MONITORING OF FIRE DETECTION SYSTEM USING ZIGBEE

Sandeep Kumar Singh*1, Viplav Yadav*2, Santosh Kumar Yadav*3, Satyendra Kumar Gupta*4

1,2,3Student (B. Tech), Department of Electrical Engineering, Shri Ramswaroop College of Engineering and Management, Lucknow, Uttar Pradesh, India
4Professor, Department of Electrical Engineering, Shri Ramswaroop College of Engineering and Management, Lucknow, Uttar Pradesh, India

ABSTRACT

Every second, a big number of precious forests are lost by fire around the world. Due to a lack of firefighting knowledge, firefighters are unable to respond to fires in a timely manner. As a result, wildfire has claimed the lives of people, animals, and important vegetation. This suggested system is built around sensor nodes that are enabled to communicate with one another via wireless technologies. The system is divided into three sections: detection, monitoring, and wireless sensor networks. Simulated Sensor Program was used to create the detecting component. A forest fire is detected using a temperature sensor (LM35), a humidity sensor (DHT11), and a gas sensor (MQ2). The monitoring section includes an LCD display. The ZigBee protocol is used to communicate between wireless sensor networks.

Keywords: Arduino, Gas Sensor, Temperature Sensor,

I. INTRODUCTION

Many natural disasters have struck the planet recently in various ways. Forest fires are one of the most dangerous natural disasters, and they can have disastrous implications for the ecology, thus early identification is crucial. As the number of persons who start forest fires grows around the world, so does the number of fire incidents, posing a serious environmental threat. The majority of humans and animals are killed because firefighting and fire prevention are not available in a timely manner, and fire information is not available to the fire department in a timely manner. This suggested system includes sensors (temperature, humidity and gas). They discover the problem, alert the main station, and report the findings. In this proposed system, there are three nodes (nodes 1, node 2 and main node). Each node has a temperature sensor (LM35), a humidity sensor (DHT11), and a gas sensor in addition to the Arduino and ZigBee wireless module (MQ2).

II. LITERATURE REVIEW

Below are some of the previously researched key literatures.

In 2012, P.S. Jadhav and V.U. Deshmukh suggested a ZigBee Wireless Sensor Network Forest Fire Monitoring System.[1], which includes monitoring nodes base stations, communication systems, internet access, and the monitoring hardware and software system structure, is designed for habit monitoring automation, agricultural, and security. The author has constructed a device based on the WSN protocol that contains temperature, smoke, and humidity sensors, as well as the processor LPC2138 and ZigBee as an RF device. The processor module in this system is in charge of controlling the sensor nodes, as well as storing and processing the data they acquire.

U. Arun Ganesh, M. Anand, S. Arun, M. Dinesh, P. Gunaseelan, and R. Karthik presented Forest Fire Detection Using Optimized Solar-Powered ZigBee Wireless Sensor Networks [5] in 2013. When the temperature surpasses a particular threshold, an alert is sent to the base station through SMS (Short Message Service) and a call is made using the GSM module, according to the suggested system solution for early forest fire detection. GSM modems were employed in all previous study efforts to notify the forest department of the forest’s danger situation. The ZigBee module is utilised in this system to perform serial communication between two nodes, allowing forest fire information to be conveniently relayed. The suggested system has the potential to save the lives of countless humans and animals, as well as important forest.
III. BLOCK DIAGRAM OF THE SYSTEM AND COMPONENTS

The complete system is depicted in Figure 1 as a block diagram. An Arduino Mega, a temperature sensor, and a power supply are included in this system. ZigBee module and gas sensor.

![Diagram](image)

Fig.1. Block diagram of overall system

This study describes a working model of a forest fire detection and monitoring system that can be utilized for both firefighting and fire prevention. There are three nodes that make up this system. A fire accident is detected by the temperature, humidity, and gas sensors in node1. These sensors detect fire characteristics in the forest on a continual basis and send sensor values to node 2 via the ZigBee wireless communication module. Node2 has two capabilities: broadcast and receiver. It starts by getting sensor data from node 1. Second, read sensor readings on node 2 and transfer node 1 and 2 sensor data to the main station. This node reads sensor readings, receives sensor data from node 2, and displays them on the main node's LCD.

3.1 ZigBee Module

ZigBee is a wireless network protocol designed for sensor and control networks with low transmission rates. ZigBee is a wireless communication protocol developed by a coalition of software, hardware, and service businesses.

A typical standard is wireless sensor and controller networking. Unlike other wireless standards, ZigBee is intended for devices with minimal connectivity. Low cost, good security, low battery usage, simplicity, and interoperability with other ZigBee devices are among the key motivators. This research makes use of the XCore2530 ZigBee module. Based on the CC2530F256, the XCore2530 is a ZigBee module. The XCore2530, when used with our Coordinator/Router firmware, allows for transparent UART data transmission, just like any other UART module.

Figure-2. XCore2530 ZigBee module
3.2 Arduino Mega

The Arduino Mega 2560 microcontroller board is based on the ATmega2560. It has 54 digital I/O pins (14 of which can be used as PWM outputs), 16 analogue I/O pins, 4 UARTs, a 16 MHz crystal oscillator, a USB port, a power jack, an ICSP header, and a reset button.

It comes with everything you need to get started with the microcontroller; simply plug it into a computer via USB or power it with an AC-to-DC adapter or battery. The Mega is meant to work with the majority of Arduino Duemilanove and Diecimila shields.

3.3 Temperature Sensor (LM35)

The Arduino Mega 2560 microcontroller board is based on the ATmega2560. It has 54 digital I/O pins (14 of which are PWM outputs), 16 analogue I/O pins, 4 UARTs (hardware serial ports), a 16MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

It comes with everything you need to get started with the microcontroller; simply plug it into a computer via USB or power it with an AC-to-DC adapter or battery. The Mega is compatible with the vast majority of Arduino Duemilanove and Diecimila shields. In the aftermath of a forest fire, temperature rise is a regular occurrence. A forest fire could be the blame for the temperature increase. The LM35 is used to detect the temperature. A temperature rise above normal can signal the start of a forest fire.

Temperatures between 0 and 150 degrees Celsius can be detected with the LM35.

3.4 Gas and Smoke Sensor

Temperatures between 0 and 150 degrees Celsius can be detected with the LM35.
One of the most recognizable characteristics of a fire is smoke. As a result, smoke detectors can be quite valuable in identifying forest fires. Smoke sensors come in a variety of shapes and sizes.

The smoke sensor utilized in this project is a MQ2 sensor that detects methane, butane, and LPG, depending on sensor availability and cost. Combustible and flammable gases are also detected by the detector. When a gas interacts with the MQ2 sensor, it is first ionized, then absorbed by the sensing element. This absorption results in a potential difference on the element, which is transmitted to the processing unit via the output pin as current.

IV. DEVELOPMENT OF SYSTEM

The system flow chart in Figure depicts the sequential processes and stages required to complete a certain activity in the application. To begin, the system's serial initialization is set to 38400bps. The values of Node1 reads parameters when the system first booted up (such as temperature and gas). The measurements that detect the forest's status are then relayed to Node2 starts with the character * when using the ZigBee module. Values from node 1 are verified in node 2 to see if they start with a * character. If this is the case, collect sensor values from node1.

Figure-6. System Flow Chart

If not, continually read sensor readings from node1. Node2 also reads the values of sensors. After that, starting with the $ character, the sensor values from nodes 1 and 2 are sent to the main node. Node 3 reads the sensor values from the main node and displays them on the LCD. The data from node2 is then examined to see if it starts with the letter $. Collect data from node 2 and display it on the LCD if this is the case.

V. EXPERIMENTAL TEST AND RESULT

An ARDUINO, temperature (LM35), humidity (DHT-11), and gas (MQ2) sensors, as well as a ZigBee module, are all included in this circuit. The power supply for the following circuit is a 12V battery. All of the components in this system were controlled by an Arduino Mega.

There are 54 digital I/O pins on the Arduino Mega. The LM35 is attached to the Arduino A2 pin, while the DHT-11 is connected to pin 4.

MQ2 is connected to Arduino's A0 pin.

As illustrated in Figures 9 and 10, the sensing node2 and main node are the same as the node1.
VI. CONCLUSION

Using Zigbee wireless communication technology, the system detects and monitors fires. In locations where there is no wired infrastructure, wireless communication provides a low-cost and straightforward approach to provide network connectivity. In this concept, Zigbee enables low power consumption and simple wireless communication to communicate fire parameter values for maximum coverage area. This system is very compatible with any system due to the flexibility of wireless technologies. In the long run, this approach will benefit the planet and save human lives. As we can see, fire accidents are becoming more common, resulting in loss of life and property. To lessen the damage, various systems are utilized, which assist in detecting fires and gas leaks and taking appropriate action to mitigate the harm. As a result, this technology is utilized to detect fires, transfer data to neighboring authorities, and provide the necessary information about the situation.

VII. REFERENCE


