

RF Based Wireless Fire Security System for Hospitals

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Abstract—Wireless Fire Security System increases the security against fire as compared to conventional fire security systems. Conventional fire security systems are wired and they usually contain smoke detectors and control panel. The control panel is sometimes hard to operate. It's hard to understand the control panel and operation of security systems. In hospitals and other health care institutions high security against fire is required in order to protect the expensive equipments and chemicals. Every organization needs proper insurance and safety for their equipments and patients. Radio frequency based fire security system was designed to provide high security against fire with easy to use, hand-held portable control unit. Anyone can easily operate the portable receiver without additional training or knowledge. Wireless fire security system for hospitals is also very low cost device.

Index Terms— DC operated fire security system, fire safety, portable control unit, radio frequency.

I. INTRODUCTION

To provide the proper safety against fire, the fire detection is very important. Normally the fire is detected using smoke detectors, but after detecting fire the operator or the user should know the exact place of fire. This paper presents a system that will detect and show the exact place of fire (for example in floor or any room). It is basically 2 channel device that can detect fire in specific rooms or floors [1].

Anyone can use it either for 2 floors or 2 rooms. The output will be displayed on LCD. The whole system operates on the wireless transmission. RF signals are used in this system in order to show the output. We can attach 7 smoke detectors in one floor or room (as per requirement), so total 14 smoke detectors are used in this system to provide proper safety. We can also connect the temperature sensor or pressure sensor with the transmitters of the system.

The whole system works on DC as well as on AC. Rechargeable batteries are installed in the system. We can easily charge the system using 9 volt battery charger. The overall system is very easy to install and use [2].

II. DESIGN METHODOLOGY

A. Basic working of the system

Wire Fire Security System works in three basic phases: *Transmitter*: Smoke detector first detects the smoke or fire in the place which is attached to the transmitter through wire to supply the voltages to the smoke detector. When the smoke detector detects the smoke, transmitter indicates the LED for fire emergency and it can also operate the external circuit with the help of built-in relay in the transmitter. Transmitter then transmits the signals through radio frequency to the transceiver.

Transceiver: Transceiver receives the signals from transmitter and then sends them to the portable detector. The basic function of transceiver is to extend the range of the fire security system. It also operates through DC rechargeable battery.

Portable receiver: Portable receiver can be carried anywhere within the range (70-75 meters). It is easy to use and any one can operate it. It receives the signals from the transceiver and shows the information or emergency signals on the LCD screen. It also operates through the DC rechargeable battery as well as with the AC power. [3]

B. Basic designing of the system

Detection/Transmitter phase

In detection phase, smoke detectors are required in order to detect smoke. A smoke detector is a device that detects smoke, typically as an indicator of fire. Commercial, industrial, and mass residential devices issue a signal to a fire alarm system, while household detectors, known as smoke alarms, generally issue a local audible and/or visual alarm from the detector itself. Smoke detectors are typically housed in a disk-shaped plastic enclosure about 150 millimeters (6 inches) in diameter and 25 millimeters (1 inch) thick, but the shape can vary by manufacturer or product line. The smoke detector is attached with the transmitter circuit. Transmitter consists of LEDs and relays, capacitors are used to make continuous pulse of 1 minute to 3 seconds in order to transmit the signals.

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RF transmitter is also used with the rechargeable battery inside the transmitter's box [4].

Transceiver phase: Transceiver circuit is a small circuit that is used to increase the range of the system. It consists of receiver that contains RF module and remote / transmitter that will transmit signals to the portable receiver. It also contains relay and capacitors for delay and switching. This whole box operates on rechargeable DC battery.

Portable receiver phase: It contained LCD and RF module to receive the RF signals from transceiver. It also contained PIC microcontroller IC, which has been programmed the PIC IC in order to display the required result on the LCD screen. Programming has been done in C-language using its suitable compiler. Portable receiver also contained relay or buzzer for emergency indication. The whole portable receiver is operated through the DC rechargeable batteries. Whole system is shown in Figure 1 and 2 and complete phase of system is summarized in Table 1.

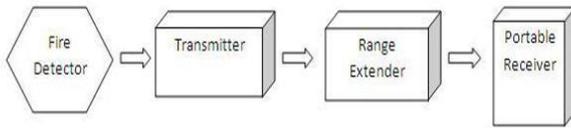


Figure.1 Block diagram of the fire security system for hospitals

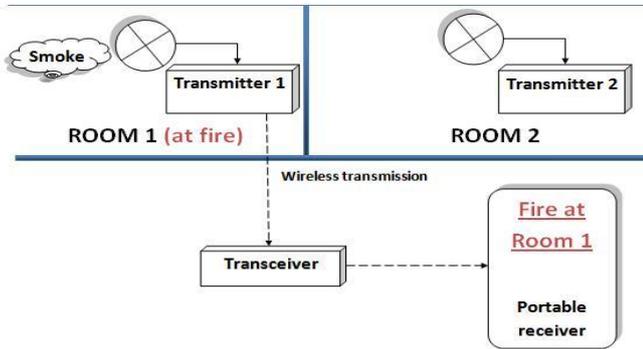


Figure.2 Functional diagram of the fire security system for hospitals

Table 1: Complete Phase of the project

Stages	Design methodology
<i>Transmitter</i>	Interfaced smoke detectors with the RF transmitter. Connected transmitter with the relays and adjusted the voltage requirements of the circuit. Operated circuit through 9 volt re-chargeable battery.
<i>Range extender</i>	Interfaced receiver of one RF circuit with another RF circuit. Operated both circuits with 9 volt re-chargeable battery. Designed circuit of charger to charge the device. Connected the relays.
<i>Portable receiver</i>	Interfaced receiver with the micro-controller and LCD. Programmed PIC micro-controller. Operated whole circuit with 9 volt re-chargeable battery. Designed the circuit.
<i>Finalization of the project</i>	Casing and final testing of the device has been done in the hospital.

C. Basic technology used for RF signals

RF car door lock system has been used in this project to transfer the signals through radio frequency. As we know car door lock system is easily available and it is also very cheap. In order to reduce the cost, conventional RF modules of 100 meters or more range were not used. Instead, we have combined two (2) RF car security systems to increase the range of the fire system. We interfaced the circuit of RF car door lock system to a PIC microcontroller.

III. DISCUSSION

Transmitter phase contains the rechargeable battery that is and basic circuit components. The smoke detector is attached with the transmitter circuit. Transmitter consisted of LEDs and relays, capacitors are used to make continuous pulse of 1 minute into 3 seconds in order to transmit the signals. RF transmitter is also used with the rechargeable battery inside the transmitter's box [6].

Transceiver Phase: Transceiver circuit is a small circuit that is used to increase the range of the system. It consists of the

receiver that contains RF module and the remote/ transmitter that will transmit signals to the portable receiver. It also contained relay and capacitors for the delay and switching. This whole box operated on rechargeable DC battery.

Receiver Phase: It contained LCD and RF module to receive the RF signals from transceiver. It also contained PIC IC which has been programmed to display the required result on the LCD screen. Programming has been done in C-language using its suitable compiler. Portable receiver also contained relay and buzzer for emergency sound. The whole portable receiver is operated through the DC rechargeable batteries [7].

Comparison with conventional fire systems: There are many fire security systems available in the market with different types of benefits and specifications but this RF fire security system combined all those benefits in one system. Conventional fire systems have difficult and hard to operate receiver unit. They also require a computer and electricity connection to operate the RF fire security system has DC operated function with the option to connect with computer (if available) or it can be used without a computer connection because of the portable receiver. DC batteries can be used for several days or hours depending on the use and type of smoke detectors. Size of the portable receiver is small like a cell phone and it's very light in weight. Depending on the requirements, RF fire security system for hospitals can be connected with the GSM and it will be operated and controlled from anywhere. It is also very affordable. The overall cost of designing of the RF based fire security system is around 60-70 Euros.

IV. IMPROVEMENTS FOR FUTURE

There are certain sets of possibilities to improve this fire security system. Some of these possibilities are described below:

Make an external Circuit: In order to provide effective fire extinguishing technique we can make a fire extinguisher circuit at the output of the project.

Extend the Range: Current range of the project is about 75 meters that can be extended if the receiver of RF modulator of certain frequency will be attached.

Sensitive smoke detectors: If we attach the sensitive smoke detectors with the transmitter then it will detect the smoke much efficiently and quickly.

Interfacing with computer: We can transmit signals to the computer also. For this, a special circuitry is required that will interface the receiver with the computer.

Installing vibrator: A vibrator can also be installed in order to get the output on the portable receiver.

V. CONCLUSION

Wireless hospital's fire security system provides full security against fire because it can detect the fire at any specific area and sends the signals immediately to the portable receiver. The receiver can be carried anywhere within the range of the system that is nearly 75 meters. RF signals are transmitted accurately without any false triggering. External circuits can also be installed with this system because an additional option is also given for connecting the external circuit. [5]

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