GAS MONITORING SYSTEM

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

OF THE DEGREE OF

BACHELOR OF ENGINEERING

IN

INFORMATION TECHNOLOGY

BY

MITESH REGE

SHIVAM MISHRA

PRAJNA SHETTY

UNDER THE GUIDANCE OF

Prof. Suvarna Aranjo

(Department of Information Technology)

DEPARTMENT OF INFORMATION TECHNOLOGY

XAVIER INSTITUTE OF ENGINEERING

UNIVERSITY OF MUMBAI

2021 – 2022

Institute Vision

To nurture the joy of excellence in a world of high technology.

Institute Mission

To strive to match global standards in technical education by interaction with industry, continuous staff training and development of quality of life.

Department Vision

To nurture the joy of excellence in the world of Information Technology.

Department Mission

M1: To develop the critical thinking ability of students by promoting interactive learning.

M2: To bridge the gap between industry and institute and give students the kind of exposure to the industrial requirements in current trends of developing technology.

M3: To promote learning and research methods and make them excel in the field of their study by becoming responsible while dealing with social concerns.

M4: To encourage students to pursue higher studies and provide them awareness on various career opportunities that are available.

Program Education Objective (PEO)

After 3-5 years of graduation, Information Technology Engineering Graduates will be

PEO1: employed as IT professionals, and shall engage themselves in learning, understanding,
and applying newly developed ideas and technologies as their field of study evolves.

PEO2: competent to use the learnt knowledge successfully in the diversified sectors of
industry, academia, research and work effectively in a multidisciplinary environment.

PEO3: aware of professional ethics and create a sense of social responsibility in building
the nation/society.

Program Specific outcome (PSO)

PSO1: Demonstrate the ability to analyze and visualize the business domain and formulate appropriate information technology solutions.

PSO2: Apply various technologies like Intelligent Systems, Data Mining, IOT, Cloud and Analytics, Computer and Network Security etc. for innovative solutions to real time problems.

Program Outcomes (PO)

Engineering Graduates will be able to

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first

principles of mathematics, natural sciences and engineering sciences.

PO3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

XAVIER INSTITUTE OF ENGINEERING

MAHIM CAUSEWAY, MAHIM, MUMBAI - 400016.

CERTIFICATE

This to certify that,

MITESH REGE **(201903038)**

SHIVAM MISHRA **(201903029)**

PRAJNA SHETTY **(201903046)**

Have satisfactorily carried out the Sensor Lab MINI-PROJECT work titled **"GAS MONITORING SYSTEM"** in partial fulfillment of the degree of Bachelor of Engineering as laid down by the University of Mumbai during the academic year 2021-2022.

Prof. Meena Ugale
HOD - Information Technology Dept

Prof. Suvarna Aranjo
Subject Incharge

22/4/22

Date: 21/05/22

Place: MAHIM, MUMBAI

PROJECT REPORT APPROVAL FOR T.E.

The project report entitled "GAS MONITOTING SYSTEM" by Mitesh Rege, Shivam Mishra and Prajna Shetty is approved for the degree of B.E. in Information Technology

Examiner

1) _____ 02/05/22

2) _____

Supervisor

1) _____ 22/4/22

2) _____

Date – 21/05/22

Place – Mahim, Mumbai

DECLARATION

I declare that this written submission represents my ideas in my own words and where other's Ideas or words have been included, I have adequately cited and referenced the original sources.

I also declare that I have adhered to all the principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission.

I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which thus have not been properly cited or from whom proper permission have not been taken when needed.

Mitesh Rege (201903038) M.P.Rege

Shivam Mishra (201903029) Smishra

Prajna Shetty (201903046) Shetty

Date: 21051122

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Acknowledgement

With a deep sense of gratitude, we would like to thank the guidance of our project guide Prof. Suvarna Aranjo for providing us time-to-time assistance with such an environment to achieve goals of our project and supporting us constantly.

We express our sincere gratitude to our Honorable Principal Mr. Y. D. Venkatesh for encouragement and facilities provided to us.

We would like to place on record our deep sense of gratitude to Prof. Meena Ugale, Head of Dept Of Information Technology, Xavier Institute of Engineering, Mahim, Mumbai, for her generous guidance, help and useful suggestions.

We would also like to thank our entire Information Technology staff who have willingly cooperated with us in resolving our queries and providing us all the required facilities on time.

Mitesh Rege ----------

Shivam Mishra ----------

Prajna shetty ----------

Xavier Institute of Engineering
Mahim, Mumbai 400016
Department of Information Technology
(Affiliated to University of Mumbai)

Class/ Sem/ A.Y: TE IT/ VI/ 2021-2022

Course Name: Sensor Lab [ITL603]

Group No: 3
Name & Roll No: 1)Mitesh Rege
2)Shivam Mishra
3)Prajna Shetty

Mini Project

LO1: Differentiate between various wireless communication technologies based on the range of communication, cost, propagation delay, power and throughput.
LO2: Conduct a literature survey of sensors used in real world wireless applications.
LO3: Demonstrate the simulation of WSN using the Network Simulators
LO4: Demonstrate and build the project successfully by hardware/sensor requirements, coding, emulating and testing
LO5: Report and present the findings of the study conducted in the preferred domain.
LO6: Demonstrate the ability to work in teams and manage the conduct of the research study.

Rubrics For Mini Project Work

Roll No.	Name of the Student	Problem Statement (15)	Creativity & Quality of Work done (15)	Punctuality & lab ethics (10)	Performance/ Presentation (10)	Total (50)
1	Mitesh Rege	13	13	08	08	42
2	Shivam Mishra					
3	Prajna Shetty					

Prof. Suvarna Aranjo
2/5/22

Xavier Institute of Engineering
Mahim, Mumbai 400016
Department of Information Technology
(Affiliated to University of Mumbai)

LAB OUTCOMES ATTAINED

SR No	LO Attained LOin the Mini Project	Description
1	LO1	Differentiate between various wireless communication technologies based on the range of communication, cost, propagation delay, power and throughput.
2	LO2	Conduct a literature survey of sensors used in real world wireless applications.
3	LO3	Demonstrate and build the project successfully by hardware/sensor requirements, coding, emulating and testing
4	LO6	Demonstrate the ability to work in teams and manage the conduct of the research study.

Mitesh Rege (201903038) ----------

Shivam Mishra (2019029) ----------

Prajna Shetty (201903036) ----------

XAVIER INSTITUTE OF ENGINEERING
BE (IT) SEM-VIII (AY: 2021-22)

Subject: Sensor Lab (Lab code:ITL603)

SENSOR LAB

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
ITL603	Sensor Lab	--	02	--	01	01

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test1	Test 2	Avg.					
ITL603	Sensor Lab	--	--	--	--	--	25	25	50

LAB OBJECTIVES:

Sr. No.	Lab Objectives
	The Lab experiments aims:

1	Learn various communication technologies, Microcontroller boards and sensors.
2	Design the problem solution as per the requirement analysis done using sensors and technologies.
3	Study the basic concepts of programming/sensors/ emulators.
4	Design and implement the mini project intended solution for project based earning.
5	Build, test and report the mini project successfully.
6	Improve the team building, communication and management skills of the students.

Bloom's Taxonomy Levels:

1 = Remembering, 2= Understanding, 3 = Applying, 4 = Analyzing, 5 = Evaluating, 6 = Creating

LAB OUTCOMES:

Students will learn to:

LO	Description	Bloom's Level	PO
LO1	Differentiate between various wireless communication technologies based on the range of communication, cost, propagation delay, power and throughput.	L1,L2	1,2,3,4,9,10
LO2	Conduct a literature survey of sensors used in real world wireless applications.	L1,L2	1,2,3,4,9,10
LO3	Demonstrate the simulation of WSN using the Network Simulators (Contiki/ TinkerCAD/ Cup carbon etc).	L1,L2,L3	1,2,3,4,5,9,10,11
LO4	Demonstrate and build the project successfully by hardware/sensor requirements, coding, emulating and testing	L1,L2,L3	1,2,3,4,5,6,8,9, 10,11,12
LO5	Report and present the findings of the study conducted in the preferred domain.	L1,L2,L3	1,2,3,4,5,6,8,9, 12
LO6	Demonstrate the ability to work in teams and manage the conduct of the research study.	L1,L2,L3	1,2,3,4,9,10

XAVIER INSTITUTE OF ENGINEERING

Department of Information Technology
SEM VI
AY: 2021-22
Subject: Sensor Lab

1. Introduction to Wireless Sensor Network (LO1)

Wireless Sensor Network (WSN) is an infrastructure-less wireless network that is deployed in a large number of wireless sensors in an ad-hoc manner that is used to monitor the system, physical or environmental conditions.
Sensor nodes are used in WSN with the onboard processor that manages and monitors the environment in a particular area. They are connected to the Base Station which acts as a processing unit in the WSN System.
Base Station in a WSN System is connected through the Internet to share data.
WSN can be used for processing, analysis, storage, and mining of the data.

2. Introduction to your Mini-Project Topic (LO2)

2.1 Problem Definition

A gas detector is to ease humans on detecting the presence of those dangerous gases within an area to prevent disaster. Nowadays, the gas detector has been innovated into various ways of detection, for example infrared thermal imaging gas leak detection, gas leakage detection with monitoring system, and wireless gas sensor network. This project has designed and developed a wireless gas monitoring system by using Arduino and ThingSpeak

2.2 Aims and Objectives

we are making an IOT based Gas level Indicator using Node MCU ESP8266-12e wi-fi board and MQ2 gas Sensor by interfacing with Thingspeak. We will show the measured data on the Thingspeak interface in the graph or chart.

2.4 Scope of the project

In this project the level of the gas is monitored When you have a gas detection system, you can monitor the amount of gases in your environment. Because of this, you can tell when there is a higher chance of poisoning, explosion, fire or asphyxiation.

2.5 Features of the project

One will be able to see the readings after measuring the gas level in ppm on the Gas level monitoring system using Thingspeak IOT platform in which after a several raised value, it will indicate as a graphical point where the Gas Level increases above the set value.

3. Review of Literature (LO2)

Home can provide safety, convenience, and efficiency for people in the 21st century. An intelligent home system is integrated by many function and systems. At present, the gas pipeline plays an increasingly important role in modern life. Natural gas pipeline leak accidents have occurred due to a variety of unexpected natural or man-made factors. These leaks seriously endanger the safety of human life. One of the important systems is the gas detection function in an intelligent home. The gas leakage event may involve danger for life. There have been many deaths around the world because of gas leakage. The deaths are especially rising as last year more than one hundred people were killed because of gas leakage all over the world.

There are not many buildings that have gas leakage detectors because of their price and installation. Even if there are detectors installed the primitive technology that is used in the devices make them unreliable because of false alarms and those which are free or are reliable are priced at a very high range. As a result, they are often avoided. The gas leakage detection device is fixed on the wall or ceiling. It is not very convenient that uses many gas leakage detection modules in the home. In the paper, we design a gas leakage monitoring system to monitor gas level event, and transmit information to users.

LPG consists of mixture of propane and butane which is highly flammable chemical. It is odorless gas due to which Ethanethiol is added as powerful odorant, so that leakage can be easily detected. There are other international standards like EN589, amyl mercaptan and tetrahydrothiophene which are most commonly used as odorants.

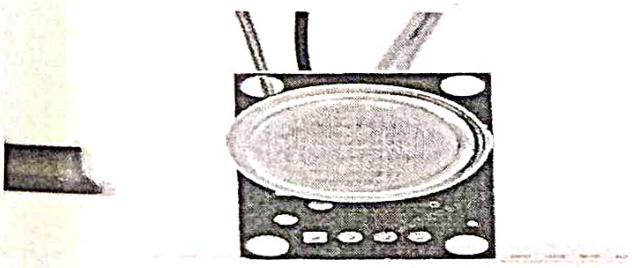
Some people have low sense of smell, may or may not respond on low concentration of gas leakage. In such a case, gas leakage security systems become an essential and help to protect from gas leakage accidents

4. System Description

4.1 Hardware, Software and cloud platforms used

- **MQ2 Sensor**

MQ2 is one of the commonly used gas sensors in MQ sensor series. It is a Metal Oxide Semiconductor (MOS) type Gas Sensor also known as Chemiresistors as the detection is based upon change of resistance of the sensing material when the Gas comes in contact with the material. Using a simple voltage divider network, concentrations of gas can be detected.



Pin No:	Pin Name:	Description
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	You 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

MQ2 Gas sensor works on 5V DC and draws around 800mW. It can detect LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentrations anywhere from 200 to 10000ppm.

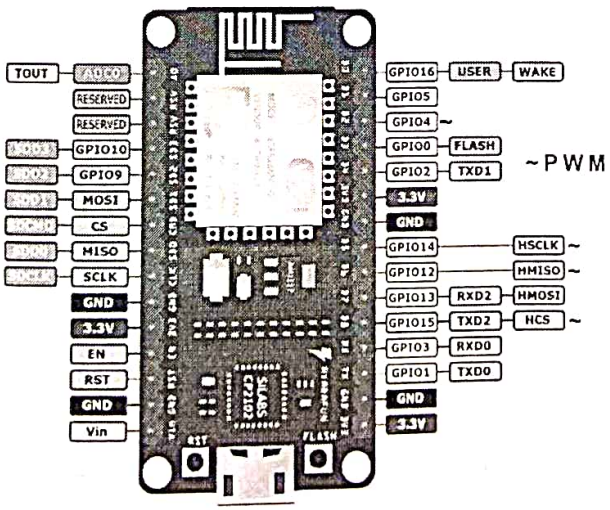
Here are the complete specifications

Operating voltage	5V
Load resistance	20 KΩ
Heater resistance	33Ω ± 5%
Heating consumption	<800mw
Sensing Resistance	10 KΩ – 60 KΩ
Concentration Scope	200 – 10000ppm
Preheat Time	Over 24 hour

- **NodeMCU ESP8266 CP2102 NodeMCU WIFI Serial Wireless Module**

The development board equips the ESP-12E module containing ESP8266 chip having **Tensilica Xtensa® 32-bit LX106 RISC microprocessor** which operates at **80 to 160 MHz** adjustable clock frequency and supports **RTOS**.

- Operating Voltage: 2.5V to 3.6V
- On-board 3.3V 600mA regulator
- 80mA Operating Current
- 20 µA during Sleep Mode
- ESP8266 CP2102 NodeMCU LUA ESP-12E WIFI Serial Wireless Module
- Built-in Micro-USB, with flash and reset switches, easy to program
- Full I/O port and Wireless 802.11 supported, direct download no need to reset
- Arduino compatible works great with the latest Arduino IDE/Mongoose IoT/Micro python



- **ThinkSpeak**

ThingSpeak is IoT Cloud platform where you can send sensor data to the cloud. You can also analyze and visualize your data with MATLAB or other software, including making your own applications.

The ThingSpeak service is operated by MathWorks. In order to sign up for ThingSpeak, you must create a new MathWorks Account or log in to your existing MathWorks Account.

ThingSpeak is free for small non-commercial projects.

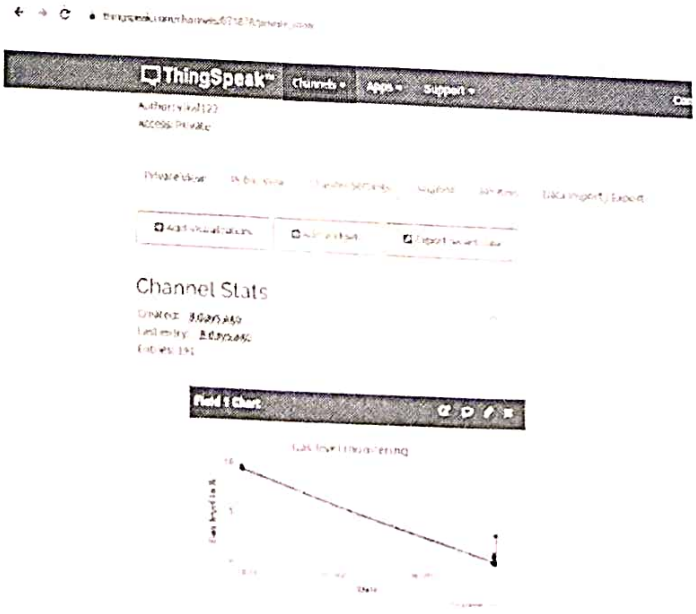
ThingSpeak includes a Web Service (REST API) that lets you collect and store sensor data in the cloud and develop Internet of Things applications. It works with Arduino, Raspberry Pi and MATLAB (premade libraries and APIs exists) But it should work with all kind of Programming Languages, since it uses a REST API and HTTP.

4.2 COST OF THE PROJECT

COMPONENTS	PRICE
MQ2 SENSOR	210
NODEMCU	200
WIRES	6
TOTAL	416

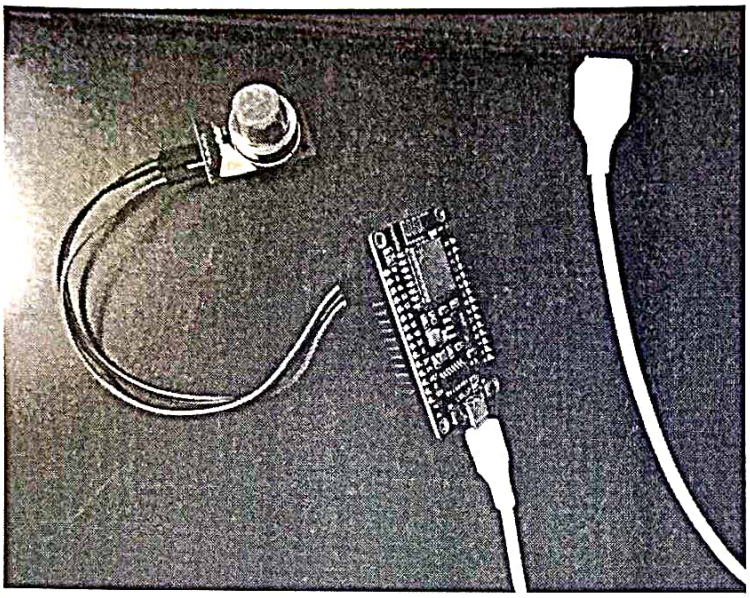
4.3 Implementation Methodology

- Go to https://thingspeak.com/
- Sign up to the account.
- After Sign up/Sign in Go My channel and create a new channel



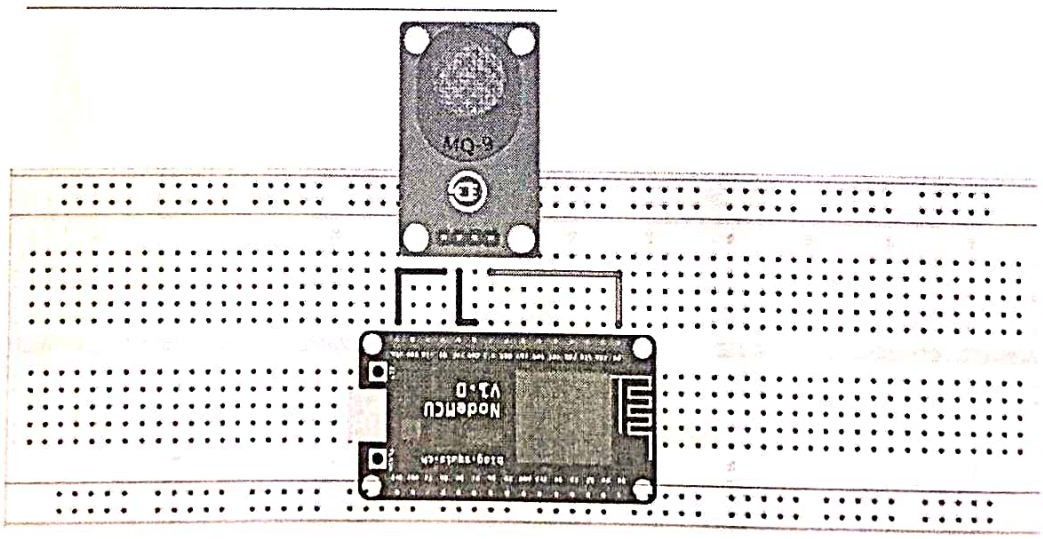
- Now go to the API keys Copy your API key and Paste in your Code.

- After uploading the code, you will able to see the readings after measuring the gas level in ppm on the Gas level monitoring system using Thingspeak IOT platform in which after a several raised value, it will indicate as a graphical point where the Gas Level increases above the set value.



4.4 Hardware circuit diagram

- Connect **VCC** pin of MQ-2 Gas Sensor module to **Vin** pin of NodeMCU ESP8266-12E Board.
- Connect **GND** pin of MQ-2 Gas Sensor module to **GND** pin of NodeMCU pin of ESP8266-12E Board.
- Connect **D0** pin of MQ-2 Gas Sensor module to the **A0** pin of NodeMCU ESP8266-12E board



4.5 Code

Gas_Project | Arduino 1.8.19

File Edit Sketch Tools Help

Gas_Project

```
#include "ThingSpeak.h"
#include <ESP8266WiFi.h>

//------- WI-FI details ----------//
char ssid[] = "Miteshsensor"; //SSID here
char pass[] = "12345678"; // Passowrd here
//--------------------------------//

//----------- Channel details ---------------//
long Channel_ID = 1717194; // Your Channel ID
const char * myWriteAPIKey = "6QXFNUOJXZSGLLJR"; //Your write API key
//-------------------------------------------//

//const int Field_Number_1 = 1;
////const int Field_Number_2 = 2;
//String value = "";
//int value_1 = 0, value_2 = 0;
//int x, y;

WiFiClient  client;
int led = D4;
int mqu = A0;

void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
```

Gas_Project | Arduino 1.8.19

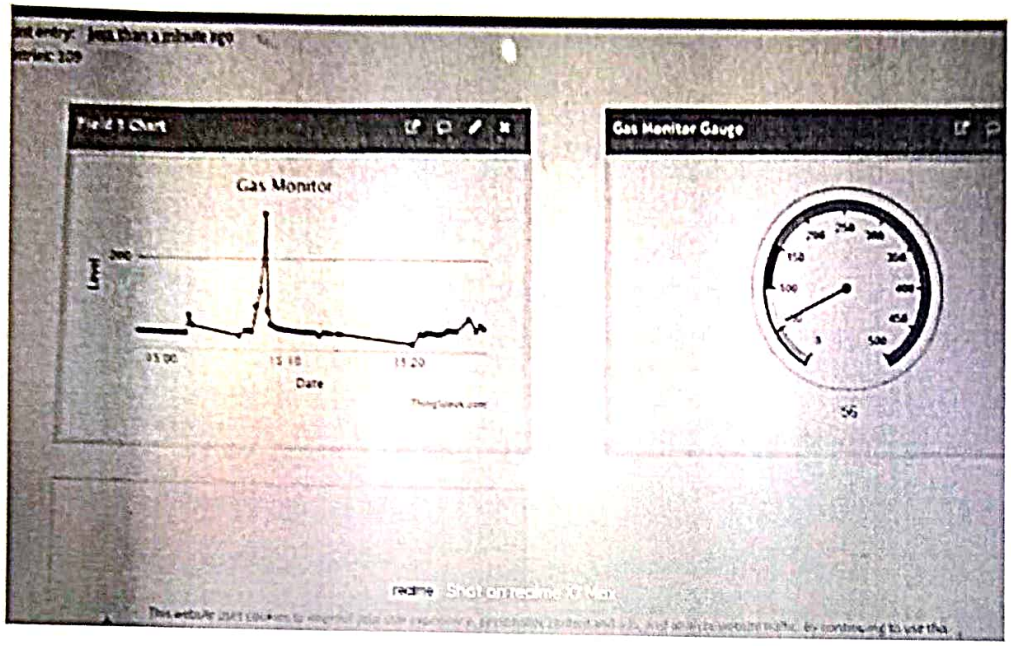
File Edit Sketch Tools Help

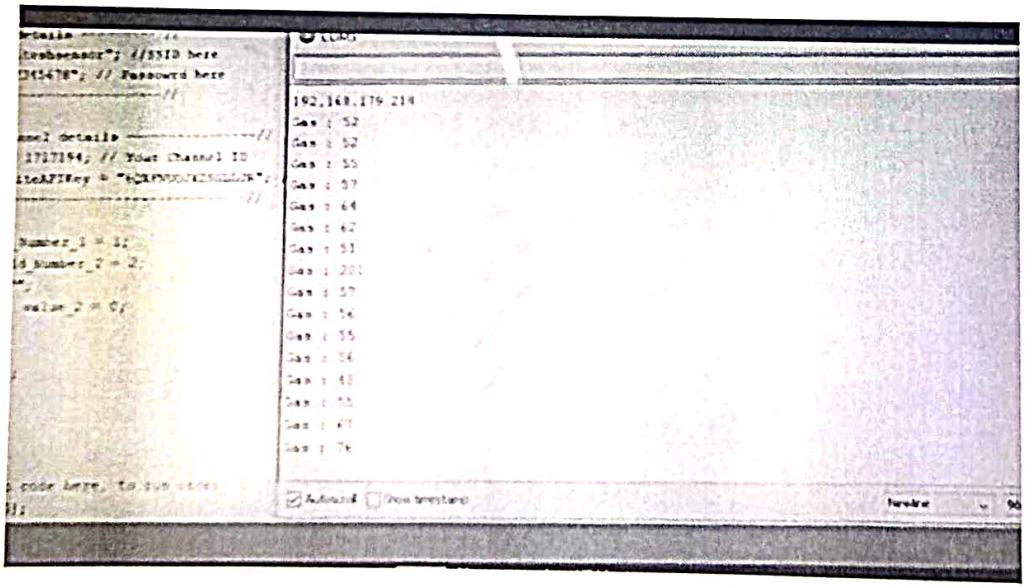
Verify

Gas_Project

```
  Serial.println("NodeMCU is connected!");
  Serial.println(WiFi.localIP());
  ThingSpeak.begin(client);
}

void loop() {
  // put your main code here, to run repeatedly:
  int val = analogRead(mqu);
//  Serial.println(val);
//  digitalWrite(led, HIGH);   // turn the LED on (HIGH is the voltage level)
//  Serial.println("Led is on");
//  delay(1000);                       // wait for a second
//  digitalWrite(led, LOW);    // turn the LED off by making the voltage LOW
//  Serial.println("Led is Off");
//  delay(1000);                       // wait for a second



  Serial.println("Gas : " + (String) val);

  ThingSpeak.writeField(Channel_ID, 1, val, myWriteAPIKey);
//  ThingSpeak.writeField(myChannelNumber, 2, h, myWriteAPIKey);
  delay(2000);
}
```

4.6 Final Prototype





4.7 Conclusion and Future scope of the project

Gas monitoring system is essential to prevent accidents and to save human lives. When you have a gas detection system, you can monitor the amount of gases in your environment. Because of this, you can tell when there is a higher chance of poisoning, explosion, fire or asphyxiation. From this we can clearly understand the importance of IOT in the coal and gas industries. It will make the continuous monitoring of gas level very easy.

4.8 Constraints for real time deployment

Huge industries, especially oil refineries are severely exposed to harmful explosions and human risks even with a slightest of the gas leak. Moreover, the expenses due to gas leakages are enormous. A gas monitoring solution not only detects toxic gases but also identifies changes in air quality. It can also be used commercially in in-house buildings to detect the presence of carbon dioxide and other combustible gases at less expenses . An IoT-enabled gas monitoring system is designed specially to prevent explosions and fire disasters in the facilities and thus save human lives.

4.9 References

1. https://rees52.com/diy-iot/4840-make-a-gas-level-monitoring-system-using-mq-2-gas-sensor-module-with-nodemcu-esp8266-12e-board-kt572?search_query=kt572&results=1
2. International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 11 | Nov 2020 www.irjet.net p-ISSN: 2395-0072

EXTERNAL EXAMINER'S FEEDBACK FORM

Name of External examiner Nagaveni Hebbar

College of External examiner: TSEC

Date of Examination: 2 / 5 / 22

Group no: 3

Topic: GAS MONITORING SYSTEM

No. of students in project team: 3

Student Performance Analysis (Put Tick as per your Observation)

Excellent (3) VeryGood(2) Good(1)

Sr. No.	Observation	(3)	(2)	(1)
1	Quality of problem and Clarity			
2	Innovativeness in solutions			
3	Cost effectiveness and Societal impact			
4	Full functioning of working model as per stated requirements			
5	Effective use of skill sets			
6	Effective use of standard engineering norms			
7	Contribution of an individual's as member or leader			
8	Clarity in written and oral communication			
9	Overall performance		✓	

Examiner's Comments: _____

_____

2/05/22

Name, Date & Signature

ExternalExaminer