# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## DEVELOPMENT OF LPG LEAKAGE DETECTION USING NODEMCU ESP8266

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunication) with Honours.



by

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2021

## DECLARATION

I hereby, declared this report entitled “Development of LPG Leakage Detection Using NodeMCU ESP8266” is the results of my own research except as cited in references.

| | | |
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| Date | : | 13 February 2021 |

**APPROVAL**

This report is submitted to the Faculty of Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Telecommunicatios) with Honours. The member of the supervisory is as follow:

Signature : .....

Supervisor Name : MR.MOHD ERDI BIN AYOB

Date : 13/02/2021

**DEDICATION**

This report is dedicated fully to my backbones which is my family, my lecturers and all my course mates who has involved directly or indirectly.

## ABSTRAK

Laporan ini mencadangkan sebuah sistem pemantauan gas di rumah menggunakan aplikasi Blynk yang membangun dengan kos yang rendah dan membolehkan pengguna mengawal Gas petroleum cecair rumah. Projek ini adalah untuk membina sistem pemantauan Gas petroleum cecair rumah yang berkaitan dengan platform IoT, Blynk. Data-data tersebut akan dimaklumkan dalam aplikasi android. Pengguna akan diberitahu bahawa gas LPG di rumah dalam keadaan on / off. Bukan itu sahaja, dengan pengesan gas, jika berlaku apa-apa kebakaran di rumah, pengguna akan mendapat pemberitahuan dengan segera melalui applikasi android. Modul ESP8266 Wifi disepadukan untuk menghantar data melalui Wifi kerana teknologi internet telah dinaik taraf di Malaysia. Semua sistem masuk disepadukan dengan Wifi sekarang untuk menjadikan kehidupan lebih mudah. Ini membantu pengguna memantau sistem tidak kira di mana sahaja dan bila-bila masa. NodeMCU ESP8266 digunakan sebagai mikrokontroler dalam sistem ini untuk mengawal sistem. Apabila pengguna terlupa untuk tutup suis gas atau kebocoran gas berlaku disebabkan gas suis tidak tertutup, ia akan menghantar pemberitahuan dalam aplikasi android serta ianya dapat mengawal melalui aplikasi blynk.

## ABSTRACT

This report proposes a low cost LPG gas leakage detecting system using Blynk application which enables users to monitor their home gas. The project is to build a home gas monitoring system which was connected to the IoT platform, Blynk. The data will be communicated in the android application. Consumers will be notified whether home gas are on / off. Not only that, with gas detectors, if there was fire at home, users will be notified immediately via android application. The ESP8266 Wifi module is integrated to transmit data over Wifi as the internet technology has been upgraded in Malaysia. All systems are integrated with Wifi now to make life easier. This helps users monitor the system no matter where and when. The NodeMCU ESP8266 is used as a microcontroller in this system to control the framework. When a user forgets to turn off the home gas or leakage happen due to open gas, it sends a notification in the android application and user can controls it via Blynk application.

## ACKNOWLEDGEMENTS

I would like to express deepest appreciation to my project supervisor, Mr. Mohd Erdi Bin Ayob who has given persistent encouragement throughout this project. He also has guided, giving brilliant opinions and ideas in completing this project over the years. Without his tremendous support, the road may seem difficult and bushed.

After that, I would like to thank both my parents, Mr. Palani Andiappen and Mrs. Sivecelvee Sinnappan, for your belief and moral support in completing this journey. Including my brother and my cousins.

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# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| UTeM | - | Universiti Teknikal Malaysia Melaka |
| RF | - | Radio frequency remote control |
| RX | - | Receiver |
| TX | - | Transmitter |
| LPG | - | Liquefied Petroleum gas |
| O/P | - | Output |
| App | - | Application |
| AC | - | Analog converter |
| DC | - | Digital converter |
| IoT | - | Internet of Things |

# CHAPTER 1

# INTRODUCTION

## 1.0 Introduction

The basic idea and developments of the Liquefied Petroleum Gas (LPG) leakage detection are based on the use of the Internet of Things (IoT) platform. As an IoT platform, Blynk application is used in this project. This chapter gives an overview of the project regarding background of the project, the problem statement, objectives to achieve, scope of the project and the thesis organization of the overall project.

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## 1.1 Project Background

The Internet of Things is aimed at facilitating life by automating any small task that lies around us. As much as IoT helps in automating processes, the advantages of IoT can also be extended to improve current safety standards. Safety has always been an important criterion in the construction of houses, constructions, factories, and cities. The increased concentration of certain radioactive elements will prove extremely dangerous. These gasses may be inflammable under certain conditions of temperature and humidity, toxic after exceeding the specified concentrations thresholds or even a contributing factor in environmental air pollution leading to problems such as smog and poor visibility, which can cause serious accidents and adverse effects on people's health

.

In addition, The majority of societies have a mechanism for fire safety. In any scenario, it will use when there is a fire. So as to have a command over such conditions this

framework is suggested that utilizes sensors which is equipped for recognizing the gases, for example, LPG, CO2, CO and CH4. In detail normal gases as liquefied petroleum gas (LPG) are broadly utilized in this project. The gases will certainly leak and the system should be checked continuously. By having the LPG leakage detection framework can assist with limiting the hazard and prevent fire mishappen.

However, the purposed topic focuses on Gas leak identification and automated gas valve regulation. The Gas Leakage Detection Framework that provides home security, detects the LPG leakage and alerts the user to the leakage through a notification via Android application and turns off the gas valve from anywhere through the user's Internet Of Things ( IOT).

Moreover ,the advantages of the system is that it continuously monitors the leakage of the LPG present in the cylinder using MQ-7 sensor and if the gas leakage occur and over the limit that have been set ,so the buzzer and exhaust fan will on automatically to alert people at home and the use of exhaust fan is to minimize the concerntration of gas in air because LPG is being heavier than air, it do not disperse easily and may lead to suffocation when inhaled and when ignited may lead to explosion. An added feature is that if the users accidently forget to turn off the gas burner, first it have been set to off automatically at the same time consumer can monitored and control using blynk application So the problem of wastage of the energy is solved.

## 1.2 Problem Statement

Gas leakage is a typical problem in households and businesses Where it is no longer detected and fixed at the same moment, it tends to be the cause of the loss of homes and lives. The leaking of gas can be dangerous. People operating in toxic atmospheres are at risk of open flame, which is the cause of a fireplace outbreak. Fatalities and deaths are a threat to their work. Potentially lethal carbon monoxide is also very dangerous to life. A leakage of natural gasoline may be risky as it will increase the danger of fire or explosion. Local gas companies 'work hard to give satisfactory notice in the event of a gas leakage. Since methane and in this way, natural gaseous doesn't have any adour, the fuel endeavor includes an admonition "spoiled egg" smell (mercaptan or a tantamount sulfur based thoroughly compound) that might be without trouble identified by utilizing the larger part. However, persons who have a dwindled sense of smell may not be equipped to rely on this safety system. In addition, leakage can occur at a time when no one is in the region that would raise the likelihood of an explosion.



In certain sectors, one of the main components of any protection strategy for mitigating risks to persons and plants is the use of early warning systems such as gas indicators. These can help to provide longer periods during which remedial or defensive practices are needed. It can also be used as part of a full automated control and protection system for an industrial plant. Rapid expansion of oil and gas industry results in gas leakage incidents which are very serious and dangerous. Solutions need to be found in order to reduce the effects of these events, as gas spills often result in substantial losses. The challenge is not only to build a system prototype that can only detect it, but also automatically respond to it once the leakage happens.

Figure 1.1: Damage that occurred due to LPG explosion

Figure 1.1 above is an example of an eruption of LPG. Such an accident can occur because it is not adequately supervised. In four-season nations, such as Russia, LPG is used as one of the heaters to steam the homes of people during the winter. No one was in the building at the time of the blast.

## 1.3 Objectives

The aim of this project is to make a development in LPG leakage detection by displaying the alert notification to user via blynk application. Therefore, there are several objectives stated to fulfill the project criteria:

I. To design a portable and low cost gas leakage detector.

II. To develop the smart gas leakage detector and monitoring system using Blynk application.

III. To apply user monitoring gas leakage detection system from any location.

## 1.4 Scope

The scope of this thesis relates to the aim of the prototype as set out below:



1. There have been developments in computer technology, electronic communication, wireless communication, the world of telecommunications, and this opens the door to the Internet of Things. It is split into two main sections which are the transmitter and receiver of the LPG leak detection system. As a result, the Internet of Things plays a role as a network-connected system that can be a sensor, a cell phone or something that can send and receive information in a contact channel anywhere in time and deliver value-added services for consumers to make their life better.

2. This research uses the MQ-7 sensor to diagnose leakage of liquefied petroleum gas. The MQ-7 sensor can interface with the NodeMCU ESP8266 to provide the NodeMCU ESP8266 Internet connectivity for mobile applications that are open to it. The NodeMCU ESP8266 acts as an input or receiver from the MQ-7 sensor and stores it directly in Blynk for smartphone applications.

## 1.5 Thesis Organization

This proposition is comprised of 5 sections. Following this first part which explained the background detailing and came up with main concept of this LPG leakage detection system. Chapter 2 describes the earlier research papers which is same as this framework and includes comparison of the components that have been used in the articles. Hence, chapter 3 consequently characterizes a drawn out efficiency system dependent on the new strategy including of system flowcharts, hardware, and programming program recreations. Chapter 4 portrays the last part of a general view assessment structure as layouts principle segments and various advances that structure new strategies. To sum up, chapter 5 discusses overview result of the project and give suggestion for enhancement to this framework.

# CHAPTER 2

# LITERATURE REVIEW

## 2.0 Introduction

Essentially, this section contains a number of articles , journals and conferences dedicated to a brief summary and relevant to the project to be undertaken. This study focuses on the development of the detection of LPG leakage using NodeMCU ESP8266. The study shows that LPG computerization systems which controlled by android based phones or tablets with Blynk Application. Every module has its own highlights from the journals. A few industries are currently legitimately selected and are working to give better features of LPG leakage computerization structure.

The flexible use of a high-precision gas leak detection device in homes that saves time, resources, and plays an important role in modern times. This technology focuses primarily on the automated monitoring of gas leakage. This research paper includes extensive details on the NodeMCU ESP8266 LPG leak detection and protection framework and how to handle home gas leakage using the Android application.

## 2.1 An Overview of Liquefied Petroleum Gas Leakage Detection Using NodeMCU ESP8266

Liquefied Petroleum Gas (LPG) is a necessary need of every household, its leakage should lead on to a catastrophe. There are diverse products for detecting the leakage to warn on LPG leakage and prevent any mishappening. Here we evolved an alarm primarily based on NodeMCU ESP8266 LPG gas detector. When gas leakage takes place, this device detects it and makes an warning by means of activating the buzzer with the connected circuit.

To come across LPG gas we used an MQ-7 sensor module. MQ7 Gas sensor can locate LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentrations everywhere from 200 to 10000 ppm. When awareness reached its setting stage, NodeMCU ESP8266 gets a HIGH pulse from the LPG Gas sensor, the (" CO GAS=") and message is displayed on 16x2 LCD and the buzzer is brought about, which again and again beeps until the gas detector sensor not detecting the gas within the atmosphere and automatically led and exhaust fan will on directly to clear the existing LPG gas. Moreover, NodeMCU ESP8266 sends alert notification to user via Blynk application and user can monitor and control from their exact location.

## 2.2 Past Related Project Research

### 2.2.1 Intelligent Gas Leakage Detection System with IoT Using ESP 8266 Module

V.Naren et al (2018) developed and applied the IOT-based model for an industrial / home gas leakage monitoring network. The project's primary aim is to make Household a completed product with a Gas Leakage Detection System. With the advancement of the internet in households, with the implementation of the internet of things the surveillance will be further improved. The device consists of an integrated wooden box with Arduino controller, solenoid, MQ5 detector, ESP Wi-Fi module and a Buzzer. The sensor head is located right above the valve head and the tube. A solenoid is positioned in such a way that it can close the pipe if there is a warning to interrupt gas flow. Arduino functions as monitor center. ESP module is used to connect Arduino to IoT as Wi-Fi module. The Arduino signal is interfaced with Thingspeak known as IoT technology. This app has the function of activating the online warning notifications to the customer. Thingspeak functions by developing a flow chart of Arduino's signals and sending warning messages as Twitter messages to the user's account using a Thingspeak called “Thingtweet”. In this way, other users can be interfaced, including the neighbourhood, so that everyone in the local area gets to know and can respond quickly when there is problem. Besides this, an Arduino 12V buzzer is linked to indicate the user offline. A time limit is set for the buzzer. The product is cost-effective, and can also be used in hotels.

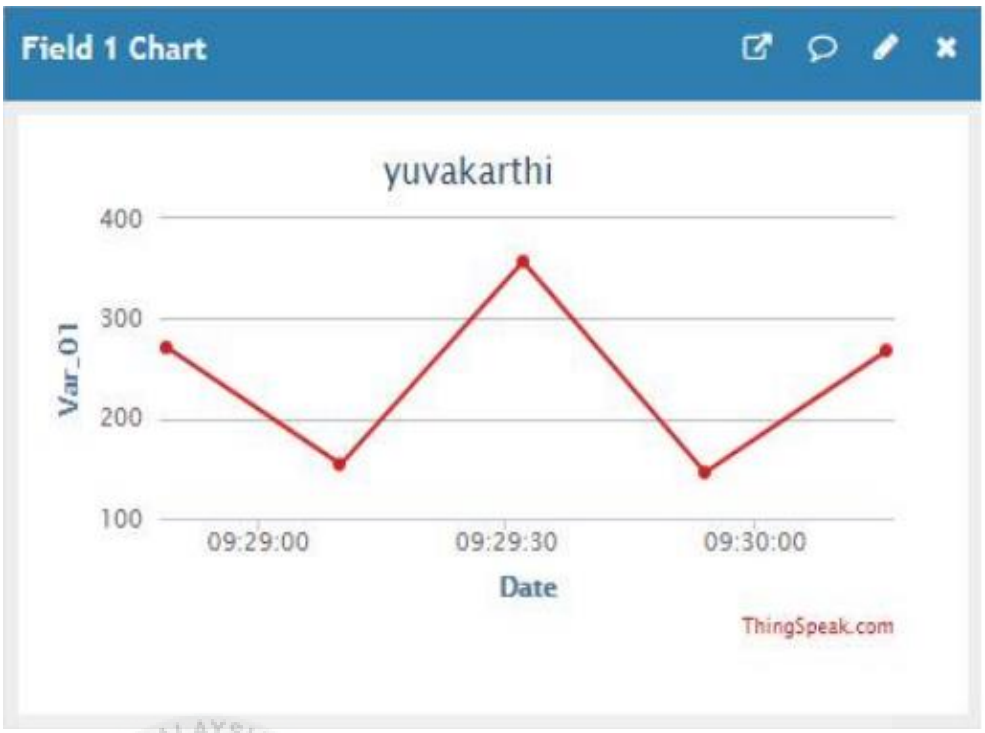


Figure 2.1: Time Chart for different gas sources in Thingspeak

Var 01 indicates how regularly the MQ5 sensor recognizes the gas. The breaking point has been set at 300 and the information is sent to Arduino as soon as the sign arrives at 300, from which the power goes to the Solenoid valve and the Buzzer. Around the same time, a message from a post is sent to the client's twitter account. This procedure happens quickly and ought to maintain a strategic distance from further gas spillage. local twitter records can likewise be interfaced to advise them whenever a crisis exists.

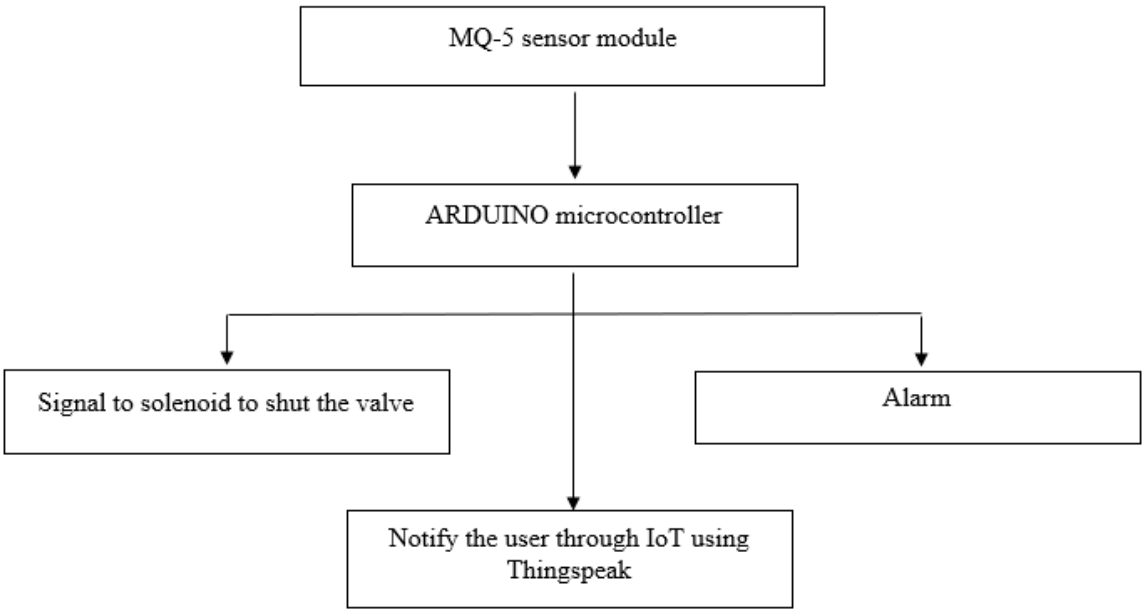


Figure 2.2 : System Architecture

### 2.2.2 GAS LEAKAGE DETECTION AND SMART ALERTING SYSTEM USING IOT

Shital Imade, et al (2018) have built up a cloud-associated savvy LPG gas chamber platform that goes about as a security instrument to distinguish low-level LPG gas spillage to maintain a strategic distance from mishaps. So as to give constant observing and cautioning over the Internet, it is likewise equipped for detecting fire breakout in the gas zone and weight. At the point when an unpredictable condition is watched, the framework will send an alarm to the client's android application and will likewise create an email cautioning to different specialists. In addition , the system automatically takes precautionary safety steps when sensing a gas leakage or a fire outbreak, such as shutting the gas valve, opening the ventilation, enabling the fire sprinkler and shutting off the supply of home appliances. The application associates with the web through

Wi-Fi and in this manner builds the stage's adaptability inside house premises. The framework is actualized with a Wi-Fi-fit ARM Cortex-M4 microcontroller. This framework gives a total, ease, viable and easy to use method of constant checking and remote control of gas spillage and instruments of anticipation in family unit and mechanical segments.

**Device hardware features:**

a) Live monitoring and control

The mobile app will view the remaining amount of LPG gas, other system status present in room temperature. These data are updated every few seconds and live monitoring is provided in real time. Additionally, the actuators connected to the device can be operated from the smartphone application which gives the user additional benefits.

b) On-Demand Automatic Reordering Facility

When the system is configured in automatic reordering mode, the system automatically sends a gas cylinder requesting an email to the gas vendor or gas distributor if the gas level falls below a certain threshold. Until allowing this capability the user must save the gas distributor's e-mail address.

c) Low Weight Warning

Once a new gas cylinder is shipped, the user will press a button on the system that begins the cylinder weight calculation process and if it detects low weight cylinder, indicating low fuel content, it will quickly notification the user's mobile app to this and send an e-mail alert to the gas agency to report the event. This is a valuable feature when it comes to seeking and avoiding a low weight gas cylinder at delivery.

d) Actuators

The gas valve placement is operated by a servo motor, while the DC fan motor mechanism functions as a ventilation / exhaust ventilator. A fire sprinkler motor can do the work of another DC electric motor. All of these motors are operated using correct generation of PWM signals. The AC relay circuitry is used to break off electrical power supplies from the mains.

e) Local Audio Alarm

A loud beep alarm sound is intermittently produced to alert neighbours.

f) Device User Interface

Notification LEDs are used to show Wi-Fi provisioning and link status to cloud servers.

### 2.2.3 Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor

Rohan Chandra Pandey et al (2017) proposed LPG sensor detector for hazardous LPG leakage in our home or petrol station, stockpiling tank zone and even in vehicles utilizing LPG gas as their fuel. This unit can be effectively coordinated into an alert circuit/gadget to sound a caution or give a LPG focus visual pointer. The sensor mixes astounding affectability with a quick reaction time. On the off chance that there is the objective ignitable gas, the conductivity of the sensor is higher alongside the rising grouping of the gas. LPG gas sensors modify the conductivity to its relating gas fixation yield signal. The MQ-2 gas sensor appeared in the figure is utilized to identify the harmful gas and is exceptionally delicate to LPG, just as to respond to Natural gas. It is a versatile gas finder with a long assistance life and ease. Model No. MQ-2 Sensor Type Semiconductor Standard Bakelite (Black Bakelite) Gas PROPANE, HYDROGEN, LPG 300-1000ppm (Hydrogen, Propane, LPG) discovery. When there are the objective flammable gasses, the conductivity of the sensor ought to be higher along the expanding gas fixation.



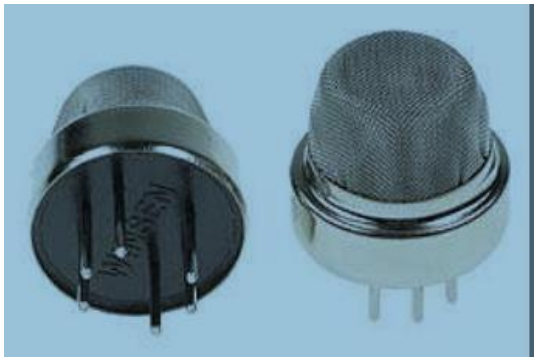

Figure 2.3: MQ-2 Gas Sensor

Furthermore, Raspberry pi 3 has been utilized as a solitary board PC with remote LAN and Bluetooth. It is an adaptable processor fit for running a wide scope of ARM GNU/Linux frameworks just as Windows 10 IOT. The raspberry pi 3 is incorporated in undertaking model that underpins linux working framework and python language coding orders that assist us with following and screen the recognized gas level through a sensor, and is connected up with a free site page that is associated through the raspberry pi 3 stage cloud interface, which thusly runs on an assortment of python coding orders that distinguish and educate us regarding the continuous gas level worth by means of MQ-2 sensor units in the plant.

### 2.2.4 Liquefied Petroleum Gas (LPG) Leakage Detection and Monitoring System

Tamil Selvi a/p Sitan and Aimi Syamimi Ab Ghafar (2018) have proposed framework which is known as LPG leakage recognization and checking framework where clients can be informed the gas spillage and the heaviness of chamber gas can be observed by utilizing the cell phone whenever and from anyplace as long as it is associated with the web. Fig 2.4 underneath delineates the general meaning of the proposed program. Two kinds of sensors are utilized inside this project which is MQ6 gas sensors that just distinguish LPG gas and 40 kg load cell with HX711 balance module amplifier. cell of module enhancer. The two sensors are associated with NODEMCU ESP8266 gadget. This gadget can interface with Wi-Fi, for IoT include. There are two sorts of caution alarms as well. Physical caution is created utilizing ringer and non-physical caution is created by sending alert through client email and cell phone warning. Also, the gas spillage and chamber weight information were refreshed progressively to Blynk cloud. Blynk is one sort stage for IoT.

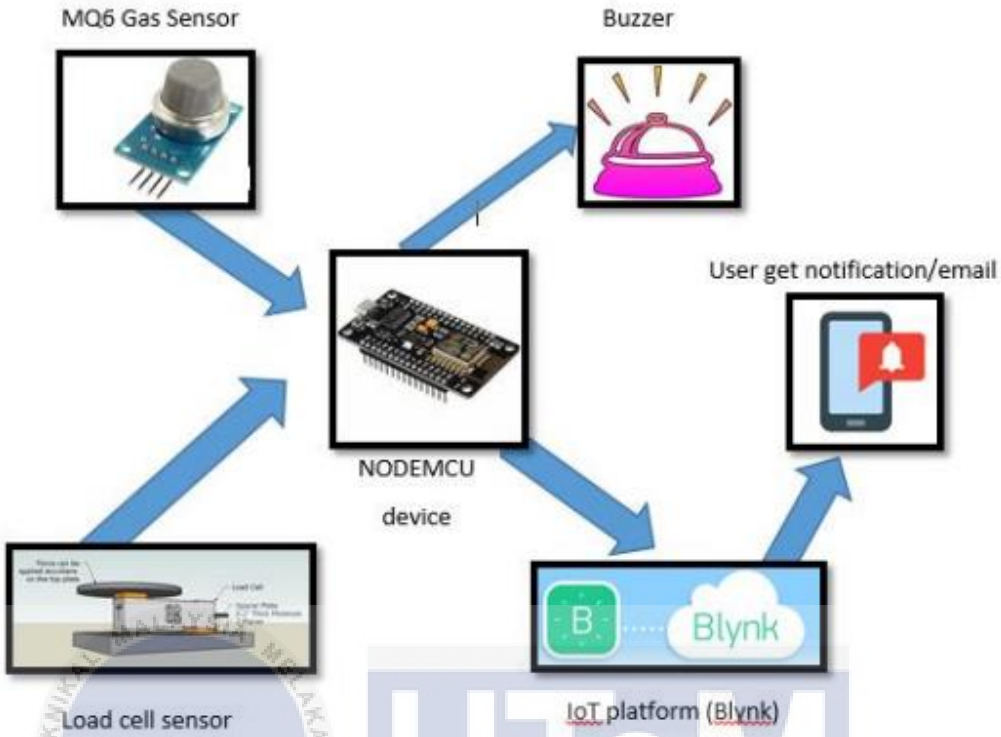


Figure 2.4: Overall system setup



This task is partitioned in four stages. In Phase 1, blinking of LED light is worked to test the NodeMCU ESP8266 and screen the ON and OFF by means of IoT gadget. The point of this stage is principally trying on IoT structure NodeMCU ESP8266. In Phase 2, the development of the detecting gadget utilizing LPG gas sensor and burden cell is moved up to the equipment segment while the programming for both is in the product section. In stage 3, the equipment segment is refreshed by utilizing buzzer to make the notice framework, and the product assembles the ready framework program code. At long last, the advancement of equipment on checking framework utilizing IoT and cautioning system utilizing email is worked in stage 4, and the product partition included IoT gadget settings.

This stage is the place clients can check chamber condition and weight by means of the site of the IoT gadget.

## A. Hardware development

The development of the leakage detection and monitoring system design of Liquefied Petroleum Gas (LPG) is shown in Fig. 2.4. Most essential is this system's brain which is the NodeMCU ESP8266 fitted with Wi-Fi connectivity. Since NodeMCU ESP8266 is embedded with its own microcontroller, an external microcontroller is therefore not needed, and programming can be programmed using the Arduino IDE itself. The detector device is also equipped with a gas detector LPG MQ6, which detects gas leakage in the surrounding environment . At the point when the gas identifier identifies the gas spillage the piezoelectric signal rings and an admonition message is likewise sent to the client through email. The gadget is likewise fitted as a detecting unit with a heap cell to follow the heaviness of the gas chamber and to send a notice message to the client by means of his email. The HX711 balance module is associated with a heap cell that capacities as an enhancer when an A/D converter is set up. This framework additionally utilizes the IoT idea as its control and cautioning framework. The necessary information gathered by NodeMCU ESP8266 is sent to the cloud for the Blynk application and can be gotten to by the clients at whenever they need.

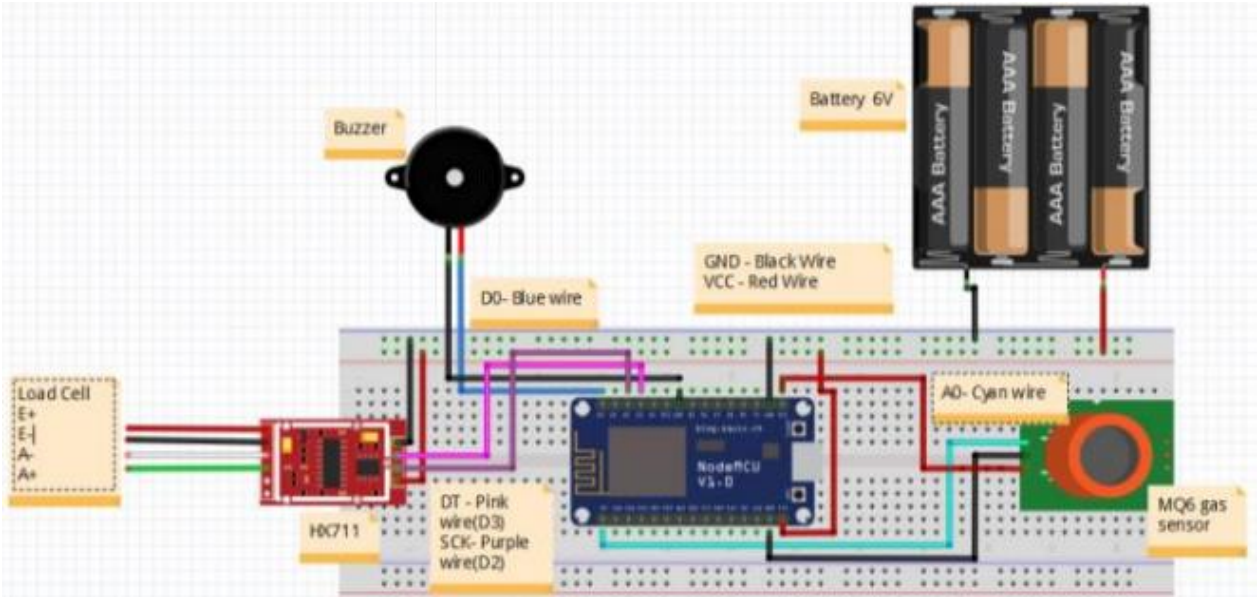


Figure 2.5: Circuit diagram of LPG gas detector with monitoring system

**B. Development of Software**

This portrays the programming of the processor integrated with the detecting unit (gas sensor and burden cell), the alert unit (rings the buzzer and sends cautioning messages) and the observing unit (refreshing the information) through the site of the Internet of Things (IoT) as indicated by the stages. fig.2.6 presents the flowchart programming as per the four cases in this framework

.

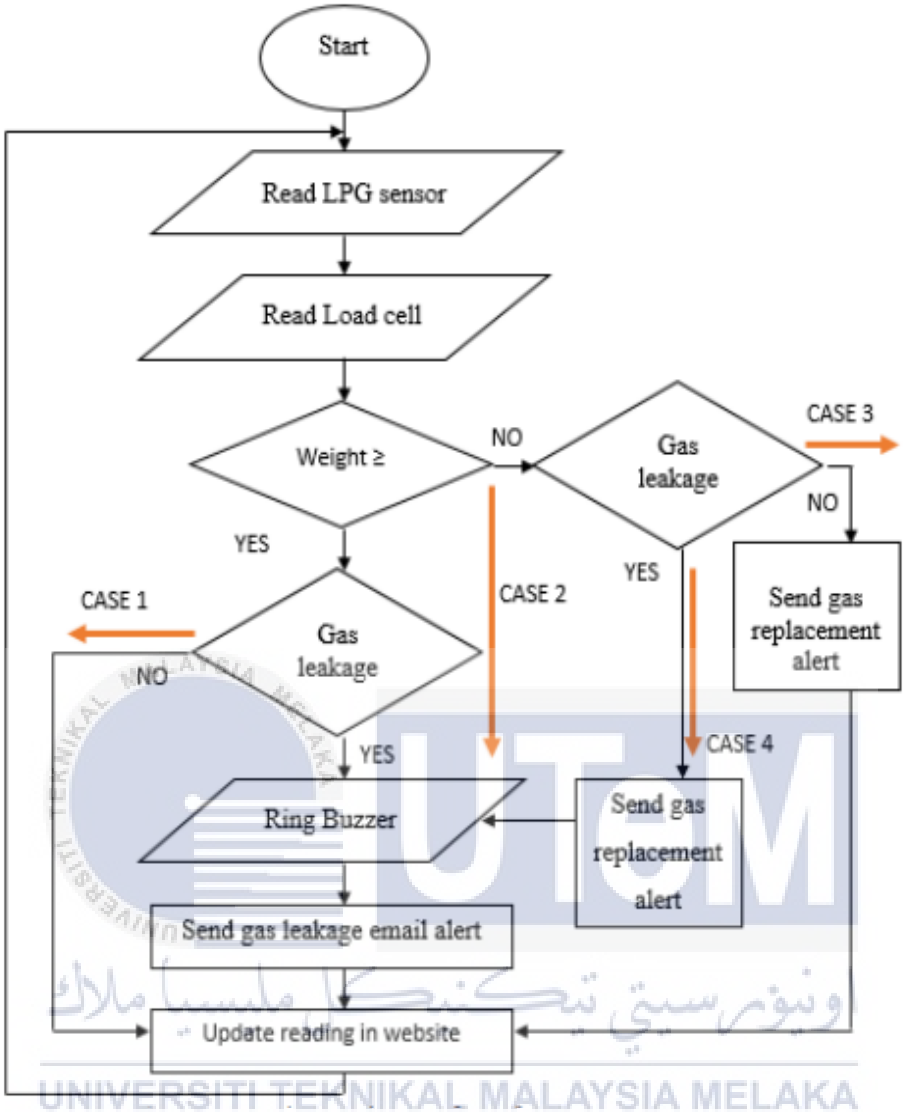


Figure 2.6: Flowchart for four cases

### 2.2.5 IOT Based Smart Gas Monitoring System

Anandhakrishnan .S et al (2017) have created "IOT based Smart Gas Monitoring System" This proposed gadget targets distinguishing financial energizes, for example, oil, fluid oil gas, liquor and so forth and accommodates the observing of the gas leakage via consequently shutting the valve. The following element of the theme is to ensure gas chamber from gas shop is reserved. For all the sensors to identify the spilled gas from the sensor and send it to the web. By programming on the web, the detected signal is coordinated to the android application utilizing the android application that we give the sign to remove the gas valve from a far off area. In this manner it diverts from IOT to the web again and shuts the gas chamber valve. Utilizing this gadget may likewise maintain a strategic distance from the gas wastage issue. Perhaps, if the burner is left on by accidentally, it may alert the user about the problem. If the burner is on, and no vessel is on top of it, an alarm will go off.



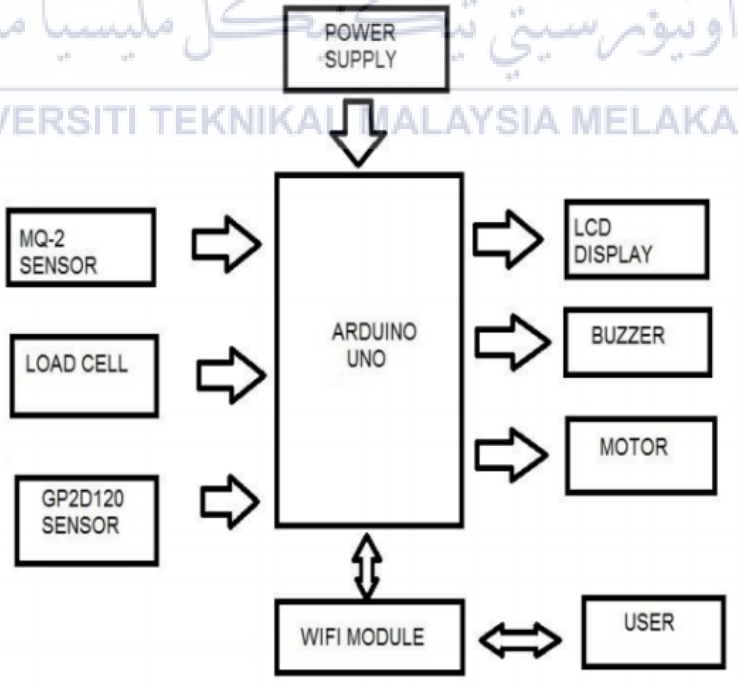


Figure 2.7 : Block diagram of the system

### 2.2.6 Home and Industrial Safety IoT on LPG Gas Leakage Detection and Alert System

Zainal H. C. Soh, et al (2019) present a gadget for following the gas level (leakage) identified by the gas sensor and sending it to Ubidots by means of IoT, the information can be preused over from the dashboard of Ubidots and giving the proprietor early admonition of the spillage. Referring to the block diagram in Figure 2.8 below, the network built consists of 1) a sensor node installed using an Intel Edison board linked to a buzzer, LEDs and MQ2 gas sensor; 2) a Wi-Fi router connecting the sensor node to a Ubidots IoT Cloud platform and 3) a Ubidots Cloud framework consisting of a secure IoT application organisation; Ubidots Dashboard for viewing and visualizing gas level data and Ubidots Data Analytic for evaluating the gas leakage detection level threshold limit that invokes a gas leakage warning to home owner via smartphone telegram / sms.



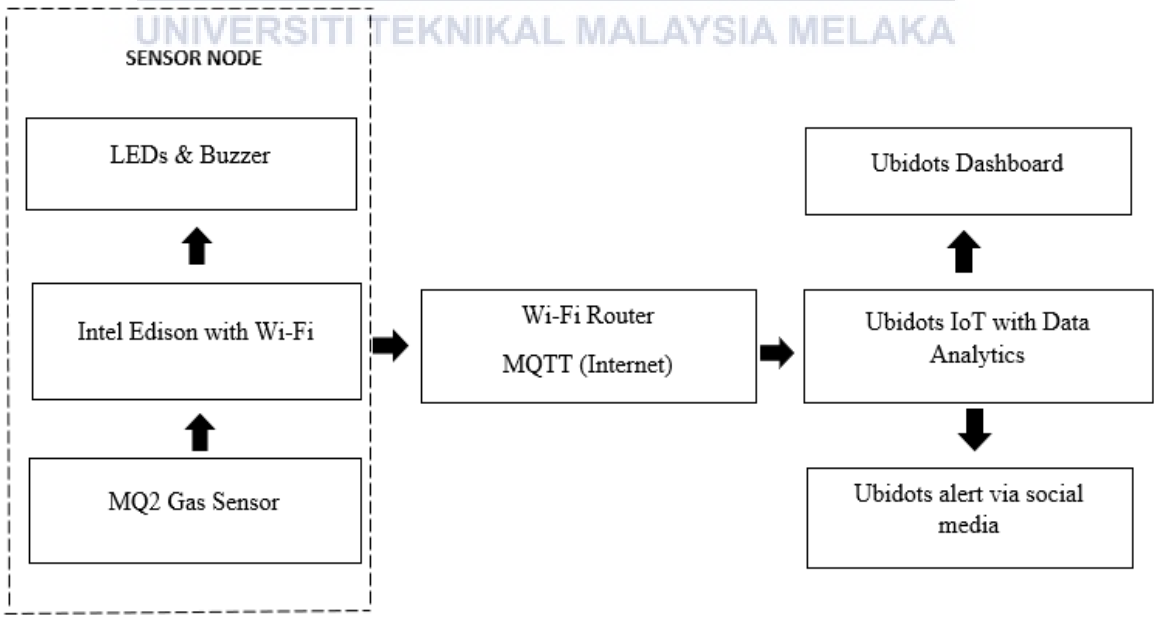


Figure 2.8. Block Diagram of LPG Gas Leakage Alert System

This system's main operation is focused on the monitoring of gas leakage in houses, restaurant workplaces, and other locations. Firstly, the architecture must run constantly as it needs to gather all the user-based data about the gas leakage. Gas leaked occurred without warning, which can occur in the morning, daytime and evening. Also while there are people in the building, minor gas leaks are difficult to identify. So one of the key priority here would be on this device gas sensor since this project cannot be completed without it. The gas sensor can sense any external gas depending on the type of MQ used by the consumer .

Additionally, this project utilizes the MQ-2 gas sensor since it had the capacity to distinguish the LPG just as propane and butane. This sensor has the capacity of recognizing gas, for example, LPG, smelling salts, sulfur dioxide, hydrogen sulfide, carbon monoxide, methane gas and that's only the tip of the iceberg. MQ-2 is incredibly gas-inclined. It can likewise identify smoke, however not as successful as when distinguishing a gas. The ordinary finding out about gas spillage is around 500ppm. Regardless, in this stage, the limit is 800 ppm in light of the fact that to make the procedure of exploration less difficult. MQ-2 is equipped for detecting from 200ppm to 5000ppm, while MQ-5 is fit for detecting more than up to 10000ppm. All MQ-2 and MQ-5 are utilized in this venture to detect the gases.



The data collected on the gas level is continuously transmitted to Ubidots IoT Cloud via sensor node centered on Intel Edison. All the data that Intel Edison gathers and sends is then stored in the Ubidots database. To send information to Ubidots IoT Cloud, the Intel Edison sensor hub is associated with web switch by means of Wi-Fi interface. The

dashboard interface and screen for the framework the executives and occasion the executives are accessible in Ubidots. The dashboard show is a graphical diagram of assembled information giving access to or watching the gas level outline in their homes. Data visualization is detailed and well structured, allowing for simple surveillance of their home and from their office. In the occurrence of gas leakage the gas sensor detected an indication of gas leakage in the air more than 800 ppm, The sensor node will sound the buzzer and turn on the red warning alert LED on-site. The data level of the gas leakage is also sent to Ubidots IoT, and a notification case is sent to owner.

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### 2.2.7 Detection of Liquefied petroleum gas using sensor through arduino uno microcontroller

Aastha Singh, et al (2018) proposed the detection through arduino uno microcontroller of petroleum gas through utilization of sensor. Arduino Uno is the critical and most important piece of the program. Arduino screens the entirety of the yield gadgets. All the while, it peruses and controls sensor inputs. The MQ2 sensor has an electrochemical sensor, which changes its resilience for differing gas focuses. The sensor is associated in arrangement to shape a voltage divider circuit with a variable resistor and the variable resistor is utilized to change the affectability. At the point when one of the vaporous components referenced above comes into contact in the wake of warming with the sensor, the protections of the sensor change. The resistance adjustment affects the voltage around on the sensor, and a microcontroller will read the voltage. By understanding the reference voltage and the resistance of the other resistor the voltage value can be used to determine the resistance of the sensor. For a different type of gasses the sensor has different sensitivities.

The characteristic sensitivity curve for the various forms of gasses is seen below.

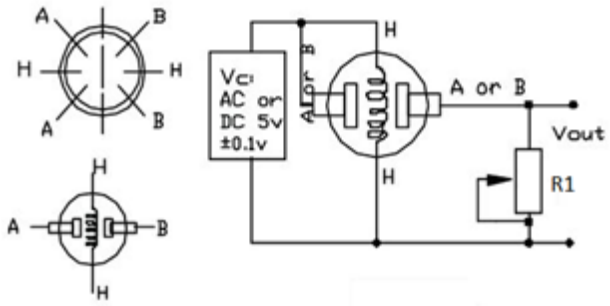


Figure 2.9: Voltage divider circuit form through the connection between Sensor series with a variable resistor

Unit configuration is broken down into three major stages. In the initial stage, the gas sensor detects the gas leakage. This senses the gas leakage and the microcontroller gets the signal. After that the microcontroller receives the signal in the second stage, which is sent by gas sensor. It imparts the actuation sign to other associated outer gadgets, for example, the LCD show . The LCD show what gas is as of now distinguished. Arduino's LCD Display gets numerous warnings. With the help of GSM modem connected to the Arduino Uno board, client gets SMS warning.

In addition, the circuit displays the sum of LPG in the air. The circuit sounds an alert, and when the fixation arrives at a predetermined sum, a hand-off excursions. MQ2 is the sensor for gas utilized in this undertaking. MQ2 is a gas sensor dependent on SnO2, equipped for distinguishing gases, for example, methane, propane, butane, gas, smoke, hydrogen and so forth. Since LPG incorporates basically propane and butane, MQ2 sensor can be utilized for LPG detecting. At the point when the sensors sense the gas noticeable all around, the

message seen on the LCD "GAS LEAK" will be transmitted to the enrolled number and the signal will emanate sound and check. Around the same time, we can even add an exhaust fan to the controller to minimize the gas leakage. Once the user receives the message, they will send the instruction via message what's more, when the controller gets the message, the fan is on, here we utilize the fan to release the gas outside the structure, for example to limit the gas concerntration inside the room.

When LPG gas doesn't distinguish the "NO GAS LEAK" cautioning appeared on the LCD and no sound produced from Buzzer. No message that has been sent.

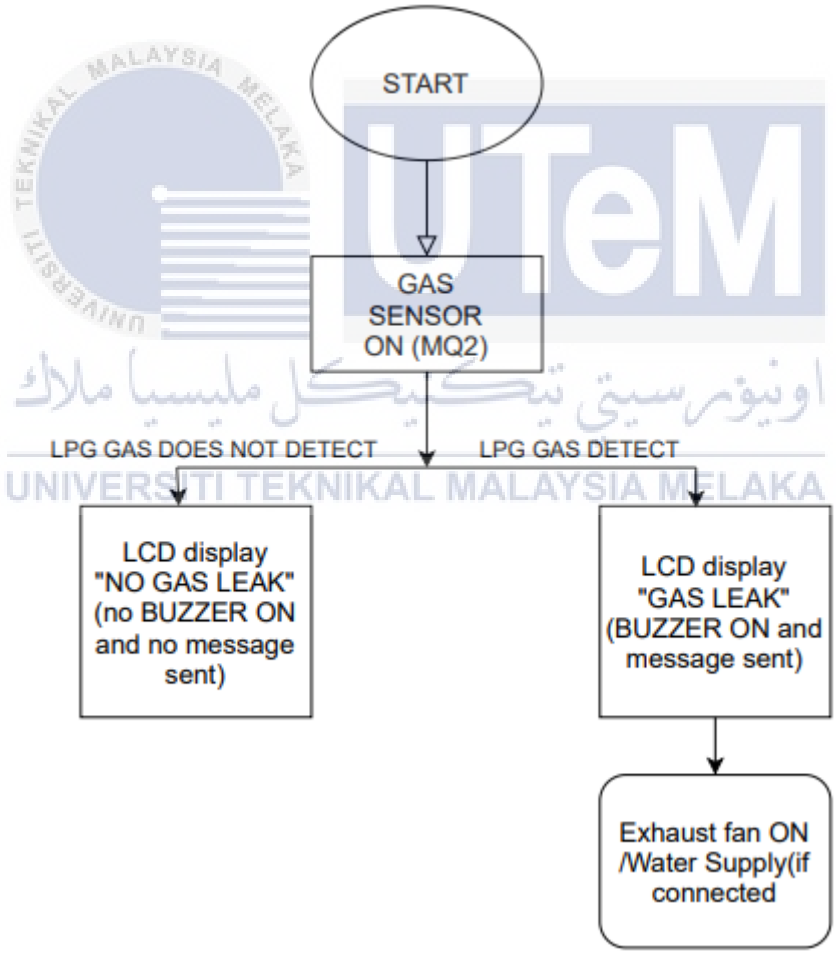


Figure 2.10: Flowchart of the working

### 2.2.8 Wireless Sensor Network on LPG Gas Leak Detection and Automatic Gas Regulator System Using Arduino

Dewi and Y Somantri (2017) created LPG Gas Leak Detection and Automatic Gas Regulator System Using Arduino Wireless Sensor Network. This framework is part into two which are fundamental framework and supportive network. The key framework is the Arduino Uno, the MQ-6 gas sensor, the Bluetooth HC-05, the bell, the LED, the LCD, the fumes fan and the simultaneous engine. This strategy is the principle investigation framework. Moreover, the supporting gadget is the Arduino Nano that will run the MQ-6 and BluetoothHC-05. The framework would be found autonomously from the fundamental framework and remotely joined to it. WSN joins the recognition to two areas. The primary sensor ties the principle gadget straight away and is placed in the gas tube. The subsequent sensor joins to the subsequent gadget and is situated close to the oven and the association with the hose..



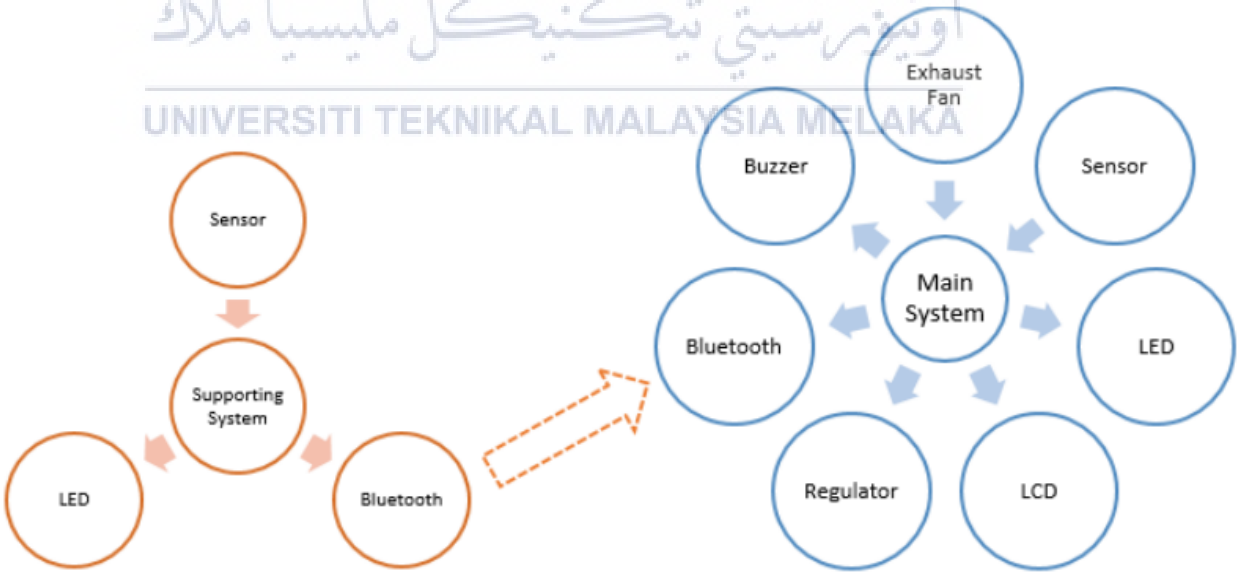


Figure 2.11 : Hardware Design.

## 2.2. Hardware Design

Some equipment is utilized in research. For the two arrangements, Arduino Uno and Nano are utilized as microcontroller. The gas sensor is MQ-6. MQ-6 is especially helpless to mixes of flammable gas and LPG, including Propane and Butane. MQ-6 can identify gas convergence of 300-10,000 ppm. Bluetooth HC-05 is utilized to interface all gadgets as the remote module. HC-05 has an information pace of 3 Mbps and a length of around 10 m. The buzzer and the LED give ready framework. The LCD shows the degree of the gas spillage. The fumes gas will kill the air as it spills. While, one phase synchronous motor powers the automatic regulator. The fan normally uses the synchronous motor as rotary.

The main device hardware design is constructed with a plastic container. The first container is hanging on the gas tube. The supporting device is also equipped with a plastic container that was positioned near the hose. Nonetheless, these two containers have different plastic materials. The second container can be placed anywhere, due to its flexibility. This is flexible since the first container does not need wire to be attached. The second container can be mounted from the first container up to a maximum range of 10 m.



AC is used as power supply by the main system. Since too many parts are used, AC is used as a substitute for the battery. The supporting device also uses the battery because it consists of Arduino Nano,HC-05,MQ-6, and LED. The battery also uses the flexibility to support it.

2.3. Software Design

All the work out of computer design is software design. Thus it allows a program that operates according to the instructions needed. If Arduino is used, then with Arduino IDE the programming design is performed in full.

```
void setup() {
  digitalWrite(FAN, HIGH);
  digitalWrite(REG, HIGH);

  pinMode(LED_YELLOW, OUTPUT);
  pinMode(LED_GREEN, OUTPUT);
  pinMode(LED_RED, OUTPUT);
  pinMode(sensor, INPUT);
  pinMode(BUZZER, OUTPUT);
  pinMode(FAN, OUTPUT);
  pinMode(REG, OUTPUT);
  pinMode(limswitch, INPUT);

  lcd.setBacklightPin(BACKLIGHT_PIN,POSITIVE);
  lcd.setBacklight(HIGH);
  lcd.begin(16, 2);
  digitalWrite(LED_YELLOW, HIGH);
  tone(BUZZER, 2500);
  delay(100);
  noTone(BUZZER);
  delay(100);
  tone(BUZZER, 2500);
  delay(100);
  noTone(BUZZER);
  delay(100);
```



Figure 2.12 : Arduino Ide Program

2.4. Simulation

The first thing to do in the process of simulation is calibration of the sensors. Specific equipment for sensor calibration can cost a great deal. It will also take too much time and will require specific knowledge. But, if the correct test is used to calibrate, it should display as reliable as it would. And a basic Arduino program is the simpler way to calibrate the sensor. One of the online websites for designing devices offers the calibration system. Calibration will be done with 1000 ppm LPG. And we could get the read value of MQ-6.

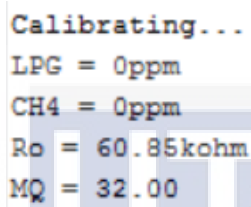


Figure 2.13: MQ-6 Calibration.



The standard for LPG is 2000 ppm (10 percent LEL) as indicated by information gave by NIOSH. LEL is a Lowest Explosive Limit shortened form. There are two blast procedures to recollect while assessing the combustible gas occurrence, which are explosion and deflagration. Explosion is a shocked reaction wherein the fire moves at supersonic speed (quicker than sound). In spite of the fact that deflagration occurs at subsonic level, the fire runs.

The simulation can be begun after the sensor calibration is completed. The gas coordinate is utilized in this reproduction to offer reenactment of the gas spillage around the sensor. The sensor detects the gas and transmits the information to principle framework Arduino.

Arduino then actuates all the admonition frameworks, demonstrates the information to the Monitor, turns on the fan and discharges the regulator.

### 2.2.9 Early detection of LPG gas leakage based Wireless Sensor Networking

Medilla Kusriyanto, et al (2018) built up a wireless sensor framework for the detection of gas leakage. The framework is intended for use in the assurance of the home where apparatuses and radiators that utilization flammable gas and LPG might be a wellspring of hazard. The framework may likewise be utilized for other modern applications or plants that depend on LPG and petroleum gas in their activities. Gadget design comprises of two essential modules: the module for recognizing and transmitting, and the module for accepting. The sensor and transmission module utilizes an extraordinary detecting circuit intended for this reason to screen changes in gas fixation. This module tests if an ascent in vaporous fixation has arrived at a specific indicated edge. On the off chance that the sensor detects a gas focus change, the sensor actuates and sends a varying media cautioning and a sign to the beneficiary module. The collector module fills in as a handheld notice framework empowering versatility inside the premises of the home. The framework was checked utilizing LPG, and because of fixation changes, the admonition was activated. A model of a Wireless Sensor Network (WSN) for identifying and finding gas spillage from an indoor complex condition. In explicit, a versatile hub makes a trip inside a structure to follow any carbon dioxide (CO2) spillage, to help and show the level and area of the spillage.

### 2.2.10 Development of wireless sensor network system for LPG gas leakage detection system

T.H.Mujawar et al (2015) utilized the Arduino and XBee to introduce structure and improvement of a wireless gas leakage checking framework. The system is worked in a star-type topology with gadgets and sensors in it and afterward screens all gadgets through a XBee organize door hub and finds a way to stay away from critical hazard. The framework proposed utilizes XBee as a remote framework, sensors, and Arduino controller that improves framework execution as well as gives safety efforts.

The examination was really directed utilizing Arduino nano board, MQ-2/MQ-6 gas sensor, XBee and a GSM module. The sensor has magnificent affectability joined with a quick minimal effort reaction time. Under gas spilling circumstance message with Arduino GSM shield is naturally sent to the assigned individual or relative.



Traditionally, the detection of gas leakage is tracked by a wired sensor network, with considerably high power demands and repair costs. The best alternative is to surmount the shortcomings of the conventional wireless sensor network system. Wired sensor network's high power criteria can be made simpler using WSN technology that uses separate protocol standards for short-range wireless communication like Bluetooth, WI-Fi and Zigbee. Presently, Zigbee is commonly used for real-time tracking of the hazard zone in the gas leakage detection applications. The conceptual concept is tracked by Lab-VIEW. However, compared to the recorded methods, GUI generated using LabVIEW tool is more collaborative, simpler and more accurate.

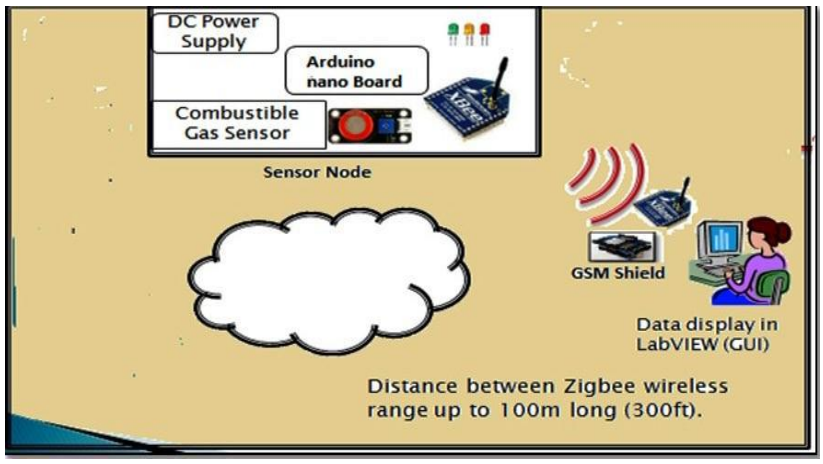


Figure 2.14: Block diagram of a wireless gas sensing s system

The proposed framework essential square outline as appeared in figure 2.14. The essential WSN sensor hub design comprises of a sensor unit, a simple sign preparing unit, a processing unit and a remote specialized gadget. These design techniques were utilized for demonstrating the WSN hubs.



Figure 2.15: wireless sensor node

## 2.3 Comparison of Literature Review

| Author | Microcontroller | Monitoring System | Communication System | Advantage | Disadvantage |
|---|---|---|---|---|---|
| V.Naren et.al (2018) | Arduino UNO Microcontroller | Mobile phone and LCD | ESP Module and Internet of things (IoT) | User friendly and real-time monitoring | expensive |
| Shital Imade et al (2018) | ARM Cortex-M4 | smartphone | Internet of things (IoT) | low-cost, effective and user-friendly | Complex design |
| Rohan Chandra Pandey et al (2017) | Raspberry pi 3 | Computer | Wireless LAN and Bluetooth | more efficient, more applicable | Delay |
| Tamil Selvi a/p Sitan and Aimi Syamimi Ab Ghafar (2018) | NodeMCU ESP8266 microcontroller | Smartphone | Blynk app ,Internet of Things (IoT). | Easy to monitor and user friendly | Complex programming |
| Anandhakrishnan S et al (2018) | Arduino Uno Board | Laptop and LCD | ESP8266 WiFi Module | more effective and ecofriendly | Complex programming |
| Zainal H. C. Soh et al (2019) | Wi-Fi router | Laptop and mobile phone | Wi-Fi Shield and Ubidots Cloud platform | WiFi network available , high speed | Expensive, Unsecure |
| Aastha Singh et al (2018) | Arduino UNO | Mobile phone and LCD | GSM modem | More Efficient | Not very user friendly |

| | | | | | |
|---|---|---|---|---|---|
| Dewi and Y Somantri (2018) | Arduino Uno | Mobile Phone and LCD | Wireless Sensor Network (WSN) and wireless module Bluetooth HC-05 | Cost effective, Easily applicable | Complex design |
| Medilla Kusriyanto et al (2018) | Microcontroller | Mobile phone and LCD | GTalk app and XBee PRO S2B | Low cost and easy to use | Complicated programming |
| T.H.Mujawar et al (2015) | Microcontroller and Arduino nano board | Mobile phone and LCD | Arduino GSM shield and wireless sensor network (WSN) | low cost and high sensitivity | high power demands and repair costs |

## 2.4 Summary

There are numerous gas leakage observing system have been constructed. Each gas leakage observing has its own favorable circumstances and downside, which is refined in this section. This task means to create gas leakage observing framework with applications. The oddity is utilized current innovation android cell phone that will make change the device gas leakage observing to cell phone. It likewise offers operational types of assistance and directs the checking acknowledged and cautioning the board, dynamic and leakage controlling is altogether improved. Consequently, the security of society and friendly improvement will contribute by this project

# CHAPTER 3

# METHODOLOGY

## 3.0 Introduction

The development of the Blynk LPG leak detection system involves hardware selection, component testing and product designation. In addition, the system must also verify that the circuit is operating correctly and that the connecting component of the circuit is effectively interfacing. The NodeMCU ESP8266 is used as an interface for transmitting and receiving information linked to the Wifi module and the MQ-7 sensor within the circuit. The application of this gas leak detection device can be monitored using a cellular smartphone using the Wifi module.

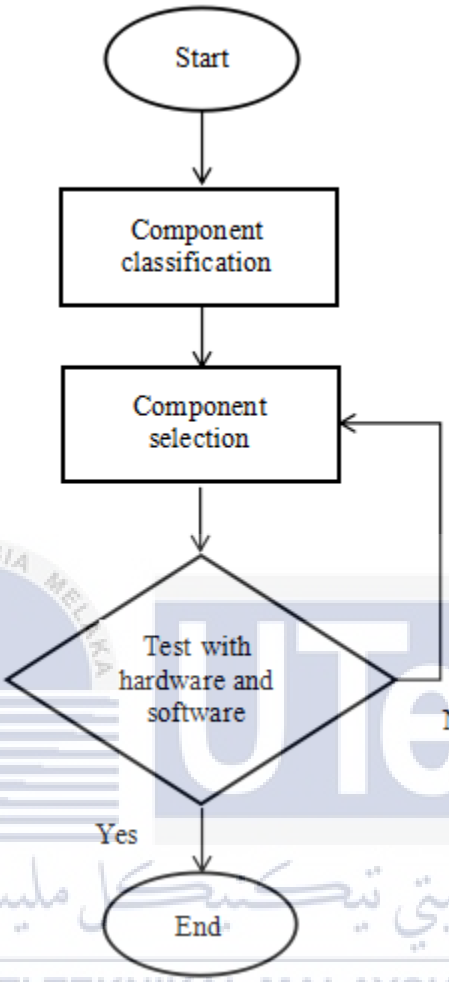



Figure 3.1 : Project preparation Flow chart

The diagram above shows that the starting point of this project will be designed and operated according to the objective in question. Second, the device for this framework is critical in order to identify and select the correct hardware part classification by undergoing analysis. Next, the selection of components is carried out with best process and systematic planning. After all steps have been taken, the process continues to be discussed and analyzed for hardware and software testing. Activity is success means that the preparation

of the project will end, but if it does not mean that it will go back to the selection of the components.

## 3.1 Overview of the system requirements

### 3.1.1 Main system requirement

The system developed should provide the user with the needed functionality and performance, and should be maintainable, reliable and usable. Providing responses quickly, reliably and on time when dealing with unexpected events is crucial. These are the most important high level and general requirements that the system must satisfy. System requirement is usually divided into two classes that are both functional and non-functional requirements. The first describes what the system should do and is perceptible to the user, while the second describes limitations on how the user implements the functional requirement, and not necessarily perceptible.



The specification review of the LPG gas detection system via the Internet of Things ( IoT) has been investigated at this point. A few previous analyzes of literature on this subject have been discovered by carrying out any research either in a journal, in an article or in a newspaper. In addition, the description of the framework is being explored in this area. So, towards completion of the system, it will meet its specification that we understand and ensure the need for an Internet of Things ( IoT) gas leak detection system.

### 3.1.2 General characteristics of LPG leakage detection system

The framework will permit users to be cautioned in functional prerequisites about the gas leakage and close the gas valve utilizing the interface made in the application. The application 's principle menu will show the user's arrangement setup to modify the program. It will give user instruction to monitor the system for the gas leakage. The framework reaction time execution relies on how refined the sensors are.

### 3.1.3 Features and functions of LPG leakage detection system

The device must be user friendly to the non-functional criterion. Users need to be able to understand and study the system's function, so users will know how to manage the system without referring to the manual when using the system. Moreover, users will always define the device's hardware or software for each section of the network. This event notice highlight is viewed as a significant necessity since it takes into account continuous notice if problematic events happen in one circumstance, example, the concern hits its setting point, the framework sends notification by applications. This will enable real-time information regarding the status of gas leakage at home and its sensors. The detection of gas leakage in homes therefore brings one major advantage, namely real-time analysis of these parameters.

## 3.2 Hardware and software selection

The system has two parts which are hardware and software. The hardware system consists of NodeMCU ESP8266 Wifi module, MQ sensor, Buzzer, LED, Exhaust fan, LCD display and gas valve switch. The software consists of the Blynk application. Blynk allow to create several interfaces for the project using smart gadget. To monitor LPG leakage these hardware modules are used. NodeMCU ESP8266 will help develop an interface between the software and the hardware. The NodeMCU ESP8266 can also aid in the sending and reception of the user's data.

### 3.2.1 NodeMCU ESP 8266

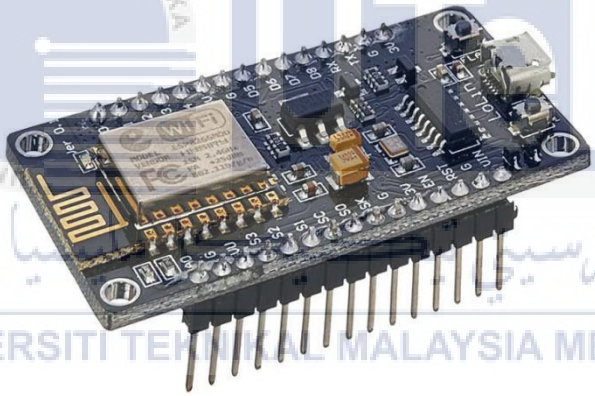



Figure 3.2: NodeMCU ESP 8266

NodeMCU ESP8266 was chosen for operate the LPG leakage detector which can basically interface with a smartphone with an AC to DC connector. The NodeMCU ESP8266 differs in that it doesn't use the FTDI USB-to-serial driver chip from any single that goes before board. Even the libraries and affordable online resources make it an excellent platform for the beginners to take a shot. Its benefit is that it can be changed with the language C++.

There are also only enough 128 KB of RAM and 4 MB of Flash memory (for program and data storage) to handle the large strings that make up web pages, JSON/XML data, and all can be inserted directly on IoT devices. The 802.11b/g/n HT40 Wi-Fi transceiver is integrated into the ESP8266 so that it can not only link to the Wi-Fi network and communicate with the Internet, but also set up its own network, allowing other users to connect directly to it. This makes the ESP8266 NodeMCU much more versatile.

As the operating voltage range of the ESP8266 is 3V to 3.6V, the board comes with an LDO voltage regulator to keep the voltage constant at 3.3V. It can supply up to 600mA consistently, which should be more than satisfactory if ESP8266 pulls up to 80mA during RF transmission. On one side of the board, the regulator's output is also graded and listed as 3V3. This pin can be used to provide power to external components. Power is supplied by an on-board MicroB USB connection to the ESP8266 NodeMCU. Instead, the VIN pin may be used to directly supply the ESP8266 and its peripherals while the 5V voltage source is regulated. An significant point is not pressing the reset button, so programs running on a similar device will reset it. Finally, owing to its simple and powerful features, NodeMCU ESP8266 is the most rational controller on the computerization scheme.

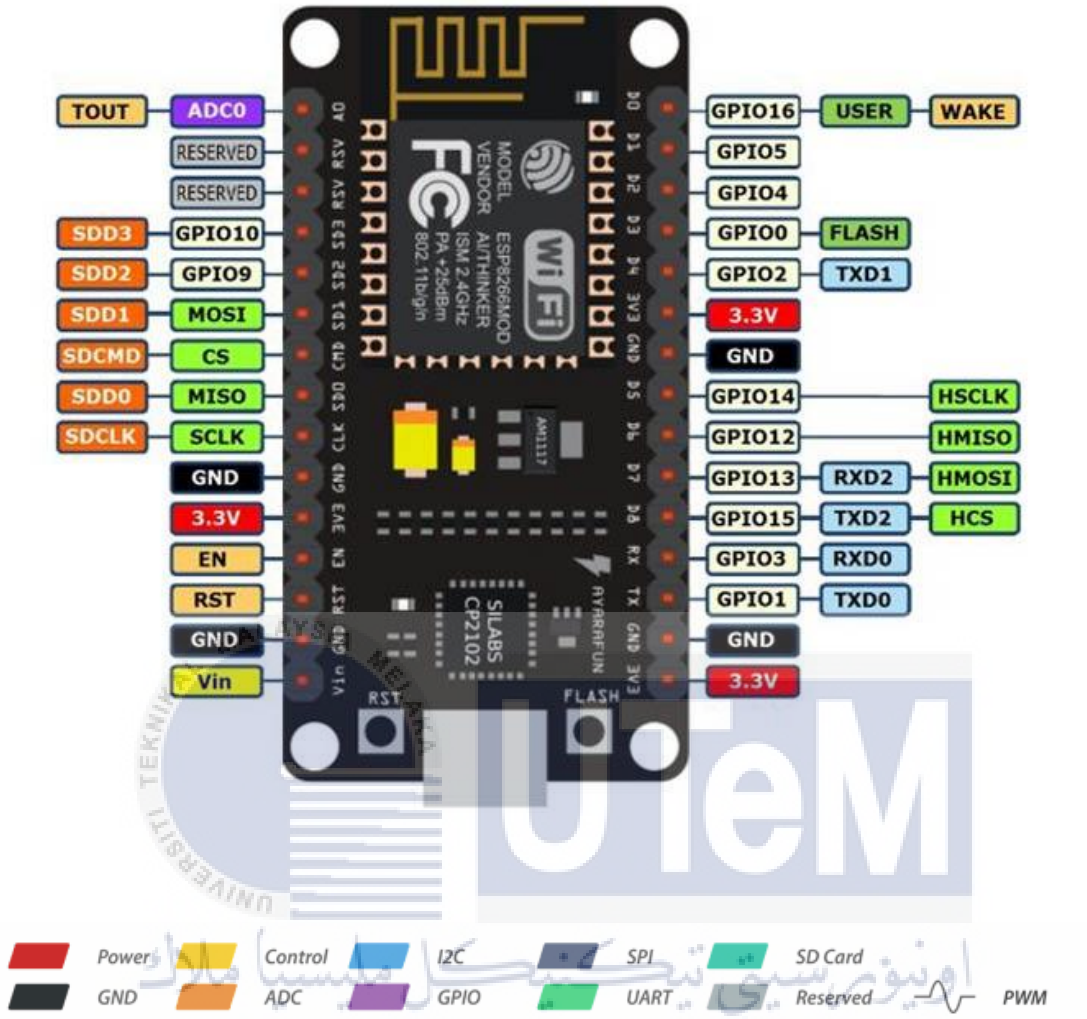


Figure 3.3: Schematic Diagram of NodeMCU ESP8266

| Pins | Function |
|---|---|
| Power Pins | • Four power pins viz.<br>• One VIN pin and three 3.3V pins.<br>• The VIN pin can be used to directly supply the ESP8266 and its peripherals<br>• The 3.3V pins are the output of an on-board voltage regulator. |
| GND | • Ground pin of ESP8266 NodeMCU development board. |
| 12C Pins | • Hook up all sorts of I2C sensors<br>• Can be realized programmatically, and the clock frequency is 100 kHz at a maximum. |
| GPIO Pins | • ESP8266 NodeMCU has 17 GPIO pins<br>• Assigned to various functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically. |
| ADC Channel | • Embedded with a 10-bit precision SAR ADC.<br>• Testing power supply voltage of VDD3P3 pin<br>• Testing input voltage of TOUT pin. |
| UART Pin | • 2 UART interfaces, i.e. UART0 and UART1<br>• Provide asynchronous communication (RS232 and RS485)<br>• Communicate at up to 4.5 Mbps. UART0 (TXD0, RXD0, RST0 & CTS0 pins) |
| SPI Pins | • 4 timing modes of the SPI format transfer |

| | |
|---|---|
| | • Up to 80 MHz and the divided clocks of 80 MHz<br>• Up to 64-Byte FIFO |
| SDIO Pins | • Directly interface SD cards.<br>• 4-bit 25 MHz SDIO v1.1 and 4-bit 50 MHz SDIO v2.0 are supported. |
| PWM Pins | • 4 channels of Pulse Width Modulation (PWM).<br>• Implemented programmatically<br>• Used for driving digital motors and LEDs. |
| Control Pins | • Used to control ESP8266.<br>• Pins include Chip Enable pin (EN), Reset pin (RST) and WAKE pin. |

**Table 3.1: NodeMCU ESP8266 Pinout Configuration**



## 3.3 Product Preparation

This section will discuss the product preparation process for the LPG leakage detection and NodeMCU ESP8266 to operate the gas leakage detection system in connection of internet with Wifi module. In this experiment, the result of LPG leakage detection system and NodeMCU ESP8266 were connected together in order to detect the gas leakage and security system circuit as LED , buzzer, Gas Valve and exhaust fan before testing the product system functionality.

### 3.3.1 Program Interpretation

Arduino 's C or C++ software is used to compiling and simulating product encoding and create a program that is the workspace troubleshooting and import the code from the product into the monitor. The NodeMCU ESP8266 uses programming C or C++ and in view of wiring. NodeMCU ESP8266 contains the Wiring library for simple interpretation of the input or output process. This software may be executed using 2 functions that are setup() and loop().

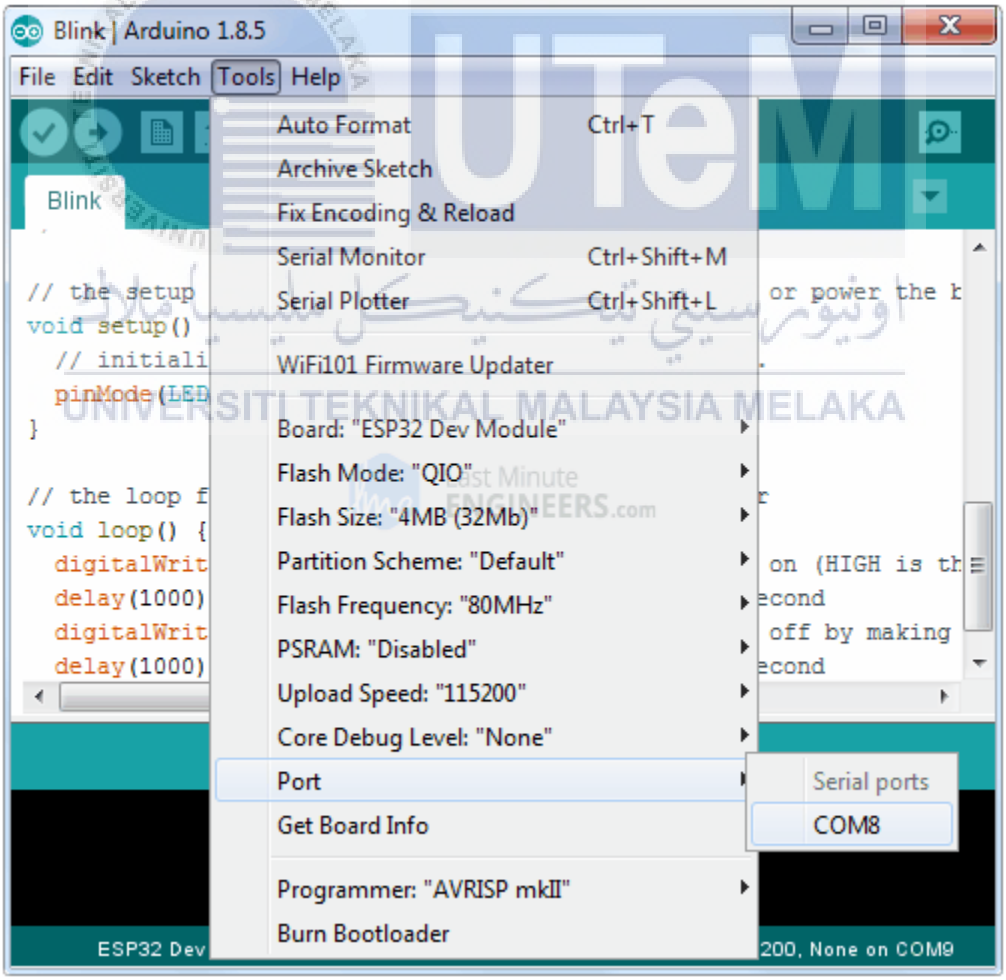


Figure 3.4 : The NodeMCU C++ interface

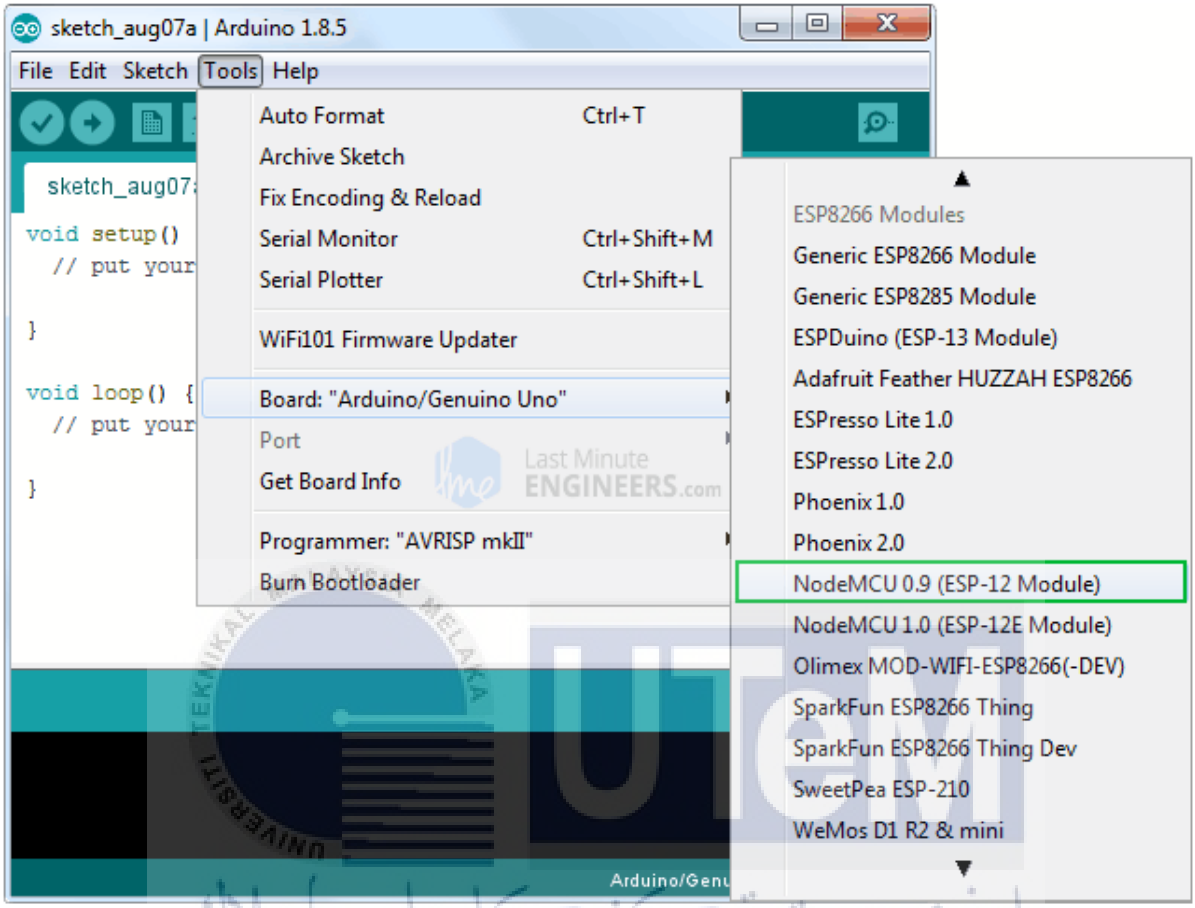


Figure 3.5 : NodeMCU C++ script

### 3.3.2 Hardware Designation

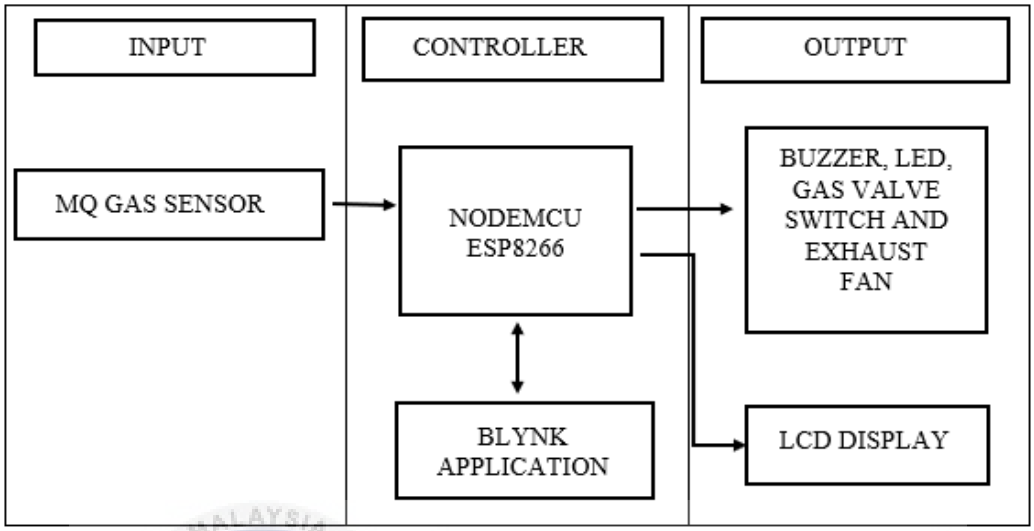


Figure 3.6 : Block diagram of input, output and the process for LPG leakage detection using NodeMCU ESP8266

The above block diagram defines the input and output of the part used in the process. Hardware functioning as input in this device is Gas detector. Meanwhile, the main output is gas valve switch and smartphone. The main power of this system is NodeMCU ESP 8266 Wifi Module. With this device, the Wifi module is essential as it can only link the internet when NodeMCU requires power to send and receive data to make the system run properly. The NodeMCU ESP 8266 is a microcontroller that will transmitting and reception of the signal via internet. All the data will be shown in the Blynk program.

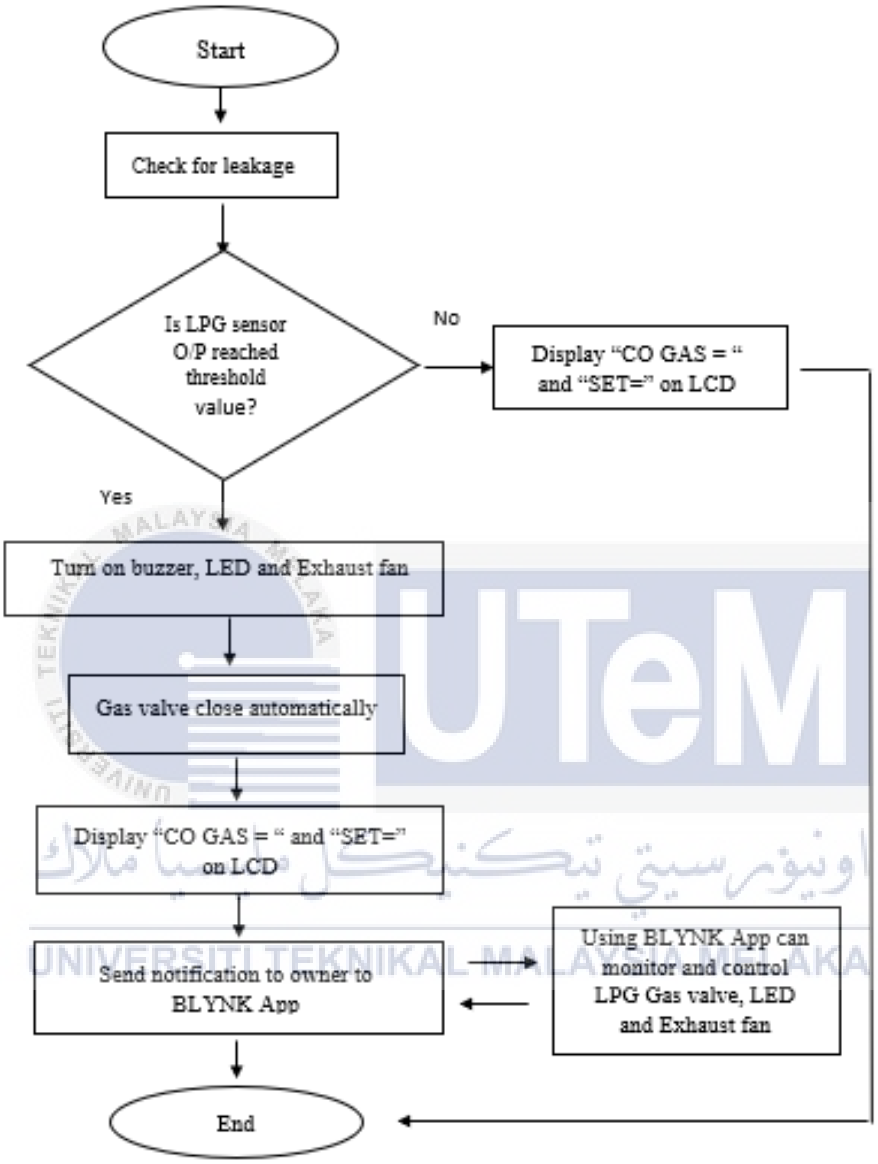


Figure 3.7 : Flowchart of Gas leakage detection system

The above flowchart shows the process of LPG gas leakage detection that operate systematically with major components such as NodeMCU ESP 8266 Wifi Module.

The major element is MQ 7 sensor which detect the leakage of the Liquefied Petroleum Gas. If the concentration is higher than or equal to the threshold value, the gas detector will function. Few components will be turn on when the gas leaks reach the threshold value, the components such as LED, Buzzer and Exhaust fan. The secure part of this project is once gas leaks reach threshold value, the gas valve close automatically. Moreover, LCD will display 'CO GAS=' and 'SET=' and also send notification to the owner via Blynk application. The LPG gas condition will be update in Blynk application and Blynk app can monitor and control Off the LPG gas and also the LED and Exhaust fan.

### 3.3.3 Product layout

This segment will clarify how to create a WIFI link to the ESP8266 NodeMCU. First, for the module, it will run the module on the NodeMCU and use the smartphone application to monitor the level of gas concerntration. Second, for the sensor, connect the MQ sensor to the NodeMCU ESP8266 and detect the gas concerntration of the LPG gas. In addition, NodeMCU ESP8266 is an open source that contains all elements of the platform, including hardware, software and documentation. Inside the NodeMCU ESP8266 program, it will be able to write code to send a system trigger instruction. In addition, the NodeMCU ESP8266 microcontroller connects to the LCD, the gas valve switch, the exhaust fan, the buzzer and the LED to warn and alarm users.



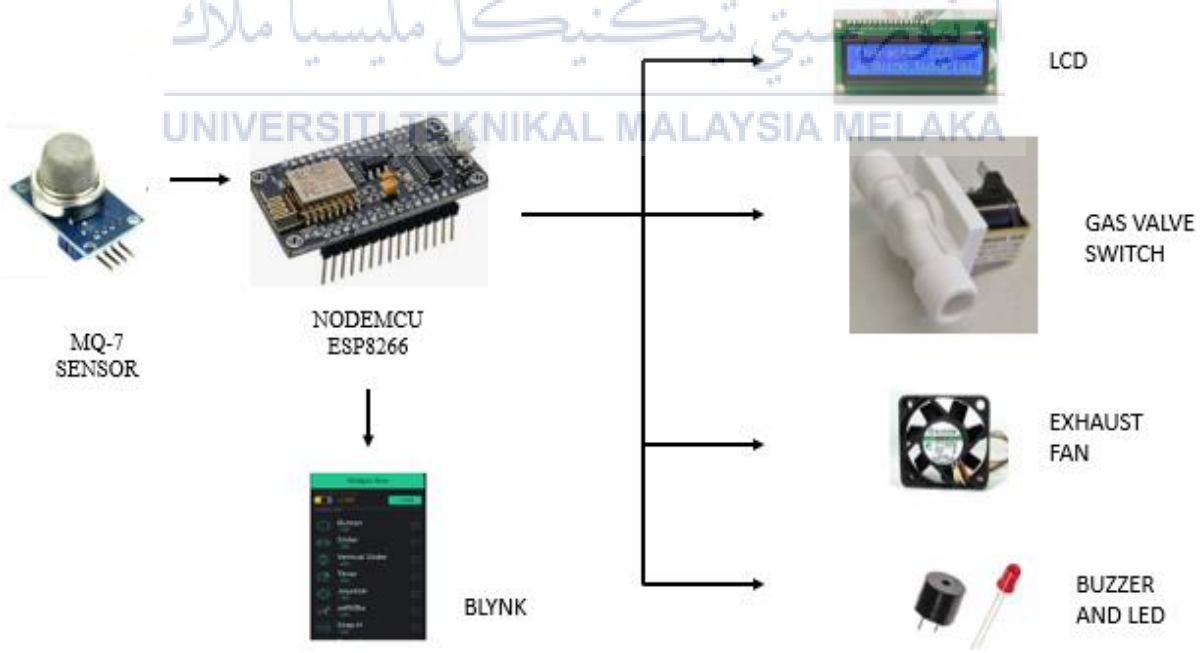


Figure 3.8: LPG Leakage Detection System with Blynk

## 3.4 Software Implementation

The software component is consisted of electronic projects and applications that used NodeMCU ESP8266 WiFi module networking to complete the android application to monitor and control the LPG gas valve. It is important to select the easy-to-understand program and framework that consumers will understand. Besides that, it is important to run the present android, and to adapt the software creation that is used for the program. The Blynk program will support users build the interface, since the framework connected to NodeMCU ESP8266 needs installing Blynk library to connect it to NodeMCU apps. If the library is connected, it simply needs to construct a sketch in NodeMCU ESP8266.

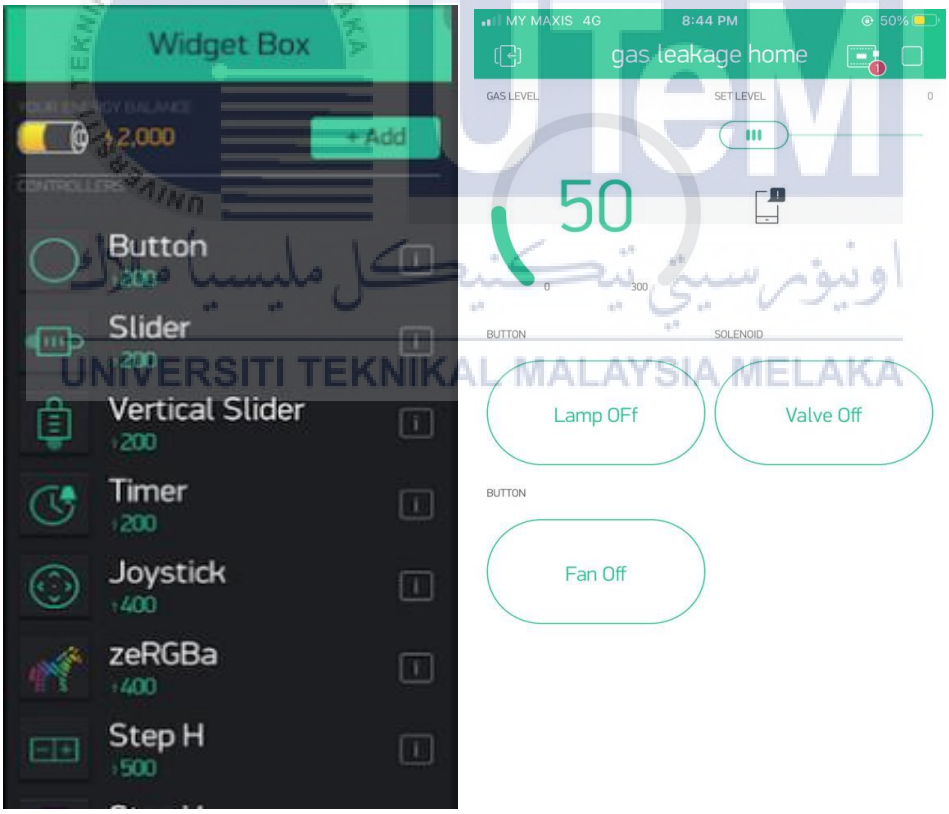


Figure 3.9 : Widgets found Blynk Iot Platform

## 3.5 System Application

Hardware includes the components or equipment required to develop the detection of LPG leakage. The use of the WiFi module with NodeMCU was important in order to create an excellent image and network for the device control. The key characteristics that would be considered for the determination of the NodeMCU ESP8266 WiFi module were sensitivity, cost, precision, range, steadiness and reaction time. As a part of this project, NodeMCU ESP8266 WiFi module, and Gas Detector will be used.

## 3.6 Testing

The ending step of this project will be the testing place for the support process. In this phase, the system must attempt to test and verify if the system is capable of functioning successfully without errors and problems in running the systems as is the specification supplied. If a few failures are detected in the system, the system will operate better again if the program is corrected. This technique is important since the monitoring of the system will avoid some errors. Then the users can use the functionality of the system without any errors.

## 3.7 Maintenance

Maintenance part is an incomplete component of the development of the project, because it is necessary to ensure that the system maintains recharge to suit the specifications and also manages the system so that the system can work properly. Rather than that, assistance has to be provided from time to time, as the problem may not appear immediately and explicitly. Users may choose other LPG leakage detection system that will detect the gas leakage and security frameworks that better manage lives if the device is not updated.

# CHAPTER 4

# RESULTS AND DISCUSSION

## 4.0 Results and Analysis

Here discusses and outlines the configuration of the liquefied petroleum gas leakage detection system and the use of Wi-Fi technologies. This research has analyzed the overall results of hardware and software testing and data form testing. NodeMCU ESP8266 is used for the monitoring of LPG leakage detection. The microcontroller NodeMCU ESP8266 is based on the wifi module ESP8266 and will use Arduino IDE to program. This project's hardware is interfaced with the software of the smartphone application to run and monitor the device. The ultimate process is therefore based on NodeMCU ESP8266. It plays a vital role in this system's functioning. The command will be control by android application through simulation from NodeMCU. Therefore, this section describes the added features used in the implementation of the software and the effective development of the hardware. Based on the overall result and analysis of this project, the device for the detection of LPG leakage is demonstrated by testing and troubleshooting, which is suitable for operating as planned as project 1 in the previous segment. There are some issues during the assembly checking of the system that seem to interrupt the process from progressing to the next stage. Both ESP8266 wifi module and Arduino Mega correct communication are the crucial components to start and end up the right way working system as planned earlier but when tried to interface both the hardware there are constantly pop up some errors and even after

troubleshoot several times. Therefore, after swapping both hardware with NodeMCU ESP8266, it can get performance and function well. In addition, the procurement of components and the identification of the correct components for the project are also important for the progress of the project.

## 4.1 Overall setup analysis of LPG leakage detection system

### 4.1.1 Software Analysis

The Arduino IDE software has been used in this project to program all the input and output components. Arduino IDE is an open source framework for this project that will build a complex mix of both hardware and software at one time. At Arduino IDE can write code and then upload it to the code executing microcontroller, interacting with inputs and outputs such as NodeMCU ESP8266, MQ-7 sensor, Exhaust fan, LED, gas valve switch, and Buzzer. It is compulsory for the software to be included in the Arduino IDE library and component board. To successfully run the coding, this project includes an existing library such as Blynk and software serial. Thus, libraries and boards are necessary for the board segment to run project coding without error messages in order to proceed to the next progression.

### 4.1.2 Hardware development

The hardware and components that have been used in this project are NodeMCU ESP8266, MQ sensor, Gas valve switch, Exhaust fan, LED, and Buzzer. Power supply give power connection to NodeMCU ESP8266 to be ON the overall system. There are three ways connection for MQ-7 sensor and NodeMCU ESP8266 been successfully done. First, there will be connection between A0 pin of NodeMCU ESP8266 and A0 pin of MQ-7 sensor, then connection from the ground ESP8266 connected to the ground of MQ-7 sensor, last connection between pin vcc MQ-7 sensor and pin 3V of NodeMCU. Then, the NodeMCU ESP8266 adapter use the connection from changes 5v to 3.3v because to avoid several damages to the microcontroller and to reduce the heat power. Therefore, if microcontroller connected directly with 5v then it might makes the module so hot. Then, proceed with connection of microcontroller with the output components. Initially, the LCD pins D4, D5, D6 and D7 where connected to NodeMCU output pins 8 to 11 and the LCD vss pin connected to voltage source. For the LED and buzzer, both are connected to the output pins of 6 and 3 of microcontroller and the ground pins are gathered. For the gas valve, the vss pin connected to 5v and have two input pins connected from the NodeMCU. Meanwhile, the NodeMCU is solder to the PCB board and other output are connected to PCB board through jumping wires.

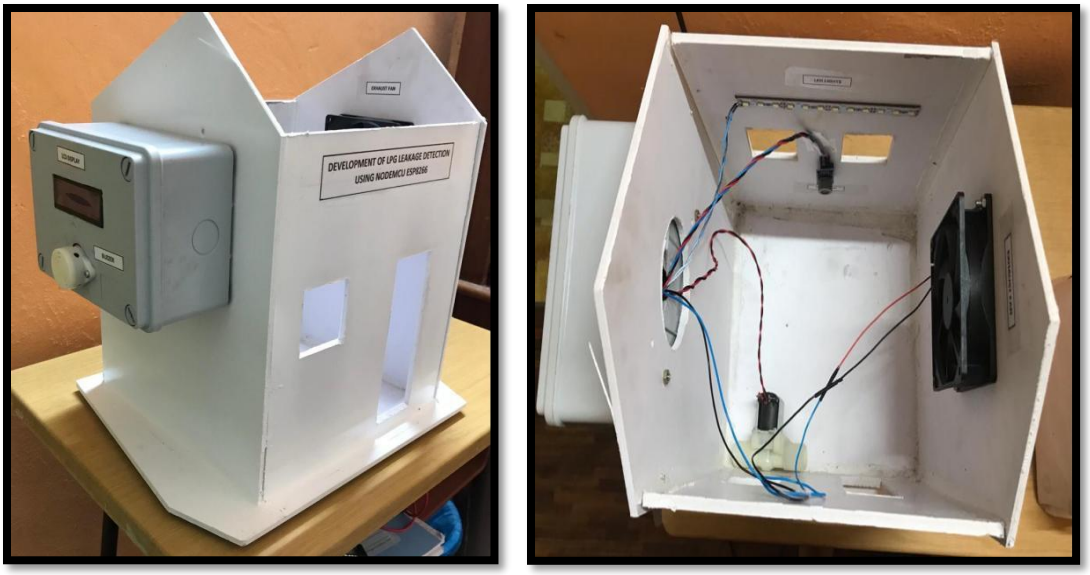


Figure 4.1: Full setup of hardware circuit

### 4.1.3 Blynk Application Analysis

This project uses the Blynk IoT mobile application as a source. The Blynk IoT is an open source cloud solution and as a platform used by IOS or Android to monitor and get data over the internet from any microcontroller via smartphone. Blynk's hardware library supports and operates for NodeMCU ESP8266. To build a prototype, Blynk is quick to use and is a feasible method. The first vital priority to identify, drug and insert into a digital dashboard known as the development of a graphical interface is the widgets in the Blynk app. Thus, 3 widgets are included and for this design, screen gas concerntration meters have also been used.

Hence, the LED, gas valve and exhaust fan are the three widgets. The gas valve is automatically closed in two ways that the gas concerntration reaches 65 ppm, and the second method is to shut the gas valve using Blynk application before the gas concerntration reaches 65 ppm. In addition, for the LED and exhaust fan, the fan and LED close automatically when the concerntrations decreases to a threshold value of 65 ppm. Otherwise, with Blynk app widgets in smartphones, users can close the fan and LED.

To end up, this project was designed to be more advanced and even innovative relative to prior projects found in Chapter 2 in previous journal sections. Therefore, the projects before are not typically using the Blynk application, the Blynk app is user-friendly and has a special function which is Blynk bridge. Another method of connecting between two ESP8266 modules is the Blynk bridge, or ESP8266 to ESP8266 communication. Using the Blynk cloud server as a live central transaction controller, it will interconnect all the works.

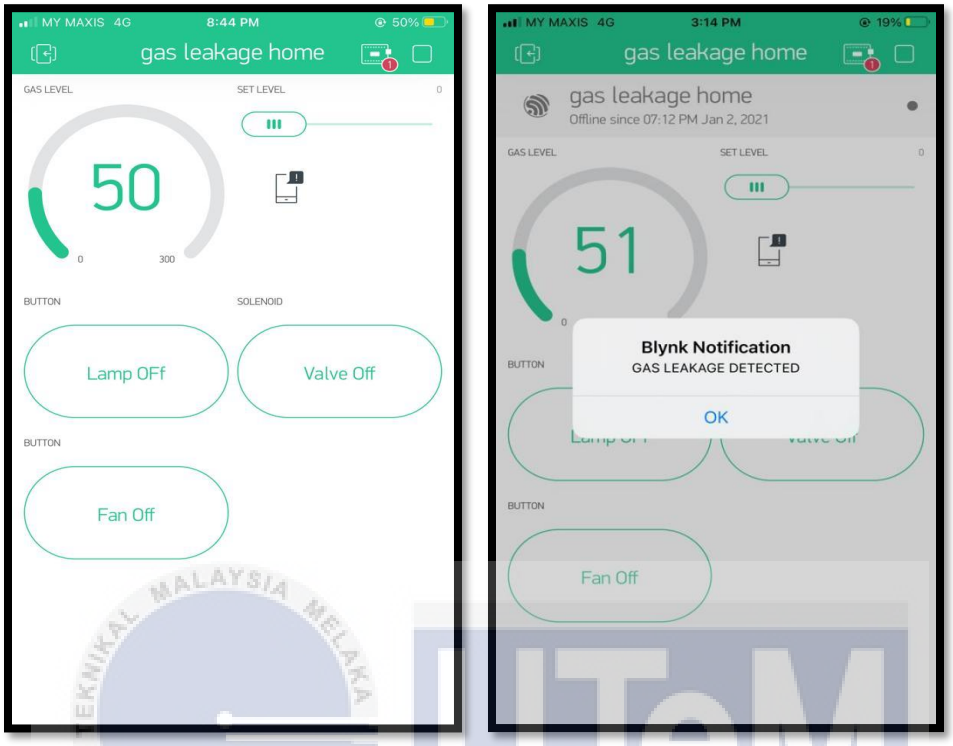


Figure 4.2: Overall project Blynk app setup

## 4.2 The Final Result of Project

The result has been obtained and recorded for the overall operation of these LPG Leakage detection system to prove that this project done with successful and able to commercial as it wanted to use by the users. The Gas concentrations had been adjusted and set in the Blynk app be the main result for this project to manipulate the analysis. LPG leakage detection system started with the MQ Sensor is set with gas concentrations threshold level of 65 ppm and function when gas concentrations level reach 65 ppm and above. Therefore, the gas valve close automatically and buzzer, exhaust fan, and LED on to clear and alert the users. Moreover, through Blynk app can control the gas valve, LED and exhaust fan when the mobile application notify with alert message to the users. Other than that, the system is performed with only gas concentration at the distance of the wifi module NodeMCU ESP8266, which is detected and analyzed through one complete result. Tables and graphs would also be discussed and analyzed after the results and integrated with a graph with both the input and output data to obtain more clear information needed for users.

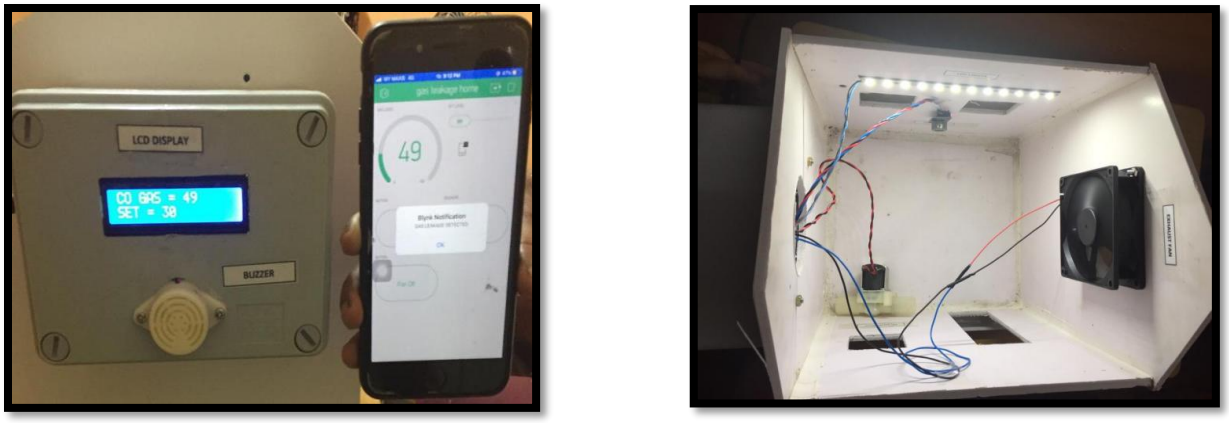


Figure 4.3: Full hardware and software set

### 4.3 Analysis for NodeMCU ESP8266 Duration with Data

This test is conducted with the NodeMCU ESP8266 wifi module to transmit and receive signal response and also interpret the collected data as seen in table 4.1. For certain distances, the time was taken for the result evaluation is from indoor. The gas sensor and the wifi module NodeMCU ESP8266 were able to detect and interact well from 10 cm to 40 cm from the test, the distance from 50 cm to 70 cm is medium response from the gas sensor, little weak when the gas sensor is placed between 80 cm and 90 cm. This takes a long time for the device to sense when the gas sensor is positioned above >100cm away. As from overall discussion, the overall system is capable for a connection as shown below in table 4.1.

| Distance(cm) | Overall transmit data status | Status of speed by NodeMCU ESP8266 Wifi Module | Time taken by NodeMCU ESP8266 Wifi Module (mins) |
|---|---|---|---|
| 10 | Achieve | Fast | <1.5 |
| 20 | Achieve | Fast | <1.5 |
| 30 | Achieve | Fast | <1.5 |
| 40 | Achieve | Fast | <1.5 |
| 50 | Achieve | Medium | 1.5 |
| 60 | Achieve | Medium | 1.5 |
| 70 | Achieve | Medium | 1.5 |
| 80 | Achieve | Slow | >1.5 |
| 90 | Achieve | Slow | >1.5 |
| >100 | Late | Too Slow | - |

Table 4.1. Overall data is transmitted and retrieved by NodeMCU ESP8266 Wifi Module

.

Therefore, seven different distances have been chosen to test NodeMCU ESP8266 Wifi Module to respond to the systems signal reception. In order to get the average time taken by the measurement process, the NodeMCU ESP8266 Wifi Module response with distances has been obtained for three different data. Table 4.2 displays the chosen time taken for NodeMCU ESP8266 Wifi Response Module depending on the distances specified. For reading distances between 10 cm and 20 cm, the response time of the ESP8266 Wifi module is approximately 1.37 minutes.

| Trial | Time taken of NodeMCU ESP8266 Wifi module to response (min) |
|---|---|
| **1** | **1.3** |
| **2** | **1.4** |
| **3** | **1.4** |
| **Average** | **1.37** |

Table 4.2: Selected time taken for NodeMCU ESP8266 Wifi module to response with 10 cm and 20 cm distances.



Then proceed positioning the device at a distance of 30 cm and 40 cm and the time taken for the NodeMCU ESP8266 Wifi module to respond was recorded. The average time taken is around 1.43 minutes shown in Table 4.3.

| Trial | Time taken of NodeMCU ESP8266 Wifi module to response (min) |
|---|---|
| **1** | **1.5** |
| **2** | **1.3** |
| **3** | **1.5** |
| **Average** | **1.43** |

Table 4.3: Selected time taken for NodeMCU ESP8266 Wifi module to response with 30 cm and 40 cm distances.

Next, table 4.4 below displays the recorded time taken for the NodeMCU ESP8266 Wifi module to react at distances of 50 cm and 60 cm. The average time reading of the NodeMCU ESP8266 Wifi module to response was equivalent to 1.53 minutes.

| Trial | Time taken of NodeMCU ESP8266 Wifi module to response (min) |
|---|---|
| **1** | **1.5** |
| **2** | **1.6** |
| **3** | **1.5** |
| **Average** | **1.53** |

Table 4.4: Selected time taken for NodeMCU ESP8266 Wifi module to response with 50 cm and 60 cm distances.

Table 4.5 shows the time taken by the NodeMCU ESP8266 Wifi module response from 70 cm and 80 cm distances. Thus, the NodeMCU ESP8266 Wifi module response at an average time reading of 1.77 minutes. This is because the LPG Leakage detection system placed quite far away from the butane gas.



| Trial | Time taken of NodeMCU ESP8266 Wifi module to response (min) |
|---|---|
| **1** | **1.6** |
| **2** | **1.8** |
| **3** | **1.9** |
| **Average** | **1.77** |

Table 4.5: Selected time taken for NodeMCU ESP8266 Wifi module to response with 70 cm and 80 cm distances.

Table 4.6 demonstrates the selected time taken to react to the NodeMCU ESP8266 Wifi module over distances between 90 cm and 100 cm. The average reading around 1.83 minutes. The reason behind was the system is far from the starting point.

| Trial | Time taken of NodeMCU ESP8266 Wifi module to response (min) |
|---|---|
| **1** | **1.8** |
| **2** | **1.9** |
| **3** | **1.8** |
| **Average** | **1.83** |

Table 4.6: Selected time taken for NodeMCU ESP8266 Wifi module to response with 90 cm and 100 cm distances.

Eventually, table 4.7 below indicates the time taken for the NodeMCU ESP8266 Wifi module to run over a distance of 100 cm. The estimated average read time is equivalent to 2.13 minutes to get the NodeMCU ESP8266 Wifi module to response. The range between the system and LPG gas was very long. While this makes it very slow and late for the NodeMCU ESP8266 Wifi module to respond.

| Trial | Time taken of NodeMCU ESP8266 Wifi module to response (min) |
|---|---|
| **1** | **2.1** |
| **2** | **2.2** |
| **3** | **2.1** |
| **Average** | **2.13** |

Table 4.7: Selected time taken for NodeMCU ESP8266 Wifi module to response with above 100 cm distances.

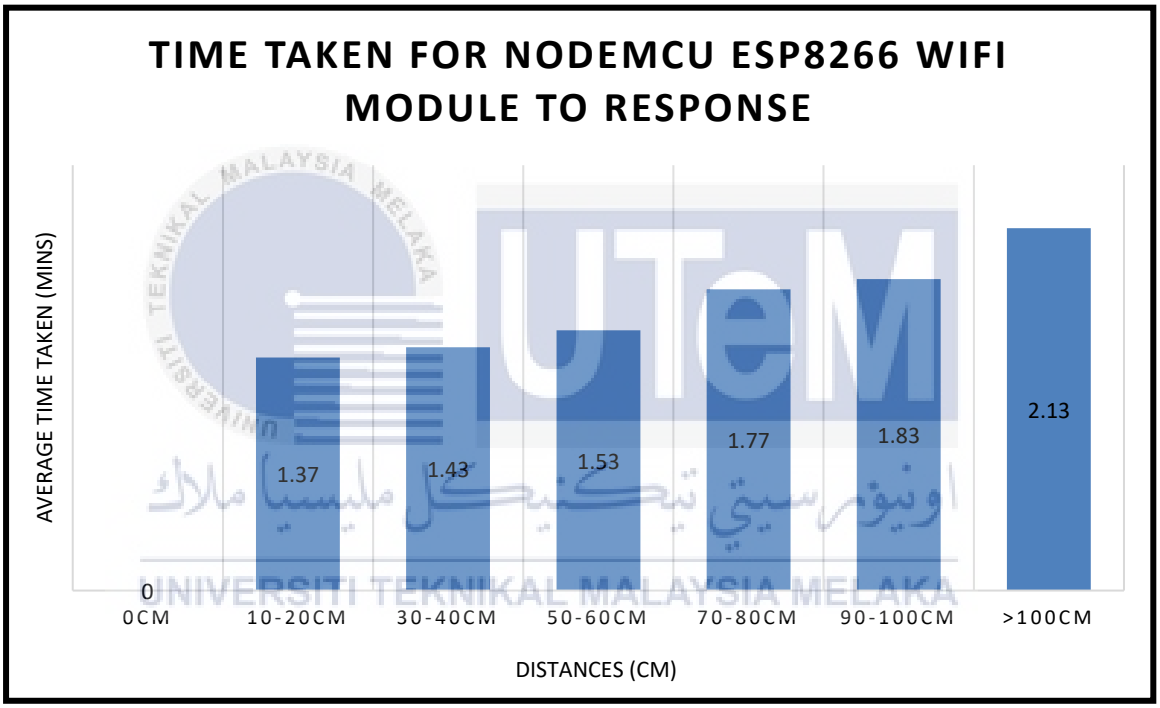


Figure 4.4: Graph shows Time taken for NodeMCU ESP8266 Wifi module to response with the chosen Distances (cm).

Based on data obtained from the testing of NodeMCU ESP8266 Wifi module with the seven distance range response was tabulated and outlined as Figure 4.4 in the graph above. The average time taken by the NodeMCU ESP8266 Wifi module to react to the distances was specified in Figure 4.4. The highest point is at distances above 100 cm, which requires more time to react by the NodeMCU ESP8266 Wifi module, which is 2.13 minutes. So this

project has been checked with distances very far apart and it reports that the NodeMCU ESP8266 Wifi module operates very late and time taken is too long. Meanwhile, the value of average time taken for distances with both 70 cm and 80 cm and the 50 cm and 60cm gradually same. The difference between two average time taken are 24 minutes which for 1.53 minutes from 50 cm and 60 cm while 1.77 minutes for 70 cm and 80cm distances. The NodeMCU ESP8266 Wifi module required approximately 1.43 minutes for the 30 cm and 40cm range distances to react. Due to higher signal power when it is mounted next to the hardware setup of this project, the NodeMCU ESP8266 Wifi module response at 1.37 minutes for the distance of 10 cm and 20 cm.

## 4.4 Project cost

The table below shows the components used and total cost of this project.

| No | Components | Quantity | Unit/Per Cost | Price (RM) |
|---|---|---|---|---|
| 1. | AC wire with Adapter | 2 | 20.00 | 40.00 |
| 2. | MQ-7 Sensor | 1 | 35.00 | 35.00 |
| 3. | NodeMCU ESP8266 Wifi module | 1 | 48.50 | 48.50 |
| 4. | Resistor | 12 | 0.40 | 4.80 |
| 5. | Voltage Regulator 3V | 4 | 2.20 | 8.80 |
| 6. | 12V Exhaust Fan | 1 | 4.20 | 4.20 |
| 7. | LED | 20 | 0.10 | 2.00 |
| 8. | Buzzer 6-12V | 1 | 3.00 | 3.00 |
| 9. | LCD | 1 | 11.50 | 11.50 |
| 10. | Gas Valve Switch | 1 | 45.00 | 45.00 |
| 11. | PCB | 1 | 18.00 | 18.00 |
| **Total** | | | | **220.80** |

Table 4.8: List of prices of different components

# CHAPTER 5

# CONCLUSION AND FUTURE WORK

## 5.0 Introduction

All the goals laid out in Chapter 1 will be concluded in this chapter. Other than that, this chapter also proposes future recommendations that are beneficial for further development and research.

## 5.1 Conclusion

To conclude, this method of LPG leakage detection using NodeMCU ESP8266 has successfully achieved the specified objective. The NodeMCU ESP8266 Wifi module was used to develop the LPG leakage detection system to monitor at anytime and anywhere. This project would allow users to use the Blynk application to detect the leakage of gas. Blynk app is a mobile application that can provide information and status via smartphone about LPG gas concerntrations . Blynk app program can be downloaded from Google Play Store and the application can receive data using the MQ 7 gas sensor that is able to support the ESP 8266 wifi module's Wifi connection. The performance for this device is not only Blynk App in addition to LCD, LED, exhaust fan and also mainly Gas valve switch that is used to close the gas valve if gas leakage happens and reach the risk state condition. Based on the designed results, the real time LPG leakage detection system has been working as expected. The concerntration of gas status consisting warning and danger alert were

displayed as an information to the users. So, it can be found that this LPG leakage detection project capable to detect, display, give alarm and clear the LPG gas at the affected area if gas leakage happens in the future and also notify the users through Blynk App.

## 5.2 Future Work

Future studies to improve the monitoring of LPG leakage for enhancement are outline. The first set of suggestions, is to use the Global Wifi Hotspot whenever the project is implemented. For example, there are line problem at some places which may interrupt the data receiving and transmitting for the Blynk application software. Therefore, by using strong wifi connection may give a strong communication between the system and Blynk application. Furthermore, the USB camera is also recommended to feed or broadcast the image of the area near the LPG gas in real time to or through a mobile network smartphone. The camera will easily monitor the condition of the home gas and user able to know the cause of the leakage happen whenever the LPG leakage happen in future. Other than that, the recommendation involved the use of the Blynk application to further advance the functionality of the LPG leak detection and alerting system.

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# APPENDICES

**Appendix 1: NodeMCU ESP8266 Programming code**

```
#include <LiquidCrystal_I2C.h>
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

#define led D5
#define fan D6
#define valve D7
#define buzzer D8
int set1 = 30;
int led1;
int fan1;
int valve1;

LiquidCrystal_I2C lcd(0x27, 16, 2);


char auth[] = "AJr9DYeC32gjI4s4YSZ-q6NA1ecRbZVG";
char ssid[] = "gas_leak1";
char pass[] = "gas_leak1";
int gas1;
void setup()
{
  lcd.init();
  lcd.backlight();
```

```
 Serial.begin(9600);
 pinMode(led,OUTPUT);
 pinMode(fan,OUTPUT);
 pinMode(valve,OUTPUT);
 pinMode(buzzer,OUTPUT);

 digitalWrite(led,LOW);
 digitalWrite(fan,LOW);
 digitalWrite(valve,LOW);
 digitalWrite(buzzer,LOW);

 beep();
 lcd.clear();
 lcd.setCursor(0, 0);
 lcd.print("Connect to wifi");
 Serial.print("Connecting to ");
 Serial.println(ssid);
 WiFi.begin(ssid, pass);

 int wifi_ctr = 0;
 while (WiFi.status() != WL_CONNECTED) {
 delay(500);
 Serial.print(".");
 }
 beep();
 beep();
   lcd.clear();
   lcd.setCursor(0, 0);
 lcd.print("WiFi connected");
 Serial.println("WiFi connected");
 delay(1000);
     lcd.clear();
   lcd.setCursor(0, 0);
 lcd.print("connect to blynk");
 Serial.println("connect to blynk");
 delay(100);

    Blynk.begin(auth, ssid, pass);
   lcd.setCursor(0, 0);
 lcd.print("blynk connected");
 Serial.println("blynk connected");
 delay(100);
 beep();
}
```

```
void loop()
{

  read_gas();
  display1();
  Blynk.run();

}

void read_gas()
{
  gas1 = analogRead(A0);
  if (gas1 > set1)
  {
   Blynk.notify("GAS LEAKAGE DETECTED");
    beep();

  }
   Blynk.virtualWrite(V0, gas1);
}


void beep()
{
    digitalWrite(buzzer,HIGH);
    delay(300);
    digitalWrite(buzzer,LOW);
    delay(100);

}
void display1()
{
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("CO GAS = ");
 lcd.print(gas1);
 lcd.setCursor(0,1);
 lcd.print("SET = ");
 lcd.print(set1);
 delay(200);
}
```

```
BLYNK_WRITE(V1)
{
  led1 = param.asInt();
  if(led1 == 1)
  {
  digitalWrite(led,HIGH);
  }
   if(led1 == 0)
  {
  digitalWrite(led,LOW);
  }
}

BLYNK_WRITE(V2)
{
  valve1 = param.asInt();
  if(valve1 == 1)
  {
  digitalWrite(valve,HIGH);
  }
   if(valve1 == 0)
  {
  digitalWrite(valve,LOW);
  }
}
BLYNK_WRITE(V3)
{
  fan1 = param.asInt();
  if(fan1 == 1)
  {
  digitalWrite(fan,HIGH);
  }
   if(fan1 == 0)
  {
  digitalWrite(fan,LOW);
  }
}

BLYNK_WRITE(V4)
{
  set1 = param.asInt();
}
```

## Appendix 2: Gantt Chart for PSM 1 and PSM 2

GANTT CHART PSM 1

| Project Activity | W 1 | W 2 | W 3 | W 4 | W 5 | W 6 | W 7 | W 8 | W 9 | W 10 | W 11 | W 12 | W 13 | W 14 | W 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Title Confirmation & Discussion with Supervisor | ■ | ■ | | | | | | MID TERM | | | | | | | |
| Finding Research Papers | | ■ | ■ | ■ | ■ | ■ | | | | | | | | | |
| Gantt Chart | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ |
| Chapter 1: Introduction | | | | ■ | ■ | | | | | | | | | | |
| Chapter 2: Literature Review | | | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | | | | | |
| Chapter 3: Methodology | | | | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | | | | |
| Slide Presentation | | | | | | | | | | | | ■ | | | |
| Draft Report | | | | | | | | | | | | | ■ | | |
| Final Report | | | | | | | | | | | | | | ■ | ■ |
| Compile and Turnitin PSM 1 | | | | | | | | | | | | | | ■ | ■ |
| Presentation 1 | | | | | | | | | | | | | | | ■ |
| Progress Report | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |



GANTT CHART PSM 2

| Project Activity | W 1 | W 2 | W 3 | W 4 | W 5 | W 6 | W 7 | W 8 | W 9 | W 10 | W 11 | W 12 | W 13 | W 14 | W 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PSM 2 Briefing | ■ | | | | | | | MID TERM | | | | | | | |
| PSM 2 Workshop 1 | | ■ | | | | | | | | | | | | | |
| PSM 2 Workshop 2 | | | ■ | | | | | | | | | | | | |
| Discussion with SV | | | | ■ | ■ | | | | | | | | | | |
| Progress Work 1 : Evaluation by SV | | | | | | ■ | | | | | | | | | |
| Discussion with SV | | | | | | | ■ | | ■ | ■ | | | | | |
| Submit Draft Report to SV | | | | | | | | | | | ■ | | | | |
| Progress Work 2 : Submit Final Draft Report to SV | | | | | | | | | | | | ■ | | | |
| Slide Preparation / Mock Presentation | | | | | | | | | | | | | ■ | | |
| PSM 2 Project Presentation | | | | | | | | | | | | | | ■ | |
| Evaluation by Examiner | | | | | | | | | | | | | | | ■ |
| Progress Report | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |