Experimental Paper on Microcontroller based Fire Detection Alarm System

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Abstract

The need for an effective and reliable intrusion detection with an alarm system have become vital necessity because of the frequent and rampant cases of burglary. Attack on homes, offices, factories, banks etc. is increased. With the advancement in technology, motion can be detected by measuring change in speed or vector of an object in the field of view. This can be achieved either by mechanical devices that physically interact with the field or by electronic device that quantifies and measures changes in the given environment. The motion detector is not only used as intruder alarm but also used in many applications like home automation system, energy efficiency system, etc. This project is built using an embedded microcontroller system capable of detecting motion of an intruder in a restricted area and then triggering an alarm system, motion detector system, however passive infrared sensor detected the motion of the person using the person body heat. The passive infrared (PIR) sensor which is the motion detector used in this project is attached to a microcontroller which activates the alarm system and any other attached output device to notify the house owner. The initial testing of the design shows that it worked as expected.

Keywords - *Microcontroller, Alarm /Siren, Mechanical Device and Motion Detector, Sensors*

I. INTRODUCTION

A fire alarm is used to prevent or reduce the hazardous effects of smoke and fire to individuals and provides property protection. The most basic mechanism is an alarm system. It warns people to leave a building at once and alert a fire department, initiate or smoke control functions, and identify the location of a fire within a structure. The latest models in fire alarm systems utilize microprocessors and can record the time and sequence of events. They may also synchronize a voice message announcing the fire location and recommended action to the personnel at risk. Original, onsite watchman provided the only fire alarm system but with the advent of electric power, boxes wired to fire departments provide a warning system from city streets and institutional buildings such as schools. Most of the modern fire alarm systems are automatic, consisting of thermostat activated devices. At certain temperature, an alarm makes sound or reports to a central office, such as municipal fire station. Some alarms are set to go off whenever the thermostat shows a rapid temperature rise. The thermostat is usually placed at or near the ceiling, where it will be affected immediately by increase in temperature. Another type of alarm is actuated by a photoelectric cell. When smoke darkens the room slightly, the alarm is activated. Another highly sensitive device that contains a small amount of radioactive material that ionizes the air in a chamber is widely used. In this method, a continuously applied voltage causes a small current to flow through the ionized air which sets the alarm ON or OFF.

Microcontroller based fire detection and alarm system consists of initiating devices and alarm signals in which all or some of the initiating devices are activated by automatic mechanism. An arrangement of detectors as certain the presence of combustion by sensing heat, smoke, or flames. The detectors can be self-communicating or connected to a fire alarm control, panel to initiate either alarm devices.

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.

II. FIRE DETECTION AND ALARM SYSTEMS

In this paper conventional fire alarm system and its components are used with all wired to the same cable that connects them to a fire alarm control panel. The control panel displays a signal when these

components activate. Conventional fire alarm system is inexpensive and work well in small facilities. The main problem with conventional fire alarm system is that when a fire alarm component produces a signal and it appears on the control panel there is no way to know which component it is in the building.

A. Microcontroller used for this work

A fire measuring instrument employed shall be stable with time and with changes of environmental conditions which might occur between two measurements. It shall give a reading that is directly proportional to fire concentration. The detector positions the light sensor directly in the beam of a light source. Fire interfaces with light transmission, and light received by the sensor decreases. A signal is sent to the instrument when light transmission drops to a pre-determined level. It is essentially consist of a light source (lamp) to give a uniform and constant beam of light and a light sensor placed at some distance from the source in the line of the beam to receive light output from the source. The block diagram of microcontroller based fire detection and alarm system is shown in fig.1.

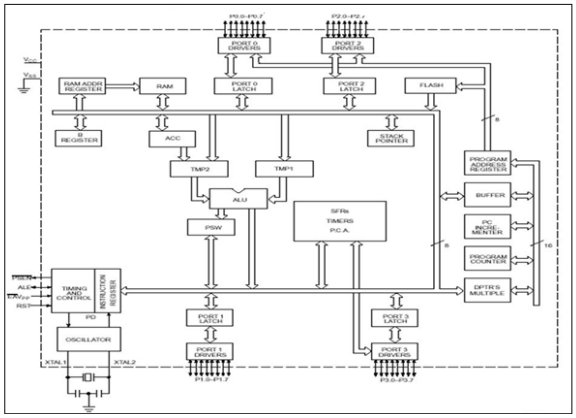

Fig 1 Block diagram of Microcontroller

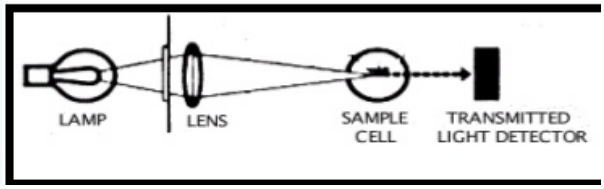

Fig 2Principle of functioning of detector

B. Detector

Fire detectors have greatly improved residential life safety by quickly detecting and alerting building occupants to the harmful effects of fire. Fire and toxic gases are the leading killers of people at home. Fire detectors are hard or permanently wired, battery operated, or a combination of hard wiring with a battery backup. The detector, which has a light beam aimed at alight sensor, when the fire particles obscure or block the light beam, the light sensor notes the loss of light and activates the alarm.

Detectors utilizing light scattering principle consist of a light beam produced by a light source which is generally a filament lamp or a light emitting diode and a photo sensitive device. These are mounted in a light proof housing designed to allow smoke to flow into it unimpeded. In non-fire condition i.e., when no smoke is present in the chamber, light from the light source doesn't fall into the photoelectric cell. When smoke particles enter the chamber smoke light is deflected towards the photo electric cell. When smoke particles enter the chamber smoke light is deflected towards the

C. Working of the system

Fire alarms hold promise for improving fire detection by both increasing sensitivity to fire while decreasing nuisance alarms. Eventually, to provide a fair assessment of performance, some type of uniform testing protocol needs to be advanced in order to demonstrate consumers. Standard fire sensitivity tests provide one way to assess fire detection performance, but there no standards related to nuisance alarms. Basically, there are two of tests will be in the fire alarms, Fire emulator/Detector evaluator. Comparisons of these tests, a smouldering chair and cooking oil free, to their emulated scenarios in the FE/DE are described and short comings identified. Based on these results and previously reported emulated and fire and nuisance tests, the proposed methodology shows promise in relating full scale alarm tests to reproducible laboratory tests at a level sufficient to assess alarm performance where sensors respond to convicted heat and smoke.

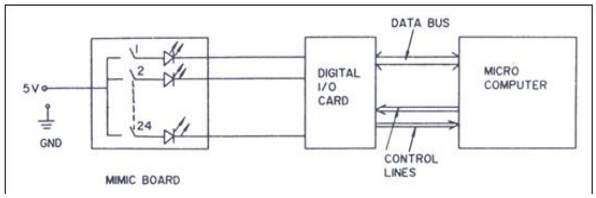

Fig 3 Circuit diagram

III. RESULTS AND DISCUSSION

The development of an apparatus for evaluating the performance of multi sensors devices, called the Fire Emulator/Detector (or FE/DE), the apparatus shows real promise for international standardization. The efficacies of current sensor technologies, examines nuisance alarm sources, and develop data with which alarm algorithms might be developed for multi-sensor devices. In computational fire modelsto develop a 'sensor-driven' or 'inverse' model. Where traditional fire models state with the heat release rate of the fire and predict the fire's impact on the building this model takes the analog signal from fire sensors and predicts the heat release rate of the fire most likely to be producing those signals. This model holds promise in allowing fire alarm systems to produce real time data of significant use to the service in making tactical decisions, as well as evaluating

detector signals for consistency with fire chemistry and physics and determining the level of threat to people and property. Fire detectors and the systems to which they connect play a significant role in the reduction of fire losses.

To avoid malfunctions and unwanted alarms and to make sure the fire detection system will perform as expected in the event of fire, hence it is necessary to test and calibrate the system, so that the system can correctly and maintain reliability detectors found to be unreliable and /or with reduced sensitivity must be replaced or cleaned and recalibrated.

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IV. CONCLUSION

Conventional detection system have several disadvantages such as, it gives false alarms and maintenance problems due to pressure leakage caused due to adverse weather conditions, such as UV radiation, heavy rains and high wind velocity etc., the other disadvantage is that is cannot be configured at required temperature depending upon the site conditions, after every fire detection element needs to be replaced and also it has no inbuilt self-diagnose facility. Therefore the industries should go for heat detection system, which is highly reliable and has in-built self-diagnostics to feature check the healthiness of the system preferably it should of non-pressurized type to avoid maintenance and does not give any false alarm. It should have the advantage of required pertest temperature suiting to site conditions, as well as application requirement. The conventional type system is not programmable. The limit of address is zone, only facility zone can be maintained. Each detector can be identified the particular non-functioning detector.

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