

Forest Fire Detection System using GSM Module

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Abstract - Fire security is a significant part of everyday life. Security measures are taken at organization, businesses, and family unit levels. But forest fires cannot be ignored. Forests are important for human survival and social development. Forests protect earth's ecological balance. This paper presents a less cost automated fire security system for forest purpose using GSM technique for fire detection in the initial phase. This fire detection system consists of a smoke sensor MQ-4 and temperature sensor LM-35. Additionally, buzzer, LCD display and GSM module is interfaced with Arduino board.

Key Words: Temperature sensor, Smoke sensor, GSM module, Arduino UNO, WSN

1. INTRODUCTION

Fire is a natural phenomenon that causes damage to lives and property. There are many techniques that have been used in the past to detect the indications of occurrence of forest fire[1] like variation in temperature, humidity, smoke concentration etc. The system discussed here is based on just two indicators, change in temperature and smoke concentration of the region. Therefore, the system is low cost but beneficial for fire detection purpose in the initial phase[2], before the fire covers a large area and destroys the flora and fauna of the forest area. Arduino-UNO[3] development kit is used to interface the two sensors, LM-35[4] and MQ-4[5].

The figure shown below represents the block diagram of the fire detection system:

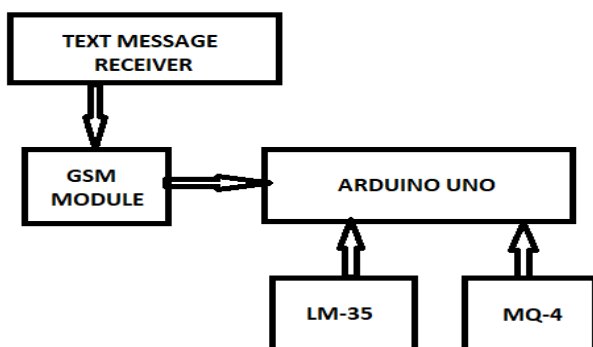


Fig. 1. Block diagram of fire detection system

Arduino UNO[2] comes as board fitted with ATmega328 microcontroller. It comprises of 20 propelled data/yield pins, out of which 6 can be used as PWM yields and 6 can be used as straightforward information sources. Furthermore, the board comprises of a 16 MHz resonator, a USB affiliation, a power jack, an in-circuit system programming (ICSP) header and a reset button. It is simply connected with a PC with the help of USB connection and projects can be stacked on to it utilizing Arduino IDE.

LM35[3] is a temperature estimating gadget having a simple yield voltage corresponding to the temperature. It gives yield voltage in Centigrade (Celsius). It doesn't require any outside alignment hardware. The affectability of LM35 is 10 mV/degree Celsius. LM35 gadget draws just 60 µA from the gracefully, The LM35 gadget is evaluated to work over a -55°C to 150°C temperature run.

MQ-4[4] gas sensor has high affectability to Methane, additionally to Propane and Butane. The sensor could be utilized to recognize distinctive burnable gases, particularly Methane. It is with minimal effort and long life, reasonable for various applications like household gas spillage locator, mechanical Combustible gas finder, compact gas indicator and so forth.

Certain other components like buzzer, G.S.M module, LCD display are also used. Buzzer will ring when the threshold values are exceeded so that people in the neighboring area are informed about the impending danger, emergency response centers become active and analysts at the base station start recording the temperature changes and variations in smoke concentration. G.S.M module is needed for communication with the base station using serial communication standard. Temperature readings are displayed on the LCD display which are later transmitted to the receiver mobile phone using GSM[6] when the threshold value of 55 degree centigrade is crossed.

2. Working of the forest fire detection system

For developing this forest fire detection system[7] only a few components are needed, namely, MQ-4 smoke sensor, LM-35 temperature sensor, Arduino UNO development board, GSM module.

The system architecture is given below:

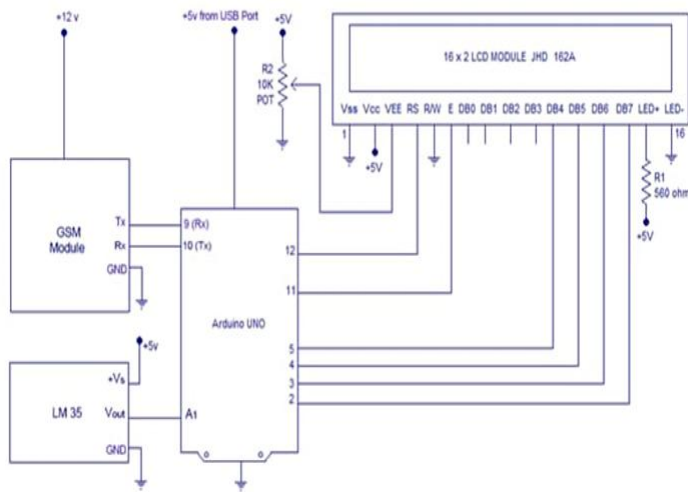


Fig. 2. Circuit diagram of GSM based fire detection system using Arduino UNO

The woodland fire recognition module works in three distinct stages. The principal stage comprises of perusing outside ecological boundaries for example temperature and smoke focus utilizing temperature sensor LM-35 and smoke sensor MQ-4. The sensors read boundaries like temperature and air quality and transmit this data to the following closest hub. This procedure goes on until the data arrives at the last node(multi-bounce transmission). This is the second phase of the general procedure. The third stage comprises of transmission of the data to the woodland fire observing unit or base station where the sensor readings are contrasted and the pre-characterized edge esteems to see if there is fire or no fire[8].

The figure shown below demonstrate the work flow of the fire detection system:

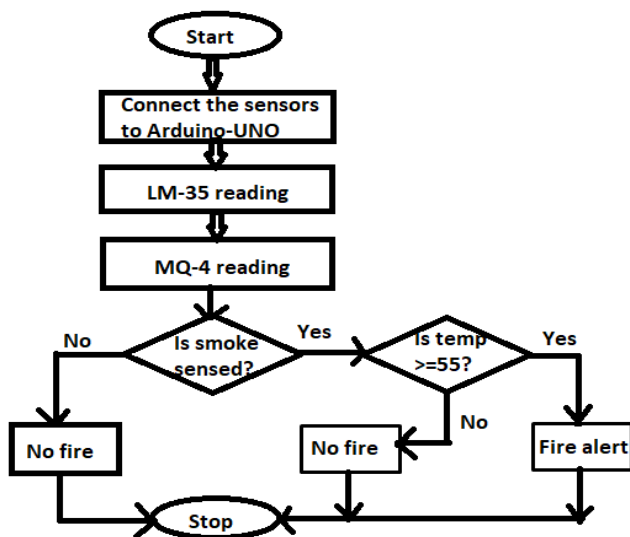


Fig. 3. Flow diagram of the fire detection system

Two sensors, temperature sensor LM35 and smoke sensor MQ4 are interfaced with Arduino UNO. The sensors pass on the readings to the Arduino board that has Atmega16 microcontroller, which will compare the readings with the threshold values. When the threshold limits[9] are exceeded, information goes to the receiver on mobile phone through GSM module. Then, the necessary actions to avoid spreading of fire are initiated.

3. Results

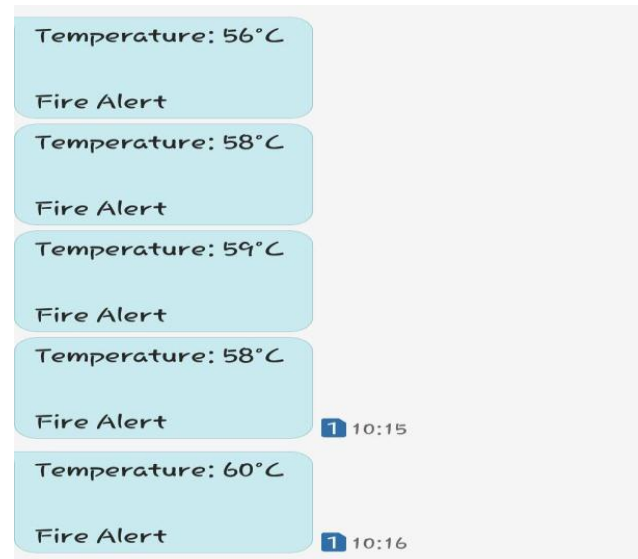


Fig. 4. The figure above represents that “fire alert” message is generated when the temperature exceeds 55 degree centigrade mark.

4. Conclusion

Using this GSM based forest fire detection and prevention system, temperature and smoke concentration of the forest area under surveillance can be easily obtained. The system is low cost, simple and efficient since it involves less components; algorithm used can be easily implemented and the sensors regularly keep providing the readings for monitoring purpose.. One of the fundamental points of interest of this framework is its adaptability. There is scope of connecting a few more sensors for more accurate fire detection.

References

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