# ARM Based Forest Fire Detection System

**Prof. S. B. Gholap *, A.S. Jidagi ****
* Assoc. Professor in Department of Electronics and Telecommunication Engineering,
Sinhgad Institute of Technology, Kusgaon(Bk.), Lonavala, Pune, India,410401

** Department of Electronics and Telecommunication Engineering,
Sinhgad Institute of Technology, Kusgaon(Bk.), Lonavala, Pune, India,410401

***Abstract***-A recent study on forest fires indicates that some approaches in determining the impacts of forest fires have grossly overestimated the number of live trees that burn up and the amount of carbon dioxide released into the atmosphere as a result. When a very severe fire kills almost all of the trees in a patch, the trees are still standing and only drop to the forest floor, decay and release their carbon content very slowly over several decades resulting a forest from a carbon sink into an atmospheric carbon source in the near-term, considering forest and atmosphere surrounded by it as indestructible resources, an effort has been made to prevent it. A system to detect forest fire is proposed here based on LPC2148 and CC2500 chip with Radio frequency half duplex communication Data exchange among all network blocks modules described in detail. Major parameters to be monitored for forest fire detection are measured by using the sensors. Entire forest is covered by huge number of wireless sensors and the information collected from each part of forest is collected and analyzed. To achieve data exchange inside a wireless network a program running on a host computer generates a request through host computer and sensor network gives response.[2]

***Index Terms***- Battery powered, forest fire detection, half duplex communication and wireless sensor network.

## I INTRODUCTION

The Fire effects are the physical, chemical, and biological impacts of fire on ecosystem resources and the environment. The effects of fire include its role in changing air quality, water quality, soil properties, altering vegetation and related impacts on wildlife. Forest is considered as one of the most important area for maintaining earth's ecological balance. Further forest fire causes tangible losses may produce a knock-on effect in the form of a reduction in output and employment in industries dependent on wood as raw material.

Proposed System uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and sends out a digital signal on the data pin once every 2 seconds. CC2500 provides 30 meter range with on board antenna of transceiver in a typical system; this transceiver will be used together with a microcontroller. It provides extensive hardware support for packet handling, data buffering, burst transmissions, clear channel assessment, link quality indication and wake on radio. It can be used in 2400-2483.5 MHz ISM/SRD band systems. It offers Low power consumption. Gateway module has RJ45; RS232 and GPRS connectivity Ethernet module utilizes the new Microchip ENC28J60 Stand-Alone Ethernet Controller IC featuring a host of features to handle most of the network protocol requirements. The module connects directly to most micro controllers with a standard SPI interface with a transfer speed of up to 20 MHz

## II SYSTEM OVERVIEW

The proposed system includes Sensors, Controlling and processing unit and Wireless Transceiver module [1].

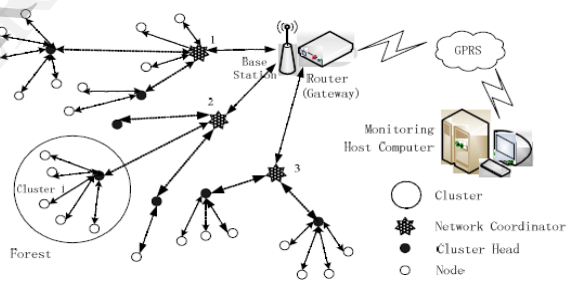


Figure 1.Structure of Wireless Sensor Network for Forest Fire Detection

**Sensor node:** Sensor node includes humidity and temperature sensor (DH-11) which gives output in 1 Wire protocol.LCP2148 listens to cluster head and returns a data read from sensor. RF transceiver transmits and accepts signal at 2.4 GHz. Intermediate node comprise of cluster head, and network coordinator .Router accepts requests from host pc and broadcasts to network coordinators and provides RS 232, Ethernet connectivity for communication [3]

Host PC displays map of a forest where all nodes can be seen showing temperature &humidity.

### *A. The Sensor*

Figure 2 shows building blocks of Sensor node. The sensor used here is DHT11 which measures the two parameters Humidity and Temperature. The DHT11 is a basic, low-cost digital temperature and humidity

sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and sends out a digital signal on the data pin Its fairly simple to use, but requires careful timing to grab the data.

This sensor outputs data once every 2 seconds. The following Snapshots depict images of the request sent by the MCU to the DHT and following the packet which is the response for the request.

After decoding the data, the results are displayed in the following form.

Humidity 0b00101011.0b00000000 = 43.0%

Temperature 0b00010111 = 23 C.

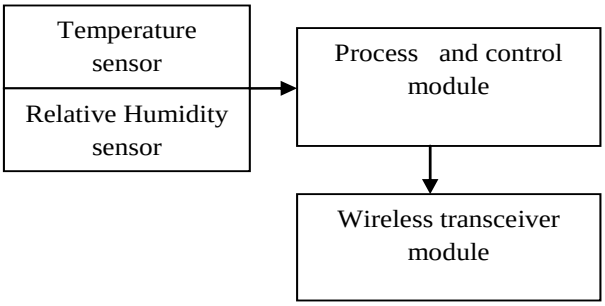


Figure 2.Structure of Sensor Node

### B. *Arm Controller LPC2148*

Due to tiny size and low power consumption, PC2148 is ideal for the proposed application where miniaturization is a key requirement, such as access control and point-of-sale.

The LPC2148 microcontroller is based on a 32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support that combine microcontroller with embedded high speed flash memory ranging from 512KB and 40KB on chip

SRAM A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty.

Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 KB up to 40 KB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for this application.

### C. *RF Tranceiver*

CC2500 module from Texas Instruments is used as RF transceiver provides 30 meter range with onboard antenna. In a typical system, this transceiver will be used together with a microcontroller. It provides extensive hardware support for packet handling, data buffering, burst transmissions, clear channel assessment, link quality indication and wake on radio. It can be used in 2400-2483.5 MHz ISM/SRD band systems. It offers Low power consumption, Integrated bit synchronizer, Integrated IF and data filters, High sensitivity (type-104dBm), programmable output t power -20dBm ~1dBm,wide operation temperature range : -40~+85 deg C, good operation voltage: 1.8~3.6 Volts operating at 2.4~2.483 GHz

### D. *Gateway Design*

Gateway module has RJ45, RS232 and Radio connectivity as shown in figure3.

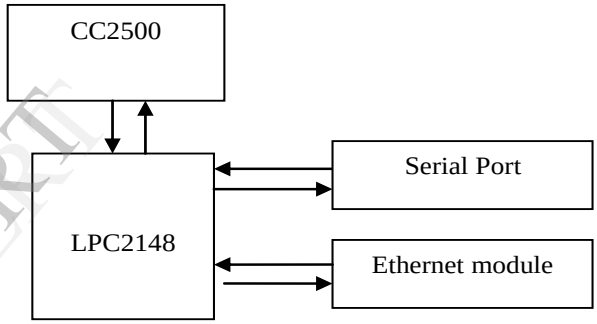


Figure 3.Structure of Gateway

### E. *Ethernet Module*

It is consisting of Ethernet controller (ENC28J60).It needs very less external components. This module utilizes the new Microchip ENC28J60 Stand-Alone Ethernet Controller IC featuring a host of features to handle most of the network protocol requirements. The module connects directly to most microcontrollers with a standard SPI interface with a transfer speed of up to 20 MHz It includes a ENC28J60 Ethernet controller, an RJ45 socket with link/activity lights and integrated transformer. This Ethernet module enables us to connect a particular embedded device (equipped with SPI support) on to a network. By using this Ethernet module (along with a microcontroller running a small TCP/IP stack) applications like Embedded Web server can be easily developed.

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## III CONCLUSION

The article presents a kind of scheme of forest fire detection system based on ARM, introduces the principle of the system. An idea proposed here is advantageous over traditional forest fire detection methods like ground patrolling, watching tower, long distance video monitoring and satellite monitoring. The wireless signal transmission is solved by RF transceiver and the communication technique used. It has reduced the software overhead. With little modification in hardware and software other functionality can be implemented. Physical implementation of Radio frequency operated sensor network for forest fire detection has wide application as this is an extremely essential for ecological balance.

This proposed idea accompanied by satellite monitoring provides better solution for forest fire detection and fire fighting as well.

## IV REFERENCES

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