



## IoT Based Automatic Fire Detection and Precautionary System

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### ABSTRACT

Detection of fire in homes is necessary to avoid destruction of property due to fire accidents both natural and induced. Detection of fire can prove to be very important as it could mean the difference between life and death. Fires can occur from anywhere and at any point of time, hence the presence of Fire Alarm System helps in keeping your family safe. Some people don't see the need to have a fire alarm system. They just assume that they could smell the fire and run out in time. The average time for a house to burn down nowadays is just 60 seconds. So, by the time you smell the fire and try to run away, the fire has probably engulfed the house. The Internet of Things (IoT) is a system of devices connected and accessible through the internet. The 'Thing' in IOT could refer to any physical device, varying from a toaster to an automobile. These devices can be connected through the internet and help us manipulate or collect data from them. In this paper, we will be using a wide variety of sensors to detect the presence of fire and alert its presence to the watchman and fire officials. It discusses in detail about the functions of each module and its implementation in an elaborate manner. It also discusses the application of Iot Technology in relation to fire detection technologies.

**Keywords:** Fire Sensors, Smoke Sensors, Water Pump, Buzzers, Public Places, Iot app.

### Introduction

The Ready Made Garments (RMG) industry is the main driving force of the economy of Bangladesh. The RMG sector of Bangladesh is the main catalyst behind the averaged GDP growth rate. Over 4.2 million employment opportunities have been provided by this sector. More than a million laborers are working in these garments factories. But this outstanding growth is being challenged by the frequent accidents in factories and industries. Over the past decade the RMG sector of Bangladesh has been through a number of tragic accidents. The majority of those accidents were caused by fire. On 24 November 2012, fire took 117 lives in "Tazreen Fashion factory" in capital Dhaka [1]. 8 lives were lost when a fire broke out at a textile factory in the Mirpur industrial district on May 9, 2013. On 14 December 2010, 30 people died and 200 were seriously injured when fire broke out at the garment factory, "That's It Sportswear Ltd" in Ashulia, Dhaka. Twenty two lives were lost when a deadly fire broke out at the "Garib and Garib" factory in Gazipur, Dhaka on February 2010 [2]. This incident shows that many garment factories do not have proper fire prevention and rescue system. Hundreds of factories are vulnerable to fire broke out because the factories are very old and lack fire detection technology. Moreover, most of the factories do not have an automatic system to stop fuel and electricity supply when fire breaks out, and it takes a lot of time for the fire service to reach the disaster spot. In this perspective, a system to detect fire and alarm the employees before it breaks out is a crying need. In this paper, we designed an IOT based fire alarming system to help detect fire as soon as possible and save precious human lives. The system will use several sensors to detect any symptoms of fire. The sensors will be placed on proper places after doing surveys on the factory for its vulnerable places of fire. After choosing the best places for placing the sensors, the sensor will be activated. The data collected by sensors will be sent to Arduino microcontrollers placed on various places. The microcontroller will then process the data. All the microcontrollers will be controlled centrally by Raspberry Pi microcomputer. Intelligent algorithm is used to decide when to start alarm for fire. Besides, the system will stop gas and electricity supplies on sensing fire break out and will start firing suppression system, like opening fire extinguishing water valves. At the same time the system will send SMS using GSM module to the nearby fire service station informing them of the incident. The system will also inform the location of the fire to the administrator using GPS module. Several types of sensors will be used, for example, temperature sensor, gas sensor, smoke sensor, flame sensor, etc.

### Literature Review

In this section we will discuss about various existing fire detection methods. A.V.Duraivel proposed a system using raspberry Pi 3. They designed the system by using a wide variety of sensors, a video camera and a sprinkler. It is highly compact and provides an authenticated detection process. The disadvantage of this system is that it will need to be connected to a Wi-Fi network. S.Naveen proposed a system using Raspberry Pi, gas sensor, flame sensor and a temperature sensor. In this system, the gas and flame sensor are first triggered and then checked by the Raspberry Pi. The temperature signal is then activated for confirmation. R.Dhanujalakshmi designed a system which detected the presence of fire using image processing techniques. They used a Raspberry pi for the computation. The disadvantage was that the algorithm is very complex and needed perfect conditions to work efficiently.

Sailaja Vungarala designed a system using sensors and an Arduino which identified the flames based on its shapes and colours. The disadvantage in this method is that it does not have a long range and needs monitoring for efficient usage. E.Saraswathi designed a system using sensors and an Arduino Uno board. In this system, The sensor networks are programmed with various user interfaces suitable for user of varying ability and for expert users such that the system can be maintained easily and interacted with very simply. The disadvantage is that the energy consumption is high and since there is no good authentication system, it may lead to many false alarms.

Sowah et. al. [3] designed and implemented a fire detection system for vehicle using fuzzy logic. They used temperature, flame and smoke sensors for sensing fire. The system also can extinguish fire in 20 seconds and they used the air-conditioning system for extinguishing fire. The author in [4] proposed a paradigm for detecting forest fire with the help of wireless sensor network. The authors have focused on how to process the data collected by the sensors rather than how to detect or sense the fire. They used neural network for processing the collected data and make the network energy efficient. A fire alarming system based on video processing propounded in [5]. They used smoke color and spreading characteristics of smoke to detect possible fire outbreak. But processing the images is time consuming and needs sophisticated resources. In case of a garment factory, the fire should be detected as soon possible because the garments are very much susceptible to fire. In [6], a fire monitoring and control system was designed where they used various sensors like flame, smoke, gas sensors for detecting fire and starting fire extinguishing process.

### **Existing System**

Safety is a crucial consideration in the design of residential and commercial buildings in order to safeguard against loss of life and damage to property. The existing fire alarm system in market nowadays is too complex in terms of its design and structure. Since the system is too complex, it needs regular maintenance to be carried out to make sure the system operates well. Meanwhile, when the maintenance is being done to the existing system, it could raise the cost of the system.

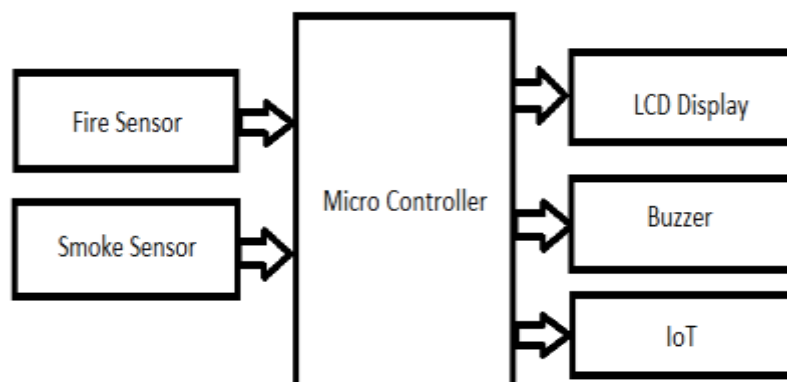
### **Proposed System**

This proposed system is an automated fire detection system, which on detecting fire, will take proactive measures of alerting the respective personnel, in addition to raising the alarm like a conventional fire detection system. It is implemented using the components like Micro Controller, Fire sensor Buzzer. All components are interfaced with the Micro Controller and works by automation as per uploaded code. when fire is detected within the deployed area, the notification regarding the fire accident will be send to our mobile and an alert mail, with the specifications of the accident location will be send to the fire station along with the alarm buzzing, alerting the people around, and the water pump gets turned on automatically and helps in cooling the surroundings. With this system, we can overcome the problem which is in the existing system. The fire sensors are deployed in small black box around the space to be monitored. If any fire is detected by the sensor, it sends the information to the Micro Controller.

### **METHODOLOGY:**

Smart fire detection system with automatic BUZZER has been developed to solve the slow response issue of fire accidents. The inputs provide readings for the system to analyze, such as sensors and Wi-Fi module that works as a transmitter for the sensor readings. Temperature, gas, and flame sensors are inputs. The readings from the inputs are displayed on the web page. Outputs like LED and Buzzer indicate a fire. When ever the fire or smoke is released in the shopping malls schools, theaters, showrooms, industrial areas etc. the sensor detect the fire and smoke and give the alert by using buzzer and we can also monitor by using the blink app wherever you are in the world.

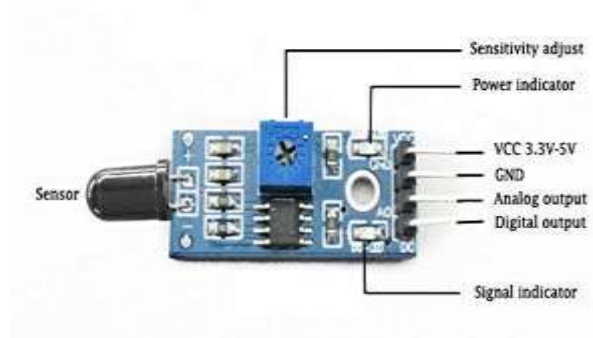
### **Block Diagram**



## HARDWARE REQUIREMENTS:

### FIRE SENSOR:

A flame-sensor is one [kind of detector](#) which is mainly designed for detecting as well as responding to the occurrence of a fire or flame. The flame detection response can depend on its fitting. It includes an [alarm system](#), a natural gas line, propane & a fire suppression system. This sensor is used in [industrial boilers](#). The main function of this is to give authentication whether the boiler is properly working or not. The response of these sensors is faster as well as more accurate compare with a heat/smoke detector because of its mechanism while detecting the flame.



- Pin1 (VCC pin): Voltage supply ranges from 3.3V to 5.3V
- Pin2 (GND): This is a ground pin
- Pin3 (AOUT): This is an analog output pin (MCU.IO)
- Pin4 (DOUT): This is a digital output pin (MCU.IO)

### BUZZER:

The buzzer is a sounding device that can convert audio signals into sound signals. It is usually powered by DC voltage. It is widely used in alarms, computers, printers and other electronic products as sound devices.



An audio signaling device like a beeper or buzzer may be electromechanical or [piezoelectric](#) or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

### MQ 2 Gas sensor:

The MQ2 sensor is one of the most widely used in the MQ sensor series. It is a MOS (Metal Oxide Semiconductor) sensor. Metal oxide sensors are also known as Chemiresistors because sensing is based on the change in resistance of the sensing material when exposed to gasses.

The MQ2 gas sensor operates on 5V DC and consumes approximately 800mW. It can detect LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentrations ranging from 200 to 10000 ppm.



**LCD:**

we always use the devices which are made up of LCDs such as CD players, DVD players, digital watches, computers, etc. These are commonly used in the screen industries to replace the utilization of CRTs. [Cathode Ray Tubes](#) use huge power when compared with LCDs, and CRTs heavier as well as bigger. These devices are thinner as well power consumption is extremely less. The [LCD 16x2 working principle](#) is, it blocks the light rather than dissipate. This article discusses an overview of LCD 16X2, pin configuration and its working.

**CONCLUSION**

Fire breakouts create serious health and Infrastructure hazard, associated with it is unavoidable injuries or loss of lives in one hand, partial or complete damage to properties. This loss is inestimably enormous; hence this paper proposes the development of IOT based fire department alerting system. This model constantly monitoring the fire signal and will send warning to alert the user and nearest fire station. This application targets people who don't have someone to be at home, office or any other workplace so when they away from their place they are notified about the fire problems if any. Using this application will help these people as they will be informed quickly about the incident and also the nearest fire department will be notified in an effective way. The application has a notification feature which notifies the user and the nearest fire station plus the domestic help so that a quick action can be taken. It is also very efficient and hence very easy to use. This system has tried to solve almost every problem related to the safety of homes and its assets.

**FUTURE SCOPE**

The framework which we have assembled is only one single unit for testing reason; the equivalent should be possible on a substantial scale. The framework can be actualized by including different new highlights, for example, camera. Including a Camera will give a reasonable image of the site of mishap in this manner enabling policeman to get the outcomes quick and as that issue even suspects. It can likewise be utilized for review purposes in future and to keep comparative mishaps from occurring. What's more, the framework can naturally gauge the power of flame so local group of fire-fighters station can realize how much work power will be required to beat this issue this as well as the measure of quencher required can likewise be created by further research, this will spare the errand of workforce at the stations. Model can likewise be outfitted with water sprinklers which will be valuable for controlling little events of flame, contingent upon spending we can introduce it the entire territory on greatest safeguard.

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