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## Design of Fire Detection Sensor and Monitoring System.

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### ABSTRACT

Fire detection system plays an important role in maintaining and monitoring the safety of people and equipment's in the industrial environment or reactors. Smoke detectors sense the smoke/fire condition and generate alarm information. The fire alarm system receives and confirms the fire condition, and also locates where the incident happened. This entire system is realized using microcontroller/computers. There are many fire alarm systems and fire/smoke sensors available in the market. But they are all imported at high foreign exchange. So the main objective of this project is to design a prototype fire sensor/panel towards the development of complete fire detection system for nuclear reactors, at low cost.

**Keywords:** Smoke, Smoke chamber, LED light, photodiode, Pic microcontroller, display, pulse counting device, power supply

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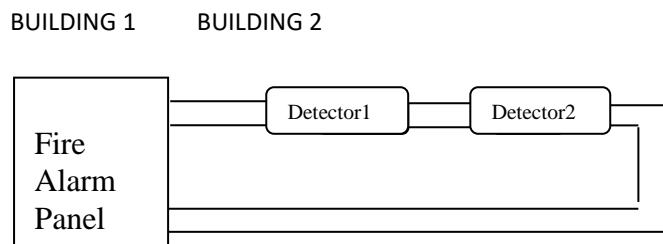
**INTRODUCTION**

Safety is the most important factor of buildings, industries and factories for people. A fire detection sensor can be implemented by one of three types of sensors those are smoke sensor, gas sensor and temperature sensor. Among these three types of sensors the smoke sensors are widely used all over. It can detect fire at the very initial stage than that of other two sensors and it is comparatively low cost. After smoke detector the most commonly used is temperature sensor, those sensors which can detect Temperature or heat. These types of sensors vary from simple on/off devices which control the hot water heating system to highly sensitive semiconductor and it can control complex process control incinerator plants.

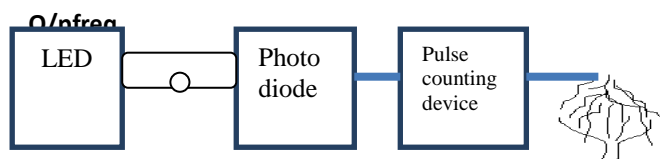
A smoke sensor provides rapid response time and it operates by any of the two ways such as ionization method and photoelectric method. In this paper we are using the photoelectric method. The entire system is controlled by microcontroller. The monitoring system receives and confirms the fire condition and also locates where the incident happened. A simple fire detection system for buildings and industries by using an LED, photodiode and a microcontroller is designed and implemented in this paper. We have designed a chamber where the smoke from the surrounding can be disturbing the absorption of light by the photodiode and frequency will be reduced. The advantage of using this fire sensor and monitoring system is that it can detect 256 detectors from the buildings and all of the sudden the information will be transmitted to panel alarm system and then the information will be transmitted to panel alarm system and then to the operators.

The information from the buildings to fire alarm panel can be transmitted by cable wires; if any crack occurs in wires it can be automatically isolated from the circuit. The cable which we have used is twisted wire cable.

**SYSTEM OVERVIEW**



**PROPOSED MODEL**



**Smoke**

This model consists of a sensing part, an oscillating part and an instrumentation part. Smoke detected by the sensing device will be transmitted to the oscillator and the oscillator passes the varying signal information to the instrumentation device. The AT89C51ED2 microcontroller device controls the whole working the device. It sends the frequency count values to the LCD display and when the device detects the smoke buzzer start to buzz and led glows alternatively.

**RELATED WORKS**

Huiping Huang, Shide Xiao, XiangyinMeng et al. separately with pyroelectric infrared detector, temperature sensor, smoke detector and gas sensor. When the pyroelectric infrared detector finds that some people intrudes into the house abnormally, the sensors will detect and send encoded alarm signal to the home control center through the WSN established in home. Once wireless control center receives alarm signal, it can send alarm information to users by the GSM module and GSM network

P. N. Narendra Reddy, P. I. Basarkod, S. S. Manviet. et al the system continuously check the surroundings and it had stored a list of temperature and the trespassers detected performed by monitoring node. Fire extinguishing system switches the extinguisher as fast as it detects the fire or the temperature crosses the constant threshold level, performed by extinguishing node. The importance of using Zigbee detected fire extinguishers in a hospital building has also been demonstrated.

Mengxin Li, WeijingXu, and Jingjing Fan et.al the fire detection methods based on video images in few years. By this, it is clear to see that the video based fire detection technology can be distributed into two main areas: the characteristics detection of flame and smoke. This fire detection can progress the accuracy of the fire alarm, real-time and robustness. If optimal algorithms can be assumed for each part of this detecting motion area and detecting the fire characteristics. When the fire broke out the two noticeable factors can be identified such as flame and smoke so the fire detection technology using the video can be classified into two classes: fire-flame detection and fire smoke detection in video according to object detected

MagyKandil, May Salama , SamiaRashad et ala method to detect fire flame and smoke in the real-time by processing the video data generated by an ordinary camera monitoring the scene. The objective of this project is recognizing and modeling fire shape evolution in the stochastic visual phenomenon. It focuses on detection of fire in image structures by applying a hybrid algorithm that depends on improving the structure of a feed forward neural network. Fire detection experiments by using a number of algorithms were operated.

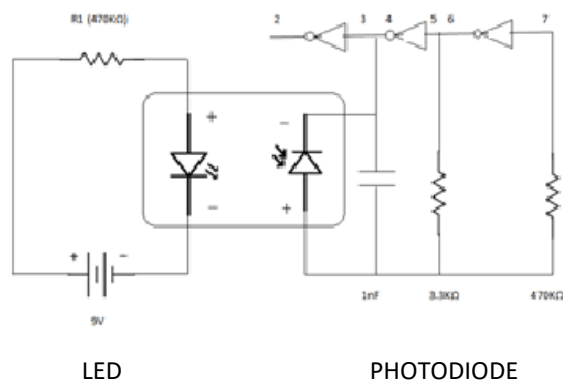
V Bianco, M Paturzo, A Finizio, LMiccio and P. Ferraro et al .the thermo graphic cameras can be able to find the smoke that is blinded by the flame emission. Here two methods showed which give the chance to solve the problem relying on Infrared Radiation (IR) active imaging modalities. The lens less IR Digital Holography method can find it very clearly through flames by the interferometry approach. Experimental suggestions are informed to validate both the methods and the comparison between the two approaches is carried out.

### CIRCUIT IMPLEMENTATION

The 5mm red led and photodiode is kept in a chamber so that the light from led falls on the photodiode and it is the sensing part. The photodiode is connected to an ic4049 and works with a dc power supply. The led is connected to a resistor and it works with a 5v battery. The housing for both led and photodiode is made and named as the oscillator. When this sensing part detects the smoke nearby it will scatter the led light rays falling on photodiode and the frequency of light may vary. This may leads to the change in frequency of light gradually. The information signal is transmitted to the pulse counting device with a microcontroller. The signal is passed to the microcontroller by a gate channel and this microcontroller pass the information to the LCD display and it sets a threshold frequency. If the frequency of light measured above the threshold frequency the buzzer connected to the pulse counting device start to buzz and the led connected alternatively glows. Both the led and buzzer have same interval.

The circuit diagram for LED light, and the light source which we are using is Red colored 5mm range Light Emitting Diode is two-lead semiconductor light source. It is a p-n junction diode, which emits light when activated .When suitable voltage is applied to the lead; electrons are able to recombine with electron holes within the device and releasing energy in the form of photons. The circuit diagram for photodiode is given below. This is a semiconductor device that converts light into current. Photodiode may contain optical filters, built-in lenses, and may have large or small surface areas. The led and photodiode is chambered. As per the experiment the light from the led is absorbed by the photodiode, the output frequency of the photodiode is measured in the Digital storage oscilloscope. The frequency of photodiode across presents of light and absence of light is noted. When the smoke enters to the chamber the led light scatters and the photodiode frequency varies.

**Circuit Implementation:**



**Led and Photodiode using IC 4049**

**MICROCONTROLLER AND MONITORING SYSTEM**

**Microcontroller**

The micro-controller with embedded program in its flash memory forms the brain of the hardware. The different tasks to be performed in the predefined manner are embedded in the flash ROM using flash programmer. Once the embedded system is integrated to the hardware blocks, upon power on the system performs the tasks as desired by the programmer. The embedded program can be written in high-level languages and cross compiled or can be written in assembly language and compiled using assembler to generate a hex file. The hex file is then “burned” into the program memory of micro-controller. The micro-controller is selected based on the functional requirements and the on chip hardware features. The chip used in this project is AT89C51ED2  $\mu$ C.

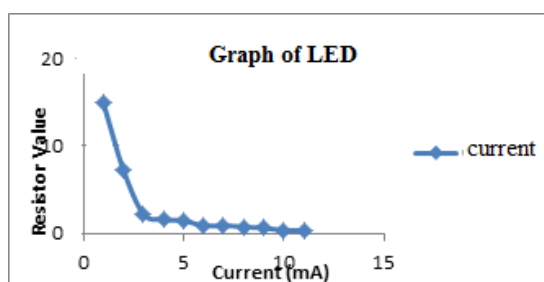
**Monitoring System**

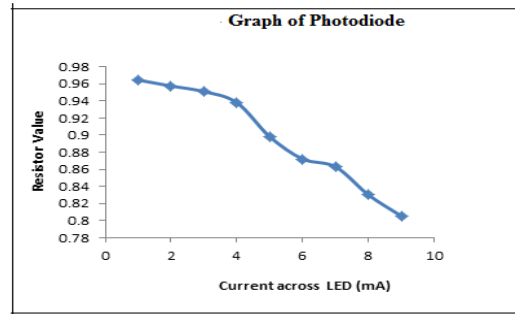
The display block consists of an LCD to locally monitor the parameter that is sensed at the input terminals. These parameter values are updated with respect to the sampling rate. The signal for enabling and disabling the LCD segment is passed from the micro-controller. The LCD display Module is built in a LSI controller. It internally has two registers, instruction register (IR) and data register (DR). IR stores instruction codes such as display clear, cursor shift, and address information for display data RAM (DDRAM) & character generation RAM (CGRAM).

Address information is written into IR & data is written into or read from DR. Register select (RS) is used to select the two reg. Busy flag when set to 1 will not accept next instruction, address counter (AC) assigns address to DDRAM & CGRAM.

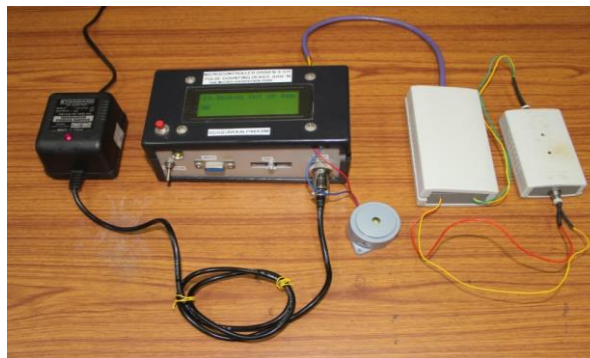
**RESULT AND DISCUSSION**

The following graph shows the current values of led light and photodiode with various resistor values.





**Practical implementation of the smoke detector**



**CONCLUSION AND FUTURE WORKS**

In this paper, an automatic fire detection and monitoring system are based on wireless sensor networks is designed and developed with the use of a Led, photodiode and a pulse counting device. Prototype system tests show that the system can provides early extinguishing of a fire calamity so that damages will be reduced in actual fact. We must pre-arrange the location of each detector in this system due to localization mechanism is not considered. In order to reduce the installing workload and it makes the system more convenient, automatic localization mechanism is the focus of our future work. The main objective of this project is to design a prototype fire sensor/panel towards development of complete fire detection system for nuclear reactors, It allows for quick assessment of the exact location of fire at low cost.

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