

# CNG/LPG Gas Accident Prevention With GSM Alert

Submitted in partial fulfillment of the requirements  
of the degree of

(Bachelor of Engineering)

By

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# APPROVAL SHEET

## Project Report Approval for B. E.

This project report entitled (*CNG/LPG Gas Accident Prevention With GSM Alert*) by

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is approved for the degree of B.E EXTC.

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Place: New Panvel

# DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Date:

# ACKNOWLEDGEMENT

We appreciate the beauty of a rainbow, but never do we think that we need both the sun and the rain to make its colors appear. Similarly, this project work is the fruit of many such unseen hands. It's those small inputs from different people that have lent a helping to our project.

I also take this opportunity to express a deep sense of gratitude to **Prof. Mr. Mujib Tamboli**, HOD of EXTC department for his cordial support, valuable information and guidance, which helped us in completing this task through various stages.

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# ABSTRACT

Gas leakage is a major problem with industrial sector, residential premises and gas powered vehicles like CNG (compressed natural gas) buses, cars. One of the preventive methods to stop accident associated with the gas leakage is to install gas leakage detection kit at vulnerable places. The aim of this project is to present such a design that can automatically detect and stop gas leakage in vulnerable premises. In particular gas sensor has been used which has high sensitivity for propane ( $C_3H_8$ ) and butane ( $C_4H_{10}$ ). Gas leakage system consists of GSM (Global System for mobile communications) module, which warns by sending SMS. However, the former gas leakage system cannot react in time. This project provides the design approach on both software and hardware.

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# **Chapter 1**

## **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.

Bhopal gas tragedy was an example of gas leakage accident in India. This was world's worst gas leakage industrial accident. Gas leakage detection is not only important but stopping leakage is equally essential. 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 call is sent to an authorized person informing him about the leakage

## **OBJECTIVES OF THE PROJECT**

- Detect Gas Leakage (like LPG leak, Butane leak, Methane leak) or any such petroleum based gaseous substance that can be detected using MQ5 Sensor.
- Setup an SMS based Alert Mechanism and send 3 SMS (3 alert messages) to 2 specified mobile numbers (input inside the arduino program)
- Produce a sound alarm upon gas leak and stop the alarm once gas leak is under control (gas presence in atmosphere is under normal range)
- Display status in an LCD using a 16×2 LCD module.

# Chapter 2

## RELATED THEORY

### 2.1 ARDUINO UNO:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, 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.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

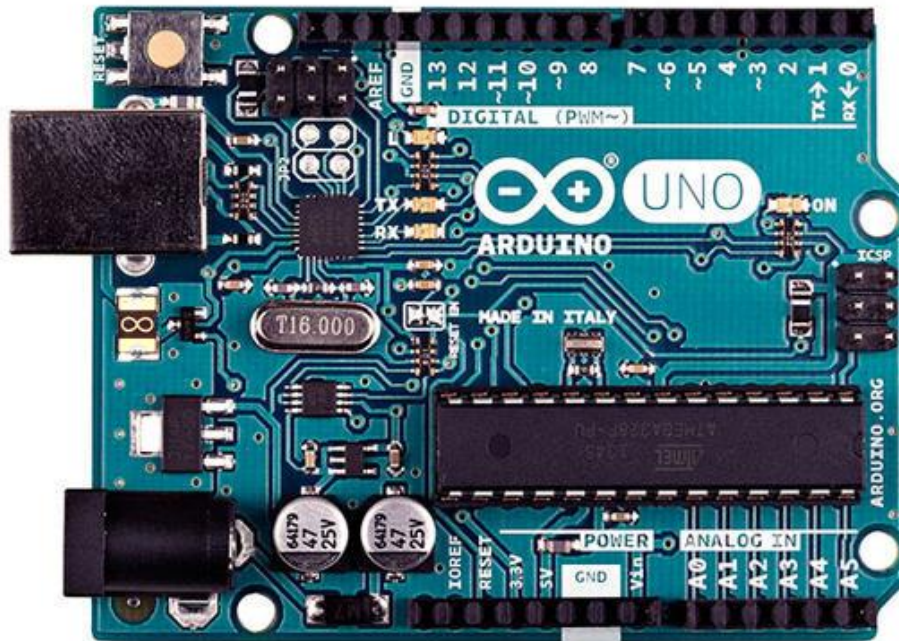
Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

Revision 3 of the board has the following new features:

- 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin, that is reserved for future purposes.
- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.





## Arduino Microcontroller

Microcontroller	ATmega328
Architecture	AVR
Operating Voltage	5 V
Flash memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB
Clock Speed	16 MHz
Analog I/O Pins	6
EEPROM	1 KB
DC Current per I/O Pins	40 mA on I/O Pins; 50 mA on 3,3 V Pin

## General

Input Voltage	7-12 V
Digital I/O Pins	20 (of which 6 provide PWM output)
PWM Output	6
PCB Size	53.4 x 68.6 mm
Weight	25 g
Product Code	A000066 (TH); A000073 (SMD)

## Programming

The Arduino/Genuino Uno can be programmed with the (Arduino Software (IDE)). Select "Arduino/Genuino Uno" from the Tools > Board menu (according to the microcontroller on your board).

The ATmega328 on the Arduino/Genuino Uno comes preprogrammed with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.

The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available in the Arduino repository. The ATmega16U2/8U2 is loaded with a DFU bootloader, which can be activated by:

- On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2.
- On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

## Warnings

The Arduino/Genuino Uno has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than

500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

## **Differences with other boards**

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

## **Power**

The Arduino/Genuino Uno board can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector.

The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

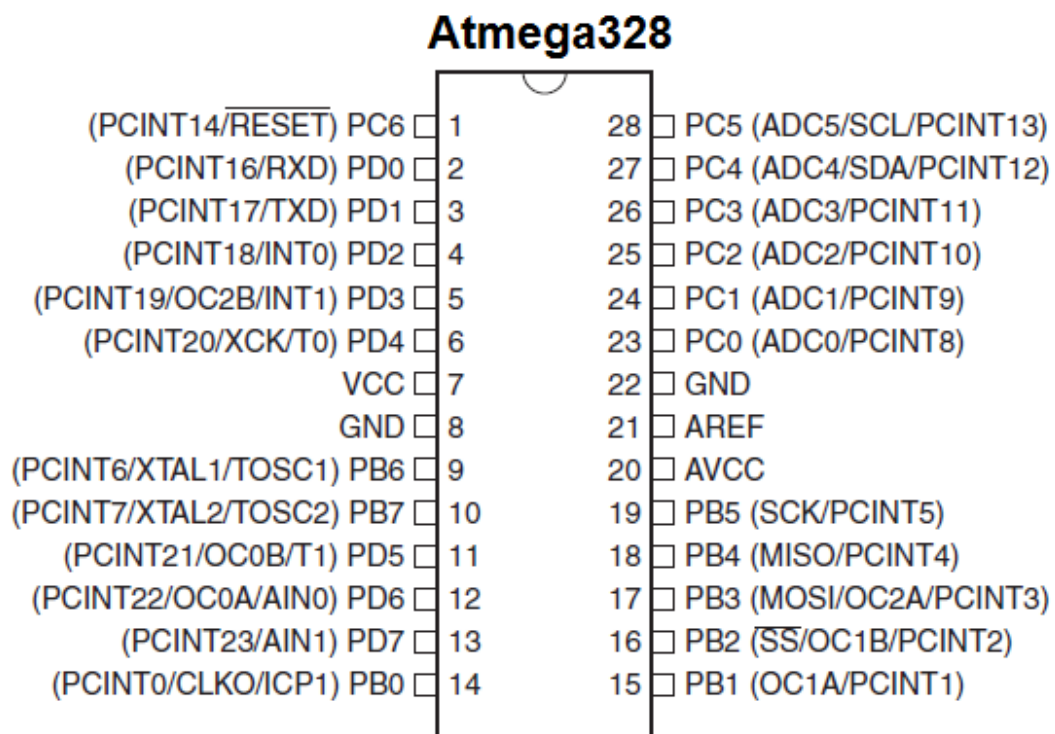
- Vin. The input voltage to the Arduino/Genuino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- 5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
- 3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- GND. Ground pins.
- IOREF. This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

## Memory

The ATmega328 has 32 KB (with 0.5 KB occupied by the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM Library).

## Input and Output

See the mapping between Arduino pins and ATmega328P ports. The mapping for the Atmega8, 168, and 328 is identical.



Each of the 14 digital pins on the Uno can be used as an input or output, using `pinMode()`, `digitalWrite()` and `digitalRead()` functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- 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. See the `attachInterrupt()` function for details.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the `analogWrite()` function.
- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
- LED: 13. There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though it is possible to change the upper end of their range using the AREF pin and the `analogReference()` function.

There are a couple of other pins on the board:

- AREF. Reference voltage for the analog inputs. Used with `analogReference()`.
- Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

## Communication

Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A SoftwareSerial Library allows serial communication on any of the Uno's digital pins.

The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino Software (IDE) includes a Wire library to simplify use of the I2C bus;

Rather than requiring a physical press of the reset button before an upload, the Arduino/Genuino Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino Software (IDE) uses this capability to allow you to upload code by simply pressing the upload button in the interface toolbar. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

The Uno board contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line.

## Revisions

Revision 3 of the board has the following new features:

- 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin, that is reserved for future purposes.
- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.
-

## **2.2 SIM900 GSM MODULE**

This is a GSM/GPRS-compatible Quad-band cell phone, which works on a frequency of 850/900/1800/1900MHz and which can be used not only to access the Internet, but also for oral communication (provided that it is connected to a microphone and a small loud speaker) and for SMSs. Externally, it looks like a big package (0.94 inches x 0.94 inches x 0.12 inches) with L-shaped contacts on four sides so that they can be soldered both on the side and at the bottom. Internally, the module is managed by an AMR926EJ-S processor, which controls phone communication, data communication (through an integrated TCP/IP stack), and (through an UART and a TTL serial interface) the communication with the circuit interfaced with the cell phone itself.

SIMCom presents an ultra compact and reliable wireless module. The SIM900A is a complete Dual-band GSM/GPRS module in a SMT type which is designed specially for Chinese market, allowing you to benefit from small dimensions and cost-effective solutions.

Featuring an industry-standard interface, the SIM900A delivers GSM/GPRS 900/1800MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900A can fit almost all the space requirements in your applications, especially for slim and compact demand of design.

The processor is also in charge of a SIM card (3 or 1,8 V) which needs to be attached to the outer wall of the module.



In addition, the GSM900 device integrates an analog interface, an A/D converter, an RTC, an SPI bus, an I<sup>2</sup>C, and a PWM module. The radio section is GSM phase 2/2+ compatible and is either class 4 (2 W) at 850/ 900 MHz or class 1 (1 W) at 1800/1900 MHz.

The TTL serial interface is in charge not only of communicating all the data relative to the SMS already received and those that come in during TCP/IP sessions in GPRS (the data-rate is determined by GPRS class 10: max. 85,6 kbps), but also of receiving the circuit commands (in our case, coming from the PIC governing the remote control) that can be either AT standard or AT-enhanced SIMCom type.

The module is supplied with continuous energy (between 3.4 and 4.5 V) and absorbs a maximum of 0.8 A during transmission.



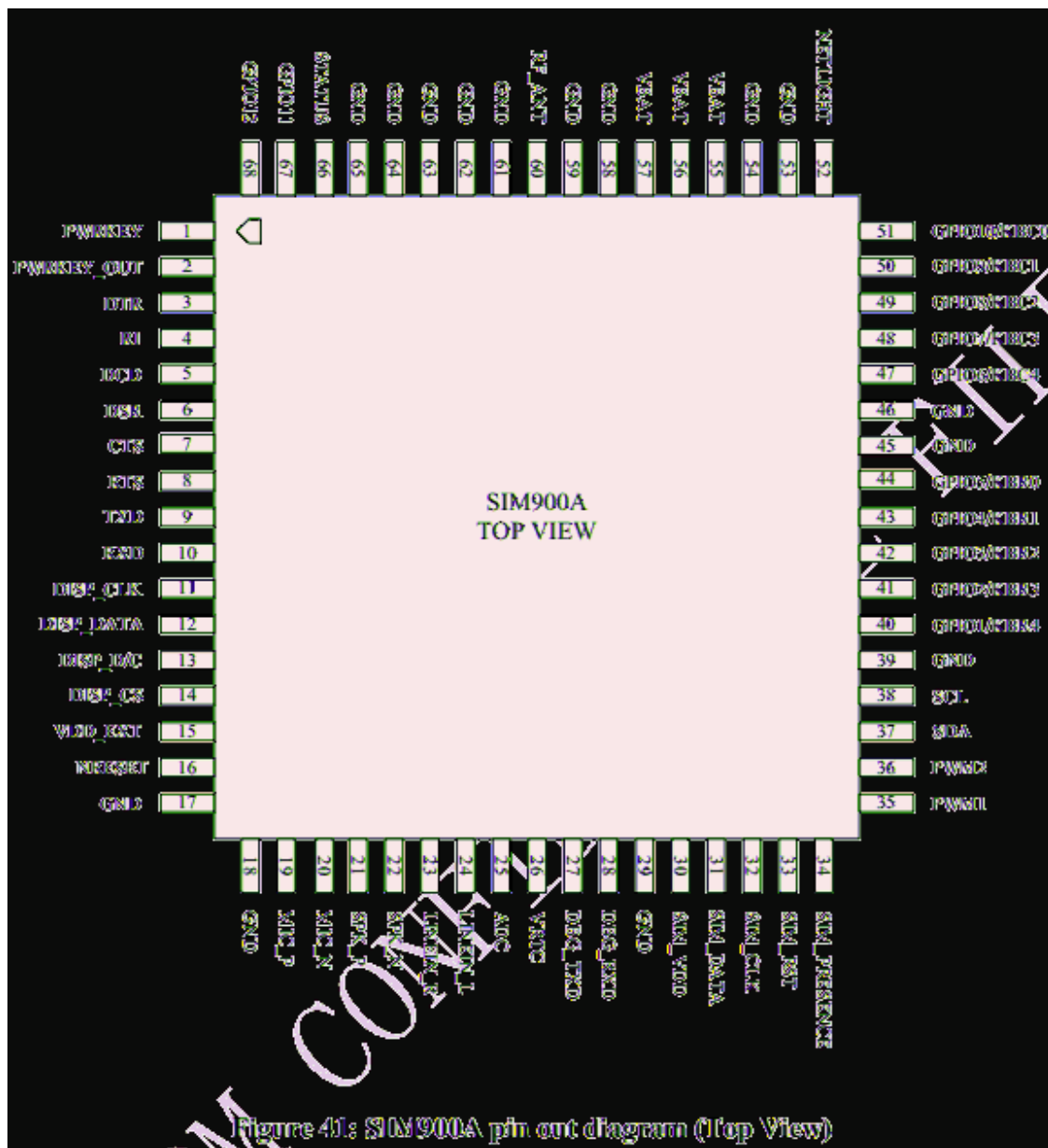


Figure 41: SIM900A pin out diagram (Top View)

### Features:

- Quad-Band 850/ 900/ 1800/ 1900 MHz
- Dual-Band 900/ 1900 MHz
- GPRS multi-slot class 10/8GPRS mobile station class B
- Compliant to GSM phase 2/2+Class 4 (2 W @850/ 900 MHz)
- Class 1 (1 W @ 1800/1900MHz)

- Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)
- Low power consumption: 1.5 mA (sleep mode)
- Operation temperature: -40°C to +85 °C
- The default baud rate is 115200.
- Connect PWR & GND momentarily to power up the module.
- Min input voltage 6V. Recommended operating voltage 7.5V.
- If the module goes out of power after couple of seconds after power up then check your power source.

## 2.3 MQ6 GAS MODULE:

This sensor module utilizes an MQ-6 as the sensitive component and has a protection resistor and an adjustable resistor on board. The MQ-6 gas sensor is highly sensitive to LPG, iso-butane, propane and less sensitive to alcohol, cooking fume and cigarette smoke. It could be used in gas leakage detecting equipments in family and industry. The resistance of the sensitive component changes as the concentration of the target gas changes.



Sensitive material of MQ-6 gas sensor is SnO<sub>2</sub>, which with lower conductivity in clean air. When the target combustible gas exist, the sensor's conductivity is more higher along with the gas concentration rising. Please use simple electrocircuit, Convert change of conductivity to correspond output signal of gas concentration.

## Features:

- Continuous Analog output
- 3-pin interlock connector
- Low cost and compact size

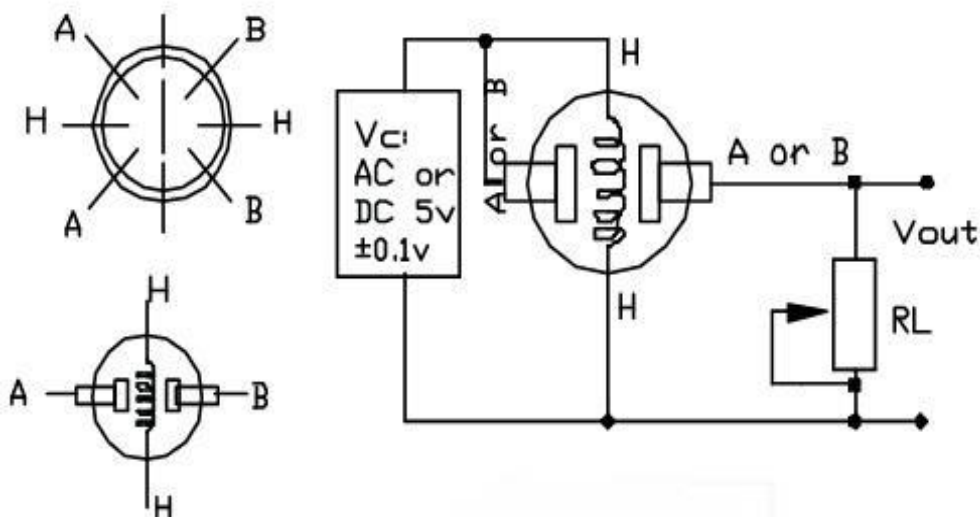
## Character

- Good sensitivity to Combustible gas in wide range
- High sensitivity to Propane, Butane and LPG
- Long life and low cost
- Simple drive circuit

## Applications

- Domestic gas leakage detector
- Industrial Combustible gas detector
- Portable gas detector

## Internal Circuitry:



## Technical Specifications:

Model		MQ-6	
Sensor Type		Semiconductor	
Standard Encapsulation		Bakelite, Metal cap	
Target Gas		LPG	
Detection range		300~10000ppm (Propane)	
Standard Circuit Conditions	Loop Voltage	$V_c$	$\leq 24V$ DC
	Heater Voltage	$V_H$	$5.0V \pm 0.1V$ AC or DC
	Load Resistance	$R_L$	Adjustable
Sensor character under standard test conditions	Heater Resistance	$R_H$	$26\Omega \pm 3\Omega$ (room tem.)
	Heater consumption	$P_H$	$\leq 950mW$
	Sensitivity	$S$	$R_s(\text{in air})/R_s(\text{in } 2000\text{ppm } C_3H_8) \geq 5$
	Output Voltage	$V_s$	$2.5V \sim 4.0V$ (in 2000ppm $C_3H_8$ )
	Concentration Slope	$\alpha$	$\leq 0.6(R_{3000\text{ppm}}/R_{1000\text{ppm}} C_3H_8)$
Standard test conditions	Tem. Humidity	$20^\circ C \pm 2^\circ C$ ; $55\% \pm 5\% RH$	
	Standard test circuit	$V_c: 5.0V \pm 0.1V$ ; $V_H: 5.0V \pm 0.1V$	
	Preheat time	Over 48 hours	

## Sensitivity Characteristics

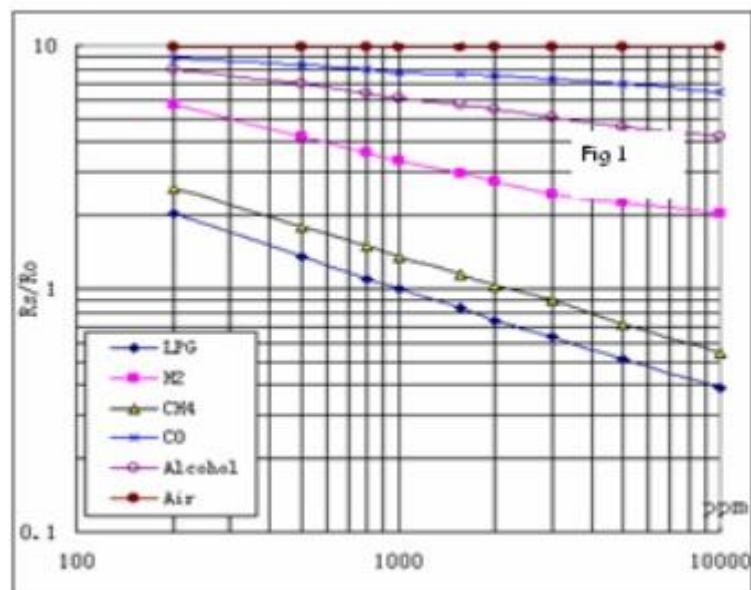


Fig. shows the typical sensitivity characteristics of the MQ-6, ordinate means resistance ratio of the sensor ( $R_s/R_o$ ), abscissa is concentration of gases.  $R_s$  means resistance in different gases,  $R_o$  means resistance of sensor in 1000ppm LPG. All test are under standard test conditions.

## Influence of Temperature/Humidity

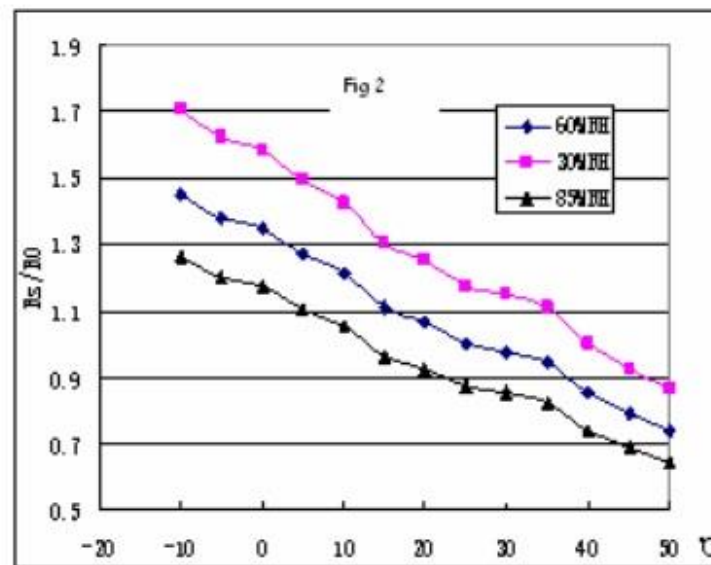
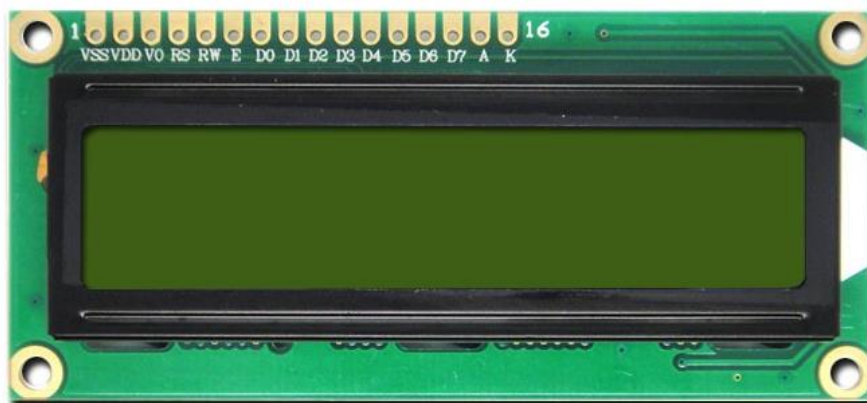


Fig. shows the typical temperature and humidity characteristics. Ordinate means resistance ratio of the sensor ( $R_s/R_0$ ),  $R_s$  means resistance of sensor in 1000ppm Methane under different tem. and humidity.  $R_0$  means resistance of the sensor in environment of test conditions. 1000ppm Propane, 20°C/65%RH

## 2.4 16x2 LCD MODULE:

LCD (Liquid Crystal Display) 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. Click to learn more about internal structure of a LCD.

## Pin Configuration:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	V <sub>CC</sub>
3	Contrast adjustment; through a variable resistor	V <sub>EE</sub>
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V <sub>CC</sub> (5V)	Led+
16	Backlight Ground (0V)	Led-

V<sub>EE</sub> pin is meant for adjusting the contrast of the LCD display and the contrast can be adjusted by varying the voltage at this pin. This is done by connecting one end of a POT to the V<sub>CC</sub> (5V), other end to the Ground and connecting the center terminal (wiper) of of the POT to the V<sub>EE</sub> pin. See the circuit diagram for better understanding.



The JHD162A has two built in registers namely data register and command register. Data register is for placing the data to be displayed , and the command register is to place the commands. The 16×2 LCD module has a set of commands each meant for doing a particular job with the display. We will discuss in detail about the commands later. High logic at the RS pin will select the data register and Low logic at the RS pin will select the command register. If we make the RS pin high and the put a data in the 8 bit data line (DB0 to DB7) , the LCD module will recognize it as a data to be displayed . If we make RS pin low and put a data on the data line, the module will recognize it as a command.

R/W pin is meant for selecting between read and write modes. High level at this pin enables read mode and low level at this pin enables write mode.

E pin is for enabling the module. A high to low transition at this pin will enable the module.

DB0 to DB7 are the data pins. The data to be displayed and the command instructions are placed on these pins.

LED+ is the anode of the back light LED and this pin must be connected to Vcc through a suitable series current limiting resistor. LED- is the cathode of the back light LED and this pin must be connected to ground.

### **16×2 LCD module commands.**

16×2 LCD module has a set of preset command instructions. Each command will make the module to do a particular task. The commonly used commands and their function are given in the table below.

## LCD Commands

HD44780 instruction set

Instruction	Code										Description	Execution time**
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
<a href="#">Clear display</a>	0	0	0	0	0	0	0	0	0	1	Clears display and returns cursor to the home position (address 0).	1.64mS
<a href="#">Cursor home</a>	0	0	0	0	0	0	0	0	1	*	Returns cursor to home position (address 0). Also returns display being shifted to the original position. DDRAM contents remains unchanged.	1.64mS
<a href="#">Entry mode set</a>	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction (I/D), specifies to shift the display (S). These operations are performed during data read/write.	40uS
<a href="#">Display On/Off control</a>	0	0	0	0	0	0	1	D	C	B	Sets On/Off of all display (D), cursor On/Off (C) and blink of cursor position character (B).	40uS
<a href="#">Cursor/display shift</a>	0	0	0	0	0	1	S/C	R/L	*	*	Sets cursor-move or display-shift (S/C), shift direction (R/L). DDRAM contents remains unchanged.	40uS
<a href="#">Function set</a>	0	0	0	0	1	DL	N	F	*	*	Sets interface data length (DL), number of display line (N) and character font(F).	40uS
<a href="#">Set CGRAM address</a>	0	0	0	1	CGRAM address					Sets the CGRAM address. CGRAM data is sent or received after this setting.	40uS	
<a href="#">Set DDRAM address</a>	0	0	1	DDRAM address					Sets the DDRAM address. DDRAM data is sent or received after this setting.	40uS		
<a href="#">Read busy-flag and address counter</a>	0	1	BF	DDRAM address					Reads Busy-flag (BF) indicating internal operation is being performed and reads address counter contents.	0uS		
<a href="#">Write to CGRAM or DDRAM</a>	1	0	write data					Writes data to CGRAM or DDRAM.	40uS			
<a href="#">Read from CGRAM or DDRAM</a>	1	1	read data					Reads data from CGRAM or DDRAM.	40uS			

## **LCD initialization.**

The steps that has to be done for initializing the LCD display is given below and these steps are common for almost all applications.

- Send 38H to the 8 bit data line for initialization
- Send 0FH for making LCD ON, cursor ON and cursor blinking ON.
- Send 06H for incrementing cursor position.
- Send 01H for clearing the display and return the cursor.

## **Sending data to the LCD.**

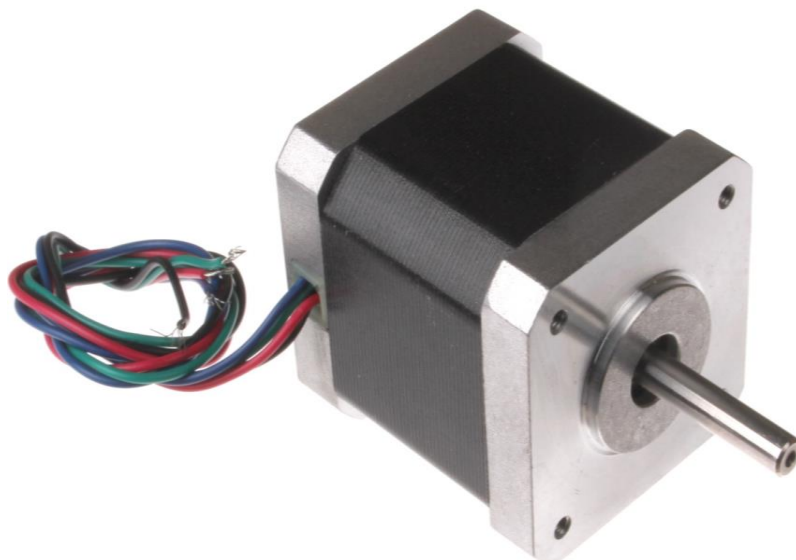
The steps for sending data to the LCD module is given below. I have already said that the LCD module has pins namely RS, R/W and E. It is the logic state of these pins that make the module to determine whether a given data input is a command or data to be displayed.

- Make R/W low.
- Make RS=0 if data byte is a command and make RS=1 if the data byte is a data to be displayed.
- Place data byte on the data register.
- Pulse E from high to low.
- Repeat above steps for sending another data.

## 2.5 STEPPER MOTOR:

A stepper motor or step motor or stepping motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed.

Switched reluctance motors are very large stepping motors with a reduced pole count, and generally are closed-loop commutated.



DC brushed motors rotate continuously when DC voltage is applied to their terminals. The stepper motor is known by its property to convert a train of input pulses (typically square wave pulses) into a precisely defined increment in the shaft position. Each pulse moves the shaft through a fixed angle.

Stepper motors effectively have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are energized by an external driver circuit or a micro controller. To make the motor shaft turn, first, one electromagnet is given power, which magnetically attracts the gear's teeth. When the gear's teeth are aligned to the first electromagnet, they are slightly offset from the next electromagnet. This means that when the next electromagnet is turned on

and the first is turned off, the gear rotates slightly to align with the next one. From there the process is repeated. Each of those rotations is called a "step", with an integer number of steps making a full rotation. In that way, the motor can be turned by a precise angle.

### **Advantages:**

**Positioning:** Since steppers move in precise repeatable steps, they excel in applications requiring precise positioning such as 3D printers, CNC, Camera platforms and X,Y Plotters. Some disk drives also use stepper motors to position the read/write head.

**Speed Control:** Precise increments of movement also allow for excellent control of rotational speed for process automation and robotics.

**Low Speed Torque:** Normal DC motors don't have very much torque at low speeds. A Stepper motor has maximum torque at low speeds, so they are a good choice for applications requiring low speed with high precision.

### **Limitations:**

**Low Efficiency:** Unlike DC motors, stepper motor current consumption is independent of load. They draw the most current when they are doing no work at all. Because of this, they tend to run hot.

**Limited High Speed Torque:** In general, stepper motors have less torque at high speeds than at low speeds. Some steppers are optimized for better high-speed performance, but they need to be paired with an appropriate driver to achieve that performance.

**No Feedback:** Unlike servo motors, most steppers do not have integral feedback for position. Although great precision can be achieved running 'open loop'. Limit switches or 'home' detectors are typically required for safety and/or to establish a reference position

### **Types of Steppers**

There are a wide variety of stepper types, some of which require very specialized drivers. For our purposes, we will focus on stepper motors that can be driven with

commonly available drivers. These are: Permanent Magnet or Hybrid steppers, either 2-phase bipolar, or 4-phase unipolar.

### **Motor Size**

One of the first things to consider is the work that the motor has to do. As you might expect, larger motors are capable of delivering more power. Stepper motors come in sizes ranging from smaller than a peanut to big NEMA 57 monsters.

Most motors have torque ratings. This is what you need to look at to decide if the motor has the strength to do what you want.

NEMA 17 is a common size used in 3D printers and smaller CNC mills. Smaller motors find applications in many robotic and animatronic applications. The larger NEMA frames are common in CNC machines and industrial applications.

The NEMA numbers define standard faceplate dimensions for mounting the motor. They do not define the other characteristics of a motor. Two different NEMA 17 motors may have entirely different electrical or mechanical specifications and are not necessarily interchangeable.

## Chapter 3

### LITERATURE SURVEY

[1] Hesong Huang, Hongning Bian, Shuchuan Zhu published A Greenhouse Remote Monitoring System Based On GSM in which system can detect temperature, CO<sub>2</sub> concentration, Humidity in the greenhouse real time and control the working states of the field equipments and the GSM Module according to the difference between the testing value and the setting value. The system can realise remote alarming function and remote data connection with the PC by the GSM/GPRS Module when testing value is transfinite. In addition, user can set standard values of parameters or inquiry testing values by mobile phone. This system has lots of advantages, for example, low cost, low communication price, stable link, large coverage etc. Therefore it is easy to popularized. The market prospect is bigger

[2] A Wireless Home Safety Gas Leakage Detection System published by Luay Fraiwan, Khaldon Lweesy, Aya Bani-Salma, Nour Mani e presents a prototype for wireless gas leakage systems that can be used mainly in household safety and many other applications in the industry and environment. For example it can be used in facilities where gas cylinders are stored. Any leakage can be recognized through the receiver module. The use of a sensor that is sensitive to small changes of concentration provides an excellent tool to detect a gas leak as it can detect small concentrations down to 100 ppm. The sensor used in the system may be affected by the surrounding temperature and humidity, therefore calibrating the system at the start up of operation was done to determine the zero set point. The sensitivity of the entire system can be adjusted by changing the load resistor of the sensor which provides the flexibility to externally calibrate the system to avoid any false alarms. The algorithm used in the microcontroller system depends on detecting the change of gas concentration levels and therefore the output voltage of the sensor. This gives the system the advantage of detecting leaks of the gases that the sensor detects. Measuring the actual concentration of a certain gas can not be easily done with this sensor, since it can detect many gases at the same time and has a non-linear sensitivity curve. The proposed system can be supplied with a switching circuit along with an electromechanical solenoid valve that can disable

the flow of gas from the source in case of detected gas leakage. Further improvement can be introduced to the system by including a temperature measurement system to be used for temperature compensation, which can be done through the microcontroller to reduce the number of false positives and false negatives.

[3] Ashish Shrivastava, Ratnesh Prabhaker, Rajeev Kumar & Rahul Verma, published GSM Based Gas Leakage Detection System in which they described a new approach for gas leakage detection system at a low concentration. The leakage is detected with the help of MQ-6 Gas Sensor. The sensor sends a signal to microcontroller. In the next step microcontroller sends an active signal to other externally connected devices. The efficiency and memory of the microcontroller can be increased if Philips Microcontroller is used in place of AT89C51. Multiple SMS can be sent by changing programming GSM Module. To change the SIM Card we have to make changes in program.

[4] A technical paper named Microcontroller Based LPG Gas Leakage Detector Using GSM Module, introduced by author Ankit Sood, Babalu Sonkar, Atul Ranjan and Mr. Ameer Faisal presents a research work which is easy to use and gives remote indication to the user. The sensor used in this Research Work has excellent sensitivity combined with a quick fast response time. The system is highly reliable, tamper-proof and secure. In the long run the maintenance cost is very less when compared to the present system. It is possible to get instantaneous results and with high accuracy.



## **Chapter 4**

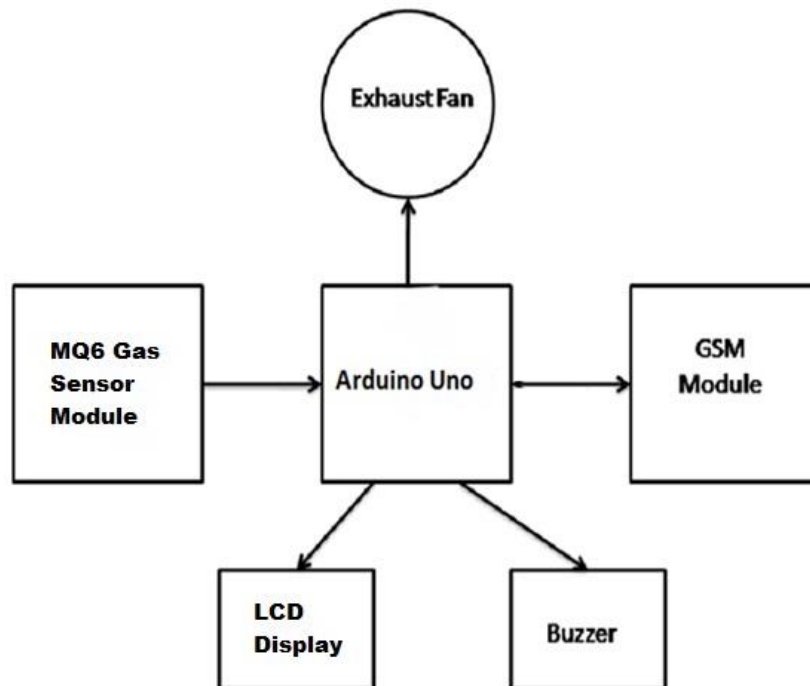
### **PROBLEM STATEMENT**

Liquefied Petroleum Gas is constituent of Butane and Propane gases, which are highly inflammable in nature. The LPG is an odorless gas and hence the addition of Ethanethiol allows it to exhibit an odor during its leakage. An ideal gas sensor can be used to sense the leakage of an LPG from vehicles, industries, homes and other residential areas. If there is a leakage of LPG, we can easily identify by its concentration through the gas sensor and by means of rise in temperature. The LPG is widely used for domestic purposes such as boiling, heating and cooking. Some people may have a low sense of smell and in such cases they may not be able to respond for the gas concentration present. Thus, a security based LPG detection system is essential to provide alertness, safety and security from any harmful gas leakage accidents. The incidents such as Kumbakonam and Bhopal gas tragedy were the examples of the world's worst gas leakage accidents. This leakage detection system detects the gas leakage and also stops the gas supply along with an alarm and a GSM alerts the specified user. The gas sensor we used here, identifies the toxic gases apart from LPG and its voltage goes LOW when there is a leakage of any toxic gas. LOW signal is sent to a microcontroller which in turn sends those signals to the buzzer hence, rising an alarm. After a few milliseconds, the gas leakage message is sent to the user recognized mobile number via GSM module

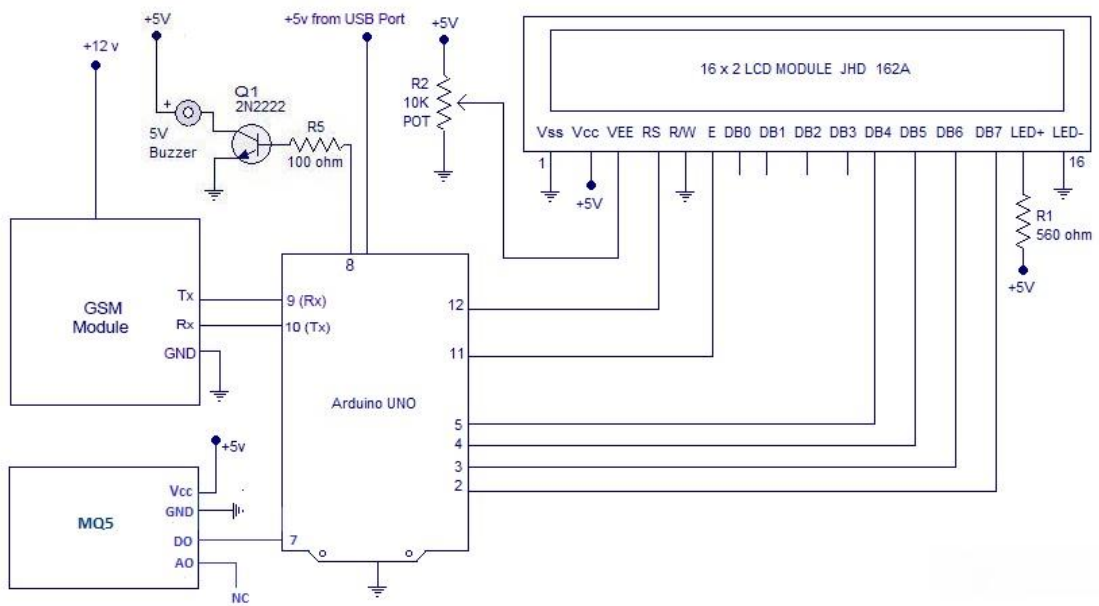
# Chapter 5

## DESIGN METHODOLOGY

### 5.1 BLOCK DIAGRAM



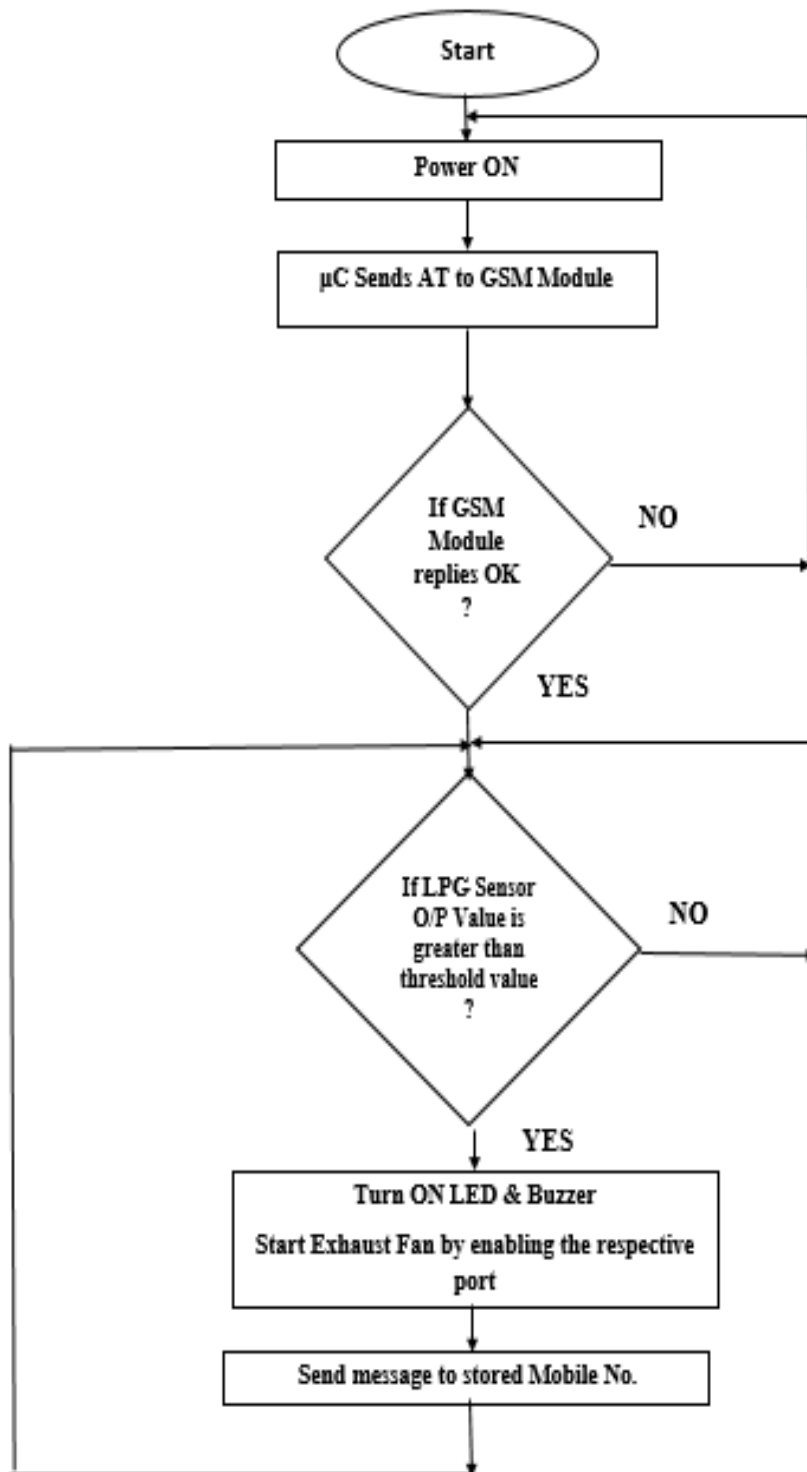
## 5.2 CIRCUIT DIAGRAM



## **5.3 ALGORITHM**

1. Power ON the system.
2. Send AT signal from Micro-controller unit to the GSM module.
3. If GSM module replies with Ok then proceed further.
4. Compare the LPG sensor's value with the threshold value.
5. If the sensed value is greater than the threshold value then turn ON the LED and Buzzer and the exhaust fan by enabling the port.
6. send the message to the stored Mobile Number.
7. If the sensed value is less than the threshold value then sense again.

## 5.4 FLOW CHART



## 5.5 PROGRAM

```
#include <SoftwareSerial.h>
#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
SoftwareSerial mySerial(9, 10);

int sensor=7;
int speaker=8;
int gas_value, Gas_alert_val, Gas_shut_val;
int Gas_Leak_Status;
int sms_count=0;

void setup()
{

pinMode(sensor,INPUT);
pinMode(speaker,OUTPUT);
mySerial.begin(9600);
Serial.begin(9600);
lcd.begin(16,2);
delay(500);

}

void loop()
{
CheckGas();
CheckShutDown();
}

void CheckGas()
{

lcd.setCursor(0,0);
lcd.print("Gas Scan - ON");
Gas_alert_val=ScanGasLevel();
if(Gas_alert_val==LOW)
```

```

{
  SetAlert(); // Function to send SMS Alerts
}}

int ScanGasLevel()
{
  gas_value=digitalRead(sensor); // reads the sensor output (Vout of LM35)

  return gas_value; // returns temperature value in degree celsius
}

void SetAlert()
{
  digitalWrite(speaker,HIGH);
  while(sms_count<3) //Number of SMS Alerts to be sent
  {
    SendTextMessage(); // Function to send AT Commands to GSM module
  }
  Gas_Leak_Status=1;
  lcd.setCursor(0,1);
  lcd.print("Gas Alert! SMS Sent!");
}

void CheckShutDown()
{
  if(Gas_Leak_Status==1)
  {

    Gas_shut_val=ScanGasLevel();
    if(Gas_shut_val==HIGH)
    {

      lcd.setCursor(0,1);
      lcd.print("No Gas Leaking");
      digitalWrite(speaker,LOW);
      sms_count=0;
      Gas_Leak_Status=0;
    }}
}

void SendTextMessage()

```

```

{
  mySerial.println("AT+CMGF=1"); //To send SMS in Text Mode
  delay(1000);
  mySerial.println("AT+CMGS=\"+918286001808\\r\"); // change to the phone
number you using
  delay(1000);
  mySerial.println("Gas Leaking!"); //the content of the message
  delay(200);
  mySerial.println((char)26); //the stopping character
  delay(1000);
  mySerial.println("AT+CMGS=\"+918898788021\\r\"); // change to the phone
number you using
  delay(1000);
  mySerial.println("Gas Leaking!"); //the content of the message
  delay(200);
  mySerial.println((char)26); //the message stopping character
  delay(1000);
  sms_count++;
}

```

## 5.6 PCB Design

### Introduction

A printed circuit board (PCB) mechanically supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper sheets laminated onto a non-conductive substrate. Components (e.g. capacitors, resistors or active devices) are generally soldered on the PCB. Advanced PCBs may contain components embedded in the substrate.

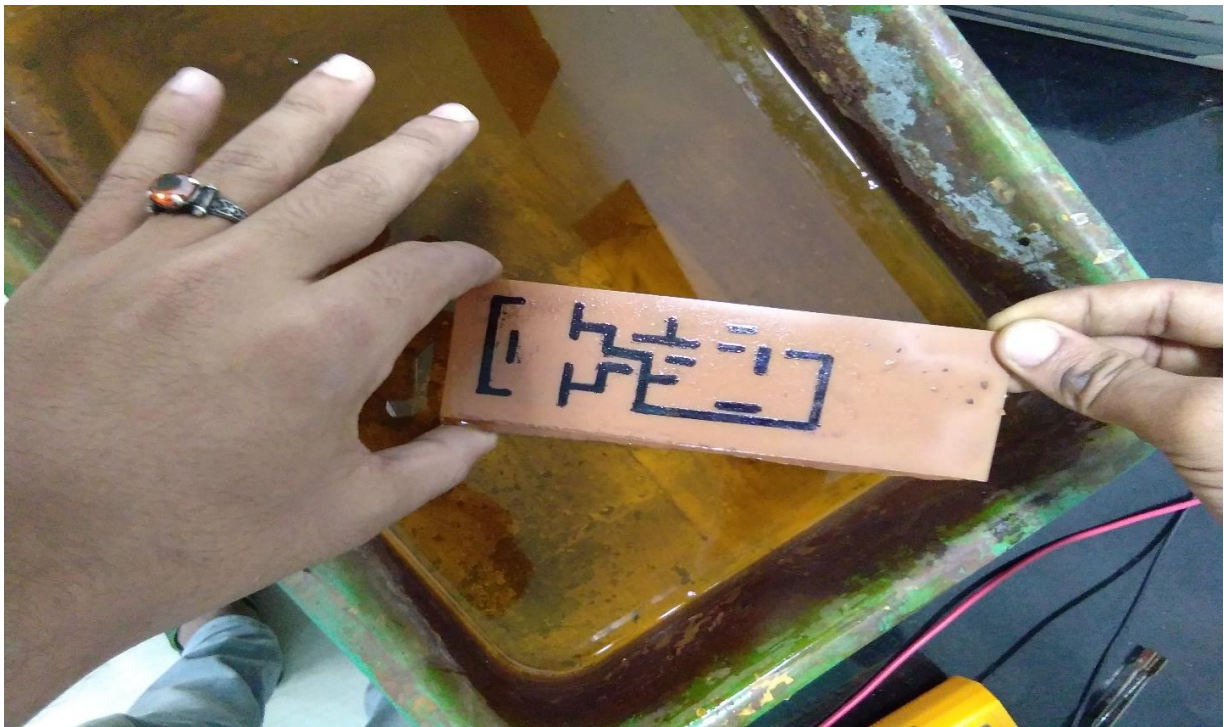
PCBs can be single sided (one copper layer), double sided (two copper layers) or multi-layer (outer and inner layers). Conductors on different layers are connected with vias. Multi-layer PCBs allow for much higher component density.

### PCB Making

PCB is Printed Circuit Board which is of insulating base with thin layer of copper foil. The circuit diagram is then drawn on the PCB with a permanent marker and



then it is dipped in the solution of Ferric Chloride ( $\text{FeCl}_3$ ) so that unwanted copper is removed from the PCB thus leaving components interconnection on the board.



After that holes are drilled with 1mm or 0.8mm drill. Now the marker on the PCB is removed.



The Printed Circuit Board is now ready for mounting the components on it.

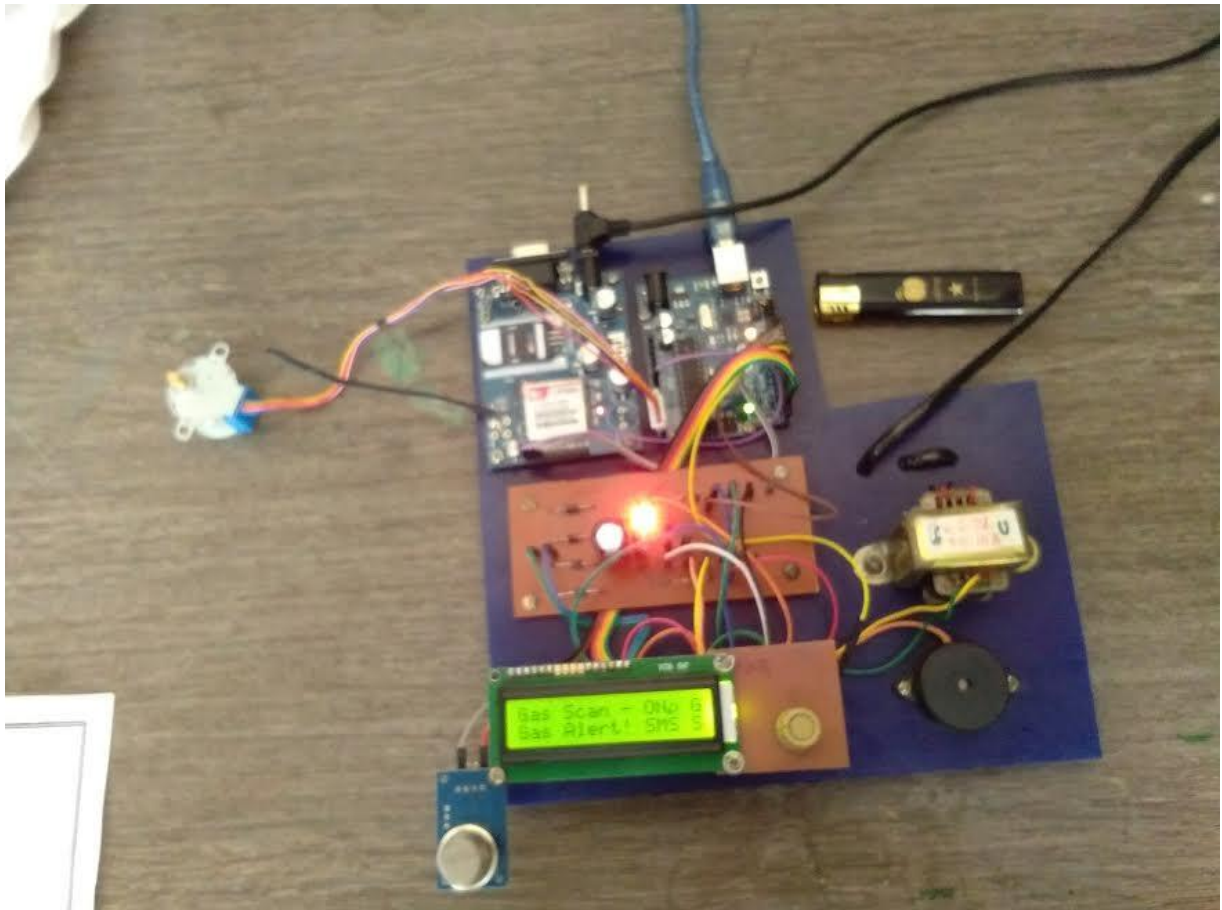
## **Soldering**

For soldering of any joints first the terminals are cleaned to remove oxide film or dirt on it. If required flux is applied on the points to be soldered. Now the joints to be soldered is heated with the help of soldering iron. Heat applied should be such that when solder wire is touched to joint, it must melt quickly. The joint and the soldering iron is held such that molten solder should flow smoothly over the joint. When joint is completely covered with molten solder, the soldering iron is removed. The joint is allowed to cool without any movement. The bright shining solder indicates good soldering. In case of a dry solder joint, an air gap remains in between the solder material and the joint. It means soldering is improper. This is removed and again soldering is done.





## Final Project



## Chapter 6

### COST ANALYSIS

<b>Sr. No</b>	<b>Description</b>	<b>Qty</b>	<b>Price</b>
1	SIM900 GSM Module	1	950
2	Arduino Uno	1	550
3	MQ-6 Gas Sensor	1	120
4	LCD Display	1	110
5	Voltage Regulator IC7805	1	10
6	Resistors	2	2
7	Potentiometer	1	10
8	Capacitor	1	2
9	PCB	1	10
10	Transistors (BC547 & Q2N2222)	2	10
11	Connectors	40	100
12	Transformer 06-0-06V, 750 mA	1	70
13	Buzzer	1	30
14	Mains Cord	1	30
15	LED	1	2
16	Stepper Motor	1	120
17	Diodes IN4007	4	4

# **Chapter 7**

## **ADVANTAGES & LIMITATIONS**

### **7.1 ADVANTAGES**

1. Detection & Prevention of any sort of gas leakage.
2. Cost Efficient
3. Less Complex Circuit
4. No environmental effect

### **7.2 LIMITATIONS**

Its sensitivity depends on humidity and temperature.

# **Chapter 8**

## **APPLICATION**

This project is applicable in following fields:

1. Domestic gas leakage detector
2. Industrial Combustible gas detector
3. Portable gas detector
4. Homes
5. Factories
6. LPG storage
7. Gas cars
8. Hotels etc.

## **Chapter 9**

### **CONCLUSION & FUTURE SCOPE**

Gas leakages in households and industries cause risk to life and property. The present project provides a solution to prevent such accidents by not only monitoring the system but by also switching off the main power and gas supplies in case of a leakage.

The solution provided can be further enhanced by displaying in the LCD unit how much amount of gas is leaked. We can also incorporate the location detection feature for the gas leakage area. As we are using a SIM900 Module which is also a GPRS module, the gas leakage data can also be interfaced to the internet for further analysis.



# Chapter 10

## REFERENCES

- H. Huang, H. Bian S. Zhu, “A Greenhouse Remote Monitoring System Based on GSM,” in Proc. of IEEE International Conference on information management, pp. 357-360, 2011.
- A Wireless Home Safety Gas Leakage Detection System: Luay Friwan, Khaldon Lweesy, Aya Bani-Salma , Nour Mani. IEEE 2011.
- Ashish Shrivastava, Ratnesh Prabhaker, Rajeev Kumar & Rahul Verma, “GSM Based Gas Leakage Detection System”, International Journal Of Emerging Trends In Electrical & Electronics (IJETEE-ISSN:2320-9569) Vol. 3, Issue 2, pp: (45-48), Month: May 2013.
- Ankit Sood, Babalu Sonkar, Atul Ranjan, Mr. Ameer Faisal, “Microcontroller Based LPG Gas Leakage Detector Using GSM Module”, International Journal of Electrical and Electronics Research Vol. 3, Issue 2, pp: (264-269), Month: April - June 2015.