

POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

AUTOMATIC CUT OFF GAS USING IOT

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DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE : AUTOMATIC CUT OFF GAS USING IOT

SESSION : DECEMBER 2019

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is a final year student of **Diploma in Electrical Engineering, Department of Electrical, Politeknik Shah Alam**, which is located at **40150, Shah Alam, Selangor**. (Hereinafter referred to as 'the Polytechnic').

2. I acknowledge that 'The Project above' and the intellectual property therein is the result of our original creation /creations without taking or impersonating any intellectual property from the other parties.
3. I agree to release the 'Project' intellectual property to 'The Polytechnics' to meet the requirements for awarding the **Diploma in Electrical Engineering** to me.

Made and in truth that is recognized by;

a) **MUHAMMAD FARIS BIN ADNAN**
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(.....)
**MUHAMMAD FARIS BIN
ADNAN**

In front of me, **PUAN FA`IZAH BINTI
YA`ACOB** (Click here to enter text.)

)
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As a project supervisor, on the date:

ACKNOWLEDGEMENTS

Thanks to Allah S.W.T for granting me strength and time to accomplish my final year project. I am also would like to thank to those who were helped me directly or indirectly in making this final year project success.

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ABSTRACT

Nowadays gas leakage and gas detection is a major problem in our daily lives. Liquid Petroleum Gas (LPG) is highly flammable and can inflict damage to life and property. Gas leaks can happen without even realizing it. Sometimes it could forget to check the hose and gas regulator connection whether it is a leak or not well connected. The 'reminder' app on the smartphone can be a great way to remember a specific date or time. For example, a 'reminder' alarm is set for 5 minutes after cooking or heating something in the kitchen. The project will inform if the LPG gas is leakage when there is no one at home. LPG gas is currently the most used gas in home for cooking purposes. By using the application through the Internet of Things (IOT) it will notify the consumer there is a gas leakage in their home from anywhere in the world. If the gas is leak, the system will inform by activating the alarm. The aim is to reduce the risks in the kitchen and industries using the Internet of Things. The microcontroller that used is Arduino Uno R3. MQ-2 Gas Sensor used to detect gas leakages in a kitchen or industries. DC Gear Motor is used to rotate the gas regulator to 180° anti-clockwise. Relay is used for controlling the DC Gear Motor. With the help of Blynk application, it will send the notification to a smartphone by using Wi-Fi module ESP8266. The buzzer will operate when the MQ-2 Gas Sensor detects gas leaks.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

My project is about to avoid gas leakage in the kitchen whether at home or outdoors. My project will inform us if the gas is leakage when there is no one at home. By using android app trough Internet of Things (IOT) it will notify the user and automatically shut off the gas valve, from anywhere in the world. When the gas is leak the buzzer will activate before Internet of Things (IOT) notify the user.

1.2 Background Research

LPG (Liquefied Petroleum Gas or Liquid Petroleum Gas), is a flammable mixture of hydrocarbon gases used as fuel in heating appliances, cooking equipment, and vehicles. Safety has been an important thing for designing a home, buildings, cities and industries. The usage of the gas cylinder is rapidly increased but at the same time it is extremely dangerous, it can cause fire accidents. An efficient and fast working microcontroller is needed for monitoring and controlling purpose.

1.3 Problem Statement

Gas leaks can happen without ever realizing it. Sometimes it could be forget to check the hose and gas regulator connection weather it is leak or not well connected. The 'reminder' app on smartphone can be a great way to remember a specific date or time. For example, a 'reminder' alarm is set for 5 minutes after cooking or heating

something in the kitchen. The project will inform if the Liquefied Petroleum Gas (LPG) gas is leakage when there is no one at home. LPG is currently the most used gas in home for cooking purposes. Sometimes forget to turn off the burner which may also lead to damages. By using the application through Internet of Things (IOT) it will notify the user there is a gas leakage in their home from anywhere in the world. If the gas is leak, the system will inform by activating the buzzer.

1.4 Objective of Research

The main objective of this project is to avoid fire when there is a gas leak in the kitchen.

More specifically the principle objective of this research is:

1. To design an automatic cut off gas using Internet of Things (IOT).
2. To implement the solution when a gas leak in the kitchen but no one at home. Fires will occur when there is no fast action to be done.
3. To develop an application when there is a gas leak it will send the notification to smartphone.

1.5 Scope Research

My final year project is using hardware and software. One of the hardware I used is Arduino Uno. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs, light on a sensor, activating a motor, turning on an LED, publishing something online and more. Then, gas sensor (MQ2) detects combustible gasses and smoke. Gas sensor (MQ2) module is useful for gas leakage detection (in home and industry). The output voltage

from the gas sensor increases when the concentration of gas. Sensitivity can be adjusted by rotating the potentiometer.

Moreover, buzzer is a device which makes a buzzing or beeping noise. The buzzer will notify when the gas cooker is not turn off. Then, DC Gear Motor is used to shut off the gas regulator. The limit switch is used to turn off the DC Gear Motor when the gas regulator has rotate 180° anti-clockwise.

Furthermore, ESP8266 Wi-Fi Module is a self-contained SoC with integrated TCP/IP protocol stack that can give access to your Wi-Fi network (or the device can act as an access point). One useful feature of Uno Wi-Fi is support for OTA (over-the-air) programming, either for transfer of Arduino sketches or Wi-Fi firmware. ESP8266 is suitable to use for Internet of Things (IOT) projects. After that, jumper wires male-to-male and male-to-female are used to connect the input and output from Arduino Uno.

For software, I am using Arduino Ide. **Arduino** consists of both a physical programmable circuit

1.6 Project Significance

The project is about to avoid fire when gas leakage in the kitchen whether at home or outdoors. Furthermore, the product will inform if the gas is leakage when there is no one at home. By using an application through Internet of Things (IOT) it will notify the user and automatically shut off the gas regulator, from anywhere in the

world. When the gas is leak the buzzer will activate then it will automatically turn off the gas regulator by using DC Gear Motor before Blynk application send notification to the user.

1.7 Chapter summary

The chapter consists of the introduction of the project and the solution to avoid fires when a gas leak. Moreover, it also discusses a little bit about the components that are used. Lastly, it discusses about how the circuit will operate.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

These sections contain literature review that discuss about Liquefied Petroleum Gas (LPG) as the most fuel of cooking.

2.2 Recommended gas in the kitchen

Almost all the peoples are using Liquefied Petroleum Gas (LPG) as a fuel of cooking. LPG is flammable gas it has potential to cause fire accidents heavily. Liquefied Petroleum Gas (LPG) is a flammable mixture of hydrocarbon gases used in heating appliances and is an important source of energy for many homes and businesses in Malaysia. LPG, like Natural Gas, has relatively few chemical

components. Hence, it is easy to achieve the accurate fuel to air mix ratio so as to allow a complete combustion process. It's clean burning properties makes it an ideal substitute for traditional fossil fuels such as wood, coal and other organic matter.

In Malaysia, LPG is often used in homes for cooking. This energy source is usually supplied using gas cylinders, which limits the practicality of its usage. With Gas Malaysia's piped LPG system, you no longer have to face the constraints of storage or hazardous risks from using gas cylinders. Piped gas allows energy to be supplied to a variety of appliances besides the hob, such as water heaters and clothes dryers.

2.3 Control system

A control system is a set of mechanical or electronic devices that regulates other devices or systems by way of control loops. Typically, control systems are computerized. There are two main types of control loops: Open loops, which operate with human input, and closed loops, which are fully autonomous. Some loops can be switched between closed and open modes. When open, a switchable loop is manually controlled and when closed it is fully automated.

Programmable logic controllers (PLCs), programmable automation controllers (PACs), remote terminal units (RTUs), control servers, intelligent electronic devices (IEDs) and sensors are some of the elements of control loops that are in turn a part of control systems. The control loops that make up control systems are generally made themselves of a sensor, a controller and a final control element. The sensor reads the process variable or a related measurement. The controller receives the signal from the sensor and then forwards it to instrumentation, to remote terminal units and to final

control elements where the process variable is adjusted, to be kept constant at what is known as a set point.

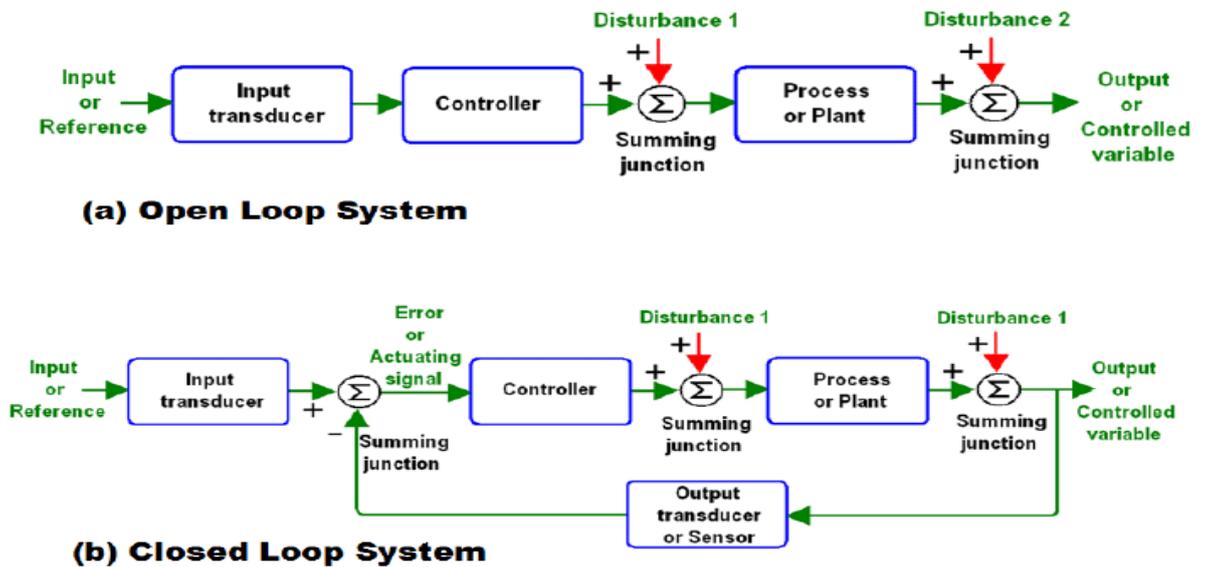


Figure 2.1 of open loop system and closed loop system

2.3.1 Microcontroller

Microcontroller is a term used to describe a system that includes a minimum of microprocessor, program memory, data memory and input-output (I/O). Some microcontroller systems also include timers, counters, analog to digital (A/D) converters and so on. It is basically a single chip computer used or embedded with other devices or equipment for control functions and is also called embedded controller.

2.3.2 Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

2.4 Chapter summary

In this chapter consists of LPG gas as a recommended gas in the kitchen. Then, the explanation of the close loop and open loop system. After that, the microcontroller that being used in the project.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

I have decided to make AUTOMATIC CUT OFF GAS as my final year project. I am using Arduino Uno R3, DC Gear Motor, Wi-Fi Module ESP8266, Single Channel 5V Relay, MQ-2 Gas Sensor and buzzer as the output. MQ2 Gas Sensor is one of the important parts in my final year project because it being used for sense the gas leakage.

3.2 Project design and overview

The main controller of this is Arduino Uno R3. Arduino Uno R3 is a microcontroller that controlled all components of the project. The reason of using Arduino Uno R3 as a microcontroller is the price is cheaper compared to others microcontroller. Moreover, Arduino Uno R3 is widely being used for many projects so the coding can be found easily.

The MQ-2 gas sensor is a sensor that connected with Arduino Uno R3. The Wi-Fi module ESP8266 also connected with Arduino Uno R3. It is used for send the notification through Blynk application when MQ-2 gas sensor is working.

3.2.1 Block Diagram of Final Year Project

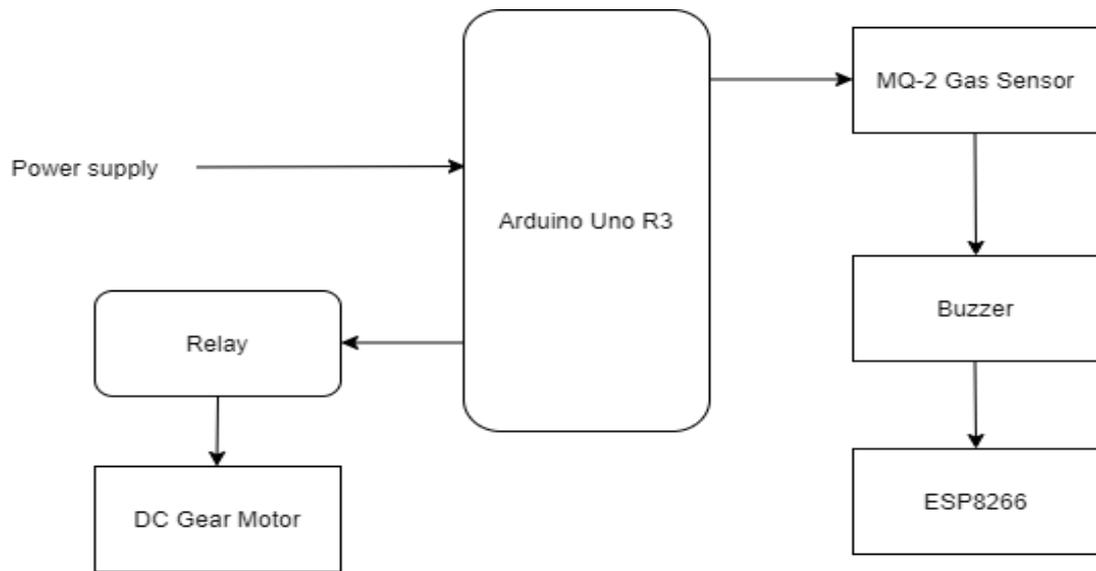


Figure 3.1 of Block Diagram of Final Year Project

3.2.2 Flowchart of the Final Year Project

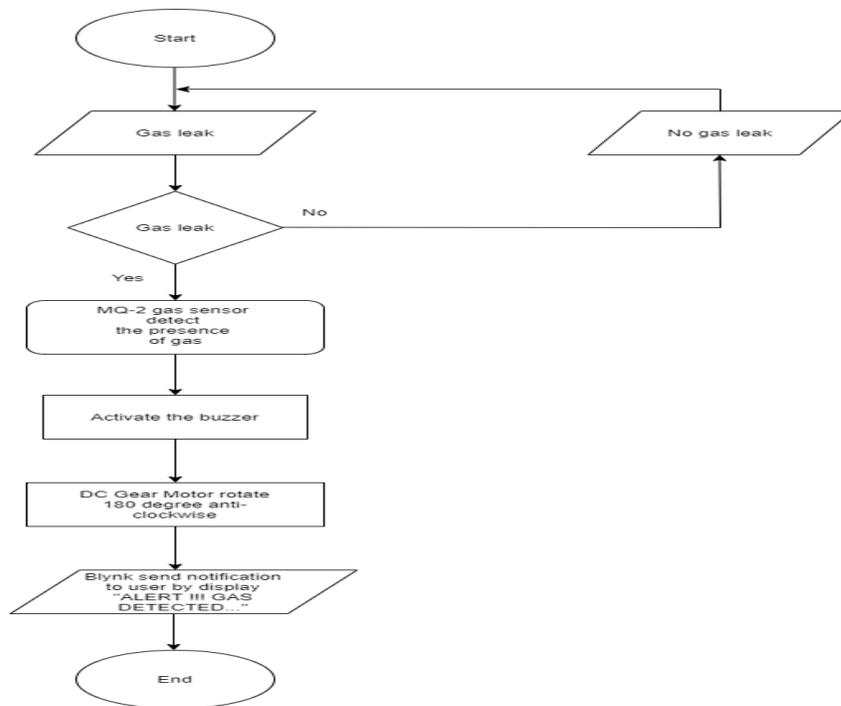


Figure 3.2 of Flowchart of the Project

3.3 Project Hardware for Final Year Project

The microcontroller of the project is Arduino Uno R3. MQ-2 gas sensor is a sensor that detects the presence of gas. DC Gear Motor to cut off the gas regulator by rotating 180° anti-clockwise. Then, Single Channel 5V Relay is to control the DC Gear Motor. The limit switch is to stop the circuit when DC Gear Motor rotates 180° anti-clockwise. Lastly, the buzzer will sound when MQ-2 gas sensor detects the presence of gas.

3.3.1 Schematic Circuit for Final Year Project

Figure 3.3 shows the circuit of Final Year Project by using Proteus

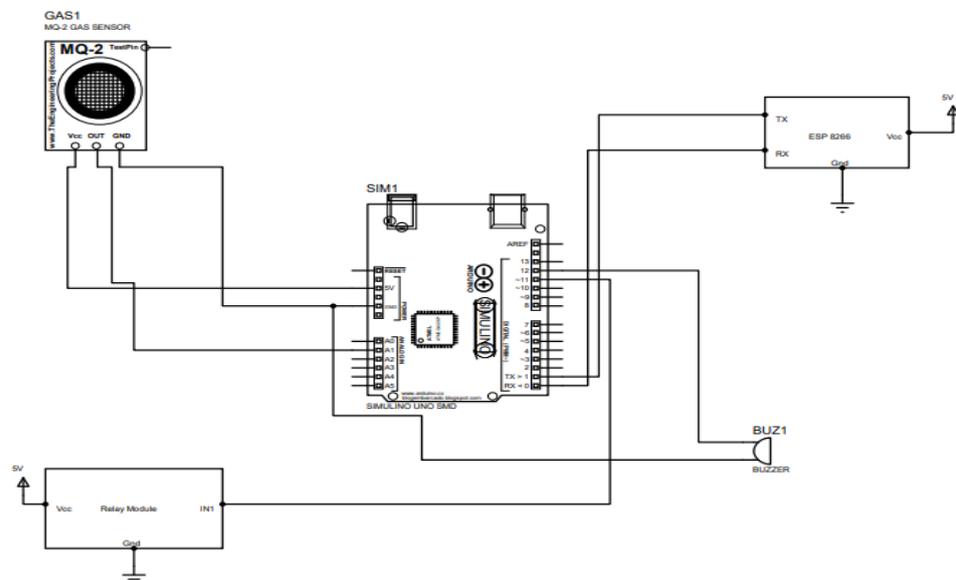


Figure 3.3 Circuit of Final Year Project

3.3.2 Description of main components

MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide. MQ2 gas sensor is also known as chemiresistor. It contains a sensing material whose resistance changes when it comes in contact with the gas. This change in the value of resistance is used for the detection of gas. MQ2 is a metal oxide semiconductor type gas sensor. Concentrations of gas in the gas are measured using a voltage divider network present in the sensor. This sensor works on 5V DC voltage. It can detect gases in the concentration of range 200 to 10000ppm.

These sensors are used to detect the presence of gases in the air such as methane, butane, LPG and smoke but they are unable to distinguish between gases. Thus, they cannot tell which gas it is. Module version of this sensor can be used without interfacing to any microcontroller and is useful when detecting only one particular gas. This can only detect the gas. But if ppm has to be calculated then the sensor should be used without module. This sensor is also used for Air quality monitoring, Gas leak alarm and for maintaining environmental standards in hospitals. In industries, these are used to detect the leakage of harmful gases.

3.3.2 Component 1 : DC Gear Motor

A Direct Current (DC) motor is a rotating electrical device that converts direct current, of electrical energy, into mechanical energy. A gear motor is an all-in-one combination of a motor and gearbox. The addition of a gear head to a motor reduces the speed while increasing the torque output. The most important parameters in regards to gear motors are speed (rpm), torque (lb-in) and efficiency (%). In order to

select the most suitable gear motor for your application you must first compute the load, speed and torque requirements for your application.

3.3.2.2 Component 2 : Wi-Fi module ESP8266

The ESP8266 is a System on a Chip (SoC), manufactured by the Chinese company Espressif. It consists of a Tensilica L106 32-bit micro controller unit (MCU) and a Wi-Fi transceiver. It has 11 GPIO pins* (General Purpose Input/Output pins), and an analog input as well. This means that it can program like any normal Arduino or other microcontroller. And on top of that, the Wi-Fi communication, use it to connect the Wi-Fi network, connect to the Internet, host a web server with real web pages, and let the smartphone connect to it. This chip has become the most popular IOT device available.

3.3.2.3 Component 3: Single Channel 5V Relay

The Single Channel Relay Module is a convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps and AC load. It is designed to interface with microcontroller such as Arduino, PIC and etc. The relays terminal (COM, NO and NC) is being brought out with screw terminal. It also comes with a LED to indicate the status of relay.

3.3.3 Circuit operation

The circuit operation of the Final Year Project is when the gas sensor detects the presence of the gas, the buzzer will sound. Then, it will make the Relay works to normally close. After that, the DC Gear Motor will automatically rotate 180° anti-clockwise until it touch the limit switch. After that, ESP8266 will send the notification through Blynk application to notify the user.

3.4 Project software

Software that being used in the project is Blynk application. Blynk is a Platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. . The UI of the Apps is shown below:

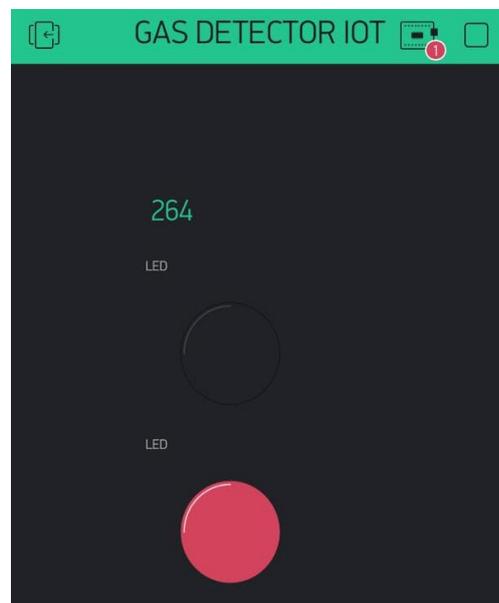


Figure 3.4 UI of the Blynk Application

3.5 Prototype Development

For prototype development I have decided to make gas sensor as my mini project. I am using Arduino Uno R3, MQ-2 gas sensor and buzzer as the output. We were assigned to create a mini project related to our final project, so I have chosen to make the gas sensor a mini project. Gas sensor is one of the important parts in my final year project because it being used for sense the gas leakage.

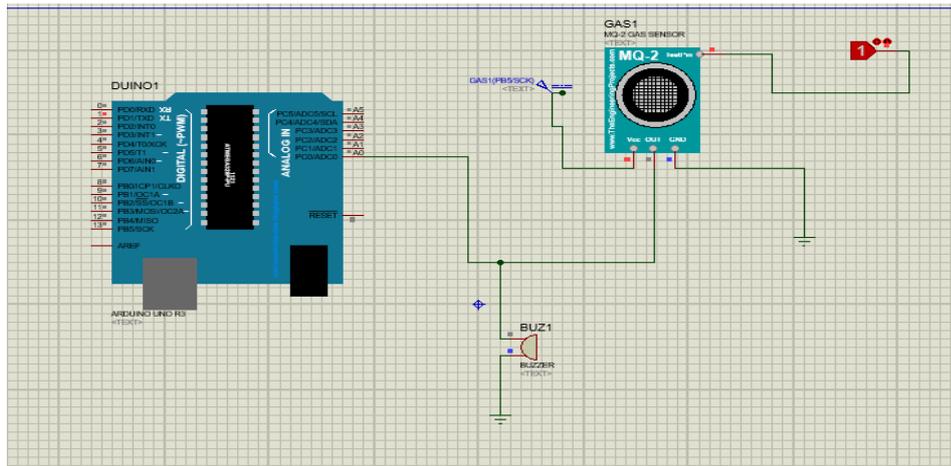


Figure 3.5 circuit diagram of Prototype Development

3.5.1 Mechanical design/product layout



Figure 3.6 front view of the project

3.6 Sustainability element in the design concept

The design show that the position of project box when DC Gear Motor is connected to gas regulator. The reason only used gas regulator instead of gas tank because it is easy to move the project.

3.7 Chapter summary

In this chapter consists of the components that being used in the project. Moreover, it shows the flowchart and block diagram of the project. Then, it discuss about the main components such as ESP8266, DC Gear Motor and Relay.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

This section contains the result and analysis that has been taken from LPG gas and disposable gas lighter. The purpose for using from LPG gas and disposable gas lighter is to record the temperature of the gas that can be detected by MQ-2 gas sensor. The temperature can be seen through Blynk application.

4.2 Result and Analysis

- a. LPG gas



Figure 4.1 of by using LPG gas

b. Disposable Gas Lighter



Figure 4.2 by using Disposable Gas Lighter

The data of LPG gas and Disposable Gas Lighter shown below

Type of gas	Temperature of MQ-2 gas sensor
LPG gas	135°C
Disposable Gas Lighter	750°C

Table 4.1 of data of LPG gas and Disposable Gas Lighter

4.3 Discussion

Two types of gas had been tested to observe the temperature and also to test the function of the project. Firstly, the MQ-2 gas sensor only can detect the gas by the range of below 2cm. The temperature of LPG gas is low than Disposable Gas Lighter because the MQ-2 gas sensor is located far from the gas leak. The gas is open from kitchen stove for 1 minute and there is no output occurred. Then, the temperature of Disposable Gas Lighter is high because the MQ-2 gas sensor is located

near the Disposable Gas Lighter. When the MQ-2 gas sensor detects the presence of gas, the buzzer will sound. The data can be seen from Blynk application or serial monitor of Arduino Ide by using Wi-Fi module ESP8266. After that, it will send the notification through the application by written “GAS LEAKS!!!”. From the Arduino Ide the coding has been set for Blynk application to keep monitoring if the temperature of MQ-2 gas sensor is below 260°C. The example of Blynk application is shown below.

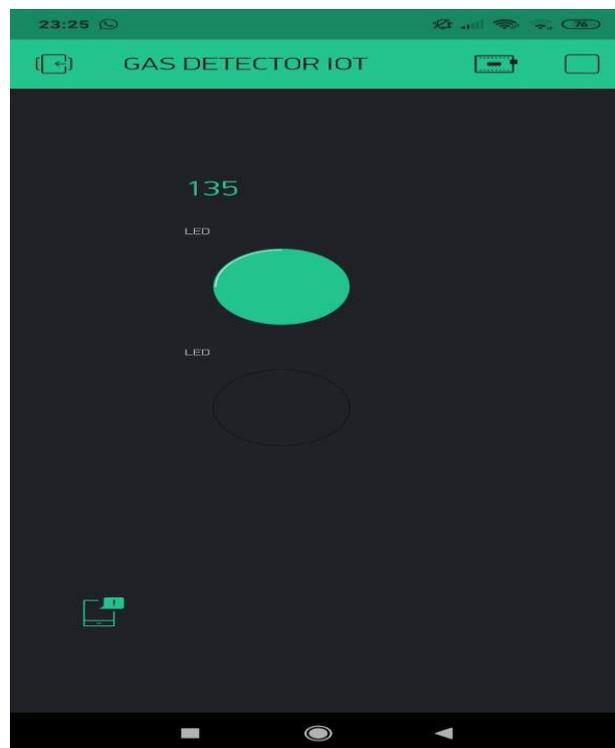


Figure 4.3 of gas temperature on Blynk application

The buzzer will automatically on when MQ-2 gas sensor detects the presence of gas for temperature more than 260°C.

4.4 Chapter Summary

There are two section of this chapter firstly discuss about type of gas that has been used to record the temperature that can MQ-2 gas sensor detects. Secondly, observing the output from the hardware when MQ-2 gas sensor detects the presence of gas.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

To summarize the overall results, the conclusion must be drawn in order to see the benefits of the project and also to improve the project to its fullest potential

5.2 Conclusion

In our modern scenario, the usage of LPG has increased in a greater manner. As a result of this, the damages caused by the leakage of gas are increasing day by day. So as to eradicate these problems the advanced system of Internet of Things (IOT) is being used. It is used in a wide range of applications in present-day society and introducing a vast scope to the future. Moreover, this final year project is more effective and eco-friendly due to the reason for detecting the leakage of gas by using MQ-2 gas sensor and cut off the gas regulator by using DC Gear Motor. So it is mainly designed for the safety of people and property. Using IOT, it will notify the user through Blynk application when there is gas leakage in their kitchen. Lastly, the project is recommended to household because they cook every day in the kitchen so the used of LPG gas is high.

5.3 Suggestions for Future Work

The project is suggested to be upgrade based on its limitations. The MQ-2 gas sensor should have detects the presence of gas in a range of more than 2cm. Then, the circuit should be working when there is a gas leak even the value of temperature not more than 260°C.

5.4 Chapter summary

In this chapter it discuss about the effective of the project and the future work that should be done to increase the project functions.

CHAPTER 6

PROJECT MANAGEMENT AND COSTING

6.1 Introduction

This chapter show about the project planning and the total cost that being spend to complete the project.

6.2 Gant Chart and Activities of the Project

Project timeline for DJK Final Year project

Timeline

NO	TASK	WEEK													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	SELECTION OF PROJECT TITLE														
2	DEFEND ON PROJECT TITLE														
3	MAKE RESEARCH AND PLAN ON THE PROJECTS														

4	IDENTIFY AND BUY THE COMPONENTS																		
5	COLLECT THE INFORMATION AND START THE PROJECT																		
6	MAKE A PROGRAM FOR THE PROJECT																		
7	IDENTIFY AND SOLVE THE PROBLEM FOR PROGRAM																		
8	INSTALLING THE COMPONENT																		
9	APPLYING THE PROJECT																		
10	PRESENTATION																		
11	MAKING A REPORT																		

Table 6.2 of Gant Chart

6.3 Milestone

AUTOMA

21	Task Name	Implementation	Duration (Days)	Cost (RM)	Date
	AUTOMATIC CUT OFF GAS USING IOT	Plan	98	675.00	
		Actual		367.00	
22	INSTALLATION	Plan	84	565.00	9/12/2019
		Actual	84	362.00	
23	INSTALLATION OF COMPONENTS ON PCB	Plan	35	25.00	9/12/2019
		Actual	42	0.00	
24	INSTALLATION OF WIRING	Plan	28	70.00	6/1/2020
		Actual	35	20.00	
25	INSTALLATION OF SOFTWARE	Plan	35	300.00	6/1/2020
		Actual	48	175.00	
26	INSTALLATION OF CONTROL CIRCUIT / SYSTEM	Plan	42	150.00	19/8/2019
		Actual	42	155.00	
27	INSTALLATION OF PROJECT CASING	Plan	28	20.00	3/2/2020
		Actual	35	12.00	
28	TESTING	Plan	91	20.00	17/2/2020
		Actual	91	5.00	
29	TEST THE ELECTRONIC PART	Plan	35	0.00	6/1/2020
		Actual	42	0.00	
30	TEST THE MECHANICAL PART	Plan	28	20.00	29/7/2019
		Actual	35	5.00	
31	TEST THE OVERALL PROCESS / PROJECT	Plan	28	0.00	13/1/2020
		Actual	35	0.00	
32	DOCUMENTS	Plan	98	90.00	9/12/2019
		Actual	98	0.00	
33	PREPARATION OF SLIDE PRESENTATION	Plan	28	10.00	17/2/2020
		Actual	35	0.00	
34	PREPARATION OF LOGBOOK	Plan	98	30.00	16/12/2019
		Actual	105	0.00	
35	PREPARATION OF PROJECT 2 FINAL REPORT	Plan	98	30.00	16/12/2019
		Actual	98	0.00	
36	PREPARATION OF INSTRUCTION MANUAL	Plan	42	20.00	24/2/2020
		Actual	49	0.00	
37	END	Plan	7	0.00	29/3/2020
		Actual	7	0.00	

Table 6.3 of Milestone

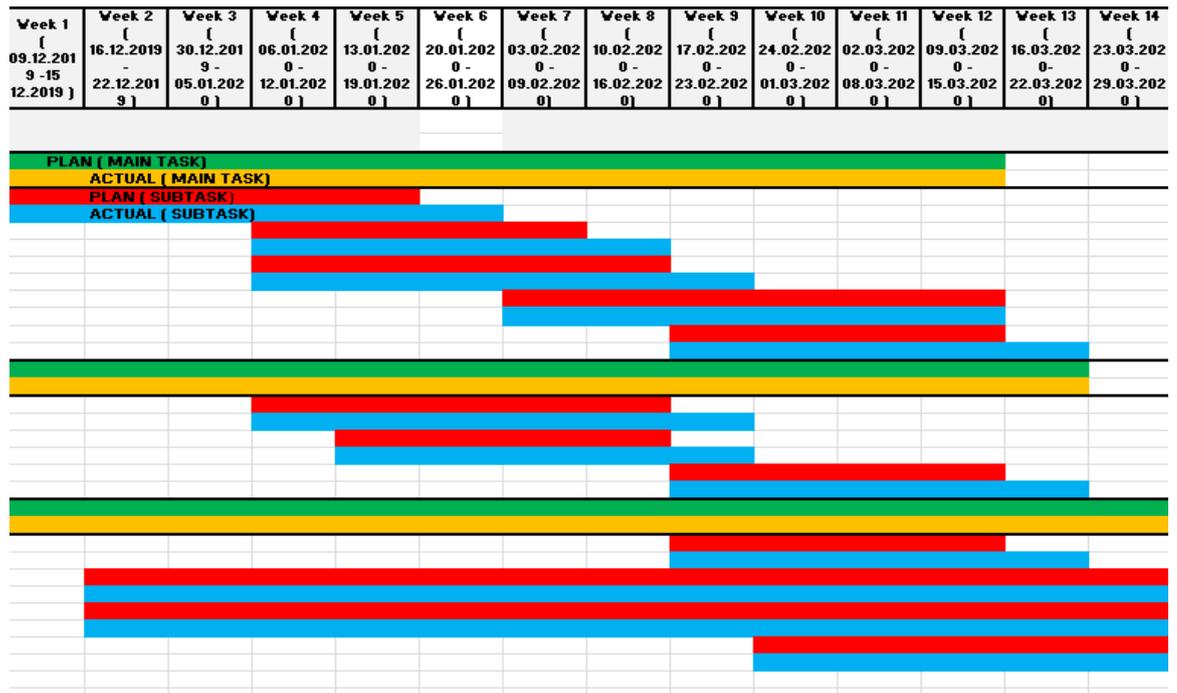


Table 6.4 of Milestone Bar

6.4 COSTING

BIL	ITEM	PRICE	QUANTITY
1	Project Box	RM12.00	1
2	Buzzer	RM1.40	1
3	MQ-2 Gas Sensor	RM13.00	1
4	Jumper wire male to female	RM3.00	40
5	Jumper wire male to male	RM3.00	40
6	Arduino Uno R3	RM27.00	1
7	Wi-Fi module ESP8266	RM10.00	1
8	DC Gear Motor	RM60.00	1
9	Single Channel 5V Relay	RM5.00	1
10	Gas regulator	RM25.00	1
11	Double sided tape	RM5.00	3
	TOTAL	RM174.40	

Table 2.4 of total costing

6.5 Chapter summary

In the chapter consists the total cost of the project that being spent. Then, it also shows the guideline of project planning.

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