Forest Fire Detection Using IoT

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Abstract - India has 67.5 mHa of Forest cover, of which 44 mHa (65%) is prone to forest fires annually, causing a loss of approximately 105 million US dollars. The annual cost of fighting conventional forest fires with petrol is close to Rs 44 million. massive amount of fires that appear out of the blue. economic and ecological effects. The number of fires worldwide is rising. Wildfires are uncontrolled fires that seriously harm both natural and societal resources. Once the fire is started, it spreads quickly throughout the forest, causing enormous damage. Wildfires can occur for a variety of reasons, including lightning, extremely hot and dry weather, a severe drought, and human ignorance. Forests have suffered significant damage over the previous ten years, with the majority of those mishaps being brought on by forest fire. This IoT-based system uses a variety of sensors to rapidly identify wildfires. Using an Internet of Things NodeMcu module, it sends data to a server and notifies the system of the fire. This device will aid in the early detection of wildfires, making it easier to put them out or control them and preserving precious forest life.

*Key Words***:** 44mHa (65%), 44 million, IoT, NodeMcu, Server, Notifies,

1. Introduction

The forest plays a very important role in any country and in mankind as a whole. They contribute to the environmental, economic, and social well-being of the country. The forests are very crucial for the survival of the wildlife and also play an important role in the food chain to maintain the ecological balance. All of us depend on the forest for our survival, which includes activities from the air we breathe to the wood we use. In addition to providing homes for animals and a means of subsistence for people, forests also protect watersheds, prevent soil erosion, and lessen the effects of climate change.

A wildfire is an uncontrolled fire that causes significant damage to natural and human resources. Once the fire starts to ignite, it rapidly spreads all over the forest and results in massive destruction. Some of the reasons for wildfires are lightning, extreme hot and arid weather, severe drought, and human unawareness. Over the past decade, there has been enormous destruction in the forest, in which the majority of those accidents were caused by forest fire.

This is an IoT based system that detects wildfire instantly through different sensors and using the Internet of Things, node mcu module, it sends data to the server and warns the system about wildfire. This system will help detect wildfires at an early stage so that stopping or controlling them becomes easy, saving valuable forest life.

2. Literature Survey

This paper describes an IOT-based forest fire detection system. The only options to prevent significant losses and damage to the environment and cultural heritage are early warning and quick action in the event of a fire outbreak. So, the quickest and most accurate fire detection and localization are the main objectives of fire surveillance. It is much simpler to put out a fire in its early stages and when the originating point is recognized. For managing the fire throughout all of its stages, information concerning the fire's development is also quite helpful. based on these facts. Robots are used in the current system to put out fires, however they have their own benefits and drawbacks. Through a variety of sensors and the IOT cloud, this system attempts to detect and monitor forest fires. Continuous monitoring and value uploading to the cloud are both possible.[1]

We are implementing the idea to rescue forests in our proposed system utilizing IOT as the foundation. It is well-known that it is a hot issue and is simple to obtain. We have used sensors like flame sensors and DHT sensors, which work with the Arduino Uno platform based on the given code. The sensor values are updated using a cloud platform called Firebase. When the predefined threshold value changes, the device automatically notifies the user via an app as to whether smoke or fire has been detected.[2]

This system's foundation is a network of infrared sensors. This method, which is based on infrared image processing, instantly detects any fire in the forest to ascertain if it is present or not. Widespread usage of sensor networks makes it possible for humans to monitor vast forest tracts. This study describes a method for using IR sensors to automatically monitor forests. The paper solely discusses utilizing image processing to detect fires and relay photographs of such fires.[3]

The primary goal of the proposed system is to combat forest fires and identify them, which involves using the earliest fire detection techniques, correctly classifying fires, and having quick responses from forest officials. They thus employ various cutting-edge technologies, including as drones that continuously patrol the fire area and artificial intelligence (AI). In order to

find the fire as quickly as possible, they are employing two different types of drones: a fixed-wing drone and a rotary-wing drone. The fixed-wing drone continuously scans the region and keeps watch over the ground beneath the forest.[4]

In this proposed system both drones will eventually have computers and have efficient processing capabilities of their own, the proposed system is entirely autonomous. The data captured by the thermal cameras may be analyzed without the use of centralized computer engines, allowing them to analyze and detect the fire. With the help of computer vision techniques, this suggested system intends to use artificial intelligence by allowing drones to predict fires.[5]

In the suggested system, obtaining the magnitude at each point 'I' on an input image is made possible by the technique of image edge detection, which involves detecting the edge of an image. The algorithm being employed determines the accuracy of edge detection. On the input images, the Sobel operator measures the 2-D spatial gradient. The Sobel can detect visual noise and emphasize it as edges since it is sensitive to it.[6]

This system's foundation is a study of edge detection operators' performance. The postprocessing phases in image analysis include the processing of the image. An edge is defined as a change in intensity in an image. Based on its performance characteristics, this research compares a number of operators, including Sobel, Prewitt, Roberts &, and Canny.[7]

3. Proposed System.

All the connectivity between the electronics boards and sensors is as shown below in the Fig. block diagram.
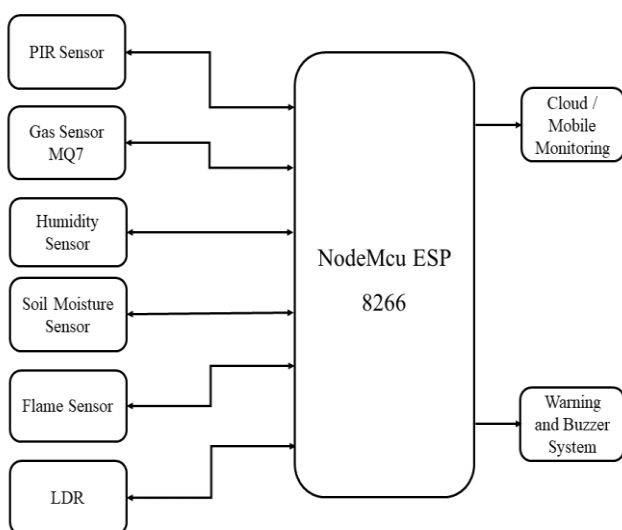

Fig. Block Diagram

In this system, there are two different parts. In the hardware part, there are sensors connected to the NodeMCU ESP8266

controller. That sensor sends data to the cloud using Internet of Things technology. And using the software part of the Blynk IoT cloud platform, users can monitor all these sensors status using Blynk gauges and leds.

When we switch on the power supply, the ESP8266 modules connect with the Blynk IoT Cloud Platform. The PIR Motion Sensor monitors animal motions; the MQ7 gas sensor monitors smoke levels; the temperature sensor monitors temperature and humidity; the soil moisture sensor monitors soil moisture; the flame sensor monitors flame data; and the buzzer provides necessary alerts based on the threshold values set for these sensors user get required alerts on cloud & Hardware.

4. Conclusion

Fire detection, when the flame gets increased the buzzer will get activated and intimation will be conveyed to the authorities. So by using this technic we can protect the forests and we can save wild animals. The only options to prevent significant losses and damage to the environment and cultural heritage are early warning and quick action in the event of a fire outbreak. So, the quickest and most accurate fire detection and localization are the main objectives of fire surveillance. When a fire is in its early stages and the beginning place is recognized, it is considerably simpler to put it out.

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