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# Wild Fire Detection using Internet of Things

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**ABSTRACT**

Forests are considered as saviour of earth's ecological balance and considered to be one of the most essential resources. It has been found in a survey that 80% losses caused in the forest due to fire would have been avoided if the fire was detected immediately. However, due to some reasons forest fire occurs which can affect the life of people, wild animals, forest resources and hence a disastrous loss to the environment. Forest fire detection is one of the most safety-critical applications. Arduino platform based IoT enabled fire detector and monitoring system is the solution to this problem. In this work, fire & Humidity detector is built using Arduino Uno which is interfaced with a temperature sensor, a Humidity sensor, LCD display and AC pump. A fire alarm is triggered whenever the temperature and humidity levels greater than a certain value, the concerned sensor detects and send data to the controller in the Arduino Uno. Now the controller initializes the relay and switch ON the AC pumping motor to reduce the fire. With the help of IoT technology, the whole monitoring process made smarter by connecting to the webpage. The node MCU WI-FI Module is used here to upload data on to the server.

***Keywords:-*** IoT Platform, ThingSpeak, Arduino, Wi-Fi Module, sensors.

## I. INTRODUCTION

In recent years, the prevention and monitoring of Forest Fires has become a global concern in Forest Fire prevention organizations. However, due to some reasons forest fire occurs which can affect the life of people, wild animals, forest resources and hence a disastrous loss to the environment [1]. Internet and its applications have become an integral part of today's human life [2]. Now a day's people are striving a lot to accomplish their tasks as smart as possible. The frequency of large-scale forest fires continues to increase aided several factors such as climate change, destruction of vegetation and global warming [3]. In many cases the authorities do not have any fire pre-warning system using high speed technology [4]. Many real time problems have been solved through this concept. Internet of Things is the next stage of automation since the limitations of automation that is monitoring and control on time to time basis is being overcome by IoT because it enables the system to be monitored and controlled irrespective of time and place.

Some of the applications of Internet of Things:

i) Environmental monitoring
ii) Infrastructure management
iii) Energy management
iv) Manufacturing Medical & Healthcare systems
v) Home and Industrial automation
vi) Intelligent transportation

## II. EXISTING METHODS

Effective solution for detecting forest fires proposed in [5] consists of smart sensor which uses tree power for its operation and a GSM module which is connected to the GSM network for transmitting the detected fire alarm. The centre in turn processes the signal and takes necessary action to counteract the situation. A solution for forest fire using ZIGBEE and GPRS system is projected in [6]. In this paper, continuous monitoring of two parameters Temperature and Humidity helps to detect the occurrence of wildfire. Implementation of image processing based forest fire detection using YCbcr colour model was proposed in [7]. This method adopts rule based colour model due to its less complexity and effectiveness. YCbcr colour space effectively separates luminance from chrominance compared to other colour spaces like RGB and rgb (normalized RGB).

From the observations made through the above said methods, it is found that forest fire detection system was developed using GSM modules, ZIGBEE technology,

Bluetooth and WSN technology. The following are the drawbacks in the existing methods

- Inability of accessing the database from any area.
- Poor reliable in detection and non-flexible network.
- Unexpected fire accidents may occur due to the delay in the data management, ineffective warning and alerting systems, improper and delayed data sharing to the respective authorities etc.

## III. PROPOSED METHOD

By considering all the problems in the existing systems required hardware is added according to the requirements that are to be achieved and an innovative system is developed & its operation is described with the help of prototype. The following are the advantages of the proposed system:

1. Less requirement of manual interference for monitoring and operating.
2. Operation execution time is less.
3. Fire detection is very accurate and false information's are rare.
4. The wireless system is simple and flexible with network structure.
5. Alerting, informing, monitoring and control will be executed in the approximate time without fail and delay which avoids the occurrence of accidents due to improper management and control.
6. Each and every observation can be operated and monitored in a smart way over a website or an android application.
7. The measurement data received by the computer system from sensor node are periodically saved in the data base server.

## IV. SYSTEM ARCHITECTURE

The proposed system employs sensors to measure the fire level in the forest on continuous basis. Also some hardware is employed as per the requirement to get the desired output. This collected data will be the input to the system and in accordance with it predefined output actions are attained via internet. Wild fire detection using IoT is a very innovative method, which helps to reduce the fire accidents occur in the forest. This proposed system monitors the fire levels and informs about the fire levels via web page. In the design of IoT based system the sensors are act as inputs to the system. For this the system uses the DHT11 sensors which are used to measure the temperature and humidity levels in the forest on the continuous basis from time to time. The block diagram of proposed system shown in Fig.1 consists of Arduino family microcontroller (ATMEGA328P), Relay, voltage regulator, WI-FI module, LCD, Node-MCU, DHT11 Sensor for sending data, whereas webpage is built to show the status to the user monitoring it. The webpage gives a graphical view of the fire level. The processing of data is carried out in the microcontroller to get the desired output. Temperature and Humidity level analysis are monitored and displayed in the LCD display unit whenever the respective sensor value is more than a certain threshold value.

The threshold levels of the sensors are stored in the web page automatically. This data can be accessed from anywhere irrespective of time through internet by using Thingspeak channel. In order to provide internet support to the prototype a WI-FI module is added to the system. A software program is developed to define the functioning of prototype, according to the instructions of the program at the prescribed conditions [8]. The DC motor activated directly through the microcontroller whenever threshold level is raised this information is automatically updated in the web page and information given to the user.

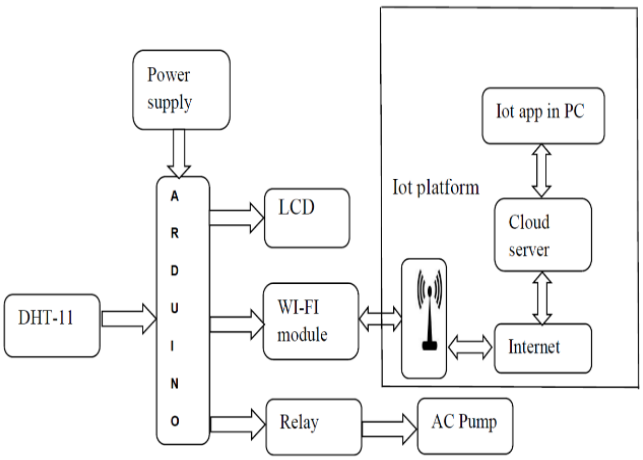

Fig. 1: Block Diagram of Proposed system

## V. RESULTS AND DISCUSSIONS

The processing of data is carried out in the microcontroller to get the desired output. Temperature and Humidity level analysis are monitored and displayed in the LCD display unit whenever the respective sensor value is more than a certain threshold value as shown in Fig.2.

The threshold levels of the sensors are stored in the web page automatically. This data can be accessed from anywhere irrespective of time through internet by using thingspeak channel.

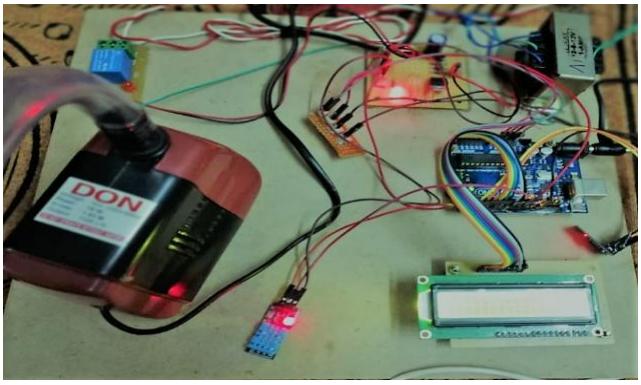


Fig. 2: Prototype of proposed system

The LCD display unit displays the title of the project as a sign of initiation of the functioning of the program. LCD reads the data from arduino board which is directly interfaced with the Node Module in the system.


Fig. 2(a)


Fig. 2(b)

The results obtained at the different levels of fire level in the forest that are measured through the DHT11 sensor are shown in Fig. 2.

Fig. 2(a) represents the levels of fire measured through DTH11 at temperature level as 32 and Humidity as 95.

Fig. 2(b) represents the levels of fire measured through DTH11 at temperature level as 33 and Humidity as 95. It is clear from the results that the fire level is in normal condition. It will not affect the area of the forest. The LCD display reads the data from the arduino board which is directly interfaced with the Node module.


Fig. 2(c)


Fig. 2(d)


Fig. 2(e)

Fig. 2(c) represents the levels of fire measured through DTH11 at temperature level as 34 and Humidity as 74. From the result it is observed that the fire level is greater than the threshold level. Whenever it is greater than the threshold voltage there may be a chance of occurrence of fire in the forest area. So we will get fire alert message as shown in Fig. 2(d). The data regarding the fire levels measured by the sensors is updated in the "Thingspeak" application and displayed through LCD display as shown in Fig. 2(e).

In order to provide internet support to the prototype a WI-FI module is added to the system.

Fig. 2(f): DC motor

The DC motor shown in Fig. 2(f) is activated directly through the microcontroller whenever the sensor level is greater than the threshold level. Similarly, it is deactivated when the sensor level is less than the threshold value. A delay of seconds is provided in the code for the updating and activation of the data in the application. This information is automatically updated in the web page and also sends to the user. The authorized user can access this information within no time. Through the WI-FI IOT Module in the hardware of the system, the data management is carried out through Internet of Things platform. The internet access to the Wi-Fi module in the hardware is provided via hotspot.

The authentication to the hotspot to allow internet access to the module is predefined in the program itself by entering the respective "User ID" and "Password" as shown in Fig. 2(g), Fig. 2(h) and Fig. 2(i).


Fig. 2(g)

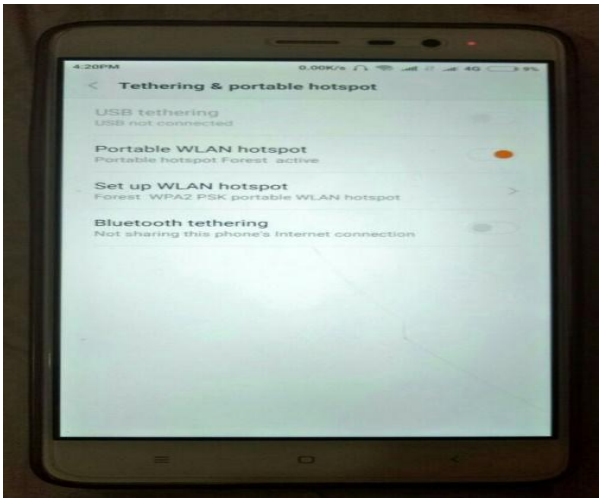


Fig. 2(h)

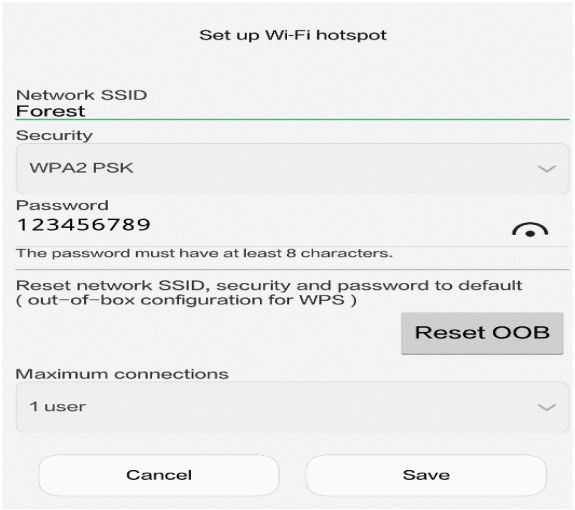


Fig. 2(i)

## VI. CONCLUSION

An advanced system for wild fire powered by IOT is developed which overcomes the demerits of the existing technologies of wild fire monitoring and detection.

The "ThingSpeak" IoT platform with the embedded analytics gave a real time solution to the problem in an efficient way from any corner of the globe. This may further pave way for the milestones of "Digital India".

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