

# Forest Fire Alarm System with Location Detection

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**Abstract:** The forest fire detection system describes an idea about the early detection of fire. The basic components are sensors and routers. Mostly 4-5 sensors are connected to a router using star topology. The signal of fire detection passes from sensors to routers and then to the central computer. All the connections are held wireless. This system displays the location of fire using the map and it is trapped using the travelling way of signals. It triggers an alarm for giving an idea about the fire. Also reduces false alarms, as the turning on the effect of alarm is based on the temperature sensed by sensors.

**Keywords:** Forest Fire Detection, Alarm System, Heat Sensor, Temperature Sensor

## Introduction

Forests are very important for balancing the earth's atmosphere and they grow in many places around the world. Forest is an ecosystem that includes many plants and animals. Temperature and rainfall are the two most important things for forests. Forest fire is the most increasing threat in the environment. Forest fire is the burning of the tropical, temperate, and boreal forest either by natural fire or man-made fire and is related to land clearing and deforestation. A forest fire can be divided into five types as surface fire, underground fire, ground fire, crown fire, and firestorms. Surface fire mostly focuses on the forest floor. Underground fire mostly takes place in dense forest beneath the surface. Ground fire burns most of the roots and other materials on the surface. Crown fire begins with crowns of trees and shrubs and slowly spreads over the forest. Firestorms are the most rapidly spreading fire. A forest fire has mainly caused i.e. man-made and natural. Natural forest fire begins with natural reasons such as an increase in temperature and dryness, lightning, etc. Man-made fire is reflex action over man-made activities such as naked flame, cigarette or bidi, electric sparks, or any sources of ignition. Forest fire leads to the emission of smoke that contains particulate matter that may have adverse effects upon the human respiratory system. Forest fire also causes air pollution which affects animal and human life also. Forest fire causes a lot of damage to the environment that's why we need to think seriously about it.

In recent years new technologies are emerging to avoid forest fire. There are many solutions such as Tower monitoring, Monitoring by Image processing, Monitoring through cameras, etc. But these methods are having some drawbacks. Detection of forest fire using CCD cameras, in this they have installed cameras on towers in the forest for capturing images and IR detectors for sensing smoke. There is one more system which is different from all other i.e., mobile biological sensors, in this sensors are connected to the body of native animals and it senses the sudden changes in actions of animals. Apart from these two systems, a lot of work has been done in some systems that are based on image processing, video cameras. In that type of system, most of the images are captured, and based on the YCbCr algorithm images are classified. Some satellite-based systems are also in demand. These systems may generate false alarms in some situations. So, to overcome these drawbacks forest fire detection system which includes wireless sensors came into the picture.

Most studies have done on forest fire using sensors but this system is quite different from others existing systems. This wireless sensor system is used to detect fire and its location in the forest. This system includes wireless temperature sensors, routers, and a PC/mobile on which the scouts will receive the signals regarding forest fire. Sensors sense the temperature and routers are for establishing communication between the sensor and central computer. Also, the map is displayed on the screen of the central computer with turning on the alarm to alert or we can say to give an idea about the fire. There are fewer chances that this system will generate a false alarm. So, this system is considered more efficient more accurate. This is not a new idea but quite modified. This paper mainly focuses on the design and implementation of a Forest fire Detection System.

## Methods

Our entire system is divided into three classes namely:

### 1) Temperature Sensor

These are the devices that will keep a constant eye on the temperature. Once the critical temperature is reached it sends a warning and the location of the sensor to the next class. The sensors can also be upgraded to measure air pressure and humidity as these factors also heavily affect forest fires. These devices will be powered by batteries for easy maintenance and will be easily replaceable. Each sensor covers a small area in the forest and a bunch of sensors covers a small portion and this bunch is connected to the next class.

### 2) Router

These are the next class and are directly connected to the bunch of sensors that cover a small area in the forest. There are many routers that cover the entire portion of the forest and forms a network around it. When the sensor sends a warning and the address then it passes from the routers to network to finally in third class.

### Features

- 1) Incredible speed
- 2) Increased capacity
- 3) Multi-network, extensive interfaces
- 4) High-quality industrial-grade design
- 5) Secure and reliable network
- 6) Supports 5G network
- 7) Have 5 ports

### 3) Central Computer

It is the third class and last class of the detection system. It is a computer that is connected to the network covering the forest and continues to read any signal to detect any warning about critical temperature to be reached in certain areas of the forest. If the warning is detected then it reads the address and then informs the scouts about the location of the detected area so they can take necessary actions.

### Materials used



Fig. - Temperature sensors

Wireless  
communication  
router G930-NT  
cellular 3G 4G LTE



Fig. - Routers



Fig. - Central computer

### Working

The methodology will be adopted as follow:

1. The system will consist of three modules as one is wireless sensors, the second is routers and the last one is control center.
2. Sensors will be connected to the trees, each will be in the particular area comprising some area in control.
3. All the sensors will be connected to the routers and each router can interact with each other for further communication.
4. All routers are connected to the control center for monitoring purposes.
5. The temperature of the fire is about 800 °C to 1200 °C.
6. Sensors will be programmed to detect the heat from about 700 °C to 750 °C for early detection of fire.
7. Suppose a sensor detects its environmental temperature to be around 750 °C then it will transform the address of that sensor to its assigned router, the router will add its own address to the data and sends it to the central controller, if the controller is nearby router then it will send signal directly to the controller instead of sending to another router.
8. In this way, according to the position of the router, we will get the location of the fire in the controller.

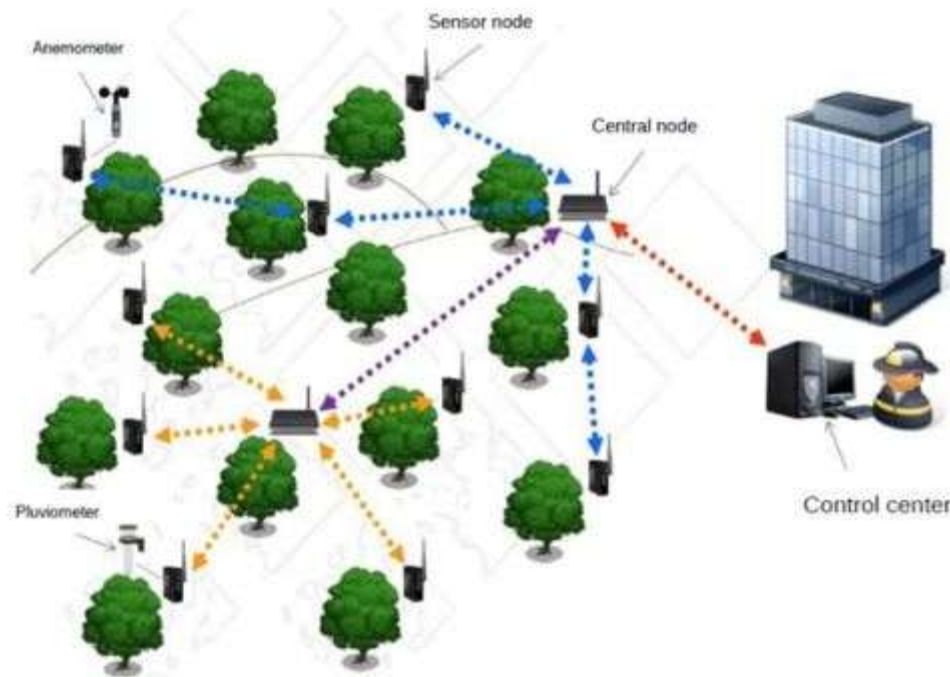


Fig. - Connection Diagram

### Discussion

This system is pollution-free and need not set up again once the connections have been done. Only the working of sensors and routers needs to check.

### Advantages

1. Use of sensors is very efficient.
2. It brings correctness to the system.
3. Due to topology, signals are sent to the proper position.
4. As the signal passes through sensors to routers and then from routers to a central computer, it is easy to identify the location of the fire.
5. Due to the alarm system, guards get an idea of fire immediately.
6. It reduces false alarms.

### Disadvantages

1. For a significant large forest, the number of sensors and routers needed to increase. So, cost also increases simultaneously.
2. Connections are very complex to handle.

### Result

The system is very efficient and environment-friendly. It works properly as discussed above. Logically, it begins from sensing the temperature and aims to receive the signals by a central computer. The main purpose i.e., to extinguish the fire and save the wildlife is achieved by this system. The system will work as given in the methodology. This system has advantages over existing systems.

**Link:** <https://drive.google.com/file/d/1AZzSNki5YT9iA9xKyNwLVxexfnE74bze/view?usp=sharing>

Following are some pictures of the system:



Fig. - Introduction



Fig. - Network of sensors



Fig: Detection of fire



Fig: Guards visiting the location

### Conclusion and Future Scope

Forests are one of the main parts of our earth and are vanishing day by day. As compared to other methods of forest fire detection, the wireless sensor system is more efficient. In other techniques, there is a possibility of getting a false alarm, while in a wireless sensor system no false alarm will be generated. This system is useful for the early detection of fire. This system consists of sensors, routers, and a computer as a central monitor. It specifies three communication interfaces such as communication between sensors and routers then between routers to routers and routers to central communication. It also needs a topology for connecting sensors and routers. The basic point of this system is temperature. Depending on the temperature the working of this system takes place.

This system aims to present a different way of saving forests. This system will be significantly useful for the forest department or guards. This Forest Fire Detection System is used to detect the fire early, used to alert the forest department about the fire, used to save the environment from pollution. Also, we can save the lives of many animals and trees.

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