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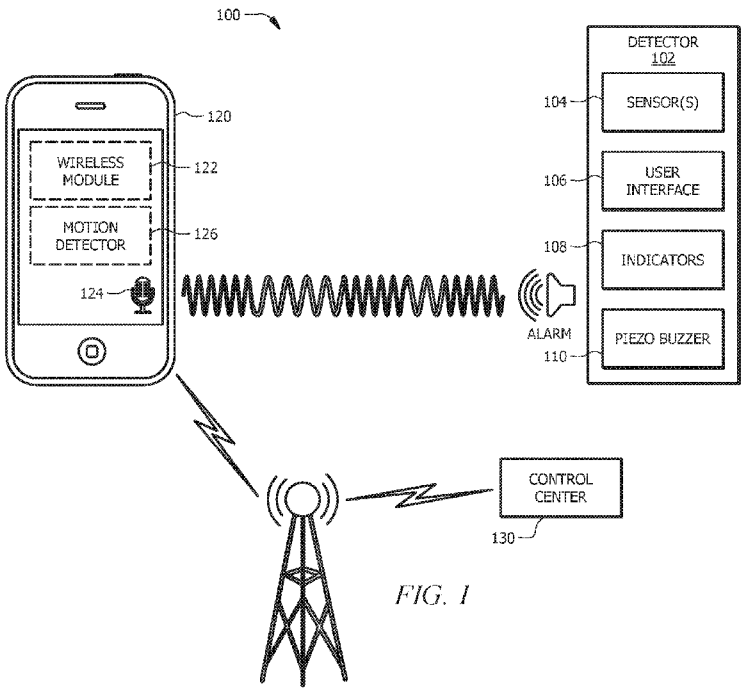

FIG. 1

(57) Abstract: Embodiments relate generally to communication systems and methods, wherein a system (100) may comprise a detector device (102) comprising at least one sensor (102), and a piezo buzzer (110); and a mobile device (120) carried by a user comprising a microphone (124), wherein when an alarm is activated by the detector device, the piezo buzzer generates an alarm signal, and wherein the mobile device is configured to receive the alarm signal via the microphone, and identify the alarm based on the received alarm signal.

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MAN DOWN DETECTION FOR PERSONAL SAFETY ALARM DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

REFERENCE TO A MICROFICHE APPENDIX

[0003] Not applicable.

BACKGROUND

[0004] In hazardous work environments, users may carry gas detectors with them as they work, to allow for detection of gas exposure. The gas detector may alert the user if exposure limits are reached while the user is wearing the gas detector. Gas detectors may comprise interfaces for communicating with the user, such as displays, lights, buzzers, and input buttons. Gas detectors may be configured with settings for alarms, exposure limits, display settings, light and buzzer settings, etc.

SUMMARY

[0005] In an embodiment, a communication system may comprise a detector device comprising at least one sensor, and a piezo buzzer; and a mobile device carried by a user comprising a microphone, wherein when an alarm is activated by the detector device, the piezo buzzer generates an alarm signal, and wherein the mobile device is configured to receive the alarm signal via the microphone, and identify the alarm based on the received alarm signal.

[0006] In an embodiment, a communication system may comprise a detector device carried by a user comprising at least one sensor, a piezo buzzer, and a wireless module; and a mobile device carried by the user comprising a wireless module, wherein the piezo buzzer is configured to detect

the motion of the detector device, and therefore the motion of the user, wherein when an alarm is activated by the detector device, the piezo buzzer generates an alarm signal, and wherein the mobile device is configured to wirelessly receive alarm information from the detector device.

[0007] In an embodiment, a method for communicating an alarm from a detector device to a mobile device may comprise detecting, by the detector device, that a gas level has exceeded a threshold; activating, by the detector device, an alarm indicating the exceeded threshold; generating, by a piezo buzzer of the detector device, an alarm signal; receiving the alarm signal via a microphone of the mobile device; and identifying, by the mobile device, the alarm information based on the received alarm signal.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] For a more complete understanding of the present disclosure, reference is now made to the following brief description, taken in connection with the accompanying drawings and detailed description, wherein like reference numerals represent like parts.

[0009] FIG. 1 illustrates a communication system according to an embodiment of the disclosure;

[0010] FIG. 2 illustrates another communication system according to an embodiment of the disclosure; and

[0011] FIG. 3 illustrates a method for communicating an alarm from a detector device to a mobile device according to an embodiment of the disclosure.

DETAILED DESCRIPTION

[0012] It should be understood at the outset that although illustrative implementations of one or more embodiments are illustrated below, the disclosed systems and methods may be implemented using any number of techniques, whether currently known or not yet in existence. The disclosure should in no way be limited to the illustrative implementations, drawings, and techniques illustrated

below, but may be modified within the scope of the appended claims along with their full scope of equivalents.

[0013] The following brief definition of terms shall apply throughout the application:

[0014] The term "comprising" means including but not limited to, and should be interpreted in the manner it is typically used in the patent context;

[0015] The phrases "in one embodiment," "according to one embodiment," and the like generally mean that the particular feature, structure, or characteristic following the phrase may be included in at least one embodiment of the present invention, and may be included in more than one embodiment of the present invention (importantly, such phrases do not necessarily refer to the same embodiment);

[0016] If the specification describes something as "exemplary" or an "example," it should be understood that refers to a non-exclusive example;

[0017] The terms "about" or "approximately" or the like, when used with a number, may mean that specific number, or alternatively, a range in proximity to the specific number, as understood by persons of skill in the art field; and

[0018] If the specification states a component or feature "may," "can," "could," "should," "would," "preferably," "possibly," "typically," "optionally," "for example," "often," or "might" (or other such language) be included or have a characteristic, that particular component or feature is not required to be included or to have the characteristic. Such component or feature may be optionally included in some embodiments, or it may be excluded.

[0019] Embodiments of the disclosure include methods and systems for communicating an alarm and/or other information from a detector device to a mobile device. Signals output from detector devices are important for indicating danger or hazards during an emergency situation. When

faced with a gas exposure accident or a dangerous environment, if the detector device is unable to communicate with a control center or other outside supervisor, it is difficult to identify the dangerous situation.

[0020] By utilizing a mobile device that is carried by the user, the signals from the detector device may be communicated to a control center or supervisor. The detector device may generate signals (which may comprise sounds, beeps, and/or short range wireless signals) that may be received by the mobile device and forwarded on to the control center. Additionally, motion detectors may monitor the motion of the user, and in some cases other sensors may monitor the physical state of the user, and this information may be forwarded by the mobile device to the control center as well.

[0021] Referring now to FIG. 1, a communication system 100 is shown. The system 100 may comprise a detector device 102, which may be a gas detector, where the detector device may comprise one or more sensors 104 configured to sense information about the environment and/or the user. The detector device 102 may also comprise one or more user interface elements 106, such as a display and/or input buttons, as well as one or more indicators 108, such as lights, beepers, etc. In some embodiments, the detector device 102 may comprise a piezo buzzer 110 configured to generate one or more signals (or beeps). For example, when an alarm is activated by the detector device 102 based on the input from the sensors 104, the piezo buzzer 110 may generate an alarm signal.

[0022] The communication system 100 may also comprise a mobile device 120 that may be carried by a user. The mobile device 120 may comprise a microphone 124 configured to receive the beeps or signals generated by the piezo buzzer 110. The mobile device 120 may also comprise a wireless module 122, wherein the wireless module 122 may allow for wireless communication to and from the mobile device 120. For example, the mobile device 120 may wirelessly communicate

with a control center 130, where a monitor or supervisor may receive information about the user from the mobile device 120. In some embodiments, the beeps or signals received by the mobile device 120 from the detector device 102 may be wirelessly forwarded from the mobile device 120 to the control center 130.

[0023] In some embodiments, the piezo buzzer 110 of the detector device 102 may periodically generate a confidence signal that is received by the mobile device 120. The confidence signal may indicate that the detector device 102 is operating and functional. When a confidence signal is not received from the detector device 102, the mobile device 120 may identify a communication fault between the detector device 102 and the mobile device 120. The communication fault may be caused by many factors including loss of power, malfunctioning sensor(s), malfunctioning piezo buzzer, etc. When a communication fault is identified by the mobile device 120, this information may be indicated to the user, via the mobile device 120, and/or may be wirelessly communicated to the control center 130, so that the detector device 102 may be inspected to determine the source of the fault.

[0024] In some embodiments, when an alarm is indicated by the detector device 102 based on the input from the sensors 104, the piezo buzzer 110 may generate an alarm signal or beep. In some embodiments, the piezo buzzer 110 may be configured to generate a plurality of different signals that indicate different information. For example, different frequencies, patterns, or tones may be used to communicate different signals. In some embodiments, the alarm signal can be an audible signal, a sound signal (which may or may not be in the audible range), or the like.

[0025] The mobile device 120 may be configured to receive these signals and identify an alarm, alert, indication, or other information based on the received signal. In some embodiments, a look-up table or other similar storage mechanism may be stored by the mobile device 120, wherein the

signals generated by the detector device 102 may be associated with an alarm, alert, indication, or other information in the look-up table. Then, the mobile device 120 may forward the determined information to the control center 130. Alternatively, the signal received by the mobile device 120 from the detector device 102 may be processed by the mobile device 120 and forwarded to the control center 130, where the control center 130 may access a look-up table to identify the alarm, alert, indication, or other information associated with the signal.

[0026] In some embodiments, the piezo buzzer 110 of the detector device 102 may be configured to monitor the motion of the detector device 102, such that when the detector device 102 is carried by a user, the piezo buzzer 110 monitors the motion of the user. In some embodiments, the piezo buzzer 110 may be configured to identify when a user falls and/or when a user is not moving. Changes in the signal from the piezo buzzer 110 may be correlated to the motion of the user. So, in some embodiments, the piezo buzzer 110 may serve two functions: monitoring the motion of the user, and generating alarm and confidence signals. In some embodiments, the piezo buzzer 110 may be configured to generate a "man-down" alarm when a fall and/or no motion is detected by the piezo buzzer 110.

[0027] In some embodiments, the mobile device 120 may comprise a motion detector 126, such as an accelerometer, that is configured to monitor the motion of the user when the mobile device 120 is carried by the user. This motion information may be monitored to determine if a user has fallen and/or if a user is no longer moving, and may be wirelessly communicated to the control center 130.

[0028] The motion information may be combined with the sensor information from the detector device 102 and communicated to the control center 130, where the control center 130 may be configured to generate an overall assessment of a user based on the received information.

[0029] In some embodiments, the sensors 104 of the detector device 102 may comprise gas sensors, temperature sensors, pressure sensors, humidity sensors, light sensors, and/or other environmental sensors. In some embodiments, the sensors 104 of the detector device 102 may comprise biometric sensors, such as heart rate monitors, temperature monitors, respiratory monitors, etc.

[0030] Referring now to FIG. 2, a similar communication system 200 is shown comprising the mobile device 120 and detector device 102. In the embodiment shown in FIG. 2, the detector device 102 may comprise a wireless module 112, and may be configured to communicate wirelessly with the mobile device 120. In some embodiments, the detector device 102 may be configured to communicate with the mobile device 120 via short-range signals, such as Bluetooth, radio frequency, and/or near field communication (NFC). In some embodiments, the mobile device 120 may be configured to wirelessly communicate using two or more communication protocols. For example, the mobile device 120 may use short-range signals to communicate with the detector device 102, wherein the devices may be in close proximity when they are carried by the user, and the mobile device 120 may use long-range signals (such as cellular, Wi-Fi, etc.) to communicate with the control center 130.

[0031] In the embodiment shown in FIG. 2, the piezo buzzer 110 of the detector device 102 may be configured to monitor the motion of the detector device 102, such that when the detector device 102 is carried by a user, the piezo buzzer 110 monitors the motion of the user. In some embodiments, the piezo buzzer 110 may be configured to identify when a user falls and/or when a user is not moving. Changes in the signal from the piezo buzzer 110 may be correlated to the motion of the user. In some embodiments, the detector device 102 may communicate a

"man-down" signal to the mobile device 120 when a fall and/or no motion is detected by the piezo buzzer 110.

[0032] In some embodiments, the mobile device 120 may comprise a motion detector 126, such as an accelerometer, that is configured to monitor the motion of the user when the mobile device 120 is carried by the user. This motion information may be monitored to determine if a user has fallen and/or if a user is no longer moving, and may be wirelessly communicated to the control center 130.

[0033] Referring to FIG. 3, a method 300 for communicating an alarm from the detector device 102 to the mobile device 120 is shown. At step 302, the gas detector may generate a confidence signal when the detector device 102 is powered on. The confidence signal may be generated periodically through the operation of the detector device 102. Generating the confidence signal may comprise activating a piezo buzzer 110. Generating the confidence signal may comprise wirelessly communicating with the mobile device 120.

[0034] At step 304, the detector device 102 may detect gas levels (and/or other environmental information). If the detected levels exceed a predefined threshold, at step 306, the detector device may indicate an alarm and generate an alarm signal. Generating the alarm signal may comprise activating a piezo buzzer 110. Generating the alarm signal may comprise wirelessly communicating with the mobile device 120.

[0035] At step 310, the mobile device 120 may receive signals from the detector device 102. Receiving the signals may comprise receiving, via a microphone 124, sounds from the piezo buzzer 110. Receiving the signals may comprise wirelessly receiving the signals from the detector device 102. At step 312, when it is determined that a confidence signal has been received from the detector device 102 (within a predefined time period), the mobile device 120 may continue

receiving signals from the detector device 102. When it is determined that a confidence signal has not been received from the detector device 102 (within a predefined time period), at step 314, the mobile device 120 may identify a communication fault with the detector device 102.

[0036] At step 316, when it is determined that an alarm signal has not been received from the detector device 102, the mobile device 120 may continue receiving signals from the detector device 102. When it is determined that an alarm signal has been received from the detector device 102, at step 318, the mobile device 120 may initiate man-down detection. In some embodiments, at step 308, the detector device 102 may complete the man-down detection via the piezo buzzer 110. In some embodiments, the mobile device 120 may comprise a motion detector 126 and may complete the man down detection.

[0037] At step 320, the information received by the mobile device 120 and/or generated by the mobile device 120 may be forward, or transmitted, wirelessly to a control center 130.

[0038] In a first embodiment, a communication system may comprise a detector device comprising at least one sensor, and a piezo buzzer; and a mobile device carried by a user comprising a microphone, wherein when an alarm is activated by the detector device, the piezo buzzer generates an alarm signal, and wherein the mobile device is configured to receive the alarm signal via the microphone, and identify the alarm based on the received alarm signal.

[0039] A second embodiment can include the system of the first embodiment, wherein the mobile device further comprises a wireless module, and wherein the mobile device is configured to wirelessly communicate the alarm information to a control center.

[0040] A third embodiment can include the system of the first or second embodiments, wherein the piezo buzzer is further configured to periodically generate a confidence signal indicating

that the detector device is operating, and wherein the mobile device is configured to receive the confidence signal via the microphone.

[0041] A fourth embodiment can include the system of any of the first to third embodiments, wherein the detector device is carried by the user, and wherein the piezo buzzer is further configured to detect motion of the detector device, and therefore the motion of the user.

[0042] A fifth embodiment can include the system of the fourth embodiment, wherein the detector device is configured to communicate a first alarm to the mobile device indicating that a gas level threshold has been exceeded, and to communicate a second alarm to the mobile device based on the motion detection by the piezo buzzer.

[0043] A sixth embodiment can include the system any of the first to fifth embodiments, wherein the mobile device is further configured to detect the motion of the mobile device, and therefore the motion of the user.

[0044] A seventh embodiment can include the system of any of the first to sixth embodiments, wherein the piezo buzzer is configured to generate a plurality of signals that indicate different information to the mobile device.

[0045] In an eighth embodiment, a communication system may comprise a detector device carried by a user comprising at least one sensor, a piezo buzzer, and a wireless module; and a mobile device carried by the user comprising a wireless module, wherein the piezo buzzer is configured to detect the motion of the detector device, and therefore the motion of the user, wherein when an alarm is activated by the detector device, the piezo buzzer generates an alarm signal, and wherein the mobile device is configured to wirelessly receive alarm information from the detector device.

[0046] A ninth embodiment can include the system of the eighth embodiment, wherein the detector device is configured to periodically generate a confidence signal indicating that the detector device is operating, and wherein the mobile device wirelessly receives the confidence signal.

[0047] A tenth embodiment can include the system of the eighth to ninth embodiments, wherein the wireless module of the detector device and the wireless module of the mobile device comprise Bluetooth modules.

[0048] An eleventh embodiment can include the system of any of the eighth to tenth embodiments, wherein the wireless module of the detector device and the wireless module of the mobile device comprise near-field communication (NFC) modules.

[0049] A twelfth embodiment can include the system of any of the eighth to eleventh embodiments, wherein the detector device is configured to communicate a first alarm to the mobile device indicating that a gas level threshold has been exceeded, and to communicate a second alarm to the mobile device based on the motion detection by the piezo buzzer.

[0050] In a thirteenth embodiment, a method for communicating an alarm from a detector device to a mobile device may comprise detecting, by the detector device, that a gas level has exceed a threshold; activating, by the detector device, an alarm indicating the exceeded threshold; generating, by a piezo buzzer of the detector device, an alarm signal; receiving the alarm signal via a microphone of the mobile device; and identifying, by the mobile device, the alarm information based on the received alarm signal.

[0051] A fourteenth embodiment can include the method of the thirteenth embodiment, further comprising wirelessly communicating, by the mobile device, the alarm information to a control center.

[0052] A fifteenth embodiment can include the method of the any of the thirteenth to fourteenth embodiments, further comprising generating, by the piezo buzzer of the detector device, a periodic confidence signal that indicates that the detector device is operating; and receiving the confidence signal via the microphone of the mobile device.

[0053] A sixteenth embodiment can include the method of any of the thirteenth to fifteenth embodiments, wherein the detector device is carried by a user, and wherein the method further comprises detecting, by the piezo buzzer, the motion of the detector device, and therefore the motion of the user.

[0054] A seventeenth embodiment can include the method of the sixteenth embodiment, wherein the detector device is configured to communicate a first alarm to the mobile device indicating that a gas level threshold has been exceeded, and to communicate a second alarm to the mobile device based on the motion detection by the piezo buzzer.

[0055] An eighteenth embodiment can include the method of any of the thirteenth to seventeenth embodiments, wherein the mobile device is carried by a user, and wherein the method further comprises detecting, by the mobile device, the motion of the mobile device, and therefore the motion of the user.

[0056] A nineteenth embodiment can include the method of any of the thirteenth to eighteenth embodiments, further comprising generating, by the piezo buzzer, a plurality of signals that indicate different information to the mobile device.

[0057] A twentieth embodiment can include the method of any of the thirteenth to nineteenth embodiments, further comprising detecting, by one or more sensors, biometric information of the user; and receiving, by the mobile device, an indication of the biometric information of the user.

[0058] While various embodiments in accordance with the principles disclosed herein have been shown and described above, modifications thereof may be made by one skilled in the art without departing from the spirit and the teachings of the disclosure. The embodiments described herein are representative only and are not intended to be limiting. Many variations, combinations, and modifications are possible and are within the scope of the disclosure. Alternative embodiments that result from combining, integrating, and/or omitting features of the embodiment(s) are also within the scope of the disclosure. Accordingly, the scope of protection is not limited by the description set out above, but is defined by the claims which follow, that scope including all equivalents of the subject matter of the claims. Each and every claim is incorporated as further disclosure into the specification and the claims are embodiment(s) of the present invention(s). Furthermore, any advantages and features described above may relate to specific embodiments, but shall not limit the application of such issued claims to processes and structures accomplishing any or all of the above advantages or having any or all of the above features.

[0059] Additionally, the section headings used herein are provided for consistency with the suggestions under 37 C.F.R. 1.77 or to otherwise provide organizational cues. These headings shall not limit or characterize the invention(s) set out in any claims that may issue from this disclosure. Specifically and by way of example, although the headings might refer to a "Field," the claims should not be limited by the language chosen under this heading to describe the so-called field. Further, a description of a technology in the "Background" is not to be construed as an admission that certain technology is prior art to any invention(s) in this disclosure. Neither is the "Summary" to be considered as a limiting characterization of the invention(s) set forth in issued claims. Furthermore, any reference in this disclosure to "invention" in the singular should not be used to argue that there is only a single point of novelty in this disclosure. Multiple inventions may be set

forth according to the limitations of the multiple claims issuing from this disclosure, and such claims accordingly define the invention(s), and their equivalents, that are protected thereby. In all instances, the scope of the claims shall be considered on their own merits in light of this disclosure, but should not be constrained by the headings set forth herein.

[0060] Use of broader terms such as "comprises," "includes," and "having" should be understood to provide support for narrower terms such as "consisting of," "consisting essentially of," and "comprised substantially of." Use of the terms "optionally," "may," "might," "possibly," and the like with respect to any element of an embodiment means that the element is not required, or alternatively, the element is required, both alternatives being within the scope of the embodiment(s). Also, references to examples are merely provided for illustrative purposes, and are not intended to be exclusive.

[0061] While several embodiments have been provided in the present disclosure, it should be understood that the disclosed systems and methods may be embodied in many other specific forms without departing from the spirit or scope of the present disclosure. The present examples are to be considered as illustrative and not restrictive, and the intention is not to be limited to the details given herein. For example, the various elements or components may be combined or integrated in another system or certain features may be omitted or not implemented.

[0062] Also, techniques, systems, subsystems, and methods described and illustrated in the various embodiments as discrete or separate may be combined or integrated with other systems, modules, techniques, or methods without departing from the scope of the present disclosure. Other items shown or discussed as directly coupled or communicating with each other may be indirectly coupled or communicating through some interface, device, or intermediate component, whether electrically, mechanically, or otherwise. Other examples of changes, substitutions, and alterations

are ascertainable by one skilled in the art and could be made without departing from the spirit and scope disclosed herein.

CLAIMS

What is claimed is:

1. A communication system (100) comprising:

a detector device (102) comprising at least one sensor (104), and a piezo buzzer (110); and

a mobile device (120) carried by a user comprising a microphone (124),

wherein:

when an alarm is activated by the detector device (102), the piezo buzzer (110) generates an alarm signal, and

the mobile device (120) is configured to receive the alarm signal via the microphone (124), and identify the alarm based on the received alarm signal.

2. The system (100) of claim 1, wherein the mobile device (120) further comprises a wireless module (122), and wherein the mobile device (120) is configured to wirelessly communicate the alarm information to a control center (130).

3. The system (100) of claim 1, wherein the piezo buzzer (110) is further configured to periodically generate a confidence signal indicating that the detector device (102) is operating, and wherein the mobile device (120) is configured to receive the confidence signal via the microphone (124).

4. The system (100) of claim 1, wherein the detector device (102) is carried by the user, and wherein the piezo buzzer (110) is further configured to detect motion of the detector device (102), and therefore the motion of the user.

5. The system (100) of claim 4, wherein the detector device (102) is configured to communicate a first alarm to the mobile device (120) indicating that a gas level threshold has been exceeded, and to communicate a second alarm to the mobile device (120) based on the motion detection by the piezo buzzer (110).

6. The system (100) of claim 1, wherein the mobile device (120) is further configured to detect the motion of the mobile device (120), and therefore the motion of the user.

7. The system (100) of claim 1, wherein the piezo buzzer (110) is configured to generate a plurality of signals that indicate different information to the mobile device (120).

8. A method for communicating an alarm from a detector device to a mobile device, the method comprising:

detecting, by the detector device, that a gas level has exceed a threshold;

activating, by the detector device, an alarm indicating the exceeded threshold;

generating, by a piezo buzzer of the detector device, an alarm signal;

receiving the alarm signal via a microphone of the mobile device; and

identifying, by the mobile device, the alarm information based on the received alarm signal.

9. The method of claim 8, further comprising wirelessly communicating, by the mobile device, the alarm information to a control center.

10. The method of claim 8, further comprising:

generating, by the piezo buzzer of the detector device, a periodic confidence signal that indicates that the detector device is operating; and

receiving the confidence signal via the microphone of the mobile device.

11. The method of claim 8, wherein the detector device is carried by a user, and wherein the method further comprises detecting, by the piezo buzzer, the motion of the detector device, and therefore the motion of the user.

12. The system of claim 11, wherein the detector device is configured to communicate a first alarm to the mobile device indicating that a gas level threshold has been exceeded, and to communicate a second alarm to the mobile device based on the motion detection by the piezo buzzer.

13. The method of claim 8, wherein the mobile device is carried by a user, and wherein the method further comprises detecting, by the mobile device, the motion of the mobile device, and therefore the motion of the user.

14. The method of claim 8, further comprising generating, by the piezo buzzer, a plurality of signals that indicate different information to the mobile device.

15. The method of claim 8, further comprising:

detecting, by one or more sensors, biometric information of the user; and

receiving, by the mobile device, indication of the biometric information of the user.

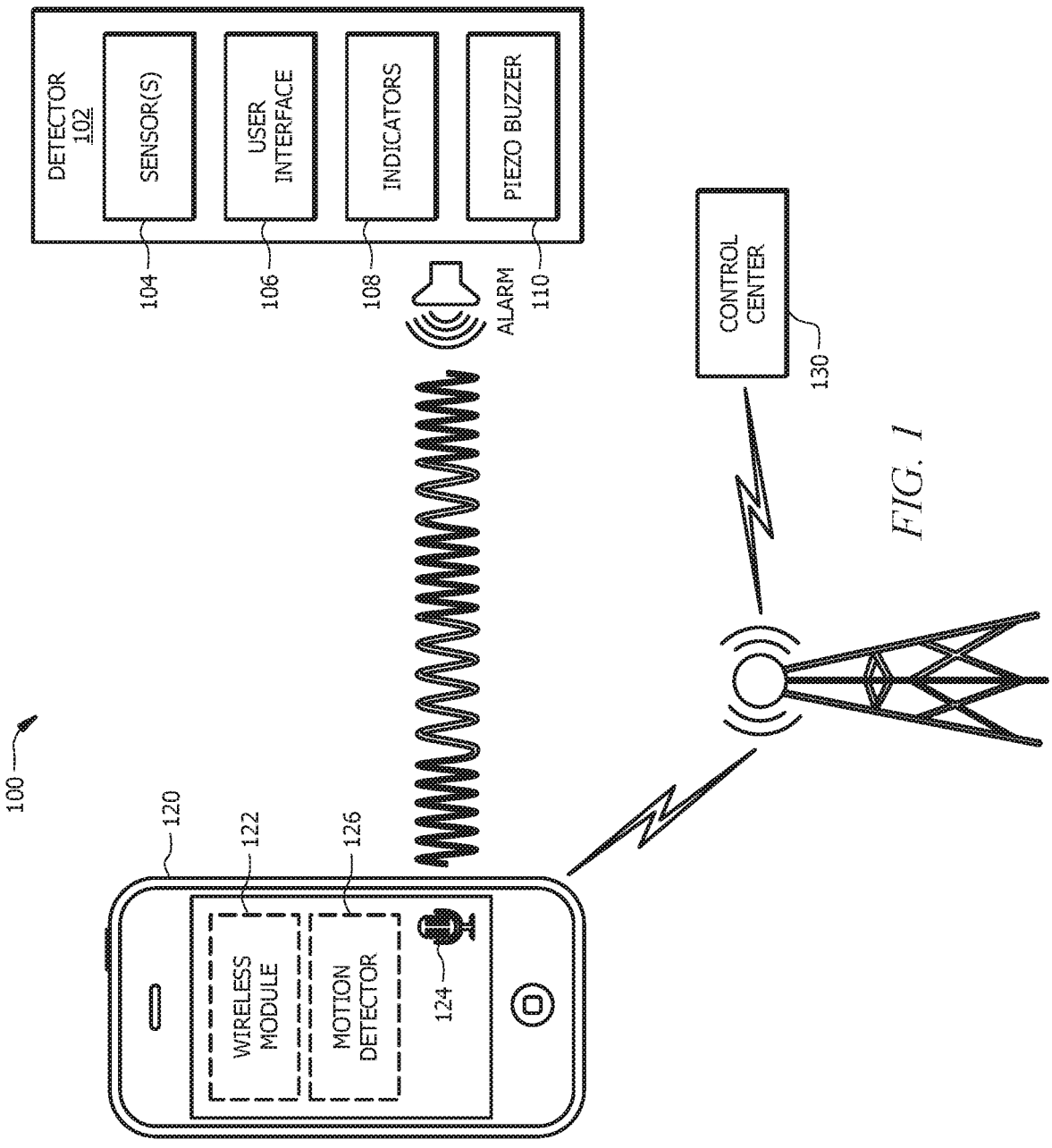
DETECTOR
102
SENSOR(S)
USER INTERFACE
INDICATORS
PIEZO BUZZER
104
106
108
ALARM
110
CONTROL CENTER
130
100
120
122
126
WIRELESS MODULE
MOTION DETECTOR
124

FIG. 1

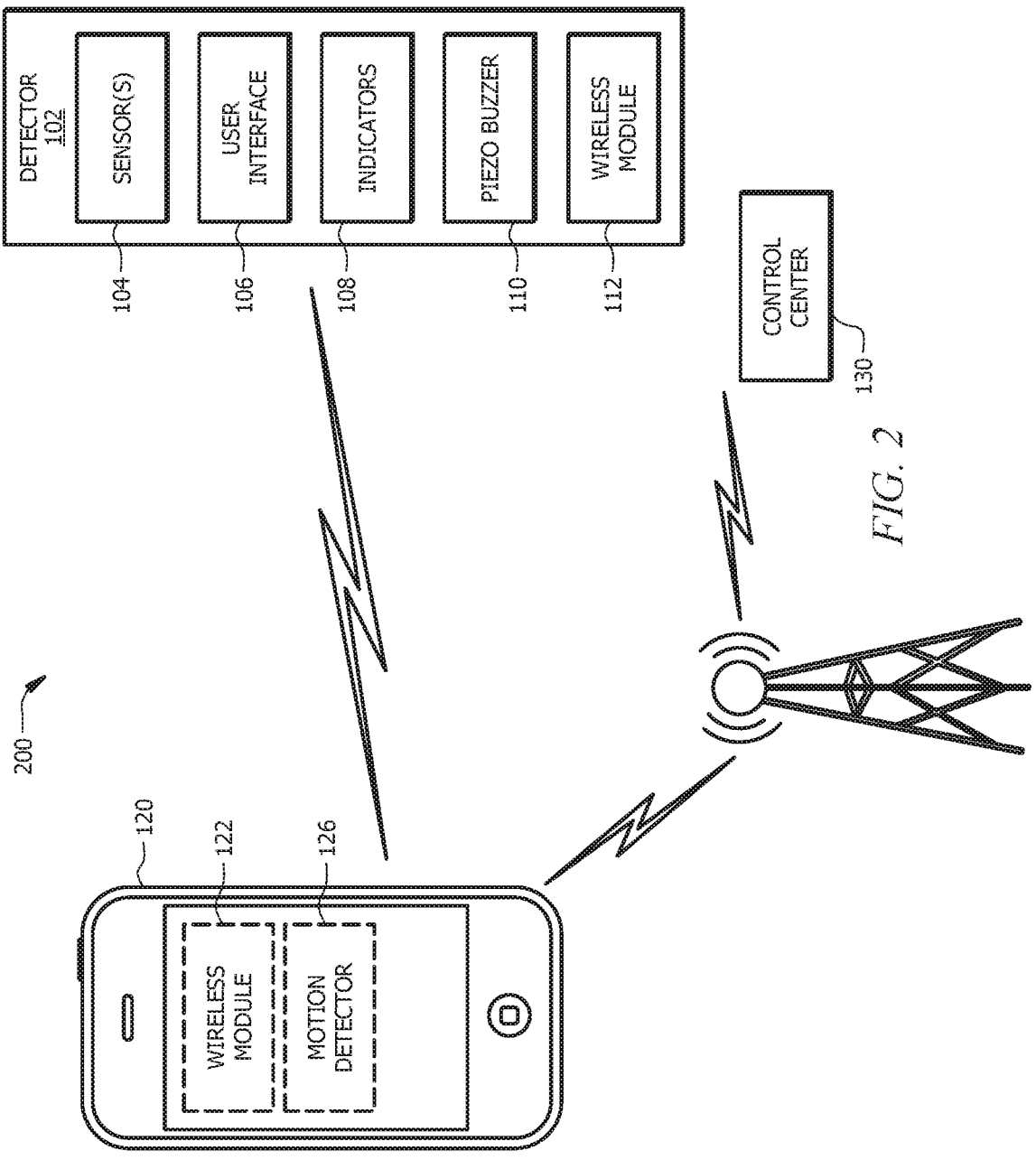
DETECTOR 102
SENSOR(S)
USER INTERFACE
INDICATORS
PIEZO BUZZER
WIRELESS MODULE
104
106
108
110
112
CONTROL CENTER
130
200
120
122
126
WIRELESS MODULE
MOTION DETECTOR

FIG. 2

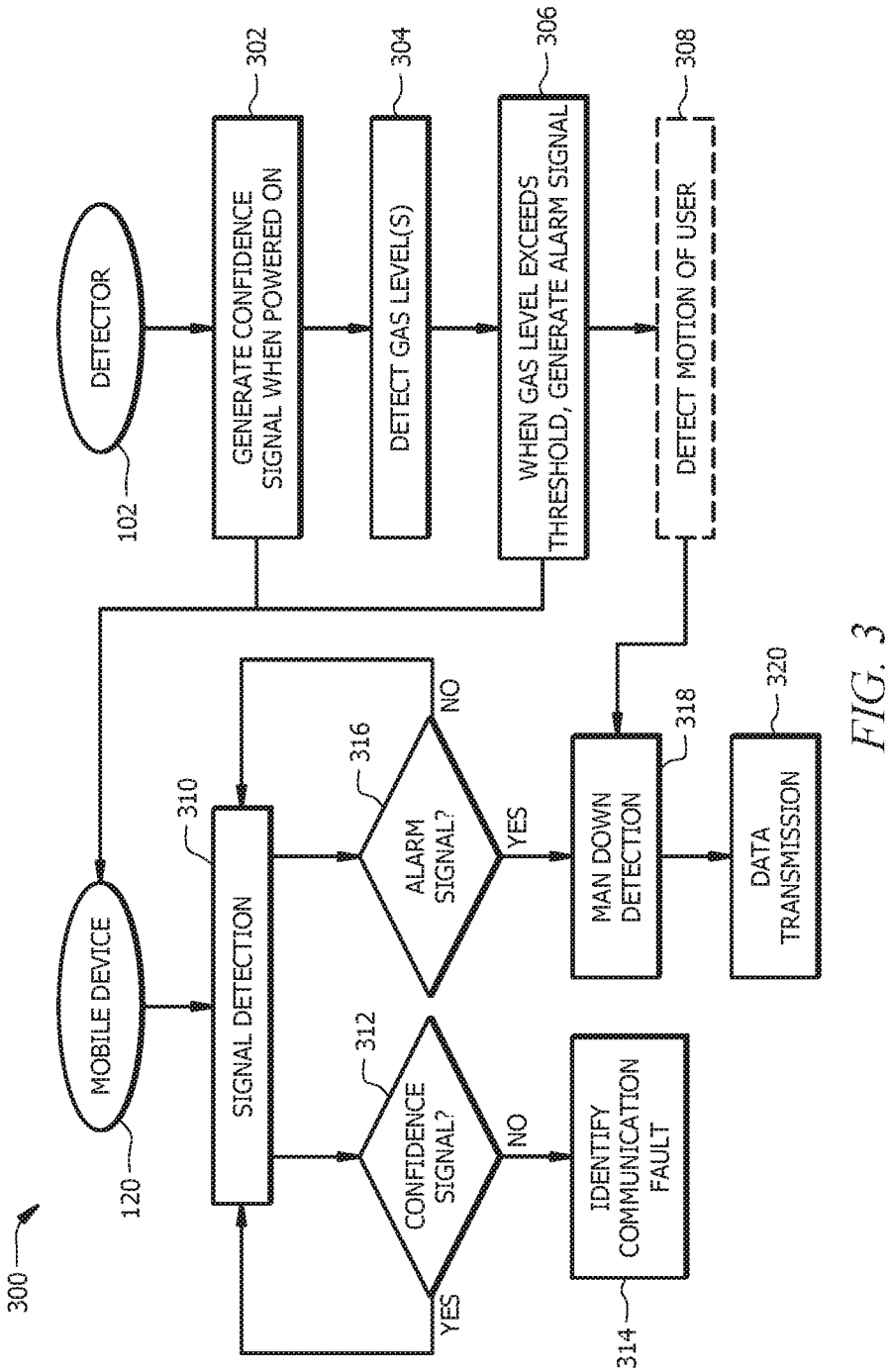
300
MOBILE DEVICE
120
DETECTOR
102
SIGNAL DETECTION
310
GENERATE CONFIDENCE SIGNAL WHEN POWERED ON
302
DETECT GAS LEVEL(S)
304
WHEN GAS LEVEL EXCEEDS THRESHOLD, GENERATE ALARM SIGNAL
306
DETECT MOTION OF USER
308
ALARM SIGNAL?
316
YES
NO
CONFIDENCE SIGNAL?
312
YES
NO
MAN DOWN DETECTION
318
DATA TRANSMISSION
320
IDENTIFY COMMUNICATION FAULT
314

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/050312

A. CLASSIFICATION OF SUBJECT MATTER
INV. G08B25/01 G08B1/08
ADD.

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)
G08B H04M

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2013/063263 A1 (DI MARCO STEPHANE [FR] ET AL) 14 March 2013 (2013-03-14) abstract paragraph [0006] - paragraph [0010] paragraph [0043]; figure 1 paragraph [0043] - paragraph [0060]; figure 1 paragraph [0062] - paragraph [0065]; figure 3	1-3, 7-10,14 4-6, 11-13,15
X	EP 2 461 299 A2 (E I TECHNOLOGY LTD [IE]) 6 June 2012 (2012-06-06) abstract paragraph [0032] - paragraph [0034]; figures 2,4,5	1,7,8,14

-/--

[X] Further documents are listed in the continuation of Box C.

[X] 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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 December 2016	09/01/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Heß, Rüdiger

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/050312

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/146127 A1 (STILP LOUIS A [US] ET AL) 28 June 2007 (2007-06-28) paragraph [0069]; figure 1 paragraph [0072] - paragraph [0096]; figures 3,4 paragraph [0189]; figure 3	1-3, 7-11,14
X	US 8 917 186 B1 (GRANT ROSEMARIE GEIER [US]) 23 December 2014 (2014-12-23) column 2, line 29 - column 4, line 7; figure 1 column 5, line 1 - line 28	1-3, 7-10,14
Y	US 2015/302719 A1 (MROSZCZAK STEPHEN J [CA] ET AL) 22 October 2015 (2015-10-22) abstract paragraph [0007] - paragraph [0018]; figure 1 paragraph [0022] - paragraph [0023]	4-6, 11-13,15

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Information on patent family members

International application No
PCT/US2016/050312

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		WO 2011101597 A1	25-08-2011
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		US 9142119 B1	22-09-2015
		US 9202363 B1	01-12-2015
		US 9262909 B1	16-02-2016
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US 2015302719 A1	22-10-2015	US 2015302719 A1	22-10-2015
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