

# IoT Based Smart System for Avoidance of Fire Accidents on Running Buses

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## Abstract

Now-a-days, fire accidents are occurring very frequently in public transport system which causes the loss of most valuable human lives and the government property. There are a number of methods to avoid fire accidents and to reduce the severity of loss in case of fire accidents in public transport system. But the damage is catastrophic as a rescue service could not reach at right time due to improper communication. So, we must further avoid and reduce the loss caused by fire accidents in buses. The main objective of our project is to detect the fire accidents and to inform the nearest respective authorities who can reach faster. Fire sensors are used to detect the fire when the crash or accidents caused. All the sensors are connected to a central controller whenever the fire is detected the controller activates the water sprinkles, sounds the alarms. A GPS module is integrated to the system through that the longitude and latitude of the location is send to the fire department authorities. Node MCU is used as the central controller in the proposed system. Final the data is send to the cloud through it will be available to all the govt. departments. Things speak cloud is used in the prototype.

**Keywords:** Fire Accidents, Internet of things (IoT), Node MCU, GPS, vehicle.

## 1. Introduction

India is country that standards second position in population in the coming year the population goes on increasing. Public transportation is the main mode of transport to maximum people in the country. The development of transportation facilities is done by government as well private tours and travel operators. The road transport is mainly by buses which require regular maintenance, lack of paying attention by many of the bus mangers or the operators toward the regular maintenance of the vehicle which leads to accidents in the running bus or vehicles [1]. The vehicle manufacturing industry follows many rules and specification for the designing which reduces the accident rate and increases protection or safety of the passengers.

Early in the morning every person wants to know the news, and the things happening around them. Most frequent news is about accidents. Less than a week after 45 people was burnt alive in their sleep in a Bangalore to Hyderabad bus. when bus met with a accident, at a time there will be loss to many people and their property and loss to government also. And mainly in AC buses, because in AC buses all the windows and doors are closed, and people require more time to escape from the accident .so our idea is to implement a preventive measure that are to be done automatically.

A fuel tank of a Uttar Pradesh state road transport corporation bus has burst after a collision with a lorry on 05<sup>th</sup> June 2017 which is travelling from New Delhi to Gonda District travelling with two drivers and 38 passengers, fire engines reached the spot after 90 minutes.

22 people are buried in this fire accident. On 31<sup>th</sup> October 2017 a private bus caught fire near Dhaula Kuan in South Delhi which is carrying 33 students of kendriya Vidyalaya's Naraina branch, it was a narrow escape. On January 20<sup>th</sup>, 2015 a Volvo bus travelling with 45 passengers from Mumbai-Hyderabad caught fire in the Telangana state Medak district. The driver stopped the bus and alerted the passengers immediately after noticing the rear-engine side fire, no one is injured but there was a property loss. A Private bus caught fire in Bangalore after hit a bike on 2<sup>nd</sup> December 2014 three are injured. On 31<sup>st</sup> august 2014 a pilgrim bus met with fire accident in Tamil Nadu's Ramanathapuram district, five passanger are killed and 6 re injured. A private bus caught fire in Maharashtra, five passengers are died and 10 injured near Talegaon wardha district, the bus is travelling from Jalgon to Nagapur on May 29, 2014. A bus travelling from Pune to Pandharpur on 5<sup>th</sup> may 2014 caught fire due to short circuit, the driver and conductor off loaded all the 46 passengers in Maharashtra. The vehicle has buried totally which belongs to Maharashtra state transport. On November 8<sup>th</sup>, 2013 a KSRTC running bus between Hassan and Bangalore driver and conductor immediately alerted to alight the passengers from the bus at Gorgunteplaya. On 30<sup>th</sup> October 2013 a private Volvo bus caught the fire near Mahbubnagar on the way from Bangalore to Hyderabad which killed 45 people and 7 are injured. In the same way many fire accidents are caused not only in India but also in many countries. Here in this paper we propose and design a prototype which avoid the fire accident in vehicles using IoT



Fig. 1: Busses caught fire and totally buried

In today’s world everything can be known to us by using internet. We can solve the problem by using the internet [2]. IOT refers to the use of intelligently connected devices and systems to leverage data gathered by embedded sensors and actuators in machines and other physical objects. When accident had happened the device automatically shares the message to the fire stations with help of internet, so we can prevent the human loss and property loss. In this paper we are design a device which automatically monitors to prevent the human loss as well property loss.

The device contains Node MCU module, which connects fire sensors, GPS module and water sprinklers and alarm system. The data from these sensors will activate the node MCU which in-turn activates the, alarm system, water sprinkler system, and GPS[3] module it will automatically shares location to cloud.

## 2. Literature of Existing Methods

There are several methods to avoid fire accidents and to reduce the severity of loss in case of fire accidents in public transport system. The existing method consists of fire extinguishers, alarms, and when fire was detected humans must use fire extinguishers shown below in figure 2 and must break glass and must ring the alarm and break the glass of emergency door. And people must inform to police stations and fire stations and hospitals.



Fig. 2: Fire Extinguisher

Information could not reach at right time due to improper communication. Preventive measures are to be implemented by human intervention only. It Takes more time to implement preventive measures manually. Automotive industry has designed a standard Fire Detection and Alarm System (FDAS) & Fire Detection and Suppression Systems (FDSS) for Buses of Type III. Whenever the fire is detected it activated the alarm

## 3. Proposed Method

The block diagram of the proposed method is shown in figure 3. The proposed idea consists of a fire detector, buzzer, water motor and a GPS module are connected to the controller which continuously monitors the whole vehicle automatically when the engine turns ON and it will be OFF state when engine turns OFF. When the surrounding value crosses the range of fire detector the design comes in to an active state when fire is detected

our proposed idea consists of a design that gives an alert to passengers and driver by alarming, pre-recorded voice through speakers in the bus (fire detected alight the bus immediately), water will be sprinkled, and the locations longitude and latitude is shared automatically to fire stations and police stations and hospitals by using GPS module[4]. Through human loss can be avoided and human loss as well.

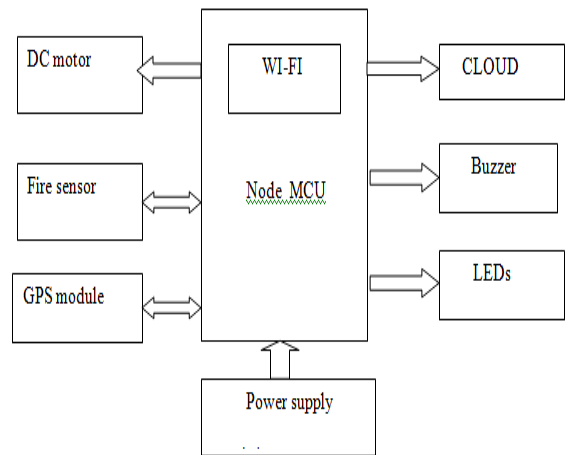
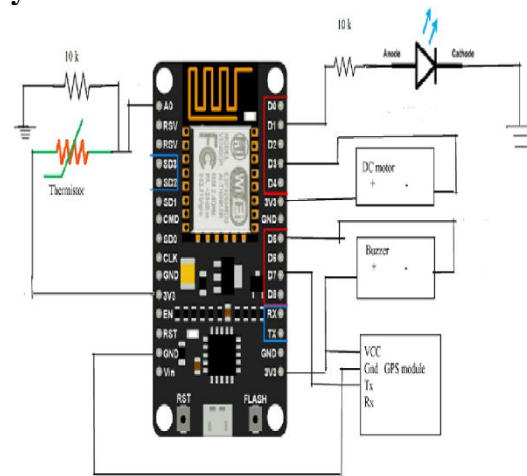


Fig. 3: Block diagram of proposed method

Node MCU comes to active state when power supply is given to it. And it is given by using a usb cable. GPS module and fire sensor is connected to the Node MCU[5] and node MCU contains a inbuilt WIFI module and by using hotspot Wi-Fi is connected. And the data is collected from the sensor and by using GPS module the location will be shared, and buzzer and water sprinkler system comes in to active state automatically.

## 4. Hardware Implementation of the Proposed System



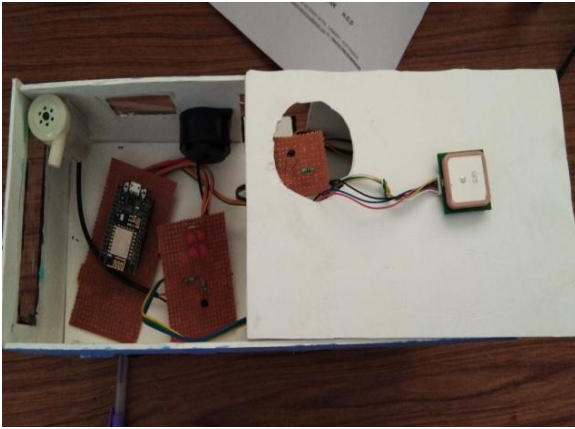


Fig. 4: Hardware Implementation of Proposed System

We had implemented a design to prevent the fire accidents on running buses. The design consists of node MCU, Fire sensor to detect fire, DC motor for water sprinkler system, GPS module to send the location and buzzer to produce a sound.

The main component of our design is node MCU which act as central controller and is connected to the bread board and the power to node MCU is given by USB cable by using a system. Mainly to detect fire there must be a sensor and we had used Thermistor to detect fire. The working of thermistor is, when there is smoke, fire on the surroundings it will detect. For the water sprinkler system, we had used a DC motor, in a typical DC motor, there are permanent magnets on the outside and a spinning armature on the inside. The permanent magnets are stationary, so they are called the stator. The armature rotates, so it is called the rotor. And it is placed in water tub. GPS (Global positioning system), it does not need any user to transmit the data it automatically tracks the location by trilateration principle. And another component is buzzer it comes to active state when fire is detected. The whole design is implemented by writing a certain code in Arduino software, and the code is dumped in to node MCU by using USB cable, and the power is also given by that cable. Connections are made as shown in the circuit diagram. And to check our design fire is too kept at sensor and when it detects it, the device comes to active state, and there is alert to the passengers and driver in the bus in the form of a sound will be produced by buzzer, and there will be LED blink, and automatic water sprinkler system, and shares location by using GPS module.

## 5. Hardware Modules used the System

**Buzzer:** A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows.

It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound



Fig. 5: Buzzer

**Fire sensor:** A thermistor is a type of resistor with resistance inversely proportional to its temperature. The word is a

portmanteau of thermal and resistor. Samuel Ruben invented the thermistor in 1930, and was awarded U.S. Patent No. 2,021,491



Fig. 6: Fire Sensor

Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting over current protectors, and self-regulating heating elements

## GPS Module

The Global Positioning System (GPS) is the main completely utilitarian Global Navigation Satellite System (GNSS). The GPS utilizes a heavenly body of in the vicinity of 24 and 32 Medium Earth Orbit satellites that transmit exact microwave signals, which empower GPS collectors to decide their area, speed,. GPS was produced by the United States Department of Defense. Its official name is NAVSTAR-GPS. Even though NAVSTAR-GPS isn't an acronym, a couple of acronyms have been made for it. The GPS satellite group of stars is overseen by the United States Air Force 50th Space Wing.



Fig. 7: GPS Module

## Things Speak

An open source cloud platform application think speak is used. Which retrieves and stores the data from the sensor or the things connected to the systems through internet that uses hypertext transfer protocol (HTTP) from the local network to the cloud? It updates all the data logs received from the sensors, tracking location applications, and the status application giving to the users and taken from the users. To use this user has create an account which contains different channels for monitoring of different parameters in the system or in the monitoring the paraments in a remote device. This cloud enables the administrator or the user to visualize the data in graphical representation. With internet-based monitoring, energy output data is transferred to a router, making it available through an online interface. The main advantage of systems like these is that your solar panel output information is readily available anywhere you can get an internet connection.

## DC water Motor



Fig. 8: DC Water motor

A DC water motor is used to sprinkle the water which works on 12v

### 6. Results

As our project is mainly to reduce accidents in buses, the whole design is shown above, and as a small prototype we had made bus with sheets. And there is graph showing the values of surroundings that was detected by sensor and this can be seen by using the thing speak app as shown in figure 8 and a message is sent to cloud shown figure 10. And location sharing can be seen by using sys4u app shown in figure 9. Preventive measures are implemented with a minimum amount of time. Human loss and property loss will be reduced. Information will reach at right time by using GPS module. As the data is sent to cloud and a social network, in fire stations and police stations there have to be one person continuously monitors that data.

### Fire Accident :437163

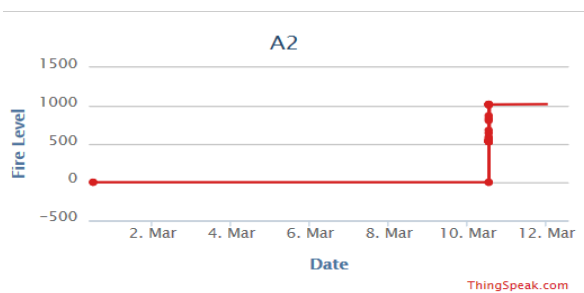


Fig. 9: Thing Speak graph

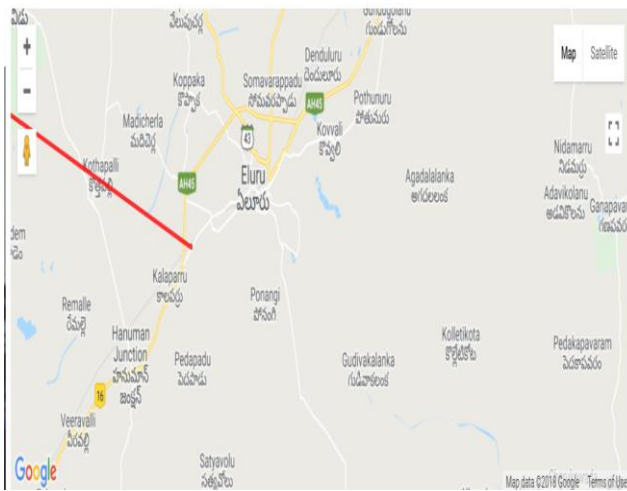


Fig. 10: GPS location in sys4u

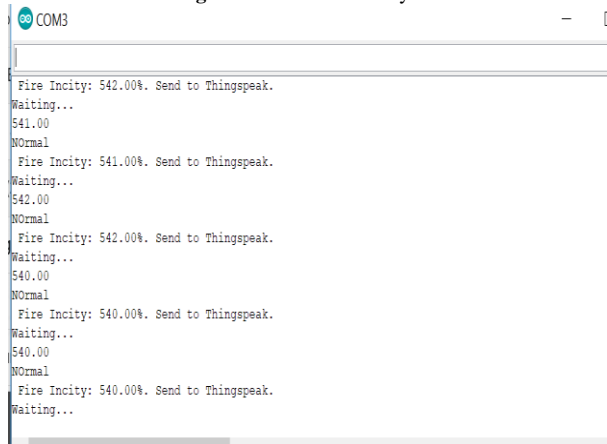


Fig. 11: Values detected by fire sensor

### 7. Conclusion and Future Scope

Internet of thing has several of applications and here we had applied in the field of fire safety and monitoring. Especially in AC buses. IOT has a broad application background in the field of real time applications mainly in security systems. This proposed system mainly focuses on reducing the human loss and property loss when accident had happened. In our proposed system the preventive measures are implemented automatically, So the time to implement them is very less, so the loss can be reduced. We propose this system as a first attempt and compliment to public transportations.

Many accidents occurs during night time, and sometimes when driver is in sleepy condition driver cannot control the bus, if there is a drowsiness detection then in that situations a alert is given to driver in the form of buzzer.

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