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(54) METHOD AND DEVICE FOR MAKING PRESENCE OF USER KNOWN TO A LIGHTING SYSTEM

(57) A device transmits control signals to a node of a building automation network. The device comprises a connector for connecting to a port of a computer device, as well as a signal input for receiving use signals from a pointing device and a signal output for forwarding said use signals to said connector. A controller and a wireless transmitter are also provided. The device is configured to forward use signals received at said signal input transparently to said signal output, and said controller is configured to make said wireless transmitter transmit said control signals in response to use signals received at said signal input.

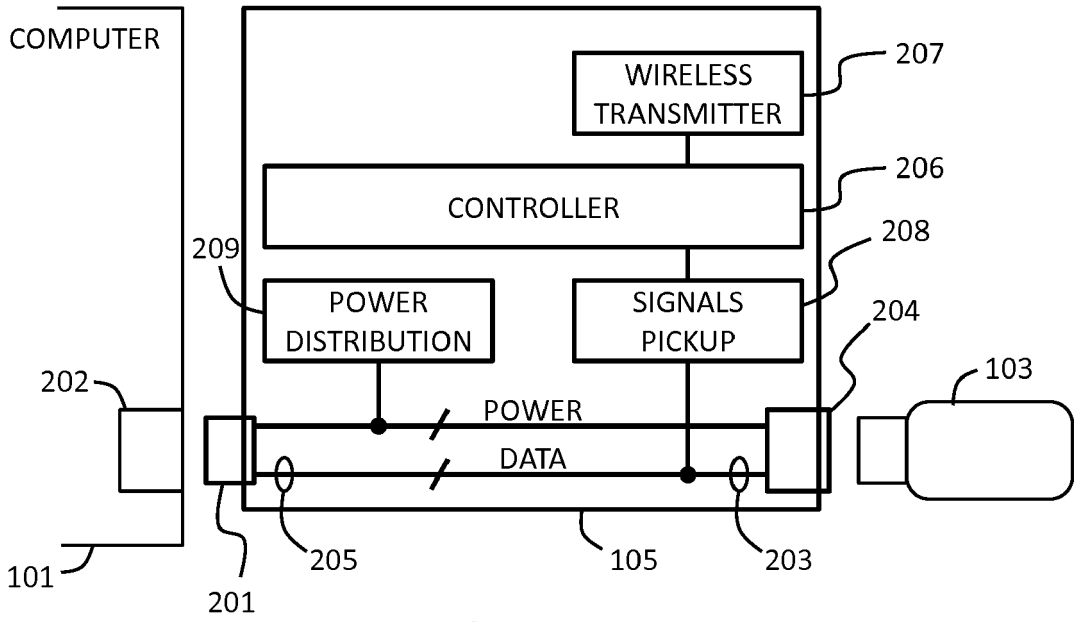


Fig. 2

EP 3 373 707 A1

Description

FIELD OF THE INVENTION

[0001] The invention relates to controlling lighting and other location-specific functions of a building automation system on the basis of detected presence of users. In particular the invention relates to making the lighting system or other building automation system aware of the presence of a user who uses a computer.

BACKGROUND OF THE INVENTION

[0002] A lighting system, or any building automation system that uses energy to operate devices that serve the needs of users, should offer enough service whenever the users need it but simultaneously save energy by not operating its energy-consuming devices or at least turning them down to a low level when the needs of the users are not that acute. As an example the lights of a room or an office space should be kept on, providing sufficient lighting when a user is present, but they can be dimmed down or shut completely off when there is nobody around who would actually need the light.

[0003] A widely used way to detect the presence of users for this kind of purposes is to monitor the space with one or more PIR (passive infrared) sensors. PIR sensors are relatively reliable for detecting movement, but their principle of operation makes them less sensitive to users who are present but do not move. An office worker sitting at a desk is a commonly encountered example. If the lighting control system of the office relies solely upon PIR sensors, the stationary user may need to wave a hand or make other noticeable movements every now and then to keep the lights on. Many users consider it extremely irritating if the lighting system fails to detect their presence and turns down the lights while the users would need them.

[0004] A prior art document US 2007/0244572 A1 suggests an improvement in which the computer of the user detects user input, such as keystrokes, mouse clicks, or the like. The computer then sends signals to the building automation system to indicate that there is a user present. This solution can be considered to solve the problem of the user being stationary, but it has its drawbacks: a particular piece of software must be installed to the computer of every user, and a communications link must be established from the computer to at least one controlling unit of the building automation system. Both installing additional software and opening communication channels to external systems may involve security risks and add the burden of required ITC maintenance, so security managers and ICT support providers are reluctant to accept them.

SUMMARY OF THE INVENTION

[0005] It is an objective of the present invention to provide a device, a method, and a computer program for providing a building automation system with reliable indications of the presence of a user. Another objective of the invention is to provide such indications without compromising information security and with minimal burden of required ITC maintenance. Yet another objective of the invention is that the device, method, and computer program can be used in a wide variety of environments and in combination with various different other devices used in such environments.

[0006] The objectives of the invention are achieved by placing an intermediate device along the communications connection between a computer device and a pointing device used as input means for said computer device. The intermediate device detects use signals coming from the pointing device, forwards them transparently to the computer device, and transmits control signals to a node of the building automation system based on the detected use signals.

[0007] According to an aspect of the invention there is provided a device for transmitting control signals to a node of a building automation network. The characteristic features of the device are listed in the independent claim.

[0008] The invention may also involve aspects that can be implemented in the form of a method and a computer program. The computer program may be embodied on a volatile or a non-volatile computer-readable record medium, for example as a computer program product comprising at least one computer readable non-transitory medium having program code stored thereon, the program code, which when executed by an apparatus, causes the apparatus at least to perform the operations described hereinbefore for the computer program in accordance with the respective aspect of the invention.

[0009] The exemplifying embodiments of the invention presented in this patent application are not to be interpreted to pose limitations to the applicability of the appended claims. The verb "to comprise" and its derivatives are used in this patent application as an open limitation that does not exclude the existence of features that are not recited. The features described hereinafter are mutually freely combinable unless explicitly stated otherwise.

[0010] The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following detailed description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Figure 1 illustrates the use of a device according to an embodiment of the invention,

figure 2 illustrates some functional blocks of a device according to an embodiment of the invention,

figure 3 illustrates some functional blocks of a device according to another embodiment of the invention,

figure 4 illustrates some functional blocks of a device according to another embodiment of the invention, and

figure 5 illustrates a method and a computer program.

DETAILED DESCRIPTION

[0012] Fig. 1 illustrates schematically a computer device 101 and a pointing device 102 used as input means for the computer device 101. A laptop computer is shown schematically as an example of a computer device, but the computer device could be also a PC or other tabletop computer, an intelligent display or data projector, a control station of an industrial process, or any other type of computer device for the use of which at least a pointing device is available as input means. A wired mouse is shown schematically as an example of a pointing device, but other kinds of pointing devices could come into question: a wireless mouse, a (wired or wireless) digitizing pad, a tracker ball, a joystick, or any other input means that provides the computer device with input information based on location and movement. In particular, the nature of a pointing device as input means dictates that it does not produce input information in textual or character form like a keyboard or keypad does.

[0013] For making the connection between the pointing device 102 and the computer device 101 the latter typically comprises a port or receptacle. The port may take the form of for example a female USB (Universal Serial Bus) connector, to which the user plugs either the male USB connector 103 at the end of the mouse cable 104, or an USB-connector-equipped transceiver that sets up the communications link with a wireless mouse or other wireless pointing device.

[0014] According to an embodiment of the invention a device 105 is connected inline between the computer device 101 and the pointing device 102. The device 105 is transparent to the computer device 101 and the pointing device 102 in the sense of communications, meaning that the communications between the computer device 101 and the pointing device 102 take place completely normally and they may remain completely unaware that there is some third device in between. The device 105 detects use signals, i.e. signals that indicate that the user uses the pointing device 102 as input means for the computer device 101, and responds by transmitting wireless control signals 106 to a nearby node 107 of a building automation network. In the schematic example of fig. 1 the node 107 is a controllable luminaire located so that it illuminates an area in which the computer device 101 is located. The node 107 may be for example a luminaire located above or close to an office table on which the computer device 101 and the pointing device 102 are placed.

[0015] An important difference between pointing devices and character-based devices like keyboards as input means is related to the content of the information they produce. A keyboard is used to produce bit strings that may represent human-readable information in accordance with widely known standards, like the ASCII (American Standard Code for Information Interchange) or USC (Universal Character Set), and that can in many cases involve aspects of confidentiality. Eavesdropping on the line between a keyboard and a computer is a major information security hazard, and can be done for example with devices called keyloggers. Therefore it can be expected that any suggestions about connecting additional devices inline between a keyboard and the computer device would be met with significant reservations. However, a pointing device is used to produce bit strings that represent movement, relative location, on-off switching (like clicks on the mouse buttons) and/or other kind of manipulation of switching elements. There are much fewer aspects of confidentiality involved with the communications between pointing devices and the computers with which they are used. Therefore a device 105 connected inline between the computer device 101 and the pointing device 102 is not inherently suspicious even in the eyes of experts on information security, let alone normal users.

[0016] A pointing device 102 is a ubiquitous part of the man-machine interface in a vast majority of environments where controllable building automation (like controllable lighting) can be used. Even users who otherwise sit absolutely still are likely to move and/or click the mouse relatively frequently. Therefore a signal to the building automation system, triggered by the mere fact that the mouse or other pointing device was used (without even having to know the actual way in which it was used), is a very reliable indicator that someone is there and needs lighting and/or other services that the building automation system can provide. Such signals can be used to replace or augment the flow of indications that the building automation system receives from PIR sensors, light sensors, carbon dioxide sensors, and other detection devices so that as a result the building automation system can make very reliable deductions about the current needs of the users.

[0017] Fig. 2 is a schematic block diagram of certain functional blocks according to an embodiment of the invention. A device 105 is provided for transmitting control signals to a node of a building automation network. The device comprises a connector 201 for connecting to a port 202 of a computer device 101. In fig. 2 it is assumed that the port 202 is of a kind that offers both a data connection and a power connection. An example of a port of this kind is the known USB port, in which case the connector 201 of the device 105 may be a USB connector. In general the port 202 is assumed to be one to which the manufacturer of the computer 101 would instruct the user to connect a pointing device, so it may be a so-called

mouse port of the computer 101.

[0018] The device 105 comprises a signal input 203 for receiving use signals from a pointing device. In the embodiment of fig. 2 the device 105 comprises a receptacle 204 conforming to a mouse port standard (such as a general communications port standard like USB, or a more specific mouse port standard like ADB, PS/2, or the like) of computers, so the signal input 203 consists of the data line or data lines coupled to the receptacle 204. Use signals are signals that a mouse or other pointing device will produce as a response to the user using it, for example by moving the mouse, clicking its switches, and/or rolling the scroll wheel; moving the pointer stick or finger across a digitizing pad; tilting a joystick; or otherwise. The use signals may involve changes in analog voltages and/or currents, and/or digitally transmitted bit values, bytes, or frames. Use signals may comprise also signals transmitted by the computer 101 towards the pointing device, but since signals coming from the pointing device are a more reliable indicator of a user actually being present, it is preferable to use them to trigger control signals to the building automation network.

[0019] The device 105 comprises also a signal output 205 for forwarding the use signals to the connector 201. The signal output 205 may be as simple as the other end(s) of one or more wires or conductive tracks that connect contact springs in the receptacle 204 to respective contact surfaces in the connector 201. Alternatively or additionally the signal output 205 may involve more elaborate signal transmitting arrangements such as optoisolators, signal amplifiers, filters, or the like. The device 105 is configured to forward use signals received at the signal input 203 transparently to the signal output 205 and further to the connector 201. If the mouse port standard (or more general communications port standard) mentioned above requires the existence of a power output, one or more power wires may also connect the respective parts of the connector 201 and the receptacle 204. As illustrated schematically in fig. 2, instead of connecting a connector 103 of a mouse or other pointing device to the port 202 of the computer 101, the user may connect the connector 201 of the device 105 to said port 202 and then plug the connector 103 of the mouse or other pointing device to the receptacle 204, after which the user can use the mouse or other pointing device completely normally to produce inputs to the computer 101 as if there was no device 105 in between.

[0020] The device 105 comprises a controller 206 and a wireless transmitter 207. A signals pickup block 208 allows the controller 206 to notice when use signals are received from a pointing device. The controller 206 is configured to make the wireless transmitter 207 transmit control signals to a node of a building automation network in response to use signals received at the signal input 203. The exact relation between received use signals and transmitted control signals can be arranged in a variety of ways, taking into account factors like required resolution on the time axis: if the building automation network does not make any presence-related decisions about dimming the lights, slowing down the air conditioning, etc. more frequently than e.g. once in five minutes, the controller 206 does not need to make the wireless transmitter transmit control signals much more frequently even if it detected use signals of the pointing device every second.

[0021] The device 105 may have its own internal power source like a rechargeable or exchangeable battery, or it may receive its operating power from the computer it is connected to. Particularly convenient is if the port 202 of the computer 101 includes a power output, like e.g. the USB ports of computers usually do. In order to maintain the compatibility and usability of the receptacle 204 as the "replacement" for the port 202 for connecting the mouse connector 103, the device should include the power line(s) between the connector 201 and the receptacle 204. This power line or these power lines may also serve as the source of operating power for the device 105. In the embodiment of fig. 2 a power distribution block 209 within the device 105 is responsible for making a connection to the power line and producing the operating voltage(s) for the functional blocks within the device 105.

[0022] Local wireless connections are a popular alternative for wired connections between a pointing device and the computer that it is controlled with. Using e.g. a wireless mouse instead of a wired one does not necessarily require any changes to the embodiment of fig. 2, because a typical wireless mouse connection involves a small transceiver that the user plugs to the USB port of the computer just like the male USB connector at the end of the wire of a wired mouse. Such a small transceiver can quite as well be plugged to the receptacle 204 of the device 105, after which the detection of use signals and resulting transmissions of control signals to the node of a building automation network can proceed in the same way as has been described above in the case of a wired connection to the pointing device.

[0023] Fig. 3 illustrates an alternative embodiment in which the device 105 comprises a wireless receiver 301 that is configured to receive signals according to a wireless mouse standard. In the embodiment of fig. 3 the wireless receiver 301 may be actually a wireless transceiver that constitutes the other end of the connection to a wireless pointing device. In other words the device 105 shown in fig. 3 may completely replace the small transceiver that would otherwise be plugged to the USB port (or other communications port) 202 of the computer 201. The device could include a signals pickup block coupled to the data line between the wireless transceiver and the connector, which signals pickup block would then inform the controller of detected use signals. However, fig. 3 shows also features of an alternative embodiment, in which the wireless receiver 301 may be just passively monitoring the wireless communications that take part between a wireless pointing device 302 and a transceiver somewhere else within the computer 101. In such a case the wireless receiver 301 would act as the signals pickup

block and inform the controller of use signals that the wireless receiver 301 found propagating between the wireless pointing device 302 and the computer 101.

[0024] Irrespective of the way in which the controller in the device 105 becomes aware of use signals indicating that the user is using the pointing device, the embodiments of the invention may be augmented with features based on analyzing the use signals. For example in the embodiment of fig. 2 the signals pickup block 208 may convey to the controller 206 all use signals it detects at the signal input 203. The controller 206 may be configured to analyse the use signals received at the signal input 203 in order to find use signals of a particular kind. Such an arrangement gives the user the possibility of using the mouse or other pointing device to control some operations of the building automation network without requiring the installation of any new control software to the user's computer.

[0025] As an example we may consider a mouse with two buttons as a pointing device, and as a node of a building automation network a luminaire that can be dimmed up or down and the colour temperature of which can be changed (a so-called tunable white luminaire). The user is told that a long press on the left mouse button gives a dimming command and a long press on the right mouse button gives a command to change the colour temperature. Whenever the user keeps the left mouse button pressed, a corresponding use signal goes to the computer through the mouse connection. Irrespective of whether such a use signal causes any reaction at the computer or not the signals pickup block 208 notifies the controller 206 of the use signal. The controller analyzes the use signal and notices that it corresponds to a long press on the left mouse button. As a response the controller 206 makes the wireless transmitter 207 transmit a control signal that tells the luminaire to dim its light up or down. Similarly whenever the user keeps the right mouse button pressed, eventually a command goes to the luminaire to change its colour temperature. In general this kind of operation may be characterised so that the controller 206 is configured to respond to received use signals of a particular kind by making the wireless transmitter 207 transmit different control signals in response to different kinds of use signals received at the signal input 203. Such different control signals may contain orders to change at least one of: intensity of light, colour of light, colour temperature of light.

[0026] If the controller 206 has the ability to transmit different control signals in response to different kinds of use signals received at the signal input, even more complicated control functions can be implemented. As an example the user may want to set up a passcode so that unauthorized persons cannot control the lighting. Setting the passcode may be initiated with a particular sequence of use signals, like long press on the right mouse button, short press on the left, and another long press on the right. This may trigger the transmission of a "set passcode" control signal, which the luminaire may acknowledge visually, e.g. by flashing the light once. Then the user may set the passcode by clicking on the mouse: for example five short clicks on the mouse buttons in the order right-left-right-right-left. The controller 206 may make the wireless transmitter 207 send to the luminaire a message revealing the form of the set passcode. Each time after this (or e.g. each day, or once per each session when the wireless transmitter 207 is within the communications range of the luminaire) when a user wants to control the luminaire the same passcode must be given first, otherwise the luminaire refuses to react.

[0027] Fig. 4 illustrates some further developments that can be used to augment or variate any of the embodiments of the invention. The concept of using the device 105 to trigger the displaying of user interface elements through the host computer is discussed first.

[0028] Although one of the advantages of the invention is that it does not require installing any additional software to the user's computer, the invention does not exclude such installing. As such it is well known that coupling an external device to a communications port (such as a USB port) of a computer may automatically trigger installing and executing one or more pieces of software that give the user an easy access to functionalities in which the external device takes part. The part of the device 105 that was previously defined as being coupled to the connector 201 was called the signal output 205. A device according to an embodiment of the invention may comprise, coupled to the signal output 205, a branch of a communications bus so that it can take part in communications on a bus that runs through the port 202 in the computer 101. In fig. 4 the branch of the communications bus is schematically shown as the bus interface block 401 that is coupled to the data line between the signal input 203 and the signal output 205. The bus interface block 401 may simultaneously take the role of the signals pickup block that was described earlier with reference to fig. 2.

[0029] The device 105 comprises, coupled to the branch of the communications bus, a memory 402 containing stored information for displaying indications of the operation of the building automation system through a computer when the device is connected to one. In the embodiment of fig. 4 the memory 402 is shown as being contained in the controller 206, but it can be also partly or completely external to the controller. The idea is that when the device 105 is plugged into the port 202 of the computer 101, the computer 101 may use information read from the memory 402 through the communications bus to display e.g. a window that comprises mouse-clickable control buttons and instructions, like "click here to brighten the light above you" or "drag this slider to change the colour temperature". Actions that the user then makes with the mouse on the display are detected in the computer just like any other mouse clicks, and corresponding information indicative of said actions is conveyed through the communications bus to the controller 206 in the device 105. The controller 206 makes the wireless trans-

mitter 207 transmit control signals to the nearest luminaire in order to implement the changes in lighting that the user selected on the display.

[0030] Another further development in fig. 4 is the inclusion of user-actuatable input means also in the device 105 itself. As examples of user-actuatable input means fig. 4 illustrates two pushbuttons 403 and 404 and the corresponding readout circuitry 405 that is used to detect user inputs, i.e. presses on the pushbuttons 403 and 404. The controller 206 is configured to respond to detected actuation of the user-actuatable input means 403 and 404 by making the wireless transmitter 207 transmit control signals to the nearby node of the building automation network. If the node is or comprises a controllable luminaire, the control signals may contain orders to change the intensity, colour, and/or colour temperature of light. The outer surface of the device 105 may comprise visible instructions like words and/or graphical symbols that tell the user, what kind of control commands can be given with the pushbuttons 403 and 404. One example is to use one of the pushbuttons to dim the intensity of light up or down and to use the other to change the colour temperature of the light.

[0031] Fig. 5 illustrates schematically a method and a computer program that the controller may execute in a device according to an embodiment of the invention. The method of fig. 5 includes the functions of detecting "basic" use signals of a pointing device and sending "dummy" control signals accordingly, and detecting special use signals like long presses and sending special control signals accordingly. Here a "dummy" control signal means one that only indicates that the presence of a user was detected, while a special control signal may be e.g. a command to change the intensity or colour temperature of the light.

[0032] As long as the controller does not detect any use signals it remains at step 501 in fig. 5. In this embodiment of the method a timer is used to prevent the transmission of control signals arbitrarily often, so detecting one or more use signals at step 501 causes a transition to step 502 where the timer is checked for expiry. If the timer has expired, the method proceeds to transmitting a ("dummy") control signal at step 503, after which the timer is started at step 504. Step 505 contains a check whether the use signal was actually a special use signal, and if it was, a special control signal is transmitted at step 506. If the timer was found to be still running at step 502, a transition directly to step 505 occurs. A negative finding at step 505 or the execution of step 506 result in a transition to the initial step 501.

[0033] Variations and modifications are possible to the detailed embodiments of the invention described above without departing from the scope of protection defined in the appended claims. For example, the device according to an embodiment of the invention may comprise a pairing functionality that allows pairing it with a particular node of the building automation system, so that the presence of a user is indicated to that node in particular and not necessarily to other nodes that would be close enough to receive the wirelessly transmitted control signals. Such a pairing functionality may work in any known way, like bringing the device very close to the appropriate node when it is first started or any time during operation, so that a convincingly strongest wireless connection forms between just these two devices and triggers the pairing. Another possible variation is to allow the device to listen to the wireless transmissions of other similar devices nearby, so that if another device has very recently transmitted a control signal, the device will not transmit another control signal only a very short time thereafter.

Claims

1. A device for transmitting control signals to a node of a building automation network, the device comprising:

   - a connector for connecting to a port of a computer device,
   - a signal input for receiving use signals from a pointing device,
   - a signal output for forwarding said use signals to said connector,
   - a controller, and
   - a wireless transmitter;

   wherein the device is configured to forward use signals received at said signal input transparently to said signal output, and said controller is configured to make said wireless transmitter transmit said control signals in response to use signals received at said signal input.

2. A device according to claim 1, wherein said connector fits into a mouse port of a computer.

3. A device according to claim 1 or 2, wherein said connector is a Universal Serial Bus connector.

4. A device according to any of the preceding claims, wherein:

   - the device comprises a receptacle conforming to a mouse port standard of computers, and
   - said signal input consists of one or more data lines coupled to said receptacle.

5. A device according to any of the preceding claims, wherein

   - the device comprises a wireless receiver configured to receive signals according to a wireless mouse standard, and
   - said signal input is coupled to said wireless receiver.

6. A device according to any of the preceding claims, wherein:

- said controller is configured to analyse said use signals received at said signal input, and
- said controller is configured to make said wireless transmitter transmit different control signals in response to different kinds of use signals received at said signal input.

7. A device according to claim 6, wherein:

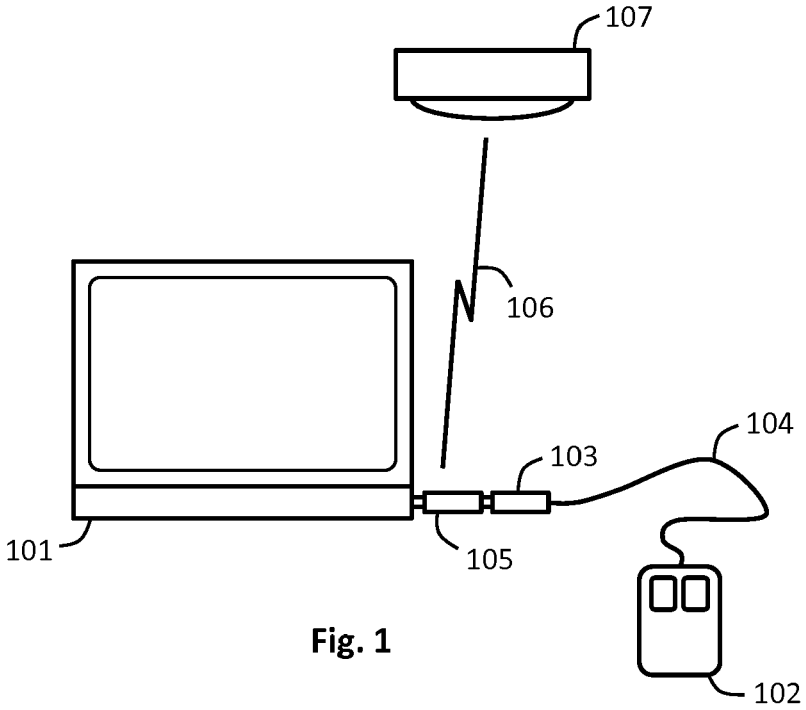
- said controller is configured to respond to received use signals of a particular kind by making said wireless transmitter transmit control signals containing orders to change at least one of: intensity of light, colour of light, colour temperature of light.

8. A device according to any of the preceding claims, wherein:

- the device comprises, coupled to said signal output, a branch of a communications bus, and
- the device comprises, coupled to said branch of the communications bus, a memory containing stored information for displaying indications of the operation of the building automation system through a computer when the device is connected to one.

9. A device according to any of the preceding claims, wherein:

- the device comprises user-actuatable input means, and
- said controller is configured to respond to detected actuation of said user-actuatable input means by making said wireless transmitter transmit control signals containing orders to change at least one of: intensity of light, colour of light, colour temperature of light.


107
106
104
103
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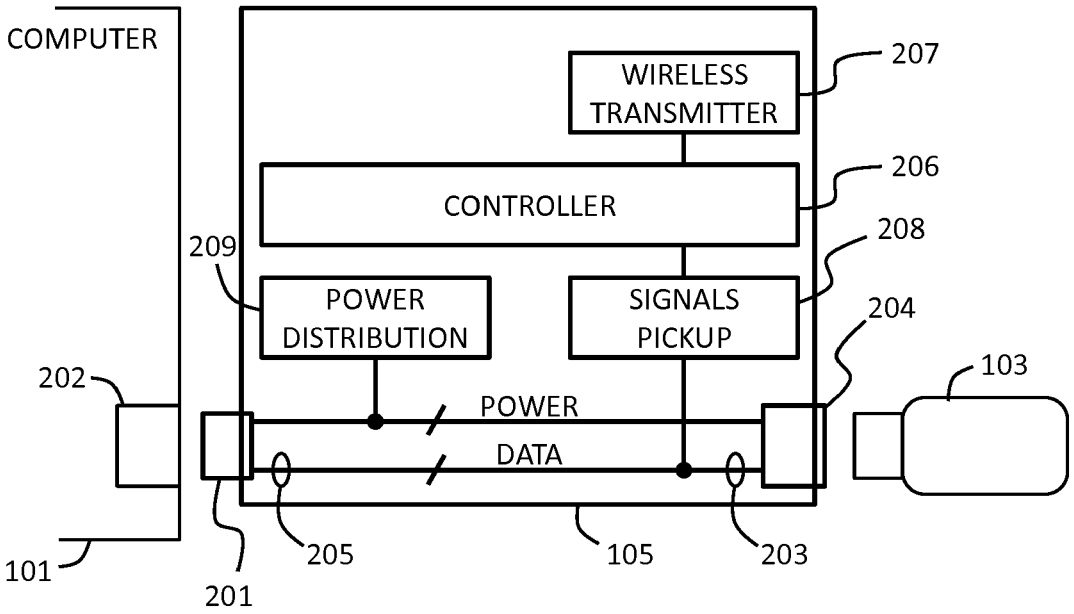
105
102

Fig. 1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CONTROLLER
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201
205
105
203

Fig. 2

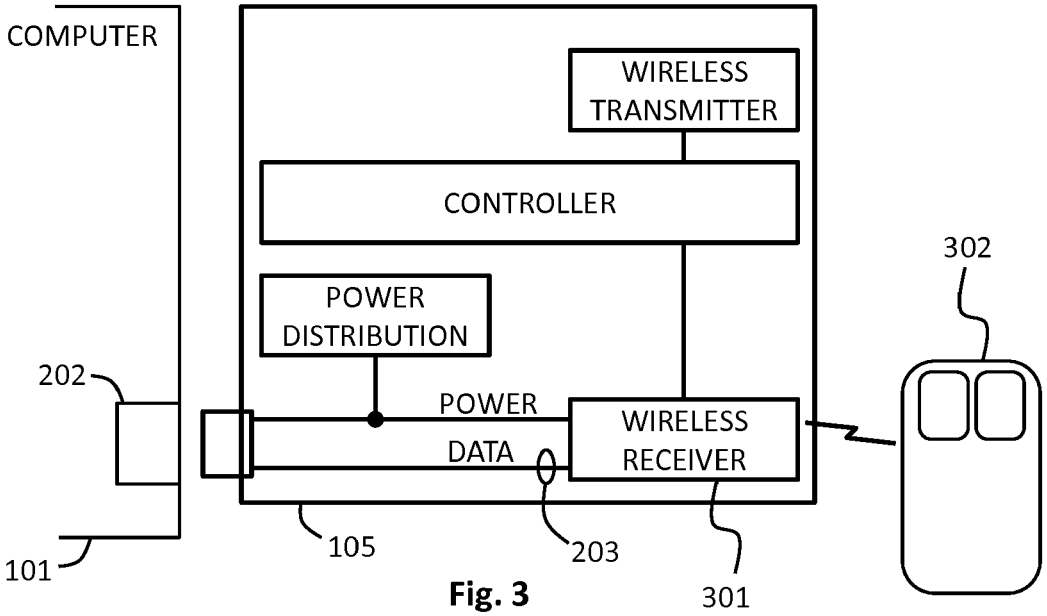
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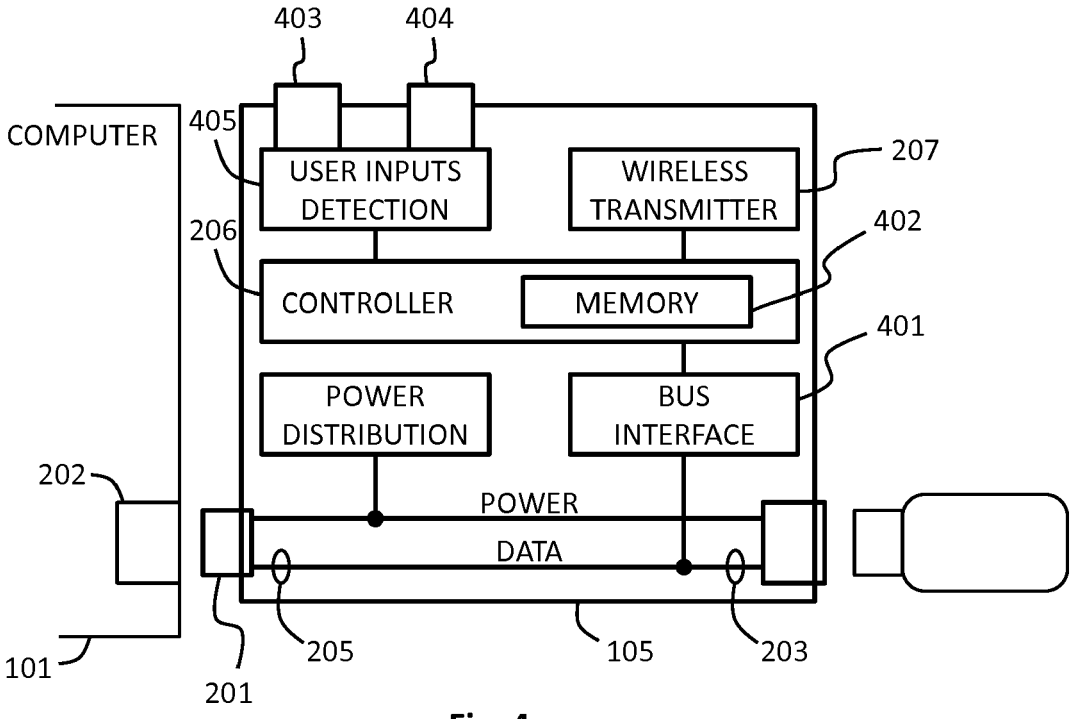
Fig. 3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207
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CONTROLLER
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BUS INTERFACE
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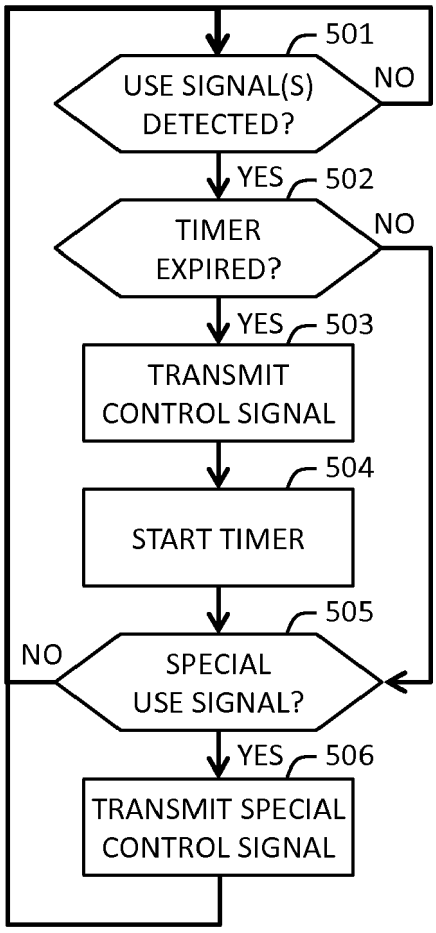
POWER
DATA
101
201
205
105
203

Fig. 4


501
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YES
502
TIMER EXPIRED?
NO
YES
503
TRANSMIT CONTROL SIGNAL
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START TIMER
505
NO
SPECIAL USE SIGNAL?
YES
506
TRANSMIT SPECIAL CONTROL SIGNAL

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 17 15 9313

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2007/036886 A2 (KONINKL PHILIPS ELECTRONICS NV [NL]; WANG LING [US]; CROUSE KENT [US];) 5 April 2007 (2007-04-05) * sentence 1 - sentence 10; figure 9 * * page 2, line 15 - line 21 * * page 11, line 6 - line 16 * -----	1-9	INV. H05B37/02
X	US 6 725 302 B1 (BENAYOUN ALAIN [FR] ET AL) 20 April 2004 (2004-04-20) * column 4, line 34 - line 64; figure 4 * -----	1-9	

TECHNICAL FIELDS SEARCHED (IPC)

H05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 October 2017	Garavini, Elisa

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 15 9313

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05-10-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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