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# FOREST FIRE AND ILLEGAL ACTIVITIES DETECTION SYSTEM USING IOT

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**Abstract -** Forest resources are the most valuable thing in the world and forest fire is most common were happening around the world. If the fire may happen at a single point and started to destroy the entire greenery forest which may destroy the entire thing in the forest including the animals which are there in the forest. By some human behaviors and at summer season the forest may automatically get fired. To overcome this type of thing we designed a project and implement the hardware kit with software which are based on the Internet of Things (IoT) which design is used to protect and early detect the forest fire in the different and proper locations in the forest. In this project, we are using some sensors to detect the fire and smoke, GPS tracking, Arduino board, and the data are stored in the cloud. By doing this we can prevent a fire from occurring in a huge area, and we can see the forest as like greenery.

***Key Words***: Fire Detection, Arduino, Sensor, GPS-module Authentication, Notification

## 1.INTRODUCTION

Forest are the protectors of earth's ecological balance.Unfortunately,the forest fire is usually only observed when it has already spread over a large area,making its control and stoppage arduous and even impossible at times.The result devastating loss and irreparable damage to the environment and atmosphere(30% of carbon dioxide (CO2) in the atmosphere comes from forest fires)[1],in addition to irreparable damage to the ecology (huge amounts of smoke and carbon dioxide(C02) in the atmosphere).Among other terrible consequences of forest fire are long-term disastrous effects such as impacts on local weather patterns,global warming and extinction of rarespecies of the flora and fauna. The problem with forest fires is that the forests are usually remote,abandoned/unmanaged areas filled with tree,dry and parching wood, leaves,and so forth that act as a fuel source.These elements form a highly combustible material and represent the perfect context for initial-fire ignitionand act as fuel for later stages of the fire.The fire ignition may be caused through human actions like smoking or barbeque parties or by natural reason such as high temperature in a hot summer day or a broken glass working as a collective lens focusing the sun light on a small spot for a length of time thus leading to fire ignition.

## 2.BLOCK DIAGRAM

Fig.1 represent the block diagram of the monitoring system. In this system one of the main component is Arduino were the entire controlling operation takes place. It is interconnected with some sensors like temperature sensor and smoke sensor. Temperature sensor measures the temperature and smoke sensor measures the smoke content in the forest. During fire there will be a steady increase in the temperature which is sensed by the temperature sensor. The smoke level also increases during fire in the forest. So this increase of the values are continuously monitored by the Arduino were the sensors are interconnected. When the temperature reaches beyond a certain level, the arduino operates its function to transmit the information about the fire in the forest. This Arduino is connected with a Wi-Fi Module and a GPS module. Wi-Fi module contains a component called ESP8266 which has some special features which is used to transmit the information to the officers through cloud or through online mode. For that it some what requires a internet connection to transmit the information about the fire in the forest. This ESP8266 is used in three ways, one as a client like a Wi-Fi, other is a server like hotspots and another is acting as both client and server and a same time. So the many systems can be interconnected as a chain reaction. The another module used is GPS module where the exact location of the fire can be detected and located. The system gives the location of the fire with latitude and longitude values by which the exact location of the fire can be located. Here IoT is used in-order to monitor and record the information about the fire in the forest. Here the monitoring activities are done continuously irrespective of fire in the forest.

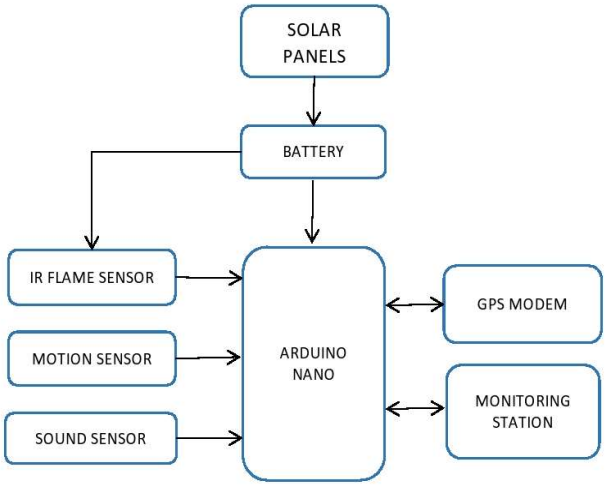


Fig.1 Block Diagram

## 2.1.EXISTING SYSTEM

In the existing system they have given an idea to detect the fire in the forest by using modern equipments. The system is proposed to detect the fire in the forest and also to alert the controller is used to control the system activities,some sensors are used to detect the fire in the forest,with detecting the fire the exact location of the fire is detected and located to the nearby forest officer.So the system is a complete IoT based system were the activities of the system is continuously monitored and the monitoring details are stored in online pages which is viewed by the officer regularly.The details are stored as a data can be viewed at any time.

## 2.2.HARDWARE COMPONENTS

### ARDUINO MODULE

Arduino is a micro-controller board which controls and monitors the activities of a specific system. The type of arduino used is Arduino UNO R3. The Arduino Uno R3 is a microcontroller board based on the ATmega328.It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The ATmega328 has 32 KB (with 0.5 KB used for the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM.


Fig.2 Arduino UNO R3

The arduino is operated at a voltage of 5v. The power supply for the Arduino can be given through USB connection or through external supply. It selects the supply automatically. The external supply can be using adapter or by using batteries. The adapter used is AC-to-Dc adapter. The arduino can be interconnected with any communication devices like computer, another arduino or to any other micro-controllers. The ATmega 28 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The arduino is connected with some of the sensors like temperature sensor and smoke sensor.

### MOTION SENSOR

Motion sensor is used to detect nearby motions.Such a device is often integrated as a component of a system that automatically performs a task or alerts a user of motion in an area.So here in forest this motion sensor is used to detect animals movement to protect it from moving out of forest area.

Fig.3 Motion sensor

### Wi-Fi MODULE

Wi-Fi module is one of the modules used in the system which is used to transfer the information. The information from the arduino is transfer to required area by using this Wi-Fi module. The Wi-Fi module used is ESP8266. This is used to access the Wi-Fi network.

Fig.4 ESP8266 module

It can be used as both client and as a server. Wi-Fi module can be used as a hotspot so that other devices can be connected and it can be used as a client where it gets the network from other processors. ESP8266 can act as a client or a server or even as a both client and server at the same time. The information about the fire in the forest is transferred to nearby area by using this module.

## IR 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.

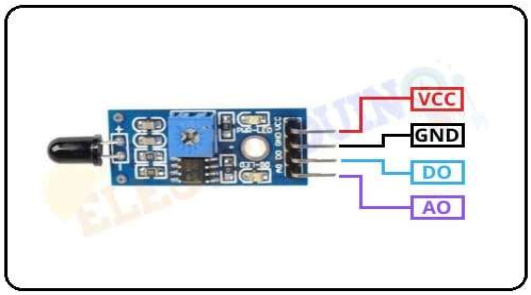


Fig.5 IR Flame Sensor

## GPS MODULE

GPS module is used to track and located the exact location of the fire in the forest. It is capable of locating the location at a high speed rate. It requires power of 3-5 V and transmits the data at 9600 bps. It also has a backup stored battery which can store the data during power failure.

Fig.6 GPS module

## SOUND SENSOR

Nowadays, a lot of security events are initiated due to some sort of sound which includes gunshots, aggressive behavior, breaking the glass. But cameras with inbuilt sound exposure facilities can add huge value to the security system. Because they give an alert automatically when real and potential incidents occur. Then immediately they activate quick and appropriate actions to reduce the consequences. This article discusses an overview of the sound sensor module.

Fig.7 Sound sensor

## SOLAR MODULE

Solar module is used to provide supply to the entire system. Since the system is designed to implement in the forest it is difficult to have a transmission line for the supply. So the system itself has to provide a power supply in the forest area it is best to have a solar panel and a battery to supply power to the system. The solar module contains a solar panel and a battery. The solar panel contains more number of solar cells which absorbs the sun light and converts it into electricity. This power is stored in a battery.

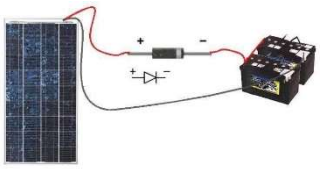

Fig.8 Solar panel with battery

## 3. CONCLUSIONS

Science and technology is panacea for all our growing problems. Predicting the natural processes are highly complex and our system needs to be tested against real time conditions. Though our system is self- sustaining and standalone, other factors which would affect the hardware were tested against time. It shall be implemented in small forest areas where chances of occurrence of forest fires were high. The system needs to be robust to withstand all the climate changes which may affect its functioning. However, our system will play a crucial role in curbing the forest fires which would prevent loss of huge resources and financial losses. We have tested in forest like conditions, but real hardship which we may face is during implementation in large area in real time.

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