

SENSORS AND ALARMS FOR MULTI-SERVICE MANAGEMENT OF A BUILDING AND OF EQUIPMENT FOR THE OCCUPANTS THEREOF

DESCRIPTION

5 **Technical field**

[01] The present invention relates to the field of alarms and sensors for facility management of a building and of equipment installed for the use of the occupants.

State of the art

10 [02] Facility management of a building comprises all the services necessary to the normal operation of an enterprise, outside of its core business and the management of human resources and financial services. Examples that can be cited include management of technical rooms, fire systems, safety, access rights, energy systems (electricity, cold, heating),
15 mail management, procurement, building servicing, green spaces, etc.

[03] The technical management of power and associated equipment (heating, air-conditioning, etc.), and safety management, traditionally comprises one or more systems consisting of a set of sensors and actuators distributed in the building and, in some cases, linked to a central
20 station.

[04] These systems make it possible in particular to measure, even control, the temperature, the flow rate and the quality of the air, etc., in different zones of the building.

[05] However, because of the size of the zones covered (for example, a
25 measurement of the CO₂ level in the central duct, a measurement of the temperature per deck, etc.) and the limited number of quantities measured, the sensors (and the actuators, if appropriate), allow for neither a knowledge nor a fine management of the comfort of the occupants.

[06] One solution would be to multiply the number of sensors by placing
30 them in each room. However, sensors have a relatively high cost and the systems currently deployed present great difficulties in terms of deployment (pulling cables), in the course of the life of the building

(reorganization of partitions, etc.) as well as during maintenance. In addition, they have a fairly short service life, of the order of 1 or 2 years for wireless systems. It is therefore currently economically unrealistic to multiply them.

5 [07] Moreover, when an occupant of such a building wants to signal an anomaly generating discomfort, he or she must either phone the central station, or send it an email, or fill out a form on a dedicated website.

[08] For efficiency reasons, the interventions of the professionals responsible for reestablishing the comfort of occupants are often organized
10 in such a way as to prioritize the interventions that are most critical and/or so as to optimize their routes.

[09] Thus, it is important for the user signaling an anomaly to also accurately identify the place of the anomaly to allow an effective intervention. Furthermore, all data assisting the professional in diagnosing
15 the criticality of the problem and in anticipating what will be needed to reestablish comfort (tools, skills, etc.) are becoming increasingly important.

[10] Regarding anomalies of lesser importance (neon lamp malfunction, ventilation problem in a room, coffee machine out of service, etc.), it seems that the users often do not signal them because the methods for doing so
20 are too complicated, or too tedious: go to a website whose address has to be remembered, login with a password, describe the place of the anomaly, etc.

[11] It would therefore be desirable to have a system for managing anomalies in a building which is easy to implement, with moderate cost,
25 easy to use for the occupants of this building, and which contextualizes the anomalies signaled to allow more effective interventions.

Description of the invention

[12] To resolve one or more of the drawbacks cited previously, a device for facility management of a building and of equipment installed for the use
30 of the occupants comprises:

- sensors for physical and/or chemical and/or biological measurements of the environment of the occupants, in particular of temperature, relative humidity or carbon dioxide level;
- a first emitter adapted to transmit the measurements collected by the sensors to a server.

[13] It further comprises an alarm that can be triggered by a user connected to a second emitter so as to transmit an alarm signal to the server and it further comprises a support containing an identifier of the device that can be read by a mobile terminal such that the server can associate the measurements collected by the sensors and/or the alarm signal with information from the mobile terminal.

[14] Features and particular embodiments that can be used alone or in combination are:

- the support further comprises a URL address, said URL address comprising the identifier, to allow a user of said mobile terminal to transmit information on the alarm to said server;
- the identifier comprises an identification of the place of installation of the device;
- the identifier is contained in a memory linked to a third emitter adapted to transmit the identifier by a wireless link to the mobile terminal; and/or
- the first emitter and the second emitter are combined in a single emitter;
- it comprises a closed housing containing an electronic circuit board powered by a standalone electrical power supply, the electronic circuit board containing:
 - a light diode from which the emission of light can be seen from the outside of the housing;
 - a temperature, relative humidity and pressure sensor;
 - a brightness sensor;
 - electrical connectors to a CO₂ sensor; and
 - an emitting antenna,

- and the housing is provided on its front face
 - with a pushbutton which allows an alarm to be triggered, the button being linked to the connectors of the electronic circuit board;
- 5 • a contactless tag;
- a server URL address and a printed number identifying the device; and
- the device further comprises a standalone energy source.

10 [15] Thus, advantageously, the association of an identifier with the device, and of an URL, if appropriate, makes it possible to manage information linked to the device in an application, a website or any software that can be run by a computer or a mobile terminal.

15 [16] An identifier of the device can be displayed on the device itself or on an associated support, or even the device can comprise a second emitter adapted to be connected wirelessly to a mobile terminal in proximity such as a smartphone, to transmit to the mobile terminal an identifier and/or a URL containing this identifier and, for example, an executable command to open a browser directed to the URL concerned.

20 [17] Thus, if he or she wishes, the user can advantageously access all or some of the information associated with the device, and for example check whether an alarm concerning the problem that he or she wants to signal has already been transmitted, and/or transmit information making it possible to qualify an alarm, by being automatically directed to the right form and with a list of information already known to the system if
25 appropriate.

[18] Thus, the device advantageously creates a link between a physical object and a virtual interface; and an original tripartite relationship between the occupant of the office, his or her employer - often the agent of the manager of the building - and the manager of the building.

30 [19] This device also advantageously allows the creation and regular enrichment of new sources of data concerning the comfort of the occupants intended for the professional responsible for ensuring the same.

It is also a means for restoring all or some of this information to the occupants and/or to the agent, or any other interested party, in a way that is ergonomical and simple to use.

5 [20] In a second aspect of the invention, a system for facility management of a building and of equipment installed for the use of the occupants comprises:

- a plurality of devices as above;
- a server linked to the plurality of devices to receive measurements from the sensors and/or alarms from the plurality of devices.

10 [21] The facility management system further comprises, on the server, means for acquiring information from mobile terminals and means for associating such information with the measurements from the sensors and/or the alarms, said information being associated with the identifier of a determined device.

15 [22] In a particular embodiment, it further comprises a plurality of supports, each support comprising an identifier similar to the identifiers of the above devices.

[23] In a third aspect of the invention, a method for technical management of a building and of equipment installed for the use of the occupants, in
20 which there is installed at least one device as above with which an alarm is triggered, comprises:

- connecting a mobile terminal to the device to receive the identifier of said device;
- obtaining an address of a server;
- 25 • transmitting, to the address of the server, a message constructed by using the human-machine interface of the mobile terminal, the message comprising the identifier of the device.

[24] In a fourth aspect of the invention, a computer program product that can be downloaded from a communication network and/or stored on a
30 computer-readable medium and/or that can be executed by a processor, comprises program code instructions for implementing the above method.

Brief description of the figures

[25] The invention will be better understood on reading the following description, given purely as an example, and with reference to the attached figures, in which:

- 5 – figure 1 represents a generic diagram of the different components of an embodiment of the invention; and
- figure 2 is a flow diagram of a method implementing the embodiment of figure 1.

Embodiments

- 10 [26] Referring to figure 1, a room of a building comprises a device 1.
- [27] The device 1 is linked by a link 3 to a server 5.
- [28] The link 3 can be a wired link or comprise, at least partly, a wireless link, preferably of low consumption.
- [29] Depending on the features sought, and in particular on the configuration of the building, it will be understood that, for example, the device 1 can be linked by a short distance wireless link to a hub (not represented). For example, the wireless link is a link of the "low power wide area" type like SigFox, LoRa, etc. This hub provides wireless links with several devices and serves as intermediary to the server 5. For example,
- 15 the hub can be connected by a wired ethernet link to the server 5.
- [30] The device 1 comprises sensors 9 for physical and/or chemical and/or biological measurements of the environment of the occupants, for example temperature, relative humidity and CO₂.
- [31] The device 1 comprises an emitter 7 adapted to send, via the link 3, information regularly and/or upon detection of an event. If the link is a wireless link, the emitter comprises an antenna (not represented).
- 20 [32] The measurements generated by the sensors 9 are sent to the server 5 by the emitter 7.
- [33] The device 1 also comprises a triggerable alarm 10 allowing a user to trigger an alarm signal transmitted by the device 1 to the server 5 by the emitter 7, or by a second emitter (not represented).
- 30

[34] The device 1 further comprises a support containing an identifier that can be read by the user or via a second (or third) emitter 11, a mobile terminal 13. This emitter 11 can be of passive or active type. For example, a URL comprising an identifier is contained in a barcode tag, a QR-code, an RFID tag, an NFC tag, a beacon or any other element allowing an automatic recognition by the mobile terminal 13, such as a mobile phone.

[35] The device 1 further comprises a standalone energy source allowing it to dispense with any connection to an electrical network. This standalone energy source is for example a battery, a supercapacitor, a mechanical energy harvester or photovoltaic cells.

[36] The mobile phone 13 comprises at least one software application allowing dialogue with the emitter, and allowing a data link with a server. This software application is for example a browser or a specific application. This software application is installed in the mobile terminal according to the usual methods well known to the person skilled in the art.

[37] The mode of operation is then as follows (figure 2).

[38] In normal operation, the device 1 is installed in a room. The device sends (step 21) the information from the sensors regularly to the server 5. There is a mapping table in the server between the device 1, and more specifically its identifier, and the position of the device, such that the information from the sensors is associated with a given location or room.

[39] Software, installed on the server 5 or on another server (not represented) connected to the server 5, can collect, clean and analyze these data to restore them, in their raw form or in an enriched form (indicator computations, graphic presentation, sending of alerts if thresholds are exceeded, intersections with other information, etc.), in order in particular to assist the personnel handling the facility management of the building.

[40] Thus, bearing in mind that control by building facility management is generally zone-based, the information uploaded by the sensors will not make it possible to finely regulate per room, but rather to detect zones with malfunctions. Thus, the possible actions are tasks and not necessarily an

action to correct one-off problems. Another action may consist simply in having data to present to the client to prove, for example, that the contractual set point temperature has indeed been delivered but that occupants are not satisfied with the associated comfort.

5 [41] When a user wants to signal an incident (for example, neon lamp failed, water leak, excessively high sound level, etc.), he or she can trigger an alarm via the device (step 23) for example by pressing on a button 10. This alarm is sent to the server 5. Like the data from the sensors, the server 5 is capable of associating the alarm received with a given device and therefore with a predetermined location.

[42] The user identifies (step 25), the device. For example, the user uses the camera of his or her telephone to scan the barcode or her or she uses the NFC link to dialogue with the RFID tag.

15 [43] The dedicated software (or a web browser connected to software on the server) presents (step 27) a form on the interface of the mobile phone to the user. The latter completes (step 29) the form by giving details on the anomaly. Then the dedicated software sends (step 31) the information collected “sur” the server 5 accompanied by the identifier of the device.

20 [44] By using its association table, the server 5 associates (step 33) the room with the description of the incident received from the phone and with the alarm, which allows an effective intervention to resolve the incident, and avoids the user having to give the place of the incident.

25 [45] The server 5 thus makes it possible to monitor incidents in progress and in real time, to have indicators, with a suitable level of detail and based on the number of devices installed, of the temperature, of the relative humidity and of the CO₂ in the building. That advantageously allows for a saving because if the rooms, or the zone, are overheated or excessively air-conditioned in relation to the set point the devices will signal it and it will be possible to adjust the temperature and therefore the energy paid for
30 based on accurate real data.

[46] In a first variant, the identifier can contain a URL (Uniform Reference Locator) address of the server 5 thus allowing the dedicated software to be

parametrized to present the form and to send the data. It may also contain a reference to the room in which the device is placed, which makes it possible to avoid having an association table on the server 5.

[47] By deploying the device 1 throughout a building, it is thus possible to have a data uploading infrastructure in the building and "local" interactions with each occupant of the building.

[48] Additionally, and for certain rooms where there is no need for the data collected by the sensors, the device can be replaced by a support containing the identifier, for example a barcode label glued to the wall. This label is used by the dedicated software according to the same modalities as the identifier of the device 1, except that no alarm is uploaded directly by the label, unlike the device 1 when the button 10 is pressed. That has the advantage of allowing for a tighter meshing of the building at lesser cost.

[49] In a second variant, the input form is presented to the user with fields previously filled out with incidents already signaled by other users at the same place, allowing him or her to not have to fill out the form again but simply to make an "n+1th" iteration on the incident already signaled. Furthermore, by analyzing the requests already stored concerning this place, the system will be able to propose a presentation to the user adapted to the real situation of the incident to be signaled, and to do so predictively with contextualized popup menus.

[50] The invention has been illustrated and described in detail with drawings and the preceding description. The latter should be considered to be illustrative and given by way of example and not as limiting the invention to this single description. Many variants are possible, for example, the form of the device, its appearance, its functions, in particular the sensors that it has, can vary according to the destination, the room, the specific equipment item concerned and the need of the occupants.

[51] Moreover, the server 5 of the example can correspond to several physical or virtual servers. For example, a first server receives the

information from the sensors of the devices 1 and a second server, of web server type, receives the anomaly uploads via the mobile phones.

[52] In a particular embodiment, the device consists of a closed parallelepipedal housing measuring approximately 2 x 5 x 5 cm provided with a cooling vent and which contains an electronic circuit board powered by a 3.6 V cell, the electronic circuit board containing:

- a light diode whose light emission is visible from the outside of the housing,
- a temperature, relative humidity and pressure sensor,
- a brightness sensor,
- electrical connectors to a CO₂ sensor and a pushbutton incorporated in the top part of the housing,
- an emitting antenna.

The housing is provided on its front face with a pushbutton which makes it possible to trigger an alarm as described above in this text, the button being linked to the connectors of the electronic circuit board. On this same front face there is glued, on the inside, an NFC (Near Field Connection) label and, on the outside, there are a URL address of the server and a number identifying the device, which also makes it possible to connect with a fixed terminal or a mobile terminal that does not have an NFC link or camera. It is also provided on its rear face with an all-support fixing adhesive (walls, ceilings, desks, coffee machines, partitions, drinks machines, etc.), in order to be installed there rapidly and immediately. The components of the device and their mode of operation are chosen such that the life (battery included) is up to 5 to 10 years without any human intervention.

[53] In the claims, the word "comprising" does not exclude other elements and the indefinite article "a/an" does not exclude a plurality.

CLAIMS

1. A device for facility management of a building and of equipment installed for the use of the occupants comprising:
 - 5 • sensors (9) for physical and/or chemical and/or biological measurements of the environment of the occupants, in particular of temperature, of relative humidity or of carbon dioxide level;
 - a first emitter (7) adapted to transmit the measurements collected by the sensors to a server;
- 10 characterized in that it further comprises an alarm (10) that can be triggered by a user connected to a second emitter so as to transmit an alarm signal to the server and it further comprises a support containing an identifier of the device that can be read by a mobile terminal such that the server can associate the measurements collected by the
- 15 sensors and/or the alarm signal with information from the mobile terminal.
2. The device as claimed in claim 1, characterized in that the support further comprises a URL address, said URL address comprising the
- 20 identifier, to allow a user of said mobile terminal to transmit information on the alarm to said server via this URL address.
3. The device as claimed in claim 1 or 2, characterized in that the identifier comprises an identification of the place of installation of the device.
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4. The device as claimed in claim 1, 2 or 3, characterized in that the identifier is contained in a memory linked to a third emitter adapted to transmit the identifier by a wireless link to the mobile terminal.

5. The device as claimed in any one of the preceding claims, characterized in that the first emitter and the second emitter are combined in a single emitter.
6. The device as claimed in any one of the preceding claims,
5 characterized in that it comprises:
 - a closed housing containing an electronic circuit board powered by a standalone electrical power supply, the electronic circuit board containing:
 - a light diode from which the emission of light can be seen from the
10 outside of the housing;
 - a temperature, relative humidity and pressure sensor (9);
 - a brightness sensor;
 - electrical connectors to a CO₂ sensor; and
 - an emitting antenna (7),
15 and the housing is provided on its front face
 - with a pushbutton which allows an alarm to be triggered, the button being linked to the connectors of the electronic circuit board;
 - a contactless label; and
 - a server URL address and a printed number identifying the device.
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7. The device as claimed in any one of the preceding claims, characterized in that it further comprises a standalone energy source.
8. A system for facility management of a building and of equipment
25 installed for the use of the occupants comprising:
 - a plurality of devices (1) as claimed in any one of claims 1 to 6;
 - a server (5) linked to the plurality of devices to receive measurements from the sensors and/or alarms from the plurality of devices;

characterized in that it further comprises, on the server, means for acquiring information from mobile terminals and means for associating such information with the measurements from the sensors and/or the alarms, said information being associated with the identifier of a determined device.

9. The system as claimed in claim 8, characterized in that it further comprises a plurality of supports, each support comprising an identifier similar to the identifiers of the devices as claimed in one of claims 1 to 6.

10.A method for technical management of a building and of equipment installed for the use of the occupants, in which there is installed at least one device as claimed in one of claims 1 to 6 with which an alarm is triggered, characterized in that it comprises:

- connecting a mobile terminal to said device to receive the identifier of said device;
- obtaining an address of a server;
- transmitting, to the address of the server, a message constructed by using the human-machine interface of the mobile terminal, said message comprising the identifier of said device.

11.A computer program product that can be downloaded from a communication network and/or stored on a computer-readable medium and/or that can be executed by a processor, characterized in that it comprises program code instructions for implementing the method as claimed in claim 10.