Advanced Forest Fire Prediction and Detection Using Arduino UNO by IOT

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Abstract **- The major cause of destruction of archaeological and cultural heritage sites, especially in the Mediterranean region is wildfires. The site here are destroyed and tended for a very long periods of time, which are usually surrounded by an old and valuable vegetation or situated close to forest regions. The sudden increase in seasonal temperatures has caused an explosion in the number of self-ignited fires in forested areas. Extreme weather conditions such as storms or floods are also the cause of great risk for these sites. The major concern of Forest fire is that, it is getting worse day by day which can be detected and predicted using micro-controller Arduino UNO based on IOT. In this project, all the sensors are interfaced with Arduino which detects the temperature and humidity produced from the fire. Values are gathered from all the Sensors and are uploaded to the cloud i.e. in Thingspeak. and monitored from the camera on the local web server i.e. Chrome.**

Index Terms **- Arduino-UNO, Humidity Sensor, Cloud, IOT, Thingspeak.**

I.INTRODUCTION

Wildfire is an uncontrolled fire, which have worst effect on natural and human resources. Once the fire started, it rapidly spreads all over the forest and results in massive destruction. Based on the Forest Survey we collected that India's data is stated that almost around 50% of the forest areas are fire prone. And the forest survey record found that 54.40% of forest in India is being exposed to occasional fire which is dangerous, 7.49% to moderately frequent fires which is harmful and we also get that 2.405 to its high incidence levels and whereas 35.71% of India's forests data which have not yet been exposed to fire of any real significance. This percentage shows that India does not have proper forest protected system. In this project, we designed a model based on IOT technology for forest fire detection system which help to detect fire as soon as possible, before the fire spread over the large area. The system is made up of several sensors which detect fire and motion. The device will be placed on proper places after doing surveys so that instant actions can be taken. A camera is setup which captures the video, records the movements when it getting fired. So that it would be helpful for the forest staff to catch the object which is the cause of fire. It insinuate the client about the fire identification. This framework is very helpful at whatever point the client is not in the place of control focus. At whatever point a fire occurs, the framework naturally predicts and alarm the client by sending an alarm to an application introduced on Cloud and monitored by camera on local web. Alert is given by buzzer.

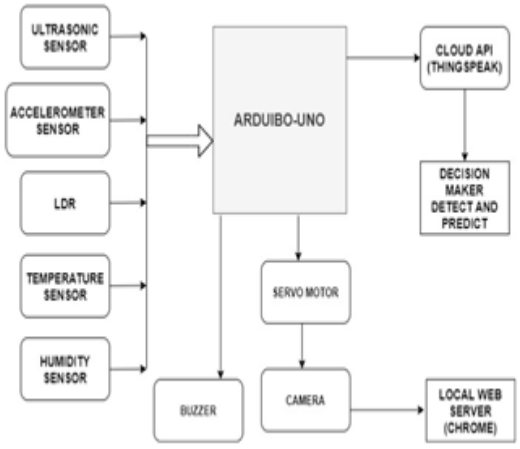

Fig 1: Block Diagram of Proposed System

II. HARDWARE AND SOFTWARE REQUIREMENTS

Arduino UNO: The Arduino UNO is an open-source type of micro-controller board which is based on the ATmega328 chip. This Board includes 14 digital IP/OP pins, 6 analog IP pins. It has onboard ceramic resonator of 16 MHz ,has port for USB connection, Onboard DC power jack, An ICSP header and a micro-controller reset button. Using this board is easy, simple to connect it to a computer with a USB cable or power it with the DC adapter or battery to get it started. External power which can come either from AC to DC battery. This adapter can be connected by plugging a center-positive plug of 2.1mm into a power jack board. Leads from a battery can also be inserted in the Ground and IP Voltage pin headers of the Power connector. The board can operate to an external supply of 6 to 20V. When the supply is less than 7V, and however, the 5V pin may supply less than 5V and the board may become unstable. If we use more than 12V, the voltage regulator may get overheat and board gets damaged. So we recommend range 5v to 12v for Arduino UNO.

Light Dependent Resistor: A Light Dependent Resistor (LDR) also known as photo resistor, a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. LDR, have a variety of functions and resistance. For instance, when it is in darkness, then it can be used to turn ON a light or to turn OFF a light when it is in the light. A typical LDR has a resistance in the darkness of 1MOhm, and in the brightness a resistance of a couple of K Ohm.

Humidity sensor: The function of humidity sensor is to detect both moisture and air temperature. The term humidity is defined as the level of water present in the surrounding air. The electronic device which is used to measure the humidity of the atmosphere is called 'Hygrometer'. If it senses any abnormal situation then the alert mail will be sent to the corresponding person depending upon the code.

Temperature Sensor: A temperature sensor is an electronics device which is designed to measure the degree of hotness or coldness in an object or of body. It's working depends upon the voltage across the diode. The change in temperature is directly proportional to the resistance of diode. The lesser the resistance, cooler the temperature and vice-versa.

Soil Moisture Sensor: Soil moisture sensors measures the volumetric water content present in soil. And the direct gravimetric measurement of the free soil moisture require removing, drying, and weighing of a sample collected, and then the sensor measures the volumetric water content indirectly by using the other properties which are present in the soil, such as dielectric constant, electrical resistance or interaction with neutrons, as the proxy for moisture content.

Ultrasonic Sensor: An ultrasonic sensor is an electronic instrument that measures the distance to an object using ultrasonic sound waves.It uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. The high-frequency sound waves reflect from boundaries to produce distinct echo patterns.

Servo Motor and Camera: Camera is used to capture the surrounding movement. Where servo motor is used to rotate the camera to 360 Degree so to view the environment in all directions.

Thing-Speak: The CLOUD i.e. Thing Speak, is an open-source Internet of Things (IOT) application and API to store and which can retrieve the data from things using protocols like the HTTP and MQTT over the Internet or via a Local Area Network (LAN).This application enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates.

Programming Tool: The product stage utilized for arduino will be Arduino IDE. The

III.WORKING

We use micro-controller as Arduino UNO for detecting a fire in forest. We are having several sensor which is connected with the micro-controller. The data is gathered with the help of several sensors like LDR, Temperature, humidity sensor around the atmosphere, etc.

The code is debug and we are able to see the parameters which is uploaded on Thing-speak. When there is a chance of fire all the sensor sense the scenario around them and fluctuation occurs in the graphs by which we can predict that whether the situation is dangerous and controllable or not.

If there is a chances that situation becomes worst it will make an alert by buzzer which shows that sensor values is exceeded from the preset threshold value. As the alert is made the person near the forest

Here camera is also setup which helps us to detect the object by which the fire is caused and we can use SD card to store the movement which would be helpful for the forest person to control the fire. The camera is attached by servo motor so that it can rotate up to 360Degree and monitor the object in all the direction. We can capture as well as record the movements.

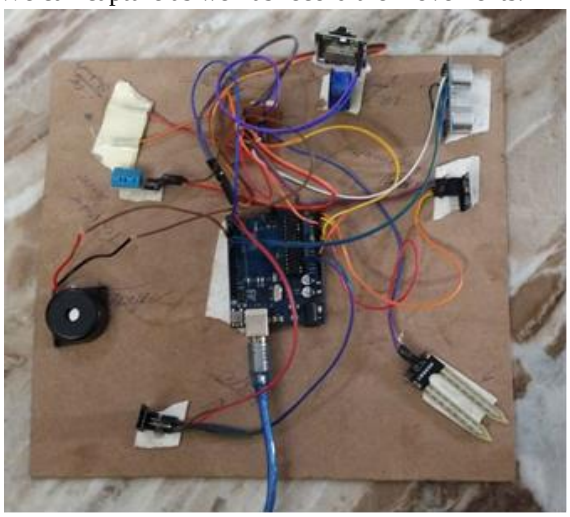

Fig 2: Hardware Setup Of Proposed System

IV.APPLICATIONS

- Can be comprehensively used in Military as there is more chances of fire.
- This can be realized in air terminals, transport stations, railroad stations as there is also risk of fire which can harm the environment.
- While monitoring of the ares where there is a potential risk and an early detection of fire plays significantly role as it shortens the reaction time, not only reduce the potential damage but also the cost of fire.
- This system can be completed health, environment and commercial applications.

V.RESULT

- When all the sensor data does not detect fire the value is 0 means the graph will show the data constant. The same value is then updated to Cloud ie. ThingSpeak.
- According to the below graphs 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 graph then we understand that fire is being caused and alert is made with the help of buzzer and with this we can predict the fire

Fig 3(a) Graphs on CLOUD API

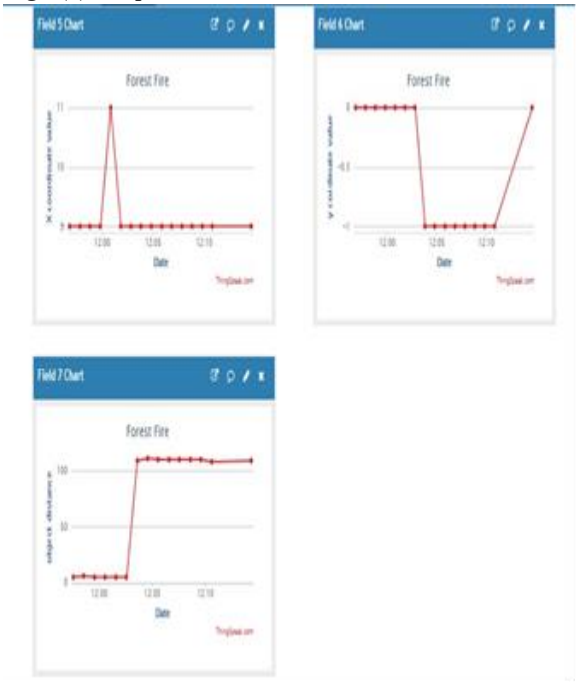

Figure: 3(b) Graphs on CLOUD API

VI.CONCLUSION

The system is developed with monitor the forest fires through IOT, free open source cloud like Thingspeak and camera whose data is displayed in local web server i.e. Google Chrome. Here we used HTTP Protocol to transfer the sensor information to the cloud. The system has numerous advantages- portable, economic and it satisfies the monitoring environment parameters through cloud. Early cautioning and quick reaction to a fire breakout are the main approaches to incredible misfortunes of natural and social legacy harms. Hence, the most critical objectives in flame observation are fast and solid identification and restriction of the fire. Data about the advance of flame is likewise profoundly profitable for dealing with the fire which amid everyone of its stages. We can observe the movements, around where the system is being imposed which helps us to know the cause of fire and instant actions can be taken.

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