KSCST

PROJECT REPORT ON

"IOT ENABLED SURVEILLANCE AND ALERTING FOR LPG CONTAINERS"

Project Reference No: **47S_BE_1439**

SJC INSTITUTE OFTECHNOLOGYCHICKBALLAPUR-562101

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

ENGINEERING

Under the Guidance of

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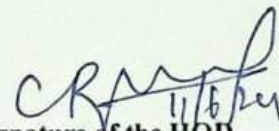|	
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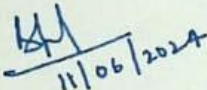
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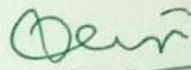
PROJECT COMPLETION CERTIFICATE

This is to certify that the Project Report entitled **"IOT ENABLED SURVEILLANCE AND ALERTING FOR LPG CONTAINERS"** which is approved by 47th series Karnataka state council for science and technology with **project reference number 47S_BE_1439** Carried out by

Mr. **SUDARSHAN G (1SJ20EC147)**, Mr. **SHREYAS.S.R (1SJ20EC136)**, S UPENDRA **(1SJ20EC130)** has been completed with no change in The Project Title and Objectives during the academic year 2023-24. Under the guidance of Dr. S. BHARGAVI Professor and Dr. VEENA S Assistant professor, Department of Electronics and Communication Engineering, SJCIT.

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ABSTRACT

There are many methods are available for booking a LPG gas in the gas agency. Methods include online booking, telephonic booking etc. But sometimes user may forget to do the booking due to the various reasons. It will be difficult situation for the one who uses LPG gas for cooking regularly. So we have proposed a new system which automatically book a cylinder when the gas is about to empty by sending a SMS by using GSM. . In addition to that LPG sensor is used to detect gas leakage in the home. If any gas leakage detected automatically it will send SMS to the owner and operates regulator to avoid leakage. GSM is one of the most cellular networks used in India. In our project load cell have been used to monitor the weight of the LPG gas regularly. The values are next feed to the microcontroller. If the gas level in the cylinder goes below the threshold level, then a SMS will be sent to gas agency automatically to book the new cylinder. Then a reply SMS will be sending to the customer about the booking status. At the same time application software must developed in the gas agency to inform and record the booking.

CHAPTER 1

PREAMBLE

1.1 INTRODUCTION

These days liquid petroleum gas (LPG) is widely used in many fields, especially in household purposes. The leakage of LPG may lead to severe casualties. So there is a risk of increased accidents, with rise in its usage. So it's necessary to have a system which continuously monitors the LPG cylinder. This project has an effective way of monitoring the gas quantity in the container and also to detect any leakage to notify the user by means of internet through IOT module.

With the raising demand for LPG, users have to be compelled to pre book their LPG cylinder a minimum of a month before the delivery of the new LPG cylinder. Most of the days, users find it difficult to figure out what quantity of LPG left at intervals the cylinder and this causes tons of bother to them.

The principal participants in the LPG industry – producers, suppliers, traders, marketers, equipment manufacturers, transporters and installers – all have responsibilities in the area of safety. They should collaborate to ensure the efficient discharge of their responsibilities. Because of the wide range of LPG applications, and the variations in the scale of usage, there are many categories of consumer. These range from households (often the largest single category) to industrial or chemical complexes where LPG may be only one of many hazardous products on site.

Now a day‟s every one want a facility which reduce their efforts, time and provide a way to do their work more easily. For cooking food all lpg gas is used. It produced in 1910 by „Dr. Walter Snelling‟. LPG is a mixture of commercial propane and commercial butane having saturated as well as unsaturated hydrocarbons. LPG having versatile nature so its demand raise day by day.

In INDIA gas distributer uses IVRS, SMS or ONLINE booking for LPG which are time consuming methods in fast running life.Some uneducated people are not able to do these task and busy schedule people they haven't sufficient time to do all the activity. Also safety plays the important role. As there are many accidents happen due to gas leakage. So to avoid these difficulties this project is developed. This project is designed by considering a safety issues and also provide Easy way for LPG booking. In the project MQ-6 gas sensor is use to sense the leakage gas. After that leakage motor will close the regulator and through GSM message is send to the user.

1.2 OBJECTIVES

The objectives of this project are:

1) Detection of leakage occurring by an LPG cylinder.

2) Monitoring the level of gas left in the cylinder used in households , restaurants , Industries.

3) Detection of fire LPG cylinder and sending indication through a notification to household people.

1.3 PROBLEM STATEMENT

A significant challenge associated with LPG gas usage is the occurrence of leaks. The primary issue lies in the fact that even when an alarm is activated, users may remain unaware of the gas leakage if they are not present at their residence or premises. To address this concern, a proactive approach involves regular weight checks of the gas cylinder. By monitoring the cylinder's weight periodically, users can receive timely notifications when the gas level is low, enhancing their awareness and allowing them to take necessary precautions. Additionally, in the absence of household occupants, conventional fire detection methods may prove ineffective, making it crucial to explore alternative means of identifying fires in unattended areas.

1.4 METHODOLOGY

➢ The level of LPG is measured using the load sensor. The output of the sensor is connected with Arduino R3.

➢ By using this, user can detect the current LPG level and it is continuously displayed on the LCD. User know the validity of LPG usage from the date of initialization.

➢ The principle behind working of this project is the opaqueness property of smoke. In case when there is no smoke the infrared sensors are continuously in view of each other.

➢ Temperature sensor will keep track of the real time temperature to the room. If the temperature of the room starts increasing or any gas leak is detected, the respective authorities would be notified immediately.

➢ Using temperature sensor and air quality sensor the system will detect a fire breakout when there are no people around the vicinity.

➢ Gas leakage is detected by the gas sensors (MQ-6). By using this, user can detect the current LPG level and it is continuously displayed on the LCD.

CHAPTER 2

LITERATURE SURVEY

Paper 1

Authors: Sayeda nahid & Navid Anjum

Research focus : Development of a Smart Automatic Gas Leakage Detector

Published on : 16 July 2023

Description : This paper [1] analyses that LPG is widely used as a source of fuel, mainly in urban regions. Due to the extremely combustible nature of the gas, there is always the risk of gas leakage as a consequence of carelessness or failure of the regulating valve on the gas cylinder, which poses a significant risk. Gas-related fires are on the rise, which may be prevented by utilizing a gas leakage detection system,necessitating the creation of a microcontroller-based cooking gas detector. The use of a microcontroller allows for the creation of a highly precise and quick reaction time detecting system.

Paper 2

Authors: Adnan Al Neon, Sal Sabila & Rashedur M Rahman

Research focus : Smart Fire Detection and Security System

Published on : 10 January 2023

Description : This paper [2] goal is to design and implement a microcontroller-based smart fire detection and security system with real-time web integration. Most of the available fire alarms depend on the gas sensor only, which is not efficient enough to secure life and property. To minimize the issue, we bring a multi-sensor fire detection and notification technology. The significance of our study is to detect fire at an early stage with the help of multiple sensors like temperature, gas, and flame. We also use a motion sensor for detecting movement during a fire event. It can be used for security purposes as well.

Paper 3

Authors : Somashekhara Reddy, Raja Praveen K N

Research focus : LPG Gas Detection and Monitoring Using IoT

Published on : 06 June 2023

Description : This paper[3] explains that minor leak can build up an explosive gas concentration, making leaks exceedingly dangerous. The current gas detector is less effective because the user can only detect gas leaks by utilising it. It's risky because gas leaks must be found early. The Gas Leakage Detector with Alert System was created to prevent fire or explosion in homes or businesses. This gas detector continually detects gas if it has power. Arduino UNO was utilised as the CPU to process sensor information and deliver an SMS alert to the user. The buzzer will ring until harmful gas levels are reached. These projects avoid fires from unattended cooking and gas explosions from gas leaks.

Paper 4

Authors: Ashraf Zaher, Ahmed Al-Faqsh, Hasan Abdulredha

Research focus : A Fire Prevention/Monitoring Smart System

Published on : 16 May 2022

Description   : This paper[4] explains the probability of fires is highly increasing in buildings under construction, where melting and other fire-related processes take place excessively. In addition, fires generate smoke that causes serious injuries to human health. For instance,when going to camping, people may breathe in carbon monoxide and other toxic gases, formed due to the burning of charcoal, which leads to hazardous health issues. Moreover, and especially in the Middle East and the GCC, oil and gas leaks can seriously add to the problems of fires.Huge amount of H 2 S gases and other liquid petroleum gases (LPG) leaks occur in Kuwait oil rigs and refineries, causing harmful diseases.

Paper 5

Authors : Pushpendra Kumar Pateriya, Abishek Shah

Research focus : IoT-based LPG Gas Leakage Detection and Prevention System

Published on : 26 March 2023

Description   :This paper[5] analysis that LPG (Liquefied petroleum gas) is a form of natural gas which has been liquefied under extreme pressure and then contained in a metal cylinder. It is very sensitive to fire and can cause a great disaster if it's exposed to any fire source without precaution. LPG is more available than any other natural gas so most people choose LPG for their needs like cooking and other needs. So the event of gas leakage or blast occurring by leaked gas is frequently seen and heard. In this paper, a device has been introduced to prevent any possible accident from happening. It is called Smart Gas and Fire detector. The device can detect any spillage of gas and fire very quickly and send a response via gsm tool directly to the user very fast and a buzzer is set up to alert.

Paper 6

Authors : Rohith Naidu V, Prathapa, Rakshith S Gowda

Research focus : Smart LPG Gas Level Detection and Safety System using IoT

Published on : 22 December 2022

Description   :This paper[6] explains LPG is an odourless gas which is a mixture of propane and butane. It contains both saturated and unsaturated hydrocarbons. Ethyl Mercaptan is the stanching agent which is used to impart odour to the odourless LPG. LPG is liquefied under moderate pressure and has replaced many conventional fuel systems in household and commercial sectors. Though it is one of the most commonly used fuels, it has an explosive range of 1.8%9.5% volume of gas in air.The main application of the LPG is that it is used in the place of chlorofluro carbon which cause great damage to the ozone layer. LPG is packed into 3 categories according to the weight of the LPG in the cylinder: Household, Commercial and Industrial.

CHAPTER 3

PROPOSED SYSTEM

3.1 BRIEF PROPOSED SYSTEM

1.   LPG gas detection

2.   Auto gas booking.

3.1.1 LPG gas detection

 In LPG gas detection of leakage gas is done by gas sensor which is interfaced with microcontroller. When gas is detected motor will be turn on and it immediately turn off the gas regulator at the same time the user is informed about the gas leakage by sending the SMS, turning on the buzzer and also message displaying on LCD.

3.1.2 Auto gas booking.

In auto gas booking user can continuously measure the amount of gas which is present in the cylinder. When gas level goes below the set level then message will be send to the gas agency through GSM and confirmation message received by the user from gas agency. So user get cylinder within time.

3.2 BLOCK DIAGRAM OF PROPOSED SYSTEM

The block diagram of proposed system is shown in fig 3.1
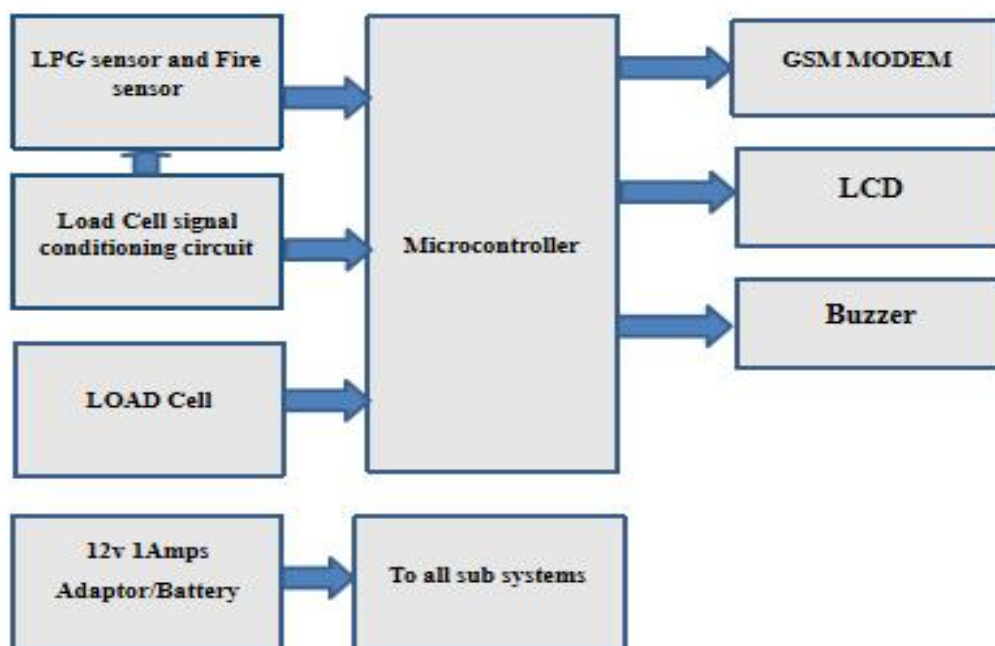
Fig 3.1 : Block diagram of proposed system.

3.2.1 Microcontroller

It is central processing and control unit of the project it receives the output from load cell signal conditioning circuit, LPG sensor, coverts into digital signal and processes the digital information and compares the digital information with pre-stored values. Based on the result of comparison sends the message to the gas booking agency. In case of gas leakage detected it controls servo motor to turn off cylinder regulator.

3.2.2 Gas leakage sensor

Gas leakage sensor is used to sense gas leakage in the home, industries, produces electrical signal as output which is equivalent to amount of gas leakage detected.

3.2.3 Fire sensor

A flame detector is a type of sensor that can detect and respond to the presence of a flame. These detectors have the ability to identify smokeless liquid and smoke that can create open fire. For example, in boiler furnaces flame detectors are widely used, as a flame detector can detect heat, smoke, and fire.

3.2.4 Load Cell

A load cell is a transducer that is used to convert a force into electrical signal. Mostly cantilever or bending type load cell is used. Here weight of the cylinder is measured by placing the cylind er on load cell arrangement. Actually Load cell consists of four strain gauges in a Wheatstone bridge configuration. Firstly by using mechanical arrangement the force being sensed deforms a strain gauge and then strain gauge measures the deformation as an electrical signal, because the strain changes the effective electrical resistance of the wire. Out of the bridge is due to the applied pressure or force of the cylinder.

3.2.5 GSM (Global System for Mobile Communication)

Collects the information from microcontroller and transmits the information to gas agency in case of less amount of gas detected, if leakage is detected its sends information to owner through the link to the concerned authority via RF link.

3.2.6 Cylinder regulator control unit

It consists of servo motor to control angular movement of gas regulator Knob; the motor rotates from 0 degree to 90 degree and from 90to 0 degree.

3.2.7 Buzzer

It is controlled by microcontroller used as alarming it beeps when LPG leakage is detected and also it makes beep sounds while it is in on state.

3.2.8 LCD [Liquid Crystal Display]

It is used to display amount of gas remain in cylinder and status of gas regulator.

3.2.9 Power Supply

Built using 12v/2Amps battery or adopter with voltage regulator to provide 5v supply. The 12 volts supply is used by GSM and motor five volt is given to sensors and microcontroller.

CHAPTER 4

HARDWARE AND SOFTWARE REQUIREMENTS

4.1 HARDWARE REQUIREMENTS

- ➢ ATmega328 PU controller-8bit controller,16MHZ frequency

- ➢ MQ2 gas sensor,5V
.
- ➢ Fire sensor

- ➢ Servo motor 10 torque,5v

- ➢ GSM sim 800 MODEM, 12v 2 amps

- ➢ 12v, 2 Amps Adopter.

- ➢ Voltage regulator LM317 adjustable regulator/7805 5 v regulator

- ➢ Buzzer 12v Piezo electric type.

- ➢ LCD 16x2 5v 500mA

- ➢ HX711 load cell signal conditioner

- ➢ Load cell 40kg

4.2 SOFTWARE REQUIREMENTS

- ➢ Operating system: Windows 7/8

- ➢ Software Tool: Arduino IDE 1.8.1

- ➢ Programming language: Embedded C

- ➢ Software Tool 2: Ki-cad 4.0.7 for circuit designing.

4.1 HARDWARE REQUIREMENTS

4.1.1 Arduino Uno R3

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). The board can operate on an external supply of 6 to 20 volts.

Arduino Uno R3 Front   Arduino Uno R3 Back
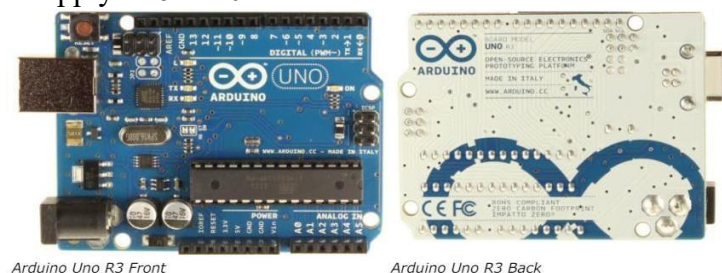
Fig 4.1 : Board diagram of Arduino Uno R3

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.

Specifications

Microcontroller

ATmega328

Operating

Voltage 5V

Input Voltage (recommended) 7-12V Input

Voltage (limits) 6-20V Digital I/O Pins 14 (of

which 6 provide PWM output)

Analog Input Pins 6 DC Current per I/O Pin 40 mA DC Current for

 3.3V Pin 50 mA Flash Memory 32 KB (ATmega328) of which 0.5

KB used by bootloader

SRAM 2 KB (ATmega328)

EEPROM 1 KB (ATmega328) Clock Speed 16 MHz

Power : The Arduino Uno 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 of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be 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 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. Memory The ATmega328 has 32 KB (with 0.5 KB used for 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 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 a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. 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.

- 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 connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off. 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 is it possible to change the upper end of their range using the AREF pin and the analogReference() function. Additionally, some pins have specialized functionality:

- 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. See also the mapping between Arduino pins and ATmega328 ports. The mapping for the Atmega8, 168, and 328 is identical. Communication The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX).

4.1.2 7805 Voltage Regulator

7805 is a three terminal linear voltage regulator IC with a fixed output voltage of 5V which is useful in a wide range of applications.
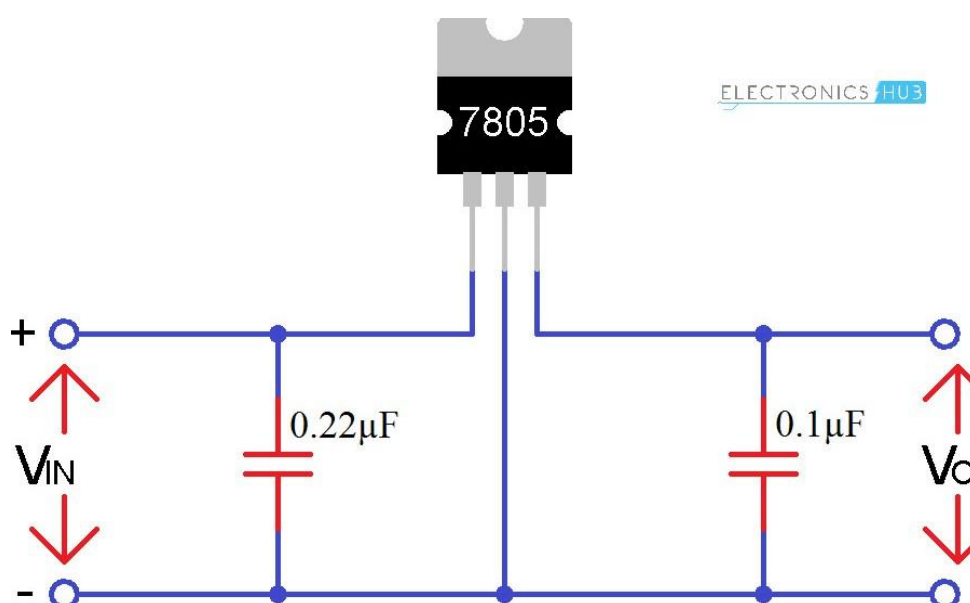

Fig 4.2 : Circuit diagram of 7805 regulator

Currently, the 7805 Voltage Regulator IC is manufactured by Texas Instruments, ON Semiconductor, STMicroelectronics, Diodes incorporated, Infineon Technologies, etc.

They are available in several IC Packages like TO-220, SOT-223, TO-263 and TO-3. Out of these, the TO-220 Package is the most commonly used one (it is the one shown in the above image).

Some of the important features of the 7805 IC are as follows:

- It can deliver up to 1.5 A of current (with heat sink).

- Has both internal current limiting and thermal shutdown features.

- Requires very minimum external components to fully function.

PIN DIAGRAM OF 7805 VOLTAGE REGULATOR IC

As mentioned earlier, 7805 is a three terminal device with the three pins being 1. INPUT, 2. GROUND and 3.OUTPUT. The following image shows the pins on a typical 7805 IC in To-220 Package.

BASIC CIRCUIT OF 7805

As per the datasheeţs of 7805 IC, the basic circuit required for 7805 to work as a complete regulator is very simple. In fact, if the input supply is an unregulated DC Voltage, then the need of the two capacitor (even those are not mandatory depending on the implementation). The below circuit shows all the components required for a 7805 IC to work properly. The $0.22\mu F$ Capacitor near the input is required only if the distance between the regulator IC and the power supply filter is high. Also, the $0.1\mu F$ Capacitor near the output is optional and if used, it helps in the transient response as shown in fig 4.3
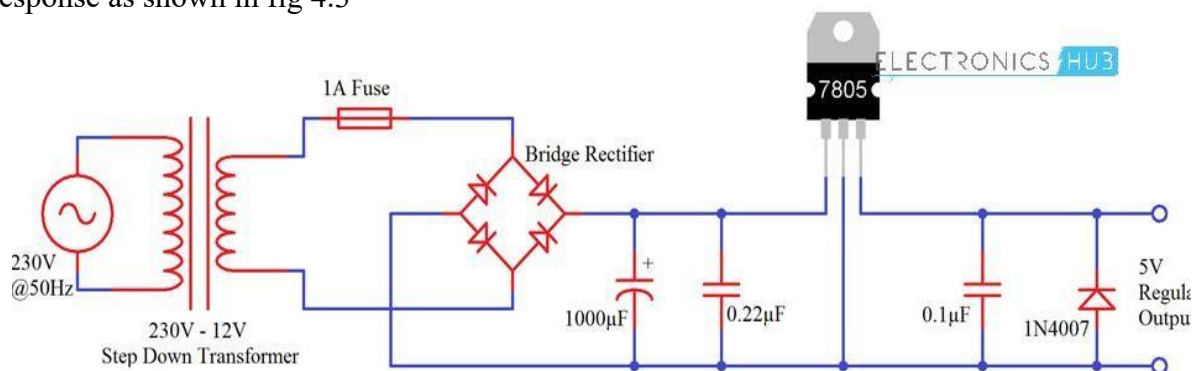

Fig 4.3 : Inter circuit connection of 7805 Regulator

Working

The AC power supply from mains first gets converted into and unregulated DC and then into a constant regulated DC with the help of this circuit. The circuit is made up of transformer, bridge rectifier made up from diodes, linear voltage regulator 7805 and capacitors.   If you observe, the working of the circuit can be divided into two parts. In the first part, the AC Mains is converted into unregulated DC and in the second part, this unregulated DC is converted into regulated 5V DC. Initially, a 230V to 12V Step down transformer is taken and its primary is connected to mains supply. The secondary of the transformer is connected to Bridge rectifier (either a dedicated IC or a combination of 4 1N4007 Diodes can be used). A 1A fuse is placed between the transformer and the bridge rectifier. This will limit the current drawn by the circuit to 1A. The rectified DC from the bridge rectifier is smoothened out with the help of 1000μF Capacitor.

So, the output across the 1000µF Capacitor is unregulated 12V DC. This is given as an input to the 7805 Voltage Regulator IC. 7805 IC then converts this to a regulated 5V DC and the output can be obtained at its output terminals.

4.1.3 Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric
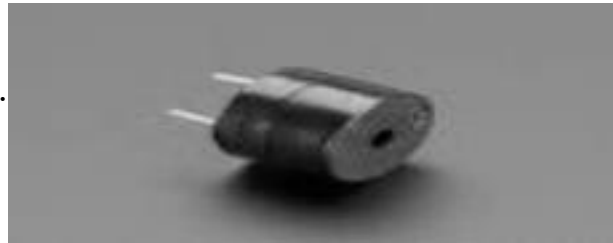
Fig 4.4 : Buzzer

Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or key stroke. Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination,. It generates consistent single tone sound just by applying D.C voltage. Using a suitably designed resonant system, this type can be used where large sound volumes are needed. At Future Electronics may stock many of the most common types categorized by Type, Sound Level, Frequency, Rated Voltage, Dimension and Packaging .

FEATURES

- Input supply: 5 VDC
- Current consumption: 9.0 mA max
- . Oscillating frequency: 3.0 ±0.5 KHz
- Sound Pressure Level: 85dB min.

APPLICATIONS OF BUZZER

- Confirmation of user input (ex: mouse click or keystroke)
- Electronic metronomes
- Sporting events
- Judging Panels

4.1.4 NODE MCU ESP66 12E

It is an open-source firmware and development kit that plays a vital role in designing a proper IoT product using a few script lines.
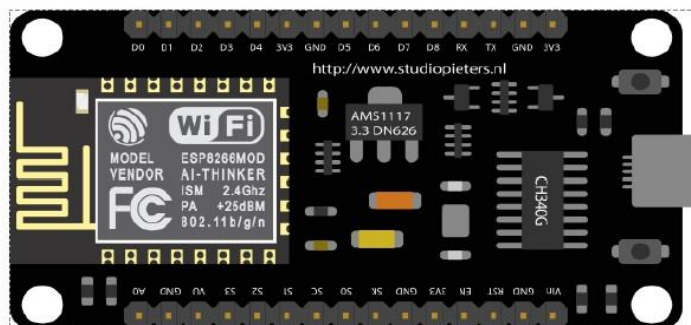
Fig 4.5 : Model diagram of Node MCU ESP66 12E

The best way to develop quickly an IoT application with less Integrated circuit to add is to choose this circuit "NodeMCU". The module is mainly based on ESP8266 that is a low-cost Wi-Fi microchip incorporating both a full TCP/IP stack and microcontroller capability. It is introduced by manufacturer Espressif Systems. The ESP8266 NodeMcu is a complex device, which combines some features of the ordinary Arduino board with the possibility of connecting to the internet. Arduino Modules and Microcontrollers have always been a great choice to incorporate automation into the relevant project. But these modules come with a little drawback as they don't feature a built-in WiFi capability, subsequently; we need to add external Wifi protocol into these devices to make them compatible with the internet channel. This is the famous Node MCU which is based on ESP8266 WiFi SoC. This is version 3 and it is based on ESP-12E (An ESP8266 based WiFi module). Node MCU is also an open-source firmware and development kit that helps you to prototype your IOT product within a few LUA script lines, and of course it can always program with Arduino IDE.

Features

1. Open-source

2. Arduino-like hardware

3. Status LED

4. MicroUSB port

5. Reset/Flash buttons

6. Interactive and Programmable

7. Low cost

8. ESP8266 with inbuilt wifi

9. USB to UART converter

10. GPIO pins

4.1.5 LCD [Liquid Crystal Display]

A Liquid Crystal Display (LCD) is a thin, flat panel display used for electronically displaying information such as text, images and moving picture.

Fig 4.6 :Circuit diagram of LCD.

LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery powered electronic equipment. It is an electronically modulated optical device made up of any number of segments filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome. Liquid crystals were first discovered in 1888.

Types of LCD:

1. Passive matrix display

2. Active matrix display

Passive matrix display:
➢ Uses a grid of vertical and horizontal conductors comprised of Indium Tin Oxide (ITO) to create an image.
➢ There is no switching device.
➢ Pixels are addressed one at a time by row and column matrix.
➢ Only used in low resolution displays (such as watch, calculator)Slow response time, poor contrast.

4.1.6 HX711 Load Cell Amplifier

HX711 is a precision 24-bit analog to-digital converter (ADC) designed for weigh scales and in industrial control applications to interface directly with a bridge sensor.
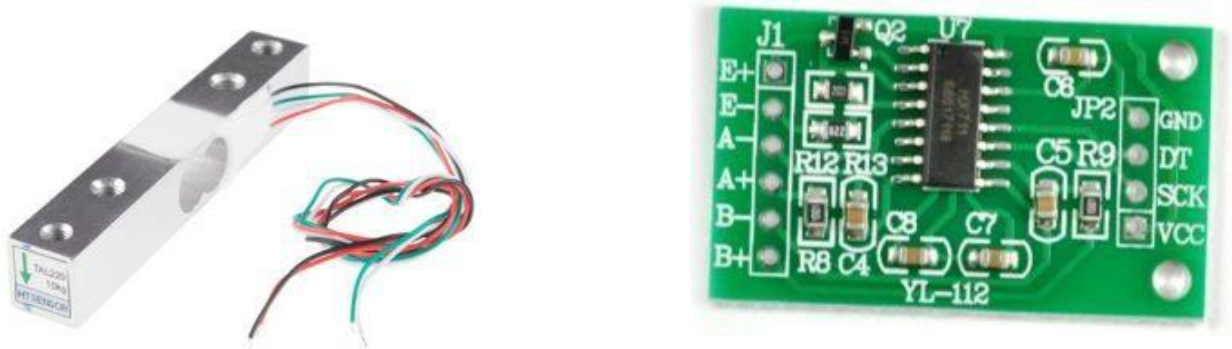
Fig 4.7 : Load cell connection diagram and it's pin out

Here an interfacing 40Kg load cell to the arduino using HX711 Load cell amplifier module. The input multiplexer selects either Channel A or B differential input to the low- noise programmable gain amplifier (PGA). Channel A can be programmed with a gain of 128 or 64, corresponding to a full-scale differential input voltage of ±20mV or ±40mV respectively, when a 5V supply is connected to AVDD analog power supply pin. Channel B has a fixed gain of 32. Onchip power supply regulator eliminates the need for an external supply regulator to provide analog power for the ADC and the sensor. Clock input is flexible. It can be from an external clock source, a crystal, or the on-chip oscillator that does not require any external component. On-chip poweron-reset circuitry simplifies digital interface initialization. There is no programming needed for the internal registers. All controls to the HX711 are through the pins.

Most Load cell have four wires red, black, green and white. On HX711 board you will find E+, E-, A+, A- and B+, B- connections. Connect load cell

Red wire to E+

Black wire to E-

Green wire to A-

White wire to A+

Adding the right proportion of additives to building materials is essential. For this purpose, special building materials scales using accuracy class C3 load cells are available for mixing additives such as ash or sand.

4.1.7 MQ2 Gas Sensor

MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide.


Fig 4.8 : MQ2 Gas sensor

MQ2 gas sensor is also known as chemi-resistor. It contains a sensing material whose resistance changes when it comes in co MQ2 is a metal oxide semiconductor type gas sensor. Concentrations of gas in the gas is measured using a voltage divider network present in the sensor. This sensor works on 5V DC voltage. It can detect gases in the concentration of range 200 to 10000ppm.

Working Principle

This sensor contains a sensing element, mainly aluminium-oxide based ceramic, coated with Tin dioxide, enclosed in a stainless steel mesh. Sensing element has six connecting legs attached to it. Two leads are responsible for heating the sensing element, the other four are used for output signals. Oxygen gets adsorbed on the surface of sensing material when it is heated in air at high temperature. Then donor electrons present in tin oxide are attracted towards this oxygen, thus preventing the current flow.

When reducing gases are present, these oxygen atoms react with the reducing gases thereby decreasing the surface density of the adsorbed oxygen. Now current can flow through the sensor, which generated analog voltage values. These voltage values are measured to know the concentration of gas. Voltage values are higher when the concentration of gas is high with the gas. This change in the value of resistance is used for the detection of gas.

4.1.8 Fire Sensor
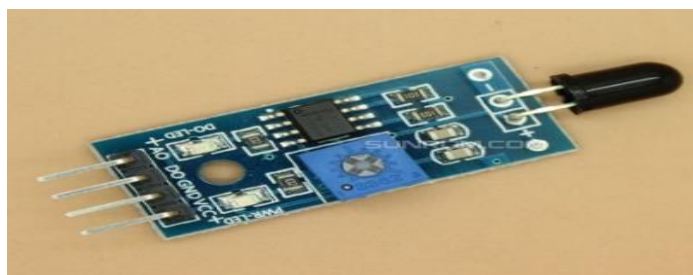
Fig 4.9 : Fire sensor.

- Operating Voltage: 3.3V to 5V DC

- Operating Current: 15ma

- Output Digital - 0V to 5V, Adjustable trigger level from preset

- Output Analog - 0V to 5V based on infrared radiation from fire flame falling on the sensor

- LEDs indicating output and power

- PCB Size: 3.2cm x 1.4cm

4.1.9 GSM Module

GSM (Global System for Mobile Communication) originally from Group Special Mobile is the most popular standard for mobile telephony systems in the world.

Fig 4.10 : GSM Module

GSM differs from predecessor technologies in that both signalling and speech channels are digital, and thus GSM is consider a second generation (2G) mobile phone system. This also facilitates the wide-spread implementation of data communication applications into the system. The implementation of the GSM standard has been an advantage to both consumers, who may benefit from ability to roam and switch carriers without replacing phones, and also to network operators, who can choose equipment from many GSM equipment vendors.

GSM also pioneered low-cost implementation of the short message service (SMS), also called text messaging, which has since been supported on mobile phone standards as well. GSM networks operate in a number of different carrier frequency ranges. With most 2G GSM networks operating in the 900MHz or 800MHz bands, where these bands were already allocated, the 850MHz and 900MHzbands were used instead.in rare cases the 400 and 450MHz frequency bands are assigned in some countries because they were previously used for first generation system. This allows eight full-rate or sixteen half-rate speech channels per radio frequencies. These eight radio time slots (or eight burst periods) are grouped into TDMA frame. Half -rate channels use alternate frames from the same timeslot. The channel data rate for all 8 channels is 270.833 kbps, and the frame duration is 4.615ms. One of the key features of GSM is the subscriber identity module, commonly known as a SIM card. The SIM is detachable smart card containing the user's subscription information and phone book. This allows the user to retain.

GSM/GPRS Modem Features :

- High Quality Product.

- Configurable baud rate, Dual-Band GSM/GPRS 900/ 1800 MHz.

- RS232 interface for direct communication with computer or MCU kit.

- SIM Card holder.

- Built in Network Status LED.

- Inbuilt Powerful TCP/IP protocol stack for internet data transfer over GPRS.

- Audio interface Connector.

- Normal operation temperature: -20 °C to +55 °C.

- Input Voltage: 3.6- 4.5 VDC.

4.2 SOFTWARE REQUIREMENTS

4.2.1 Arduino IDE

➢ Arduino IDE is open-source software, designed by Arduino.cc and mainly used for writing, compiling & uploading code to almost all Arduino Modules.

➢ It is available for all operating systems i.e. MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role in debugging, editing and compiling

the code.

Arduino Software Interface
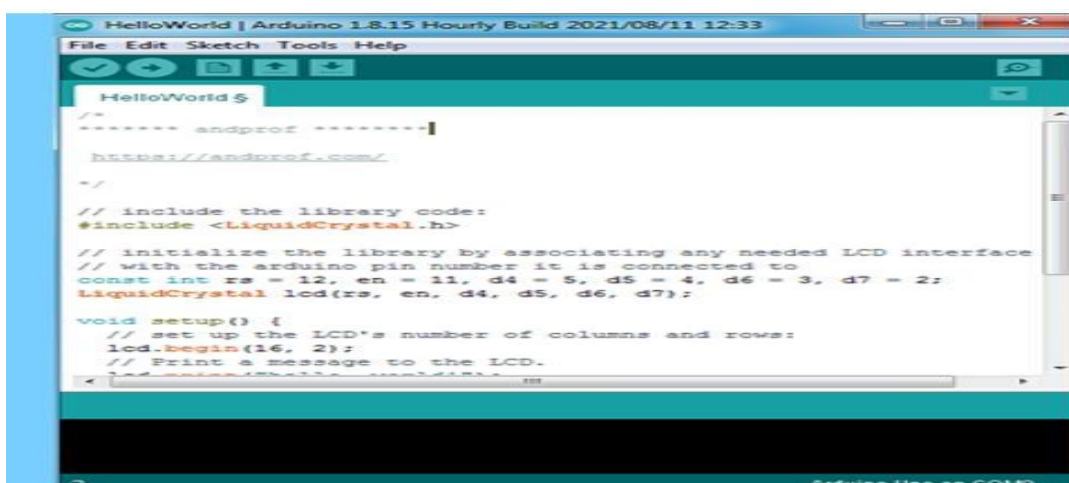
4.2.2 Menu Section
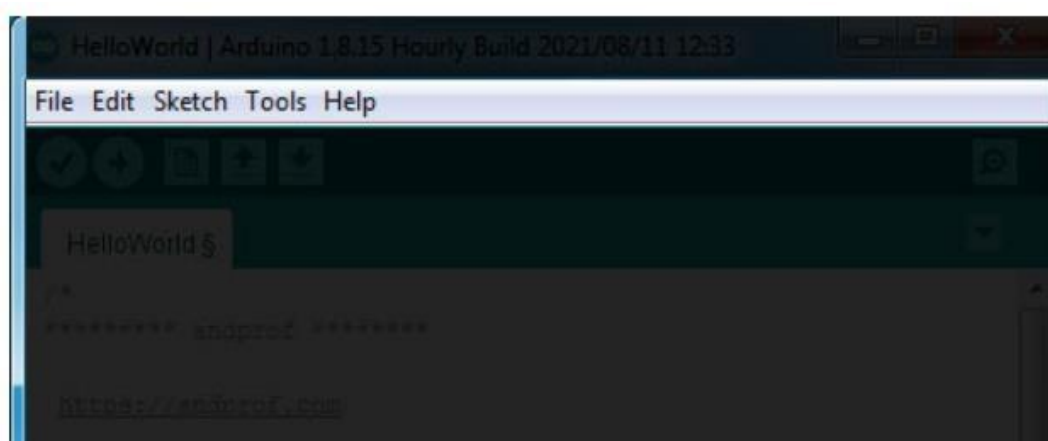
Menu is an Arduino library that enables you to create interactive menus and navigation systems for LCD displays. With Menu, you can easily add menus to your projects and navigate through them using buttons or any input device you want.

4.2.3 Toolbar Section

1. Verify: this button use to review the code, or make sure that is free from mistakes.

2. Upload: this button is use to upload the code on the arduino board.

3. New: this button use to create new project, or sketch (sketch is the file of the code).

4. Open: is use when you want to open the sketch from sketchbook.

5. Save: save the current sketch in the sketchbook.

6. Serial monitor: showing the data which have been sent from arduino.
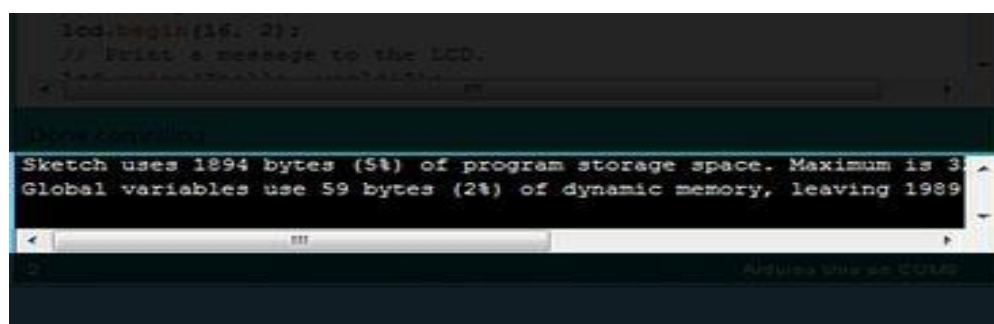
4.2.4 Code Editor Section
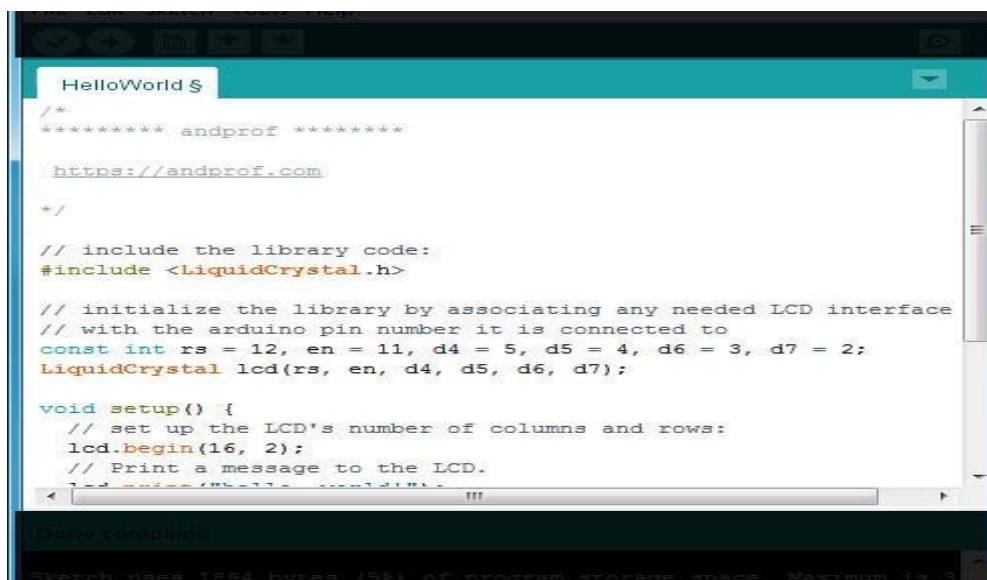
Code editor is liberator of codes, is the white space in the program, in which codes are been writing, and modifying on it.
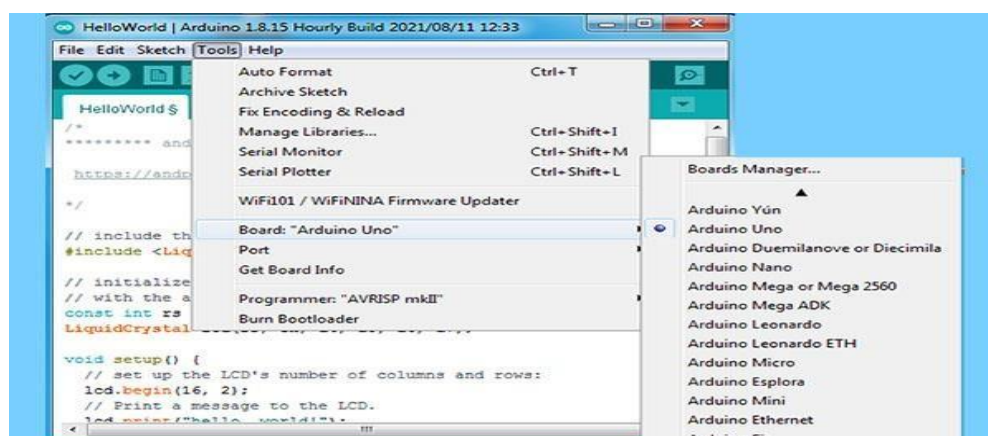
4.2.5 Status Bar Section
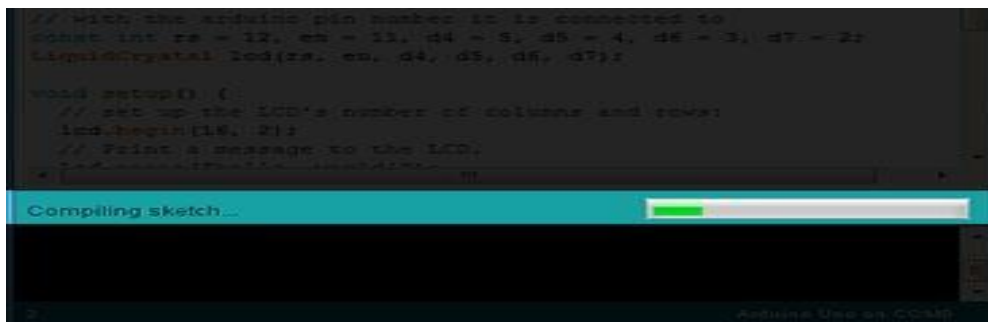
Status bar is a space can be found below the code editor, through it showing the status of operation's completion (compiling, uploading, etc.)
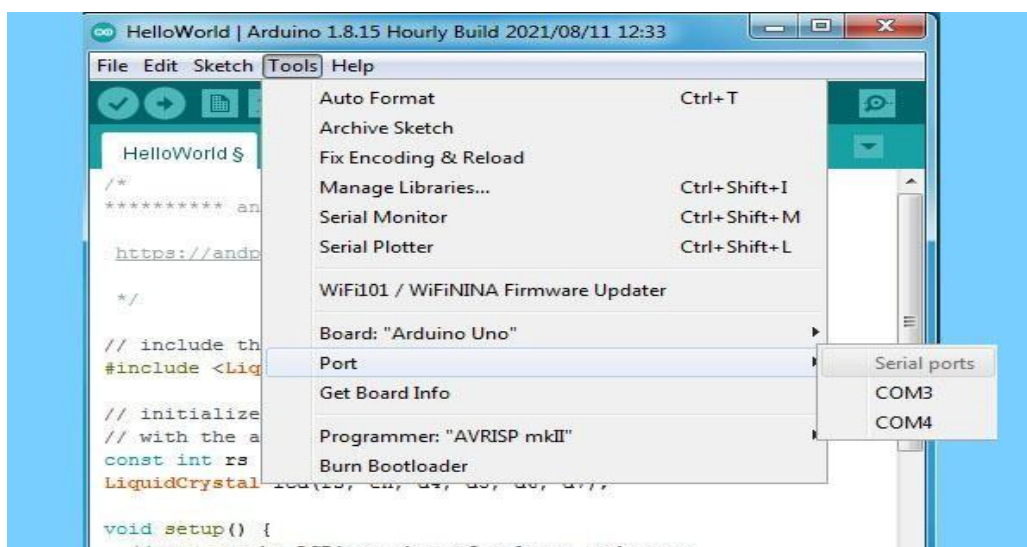
4.2.6 Serial Port & Board Selection

Program notifications this program showing you the mistakes of codes, and some problems that can be face you during the programming.

4.2.7 Program Notification Section

Serial ports selections is a space in which the program showing you the type of the port which is used to connect the arduino by computer.

4.2.8 Libraries in the Arduino IDE Package

The Arduino environment can be extended through the use of libraries, just like most programming platforms. Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data. Libraries are files written in C or C++, which provide your sketches with extra functionality (e.g. the ability to control an LED matrix, or read an encoder, etc.).To use an existing library in a sketch simply go to the Sketch menu, choose "Import Library", and pick from the libraries available. This will insert **#include** statement at the top of the sketch for each header (.h) file in the library's folder. These statements make the public functions and constants defined by the library available to the sketch. They also signal the Arduino environment to link that library's code with your sketch when it is compiled or uploaded.

4.2.9 KiCAD

KiCad is a free and open-source electronics design automation (EDA) suite. It features schematic capture, integrated circuit simulation, printed circuit board (PCB) layout, 3D rendering, and plotting/data export to numerous formats. KiCad also includes a high-quality component library featuring thousands of symbols, footprints, and 3D models. KiCad has minimal system requirements and runs on Linux, Windows, and macOS. KiCad 7.0 or 8.0 is the most recent major release. It includes hundreds of new features and bug fixes.

Some of the most notable new features include:

- A new schematic file format that embeds schematic symbols that are used in a design, meaning there is no longer the need for a separate cache library file.

- A new project file format that separates out display settings (such as which layers are visible in the PCB editor) so that these types of settings no longer cause changes to the board file or main project file, making KiCad easier to use with version control systems.

- A major overhaul of the schematic editor bringing its behavior in line with the PCB editor and conventions used by most other graphical editing software.

- Object selection and dragging now works the way most users expect when coming from other software. Support for buses of arbitrary signals, custom wire and junction colors per net, alternate pin functions, and many other new schematic features.

- A new design rule system in the PCB editor supporting custom rules that can be used to constrain complex designs with high voltage, signal integrity, RF, or other specialty needs.

- A number of improvements to the PCB editor's capabilities, including support for rounded (arc) track routing, hatched zone fills, rectangle primitives, new dimension styles, removing pad and via copper on unconnected layers, object grouping, locking, and much more.

- More flexible configuration of mouse behavior, hotkeys, color themes, coordinate systems, crossprobing behavior, interactive routing behavior, and much more.

- A new side panel UI for the PCB editor featuring layer visibility presets, opacity control of different object types, per-net and per-netclass coloring and visibility, and a new selection filter to control what types of objects can be selected.

- A redesigned look and feel, including a new design language used for all tool icons, a new default color theme, and support for dark window themes on Linux and macOS.

CHAPTER 5

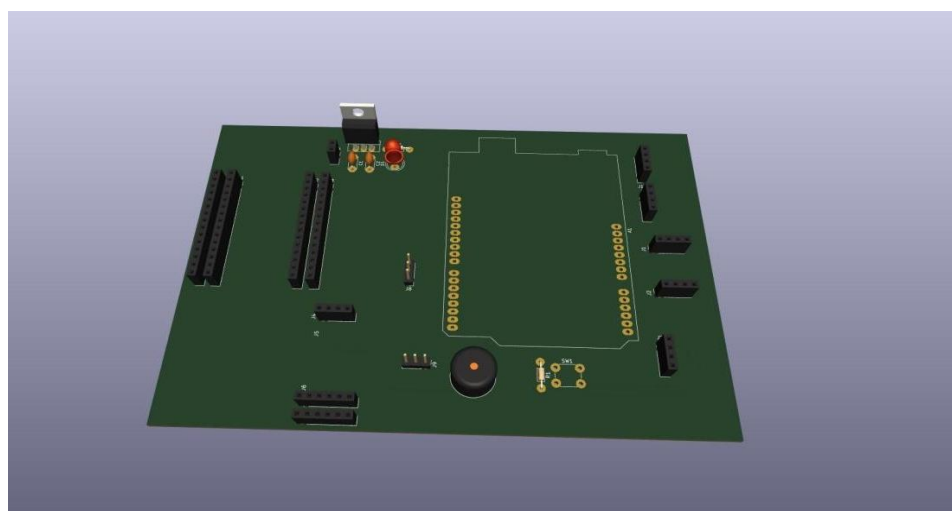# HARDWARE AND SOFTWARE IMPLEMENTATION

5.1 Circuit Schematic
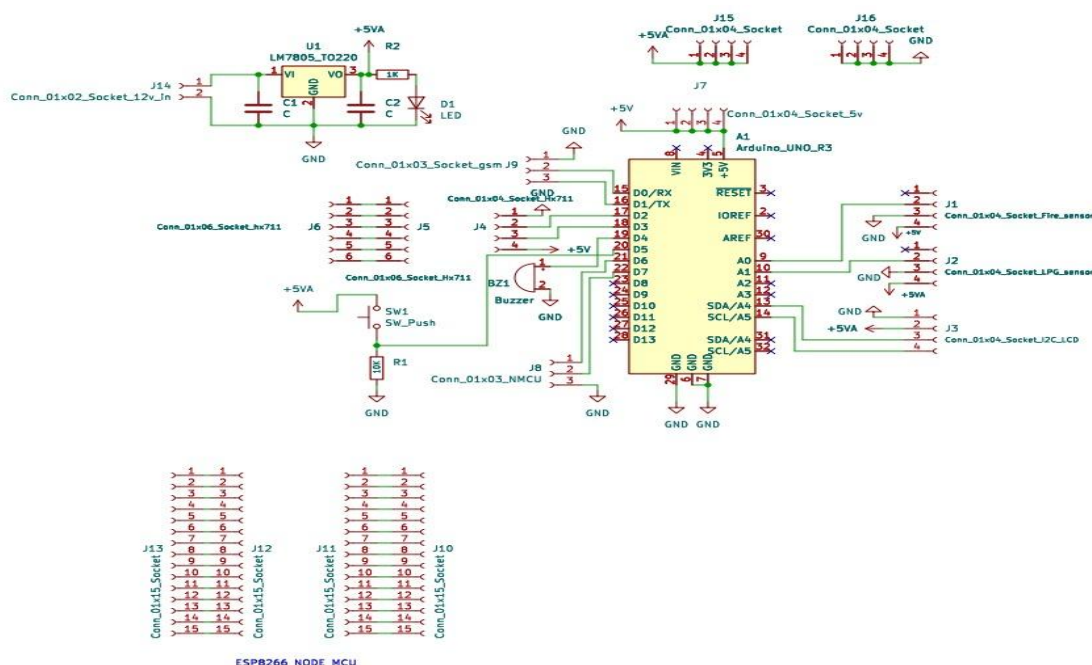
Fig 5.1 :Circuit Schematic Of Proposed System

The above figure 5.1 shows the schematic connections of Arduino UNO, Node MCU with 7805 5v voltage regulator followed by gas sensor and fire sensor.

5.2 3D view of circuit board

Fig 5.2 : 3D View Of Circuit Board

The above figure 5.2 shows the 3D view of circuit board in which Arduino UNO and Node MCU, gas sensor and fire sensor will be mounted.

CHAPTER 6

FLOW CHART OF WORKING PROJECT

The flowchart explains the main functionalities of your system, including gas level monitoring, gas leakage detection, fire detection, and LPG cylinder weight monitoring, with corresponding alerts and actions.
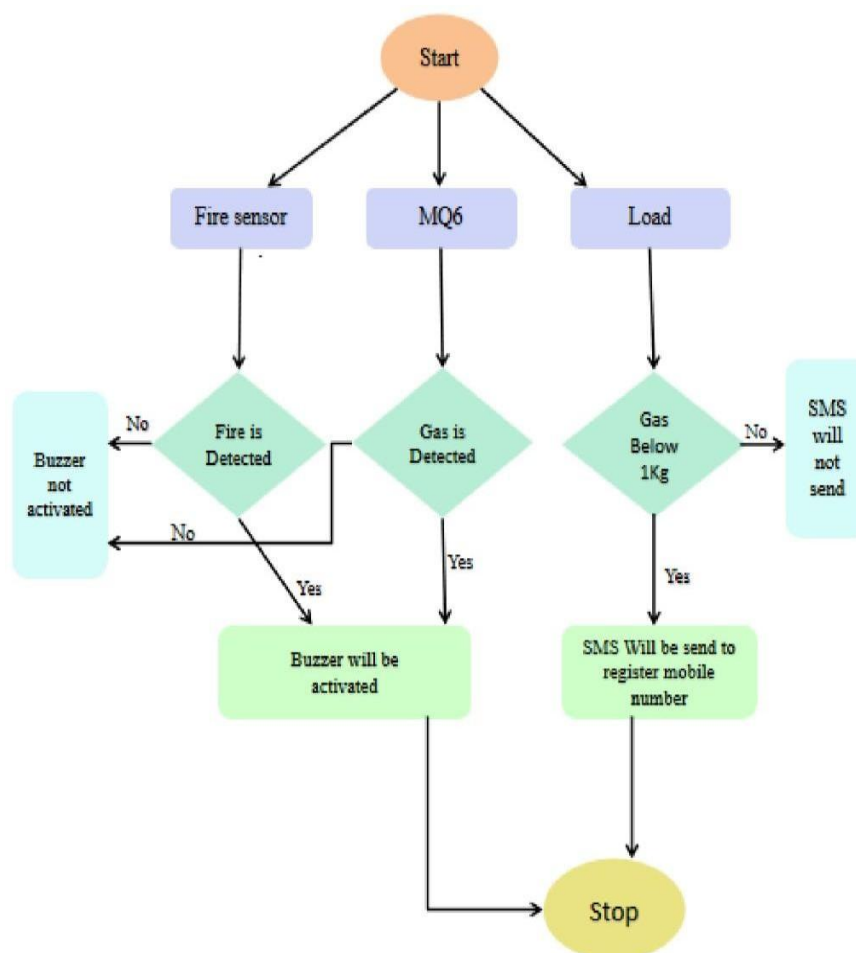
Fig 6.1: A typical Flow chart of an LPG gas leakage, Fire detection and overall Monitoring system.

The proposed IoT-based system is designed to enhance safety in LPG usage by integrating fire and MQ6 gas sensors, alongside a load sensor. The system initiates by checking for fire and gas leaks upon initialization. If a fire or gas leak is detected, the systemactivates a buzzer for immediate local alert. Additionally, if the gas level falls below 1 kg, an SMS is sent to a registered mobile number for prompt action. The system's real-time monitoring and alerting capabilities ensure timely responses, minimizing the risk of accidents. Its integration of sensors and SMS alerts enhances efficiency and safety in LPG usage, making it a valuable contribution to the field.
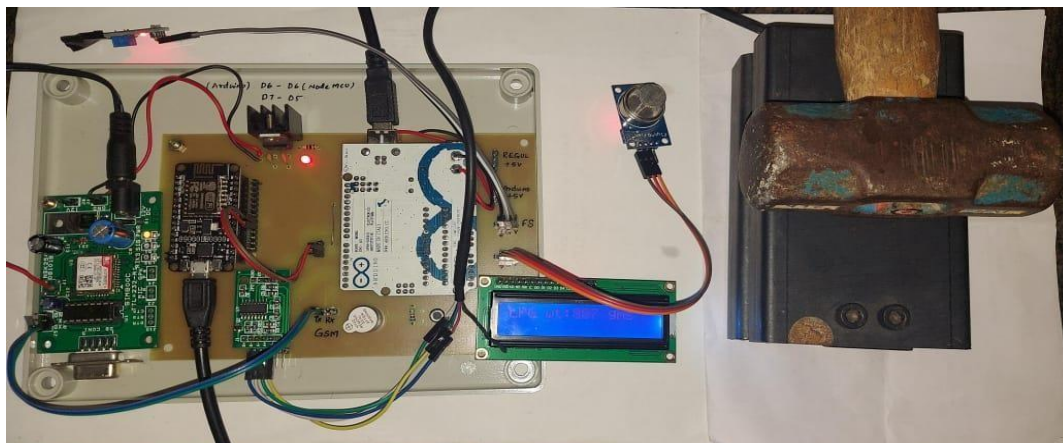
CHAPTER 7

RESULTS AND DISCUSSION

7.1 PROJECT MODULE

The connection of all the components is shown in Fig 7.1 which outputs the gas level on an LCD and also displays it in a web page.

Fig 7.1 : Overview of the Module

The fire indication is done through display in LCD, web page and give SMS alert to respected mobile number. The leakage indication is done through display in LCD, web page and give SMS alert to respected mobile number.
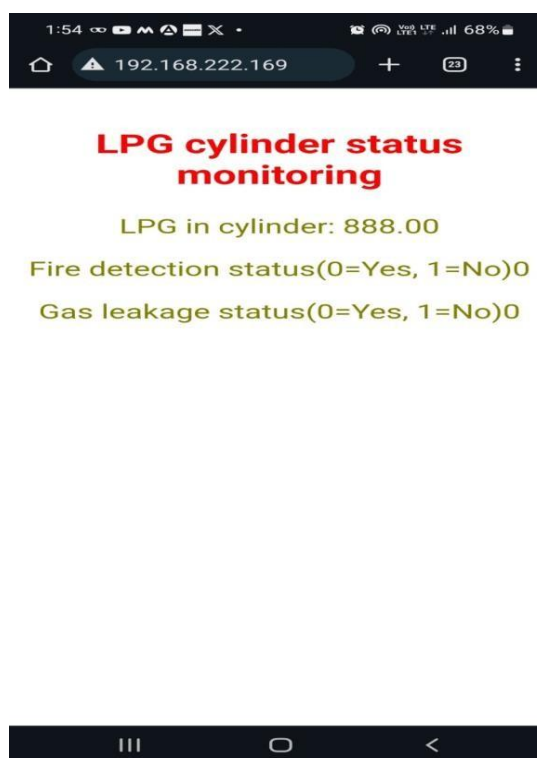
7.2 EXPERIMENTAL RESULTS

Fig 7.2 Weight of cylinder display in webpage

The above figure 7.2 shows the display of weight in an respective web page with fire detection and gas leakage status as No.

Fig 7.3 :Gas Leakage Detection display in Webpage

The above figure 7.3 shows the display of weight in an respective web page with fire detection status as No and gas leakage status as Yes.
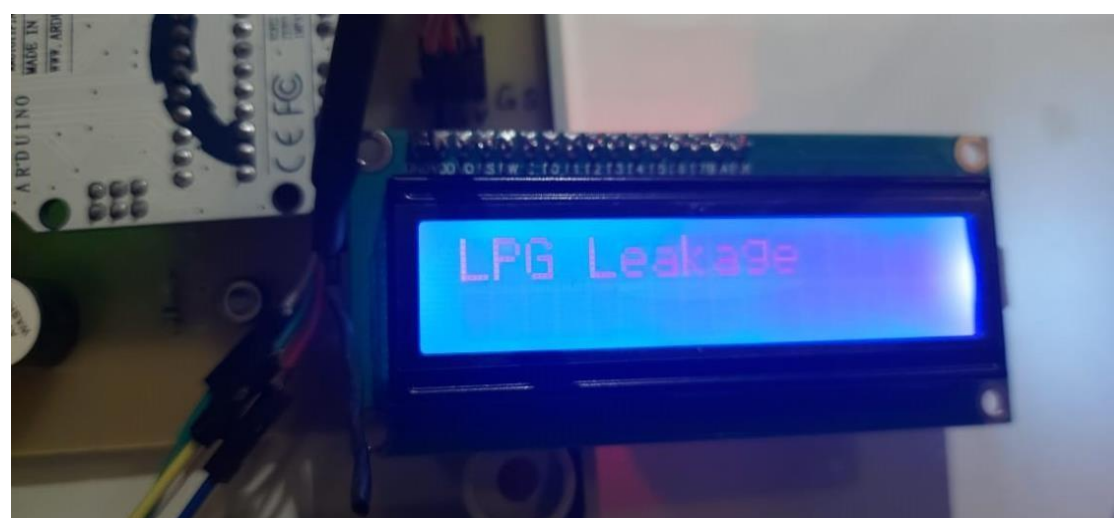

Fig 7.4 : Gas Fire detection display in Webpage

The above figure 7.4 shows the display of weight in an respective web page with fire detection status as Yes and gas leakage status as Yes.
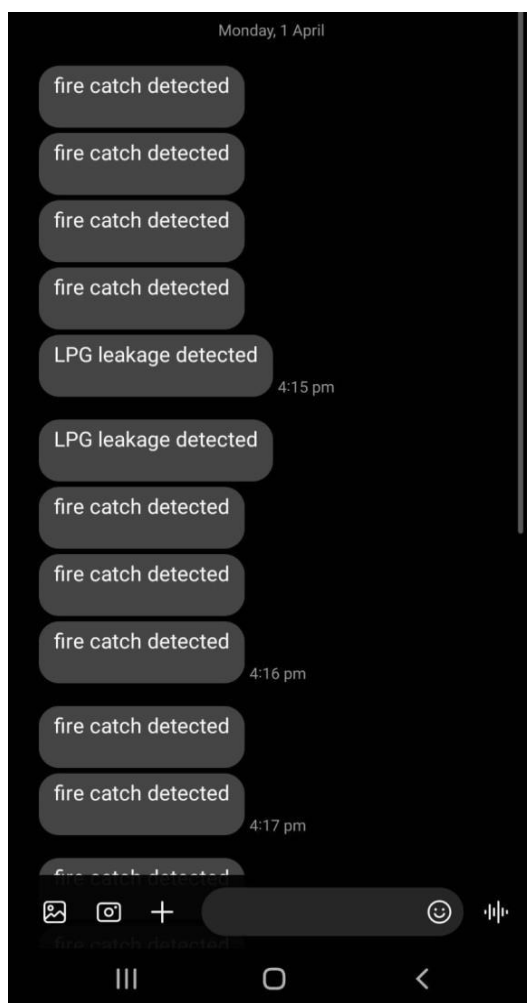
Fig 7.5 : Display of weight in LCD

Fig 7.6 :Display of Gas leakage in LCD

Fig 7.7 : Display of Fire detection in LCD

Fig 7.8: Gas Leakage and fire detection notification sent to Mobile

The system's successful implementation will result in increased efficiency in LPG gas reserves management and enhanced safety for users. It is expected to accurately detect LPG gas leaks within the detection radius of the MQ-6 gas sensor, providing timely alarms and SMS notifications to the owner. The system's ability to continuously measure the gas cylinder's weight and transmit data to the via IoT cloud for monitoring daily consumption is crucial for effective resource management.

CHAPTER 8

CONCLUSION AND FUTURE SCOPE

8.1 CONCLUSION

Our system is reasoned to help customers to upgrade their safety norms, act in accordingly with minimum requirements on environmental issues and mostly the basic function being prevented by major disasters and protect life and property from reputed Accidents. The objective of our project is to measure the gas present in the cylinder when weight of the cylinder is below the particular level, this can be done using the weight sensors. Real time weight measurement of the gas and its display on LCD makes it an efficient home security system and also can be used in industries and other places to detect gas leaks.

8.2 FUTURE SCOPE

Enhance the fire detection capabilities by implementing a multi-tiered approach, including heat sensors, smoke detectors, and advanced computer vision systems.Develop intelligent notification systems that can differentiate between critical alerts and routine notifications.Develop features that allow users to remotely control and manage their gas appliances, such as turning off the gas supply or adjusting the flame intensity.Designing the system to be scalable and flexible, allowing for easy expansion and adaptation to different environments and use cases.

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