zone-occupied alert

Background

1. Searching a burning building is one of the most important and dangerous aspects of a firefighter’s job. A search must be conducted at every fire to which fire-fighters respond. Searches can be divided into two basic types: primary and secondary. These searches are different and require different tactics. Both can be, at times, extremely dangerous.
2. The first goal of the primary search is to find the fire, so that the search crew can prioritize the areas in need of search and work back, or away, from the fire. Once the fire is in check, a search for victims can begin.
3. The secondary search is a complete search of the entire premises for all possible points of fire extension and all possible victims. **I**t is only reporting from residents and witnesses that informs this search.

Summary

1. A zone occupied alert unit (“ZOAU”) is described that can be fitted into pre-programmed fire detection zones of a building. This box consists of an alert light which flashes when a fire alarm has been generated.
2. During an emergency, occupants are prompted to press a button on a nearby ZOAU, indicating to a controller, *e.g.,* a fire alarm control panel, the occupants’ presence at that location, and thus enabling the prioritization of occupied zones that should be investigated/evacuated by emergency personnel such as fire fighters, first responders and the like.

Brief Description of the Drawings

1. Fig. 1 is a drawing illustrating an exemplary ZOAU according to embodiment of the present invention.
2. Fig. 2 is a schematic diagram of a first configuration of a fire detection system employing embodiments of the present invention.
3. Fig. 3 is a schematic diagram of a second configuration of a fire detection system employing embodiments of the present invention.
4. Fig. 4 is a state diagram illustrating the operation of an exemplary ZOAU.
5. Fig. 5 is a block diagram of an exemplary ZOAU.

Description

1. According to embodiments of the present invention, in order to assist with secondary searches for fire victims, each zone within a fire detection system or other emergency detection and notification system may be fitted with one or more Zone Occupied Alert Units (ZOAUs) by which occupants may signal their presence in a specified area. A ZOAU may comprise an alert light and button in a wall mounted box, preferably located close to the nearest fire escape or other egress.
2. The ZOAUs may be connected to a fire panel, preferably on the same wiring loop as fire/smoke or other hazardous condition detectors.
3. A ZOAU may become active, *e.g.,* by flashing its alert light (visual indicator), when a fire alarm has been generated, for example by a fire panel in response to an activated call point (pull station) or hazard detector. When the ZOAU button is pushed, the ZOAU may latch (for example, the light stops flashing and is on steady) and a signal may be sent to the fire panel to indicate the presence ofoccupants in that zone. This is designed to assist fire fighters in prioritizing their search procedure. Occupied zones can then be searched, and their respective devices deactivated as they have been checked and cleared.
4. A ZOAU may have at least three states. In a first state, the zone is not in alarm and the visual indicator is off. In a second state, a fire or other hazard has been detected and an alarm generated. The visual indicator may flash to get occupants’ attention. In a third state, someone has pressed the button on the ZOAU and the visual indicator may be steady on.
5. Hazardous conditions may include any, but is not limited to, the following: smoke, fire, heat, CO, CO2, radiation, natural gas and other toxic chemicals, active shooter, etc.
6. The visual indicator may comprise one or more LEDs or incandescent bulbs, or may be combined with a button or a touchscreen.
7. The button may be, for example, a mechanical pushbutton, toggle switch, touchscreen, etc. The visual indicator may be located within, around, or adjacent to the button.
8. Fig. 1 is a drawing illustrating an exemplary ZOAU 340 according to an embodiment of the present invention. When a command is received from a fire alarm control panel (FACP), a visual indicator 342 may begin flashing on and off at a human-perceptible rate to catch the attention of any people nearby who, for example, may not be aware that there is an emergency condition, or who may be trapped or handicapped and unable to escape their location. Non-limiting examples of human-perceptible flashing rates include 1 sec. on, 1 sec. off; ½ sec. on , 1 sec. off, etc.
9. A sign/decal 346 may be posted above, below or next to the ZOAU to indicate to those present (occupants) that they should press the pushbutton 344 on the ZOAU. Upon activation of the pushbutton 344, the visual indicator 342 may stop flashing and turn steady on or otherwise change its flash pattern to visually acknowledge the activation; at the same time, the ZOAU 340 may transmit a message to the FACP, from which the FACP determines that at least one human is present in the vicinity of the activated ZOAU. The message may be transmitted via a device loop (110 or 250 in Figs. 2 and 3 respectively) or by a separate wired or wireless medium. The FACP can then display that information on its display screen and/or transmit the information to a central monitoring station and/or mobile units carried by emergency personnel, who then know where to focus their searches.
10. Fig. 2 is a schematic diagram of a first configuration of a fire detection system employing embodiments of the present invention. A fire alarm control panel (FACP) 100 with an optional graphical screen 102 may communicate over a device loop 110 with various smoke or other hazard detectors 120, as well as manual pull-stations 130. In some system configurations, the FACP 100 may communicate with notification appliances (not shown) such as strobes, horns and speakers on the same device loop 110. Also on the loop 110 may be one or more ZOAUs (140). The number and types of devices shown in Figs. 2 and 3 are for exemplary purposes only and are not meant to be limiting.
11. When the FACP 100 receives information from an initiating device (e.g., detectors 120 and pull-stations 130) indicating that an alarm condition exists, the FACP may determine the location of the alarm condition, from which it may identify those ZOAUs that may be in the general vicinity of the alarm location. The FACP 100 may then send a command to the identified ZOAUs to activate, *i.e.*, they begin to flash their visual indicators and monitor their buttons. Alternatively, the FACP could activate all ZOAUs in a campus area, a subset of a campus, a building, a particular floor of a building, etc.
12. Fig. 2 further illustrates communication links 190 between the FACP 100 and a monitoring station 170; and between the FACP 100 and a mobile unit 180 such as a smartphone, smartpad or other handheld or mobile device.
13. Fig. 3 is a schematic diagram illustrating a second configuration of a fire detection system employing embodiments of the present invention. In this embodiment, a fire alarm control panel (FACP) 200 with an optional graphical screen 202 may communicate over a device loop 210 with various smoke or other hazard detectors 220, as well as manual pull-stations 230. In some system configurations, the FACP 200 may communicate with notification appliances such as strobes, horns and speakers (not shown) on the same device loop 210.
14. Unlike the configuration of Fig. 2, in the configuration illustrated in Fig. 3, one or more ZOAUs 240 may communicate with the FACP 200 via a separate loop 250. Alternatively, all or some of the ZOAUs 240 may communicate wirelessly with the FACP 200. The number and types of devices shown on either loop 210 / 250 are for exemplary purposes only and are not meant to be limiting.
15. When the FACP 200 receives information from an initiating device (e.g., detectors 220 and pull-stations 230) that an alarm condition exists, the FACP may determine the location of the alarm condition, from which it may identify those ZOAUs that may be in the general vicinity of the alarm location. The FACP 200 may then send a command to the identified ZOAUs to activate. Alternatively, the FACP could activate all ZOAUs in a campus area, a subset of a campus, a building, a particular floor of a building, etc.
16. Fig. 3 further illustrates communication links 290 between the FACP 200 and a monitoring station 270; and between the FACP 200 and a mobile unit 280 such as a smartphone, smartpad or other handheld or mobile device.
17. Fig. 4 is a state diagram 400 illustrating the operation of an exemplary ZOAU.
18. Normally, the ZOAU will be in an IDLE state 410, with its visual indicator off, and pressing the button will do nothing. When a fire or other hazard event (*e.g.*, an explosion or active shooter event, etc.) is detected by a controller such as a fire alarm control panel (FACP), the controller will send an activate command signal to at least one ZOAU in the area of the detected event. The controller may determine the area in which the hazard event has been detected and may send activate command signals to all of the ZOAUs in that area, or in that area and certain other nearby areas, or a whole building or campus, or even just a single ZOAU. If the ZOAU or controller can distinguish between different types of events, for example, fire vs. active shooter, different set or combinations of ZOAUs may be activated depending on the type of event.
19. Upon receiving an activation command signal from the controller, a ZOAU may transition (transition 450) to an FLASH state 412. In this state, the ZOAU may flash its visual indicator on and off at a human perceptible rate to catch the attention of any nearby occupants.
20. Of course, the most important action for occupants to do is to get to a safe place. However, if they are unable to, for example, the way is blocked by fire or smoke or doors are locked due to an active shooter event, an occupant may press the button (344 in Fig. 1).
21. Upon activation of the button, the ZOAU may send a message to the controller indicating the presence of an occupant nearby who may be trapped or need other assistance, *e.g.,* a disabled person, and transitions (transition 460) to an ON state 414. In this state, the light remains steady on to provide acknowledgement to the occupant that the button activation has been recognized. In a first configuration, the flashing alerts may cease immediately upon activation of the button. In a second configuration, the ZOAU may wait for an acknowledgement from the controller before stopping the flashing.
22. When the controller receives the signal indicating a ZOAU has been activated, *i.e.,* the message indicating the presence of an occupant, it may determine which zone or area that occupant is in and may alert emergency personnel via its front panel and/or by other means such as wired or wireless contact with portable or other equipment configured to receive this message.
23. At any time in the FLASH 412 or ON 414 states, the ZOAU may return to the IDLE state 410 upon a manual reset or a timeout (transition 440). A manual reset may be performed at the controller by an operator with authority to perform a reset. Upon a reset operation, the controller may send a reset signal to the ZOAU and the ZOAU will revert to the IDLE state and turn its visual indicator off. Alternatively, a manual reset may be performed by a responder at the ZOAU either with a physical key or by a known sequence of activations on the button; for example, one long push (>3 seconds) followed by 3 short pushes, each less than one second. Finally, the controller or the ZOAU itself may set a timer wherein if there is no activity for some predetermined time, the ZOAU reverts to the IDLE state 410.
24. Alternatively, in a further embodiment as indicated by the dashed transition line 464, rather than reverting to the IDLE state 410 from the ON state 414 when a timeout has occurred, the ZOAU may transition back to the FLASH state 412 and begin flashing again to alert occupants (if any occupants are still in that area) that the button should be pushed again. The ZOAU may send a signal to the controller indicating that it has reverted to FLASH state 412.
25. Alternatively, when a timeout has occurred in the ON state 414, as indicated by dashed transition line 466 the ZOAU may transition to a high-priority active state RE-FLASH 416, and may again resort to flashing its light, possibly in a different pattern than that used in the FLASH state 412. If an occupant activates the button in this RE-FLASH state 416, the ZOAU may send a high-priority message to the controller while transitioning (dashed transition line 470) to a high priority HI-PRI-ON state 418. In response, the controller may take some further action to call attention to the zone where the occupant is. In this HI-PRI-ON state 418, the light may stop flashing and stay steady on to acknowledge, or it may execute some other pattern and/or change in color or brightness. On a timeout, rather than reverting back to the IDLE state 410, the HI-PRI-ON state 418 may transition back to the RE-FLASH state 416 (transition 472). The various states and transitions illustrated in Fig. 4 are meant to be exemplary and not limiting.
26. The ZOAU may also be equipped with an audible device such as a buzzer or speaker to provide aural notification to nearby occupants to guide blind people toward the ZOAU. In an embodiment with a speaker, the ZOAU may have pre-programmed messages to instruct occupants on how to use the ZOAU and to acknowledge button presses. Buzzers, and any audible sounds may start and stop in parallel with the visual indicator.
27. Fig. 5 is a block diagram of an exemplary ZOAU 500. Control circuity 510 communicates with a remote controller such as a fire alarm control panel via a communication port 515. As discussed previously, the communication port may provide communications with the controller via a device loop such as 110 in Fig. 2 or 250 in Fig. 3, or it may communicate over some other wired medium or wirelessly. The control circuitry 500 may comprise hardwired circuity, a microcontroller, a field programmable gate array (FPGA), an application-specific integrated circuit (ASIC) or other electrical components, or some combination thereof. The control circuitry may require a memory (not shown) in which to store program instructions (such as firmware) to be executed as well as data.
28. The control circuitry 510 is also in electrical communication with the button 520 (corresponding to 344 in Fig. 1) and visual indicator 525 (corresponding to 342 in Fig. 1), as well as with an optional buzzer and/or speaker 530 so as to control the visual indicator 525 and the buzzer/speaker 530 and to monitor the button 520.
29. In a further embodiment of the system, door contacts and external hallway indicators such as motion detectors may communicate with the controller to indicate that occupants have exited from a room, thereby requiring reactivation if occupants are still trapped. Door or hallway activity may cause the ZOAU to revert from the ON state 414 back to the FLASH state 412 (transition 462) or from the HI-PRI-ON 418 state back to the RE-FLASH state 416 (transition 474).
30. In yet another embodiment, an intercom facility may be incorporated into some or all ZOAUs, though this may require extra wiring or wireless transceivers.
31. Multiple ZOAUs may be placed within a zone for easy and quick access.
32. The terms “light”, “alert light” or “visual indicator” as used herein are synonymous and may include any combination of LEDs, incandescent bulbs, organic LED displays, OCD displays, touchscreens, etc., and may be combined with a button or a touchscreen with a virtual button.

CLAIMS

I claim:

1. A zone-occupied alert unit, comprising:

a visual indicator;

a button;

a communication connection to a hazard alarm panel; and

control circuitry configured to:

in a first state, maintain the visual indicator steady off,

in the first state, receive an alert signal from the hazard alarm panel, and upon receiving said alert signal, entering a second state and causing the visual indicator to flash on and off at a pre-determined human-perceptible rate, and

in the second state, detect activation of the button, and in response to detecting said activation, entering a third state, sending a presence signal to the hazard alarm panel and causing the visual indicator to be steady on.

1. The zone-occupied alert unit of claim 1 wherein the communication connection is a least one of wired, wireless and optical.
2. The zone-occupied alert unit of claim 1 wherein the visual indicator comprises at least one LED.
3. A zone-occupied alert unit (ZOAU), comprising:

a visual indicator;

a manual control;

a communication interface to a hazard alarm panel; and

control circuitry configured to:

cause the visual indicator to flash at a pre-determined human-perceptible rate upon receiving an alert signal from the hazard alarm panel, and

transmitting, via the communication interface, a presence signal to the hazard alarm panel upon detecting activation of the manual control.

1. The ZOAU of claim 4, the control circuitry further configured to cause the visual indicator to be steady on upon transmitting the presence signal.
2. The ZOAU of claim 4, wherein the communication interface is at least one of: wired, wireless or optical.
3. The ZOAU of claim 4 wherein the manual control is a pushbutton.
4. The ZOAU of claim 4 wherein the visual indicator comprises at least one LED.
5. The ZOAU of claim 4 further comprising a sound generator, the sound generator comprising at least one of a buzzer or a speaker, the control circuitry further configured to cause the sound generator to sound upon receiving the alert signal from the hazard alarm panel.
6. The ZOAU of claim 9 wherein the control circuitry is further configured to silence the sound generator upon detecting activation the manual control.
7. A fire alarm system, comprising:

a fire alarm control panel (FACP);

a zone-occupied alert unit (ZOAU) at a location; and

a communication link communicatively linking the FACP and the ZOAU.

1. The fire alarm system of claim 11, the FACP transmitting to the ZOAU, via the communication link, an alert signal upon the FACP detecting an emergency condition, the ZOAU comprising:

a visual indicator,

a manual control, and

control circuitry configured to:

cause the visual indicator to flash at a first pre-determined human-perceptible rate upon receiving the alert signal, and

transmitting to the FACP, via the communication link, a presence signal upon detecting activation of the manual control.

1. The fire alarm system of claim 12, wherein upon receiving the presence signal, the FACP provides an indication of a presence of a person at the location of the ZOAU.
2. The fire alarm system of claim 13, wherein the indication is at least one of: a visual or text display on the FACP; or a transmitted message to any of first responders, firefighters, or a command or monitoring center.
3. The fire alarm system of claim 11, further comprising:

a loop coupled to the FACP communicatively connecting the FACP to initiating devices, wherein the loop also serves as the communication link between the FACP and the ZOAU.

1. The fire alarm system of claim 15, wherein the ZOAU is addressable.
2. The fire alarm system of claim 12 further comprising at least one of a door monitor and a hallway monitor in communication with the FACP,

the FACP, upon receiving an indication from one of said door and hallway monitors, transmitting a message to the ZOAU indicating that the control circuitry should cause the visual indicator to flash at a second predetermined rate.

1. A method, comprising the steps of:

detecting, at a fire alarm control panel (FACP), an emergency condition;

upon said detecting, the FACP transmitting an alert signal to at least zone-occupied alarm units (ZOAUs) in a vicinity of the detected emergency condition, each ZOAU comprising

a visual indicator, and

a manual control;

each ZOAU, upon receiving the alert signal, flashing its respective visual indicator at a pre-determined human-perceptible rate;

each ZOAU, upon detecting activation of its manual control, transmitting a presence signal to the FACP; and

upon receiving a presence signal from one or more ZOAUs, the FACP indicating presence of a person at each location from which a ZOAU transmitted a presence signal.

1. The method of claim 18, wherein the FACP indicates presence by at least one of: displaying text or graphic; or transmitting a message to any of first responders, firefighters, or a command or monitoring center.

ABSTRACT

A close up of a sign

Description automatically generated

A close up of text on a white background

Description automatically generated

A close up of text on a white background

Description automatically generated

A close up of text on a white background

Description automatically generated

A close up of a piece of paper

Description automatically generated