

**Low Cost Fire Alarm System with Sprinkler**

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Abstract: Fire mischance is an alarming episode which makes overwhelming lives and property misfortunes. Fire detectors can be of different types with various specific features depending upon different scenarios and demands. [1] Large numbers of detectors which measures temperature around the area where this system is installed in time. Once the alarm is set on, it checks around the response can be set in motion. An alarm is there to guard the location, keep it safe and give a feeling of safe environment around. It not only prevents a big losses caused by deadly fire but sometimes proves to be life savers. In this paper a low cost fire alarm system with a sprinkler system is developed which is designed in order to provide early extinguishing of a fire disaster and alert people around about the fire.

Keywords: Fire alarm; Sprinkler system; Thermistor

I. INTRODUCTION

Fire alarm systems have become increasingly sophisticated and functionally more capable and reliable in recent years. They are designed to fulfil two general requirements: protection of property and assets and protection of life. The core essence of fire alarm systems hasn't changed – give the occupants of buildings an early and clear warning of a fire. Fire accidents often lead to deaths of many people. [1] Smoke inhalation, not burns, is responsible for most deaths in a fire as smoke rapidly incapacitates people, degrade visibility and diminish the chances of fire victims reaching otherwise available exits. [1] Smoke is dangerous because it contains particles at various stages of burning that can penetrate the respiratory systems and lodge in the lungs. Toxic gases in smoke such as carbon monoxide can deplete the blood's oxygen supply. [3][4] It also contains vapours that can be poisonous when inhaled or absorbed through the skin. [1]

Since fire needs oxygen for combustion, oxygen levels can deplete quickly by combustion or displacement with other gases generated by the fire. Heat and thermal radiation are also among the inherent dangers of fire due to their effect on people and property. One breath of air that is hot enough or containing superheated gases can burn the respiratory tract and kill. [1]

The effect of fire in the workplace can be devastating. Furniture, discarded packaging, loose paper, waste bins are ready fuel for fire in the workplace. Other significant risks also come from overloaded or overheated power extensions, damaged power cords and computer equipment. [2]

The damage and hazards caused by fire in an industrial setting can extend to surrounding communities. Regular, scheduled fire risk assessments are critical to the prevention of fire in offices and industrial settings. At home where we

normally feel safest is actually the most likely place for one to die in a fire. Heating equipment, Candles and cigarettes, poor electrical connections and overload pose significant dangers.

To overcome such situations, fire alarm systems are installed for safety purpose.

The number of these systems to be installed in an area is checked by following criteria:

- i. Total area to be protected.
- ii. Type of building construction
- iii. Ceiling obstructions
- iv. Sensitivity required

Note: Area is categorized into zones and no blind spot should be left. The number of detectors and their location should be so selected that complete coverage is obtained. [6] For construction of such systems require certain steps to be followed:

Detection process: Detection devices are also known as 'initiating' devices. An initiating device gives an output of some type on the fire alarm system when activated [10]. Examples of initiating devices are:

- Smoke detectors**
- Heat detectors**

Output process: The output associated with the activation of an initiating device may be the activation of the internal sounder on the panel, a relay that will shut down the ventilation system or audio/visual devices. [10] Audio/visual devices are referred to as 'notification' appliances. Examples are:

- Horns**
- Speakers**
- Strobes**
- Combination audio/visual (A/V) devices**

Other types of notification devices are those that alert the fire department via phone lines or radio and annunciation devices. [10]

All Fire Alarm Systems essentially operate on the same principle. If a detector detects smoke or heat, or someone operates a break glass unit, then the output devices operate to warn others in the building that there may be a fire and to evacuate. Fire alarms are prime necessities in modern buildings and architectures, especially in banks, data centres and gas stations [3]. They detect the fire in ambience at very early stage by sensing heat and raise an alarm which warns people about the fire and furnish sufficient time to take preventive measures. It not only prevents a big losses caused by deadly fire but sometimes proves to be life savers. [5]

II. RELATED WORK

There are many types of fire alarms available in today's world. Below are mentioned some of them:

Simple Fire Alarm Circuit using Germanium Diode:

This is a simple fire alarm circuit using Germanium Diode. In this circuit Germanium Diode play a very important role in detecting the fire. The key component in the circuit is DR25 (germanium diode) whose resistance will decrease with increase in temperature. [7]

Fire alarm using LM341: Here is another small project on fire alarm. The thermistor is the main component which detects the fire by sudden change in the room temperature because of the heat generated by the fire. The thermistor will detect the heat and give the information to the LM741 OP-AMP. The op-amp will make the NE555 to generate pulse which has been given to a LED to buzz. [7]

Fire alarm using LM741: The working of this fire alarm is similar to that of fire alarms working with Germanium Diode, but here op amp acts as non-inverting comparator and fire alarm with Germanium Diode works only for a fixed temperature whereas Fire alarm using LM741 can work under any atmosphere. The siren effect produced in this circuit is from the capacitors used as main component. [7]

Our conclusion from the literature survey about the mentioned fire alarms is that their working is similar but these respective fire alarms are different on the basis of their output. Their outputs characterised as either buzzer or usage of LED (light emitting diode). This led to our idea of introducing sprinkler system along with the fire alarm system. This proposed fire alarm is multifunctional as it performs the function of alerting people, in case of fire, as well as it reduces the causalities and other difficulties faced by the fire fighters during such a situation.

III. SYSTEM DESIGN

The system design consists of the two steps: construction of low cost fire alarm and simultaneous implementation of the sprinkler system. The block diagram of the fire alarm system is given in fig 3.

Components Used:

- ✓ Transistors BC108 , AC128
- ✓ 9V Battery
- ✓ 4 Resistors of resistances 100kOhm and 1kOhm

- ✓ 1 Variable Resistance
- ✓ 2 Capacitors of capacitance 2.2uF and 100uF
- ✓ IC 555 Timer
- ✓ LED
- ✓ Pump
- ✓ Q3F-1Z
- ✓ Relay

IC555 Timer: The 555 timer IC is an integrated circuit (chip) used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element. Derivatives provide two or four timing circuits in one package. [9]



Fig 1: IC 555 Timer

Q3F-1Z Relay: A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches.[8]



Fig 2: Q3F-1Z Relay

Non-operational state: In case of no fire, resistance of thermistor remains unchanged, i.e., 10k ohm. Transistor remains in on state because there is sufficient voltage across the base-emitter of transistor, which makes it state unchanged. In this state, Pin 4 of IC555 which is the RESET pin is connected to the Ground, and when Reset pin is grounded, IC 555 doesn't operate. This leads to fire alarm remain in calm state.

Operational State: When change in temperature is sensed by the Thermistor, change in resistance occurs. Resistance decreases and then it leads to decrease in voltage at the base of Transistor which makes transistor get in OFF mode. This OFF mode makes the IC timer to get activated by getting a positive voltage and IC 555 starts to work and LED beeps. The LED beeps alert people about the fire scenario and they safely leave the location.

Sprinkler System: Our Sprinkler System consists of Q3F-1Z Relay and pump. This works when your fire alarm is in operational state.

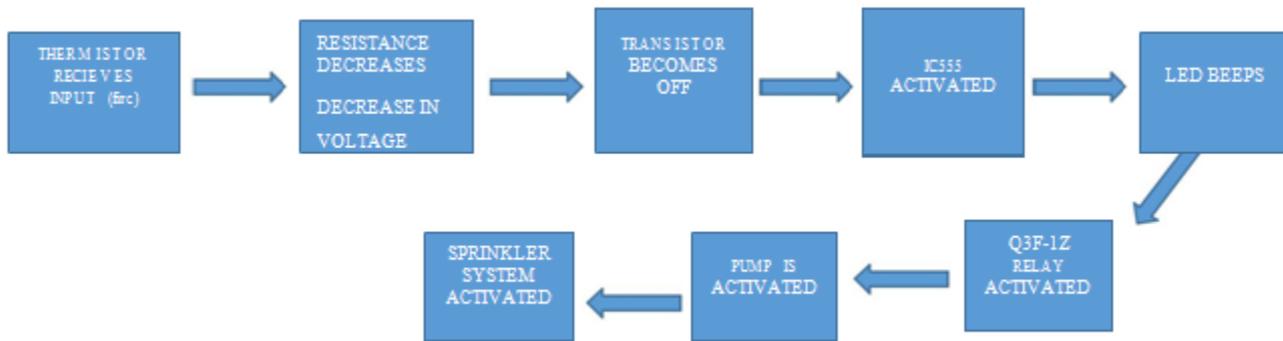


Fig 3: Block diagram of the fire alarm system

IV. EXPERIMENTAL RESULT

Our model, on testing, endowed alarm on immediate detection of fire with simultaneous working of the sprinkler system. This model is capable enough to detect fire even at a distance of 1m. The efficiency of the pumping system enables the sprinkler system to extrude water at a high force. The pressure with which the water flows is fairly enough to control the fire until proper fire rescue management arrives. The components used in this project are of minimal cost which makes it affordable and highly efficient. With minimised level of cost, this project assures to give out the best result with nil harmful effects. This fire alarm with the sprinkler system is user friendly.

Below is showcased the working model of our project:



Shortcomings faced while composing and trial working:

1. For Large scale implementation, more number of our models would be required.
2. If there is insufficient amount of water stored in the tank for the pump to operate, sprinkler system won't work.

V. CONCLUSION

To evade the fire mischance in the building the aloof method for security outline, life wellbeing arrangements and the dynamic method for settling putting out fires

appurtenances in the building can't guarantee full wellbeing. Number of factors is mindful in the fire wonder of the structures, which are to be recognized, surveyed as flame danger. Our model not only alarms the people around about the situation but also takes care of the casualties which fire fighters might have to face for a fire mishap.

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