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IOT BASED AND DEEP NEUTRAL NETWORK BASED WILD FIRE PREDICTION SYSTEM

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Abstract - *Forests, one of the most valuable and necessary resources and protect earth's ecological balance, are a natural habitat to animals and forest products are vital in our lives in many direct and indirect ways. But wildfires can cause critical damage to grounds and many other resources like properties, human life, and wildlife in superabundant amounts. Wildfires burn acres of land and destroy everything in their paths in mere minutes. Wildfire destroys homes, animals, trees and plants, wildlife as well as vegetation. The effects of wildfires are numerous and wide-ranging. It causes a hugely significant impact on the economy, environment, heritage and social fabric of rural areas. Naturally caused wildfires can be predicted using factors like temperature, humidity, soil, moisture, pressure and many more. In this approach, the prediction of forest fires by machine learning using some operational monitoring over a region and encountering changes in climate using different sensors are advocated. The Wildfire Prediction System monitors and records changes in climatic parameters and predicts the intensity of forest fire based on real-time data, thus avoiding the massive loss due to forest fires.*

Key Words: Wildfires, Forests, Machine Learning, Sensors, Climate, Prediction, Human Life.

1. INTRODUCTION

A forest is entirely a biological community for biotic as well as abiotic factors like animals, birds, trees, etc. and water, rocks, and climate in that forest area, respectively. Wildfires are one of the worst types of natural disasters to hit any part of the world. Every year there is a fire season during the Australian summer. Such wildfires are caused due to climate change. In July 2019, a massive forest fire began in Australia. In this season, at least 27 million acres of Australia have been burnt, 29 people were killed and 2,500 homes were destroyed. It is estimated that 1.25 billion animals have been lost in Australian wildfires. Research shows lightning and climate change are the causes of Australian wildfires. Another devastating wildfire in the Amazon rainforest broke out in January 2019. The forest fire continued till October 2019. 906,000 hectares of land was burned in the 2019 Amazon rainforest wildfires. According to the study of the National Interagency Fire Center(NIFC), there were an average of 67,000 wildfires annually and an average of 7.0 million acres burned annually over the past 10 years. Lightning, volcanic eruptions, earthquakes, increased temperature, dry vegetation are the few of the major causes of wildfires. Fires destroy diversity and have long-term impacts on the environment. Loss of life, agriculture, and vegetation, soil erosion, soil infertility, air pollution, water pollution and release of harmful gasses are few effects of wildfires. Global warming is the major effect of forest fires. The wildfires, when reached to danger, can be punishing, extraordinary and very difficult and to handle. Therefore predicting the occurrence of such a drastic event can be beneficial and informative and enacts an important role in taking precautionary measures to handle such event and be prepared and also avoid wildfires for future and consequently preventing its deleterious effects on the environment. In this project we used sensors to collect the temperature and humidity. This sensors are connected the arduino. By using this hardware the data is collected with the fixed interval time period. The collected data can be viewed in the hardware by using liquid crystal display and can be viewed in the cloud also. This hardware is connected to the PC to send the information to the cloud without any interruption. The uninterrupted internet connection is given to the pc using wireless sensor networks.

2. OBJECTIVES

In order to build an effective system, the parameters considered for prediction of forest fires are temperature, humidity, soil moisture, pressure and altitude. Sudden changes in these parameters can result in forest fires.

Develop a machine learning model which will:
1. Evaluate the historic forest fire data.
2. Predict the possibility of forest fires using real-time data fed into the system via IoT devices and sensors.
3. Identify a trend based on useful and distinct parameters such as location, altitude and temperature to be able to predict the possibility of the forest fires when real-time data is fed as input .

3. STUDY AREA AND METHODOLOGY

In order to build an effective system, the parameters considered for prediction of forest fires are temperature, humidity, soil moisture, pressure and altitude. Sudden changes in these parameters can result in forest fires. The sensors are used to collect the real-time data. To record the real-time temperature and humidity, a DHT11 sensor is

used. To measure the real-time soil moisture, the Yl-69 sensor is used. Yl-69 sensor has two pieces; the electronic probe and the probe with two pads. To acquire pressure and altitude the BMP280 sensors are used. The Bolt Iot platform is used for cloud storage, which can be accessed from any location. The Bolt device is connected to all the sensors to measure the real time data. The fluctuations in the values of parameters are represented by a graph and a csv file. The data can be monitored with the help of timestamps and further pushed into Google Firebase database.

Once the data is gathered, it is then One Hot Encoded into the desired labels. A Sequential model is a good choice for implementation of a densely connected network but the given problem statement works on inputs provided by a variety of sensors as well as historical data of occurrences of wildfires over several years. Therefore, to accommodate these complex requirements, an alternate Functional model may be used. This model takes in its input in two separate, parallel layers with the number of nodes corresponding to the number of associated parameters. For the input layer associated with the climate factors collected over the circuit, dense layers are used to first derive the necessary value from each factor over the training period. The challenge associated with such a model is splitting the data into training and testing sets with two separate sets of features.

4. SYSTEM ANALYSIS

4.1EXISTING SYSTEM

The already existing system or the system that has been used currently in detecting forest fire is not efficient enough to detect the fire in the initial stage. It can detect only when the fire is widely affected the forest. This cause many damages. But the costs of these devices are very high. These are not making use of the IOT that is main disadvantage of these systems.

4.2PROPOSED SOLUTION

The proposed system makes use of the IOT it can detect and warn the fire in the early stages. Even it can predict the fire occurrence well in advance with different dedicated sensors such as humidity and temperature sensors. We are using machine learning approach to increase the accuracy of the wildfire prediction, with the help GPS and GSM module based on the prediction location of the forest which is vulnerable to fire will be sent to forest department so that precautionary measures can be taken.

5. SYSTEM DESIGN

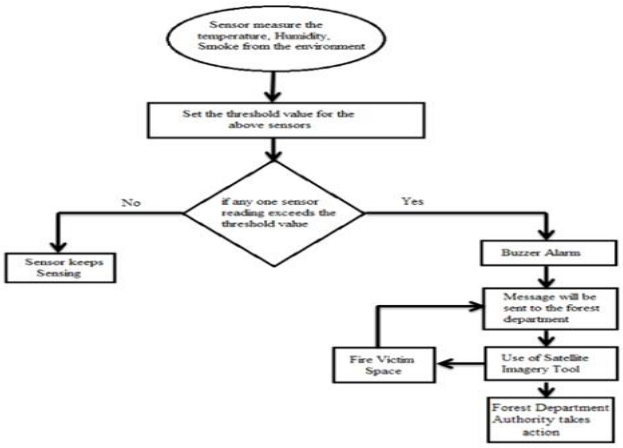

Fig -1: Operational Flow Chart

6. IMPLEMENTATION

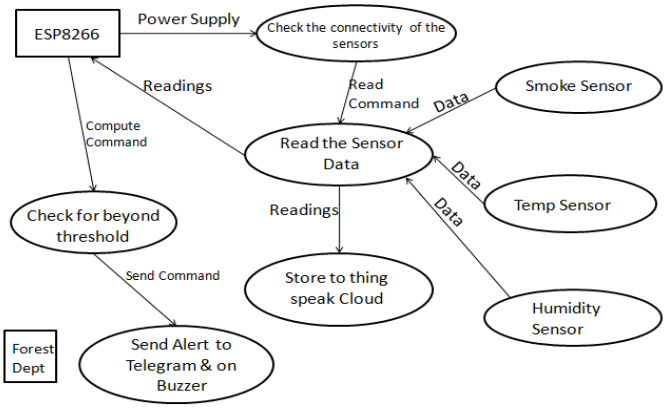

Fig -2: Data Flow Diagarm

The ESP8266 Microcontroller sensor is connected to a power supply and checks for the connectivity of the sensors. Then the read command is passed smoke, Temperature and Humidity sensors will collect the data and sends the data recorded to the sensor. Recorded data will go to the sensor and same data is stored into the thing speak cloud. ESP8266 will check for beyond the threshold and sends the alert to telegram and on buzzers.

6.1 ESP8266 MICROCONTROLLER

The ESP8266 is a low-cost Wi-Fi microchip, with a full TCP/IP stack and microcontroller capability.
The ESP8266 module enables microcontrollers to connect to 2.4 GHz Wi-Fi, using IEEE 802.11 bgn. In our project it is the heart of the project, it will collects the readings from the different sensors and process it. If temperature is greater than the threshold value it sends an alert message to the telegram application.

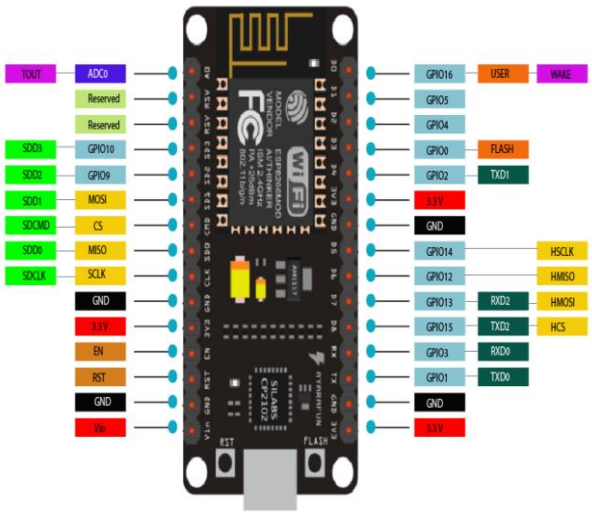

Fig -3: ESP8266 Microcontroller

6.2 DHT 21 Temperature sensor

The **DHT11** is a basic, ultra low-cost digital temperature and humidity **sensor**. It uses a capacitive humidity **sensor** and a thermistor to measure the surrounding air. In our project it is used to identify the changes in the temperature and humidity in the surrounding air of the forest. It will send the readings every 5 seconds to the microcontroller. Based on the these readings microcontroller will decide to send the alert message to the forest department.

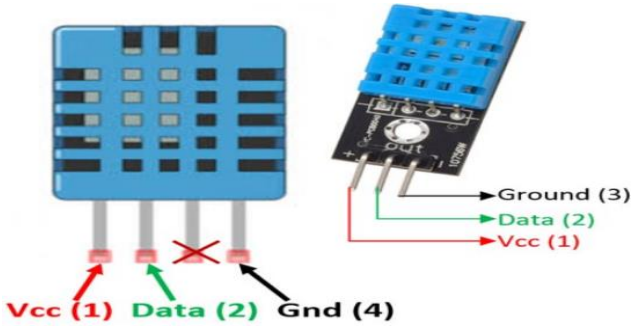

Fig -4: Temperature sensor

6.3 MQ2 smoke sensor

MQ2 is one of the commonly used gas sensors in MQ sensor series. It is a Metal Oxide Semiconductor (MOS) type Gas Sensor also known as Chemiresistors. The detection is based upon change of resistance of the sensing material when the Gas comes in contact with the material. In our project it used to detect any smoke in the device planted area.

Fig -5: MQ2 Gas sensor

6.4 Telegram mobile application

Telegram is a messaging application which is used to send text, images or video messages free of cost. It also allows using other API to create programs to integrate Telegram in their applications. There are special bots which do not need phone number to set up and can be interfaced with any embedded or software application to trigger some event using telegram text messages.

7. CONCLUSIONS

The increase in forest fires has affected the environment as well as business adversely. Wildfires can be manmade or can occur naturally. Estimating the naturally caused wildfires will help in the prevention of forest fires. Various relations between the affecting factors (such as temperature, humidity) can be used for predicting the wildfires. Predicting the wildfire based on real-time data, therefore, will be a great step towards the preservation of forests and thus the environment.

REFERENCES

[1]. Neng Wang, Xiaoqiao Meng, “Simultaneous Forest Fire Detection with WSN”.

[2]. Vandana Mohindru, Yashwant Singh, Nagesh Kumar, Aditi Kansal, “Identifying Forest Fires using Machine Learning”, ImageInformation Processing-Third International Conference, 2015.

[3].S.M.Ramesh, A.John Clement Sunder, D.Vignesh Kirubaharan,P.Dhinakar, “Forest Fire Prediction and Alert System Using Advanced WSN”, Volume 3, Issue 11, November 2014 – International Journal of Advanced Research in Electronics and Communication Engineering.

[4]. Akarsh. S, Raju. G, VivekP. J , “Forest Fire Detection System , “Vol. 3, Issue 6, June 2014- International Journal of Innovative Research in Science”, Engineering and Technology (An ISO 3297: 2007 Certified Organization).

[5]. Ragipati Karthik, M. Trinath Basu, J. Mahitha, V. Lokesh Reddy, "IoT established forest fire warning system",

[6]. A novel method to identify likely causes of wildfire By Mario Mhawej, Ghaleb Faour, Jocelyne Adjizian-Gérard ScienceDirect Journal, Volume 16, 24 January 2017, DOI: 10.1016/j.crm.2017.01.004https://www.sciencedirect.com/science/article/pii/S2212096317300141

[7].2019 Amazon rainforest wildfires – Wikipedia https://en.wikipedia.org/wiki/2019_Amazon_rainforest_wildfires

[8]. Wildfire Statistics By Congressional Research Services, October3,2019https://fas.org/sgp/crs/misc/IF10244.pdf