# Forest Fire Detection using Wireless Sensor Network

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***Abstract*:- Forest fires generally occur in wild areas due to human carelessness and change in an environment. They cause the environment and may result in human and wild animal's deaths. So that, forest fires must be detected early to prevent greater damages. There are many existing system like Satellite Systems, CCD CAMERAS, wired system and Bluetooth technology Perhaps these systems provides a complete image of the earth but after a long scan period .This is not much accurate method because it prevents fire detection just at a time, the fire starts. Compared with the traditional methods of forest fire detection, a wireless sensor network based on a ZigBee technique was proposed. WSN's are used for various applications such as habitat monitoring, automation, agriculture, and security. This article presents the design of a system for detection of temperature and humidity and smoke to prevent a disaster (forest fire) that could lead to loss of a significant number of natural threads. In this project, several tests had been conducted in order to prove the viability of the system**.

***Keywords: Wireless sensor network, zigbee.***

## 1. INTRODUCTION

Forests are part of the important Resources for human survival and social development that protect the balance of the earth ecosystem. However, because of some uncontrolled anthropological activities and irregular natural conditions, forest fires happen frequently. These fires are the most uncontrollable disasters to forest resources and the human environment condition. In this scenario, the frequency of forest fires has increased considerably due to climate change, human activities and other factors. The detection and monitoring of forest fires has become a global concern in forest fire prevention organizations. Currently, forest fire detection methods largely consist of vigils, observation from watch towers and lately satellite Monitoring (Lai, et al., 2004). Although Observation from watch towers is easy and realizable, it has several obstructions. In the first place, this method needs many financial and material resources and a up skill labor force. Second, many problems with fire protection manpower abound, such as inattentiveness, absence from the post, lack of ability for real-time monitoring and the limited area coverage. The scope of application of satellite detection systems is also restricted by a number of parameters, which reduces its effectiveness in forest fire detection. For example, a satellite monitoring system has a long scanning cycle and the resolution of its saturated pixel dots of images is low. Another problem is cloud layers may mask images during the scanning period and the real-time mathematical quantification of fire parameters is very difficult to achieve (Shu et al., 2005; Yu et al., 2005; Calle et al., 2006). Given these shortcomings of traditional monitoring, we suggest the ZigBee wireless sensor network technology and explain its application as a monitoring system. This system can monitor real-time related parameters, e.g., temperature, relative humidity, and send the data immediately to the computer of the monitoring center. The collected data will be analyzed and managed by the computer. Compared with the normal baroscopic information and basic forest resource data, the system can make an immediate assessment of a potential fire danger. The analytical results will then be sent to the relevant department as the policy-making basis by which the department will make the decision of firefighting or fire prevention.

## 2. LITERATURE REVIEW

Diaz-Delgado, R., Salvador, and R.Pons et al. (2010), [1] remote sensing of forest firesis to provide investigate a cost effective solution. This methodology has been applied to the period 1975-1993 and results have been given as a forest fire map series and a fire history map of Catalonia (Northeast of Spain). These maps have been lately converted to vector layers and all results have been integrated into a GIS. The results have been contrasted to independent administration data and commission and omission errors have been evaluated. Fire frequencies and NDVI post-fire values have been used to retrieve valuable information on the fire regime and to evaluate plant regeneration rates in Mediterranean plant communities. GIS tools are being used for further landscape analysis.

K. Khamforoosh, H.Khamforoush, "A new routingAlgorithm for Energy Reduction in Wireless Sensor Networks", (2009)[4] et al.Performance evaluation of routing protocols for wireless sensor networks in forest fire detection The forest fire detection as a monitoring network is one of these applications. Sensors collect dynamic changes such as temperature, humidity, smoke, atmospheric pressure and forward those to a single node or

a base station. This information's are sent to a long-distance data server which is located in a fire center. Due to the importance of these networks and their ability of real-time monitoring, they should be a reliablenetwork communications.

Z. Shunyang X. Du, J. Yongping and W. Riming, "Realization of Home Remote Control Network Based on Zigbee (2007)[5],et al. deals with the design of remote monitoring and controlling systems. The system consists of a real-time home monitoring sub-system and a light control sub-system. A home server with a home camera caters for home status through video to client.

Terradas, J. and Piñol et al. (2009)[2] has conferred this system because the wireless web based system has numerous applications in real time system**.** A program that analyzes satellite data in near real time and converts information into instant messages and email alerts to track forest fires.

ICIMOD helped design a system that uses satellite data to monitor and assess the damage of forest fires and then automatically sends SMS messages and emails to district forestofficers and rangers so they are better able to monitor a fire's growth and direction and alert populations when there may be a need to evacuate.

Yu, L., N.Wang, et al. (2005)[3](avoidance of fire accident on running train using zigbee wsn) proposed this system to avoid fire in running train. When fire is noticed in anyone of the compartment, temperature sensor senses the fire by the way of difference between the coach temperature and the critical temperature. It collects the signal of increased temperature and it responses to the driver display unit when it reaches above the critical fire point. Then it invokes three major processes to control the fire explosion. They are Automatic alarm system which alerts all the passengers at sleep during night.ZigBee wireless sensor network which transmits signal to the engine driver panel enabling the warning light and alarm to function. The Engine driver stops the train.

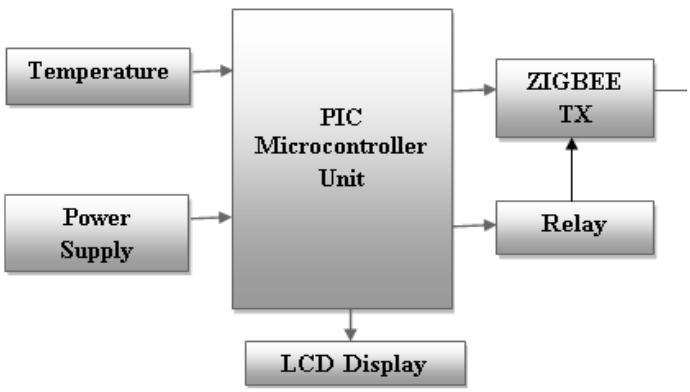


Fig1.fire detection system Block Diagram

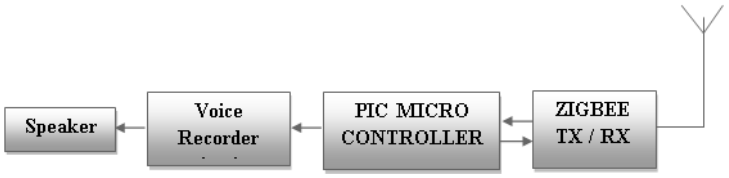


Fig2.Receiver 1 (M2M Communications)

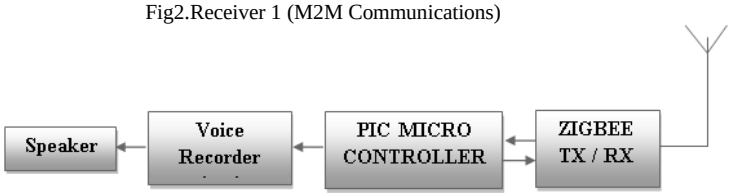


Fig3.Receiver 2

## 3. EXISTING METHODS

Now there are many methods used for providing fire detection to forest. They are remote monitoring, surveillance system and ZIGBEE technology etc. But the cost of manufacturing these systems are quite high when compared to the proposed system. In this scenario surveillance systems are that much secure like proposed system, because it is easily detecting the forest fire and send the information to long distance.

Existing systems are cost effective and they are not that much secure comparing to this proposed system. Many existing systems are based on Wireless Sensor Network and remote monitoring. These systems are efficient for detecting fire in very short duration.

## 4. METHODOLOGY

In this system there are three modules. Each one has the specific function. The device sensing the humidity, temperature, and smoke in digitally. The user set certain temperature level for the system. In case the sensed temperature level is beyond the setting level. The system transmits the information to the pc or the user.

### 1. TRANSMITTER

The system is being detected the level of temperature, Smoke by using the sensors. The analog information is converted into the digital by using ADC which is inbuilt of microcontroller .Whenever there is a fire occurring, the transmitter transmits the data through the USART.

### 2. TRANSCEIVER

This is the second module of the system. Which is used to receive the data from the transmitter of the module1 and also transmit again to the receiver2 using the zigbee technology.

### 3. RECEIVER

The receiver is used to receiving the data. Here we are using the M2M communication which is nothing but machine to machine communication. This M2M is one type of coding method software coding which can transmit the

data to the next receiver in parallel manner. In this manner we are communicating long distance.

*4.1. FLOW OF OPERATION*

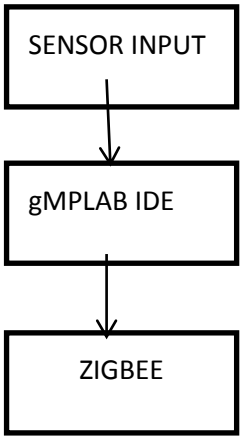


Fig4.Flow of operation

1. The sensor node is the input which is sensing the temperature, Smoke and the humidity of the environment.
2. The MPLAB IDE is the medium or the software that control all the hardware components of the security system like temperature sensor, and Zigbee.
3. Zigbee is the communication medium to transmit and receives the data to/from the users about the fire alert.

*4.2. MPLAB IDE*

MPLAB IDE is a Windows Operating System (OS) software program that runs on a PC to develop applications for Microchip microcontrollers. It is often called as an Integrated Development Environment, or IDE, because it delivers a single integrated "environment" to develop code for embedded microcontrollers. MPLAB IDE runs on a PC and contains all the components needed to design and deploy embedded systems applications. Once the code builds with no errors, it needs to be tested. A software program that simulates the execution of the microcontroller. The simulator can acquire a simulated input (stimulus), in order to model how the firmware responds to external signals. The simulator can assess code execution time, single step through code to monitor variables and peripherals and trace the code to generate a detailed record.

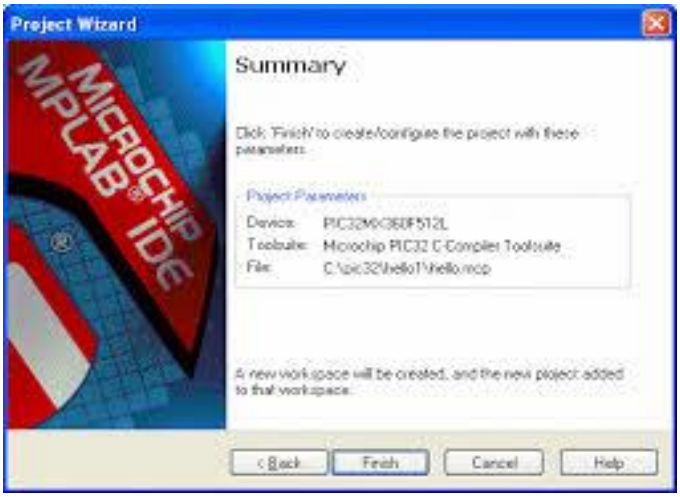


Fig5.MPLAB IDE Project Wizard

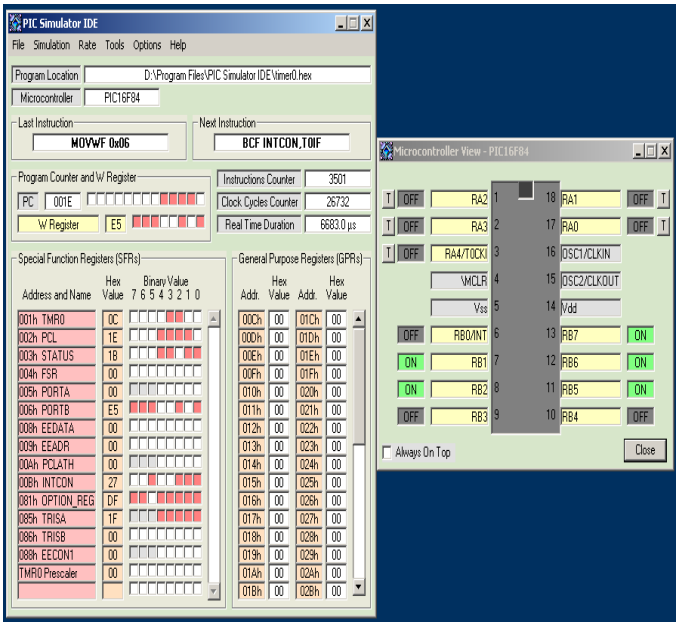


Fig6.Simulation

*4.3. Zigbee*

Zigbee is a low-rate, low-cost and low-power kind of transient wireless network communication protocol. Compared with other wireless methodologies, Zigbee has unique advantages of safe and reliable data transmission, an easy and flexible network configuration, low equipment costs and long-standing batteries. By applying a wireless sensor network based on Zigbee to a forest fire supervising system, information such as temperature and humidity at any part of the forest covered by the network could easily be collected, dealt with and examined at any time. In addition, the system can be extended significantly.

## 5. CONCLUSION

In this paper, we have presented forest fire detection in zigbee projects that use wireless sensor networks in their architectures to measure and transferring useful data. The role of a sensor node is to sense the environment, transferring and exchange sensory data with other nodes in the area. The industrial application of wireless sensor networks are in digital transmission to monitor temperature and humidity in the forest in a more timely and precise way, we pointed out unique advantages of safety in data transmission, flexibility in building the network, and low cost and energy requirements for a forest fire monitoring system based on a Zigbee wireless sensor technology that we designed.

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