

# Forest Fire Detection System using ZigBee



Shivendra Kaura, Abhinav Srivastava, Abuzar Nasir Khan, Raj Kumar, Mohd. Irshad

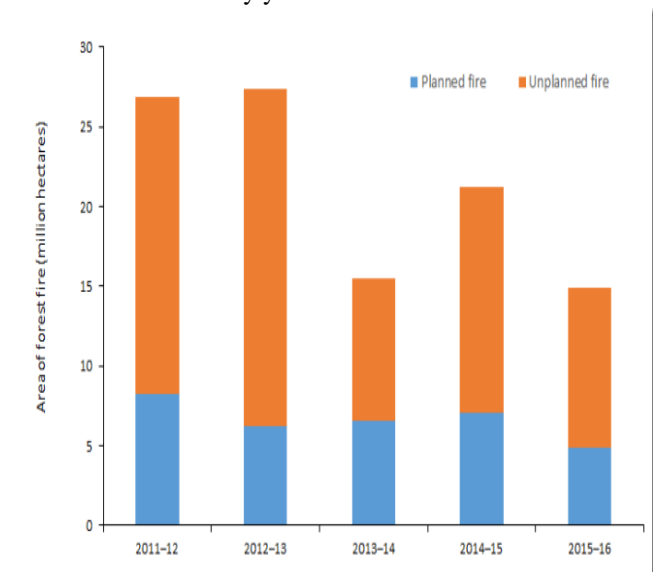
**Abstract-** The forest fires are alone not a threat to the environment but this add on multiple factors which are threat to the environment few examples are decreasing of ground water level, landslides, global warming. These are dangerous for the animal species and few vulnerable species. In recent years few a case has been heard of forest fires in Amazon, California which damaged the flora and fauna. Scientist have also predicted that by end of twentieth century the average temperature of earth will rise by 4.4 degree Celsius. The forest fire detection will give strength to the disaster response capacity. Environmental parameters such as forest temperature and humidity can be tracked in real time. From the information gathered by the system, wildfire fighting or fire prevention decisions can be taken as quickly as possible by the respective fire departments.

**Keywords:** vulnerable species, flora and fauna, forest fire, temperature, humidity.

## I. INTRODUCTION

Forests are an indispensable and essential tool for human life span and social growth while preserving the symmetry of global ecology. However, wildfires often occur due to some uncontrolled human activity and unusual natural conditions. These fires pose the most devastating threat to forest capital and the individual's habitat. The rate of wildfires has increased significantly in recent years due to climate breakdown, human activity and further aspects. Fire controlling and surveillance has set off a worldwide responsibility among forest fire safeguard agencies. At present, fire precaution strategies include large-scale patrolling, watchtower inspection, and recent satellite surveillance. Although inspection of watch towers is direct and possible, it has many drawbacks. First, this method requires a lot of financial and physical resources and a trained

workforce. Second, there are many issues with fire safety personnel such as negligence, lack of deadlines, lack of real-time monitoring, and limited area coverage. The range of satellite detection systems is limited by a wide range of factors, which reduce the impact of fire detection. For example, the satellite surveillance system has a long scanning cycle, hence the low resolution of its saturated pixel points. Another problem is that cloud layers can mask images during scanning intervals, so it is difficult to determine the real-time magnitude of the fireside parameters. Forest fires are a natural or man-made phenomenon in many parts of the world. Sensitive areas are in temperate environments where the pluviometry is sufficient to initiate significant levels of vegetation, but summers are very hot and dry, leading to dangerous fuel loads. Global warming contributes to the increase in the number and importance of these disasters. Every season, wild-land fires destroy thousands of hectares of forest, but also damage property, assets and public resources and facilities. In addition, firefighters and civilians are at risk, a terrible number every year in human life.



## II. PARAMETERS OF FOREST FIRE

The main point of humidity assessment of combustible materials is to predict whether a fire will take place. Humidity is very high in proportion to the weather, air temperature, wind and similar factors. Evaporation of water is directly affected by relative humidity. At the same time, the physical properties of combustible materials are often altered indirectly by air temperature.

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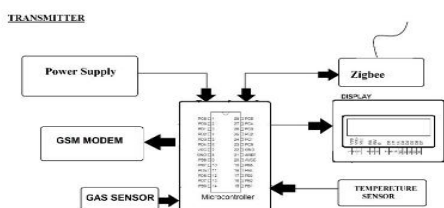
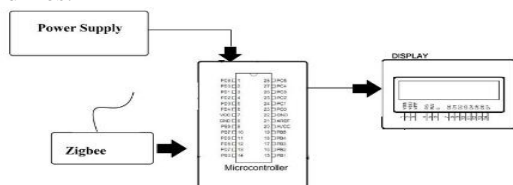
Therefore, relative humidity and air temperature are considered to be the two main factors affecting wildfires across the globe. Therefore, these two parameters are very frequent in our firefighting research and monitoring, in order to reflect moisture indirectly.

Year	Number of fires	Hectares burned	Total cost (millions)
2006	2,590	131,086	\$156.0
2005	976	34,588	\$47.2
2004	2394	220,516	\$164.6
2003	2473	265,050	\$371.9
2002	1783	8,539	\$37.5
2001	1266	9,677	\$53.8
2000	1539	17,673	\$52.7
1999	1208	11,581	\$21.1
1998	2665	76,574	\$153.9
1997	1175	2,960	\$19.0
1996	1358	20,669	\$37.1
1995	1474	48,080	\$38.5

TABLE 1  
Forest fires in the Province of British Columbia, Canada since 1995

### III. ZIGBEE WIRELESS SENSOR NETWORK

There are systems based on satellite images, but they are not used in real-time applications due to the high scanning cycle, low resolution and cost. Other systems have been proposed based on short-distance images using optical, infrared or thermal images. However, these processes are very sensitive: direct and intense sunlight, insufficient light or smog. They are also vulnerable to false alarms. However, it has no resolution, is expensive (requires radar and sound sources), and increases the risk of interference such as changes in wind direction. The system includes humidity, temperature and smoke sensors that are set to specific temperature and humidity levels, respectively. If a check is found outside the system configuration level, the system first sends this event information to another ZigBee Fit project board via the ZigBee wireless interface. Therefore, the second board that receives this information will display it on the LCD and raise the alarm so that the user is aware of the situation. The system also includes a fire sensor. As soon as the fires are reported, the system takes possible measures to prevent the fires from spreading and is not realized. Therefore, the ZigBee-based firefighting system is an effective system for eliminating wildfires.



### IV. RESULTS

1. The Blueprint of the system can be implemented in highly effective areas of forest to halt forest fires and other illegal activities, the system must be highly secure so that the cutting and trading of trees can also be prevented.
2. Transmitter and receiver units must be allocated in appropriate places for conducting experimental tests and trials.
3. LCD displays a message indicating the control station for the position where the receiver unit is placed.
4. This message acquired at the Receiver Unit is used by the forest officers for remedial action.
5. System can be implemented on a large scale with hardware and firmware enhancements that will help forest administrator and respective departments.

### V. CONCLUSION

Wireless sensor networks are more and more used in the field of environmental tracking. But now it's time to upgrade these features. In addition to its advantages that traditional monitor systems do not, materials used in detection devices, especially in back-breaking and unpleasantly rough situations, increase the temperature of the melting point. Additionally, wireless sensor technology has a broad application background in real-time wildfire surveillance. But given the complexity and characteristics of the forest, the system has not been heavily applied to practical forest fire monitoring. We have identified the advantages of low-cost, low-vacation requirements for data transmission, flexibility in network architecture, and the ZigBee wireless-based forest fire monitoring system to observe and track forest temperatures and humidity in a well-timed and accurate manner. Sensor technology we designed. Cluster-tree adaptation of the topology structure of the system. Compared to mesh structures, cluster-tree architectures are more easily created and data paths have less memory space. At the same time, there is a need to stabilize the network's structure and limit its level, which has to be changed and improvised in future research. In other words, we refer to this system as a first attempt and complement existing forest monitoring and prevention practices. It provides a strong foundation for implementing advanced wireless sensor network technology in terms of hardware. To improve system efficiency and forest fire monitoring technology, it is necessary to consider future energy use, node location, and clock synchronization issues. Before improving the quality of forest fire monitoring, it is necessary to consider some of these issues.

### FUTURE SCOPE

1. Fire detection in forest could also be possible if we used temperature sensors and humidity sensors along with the device which can also avoid wastage of valuable trees. Forest not only provides home to the large variety of flora and fauna, the animals but also the major producer of oxygen to the ecosystem.

2. The sub server unit can be used between the transmitter unit and the main receiver unit which makes the whole procedure evenly proportional and take preventive measures to alert the forest officer.
3. The system can be reformed with lower capacity components and higher versions of ZigBee, making the system more efficient.

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