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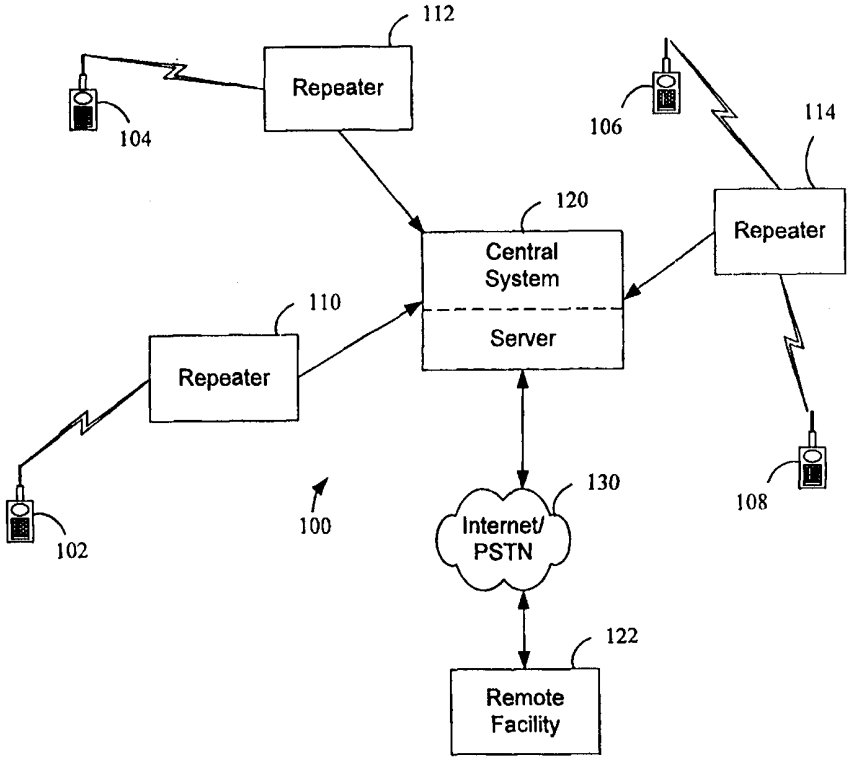
(57) Abstract

The present invention is generally directed to a system for monitoring a variety of environmental and/or other conditions within a defined region. In accordance with one aspect of the invention, a system is configured to monitor alarm condition in a defined area. The system is implemented by using a plurality of wireless transmitters (102, 104, 108), wherein each wireless transmitter is integrated into an alarm. The system also includes a plurality of repeaters (110, 112) that are dispersed throughout the region at defined locations. By defined locations, it is meant only that the location of the repeaters are known to a central computer (120). The computer may be informed of the repeater location after installation of the repeaters, as the installation location of the repeaters is not limited. Further, the system includes a computer that is configured to receive information communicated from the repeaters, and includes means for reporting the alarm condition to a remote location (122).



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SYSTEM FOR MONITORING CONDITIONS IN A RESIDENTIAL LIVING COMMUNITY

CROSS REFERENCE TO RELATED APPLICATION

This application claims benefit of U.S. utility application Serial No.: 09/271,517 filed on March 18, 1999 and entitled "*System for Monitoring Conditions in a Residential Living Community*" which is incorporated by reference herein in its entirety.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention generally relates to monitoring systems, and more particularly to a computerized system for monitoring emergency, alarm, climate, or other conditions in a defined territory.

DISCUSSION OF THE RELATED ART

As is known, there are a variety of systems for monitoring patients in, for example, a hospital or other closely controlled personal care facility. Similar systems are known to be implemented in retirement communities, or other residential living communities where patient care and monitoring is more essential than it is in, for example, an apartment complex. In facilities such as these, it is important to provide a fast response to personal needs. For example, if a crippled or elderly person falls, often that person cannot get up under their own power. Instead, the person requires assistance from others under such situations.

There are well known patient call systems, which employ an intercom system or other patient-activated call system, whereby a patient may depress a button, pull a cord, or perform some other similar activity to initiate a call for assistance. Unfortunately, these systems generally have fixed activation points. That is, these systems employ mechanisms by which a patient may request assistance, only after reaching a fixed and predetermined location. For instance, a "call" button may be provided on the wall in a bathroom location, as well as one or two other locations within the person's living area. If the person falls, then the person must usually crawl to or otherwise reach the "call" button in order to request assistance. Obviously, if the

person falls a relatively substantial distance away from the "call" button, reaching the button, in and of itself, may be a difficult task.

Another system is known, which provides patients with more convenient access for requesting assistance. Upon information and belief, a system was marketed under the name of "Life Call" that allowed a person to wear a wireless call unit that included a button that a person could depress to request assistance. This system was generally designated, or targeted, for use outside a patient care type facility. Specifically, this system was intended for in-home personal use, and included a base unit that was interfaced to a telephone line. The call unit worn by the patient transmitted a signal to the base unit, which could then initiate a telephone call to a facility that could provide medical or other appropriate response. The "Life Call" system also included an intercom that allowed the person, once a telephone connection was established, to verbally communicate from the person's remote transmitter to a remote location by way of the base unit.

A disadvantage of this type of system, however, is that the system is limited in that if a patient travels too far from the base unit, then the remote transmitter becomes out of range and cannot access the base unit.

SUMMARY OF THE INVENTION

Certain objects, advantages and novel features of the invention will be set forth in part in the description that follows and in part will become apparent to those skilled in the art upon examination of the following or may be learned with the practice of the invention. The objects and advantages of the invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

To achieve the advantages and novel features, the present invention is generally directed to a system for monitoring a variety of environmental and/or other conditions within a defined region. In accordance with one aspect of the invention, a system is configured to monitor alarm conditions in a defined area. The system is implemented by using a plurality of wireless transmitters, wherein each wireless transmitter is integrated into an alarm. In this regard, the term "alarm" is broadly

construed and may include, but is not limited to, a smoke alarm, a carbon monoxide detector, a security system, a climate control system, *etc.* The system also includes a plurality of repeaters that are dispersed throughout the region at defined locations. By defined locations, it is meant only that the location of the repeaters are known to a central computer. The computer may be informed of the repeater locations after installation of the repeaters, as the installation location of the is not limited. Further, the system includes a computer that is configured to receive information communicated from the repeaters. The computer further includes means for evaluating the received information and identifying an alarm condition and an originating location of the alarm condition, the computer further including means for reporting the alarm condition to a remote location.

Consistent with the broader concepts of the invention, the "means" for evaluating the received information and the "means" for reporting the alarm condition are not limited to a particular embodiment or configuration. Preferably, these "means" will be implemented in software that is executed by a processor within the computer. However, dedicated circuitry or other appropriate evaluating and reporting mechanisms may also be used to carry out the more broadly defined functions. In one embodiment, the computer reports alarm conditions to a remote facility by establishing a dial-up connection with a predefined phone number across the public switched telephone network (PSTN). In another embodiment, the computer reports alarm conditions to a remote facility by communicating an email message, via the Internet, or other computer network. In this regard, the computer may be connected to a LAN, whereby alarm conditions may be communicated via email messages to various persons/workstations locally.

By way of illustration, suppose an alarm condition is identified as an improper thermostat setting of the thermostat that is located in an identified room of an residential living complex. The computer may email a staff or maintenance person that may near to that room an appropriate message, so that the staff or maintenance person may check on the thermostat, before the temperature in the room reaches an extreme level. Alternatively, suppose an alarm condition is identified as an "emergency" or distress signal from a transmitter assigned to a predetermined person.

The computer may evaluate the transmitter number to identify the particular person, and then may identify the approximate location of the person by evaluating the repeater identification number, and knowing the installation location of the repeater. The computer may relay by page, alarm, or other means an appropriate distress call to assist a person in need of assistance.

It should be appreciated that, in certain embodiments, the repeaters may be eliminated from the system. Specifically, embodiments in which the transmitters are integrated into an alarm in a stationary fashion. In such embodiments, the computer may identify a transmitter location based upon the transmitter identification number alone, and the repeater identification need not be utilized. Alternatively, repeaters may be integrated into various alarms having fixed or known locations. That is, rather than integrating transmitters into alarm devices, repeaters may be integrated into alarm devices.

The repeaters may be configured to perform the repeater function as described above (*i.e.*, relaying information from transmitters to a central computer). In addition, other circuitry may be provided to directly interface with the alarm. Therefore, in addition to relaying information originating a remote transmitters, this type of repeater may also originate "transmitter" information. At the central computer, such a transmission may be recognized by identifying the repeater identification number and an alarm code, without a corresponding transmitter identification number. Therefore, a system may include some alarm devices that include integrated transmitters, and other alarm devices that include integrated repeaters.

In accordance with another embodiment of the present invention, a system may be provided for monitoring conditions in a residential living community. This embodiment of such a system may include a computer that is configured to execute at least one computer program that manages the environment of the community by monitoring select information that is reported to the computer. The system may also include a plurality of wireless transmitters configured to transmit select information a relatively limited distance. Further the system may include a plurality of repeaters that are dispersed throughout the community at defined locations. Each repeater may

be configured to receive select information that is transmitted from a nearby wireless transmitter and further communicate that select information to the computer. Finally, the computer may include means for communicating the received information to a remote facility, as well as means for evaluating a received message and determining an appropriate action to be taken. Again, "means" elements are preferably implemented in computer software, but are not intended to be limiting upon the present invention to only such an implementation.

In accordance with another, and more detailed implementation of a system constructed in accordance with an aspect of the invention, a system may include a computer configured to execute at least one computer program that manages the environment of the community by monitoring select information that is reported to the computer. The system may also include a plurality of wireless transmitters configured to transmit select information as well as transmitter identification numbers a relatively limited distance, wherein at least one transmitter is a totable transmitter, at least one transmitter is integrated into a smoke detector, and at least one transmitter is integrated into a thermostat. In addition, the system may include a plurality of repeaters dispersed throughout the community at defined locations, each repeater configured to receive select information that is transmitted from a nearby wireless transmitter and further communicate that select information to the computer, each repeater being further configured to transmit a repeater identification number along with the select information. A circuit may be configured as a gateway between the computer and an external telecommunications network. Finally, the system may include a computer program executed by the computer. In one embodiment, the computer program may more particularly include a first code segment for evaluating a received message and identifying a specific transmitter that transmitted the message, a second code segment for evaluating the received message and identifying a specific repeater that relayed the message from the specific transmitter to the computer, a third code segment for evaluating the select information that is transmitted from a transmitter and embedded within the received message, and a fourth code segment responsive to the first, second, and third segments for determining an action to be

taken based upon the select information, the identified transmitter, and the identified repeater.

DESCRIPTION OF THE DRAWINGS

The accompanying drawings incorporated in and forming a part of the specification, illustrate several aspects of the present invention, and together with the description serve to explain the principles of the invention. In the drawings:

FIG. 1 is a block diagram of a system constructed in accordance with the invention;

FIGs. 2A-2D illustrate different environments in which a transmitter unit of the present invention may be integrated within;

FIGs. 3A-3D are block diagrams that illustrate certain functional components of a transmitter, constructed in accordance with the invention;

FIG. 4A is a block diagram that illustrates certain functional components of a repeater, constructed in accordance with the invention;

FIG. 4B is a block diagram that illustrates certain other components of a repeater, constructed in accordance with the invention;

FIG. 5A is a block diagram illustrating certain physical components of a central computer constructed in accordance with the invention;

FIG. 5B is a block diagram illustrating certain functional components of a central computer constructed in accordance with the invention;

FIG. 6 is a flowchart illustrating the top-level functional operation of a system constructed in accordance with the invention; and

FIG. 7 is a flowchart illustrating the top-level functional operation of one aspect of a system constructed in accordance with the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Having summarized the invention above, reference is now made in detail to the description of the invention as illustrated in the drawings. While the invention will be described in connection with these drawings, there is no intent to limit it to the embodiment or embodiments disclosed therein. On the contrary, the intent is to cover all alternatives, modifications and equivalents included within the spirit and scope of the invention as defined by the appended claims.

Referring now to the drawings, reference is made to FIG. 1, which is a block diagram illustrating certain fundamental components of a system 100 constructed in accordance with the teachings of the present invention. More particularly, a system 100 of the present invention includes a plurality of transmitters 102, 104, 106, and 108. These transmitters 102, 104, 106, and 108 are preferably RF (Radio Frequency) transmitters, that are relatively small in size and transmit a relatively low power RF signal. As a result, the transmission range of a given transmitter 102, 104, 106, and 108 is relatively limited. As will be appreciated from the description that follows, this relatively limited transmission range of the transmitters 102, 104, 106, and 108 is an advantageous and desirable characteristic of the system 100. Although the transmitters 102, 104, 106, and 108 are depicted as including a keypad, in certain embodiments of the invention the transmitters may include only two or three buttons. In still further embodiments, the transmitters may not include any external buttons at all. Instead, the transmitters may be electrically integrated into another device, such as a smoke detector, a thermostat, a security system, *etc.*, where external buttons are not needed.

The system 100 also includes a plurality of repeaters 110, 112, and 114. Each repeater 110, 112, and 114 is configured to receive an incoming RF transmission (transmitted by a transmitter) and to transmit an outgoing signal. This outgoing signal may be a higher power RF transmission signal, or alternatively by an electrical signal over a conductive wire, fiber optic cable, or some other transmission medium. The internal architecture of a transmitter 102 and a repeater 110 will be discussed in more detail in connection with FIGS. 3 and 4. As will be described in more detail herein, the repeaters 110, 112, and 114 may be stand alone devices. Alternatively, they may be integrated into an alarm device, such as a smoke detector, a security system, a thermostat, *etc.*

A computer 120 is disposed to receive communications from the various repeaters, 110, 112, and 114, analyze the transmissions so received, and carry out any appropriate operations. In this regard, and as will be further described below, the computer 120 may communicate information, service requests, etc. to remote

locations 122 via a direct dial link over the PSTN, or via a TCP/IP connection across the Internet 130.

It will be appreciated that a system constructed in accordance with the teachings of the present invention may be used in a variety of environments. In accordance with a preferred embodiment, a system such as that illustrated in FIG. 1 may be employed in a retirement community. As will be further described below, the system may be implemented in a manner to provide universal monitoring and control of residents, as well as systems within the community. For example, an RF transmitter 102 may be worn or carried by each resident within the community (see FIG. 2A). If at any time the resident 103 is in need of medical assistance, the resident may signal for such assistance by simply pressing a button provided on the transmitter 102. In a manner that will be described below, this request for assistance may be communicated from the transmitter 102 to a nearby repeater 110. The repeater 110 may then further communicate this information to a central computer 120.

Since the transmitter unit 102 is wireless, it may be toted about without restriction or limitation. In addition, the transmitter 102 may be configured to communicate encoded information that identifies the transmission as being a request for assistance, as well as transmitting information that identifies the particular person in possession of the transmitter 102. The repeater 110 may receive and further communicate this information onto the computer 120. In addition, the repeater 110 may add a repeater identification number to the information it communicates. Accordingly, the computer 120 may evaluate the repeater identification number to ascertain the proximate location of the transmitter 102. This will assist personnel in rapidly locating the individual in need of assistance.

Once this information has been ascertained, the computer 120 may summons the appropriate personnel to provide assistance, in any of a variety of manners. One manner may be to alert one or more persons by way of a direct dial telephone connection across the PSTN 130, whereby a request for assistance may be communicated to a remote location by dialing a predetermined phone number. Alternatively, the computer 120 may communicate this information to a remote location, or locations, via the Internet. In one embodiment, a server may be provided

in connection with the computer 120 to maintain a constant connection to the Internet, so that a request issued there-across may be done so rapidly, without the delay associated with the normal start-up and connection. Alternatively, for intermittent requests, a constant connection need not be maintained to the Internet.

In accordance with one implementation of a system constructed in accordance with the invention, the computer 120 may communicate emergency request information to a centralized remote location. Such a centralized location may be configured to receive such requests from a plurality of different retirement communities, or other locations. Upon receiving requests for assistance, a person at the centralized location may then contact the appropriate personnel at a given community (the community requesting assistance). As should be appreciated, such an implementation eliminates the need for each individual community to employ a full-time person to monitor requests that come across the computer 120.

In accordance with another implementation of a system constructed in accordance with the invention, the computer 120 may be configured to issue a page to personnel in response to the request for assistance. By way of illustration, consider a vertically-integrated retirement community comprising a high-rise apartment building having many floors. There may be one or more staff individuals, at a given time, stationed on each floor. If the repeater 110, through which a request for assistance is transmitted, is located on, for example, the seventeenth floor, then the computer 120 may page a designated staff person (or office) located on the seventeenth floor, to relay the request for assistance. This page may be by way of an intercom system, a remote paging unit (*e.g.*, a personal pager), or otherwise. The information transmitted with the page may include (as will be further described below) the identification and/or description of the person needing emergency assistance.

In accordance with the universality of the present invention, transmitter units may be electrically integrated into various equipment, as well as being toted by individuals. For example, a transmitter 104, similar to transmitter 102, may be integrated into a smoke detector (see FIG. 2B), in such a way that an alarm condition from the smoke detector 105 may initiate a transmission from the transmitter 104 in much the same way that the user 103 (FIG. 2A) could initiate a transmission from the

transmitter 102 by depressing a button. Like the events described above, the transmitter 104 may transmit a transmitter identification number, as well as a transmitter code, to a nearby repeater 112. The repeater 112 may then add to this transmission a repeater identification number, which conveys location information to the computer 120. It will be appreciated that integrating a transmitter 104 into a smoke detector in this fashion, allows smoke detectors to be readily installed in a variety of locations, without having to be pre-wired into a particular location. Furthermore, for smoke detectors that have been prewired with a power source, additional communication lines need not be prewired, as communications from the smoke detector may be communicated via RF to a nearby repeater 112. Upon receiving a transmission that the computer 120 identifies as being a smoke alarm, the computer may communicate a request to a remote facility, such as a nearby fire station, as well as alerting staff persons on the premises of the emergency situation, so that corrected action may be taken immediately.

In yet another implementation, a wireless transmitter 106 may be integrated into a climate control system 105. Specifically, the transmitter 106 may be integrated into a thermostat 107 in such a way that it periodically transmits the settings of the thermostat, as well as the sensed temperature to the computer 120. This information may be sent and identified by a transmitter code indicating only routine information. If, however, the temperature controls on the thermostat are set to extreme temperatures, the transmitter code transmitted to the computer 120 may be different, so as to demand a higher priority of response.

Alternatively, a first transmitter code may be communicated for the temperature settings, and a different transmitter code may be communicated based upon temperature readings. In such an embodiment, the computer 120 may, based upon the transmitted code, make the ultimate determination as to the priority to assess a given transmission. It will be appreciated that, particularly in retirement communities having elderly and perhaps infirmed people, that the thermostat settings may be inadvertently set to inappropriate levels. Utilizing the transmission capabilities of the present invention, such settings may be closely monitored so that the appropriate personnel may be summoned to rectify a problem, before the

temperature reaches extreme levels. In the past, one alternative solution to this problem has simply been to limit the ability of persons within such a community to exercise independent control over thermostats within their room or living area. A system in accordance with the present invention overcomes the shortcomings, while providing control and flexibility to the residents within the community.

In accordance with yet another implementation of the present invention, a transmitter 108 may be integrated into a residential security system. In this regard, a transmitter may be integrated within a sensor, such as the type that may sense a window 109 (see FIG. 2D). Integrating a transmitter in this way, into either a window sensor, door sensor, a motion detector, or other security sensor, allows the system 100 of the present invention to provide more comprehensive information and monitoring capability. Furthermore, a central monitoring location can be utilized to monitor any of a variety of emergency or other conditions that may arise, providing a more cost effective system implementation. Moreover, in older structures, where security wiring may not be prewired into windows and doors, the wireless transmitter 108 allows for ready adaptation of a window, door, or other structure, without having to undertake the expense of routing security wiring throughout the structure to handle this task.

As will be further appreciated from the discussion herein, the various transmitters 102, 104, 106, and 108 may have substantially identical construction (particularly with regard to their internal electronics), which provides a cost effective implementation at the system level. Furthermore, a plurality of repeaters 110, 112, and 114, which may be identical, are disposed throughout a complex in such a way that adequate coverage in a complex or community is provided. Preferably, the repeaters, 110, 112, and 114 may be dispersed sufficient that only one repeater will pick up a transmission from a given transmitter (due in part to the low power transmission nature of each transmitter). However, in certain instances two, or even more, repeaters may pick up a single transmission. Thus, the computer 120 may receive multiple requests from the same transmitter, but from different repeaters. The computer 120 may utilize this information to triangulate, or otherwise more particularly assess the location from which the transmission is originating.

In accordance with the preferred embodiment, repeaters 110,112, and 114 may be integrated into alarm devices like the smoke alarm 105 (of FIG. 2B), the thermostat 107 (of FIG. 2C) or the security system 109 (of FIG. 2D). The advantage of integrating a repeater, as opposed to a transmitter, into an alarm device relates to the ability of the repeater to receive incoming information, as opposed to merely transmitting information. Significantly, the central computer 100 may communicate back to the repeaters. For example, in a repeater that is integrated into an alarm device, such as a thermostat, the repeater may communicate thermostat settings and/or temperature readings to the central computer 100. If the central computer 100 determines that the setting and/or readings exceed certain predetermined values it may page an attendant or other service personnel to attend to the thermostat. Alternatively, the computer 100 may communicate (via RF or otherwise) a message back to the repeater, which may be configured to assume, or override, control of the thermostat.

Reference is now made to FIG. 3A, which is a block diagram that illustrates certain functional components of a transmitter 102, of the type worn or carried by a person, in more detail. Blocks 202, 204, and 206 represent physical buttons, which a user may actuate to cause the transmitter 102 to initiate different transmissions. In the illustrated embodiments, these include a "test" button 202, a "wake-up" button 204, and a panic or "emergency" button 206. Of course, additional, fewer, or different buttons may be provided on a given transmitter, depending upon the system or implementation desired. Each of these buttons may be electrically wired to an interface circuit 208 which is configured to receive electrical signals from the buttons 202, 204, and 206, and ultimately convey that information to a data formatter 210. In one embodiment, the interface circuit 208 may simply comprise an addressable port that may be read by the data formatter 210.

For example, each of the signal lines extending between the buttons and the interface circuit 208 may be pulled up by individual pull up resistors (not shown). Depressing any of the individual buttons may ground the electrical signal line interconnecting the respective button and the interface circuit 208. The data formatter 210 may constantly read from the port defined by the interface circuit 208, and all bit

positions should remain high at any given time, if no buttons are depressed. If, however, the data formatter 210 reads a zero in one or more of the bit positions, it then recognizes that one or more of the buttons 202, 204, and 206 have been depressed.

A controller 212 is also illustrated, and may be provided to control the overall operation of the transmitter unit. The controller may be implemented by dedicated circuitry or, alternatively, may be implemented by a CPU executing code to carry out the various desired functional and features unit.

Each transmitter unit may be configured to have a unique identification code (*e.g.*, transmitter identification number) 216, that uniquely identifies the transmitter to the central computer 120 (FIG. 1). This transmitter identification number may be electrically programmable, and implemented in the form of, for example, an EPROM. Alternatively, the transmitter identification number may be set/configured through a series of DIP switches. Additional implementations of the transmitter identification number, whereby the number may be set/configured, may be implemented consistent with the broad concepts of the present invention.

Finally, an additional functional block of the transmitter 102 is an RF transmitter circuit to 218. This circuit is used to convert information from digital electronic form into a format, frequency, and voltage level suitable for transmission from antenna 219 via an RF transmission medium.

The data formatter 210 operates under the control of controller 212 to format concise data packets 222 that may be transmitter via RF to a nearby repeater. From a substantive basis, the information conveyed includes a transmitter code, as well as a transmitter identification number. As previously mentioned, the transmitter identification number is set for a given transmitter 102. When received by the central computer 120, the transmitter identification number may be used to access a look up table that identifies, for example, the person assigned to carry that particular transmitter 102. Additional information about the person may also be provided within the lookup table, such as, a physical description, and/or any other information that may be deemed appropriate or useful under the circumstances or implementation of the particular system.

In addition, a transmitter code is communicated from the transmitter 102 to the nearby repeater. FIG. 3A illustrates a lookup table 220 that may be provided in connection with the data formatter 210. The lookup table 220 may be provided to assign a given and unique transmitter code for each button pressed. For example, the test button 202 may be assigned a first code, the wake-up button 204 may be assigned a second code, and the emergency button 206 may be assigned a third code. Furthermore, additional codes may be provided as necessary to accommodate additional functions or features of a given transmitter 102. Thus, in operation, a user may depress the emergency button 206, which is detected by the data formatter 210. The data formatter 210 may then use the information pertaining to the emergency button 202 to access a look up table 220 to retrieve a code that is uniquely assigned to the emergency button 206. The data formatter may also retrieve the preconfigured transmitter identification number 216 in configuring a data packet 222 for communication via RF signals to a nearby repeater.

Reference is now made briefly to FIG. 3B, which is a block diagram illustrating certain functional blocks of a similar transmitter 104 that may be integrated into a smoke alarm. As illustrated, many of the components of the transmitter 104 are similar to that of transmitter 102 and need not be repeated herein. The principal difference between the configurations of the transmitter 102 of FIG. 3A and the transmitter 104 of FIG. 3B lies at the input of the interface circuit 208. Specifically, transmitter 102 included user interface buttons 202, 204, and 206. Transmitter 104, instead, illustrates a test button 230 and an alarm sensor/output 232. As is known, most smoke detectors/alarms include a button that allows a user to manually test the operation of the smoke alarm. This test button 230 may be input to the interface circuit 208, and may be assigned a unique code (Code 1) for communication to the central computer 120. In similar fashion, an alarm sensor 232 (or other alarm circuitry) may provide an additional input to the interface circuit 208. A unique transmitter code (Code 2) may be assigned to the alarm sensor 232 input. In this way, the data packet communicated from transmitter 104 may readily distinguish between a manual test of the smoke alarm, versus an actual alarm of the smoke alarm.

In one configuration, if an alarm output is directed to the interface circuit 208, then upon a manual test by depressing test button 230, signals from both the test button 230, as well as the alarm sensor 232 may be input to the interface circuit 208. Thus, two data packets may be communicated from the transmitter 104. One data packet may include the transmitter code associated with the test button 230, while a second data packet may include the transmitter code associated with the alarm sensor 232. In such a configuration, the central computer 120 could readily discern that the alarm sensor 232 was triggered in response to a manual test. Alternatively, the central computer 120 could detect improper operation of a smoke alarm if, for example, it received a packet indicating depression of the test button 230, but did not receive a corresponding packet indicating activation of the alarm. Of course, additional and/or alternative configurations may also be provided. For example, a similar configuration may be provided for a transmitter that is integrated into, for example, a carbon monoxide detector.

Reference is now made to FIG. 3C, which is a block diagram similar to that illustrated in FIGS. 3A and FIG. 3B, but illustrating a transmitter 106 that is integrated into a thermostat 107 (see FIG. 2C). In this embodiment, the interface circuit 208 may include multiple inputs such as a temperature control (i.e., temperature set value), as well as an actual temperature reading from a thermister out or other temperature measuring device. Other manual controls may be input to the interface circuit as well, including the value from the system on off switch 244, as well as the value of the switch indicating whether heat, fan, or AC has been selected by the thermostat control 246. In addition, depending upon the specific implementation, other controls may be provided as well. Again, each of these various input sources are routed to an interface circuit which provides the information to a data formatter 210. The data formatter may utilize a look up table 220 to access unique transmitter codes that may be communicated in a packet, via RF, to convey certain information to a computer 120. Alternatively, actual temperature values may be transmitted (as operands) to a code, which code would indicate that the operand value may be a temperature reading. In general, the operation of a transmitter 106

will be similar to that described in connection with the transmitter 102 illustrated in FIG. 3A.

Reference is now made to FIG. 3D, which is a block diagram similar to those illustrated in FIGS. 3A, 3B, and 3C. Specifically, the transmitter 108 illustrated in FIG. 3D is a transmitter of a type which may be integrated with a security alarm system. In this regard, an alarm signal 250 may be routed to the interface circuit 208, and may be associated with a transmitter code for transmission to the central computer 120. Depending upon the type of alarm system and the configuration desired, additional or different inputs may be provided to the interface circuit.

Reference is now made to FIG. 4A, which is a block diagram illustrating certain principal components within a repeater 110 of a system 100 (see FIG. 1) constructed in accordance with the present invention. As previously mentioned, a repeater 110 includes a receiver 302 that is configured to receive an incoming RF signal, and a transmitter 304 for transmitting an outgoing signal onto the central computer 120. The transmitter 304 may be configured for communicating an RF transmission signal, or alternatively for communicating an electrical signal over a conductive wire, a fiber optic cable, or other transmission medium. If the repeater 110 is configured for communicating an RF output signal in the preferred embodiment, such an RF signal would be of a higher power than the RF signal transmitted from the transmitters 102, 104, 106, and 108. In this way, the repeaters would have a greater distance of transmission than would the transmitters. Furthermore, it should be appreciated that the modulation scheme employed on the repeater transmitter 304 would be different than that employed on the remote transmitters 102, 104, 106, and 108, so that an RF transmission from a repeater would not be picked up by another repeater. The repeater 110 also includes a data formatter 306 for formatting the outgoing message. A centralized controller and other circuitry may also be included as part of the repeater, but need not be shown or described herein, as the implementation of such circuitry would be well within the understanding of a person having ordinary skill in the art.

From a substantive standpoint, the data formatter 306 takes the received signal, which includes a transmitter code and a transmitter identification number, and

adds to that an additional portion of information that includes a repeater identification number. In this regard, the repeater identification number may be provided by way of a programmable memory location, a series of DIP switches, or other mechanisms 308. Indeed, the repeater identification number may be implemented on the repeater in much the same way that the transmitter identification number is implemented on the transmitters, and as was described in connection with FIG. 3A. Therefore, a data packet 310 is created by the repeater 110 for further communication onto the central computer 120 (see FIG. 1).

Reference is now made to FIG. 4B, which illustrates certain other features of a repeater constructed in accordance with an embodiment of the present invention. For purposes of illustration, many components have been illustrated in a fashion similar to that of FIG. 4A. Additional functional blocks illustrated in FIG. 4B include an alarm device 312 (such as a thermostat, smoke alarm, security system, *etc.*), an alarm interface circuit 314, and a controller 316. In operation, the repeater 110 may communicate the a variety of information to the central computer 100, including a repeater identification number, a transmitter identification number (this may be a number identifying an alarm device), and a transmit code. In addition, the computer 100 may communicate certain information back to the repeater 110, including a repeater identification number and an alarm control code. Of course, additional or different information may be communicated back to the repeater 310, depending upon the particular embodiment.

As previously mentioned, a receiver 302 within a repeater 310 may continuously monitor for transmissions. The repeater may be configured to monitor transmissions to identify its internal identification number, which may signal to the repeater 310 that a given transmission is intended uniquely for it. In addition, an alarm control code may also be communicated to the repeater. Thereafter, a controller 316 may be configured to control the alarm device 312, via alarm interface circuit 314, in accordance the command encoded in the alarm control code. For example, one control code may be interpreted by the controller 316 to override the manual temperature setting on the alarm device 312. Another alarm code may deactivate an audible alarm on an alarm device such as a smoke alarm. Consistent with the

invention, additional or different alarm codes may be utilized. It will be appreciated by persons skilled in the art that the alarm interface circuit 314 may be uniquely configured to interface with a specialized alarm device 314. This circuit, therefore, may differ from repeater to repeater, depending upon the alarm device 312 that is interfaced. Implementation of the interface circuit 314 will be understood by persons skilled in the art, and need not be described herein. The controller 316 may utilize a lookup table or other mechanism to decode and interpret the alarm control code.

Reference is now made to FIG. 5A, which is a block diagram illustrating certain primary physical components that may be provided within the central computer 120. These include a receiver 320, a CPU 322, a memory 324, a network card, 326, a modem 328, an ISDN card 330, as well as other components that are not illustrated in the drawing. The receiver 320 may be configured to receive the incoming signal, whether the signal is received via RF signaling, conductive wire, fiber optic cable, or otherwise. The receiver 320 may then format the received signal for digital storage and store the information within memory 324. Program code within the memory 324 may also be provided and configured for controlling the operation of a CPU 322 to carry out the various functions that are orchestrated and/or controlled by the computer 120. For example, the memory 324 may include program code for controlling the operation of the CPU 322 to evaluate an incoming data packet to determine what action needs to be taken. In this regard, look up tables 326 may also be stored within memory 324 to assist in this process. Transmitter codes, transmitter identification numbers, repeater identification numbers, etc. may all be stored with associated information within look up tables 325.

Thus, one look up table may be provided to associate transmitter identification numbers with a particular user. Another look up table may be used to associate transmitter codes with the interpretation thereof. For example, a unique code may be associated by a look up table to identify functions such as test, temperature, smoke alarm active, security system breach, *etc.* In connection with the lookup tables 325, the memory 324 may also include a plurality of code segments that are executed by the CPU 322, and which largely control the operation of the computer. For example, a first code segment 332 may be provided to access a first lookup table to determine

the identity of the transmitter which transmitted the received message. A second code segment may be provided to access a second lookup table to determine the proximate location of the transmitter, by identifying the repeater that relayed the message. A third code segment may be provided to identify the content of the message being transmitted. Namely, is it a fire alarm, a security alarm, an emergency request by a person, a temperature control setting, *etc*. A fourth code segment may be provided to control the appropriate action that is to be carried out, based upon the outcomes of the first three code segments. Consistent with the invention, additional, fewer, of different code segments may be provided to carryout different functional operations.

The computer system 120 may also include one or more mechanisms through which to communicate with remote systems. For example, the computer system may include a network card 326, which would allow the computer 120 to communicate across a local area network to a network server, which in turn may contain a gateway to the PSTN or Internet. Alternative, the computer system 120 may contain a modem 328, which may be configured to provide a direct dial link to a remote system, by way of the PSTN 130. Alternatively, the computer 120 may include an ISDN card 330 configured to communicate via an ISDN connection with a remote system. Other communication gateways may be provided as well.

Reference is now made to FIG. 5B, which is a block diagram illustrating certain functional, as opposed to physical blocks that may be provided as a part of the computer 120. In this regard, a receiver 340 may be configured to receive the incoming RF data packet 310. Another functional block 342 may be configured to evaluate the various codes of the incoming data packet 310. This functional unit may employ various look up tables 344, 346, and 348 to retrieve information associated with the various codes communicated as part of a data packet. As illustrated, a first look up table 344 may associate transmitter codes with various actions or functions that are uniquely identified by the code. Simply by way of illustration, a three digit hexadecimal code may be provided to cover various transmitter codes. For example, the code 04H may be associated with the function of a wake-up call, which may be carried out by a user depressing a wake-up or call-in button 204 on a user transmitter 102. The transmitter code 8H3 may be the code that indicates a thermometer

temperature setting. A second byte (operand) may be associated with this byte and may relay the value of the temperature setting. As will be appreciated, numerous other codes may be provided and associated with certain particular functions, which may then be decoded at the central computer 120.

As second look up table 346 may be provided to associate transmitter identifications. For example, as previously described, each transmitter is preconfigured with a transmitter identification number. In the context of transmitters 102 that are carried by individuals, the transmitter identification number may be associated with a particular person (by name). As will be appreciated, additional information regarding the individual (*e.g.*, physical description) may be provided in the look up table as well). Other transmitter identification numbers may be associated with equipment, such as a thermostat, a smoke alarm, carbon monoxide detector, security system, etc. Thus, the unique transmitter code informs the central computer 120 as to the origin of the transmission.

Finally, a third table 348 may be provided to associate the receiver identification number with a given location. As previously described, repeaters 110, 112, and 114 are disposed throughout a complex, compound, or other area of interest. During the initial configuration, each repeater is configured to have a unique identification number associated with that receiver. A look up table 348 may associate these unique identification numbers with a physical location of the repeater. For example, one repeater may be physically located in an exterior courtyard, while another repeater may be physically located in a seventeenth floor recreation room. The central computer may use a look up table 348 to immediately identify the location of the repeater that received the RF transmission.

As designated in FIG. 5B, these lookup tables 344, 346, and 348 effectively provide the "who", "what", and "where" for the information that is encoded within the transmitter identification number, the transmitter code, and the repeater identification number, respectively.

Other functions may be provided in connection with the central computer 120 as well. For example, a dial out connection 352 may be established and/or maintained by the computer 120 in response to RF transmissions that are received by the receiver

340. In an alternative embodiment, the computer 120 may include an Internet gateway and/or server for maintaining either an intermittent or constant connection with the Internet. Messaging of certain types of information may be communicated via this gateway and/or dial out connection 352.

Reference is now made to FIG. 6, which is a flow chart illustrating the top-level functional operation of a system constructed in accordance with the invention. In the illustrated embodiment, the system may monitor a receiver for incoming transmissions (step 402). Once an incoming transmission is received, the system may then access a first look up table to evaluate a transmitter identification code to determine the transmitter origin of the communication (step 404). Next, the system may access a second look up table to evaluate a transmitter code to ascertain the purpose or function of the transmission (step 406). Finally, the system may access a third look up table to evaluate a repeater identification number, to ascertain the proximate location of the originating transmission (step 408). Thereafter, the system may initiate and take whatever action is deemed appropriate (step 410).

With regard to step 410, there are numerous actions that may be deemed appropriate, depending upon the content of the transmitter identification number, the transmitter code, and repeater identification number. For example, if the transmitter identification code indicates that the transmission is due in response to an alarm condition at a smoke alarm, the appropriate action may be to establish a dial up connection with a local fire department (step 412). In addition, if the system ascertained that the location of the smoke alarm (based upon the repeater identification number) was the seventh floor of a building structure, this information may also be communicated to the fire department, as this would inform them that trucks with extension ladders, buckets, or other access devices may be needed. If the transmitter identification number and transmitter code indicated that a security breach had occurred, then the corrective action may be to alert local law enforcement officers (step 441) and/or a private security service. If the transmitter identification number and transmitter code indicated that a person was requesting emergency assistance, then the corrective action may be to dial out to contact emergency personnel, or initiate a page for personnel on site to respond. Such a page or dial out may further

include location information, so that persons responding to the distress signal would know the approximate location of the person in need of assistance. If the transmitter identification number and transmitter code indicated that the message where a response to a thermostat control setting being placed at an impermissible setting, then the emergency action may be simply to disengage that climate control unit, or perhaps to dispatch (on a non-emergency basis) an onsite person to correct the thermostat setting.

It will be appreciated that a variety of other responsive actions may be taken by the computer 120 in accordance with the invention. Those illustrated herein have been provided merely for purposes of illustration, and should not be deemed to be limiting upon the broader scope and content of the present invention. In this regard, reference is made to FIG. 7 which is a flow chart illustrating the top-level functional operation of one feature of a system constructed in accordance with the invention. In the context of a retirement community, or other facility that desirably monitors the activity of a residents or patients, the system may be configured to accommodate a morning check of the person. For example, in accordance with one aspect of a preferred embodiment, residents of a retirement community are each assigned personal transmitter 102. Each morning when a person awakes, that person may depress a "wake-up" or "call-in" button 204 (FIG. 3A). A transmitter code associated with that wake-up button is transmitted, along with the transmitter identification number and repeater identification number to a central computer 120. The computer 120 then verifies that all residents have checked-in by a certain time in the morning.

In this regard, the system may monitor, periodically, a time clock. After a certain time, for example, 10:00 a.m. (step 430), the system may access a memory storage area to determine all residents who have depressed their "wake-up" button since the previous day. This would then provide a listing of all people who have checked-in for the morning. This list may be compared against the database of all residents who have been assigned a transmitter 102 (step 432). The system may then evaluate whether all such residents have checked-in for the morning (step 434). If not, the system may print a report of all persons whom have not yet checked-in (step 436). Otherwise, the system may print a report indicating that all persons have

checked in for the morning (step 438). It will be appreciated that these reports may then be forwarded, either by fax, dial-up connection, Internet connection, or simply by printing out on a local printer, to a person for patient or resident verification. Specifically, in the event that a report prints indicating that certain persons have not checked-in for the day, then an onsite staff person may be paged or otherwise prompted to check on the well being of that particular person.

It will be appreciated that the foregoing description has illustrated certain fundamental concepts of the invention, but that other additions and/or modifications may be made consistent with the inventive concepts. For example, in one embodiment a more complex system may employ transmitters having two-way communication capability. In addition to the transmitters conveying information codes in the manner described hereinabove, they may also be adapted to convey voice information. Therefore, when a person presses, for example, the emergency button on his/her transmitter, then medical personnel, staff members, or others may respond by communicating via two-way radio with that particular person. In this regard, each transmitter may be equipped with a microphone and a speaker that would allow the person to communication information such as their present emergency situation, their specific location, etc.

The foregoing description has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obvious modifications or variations are possible in light of the above teachings. For example, it should be appreciated that, in some implementations, the transceiver identification number is not necessary to identify the location of the transmitter. Indeed, in implementations where the transmitter is stationarily integrated into an alarm or other system (*i.e.*, the location of the transmitter does not change), then the computer could be configured to identify the transmitter location by the transmitter identification number alone. In will be appreciated that, in embodiments that do not utilize repeaters, the transmitters will be configured to transmit at a higher RF power level, in order to effectively communicate with the computer.

As previously mentioned, in an alternative embodiment, the transmitter units may include an internal transceiver, as opposed to merely a one-way transmitter. This would allow the communication of information from the computer (or other source) to the transmitter units. By way of illustration, but not limitation, totable/handheld transmitter units may include a number of buttons that control various functions. As discussed above, these buttons may include a "Wake-up" button, a "Test" button, and an "Emergency" button. Each of these buttons has a predetermined function. However, if a transceiver was incorporated into the transmitter units, then the central computer could effect a change in the functionality of these buttons, by communicating such information to the transmitter units. Of course, additional circuitry/logic would be incorporated into the transmitter units to monitor for such incoming transmissions.

The embodiment or embodiments discussed were chosen and described to provide the best illustration of the principles of the invention and its practical application to thereby enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth to which they are fairly and legally entitled.

WHAT IS CLAIMED IS:

1. An environmental management system for a residential living community comprising:

a computer configured to execute at least one computer program that manages the environment of the community by monitoring select information that is reported to the computer;

a plurality of wireless transmitters configured to transmit select information as well as transmitter identification numbers a relatively limited distance, wherein at least one transmitter is a totable transmitter, at least one transmitter is integrated into a smoke detector, and at least one transmitter is integrated into a thermostat;

a plurality of repeaters dispersed throughout the community at defined locations, each repeater configured to receive select information that is transmitted from a nearby wireless transmitter and further communicate that select information to the computer, each repeater being further configured to transmit a repeater identification number along with the select information;

a circuit configured as a gateway between the computer and an external telecommunications network; and

a computer program executed by the computer, the computer program further including:

a first segment for evaluating a received message and identifying a specific transmitter that transmitted the message;

a second segment for evaluating the received message and identifying a specific repeater that relayed the message from the specific transmitter to the computer;

a third segment for evaluating the select information that is transmitted from a transmitter and embedded within the received message; and

a fourth segment responsive to the first, second, and third segments for determining an action to be taken based upon the select information, the identified transmitter, and the identified repeater.

2. The system as defined in claim 1, wherein each wireless transmitter is configured to transmit a relatively low-power radio-frequency (RF) signal.

3. The system as defined in claim 1, wherein each repeater is configured to receive a radio-frequency (RF) signal.

4. The system as defined in claim 3, wherein each repeater is further configured to transmit an RF signal.

5. The system as defined in claim 4, wherein each repeater is further configured to transmit an RF signal using a different modulation than that of the RF signal received by the repeater.

6. The system as defined in claim 1, wherein the repeaters are configured to communicate with the computer by way of conductive wires.

7. The system as defined in claim 1, wherein the repeaters are configured to communicate with the computer by way of radio frequency (RF) communication.

8. The system as defined in claim 1, wherein the repeaters are configured to communicate with the computer by way of conductive fiber-optic cabling.

9. The system as defined in claim 1, wherein the transmitters further include means for receiving data relayed from the repeaters.

10. The system as defined in claim 9, wherein the transmitters further include a microphone, a speaker, and means for communicating two-way voice information to with the computer via the repeaters.

11. The system as defined in claim 1, wherein the circuit configured as a gateway includes one selected from the group consisting of: a modem for establishing a dial-up connection with a remote computer; a network card for communicating across a local area network; a network card for communicating across a wide area network; an ISDN card; and a circuit for communicating via TCP/IP protocol over the Internet.

12. The system as defined in claim 1, further including a first lookup table that is utilize by the first segment, wherein the first lookup table is configured to associate a plurality of unique transmitter identification numbers with a plurality of unique transmitter identifiers, wherein each transmitter identification number is uniquely associated a unique transmitter identifier.

13. The system as defined in claim 12, wherein transmitter identifiers include personal transmitter, smoke detector, security alarm, and thermostat.

14. The system as defined in claim 1, further including a second lookup table that is utilize by the second segment, wherein the second lookup table is configured to associate a plurality of unique repeater identification numbers with a plurality of unique territorial locations, wherein each repeater identification number is uniquely associated a unique territorial location.

15. The system as defined in claim 12, wherein transmitter identifiers include personal transmitter, smoke detector, security alarm, and thermostat.

16. The system as defined in claim 1, further including a third lookup table that is utilized by the third segment, wherein the first lookup table is configured to associate a plurality of unique transmitter code with a plurality of unique information fields associated with the transmitter codes, wherein each transmitter code is uniquely associated with a unique information field.

17. The system as defined in claim 16, wherein information fields include information including test, wake-up, and emergency.

18. A system for a residential living community comprising:

a computer configured to execute at least one computer program that manages the environment of the community by monitoring select information that is reported to the computer;

a plurality of wireless transmitters configured to transmit select information a relatively limited distance;

a plurality of repeaters dispersed throughout the community at defined locations, each repeater configured to receive select information that is transmitted from a nearby wireless transmitter and further communicate that select information to the computer;

means for communicating information from the computer to a remote location; and

means for evaluating a received message and determining an appropriate action to be taken.

19. The system as defined in claim 18, wherein each wireless transmitter is configured to transmit a relatively low-power radio-frequency (RF) signal.

20. The system as defined in claim 20, wherein each repeater is configured to receive a radio-frequency (RF) signal.

21. The system as defined in claim 20, wherein each repeater is further configured to transmit an RF signal.

22. The system as defined in claim 21, wherein each repeater is further configured to transmit an RF signal using a different modulation than that of the RF signal received by the repeater.

23. The system as defined in claim 18, wherein the repeaters are configured to communicate with the computer by way of conductive wires.

24. The system as defined in claim 18, wherein the repeaters are configured to communicate with the computer by way of radio frequency (RF) communication.

25. The system as defined in claim 18, wherein the repeaters are configured to communicate with the computer by way of conductive fiber-optic cabling.

26. The system as defined in claim 18, wherein the means for communicating the information to a remote location includes a circuit configured as a gateway that includes one selected from the group consisting of: a modem for establishing a dial-up connection with a remote computer; a network card for communicating across a local area network; a network card for communicating across a wide area network; an ISDN card; and a circuit for communicating via TCP/IP protocol over the Internet.

27. The system as defined in claim 18, wherein the means for evaluating the received information includes a computer program that is executing on the computer.

28. A system for a residential living community comprising:

a computer configured to execute at least one computer program that manages the environment of the community by monitoring select information that is reported to the computer;

a plurality of wireless transmitters configured to transmit select information a relatively limited distance; and

a plurality of repeaters dispersed throughout the community at defined locations and being integrated within alarm devices, each repeater including circuitry configured to receive select information that is transmitted from a nearby wireless transmitter and further communicate that select information to the computer, each repeater further including circuitry configured to interface the repeater to an alarm device, each repeater further including circuitry configured to receive select information that is transmitted from the computer to the repeater.

29. The system as defined in claim 28, wherein the alarm device includes a device selected from the group consisting of: a smoke detector, a carbon monoxide detector, a carbon dioxide detector, a thermostat, and a security system.

30. A system for monitoring alarm conditions within a region comprising:

a plurality of wireless transmitters, each wireless transmitter being integrated into an alarm;

a plurality of repeaters dispersed throughout the region at defined locations; and

a computer configured to receive information communicated from the repeaters, the computer further including means for evaluating the received information and identifying an alarm condition and an originating location of the alarm condition, the computer further including means for reporting the alarm condition to a remote location.

31. The system as defined in claim 30, wherein the alarm includes one or more from the group consisting of: a smoke detector, a carbon monoxide detector; a carbon dioxide detector; a temperature sensor, and a security system.

32. The system as defined in claim 30, wherein at least one transmitter is integrated into a smoke detector and at least one transmitter integrated into a security system.

33. The system as defined in claim 30, wherein the means for reporting the alarm condition includes a circuit for establishing and maintaining electronic communications across a global computer network.

34. The system as defined in claim 30, wherein the means for reporting the alarm condition includes a circuit for establishing and maintaining electronic communications across a public switched telephone network (PSTN).

35. The system as defined in claim 30, wherein at least one transmitter is integrated into a smoke detector and at least one transmitter integrated into a thermostat.

36. A system for monitoring alarm conditions within a region comprising:

a plurality of wireless transmitters, each wireless transmitter being integrated into an alarm;

a computer configured to receive information communicated from the wireless transmitters, the computer further including means for evaluating the received information and identifying an alarm condition and an originating location of the alarm condition, the computer further including means for reporting the alarm condition to a remote location.

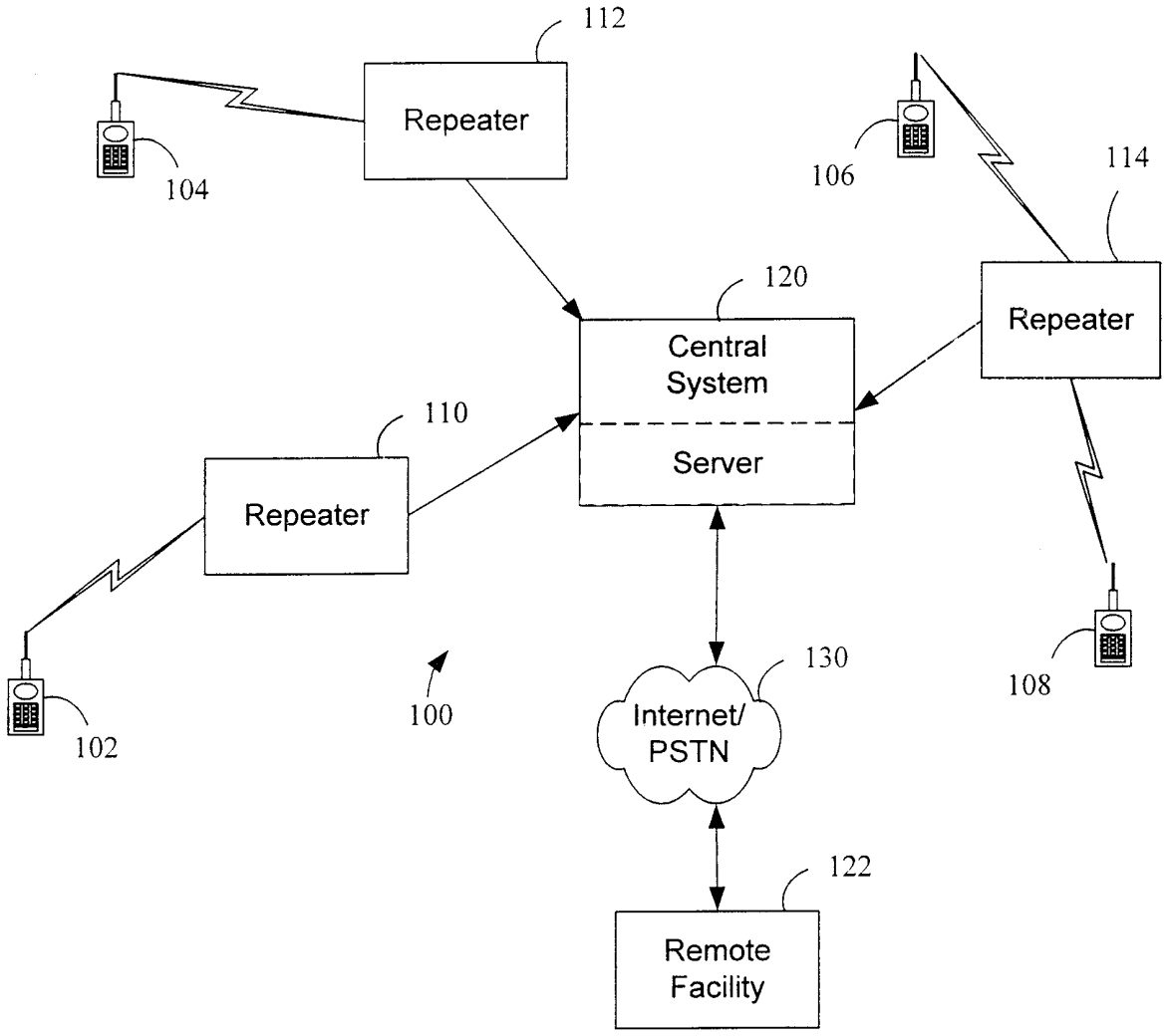
112
Repeater
104
106
114
120
Central System
Server
Repeater
110
Repeater
102
100
130
Internet/ PSTN
108
122
Remote Facility

FIG. 1

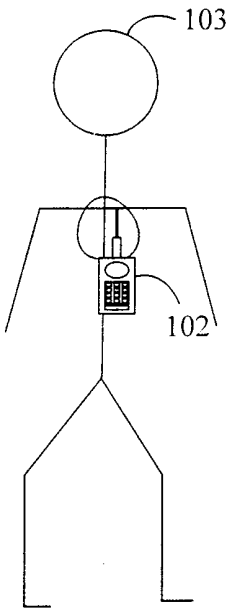

FIG. 2A

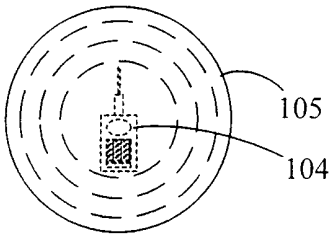

FIG. 2B

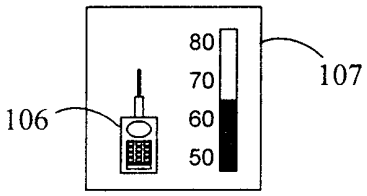

FIG. 2C

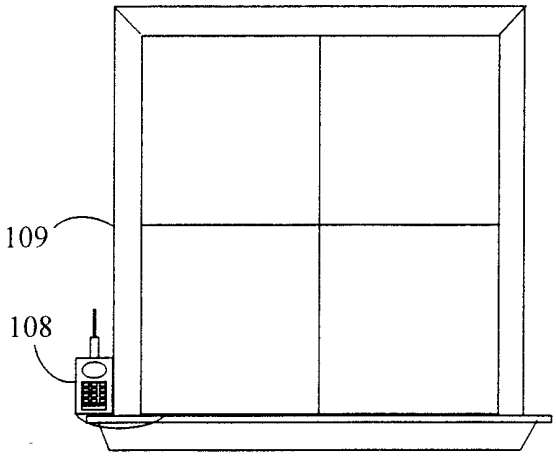

FIG. 2D

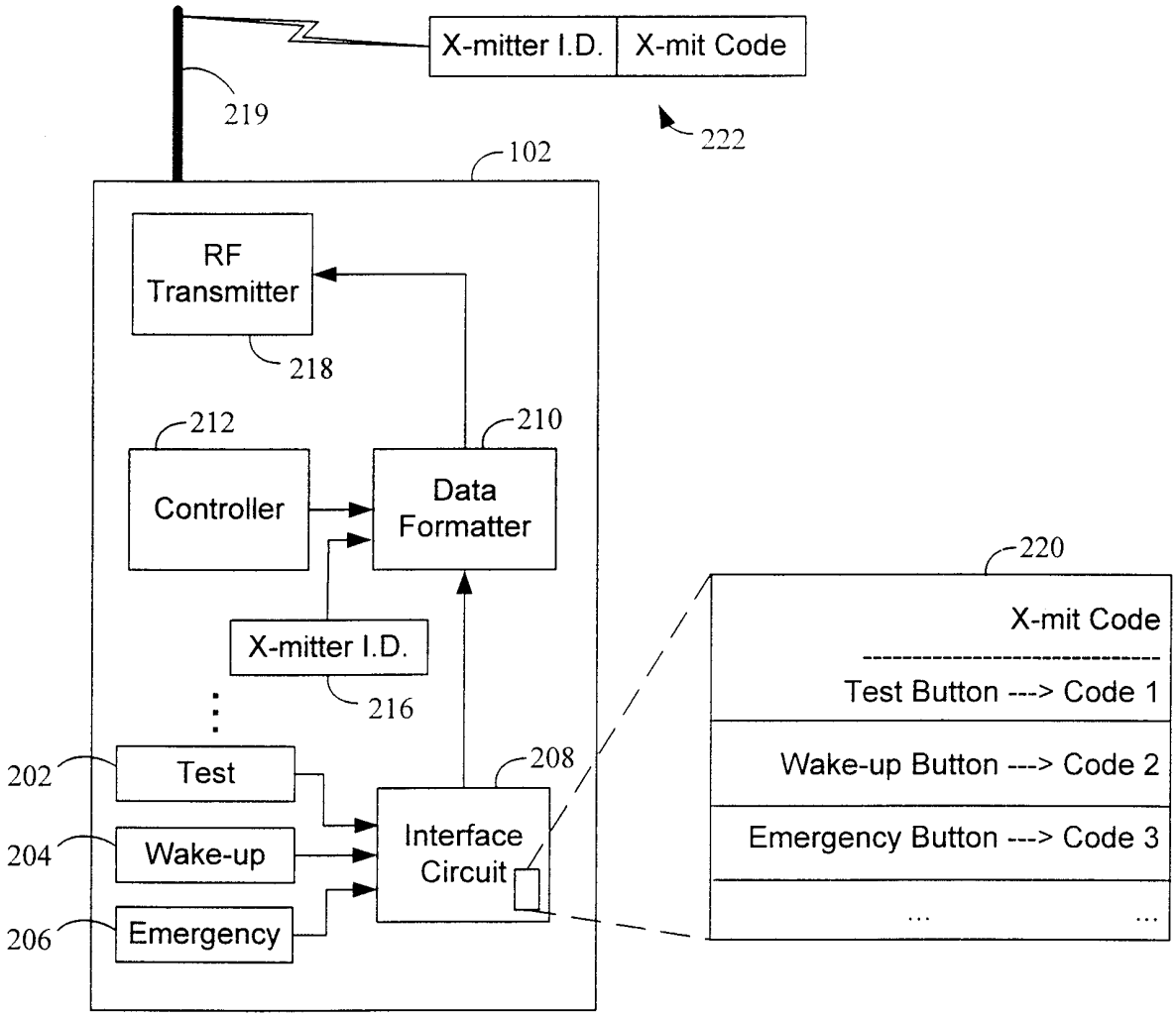
X-mitter I.D.
X-mit Code
219
222
102
RF Transmitter
218
212
210
Controller
Data Formatter
220
X-mit Code
X-mitter I.D.
216
Test Button ---> Code 1
Wake-up Button ---> Code 2
Emergency Button ---> Code 3
202
Test
208
204
Wake-up
Interface Circuit
206
Emergency

FIG. 3A

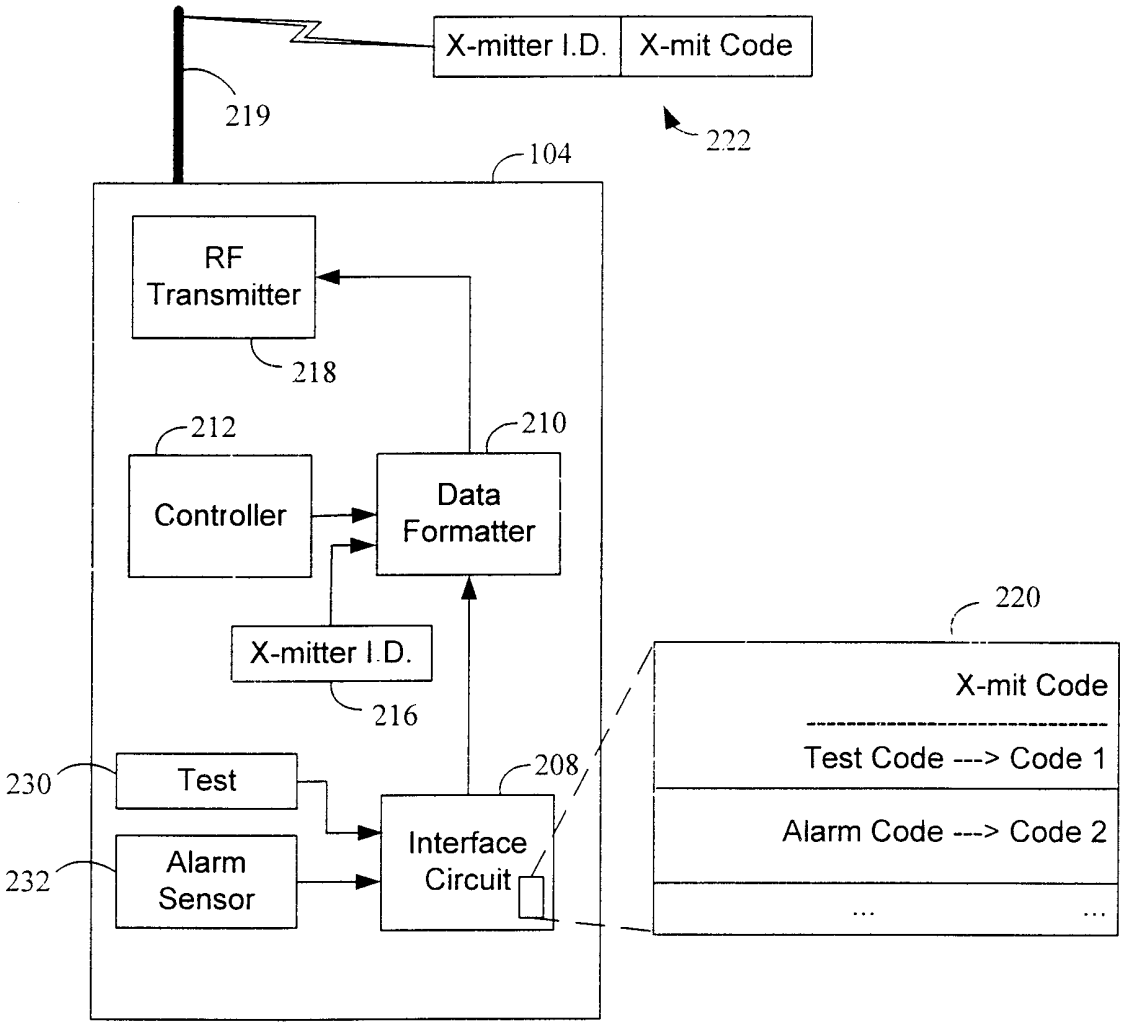
X-mitter I.D.
X-mit Code
219
222
104
RF Transmitter
218
212
210
Controller
Data Formatter
X-mitter I.D.
216
220
X-mit Code
Test Code ---> Code 1
Alarm Code ---> Code 2
230
Test
208
232
Alarm Sensor
Interface Circuit

FIG. 3B

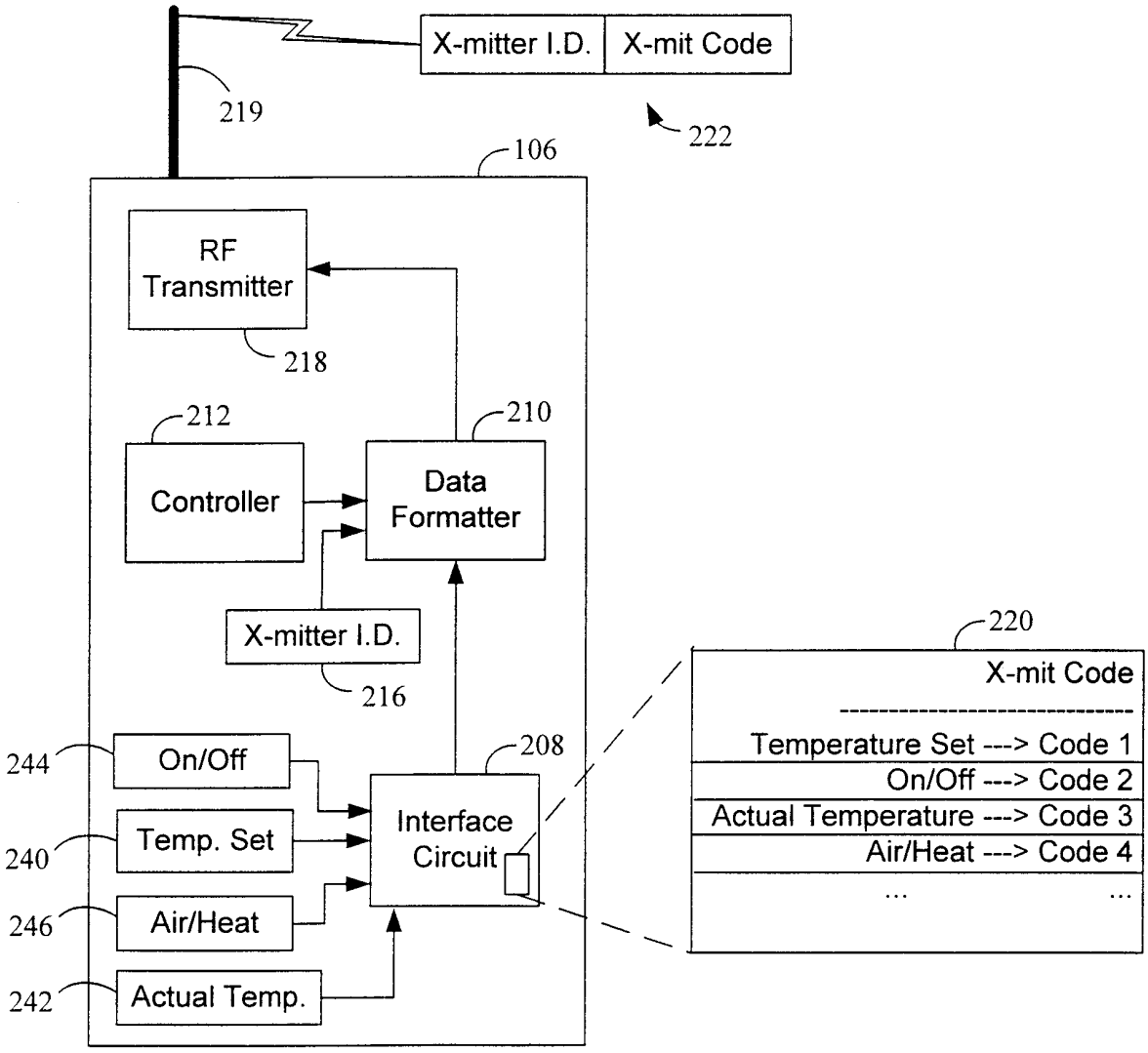
X-mitter I.D.
X-mit Code
219
222
106
RF Transmitter
218
212
210
Controller
Data Formatter
X-mitter I.D.
216
220
X-mit Code
Temperature Set ---> Code 1
On/Off ---> Code 2
Actual Temperature ---> Code 3
Air/Heat ---> Code 4
244
On/Off
208
240
Temp. Set
Interface Circuit
246
Air/Heat
242
Actual Temp.

FIG. 3C

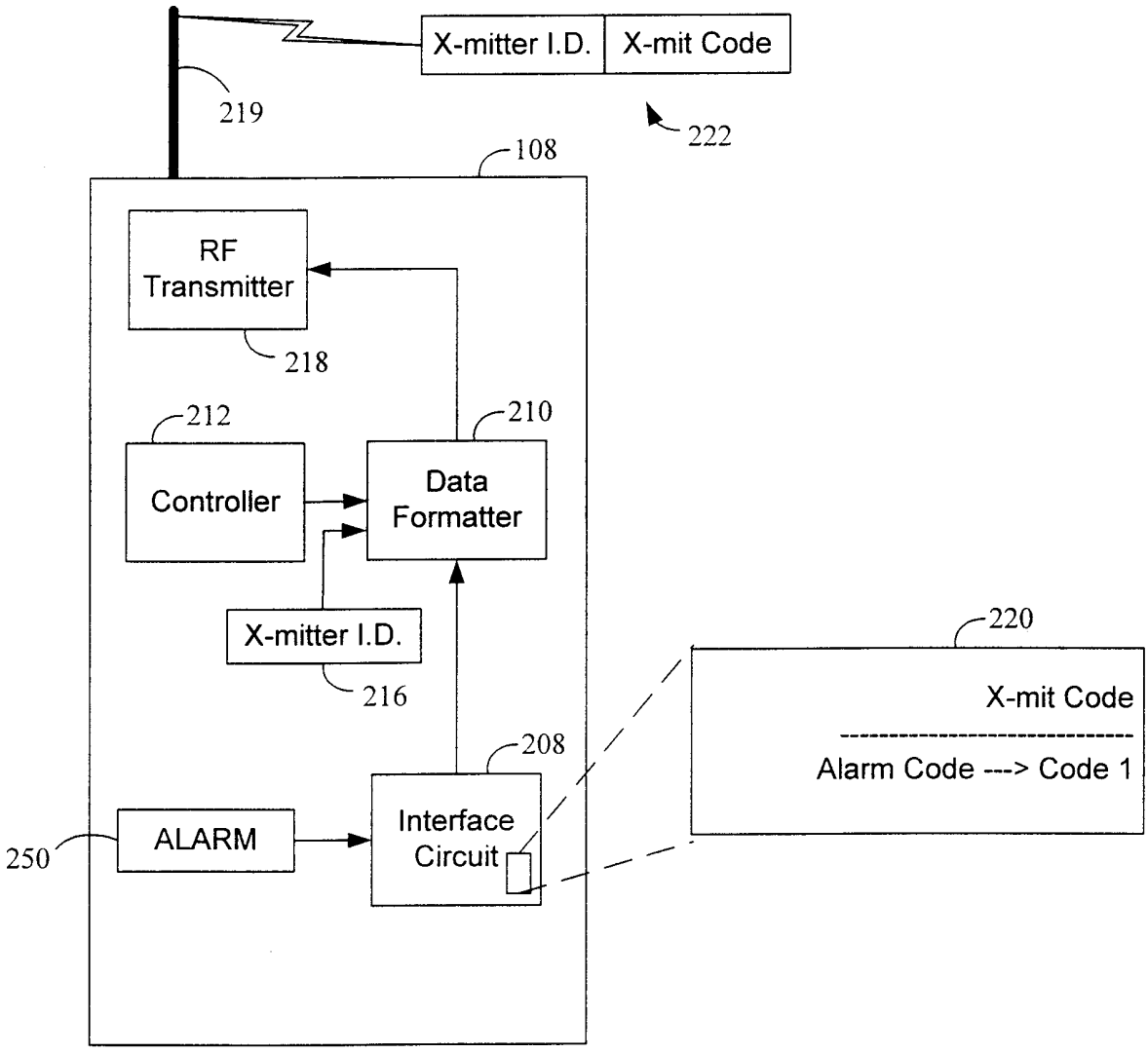
X-mitter I.D.
X-mit Code
219
222
108
RF Transmitter
218
212
210
Controller
Data Formatter
X-mitter I.D.
216
220
X-mit Code
Alarm Code ---> Code 1
208
ALARM
Interface Circuit
250

FIG. 3D

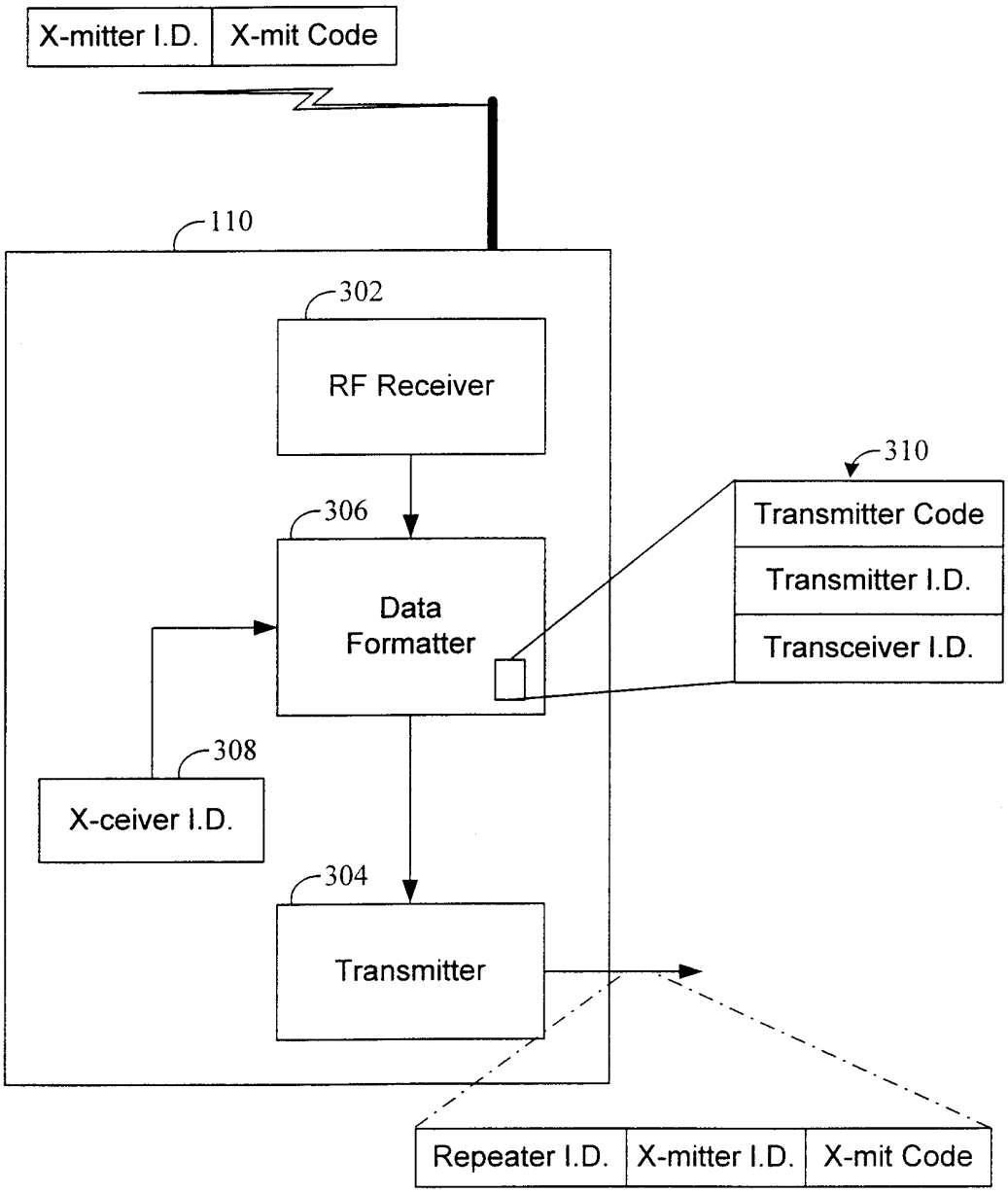
X-mitter I.D.
X-mit Code
110
302
RF Receiver
310
306
Transmitter Code
Transmitter I.D.
Transceiver I.D.
Data Formatter
308
X-ceiver I.D.
304
Transmitter
Repeater I.D.
X-mitter I.D.
X-mit Code

FIG. 4A

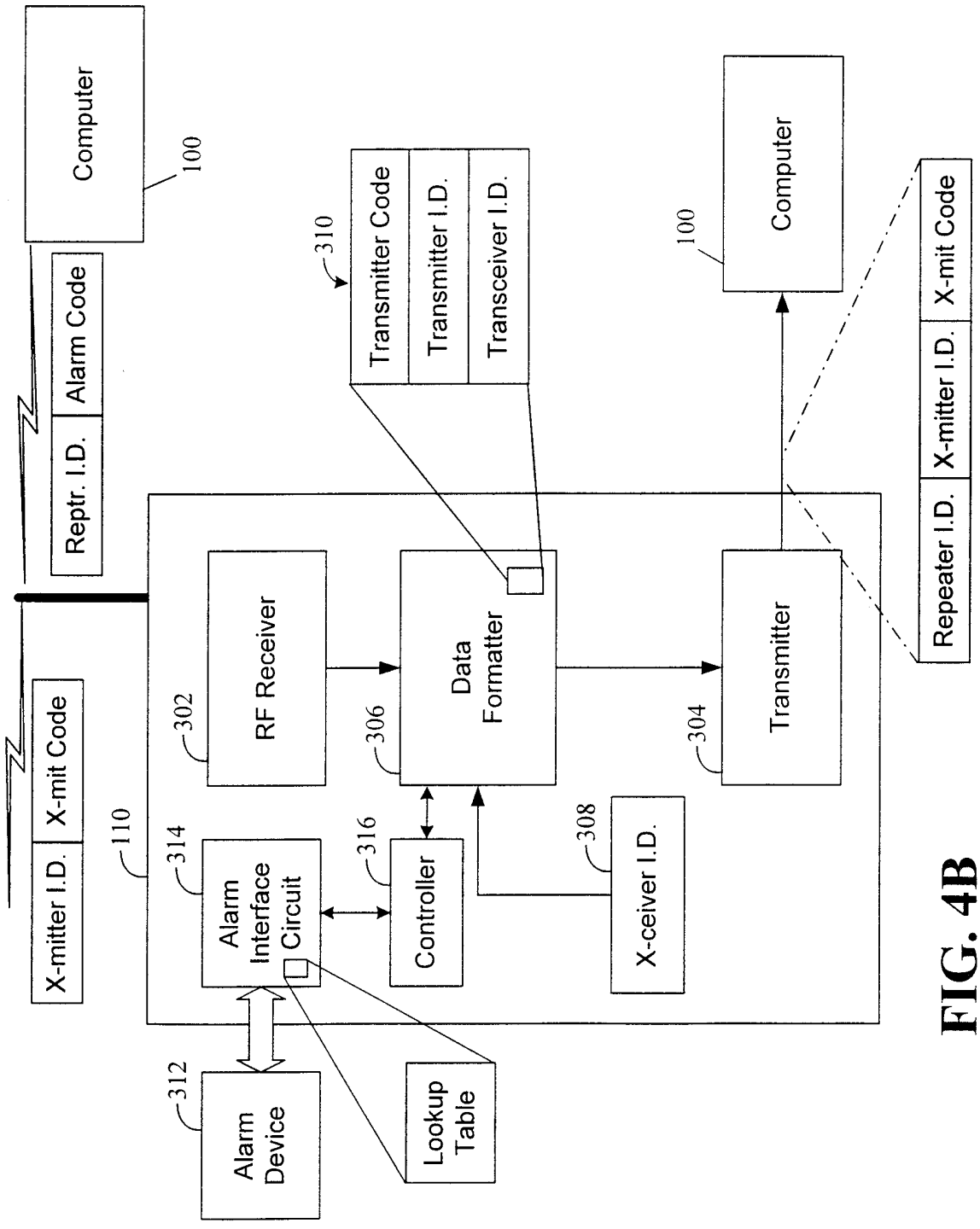
Computer
100
Reptr. I.D.
Alarm Code
X-mitter I.D.
X-mit Code
110
RF Receiver
302
Data Formatter
306
Transmitter
304
Transmitter Code
Transmitter I.D.
Transceiver I.D.
310
Computer
100
Repeater I.D.
X-mitter I.D.
X-mit Code
Alarm Interface Circuit
314
Controller
316
X-ceiver I.D.
308
Alarm Device
312
Lookup Table

FIG. 4B

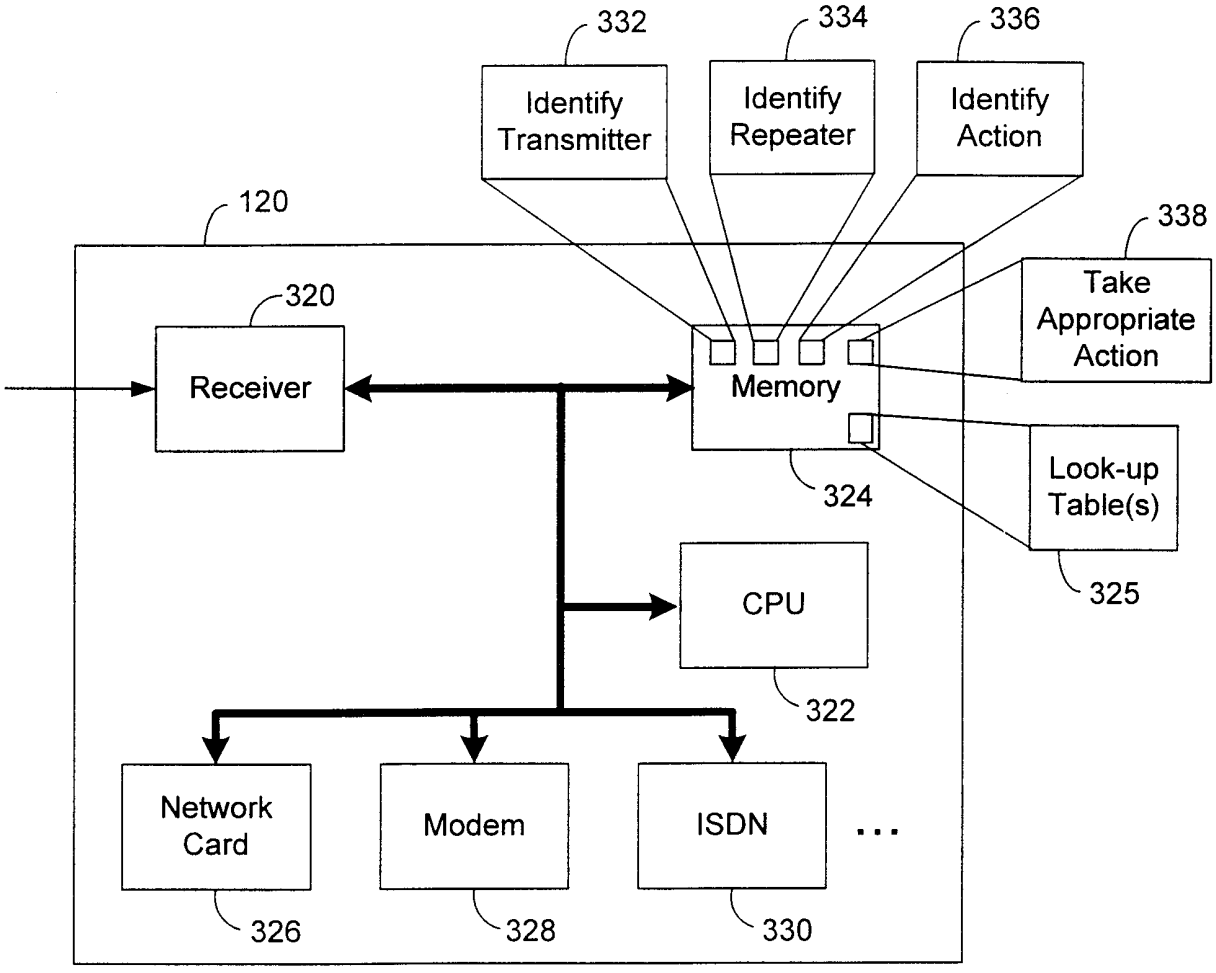
332
334
336
Identify Transmitter
Identify Repeater
Identify Action
120
338
Take Appropriate Action
320
Receiver
Memory
324
Look-up Table(s)
325
CPU
322
Network Card
Modem
ISDN
...
326
328
330

FIG. 5A

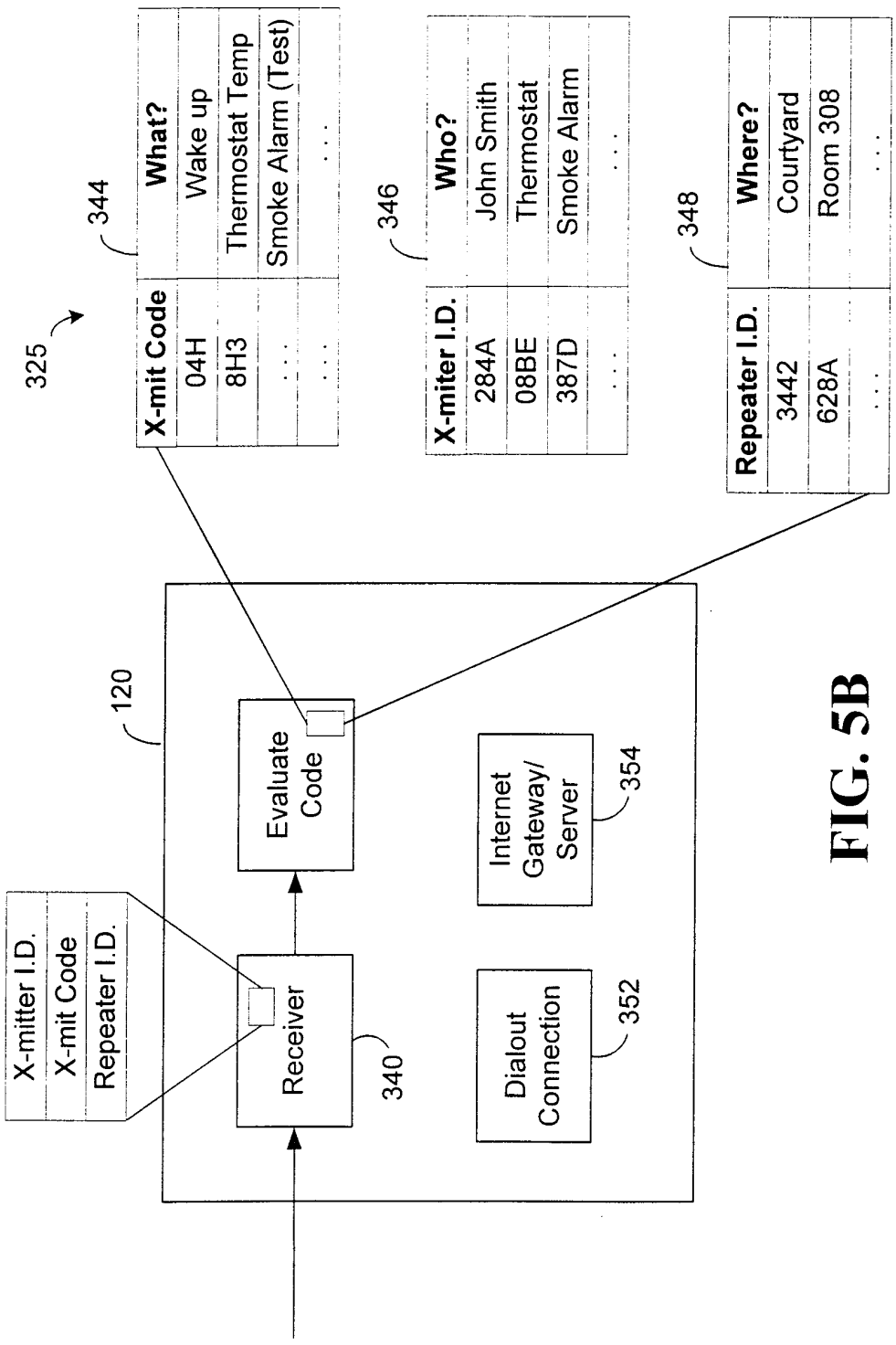
325
344
What?
Wake up
Thermostat Temp
Smoke Alarm (Test)
X-mit Code
04H
8H3
346
Who?
John Smith
Thermostat
Smoke Alarm
X-miter I.D.
284A
08BE
387D
348
Where?
Courtyard
Room 308
Repeater I.D.
3442
628A
120
Evaluate Code
Internet Gateway/ Server
354
Dialout Connection
352
Receiver
340
X-mitter I.D.
X-mit Code
Repeater I.D.

FIG. 5B

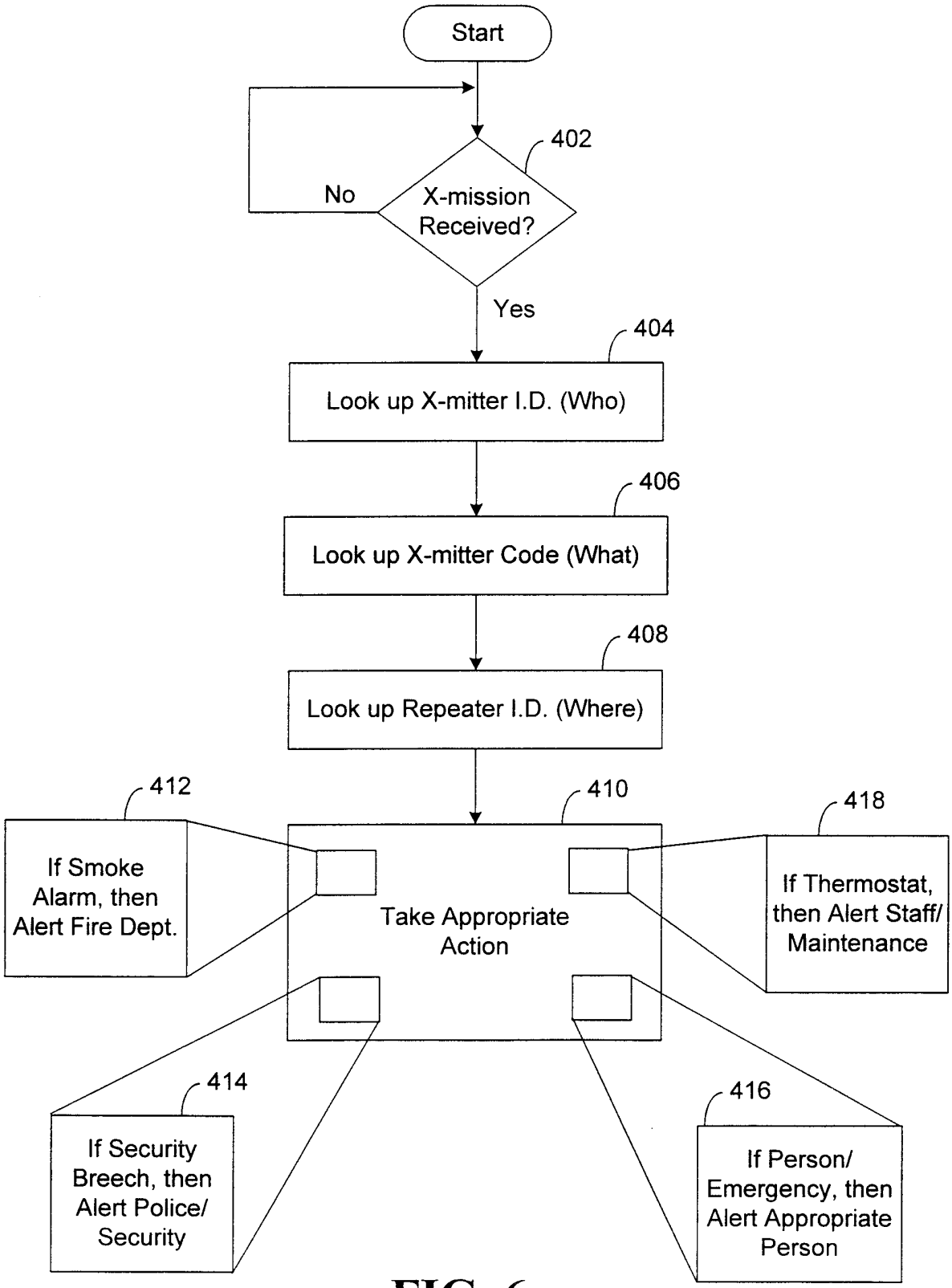
Start
402
No
X-mission Received?
Yes
404
Look up X-mitter I.D. (Who)
406
Look up X-mitter Code (What)
408
Look up Repeater I.D. (Where)
412
If Smoke Alarm, then Alert Fire Dept.
410
Take Appropriate Action
418
If Thermostat, then Alert Staff/ Maintenance
414
If Security Breech, then Alert Police/ Security
416
If Person/ Emergency, then Alert Appropriate Person

FIG. 6

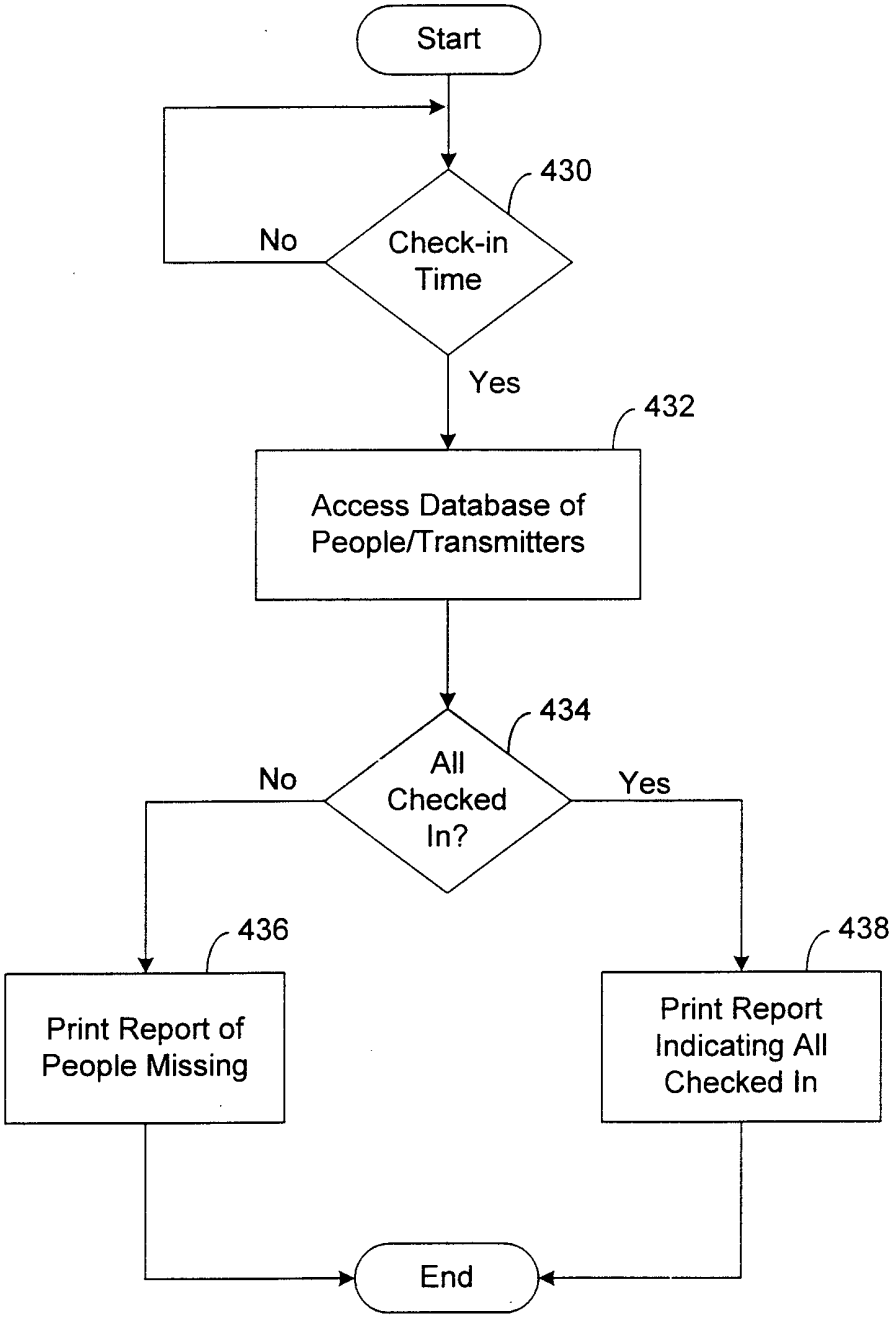
Start
430
No
Check-in Time
Yes
432
Access Database of People/Transmitters
434
No
All Checked In?
Yes
436
Print Report of People Missing
438
Print Report Indicating All Checked In
End

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/03206

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :G08B 21/00, 1/08
US CL :340/540, 539
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)

U.S. : 340/540, 539, 541, 551, 573.1

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

NONE

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

NONE

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 5,319,698 A (GLIDEWELL et al) 07 June 1994, figures 1-4, columns 4-5.	1-9, 11-16, 18-36 ------ 10, 17
Y	US 5,515,419 A (SHEFFER) 07 May 1996, col. 6.	10, 17
A	US 4,857,912 A (EVERETT, JR. et al) 15 August 1989, fig. 1.	1-36
A	US 4,630,035 A (STAHL et al) 16 December 1986, fig. 1.	1-36
A	US 5,200,735 A (HINES) 06 April 1993, fig. 1.	1-36

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"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
"A"	document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier document published on or after the international filing date	"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
"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)	"&"	document member of the same patent family
"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		

Date of the actual completion of the international search 17 JUNE 2000	Date of mailing of the international search report 09AUG2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer JEFFERY HOFSASS Joni Hill Telephone No. (703) 305-4700

Form PCT/ISA/210 (second sheet) (July 1998)★