CHAPTER I
INTRODUCTION

1.1 Introduction:

It has become important factor nowadays to bring the technology into our home and office. By making the place smart, the day-to-day activities are becoming more and easier. The development of home automation has become mandatory in homes as people are moving towards to the smart home concepts. With the help of assistant systems like Okay Google Alexa and SIRI the normal routine activities like turning ON the light can be implemented with just a single voice command. With these comforts flowing into a person's life, it has become essential to protect it from damages and accidents. This is where, Internet of things (IoT) comes into picture. As only the regular works has become smart, the things used are still the same like Gas cylinder in homes. According to the reports, over 1500 LPG accidents happen in India every day. This is equivalent to the death of 1500 people including the children. Even the neighborhood is affected in a single accident. So there comes the need to bring in technology to prevent accidents. IoT is a fast-growing technology in Industries, Cars. IoT is basis for Industry 4.0 development the primary objective of the project is to detect the gas leakage of LPG cylinders, which are commonly used in Indian homes, and alarm the user and the surrounding neighborhood using IoT. The supply gas will also be stopped with the use of solenoid, ultimately preventing the chance of accident. Open source IoT software called "Blynk apps" is used for this project. The software has feature to connect with Arduino and can also connect the user's mobile and social media like twitter, to send notification. The people in the neighborhood can also be included in case of an emergency.MQ5 LPG gas sensor is used for input. A 12V buzzer is connected along with the circuit to indicate the user offline. The Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles and has become headline news in both the specialty press and the popular media. This technology is embodied in a wide spectrum of networked products, systems, and sensors, which take advantage of advancements in computing power, electronics miniaturization, and network interconnections to offer new capabilities not previously possible

1.2 Objectives

This Project “Design and implementation of Remote Monitoring System Based on GSM & IoT (Internet of Things)” focuses on the wireless monitoring system, because the wireless remote monitoring system has more applications a remote monitoring system based on SMS through GSM & Internet of Things (IoT).

- To design and implement Advance Gas Leakage Detection & IoT Notification System.
- To design and implement GSM Mobile SMS System.

To full fill these objective we have to do following works:

- Creating an idea for Design and construction of GAS Leakage & Monitoring via GSM & Internet.
- And designing a block diagram & circuit diagram to know which components need to construct it.
- Collecting the all components and programming for the microcontroller to controlled the system.
- Setting all components in a PCB board & soldering. Then assembling the all block in a board and finally run the system & checking.

CHAPTER II
METHODOLOGY AND LITERATURE REVIEW

2.1 Methodology

Safety plays a major role in today's world and it is necessary that good safety systems are to be implemented in places of education and work. This work modifies the existing safety model installed in industries and this system also be used in homes and offices. The main objective of the work is designing microcontroller based toxic gas detecting and alerting system. The hazardous gases like LPG and propane were sensed and displayed and notify each and every second in the LCD display. If these gases exceed the normal level, then an alarm is generated immediately and also an alert message (GSM) is sent to the authorized person through the INTERNET and used ARM development board. The advantage of this automated detection and alerting system over the manual method is that it offers quick response time and accurate detection of an emergency and in turn leading faster diffusion of the critical situation. A Web page is built to show the status to the user monitoring it. The web page gives a notification via mail of the Gas leakage. The LCD screen shows the status. The system puts on the buzzer when the level of gas crosses the set limit. Thus this system helps to keep by informing about gas leakages by providing danger position of the gas leakage via a web page.

2.2 Block Diagram

Transformer

Transformer is a static device which convert electrical power from one circuit to another without changing its frequency. it Step up (or Step down) the level of AC Voltage and Current. Working principle: it work**s** on the principle of mutual induction of two coils or Faraday Laws Of Electromagnetic induction.

ATmega328

The Atmega has high performance and function with simplicity. That can be reprogrammed. That is why it is called the brain of arduino board. It stores the code. It take 5V to operate.

Liquid Criystal Display

The measured values are shown with the LCD. LCD is used for displaying the value of voltage, current, power and sunlight.

GSM Module

GSM Module is a mini GSM/GPRS core development board based on GPRS A6 module. It supports dual-band GSM/GPRS network, available for GPRS and SMS message data remote transmission. The board features compact size and low current consumption. With power saving technique, the current consumption is as low as 3mA in sleep mode. It communicates with microcontroller via UART port, supports command including GSM.

MQ-2 Gas Sensor

Sensitive for LPG, propane, hydrogen Output voltage boosts along with the concentration of the measured gases increases. Fast response and recovery. Features boost circuit. Adjustable sensitivity. Signal output indicator.

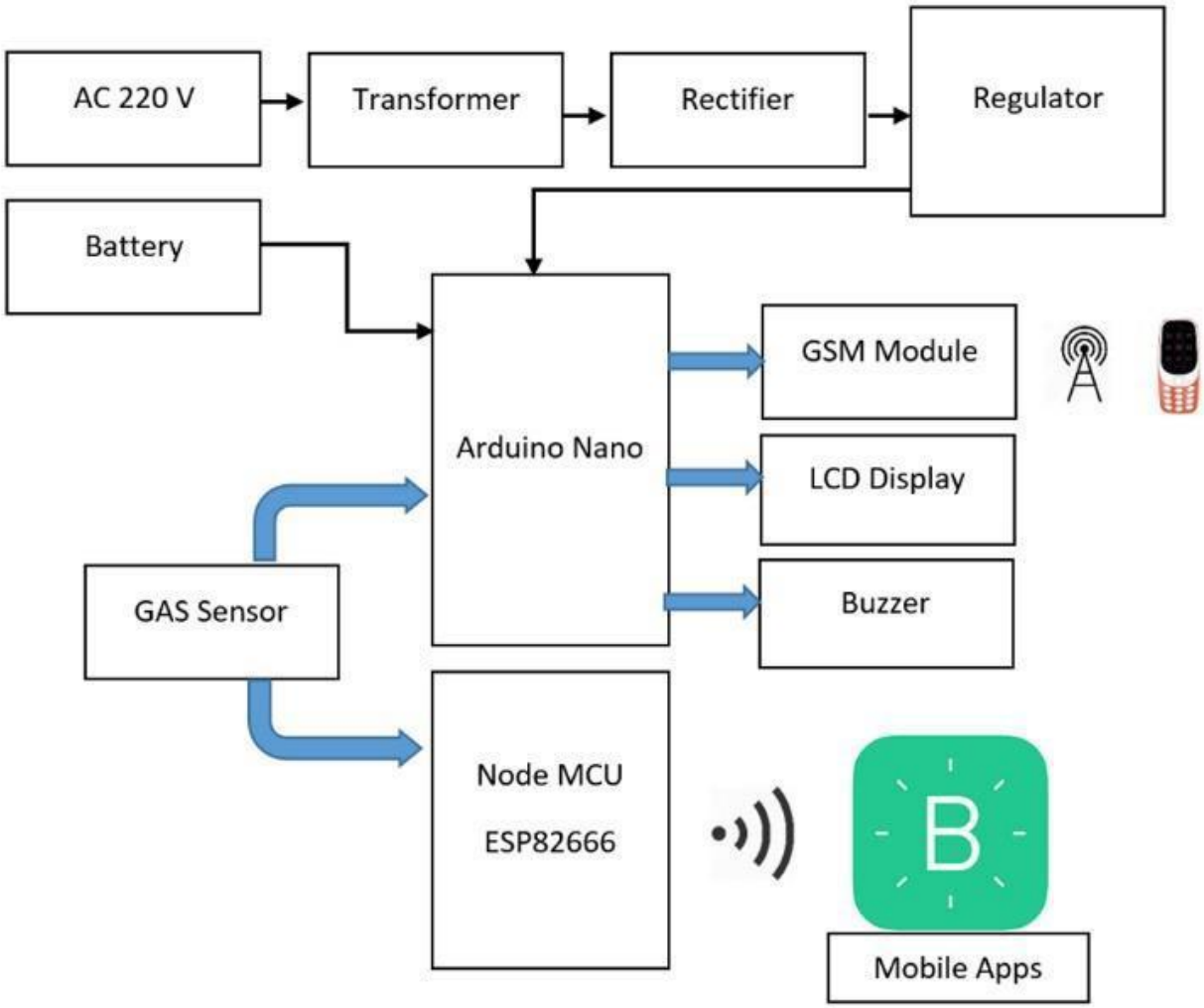


Figure 2.1: Block Diagram of GAS Leakage And Monitoring via GSM And Internet.

2.3 Working Principle:

A discussion on how the aims and objectives are met is presented. An overall conclusion IOT & GSM based gas detector is it has become more efficient, more applicable to today's applications and smarter. Work presented in this project was directed towards pushing IOT technology to the next level. The principle of operation of Operation of IOT based gas leakage and monitoring system was shown by operating the Node MCU attached with embedded system with required input and output gas level with the help of gas sensors was achieved. This result in a more efficient in operation because it is connected to a common free IOT based mobile apps specially built to notify or email the responsible authority automatically so reduces the stress of constant monitoring. The choice of using a real time gas leakage monitoring and sensing the output levels of gas has been clearly observed by the help of this system. Here we used two controllers an Arduino Nano and another one Node MCU. this project used a gas sensor MQ-2, a 16*2 LCD display, buzzer & GSM module which interfacing the two controller. Gas sensor when sensing gas then this signal sent Arduino Nano & Node MCU. Arduino Nano receiving input & sent a signal GSM Module then GSM module send a SMS to owner. After receiving input signal Node MCU update the mobile apps status via internet. This system is totally secured & workable.

2.4 Prototype Output:

The system is an intelligent system, as it does not create nuisance by continuously sounding alarm but the alarm stops beeping once the concentration of the gas in the atmosphere after leakage goes below the set point and opens the valve again for operations. This work will minimize losses occasioned by explosions due to gas leakages and improve safety of life. In particular gas sensor has been used which has high sensitivity for propane (C3H8) and butane warns by (C4H10sending) leakage However, system the consists former of fire incident gas leakage and sends SMS to the householder. This does not make provision for halting further fire incident and gas leakage. GSM module is used which alert the user by sending an SMS. Another approach uses a smart security phone attached gas leakage sensor that senses leakage and sounds an alert alarm as well as sending a SMS to the home owner and emergency services. The design of a wireless LPG leakage monitoring system is proposed for home safety. This system detects the leakage of the LPG and alerts the consumer about the leak by a SMS and as an emergency measure, the system will turn off the power supply, while activating the alarm. leak detection module consists of MQ-2 gas sensor to detect amount of combustible gas present in the surrounding.

Figure 2.2: Final Prototype Output Project

2.5 EXPENDITURE

Sl.no	Particulars	Specification	Qty.	Unit Price (Taka)	Total (Taka)
1	Arduino Nano	Atmega 328p	1	280	280
2	Node MCU	ESP8266	1	400	400
3	GAS Sensor	MQ-2	1	180	180
4	LCD Display	16*2	1	220	220
5	GSM Module	SIM800L	1	450	450
6	Indicator		2	40	80
7	Transformer	120 volt 1A	1	150	150
8	Bridge Rectifier		1	15	15
9	PCB		1	60	60
10	Others			200	500
				Total	2335/=

Table 2.1: List of Components with Price

CHAPTER III
SYSTEM ARCITECTURE
AND
HARDWARE ANALYSIS

3.1 Circuit Diagram

A high-performance logic circuit diagram reader was developed for VLSI-CAD data input. Almost all logic circuit symbols include one or more loop structures. A description is given of an efficient method for recognition of these loop-structured symbols. The proposed method.

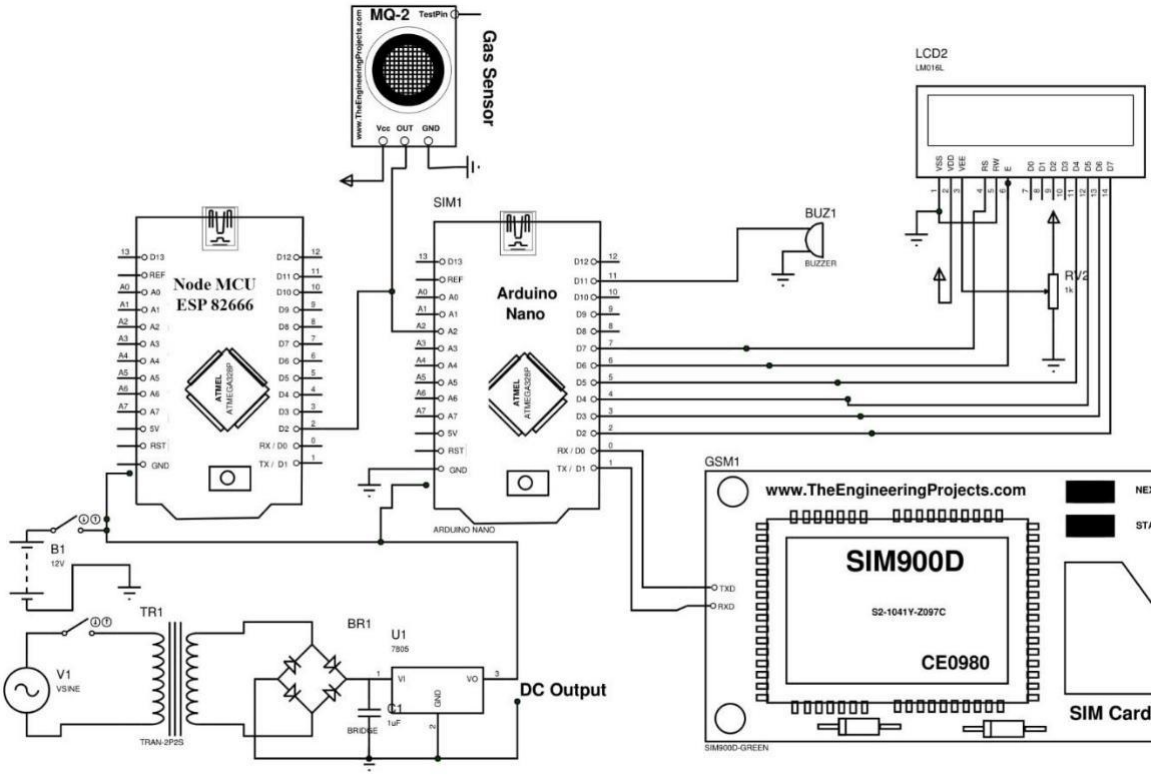


Figure 3.1: Circuit Diagram of GAS Leakage & Monitoring via GSM & Internet.

3.2 Arduino Nano

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating

interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling Lights, motors, and other actuators.

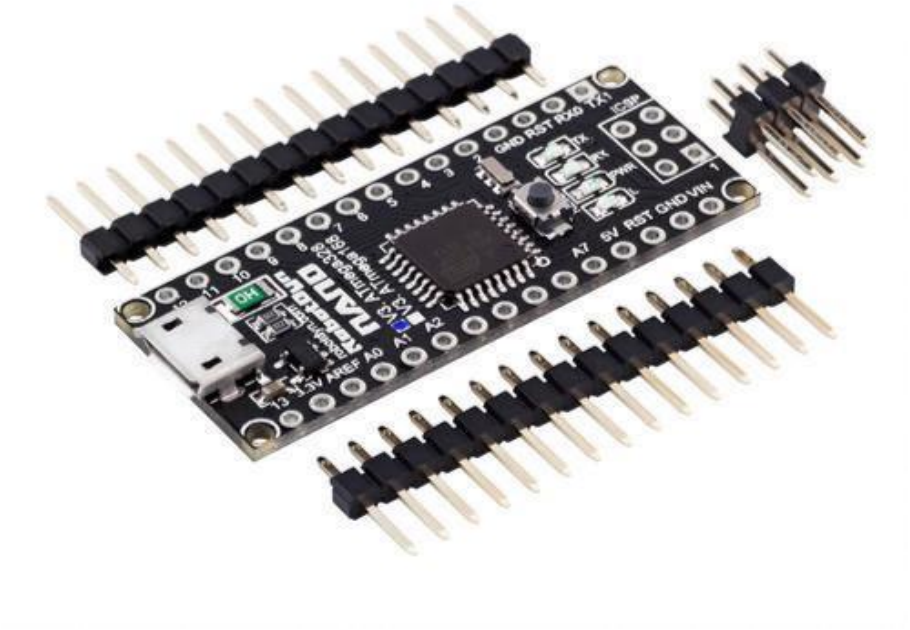


Figure 3.2: Arduino Nano

The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, Max-MSP

Arduino Nano is a surface mount breadboard embedded version with integrated USB. It is a smallest, complete, and breadboard friendly. It has everything that Diecimila/Duemilanove has (electrically) with more analog input pins and onboard +5V AREF jumper. Physically, it is missing power jack. The Nano is automatically sense and switch to the higher potential source of power. Nano's got the breadboard-ability of the Boarduino and the Mini + USB with smaller footprint than either, so users have more breadboard space. It's got a pin layout that works well with the Mini or the Basic Stamp (TX, RX, ATN, GND on one top, power and ground on the other). This new version 3.0 comes with ATMEGA328 which offer more programming and data memory space. It is two layers. That make it easier to hack and more affordable.

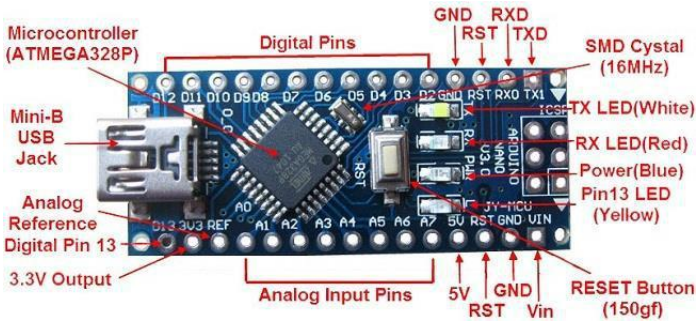


Figure 3.3: Section of Arduino Nano.

Operating Voltage (logic level):5 V

Input Voltage (recommended):7-12 V

Input Voltage (limits):6-20 V

Digital I/O Pins: 14 (of which 6 provide PWM output)

Analog Input Pins: 8

DC Current per I/O Pin: 40 mA

Flash Memory: 32 KB (of which 2KB used by boot loader)

SRAM :2KB

EEPROM: 1 KB

Clock Speed: 16 MHz

Dimensions: 0.70” x 1.70”

Features:

• Automatic reset during program download

• Power OK blue LED

• Green (TX), red (RX) and orange (L) LED

• Auto sensing/switching power input

• Small mini-B USB for programming and serial monitor

• ICSP header for direct program download

• Standard 0.1 spacing DIP (breadboard friendly)

• Manual reset switch

Microcontroller IC ATmega328p:

Figure 3.4: Microcontroller IC ATmega 328p.

The high-performance Microchip Pico Power 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

3.3 Node MCU

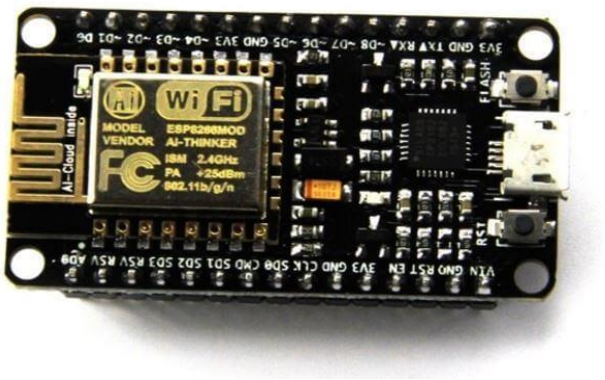


Figure. 3.5: Node MCU

Node MCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "Node MCU" by default refers to the firmware rather than the development kits. The firmware uses the Lau scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266.

Advanced API for hardware IO, which can dramatically reduce the redundant work for configuring and manipulating hardware. Code like arduino, but interactively in Lua script. Event-driven API for network applications, which facilitates developers writing code running on a 5mm*5mm sized MCU in Node is style. Greatly speed up your IOT application developing process.

Features

Wi-Fi Module – ESP-12E module similar to ESP-12 module but with 6 extra GPIOs.
USB – micro USB port for power, programming and debugging
Headers – 2x 2.54mm 15-pin header with access to GPIOs, SPI, UART, ADC, and power pins
Misc – Reset and Flash buttons
Power – 5V via micro USB port
Dimensions – 49 x 24.5 x 13mm

Node MCU was created shortly after the ESP8266 came out. On December 30, 2013, Espressif Systems began production of the ESP8266. The ESP8266 is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications (see related projects). Node MCU started on 13 Oct 2014, when Hong committed the first file of nodemcu-firmware to GitHub. Two months later, the project expanded to include an open-hardware platform when developer Huang R committed the gerber file of an ESP8266 board, named devkit v0.9.[12] Later that month, Tuan PM ported MQTT client library from Contac to the ESP8266 SoC platform,[and committed to Node MCU project, then Node MCU was able to support the MQTT IoT protocol, using Lua to access the MQTT broker. Another important update was made on 30 Jan 2015, when Devsaurus ported the u8glib to Node MCU project, enabling Node MCU to easily drive LCD, Screen, OLED, even VGA displays.

In summer 2015 the creators abandoned the firmware project and a group of independent contributors took over. By summer 2016 the Node MCU included more than 40 different modules. Due to resource constraints users need to select the modules relevant for their project and build a firmware tailored to their needs.

ESP8266 Arduino Core

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate toolchains to allow Arduino C/C++ to be compiled for these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language. Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 WiFi SoC, popularly called the "ESP8266 Core for the Arduino IDE". This has become a leading software development platform for the various ESP8266-based modules and development boards, including Node MCUs.

3.4. LCD DISPLAY:

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 LED.

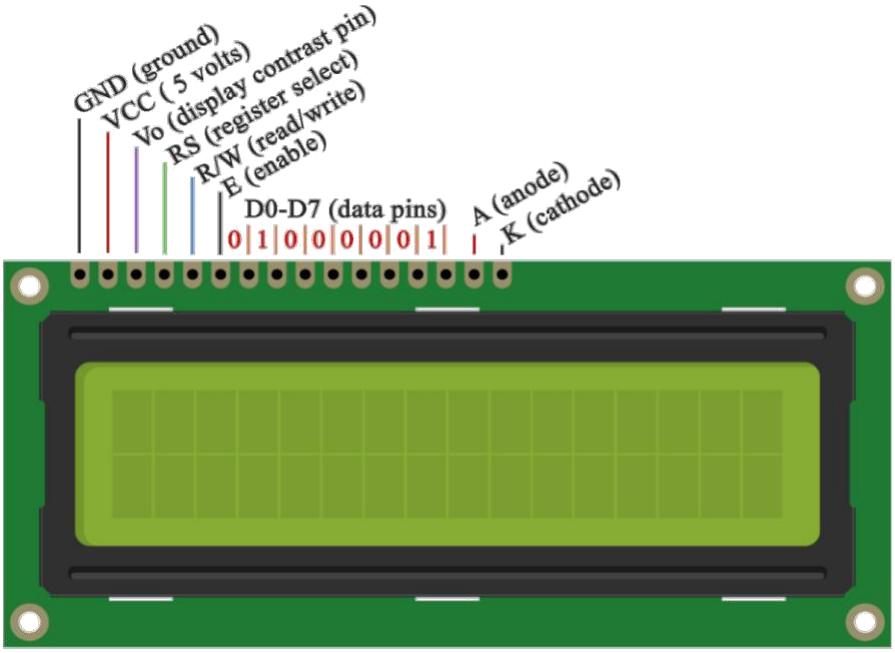


Figure 3.6: 16*2 LCD Display

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.

6. Interface pin description

Pin no.	Symbol	External connection	Function
1	Vss	Power supply	Signal ground for LCM
2	V_{DD}		Power supply for logic for LCM
3	V_0		Contrast adjust
4	RS	MPU	Register select signal
5	R/W	MPU	Read/write select signal
6	E	MPU	Operation (data read/write) enable signal
7~10	DB0~DB3	MPU	Four low order bi-directional three-state data bus lines. Used for data transfer between the MPU and the LCM. These four are not used during 4-bit operation.
11~14	DB4~DB7	MPU	Four high order bi-directional three-state data bus lines. Used for data transfer between the MPU
15	LED+	LED BKL power supply	Power supply for BKL
16	LED-		Power supply for BKL

Features of LCD Display:

5 x 8 dots with cursor

Built-in controller (KS 0066 or Equivalent) + 5V power supply (Also available for + 3V) 1/16 duty cycle

B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED) N.V. optional for + 3V power supply.

3.5 GSM Module

At the heart of the module is a SIM800L GSM cellular chip from SimCom. The operating voltage of the chip is from **3.4V to 4.4V**, which makes it an ideal candidate for direct LiPo battery supply.

This makes it a good choice for embedding into projects without a lot of space.

Figure 3.7: GSM Module

All the necessary data pins of SIM800L GSM chip are broken out to a 0.1″ pitch headers. This includes pins required for communication with a microcontroller over **UART**. The module supports baud rate from **1200bps** to **115200bps** with Auto-Baud detection.

The module needs an external antenna to connect to a network. The module usually comes with a **Helical Antenna** and solders directly to NET pin on PCB. The board also has a U.FL connector facility in case you want to keep the antenna away from the board.

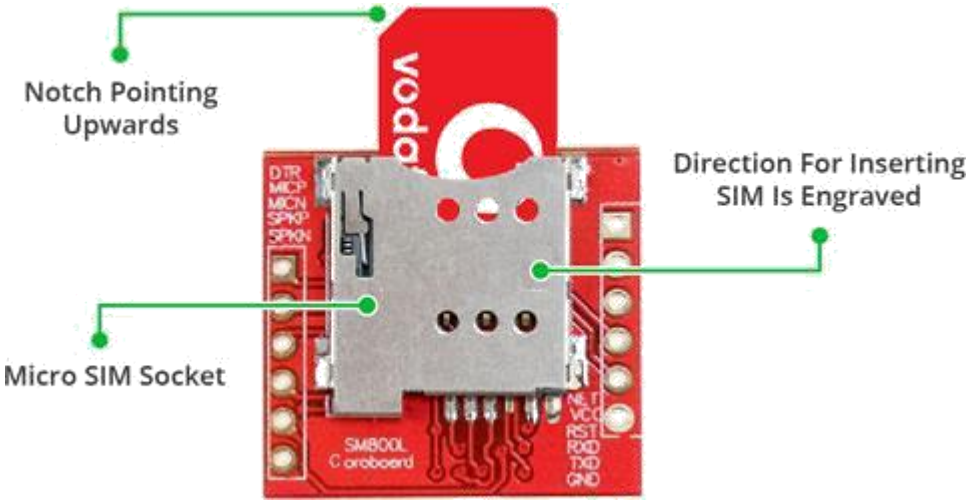


Figure 3.8: 2G Micro Sim Card

There's a SIM socket on the back! Any activated, **2G micro SIM card** would work perfectly.

Correct direction for inserting SIM card is normally engraved on the surface of the SIM socket.

This module measures only 1 inch² but packs a surprising amount of features into its little frame. Some of them are listed below:

- Supports Quad-band: GSM850, EGSM900, DCS1800 and PCS1900
- Connect onto any global GSM network with any 2G SIM
- Make and receive voice calls using an external 8Ω speaker & electret microphone
- Send and receive SMS messages
- Send and receive GPRS data (TCP/IP, HTTP, etc.)
- Scan and receive FM radio broadcasts
- Transmit Power:
    - Class 4 (2W) for GSM850
    - Class 1 (1W) for DCS1800
- Serial-based AT Command Set
- FL connectors for cell antennae
- Accepts Micro SIM Card

SIM800L GSM Module Pinout

The SIM800L module has total 12 pins that interface it to the outside world. The connections are as follows:

Figure 3.9: GSM Module

NET is a pin where you can solder Helical Antenna provided along with the module.

VCC supplies power for the module. This can be anywhere from 3.4V to 4.4 volts. Remember connecting it to 5V pin will likely destroy your module! It doesn't even run on 3.3 V! An external power source like Li-Po battery or DC-DC buck converters rated 3.7V 2A would work.

RST (Reset) is a hard reset pin. If you absolutely got the module in a bad space, pull this pin low for 100ms to perform a hard reset.

RxD (Receiver) pin is used for serial communication.

TxD (Transmitter) pin is used for serial communication.

GND is the Ground Pin and needs to be connected to GND pin on the Arduino.

RING pin acts as a Ring Indicator. It is basically the interrupt out pin from the module. It is by default high and will pulse low for 120ms when a call is received. It can also be configured to pulse when an SMS is received.

DTR pin activates/deactivates sleep mode. Pulling it HIGH will put module in sleep mode, disabling serial communication. Pulling it LOW will wake the module up.

MIC± is a differential microphone input. The two microphone pins can be connected directly to these pins.

SPK± is a differential speaker interface. The two pins of a speaker can be tied directly to these two pins.

3.6 Gas Sensor MQ-2:

This is pretty simple. Connect the D0 pin of MQ2 module to any digital pin of arduino. Let's connect D0 to pin 7 of arduino. Now we need to give power supply (Vcc) and complete the circuit by connecting to ground (Gnd). Refer the circuit diagram given below. Take a +5V connection from arduino and connect it to Vcc of MQ2 module. Finally connect the GND pin of MQ2 module to GND of arduino. That's all and we have finished the circuit.

Figure 3.10:MQ-2 GAS Sensor

gas sensor with long lifespan and low price, for domestic gas leakage alarm and flammable gas alarm use. Sensitive material of MQ-2 gas sensor, which with lower conductivity in clean air. When the target flammable gas exists, the sensor's conductivity gets higher along with the gas concentration rising. Users can convert the change of conductivity to correspond output signal of gas concentration through a simple circuit.

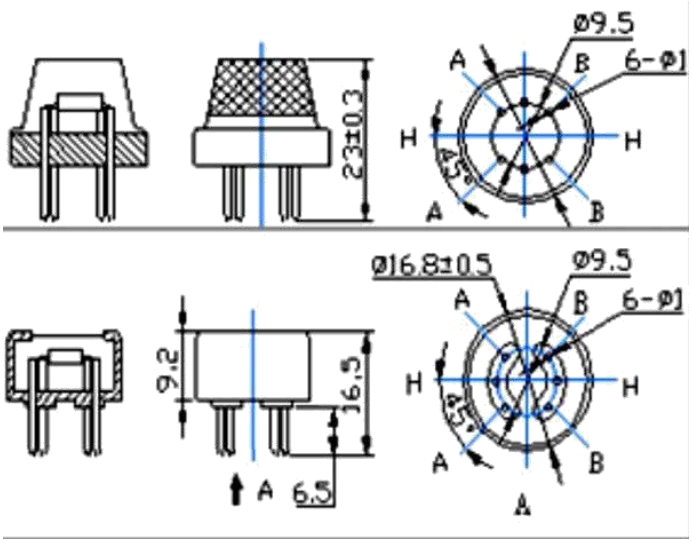


Figure 3.11: Construction of MQ-2 Gas Sensor

MQ-2 gas sensor has high sensitivity to propane and smoke, also can detect the natural gas and other flammable steam well. It is with low cost and suitable for different applications of detecting kinds of flammable gases.

Applications:

It is widely used in domestic gas leakage alarm, industrial flammable gas alarm and portable gas detector.

Pin Configuration:

Pin No:	Pin Name:	Description
For Module		
1	Vcc	This pin powers the module, typically the operating voltage is +5V
2	Ground	Used to connect the module to system ground
3	Digital Out	We can also use this sensor to get digital output from this pin, by setting a threshold value using the potentiometer
4	Analog Out	This pin outputs 0-5V analog voltage based on the intensity of the gas

For Sensor		
1	H -Pins	Out of the two H pins, one pin is connected to supply and the other to ground
2	A-Pins	The A pins and B pins are interchangeable. These pins will be tied to the Supply voltage.
3	B-Pins	The A pins and B pins are interchangeable. One pin will act as output while the other will be pulled to ground.

Features:

- Operating Voltage is +5V
- Can be used to Measure or detect LPG, Alcohol, Propane, Hydrogen, CO and even methane
- Analog output voltage: 0V to 5V
- Digital Output Voltage: 0V or 5V (TTL Logic)
- Preheat duration 20 seconds
- Can be used as a Digital or analog sensor
- The Sensitivity of Digital pin can be varied using the potentiometer

3.7 Transformer

A transformer is an electrical device used to change the value of an alternating voltage. Transformers are widely used in electrical work. They are encountered daily, in industrial, commercial and domestic situations. They vary in size from miniature units used in electronics to huge units used in power stations. The efficient transmission and distribution of electricity throughout the country would be impossible without the use of power transformers.

Transformers are also used for safety reasons on construction sites when using power tools and in domestic bathroom situations in shaver units. They are used in doorbell operation and also to power electronic equipment, battery chargers, televisions, computers, alarm systems, etc. Transformers vary considerably in construction, size and shape depending on their application.

All transformers rely on the principle of mutual inductance for their operation. Mutual inductance was discussed in detail in Unit 2.1.6 Magnetism, Electromagnetism and Electromagnetic Induction.

Transformer Symbols:

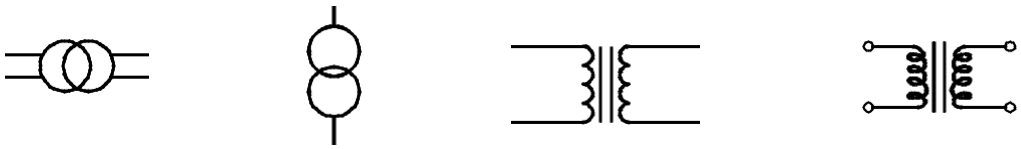


Figure 3.12: Transformer Symbols

Transformer Construction:

A transformer consists of two coils of wire called windings, which are wound onto a common iron core. The wire used in the two windings, primary and secondary, is coated with an insulating varnish. Both coils are wound onto, but insulated from the iron core. See Figure 3.13:

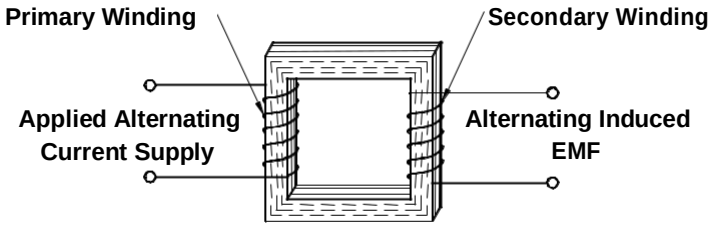


Figure 3.13: Transformer Construction.

The Transformer Principle:

When a conductor or coil is moved in a stationary magnetic field it cuts the lines of magnetic flux and an EMF is induced in the conductor or coil. This same principle also applies when a conductor is held stationary and the magnetic flux is made to change or vary.

Now consider an alternating current applied to a stationary coil. A magnetic field will build up and collapse in the coil, continually rising and falling in harmony with the applied AC current as shown in Figure 3.14

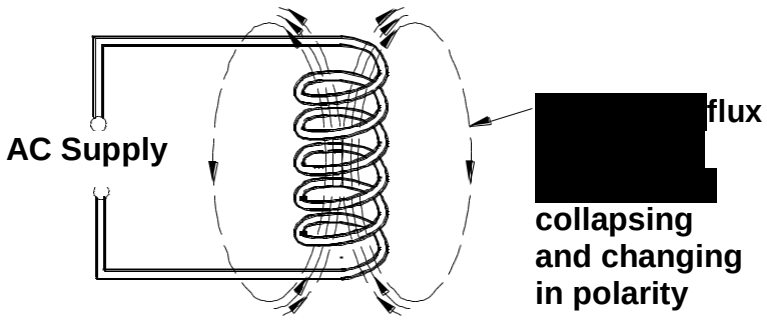


Figure 3.14: Transformer Primary Coil.

If a second coil (coil 2) is placed close to the first coil (coil 1) the alternating magnetic flux in coil 1 links with coil 2. See Figure 3.15 This results in an EMF being induced in coil 2. This is a process known as **mutual induction**.

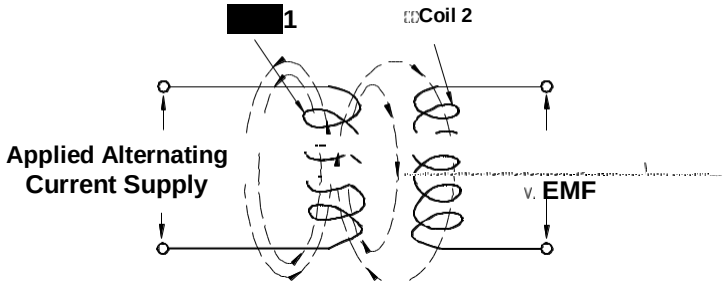


Figure 3.15: Transformer Primary Secondary Coil.

If coil 1 and coil 2 are mounted on an iron core the magnetic flux around both coils will be concentrated. This arrangement of coils and an iron core form the complete device known as a **transformer**. See Figure 3.16:

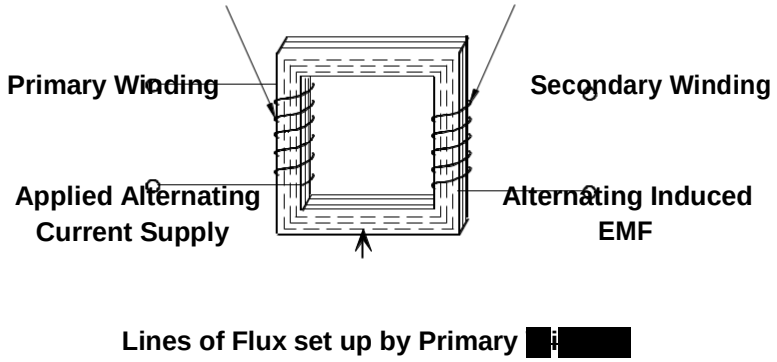


Figure 3.16: Lines of Flux set up by primary Winding.

The input coil of a transformer is fed from the AC supply and is called the **primary winding**.

The output coil, to which the load is connected, is called the **secondary winding**.

It is important to remember that there is no electrical connection between the primary winding and the secondary winding of a transformer. The only common link between the two windings is the magnetic field.

The Full Wave Rectifier:

The first building block in the dc power supply is the full wave rectifier. The purpose of the full wave rectifier (FWR) is to create a rectified ac output from a sinusoidal ac input signal. It does this by using the nonlinear conductivity characteristics of diodes to direct the path of the current.

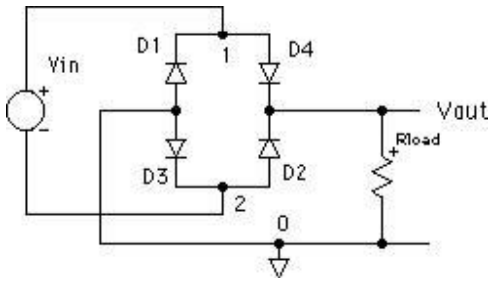


Figure 3.17: Common four-diode bridge configuration for the FWR.

Filtered Full Wave Rectifier

The filtered full wave rectifier is created from the FWR by adding a capacitor across the output.

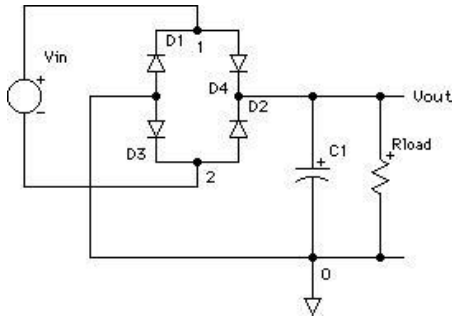


Figure 3.18: Filtered full wave rectifier.

The result of the addition of a capacitor is a smoothing of the FWR output. The output is now a pulsating dc, with a peak to peak variation called ripple. The magnitude of the ripple depends on the input voltage magnitude and frequency, the filter capacitance, and the load resistance.

To describe the source of the voltage ripple, consider the performance of the filtered full wave rectifier above. The input to the rectifier is a sine wave of frequency f. Let Vi be the full wave rectified signal input to the filter stage of the rectifier and Vo be the output. Vi can be approximated as the absolute value of the rectifier input, with frequency 2f.

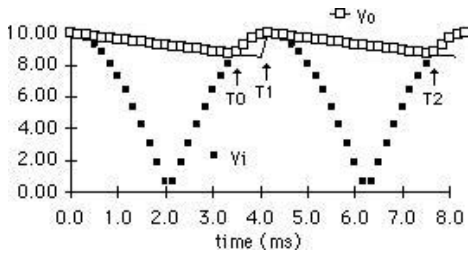


Figure 3.19: Output (Vi) and input (Vo) of a filtered full wave rectifier

In the time period from T0 to T1, the diode D1 (or D3, depending on the phase of the signal) is forward biased since Vi > VC1 (approximate the forward biased diode as a short circuit). The capacitor C1 charges and the voltage across the load R increases. From T1 to T2, the diodes D1 and D2 are reverse biased (open circuit) because Vcap > Vi, and the capacitor discharges through the load R with a time constant of RC seconds.

3.8 Capacitor

When there is a potential difference across the conductors (e.g., when a capacitor is attached across a battery), an electric field develops across the dielectric, causing positive charge (+Q) to collect on one plate and negative charge (-Q) to collect on the other plate. If a battery has been attached to a capacitor for a sufficient amount of time, no current can flow through the capacitor. However, if an accelerating or alternating voltage is applied across the leads of the capacitor, a displacement current can flow.

Figure 3.20: Capacitor

An ideal capacitor is characterized by a single constant value for its capacitance. Capacitance is expressed as the ratio of the electric charge (Q) on each conductor to the potential difference (V). The SI unit of capacitance is the farad (F), which is equal to one coulomb per volt (1 C/V). Typical capacitance values range from about 1 pF (10−12 F) to about 1 mF (10−3 F).The capacitance is greater when there is a narrower separation between conductors and when the conductors have a larger surface area. In practice, the dielectric between the plates passes a small amount of leakage current and also has an electric field strength limit, known as the breakdown voltage. The conductors and leads introduce an undesired inductance and resistance. Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass. In analog filter networks, they smooth the output of power supplies. In resonant circuits they tune radios to particular frequencies. In electric power transmission systems, they stabilize voltage and power flow.

3.9 Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the sometime, act to lower voltage levels within circuits. Resistors may have fixed resistances or variable resistances, such as those founding thermostats, visitors, trimmers, photo resistors, hamsters and potentiometers. The current through a resistor is in direct proportion to the voltage across the resistor's terminals. This relationship is represented by Ohm's law

Figure 3.21: Resistor

3.10 Theory of operation

The behavior of an ideal resistor is dictated by the relationship specified by Ohm „slaw:

V=I.R

Ohm's law states that the voltage (V) across a resistor is proportional to the current(I), where the constant of proportionality is the resistance (R). Equivalently, Ohm's law can be stated:

I=V/R

This formulation states that the current (I) is proportional to the voltage (V) and inversely proportional to the resistance (R). This is directly used in practical computations. For example, if a 300-ohm resistor is attached across the terminals of a12 volt battery, then a current of12 / 300 = 0.04 amperes flows through that resistor.

CHAPTER IV
SOFTWARE DESCRIPTION

4.1 Arduino software

The smart microcontroller unit named as Arduino Uno can be programmed with the Arduino software. There is no any requirement for installing other software rather than Arduino. Firstly, Select "Arduino Uno from the Tools, Board menu (according to the microcontroller on your board). The IC used named as ATmega328 on the Arduino Uno comes pre burned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer.

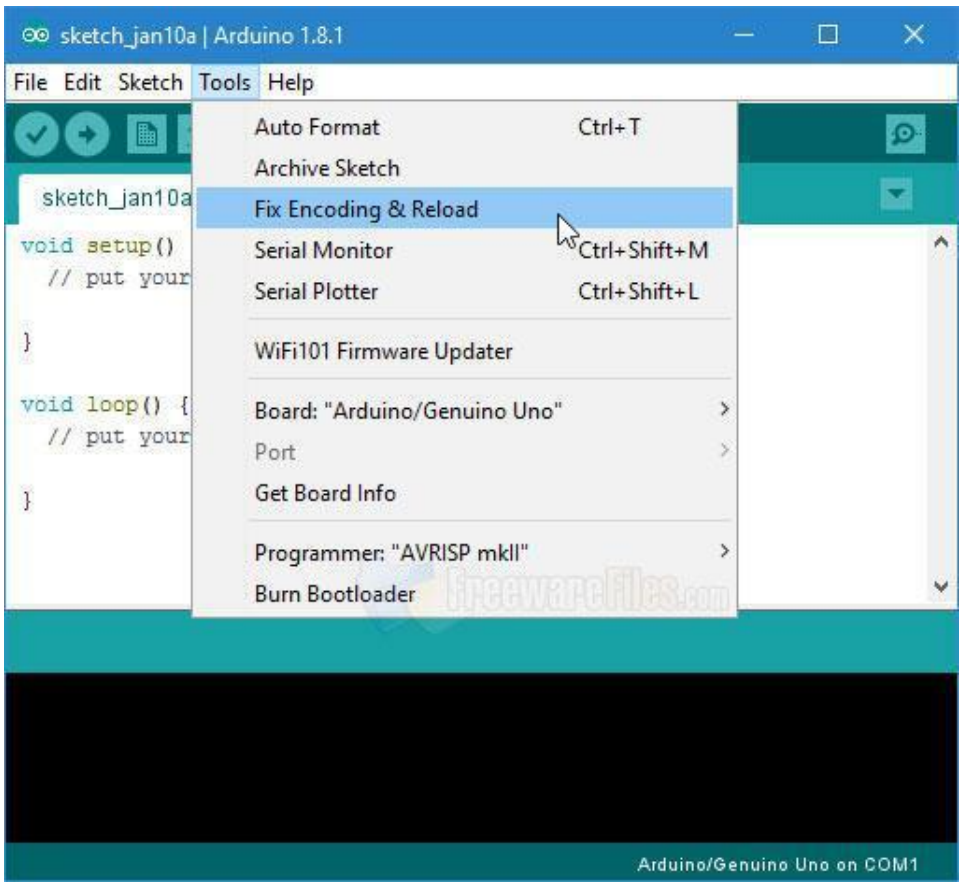


Figure 4.1: Arduino Software Interface IDE.

Communication is using the original STK500 protocol (reference, C header files). We can also bypass the boot loader and programs the microcontroller through the ICSP (In Circuit Serial Programming) header. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU boot loader, 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.

The Arduino Uno is one of the latest smart microcontroller units and has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL at (5V) with serial communication, which is available on digital pins 0 -(RX) for receive the data and pin no.1 (TX) for transmit the data. 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, an .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino 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 Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino
Software includes a Wire library to simplify use of the I2C bus. Arduino programs are written in C or C++ and the program code written for Arduino is called sketch. The Arduino IDE uses the GNU tool chain and AVR Libc to compile programs, and for uploading the programs it uses avrdude. As the Arduino platform uses Atmel microcontrollers, Atmel's development environment, AVR Studio or the newer Atmel Studio, may also be used to develop software for the Arduino.

4.2 Proteus

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards. The first version of what is now the Proteus Design Suite was called PC-B and was written by the company chairman, John Jameson, for DOS in 1988. Schematic Capture support followed in 1990, with a port to the Windows environment shortly thereafter. Mixed mode SPICE Simulation was first integrated into Proteus in 1996 and microcontroller simulation then arrived in Proteus in 1998. Shape based auto routing was added in 2002 and 2006 saw another major product update with 3D Board Visualization. More recently, a dedicated IDE for simulation was added in 2011 and MCAD import/export was included in 2015. Support for high speed design was added in 2017.Feature led product releases are typically biannual, while maintenance based service packs are released as required.

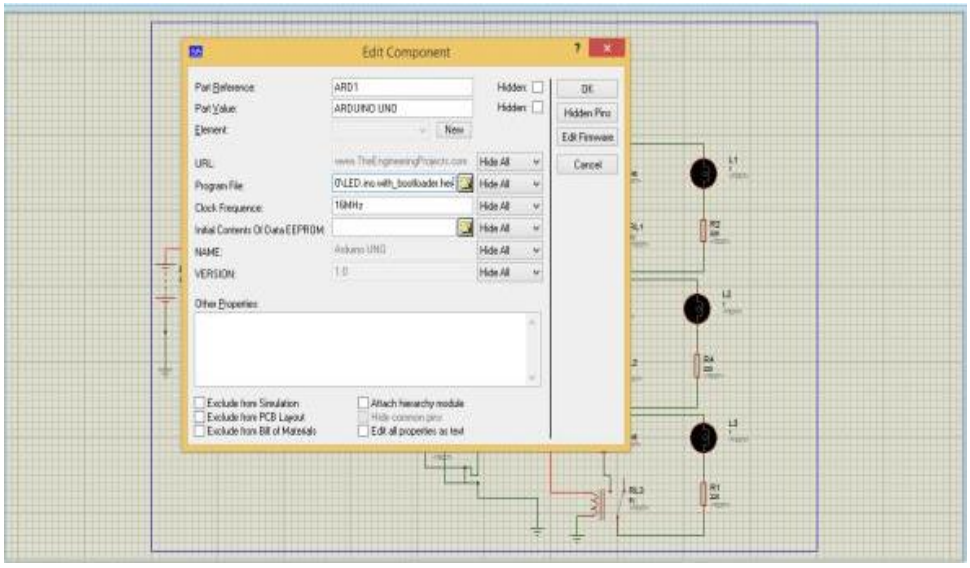


Figure 4.2: Proteus Software.

4.3 Microcontroller Simulation

The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables its use in a broad spectrum of project prototyping in areas such as motor control, temperature control and user interface design. It

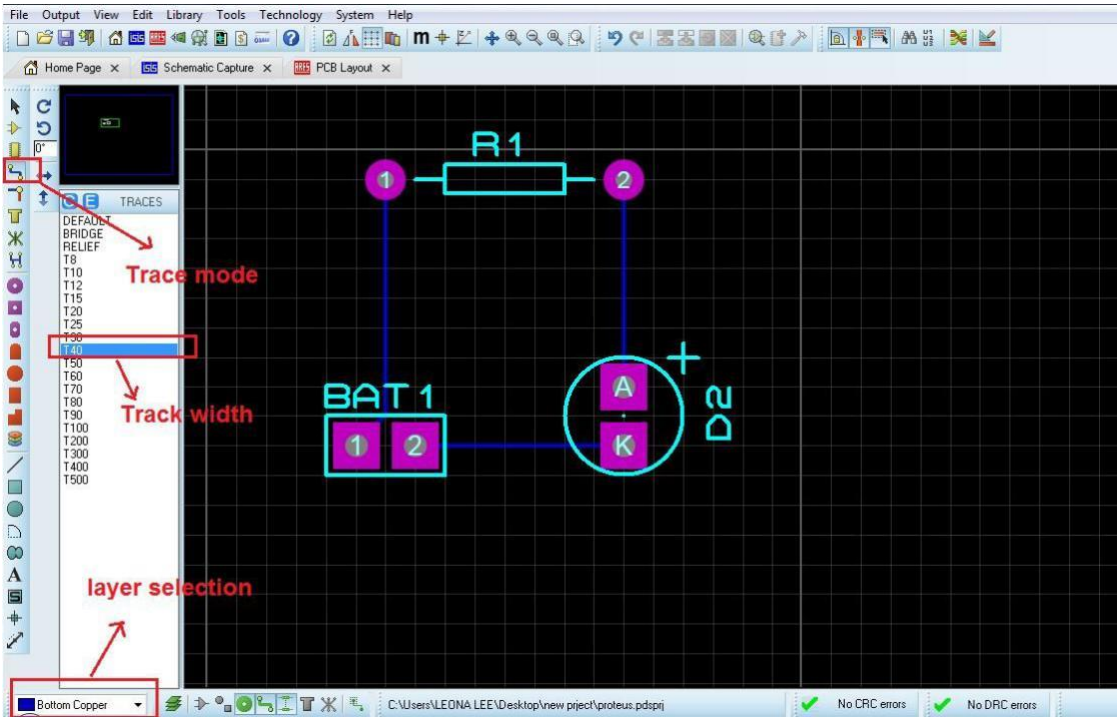
Also finds use in the general hobbyist community and, since no hardware is required, is convenient to use as a training or teaching tool. Support is available for co-simulation of:

• Microchip Technologies PIC10, PIC12, PIC16, PIC18, PIC24, dsPIC33 Microcontrollers.

- Atmel AVR (and Arduino), 8051 and ARM Cortex-M3 Microcontrollers
- NXP 8051, ARM7, ARM Cortex-M0 and ARM Cortex-M3 Microcontrollers.
- Texas Instruments MSP430, PICCOLO DSP and ARM Cortex-M3 Microcontrollers.
- Parallax Basic Stamp, Free scale HC11, 8086 Microcontrollers.

4.4 PCB Design

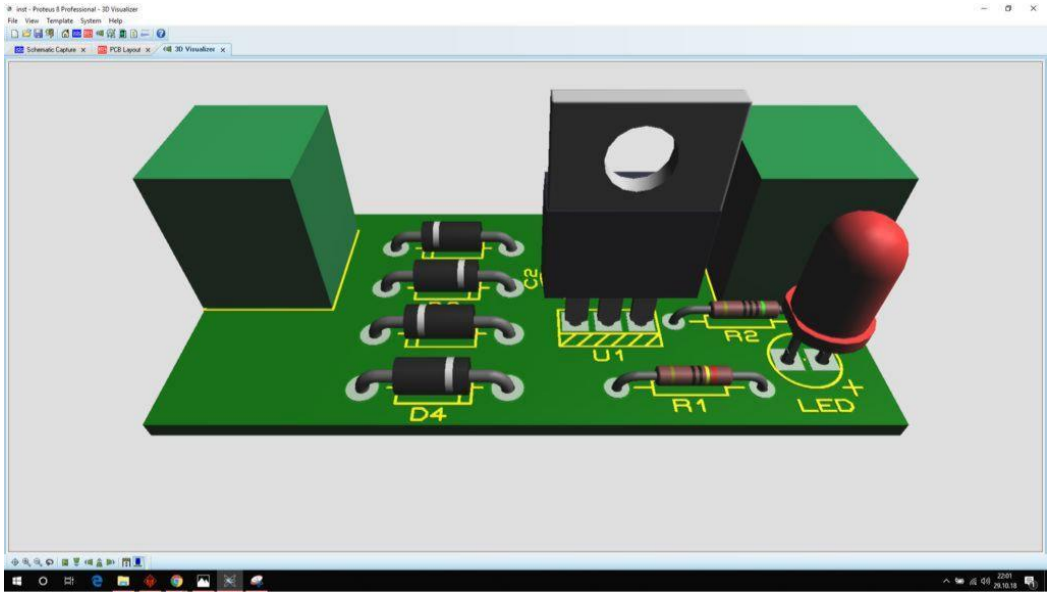
The PCB Layout module is automatically given connectivity information in the form of a net list from the schematic capture module. It applies this information, together with the user specified design rules and various design automation tools, to assist with error free board design. PCB's of up to 16 copper layers can be produced with design size limited by product configuration.



4.3: PCB Design.

4.5 3D Sami-Transparent Verification

The 3D Viewer module allows the board under development to be viewed in 3D together with a semi-transparent height plane that represents the board's enclosure. STEP output can then be used to transfer to mechanical CAD software such as Solid works or Autodesk for accurate mounting and positioning of the board.



4.4: 3D semitransparent verification.

CHAPTER V
RESULT AND APPENDIX

5.1. Our Result

The experimental model was made according to the circuit diagram and the results were as expected. Testing was carried out by increasing gas leakage sensor and releasing LPG into the atmosphere around the sensor. The leakage sensor and gas detector response unit are there to detect it. The results of test carried out on the device at different times and days for concentration leak and gas in the around the sensors. The last four values is the case of an endless loop due to high gas concentration. The device was tested placing near to leak and fire and the LPG device at different distances from the gas source. It was observed that when the leak distance from the device and sensor not sense any leak it response decrease then previous time and the LPG device was test by placing it at different distances from the gas source, the response time of the LPG system decreased as the distance from the gas source increased. Also it was observed that the sensitivity of the sensor and gas sensor was very high in gas leak.

This system is safe…

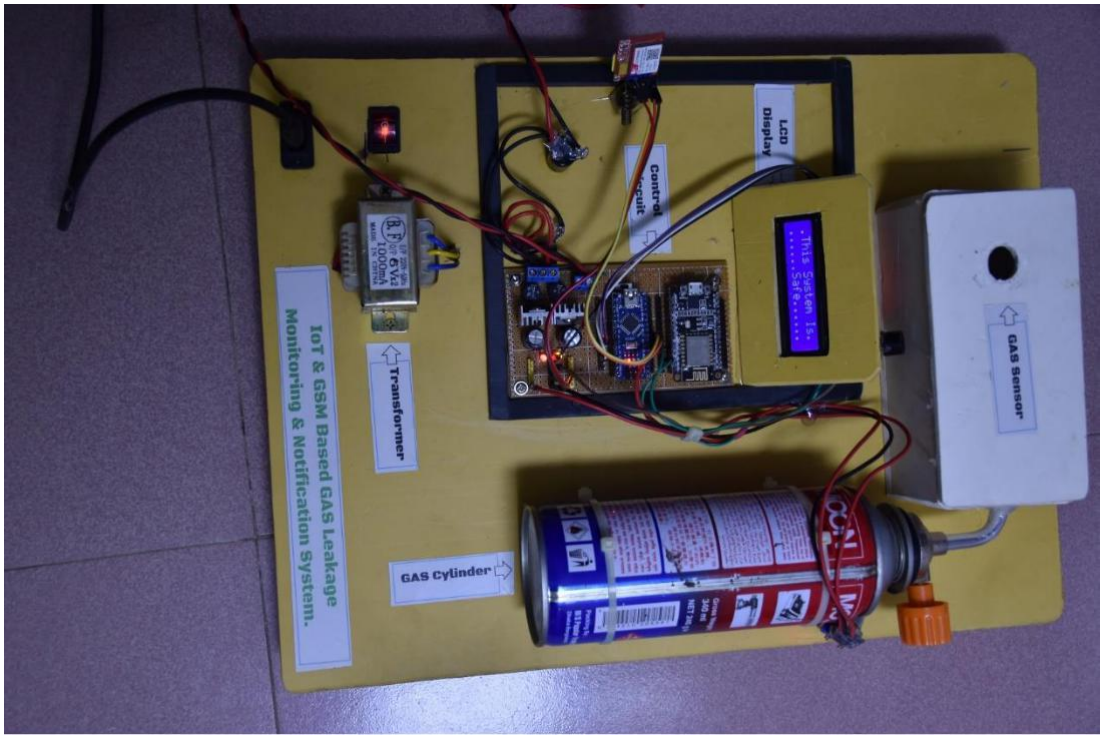


Figure 5.1: Project Result.

5.2: Appendix:

Program Code:

Program is the brain of our project. Arduino is an open-source computer hardware which works on the program's instructions.

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7, 3, POSITIVE);
int buzzer = 10;
int smokeA0 = A0;
int smokeA1 = A1;
int smokeA2= A2;
int smokeA3 = A3;
int sensorThres0 = 400;
int sensorThres1 = 400;
int sensorThres2 = 400;
int sensorThres3 = 400;

void setup() {
  lcd.begin(16,2);
    lcd.setCursor(0,0);
    lcd.print("   ...JU...  ");
    lcd.setCursor(0,1);
    lcd.print(" Fire.Det.Sec.Sys.     ");
    delay(2000);
       lcd.setCursor(1,0);
    lcd.print("C1   ");
          lcd.setCursor(5,0);
    lcd.print("C2   ");
          lcd.setCursor(9,0);
    lcd.print("C3   ");
             lcd.setCursor(13,0);
    lcd.print("C4   ");
          lcd.setCursor(1,1);
    lcd.print("SF       ");
          lcd.setCursor(5,1);
    lcd.print("SF   ");
          lcd.setCursor(9,1);
    lcd.print("SF   ");
             lcd.setCursor(13,1);
    lcd.print("SF   ");
  pinMode(buzzer, OUTPUT);
  pinMode(smokeA0, INPUT);
```

```
  pinMode(smokeA1, INPUT);
    pinMode(smokeA2, INPUT);
      pinMode(smokeA3, INPUT);
 Serial.begin(9600);
}

void loop() {
 int digitalSensor0 = digitalRead(smokeA0);
  int digitalSensor1 = digitalRead(smokeA1);
    int digitalSensor2 = digitalRead(smokeA2);
      int digitalSensor3 = digitalRead(smokeA3);
 Serial.print("Pin A0: ");
  Serial.print("Pin A1: ");
    Serial.print("Pin A2: ");
      Serial.print("Pin A3: ");
 Serial.println(digitalSensor0);
  Serial.println(digitalSensor1);
    Serial.println(digitalSensor2);
      Serial.println(digitalSensor3);

 if (digitalSensor0==LOW)
 {
  tone(buzzer, 1000, 200);
            lcd.setCursor(1,1);
  lcd.print("DN  ");
        lcd.setCursor(1,5);
  lcd.print("SF  ");
        lcd.setCursor(1,9);
  lcd.print("SF  ");
            lcd.setCursor(1,13);
  lcd.print("SF    ");
 }

 else if (digitalSensor1==LOW)
 {
            lcd.setCursor(1,1);
  lcd.print("SF      ");
        lcd.setCursor(5,1);
  lcd.print("DN    ");
        lcd.setCursor(9,1);
  lcd.print("SF      ");
            lcd.setCursor(13,1);
  lcd.print("SF      ");
  tone(buzzer, 1000, 200);
 }
```

```
 else if (digitalSensor2==LOW)
 {
            lcd.setCursor(1,1);
  lcd.print("SF        ");
        lcd.setCursor(5,1);
  lcd.print("SF       ");
        lcd.setCursor(9,1);
  lcd.print("DN       ");
            lcd.setCursor(13,1);
  lcd.print("SF    ");

  tone(buzzer, 1000, 200);
 }
else  if (digitalSensor3==LOW)
 {
            lcd.setCursor(1,1);
  lcd.print("SF       ");
        lcd.setCursor(5,1);
  lcd.print("SF        ");
        lcd.setCursor(9,1);
  lcd.print("SF        ");
            lcd.setCursor(13,1);
  lcd.print("DN       ");
  tone(buzzer, 1000, 200);
 }
   else
 {
  noTone(buzzer);
            lcd.setCursor(1,1);
  lcd.print("SF       ");
        lcd.setCursor(5,1);
  lcd.print("SF   ");
        lcd.setCursor(9,1);
  lcd.print("SF  ");
            lcd.setCursor(13,1);
  lcd.print("SF  ");
 }
 delay(100);
}
```

CHAPTER VI
CONCLUSION

6.1 Conclusion

This system provides a notification action during gas leakage by through mobile SMS & IoT notification via internet. And it activates the alarm and also sends alert messages to the users within a short time. It is an economical system which can be installed in apartments, hotels and wherever it is needed. The cost of the proposed system is lesser than the commercially available. The ultimate aim of the project is to make a finished product of Gas leakage detection system for Household. With the advancement of internet in homes, the safety can be further increased with introduction of Internet of things. The product consists of outer wooden casing in shape of a box to carry the Arduino controller, MQ2 sensor, ESP8266 Wi-Fi module and a Buzzer. Finally, we were able to complete the project successfully.

6.2 Future Scope

The model can be improved by making some changes in the program and components. Some suggestions are given below.

- In the future, security protection system can be added with it.

6.3 Advantage:

- IoT Notification.
- Mobile SMS Notification.
- Locally Alarming System.
- Cost Effective.
- Easy to Install.

6.4 Application

The project has a major application in the

- This project can be used Any Industries.
- Shopping malls, Office & Home.
- Its widely used CNG Filling Station.
- This System can be used in Gas Distribution Company.

It can be used in places where gas is used

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