Automated Fire Detection and Controlling System

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Abstract: In this paper basically a low cost fire detection and control system based on smoke and heat detection is proposed. It is comprised of a combination of electrical/electronic devices/equipments working together to detect the presence of fire and alert people through audio or visual medium after detection. These alarms may be activated from smoke detectors or heat detectors which, when detects fire. Then, it automatically operates a relay which can be used to send Short Message Service (SMS) to the registered mobile numbers and switch on a water sprayer or a Solenoid Pump to spray water or fire ceasing foam.

Keywords: Fire Detection, Audio or Visual Medium, Relay, Short Message Service (SMS), Solenoid Pump.

I. INTRODUCTION

Now a days automatic fire detection and control is becoming very essential to reduce the fire in the building and industry. Automatic fire alarm system provides real-time surveillance, monitoring and automatic alarm. A key aspect of fire protection is to identify a developing fire emergency in a timely manner, and to alert the building’s occupants and fire emergency organizations. This is the role of fire detection and alarm systems.

Generally fire detectors are designed [1] to respond at an early stage to one more of the four major characteristics of combustion, heat, smoke, flame or gas. No single type of detector is suitable for all types of premises or fires. Heat detectors respond to the temperature rise associated with a fire and smoke detector respond to the smoke or gas generated due to fire.

The authors [2] describe the overall structure and design of automatic fire alarm system and fire alarm control software. Authors [3] discussed automatic fire alarm system based on Wireless Sensor Networks and in [4] discussed quick responsive system based on SMS. Currently available different smoke detector systems and their working discussed detailed in [5]. Different conventional smoke detectors and their applications are given details in [6].

With this background, the present work is discussed with an objective to develop an automatic fire alarm and control system by detecting smoke and heat. The method is discussed in Section II. The system design and implementation is discussed in Section III. We summarize our work and conclude this paper in Section IV.

II. METHOD

Basic block diagram of the proposed automated fire detection and control system is shown in Fig.1. Here in this work very simplified version of large variety of this system is proposed to provide the basic system hardware needed.

The main units of this proposed system are:

1. Sensor: Heat sensor (H) and smoke sensor (S) senses the fire. Signal from sensor activates the ID sender unit
2. ID sender unit: ID sender gives address of the room or block where fire is detected and passes that address to the data line.
3. Data line: That ID (in binary) of the room passes to display unit via data line (CAT5). Data line also carries the signal to send fire alert message and to ON the pump for water supply for extinguishing the fire.
4. Memory unit: This unit holds the address of the room/block until the total system made OFF again.
5. Display unit: Display unit displays the ID of the room which is on fire
6. SMS (Short Message Service) sender: A SMS will be sent to fire brigade and registered mobile numbers to activate the pump automatically.
7. Pump starter unit water supply will be given in this room through sprinkler system
8. Power supply: AC 230 v or 12 v DC.
Fig. 1. Complete block diagram of automated fire detection and controlling system

Fig. 1 represents the complete block diagram of the proposed system and how the system will react if a room/block is affected by fire is also shown.

Location of different ID sender unit and different zones are shown in Fig. 2. For multistorage building location is identified by the room numbers and floor numbers and if the area is an open place not a building then the area is divided into zones and blocks as shown in Fig. 2.

Fig. 2. Division of an open area

For a multistoreyed building, (G + 3 building) the installation of the proposed system for displaying fire affected room or floor will be as shown in Fig. 3.

III. SYSTEM DESIGN AND IMPLEMENTATION

Proposed automated fire detection and controlling system is designed and implemented in this work. Experimental setup of this proposed system is shown in Fig. 4. The subsections are discussed here in brief.

Fig. 4. Experimental setup for the proposed system

A. Sensor circuit:

LDR is used in the circuit of smoke sensor as shown in Fig. 5. When the light is obstructed by smoke, the resistance of the LDR increases, therefore, the collector-base voltage increases, which makes the Q1 ON, making the Q2 also ON, which gives the signal of fire by loud horns. A tube consisting of light source and light sensing device used in our system for smoke sensing shown in Fig. 6.
B. Heat Sensor

![Heat Sensor Circuit]

The heat sensor circuit as shown in Fig. 7, works almost as the smoke sensor. Instead of LDR, thermistor is used here. With increasing heat thermistor resistance decreases. Therefore increasing collector-base voltage respected to base-emitter voltage. Which make the sensor unit ON similarly.

C. ID Sender Unit:

![ID Sender Unit Diagram]

The id sender unit shown in Fig. 8, gives the binary address of the fire affected room/block from the corresponding sensor signal.

Either or both the heat and smoke sensor senses fire.

In the Fig. 9, the first seven-segment display unit display the floor number and the second seven-segment display unit display the flat number affected by the fire. As shown in the Fig.9 the flat number 2 of first floor is affected by fire and the display unit display the corresponding floor and flat number.

Here in the system basically shown for maximum 7x7 buildings.CAT 5 wire consist of total 8 wire whose first 3 are used for floor and another 3 are used for flat and rest 2 wire for power line here. It worth extending by increasing address lines (CAT 5 wire) and number of display units for larger building or zone.

D. SMS Alert and Fire Extinguishing Unit

The signal coming from ID sender enables the relays shown in Fig.10. to activate the device for sending SMS alert to the registered mobile numbers and also activates the pump starter.

![SMS Alert and Fire Extinguishing Unit Diagram]

E. Relay Based Memory Unit

A relay has a normally closed contact (NC) and normally open contact (NO). This NC and NO can represented as binary bit 1 (HIGH) and 0 (LOW) respectively. When relay is energised NO becomes 1 (HIGH) and NC goes to 0 (LOW). Using this phenomenon of, relay is used to hold the binary address of the fire affected room/block as memory. A relay based 6 bit memory unit used in the proposed system is shown in Fig.11. We can install it in the building of 7x7 (where number of floors are 7 and number of flats are also 7). Suppose a CAT5 wire consist of 8 wire whose first 3 wire used to represent or generate the address of the floor and other 3 used to represent the address of flat hence we use 6 no of wire and rest 2 wire of CAT5 used as power line.

![Relay Based Memory System Diagram]

Experimentally it is seen that the proposed system is performed successfully in the laboratory. Here the smoke and heat is generated and seen that the smoke is entering to the smoke sensor tube and sensor output is changed accordingly and the heat is sensed by the heat sensor. The output of the sensors were connected to ID sender unit of floor/zone no. - 1 and room/block no. - 2 and as a result the proposed system detected the fire display showed the fire affected area that is floor/zone no.- 1 and room/block no. - 2 as shown in the Fig.4.
IV. CONCLUSIONS AND DISCUSSIONS

In this paper we proposed an automatic fire alert and fire distinguishing system by sensing smoke and heat. We have experimented our proposed system in our laboratory and noticed its feasibility. It is also seen that the system does not respond if the fire generates very small smoke particles and very small amount of heat. The system does not display properly if two or more than two rooms or blocks are affected at a same time.

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References

[1] www.fire.org.nz/…Fire...Alarms/

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