

# Fire detection and identification system in forest using IoT

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## ABSTRACT

Animal movement from forest areas to residential areas is currently a challenge for the wild life and forest sectors. Forests are losing trees, creating an unfit environment for animals to live. According to research, fire was responsible for 80% of the damage, which can be averted if it is caught early. A system for detecting and warning of forest fires is the proposed project's method of protecting trees. Based on the node MCU platform, IoT devices and sensors may monitor temperature, gas, and fire. In this project, a fire alarm was constructed using a node MCU connected to temperature, gas, and flame sensors as well as a buzzer and LCD. Users will receive the phone number listed in the emulator using GSM. Temperature sensor is used to indicate the high and low temperature reached displayed on Lcd, flame sensor is used to indication of flame range if it is high the forest fire will be detected and will be displayed on LCD. Whenever fire detection is observed message alert will be sent to respective mobiles and the data will be displayed on the web page which can be accessed via internet. The technology used for this design is IOT, Blynk software and GSM module (used for Mobile communication and internet). This makes it easier after the detection and to intimate it to the higher authorities.

**Keywords:** GSM module, Node MCU, IOT (InternetOfThings), Blynk Software.

## 1. INTRODUCTION

Standard insurance predicts that there would be hotspots for wildfires all around the planet. Protectors of the ecological equilibrium of the planet are forests. Unfortunately, a forest fire is typically only discovered after it has consumed a significant amount of land, which makes fighting and controlling it challenging and occasionally impossible. In addition to irreparable harm to the ecology (high levels of smog and carbon dioxide (CO<sub>2</sub>)) in the atmosphere, the repercussions include terrible and irreversible damage to the ecosystem and the atmosphere (30% of the carbon dioxide (CO<sub>2</sub>) in the atmosphere comes from forest fires)[1]. Wildfires can have disastrous long-term implications like changes to local weather patterns, global warming, and the extinction of unique plant and animal species, among other terrible cons. Relationship between meteorological components and forest eruptions. Motivation for fire assessment in remote areas in different environment regions. Many focus areas rely on the remote sensor framework checked by experts around the world suitable for observation and perception of structures that control fires. tasks, e.g. B. fire department, letters System and hoisting, coordination and national reasons, etc.

## 2. Historical Background (Literature Survey)

### Simultaneous Forest Fire Detection and Analysis with WSN:

When compared to conventional sensors, these wireless sensors are extremely expensive. When it comes to employing the sensors, there are several technological challenges. are stationed in the wooded area. These sensors are linked together. This is accomplished through the deployment of a neural community approach. The measured data will be accumulated by these deployed sensor-nodes. The data will be delivered to the main node or interface. A cluster head is another name for this major node. The information will be sent to the supervisor or master node by these cluster heads. This master node functions similarly to a computer. This is where the data from the sensors will be processed. The data is gathered and delivered at predetermined intervals. The traffic between the nodes will be reduced as a result of this.

### **Forest Fire Prediction and Alert System Using Wireless Sensor Network:**

The approach employed in this article collects temperature data from all around the forested region and transmits it to be processed. To take faster action, the course of the fire is determined, and the rate of spread is computed. The suggested gadget comprises of stand-alone boxes with many fields of sensors such as humidity and temperature sensors. These bins are spread out across the whole woodland area site to ensure complete coverage. When the temperature in a given node rises over a certain threshold, an alarm is sent to the management center.

### **3. METHOD AND METHODOLOGY**

#### **NODE MCU:**

The ESP-01 module was developed by a third-party company, Ai-Thinker, which brought the chip to the English-speaking maker community in August 2014. This small module uses Hayes-style commands to allow a microcontroller to connect to a Wi-Fi network and perform basic TCP/IP communication. Initially, however, there was little English documentation about the chip and the commands it accepts. Many hackers are attracted to the module, the chip and the software on it, as well as the translation of the Chinese documentation, because of its low price and few external components on the module, suggesting that it may one day be sold in very affordable bulk. The ESP8286 is a comparable chip with 1 MiB of flash built-in to create embedded systems.

#### **GSM:**

SIM900 is a quad-band GSM/GPRS solution in an SMT module that can be integrated into customer applications. SIM900 features industry standard interfaces and provides GSM/GPRS 850/900/1800/1900MHz voice, SMS, data and fax capabilities with minimal power consumption.

#### **FLAME SENSOR:**

A flame detector is a sensor that detects and responds to the presence of a flame or fire, making it possible to detect flames. Sounding an alarm, disabling a fuel line (such as a propane or natural gas line), and activating a fire suppression system are all possible responses to a detected flame, depending on the installation. When employed in industrial furnaces, their job is to certify that the furnace is operating properly; they can also be used to turn off the ignition system, however in many situations they do little more than warn the operator or control system. Due to the mechanisms it utilises to detect, a flame detector can frequently respond faster and more accurately than a smoke or heat detector.

#### **TEMPERATURE SENSOR**

A temperature sensor is an electronic device that records, monitors, or signals temperature changes by measuring the temperature of its surroundings and converting the input data into electronic data.

#### **GAS SENSOR:**

A gas detector is a device that detects the presence of gases in a space, and is frequently used as part of a safety system. Operators in the area where the leak is occurring can be alerted by a gas detector, giving them the opportunity to flee. Because many gases can be detrimental to organic life, such as humans or animals, this type of equipment is essential.

Combustible, flammable, and toxic gases, as well as oxygen deficiency, can all be detected with gas detectors. This type of equipment is commonly utilised in industry, and it may be found in places like oil rigs to monitor production processes and developing technologies like photovoltaics. They could be used to combat fires. The technique of detecting a gas leak is known as leak detection..

#### **LCD:**

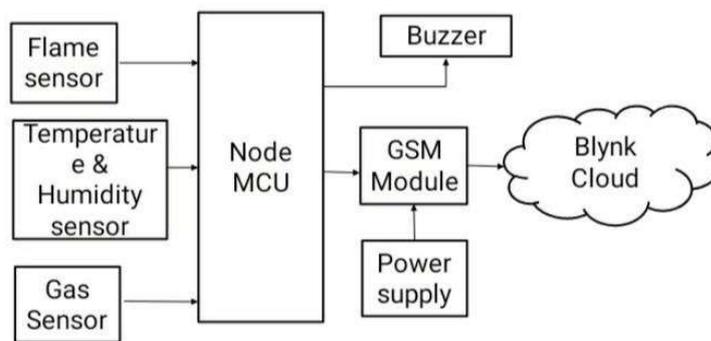
A liquid-crystal display (LCD) is a flat-panel display or other electronically manipulated optical device that uses liquid crystals and polarizers to modulate light. Liquid crystals do not directly emit light, instead relying on a backlight or reflector to create colour or monochrome images. [2] LCDs can show arbitrary images (like

on a general-purpose computer display) or fixed images with minimal information content that can be shown or hidden. Preset words, digits, and seven-segment displays, such as those seen in a digital clock, are all examples of devices that use these displays. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off

**BUZZER:**

Ringers like the TMB-course of action are alluring fit for being heard banner devices with natural faltering circuits. The advancement merges an influencing circuit unit with an acknowledgment twist, a drive circle and an alluring transducer. Transistors, resistors, diodes and other little devices go about as circuit contraptions for driving sound generators. With the utilization of voltage, current streams to the drive twist on fundamental side and to the area circle on the discretionary side. The strengthening circuit, including the transistor and the analysis circuit, causes vibration. The influencing current stimulates the twist and the unit delivers an AC alluringfield contrasting with a faltering repeat..

**4. PROPOSED DIAGRAM BLOCK DIAGRAM:**



**BLOCK DIAGRAM OF FOREST FIRE DETECTION SYSTEM**

The block diagram consists of Node MCU which is interfaced with GSM module. Flame sensor temperature sensor, gas sensor, humidity sensor given as input to Node MCU .Buzzer is taken as output and GSM module is connected to Blynk account .We can view the output in Blynk webpage. Power supply is given as input to GSM module.

**ABOUT THE WEBSITE**

Blynk is an IOT platform that allows you to operate Arduino, Node MCU, and raspberry pi via the internet and create a graphical interface by entering the correct address. This app keep track of your hardware project on your IOS or Android mobile.

**SOFTWARE IMPLEMENTATION:**

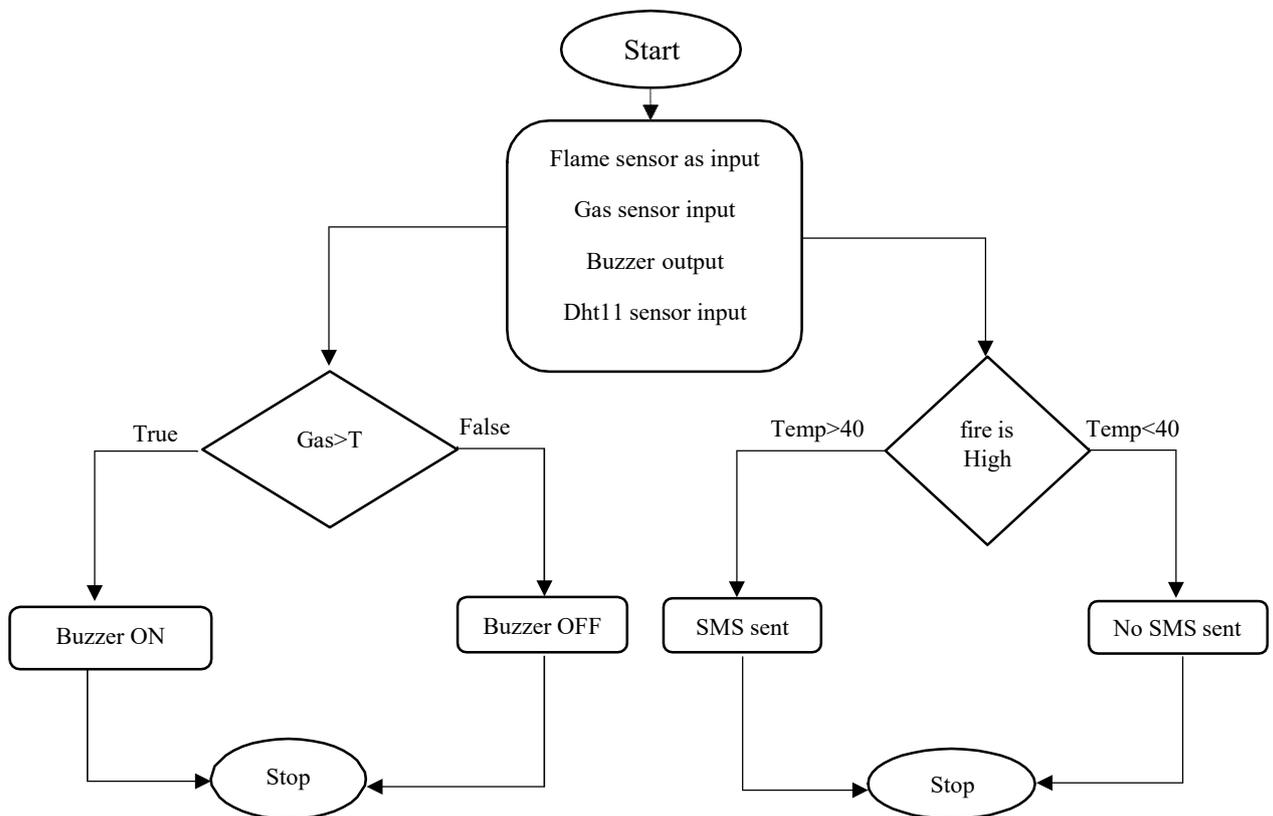
Programming language of C Standards driving gathering of trustees to address shared quality issues that exist between C advancements for various inserted structures. Truly, presented C programming requires nonstandard developments to the C language to help noteworthy highlights, for example, fixed-point math, distinctive evident memory banks, and key I/O endeavors. In past few years back, the C Standards Committee stretched out to this language to address those issues by giving a typical standards to all utilization to hold it in fast. Presented C utilizes by a long shot a large portion of the complement and semantics in standards of C, for an instance, rule() work, variables definition, datatypes insistence, restrictive declarations (if conditions, switch case), drifts (for, while), limits, shows and strings, structures, connection.

**ARDUINO IDE:**

The Arduino IDE is code editor that allows you to write code and then convert it into machine code that the micro controller can understand. It also allows you to local firmware files into the microcontroller. It also offers unique capabilities such as debugging and console support, which is why we refer to it as an integrated development environment(IDE)or simply as Arduino software.. It is a cross platform device that can run on Microsoft, Windows operating systems andcan be programmed using the Arduino IDE. We can install Arduino IDE , which comes in a varietyof versions for different operating systems.

**SOFTWARE IMPLEMENTATION**

The initialisation of this process takes place with the flames sensor,gas sensor, temperature sensoras input and the buzzer will be the output. The second step of this loop will be the presence of thegas,if the gas sensor value will be greater than the threshold value is detected buzzer will be on . If not the buzzer will be off..Parallely here the presence of the fire is also observed. If the volumeof the fire is high assume if the temperature is greater than 40degrees then the flame sensor will be on and an sms is sent to the higher authorities through the gsm module. If the temperature is less than 40 degrees then there is no intimation and the flame sensor will be off. After sending ansms to the higher authorities the process will be automatically stopped and will be intialized ifthefire is detected again



**OVERALL INTEGRATION, TESTING AND RESULTS:**

Forest Fire detection is done by using Node MCU along with Flame Sensor and Gas Sensor.We can also Know about the Temperature and Humidity in the Surroundings of the Forest. In case of Fire detection, an SMS along with the data of temperature of the surroundings of the forest in Webpage is sent and updated respectively.

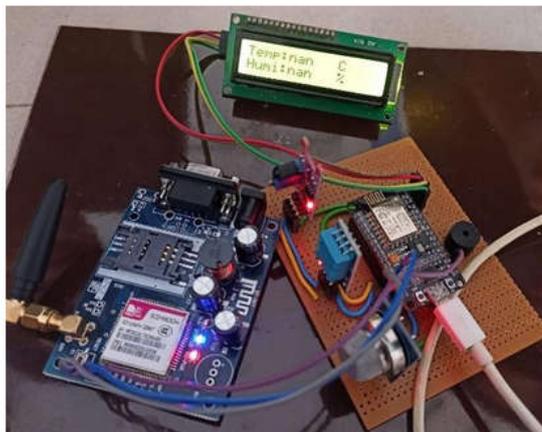


Fig.1 Interfacing of Node MCU Sensor



Fig. 2 Flame sensor output along with GSM Module



Fig. 3 Gas Sensor Output Results



Fig. 4 DHT11 Sensor Output Results

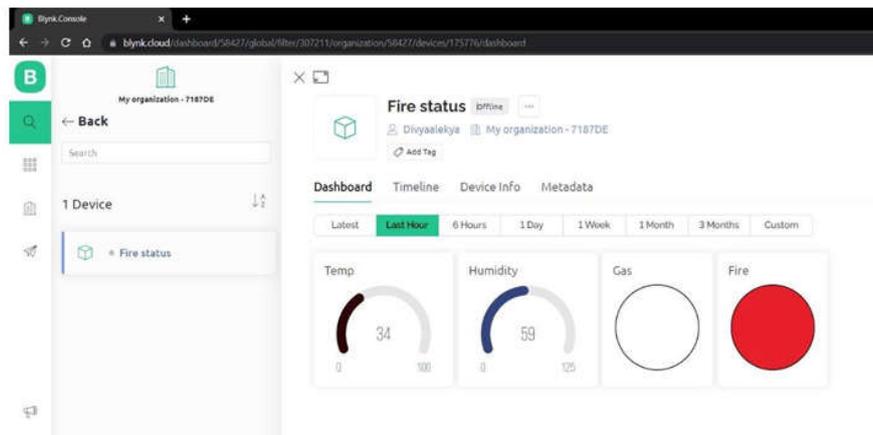


Figure 5 :Gas and fire detection displayed on web page

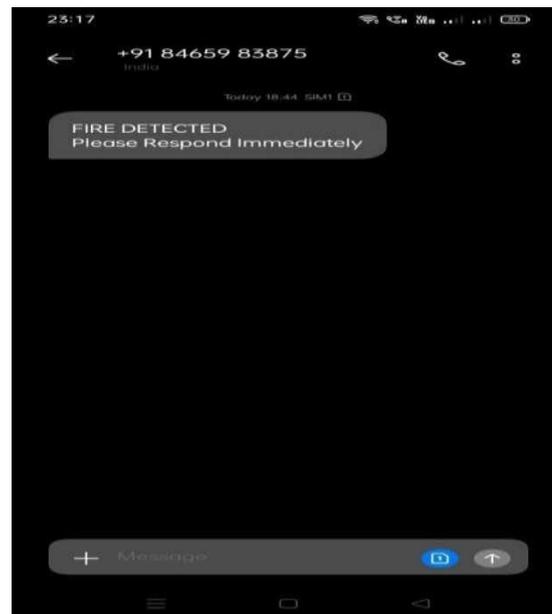


Figure 6: SMS alert to the forest authorities

## CONCLUSION

Our main goal in working on this project was to successfully monitor the forest fire in a crisis without involving any people. Node MCU, Flame Sensor, and Gas Sensor are used to detect forest fires. Additionally, we may learn about the temperature and humidity in the forest's environs.

When a fire is detected, an SMS is delivered and updated together with information on the temperature of the forest's surroundings in a webpage. Global server establishes a connection with a local server using Blynk software. A reliable platform for data storage and analysis using a GSM module is offered by Blynk software. We rely on the temperature and humidity sensor, which is highly sensitive, because the flame sensor employed in our research is used to detect the temperature. The flame sensor is set to ON only when the fire is detected at higher levels temperature whereas the presence of flame in lower level of temperature is considered to be harmless hence the flame sensors remains in the OFF condition.

Also the system alerts for Higher temperature Flame detection. Whenever the flame is Detected at higher levels of temperature, An Short message service that is an SMS is sent to the respective Forest authorities and the system also displays the live temperature and humidity rate along with the status of the fire and gas sensors. Thus, concerned ones may monitor situation at the forest whenever they would like to the status as well get an alert to there is an Forest fire immediately from anywhere and the required precautions can be taken.

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