A Project Report on

IOT ENABLED GAS LEAKAGE DETECTION SYSTEM.

Submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Engineering

in

INFORMATION TECHNOLOGY

by

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Approval Sheet

This Project Report entitled ***"IOT ENABLED GAS LEAKAGE DETECTION SYSTEM."*** Submitted by ***"Shailesh Maurya (17204008), Sankalp Patil (15104030), Akash Sapkal (16204035)"*** is approved for the partial fulfillment of the requirenment for the award of the degree of ***Bachelor of Engineering*** in ***Information Technology.*** from ***University of Mumbai***.

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Place:A.P.Shah Institute of Technology, Thane
Date:

CERTIFICATE

This is to certify that the project entitled ***"IOT ENABLED GAS LEAKAGE DETECTION SYSTEM."*** submitted by ***"Shailesh Maurya (17204008), Sankalp Patil (15104030), Akash Sapkal (16204035)"*** for the partial fulfillment of the requirement for award of a degree ***Bachelor of Engineering*** in ***n InformationTechnology.***,to the University of Mumbai,is a bonafide work carried out during academic year 2020-2021.

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Acknowledgement

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Declaration

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

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Abstract

Gas leakage is a major problem with industrial sector, residential premises and gas powered vehicles like CNG (compressed natural gas) buses, cars. One of the preventive methods to stop accident associated with the gas leakage is to install gas leakage detection kit at vulnerable places. The aim of this paper is to present such a design that can automatically detect and stop gas leakage in vulnerable premises. In particular gas sensor has been used which has high sensitivity for propane (C3H8) and butane (C4H10). Gas leakage system consists of GSM (Global System for mobile communications) module, which warns by sending SMS and webserver for continuously monitoring . However, the former gas leakage system cannot react in time.

Contents

Chapter 1

Introduction

Gas Leak Detector is a simple system that is designed to detect and notify any leakage of natural gas, methane, propane, butane, or any other flammable gas. As we advanced through many generations, we have also developed great many things in the journey. We have used Earth's natural resources to obtain many things to be done, Petroleum, coal, and all other flammable gases being some of them. Petroleum, a natural resource which is non-renewable has helped the mankind to be alive several years. Coal, another non-renewable natural resource has helped through many generations. Over the last few decades, people has been using few flammable gases for cooking, methane, propane, butane being some of them. Although, these gases do help the man, but it also is equally dangerous when not taken care of. If we seek out the recent accidents that happened in house due to gas leak, we will be seeing a handful of them. Well coming to the point, we have come up with a solution to at least control them.

1.1 Objective

1. To layout and acquire project that will perceive gas outflow like Methane leak, Butane leak, and LPG leak, Methane outflow or any such petroleum cantered on gaseous substance that can be discovered using MQ2 device.

2. To layout and set up an SMS cantered Alert method send SMS alert missives to restrict mobile number enter inside the Arduino program.

3. To layout and acquire a project that will fabricate a sound alarm during gas outflow and rest the alarm once gas outflow is regulated .

4. To show status in an LCD using a 16×2 LCD component and also on web server using EPS8266 and to resist the gas supply using Solenoid controller.

Chapter 2

Literature Review

2.1 Paper 1

Paper Title : An IoT based System for Domestic Air Quality Monitoring and Cooking Gas Leak Detection for a Safer Home

Authors: Kalpesh Gupta, Gokul Krishna G and Anjali T

Publication details : International Conference on Communication and Signal Processing, July 28 - 30, 2020, India

Findings: In this paper author has suggested a low cost low power system which will measure the concentration of CO2 in the indoor atmosphere also detect the leakage of the LPG or CNG (in situations like forgetting to switch off the stove or accidental turn on the gas stove by someone or accidental leak etc

Advantages: Proposing a hybrid low cost low power IoT based system for air quality determination and cooking fuel leak detection, enhancing the safety of the users in the house.

Disadvantages: In this system a person only get's notification about the gas leakage but no preventive measures taken to Stop the gas leakage

2.2 Paper 2

Paper Title : Automatic Smart and Safety Monitoring System for Kitchen Using Internet of Things

Authors: Harika Pudugosula Student, Master of Technology Computer Science and Engineering Amrita School of Engineering, Bangalore Amrita Vishwa Vidyapeetham, India

Publication details : Proceedings of the International Conference on Intelligent Computing and Control Systems (ICICCS 2019) IEEE Xplore Part Number: CFP19K34-ART; ISBN: 978-1-5386-8113-8

Findings: The main purpose of the paper is that to identify, address the safety of kitchen. This smart and safety monitoring system is modeled by these types of sensors namely, DTH11 sensor monitors temperature and humidity of the kitchen, IR flame sensor detects the existence of fire in the surroundings of kitchen and the leakage of gas in the kitchen is detected by using MQ-3 sensor. The interfacing of these sensors is done by using Arduino UNO and the controlling of this safety system is done by relay.

Advantages: The sensor used in this model can sense and detect the leakage of the gas, and the user gets notification regarding gas leak.

Disadvantages: To uploads the value into web server it requires the Wi-Fi module.

2.3 Paper 3

Paper Title: Gas Leakage Detection Based on IOT

Authors: Suma V, Ramya R Shekar, Akshay Kumar A

Publication details : Proceedings of the Third International Conference on Electronics Communication and Aerospace Technology [ICECA 2019] IEEE Conference Record 45616; IEEE Xplore ISBN: 978-1-7281-0167-5

Findings: This paper that put forth a new proposed system which is microcontroller based application of gas booking and gas detection systems using IOT. The sensor used in this model can sense and detect the leakage of the gas, and the user gets notification regarding to remaining percentage of gas in the cylinder as well certain action can be taken to pre-book the new cylinder without any barrier.

Advantages: The proposed system is not only capable of Sensing or detecting the gas leakages as well as alerting the user about the gas leakage by buzzer alarm and sending notification to the user in the other side automatic LPG booking is allowed this is done by using load cell.

Disadvantages: In this system her only get's notify if gas leakage is detected or the gas cylinder is empty but the user cannot monitor the actual values.

Chapter 3

Project Design

3.1 Proposed System Architecture/Working

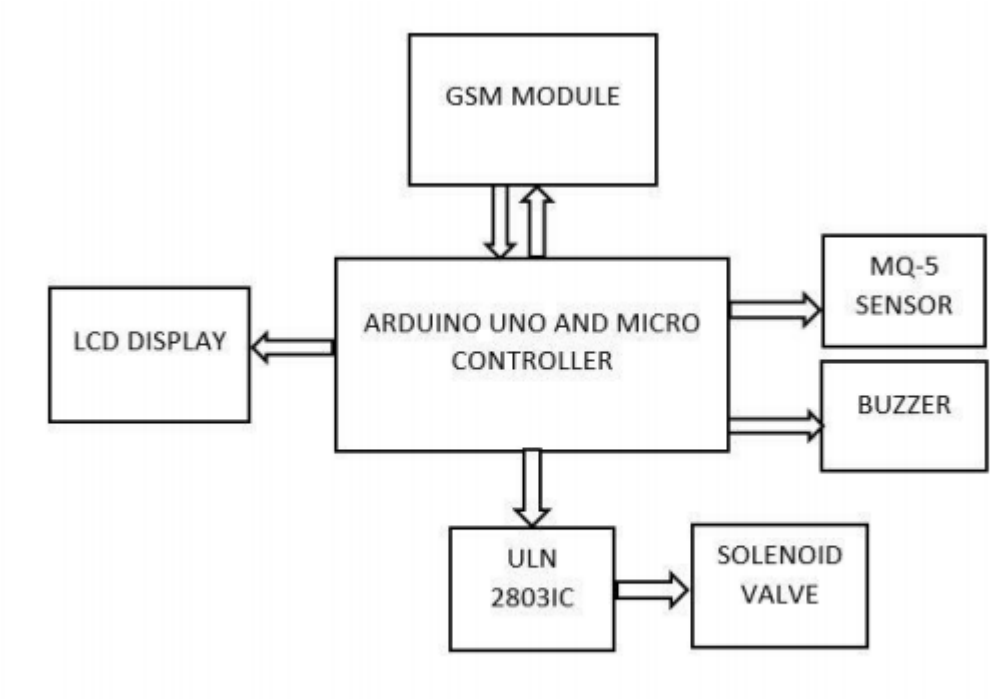


Fig.3.1

3.2 Working Flowchart

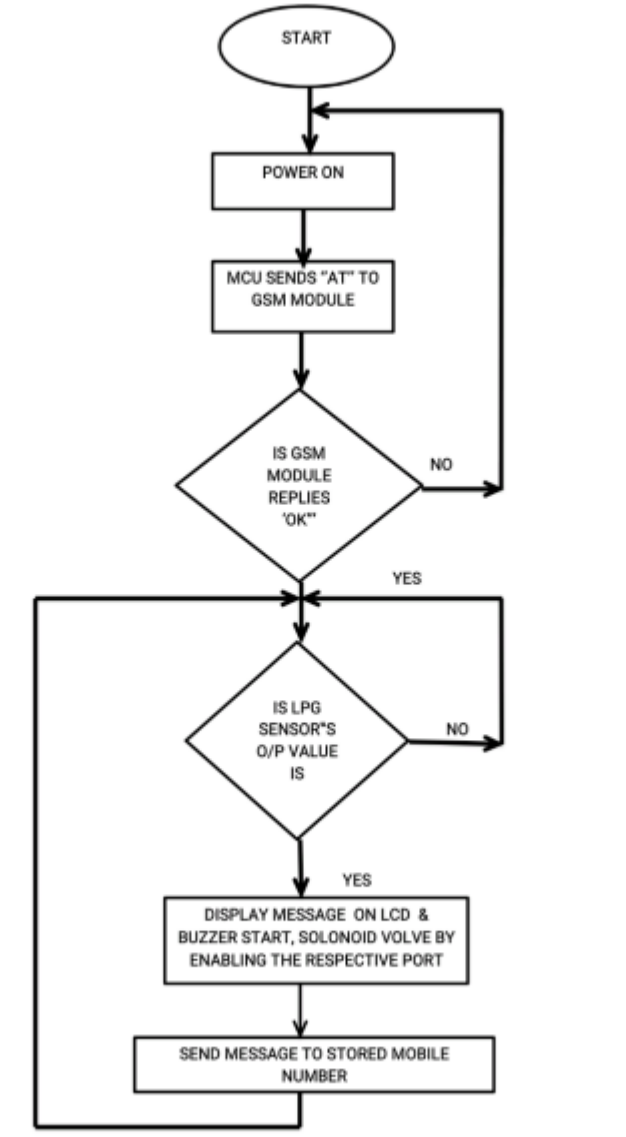


Fig.3.2

3.3 Webserver Process Block Diagram

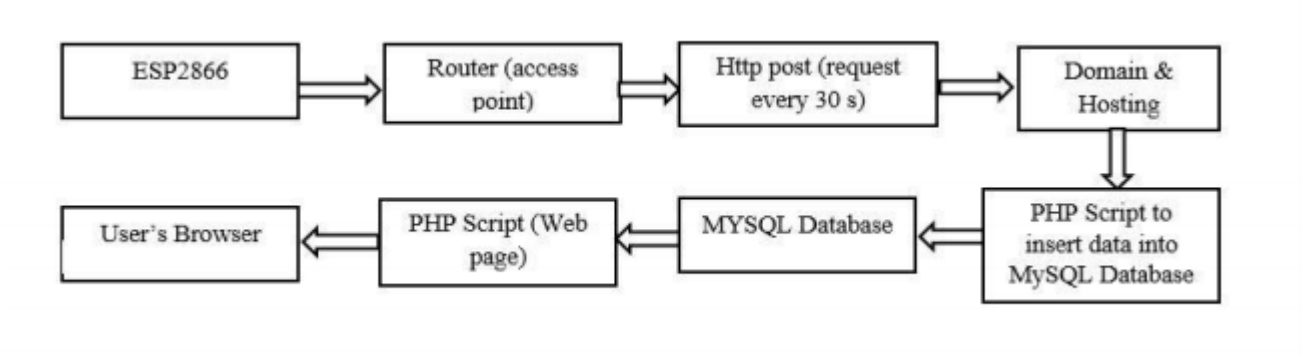


Fig.3.3

Chapter 4

Requirements

4.1 Requirements

1.Arduino :

An Arduino is an open-source microcontroller development board. In plain English, you can use the Arduino to read sensors and control things like motors and lights. This allows you to upload programs to this board which can then interact with things in the real world. With this, you can make devices which respond and react to the world at large.

For instance, you can read a humidity sensor connected to a potted plant and turn on an automatic watering system if it gets too dry. Or, you can make a stand-alone chat server which is plugged into your internet router. Or, you can have it tweet every time your cat passes through a pet door. Or, you can have it start a pot of coffee when your alarm goes off in the morning.

Basically, if there is something that is in any way controlled by electricity, the Arduino can interface with it in some manner. And even if it is not controlled by electricity, you can probably still use things which are (like motors and electromagnets), to interface with it.

The possibilities of the Arduino are almost limitless. As such, there is no way that one single tutorial can cover everything you might ever need to know. That said, I've done my best to give a basic overview of the fundamental skills and knowledge that you need to get your Arduino up and running. If nothing more, this should function as a springboard into further experimentation and learning.

Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

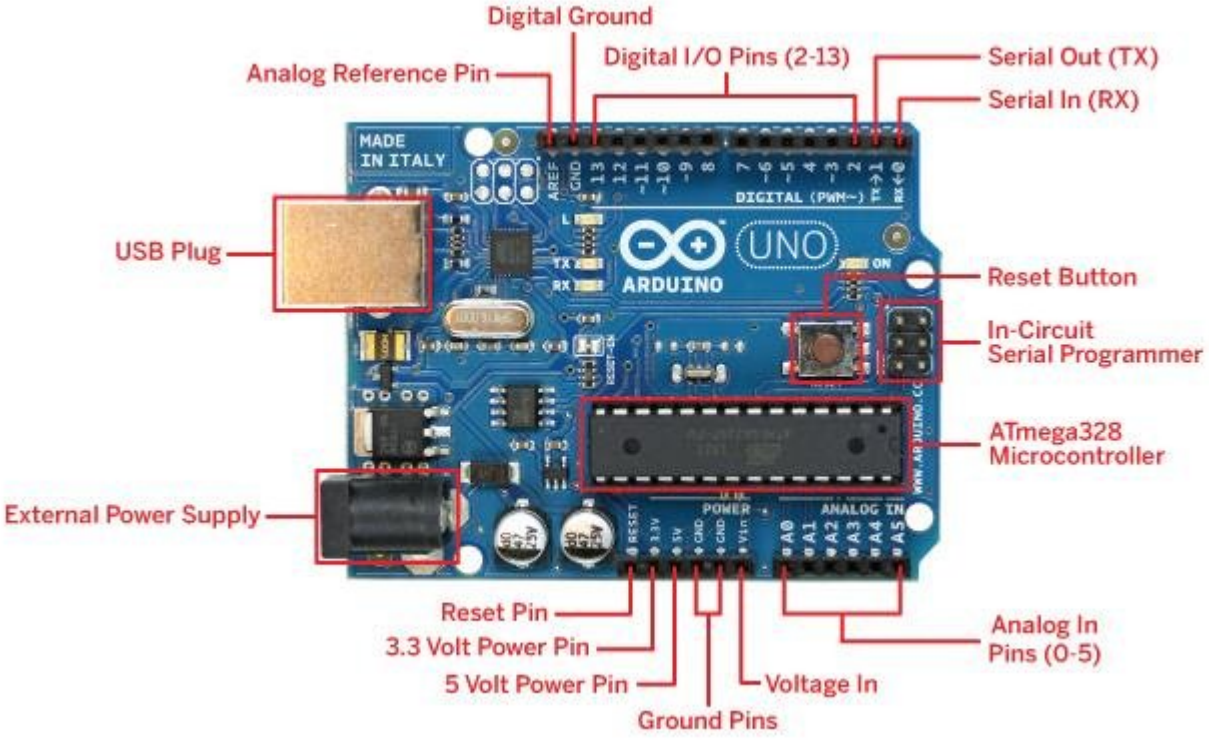

Digital Ground
Analog Reference Pin
Digital I/O Pins (2-13)
Serial Out (TX)
Serial In (RX)
USB Plug
Reset Button
In-Circuit
Serial Programmer
ATmega328
Microcontroller
External Power Supply
Reset Pin
3.3 Volt Power Pin
5 Volt Power Pin
Ground Pins
Voltage In
Analog In
Pins (0-5)
MADE
IN ITALY
UNO
ARDUINO
DIGITAL (PWM~)
POWER
ANALOG IN

Fig.1

2.GSM Module :

GSM (Global System for Mobile Communications, originally Groupe Special Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI). It was created to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones and is now the default global standard for mobile communications – with over 90A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system. The modem (modulator-demodulator) is a critical part here. These modules consist of a GSM module or GPRS modem powered by a power supply circuit and communication interfaces (like RS-232, USB 2.0, and others) for computer. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.

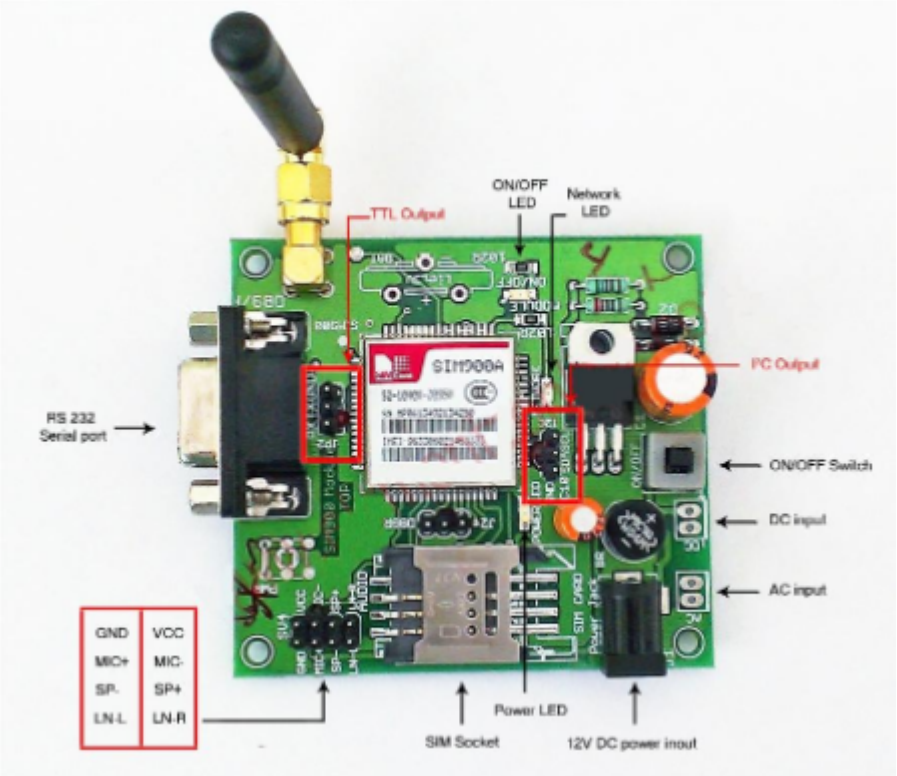


Fig.2

3.LCD Display 16*2 :

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

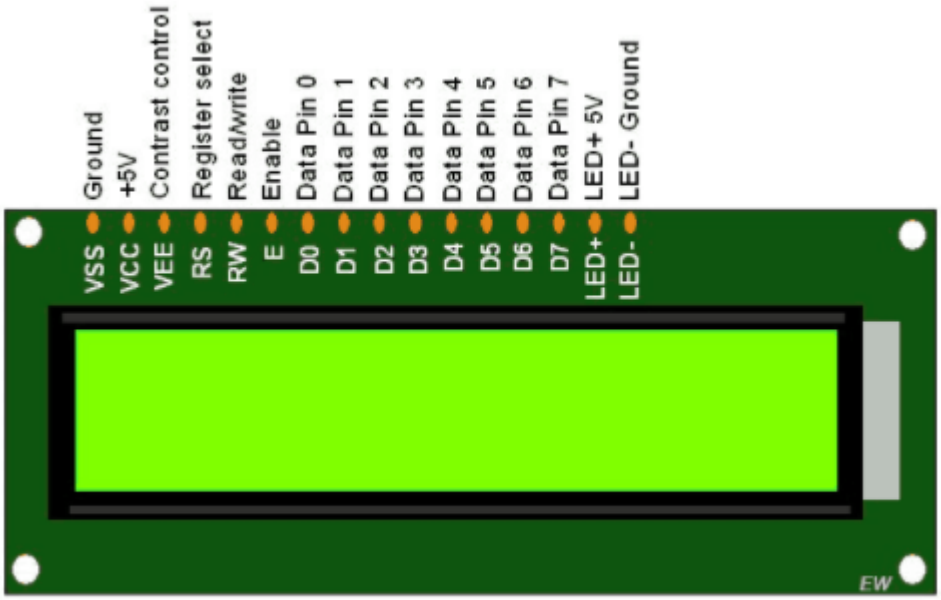


Fig.3

4.Buzzer:

Buzzer is a kind of voice device that converts audio module into sound signal. It is mainly used to prompt or alarm. According to different design and application, it can produce music sound, flute sound, buzzer, alarm sound, electric bell and other different sounds. Typical applications include siren, alarm device, fire alarm, air defences alarm, burglar alarm, timer, etc. It is widely used in household appliances, alarm system, automatic production line, low-voltage electrical equipment, electronic toys, game machines and other products and industries.

Fig.4

5.ULN2803 IC:

ULN2803 is a High voltage, high current Transistor Array IC used especially with Microcontrollers where we need to drive high power loads. This IC consists of an eight NPN Darlington connected transistors with common Clamp diodes for switching the loads connected to the output. This IC is widely used to drive high loads such Lamps, relays, motors etc. It is usually rated at 50v/500mA. This article brings out the working of ULN2803 IC and how to use it in a circuit. Most of the Chips operates with low level signals such as TTL, CMOS, PMOS, NMOS which operates at the range of (0-5) v and are incapable to drive high power inductive loads. However, this chip takes low level input signals (TTL) and use that to switch/turn off the higher voltage loads that is connected to the output side.

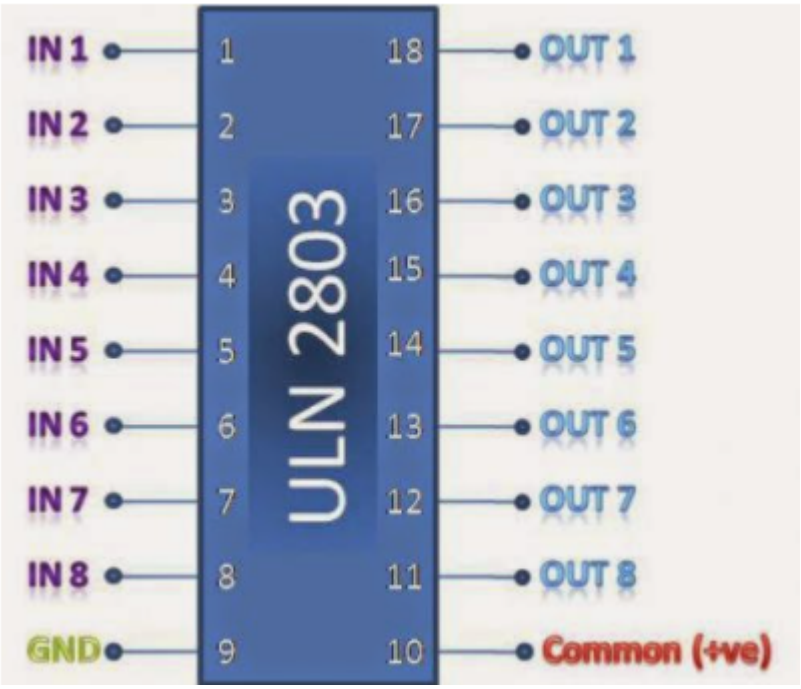


Fig.5

6.PCB Board:

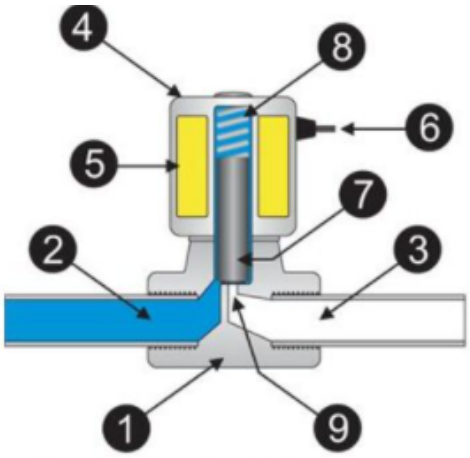
Printed circuit boards (PCBs) are the boards that are used as the base in most electronics – both as a physical support piece and as the wiring area for the surface-mounted and socketed components. PCBs are most commonly made out of fiberglass, composite epoxy, or another composite material. Most PCBs for simple electronics are simple and composed of only a single layer. More sophisticated hardware such as computer graphics cards or motherboards can have multiple layers, sometimes up to twelve.

Although PCBs are most often associated with computers, they can be found in many other electronic devices, such as TVs, Radios, Digital cameras and Cell phones. In addition to their use in consumer electronics and computers, different types of PCBs are used in a variety of other fields: Medical device, Industrial Machinery, Lighting, Automotive and aerospace industries.

Fig.6

7.Solenoid Valves:

Solenoid valves are electrically activated valves, typically used to control the flow or direction of air or liquid in fluid power systems. Used in both pneumatic and hydraulic fluid power functions, the spool or poppet design of most solenoid valves makes them perfect for various functions and applications. The spool or poppet of the valve connects to a ferrous metal plunger, which is typically spring cantered or spring offset, but may be detected instead. The plunger slides within a core tube of non-ferrous metal, itself surrounded by a coil of electrical windings. The coil exists with any range of voltage from 12-48 Vdc to 110-220 Vac. When power is sent through the coil, a magnetic field is created, which pushes or pulls the plunger, shifting the valve.



Parts of Solenoid Valve

1) Valve body
2) Inlet port
3) Outlet port
4) Coil / Solenoid
5) Coil winding
6) Lead wires
7) Plunger or piston
8) Spring
9) Orifice

Fig.7

8.Node MCU:

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit).The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits.
The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

Fig.8

9.ESP8266:

The ESP8266 is a low-cost Wi-Fi microchip, with a full TCP/IP stack and microcontroller capability.This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at first, there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, the chip, and the software on it, as well as to translate the Chinese documentation. The ESP8285 is an ESP8266 with 1 MiB of built-in flash, allowing the building of single-chip devices capable of connecting to Wi-Fi. These microcontroller chips have been succeeded by the ESP32 family of devices, including the pin-compatible ESP32-C3.

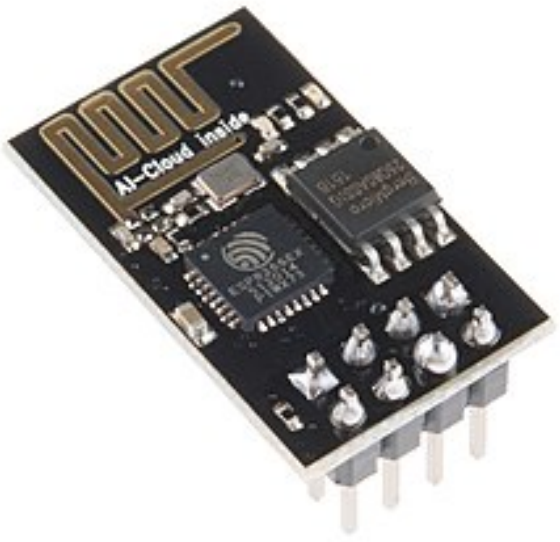


Fig.9

10.Resistors:

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat, may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated circuits.

Fig.10

11.SIM Card:

A SIM card, also known as a subscriber identity module, is a smart card that stores identification information that pinpoints a smartphone to a specific mobile network. Data that SIM cards contain include user identity, location and phone number, network authorization data, personal security keys, contact lists and stored text messages.

The SIM circuit is part of the function of a universal integrated circuit card (UICC) physical smart card, which is usually made of PVC with embedded contacts and semiconductors.

"SIM cards" are transferable between different mobile devices. The first UICC smart cards were the size of credit and bank cards; sizes were reduced several times over the years, usually keeping electrical contacts the same.

A SIM card contains a unique serial number (ICCID), international mobile subscriber identity (IMSI) number, security authentication and ciphering information, temporary information related to the local network, a list of the services the user has access to, and two passwords: a personal identification number (PIN) for ordinary use, and a personal unblocking key (PUK) for PIN unlocking.

Fig.11

12.Potentiometer:

Potentiometer is a small sized electronic component whose resistance can be adjusted manually. Increasing or decreasing the value of resistance controls the amount of current flowing in a circuit. The potentiometer is used in various electronics, for EXAMPLE: is used as volume knob in music systems, as fan regulators etc. Potentiometer has two strips made on it resistive and conductive. Resistive strip is made of carbon and is responsible for potentiometer's resistance variance feature. Conductive strip helps the potentiometer to carry the current into the circuit in accordance with the resistance. To understand the theory of our humble potentiometers (or pots).

Parts of the potentiometer:

Lugs: Potentiometers by convention have three lugs. They are numbered 1, 2, and 3 as shown in the figure.

Shaft: This is a plastic/metallic stick which is used to turn the potentiometer.

Resistive Strip: This is the heart of the potentiometer. It is a carbon strip that is printed on a phenolic strip. There are metal contacts in the end to connect it to the lugs.

Metal Wiper: When we rotate the shaft, it in turn rotates a metallic wiper which connects the lug 1 and lug2.

Fig.12

Chapter 5

Working

5.1 Circuit Diagram

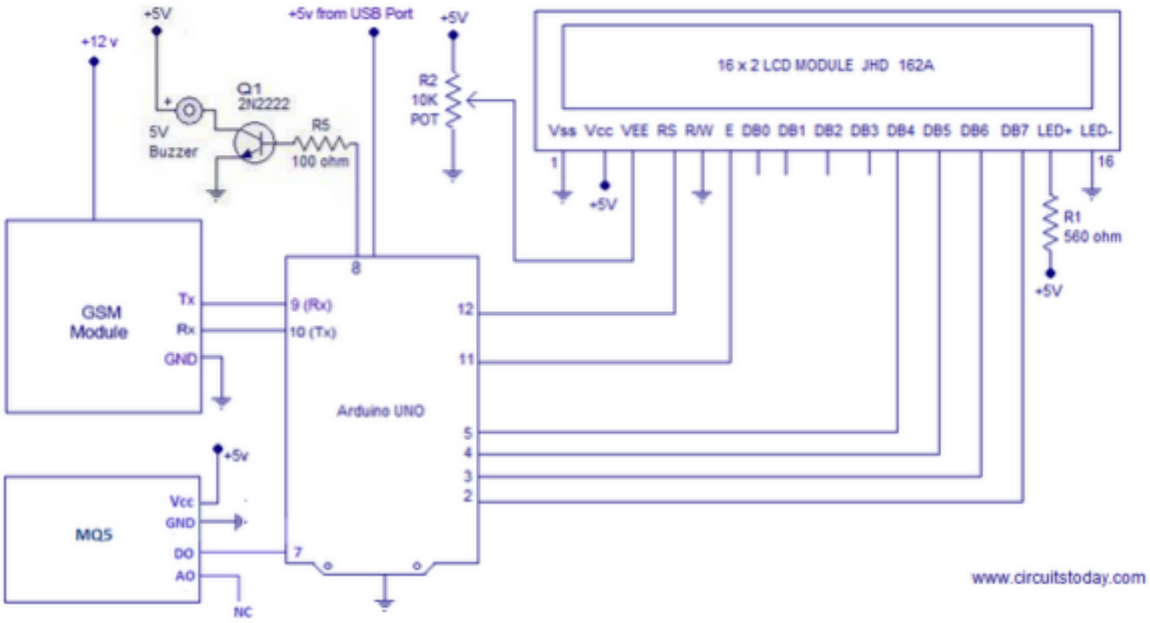


Fig. 5.1

5.2 Working Module Snapshot

Fig. 5.2

LPG is available almost everywhere to fulfill household needs and industrial demands. The MQ5 Sensor sense the gas and lcd display will show that gas leakage has been found and buzzer will beep the alert sound and sms message will send to your mobile number that gas leakage is found (the sms feature is added because sometimes we can be in office or outside from home, in that situation we can get alert msg that gas leak has been found). Instead of regulator we are using a Solenoid Valve It will play a role of regulator. When gas leak is found solenoid valve will stop the flow of gas automatically. A webserver is developed for continuous monitoring of the sensor's value. ESP2866 makes an HTTP post request to a PHP script to insert sensors value into a database. A specific domain name and hosting space are required for reaching out to the webserver.A MySQL database is prepared for storing data from the sensors. A PHP script is developed for inserting the data into the MySQL database. The user can monitor the value of the sensor from anywhere by accessing the web address.

5.3 Php nodemcumq database

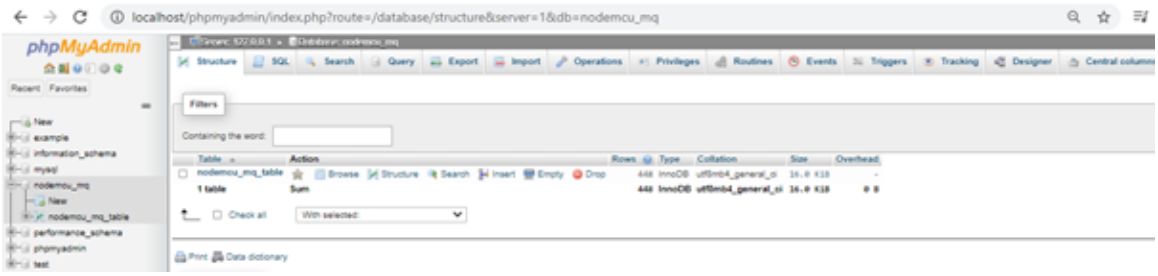


Fig. 5.3

5.4 Phpmyadmin nodemcumq and Table

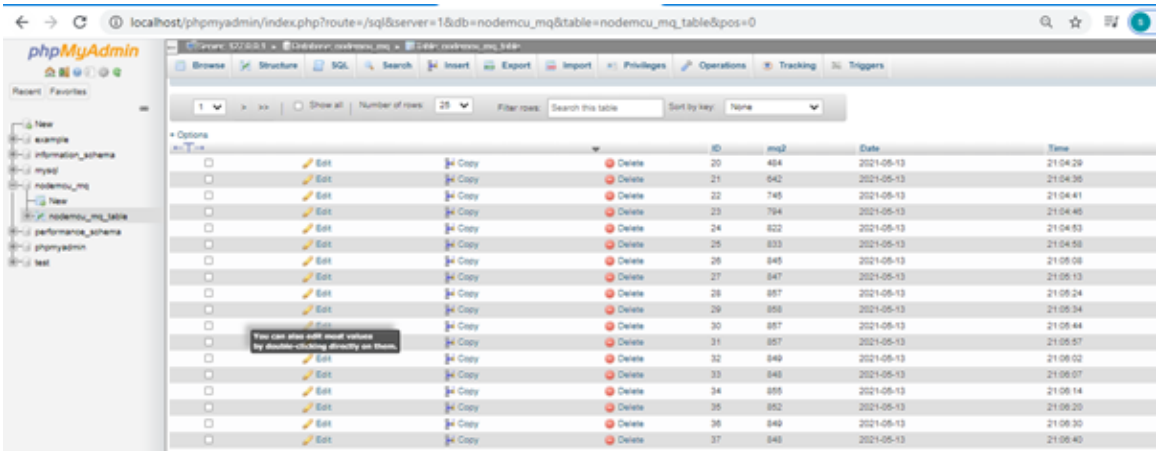
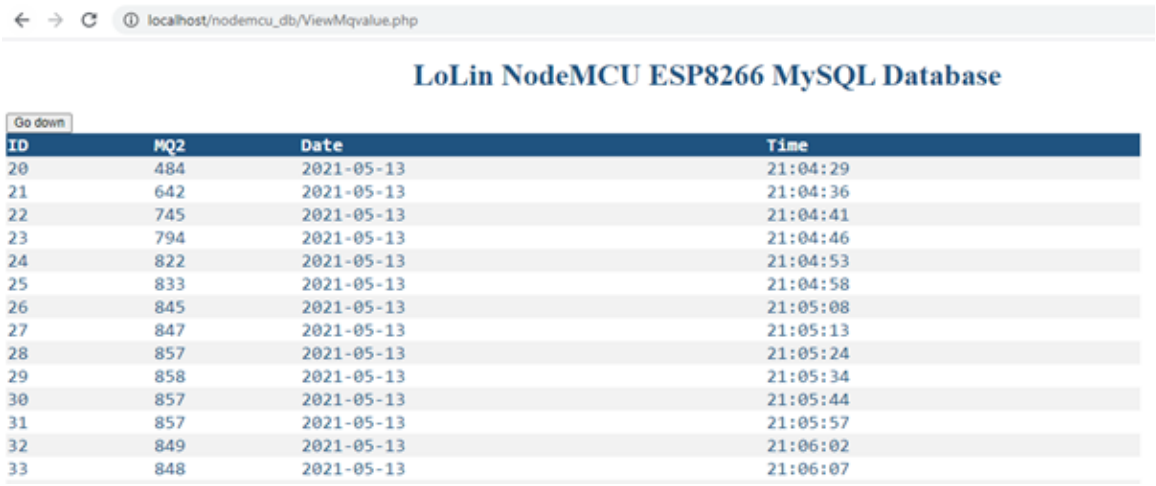


Fig. 5.4

5.5 View mq values .php



ID	MQ2	Date	Time
20	484	2021-05-13	21:04:29
21	642	2021-05-13	21:04:36
22	745	2021-05-13	21:04:41
23	794	2021-05-13	21:04:46
24	822	2021-05-13	21:04:53
25	833	2021-05-13	21:04:58
26	845	2021-05-13	21:05:08
27	847	2021-05-13	21:05:13
28	857	2021-05-13	21:05:24
29	858	2021-05-13	21:05:34
30	857	2021-05-13	21:05:44
31	857	2021-05-13	21:05:57
32	849	2021-05-13	21:06:02
33	848	2021-05-13	21:06:07

Fig. 5.5

5.6 Arduino com port data Post response

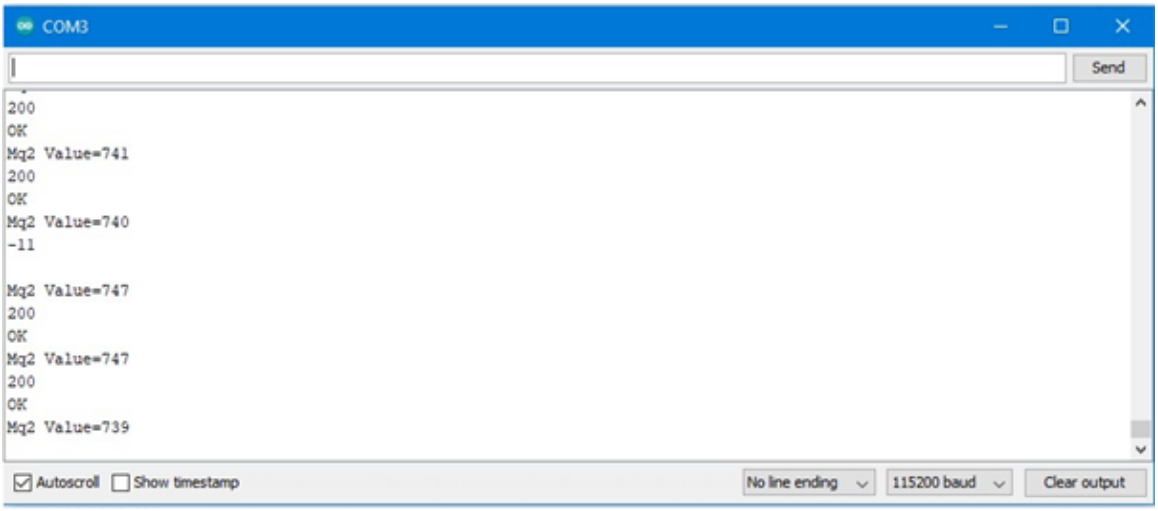


Fig. 5.6

5.7 Localhost nodemcu db

Fig. 5.7

Chapter 6

Conclusion

Internet of Things(IOT) has gained its wide popularity in recent days due to its various streams of applications which has paved way for smooth, safe and easier mode of living style for human beings.One such area of applications includes gas leakage detection.

IOT (Internet of Things) to get fastest notification of gas leakage. We will also use a website or application under the IOT technology to get fastest response from the module. The other module and things which are used in this project is GSM module, micro controller, LED for indication, a buzzer to notify local peoples and MQ 5 gas sensor module to sense the gas leakage. We shall use a Solenoid valve to OFF the knob of cylinder regulator to avoid the accidental cases due to gas leakage.

6.1 Future Scope

Our system of gas leak detector can also be upgraded. There are many relevant options that can be implemented.

1. The current system gives us notifications of leakage and also stop flow of gas.

2. This system can be furthermore upgraded to a compact version where a a mini-speaker can be used, less wiring, and many other similar upgrades can be made.

3. The current system helps us in continuous monitoring of gas values and Futher it can modified for sending notification with the help of GSM module.

4. The current system is running on localhost futher it can be setup on dedecated hosting environment.

5. Including an Automatic Shut-off device (solenoid valve)which will turn off the gas supply whenever it will detect any gas leakage.

6. Even we can develop a mobile application for monitoring.

Bibliography

[1] Kalpesh Gupta, Gokul Krishna G and Anjali T " An IoT based System for Domestic Air Quality Monitoring and Cooking Gas Leak Detection for a Safer Home" International Conference on Communication and Signal Processing, July 28 - 30, 2020, India

[2] Harika Pudugosula Student, Master of Technology Computer Science and Engineering Amrita School of Engineering, Bangalore Amrita Vishwa Vidyapeetham, India "Automatic Smart and Safety Monitoring System for Kitchen Using Internet of Things" : Proceedings of the International Conference on Intelligent Computing and Control Systems (ICICCS 2019).

[3] Suma V, Ramya R Shekar, Akshay Kumar A. "Gas Leakage Detection Based on IOT" in Proceedings of the Third International Conference on Electronics Communication and Aerospace Technology [ICECA 2019] IEEE Conference Record 45616; IEEE Xplore ISBN: 978-1-7281-0167-5