ISSN 2278-9723
DOI:10.31838/ijccts/09.02.07

Research Article

Integrated Mobile Veld Fire Detection and Alerting System for Rural Communities

SHAIK ASIF PASHA[1], SHAIK KARIMULLA[2], PANGA KOMALVENKATSAI[3], POTINENI ANIL[4], MANGIPUDI VENU[5]

[1,2,3,4]Department Of Electronics and Communication Engineering, Student, KKR&KSR Institute of technology and sciences, Guntur, Andhra Pradesh

[5]Department Of Electronics And Communication Engineering, Assistant Professor, KKR&KSR Institute of technology and sciences, Guntur, Andhra Pradesh

Email:shaikasifpasha00000@gmail.com[1],karimullas562@gmail.com[2] ,komalventaksai2017@gmail.com[3] , anilpotineni489@gmail.com[4],nkv8593@gmail.com[5]

Received: 03.07.21, Revised: 07.08.21, Accepted: 10.09.21

ABSTRACT

Socio-economic and environmental impacts of Veld fires are acknowledged, documented and widely discussed at different forums. However, what are largely missing are solutions to reduce occurrence of Veld fires mostly in rural areas. Literature also suggests that Veld fires are to increase (more intense and long burning) with warming (hot and dry conditions – climate change). This is likely to affect rural poor households who largely depend on land-based natural resources (field crops, forests harvest, grazing land); with limited access to fire brigades, that mainly serves urban cities. With warming (drier and hotter conditions), rural areas who share boundaries with mountains, rangelands, forests and wetlands are predicted to face greater threats from Veld fires because of the dry flammable biomass in these areas. Against these drawbacks and leveraging high mobile phones ownership and network coverage in rural areas, we present an integrated mobile application for Veld fire detection and notification prototype rural households can use to identify high fire danger areas and burning fires in near real time close to their location.

Keywords: Rf Module, Fire Sensor, Gsm Module, Temperature Sensor, Mobile Phone.

I. Introduction

The objective of this project is to design and monitor system for the fire alerts in the surrounding environment. The system is designed in two categories one is transmitter section and other is receiver section. It is designed in such a way that it senses the fire in surrounding environment assisted with a fire sensor at the transmitter end and communicates with the receiver section at the other end. The signal is transmitted in a wireless manner with a 433MHz RF module. At the other end of the receiver, a RF receiver module is designed to study the system. For the design of the project, the Arduino and RF module is used. The LCD display and arduino software serial monitor display the condition of a fire alert.

II. Design Of A Monitoring System

A. Existing System

A mobile phone Veld fire identification and notification application for basic and smart phones, which can be used in rural areas with limited internet coverage and areas with strong internet coverage. Therefore by leveraging ICT most Veld fires can be identified regardless of their location anytime in their early burning stages for notification to Veld firefighting stakeholders closer to the fire. Also area specific risk level of high fire danger index can be identified and shared with residents of that area on daily basis for awareness purposes. Fire spread simulation can also be shared to enhance strategic planning by fire fighters on site.

B. Proposed System

The main objective of the proposed system is to design a fire alerts in the surrounding environment. At present they are using this in rural areas with limited internet coverage and areas with strong internet coverage. This will inaccurate if there is no strong internet coverage. In order to overcome this problem, the proposed work uses RF module at both transmitting and receiver ends and data is transmitted through wireless medium with the help of antennas.

III. Hardware Components

A. Arduino Board

The Arduino which is an open-source platform has become well acquainted with people into electronics. Unlike most previous programmable circuit board the

Arduino doesn't have a separate part of hardware to load new code on to the board. We can use a USB cable to upload the new code and the Arduino also uses a version of C++ which is easier to program.
The Arduino Board has two parts:

B. Hardware

The hardware part of the Arduino Board consists of many components. Some of the main components are explained here.

- **Arduino Nano**

Arduino Nano has a total of 36 pins. Out of these 8 are analog input pins and 14 digital input/output pins (of which 6 can be used as PWM outputs). Nano has a 16 MHz SMD crystal resonator, a mini USB-B port, an ICSP header, 3 RESET pins and, a RESET button.

Fig. 1: Arduino Nano Board

- **Power Supply**

The power supply is used to power the board. The internal power supply which is inbuilt with the board is 3.3V and 5V. The external power supply given to the board is about 9 to 12V.

- **Mini USB**

The Mini USB is smaller than the standard USB but thicker than the micro USB. The Nano board is powered through this port. And it also allows us to connect the board to the computer for programming purposes.

- **Atmega328P Microcontroller**

The Atmega328P is a high-speed and efficient 8-bit microcontroller, which is based on AVR (Audio Video Recorder) RISC (Reduced Instruction Set Computing) Architecture. It is considered to be the most popular AVR controller. It consumes less power than Atmega328 Microcontroller.

- **RST**

Use to reset the Arduino Board. If this pin is supplied with 5 V, the board will reset automatically.

- **REF**

This pin is the input/output reference. It provides the voltage reference at which the microcontroller is currently operating. Sending a signal to this pin does nothing.

- **External Interrupts (2 and 3)**

These pins can be used to trigger an external interrupt in the following conditions: a low value, a rising or falling edge, or a change in value.

C. Software (Arduino IDE)

This software provides a set of information that instructs the hardware of what to do and how to do. The Arduino IDE (Integrated Development Environment) has three parts:

- **Command area**

This is the area which contains a list of menu items used for sending and receiving data between the Arduino and IDE.

- **Text Area**

In this area, we need to write our code in the form of C++ and it is also known as a sketch.

- **Message Window Area**

This area shows message from IDE in the blank area.

D. Fire Sensor

The Flame Sensor is used to detect the presence of flame or fire. This sensor responds faster and more accurate than the smoke or heat detector. It detects by the IR ways released from the flame within 3-5 seconds. It can detect the flame or wavelength of light within 760nm to 1100nm around the distance of 80cm in an angle of 60 degrees. It is very sensitive to the flame spectrum. This system has a sensitive range of approximately about 4.3 to 4.4micro meters that cover the resonance frequency of carbon dioxide which is generated in large amount by burning of hydrocarbon materials such as wood and fossil fuels.

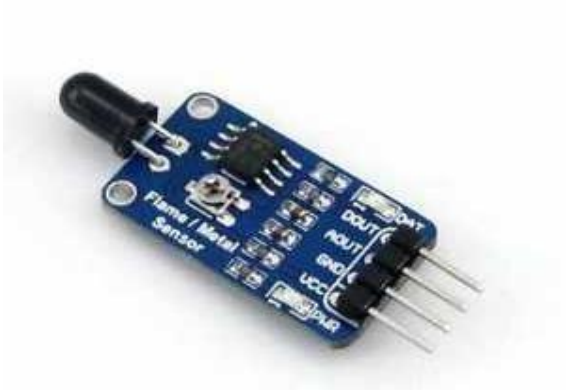

Fig. 2: Fire sensor

The IR flame detectors detect the hot Carbon Dioxide gases from fires produce a peak in total radiation, also a specific spectral pattern in the infrared range.

E. Temperature Sensors

LM35 is an analog, linear temperature sensor whose output voltage varies linearly with change in temperature. LM35 is three terminal linear temperature sensor from National semiconductors. It can measure temperature from-55 degree Celsius to +150 degree Celsius. The voltage output of the LM35 increases 10mV per degree Celsius rise in temperature. LM35 can be operated from a 5V supply and the stand by current is less than 60uA. The pin out of LM35 is shown in the figure below.

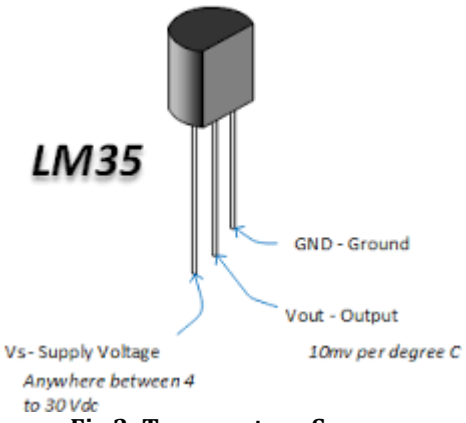

Fig.3: Temperature Sensor

F. LCD

The Liquid crystal display (LCD) used here is 16*2 line LCD display which contains 2 horizontal lines and for compressing the space of 16 display characters. It uses the property of light monitoring. They don't emit the light directly. The LCD is a flat panel or electronic visual display. It consists of low information, contents of the LCD are obtained in the fixed image or arbitrary image which can be displayed or hidden like present words, digits or seven segment display. Arbitrary images are made up of many small pixels and the element has larger elements.

Fig. 4: Liquid Crystal Display

The LCD contains two registers in inbuilt they are:

- **Command Register**

It is used to insert a special command which is a set of data in the LCD. It gives the internal command to the LCD like clear screen, setting the cursor and etc.

- Data Register

This register is used to enter the line in LCD.

G. RF Module

The Radio Frequency Module is a small electronic device to transmit/receive radio signals between two devices. It is used to communicate wirelessly with another device. This is accomplished through radio frequency communication. Many applications use RF since it doesn't require line of sight. This module contains a transmitter and a receiver of various types and ranges. It is used in the difficulty of designing radio circuit. The RF communication circuit means careful monitoring to ensure that it is not affected. This module very small in dimension and it operates in a voltage range of about 3-12v. The RF module used here is 433MHz in both transmitter and receiver part. Transmitter and Receiver are interfaced to Arduino for data transfer.

I. Transmitter

The RF transmitter receives the data from the microcontroller and it transmits wirelessly through RF through its antenna is connected in pin 4. Here the transmission occurs at the rate of 1-10kbps.

Fig. 5: RF Transmitter

This transmitter module is a small size Printed Circuit Board (PCB) which is used to transfer radio way to carry the data.

II. Receiver

The RF receiver receives the data from transmitter wirelessly. There are two types of RF receiver module they are a super regenerative receiver and super heterodyne. Super regenerative modules have low power designs and low cost. These modules are generally inaccurate because the operation of frequency is significant with power supply voltage and temperature. The super heterodyne receiver has high performance than a super regenerative receiver. They have increased stability over large temperature and voltage range.

Fig. 6: RF receiver

The RF module is used with a pair of encoder and decoder. The encoder is used for encoding the parallel data for transmission. Reception is decoded by the decoder. Some of the commonly used encoder and decoder pairs are HT12E-HT12D, HT640-HT648 etc.., In this system, digital data is represented in the form of variations in amplitude of carrier wave. This kind of modulation is called Amplitude Shift Keying.

H. GSM Module

A GSM modem or GSM module is a hardware device that uses GSM mobile telephone technology to provide a data link to a remote network. From the view of the mobile phone network, they are essentially identical to an ordinary mobile phone, including the need for a SIM to identify themselves to the network.

Fig.7: GSM Module

IV. Working

In this project we are going to demonstrate the how to alert the person during veld fires. In this we will alert a person during veld fires through SMS on the phone as well as on the LCD screen. In this project we are using RF transmitter and receiver as a transceiver to transmit and receive the signal whether it is analog or digital signal and we use a one power supply circuit to supply dc voltage to receiver side of the system. In this power supply circuit we use a rectifier which converts AC to DC which is given to the receiver side of the system. For demonstration purpose we give high temperature as 500c, when the fire sensor catches the fire then this system send message to user as fire is detected at your veld and when this 74 RF Transmitter Fire Sensor Temperature Sensor Ardunio Nano 1 temperature is cross above 500c temperature then this system will send SMS as High temperature is detected at your veld. For sending the SMS we use GSM module which as maximum range of 35 kilometers for the station. This is the overall procedure of this system.

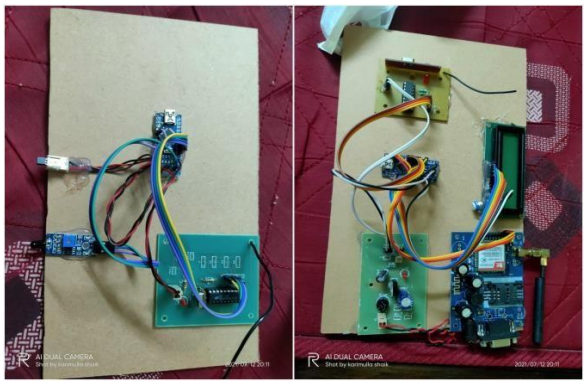

Fig.8: Hardware Equipment (RF TX And RF RX)

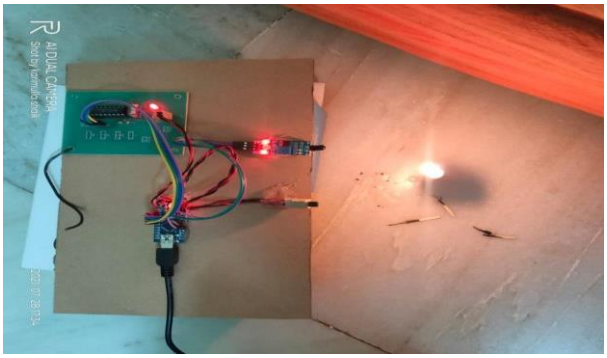

Fig.9: Fire with far distance to sensor

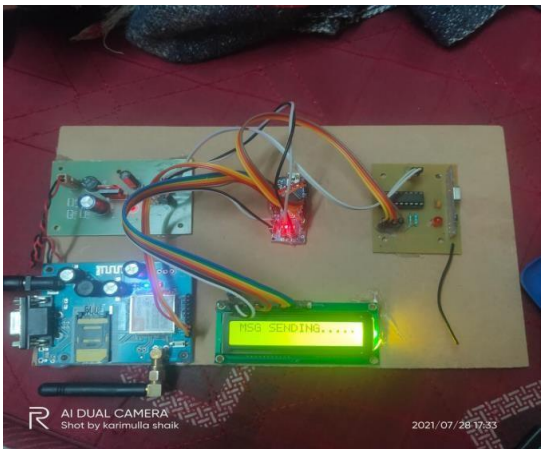

Fig.10. Sending message form GSM to Phone

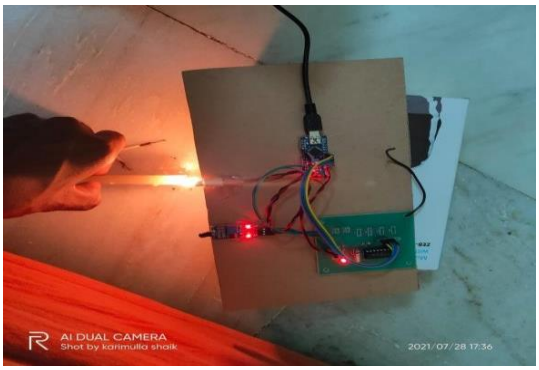

Fig.11: Fire too close to sensor (High Alert)

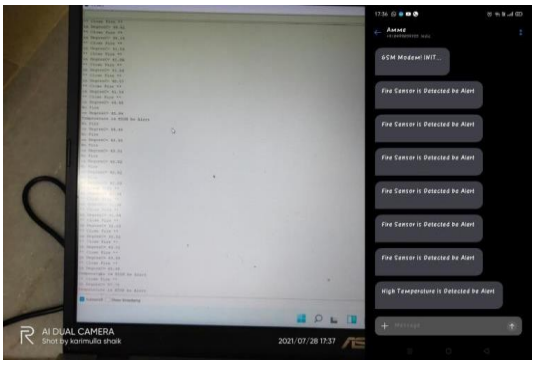

Fig.12: Message Received From GSM To Phone

V. Conclusion

This project is a simple system which presents a low cost and low power. This system has a high application in large industries, houses for safety measures. In future, we can add the water sprinkles to this system to stop the fires.

References

1. Casey CG (2008) A White Paper Report for the Fire Protection Research Foundation. Next 25 Years Conference, Washington, USA.
2. Losso A., Corgnati L., Perona G., “Early Forest Fire Detection: Smoke Identification through innovative Image Processing using Commercial Sensors”, Environment Including Global Change, Palermo, Italy.
3. Kelha V., Rauste Y., Buongiorno A., “Forest Fire Detection by Satellites for Fire Control”, European Space Agency, Finland.
4. Abhilash Dhumatkar, SumitBhiogade, ShashankRajpal, Datta Renge, Prof. V. Kale, "Automatic Fire Fighting Robot", International Journal of Recent Research in mathematics-computer Science and Information Technology.