VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi, Karnataka–590014

Mini-Project Report

On

"Home and Industrial Safety Using Fire and Gas Detection System"

Submitted in partial fulfillment of the requirements for the award of degree of

BACHELOR OF ENGINEERING

in

ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted by

Prashant Kumar	(1BI**20**EC**096**)
Premanshu Kumar	(1BI**20**EC**099**)
Ravi Kumar Chandra	(1BI**20**EC**111**)
Supriya Rani	(1BI**20**EC**156**)

Under the guidance of

Dr. E. Niranjan
Assistant Professor,
Dept. of ECE, BIT

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
BANGALORE INSTITUTE OF TECHNOLOGY
K.R. Road, BANGALORE – 560004

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BANGALORE INSTITUTE OF TECHNOLOGY

K.R. Road, V. V Puram, Bangalore-560004
www.bit-bangalore.edu.in

Department of Electronics and Communication Engineering

CERTIFICATE

Certified that the mini-project work entitled **Home and Industrial Safety Using Fire and Gas Detection System** carried out by **Mr. Prashant Kumar** USN:1BI**20**EC**096**, **Mr. Premanshu Kumar** USN:1BI**20**EC**099**, **Mr. Ravi Kumar Chandra** USN:1BI**20**EC**111** and **Ms. Supriya Rani** USN: 1BI**20**EC**156** the bonafide students of **Bangalore Institute Of Technology** in partial fulfillment for the award of **Bachelor of Engineering** in **Electronics and Communication Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2020- 2024. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library. The Mini-project report has been approved as it satisfies the academic requirements in respect of Mini-Project work prescribed for the above said Degree.

Dr. E. Niranjan	**Dr. Hemanth A. R.**
Assistant Professor	Professor & Head
Dept. of ECE, BIT	Dept. of ECE, BIT

External Viva

Name of the examiners & Signature with date

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Prashant Kumar (1BI**20**EC**096**)
Premanshu Kumar (1BI**20**EC**099**)
Ravi Kumar Chandra (1BI**20**EC**111**)
Supriya Rani (1BI**20**EC**156**)

ABSTRACT

Fire alarm system plays an important role in maintaining and monitoring the safe of all kind environments and situations. However, the usability of many existing fire Alarm system is well known but could be produce with high cost. Subsequently, it is not affordable for the low-income users. The main objective of this project is to make a fire control system with low cost. The project has three main systems the detection system the monitoring system and the appliance system. The detection system operates as the fire detector and smoke detector. This paper discusses the design and implementation of a fire alarm system using the ARDUINO UNO R3 which operates the entire system. The detectors are placed in parallel in different levels. Any signal from each detector at any level is monitored using monitoring system. The appliance system has components like GSM for sending SMS services, buzzer for alarming, where the fire is occurred. The entire system is controlled by microcontroller. The microcontroller is programmed in such way by using C-Programming with ARDUINO IDE. From the project done, the System can detect smoke, flame etc. sensed by the detector, followed by the monitoring system which indicates smoke, flame, etc. at that particular level. Finally, when the sensors form each level triggered individually, the main Buzzer operates, send SMS. Then it shows in the control panel LCD display.

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PSO2: Soft Skills: An ability to use latest hardware and software tools in Electronics and Communication engineering.

PSO3: Successful Career: Preparing Graduates to satisfy industrial needs and pursue higher-studies with social-awareness and universal moral value.

CHAPTER 1
INTRODUCTION

CHAPTER 1

INTRODUCTION

Nowadays, securing one’s property and business against fire is becoming more and more important. Monitoring commercial and residential areas all-round is an effective method to reduce personal and property losses due to fire disaster. Home fire detection is a matter of great concern, and thus many efforts are devoted in most developed countries to the design of automatic detection systems. A fire alarm system should reliably and in a timely way notify building occupants about the presence of fire indicators, such as smoke or high temperatures. A fire detector is usually implemented as a smoke sensor due to its early fire detection capability, fast response time and relatively low cost. Other options for the fire detection are based on gas sensors or temperature sensors fire detectors that use a single sensor, generally a smoke sensor, and present high false-alarm rates due to temperature changes. In order to prevent fires from occurring or minimize their impact, accurate and early detection is essential, and automatic fire detection is becoming very essential to reduce the fire in the building and industry. Automatic fire alarm system provides real-time surveillance and monitoring. A key aspect of fire protection is to identify a developing fire emergency in a timely manner, and to alert the building's occupants and fire emergency organizations. This is the role of fire detection and alarm systems. Generally, fire detectors are designed to respond at an early stage to one more of the four major characteristics of combustion, heat, smoke, flame or gas. No single type of detector is suitable for all types of premises or fires. Heat detectors respond to the temperature rise associated with a fire and smoke detector respond to the smoke or gas generated due to fire.

1.1 Description of the project

This system is a kind of stand-alone embedded system. It is a self-contained device. It takes either digital or Analog inputs from its input ports, calibrates, converts, and processes the data and outputs the resulting data to its attached output device, which either displays data, or controls and drives the attached devices. These devices could be for example, Global System for Mobile Communication (GSM) and short message service (SMS) to carry out data from the building with sensors directly alert the owners to their mobile phone. Therefore, this makes controlling damages caused by fire easier by directly sending alert notification messages to owners or fire department using GSM technology. So, we designed a smart fire alarm model. Parameters like temperature and smoke level will be controlled by microcontroller. Each of these parameters is measured by a sensor that is set at a specific range, if this sensor signals any change in that range, the system will take the appropriate action required and the system sends a daily report to the user by SMS to their mobile phone. Therefore, this makes controlling damages caused by fire easier by directly sending alert notification messages to owners or fire department using GSM technology. So, we designed a smart fire alarm model. Parameters like, temperature and smoke level will be controlled by microcontroller. Each of these parameters is measured by a sensor that is set at a specific range, if this sensor signals any change in that range, the system will take the appropriate action required and the system sends a daily report to the user by SMS.

1.2 Statement of the problem

The most prevalent threat faced by all institutions is FIRE. No institution is immune from fire. Until the owners/trustees of these institutions develop plans for dealing with the fire threat, they place the building and its occupants and collections at risk.

The complexity of these plans may vary from a simple evacuation plan, to a fire prevention program, to a more complex plan that includes passive and automatic fire protection systems almost 90% of fire damages occur due to lack of early fire detection. A fire attack is usually silent and people will know about fire only when it has spread across a large area. SMS based Fire Alert system gives warning immediately to one or more mobile numbers and hence remedy actions can be taken quickly. This helps to prevent major damages and losses created by a fire accident.

In Ethiopia the hazard of fire and related problem is occur frequently in the urban area of the country. There for existing fire alarm system in market nowadays, is too complex in term of its design and structure. Since the system is too complex, it needs regular preventive maintenance to be carried out to make sure the system operates well. Meanwhile, when the maintenance is been done to the existing system, it could raise the cost of using the system. Therefore, the project is designed with a low cost and all level users can have one for a safety purpose.

Property damaged by floods can often be dried out and restored. Structural damage from an earthquake might be repaired. Stolen property always has a chance of being recovered. Damage from fire, however, is usually permanent and irreparable. Historical buildings or contents, once reduced to ash, can never be restored. Fire is more cunning and less discriminating than a thief. It can travel (spread) through very small openings and concealed spaces to reach other parts of a building, deprive occupants of a life supporting environment, and cause partial to total destruction of property.

1.3 Objective of the project

1.3.1 General objective

The main purpose of this project is to design and implement an automatic fire and smoke detection that can be produced at a low cost with effective and competitive usage. This System is designed to be more users friendly and easy to operate at any level.

1.3.2 Specific objective

The project is also been designed to be further working vision using minimum hardware at the lower level of processing. These systems are directed at specific applications. Our objective is to design a fire and smoke detection that would fulfill the following:

- To prevent fire and smoke
- To sound the alarm if fire and smoke detection occurs.
- To indicate the state of the room as ‘Safe’ in order to avoid any confusion under normal condition. So, the system should never be in any ambiguous state.

CHAPTER 2
LITERATURE SURVEY

CHAPTER 2

LITERATURE SURVEY

Development of Multipurpose Gas Leakage and Fire Detector with Alarm System:

- This IEEE paper is proposed by S. Nivedhitha, A.P. Padmavathy, U.S. Susaritha, M. Ganesh Madhan.
- This paper is published in the year 2013.
- This paper suggests battery-powered electronic system that detects gas leakage and smoke, providing visual LED indication, wireless relay activation, and audio alarm to prevent fire accidents.

Early Detection System for Gas Leakage and Fire in Smart Home Using Machine Learning:

- This IEEE paper is proposed by Lamine Salhi, Thomas Silverston, Taku Yamazaki, Takumi Miyoshi.
- This paper is published in the year 2019.
- This paper proposes an efficient system model that integrates gas leakage and fire detection into a low-cost, centralized M2M home network.
- By utilizing machine learning and data mining techniques, it enables early prediction of risk incidences by detecting abnormal air state changes, thereby enhancing safety and protecting property in smart houses.

IoT Based System for Monitoring and Control of Gas Leaking:

- This IEEE paper is proposed by S.Z. Yahaya, M.N. Mohd. Zailani, Z. H. Che Soh, K.A. Ahmad.
- This paper is published in the year 2020.
- This paper present an IoT based system for monitoring and controlling Liquefied Petroleum Gas (LPG), which is commonly used as cooking gas at home, in order to prevent leakage.

Development of a Smart Automatic Gas Leakage Detector and Alarming System:

- This IJEDR paper is proposed by Sayeda Islam Nahid, Navid Anjum, Nusrat Zaman Chowdhury, Laila Tamanna Anni, Md. Talat Mahmu.
- This paper is published in the year 2021.
- This paper presents a microcontroller-based cooking gas detector utilizing an MQ-6 LPG gas sensor, PIC16F690 microcontroller, LCD, buzzer, and LEDs for precise and quick gas leakage

detection. The system alerts with audio visual signals, enhancing safety in gas-related environments.

A Smart Real Time Fire and Smoke Detection System:

- This IEEE paper is proposed by Mr. Aneesh. A, Mr. Austine Cyriac, Mr. Shafeek Basheer.
- This paper is published in the year 2019.
- This system is designed to detect the fire and smoke at the early stage and notify the nearest fire station through a push notification.
- The notification contains the fire or smoke warning and the location information.
- Whenever a fire occurs, the fire sensor senses the fire at very early stage itself.

CHAPTER 3
METHODOLOGY

CHAPTER 3

METHODOLOGY

In the basic overview of our project, we use sensors (MQ-3 smoke sensor and LM35 flame sensor) for input, and GSM module, GPS module, buzzer and LCD display for output. And also, ARDUINO UNO microcontroller in side it uses for the overall decision maker of the entire system. We use ARDUINO code typically C programing language to interface the hardware and the software.

3.1 Hardware Requirements

3.1.1 Arduino UNO

Arduino comprises of both a physical programmable circuit board (commonly known as a microcontroller) and a programming software, or IDE (Integrated Development Environment) that can be run on a PC, used to compose and transfer PC code to the circuit board. It can be done by using the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Unlike other programmable circuit boards, the Arduino does not require a different equipment (called a software engineer) to upload code to the circuit board, one can essentially utilize a USB link. Also, the Arduino IDE utilizes a rearranged rendition of C++, making it simpler to figure out how to program. In a word, Arduino make the functions of the micro-controller into a more accessible package. The Uno is one of the more prevalent boards in the Arduino family and an extraordinary option for the beginners.

Common Components of Arduino Boards:

There are different types of Arduino boards for different purposes. But all the boards have the majority of following components in common.

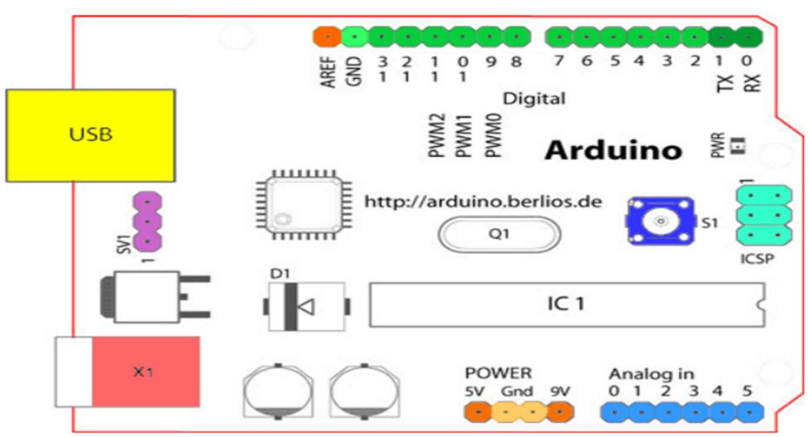

Figure 3.1: Common components of Arduino Board

Starting clockwise from the top center:

- Analog Reference pin (orange)
- Digital Ground (light green)
- Digital Pins 2-13 (green)
- Digital Pins 0-1/Serial In/Out - TX/RX (dark green) - These pins cannot be used for digital i/o (digitalRead and digitalWrite) if serial communication is also being used (e.g., Serial.begin).
- Reset Button - S1 (dark blue)
- In-circuit Serial Programmer (blue-green)
- Analog In Pins 0-5 (light blue)
- Power and Ground Pins (power: orange, grounds: light orange)
- External Power Supply In (9-12VDC) - X1 (pink)
- Toggles External Power and USB Power (place jumper on two pins closest to desired supply) - SV1 (purple)
- USB (used for uploading sketches to the board and for serial communication between the board and the computer; can be used to power the board) (yellow).

Digital Pins

The digital pins on an Arduino board can be used for general purpose input and output via the pinMode(), digitalRead(), and digitalWrite() commands. Each pin has an internal pull-up resistor which can be turned on and off using digitalWrite() (w/ a value of HIGH or LOW, respectively) when the pin is configured as an input.

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data.
- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function. On boards with an ATmega8, PWM output is available only on pins 9, 10, and 11

Analog Pins

The analog input pins support 10-bit analog-to-digital conversion (ADC) using the analogRead() function. Most of the analog inputs can also be used as digital pins: analog input 0 as digital pin 14 through analog input 5 as digital pin 19.

Power Pins

- 9V: The input voltage to the Arduino board when it’s using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). Different boards accept different input voltages ranges.

- 5V: The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- 3V3: (Diecimila-only) A 3.3volt supply generated by the on-board FTDI chip.
- GND: Ground pins

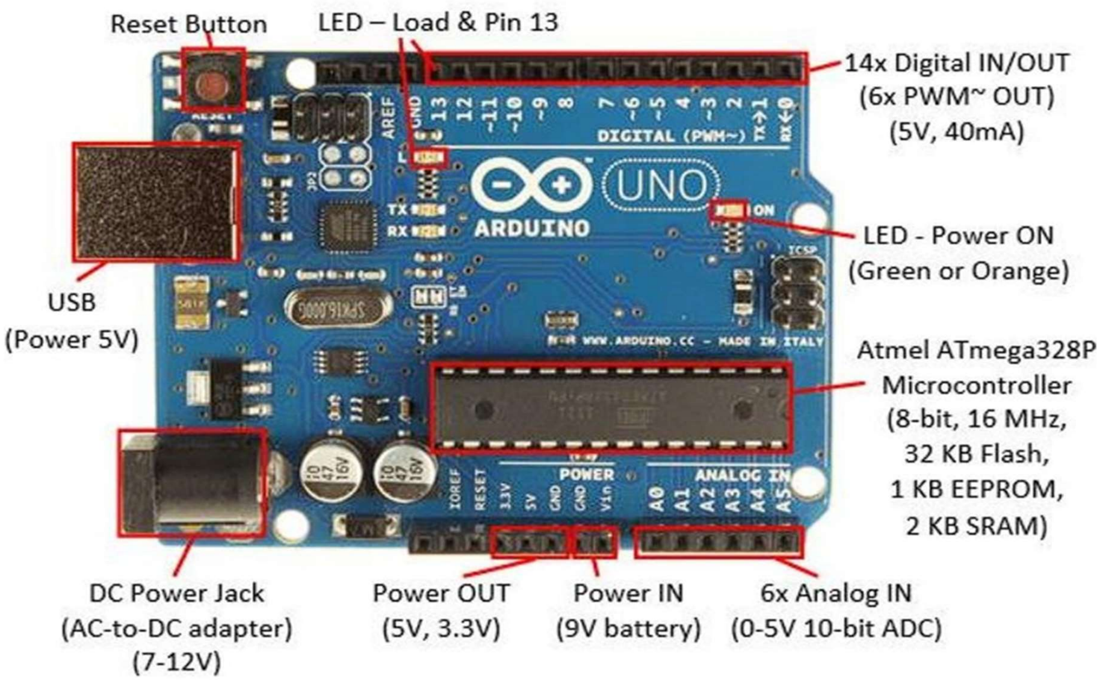

Figure 3.2: Arduino UNO

3.1.2 MQ-3 Smoke Sensor

The MQ-3 smoke sensor reports smoke by the voltage level that it outputs. The more smoke there is, the greater the voltage that it outputs. Conversely, the less smoke that it is exposed to, the less voltage it outputs. The MQ-3 also has a built-in potentiometer to adjust the sensitivity to smoke. By adjusting the potentiometer, you can change how sensitive it is to smoke, so it's a form of calibrating it to adjust how much voltage it will put out in relation to the smoke it is exposed to. We will wire the MQ-3 to an Arduino so that the Arduino can read the amount of voltage output by the sensor and sound a buzzer if the sensor outputs a voltage above a certain threshold. This way, we will know that the sensor is detecting smoke and we will sound a buzzer alerting a person such as a homeowner to this fact.

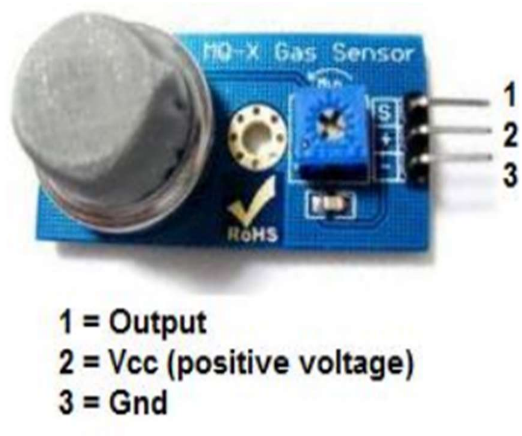

Figure 3.3: Structure and configuration of Gas sensor MQ-3

The 3 leads are Output, Vcc, and GND. The gas sensor needs about 5 volts of power in order to operate. This is done by connecting 5 volts to Vcc and GND. The Output pin gives out the voltage reading, which is proportional to the amount of smoke that the sensor is exposed to. Again, a high voltage output means the sensor is exposed to a lot of smoke. A low or 0 voltage output means the sensor is exposed to either little or no smoke.

Features:

- Wide detecting scope.
- Stable and long lifetime.
- Fast response and High sensitivity.

3.1.3 LCD Display (16X2 LCD)

A **Liquid Crystal Display** commonly abbreviated as **LCD** is basically a display unit built using Liquid Crystal technology. When we build real life/real world electronics-based projects, we need a medium/device to display output values and messages. **– Liquid Crystal Displays** comes in different size specifications. Out of all available LCD modules in market, the most commonly used one is **16X2 LCD Module** which can display 32 ASCII characters in 2 lines (16 characters in 1 line). Some of the 1602 LCD functional characteristics are as follows:

- Display capacity: 16x2 characters
- Chip operating voltage: 4.5V~5.5V
- Operating current: 2.0mA (5.0V)
- Best operating voltage: 5.0V

Figure 3.4: 16X2 LCD Display

3.1.4 GSM Module

The acronym GSM is presently understood to mean Global System for Mobile Communications. We chose the SIM 800C because that support the 2G network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also, they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. The MODEM needs AT commands, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the controller/processor. The modem sends back a result after it receives a command. Different AT commands supported by the modem can be sent by the processor/controller/computer to interact with the GSM and GPRS cellular network.

Figure 3.5: SIM800C GSM module

3.1.5 Buzzer

For alarm purposes a lot of electric bells, alarms and buzzers are available in the market that has got different prices and uses. The buzzer being used in this project is a 5-12 V buzzer and has got enough alarm sound to be used in a fire alarm system. Louder buzzer would have been even better but then their operating voltages are high as we had a supply of maximum up to 12V available with us on the board.

Figure 3.6: Buzzer

3.2 Software Requirements

In our project we used a software for writing the code.

- Arduino IDE – to write the code

3.2.1 Software Design

The program creation (development) cycle to create a C program:

- Do the requisite mental work. This is the most important part.
- Create the C source code. This can be done using a text editor, but is normally done within the IDE (Integrated Development Environment). C source files are plain text and saved with a ".c" extension.
- Compile the source code. This creates an assembly output file. Normally, compiling automatically fires up the assembler, which turns the assembly file into a machine language output file.
- Link the output file with any required libraries using the linker. This creates an executable file. For desktop development, this is ready to test.
- For embedded development, download the resulting executable to the target hardware (in our case, the Arduino development board). For the Arduino, steps 3, 4, and 5 can be combined by selecting "Build" from the IDE menu.
- Test the executable. If it doesn't behave properly, go back to step one.

A program is text that you write using a programming language that contains behaviors that you need a processor to acquire. It basically creates a way of handling inputs and producing outputs according to these behaviors. Designing a program is the fact you have to think about first, before you begin coding it. It generally involves writing, drawing, and making schematics of all the actions you want your processor to make for you. Sometimes, it also implies to write what we call pseudo code. I hope you remember that this is what we created in the previous chapter when we wanted to define precisely all the steps of our desired LED behavior. Writing a program is typically what converts the pseudo code into real and well-formed code. It involves having knowledge of programming languages because it is the step when you really write the program. This is what we'll learn in a moment. Testing is the obvious step when you run the program after you made some modifications to the code. It is an exciting moment when you also are a bit afraid of bugs, those annoying things that make running your program absolutely different from what you expected at first. Debugging is a very important step when you are trying to find out why that program doesn't work well as expected. You are tracking typo errors, logic discrepancies, and global program architecture problems. You'll need to monitor things and often modify your program a bit in order to precisely trace how it works. Maintaining the source code is the part of the program's life that helps to avoid obsolescence. The program is working and you improve it progressively; you make it up-to-date considering hardware evolutions, and sometimes, you debug it because the user has this still undiscovered bug. This step increases the life duration of your program. Programming is the process of designing, writing, testing, debugging and maintaining the source code of computer programs.

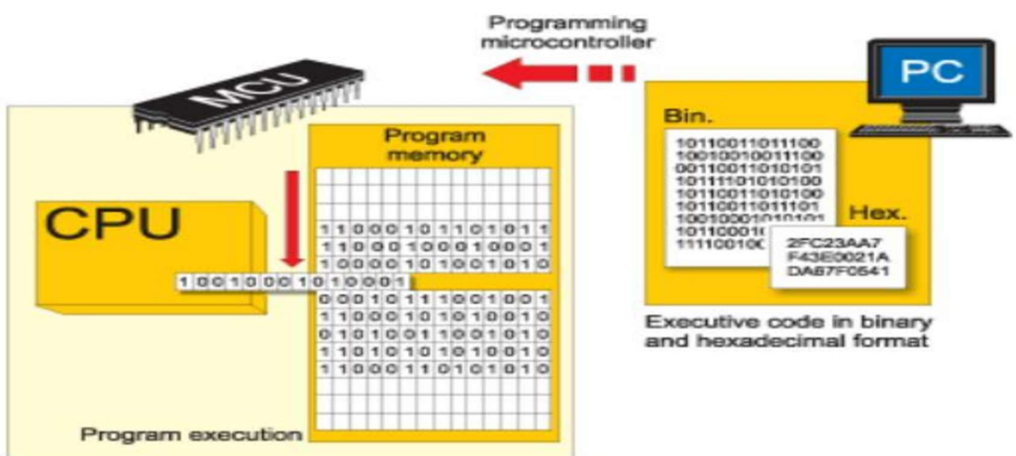

Figure 3.7: Program creation steps

The microcontroller executes the program loaded in its Flash memory. This is the so-called executable code comprised of seemingly meaningless sequence of zeros and ones. It is organized in 12-, 14- or 16-bit wide words, depending on the microcontroller’s architecture. Every word is considered by the CPU as a command being executed during the operation of the microcontroller. For practical reasons, as it is much easier for us to deal with hexadecimal number system, the executable code is often represented as a sequence of hexadecimal numbers called a Hex code. It used to be written by the programmer. All instructions that the microcontroller can recognize are together called the Instruction set.

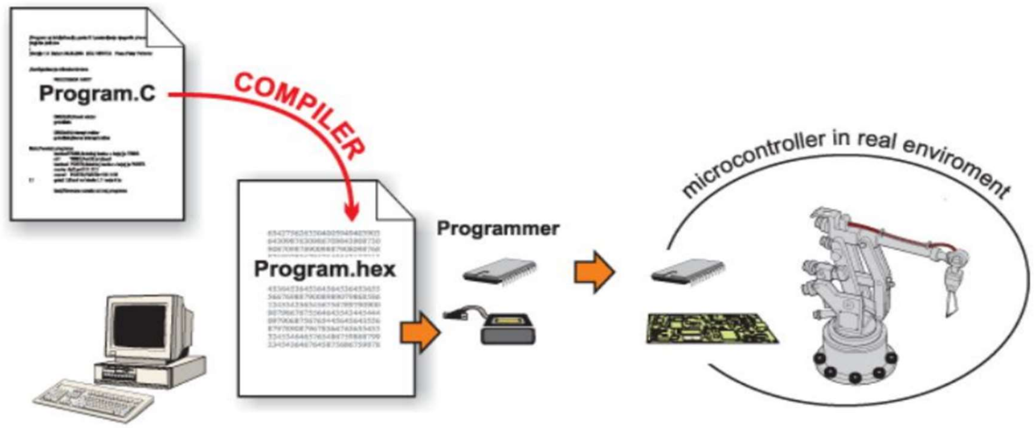

Figure 3.8: Generating hex file

Every sketch needs two void type functions that do not return any value, setup() and loop(). The setup() method is run once, just after the Arduino board is powered up and the loop() method is run continuously afterwards. The setup() is where you want to do any initialization steps, and loop() is for codes you want to run over and over again to program ATMEGA328P. At first, we have to burn boot loader of new ATMEGA328P using ARDUINO-UNO R3 Programmer. For burn boot loader connect new ATMEGA328P with programmer. Connection is shown below.

Figure 3.9: Arduino sketch simple function

Caution: Make sure Programming kit is not connected to external power source because it gets required power from USB cable connected to computer and circuit with ATMEGA328P have regulated +5V supply.

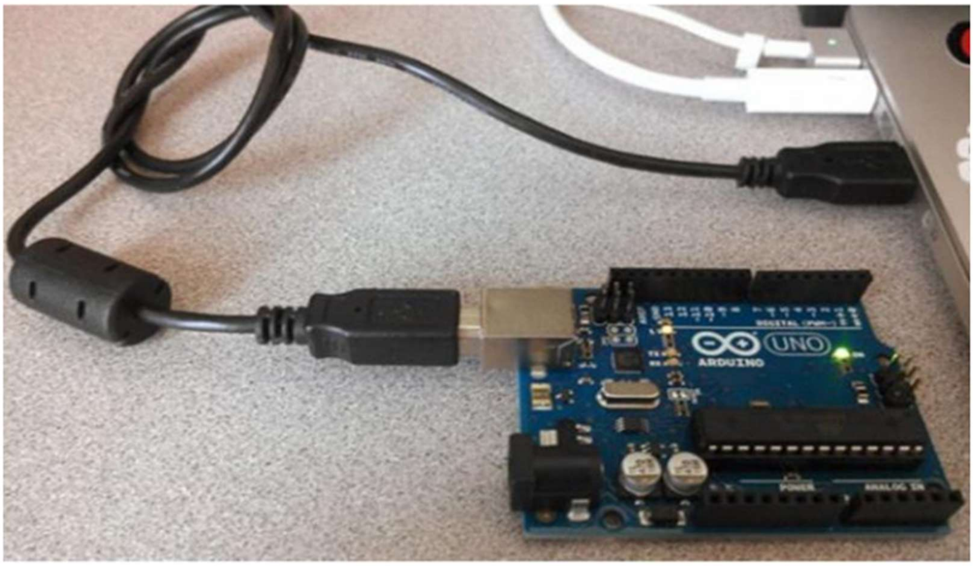

Figure 3.10: Interfacing ARDUINO Programmer with PC

Then this System is ready for burn boot loader, to do this action simply open IDE on computer then upload configuration code which is consists of two different codes named “optiLoader.h” and “optiLoader.pde”. Then upload both code to microcontroller, process is shown below.

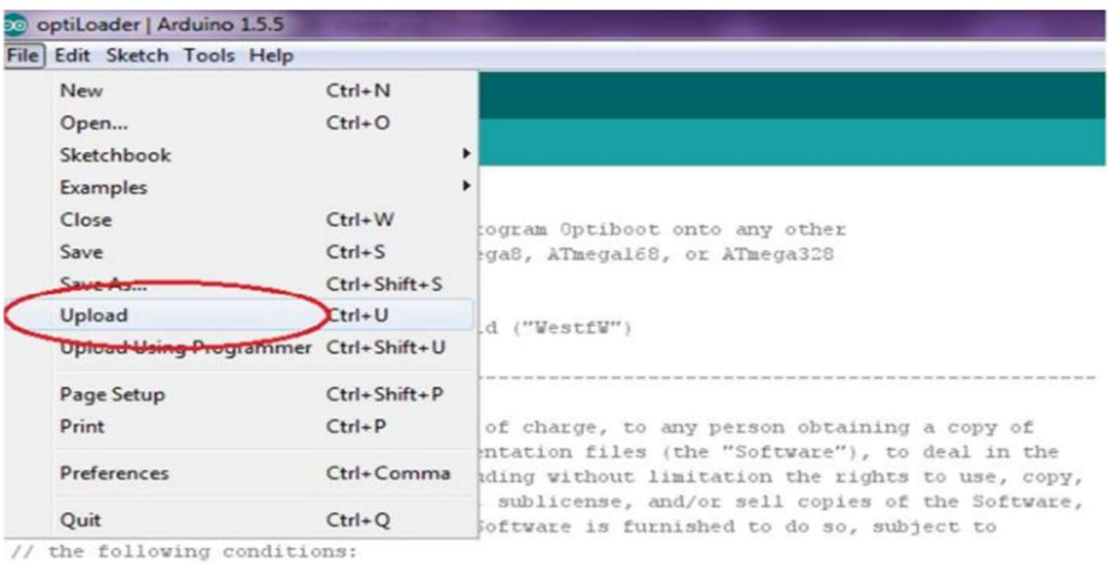

Figure 3.11: Upload Boot loader to ARDUINO Programmer

3.3 System Testing

First of all, all the hardware units of the system were tested and it was ensured that in a good working condition or not. Then each and every unit were interfaced and implemented individually with the microcontroller board and drove with the software according to the necessity of the application.

The testing of the application was not done at once after it was completed. Rather each unit of the application was tested individually. The second unit was not tested until the first unit gave the expected result and until it was not working according to the necessity of the application. After all of the units were working correctly, the units were kept together and then the whole system was developed and tested.

It was easy to figure out the bugs and the problem of the system as the behavior of each unit was known while testing it. It would be impossible to figure out the system development when a sensor gets activation and defined program and the response at the output pin D4 to D7connected LCD display will show “High Fire” consequently GSM module will most definitely will activate a message response saying “FIRE OCCURRED.

We also used in this circuit to light ON an indication LED with connected a 220Ω resistor output pin to common GND. Output pin D5 is common for the system as we defined program to activate a buzzer alarm and Exhaust-Fan ON. For instant smoke sense, we can use a high sensitivity smoke sensing detector to give high pulse to input pin of microcontroller IC from which it will get fictional activity as per program installed in the Arduino.

Arduino fire and smoke alarm system is an important system for industrial purposes as well as for household purposes. Whenever it detects fire or smoke then it instantly alerts the user about the fire through the GSM module. Software design is as shown in figure.

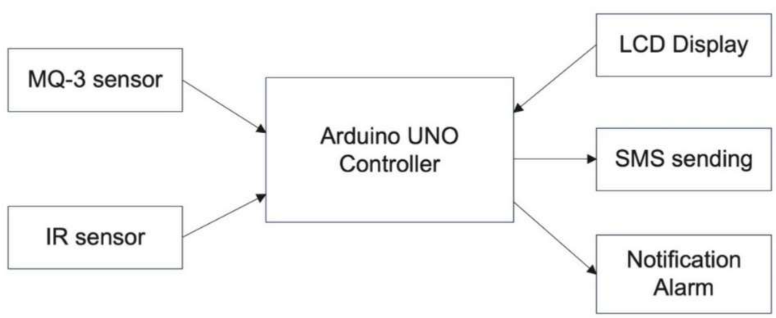

Figure 3.12: Block Diagram

The above block diagram shows interfacing of all essential components of the model. Arduino UNO is the heart of the model which is interfaced with MQ-3 sensor, IR sensor and 16X2 LCD display.

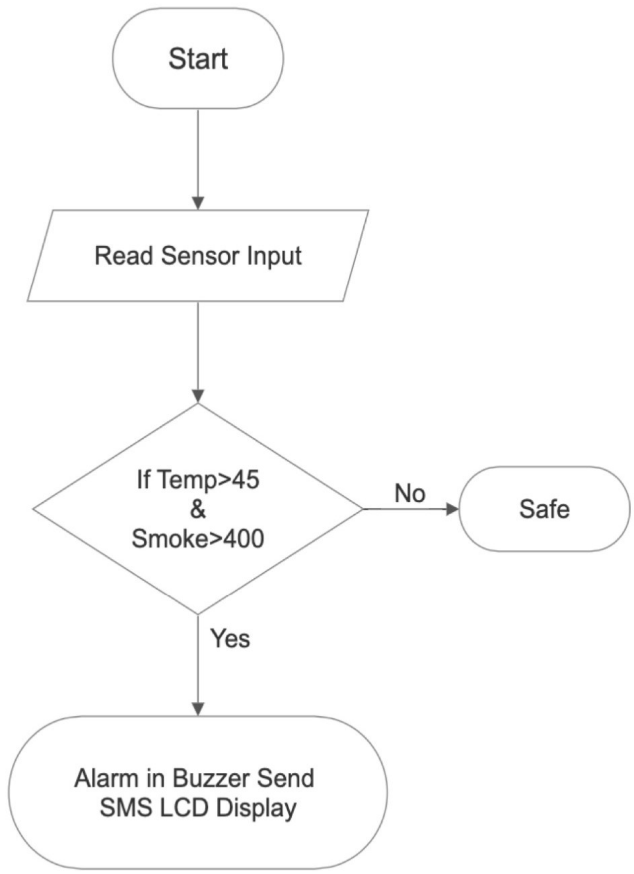

Figure 3.13: Flow Chart of the System

The above flow chart shows the flow of execution of program that drives our model. As shown firstly we begin our program which will then read sensor input in desired units. Thereafter we have decision making block of the program where it is decided whether fire accident has happened or not. Based on this decision further execution will take place. Either no fire accident has taken place and safe will be displayed on the screen or buzzer starts alarming and fire high message will be displayed on the screen.

CHAPTER 4

IMPLEMENTATION

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4.1 System Architecture

The system architecture of the automatic output appliance can be divided into three main Modules. They are:

- Sensory Module
- GSM Module
- Liquid Crystal Display (LCD) Module

The integration of the modules is producing the system which is more or less can be divided into two phases where the first phase is the output smart Appliance system and the second phase the monitoring system. The Arduino, sensory and Appliance modules are in the first phase of the system and LCD module is in the second phase monitoring system.

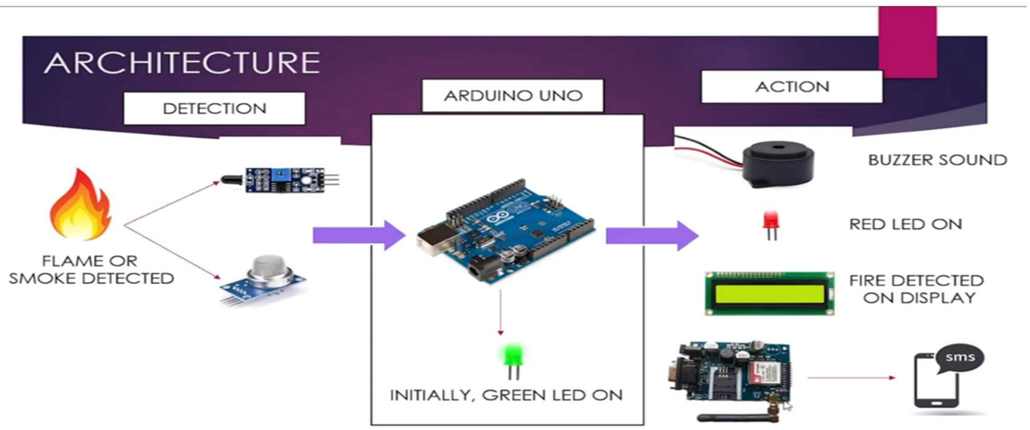

Figure 4.1: Architecture Unit

4.2 Overall System Design

The overall system design for this project report encompasses a comprehensive framework that defines the structure and functionality of the system. It outlines the key components and their interconnections, ensuring a cohesive and efficient operation. The architecture incorporates various modules and subsystems, addressing specific requirements and facilitating smooth data flow. The design emphasizes scalability, reliability, and security, considering potential future enhancements. The implementation approach includes a combination of programming languages, technologies, and tools, carefully chosen to meet project objectives. Overall, the system design aims to deliver a robust and user-friendly solution, aligning with the project's goals and providing a solid foundation for successful implementation.

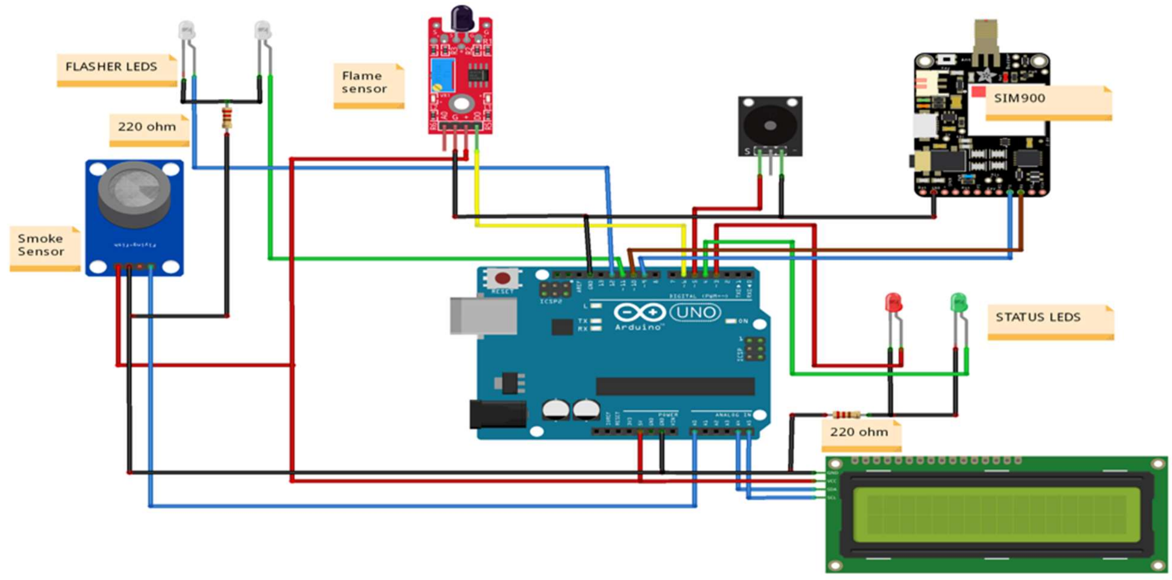

Figure 4.2: Circuit Diagram

This appliance system will produce the output in three different areas that are the same level with input is senses. Each level is sensed by the input which will trigger the same level of output and the status of the output and smoke-level view on the LCD panel. UNO module controller is the main part of the system where all the process flow will be controlled by this hardware accordingly to the defined programming in it. Arduino is chosen for the system as the controller. In other word it is the heart of this device system.

4.3 Code Snippet

The implementation of the project involved utilizing a well-known code snippet to incorporate the model into the system. The code served as the foundation for seamlessly integrating the desired functionality. This particular implementation was crucial in achieving the project's objectives.

```
#include <SoftwareSerial.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,16,2);  // set the LCD address to 0x27 for a 16 chars and 2 line display
SoftwareSerial mySerial(9, 10);
const int red = 3;
const int green = 4;
const int buzzer = 13;
const int flame = 6;
```

```
const int smoke = A0;
int thresh= 200;
int status = true;
String alertMsg;
String mob1="+917050489534";        // Enter first mobile number with country code
String mob2="+918579975327";        // Enter second mobile number with country code
void setup()
{
  pinMode(red, OUTPUT);
  pinMode(green, OUTPUT);
  pinMode(smoke,INPUT);
  pinMode(flame,INPUT);
  pinMode(buzzer, OUTPUT);

  lcd.init();                  // initialize the lcd
  lcd.clear();
  lcd.backlight();

  mySerial.begin(9600);   // Setting the baud rate of GSM Module
  Serial.begin(9600);    // Setting the baud rate of Serial Monitor (Arduino)
  delay(100);
}
void siren(int buzzer){
  for(int hz = 440; hz < 1000; hz++){
    tone(buzzer, hz, 50);
    delay(5);
  }
  for(int hz = 1000; hz > 440; hz--){
    tone(buzzer, hz, 50);
    delay(5);
  }
}
void loop()
{
  Serial.println("Gas Val: "+String(analogRead(smoke))+", Flame state:
```

```
"+String(!digitalRead(flame)));
 if (digitalRead(flame)== LOW || analogRead(smoke)>thresh)  //Flame or Smoke or Button detected
 {
  digitalWrite(red, HIGH);
  siren(buzzer);

  digitalWrite(green, LOW);
   if(digitalRead(flame)== LOW){
   lcd.setCursor(2, 1);
   lcd.write(1);
   lcd.setCursor(4,1);
   alertMsg= "FIRE HIGH";
   lcd.print(alertMsg);
   lcd.setCursor(4,0);
   lcd.print("SMOKE:"+String(analogRead(smoke)));
  }
  if(analogRead(smoke)>thresh){
   lcd.setCursor(2, 0);
   lcd.write(1);
   lcd.setCursor(4,0);
   alertMsg= "SMOKE HIGH";
   lcd.print(alertMsg);
   lcd.setCursor(4,1);
   lcd.print("FIRE:"+String(digitalRead(flame)==LOW?"HIGH":"LOW"));
  }
  Serial.println(alertMsg);  //print on lcd
  if(status){   // run 1 time only when detects the fire after fire detection
   status = false;
   String msg= "Alert Type: "+alertMsg;
   SendMessage(msg,mob1);
   delay(8000);
   SendMessage(msg,mob2);
  }
 }
 else{
  status = true;
```

```
    lcd.setCursor(4,0);
    lcd.print("SMOKE:"+String(analogRead(smoke)));
    lcd.setCursor(4,1);
    lcd.print("FIRE:"+String(digitalRead(flame)==LOW?"HIGH":"LOW"));
    digitalWrite(red, LOW);
    noTone(buzzer);
    digitalWrite(green, HIGH);
  }
  delay(500);
  lcd.clear();
}
void SendMessage(String msg, String mob)
{
  Serial.println(msg);  //Message sent to Mobile
  mySerial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
  delay(1000);  // Delay of 1000 milli seconds or 1 second
  mySerial.println("AT+CMGS=\""+mob+"\"\r"); // Replace x with mobile number
  delay(1000);
  mySerial.println(msg);// The SMS text you want to send
  delay(100);
   mySerial.println((char)26);// ASCII code of CTRL+Z
  delay(1000);
}
```

CHAPTER 5
RESULT

CHAPTER 5

RESULT

5.1 Implementation Result

The hardware of this case consists of Gas sensor, flame sensor, Arduino microcontroller, GSM SIM- 800C that is connected with Arduino module to control it. A fire alarm system is number of devices working together to detect and warn people through visual and audio appliances when smoke, fire, carbon monoxide or other emergencies are present. Fire and smoke that spread within a building can be affected by various factors such as the geometry, dimension, layout and usage of the building. If a detector detects smoke or heat, or someone operates a break glass unit, then alarm sounders operate to warn others in the building that there may be a fire and to abandon.

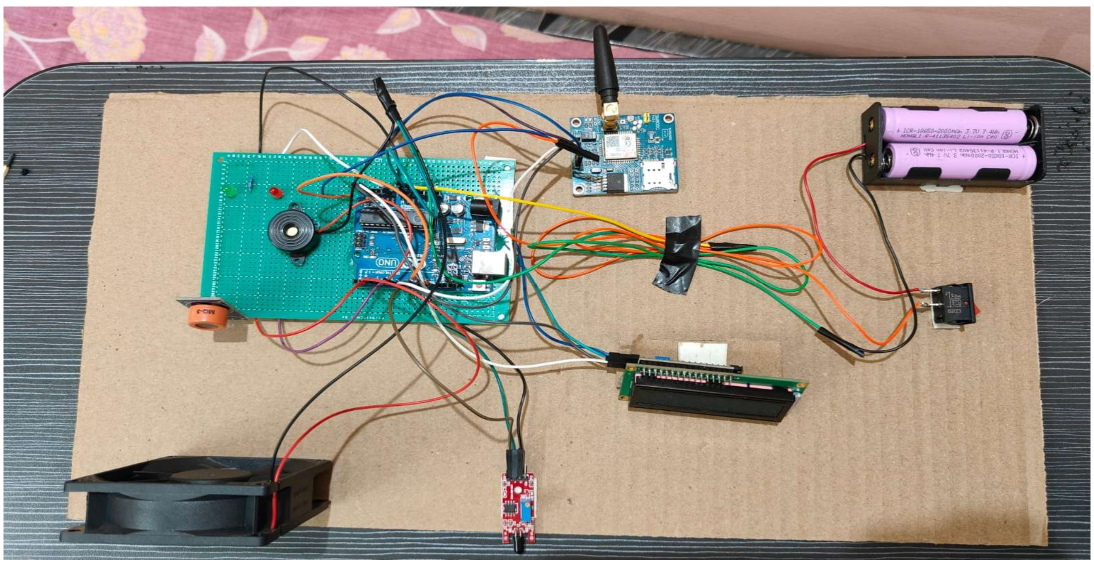

Figure 5.1: Implemented circuit connections

Initially, when no fire is detected i.e., safe environment is there then at that time green LED glows and red LED remains off. Also, buzzer is not alarming, exhaust fan is in off state as well as 'Fire Low' message is displayed on the LCD as shown in figure 5.2:

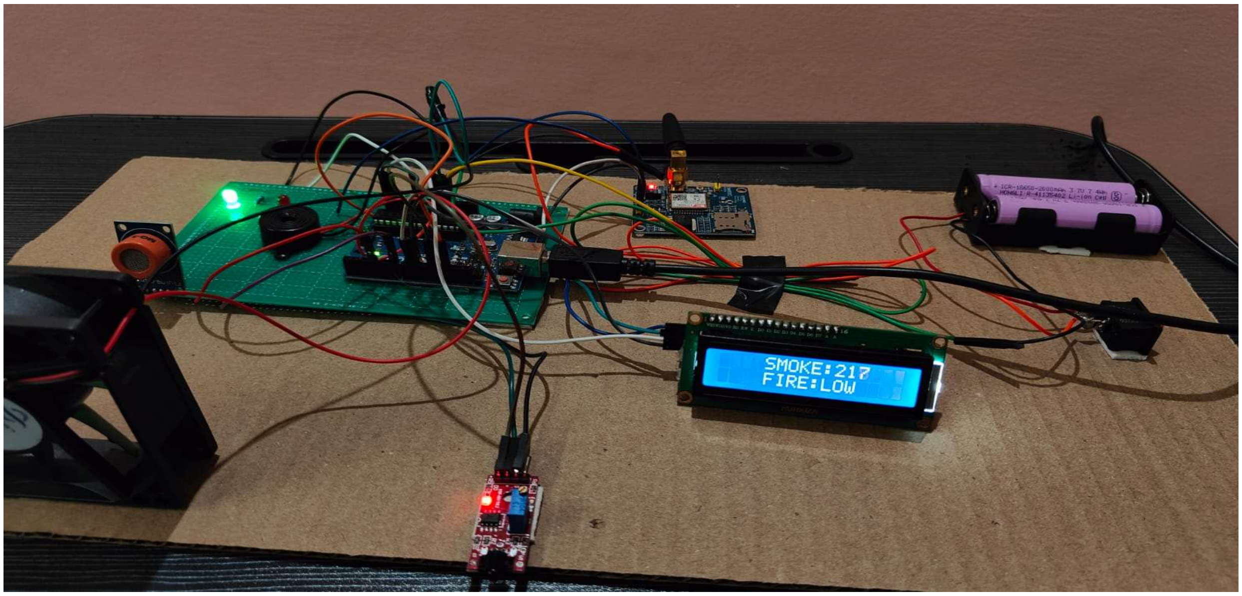

Figure 5.2: Initial state when there is no hazard

When fire accident is detected by the sensor and at that moment red LED glows and green LED get turned off. Buzzer starts alarming and exhaust fan starts rotating till smoke is eliminated. Also, 'Fire high' message is displayed on the LCD which is shown in figure 5.3:

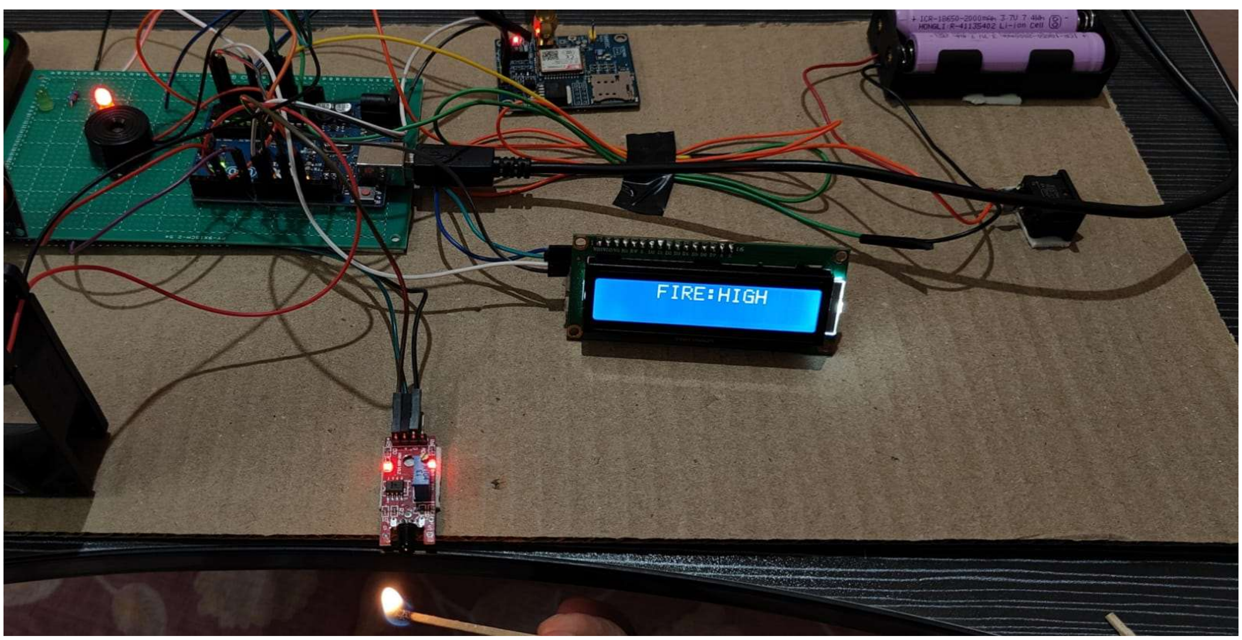

Figure 5.3: Final state when fire accident is detected

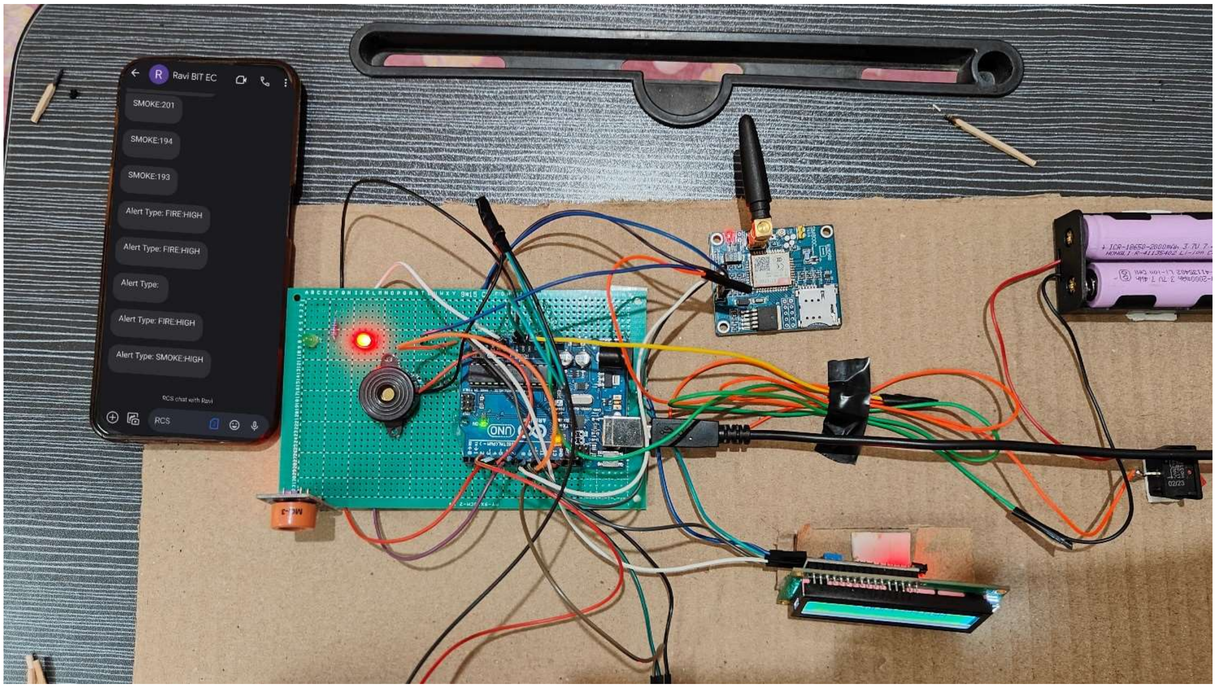

Figure 5.4: SMS message from SIM800C GSM module

Figure 5.4 shows when fire is detected then at that moment SMS message from SIM800C module is sent to the authority so that necessary actions could be taken at the earliest.

CHAPTER 6
CONCLUSION AND FUTURE WORK

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CONCLUSION AND FUTURE WORK

6.1 Conclusion:

Fire detection and alarm systems are crucial components for ensuring the safety of individuals and property in both home and industrial settings. These systems detect the presence of fire and alert occupants to evacuate the premises, providing valuable time for them to escape unharmed. In addition, these systems can also alert emergency services to respond quickly and effectively to the fire. Regular maintenance and testing of these systems are essential to ensure their effectiveness in case of an emergency. The system is very useful, simple and easy to install and the components used in the system are available in the local market. By investing in these systems, individuals and businesses can significantly reduce the risk of property damage, injury, and loss of life caused by fires. The sensor input data is connected with Arduino controller. LCD display, Buzzer and GSM module also is connected with Arduino for output result. Buzzer is notified for fire alarm and LCD is displayed the fire detection status. GSM module can be informed to specific user to know or prevent their home, office or building. This system can be applied in residential places, offices and hotels. With this system safety is assured. The system can perform different parameter measurements for early detection of building fires. There should be a minimum of two or three smoke and detectors in your home. You should install a smoke and detector on each floor of a house. Always have a smoke and detector and fire alarm system in your home for your own safety. Hence, it is crucial to prioritize safety and take proactive measures to prevent fires from occurring. Therefore, the implementation of these systems in this project is a necessary step towards creating a safe and secure environment for all occupants.

6.2 Future Work:

In the future, further research can be conducted to explore the effectiveness of integrating fire detection and alarm systems with other safety technologies such as sprinkler systems, emergency lighting, and ventilation systems. The development of smart fire detection and alarm systems that utilize artificial intelligence and machine learning algorithms can also be explored to improve the accuracy and speed of fire detection. The System can be connected by fire department to solve the problems. Additionally, it is important to educate individuals on the proper use and maintenance of fire detection and alarm systems. This can be achieved through training programs, workshops, and educational materials that provide information on how to test, maintain, and troubleshoot these systems. Finally, the implementation of fire detection and alarm systems should be accompanied by a comprehensive emergency response plan that outlines evacuation procedures, communication protocols, and emergency contact information. Regular drills and simulations can also be conducted to ensure that all occupants are familiar with the emergency response plan and can react quickly and effectively in case of a fire. We can enhance the system's capabilities by integrating additional sensors, such as gas detectors or flame sensors. A wireless communication system can be implementation to allow for centralized monitoring and control. Then, we can develop a user-friendly interface for configuring threshold values and managing notifications. Further testing and optimization can be conducted to improve the system's accuracy and responsiveness.

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