DAYANANDA SAGAR COLLEGE OF ENGINEERING

(An Autonomous Institute affiliated to VTU, Belagavi - 590018)
Accredited by National Assessment & Accreditation Council (NAAC) with 'A' grade)

A Mini Project Report on

GAS LEAK DETECTOR SYSTEM USING RASPBERRY PI

Submitted in partial fulfilment for the award of degree of

Bachelor of Engineering
in
Electronics & Instrumentation Engineering
Under Guidance Of
Prof. SILPA AJITH KUMAR
Assistant Professor
Department of E&IE,DSCE

Submitted by

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DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING
(Accredited by National Board of Accreditation (NBA)-New Delhi)
DAYANANDA SAGAR COLLEGE OF ENGINEERING
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2021-2022

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CERTIFICATE

2021-22

This is to certify that the Mini project phase entitled **"GAS LEAK DETECTOR SYSTEM USING RASPBERRY PI"** is a bonafide work carried out by **AAKASH BHATTACHARJEE (1DS19EI001), GUNARKA GIRIDHAR (1DS19EI010), SAGAR M KABBUR (1DS19EI032), and SAURABH KUMAR SINGH (1DS19EI033)** in partial fulfilment for the award of degree of **Bachelor of Engineering** in **Electronics & Instrumentation Engineering,** of **DAYANANDA SAGAR COLLEGE OF ENGINEERING**, An Autonomous Institute affiliated to VTU, Belagavi during the year **2021- 2022**. It is certified that all the corrections/suggestions indicated for the internal assessment have been incorporated in the report deposited in the departmental library. The mini project report has been approved as it satisfies the academic requirements in respect to the mini project work prescribed for the Bachelor of Engineering Degree.

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ACKNOWLEDGEMENT

The success and final outcome of this project phase -I work required the guidance and the assistance of many people. We would like to add a few words of appreciation to the people who have been a part of this right from its inspection. Without their support, patience and guidance, this task would not have been completed. It is to them we owe our greatest gratitude.

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We take this opportunity to express a deep sense of gratitude to **Dr. J.S RAJASHEKAR** Professor and Head, Department of Electronics and Instrumentation Engineering for his cordial support and guidance.

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We also feel heartiest sense of obligation to all the faculty members for their timely support and their cooperation till the completion of our project. We also extend our heartiest thanks to all the supporting staff who directly or indirectly helped us bringing out this project satisfactorily in the specified duration.

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DECLARATION

We, **AAKASH BHATTACHARJEE (1DS19EI001), GUNARKA GIRIDHAR (1DS19EI010), SAGAR M KABBUR (1DS19EI032), and SAURABH KUMAR SINGH (1DS19EI033),** declare that the Mini project entitled **"GAS LEAK DETECTOR SYSTEM USING RASPBERRY PI"** has been successfully carried out under the **guidance of Prof. Silpa Ajith Kumar,** Assistant Professor, Department of Electronics and Instrumentation Engineering, Dayananda Sagar College of Engineering in partial fulfilment of the requirement of the degree **Bachelor of Engineering in Electronics & Instrumentation Engineering of VISVESVARAYA TECHNOLOGICAL UNIVERSITY, Belagavi.** This mini project is not submitted by us to any other universities or institution for the award of any other degree.

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ABSTRACT

Gas, more specifically Liquid Petroleum Gas (LPG), is one of the primary sources of heat energy for domestic purposes in India. It has a highly combustible gas with a distinct smell that can be ignited with a single spark and reach very high temperatures.

While such high combustibility does make its usage convenient, this also makes it highly dangerous when unsupervised. Even a moderate amount of gas in a small area could rapidly combust from a tiny spark into lethal amounts of heat and fire. As recent as July 24, 2021, 9 people were killed from severe burns caused by an LPG leakage and explosion while one more has suffered critical injuries. Most homes in India have LPG cylinder storages of between 13-20 kg, and some even have multiple cylinders. Any leakage from these cylinders poses an immense risk to the safety of the house and the people in it.

LPG is completely invisible. Hence, it would be very hard to discern if LPG has accidentally accumulated in the area until a considerable amount has accumulated to be able to smell. This concentration is more than enough to cause immense harm to life.

The Raspberry Pi processors are some of the fastest and low power consuming processors in the industry, with its inbuilt Raspberry Pi OS. It has a multitude of real time applications.

This mini project aims to implement the abilities of Raspberry Pi 3B+ processor technology to create an embedded safety network to sense LPG concentrations in a volume of space, and to alert the user of the same.

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CHAPTER 1

INTRODUCTION

This mini project aims to use the capabilities of Raspberry Pi to detect the presence of LPG gas in a volume of air using MQ-2 LPG CNG Gas Sensor. We will introduce LPG into a volume of air, emulating a Gas leakage within a house. The MQ-2 LPG CNG Gas Sensor senses this leakage and sends signals to the Raspberry Pi.

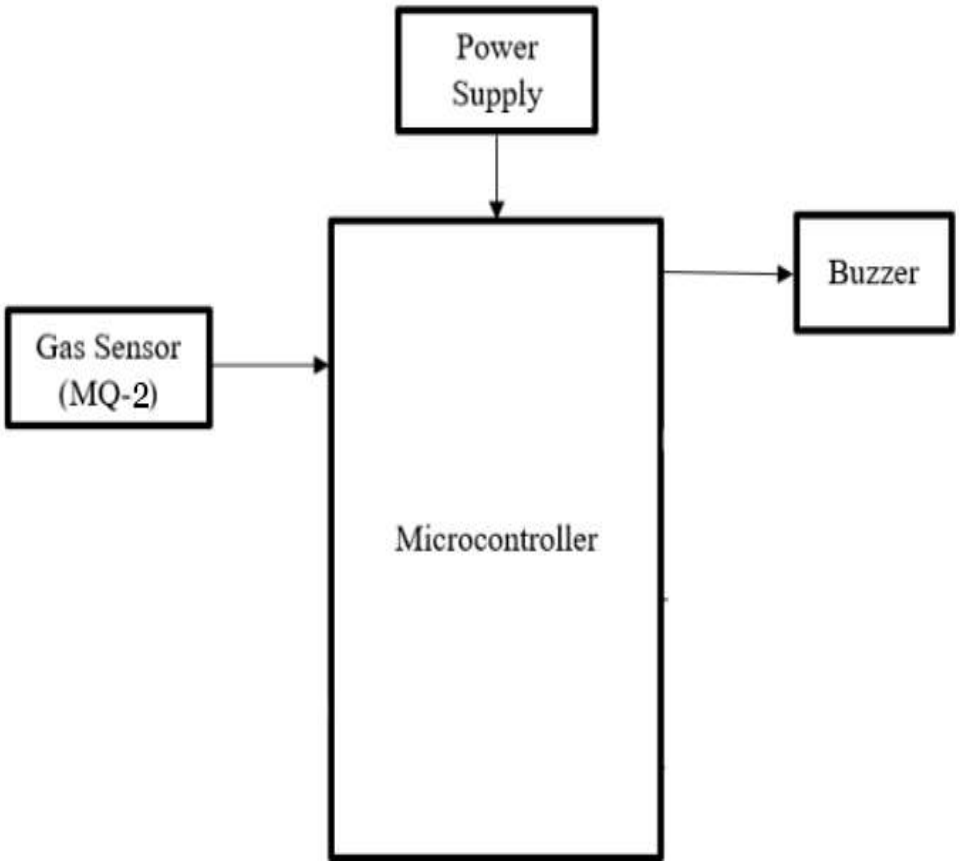

Figure 1.1: BLOCK DIAGRAM

1.1 LITERATURE SURVEY

Name of the paper	Methodology	Results
Keshamoni, Kumar, and Sabbani Hemanth. "Smart gas level monitoring, booking & gas leakage detector over IoT." 2017 IEEE 7th international advance computing conference (IACC). IEEE, 2017.	Using IoT to place a gas order, monitor gas levels and to secure the house in case of a gas leak	IoT is applied in automating the process of buying and maintenance of gas
Mahalingam, A., R.T. Naayagi, and N.E. Mastorakis. "Design and implementation of an economic gas leakage detector." Recent Researches in Applications of Electrical and Computer Engineering 3 (2012)	PIC18F1320 microcontroller sends voltage signals based on gas level threshold	The led glows green/orange/red based on levels of gas leak
Khan, Mohammad Monirujjaman. "Sensor-based gas leakage detector system." Engineering Proceedings 2.1 (2020)	Using MQ-6 sensor to detect gas levels and alert the system	The LCD and LEDs alert the user of gas leakage
Suma, V., Ramya R. Shekar, and Kumar A. Akshay. "Gas leakage detection based on IOT." 2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA). IEEE, 2019.	Gas leakage control using microcontroller and IoT	IoT is applied in gas leakage detection and protection
R. K. Kodali, R. N. V. Greeshma, K. P. Nimmanapalli and Y. K. Y. Borra, "IOT Based Industrial Plant Safety Gas Leakage Detection System," (ICCCA), 2018	IoT is used to protect an Industrial Scale plant from gas leakage	Various scales of gas leak are observed and appropriate protection system is used

1.2 OBJECTIVES OF PROJECT

The Raspberry Pi is programmed to process the signals received from the MQ-2 LPG CNG Gas Sensor and determine the concentration of the leaked gas within the volume. If the concentration of gas exceeds a certain threshold, an LED light and buzzer are switched on to alert the user of the leakage. Once the MQ-2 LPG CNG Gas Sensor sends new signals to the Raspberry Pi and the Raspberry Pi determines that the LPG levels have gone below the threshold, the Raspberry Pi goes back to normally monitoring gas levels.

CHAPTER 2

HARDWARE DESCRIPTION

- **INTRODUCTION**

The components used are:

-ALS IoT Evaluation Board (Raspberry Pi)

-Cables & Connectors

- **DESCRIPTION OF SYSTEM**

Raspberry Pi is a series of small single-board computers.

This project implements the system Raspberry Pi 3B+. The Pi 3 Model B+ has a 1.4GHz 64-bit quad-core Broadcom Arm Cortex A53-architecture processor compared with the Raspberry Pi 3 Model B's 1.2GHz CPU. It amounts to a 15 percent performance improvement compared to Raspberry Pi 3B.

It also supports dual-band wireless local-area networks at 2.4GHz and 5GHz, Bluetooth 4.2, and Bluetooth Low Energy.

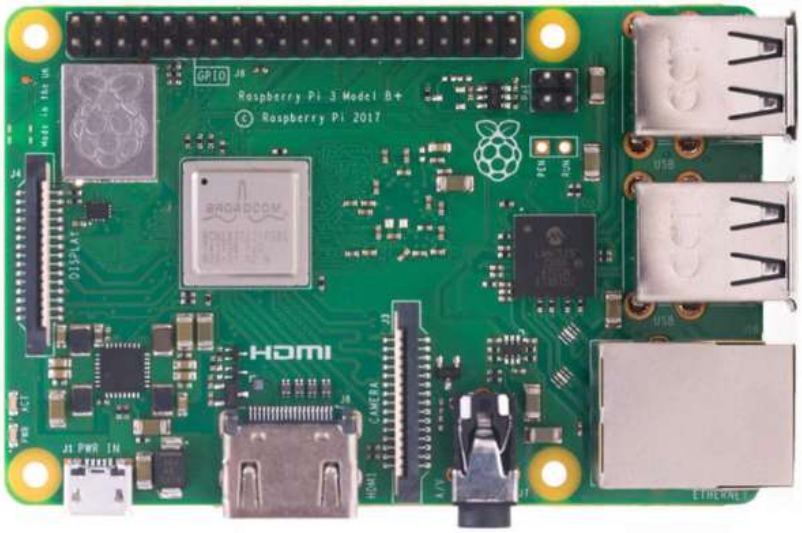

Figure 2.1: Raspberry Pi 3B+ Processor

2.1 ARCHITECTURE OF RASPBERRY PI

- **Processor**: Broadcom BCM2837B0, quad-core A53 (ARMv8) 64-bit SoC @1.4GHz
- **Memory**: 1GB LPDDR2 SDRAM
- **Connectivity**: 2.4GHz and 5GHz IEEE 802.11 b/g/n/ac wireless LAN, Bluetooth 4.2, BLE. Gigabit Ethernet over USB 2.0 (maximum throughput of 300Mbps).
- **USB**: 4 x 2.0
- **Expandability**: Extended 40-pin GPIO header
- **Video and sound**: 1 x full-sized HDMI port, MIPI DSI display port, MIPI CSI camera port, 4 pole stereo output and composite video port.
- **Multimedia**: H.264, MPEG-4 decode (1080p30), H.264 encode (1080p30); OpenGL ES 1.1, 2.0 graphics
- **SD card support**: microSD format for OS and data storage
- **Input power**: 5V/2.5A DC via microUSB connector, 5V DC via GPIO header, Power over Ethernet (PoE)-enabled (requires separate PoE add-on).
- **Environment**: Operating temperature 0 - 50C

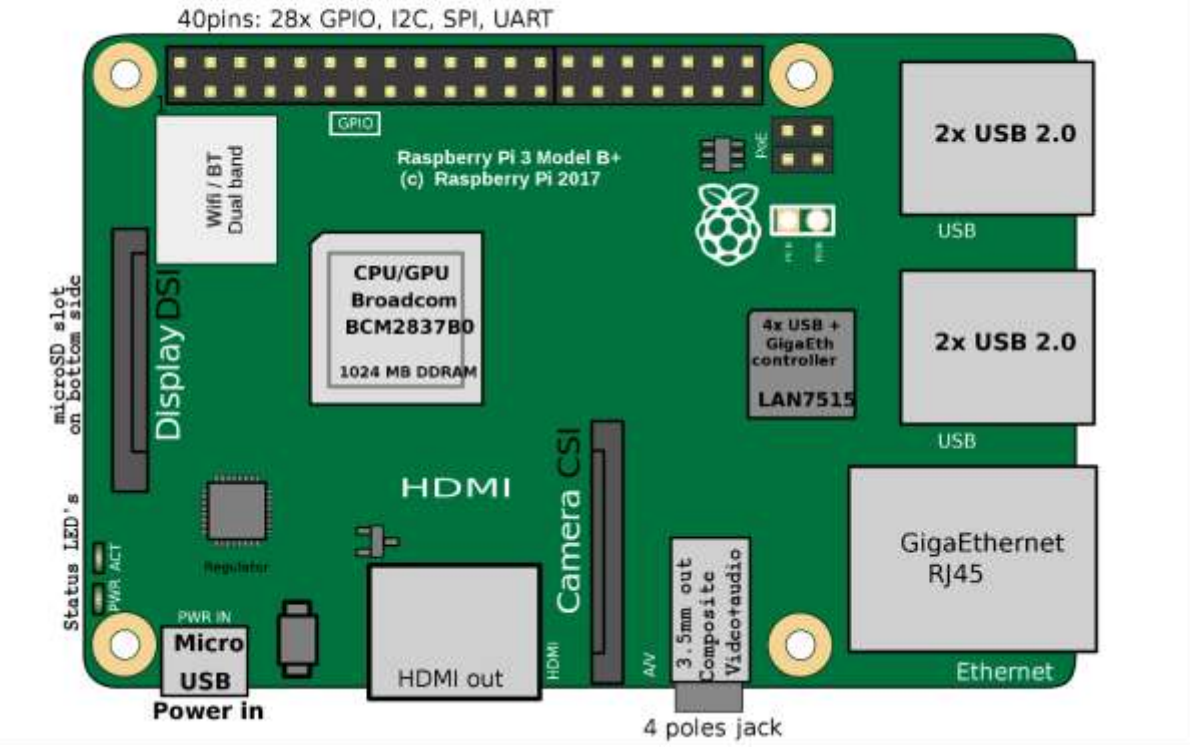

Figure 2.2: Architecture

TECHNICAL SPECIFICATIONS

- **SENSORS**

MQ-2 Gas Sensor is an electronic sensor used for sensing the concentration of gases in the air.

Figure 2.3: MQ-2 Gas sensor

FEATURES

- High sensitivity to LPG, iso-butane, propane
- Small sensitivity to alcohol, smoke.
- Fast response.
- Stable and long life
- Simple drive circuit

CONNECTOR DETAILS

-4 pin connector between Sensor and Board

-40 pin FRC connector between Raspberry Pi and Board

-USB to Keyboard

-USB to mouse

-USB to monitor

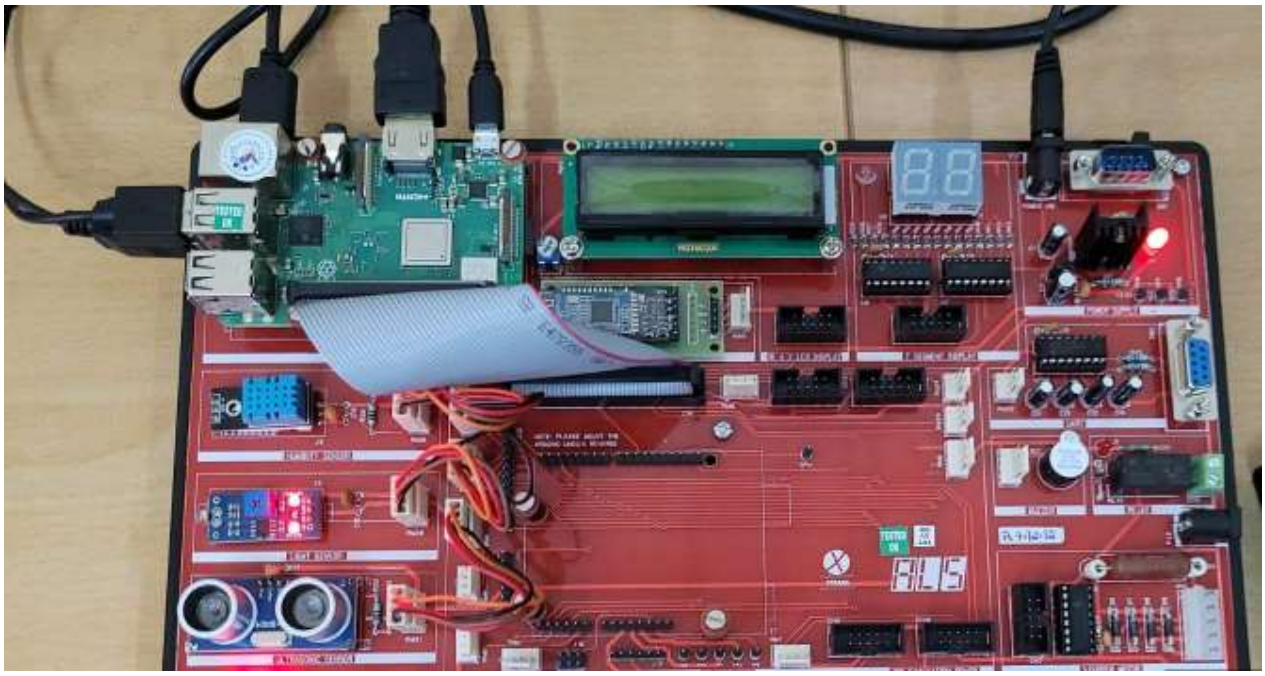

Figure 2.4: Raspberry Pi Connector Diagram

2.5 PIN DIAGRAM

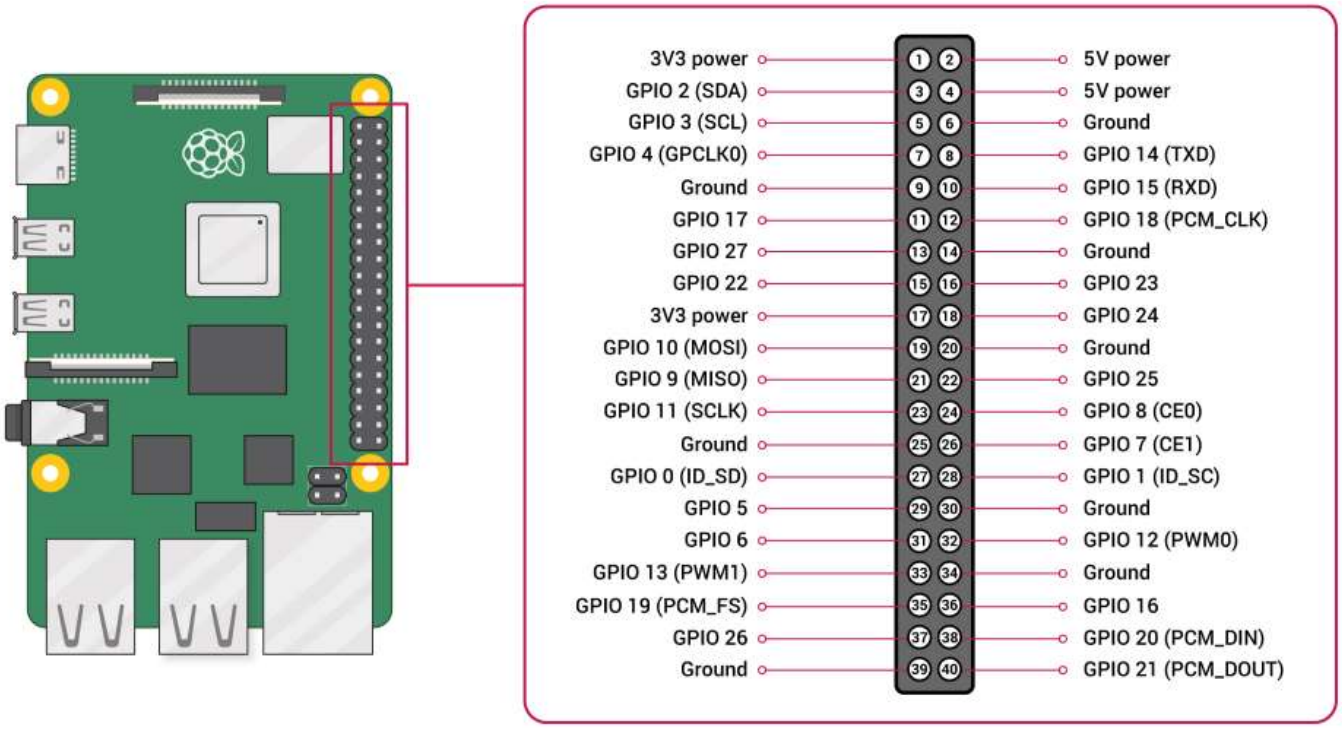

Figure 2.5: Raspberry Pi Pin configuration.

CHAPTER 3
BLOCK DIAGRAM0

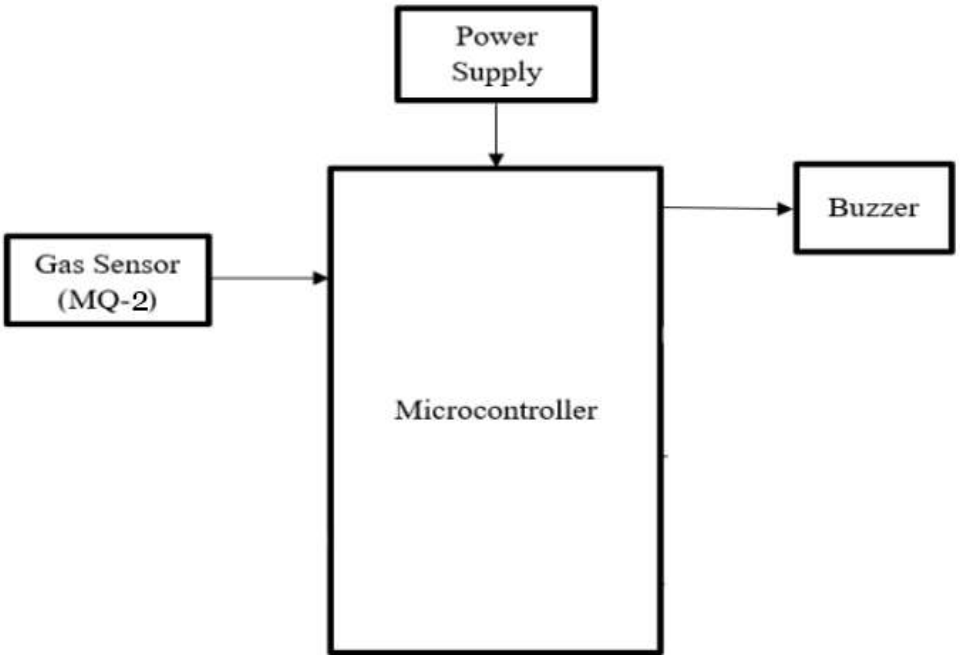

Figure 3.1: Block diagram

3.1 METHODOLOGY

- Introduce LPG gas into a volume of air (emulating a house)
- The Raspberry Pi is programmed to take in signals from the gas sensor
- The Raspberry Pi powers the LEDs and Buzzers to alert the user
- Once the gas levels are back to normal, the system turns off the alerts and returns to checking the volume for gas.

CHAPTER 4
SOFTWARE DESCRIPTION

4.1 RASPBERRY PI OS

Raspberry Pi OS (formerly Raspbian) is a Debian-based operating system for Raspberry Pi. Since 2013, it has been officially provided by the Raspberry Pi Foundation as the primary operating system for the Raspberry Pi family of compact single-board computers.

Raspberry Pi OS has a desktop environment, PIXEL, based on LXDE, which looks similar to many common desktops, such as macOS and Microsoft Windows. The desktop has a background image. A menu bar is positioned at the top and contains an application menu and shortcuts to a web browser (Chromium), file manager, and terminal. The other end of the menu bar shows a Bluetooth menu, Wi-Fi menu, volume control, and clock. The desktop can also be changed from its default appearance, such as repositioning the menu bar.

Figure 3.2: Raspberry OS

CHAPTER 5
IMPLEMENTATION

5.1 DESIGN AND DEVELOPMENT OF MODEL

- First, we connect the necessary USB and HDMI cables to load Raspberry OS onto the monitor.
- 40 pin FRC cable to connect Raspberry Pi to the rest of the Board.
- 4 pin connector between MQ-2 sensor and Board.
- Using Thonny IDE, the python code is loaded onto the processor
- From command prompt, the program is executed and gas levels are measured

MODEL ASSEMBLY

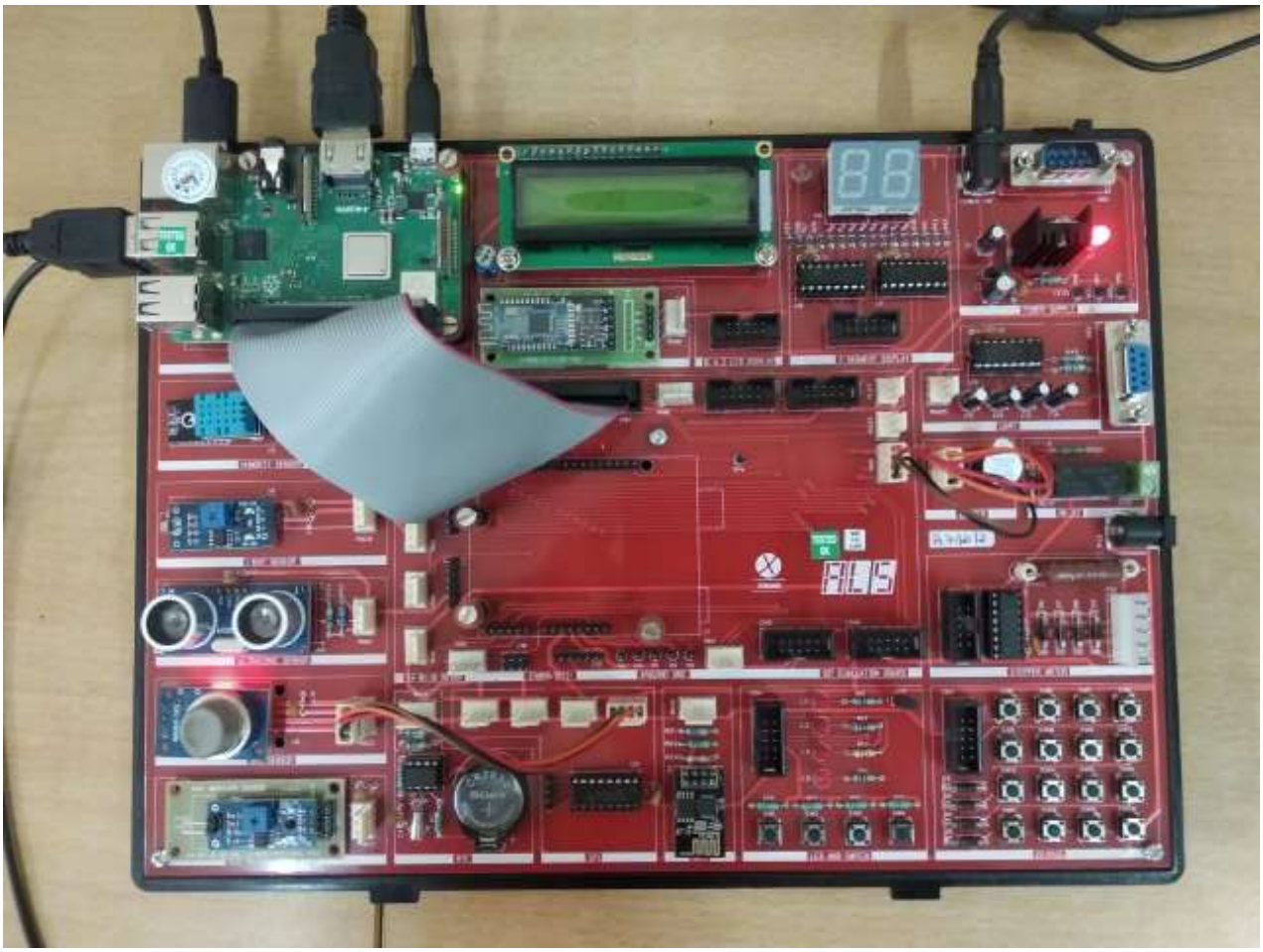

Figure 3.3: Model Assembly

CHAPTER 6
RESULT

- The gas source is brought to the sensor.
- The processor senses that the gas levels have gone above the safety threshold.
- This causes the alerts to go off and the buzzer sounds.
- Once the gas levels return to safe amount, the alerts are switched off.
- The system goes out of alert mode and continues detecting gas.

```
import Adafruit_GPIO.SPI as SPI
import Adafruit_MCP3008
import time
import RPi.GPIO as gpio

SPI_PORT   = 0
SPI_DEVICE = 0
mcp = Adafruit_MCP3008.MCP3008(spi=SPI.SpiDev(SPI_PORT, SPI_DEVICE))

gpio.setwarnings(False)
gpio.setmode(gpio.BOARD)
gpio.setup(38, gpio.OUT)

while True :
    value1 = mcp.read_adc(0)
    print("Gas Value : ")
    print(value1)
    time.sleep(2)
    if value1>=300:
        print('',value1)
        try:
            while(1):
                gpio.output(38,0)
                print("Buzzer OFF")
                time.sleep(0.2)
                gpio.output(38,1)
                print("Buzzer ON")
                time.sleep(2)

            except KeyboardInterrupt:
                gpio.cleanup()
                exit
    else:
        print('Gas Levels Normal')
```

Figure 3.4: Program Execution

```
import smtplib

server = smtplib.SMTP('smtp.gmail.com',587)

server.starttls()

server.login('dummyemail2.susa@gmail.com', 'wycgmoiaxdzheyev')

server.sendmail('dummyemail2.susa@gmail.com', 'sagarkabbur17@gmail.com', 'hello')
print('Mail sent')
```

Program to alert the user via email

- SMTP (Simple Mail Transfer Protocol) is a TCP/IP protocol used in sending and receiving e-mail.
- SMTP works as a three-step process, using a client/server model.
- First, an e-mail server uses SMTP to send a message from an e-mail client, such as Outlook or Gmail, to an e-mail server.
- Second, the e-mail server uses SMTP as a relay service to send the e-mail to the receiving e-mail server.
- Third, the receiving server uses an e-mail client to download incoming mail via IMAP and place it in the inbox of the recipient.

CHAPTER 7
CONCLUSION

LPG is completely invisible. Hence, it would be very hard to discern if LPG has accidentally accumulated in the area until a considerable amount has accumulated to be able to smell. This concentration is more than enough to cause immense harm to life.

Previously in the case of a gas leak, the people in the house would have to smell the leaked gas from the kitchen/space to realize it and try to extract it. This is very risky and would cause damage to life and surroundings.

With the help of this mini project, we have successfully alerted the persons much in advance. Using python code on Raspberry Pi OS the volume of air, which represents a room or a kitchen, is secured from a potential explosion.

This mini project was implemented keeping in mind the idea of helping households stay protected from the severe dangers to life caused by a gas leaking and exploding. With the help of Raspberry Pi processor's utility, we have fruitfully achieved this.

We would like to thank our college, DSCE, our Principal, our Head of Department and our Guide for giving us an opportunity to implement this mini project and complete it with their constant guidance.

REFERENCES

1. https://www.raspberrypi.com/products/raspberry-pi-3-model-b-plus/
2. Keshamoni, Kumar, and Sabbani Hemanth. "Smart gas level monitoring, booking & gas leakage detector over IoT." 2017 IEEE 7th international advance computing conference (IACC). IEEE, 2017.
3. Mahalingam, A., R.T. Naayagi, and N.E. Mastorakis. "Design and implementation of an economic gas leakage detector." Recent Researches in Applications of Electrical and Computer Engineering 3 (2012)
4. Khan, Mohammad Monirujjaman. "Sensor-based gas leakage detector system." Engineering Proceedings 2.1 (2020)
5. Suma, V., Ramya R. Shekar, and Kumar A. Akshay. "Gas leakage detection based on IOT." 2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA). IEEE, 2019.
6. R. K. Kodali, R. N. V. Greeshma, K. P. Nimmanapalli and Y. K. Y. Borra, "IOT Based Industrial Plant Safety Gas Leakage Detection System," 2018 4th International Conference on Computing Communication and Automation (ICCCA), 2018