und wobei die Infrarotemitter elektrisch mit einer der zumindest einen Leiterplatten (310) unter Benutzung einer Schraube verbunden sind.
 6. Vorrichtung nach Anspruch 1, wobei die gewinkelte Stütze (502) den Bewegungsdetektor (312) in die erste Richtung richtet und abnehmbare Rippen (512) zur Entfernung der Stütze enthält.
 7. Vorrichtung nach Anspruch 1, wobei die zumindest eine Leiterplatte (310) einen Bildprozessor (334) enthält, und wobei sich der Bildprozessor und zumindest ein Teil eines Kommunikationskreises auf einer Seite der Leiterplatte gegenüber einer Seite der Leiterplatte befinden, von der der Bewegungsdetektor (312) und die Kamera (314) gerichtet sind.
 8. Vorrichtung nach Anspruch 1, wobei die Vorrichtung ein Gehäuse (302) enthält, das die Leiterplatte (310) enthält, und das einen kegelförmigen Abschnitt (510) enthält, um zu vermindern, dass Störlicht den Bewegungsdetektor (312) erreicht.
 9. Vorrichtung nach Anspruch 1, wobei der Bewegungsdetektor (312) ein Passivinfrarotdetektor ist.
 10. Vorrichtung nach Anspruch 1, wobei die Vorrichtung zum Erfassen von Bildern in einem Schwarz-Weiß-Modus und in einem Farbmodus angeordnet ist.
 11. Vorrichtung nach Anspruch 10, wobei die Vorrichtung während Schwachlichtbedingungen im Schwarz-Weiß-Modus unter Verwendung von Licht arbeitet, das durch die Infrarotemitter (410, 412) vorgesehen ist, welche sich auf der Leiterplatte (310) befinden, und wobei für die Vorrichtung während Starklichtbedingungen auswählbar ist, entweder im Schwarz-Schweiß-Modus oder im Farbmodus zu arbeiten.
 12. Verfahren zum Benutzen einer integrierten Bilderfassungsvorrichtung (106) gemäß einem der Ansprüche 1 oder 2.
 13. Sicherheitssystem, umfassend eine Steuerung (102) zum Kommunizieren mit Sicherheitsüberwachungsvorrichtungen (104 bis 110), und umfassend eine integrierte Bilderfassungsvorrichtung (106) gemäß Anspruch 1, wobei die Vorrichtung in einem ersten Leistungsmodus und einem zweiten Leistungsmodus unter der Steuerung des Leistungssteuerkreises arbeitet, und wobei der erste Leistungsmodus Leistungsverbrauch von einem oder mehr der Kamera (314), des Bewegungsdetektors (312) und

des Kreises zum Empfangen von drahtlosen Steuersignalen bezüglich Leistungsverbrauch von einem oder mehr der Kamera, des Bewegungsdetektors und des Kreises zum Empfangen von drahtlosen Steuersignalen bei Betrieb im zweiten Leistungsmodus vermindert, wobei die Vorrichtung optional ferner Logik zum Komprimieren von Bilddaten enthält, die durch die Kamera erfasst wurden, und optional ferner einen zeitweiligen Speicher zum Speichern von erfassten Bilddaten und Logik zum Auswählen eines Abschnitts der gespeicherten erfassten Bilder, der an die Steuerung (102) übertragen werden soll, und eines zweiten Abschnitts der gespeicherten erfassten Bilder, der nicht an die Steuerung übertragen wird, enthält.

14. Sicherheitssystem, umfassend eine Steuerung (102) zum Kommunizieren mit Sicherheitsüberwachungsvorrichtungen (104 bis 110), und umfassend eine integrierte Bilderfassungsvorrichtung (106) gemäß Anspruch 1, wobei die Synchronisierungslogik periodische Zeiträume identifiziert, während deren Kommunikation zwischen der Bilderfassungsvorrichtung (106) und der Steuerung (102) erfolgt, und wobei der Leistungssteuerkreis den Kreis zum Empfangen von drahtlosen Steuersignalen während Zeiten, die nicht als die periodischen Zeiträume identifiziert sind, deaktiviert.

Revendications

1. Dispositif de capture d'images intégré (106) pour un système de sécurité, le dispositif de capture d'images intégré (106) comprenant :

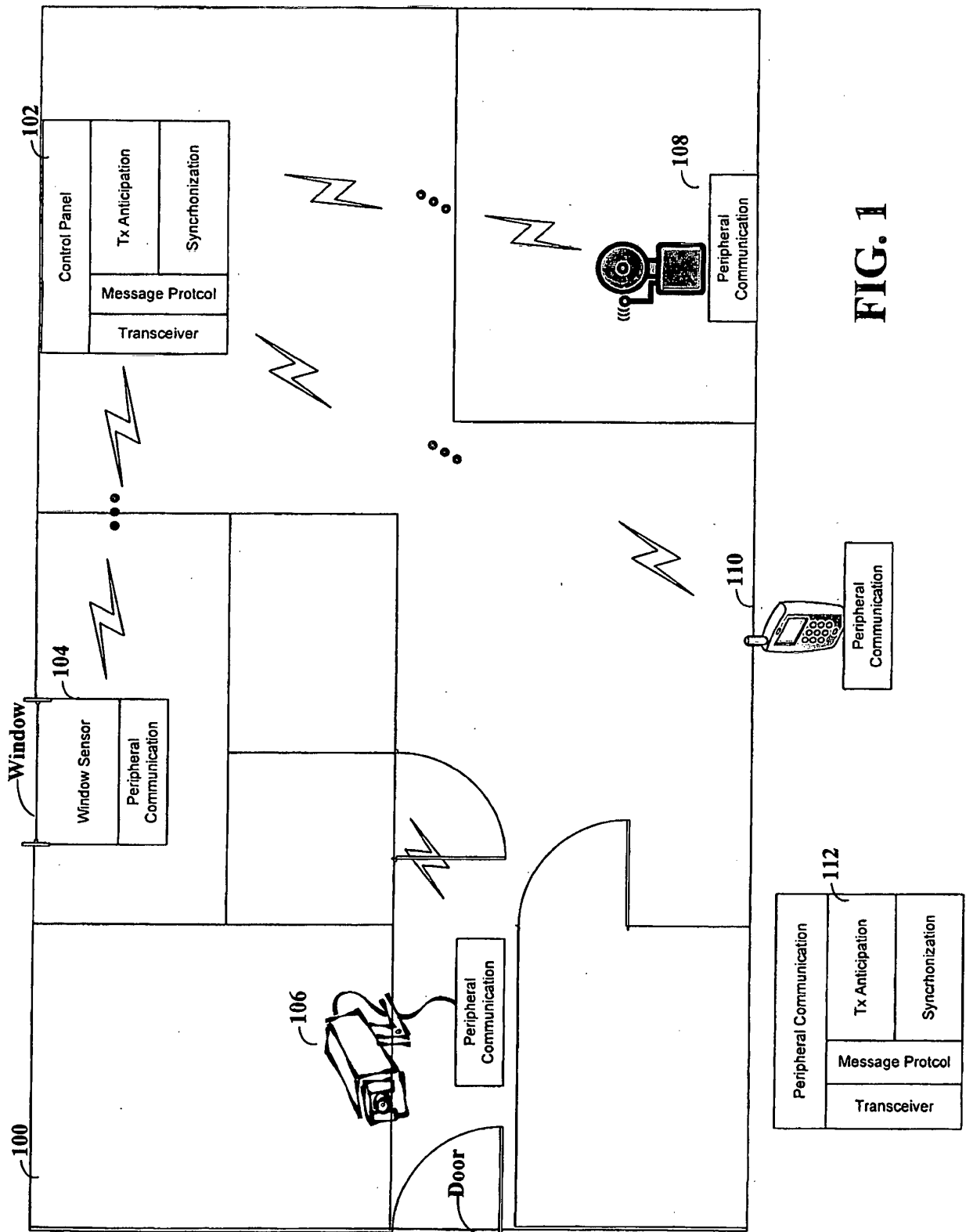
un circuit de batterie ;
 un circuit pour recevoir des signaux de commande sans fil ;
 un circuit de commande d'énergie sensible à la réception des signaux de commande sans fil pour commander l'utilisation du circuit de batterie ;
 une caméra (314) ;
 un détecteur de mouvement (312) ;
 une structure de plaquette de circuits imprimés (310, 502) qui intègre électriquement la caméra (314) et le détecteur de mouvement (312), dans lequel la structure de plaquette de circuits imprimés (310, 502) comprend une plaquette de circuits imprimés (310) sur laquelle la caméra (314) est montée et un support oblique (502) sur lequel le détecteur de mouvement (312) est monté, le détecteur de mouvement (312) étant monté sur le support oblique (502) de sorte que le détecteur de mouvement (312) pointe dans une première direction et la caméra (314) étant montée sur la plaquette de circuits imprimés de

sorte que la caméra (314) soit dirigée dans une seconde direction différente ; et
 un circuit logique pour synchroniser la transmission de données entre le circuit pour recevoir des signaux de commande sans fil et le contrôleur (102).

2. Dispositif selon la revendication 1, comprenant en outre un boîtier et dans lequel au moins une plaquette de circuits imprimés (310), le détecteur de mouvement (312) et la caméra (314) sont fixés dans le boîtier de sorte que le détecteur de mouvement (312) et la caméra (314) fournissent un champ de vision commun.
3. Dispositif selon la revendication 1, comprenant en outre un câble en ruban pour intégrer le détecteur de mouvement (312), la caméra (314) et la plaquette de circuits imprimés sur laquelle le détecteur de mouvement (312) et la caméra (314) sont montés.
4. Dispositif selon la revendication 1, dans lequel le circuit de commande d'énergie est sensible au contrôleur (102) pour limiter la consommation d'énergie du circuit de batterie, dans lequel le dispositif (16) comprend un boîtier (302) qui fixe la au moins une plaquette de circuits imprimés (310) et une source d'énergie indépendante, et qui est à même de diriger le détecteur de mouvement (312) selon un certain angle le long d'un plan sensiblement horizontal (206) et pour diriger la caméra (314) vers le bas afin de couvrir une surface située en dessous du plan sensiblement horizontal.
5. Dispositif selon la revendication 1, comprenant en outre :

deux émetteurs d'infrarouges (410, 412) intégrés à une surface de la au moins une plaquette de circuits imprimés (310) en utilisant une ou plus de connexions filaires (320, 322) ; et
 deux supports qui dirigent l'un des émetteurs d'infrarouges selon un angle différent de l'angle de l'autre émetteur d'infrarouges, éventuellement dans lequel les émetteurs d'infrarouges (410, 412) s'écartent l'un de l'autre, ce qui a pour effet d'augmenter l'angle d'éclairage des deux émetteurs par rapport à l'angle d'éclairage des deux émetteurs dirigés parallèlement l'un à l'autre et dans lequel les émetteurs d'infrarouges sont connectés électriquement à l'une des au moins une plaquette de circuits imprimés (310) en utilisant une vis qui raccorde également physiquement un processeur vidéo (334) à la plaquette de circuits imprimés ; ou dans lequel les émetteurs d'infrarouges (410, 415) sont dirigés en s'écartant l'un de l'autre, ce qui a pour effet d'augmenter l'angle d'éclairage provenant

- des deux émetteurs par rapport à l'angle d'éclairage des deux émetteurs dirigés parallèlement l'un à l'autre et dans lequel les émetteurs d'infrarouges sont connectés à l'une des au moins une carte de circuits imprimés (310) en utilisant une vis. 5
6. Dispositif selon la revendication 1, dans lequel le support oblique (502) dirige le détecteur de mouvement (312) dans la première direction et comprend des nervures enlevables (512) pour retirer le support. 10
7. Dispositif selon la revendication 1, dans lequel la au moins une carte de circuits imprimés (310) comprend un processeur d'images (334) et dans lequel le processeur d'images et au moins une partie d'un circuit de communication sont situés d'un côté de la plaquette de circuits imprimés opposé à un côté de la plaquette de circuits imprimés d'où le détecteur de mouvement (312) et la caméra (314) sont dirigés. 15 20
8. Dispositif selon la revendication 1, dans lequel le dispositif comprend un boîtier (302) qui contient la plaquette de circuits imprimés (310) et qui comprend une partie en forme de cône (510) pour réduire la lumière parasite susceptible d'atteindre le détecteur de mouvement (312). 25
9. Dispositif selon la revendication 1, dans lequel le détecteur de mouvement (312) est un détecteur d'infrarouges passif. 30
10. Dispositif selon la revendication 1, dans lequel le dispositif est aménagé pour capturer des images en mode noir et blanc et en mode couleur. 35
11. Dispositif selon la revendication 10, dans lequel, au cours de faibles conditions de lumière, le dispositif fonctionne en mode noir et blanc en utilisant la lumière fournie par les émetteurs d'infrarouges (410, 412) situés sur la plaquette de circuits imprimés (310) et dans lequel, au cours de conditions d'éclairage élevées, le dispositif peut choisir d'opérer en mode noir et blanc ou en mode couleur. 40 45
12. Procédé d'utilisation d'un dispositif de capture d'images intégré (106) selon la revendication 1 ou la revendication 2. 50
13. Système de sécurité comprenant un contrôleur (102) pour communiquer avec des dispositifs de surveillance de sécurité (104-110) et comprenant un dispositif de capture d'images intégré (106) selon la revendication 1, dans lequel le dispositif opère dans un premier mode d'énergie et dans un second mode d'énergie sous le contrôle du circuit de commande d'énergie et dans lequel le premier mode d'énergie 55
- réduit la consommation d'énergie d'un(e) ou plus de la caméra (314), du détecteur de mouvement (312) et du circuit pour recevoir des signaux de commande sans fil par rapport à la consommation d'énergie desdits un(e) ou plus de la caméra, du détecteur de mouvement et du circuit pour recevoir des signaux de commande sans fil opérant dans le seconde mode d'énergie, le dispositif comprenant éventuellement en outre un circuit logique pour comprimer des données d'images capturées par la caméra et comprenant éventuellement en outre une mémoire temporaire pour stocker les images capturées et un circuit logique pour choisir une partie des images capturées stockées à transmettre au contrôleur (102) et une seconde partie des images capturées stockées qui n'est pas transmise au contrôleur.
14. Système de sécurité comprenant un contrôleur (102) pour communiquer avec des dispositifs de surveillance de sécurité (104-110) et comprenant un dispositif de capture d'images intégré (106) selon la revendication 1, dans lequel le circuit logique de synchronisation identifie des tranches périodiques au cours desquelles la communication se produit entre le dispositif de capture d'images (106) et le contrôleur (102) et dans lequel le circuit de commande d'énergie désactive le circuit pour recevoir des signaux de commande sans fil au cours d'une période non identifiée comme correspondant aux tranches périodiques.



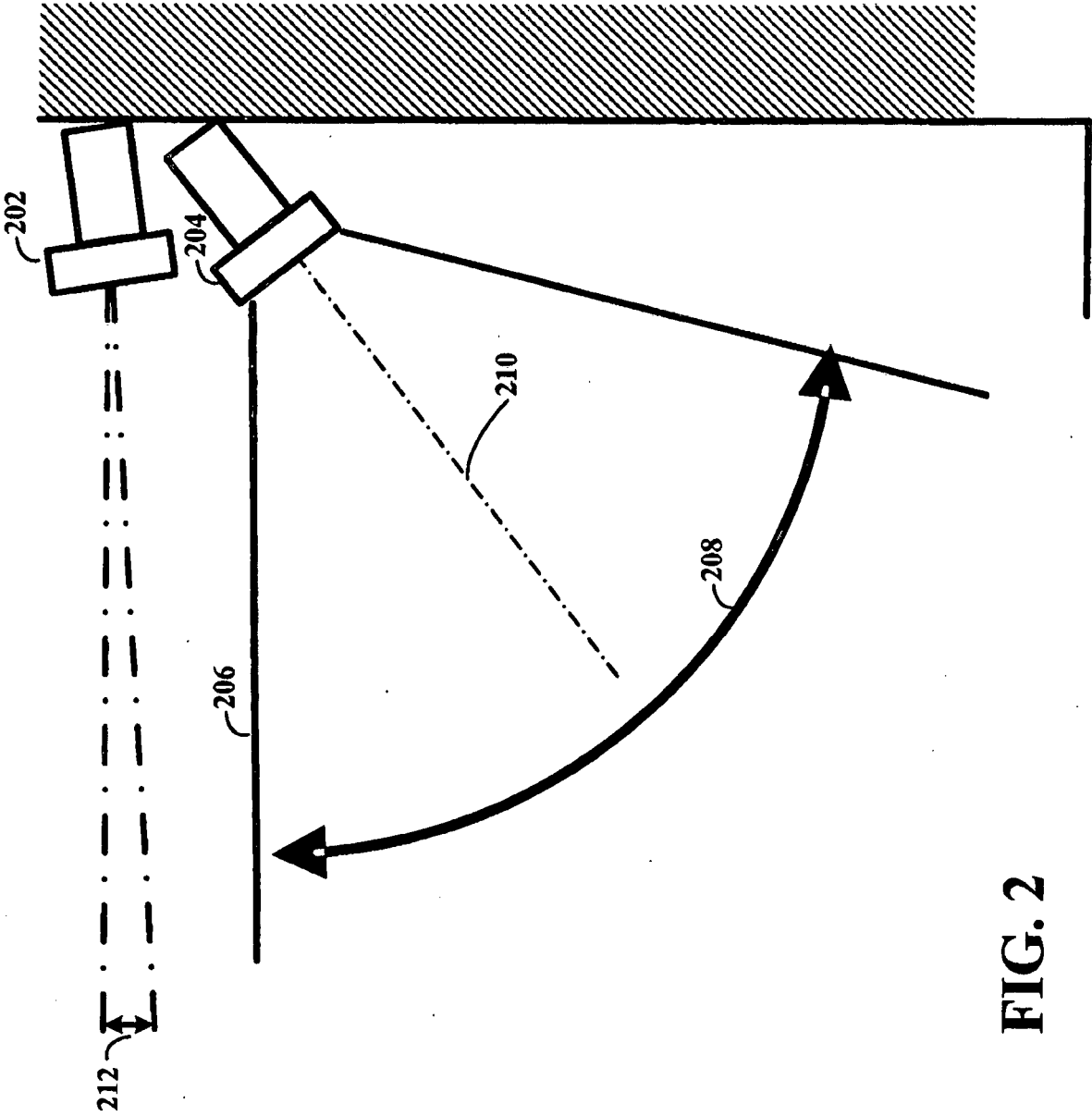


FIG. 2

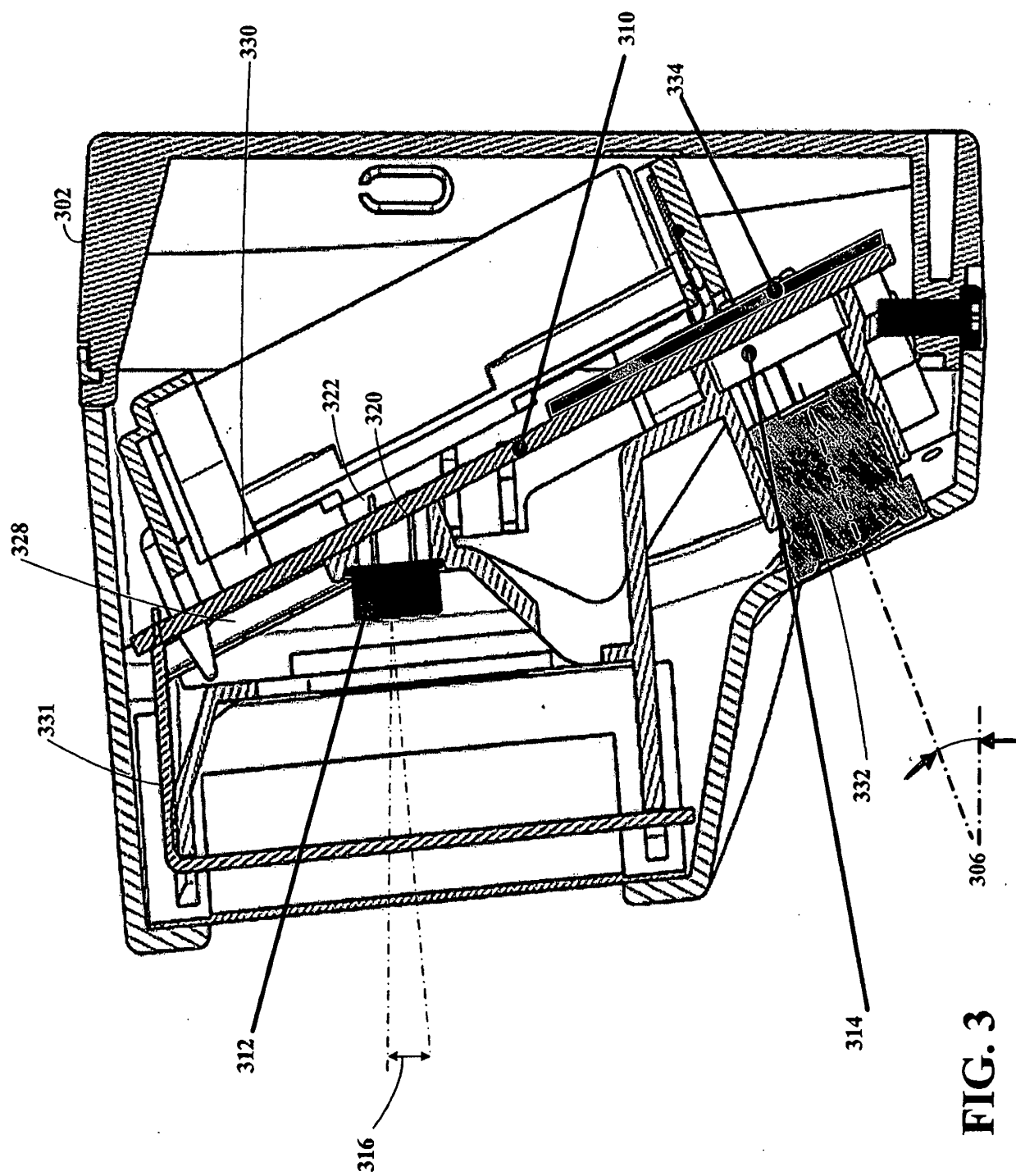


FIG. 3

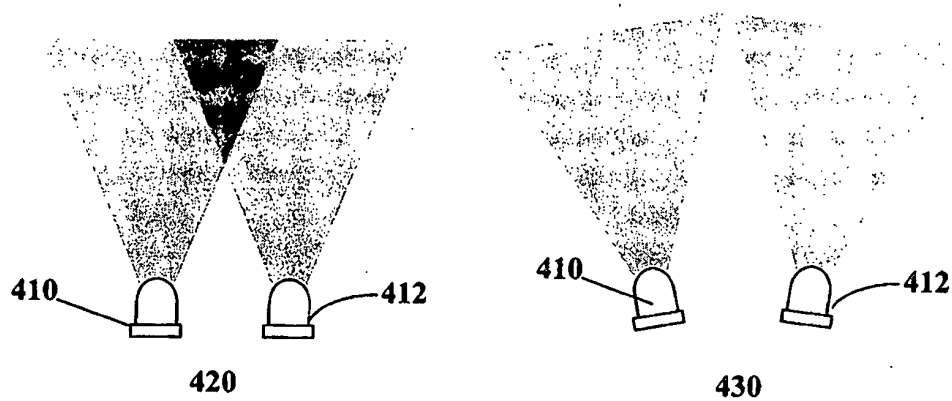


FIG. 4A

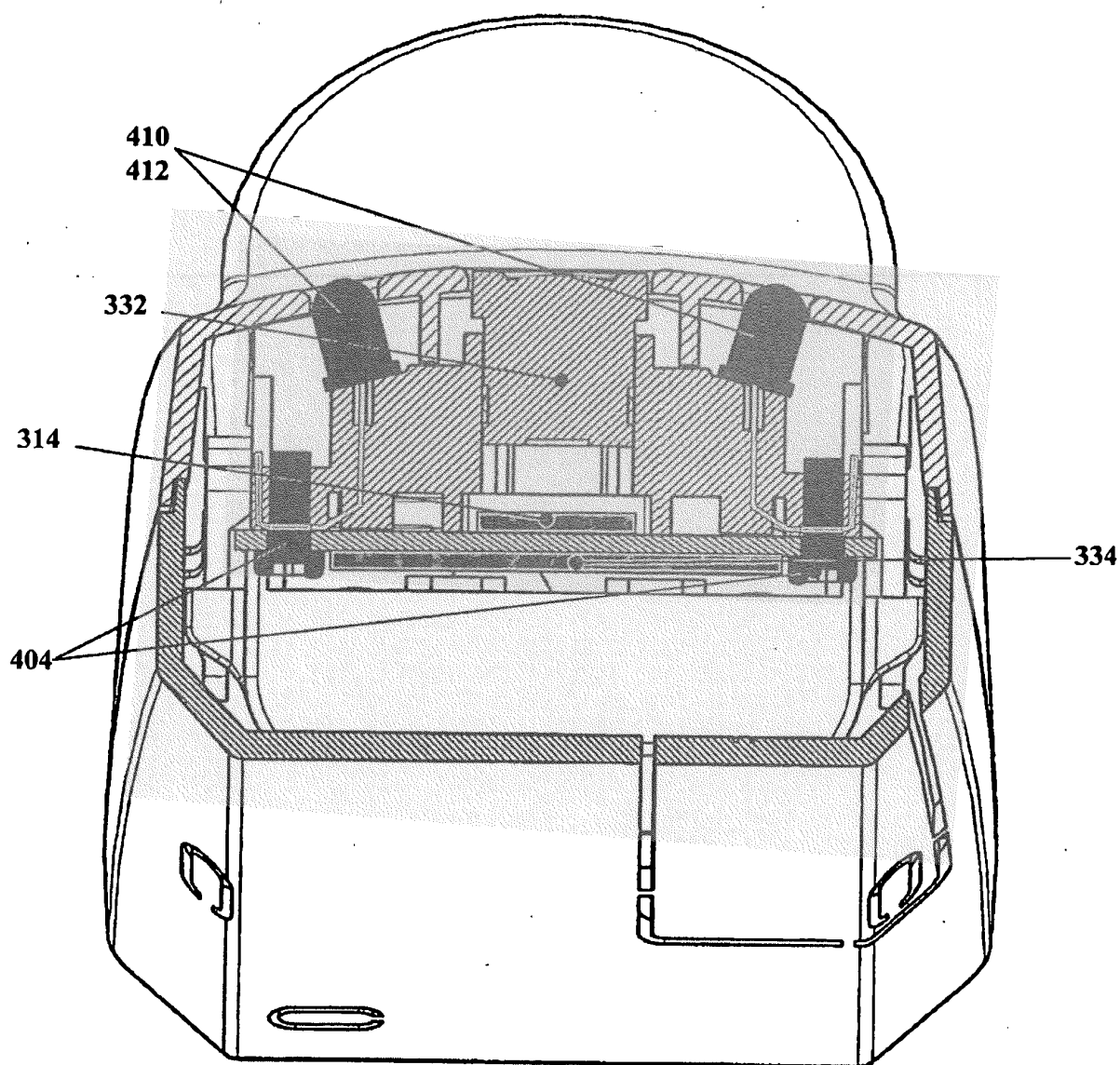


FIG. 4B

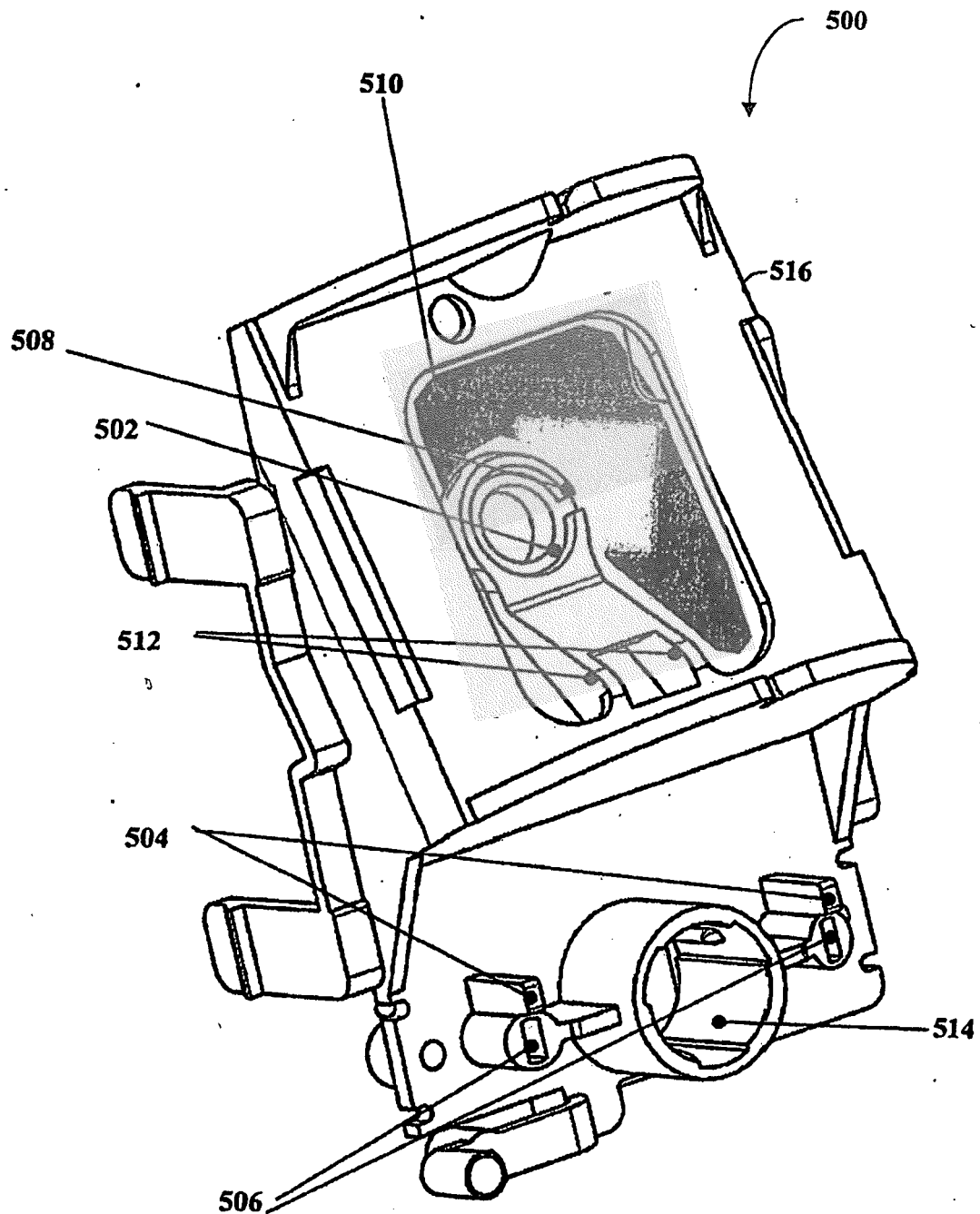


FIG. 5

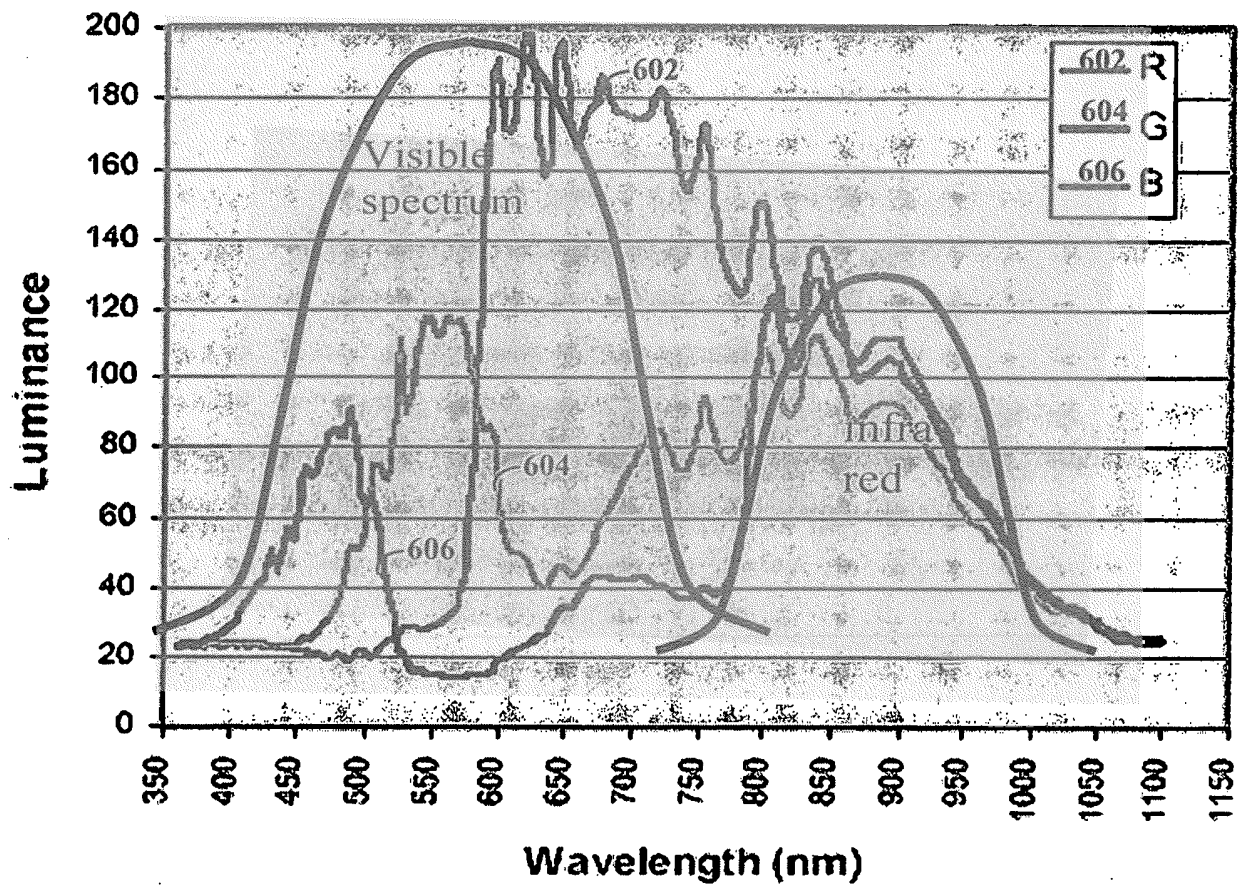


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 01575009 A [0008]
- WO 9725696 A [0008]
- US 7835343 B [0017] [0028] [0040]
- EP 1363260 A [0017]
- US 7463145 B [0018]
- US 555528 A [0031]