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[Technology](#), [Artificial Intelligence](#)



## **Introduction**

The Internet of Things (IoT) is one of the major technological innovation which is used to monitor natural and artificial resources for predicting, observing, controlling and detecting existence events like flood, fire, gas and water leak that can make easier and more comfortable of human life. The term “ Internet of Things” (IoT), come in front by Kevin Ashton in 1999, has been in use for several years and continues to be of interest, specifically when it comes to technological progress. To make emergency response real-time, IOT enhances the way first responders and provides emergency managers with the necessary up-to-date information and communication to make use those assets.

According to the report of Bangladesh fire service and civil-defense, an estimated average of 16858 fire events occurs in only 2016. These fire caused an average 52 civilian deaths, 247 civilian injuries along with 20 officers and 240 crores to in-directly damage in 2016. Most of the victims are workers of different garments factory, cotton warehouse, manufacturing company, shopping complex and multi-store complex building. Many of these deaths and injuries can presumably be avoided if evacuees had knowledge of the location of the fire and a solid exit strategy. In an age of IoT devices, there are no such commercial and effective products available to address this problem. And which are available they are not effective and efficient to provide proper information and guidance for evacuation in real time with location.

In this project, we propose a technology that can be used as an intelligent fire defense guidance system for victims, firefighters and control room. The goal is to inform occupants and emergency services of the location of the fire and provide a real-time safe path of evacuation.

## **Background and Present State of the Problem**

As we have observed that, there has been a large amount of prior research and work in intelligent fire response system. Mainly the work is to get data from spot, analyze and provide message to the victims and proper guidance to evacuate safely and rapidly. We found that fire response systems installed in various building which have lack of intelligent interconnected features. Most fire alarms and systems are not equipped with modern and up to date technology. The inadequacies of main points are

1. The scope is smaller
2. The intelligent degree is low
3. The low level of network
4. Fire detection sensitivity is very low

Traditional fire response system generally form a fire sensor network with cable technology, connection between all device through copper core insulation wire or copper cable, complex design, poor performance, erosion and large number of false alarm. However, these works mainly focus on the formulation of an evacuation route based on the construction layout of the building before the disaster happens. Z. Han et al in 2013 have shown effective use of integrated evacuation route planning based on real time fire data in high rise buildings. But here he emphasized to enhance the

evacuating guidance only. A patent was also filed in 2015 on " Large high-rise building indoor fire urgent evacuation indication escape method and system".

We seem that all the works done before are not capable to reduce death, injuries and loss of property cause they did for specific work like one tried to get data properly, one tried to analysis the data and send message to fire station and victim without direction and guidance. And someone researched to develop android app for guidance without concern of data from sensors and also these are not intelligent. We propose a technology that will change the traditional layout of cable fire warning system, expanding the coverage of fire detection, to help us get to know more timely and accurate information of fire. A system is needed that can be implemented with the existing infrastructure that will be reliable, fast, and effective. This system is not meant to replace (although it potentially can in future) existing fire alarms, but rather add intelligence to them with proper information and guidance with up to date for this era.

### **Objective with Specific Aims and Possible Outcomes**

The main objective of this work is design a system which can analyze the situation of hazards and provide guidance to all possible people who are related with this. The key objective and possible outcomes of this work may mention in the following:

- To develop a device that can detect the symptom and the location of fire hazards.

- To design a messaging system that will send guidance to 2G subscriber, control room and fire stations.
- To develop an android app which will give safe and shortest exit path to evacuate directions with maps.
- To evaluate the all system performance in real environment.

### **Outline of Methodology**

The key objective of our work is to develop a system that detect the fire hazard situation, analyze and calculate the risk of current situation and provide information and guidance through wireless network to victims, people who are staying others floors of building and to the firefighters. To do this we can divide our methodology into three parts

1. Perception layer
2. Network layer
3. Application layer.

### **Perception layer**

This layer is responsible for data acquisition and conversion. The acquisition of real-time data on fire depends on the sensor system and the wireless data transmission system. The sensors system include smoke detectors, flame detectors, flammable gas detector and GPS module. In modern high rise complex building there is at least one smoke, flame, gas sensor and a GPS module need for each room. The device has to be set at corner of ceiling so that sensor cover maximum area and give flexibility to fit the requirement of data acquisition. When the sensors work, the sampling periods of all the detectors are set to fix time like 2 or 4 seconds. A higher sampling frequency

has better timeliness of digital signal, which is the technological foundation of this real-time method.

### **Network layer**

The transmission and processing of data in the network layer, network communication infrastructure including mobile communication network and Internet. Through the network, all kinds of information can be collected for reliable delivery. A network need to be established to flow the all data from perception layer and for analyzing, calculating of that data and for providing information to users, clients or subscribers. So for this criteria we may use Espressif Wi-fi controller. ESP32 is well known for its hybrid functionality which consists of Bluetooth and Wi-Fi. It supports WPA/WPA and WEP for security aspects. It has some built in sensors like Hall sensor, Ultra low noise analog amplifier and touch interface. Here the network make the path or route of data transmitting data from sensors to processing unit then to the subscribers.

### **Application layer**

The application layer is the core value of IoT technology. Its main task is to obtain the huge amounts of intelligent sensory information data for further processing, to provide customized information services needed for the user. For the intelligent emergency fire response system, function of the application layer is the data management, risk calculation, measuring optimal and safe path for evacuation and application and user interface for providing information. Here for cloud service Adafruit. io will be used which makes raw data sensed. The messaging system MQTT APIs are wrap with the

library of Adafruit. io. The informative message will publish from here to send. For risk calculation we may use interpolating method. And for route analysis of evacuating we may use first marching and level set method. After doing this we need to send message to subscriber. We may send message through MQTT for 2G user and we will develop android app which will show the optimal path direction and distance through map.