Minor Project 2

End-Term Report

On

IGNIS: A Fire Alarm

Submitted By:-

Name	Course	SAP	Roll No
Hardik Gupta	BCA(IOT)	500089339	R252221023
Namra Tyagi	BCA(IOT)	500091016	R252221044
Sarita Roy	BCA(IOT)	500096641	R252221100

School of Computer Science

University of Petroleum and Energy Studies

Dehradun – 248007

February – May, 2023

Acknowledgement

We would like to express our sincere gratitude to all those who have contributed to the successful completion of this *Minor Project 2*. Firstly, we would like to thank Mr. *Sandip Kumar Chaurasiya* for providing us with valuable guidance and support throughout the project. His expertise and insights have been instrumental in shaping this project. We would also like to thank our friends and family for their unwavering support and encouragement. Their constant motivation has kept me going on during all the challenging times that we faced during this project. Lastly, we would like to thank *University of Petroleum and Energy Studies* for providing us with the necessary resources and facilities to carry out this project.

Thank you once again for your invaluable contribution in the development of this Project.

Sincerely,
Hardik Gupta _____
Namra Tyagi _____
Sarita Roy _____

Mentor:

Mr. Sandip Kumar Chaurasiya

Sign: _____

Panel:

Dr. Saroj Shivagunde

Sign: _____

Table of Contents

Abstract

The aim of this project is to design and develop a fire alarm system that can detect smoke and trigger an alarm to alert the owner of a potential fire hazard. The system is equipped with a smoke sensor that can detect the presence of smoke and activate the alarm. In addition, the system is designed to send an SMS and make a call to the owner's phone number to alert them of the potential fire hazard.

The system is built using an Arduino microcontroller, a MQ2 smoke sensor, a SIM800L GSM module, a DHT11 Temperature Sensor and a buzzer. The smoke sensor is connected to the Arduino, which processes the data and activates the alarm and the GSM module. The GSM module is used to send an SMS and make a call to the owner's phone number.

The system is tested and evaluated for its effectiveness in detecting smoke and triggering the alarm and sending the SMS and call. The results show that the system is highly effective in detecting smoke and alerting the owner of a potential fire hazard.

Overall, this project provides a cost-effective and reliable solution for fire detection and prevention in homes and other buildings.

Chapter 1: Introduction

Fires can be devastating and can cause significant damage to property and even loss of life. Therefore, it is essential to have a reliable fire alarm system in place to detect and alert occupants of a potential fire hazard. In this project, we aim to design and develop a fire alarm system that can detect smoke and trigger an alarm to alert the owner of a potential fire hazard.

The system is equipped with a smoke sensor that can detect the presence of smoke and activate the alarm. In addition, the system is designed to send an SMS and make a call to the owner's phone number to alert them of the potential fire hazard. This feature ensures that the owner is notified of the potential fire hazard even if they are not present in the building.

The system is built using an Arduino microcontroller, a MQ2 smoke sensor, a SIM800L GSM module, a DHT11 Temperature Sensor and a buzzer. The smoke sensor is connected to the Arduino, which processes the data and activates the alarm and the GSM module. The GSM module is used to send an SMS and make a call to the owner's phone number.

The project aims to provide a cost-effective and reliable solution for fire detection and prevention in homes and other buildings. The system is tested and evaluated for its effectiveness in detecting smoke and triggering the alarm and sending the SMS and call. The results show that the system is highly effective in detecting smoke and alerting the owner of a potential fire hazard.

Chapter 2: Problem Statement

The problem addressed by this project is the lack of reliable and cost-effective fire alarm systems that can detect smoke and alert the owner of a potential fire hazard. Traditional fire alarm systems are often expensive and require professional installation, making them inaccessible to many homeowners and small businesses. Additionally, many existing fire alarm systems are not equipped with features such as SMS and call alerts, which can be crucial in alerting the owner of a potential fire hazard when they are not on the premises.

This project aims to address these issues by designing and developing a fire alarm system that is affordable, easy to install, and equipped with features such as smoke detection, alarm activation, and SMS and call alerts. By providing a cost-effective and reliable solution for fire detection and prevention, this project can help to reduce the risk of fire-related accidents and save lives.

Chapter 3: Objectives

1. To design and build a fire alarm system that can detect smoke and trigger an alarm.

2. To integrate the fire alarm system with a GSM module that can send SMS and make calls to the owner's phone number in case of a fire emergency.

3. To ensure that the fire alarm system is reliable and accurate in detecting smoke and triggering the alarm.

4. To make the fire alarm system easy to install and use for the owner.

5. To test the fire alarm system thoroughly to ensure that it meets safety standards and regulations.

Chapter 4: Literature

[1] We referred this paper to help us understand the interfacing between Arduino and WSN. The implementation of WSN is key for our project as it is very reliable and fast medium of data transfer.

[2] This is a similar model of the system we are creating just with a wired connection. We compared the system performance of wired and wireless devices.

Chapter 5: Methodology & Outcomes

Working:

The System activates if one of the conditions are true:

1. Smoke level has crossed the threshold value.
2. Temperature has exceeded 50 Degrees.

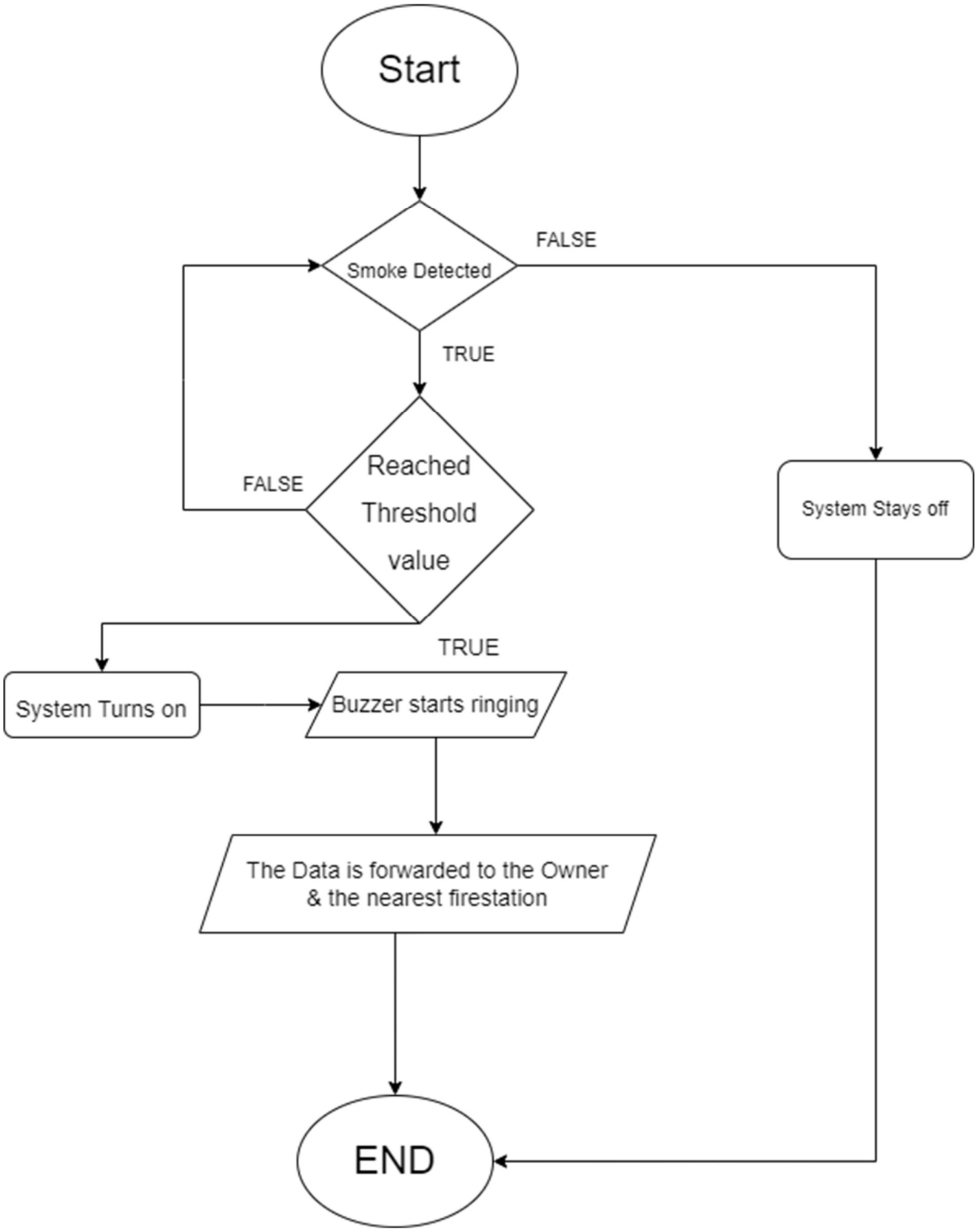
Upon activation the system sounds the buzzers and displays warning sign on the LCD display.

Within few seconds, a text is forwarded to the number mentioned in the program with a custom message followed by a call on those very numbers. This process is looped every 20s until the sensor values reach below the threshold levels.

All sensors including the LCD display run on 5v power supplied by the Arduino Uno Board.

The SIM800l GSM module requires power between 3.4v – 4.7v which cannot be supplied through the Arduino Board; therefore, we have also attached a 3.7v 1200 mAH rechargeable Lipo Battery which powers the GSM Module. The power consumption of the battery depends on how many times the system gets activated.

Flow Chart:

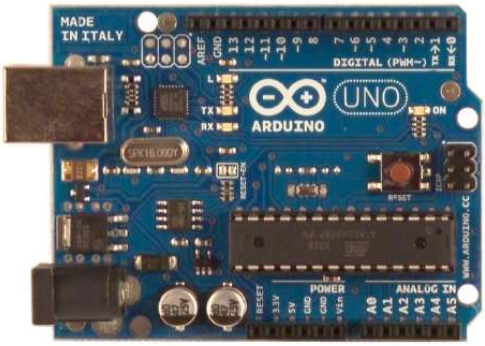

Start
Smoke Detected
FALSE
TRUE
Reached Threshold value
FALSE
System Stays off
TRUE
System Turns on
Buzzer starts ringing
The Data is forwarded to the Owner & the nearest firestation
END

Algorithm:

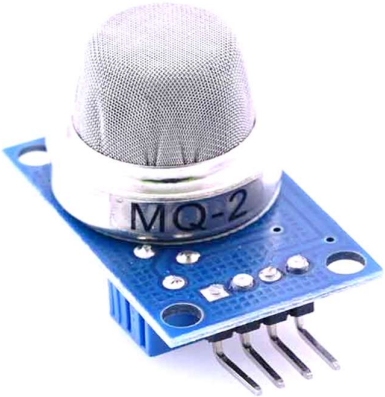
1. Set up a smoke detector that can detect smoke and trigger an alarm.
2. Connect the smoke detector to a microcontroller or a computer that can process the signal from the detector.
3. Write a program that listens for the signal from the smoke detector and triggers an alarm when smoke is detected.
4. Set up a GSM module that can send SMS and make calls.
5. Write a program that sends an SMS and makes a call to the owner's phone number when the alarm is triggered.
6. Test the system to make sure it works properly.

Components used in the Project:

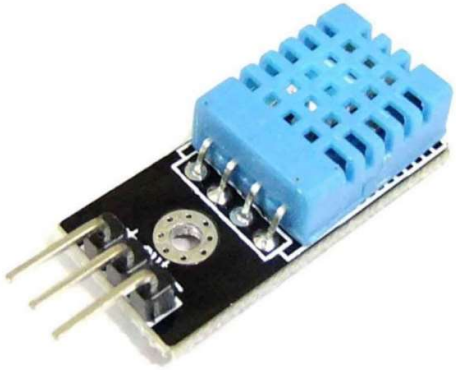
- Arduino UNO Board



- MQ2 Gas Sensor



- DHT11 Temperature Sensor



- SIM800L GSM Module

- Piezo Electric Buzzers

- 3.7v Lipo 1200 mAH battery

- 16x2 LCD Screen with I2C

- Jumper Cables

Code:

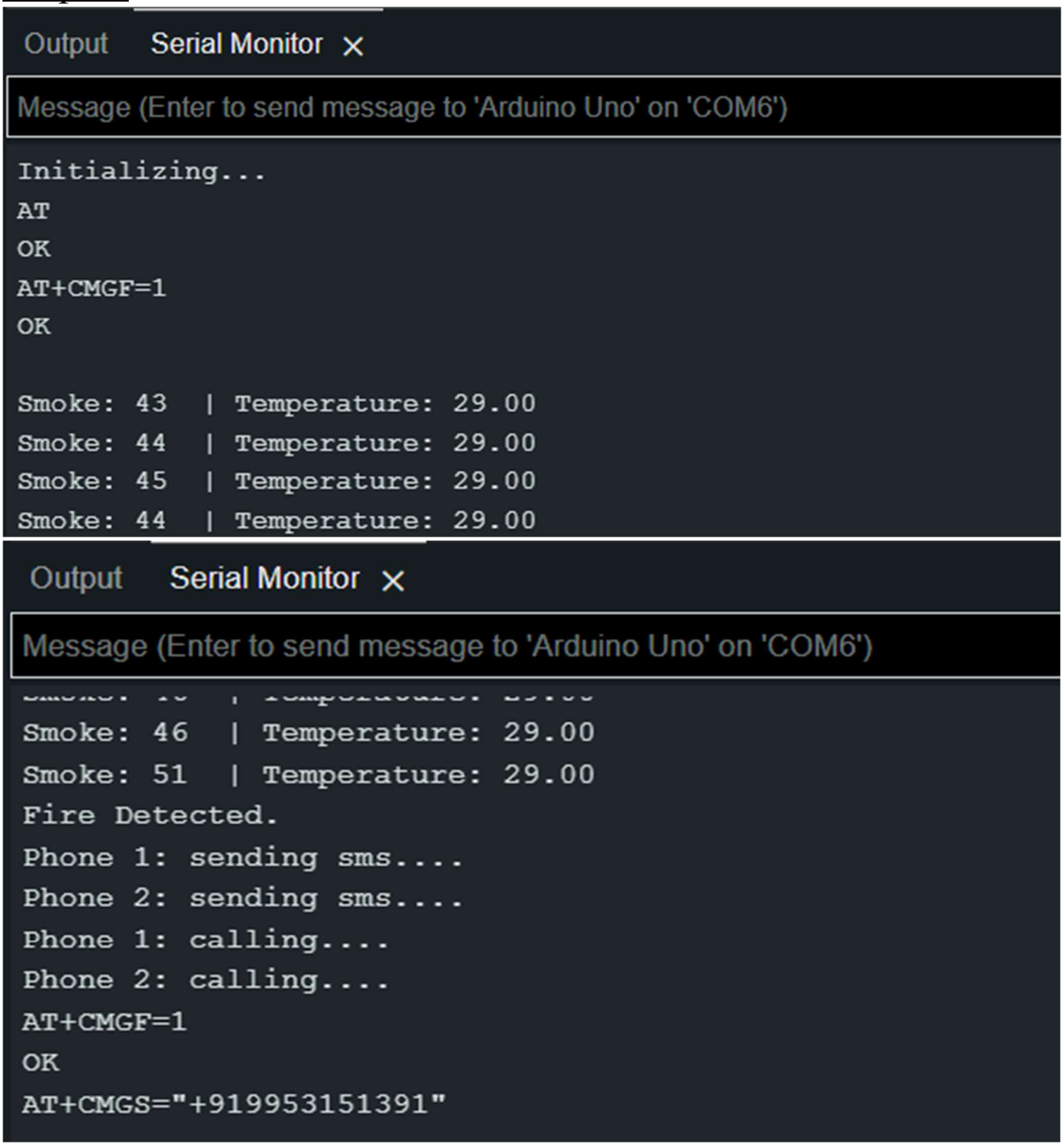
```
//Include Libraries
#include <SoftwareSerial.h>
#include <dht.h>
dht DHT;
#include <LiquidCrystal_I2C.h>


LiquidCrystal_I2C lcd(0x27 ,16,2); //Initialise LCD Display

//Alarm reciever's phone number with country code
const String PHONE_1 = "+919953151391";
const String PHONE_2 = "";
const String PHONE_3 = "";


//Set Pin Numbers
#define rxPin 2
#define txPin 3
SoftwareSerial sim800L(rxPin,txPin);


#define MQ2_pin A3
#define TempPin A2
#define buzz_pin 4


void setup()
{
  //Begin serial communication: Arduino IDE (Serial Monitor)
  Serial.begin(9600);
  //Begin serial communication: SIM800L
  sim800L.begin(9600);

  lcd.init();
  lcd.clear();
```

```
  pinMode(buzz_pin, OUTPUT);
  digitalWrite(buzz_pin,LOW);

  Serial.println("Initializing...");
  //Once the handshake test is successful, it will back to OK
  sim800L.println("AT");
  delay(1000);
  sim800L.println("AT+CMGF=1");
  delay(1000);
}

void loop()
{

  while(sim800L.available()){
  Serial.println(sim800L.readString());
  }

  int readData = DHT.read11(TempPin); //Temperature
  float temp = DHT.temperature;

  int MQval = analogRead(MQ2_pin); //Smoke
  Serial.print("Smoke: ");
  Serial.print(MQval);
  Serial.print("  | Temperature: ");
  Serial.println(temp);
  delay(1000);

  //The fire is detected, trigger Alarm and send sms
  if (temp > 50 || MQval > 50 ) //Condition
  {
    digitalWrite(buzz_pin,HIGH);

    lcd.backlight();      // Backlight is on
    lcd.setCursor(2,0);   //Set cursor to character 2 on line 0
    lcd.print("   WARNING!  ");
    lcd.setCursor(2,1);   //Move cursor to character 2 on line 1
    lcd.print("FIRE Detected");
```

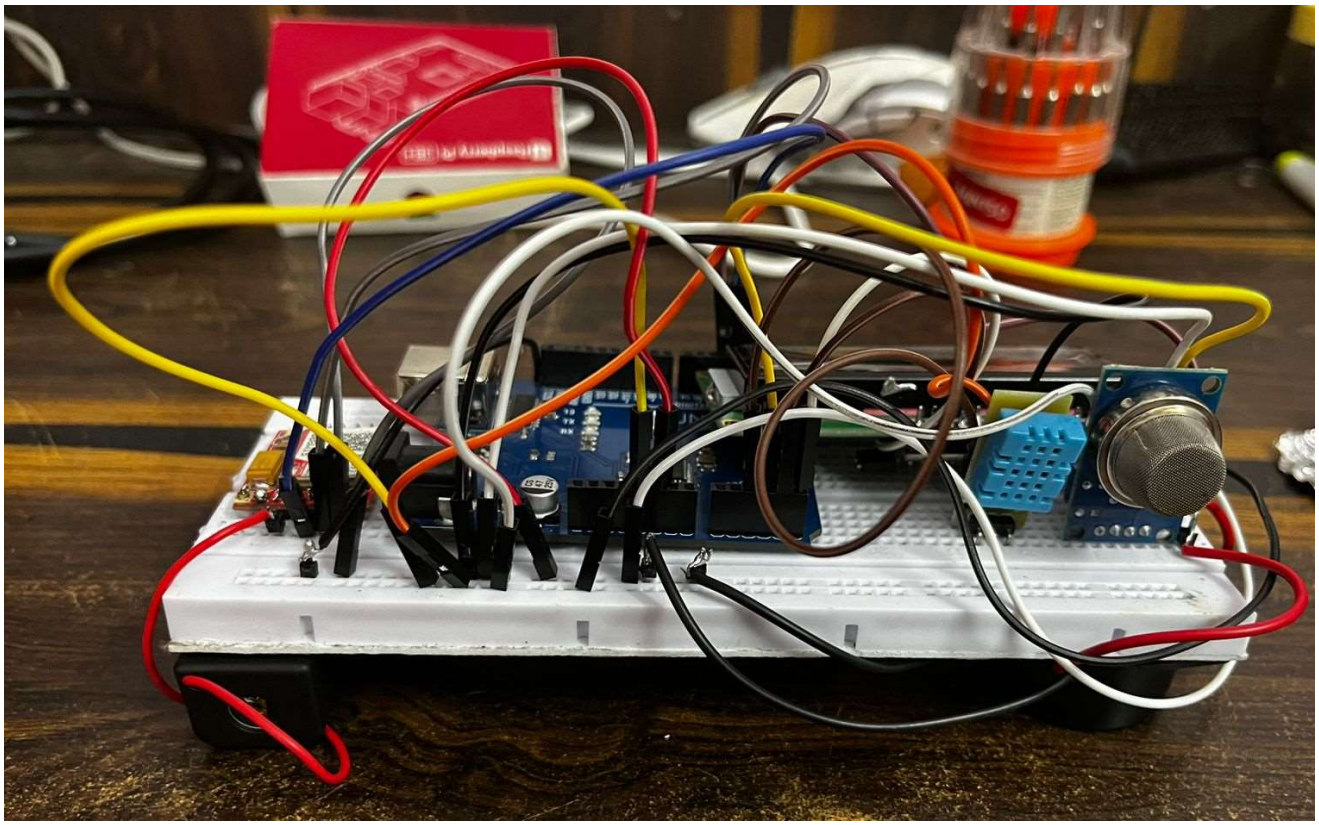
```
    Serial.println("Fire Detected.");
    send_multi_sms();
    multi_call();
  }
  //No fire is detected, turn OFF Alarm
  else
  {
    digitalWrite(buzz_pin,LOW);
    lcd.clear();
  }
}
void send_multi_sms()
{    //If Number is Declared send sms when function is called.
  if(PHONE_1 != ""){
    Serial.print("Phone 1: ");
    Send_sms("Fire is Detected at XYZ_Address", PHONE_1);
  }
  if(PHONE_2 != ""){
    Serial.print("Phone 2: ");
    Send_sms("Fire is Detected at XYZ_Address", PHONE_2);
  }
  if(PHONE_3 != ""){
    Serial.print("Phone 3: ");
    Send_sms("Fire is Detected at XYZ_Address", PHONE_3);
  }
}
void multi_call()
{    //If Number is Declared, call when function is called.
  if(PHONE_1 != ""){
    Serial.print("Phone 1: ");
    Make_call(PHONE_1);
  }
  if(PHONE_2 != ""){
    Serial.print("Phone 2: ");
    Make_call(PHONE_2);
  }
  if(PHONE_3 != ""){
    Serial.print("Phone 3: ");
    Make_call(PHONE_3);
  }
}
```

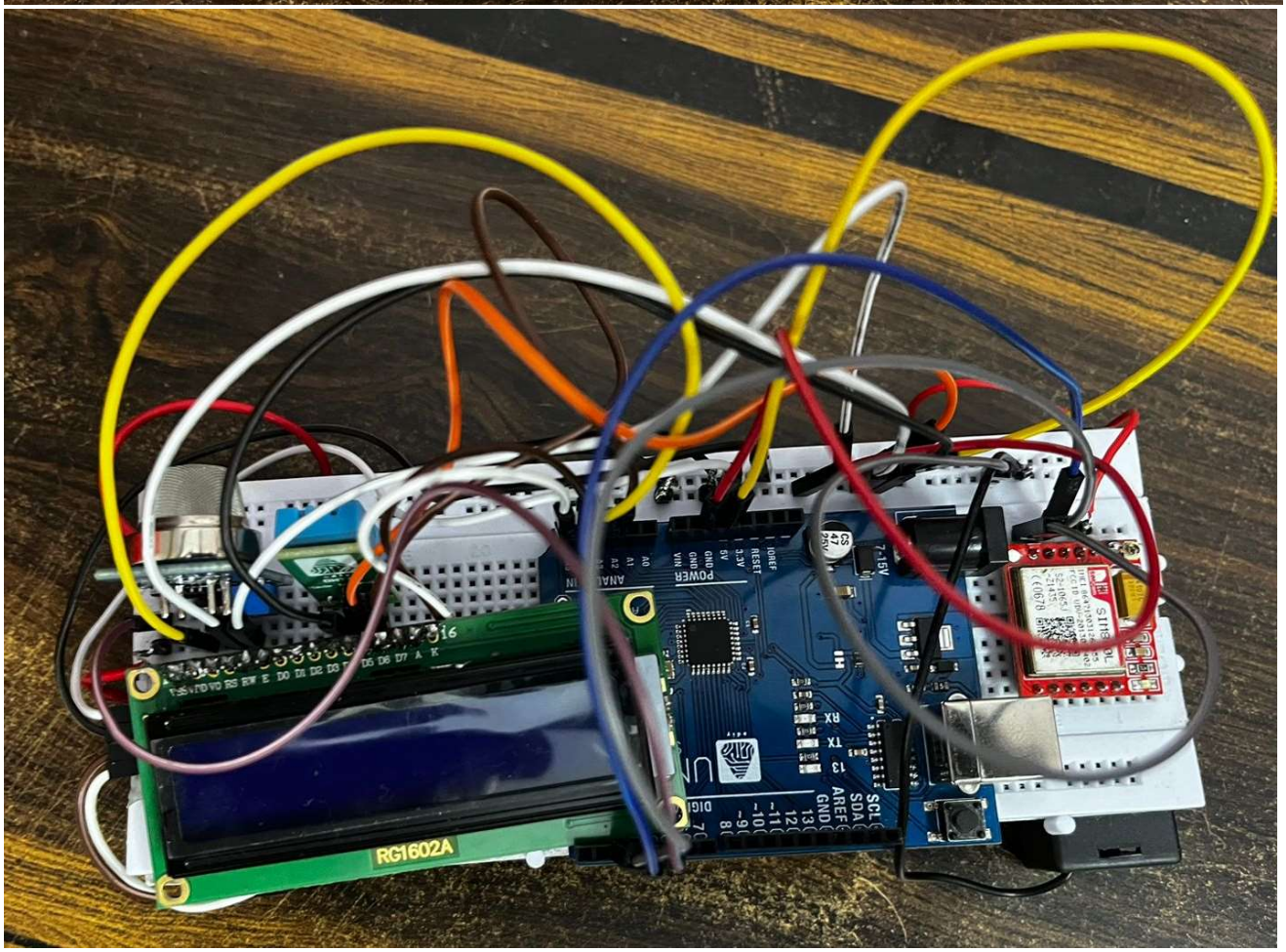
```
void Send_sms(String text, String phone)
{    //Sms function
    Serial.println("sending sms....");
    delay(50);
    sim800L.print("AT+CMGF=1\r");
    delay(1000);
    sim800L.print("AT+CMGS=\""+phone+"\"\r");
    delay(1000);
    sim800L.print(text);
    delay(100);
    sim800L.write(0x1A);
    delay(5000);
}


void Make_call(String phone)
{    //Call Function
    Serial.println("calling....");
    sim800L.println("ATD"+phone+";");
    delay(20000); //20 sec delay
    sim800L.println("ATH");
    delay(1000); //1 sec delay
}
```

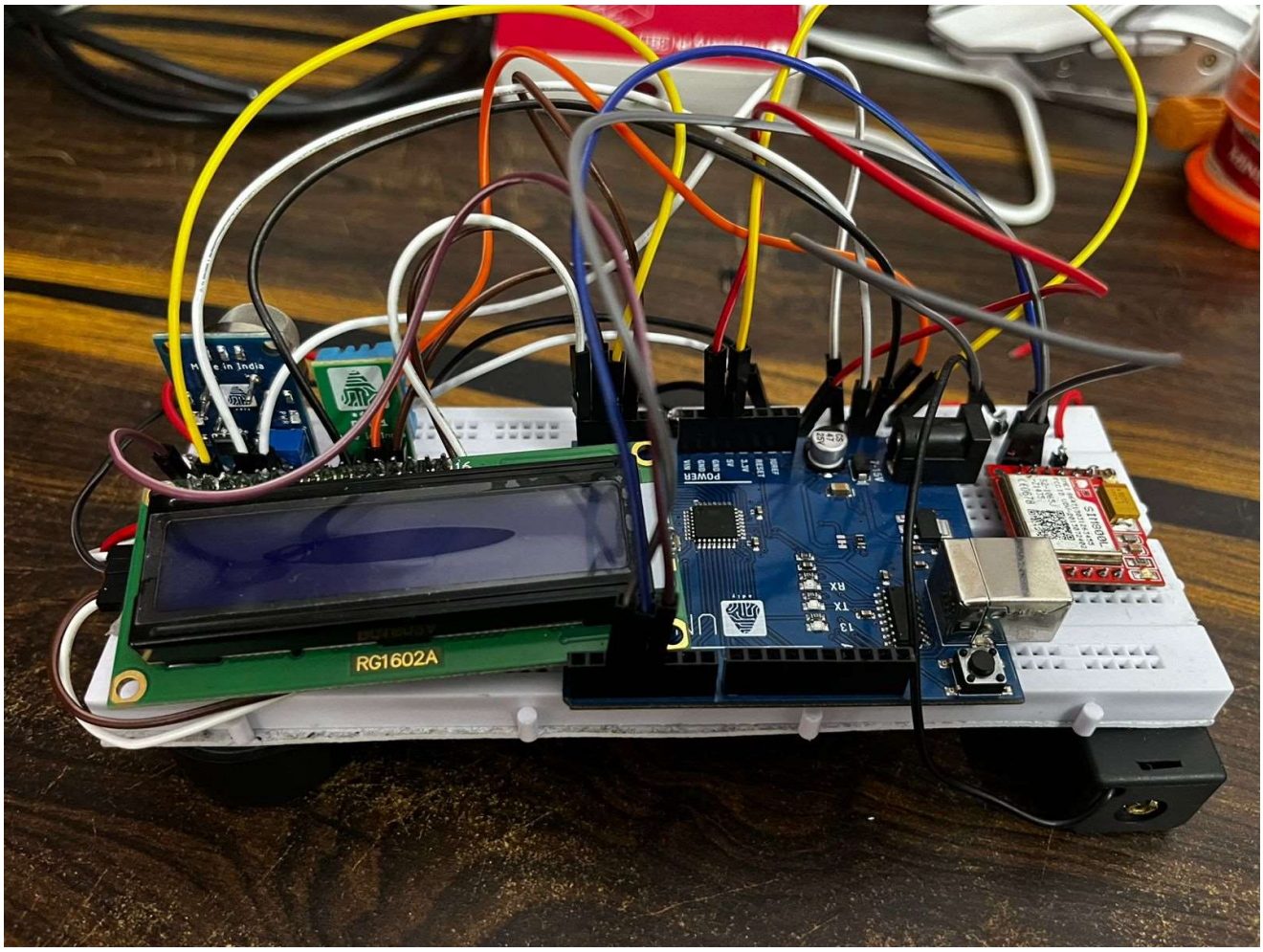
Output:


Output
Serial Monitor
Message (Enter to send message to 'Arduino Uno' on 'COM6')
Initializing...
AT
OK
AT+CMGF=1
OK
Smoke: 43 | Temperature: 29.00
Smoke: 44 | Temperature: 29.00
Smoke: 45 | Temperature: 29.00
Smoke: 44 | Temperature: 29.00
Output
Serial Monitor
Message (Enter to send message to 'Arduino Uno' on 'COM6')
Smoke: 46 | Temperature: 29.00
Smoke: 51 | Temperature: 29.00
Fire Detected.
Phone 1: sending sms....
Phone 2: sending sms....
Phone 1: calling....
Phone 2: calling....
AT+CMGF=1
OK
AT+CMGS="+919953151391"

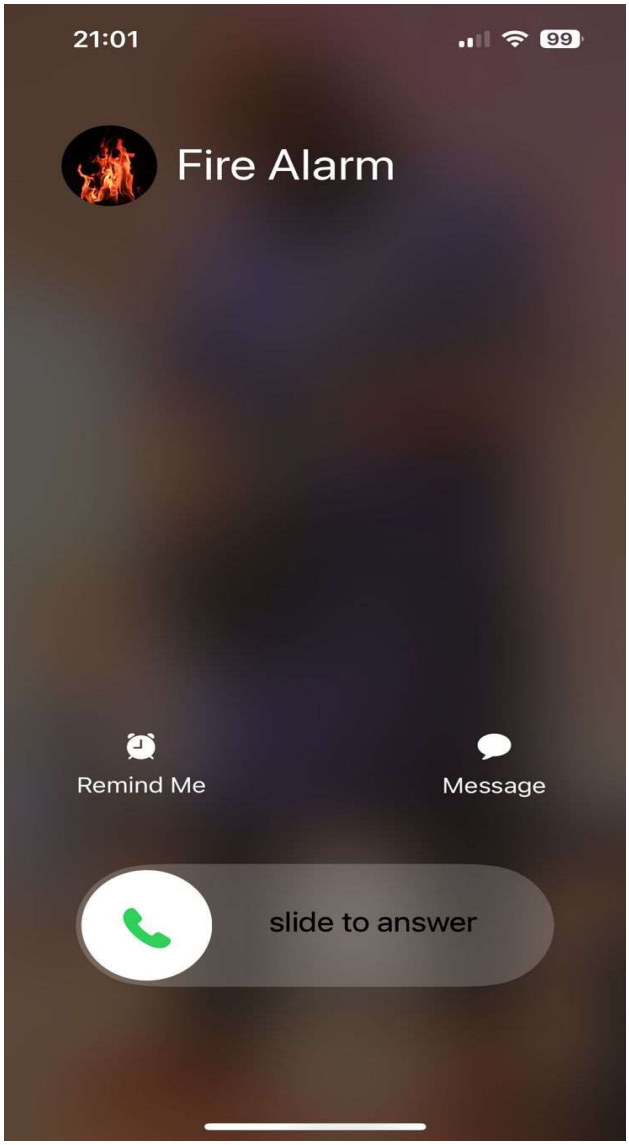
Model:






RG1602A

Screenshots:



References:

- [1] V. Pande, W. Elmannai and K. Elleithy, "Classification and detection of fire on WSN using IMB400 multimedia sensor board," 2013 IEEE Long Island Systems, Applications and Technology Conference (LISAT), Farmingdale, NY, USA, 2013, pp. 1-6, doi: 10.1109/LISAT.2013.6578247.
- [2] A. Acakpovi, D. T. Ayitey and E. N. Adjaloko, "Innovative Fire Detection and Alarm System for Sustainable City Development," 2021 International Conference on Cyber Security and Internet of Things (ICSIoT), France, 2021, pp. 30-36, doi: 10.1109/ICSIoT55070.2021.00015.
- "How to Send SMS with GSM Module" by Circuit Digest. https://circuitdigest.com/microcontroller-projects/how-to-send-sms-with-gsm-module
- "How to Make a Call with GSM Module" by Circuit Digest. https://circuitdigest.com/microcontroller-projects/how-to-make-a-call-with-gsm-module
- "How to Build a Smoke Detector Circuit" by Circuit Digest. https://circuitdigest.com/electronic-circuits/smoke-detector-circuit