Forest Fire Detection System using IoT

Group number-19

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Abstract— In an evolving world, protecting our environment is very important. Many incidents of man-made and natural disasters have occurred around the world. Wildfire is one such environmental disaster. When a fire begins in the deep forest of, everything burns and is destroyed and spreads throughout the forest of. On hot days, fires spread and drought in the forest areas of destroys trees and grass. In order to protect the flora and fauna habitat in the forest, it is necessary to contain such a wildfire catastrophe.

The purpose of this work is to design and implement an IoT-based system that is self-sufficient, predicts and detects wildfires, and sends the exact location to affected personnel to help extinguish the fire. Is to do. Delete location to start slowly. This allows the to take precautions to prevent fires from spreading over vast areas and to prevent fires that may occur in the near future.

Keywords— Fire Detection, Arduino, Sensors, GPS receiver, Authentication, Notification.

1.INTRODUCTION

Forests are a vast area inhabited by trees and animals. Forests cover approximately 4,0 hectares, or about 30% of the earth's land area. Forests are one of the major pillars of the country's economy. forests usually contain different types of trees and animals. Wildfires are quickly overlooked, damaging millions of hectares of and killing many in many countries each year. These wildfires can cause catastrophes around. The losses from wildfires are enormous, with affecting both animals and trees. Recently, the number of forest fires in the world has increased by . This forest fire is due to a natural or man-made disaster.

2.IMPORTANCE OF THE PROBLEM

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. 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.

3.Summary

In this Project, GPS module is connected with the Arduino module, when the Arduino notices that the fire has occurred with the help of temperature and smoke sensor it gives the information to the nearby area through Wi-Fi module along with the latitude and longitude values from the GPS module. By receiving the longitude and latitude values the exact location can be located. Here GPS is integrated with an antenna which is used to find the values of the place.

4. Questions we have answered

- Flame sensor usage for detection of flame in nearby areas
- Usage of temperature sensor DHT22 instead of DHT11 for Increase in area coverage to detect the change in temperature
- Better implementation of information passage.
- Usage of gps receiver to find exact location and time.

5.Problems that paper addresses

Forest fires are considered as one of the most widespread hazards in a forested landscape. Forest fire detection has been a focus of many researchers for the last decade because of increased forest fire case reports from all over the world due to severe damage to society and the environment. Dense forests play a major role in balancing the ecosystem.

6.Block Diagram

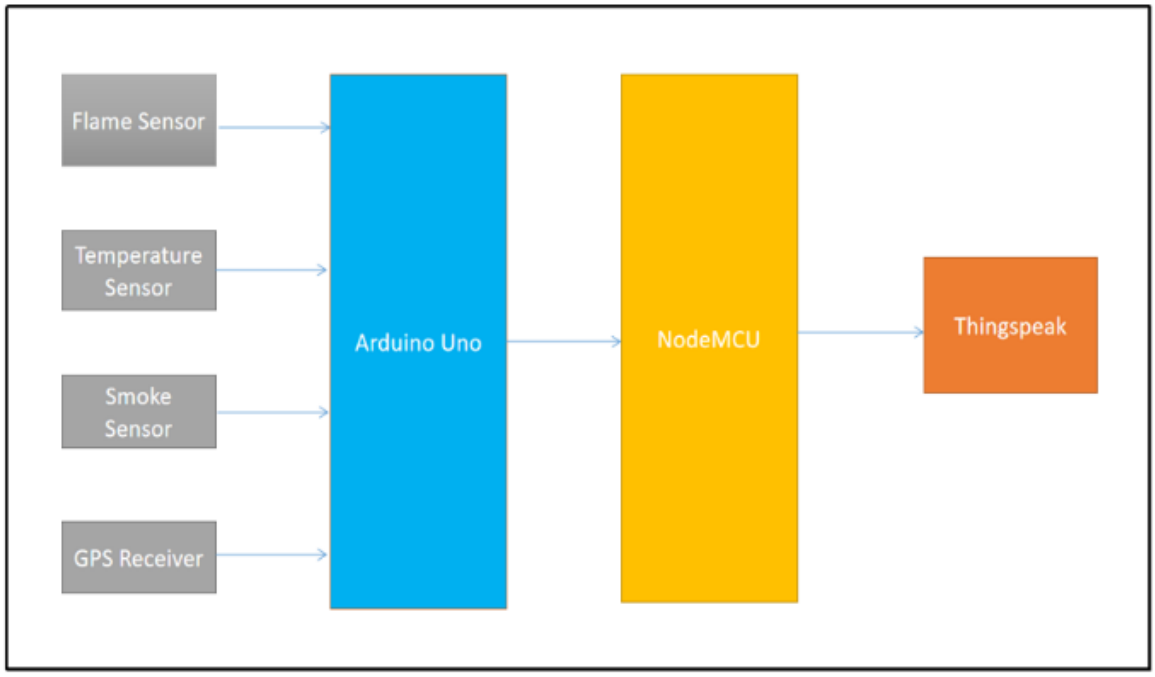

Fig-1 Block Diagram

7.Components

- Arduino

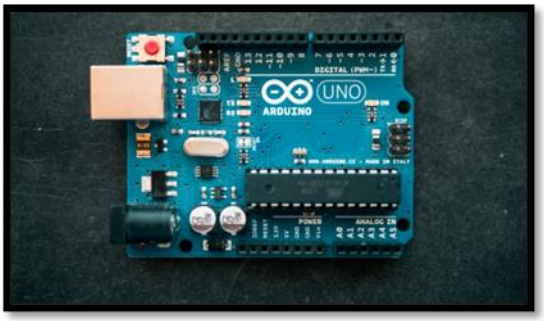

Fig-2 Arduino

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (for prototyping) and other circuits The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs. The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the Arduino language.

- DHT22 Sensor

Fig-3 DHT 22 Sensor

The DHT22 sensor is the successor of the DHT11 module, it can either be purchased

as a sensor or as a module. Either way the performance of the sensor is same. The sensor will come as a 4-pin package out of which only three pin will be used whereas the module will come with just three pins as shown in the DHT22 pinout above.

The only difference between the sensor and module is that the module will have a filtering capacitor and pull-up resistor inbuilt, and for the sensor you have to use them externally if required.

- MQ-2 Sensor

Fig-4 MQ-2 Sensor

MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide.MQ2 gas sensor is also known as chemiresistor. It contains a sensing material whose resistance changes when it comes in contact with the gas. This change in the value of resistance is used for the detection of gas.

- Flame Sensor

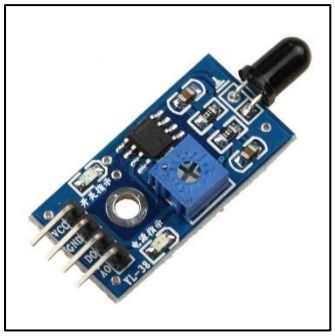

Fig-5 Flame Sensor

A flame-sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame. The flame detection response can depend on its fitting. It includes an alarm system, a natural gas line, propane & a fire suppression system. This sensor is used in industrial boilers. The main function of this is to give authentication whether the boiler is properly working or not. The response of these sensors is faster as well as more accurate compare with a heat/smoke detector because of its mechanism while detecting the flame.

- GPS receiver

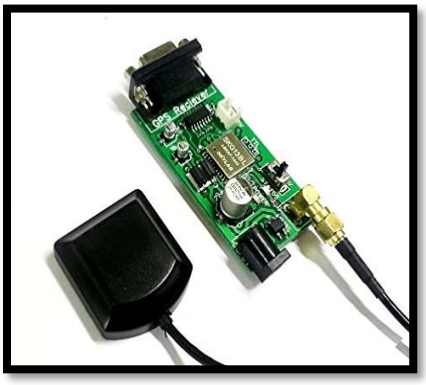

Fig-6 GPS receiver

A satellite navigation device, colloquially called a GNSS receiver, GPS receiver, or simply a GPS, is a device that is capable of receiving information from GNSS satellites and then calculate the device's geographical position. Using suitable software, the device may display the position on a map, and it may offer routing directions.

- Node MCU

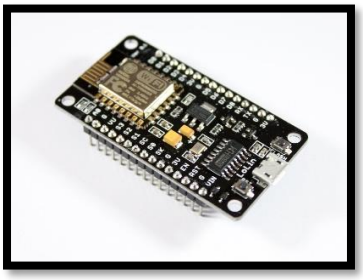

Fig-7 Node MCU

Node MCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support for the ESP32 32-bit MCU was added.The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open-source projects, such as lua-cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support or the 32-bit ESP32 has also been implemented.

8.Working principle:

First, the presence of fire is detected through three specific methods:
1)If the fire is near the node it is detected by the flame sensor and increase in temperature of the surroundings.
2) If the fire is out of the flame sensor range which is small, then by an increase in temperature and difference in humidity and smoke (if present) the fire is detected.
3) If the fire is a bit far from the node and smoke is detected around the node it is also considered a forest fire.
Once the fire is detected it sends the signal to a nearby base and hence alerting the people or respective officials about forest fire and to take adequate measures. This process is repeated at regular intervals of time for prototype we have used 2 seconds. There is also a light signal around to indicate the people around or near the place to stop the fire in the initial stage itself if possible.
So such nodes are placed all over the forest at a uniform distance from each other(around 50 meters and It can detect gases in the concentration of range 200 to 10000ppm.) and they are all connected to the base or multiple bases based on the area of coverage for information passage.

9.Graphical Representation of Data

- Thing Speak to represent the data and current value of smoke sensor, flame sensor and temperature, humidity. Also, it will include the latitude and longitude where it is being detected. And a button showing the fire presence

Fig-8 Humidity values

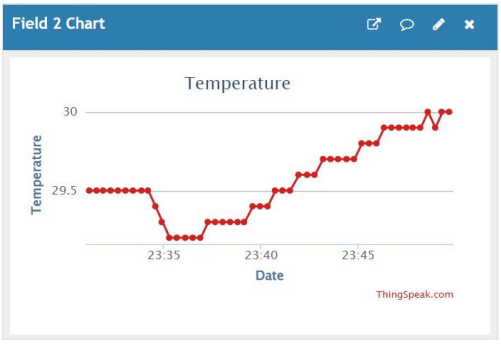

Fig-9 Temperature Graph

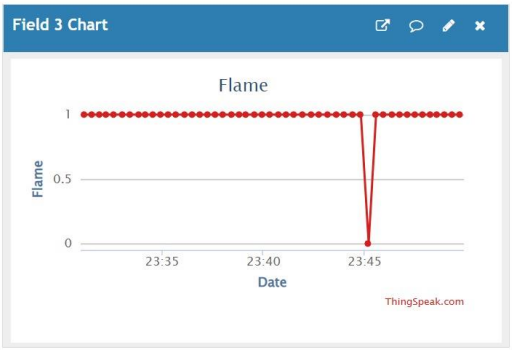

Fig-10 Flame Graph

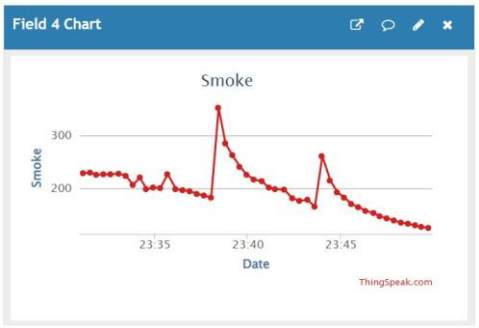

Fig-11 Smoke Graph

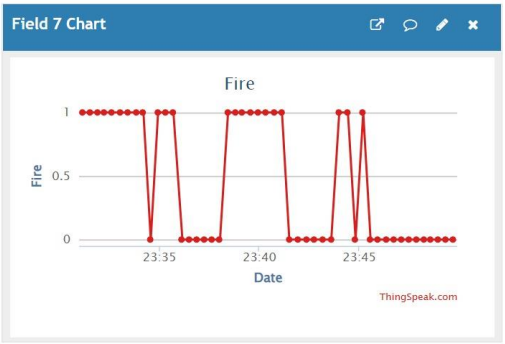

Fig-12 Fire detection

Web Page:

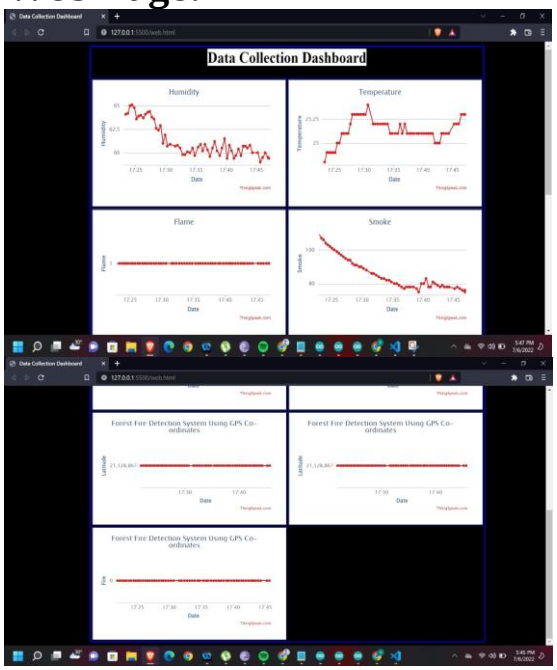

Fig-13 Web Page

Strengths

- It minimizes the human effort as it works automatically. This can be easily accessed. The main objective of our project is to receive an alert message to the respective user
- Also, to provide the location of the fire to avoid any unnecessary wastage of time in the search
- To be accurate about the fire and send a signal.
- To overcome the fire in the initial stage if possible.

Weaknesses

The main drawback is that it has fewer coverage range areas. Due to this factor, we are supposed to make multiple nodes to cover the entire forest. So, it becomes too expensive.

At current stage it is not possible to have internet over the entire forest.

10.Future Scope

Seeing the growth of AI, it is possible to use it in collecting data from the sensors and analyse it and find next possible place where there is chance of forest fire.

Also, industrial sensors can be used for better ranging and accuracy.

Considering real time application we can use GSM module and upcoming data networking modules where SIM cards can be used in the module for internet.

With increasing data availability and coverage, it will be possible to have internet even in forest

11.Conclusion

This model of forest fire detection will be very helpful in case of emergencies to alert officers. Taking into account the future scope of this model will be a really big one because with the raise of artificial intelligence the data from the sensors can be fed as input to further analyse it to find the frequencies and other useful factors that determine a forest fire happening and obtain patterns from it and avoid further future forest fires and make the world a better place to live for humans by conserving forests. This also helps in pinpointing the exact location where the fire is detected which reduces the time wastage and also increases the efficiency for better work and reduce and damages possibly. Also it can help to notify the people around through lights. It can also become more accurate over years by AI and also through the data acquired to get appropriate threshold value.

Basic Prototype

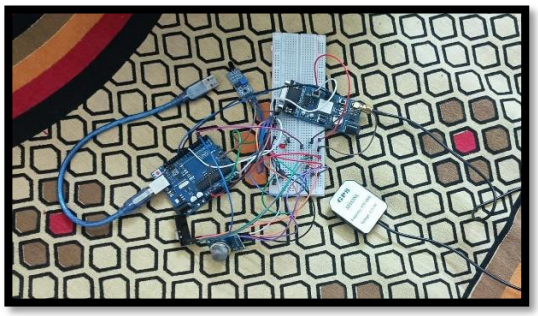

Fig-14 Prototype

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