

IOT based System for Forests Fire Detection

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Abstract— Fire is a threat to our forests Human intervention is one the major cause of forest fires. In addition to destroying wooden areas fire jeopardizes our safety. In order to detect the forest fire several attempts have been made using different techniques from optical fire sensor, satellite based methods and wireless sensor networks. Early detection of forest fire is most important and may save the resources and wealth of forest. In this project we are using different sensors and arduino uno board to detect environmental changes due to forests fires. By which we may get notification remotely through various devices like smartphones. In this project, we are mainly focusing on surface fires happening in forests.

Key words: Arduino UNO, Eagle Software, Flame Sensor, GSM Module, Temperature Sensor, Smoke Sensor

I. INTRODUCTION

Our topic is related to prevention of trees, grasses, types shrubs - the flora of our earth. Today's life we have understood the value of plants. Our atmosphere is present because of plants. We get valuable oxygen because of trees & plants so the protection of our ecosystem balancer is very important in our life [2]. Forest ecosystems are dynamic and complicated. Disturbance to any part of the network affects the balance of relationships and equally on the complete schemes either absolutely or negatively [1]

The fire-triangle i.e the components of fire Fuel, Oxygen & Heat. The direction of fire depends upon all the three components, where the proportion of such elements is higher the faster the fire can grow. The best way to prevent such wildfire is to detect fire as early as possible to detect the fire main environmental conditions one has to monitor are relative humidity, temperature. Where relative humidity and temperature can detect the condition where fire can occur and exact situation where fire has occurred or not occurred. Two factors which have direct influence on fire are relative humidity and temperature. Humidity is nothing but moisture in the form of water vapour present in the atmosphere.[1]

Relative humidity is the percentage ratio of actual water vapour contain to the amount of water vapour that would saturate the atmosphere at the same temperature. If the humidity is low in environment, fuels normally transfers its moisture to the atmosphere and becomes flammable. Sudden decrease in humidity indicates that the fire alerts. Temperature is very essential factor in detecting the wildfire as it is a measure requirement in ignition and continuing the process.

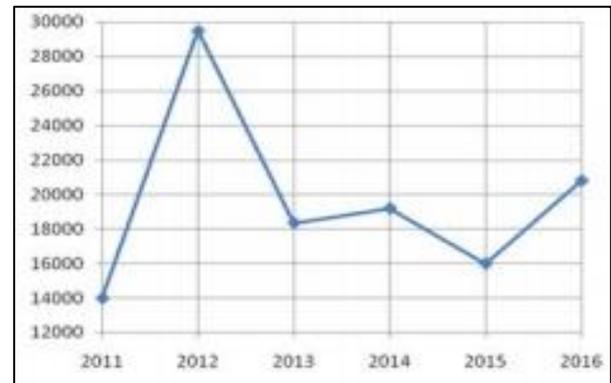


Fig. 1: Forest fires over the years [3]

Fire is capable of doing unusual things like spreading from shrub to shrub which refers to crawling, most of the times spreading at an unbelievable speed from the top of the forest that tends to be crowning and it is very dangerous as it diminishes the oxygen. One more type of fire is known as jumping and spotting fire that happens through the burning branches and leaves which are carried away by wind. There is a sudden increase in forest fires across the year of 2016 that is 20,500 hectares fires as compared to the 15,900 hectares of fires in 2015 according to the tabled data in Lok Sabha. Forest fires as much as 117,369 hectares were detailed since 2011 [3].

II. RELATED WORKS IN FORESTS FIRE DETECTION SYSTEM

In the year 2017, they have analyzed the existing forest fire detection techniques limited to wireless sensors only. Numbers of popular wireless sensor network based forest fire detection techniques have been explored and their merits along with the demerits have are reported during findings [3].

In the year 2017, they have presented an algorithm to detect the wildfire based on the changes occurring in humidity and temperature during fire and presents methodology based ZigBee and GPRS wireless sensor network which provides low cost solution with long life time, low maintenance and good quality service as compared to traditional method of wildfire detection [1].

In the year 2015, they have used HTTP REST architecture as communication platform. It tackles first step of implementing Open MTC as M2M and IOT communication platform. Involved sensors are carbon monoxide gas concentration, temperature, and, humidity, combined with ZigBee and ARduino microcontroller to make up 2 Device Application connected to Open MTC GSCL [2].

III. PROTOTYPE

In this project, we are making a fire detection system for forests using different sensors on the arduino uno board. This is to make people or the surrounding residents about the fire so, that they could take proper precaution in order to reduce

the loss of natural habitat including both natural resources and human life.

The hardware interfaces used are:

- Arduino UNO
- LM35 sensor
- Smoke sensor
- Flame sensor
- Power Supply
- GSM

The software used is Arduino, and for simulation diagram, it is done by Eagle software

Compare value with threshold

- 1) Description: The Arduino UNO board will give all the data to the PC then it will compare it with threshold value.
- 2) Trigger: Starts checking if value is less or above the threshold.
- 3) Precondition: There should be threshold value.
- 4) Basic Flow:
 - 1) Compares the value
 - 2) And performs controlling operations
- 5) Post Condition: The value or message is been send.

Hardware Components:

A. Temperature sensor LM35:-

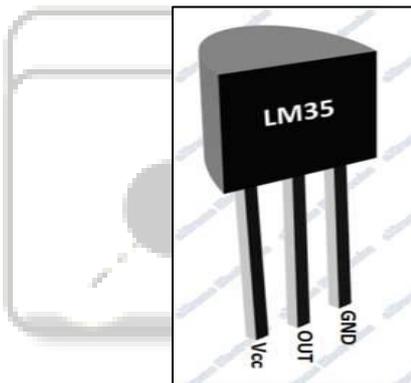


Fig. 2: Temperature sensor

The LM35 series are precision integrated-circuit temperature sensors, its output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 has an advantage over linear temperature sensors calibrated in Kelvin.

B. Smoke Sensor (MQ2):-



Fig. 3: Gas sensor

Detect any type of gases or smoke burning of materials or cigarettes causes's fire to overcome this issue. Its detection zone is 300-10000 ppm, characteristics gas: 10000 ppm. It operates at temperature -20 to 50° C.

C. Flame sensor:

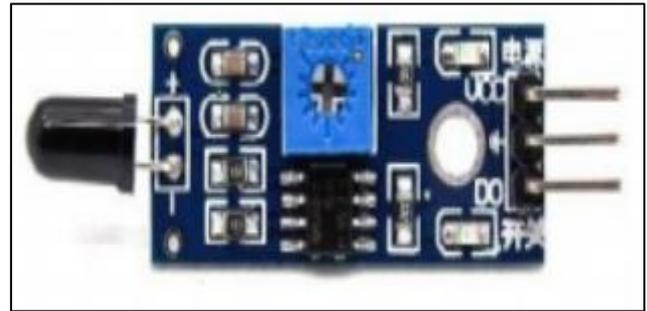


Fig. 4: Flame sensor

The flame sensor is used to detect the presence of fire or other infrared source (Flame or a light source of a wavelength in the range of 760 nm to 1100 nm can be detected). It can be used in firefighting robot or heat seeking robot. Some Features Small and compact in size, Adjustable threshold value, 2 state binary output (logic high and low), Easy mounting with a screw hole.

D. GSM:-

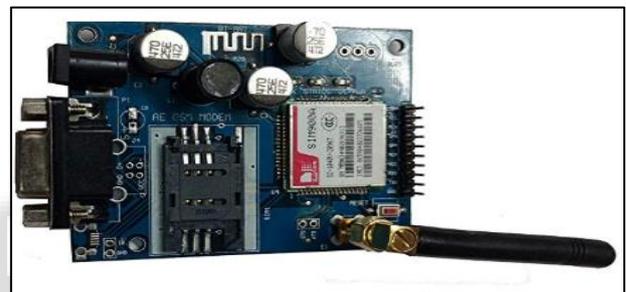


Fig. 5: GSM module

SMS-GSM Processing: with environmental and location data available, this module performs the actual data transmission using SMS services back to the tracking device in a character-based format. Note that all required information can be fitted in one SMS message (160 bytes). Here, we used SIM 900 GSM/GPRS module which delivers GPS/ GPRS850/900/1800/1900MHz performance for messaging, in a small factor and with low power consumption. This SIM socket for SMS transmission. In addition, this module can receive the command from the tracking device, again via SMS services, to let the sensing device perform a particular task, e.g. determining a specific threshold to activate GPS functionalities.

IV. HARDWARE DESIGN

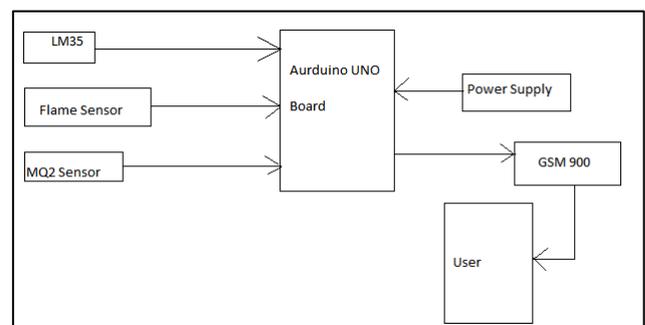


Fig. 6: Hardware design of proposed system

V. FLOWCHART

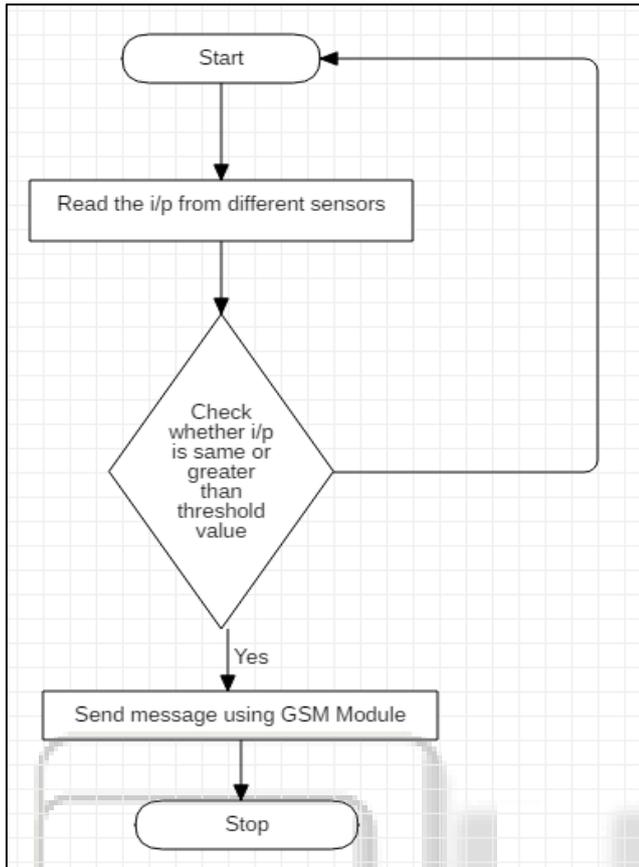


Fig. 7: Flowchart of system

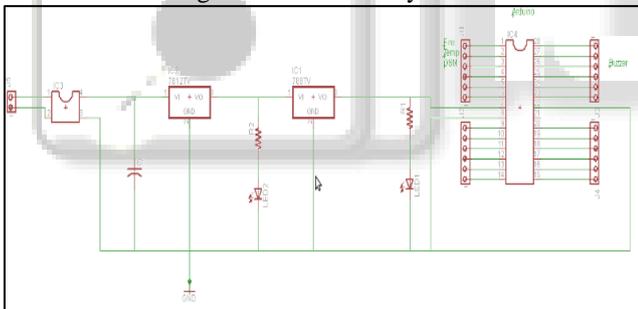


Fig. 8: Schematic Diagram of the system.

VI. CONCLUSION

Forests fires are extreme critical issue in many countries, where global warming also leads for making it more serious. It is accepted universally, that prevention of forests fires from happening, the foremost requirement is to spend in new techniques and apparatus that enables an efficient system. In this project, we monitor the values of smoke, temperature, flame such that if any two among three parameters shows highest value the message is been send. The information is send through GSM Module.

Thereby making people or the surrounding residers aware about the wildfire, so that proper precaution can be done to reduce the loss of natural habitat including both natural resources and human life. Suggestions for further researches are: to record the values of all the parameters that can be stored in database, which can be used further to analyze the conditions.

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