

DESIGN AND SIMULATION OF PROPOSED FIRE ACCIDENT DETECTION SYSTEM

Ritesh Kumar Ojha*

Gaurav Sharma**

ABSTRACT

We all know that the occurrence of natural disasters is unpredictable. This paper focuses on fire detection in forests, industries and houses anywhere and to reduce its severities. The fire-detection system plays a pivotal role in green buildings. By detecting a fire quickly and accurately and providing early warning notification, a fire-detection system can limit the emission of toxic products created by combustion, as well as global-warming gases produced by the fire itself and protects us from damage. This instrument is used to detect fire accidents which occur due to increase in temperature, decrease in humidity, release of hazardous gas like methane, butane, propane etc. We have used DHT11 sensor to detect temperature and humidity, MQ-2 sensor for the detection of gas leakage and GSM module is used as a mode of communication for this method.

Keywords: Arduino Uno, Gas Sensor, Humidity Sensor, MQ-2, Temperature.

INTRODUCTION

This system is designed to prevent fire accidents which may cause loss of property, human life and production of global warming gases. The proposed system measures and records the parameters like temperature, humidity, and gas levels using appropriate sensors like DHT11 and MQ2 without any human intervention. The data is collected by ARDUINO and displayed on the liquid crystal display continuously. We used ARDUINO UNO development board because of its simple programming, low cost, less power consumption, memory, on chip ADC, on chip PWM, In System Programming (ISP). The communication between Arduino and PC is done through serial communication using serial communication port of the computer. In this system. We have used GSM module for remote monitoring and sensing purpose due to which we can attain maximum automation of system. The MQ2 gas sensor is used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide.

*Ritesh Ojha is Assistant Professor in Department of ECE, Mewar University, Chittorgarh, Rajasthan. His area of interest is Embedded Systems. Email: riteshojha3@gmail.com.

**Gaurav Sharma is Assistant Professor in Department of ECE, Mewar University, Chittorgarh, Rajasthan. His area of interest is Microcontroller, IoT based system design. Email: hodece@mewaruniversity.co.in.

This sensor is popularly known due to its low cost and efficient performance. A cycle of temperature and gas variant values are observed in Real time by which we can send the alert depending upon those values. Usama(2014) proposed GSM based temperature and water level monitoring system to detect the water level and temperature in the industries using PIC microcontroller. This paper represents the temperature level of water in particular tank. The message of temperature level in water is sent to mobile phones using GSM modem. Madan(2015) proposed a system for remote monitoring and control based on GSM and Bluetooth technology and used efficiently to monitor and control the field parameters required for automatic irrigation. Gouda(2014) proposed a real time weather monitoring and controlling system. Pressure sensor and humidity sensor are used as main components to display the values and send the message using GSM module. LM 35 and DHT11 sensors are used to detect temperature and humidity. This is limited to small area and it is not an alerting system. We have developed an alerting system using GSM Module. LM35 which is unnecessary is removed as temperature and humidity can be measured using DHT11 and a gas sensor is included. All the data is collected by the microcontroller and displayed on LCD continuously and whenever there is change in pre-set values, alert message will be sent to the given mobile numbers in the codes. Whenever gas is detected. exhaust fan gets ON. Alert using GSM is implemented by maintaining certain mobile numbers using AT commands. This activates the network in between the GSM module and Prototype. Whenever the message is sent, it again checks for Fire Shutdown and sends safe message.

BLOCK DIAGRAM

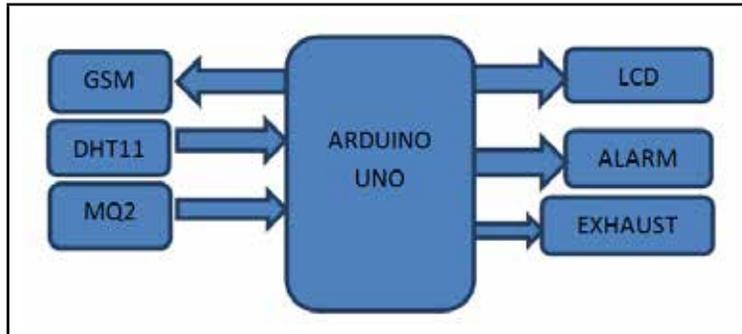


Fig.1: Block Diagram

DHT 11 SENSOR

It is used for sensing temperature and humidity. It consists of a thermistor and a capacitive humidity sensor which is used to measure the humidity of surrounding air.

FEATURES

- It is easily available in the market at low cost.
- It requires 3-5 Volts and I/O.
- It consumes maximum 2.5mA current.
- It is good at 20-80% Humidity with error of 5%.

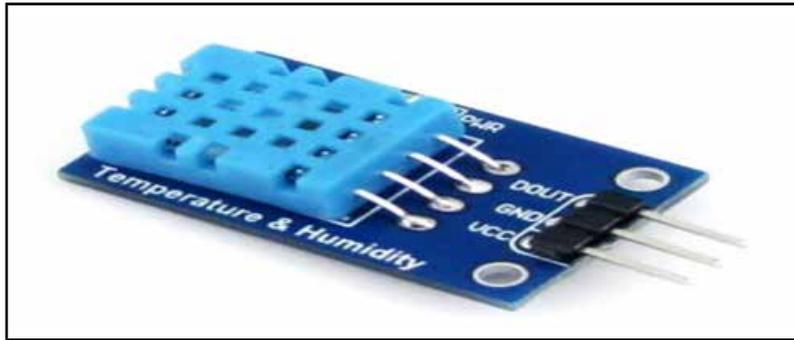


Fig.2: DHT11 Sensor

MQ-2 SENSORS

It consists of a small heater inside along with an electro-chemical sensor. It produces an analogue output signal. This sensor is widely used in home and industries for detecting the leakages of various gases like LPG, butane, propane, methane, alcohol, hydrogen and smoke with great accuracy.

ARDUINO UNO

The ARDUINO UNO board has a microcontroller ATMEGA 328 P-PU. This microcontroller has 14 digital I/O pins, out of which six pins can be used for PWM. It consists of 16 MHz crystal oscillator on-board. It uses serial communication. It can function with both USB cable and +12 V DC power supply. Arduino is reliable and low cost. ARDUINO IDE is open source software which can be used to program the microcontroller. It has On-Chip ADC. I2C Communication support built in RX and TX pins which are used for communication purpose. The word length of ATMEGA328 P microcontroller is 8-Bit which is used in Arduino for programming. ATMEGA328 P microcontroller has RISC Architecture which has 20 MIPS Throughput at 20 MHz Frequency. It consists of high end non-volatile Segmented Memory in System Flash Memory. It provides us programming lock for Software Security. It consists of two 8 bit Timer/Counter with separate pre-scalar compare mode and 16 bit Timer/counter with capture mode. It also consists of 6 and 8 channel temperature measurement unit. It consists of On-Chip Brown out Reset, Interrupts and Wake Up on Pin change. It has internal calibrated oscillator with six sleep modes like: Idle, Power Down, ADC Noise reduction, Power saver mode and both Standby mode and Extended Standby modes. It requires very less power as compared to 8051 and PIC Microcontroller of 1.8 to 5.5V which is nearly equal to 25 degrees centigrade.

SYSTEM SOFTWARE

We have used ARDUINO IDE for programming and PROTEUS professional 8.11 for simulating the proposed system. The PROTEUS 8.11 design suite is unique software which has the ability to simulate any kind of microcontrollers either high end or low end using the concept of mixed mode SPICE simulation. This is a virtual system which yields better design cycle of the designed system and helps in reducing the time to design and complex developing environment.

PROPOSED CIRCUIT SIMULATION

Circuit Diagram of Proposed Fire Accident Detection System is shown in Figure 3.

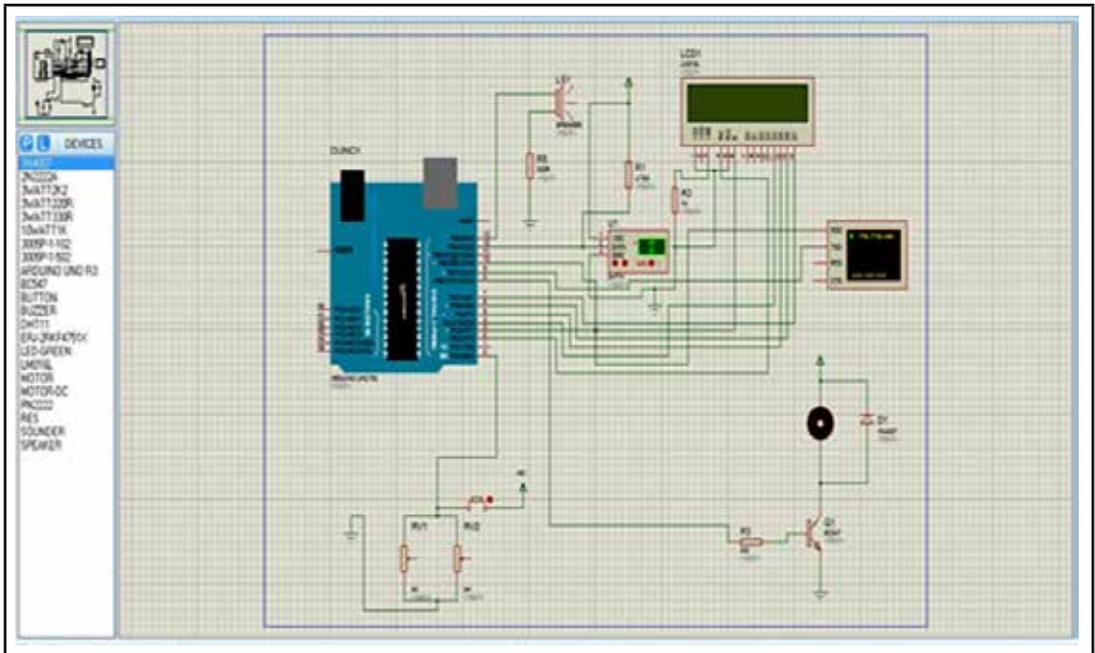


Fig.3: Circuit Design in Proteus

Proteus simulation checks for the temperature and gas leakage is shown in Figure 4.

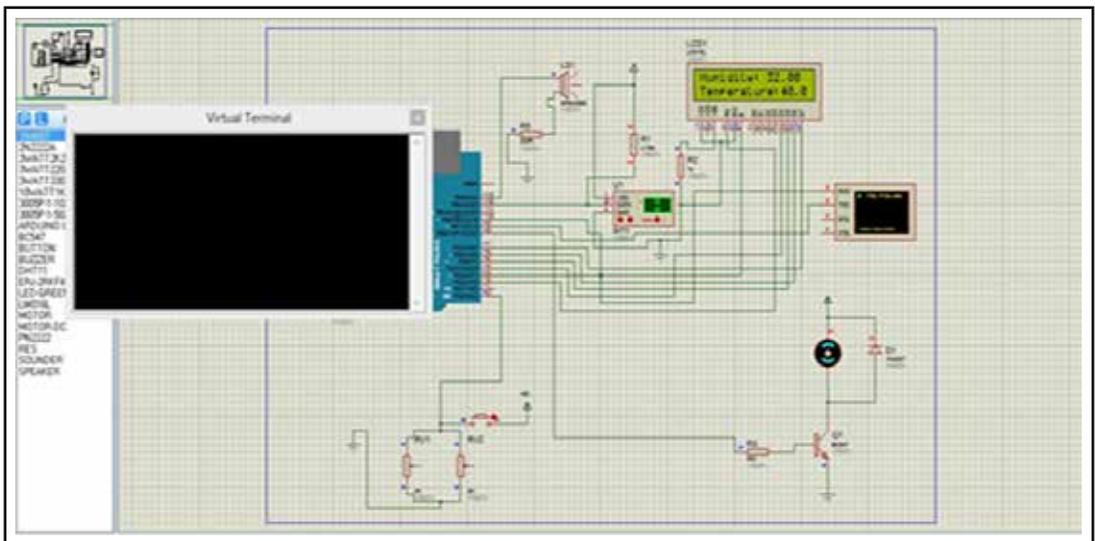


Fig.4: Before Fire Accident and Gas Leakage

Fire accident detection is observed and message is sent through virtual as shown in Figure 5.

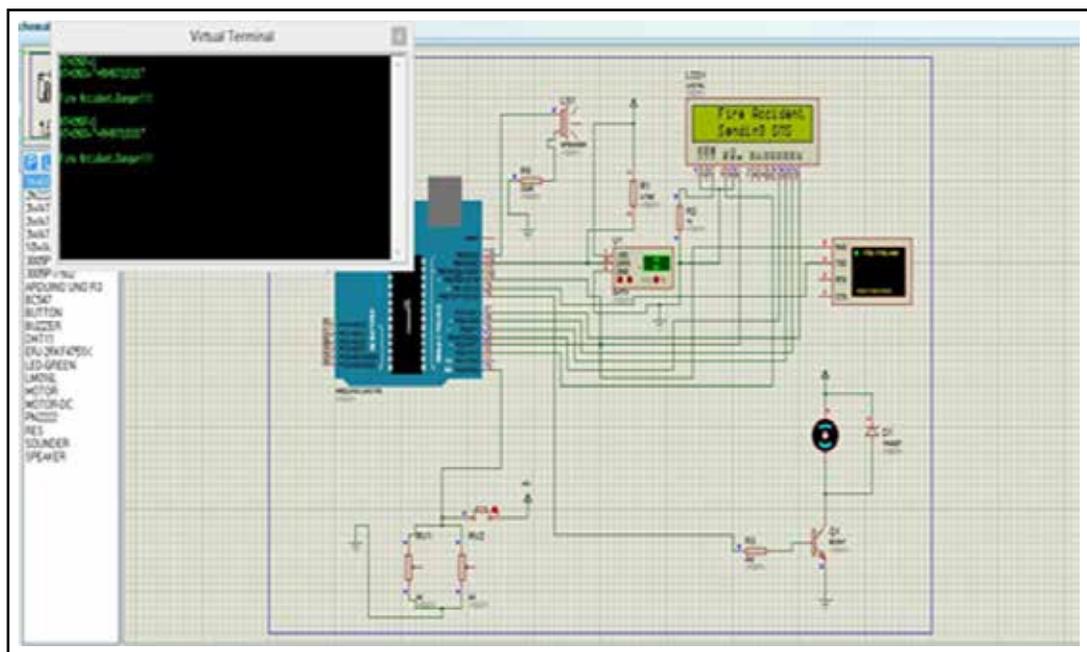


Fig.5: Fire Accident Detection with SMS

CONCLUSION

ARDUINO based fire accident detection system was designed implemented and tested. The system comprises of ARDUINO UNO board, temperature and humidity sensor, buzzer and GSM module. It is also cost effective and user friendly that enables monitoring and control of devices including sensors, automatic security notification and real time weather status display. The number of sensors is not limited and we can extend this application using more number of sensors with the help of serial communication protocols like I2C, CAN, etc. also, these values can be monitored from anywhere in the world using IOT technology by interfacing our system to the web.

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