ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology
Vol. 2, Issue 5, May 2015

Automated Fire Detection and Controlling System

Kausik Sen[1], Jeet Sarkar[1], Sutapa Saha[1], Anukrishna Roy[1], Dipsetu Dey[1], Sumit Baitalik[1], Chandra Sekhar Nandi[2]

Students of Applied Electronics and Instrumentation Engineering Department, University Institute Of Technology, Burdwan University,W.B. India[1]

Faculty of Applied Electronics and Instrumentation Engineering Department, University Institute Of Technology, Burdwan University, W.B. India.[2]

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.

Copyright to IARJSET
DOI 10.17148/IARJSET.2015.2506

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
Vol. 2, Issue 5, May 2015

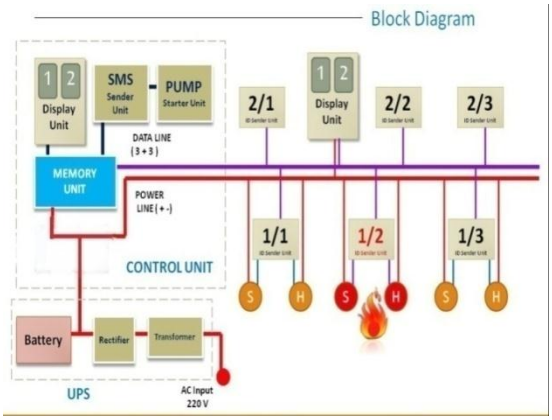

Fig.1. Complete block diagram of automated fire detection and controlling system

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 a open place not a building then the area is divided into zones and blocks as shown in Fig.2.

Block 1 4/1	Block 2 4/2	Block 3 4/3	zone4
Block 1 3/1	Block 2 3/2	Block 3 3/3	zone3
Block 1 2/1	Block 2 2/2	Block 3 2/3	zone2
Block 1 1/1	Block 2 1/2	Block 3 1/3	zone1

Fig.2. Division of a open area

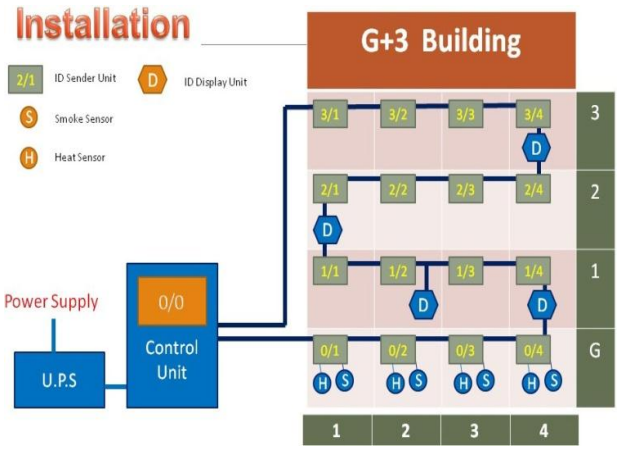

Fig.3.Iinstallation of the proposed system to display fire affected room

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 set up of this proposed system is shown in Fig.4. The subsections are discussed here in brief.

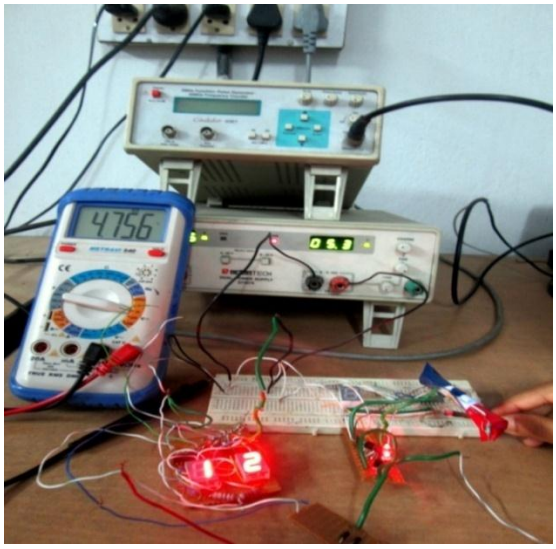

Fig.4. Experimental set up for the proposed system

A. Sensor circuit:

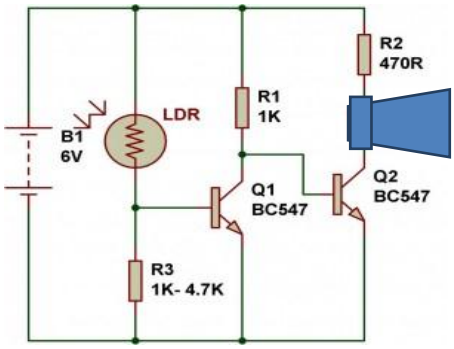

Fig.5. Smoke sensor circuit

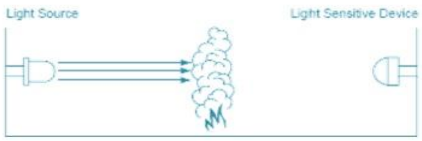

Fig.6. Smoke sensing tube

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.

Copyright to IARJSET
DOI 10.17148/IARJSET.2015.2506

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
Vol. 2, Issue 5, May 2015

B. Heat Sensor

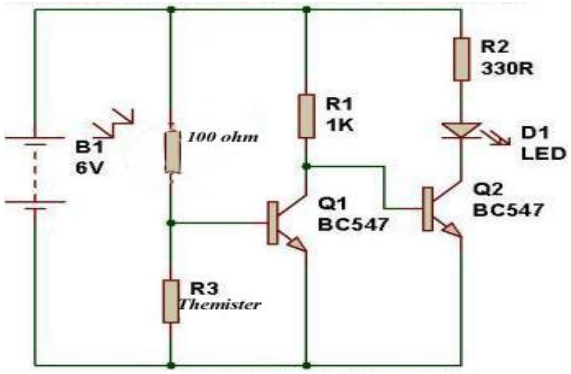

Fig.7. Heat sensor circuit

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:

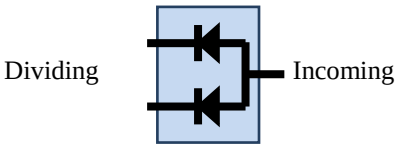

Fig.8. Id sender unit

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 7×7 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.

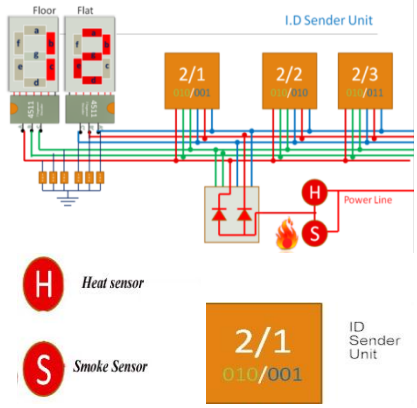

Fig.9. Working of id sender unit

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.

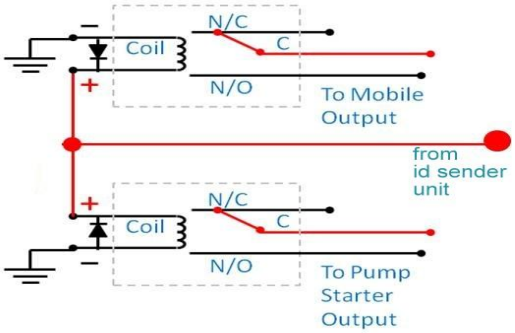

Fig.10. SMS alert and fire extinguishing unit

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 7×7 (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.

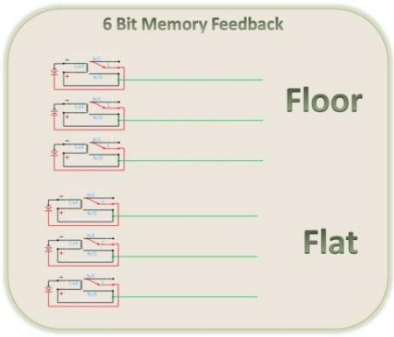

Fig.11. Relay based memory system

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.

Copyright to IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
Vol. 2, Issue 5, May 2015

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.

ACKNOWLEDGMENT

The authors wish to express their gratitude to Mithun Ghosh, service engineer, Ashida Electronics Pvt Ltd. for providing this idea.

References

[1] www.fire.org.nz/...Fire...Alarms/
[2] Huide Liu ; Lili Gao ; Suwei Li ; Tao Wu
" About automatic fire alarm systems research", The 2nd IEEE International Conference on Information Management and Engineering (ICIME), 16-18 April 2010, pp. 419 – 421.
[3] Lei Zhang, and Gaofeng Wang, "Design and Implementation of Automatic Fire Alarm System based on Wireless Sensor Networks",
[4] Proceedings of the 2009 International Symposium on Information Processing (ISIP'09) *Huangshan, P. R. China, August 21-23, 2009, pp. 410-413*
[5] Omar Asif, Md. Belayat Hossain, Mamun Hasan, Mir Toufikur Rahman, Muhammad E. H. Chowdhury**, "**Fire-Detectors Review and Design of an Automated, Quick Responsive Fire-Alarm System Based on SMS", Scientific Research Publishing Inc, 28th August 2014.
[6] www.systemsensor.com.
[7] www.pertronic.co.nz/convention_systems/

BIOGRAPHIES

Kausik Sen, Studying B.E on Applied electronics and instrumentation Engineering at University Institute of Technology, Burdwan University,2011-2015

Jeet Sarkar, Studying B.E on Applied electronics and instrumentation Engineering at University Institute of Technology, Burdwan University,2011-2015

Sutapa Saha, Studying B.E on Applied electronics and instrumentation Engineering at University Institute of Technology, Burdwan University,2011-2015

Anukrishna Roy, Studying B.E on Applied electronics and instrumentation Engineering at University Institute of Technology, Burdwan University,2011-2015

Dipsetu Dey, Studying B.E on Applied electronics and instrumentation Engineering at University Institute of Technology, Burdwan University,2011-2015

Sumit Baitalik, Studying B.E on Applied electronics and instrumentation Engineering at University Institute of Technology, Burdwan University, 2011-2015