GAS LEAKAGE AND FIRE ALERT WARNING SYSTEM VIA GSM

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Approval

This is to certify that the report work entitled Gas leakage and fire alert warning system via GSM has been approved by the Examination Committee for the partial fulfillment of the requirement for the degree of Bachelor of Science (Engg.) in Information and Communication Technology, Mawlana Bhashani Science and Technology University, Santosh, Tangail-1902, Bangladesh in 16 may 2018 .

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Abstract

This project is about designing a gas leakage and fire alert warning system via GSM. This project used microcontroller system, sensors, GSM modem and several other devices. This system uses Microchip microcontroller as a tool to collect input data, process and release output data. The significant of this project is to briefly show how to connect a microcontroller system with input and output devices consists of LCD display and GSM modem.

The leakage of dangerous and flammable gas like LPG in cars, service stations, households and in storage tanks can be detected using the gas sensor unit. This unit can be easily integrated into a unit that can sound an alarm. The sensor has great sensitivity and rapid response time. This sensor can also be used to sense other gases like isobutane, propane and even cigarette smoke. The output of the sensor goes LOW as soon as the sensor senses any gas leakage in the atmosphere. This is detected by the microcontroller and buzzer is turned on. After a delay of few milliseconds, the exhaust fan is also turned on for throwing the gas out and the main power supply is turned off. A message 'LEAKAGE' is sent to a mobile number that is predefined.

Home security fire related hazards need special attention, so one stop solution for all fire related accidents like breakout fire, smoke and combustible gas leakage are considered. An ideal flame sensor can be used to detect the presence of a dangerous fire in any place like cars, service station of cylinders, storage tank, homes etc. The Flame sensor senses fire. If the Flame sensor senses fire, the output of this sensor goes high. This is detected by the microcontroller and buzzer is turned on. After a delay of few milliseconds, the Water Pump is also turned on for throwing the water to affected area and the main power supply is turned off. A message " FIRE ALERT " is sent to a mobile number to the owner of the house that is predefined. A message " FIRE ALERT AND ADDRESS " is also sent to the nearest Fire service office.

Acknowledgments

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INTRODUCTION

Gas leakages are a common problem in households and industries. If not detected and corrected at the right time, it can also be life threatening. Unlike a traditional gas leakage alarm system which only senses a leakage and sounds an alarm, the idea behind our solution is to turn off the main power supply and gas connection as soon as a gas leakage is detected apart from sounding the alarm. In addition to this, a message is sent to an authorized person informing him about the leakage. There are mainly three units, in this circuit: sensor unit, microcontroller unit and GSM modem. For detecting dangerous & flammable gas leaks in any closed environment such as a car, house, service station or storage tank, a gas sensor is used which detects natural gas, LPG and coal gas. This sensor can also be used to sense other gases like iso-butane, propane and even cigarette smoke. This unit can easily be incorporated into an alarm unit to sound an alarm.

Fire safety is an important aspect of day to day life. Safety measures are to be taken at institute, industries, household, Home automation etc. The scheme consists of a sensor MQ-6 Sensor. It consists of 2 coils named sensing coil and electrodes, Sensitive coil is made up of SnO_2 (tin di-oxide) which has lower conductivity in clean air. When any gas exists, the sensors conductivity increases along with the increase in gas concentration. A simple electro-circuit is used to convert the change of conductivity to respective output signal of gas concentration. An Arduino is used which is interfaced with components like exhaust fan, buzzer, G.S.M module, L.E.D. and the MQ-6sensor. The arduino is Programmed in such a way that in case of leakage, it is detected by the microcontroller and it gives an indication via buzzer, L.E.D. and a message is sent to respective mobile number after a delay of 5 seconds, the exhaust fan is turned on via a command which is being sent by "Arduino Mega" .

OBJECTIVE

❖ To detect the leakage of LPG gas and Fire occurred in a closed environment.
❖ To inform the user about the leakage of gas and Fire alert via SMS.
❖ To inform nearest Fire service office about the fire via SMS.
❖ To activate the alarm unit to inform neighbor about the gas leakage and Fire Alert.
❖ To switch on the exhaust fan as a primary preventive measure against gas leakage.
❖ To switch on the Water Pump as a primary preventive measure against the Fire.
❖ To turn off main power supply after gas leakage or Fire Detected.

Component

MQ-6 Gas Sensor:

MQ-6 gas sensor modules are used in gas leakage detecting equipment in family and industry, are suitable for detecting of LPG, iso-butane, propane, LNG, avoid the noise of alcohol and cooking fumes and cigarette smoke. MQ-6 is a Sensor for Natural Gases Sensitive material. When the target combined gas exist, the sensors conductivity is heavier with the gas concentration rising. The sensor can be used to detect different combustible gas, especially Methane.
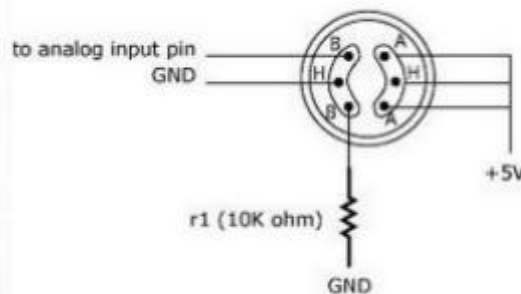
Feature

- ❖ High sensitivity to CH4, Natural gas
- ❖ Small sensitivity to alcohol, smoke
- ❖ Fast response
- ❖ Stable and long life
- ❖ Simple drive circuit

Pin

```
VCC - 5V
GND - GND
S   - Analog pin0
```

The Grove Flame Sensor

The Grove - Flame Sensor can be used to detect fire source or other light sources of the wavelength in the range of 760nm - 1100 nm. It is based on the YG1006 sensor which is a high

speed and high sensitive NPN silicon phototransistor. Due to its black epoxy, the sensor is sensitive to infrared radiation. In fire fighting robot game, The sensor plays a very important role, it can be used as a robot eyes to find the fire source.
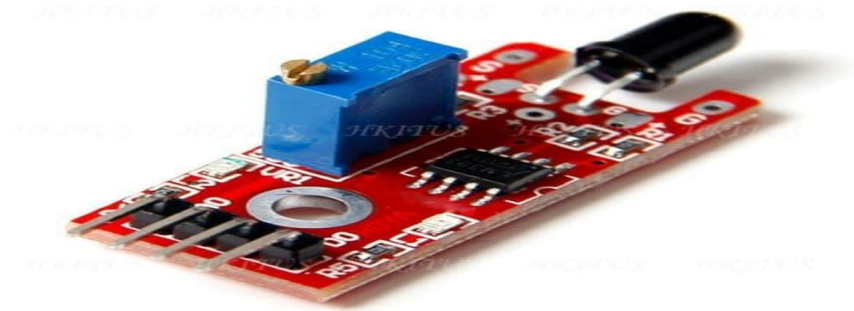
Features

- ❖ Grove Interface
- ❖ High Photo Sensitivity
- ❖ Fast Response Time
- ❖ Easy to use
- ❖ Sensitivity can adjustable

LCD DISPLAY

 LCD stands for Liquid Crystal Display. They have become very common with industry by clearly replacing the use of Cathode Ray Tubes (CRT). CRT consumes more power than LCD and also bigger and heavier. We all know about LCD‟s, but no one knows the exact working of it. LCD is finding wide spread use replacing LEDs (seven segments or other multi segment LEDs) due to the following reasons:

- ❖ The declining prices of LCDs.
- ❖ The ability to display numbers, characters and graphics related data. This is in contrast to LEDs, which are limited to numbers and a few characters.
- ❖ Incorporation of a controller into the LCD, thereby making the CPU to keep displaying the data.
- ❖ Ease to program for characters, strings and graphics related data.

G.S.M. Module

Global System for Mobile Communications or GSM is the world's most popular standard for mobile telephone systems.GPRS module is a breakout board and minimum system of SIM900 Quad-band/SIM900A Dual-band GSM/GPRS module. It can communicate with controllers via

AT commands (GSM 07.07, 07.05 and SIMCOM enhanced AT Commands). AT is the abbreviation for Attention. This module supports software power on and reset . A fixed number is used in system to apply different operations like,

Messaging and calling

For sending message, a GSM Module named SIMCOM900a is used.
Some useful AT Commands to program GSM

1) **AT** - This command is used to check communication between the module and the computer.

2) **AT +CMGF** - This command is used to set the SMS mode. Either text or PDU mode can be selected by assigning 1 or 0 in the command.

3) **AT +CMGW** - This command is used to store message in the SIM.

4) **AT+CMGS** - This command is used to send a SMS message to a phone number.

5) **ATD** - This command is used to dial or call a number.

6) **ATA** - This command is used to answer a call. An incoming call is indicated by a message "RING" which is repeated for every ring of the call. When the call ends "NO CARRIER" is displayed on the screen.

7) **ATH** - This command is used to disconnect remote user link with the GSM module

Arduino Mega
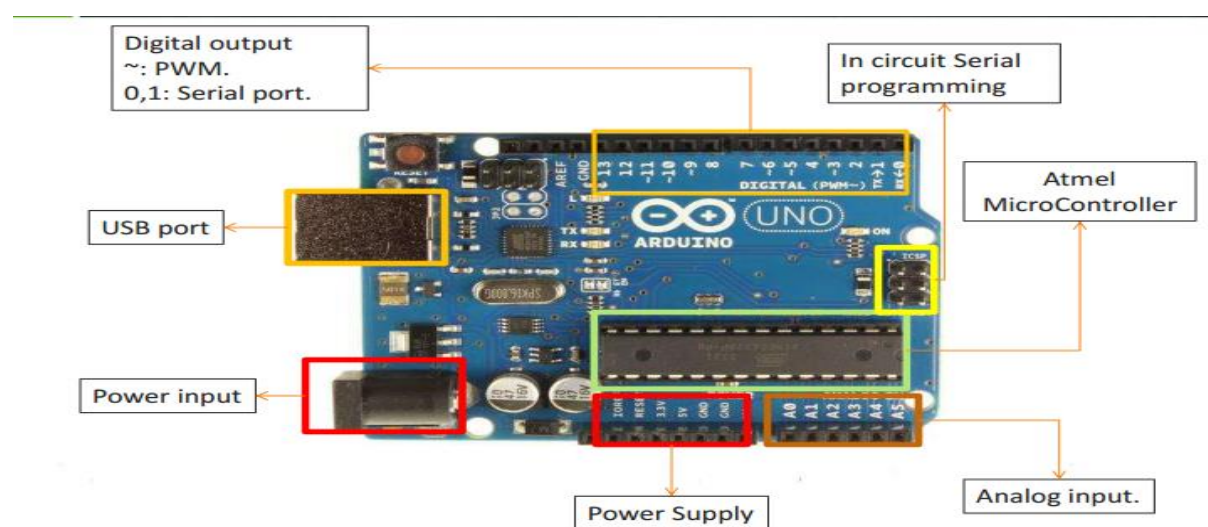
- ❖ **Processor:** 16 MHz ATmega16U2
- ❖ **Flash memory:** 32KB
- ❖ **Ram:** 2KB
- ❖ **Operating Voltage:** 5V
- ❖ **Input Voltage:** 7-12V
- ❖ **Number of analog inputs:** 6
- ❖ **Number of digital I/O:** 14 (6 of them Pulse Width Modulation — PWM)

The features of Arduino

- ❖ Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.
- ❖ Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.
- ❖ Finally, Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.

PIN FUNCTIONS

There is a little description of pin function about arduino in given below,

- ❖ **USB To PC** : It is used to communicate Arduino via Universal Serial Bus to PC for programming/sending data to Arduino serially.

- ❖ **7V to 12V DC Input :** For external supply, the voltage range of 7V to 12V DC is recommended. The 9V battery can be used to power your Arduino Uno board.

- ❖ **Reset Button :** It Resets the Arduino board if pressed.

- ❖ **ICSP :** Abbreviated as In Circuit Serial Programming which consists of MOSI, MISO, SCK, RESET, VCC, GND. It is either used to program USB or Microcontroller.

- ❖ **SDA :** Serial Data, It is the bidirectional data line that is used by I2C.

- ❖ **SCL :** Serial Clock, It is used to indicate that data is ready on bidirectional data line that is used by I2C.

- ❖ **AREF :** Analog Read Reference, It is mainly used for analogReference() function calls, as default it is not required but to use it you have to add some voltage source between 0 to5V.

- ❖ **GND :** Ground.

- ❖ **SCK :** Serial Clock, which is used by SPI (Serial Peripheral Interface). It is clock generated by 'Master' which is used to clock the data to the 'Slave'.

- ❖ **MOSI :** Master Out Slave In, The data is transmitted from Master to Slave. (Master -> Slave)

- ❖ **MISO :** Master In Slave Out, The data is transmitted to Master from Slave. (Slave -> Master)

- ❖ **SS :** Slave Select, It is used to select the 'Slave'. Make high to SS pin to deactivate & make low to activate it.

- ❖ **INT1 &INT0 :** These are hardware interrupts, it calls the ISR (Interrupt Service

Routine) when the pin change occurs.

❖ **TX :** Transmit, It is used to transmit TTL serial data. It is also referred as 'outwards' since it 'transmits' data from Arduino to other connected peripheral device.

❖ **RX :** Receive, It is used to receive TTL serial data. IT is also referred as 'inwards' since it 'receives' data from external hardware to Arduino.

❖ **Vin :** Voltage In, If you're powering your Arduino board from USB nothing is obtained from Vin pin.

❖ **5V Pin :** It is used to power external components connected to Arduino which needs 5V.

❖ **3.3V Pin :** It is used to power external components connected to Arduino which needs 3.3V

❖ **IORef :** Input Output Voltage Reference, It allows shields connected to Arduino board to check whether the board is running at 3.3V or 5V.

Block Diagram
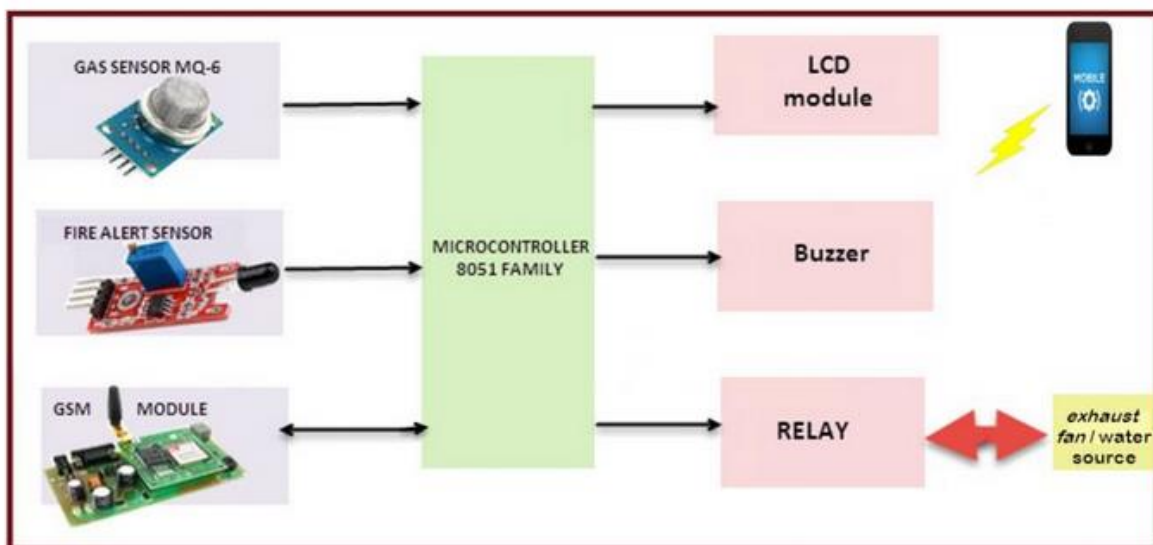
Block diagram of The home and industry safety using fire and gas alarm system

Corresponding Code:

```
#include <SoftwareSerial.h>
#include<LiquidCrystal.h>
LiquidCrystal lcd(1, 3, 4, 5, 6, 7);
SoftwareSerial SIM900A(10,11);

int motor1 = 2;
int greenLed = 8;
int redLed = 9;
int buzzer = 12;
```

```
int FLAME=13;
int motor = 52;

void setup()
{
 SIM900A.begin(9600);   // Setting the baud rate of GSM Module
 lcd.begin(16,2);
 pinMode (buzzer, OUTPUT);
 pinMode (redLed, OUTPUT);
 pinMode (greenLed, OUTPUT);
 pinMode (motor, OUTPUT);
 pinMode (motor1, OUTPUT);
 analogReference(DEFAULT);
 pinMode(FLAME, INPUT);
 Serial.println ("SIM900A Ready");
 delay(100);
 Serial.println ("Type s to send message or r to receive message");

}
void loop()
{
 float vol1;
 int sensorValue1 = analogRead(A0);
 vol1=(float)sensorValue1/1024*5.0;
 int fire = digitalRead(FLAME);
 //Serial.println(vol1,1);int fire = digitalRead(FLAME);
 delay (1000);
 if (vol1>=1.4)
  {
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Gas has leackage");
  lcd.setCursor(0,1);
  lcd.print("SMS SENT FAN ON");
  digitalWrite(redLed, HIGH);
  digitalWrite(greenLed, LOW);
  digitalWrite(buzzer,HIGH);
  digitalWrite(motor1,HIGH);
  SendMessage();
  }
  else if ( fire == HIGH)
  {
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Fire Has Occured");
  lcd.setCursor(0,1);
  lcd.print("SMS SENT PUMP ON");
  //Serial.println("Fire! Fire!");
  digitalWrite(buzzer,HIGH);// set the buzzer ON
  digitalWrite(redLed, HIGH);
  digitalWrite(greenLed, LOW);
  digitalWrite(motor,HIGH);
  SendMessage1();
```

```arduino
   }

  else
  {
   lcd.clear();
   lcd.setCursor(0,0);
   lcd.print("WELCOME TO OUR");
   lcd.setCursor(0,1);
   lcd.print("PEACE HOUSE");
   digitalWrite(buzzer,LOW); // Set the buzzer OFF
   digitalWrite(redLed, LOW);
   digitalWrite(greenLed, HIGH);
   digitalWrite(motor,LOW);
   digitalWrite(motor1,LOW);
  }

 if (Serial.available()>0)
  switch(Serial.read())
  {
   case 's':
     SendMessage();
     break;
   case 'r':
     RecieveMessage();
     break;
  }
 if (SIM900A.available()>0)
  Serial.write(SIM900A.read());
}
 void SendMessage()
{
 Serial.println ("Sending Message");
 SIM900A.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
 delay(1000);
 Serial.println ("Set SMS Number");
 SIM900A.println("AT+CMGS=\"+8801521219939\"\r"); //Mobile phone number to send
message
 delay(1000);
 Serial.println ("Set SMS Content");
 SIM900A.println("Gas leackege????");// Messsage content
 delay(100);
 Serial.println ("Finish");
 SIM900A.println((char)26);// ASCII code of CTRL+Z
 delay(1000);
 Serial.println ("Message has been sent");
}
 void SendMessage1()
{
 Serial.println ("Sending Message");
 SIM900A.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
 delay(1000);
 Serial.println ("Set SMS Number");
```

```
  SIM900A.println("AT+CMGS=\"+8801521219939\"\r"); //Mobile phone number to send
message
  delay(1000);
  Serial.println ("Set SMS Content");
  SIM900A.println("Fire Detected????");// Messsage content
  delay(1000);
  SIM900A.println("AT+CMGS=\"+8801521441591\"\r"); //Mobile phone number to send
message
  delay(1000);
  Serial.println ("Set SMS Content");
  SIM900A.println("HELP US! FIRE HAS OCCURED AT ICT,MBSTU,SANTOSH");//
Messsage content
  delay(100);
  Serial.println ("Finish");
  SIM900A.println((char)26);// ASCII code of CTRL+Z
  delay(1000);

}
}
```

Working Principle

In GSM based LPG gas Leakage with Alert System MQ-6 gas sensor, Flame sensor as input devices and Piezoelectric buzzer,16x2 LCD display and GSM module used as output devices.

LCD showing output of Temperature, gas level and weight Actually the room temperature is 25°C, but we increased temperature by Fire. Initially before gas leakage the output of gas sensor is 0 ppm, but when it sense gas the output is 267 ppm. The above figure represents SMS messages in user mobile phone which is send by GSM module for different kinds of input reaction in our project. The message " Gas leakage " is sent to the user when the LPG gas Leakage also the fan on which flow out the leakage gas. Also LCD shows "Gas has Leakage, SMS sent Fan on" .

When Fire is Occurred at home then the flame sensor sense the value. Then alarm is on and SMS send to the user " Fire Detected " and "Help us! Fire has occurred at ICT MBSTU Santosh" to the nearest fire service office. The water pump is on for throw the water to the fire affected area until fire under control. Also LCD shows "Fire has Occurred, SMS sent pump on".
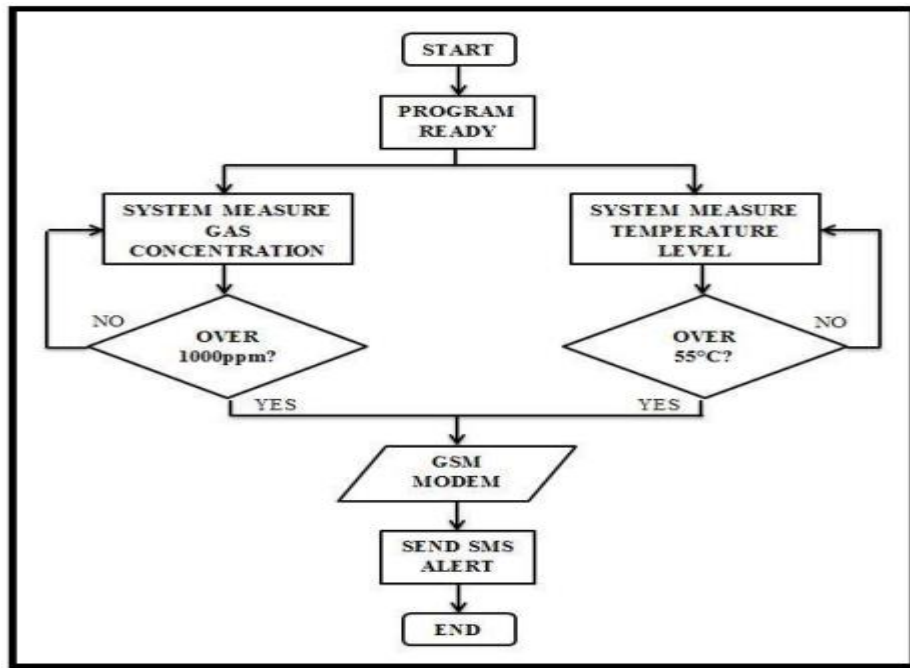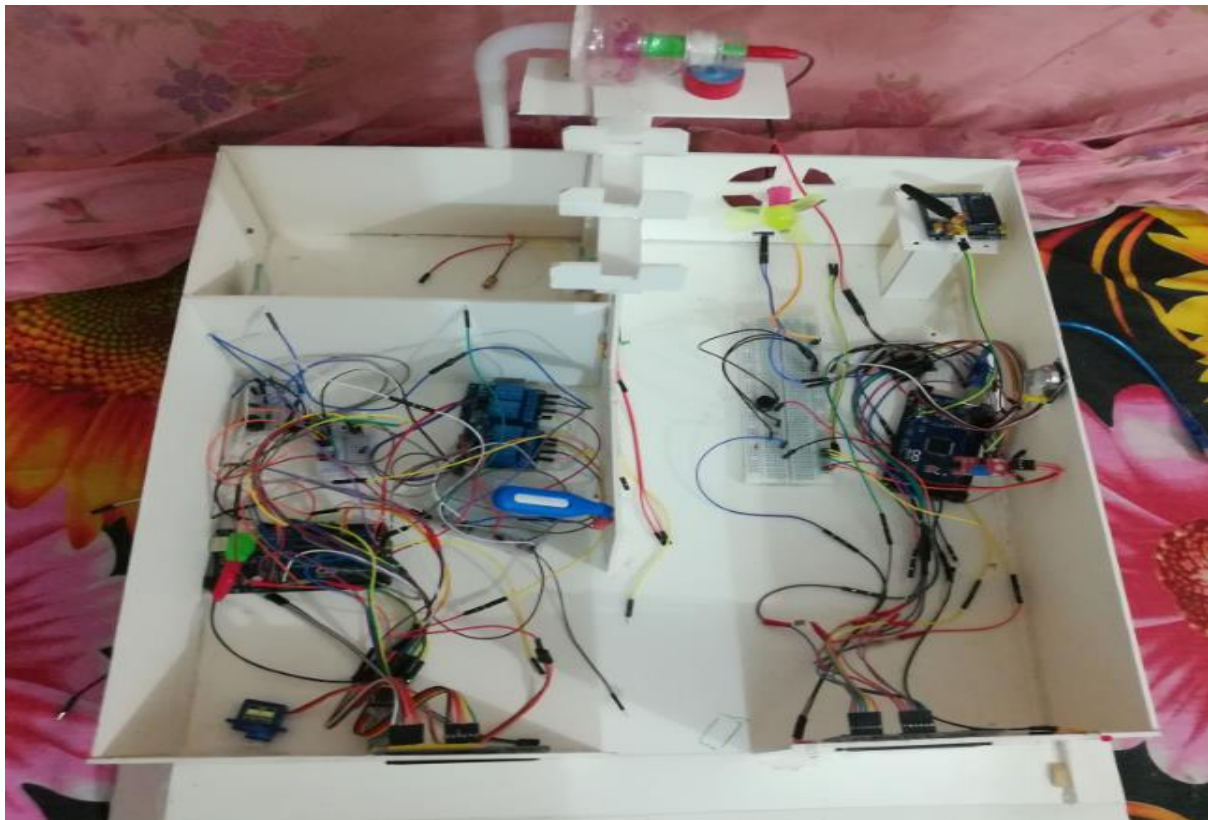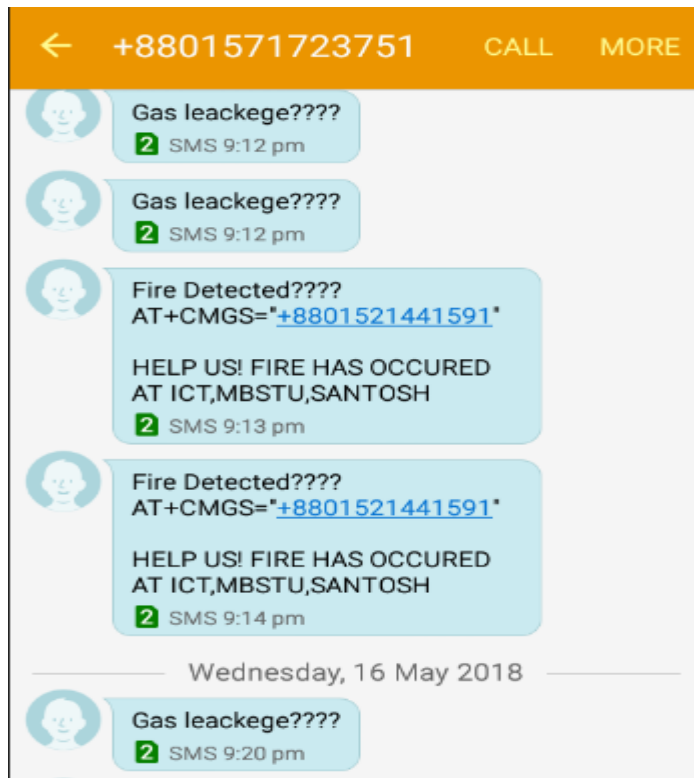
Fig: Flowchart of working principle of this system.
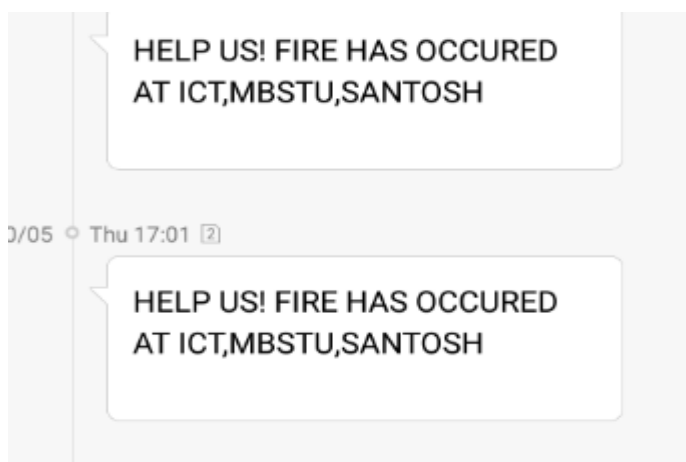
Hardware Architecture

Result

When Gas Is Leakage And Fire Occurred:

When Fire occurred then Fire Service Office:

Conclusion

Gas leakages and Fire occurred in households and industries cause risk to life and property. A huge loss has to be incurred for the accident occurred by such leakages and Fire Occurred. A solution to such a problem is to set up a monitoring system which keeps on monitoring the leakage and Fire Occurred of any kind of flammable gases and protects the consumer from such accidents. The present project provides a solution to prevent such accidents by not only monitoring the system but also by switching off the main power and gas supplies in case of a leakage. In addition to this, it activates an alarm as well as sends a message to the user. It also turns on the exhaust fan. When fire is occurred then it activates an alarm as well as sends a message to the user and also sends a message to the nearest Fire Service office. It also turns on the Water Pump which throw the water to the Fire affected Area until fire under control.

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