

# A Brief Study on Alarm System of Fire

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**ABSTRACT-** Fires are a significant issue in homes, workplaces, and factories, among other places. It is hazardous and requires a high level of security and supervision in order to prevent loss of the life or property. Installing a fire alarm systems in susceptible places is one of preventative steps to avert the risk. It can detect heat in a particular environment, raise an alert, turn off the building's mains, and even spray water to lessen the severity of the fire. This paper discusses the introduction of fire alarm systems, the advantages and challenges of a fire alarm system, as well as the different detectors that are utilized in a fire alarm system. This paper is beneficial to individuals who need knowledge about fire alarm systems. Fire alarm systems may be changed in the future by incorporating new technologies such as the Internet of Things, Machine learning and additional modules such as GSM.

**KEYWORDS-** Alarm System, Detection, Heat Detector, Fire, Smoke Detector.

## I. INTRODUCTION

Fires have long been seen to be a hazardous catastrophe that may result in property damage, death, and even destruction. One of these catastrophes struck the area where the residents live. When compared to other risks, flames have been a recurring, catastrophic, and most important tragedy in many disasters [1]. The danger of catastrophic fires and other severe catastrophes has risen year after year as urbanization has accelerated [2]. Early identification of flames and caution are two critical factors in putting out fires quickly and avoiding significant losses and property damage. As a consequence, having a dependable fire alarm system is essential, particularly in buildings with a vast amount of people or valuable items [3].

Fire accidents are becoming increasingly common these days, resulting in the loss of people life or property [4]. Making fire and utilizing fire near tissue and quickly burn conditions, Transporting gas cylinders, stoves, gasoline, kerosene oil, and other items, Smoking a cigarette and tossing it carelessly as well as Electrical wire short-circuit are some of the most common causes of fire accidents. This carelessness resulted in the loss of more property and human lives because of the fire [5].

Automatic fire detection raises a number of issues, the most significant of which are various sensor combinations and suitable methods for fast and noise-tolerant detection of fire. Researchers have been researching flames in a

variety of settings, including residential areas, forests, and mines, in order to develop methods for fire monitoring [6]. Separating fire sources from noise sources is a critical problem in automated fire detection. The overall tendency for home fires, whether blazing or non-flaming (smouldering smoke fires), is to concentrate on sensor and sensor combinations or detection methods [7]. To put it another way, researchers have concentrated on either finding the optimum collection of sensors that can detect fire using basic methods when used together or developing sophisticated detection techniques that utilize a single or at most a limited number of simple sensors [8].

### A. Fire Alarm Systems

The purpose of the fire detection systems is to alert everyone to a disaster so that together we can act immediately to protect ourself, company employees, or the general public [9]. Fire alarms are found in offices, industries, and public areas; they are indeed a part of everyday life, yet they are generally neglected unless there is a crisis, in which case they might just save our lives [10]. If the alarm sounds, ultrasonic sensors will operate to inform people in the buildings there might be a fire as well as that they should evacuate [11].

A remotely signal device may have been included in the fire alarm system, which will either alert the emergency services via a central train station. The Automatic Fire Alarm Panel seems to be the "brain" of both the fire detection system [12]. It serves as the central hub for all detecting signals to just be attached to or provides users with a status indication.

### B. Various detectors used in Fire Alarms System

The detection sensors, which range from complex intelligent smoke detectors to simple manually operated break glass devices, are at the core of a fire suppression system [13]. There are many different types, but we can categories them as follows:

#### 1) Heat Detector

Heat detectors can function on a set temperature basis, triggering an alarm if indeed the temperature is raised over a certain level, or they can work upon that rate of variations in climate. Detection systems work similarly to electrical fuses in that they include a thermodynamically stable alloy that is heat sensitive. If a certain temperature is achieved, the alloys changes from either a solid to a liquid, activating the alarm. Figure 1 depicts the Temperature Sensing Module in a Fire Alarms Systems [14].



Figure 1: Illustrates the module of Heat Detector used in Fire Alarm System[15]



Figure 2: Illustrates the module of Ionization Smoke Detector used in Fire Alarm System[17]



Figure 3: Illustrate the modules of Carbon Monoxide Detector used in Fire Alarm System[20]

### C. Smoke Detectors

Smoke detectors can be categorized into two types:

#### 1) Ionization Smoke Detector

An ionisation smoke detector ionises the air with a radioisotope, usually americium-241, and detects a change due to smoke, triggering an alert. Optical detectors are more sensitive to flames in the early smouldering stage than ionisation detectors, which are more sensitive to fires in the blazing stage. Two electrically charged plates are sandwiched with radioactive material. This ionises the air and allows current to pass between them. While in the chamber, smoke interferes with ion movement and reduces the current flow, triggering the alarm. Figure 2 shows the module of Ionization Smoke Detector used in Fire alarm system [16].

#### 2) Light Scattering Smoke Detector

It works on Tyndall effect. The spot type Tyndall-principle photoelectric detector detects smoke by detecting reflecting light by smoke particles. The smoke particles approach the detector as well as reflect or scatter light from the device's tiny bulb, or LED.

#### 3) Carbon Monoxide (CO) Detector

It is a sensor that measures the amount of CO gases in order to avoid carbon monoxide poisoning. CO is a colorless, odorless and tasteless chemical generated by an incomplete burning of carbon-containing molecules. It is commonly known as the "silent killer" since it is practically undetected by humans without utilizing detecting equipment [18]. Elevated amounts of CO may be hazardous to people, depending on the volume of gas that is available and the duration of exposure. Smaller concentrations may be hazardous across longer durations, whereas rising concentrations need decreasing exposure durations to be detrimental. Figure 3 illustrate the modules of the Carbon Monoxide Detector [19].

#### 4) Multi-Sensor Detector

Multi-sensor detectors, which are meant to monitor smoke, heat, and/or CO, assist minimise false alarm rate by



Figure 4: Illustrates the module of Multi-sensor Detector used in Fire Alarm System[21]

#### 5) Manual Calls Points

Workers can trigger the alarms by breaking the frangible part on the fascia with a Mechanical Calls Point, also called as both a Break The window Active Communication.

#### D. Benefits

- Fire alarm system provide 24/7 monitoring.
- These systems are cheap and affordable to all people.
- Early detection of fire is achievable using these systems.
- Smoke Inhalation can be avoided using these systems.

#### E. Challenges

- If the batteries aren't charged, the system is effectively worthless since it won't function.
- For big workplaces or houses, range may be an issue, since a poor Wi-Fi connection can cause the device to malfunction.

## II. LITERATURE REVIEW

Majid Bahrepour et al. discussed survey on Wireless Sensors Networks for the Automatic Fire Detections [22]. Automatic weapons monitoring is critical for detecting or suppressing fires in timely manner. Numerous studies are being conducted to determine the best sensor combinations or methodologies for early fire detections. Fire detection has previously been considered perhaps an applications of a specific area or a main concern for which approaches have been created (e.g., fire detections utilising remotes sensing techniques). These approaches originate from a variety of disciplines among fire experts, including computer engineering, geography including environmental sensing, but instead fire safety. We examine previous research from three angles in this paper: (1) home fire detection approaches, (2) detections or avoidance techniques, or (3) the role of different sensors in earlier fire detections.

Ola Willstrand et al. discussed a survey on Fire alarm & fire detections systems in vehicle [23]. The research article is part of a larger investigation of fire detection and fire alarm systems in trucks. Fire detection technologies, standards and guidelines, including research in the field are

examining the signals across many sensors before determining if the source of the input is a real fire or one of several false alarm situations. Figure 4 shows the module of Multi-sensor Detector.

all discussed in this section. The primary goal of this assignment is to provide background information for such development's other project tasks. Understanding of many types of investigative techniques is provided, as well as how the systems function as well as their pros or downsides. The overall goal of developing an international match standard for detections systems in heavy trucks necessitates a thorough review of all relevant standards and suggestions, including those used in related industries such as rail, aviation, or the maritime industry. Finally, a summary of historical and ongoing research on fire detection in autos is provided.

Deepika K et al. discussed Automatics Fire detections or Rescue System based on GSM[24]. In real time world rail travel plays important part in our lives. So, the people may anticipate the security trip. However, today's fire disaster is a big source, since it occurs when fire is detected in unexpected settings such as natural hazards and human-caused difficulties. This article describes automatic fire detections but also rescue systems that use Wireless Sensors Network technology to continuously monitor as well as sweep the range of temperature or gas sensors. Whenever a fire is spotted, the constantly updated device transmits monitoring data to the observing centre it through Communications and the necessary help is dispatched. Previously, the fire loss was reduced by using an automatic misting system. As a result, this strategy saves men's careers but also state property by allowing them to take the necessary action.

Qin Wu discussed a Intelligent Smoke Alarm System[25]. Human-caused fires are still a significant issue, and homes are particularly vulnerable to fire. People have recently started using smoke alarms with just single detector to fire detection. Smoke is released in a variety of ways throughout everyday life. A sole sensor is ineffective in detecting fire. People may now remotely monitor their homes to assess their present state thanks to fast advancements in Internet technology. This article presents an automated smoke alarm system that builds a wireless network using ZigBee transmission technology, utilizes random forest to detect smoke, and uses E-charts to visualize data. In comparison to a conventional smoke alarm, the reliability and stability of the fire warning are improved by integrating real-time dynamic changes of different environmental variables, and the display of the data allows users to track the surroundings more intuitively. The recommended system includes a smoke detection module, a wireless access module, or an intelligent information and data presentation module. The collected relevant conditions has now been sorted into four groups. kitchen cooking, water mist, normal air, and fire smoke. Reducing the number of miscalculations also implies enhancing the user's personal and property safety.

## III. DISCUSSION

Fire detection systems are designed to identify the presence of flames early in the growth of a fire so that people may be evacuated. Alarm systems, which typically send signals to or from an employee's monitoring station, alert at least the building's occupants. There are different sensors are used in Fire alarm system like heat sensor, Multi-sensor detector, Smoke detectors, Carbon monoxide detector. Like every technology, these systems have various advantages as they detect the fire early so that people or resident can evacuate the building early before fire extends, also monitor our house for 24/7. Without batteries, these systems are useless and the range of these systems is less, are some of the disadvantages of these systems. In future, these problems can be minimized by adapting new technologies and mechanisms.

#### IV. CONCLUSION

The Alarm Systems System is critical in identifying fires at an early stage. A smoke detector systems can be installed in a variety of locations, including homes, hospitals, automobiles, or other spaces. This paper discusses the introduction of fire alarm system, various detectors used in these systems, its benefits and challenges. This paper is helpful in research study for developing advance alarm system. Like every technology have some benefits and challenges, this fire alarm system have some advantages as well as challenges, it monitors our homes for 24/7 and these systems are cheap and affordable easily. These systems are useless without batteries and range is low are some of the drawbacks of these systems. In future, these problems can be minimized by adapting new technologies and mechanisms.

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