GSM Based Fire and Smoke Alert System



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Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

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Certification

This is to certify that this project entitled " **GSM Based Fire and Smoke Alert System**" is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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ACKNOWLEDGEMENT

The report titled as on " **GSM Based fire and Smoke alert System**" has been prepared to fulfill the requirement of our practicum program. In the process of doing and preparing our practicum report, we would like to pay our gratitude to some persons for their enormous help and vast co-operation.

At first, we would like to show our gratitude to the University authority to permit us to do our practicum. Specially, we would like to thank to our honorable teacher **Tabassum Alam Meem,** Lecturer, Department of Electrical & Electronics Engineering, SU– Sonargaon University, Dhaka, for his valuable and patient advice, sympathetic assistance, co-operation, contribution of new idea. Deep theoretical and hardware knowledge & keen interest of our supervisor in this field influenced us to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

Finally, we would like to thanks again to the respected **Vice- Chancellor of SU, Professor Dr. Md. Abul Bashar** also thanks to **Head of Department of SU , Electrical & Electronics Engineering, Professor Dr. M. Bashir Uddin** because they are designated such an environment for learning through which we got the opportunity to acquire knowledge under Bsc in EEE program, and that will be very helpful for our prospective career.

We are, indeed, grateful to all those from whom we got sincere cooperation and help for the preparation of this report

ABSTRACT

An Microcontroller based house fire alarm system using a GSM Module is described in this paper. The project's primary goal is to keep residents and their belongings safe from fires, which are a common hazard in residential areas. It uses an Arduino Uno board and an ATmega328 microcontroller. The ATmega328 is the primary controller for the temperature-triggered fire alarm in the average home. The fire's heat is detected by an Ir sensor. The GSM module will use SMS to send an alarm to the user's mobile phone. A warning message will appear on the LCD display and an SMS alert will be sent to the user's phone when the temperature rises above 40C. Documentation and discussion of the test's outcomes are required. This device can assist users enhance their safety standards by providing an early response in the event of a potential accident. Finally, users will be able to protect themselves, as well as those they care about, from the disaster.

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ABBREVIATIONS

DC	Direct Current
AC	Alternating Current.
GSM	Global System for mobile
IOT	Internet OF Things
IR	Infrared Receiver
SRAM	Static Random Access Memory
EEPROM	Electrically Erasable programme Read only Memory
LPG	Liquefied Petroleum Gas

CHAPTER I

INTRODUCTION

1.1 Introduction

Every day, we hear of fire accidents happening somewhere. It takes the lives of many people and damages huge property. Most of the damages in fire accidents occur due to a lack of early fire detection, it is a very big problem. So, here we will try to solve this problem with the help of smart technology. In this project, we will learn how to make a GSM Based Smart Fire Alert System, which alerts fire brigade when the fire started. This system alerts fire brigade by sending a text message/SMS to a specific user's Mobile number and generates sound to warn the people who are present at the accident spot. This system can save many lives and protect from property damage. We can use this system at the office, building, bank, school, factory, shopping mall, etc. places.

According to the U.S. Fire Administration, thousands of people are killed in fires across the U.S. Thousands of others sustain serious injuries resulting from fires. Even though the death rates associated with fire have declined in recent years, these deaths and injuries can be avoided by the installation of smoke detectors. Installing smoke detectors on every level of the home, including the kitchen, bedroom, basement, and patio can reduce the risk of getting injured or dying from a fire in your home or business. If you're ready to install smoke detectors in your home or business, get in touch with HomeOps Electric. Our knowledgeable and experienced electricians have the ability to install, repair, and replace various models of smoke detectors. Smoke, fire, vibration, gas and temperature detection and alert system using smart sensors will allow the people to keep their home and industries safe from accident like the gas leakage, smoke, and fire. We can make our environment and industries smart and safe by using this system. With a home or industries that has this advantage; you can know how atmosphere is there. It is an injurious smoke, fire, vibration, gas, and temperature that can damage event death. With a system we will cope with smoke, fire, vibration, gas leakage. Smoke, fire, vibration, gas, and temperature detector will only detects data from different sensor. The alert system is system that is used from sending information through GSM

networking. We will also monitor to the smoke, fire, vibration, gas, and temperature by displaying on computer.

1.2 Background Study

The use of different IoT devices for home automation has become very popular in recent years. Fire detection and avoidance of fire accidents is one of the necessary and important application of home automation using IoT. Traditional fire alarm system requires huge installation cost and labour. The proposed IOT based fire alarm system basically detects fire at an early stage, generates an automatic alarm and notify the remote user or fire control station about the fire outbreak.

1.3 Objectives

The main objective of this system is to introduce a automated smart grid system with The fire is detected at an early stage and the system generates an alarm and sends SMS or call alerts to mobile numbers stored inside the Arduino program, via the GSM module. Simultaneously, a water sprayer producing device is switched on for the control of fire. This prototype system can help users to improve their safety standards with immediate response by preventing accidents. This will eventually allow both the lives and the properties from the disaster. The functions of each module and its implementation is described in detail.
Purposes and project objective is to design the project system that can detect smoke, fire, vibration, gas and also checking the temperature of the home or industries. ¬ The system will show the concentration of smoke, fire, vibration, gas and change the temperature and sends SMS on mobile and email as raising. ¬ The alarm as a caution condition the concentration exceeds safe concentration.

1.4 Project Organization

In this report, Chapter one covers introduction, background, objectives. Chapter two represents theory, description of the arduino uno, sim800l GSM, smoke detector, flame sensor, dc buck lm2596 dc-dc buck converter step down module , other components. Chapter three describes and working principle of the project. In chapter four we have discussed result and discussion, cost estimation, future modification, conclusion.

CHAPTER II

THEORY OF THE PROJECT

2.1 Introduction

This chapter includes the total over view of the device. In this chapter we have followed-up the theory of Arduino uno Smoke detector GSM SIM800L Module Flame sensor DC-DC BUCK CONVERTER Buzzer,Adopter 12v 2A ,Bread board ,Connecting wires, IR LED , and other components. Here we can know that the total system overview of the projects. And we will also know that how the equipment are working with each other. This chapter discusses project to improving two major parts of this project that need to be developed software and Hardware. For the hardware part it consists of system board which includes arduino, GSM module, gas sensor, temperature sensor, fire sensor, vibration sensor, smoke sensor and buzzer.

2.2 Theory

We've developed the system that can handle this critical switching situation perfectly. The passage of smoke into the chamber causes the light from the source to be scattered and fall on the photocell. The photocell output is being used to initiate an alarm. In the Light obscuring smoke detector, smoke interferes with a light beam between a light source and photocell. A fire alarm system is used primarily to evacuate the premises in the event or occurrence of a fire condition and then secondarily to report the fire to the proper authorities, in this paper basically a low cost fire detection and control system based on smoke and heat detection is proposed. The use of wireless automation in almost all the field of power, gas, agriculture and security systems has over the years provided novel solutions to remote operations, in the paper the implementation of a SMS based communication system is incorporated to a smoke detection system in the case of a fire. The implemented design is cheap and effective. The SMS sending feature included in the design increases the reliability of the system. The design has been developed since the social and economic cost of natural. This has been achieved through the installation of smoke detection and control system equipped with fast detection capability. In this paper, we present a robust ionization based smoke detection and control system with various notification mechanisms such as; buzzer, LCD, GSM and water control system. This was achieved through an automatic ionization smoke detection system designed and simulated in Proteus environment and then developed into a prototype. The results obtained shows that the system can effectivel.

2.3 Fire Safety

Fire safety is the set of practices intended to reduce the destruction caused by fire. Fire safety measures include those that are intended to prevent the ignition of an uncontrolled fire and those that are used to limit the development and effects of a fire after it starts.

Fire safety measures include those that are planned during the construction of a building or implemented in structures that are already standing, and those that are taught to occupants of the building.

Threats to fire safety are commonly referred to as fire hazards. A fire hazard may include a situation that increases the likelihood of a fire or may impede escape in the event a fire occurs.

Fire safety is often a component of building safety. Those who inspect buildings for violations of the Fire Code and go into schools to educate children on fire safety topics are fire department members known as Fire Prevention Officers. The Chief Fire Prevention Officer or Chief of Fire Prevention will normally train newcomers to the Fire Prevention Division and may also conduct inspections or make presentations

2.4 Arduino Uno

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language and the Arduino Software (IDE), based on Processing.

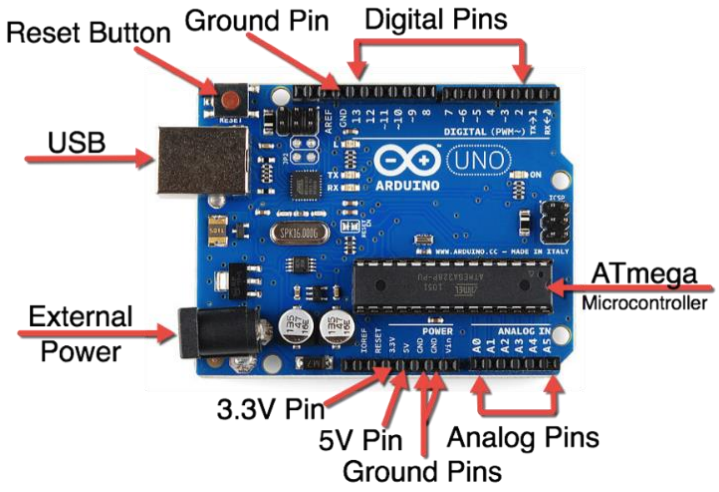


Fig: 2.4.1 Arduino UNO Pin Diagram

Technical specifications:

Table 2.3.2: Technical specifications of Arduino UNO

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz

2.5 Smoke Detector

A smoke detector is a device that senses smoke, typically as an indicator of fire. Smoke detectors are usually housed in

Commercial smoke detectors issue a signal to a fire alarm control panel as part of a fire alarm system.



Fig: 2.5.1 Smoke Detector

2.6 GSM

Global system for mobile communication (GSM) is wide area wireless communications system that uses digital radio transmission to provide voice, data, and multimedia communication services. A GSM system coordinates the communication between a mobile telephones (mobile stations), base stations (cell sites), and switching systems. Each GSM radio channel is 200 kHz wide channels that are further divided into frames that hold 8 time slots. GSM was originally named Groupe Special Mobile. The GSM system includes mobile telephones (mobile stations), radio towers (base stations), and interconnecting switching systems. The GSM system allows up to 8 to 16 voice users to share each radio channel and there may be several radio channels per radio transmission site (cell site).



Fig:2.6.1: GSM

2.7 Flame Sensor

A sensor which is most sensitive to a normal light is known as a flame sensor. That's why this sensor module is used in flame alarms. This sensor detects flame otherwise wavelength within the range of 760 nm – 1100 nm from the light source.



Fig:2.7.1: Flame Sensor

2.8 Dc-Dc Buck Converter

This module features the adjustable LM2596 step-down (buck) switching regulator, capable of driving a 3A load with excellent line and load regulation. This is an LM2596 DC-DC buck converter step-down power module with high-precision potentiometer, capable of driving a load up to 3A with high efficiency, which can work with Arduino UNO



Fig:2.8.1: Dc-Dc Buck Converter

2.9 Buzzer

When smoke is detected then sound generate by Buzzer



Fig: 2.9.1: Buzzer

2.10 12V DC Power supply Adapter

A bridge rectifier circuit is a common part of the electronic power supplies. Many electronic circuits require rectified DC power supply for powering the various electronic basic components from available AC mains supply. We can find this rectifier in a wide variety of electronic AC power devices like home appliances, motor controllers, modulation process, welding applications, etc.

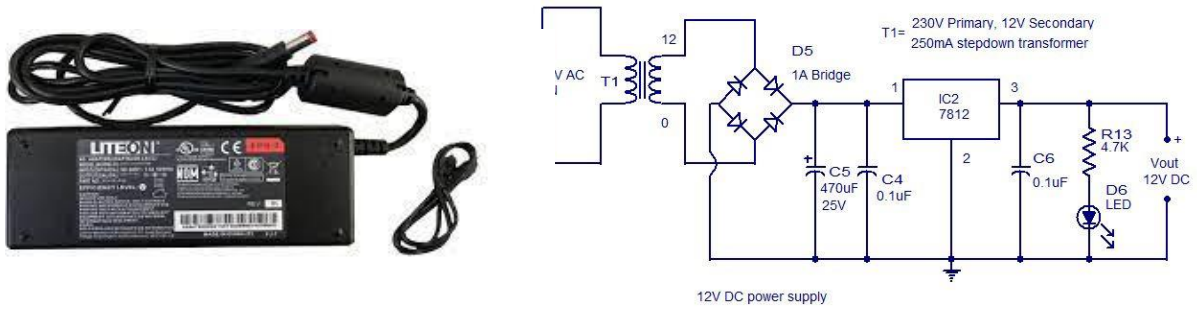


Fig: 2.10.1: 12V DC Power supply Adapter

12 Volt DC 1 Amp power supply is suitable for powering a wide range of applications including many other device . Features: 100% Brand New Excellent Quality Short Circuit, Over Voltage & Over Current Protection. Meet CEC Energy Efficiency Level IV. Incredibly Low Fault Rates No Minimum Load

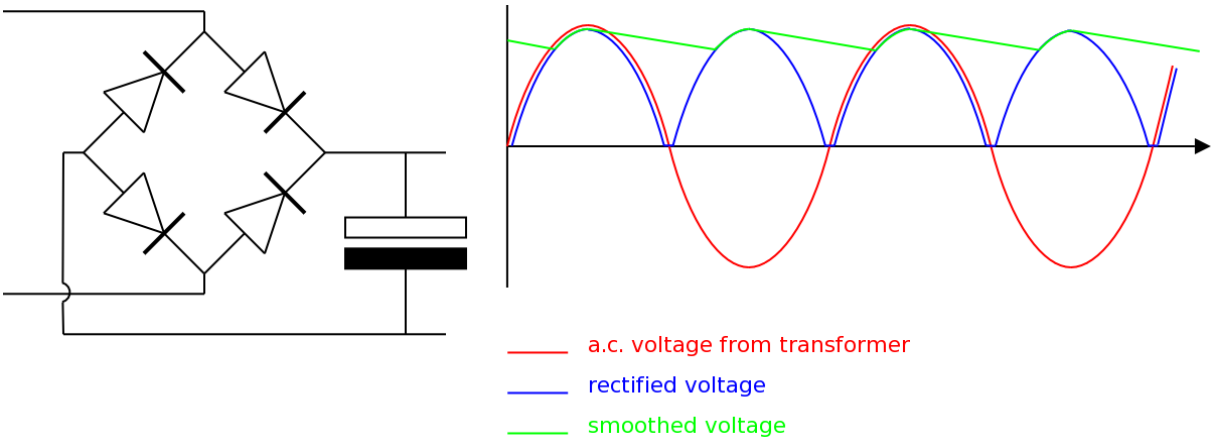


Fig: 2.10.2: Output Waveforms of 220V/12V rectifier

CHAPTER III

DESING & WORKING MATHODOLOGY

3.1 Introduction

In this chapter fully cover with discuss design and fabrication of this project. Here we will discuss about developed block diagram and briefly describe about the circuit description and also learn about working principle. Total project flow chart is also available in this chapter.

3.2 Block Diagram

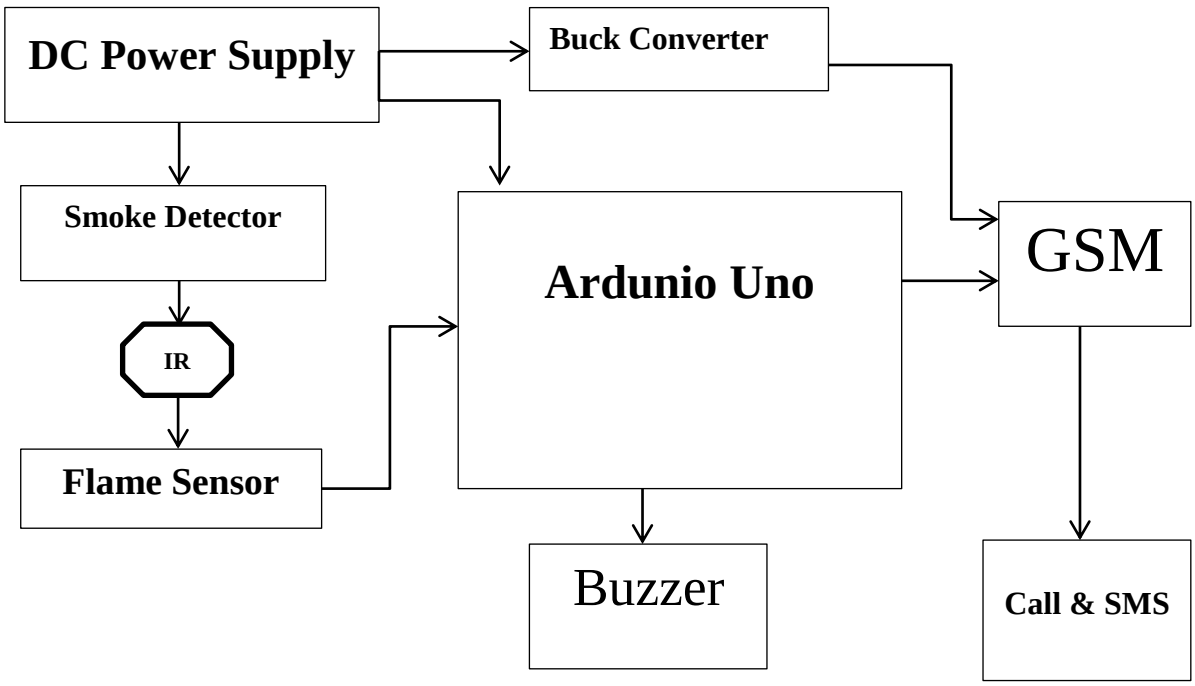


Fig: 3.2.1: Block diagram of project

Here's the block diagram of our Smoke and fire system Iot. We can clearly describe the working process through this block diagram. Firstly we have power sources to supply electricity. One is the Smoke Detector and the other is the Arduino Uno,Buck Converter. Generally Smoke is the first priority of supplying the electricity. Our Ardunio system continuously Detected Smoke or fire . If any unwanted situation occurs such as under smoke or fire for flame sensor, or Exftra smoke of any of those sources, our system immediately Buck converter supply line convet to signal pass GSM. If both of flame and ardino uno minimum threshold, it combines the two sources. A GSM module are active keeps the sms and after 20 second letter call going selcted number .

3.3 Circuit Description

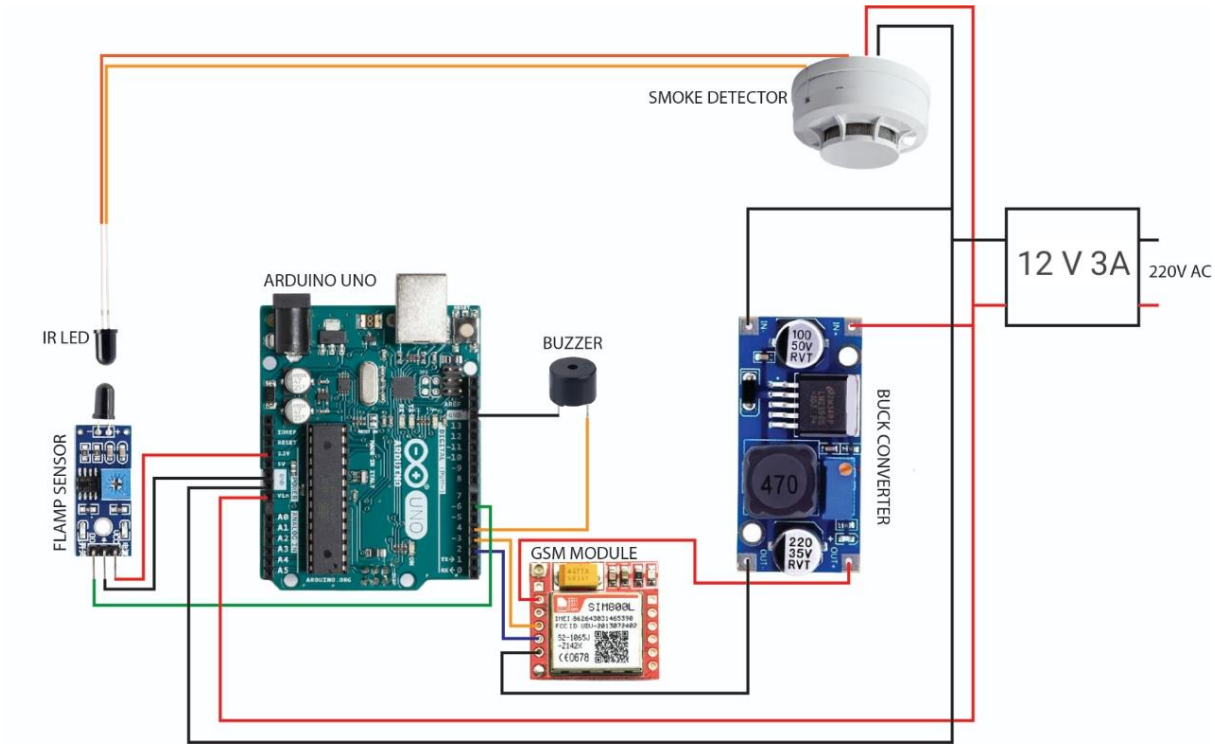


Fig: 3.3.1: Circuit diagram of the Project

The above-given diagram is tested and verified you can use this diagram in your project. and if you have any doubt we are explaining the diagram below.

- Connect Arduino Tx to the GSM Rx
- Connect Arduino Rx to the GSM Tx (Note:- plug out the Rx wire of the Arduino during the upload program)
- Connect Arduino A4 to the I2C SCL
- Connect Arduino A5 to the I2C SDA
- Connect Arduino 4 to the Flame sensor DO
- Connect Arduino 5 to the LED +ve pin
- Connect Arduino 6 to the Buzzer +ve pin
- Common all device Ground to each other.

GSM module works with the Arduino with the UART protocol which is also known as the serial data protocol.

in this protocol the shift register is used to make the parallel data to the serial data.you must know the AT command to operate the GSM module.

there are a lot of AT commands but we are using only some AT commands.

check our GSM Projects

.3.4 Overview of Sensor Based Smart Fire Detection and Fire Alarm System

This device can assist users enhance their safety standards by providing an early response in the event of a potential accident. Finally, users will be able to protect themselves, as well as those they care about, from the disaster.

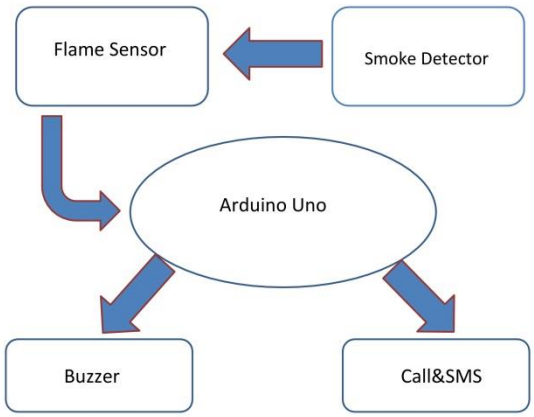


Fig: 3.4.1: GSM Based fire And Smoke alert System

3.5 Working Principle

After connecting all components according to the circuit diagram and uploading the code to the Arduino board, now turn on the circuit power supply. Then the Arduino starts working step by step according to the code.

In the beginning, the Arduino makes the connection to the Network through the SIM800L GSM Module. At the same time, smoke & temperature sensor starts to sense the temperature around it and generates digital output voltage. Its output voltage glow a IR led.

The flame sensor sense the infarad Ray from led and deliver a output to ardunio

The Arduino read this voltage you can read all the AT commands in our previous post which is a GSM-based circuit breaker.

When a fire accident occurs, then the room is covered by smoke. Due to this, the output voltage of smoke detector is also increasing. The Arduino reads this output voltage by a flame sensor

When the room temperature is increases then the Arduino sends a “Fire is detected (location)” message to a particular phone number through the GSM module (you can change the message

text and phone number in Arduino code). At the same time, the Red LED and buzzer also turn on, these warn people inside the room.

During the normal condition there is no action in the ardunio.

3.6 Image of the Project

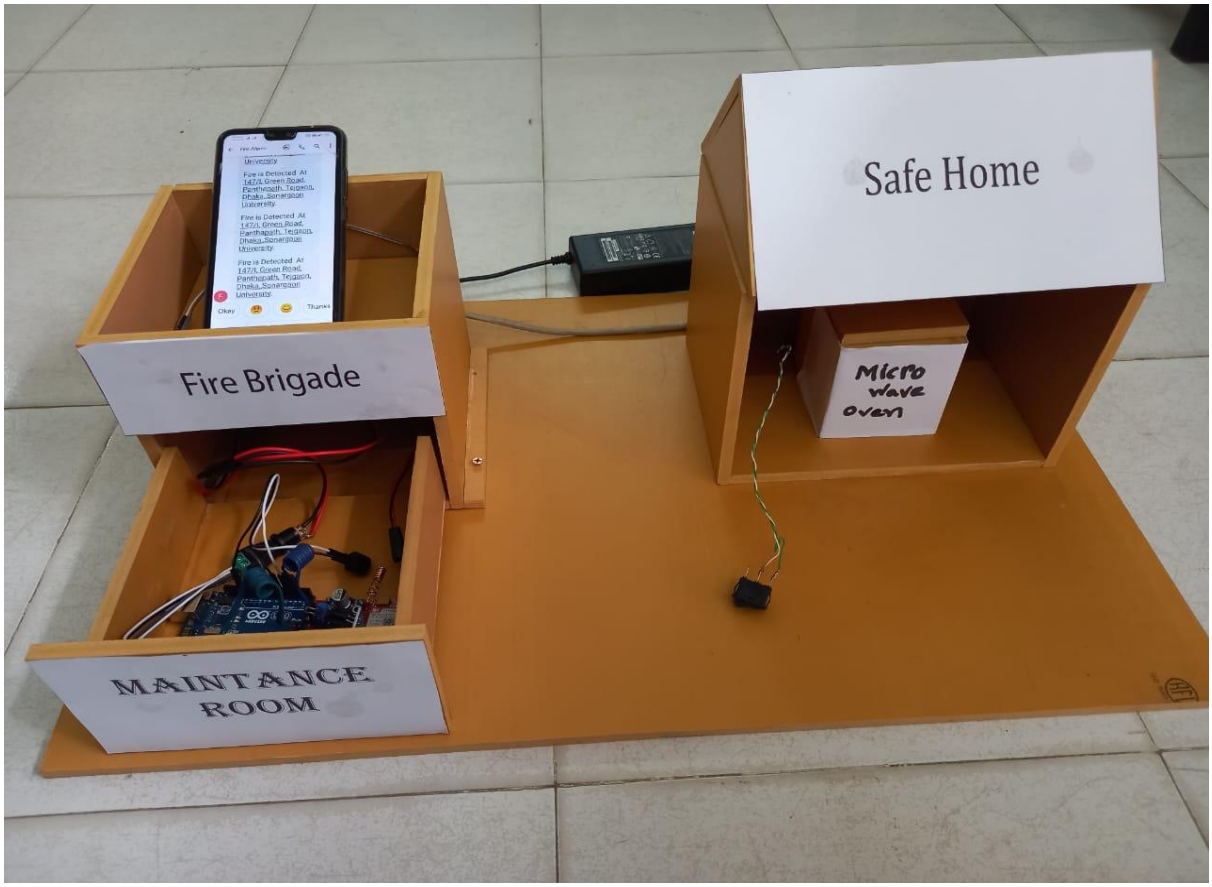


Fig: 3.6.1: Real image of the project

3.7 Used Materials

1.	Arduino uno	1
2.	Smoke detector	1
3.	SIM800L GSM Module	1
4.	Flame sensor	1
5.	Dc Buck Lm2596 Dc-Dc Buck Converter Step Down	2
6.	Buzzer (B1)	1
7.	Adopter 12v 2A	1
8.	bread board	1
9.	Connecting wires	as per need

3.8 Conclusion

In this chapter we have discussed the block diagram,circuit discription, working principle, flow chart also show the real image of the project and others. In the later part of this paper we discussed the result & discussion of the project to make the concept clear to anyone.

Chapter IV

RESULT & DISCUSSION

4.1 Introduction

This chapter contains the results obtained and discussion about the project. We have also covered discussions about advantages, disadvantages and limitation of current version of the protection system.

4.2 Result

Security is the main concern for everyone. Everyone wants to live securely in his/her house. Everybody wants themselves to keep safe or secure from various incidents like theft in their house or accidents caused due to LPG gas leakage or accidents due to fire in their house. GSM based Home Security System project has 4 modules along with a GSM modem. GSM modem is used to send the SMS whenever there are changes in any of the three modules.

4.3 Advantags of Sensor Based Smart Fire Detection and Fire Alarm System

- Does not require Wi-Fi or Bluetooth connection.
- Helps in reducing fire damages by 90% by early fire detection.
- Cost effective

4.4 Disadvantages of Sensor Based Smart Fire Detection and Fire Alarm System

- Maximum 3 phone numbers can be registered.
- Does not help in putting out the fire, just alerts the predefined mobile numbers

4.5 Advantages of GSM

- .No roaming charges on International calls.
- Worldwide connectivity and extensive coverage.
- .SAIC and DAIC techniques used in GSM provide very high transmission quality.
- The phone works based on the SIM card so that it is easy to change the different varieties of phones by users.

4.6 disadvantages of GSM:

- .Electronic interference. Because GSM uses a pulse-transmission technology, it is known to interfere with electronics like hearing aids.

- Bandwidth lag
- Limited rate of data transfer
- Repeaters

4.7 Discussion

By implementing above systems there are various benefits.

- The first module of this project detects if any person is entering the house. This feature is helpful at night time or whenever we are out of our homes
- The second part of the project serves the functionality of a door-latch opening using a password entered through the keypad. As well as sending this data to a GSM modem through the serial port. This module also turns on the buzzer if 3 wrong passwords are entered consequently. Users can change this password anytime he/she wish using a keypad.
- The third module uses an LPG gas sensor to detect gas leakage. If there is a leakage then the buzzer is turned on.
- he fourth module uses a Temperature sensor to detect fire in the house. Whenever the temperature sensor crosses the threshold level, a buzzer is activated and an SMS alert is sent to the owner of the house
- The main advantage is that the system's action can be changed according to the situation

4.8 Applications

Sensor Based Smart Fire Detection and Fire Alarm System is important role in modern smart technologies. Following are the most common applications of smart grid technology.

4.9 Conclusion

Fire accident claims the lives of innocent people around the world every single day. A small amount of fire is able to damage a huge part of a society. Although smoke detectors and fire alarms alert people of danger, they often have few choices other than escaping from a building and calling the fire department. In this paper, it can be concluded that the proposed system can provide a secure, safe, and efficient way for preventing or combating fire accident

Chapter V

CONCLUSION

5.1 Conclusion

The purpose of this project is to assist fire brigade in overcoming the issue of fire spreading when the no one is not present in the structure. Resident spaces and the building are constantly prone to unexpected or critical situations that go unnoticed by those within. Residents can use the home alert system to keep their homes safe, according to the findings. Compared to other alarm systems already on the market, the one we designed is really affordable, and it's simple to install in most residences. The usage of smoke detector in the system ensures that the system is able to detect smoke or high temperatures. Because of its adaptability and ease of use, this gadget may be used in a wide range of settings, including homes, hostels, factories, and the transportation industry, among many others. Users only need to place the device where they want it to work to keep their desired area safe from the threat of oncoming flames. When the gadget detects that the smoke, a GSM text message will be sent to the fire brigade. This will make the users aware of the dangerous condition, and they will be able to quickly prevent it from occurring.

5.2 Future Work

As new technologies emerge, dealers should be sure to leverage both timeless and emerging technologies to target more customers. Devices are becoming more and more capable, and regardless their application, they are all evolving to connect to the internet and cooperate with other devices. Consumers look for smart home technology along with commercial products that work in a cohesive environment. Along with investigating which products to sell, we encourage dealers to take a serious look at reliable partners to provide wholesale alarm monitoring services for devices so that consumers never go without protection.
It will given assurance to consumer & fire brigade safety. A Voice announcement system can be added to indicate device conditions. We can add a voice announcement system along with the buzzer so if there are hazardous parameters detected then the respective voice messages will be announced.

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Appendix

Code

```
#include <SoftwareSerial.h>


const String PHONE_1 = "+8801928960049";
const String PHONE_2 = ""; //optional
const String PHONE_3 = ""; //optional



#define rxPin 2
#define txPin 3
SoftwareSerial sim800L(rxPin,txPin);

#define flame_sensor_pin 6
//fire_flag = 0 means no fire detected
boolean fire_flag = 0;

#define buzzer_pin 4



void setup()
{

  Serial.begin(115200);



 Serial.begin(115200);


 sim800L.begin(9600);


 pinMode(flame_sensor_pin, INPUT);


 pinMode(buzzer_pin, OUTPUT);
 digitalWrite(buzzer_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()){
```

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

  int flame_value = digitalRead(flame_sensor_pin);



  if(flame_value == LOW)
  {
    digitalWrite(buzzer_pin,HIGH);
    |
    if(fire_flag == 0)
    {
      Serial.println("Fire Detected At 147/I, Green Road, Panthapath, Tejgaon, Dhaka,,Sonargaon University.");
      fire_flag == 1;
      send_multi_sms();
      make_multi_call();
    }

  }

  else
  {
    digitalWrite(buzzer_pin,LOW);
    fire_flag = 0;
  }


}


void send_multi_sms()
{
  if(PHONE_1 != ""){
    Serial.print("Phone 1: ");
    send_sms("Fire is Detected  At 147/I, Green Road, Panthapath, Tejgaon, Dhaka,,Sonargaon University.", PHONE_1);
  }
  if(PHONE_2 != ""){
    Serial.print("Phone 2: ");
    send_sms("Fire is Detected", PHONE_2);
  }
  if(PHONE_3 != ""){
    Serial.print("Phone 3: ");
    send_sms("Fire is Detected", PHONE_3);
  }
}

void make_multi_call()
{
  if(PHONE_1 != ""){
    Serial.print("Phone 1: ");
    make_call(PHONE_1);
  }
  if(PHONE_2 != ""){
    Serial.print("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)
{
    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)
{
    Serial.println("calling....");
    sim800L.println("ATD"+phone+";");
  if(PHONE_3 != ""){
    Serial.print("Phone 3: ");
    make_call(PHONE_3);
  }
}

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