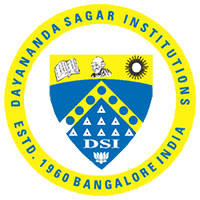
**Department of Information Science and Engineering**

**Abstract: Team 2**

**IOT based Forest Fire Detection System**

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Date:

Place:Bangalore

# Document History

# Change History

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| Version | Status | Date | Author | Approver | Reviewed  date | Approval  date |
| 0.1 | Approved | 01 Apr 2022 | Nokia UC | - | - | - |
| 1.0 | Approved | 11 Apr 2022 | Nokia UC | Rajat Duggal | 11 Apr 2022 | 11 Apr 2022 |
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Abstract

Fire, as one of the world's biggest calamities, must be identified at the right moment before it can do significant damage to the atmosphere, living beings and resources. In one way or another, these renewable resources are very essential to mankind. Forest fires are the most common hazards in forests which lead to serious destruction of forest wealth, biodiversity and natural habitat. According to a study, 75-80 percent of the various casualties caused by fire might have been prevented if the misfortune was detected quickly. Particularly in the case of a forest fire, this results in a significant loss to the environment and makes it extremely dangerous for the wildlife habitat. To avoid such losses, an automated system is needed that can provide early detection of any fire situation via any of the alarm systems. In order to achieve early detection, there are two most used traditional methods of human surveillance.

• Human observation

• Automation approach

Traditional methods of human surveillance are directly through human observation and through distant video surveillance. This requires 24/7 continuous monitoring. The automated fire alert detection system by which one can achieve surveillance through the automation approach of detection proposed in this project comprises three sensors, namely flame, temperature (DHT) and CO2 MQ135. These sensors detect change in a measurable physical quantity and intimate the nearest fire extinguishing station. Internet of Things (IoT) technology has brought revolution to each and every field of common man’s life by making everything smart and intelligent. IoT refers to a network of things which make a self-configuring network. The development of IOT based Forest Fire Detection System will be helpful in mapping emergency plans and making them more effective during the occurrence of any disaster. In this project, the intention is to build a Forest fire detection system using IoT which would detect the fire and send an emergency alert to the Authority through IoT. Here a GSM/GPRS module is used to communicate with IoT servers.

Table of Contents

Section 1:

[Document History 2](#_Toc100568083)

[Change History 2](#_Toc100568084)

[Abstract 3](#_Toc100568085)

[Problem statement 5](#_Toc100568086)

[Brief solution 6](#_Toc100568087)

[Block diagram/Flow chart 7](#_Toc100568088)

[Components used 8](#_Toc100568089)

[Hardware Components 8](#_Toc100568090)

[Software Components 8](#_Toc100568091)

[Construction steps/Working procedure 9](#_Toc100568093)

[Output/Result 10](#_Toc100568094)

[Conclusion 11](#_Toc100568095)

Section 2:

[Innovation 12](#_Toc100568096)

[Future Enhancements 13](#_Toc100568097)

[Open points 14](#_Toc100568098)

[Publications: White paper, IEEE, IPR 15](#_Toc100568099)

[Project plan 16](#_Toc100568100)

# **Section 1**

# Problem statement

Forest fires are common hazards in forests that cause a lot of harm to wildlife as well as the environment. It could be avoided if a robust system could be deployed in forest areas to detect the fire and alert the fire extinguishing authority to take immediate action. In this project, the intention is to build a Forest fire detection system using IoT which would detect the fire and send an emergency alert to the Authority through IoT. Here a GSM/GPRS module is used to communicate with IoT servers as usually in forest areas network bandwidth is very low or not available. Hence a 2G network is preferable to communicate with the server.

# Brief solution

In this project, we will design an IOT based forest fire detection system. The working of the project is pretty simple: detect the fire and send an emergency alert to Authority through IoT.

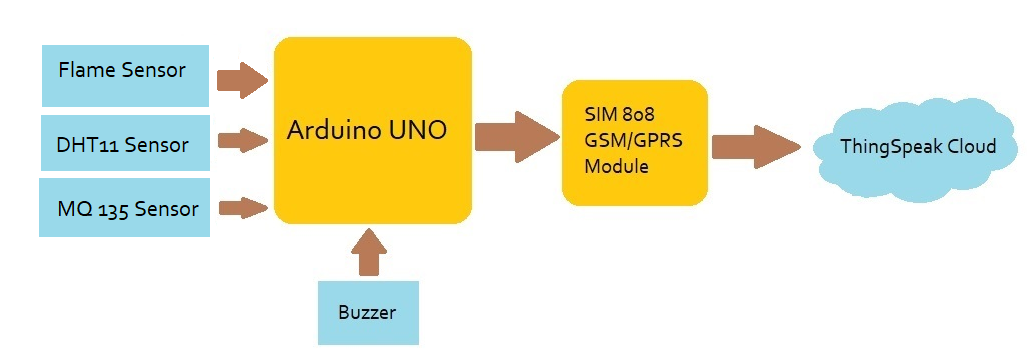
Many researchers came up with the solution by using various types of control and detection systems. It is a detection system equipped with a GPS navigation system and a flame sensor.

As shown in the schematic block diagram below, the project consists of Flame sensor, DHT11 Sensor, MQ135 Sensor, Arduino Nano & SIM808 GSM/GPRS module as its primary components. The fire can be detected by the flame sensor which gives a digital output that corresponds to the fire status and is received by the Arduino Nano.

Arduino compares the signal and triggers the SIM808 in case of fire incidents. SIM808 is a compact module that allows GPRS transmission, send/receive SMS, and making voice calls. The SIM808 module has two antennas included on it. The first is for a ring antenna which can be soldered directly on the board and the other is meant for an external antenna. Through AT commands, SIM808 communicates with thingspeak server.

# Block diagram/Flow chart

# The diagrammatic representation for project is as follows:



# Components used

## Hardware Components

* Arduino UNO <<[amazon links](https://docs.google.com/spreadsheets/d/188FSCLnrH7gheBhDjPV4PqIJtqKOIZhJ/edit?usp=sharing&ouid=103655246549530266996&rtpof=true&sd=true)>>
* SIM808 GPS/GPRS/GSM Module
* Sensors-
  + Flame
  + DHT
  + CO2 MQ135
* Buzzer, LEDs
* 9V- 1A Battery
* Breadboard
* 5 V DC power supply
* Jumper wires and cables.

## Software Components

## 

* Arduino IDE (1.8.13)
* ThingSpeak Account (Cloud)
* Software Serial

# Construction steps/Working procedure

The Working procedure are as follows:

1. Connect the Flame sensor, DHT sensor and the CO2 sensor to the microcontroller (Arduino UNO) using Jumper wires and breadboard.
2. Also connect SIM808 module via Logic shifting resistors.
3. Connect the buzzer and LEDs for the alarming system.
4. Supply DC current (9V-1A) to SIM808 module to power it on.
5. 5V DC external supply is given to Arduino UNO for the working of UNO and the sensors.
6. After successful integration of hardware, Arduino IDE is used to code those components.
7. Cloud platform needs to be set up, where the real-time data will be received.
8. Once all the data is received, the intensity of the fire will be estimated and the level of the wild fire will be determined.

After successful completion of hardware as per the above circuit diagram, the IoT platform needs to be set up, where the real-time data will be received. Here Thingspeak is used to store the parameters and show them in GUI.

For setting up the Thingspeak account follow the steps below:

○ First, go to https://thingspeak.com/ and create a new free Mathworks account if you don’t have a Mathworks account before.

○ Sign in to Thingspeak using your credentials and click on “New Channel”.

Now fill up the details of the project like Name, Field names, etc. Then click on “Save channel”.

○ Record the Credentials

○ Select the created channel and record the following credentials.

○ Channel ID, which is at the top of the channel view.

○ Write API key, which can be found on the API Keys tab of your channel view.

○ Add widgets to your GUI

○ Click on “Add Widgets” and add four appropriate widgets like gauges, numeric displays, and indicators. In my case, I have taken the Indicator for Fire Alert. Select appropriate field names for each widget.

# Output/Result

The output of the proposed system is as follows:

The fire and smoke sensors detect the respective elements and this initializes an alert and activates the system. This, in turn, sends the location, which is detected by the GPS module, with an alert message via SMS to the user with the help of the GSM module that has been incorporated into the system. Once the user receives the alert message, the required action can be taken to control and cease the fire.

The wireless transmission using RF, from one node to another node was experimented up to 1m. As there would not be any obstructions in the forest, the RF modules can work up to one meter efficiently. For GSM module to work properly, there should be a minimum network coverage to send an SMS with location. The nodes can be placed 1m away from each other, for maximum coverage of the forest area with minimum number of nodes and to perform with good efficiency. The fire and smoke sensors were tested up to 1m.

# Conclusion

Early cautioning and quick reaction to a fire breakout are the main approaches to dodge incredible misfortunes and natural and social legacy harms. Hence, the most critical objectives in flame observation are fast and solid identification and restriction of the fire. It is substantially less demanding to stifle a fire when the beginning area is known, and keeping in mind that it is in its beginning periods. Data about the advance of flame is likewise profoundly profitable for dealing with the fire amid every one of its stages. In light of this data, the fire battling staff can be guided on focus to hinder the fire before it achieves social legacy destinations and to smother it rapidly by using the required putting out fires’ hardware and vehicles.

The improved system can be deployed for tenement appliances and in industries also. However, the system above is meant for sincere opinion news only. As a tomorrow aggravation, several-decision companies through the IOT landing are studying an object and the exploration is being done to effectuate this enormous toil.

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# **Section 2**

# Innovation

The already existing system or the system that has been used currently in detecting forest fire is not efficient enough to detect the fire in the initial stage. It can detect only when the fire is widely affecting the forest. This caused many damages. But the cost of these devices is very high. These are not making use of the IOT that is the main disadvantage of these systems. If it makes use of the IOT it can detect and warn the fire in the early stages. Thus, in this project, the main focus is to detect the fire in the early stages and creates a high-pitched ringing sound or alarm that ranges up to 3 km to help save the wildlife and the humans present around the affected area. On detection it also immediately intimates the nearest fire extinguishing office by sending a pre-recorded message via call indicating the occurrence of fire

followed by an SMS which will be sent to the officer-in-charge which will contain the GPS location or the coordinates of the place of occurrence of fire. In the next step, the details of the damage including the temperature readings will be uploaded to a cloud platform for future analysis.

# Future Enhancements

In the future, we can develop this model to minimize the energy consumption of all sensors. Also, industrial sensors can be used for better ranging and accuracy. We can also install a wind sensor to the system which helps to determine the direction of the fire and the rate at which it will spread. Along with this we can implement an automatic fire extinguisher system. As soon as a sensor detects fire, the extinguisher gets activated.

# Publications: White paper, IEEE, IPR

* IEEE-

https://ieeexplore.ieee.org/document/8878808

* IRJET-

<https://www.irjet.net/archives/V8/i4/IRJET-V8I4360.pdf>

# Project plan

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sl.No. | Project Milestone | Status | Proposed completion date | Actual completion date | Remarks |
| 1 | Problem Statement final | Done |  |  |  |
| 2 | Abstract readiness | Done |  |  | Ongoing |
| 3 | Hardware List submission | Done |  |  | Blockers |
| 4 | Project Report updates | Ongoing |  |  |  |
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