

Forest Fire Detection Using Arduino Based WSN

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Abstract

This paper portrays forest fire detection using Arduino based wireless sensor network. Forest fire is repetitive phenomena, natural or man-made in many parts of world. In order to fight against this disaster, it is needful to carry a broad, adoptable approach that enable situational awareness and instant responsiveness. In this work, system that detect presence of fire via sensor and send information to monitoring center. The important feature is ability to remotely send an alert to server using node MCU where fire detected. This system also alerts the user using GPS module. Advantage of this system is it detect early fire.

Keywords- *Arduino, Sensor, Node MCU, GPS Module*

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1. Introduction

Forest fire is an unmanageable fire occurring in wild forest so it is necessary to find out these fires early to prevent damage to biological ecosystem [1]. Forest fire also called as bush fire or hill fire is an unrestricted fire occurring in wild or forest area. Every year lots of acres of forest are burnt down. The land where woodland is burnt it will become not possible to develop vegetation over there. This is due to fact soil becomes water repellant and accepts no more water, leading to discount in floor water level. Mostly global warming is occurred due to increasing forest fire. In this paper we use affordable components, connectivity and wireless communication for better result, also system has lower power consumption and faster processing ability at low cost [2]. Common reason for forest fire is lightning, extreme hot temperature and human carelessness [3]. According to National Fire Danger Rating System (NFDRS), if a fire is distinguished inside 6 minutes of its event then it tends to be effortlessly arranged off before it transforms into a huge scope fire [4]. we used wireless sensor which is one of the Method to detect forest fire early. So there is an urgent want of the hour to develop a device or system that could stumble on and alert the worried government approximately the health as early as possible.

Main objectives are

- It detects forest fire early.
- After detection it send alert message to user & monitoring station.

2. Literature Review

As of late, the recurrence of woodland fires has expanded extensively because of environment changes, human exercises and different variables. The counteraction and observing of Forest Fires has become a worldwide worry in Forest Fire anticipation associations.

The global warming will constantly be contributing to increasing the number of fires and the damages caused by them. [8,10] Each season, besides thousands of hectares of forest being destroyed, there are a lot of assets and properties being affected as well. Even more, both the fire fighters and the civilians' lives are also in danger. Temperature measurements, the levels of methane, gasoline and CO₂ can be used as a leading indicator for the early detection of forest fires.[9] An advanced system for Forest Fire Detection was developed which overcomes the demerits of the Existing technologies of Forest Fire Detection. Remote sensor one of the methods for early woods fire location. For future research, the proposed system can be improved, for example by integrating a surveillance camera for a more precise monitoring process and detection. This system can also be implemented in places where rare wild lives are living and precious trees are planted and to prevent forest fires.[7] The primary requirement for picking this specific application for the recognition of timberland fires is to defeated the bad marks present in the current advancements of MODIS and Basic Remote Sensor Network-based Forest Fire Detection Systems and a high level framework is created for the discovery of woods fires [6]

3. Functional Block Diagram

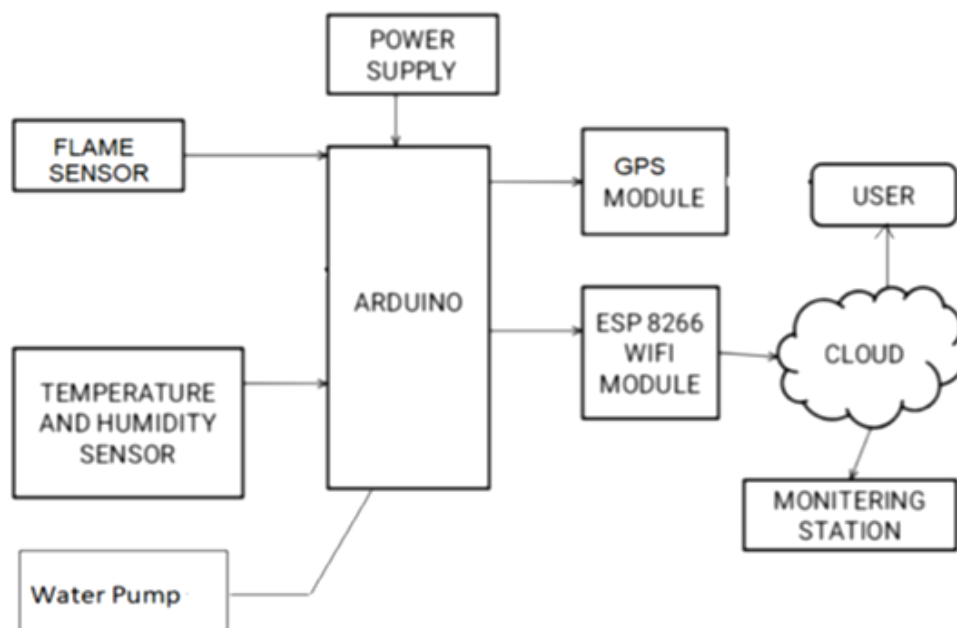


Fig.1.Functional Block Diagram

Two sensors are connected to Arduino namely flame sensor and temperature & humidity sensor (DHT11). These two sensor senses different factors such as temperature, humidity voltage respectively. Threshold values of flame sensor, temp.& humidity sensor is stored in Arduino. Main function of Arduino (Node MCU) is to process & compare Analog input values with threshold values. Check whether input Analog values is greater than threshold values or not. Power supply is given to Arduino to start the model. GPS module is used to detect location of firing area. Also from GPS module we get to know longitude & latitude of forest firing area. Whenever we want to send an alert internet connection is required so we used wi-fi module here. To connect hardware to internet we used cloud.

After fire occurred it send an alert to monitoring station & user. Water pump is used to extinguish fire for particular period.

4. The Working Principle

Flame sensor is connected to wi-fi module using jumper wires. Similarly temperature & humidity sensor (DHT11) also connected to ESP8266 wi-fi module. Then the output of flame sensor & DHT11 sensor is connected to Arduino. Water pump (motor) is connected to another pin of Arduino. Water pump is situated at water. Initially fire should be in off state. We have to measure Threshold values of temperature, humidity according to present atmosphere. We are using embedded C programming language here. Arduino IDE is software used to run the program. As temperature & humidity values are in digital form. Now, we have to put fire alongside of flame sensor. So when temperature & humidity values are greater than threshold values. Then it Send alert to monitoring station and user through G-mail. Alert message Send longitude & latitude of particular firing position with the help of GPS module. Also it send current increasing temperature and humidity values through G-mail. Then monitoring station will start water pump so that fire will not spread widely.

5. Arduino (Node MCU)

In this paper Arduino microcontroller is utilized for plan and improvement of inserted PC framework. Arduino uno is microcontroller board based on 8bit ATmega328. Arduino has 14 digital input/output pins. It contains all that expected to help the microcontroller just associate it to a PC with a USB link or force it with an AC-to-DC connector or battery to begin. Arduino provide low cost. Arduino can detect the climate by accepting contribution from assortment of sensors and influence its environmental factors by controlling lights, engines and different actuators [5]. Pin diagram of Arduino is shown in Fig.2.

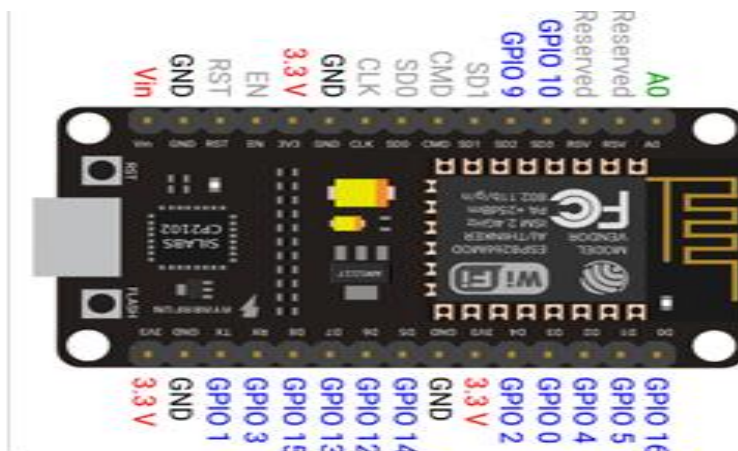


Fig.2 .Pin Diagram

6. Result and Conclusion

In Proposed system, all the sensors are interfaced to the microcontroller and monitored using a single system. To recognize the fire in the woodland fire edge worth of temperature is taken as 27°C . The temperature and humidity levels are monitored continuously with the help of sensors. The key feature of the system is the ability to remotely send an alert to the server using Node MCU whenever fire is detected. Cost requirement for this project is very less. The system will also alert the user by using a Gmail. When the presence of fire detected it continuously monitored it. The advantage of using this system is that it can detect early fire. The examinations are acted in an all-around controlled ongoing climate.

In this paper Arduino based Forest fire detected and monitored. At start, environment temperature & humidity is measured and named it as threshold temperature and humidity respectively. When the temperature is greater than threshold value it sent an alert. The alert result is shown in Fig. 4 below. Alert signal is send to monitoring station through G-mail. Alert signal shows Temperature & humidity reading. Advantage of this system is it detect fire early. After detecting fire it start the motor for extinguish purpose. Experiment are performed in well controlled real time environment. Fig. 3 shows hardware of proposed system.

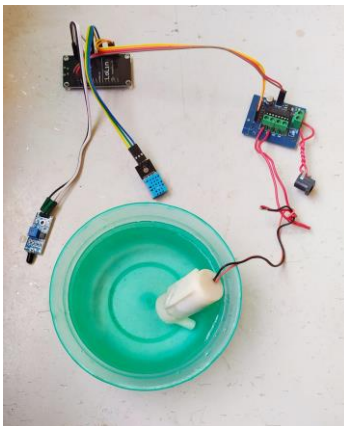


Fig.3 Hardware

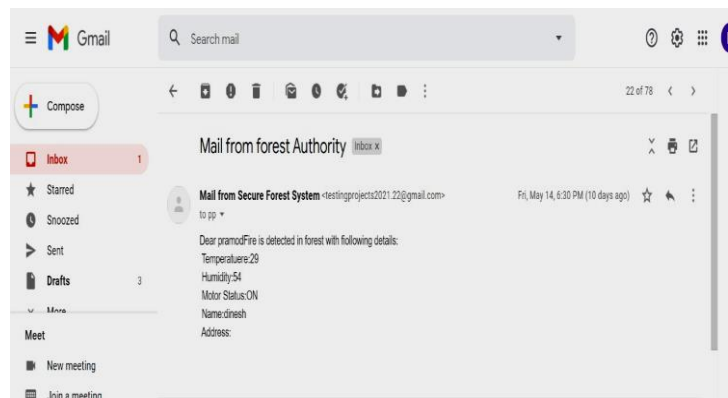


Fig.4 Result

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