

# Fire Detection System with GSM Using Arduino

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**Abstract:** 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 gas sensor can be used to detect the presence of a dangerous LPG leak in any place like cars, service station of cylinders, storage tank, homes etc.but this sensor senses combustible gases like iso-butane, propane, LNG and cigarette smoke.

If the LPG sensor senses a combustible gas leakage, the output of this sensor goes high. This high signal is monitored by the Arduino Uno and will identify the leakage of LPG. After a few seconds delay, it turns ON an exhaust fan for removing gas out from the area and sends a messages as "FIRE ALERT" to the registered mobile number.

**Keywords:** Fire safety, Arduino GSM, MQ5 Sensor

## 1. Introduction

Fire safety is an important aspect of day to day life. Safety measures are to be taken at institute, industries, household, Home automation [6,7] etc. The scheme consists of a sensor MQ-5 Sensor. It consists of 2 coils named sensing coil and electrodes, Sensitive coil is made up of SnO<sub>2</sub> (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<sup>[1]</sup>. 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-5 sensor. 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 Uno" (Uno means one in Italian).

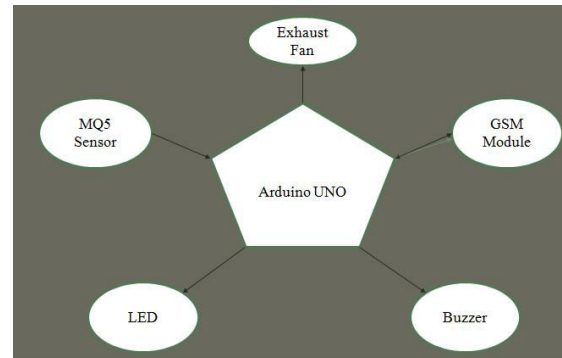


Figure 1. System Assembly

## 2. Components

- **MQ-5 Gas Sensor**  
The first smoke detector was manufactured by Meili and Jaeger in early 1940s<sup>[3]</sup>. MQ-5 Gas Sensor is a Semiconductor sensor, target gases of sensor are methane and LPG. It has a detection range of 300~10000PPM<sup>[2]</sup>. Sensor can work for both AC and DC Voltages.
- **Arduino Uno**  
Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.
- **G.S.M. Module**  
Global System for Mobile Communications or GSM is the world's most popular standard for mobile telephone systems[4]. 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<sup>[5]</sup>

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.
- Exhaust Fan
  - Buzzer
  - L.E.D.
  - Battery

### 3.Working Principle

The sensing material in gas sensors is metal oxide, usually SnO<sub>2</sub>(tin di-oxide). When a metal oxide crystal such as SnO<sub>2</sub> is heated at a certain high temperature in air, oxygen is adsorbed on the crystal surface with a negative charge, donor electrons in the crystal surface are transferred to the adsorbed oxygen, resulting in leaving positive charges in a space charge layer. This forms a surface potential which serves as a potential barrier against electron flow.

In the sensor, electric current flows through the grain boundary of SnO<sub>2</sub> crystals. At grain boundaries, adsorbed oxygen forms a potential barrier which prevents electrons from moving freely. In the presence of a deoxidizing gas, the surface density of the negatively charged oxygen decreases, so the barrier height in the grain boundary is reduced. The reduced barrier height

decreases sensor resistance, hence conductivity of the sensor increases.

### 4.Interconnections of GSM with Arduino Uno

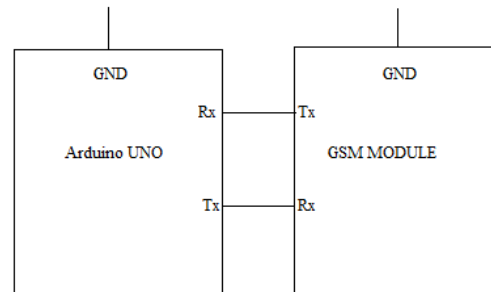


Figure 2.Interconnection between GSM and arduino

For connection, Transmitter Pin (Tx) of Arduino is connected to Receiver Pin (Rx) of GSM Module and Vice Versa.Ground Pin (GND) of both is shorted.

### 5.Hardware Architecture

Analog pin of MQ-5(A0) sensor is connected to A5 pin of Arduino UNO.GSM and Arduino is connected as mentioned above in the circuit diagram. Power supply to Arduino is given by a 9V battery .Both GSM and MQ-5 sensor components are powered by Arduino 5V pin.

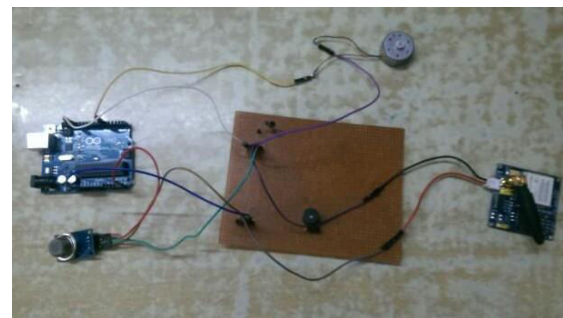


Figure 3.Hardware Set up

### 6. Arduino Code:-

```
int smokeA0 = A5;
# Threshold Value
int sensorThres = 70;
void setup() {
```

```
pinMode(smokeA0, INPUT);  
  
Serial.begin(9600);  
  
}  
  
void loop() {  
  
int analogSensor = analogRead(smokeA0);  
  
Serial.print("Pin A0: ");  
  
Serial.println(analogSensor);  
  
if (analogSensor > sensorThres)  
  
{  
  
Serial.println("AT+CMGF=1\r\n");  
  
delay(5000);  
  
Serial.print("AT+CMGS=\"");  
  
Serial.print("*****");  
  
Serial.print("\r\n");  
  
delay(2000);  
  
Serial.print("Fire ALert");  
  
Serial.write(0x1A);  
  
while(1);  
  
}  
  
}
```

## 7.Result

Leakage was detected and the alert message was sent to the registered mobile number.

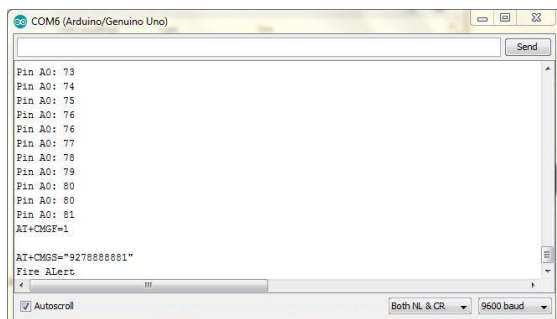


Figure 4. Monitoring system

## 7.Conclusion

Detection system for gas leakage is proposed. When gas leak occurs, the system senses the leakage and sends an alert SMS to registered user and turn on Buzzer, other precautionary measures like switching on of exhaust fan will take place in the system controlled by Arduino UNO

## 8.Acknowledgement

A project on “FIRE DETECTION SYSTEM WITH GSM MODULE USING ARDUINO” is build. Knowledge and experience was gained in order to make it. Satisfactory results have been received. In future we can also fulfil our technical requirements.

## 9.References

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