IOT Enabled Forest Fire Detection and Management

Deepthi S
Department of TCE,
GSSSIETW,
Mysore, Karnataka, India.

Shushma G Krishna
Department of TCE,
GSSSIETW,
Mysore, Karnataka, India.

Sahana K B
Department of TCE,
GSSSIETW,
Mysore, Karnataka, India.

Vandana H R
Department of TCE,
GSSSIETW,
Mysore, Karnataka, India.

Latha M
Assistant Professor,
Department of TCE,
GSSSIETW, Mysore, Karnataka, India.

***Abstract*—This project deals with the detection and management of forest fire with the combined technology. Forest fire are very common which is a massive disaster to the environment and wildlife. In order to protect these, there need to be taken early caution measures to control the spreading fire. Usually it requires massive dependency of man power, transportation facility and lagging to trace true area will leads to delay in taking actions. Through this look up we have come up with the solution for this by implementing the IOT technology. Where the DHT11 and flame sensors detects the fluctuation in the temperature and humidity continuously and using Node MCU microcontroller which is also a Wi-Fimodule sends these values to the cloud as database, if these value exceeds the threshold value then a pop up alert message will be sent by the cloud to the respective forest department immediately. Where we can avoid major loss and spreading of fire to large area at its early stage.**

Keywords—Arduino uno, Node MCU, DHT11 sensor, Flame sensor, MIT app inventor, Google firebase.

I. INTRODUCTION

Forest fires are as old as the forests themselves. when there is no rain for months during summer, the forests become littered with dry leaves and twinges, which could burst into flames initiated by even the slight spark They pose a threat not only to the forest wealth but also to the entire regime to fauna and flora seriously disturbing the bio-diversity and the ecology and environment of a region, also there is a danger for wild life, domestic crops and to the nearest people.. So there is a necessary to avoid the excess of losses due to forest fire by controlling the fire in its early stages.

In the present technologies like ruled base image processing and MODIS systemsthere are many drawbacks like having high false alarm rate where alarm notification may not give a proper and exact notification at emergencies, also response time is quite big as they use robots to extinguish the fire accidents and temporal representation of the affected area. The main drawback is there is no facility of getting direct notifications to the mobile app immediately at the time of fire burst, all these drawbacks may leads to the rapid spread of the forest fire throughout the larger area of the forest leading to major damage and loss. It requires human force in big number which is a risky process.In the proposed system we have used high sensitive sensors which reduces the false alarm rate by enhanced data collection. The sensors and micro controller will continuously monitor and sends the data to the database (cloud) as value due to which minimization of the false alarm is achieved also response time is minimized . This system is user friendly as we have introduced mobile application where direct pop up alert message can be received through the mobile app by more than one device at the same time and also this message can be received being at any corner of the globe which has internet access and linked with our cloud. Cost is affordable and minimized the human efforts.

The main aim of our project is detection and monitoring the forest fire and to minimize the effect of fire breakout by controlling in its early stage also to protect wild life and domestic crops by informing about the fire breakout to the respective forest department as early as possible. We have implemented the IOT technology to achieve our objective. This method includes the combination of software coding in Arduinouno platform using c programming, mobile app (application) development, which is developed based on the algorithm of the project using MIT app inventor platform , cloud computing where it is created in the google firebase to fetch the data from the microcontroller hence the name database (cloud) and hardware components. Where the hardware components includes two different sensors and microcontroller which is also a WiFi module.

Two sensors are used in this project to monitor the flame, temperature and humidity rates in a specific location by DHT11 sensor and flame sensor. These sensors are connected to a NodeMCU microcontroller where this act as a wifi module. The NodeMCU will continuously sends the data from the sensors to a database that is to the cloud which we have created. In case of fire outbreak the temperature will increase and the humidity will decrease, these abnormal changes in the rates will be detected by the DHT 11 sensor and if there is a fire breakout the flame sensor will sense it, the NodeMCU then will receive these changes as a data from the sensors and send it to the database or cloud which will be stored there as a values, these values are compared with the threshold value. This threshold value is setup in the database, it is set depending upon the environment of the area where the detection is needed. If the values received crosses the threshold value then the cloud or database will send the pop up message saying “flame detected” to a mobile phones to inform respective department about the situation , it can be

used also to send a notification to the fire stations and hospitals in case of fire outbreak in forests, factories, houses etc.…,.

II. LITERATURE REVIEW

Some of the relevant literary works in this field are briefed below: The one fourth area of Karnataka is covered by forest, the forest and bio-diversity of the India are at the considerable chance and beneath enormous pressure. General causes of forest fire are extreme hot and aired weather, lightning and human carelessness. In order to protect these huge stretches of forest land, there need to be taken early caution measures to control of spreading fire. Usually it requires massive dependency of man power where due to climate situation, transportation facility and lagging to trace true area will leads to delay in taking actions. Through this look up we have come up with the technology where sensing surrounding can be developed with large vast range of wireless sensor nodes, and Node MCU based IOT empowered fire indicator and observing framework is the answer for this issue [8].

The research work performed by Ahmed Imateaj and T Saikumar and Vinay Dubeydescribes the objective of this work is to design a IOT based system that can detect the fire as early as possible before the fire spread over the large area and to prevent poaching. Our system consist of flame sensor which is used for fire detection, PIR sensor for intruder detection with the help of image processing, If any catastrophic event occurs the system will immediately sends the alert message along with picture of the affected region and device location and T saikumar says Implement IOT to monitoring atmospheric CO2 rate using MG811 carbon dioxide sensor and early detection of forest fires using temperature and humidity sensor with Raspberry pi. The main aim of the system is to detect the fire and protect our entire system from fire related calamities. And vinaydubey says. According to a survey, approximately 80% losses are accrued in the forest due to the late detection of fire. So to overcome this problem, we use the Internet of things technology. In this paper, early fire detection model has been proposed with the help of the Raspberry Pi microcontroller and required sensors [11].

In this paper Forest fire detection system using IOT, Early warning and immediate response to a fire breakout are the only ways to avoid great losses and environmental and cultural heritage damages. Hence, the most important goals in fire surveillance are quick and reliable detection and localization of the fire. It is much easier to suppress a fire when the starting location is known, and while it is in its early stages. Information about the progress of fire is also highly valuable for managing the fire during all its stages. Based on this information. In existing system, they use robots to extinguish the fire accidents but robots have its own advantages and disadvantages. In this system we go for detection and Monitoring of forest fires through several sensors and send to IOT cloud, Continuous monitoring and uploading values to cloud can be achieved [12].

III. METHODOLOGY

In this proposed system we are using IOT as base to execute the plan to save forests. As we know it is a trending topic and easy to access. We have used sensors like flame sensor and DHT sensors which performs on the basis of the written code using Arduino Uno platform. A cloud platform called firebase is used to update the values of the sensors. When there is change in the set threshold value then it automatically sends a message to the user through an app saying whether fire is detected or smoke is detected. A threshold value is set for every sensor and they sense the environment changes and update it to the nearest forest officer at the earliest. We have used Nodemcu as the microcontroller which will receive data from sensors and send it through internet to a database or cloud which will be stored as values.

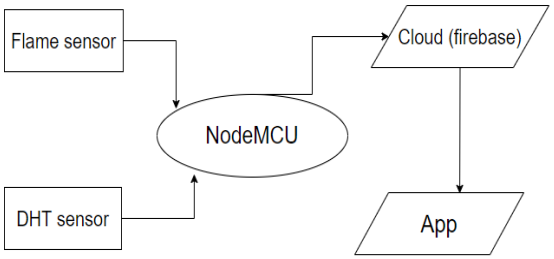

Fig 1: Block Diagram of proposed system.

To design this project specifically NodeMCU model is used, because to perform multiple tasks simultaneously and IOT is used to perform tasks automatically. NodeMCU is comprising of 30 GPIO pins out of which at most 5 to 6 pins are used as general purpose input and output pins. The GPIO pin 3, 4 and 5 are taken as input pin, and output is calculated using IOT cloud platform called firebase.

According to the circuit diagram we have used laptop as the power source. Connections are as showed in the figure. D2 pin has DHT sensor, D5 pin has Flame sensor and to the D1 pin has been connected to laptop. Once the code in the laptop has been accessed then the host code from google firebase will be copied and then pasted to the MIT App inventor. Later the values will be accessed from firebase then according to changes in the threshold value the firebase accessing the sensors the message will be sent to an app created by MIT App inventor.

Hardwarerequirements

- Flame sensor.
- DHT sensor.
- Node MCU.
- Jumpers.

Softwarerequirements

- Arduino Uno
- Google firebase

- MIT App inventor

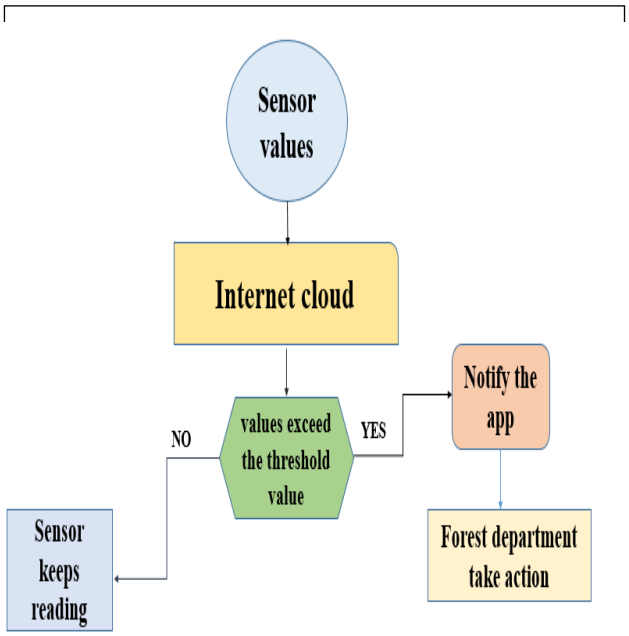

Fig 2: Flow chart of the methodology

IV.ADVANTAGES

The proposed system detects the forest fire at a faster rate compared to existing system. It has enhanced data collection feature. The major aspect is that it reduces false alarm and also has accuracy due to various sensors present. It minimizes the human effort as it works automatically. This is very affordable due to which can be easily accessed. The main objective of our project is to receive an alert message through an app to the respective user.

V. DISADVANTAGES

The electrical interference diminishes the effectiveness of radio receiver. The main drawback is that it has less coverage range areas.

VI. APPLICATIONS

Fire detection and management plays a very crucial part in terms of safety. Therefore this proposed system can be implemented in malls, offices, data centers etc..,.

VII. FUTURE SCOPE

Additional pump can be added so that it automatically sends water when there is a fire breakout. Also industrial sensors can be used for better ranging and accuracy.

VIII RESULTS

- When the flame sensor data does not detect fire the value is 0. The same value is then updated to Google Firebase.

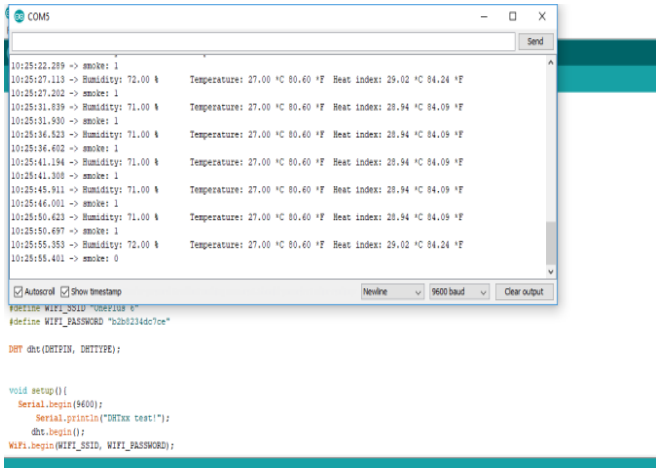

Fig 3: Screenshot of Serial Monitor where values are recorded continuously

- According to the above diagram we can observe that continuously temperature and humidity values are displayed in the app for monitoring purposes. When we monitor the changes regularly, if there is any change in value then a message is sent stating fire is detected or not detected

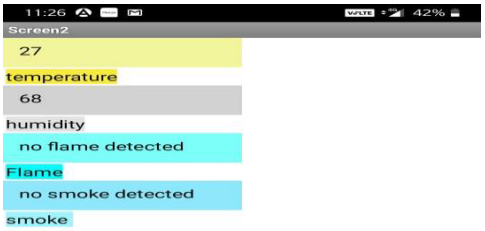

Figure 4:

As discussed earlier we can observe the changes in the app continuously. When the value crosses the set threshold value then automatically the user or nearest forest officials will be notified which will help them to take necessary actions immediately so that much loss doesn't occur. The app notifies the user with a message that fire is detected.

Fig 5: Screenshot of app when fire is detected

IX CONCLUSIONS

This type of system is the first of its kind to ensure no further damage is then to forests when there is fire breakout and immediately a message is sent to the user through the App. Immediate response or early warning to a fire breakout is mostly the only ways to avoid losses and environmental, cultural heritage damages to a great extent. Therefore the most important goals in fire surveillance are quick and reliable detection of fire. It is so much easier to suppress fire while it is in its early stages. Information about progress of fire is highly valuable for managing fire during all its stages. Based on this information the firefighting staff can be guided on target to block fire before it reaches cultural heritage sites and to suppress it quickly by utilizing required firefighting equipment and vehicles. With further research and innovation, this project can be implemented in various forest areas so that we can save our forests and maintain great environment.

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