



ISSN: 2320-8090

Available online at <http://www.journalijcst.com>

International Journal of Current Science and Technology  
Vol.4, Issue, 3, pp. 154-157, March, 2016

IJCST

## RESEARCH ARTICLE

### GSM BASED LPG ALERT DEVICE

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#### ARTICLE INFO

##### Article History:

Received 15<sup>th</sup> December, 2015

Received in revised form 21<sup>st</sup>

January, 2016

Accepted 06<sup>th</sup> February, 2016

Published online 28<sup>th</sup>

March, 2016

#### ABSTRACT

This ALERT ME is a microcontroller based project. This project emphasizes on the safety from LPG gas leakage. Here if there is enough LPG concentration in home atmosphere it will cut-off the power and will send a SMS to owner's mobile and BUZZER will get rung until the LPG concentration comes to normal. This project has two main parts – Microcontroller (ARDUINO UNO) and GSM kit (GSM SIM 300). This project will prevent to set fire from short-circuit. As it is GSM based owner will get notification even when he/she will not present in the room and as power get automatically cut off so owner needs not to be worried.

##### Key words:

ARDUNIO UNO, GSM SIM 300,

LPG Sense, Power trip, LCD.

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## INTRODUCTION

There is one input for this project that is LPG gas concentration in the atmosphere. If this value is greater than or equal to the threshold value then this system will get activated. There are 3 outputs of this system – BUZZER, SMS notification, Power Trip. There will be a LCD attached to this system to provide the status.

### Implementation

This project is based on microcontroller. Here we have used Arduino UNO. GSM 300 kit has been used for remote access. Here is the details of implementation.

#### Hardware

##### Arduino

Arduino[1] is a single-board microcontroller, intended to make building interactive objects or environments more accessible. It is a tool for making computers that can sense and control more of the physical world than our desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

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#### Relay Driver

Relays[2] have been around for a long time and though often now replaced with solid state switches, they have unique properties that make them more robust than solid-state devices and are not going away. The unique properties are high current capacity, ability to withstand ESD and drive circuit isolation. There are numerous ways to drive relays.

#### GSM 300

This is a plug and play GSM Modem[3] with a simple to interface serial interface. Use it to send SMS, make and receive calls, and do other GSM operations by controlling it through simple AT commands from micro controllers and computers. It uses the highly popular SIM300 module for all its operations. It comes with a standard RS232 interface which can be used to easily interface the modem to micro controllers and computers.

#### Software

The Arduino integrated development environment (IDR) is a cross-platform application written in Java, and derives from the IDR for the language and the Wiring projects. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a sketch. Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring"

from the original Wiring project, which makes many common input/output operations much easier. Users only need define two functions to make a runnable cyclic executive program:

- Setup(): a function run once at the start of a program that can initialize setting
- Loop(): a function called repeatedly until the board powers off.

## Hardware Equipment

### Arduino UNO

The open-source platform, Arduino is mainly used for Electronic based project building purpose. Arduino consists a physical programmable circuit board (microcontroller board based on the ATmega328) and a piece of s/w or IDE(Integrated Development Environment) that is used to write and upload computer code to the physical board.

The Arduino Uno is ATmega328 based microcontroller board. Arduino board needs a power source connection connecting with a USB cable coming from computer or wall power supply that is terminated in a barrel jack. According to picture USB connection is labeled (1) & the barrel jack is labeled (2). Including 6 digital I/O pins(3,5,6,9,10 and 11 on the Uno)used for PULSE –WIDTH MODULATION(PWM) output, the microcontroller has 14 digital I/O pins, 6 analog inputs pins(A0 through A5 on the Uno) which can read the signal from analog sensor(ex- temperature sensor) & convert it into the digital value that we can read,16 MHz ceramic resonator, an ICSP HEADER & a RESET button.

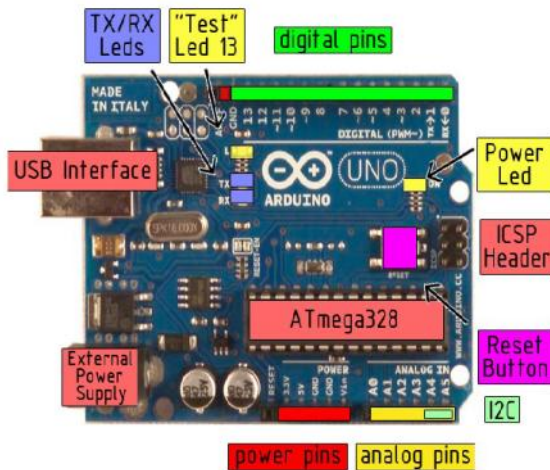


Figure 1 Arduino UNO

### GSM SIM 300

This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily. The modem can either be connected to PC serial port directly or to any microcontroller. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. In GPRS mode you can also connect to any remote FTP server and upload files for data logging.



Figure 2 GSM SIM 300

### LCD

Liquid Crystal Display[4] screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.



Figure 3 LCD screen

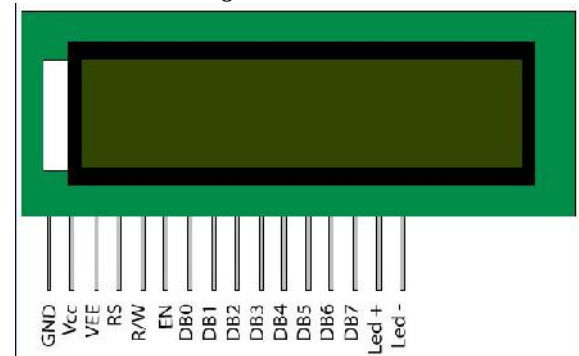


Figure 4 LCD pin diagram

### Gas leakage module using the MQ-5 gas sensor

The working principle behind the MQ-5[5] gas sensor is as follows: The sensor has a sensitive filament made of SnO<sub>2</sub>. In the presence of clean air, this filament tends to have lower

electrical conductivity. When a combustible gas such as LPG is introduced, the filament's conductivity rises, and the amount of change in its conductance/resistance can be used to indicate the equivalent gas concentration. This effect tends to be particularly pronounced at higher temperatures, and resistive heating element is present as well. SnO<sub>2</sub> is particularly sensitive to Methane, Butane and Propane, but is also sensitive to other combustible gases as well.

The Technical specifications for the MQ-5 sensor are tabulated here:

**Table 1** Technical Specifications of the MQ-5 Gas leakage sensor

| Model No.              | MQ-5                                                     |                                                                                   |
|------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------|
| Sensor type            | Semiconductor                                            |                                                                                   |
| Standard Encapsulation | Bakelite (Black Bakelite)                                |                                                                                   |
| Detection Gas          | LPG, Methane, coal gas                                   |                                                                                   |
| Concentration          | 300 10000ppm (Methane, Propane, Butane, H <sub>2</sub> ) |                                                                                   |
| Circuit                | Loop Voltage                                             | V <sub>L</sub> $\leq 24V$ DC                                                      |
|                        | Heater Voltage                                           | V <sub>H</sub> $5.0V \pm 0.2V$ AC or DC                                           |
|                        | Load Resistance                                          | R <sub>L</sub> Adjustable                                                         |
| Character              | Heater Resistance                                        | R <sub>H</sub> $31.7 \pm 3.0 \Omega$ at room Temp.                                |
|                        | Heater consumption                                       | P <sub>H</sub> $\leq 900mW$                                                       |
|                        | Sensing Resistance                                       | R <sub>s</sub> $2K\Omega - 20K\Omega$ (in 2000ppm C <sub>3</sub> H <sub>8</sub> ) |
|                        | Sensitivity                                              | S $R_s(\text{in air})/R_s(1000ppm C_3H_8) \geq 5$                                 |
|                        | Scope                                                    | $\alpha$ $\leq 0.6(R_{1000ppm}/R_{500ppm I_2})$                                   |
| Condition              | Tem. Humidity                                            | $20 \pm 25\% \pm 5\%RH$                                                           |
|                        | Standard test circuit                                    | V <sub>L</sub> : $5.0V \pm 0.1V$<br>V <sub>H</sub> : $5.0V \pm 0.1V$              |
|                        | Preheat time                                             | Over 48 hours                                                                     |

The working of the MQ-5 sensor can be explained using Pic 1. The heating coil H is in contact with the SnO<sub>2</sub> filament. In the presence of clean air, the resistance across the heating coil does not vary, but when a combustible gas is present, the resistance of the SnO<sub>2</sub> filament drops, which results in a corresponding rise in Output Voltage (V<sub>out</sub>), and this output voltage can be measured to indicate the concentration of any combustible gas that is present



**Figure 5** MQ-5

### Algorithm

Step – 0 : Start  
 Step – 1 : Initialize input pin and output pin  
 Step – 2 : If LPG sense goto Step - 4 else goto Step – 6  
 Step – 3 : Buzzer activate  
 Step – 4 : SMS get sent to owner's mobile  
 Step – 5 : Power trip

Step – 6 : Goto Step – 1

Step – 7 : End

### Pseudo Code

```
var phone[]="Owner's Mobile";
mq2=A0;
rel=13;
buz=10;
swtch_state1=0;
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
```

```
//setup()
pinMode(rel,OUTPUT);
pinMode(buz,OUTPUT);
digitalWrite(rel,LOW);
digitalWrite(buz,LOW);
lcd.begin(16,2);
//loop()
d=analogRead(mq2);
lcd.setCursor(0,0);
lcd.print("LPG SENSOR");
if(d<60)
{
p=0;
}
else
{
p=(d-60)/9.64;
}
lcd.setCursor(0,1);
lcd.print(p);
lcd.setCursor(5,1);
lcd.print("%");
if(p>=30)
{
digitalWrite(rel,LOW);
digitalWrite(buz,HIGH);
lcd.setCursor(9,1);
lcd.print("TRIP");
Serial.print("AT+CMGS=\"");
Serial.print(phone);
Serial.println("\n");
while(Serial.read()!='>');
{
Serial.print("Gas leaked");
delay(500);
Serial.write(0x1A);
Serial.write(0x0D);
Serial.write(0x0A);
delay(5000);
}
}
else
{
digitalWrite(rel,HIGH);
digitalWrite(buz,LOW);
}
delay(500);
lcd.clear();
}
```

# Flowchart

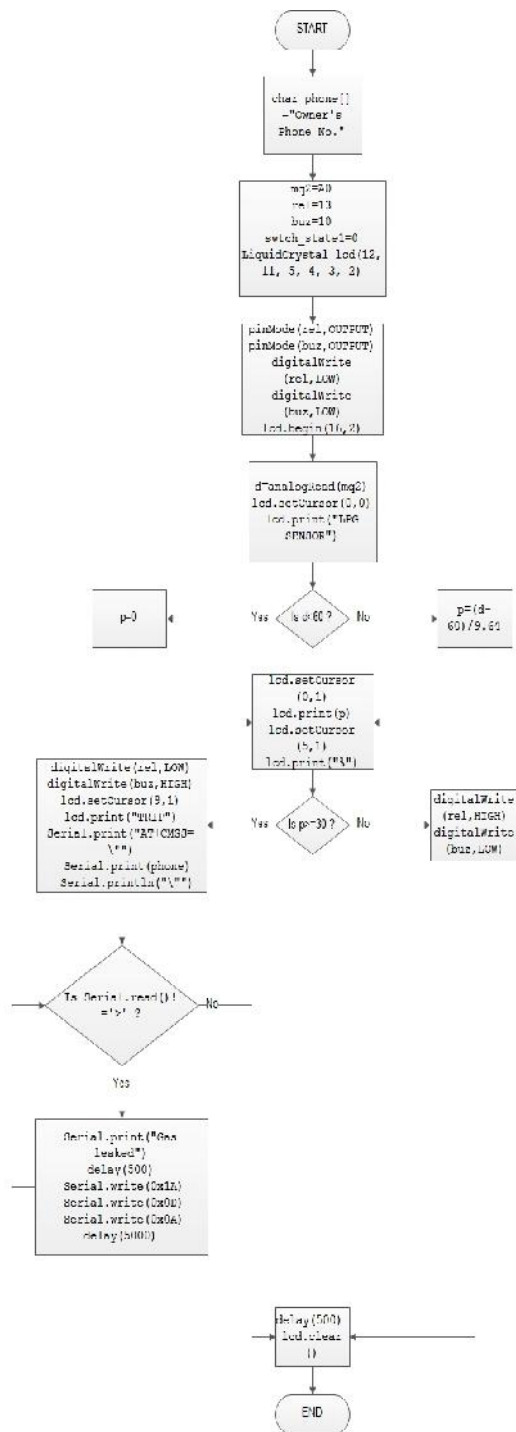


Figure 5 Flowchart

# Functional Circuit Diagram

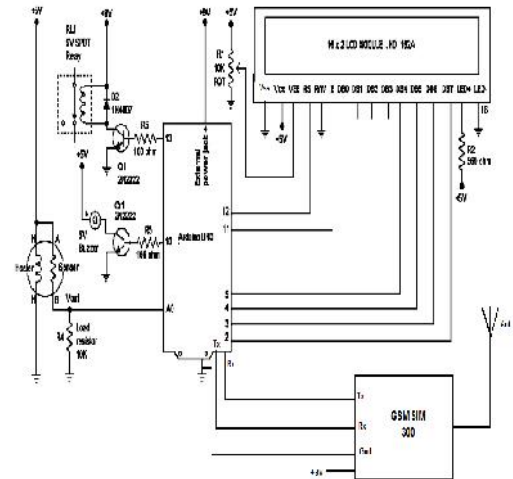


Figure 6 Functional Circuit Diagram

# CONCLUSION

Our System has several advantages like robust, microcontroller based – so reliable, GSM based – so remotely accessible, ‘power trip’ feature – so no provision of setting fire from short circuit.

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