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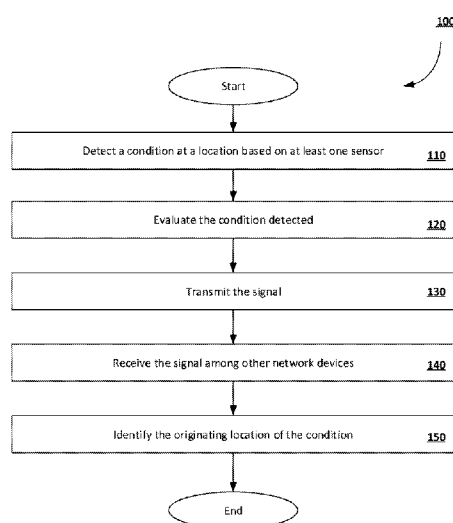


Figure 1

(57) Abstract: Certain embodiments of the disclosure can include methods, devices, and systems for locating an electronic signal sent in a large, enclosed space, including hotels and offices. The embodiments can include initiating a signal from a location within the large, enclosed structure triggered by, for example, atmospheric conditions or user input, among other triggering mechanisms. The signal can then be transmitted via low-energy, low-cost network devices placed efficiently throughout the building. Devices within the network read the message signal and efficiently continue its transmission through the network. When received by a display device, the message can be identified by its originating location and mapped against a layout of the building.

EMERGENCY BUTTON

DESCRIPTION

Cross Reference to Related Applications

[0001] The present application claims the benefit of US provisional patent application number 62/815,136 filed on 7 March 2019, the disclosure of which is incorporated in its entirety herein by reference.

Field of Invention

[0002] The present disclosure relates to electronic location tracking and communication.

Background

[0003] Presently, large enclosed structures pose many problems to communications within the structures. Transmitting a signal throughout a large, enclosed structure, and identifying the origin of that signal pose unique challenges as compared to an outdoor environment where various telecommunication methods (e.g. GPS, cellular communications, etc.) are available. Cellular communications are spotty at best and often nonexistent the deeper into the building a communications device is located. In some structures, such as hospitals, cellular communications are prohibited in certain parts of the hospital because of the interference that cellular devices can cause with some healthcare machine operation. Further, a cellular phone by itself is not easily accessible in a moment of emergency, and therefore an additional wearable panic button device is often required.

[0004] Wi-Fi networks have been tried to attempt to bridge these communication dark spots, but Wi-Fi technology has some problems of its own. For example, Wi-Fi devices are generally power-intensive and expensive to implement in very large structures. Most Wi-Fi devices receive energy from wall power outlets so that a power outage in a building would cease the Wi-Fi device operation. Some conventional systems require their devices to include a BLUETOOTH network adapter as well as a Wi-Fi or

cellular adapter for communications. This significantly increases the cost and energy requirements for the device. Finally, in current conventional systems, if there is a single point of failure—because of a dead spot, internet outage, or power outage, for example—that part of the network will fail, and will possibly take down the entire system. In these types of systems, there is no way to know which link has been broken without checking each one individually. A solution is needed that can span wide distances with many walls, floors, ceilings, and other obstacles, and which can operate with low-cost devices that can utilize independent power sources when necessary.

Summary of the Invention

[0005] Some or all of the above needs and/or problems may be addressed by certain embodiments of the disclosure. Certain embodiments can include methods, devices, and systems for location identification and tracking within a large, enclosed building. According to one embodiment of the disclosure, there is disclosed a method. The method can include detecting a condition at a location. The method can then evaluate that condition based on, for example, severity. The method can transmit an electronic signal from a first network adapter based on the evaluation. The method can also include receiving that signal from a second network adapter. And the method can include identifying the location of the origin of the signal, and the location of the condition.

[0006] According to another embodiment of the disclosure, there is disclosed a device. The device can include at least one sensor to detect a condition at a location within an enclosed building. The device can include at least one microprocessor to perform computer operations required or desired by the device and to carry out computer-readable instructions stored on at least one computer memory of the device. The computer instructions can include operability to evaluate the condition or conditions detected by the one or more sensors. The instructions can be further operable to transmit an electronic signal based on the evaluation. The computer-readable instructions can also be operable to receive the signal at a different endpoint of the device, and then forward the signal on, and can identify the location of the originating condition.

[0007] According to another embodiment of the disclosure, there is disclosed a system. The system can include a plurality of devices networked together to

communicate within an enclosed building. The system can also include at least one device capable of network communication outside the enclosed building. And the system can include a display screen or control center where the originating location of a signal, such as an emergency signal, can be displayed against a floor plan of the enclosed building, for example.

[0008] Other embodiments, devices, systems, methods, aspects, and features of the disclosure will become apparent to those skilled in the art from the following detailed description.

Brief Description of Drawings

[0009] The detailed description is set forth with reference to the accompanying drawings, which are not necessarily drawn to scale. The use of same reference numbers in different figures indicate similar or identical terms.

[0010] FIG. 1 is a flow diagram of an example method of signal transmission and location identification within an enclosed building, according to an embodiment of the disclosure.

[0011] FIG. 2 illustrates a block diagram representing a location tracking device, according to an embodiment of the disclosure.

Detailed Description of the Preferred Embodiments

[0012] In order that the present invention may be fully understood and readily put into practical effect, there shall now be described by way of non-limiting examples of preferred embodiments of the present invention, the description being with reference to the accompanying illustrative figures.

[0013] Certain embodiments herein relate to location identification and tracking within a large, enclosed building. Accordingly, a method can be provided to identify and track an electronic signal within an enclosed building. For example, Figure 1 is a flowchart illustrating a process 100 for location identification, according to various aspects of the present disclosure. The process 100 can begin at block 110. At block 110, process 100 can detect a condition at a location within a large, enclosed building. The building can be of any size, and among the largest buildings. For example, the building can be a large warehouse, office building, hospital, hotel, and government building. Some of these buildings often include

objects and structures which can serve as obstacles for computer network communication. Process 100 can serve to mitigate or avoid these obstacles to ensure network communication with minimal or no “dead spots.”

[0014] The type of condition detected can include an environmental condition, a pressure exerted by a person, or the passage of a time period. In some embodiments, the detection can be triggered by a person pressing a button on a mobile or wearable device. The sensor can detect the pressure exerted by the person and emit an alert signal. In some embodiments, the signal can include information about the device, the wearer, and the location. In other embodiments, the signal might not include any identifying information, and the device emitting the signal may focus its efforts on emitting as strong a signal as possible so that the emission can be detected as broadly as possible.

[0015] At block 120, process 100 can evaluate the condition that was detected. If the condition is pressure exerted by a person, then process 100 can determine if the pressure was exerted intentionally or accidentally. For example, if the pressure is detected to be exerted for a second or less, process 100 can determine this is an accidental pressure and that, therefore, no alert signal needs to be sent. In some embodiments, process 100 can respond to an accidental pressure with haptic feedback, such as vibration, light, or sound, to convey a message to the person, such as that the device is in proper working order. In other embodiments, process 100 can evaluate that the pressure exerted requires that an alert signal be sent, for example if the pressure exerted is detected to be for a longer duration, such as 3 to 4 seconds or more. In some embodiments, process 100 can additionally or alternatively include other sensors, such as environmental sensors. These environmental sensors can include sensitivity for the detection of excessive sound, such as to detect an explosion or gunshot; temperature, such as to detect fire or deviation from acceptable and comfortable conditions; humidity, such as to detect a water leak. Process 100 can evaluate a current reading of an environmental condition for appropriateness and make a determination whether an alert signal will be sent. When detecting the passage of a time period, process 100 can evaluate

how much time has passed since a previous transmission and, if appropriate, transmit another signal based on this period regularity.

[0016] At block 130, process 100 can transmit the signal to the network, including the location of the alert and the identity of the wearer, if any. Network nodes can also regularly report non-emergency messages such as their individual status including battery level, primary mesh network connection partner, and mesh cluster size. These types of information can be reported hourly if desired. Other types of information can be reported less often if desired, such as nearby nodes and information about all mesh connection partners. In some embodiments, this transmission can include a network adapter. Any network adapter fit for the purpose can be used, such as BLUETOOTH, Wi-Fi, and cellular technologies, and the like. In some embodiments, low-energy network devices are desirable to promote longer lasting components and devices within process 100. For example, BLUETOOTH low energy (BLE) technology can be utilized by process 100 to promote low cost components and low power usage of a system running process 100. In some embodiments, the initial signal emitted, by a triggering condition for example, might not include a network adapter. In these embodiments, a network device within range of the originating signal can be used to communicate an alert on the network. The alert device can transmit the originating signal to any device in range, and any receiving device can then retransmit the signal, along with additional information about the location for example, to other devices, so that the signal travels through the network. In some embodiments, each device can broadcast a signal so that all other devices can receive, process, and retransmit the signal as necessary. In other embodiments, in addition to broadcasting, the signal can be unicast or multicast, that is, sent only to specific devices of the network, rather than to all devices within communicative reach..

[0017] At block 140, process 100 can receive a signal sent based on an initiating condition. As is also true at block 130, the network communication received at block 140 can be of varying and multiple technologies and protocols.

[0018] At block 150, process 100 can identify the originating location of the condition. The signal received at block 140 can include message information about the condition, originating device, and location, among other things. In some embodiments, the signal might not include any identifying information, and the receiving step can rely on the strength and direction of the signal for identification.

[0019] In addition or in substitution to these named steps, process 100 can also include other steps. For example, process 100 can include deactivating an alert after the alert has been reviewed and resolved at an endpoint. The deactivation can be manual and it can be algorithmic based, for example, on an evaluation of the condition(s) that triggered the alert.

[0020] The operations described and shown in process 100 of Figure 1 can be carried out or performed in any suitable order as desired in various embodiments of the disclosure, and process 100 can repeat any number of times. Additionally, in certain embodiments, at least a portion of the operations can be carried out in parallel. Furthermore, in certain embodiments, fewer or more operations than described in Figure 1 can be performed.

[0021] Process 100 can optionally end after block 150.

[0022] According to another embodiment of the disclosure, there is provided a device. For example, device 200 can be provided for location identification and tracking. Device 200 can include computer and electronic hardware and software necessary or desirable for diverse and ad hoc network communication. Figure 2 depicts an example schematic diagram representing one embodiment for location identification and tracking. Device 200 can include an originating component 205 such as an emergency button, sensor, or wearable panic button. Component 205 can include its own power storage such as a rechargeable or replaceable battery, and can include a standard method of attachment such as a clasp or magnet. Component 205 can include at least one sensor capable of detecting one or more triggering conditions, at least some of which can be mobile sensors. In some embodiments, component 205 can include a sensor operable to detect a pressure exerted by a person in contact with the sensor. For example, component 205 can

detect a person pressing a button of component 205. In some embodiments, component 205 can detect one or more environmental conditions in proximity of its one or more sensors. For example, at least one sensor of component 205 can detect the humidity and/or ambient temperature around a sensor. Component 205 can also include a sensor to detect the noise level nearby. Component 205 can include a sensor to detect the passage of a time period, and to trigger every time that period expires.

[0023] Device 200 can include at least one network node 210 to communicate the condition internally along the network. Device 200 can include many nodes 210, and the nodes 210 can be of uniform or varying network technologies and protocols. As depicted in Figure 2, for example, alert device 205 and all nodes 210 (210-a, 210-b, 210-c, 210-d) can use BLUETOOTH technology, such as BLE. In some embodiments, device 205 can be BLE, some nodes 210 can be BLE, and other nodes 210 can use Wi-Fi. The network can be a mesh network, and can include ad hoc components and connections. Some nodes 210 can use wireless local area networking (WLAN) while other nodes, and other network components, can utilize wired components or other technologies. Nodes 210 can include independent power sources and can also share a power source with another node 210 or other device.

[0024] Device 200 can also include a gateway 215 to communicate outside the enclosed building network. In some embodiments, device 200 can include multiple gateways 215 and multiple access points. These additional components can be redundant for failover purposes, and the workload can be distributed among them. Gateway 215 can include multiple network adapters such as BLE to communicate with the internal network and Wi-Fi, cellular, or ethernet to communicate outside the enclosed building. In this way, low-cost and low-energy network components can compose the internal building network with only minimal higher-cost and higher-energy components utilized for external communication. Gateway 215 can then use one or more of its network adapters to communicate the alert initiated by component 205 to a third party such as a server 220. The third

party 220 can then display the alert and the map of the location, such as via a floor plan, on a computer monitor to be attended by a user, such as a human user monitoring emergencies. In some embodiments, server 220 can be an emergency contact designated for the alert.

[0025] Device 200 can handle multiple and many alert signals. In embodiments that include a display of the alert and the floor plan of the building, device 200 can also include updated positioning of the alert, if the alert has indeed changed locations. In some situations, if component 205 is being worn or handled by a person, that person may change locations within the building, and this updated location information is critical in resolving the alert. For example, if the person is in trouble, the updated location is necessary to direct emergency personnel to the alert. In other situations, such as when component 205 is attached to an object being sought for inventory, the updated location is necessary for finding the object in the unexpected location.

[0026] According to another embodiment of the disclosure, there is provided a system. For example, a system can be provided for detecting a condition in a large, enclosed building, communicating that condition within the difficult network environment of building with its walls, ceilings, floors, and many other obstructions, and then communicating the condition outside the building's confines for attention. The system can include an alert device that can be mobile and, in some embodiments, wearable. The alert device can be worn on a lapel, sleeve, pocket, or anywhere else it would be convenient and easy to trigger manually, even in an extreme emergency. When activated, an alert device can vibrate and/or illuminate its lights such as LEDs.

[0027] The system can include a plurality of network devices, or smart beacons, to transmit a signal sent from an originating device. It is not unusual for the system to include hundreds or thousands of internal network nodes. The originating signal can be an emergency signal sent by a person or otherwise triggered by a condition, such as an environmental condition within the building or a certain passage of time for that device. In large buildings, and in buildings with

many obstacles, such as hospitals and hotels, the system can include a multitude of network devices such that the strength of the signal will be certain to travel to its necessary endpoint. Smart beacons can be mounted within twenty-five feet (25 ft.) of another smart beacon or gateway. To mitigate the need for frequent changing or charging of the batteries for the many network devices, the system can include low-energy technology components, such as BLE communication. And to mitigate the cost of using a large number of network devices in large, complex environments, the system can include low-cost network components. The system's usage of low-cost components can also increase some redundancy in the network connectivity by including slightly more network components than absolutely required. In this way, the failure of a single network component would not mean the failure of the system as a whole, and this is a different outcome than if the network were sparsely populated with more expensive and fewer network components, which are still subject to a similar failure rate despite the increased cost.

[0028] The system can also include at least one external network device capable of communicating, not only with the network nodes internal to the building, but also capable of communicating with an outside computer network, such as the internet. In some embodiments, internal nodes such as smart beacons can send the signal to a gateway, and the gateway can send the signal via an access point to an endpoint location. An access point can also include a failover network adapter, such as an LTE, or cellular, connection. In the embodiment where the internal nodes use BLE, the external node can include both BLE and at least one other network adapter, such as Ethernet or cellular. And whereas the internal network nodes can be located virtually anywhere within a building, even a rigidly designed building, the at least one external network device must be in a location where communicative access to an external network is possible. At the same time, the external network device must still be in communicative reach with at least one of the internal network nodes. The external network device can then transmit the event, such as the emergency or alert, to a third party, such as an emergency contact or computer display. In some embodiments, the signal will be transmitted to a central processing

storage area of the system, or other appropriate storage for usage with a particular system. In some embodiments, the processing and storage of system-specific information can be in either or both of a cloud-computing location or on-site.

[0029] The system can include an endpoint, such as an alert console or computer screen, to display the location of the electronic signal sent by the alert device. In some embodiments, the alert console can include a tablet computer used on-site for displaying and managing the system. This can be displayed based on a floor plan, for example, and the system can display any other information contained in the signal in addition to the location of the originating alert. In some embodiments, the nature of the alert can also be contained in the message, such as the humidity, temperature, noise, and time sensor readings. In some embodiments, the alert device can be worn by a hotel employee, or in fact many hotel employees, and the system can track the wearers while they are on the work premises. The display screen can then show which employees are nearest to one location or another, in case that location is in need of attention. In some embodiments, the alert device can be worn by hospital staff, doctors, and nurses and the multitude of emergency signals and conditions that regularly occur in a hospital can all be displayed and tracked by the system. In some embodiments, the transmission of additional signals can be evaluated substantially synchronously with the receipt of the signals, such that the information displayed is substantially live tracking. In some embodiments, when an alert is triggered, the alert devices as well as other components can be operable to record sound and video. This sound and video can also be transmitted along the network to the endpoint, and can be stored at the device for later retrieval.

[0030] The system can include multiple and redundant sources of power. In some embodiments, the alert devices and the plurality of network nodes can be partially or completely reliant on battery power, and the batteries can be rechargeable or replaceable. The system can also include a charging station and instructions to have the alert devices returned after each staff shift, and charge the devices until pickup for the next shift. In some embodiments, the network nodes

can rely on a wired energy source. Similarly, the external network devices can be primarily powered by wired energy, but revert to batteries or uninterruptible power sources if there is a power outage. In this way, the system's reliability and uptime are increased.

[0031] In some embodiments, the system can include a map importation module in order to utilize a building's floor plan into the electronic system. For example, if the building's floor plan exists only on a sheet of paper, the system's importation module can convert that image, such as through electronic scanning, and then recognize the components of the electronically scanned into usable information which the system can use to disseminate locations. Additionally, the map importation module can also convert other formats of floor plans, such as spreadsheets, into information that can be used by the system's identification and display algorithms. In some embodiments, the layout of the networked nodes can be based on this imported floor plan, including with the aid of optical character recognition, a camera, and/or room number. Using this floor plan information, network nodes can then be associated in a database with a location in the building. In some embodiments, network nodes can be assigned unique identifiers, placed into rooms as needed, and then mapped and recognized by the system when it initializes.

[0032] As desired, embodiments of the disclosure may include devices and systems with more or fewer components than are illustrated in the drawings. For example, in some embodiments an alert device can send a signal directly to a gateway without first transmitting through the network nodes. Additionally, certain components of the devices and systems may be combined in various embodiments of the disclosure. The devices and systems described above are provided by way of example only.

[0033] The features of the present embodiments described herein may be implemented in digital electronic circuitry, and/or in computer hardware, firmware, software, and/or in combinations thereof. Features of the present embodiments may be implemented in a computer program product tangibly embodied in an

information carrier, such as a machine-readable storage device, and/or in a propagated signal, for execution by a programmable processor. Embodiments of the present method steps may be performed by a programmable processor executing a program of instructions to perform functions of the described implementations by operating on input data and generating output.

[0034] The features of the present embodiments described herein may be implemented in one or more computer programs that are executable on a programmable system including at least one programmable processor coupled to receive data and/or instructions from, and to transmit data and/or instructions to, a data storage system, at least one input device, and at least one output device. A computer program may include a set of instructions that may be used, directly or indirectly, in a computer to perform a certain activity or bring about a certain result. A computer program may be written in any form of programming language, including compiled or interpreted languages, and it may be deployed in any form, including as a stand-alone program or as a module, component, subroutine, or other unit suitable for use in a computing environment.

[0035] Suitable processors for the execution of a program of instructions may include, for example, both general and special purpose processors, and/or the sole processor or one of multiple processors of any kind of computer. Generally, a processor may receive instructions and/or data from a read only memory (ROM), or a random access memory (RAM), or both. Such a computer may include a processor for executing instructions and one or more memories for storing instructions and/or data.

[0036] Generally, a computer may also include, or be operatively coupled to communicate with, one or more mass storage devices for storing data files. Such devices include magnetic disks, such as internal hard disks and/or removable disks, magneto-optical disks, and/or optical disks. Storage devices suitable for tangibly embodying computer program instructions and/or data may include all forms of non-volatile memory, including for example semiconductor memory devices, such as EPROM, EEPROM, and flash memory devices, magnetic disks such as internal

hard disks and removable disks, magneto-optical disks, and CD-ROM and DVD-ROM disks. The processor and the memory may be supplemented by, or incorporated in, one or more ASICs (application-specific integrated circuits).

[0037] The features of the present embodiments may be implemented in a computer system that includes a back-end component, such as a data server, and/or that includes a middleware component, such as an application server or an Internet server, and/or that includes a front-end component, such as a client computer having a graphical user interface (GUI) and/or an Internet browser, or any combination of these. The components of the system may be connected by any form or medium of digital data communication, such as a communication network. Examples of communication networks may include, for example, a LAN (local area network), a WAN (wide area network), and/or the computers and networks forming the Internet.

[0038] The computer system may include clients and servers. A client and server may be remote from each other and interact through a network, such as those described herein. The relationship of client and server may arise by virtue of computer programs running on the respective computers and having a client-server relationship to each other.

[0039] The above description presents the best mode contemplated for carrying out the present embodiments, and of the manner and process of practicing them, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which they pertain to practice these embodiments. The present embodiments are, however, susceptible to modifications and alternate constructions from those discussed above that are fully equivalent. Consequently, the present invention is not limited to the particular embodiments disclosed. On the contrary, the present invention covers all modifications and alternate constructions coming within the spirit and scope of the present disclosure. For example, the steps in the processes described herein need not be performed in the same order as they have been presented, and may be performed in any order(s). Further, steps that have been presented as being performed separately may in alternative

embodiments be performed concurrently. Likewise, steps that have been presented as being performed concurrently may in alternative embodiments be performed separately.

CLAIMS

What is claimed is:

1. A method for communicating an event in an enclosed building, the method comprising:
 - detecting, via at least one mobile sensor, a condition at a location;
 - evaluating, via at least one microprocessor, the condition;
 - transmitting, via at least one network adapter, a signal based on the evaluation;
 - receiving, via an endpoint device, the signal; and
 - identifying, via the at least one microprocessor, the location of the condition.
2. The method as recited in claim 1, wherein detecting comprises detecting a pressure exerted by a user on a device.
3. The method as recited in claim 1, wherein detecting comprises sensing one of humidity, temperature, sound, and an expiration of a time period.
4. The method as recited in claim 1, wherein the at least one network adapter comprises a mesh network of BLUETOOTH-enabled adapters.
5. The method as recited in claim 1, further comprising transmitting, via the at least one network adapter, the identification of the location to a third party.
6. The method as recited in claim 1, further comprising tracking, via the at least one microprocessor, an updated location of the event based on an additional signal.
7. The method as recited in claim 1, further comprising displaying, via at least one display adapter, the location based on a floor plan.
8. A device for communicating an event in an enclosed building, the device comprising:
 - at least one sensor to detect a condition at a location within the enclosed building;
 - at least one alert device;
 - at least one network node; and
 - a network gateway.
9. The device as recited in claim 8, wherein the condition is a pressure exerted by a user on a mobile device.
10. The device as recited in claim 8, wherein the condition is one of humidity, temperature, sound, and an expiration of a time period.
11. The device as recited in claim 8, wherein the at least one network node comprises low-energy BLUETOOTH-enabled adapters for signal transmission.

12. The device as recited in claim 8, further comprising an endpoint device to receive a communication of the event.
13. The device as recited in claim 12, wherein the endpoint device is further operable to track an updated location of the event based on an additional signal.
14. The device as recited in claim 8, further comprising a display of the location based on a floor plan.
15. A system for locating an electronic signal in an enclosed building, the system comprising:
 a plurality of internal network devices to transmit the electronic signal within the enclosed building;
 at least one external network device to transmit the electronic signal outside the enclosed building; and
 at least one screen to display the location of the electronic signal based on a floor plan.
16. The system as recited in claim 15, further comprising a portable device to emit the electronic signal when triggered.
17. The system as recited in claim 16, wherein the portable device comprises at least one sensor operable to detect a condition to trigger an emission of the electronic signal.
18. The system as recited in claim 15, wherein a power source of the system is independent of a power source of the enclosed building.
19. The system as recited in claim 15, wherein the display of the location is updated substantially synchronously with receipt of additional electronic signals.
20. The system as recited in claim 15, further comprising a map importation module to convert raw floor plan information to be used by the system.

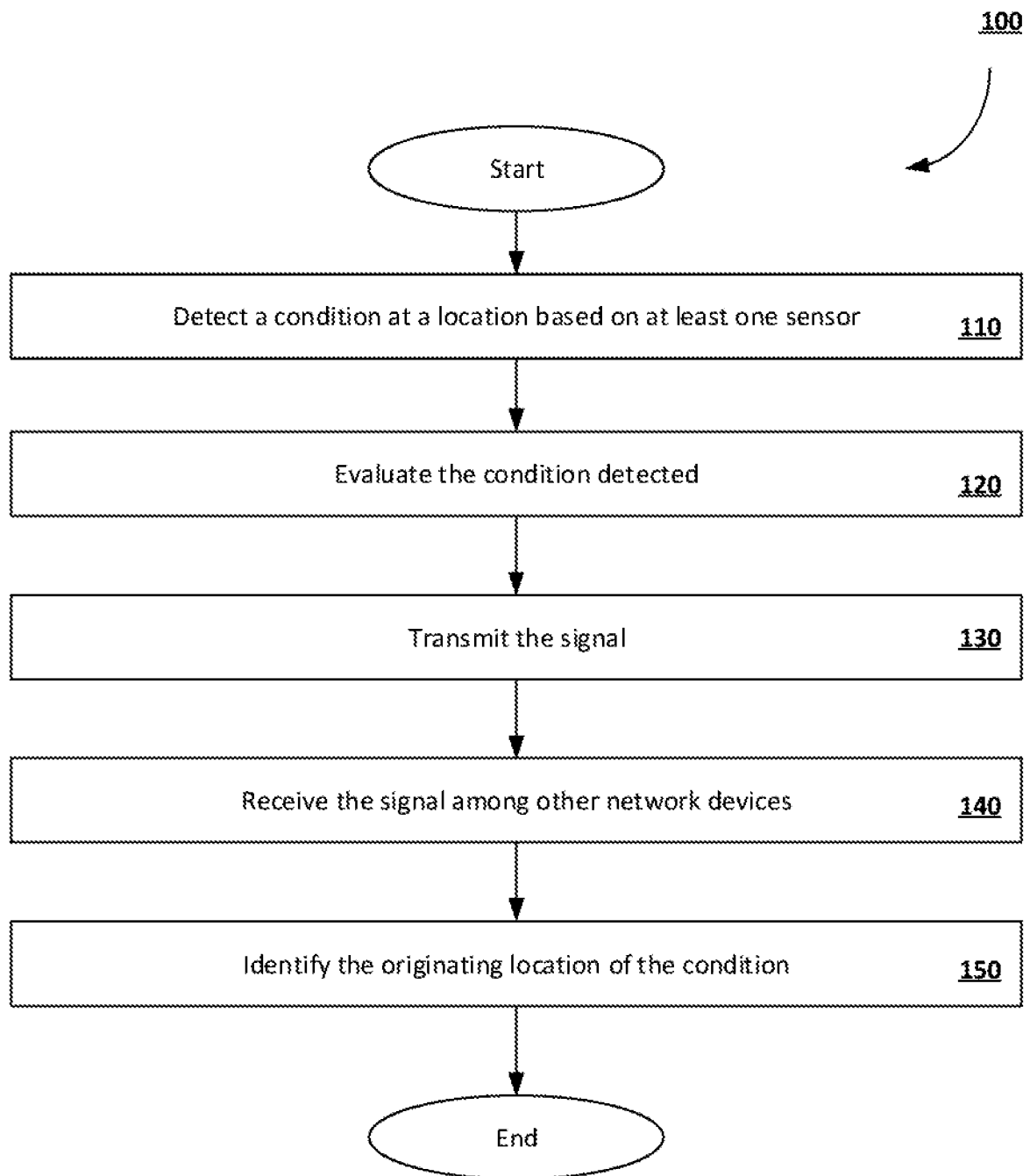


Figure 1

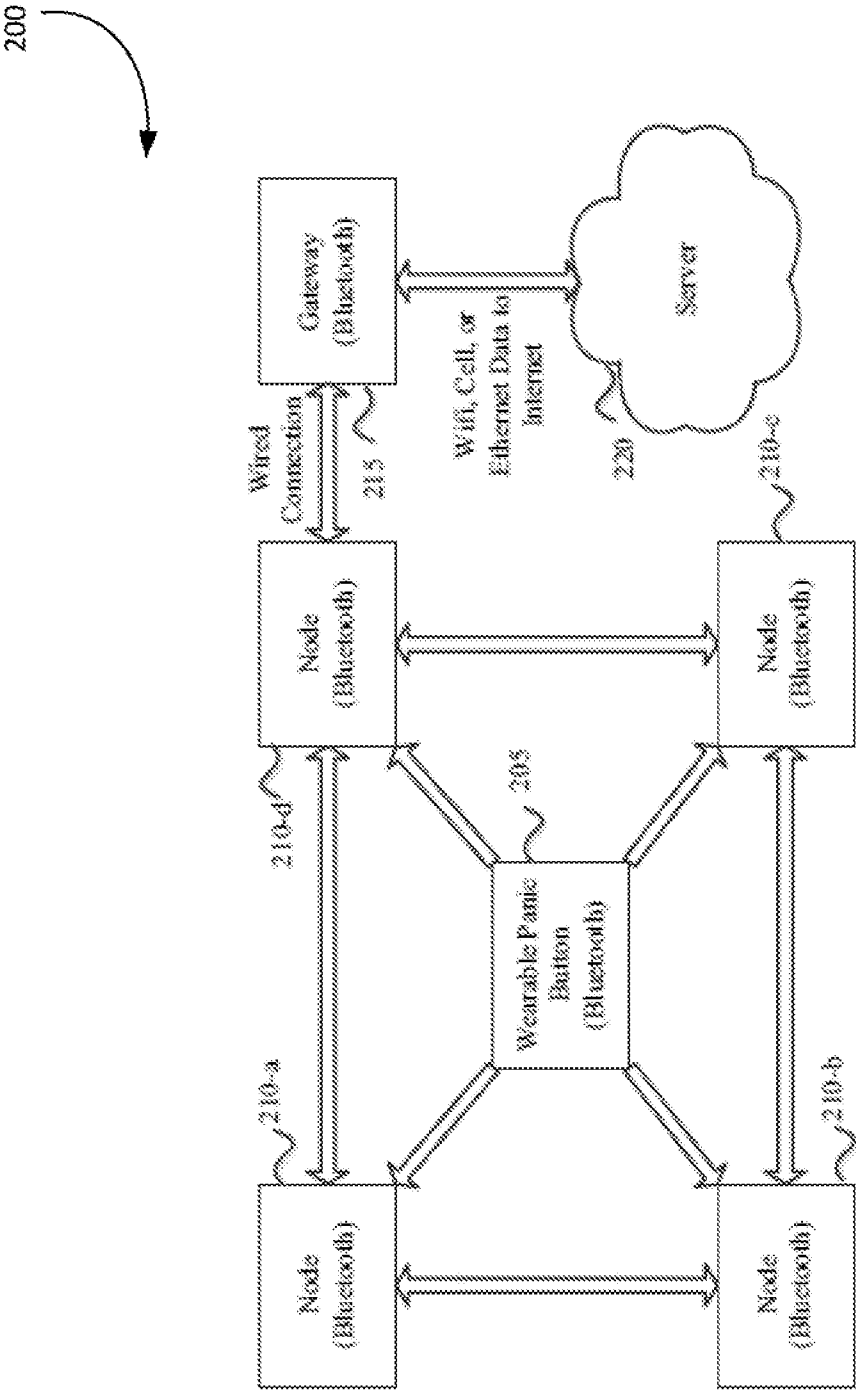


Figure 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2020/021711

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G08B 17/10; G08B 19/00; G08B 25/00; G08B 25/10 (2020.01)
 CPC - G08B 17/10; G08B 19/00; G08B 25/009; G08B 25/10 (2020.05)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 see Search History document

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	WO 2017/137393 A1 (TYCO FIRE & SECURITY GMBH) 17 August 2017 (17.08.2017) entire document	1, 3, 5, 6 --- 2, 4, 7
Y	US 2011/0306304 A1 (FORUTANPOUR et al) 15 December 2011 (15.12.2011) entire document	2
Y	US 2017/0372568 A1 (ONEEVENT TECHNOLOGIES, INC.) 28 December 2017 (28.12.2017) entire document	4, 7
A	US 2017/0103646 A1 (COMCAST CABLE COMMUNICATIONS, INC.) 13 April 2017 (13.04.2017) entire document	1-7
A	US 2017/0039838 A1 (GOOGLE INC.) 09 February 2017 (09.02.2017) entire document	1-7
A	US 2008/0278316 A1 (KATES) 13 November 2008 (13.11.2008) entire document	1-7

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

☐ See patent family annex.

* Special categories of cited documents:

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

"D" document cited by the applicant in the international application

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

26 June 2020

Date of mailing of the international search report

17 JUL 2020

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
 P.O. Box 1450, Alexandria, VA 22313-1450
 Facsimile No. 571-273-8300

Authorized officer

Blaine R. Copenheaver

Telephone No. PCT Helpdesk: 571-272-4300

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2020/021711

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
See extra sheet(s).

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-7

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2020/021711

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-7, are drawn to a method for communicating an event in an enclosed building, the method comprising evaluating, via at least one microprocessor, the condition.

Group II, claims 8-14, are drawn to a device for communicating an event in an enclosed building, the device comprising: at least one alert device.

Group III, claims 15-20, are drawn to a system for locating an electronic signal in an enclosed building, the system comprising: a plurality of internal network devices to transmit the electronic signal within the enclosed building.

The inventions listed as Groups I, II and III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: evaluating, via at least one microprocessor, the condition; transmitting, via at least one network adapter, a signal based on the evaluation; receiving, via an endpoint device, the signal; and identifying, via the at least one microprocessor, the location of the condition as claimed therein is not present in the invention of Groups II and III. The special technical feature of the Group II invention: at least one alert device; at least one network node; and a network gateway as claimed therein is not present in the invention of Groups I or III. The special technical feature of the Group III invention: a plurality of internal network devices to transmit the electronic signal within the enclosed building; at least one external network device to transmit the electronic signal outside the enclosed building; and at least one screen to display the location of the electronic signal based on a floor plan as claimed therein is not present in the invention of Groups I or II.

Groups I, II and III lack unity of invention because even though the inventions of these groups require the technical feature of a method for communicating an event in an enclosed building, the method comprising: detecting, via at least one sensor, a condition at a location, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 2011/0306304 to Forutanpour et al. teaches a method for communicating an event in an enclosed building, the method comprising: detecting, via at least one sensor, a condition at a location (Paras. [0024-0027], [0038]).

Since none of the special technical features of the Group I, II or III inventions are found in more than one of the inventions, unity of invention is lacking.