INSTITUTE KEMAHIRAN MARA JOHOR BAHRU

HAZARDOUS GAS DETECTION WITH IoT

INSTITUTE KEMAHIRAN MARA JOHOR BAHRU for the
DIPLOMA IN GAS ENGINEERING
TECHNOLOGY

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ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious, the Most Graceful. I would like to express my sincere gratitude to Him for giving me the strength, health and ability to complete my project of “HAZARDOUS GAS DETECTION WITH IOT” and complete this report within the given time period. I also would like to extend my gratitude to my supervisor, En Ts. MUHAMMAD HASHRUL TAHPIZ BIN IBRAHIM. For his concerned, kindness, advised and helped to make sure my project is done nicely. Without his guidance from the beginning until the completion of this report, the progress of this project may stuck and cannot be done and documented success.

Last but not least, greatest credit goes to my parents and my siblings for their encouragement that make me strong when I encounter with any problems. I also would like to thanks all my lecturer, especially En Ts. MUHAMMAD HASHRUL TAHPIZ BIN IBRAHIM have been helping me directly from the beginning until the final stage in this project. Their opinion and suggestion is very useful. May all the good deeds that were done will be blessed by Allah.

ABSTRACT

As this world is raising in the development of technology and the human races, the surroundings in which we live in is endangered with black smoke, gases and some sort of chemical that would harm our life. However, one of the most accident that always happened in industry nowadays is gas leakage. The gas that usually leaks is LPG such as butane and methane. LPG is mostly used for cooking, heating, lighting and cooling. This gas is highly flammable, the leaks of this gas can be so dangerous because it increases the risk of explosion. Gas leaks in the industry have been occurring lately and have left many human lives at risk especially workers working in the industry. This happened because the workers could not detect the leak quickly and caused the missing gas to spread all over the place. There are some harmful gases that can be found in factories such as propane, methane and ammonia. Inhalation of those gas can cause euphoria, drowsiness, unconsciousness, asphyxia, cardiac arrhythmia, fluctuations in blood pressure and temporary memory loss, when abused directly from a highly pressurized container, and can result in death from asphyxiation and ventricular fibrillation. This gas is also highly flammable whereby it can cause a big explosion and cause death.

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CHAPTER 1

INTRODUCTION

1.1 Background Research

This gas can harm human's life by inhaling it for a few minutes because it can make us feel dizzy and fainted. In 6 December 2018, The explosion of a fast-food restaurant in the City ONE Megamall mall was believed to be caused by a butane-type liquid petroleum gas (LPG) leak. The incident resulted in 3 workers being killed as a result of collapsing walls and ceilings and injuring 41 other victims, including civilians visiting the mall. Retrieve from, Joni.M. (2018,December).Kebocoran gas dipercayai punca letupan https://www.bharian.com.my/berita/kes/2018/12/506078/kebocoran-gas-butanedipercayai-punca-letupan. In this cases, gas leak detector becomes necessary because it can help people from the danger of any gas leaks. There are several research papers have been published on gas leak detection techniques. We have studied a research articles about gas detector based on IoT from Sahu, L. K. (2017). Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ2Sensor. https://www.ijedr.org/papers/IJEDR1702333.pdf.. This document presents the detection using alarm and consists a Wi-Fi module that will inform the user by sending an SMS message to their phone. The LPG leak detection with reporting system has been introduced and can be used with alternating current. In this products, LCD and air valve is used and Arduino

Uno as a microcontroller and provide a power of + 5V. MQ-2 gas is used to detect LPG. In this project, butane and methane were used because it is affordable and it is easy to obtain compared to the others. Thus, this two gases are mainly used either in factory restaurants and home.

1.2 Problem Statement

Gas leaks in the industry have been occurring lately and have left many human lives at risk especially workers working in the industry. This happened because the workers could not detect the leak quickly and caused the missing gas to spread all over the place. There are some harmful gases that can be found in factories such as propane, methane and ammonia. Inhalation of those gas can cause euphoria, drowsiness, unconsciousness, asphyxia, cardiac arrhythmia, fluctuations in blood pressure and temporary memory loss, when abused directly from a highly pressurized container, and can result in death from asphyxiation and ventricular fibrillation. This gas is also highly flammable whereby it can cause a big explosion and cause death. According to BERNAMA on 9 May 2022 reported that five families were injured after their house in Taman Cenderawasih, Nibong Tebal exploded, believed to be due to a gas leak in last night's incident.

1.3 Research Objective

I. To design micro-controller system detector and alarm towards LPG and NG gas.
II. To develop a product using automatic alarm system and control system to prevent the gas leakage to spread out by using MIT App Inventor.

1.4 Scope of Research

Our idea is to develop a gas detector only for two types of gases, which is LPG and NG. This sensor only detects a gas at a time and the concentration scope is 200-10 000 Ppm. The type of the micro-controller that we used in this project is Arduino Uno that support a 5V power supply.

1.5 Project Definition of Terms / Operation

- Buzzer

  A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

- Butane

  Butane is one of the organic compound that contain C4H10 and it is an alkane that consist of 4 carbon atoms. Butane is a gas that highly flammable and this gas is one of the LPG gases.

- Sensor

  A sensor is a device, module, machine, or subsystem that is used to detect events or changes in the environment and send the information produce to other electronics. A sensor is always being used with other electronics components. The uses of sensors have been expanded beyond the traditional fields of temperature, pressure or flow measurement.

- Solenoid Valve

  Solenoid valve is an equipment that is efficient to converting electric signal into pneumatic functions. By applying electricity to the solenoid, it will quickly direct air through the valve and into the circuit. The quick response time and high flow rates make the pneumatic solenoid valves a suitable equipment to be used in numerous applications.

1.6 Chapter Summary

We can conclude that this kind of leakage are really harmful because it may also damage your heart by causing irregular heart beat and high blood pressure. It may also reduce blood cells, damage lungs and cause liver and kidney inflammation. Explosion from LPG can result in serious burns and can cause multiple injuries and even, death.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this topic, we will explain about the studies that have been conducted by other existing parties where the study is related to the project field that is being executed. We also accommodate relevant issues that can be an evidence of interest on the objectives of the study.

2.2 Theory / Concept

LPG leakages are a mutual hindrance in household and manufacturing nowadays. It is very life threatening if you will not distinguish and modified right away. The idea about our project is to give a solution by power cut the gas pipeline as soon as a gas leakage is perceived and activating the sounding alarm. In addition to this, the authorized person will receive a message informing him about the leakage. There is existing product built by some people which is use arduino, speaker MQ-2 sensor and small turbine. Their concept of project is to eliminate gas concentrations in order to avoid fires or explosion by using the small turbine. Meanwhile our project use solenoid air valve to cut off the gas pipeline to stop the gas pipeline from transporting the gases. In addition, this project will need medium such as Arduino Uno to connect the arduino to a smartphone to act a short message informing the authorized people about the leakage.

2.3 Previous Research

According to ABS-CBN news 2017 that from January to June last 2017, the BFP has recorded a total of 2,522 fire incidents. It was confirmed that LPG is one of the major cause of fire and explosion happened during year where half of the total which is 1,253 beside from the electrical causes.

Arduino Uno is a hardware that has output and input pin for input and output component. Our recommendation is to use Arduino Uno as platform to upload a software to run our projects. The sensors used are MQ-2 that are functional sensors for gas detection including butane and methane. Our plan is to build a warning system and use air valve as a casting for the leaking gas channels. Among the other components that are used are the 12V adaptor to give power supply to the solenoid valve.

Based on existing, they used Arduino Uno board as a microcontroller and connect it with a Wi-Fi module. Alshammari, B. F., & Chughtai, M. T. (2020, December 16). IoT Gas Leakage Detector and Warning Generator. https://www.etasr.com/index.php/ETASR/article/view/3712. So we improve the product by changing the microcontroller from Arduino Uno Wi Fi to Bluetooth as they already had it attached to the board. It will make it easier for user to create the coding and it will be shorter.

2.4 LPG Gases

LPG stand for Liquefied Petroleum Gas. This gas is highly flammable mixture of hydrocarbon which is found used in fuel heating appliances, cooking equipment and vehicles. “(LPG or LP gas), is a flammable mixture of hydrocarbon gases used as fuel in heating appliances, cooking equipment, and vehicles. It is increasingly used as an aerosol propellant and a refrigerant, replacing chlorofluorocarbons in an effort to reduce damage to the ozone layer.” LPG can be compressed at a ratio of 1:250, which enables it to be marked in portable containers in liquid form and it is safe fuel and ignites only within the specified LPG-Air ratio of 2% to 9%. A high calorific value of 11,900 Kcal/Kg results in high efficiency heat output. LPG is set up by refining petrol or "wet" flammable gas, and is predominantly gotten from petroleum derivative sources, being produced during the refining of oil (unrefined petroleum), or removed from oil or flammable gas streams as they rise out of the ground. It was first delivered in 1910 by Dr. Walter Snelling, and the main business items showed up in 1912. It as of now gives about 3% of all energy devoured, and consumes generally neatly with no sediment and not many sulphur outflows. As it is a gas, it doesn't present ground or water contamination risks, yet it can cause air contamination. LPG has a regular explicit calorific estimation of 46.1 MJ/kg contrasted and 42.5 MJ/kg for fuel oil and 43.5 MJ/kg for premium evaluation petroleum (gasoline).[8] However, its energy thickness per volume unit of 26 MJ/L is lower than either that of petroleum or fuel oil, as its overall thickness is lower (about 0.5–0.58 kg/L, contrasted with 0.71–0.77 kg/L for gas). The only way to predict the leakage of the LPG gas is by its smell followed by detergent solution application method for spot identification.

2.5 MIT App Inventor

Figure 1 . MIT Application

MIT application is an IoT platform for iOS or Android smartphones that is utilized to control Arduino, Raspberry Pi and NodeMCU through the Internet. This application is utilized to make a graphical interface or human machine interface (HMI) by aggregating and giving the suitable location on the accessible gadgets. MIT was intended for the Internet of Things. It can handle equipment distantly, it can show sensor data, it can store data, visualize it and do numerous other things.

2.6 (ISIS) Proteus 8 Professional

Figure 2 . Proteus 8 Professional

Proteus 8 is an application for PC or computer. Proteus 8 are used for design a simulation circuit before wired it in the real circuit. Furthermore, this app contains many libraries (electronic component) such as buzzer , arduino uno r3 etc make Proteus 8 app is suitable for designing a simulation circuit for our project.

2.7 Chapter Summary

We learn about the studies that have been conducted by other existing parties where the study is related to the project field that is being executed. It also accommodate relevant issues that can be an evidence of interest on the objectives of the study.

CHAPTER 3

METHODOLOGY

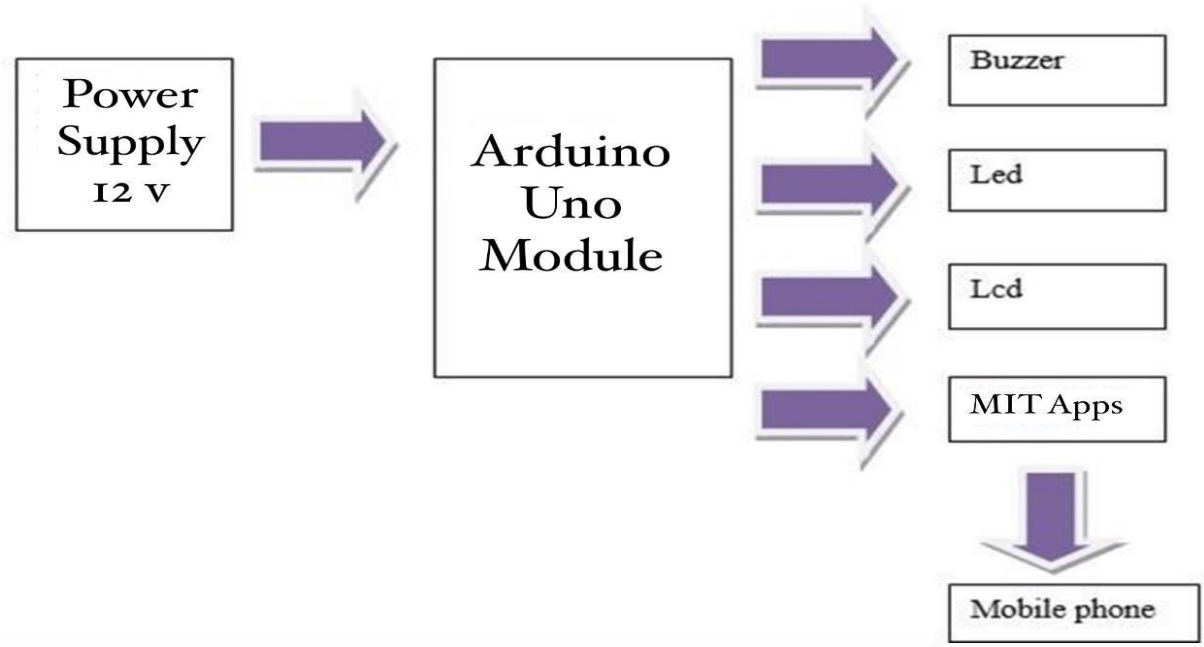
3.1 Introduction

In methodology, there are process to develop this project. The methodology consists on how we develop a software using arduino app and how the outer design/layout of the project. We also will provide flow chart for software and hardware we developed. Also include a drawing for outer layer.

3.2 Project Design And Overview

Algorithms techniques application used is Arduino Source Code. Then compiled it using Arduino application. Built a source code using arduino application for our project and also already sketched the simulation using Proteus 8 Professional application. Furthermore, source code is built and sketched the simulation by referring internet and do some modifications.

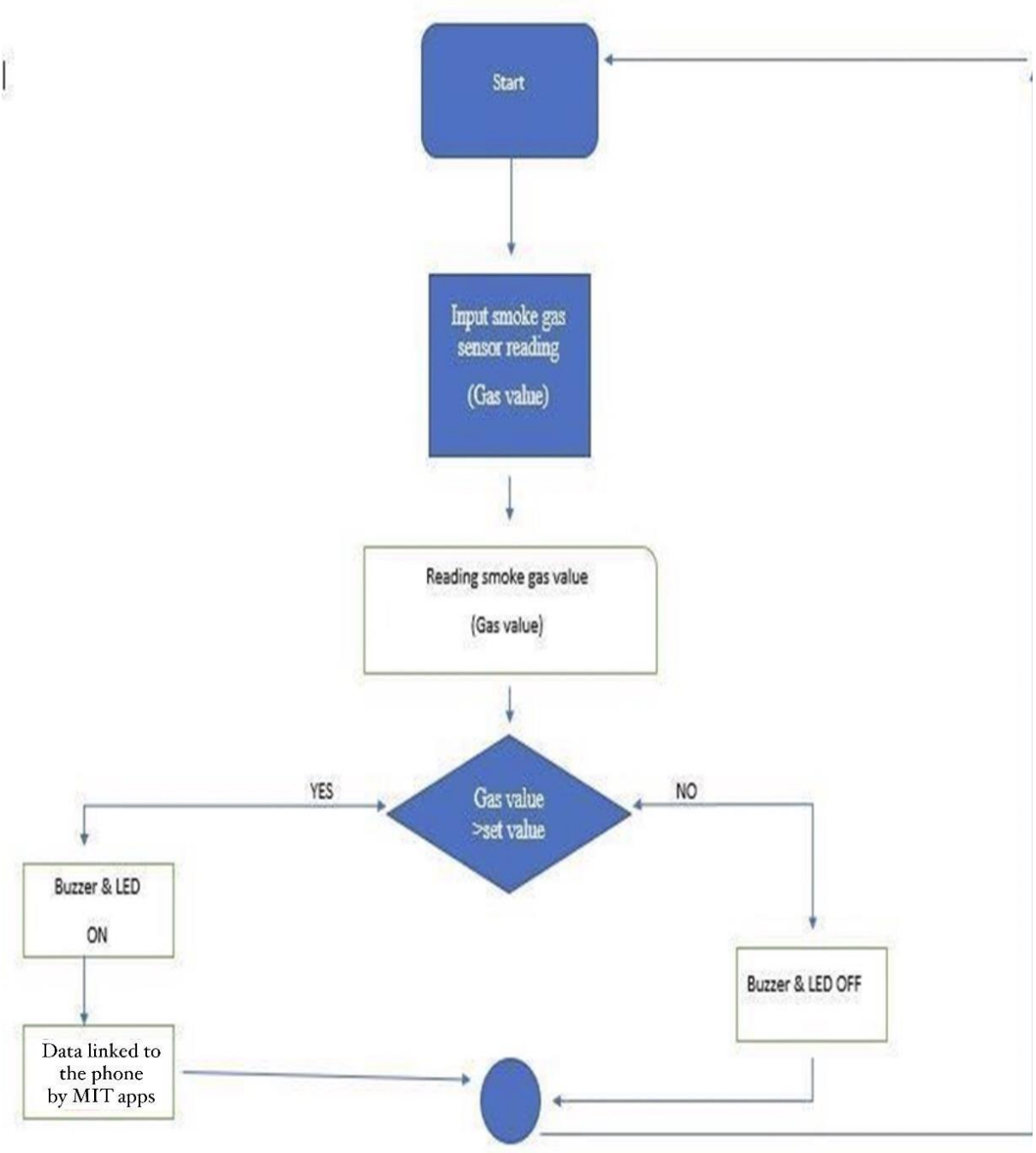
3.2.1 Block Diagram of the Project



Description of Block Diagram

1. Temperature sensor **:** It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin
2. Smoke sensor **:** Detect smoke and surrounding air.
3. Arduino Uno : This system is used as a microcontroller for controlling all the activities of all the modules involved in the process. This kit is embedded inside the smoke sensor.
4. Buzzer : The buzzer will be sound when the smoke reach the target.
5. MIT App: To give alert notification to the phone when smoke were detect.
6. Mobile phone : MIT app will connect in mobile phone to get the info and the notice will pop up on the phone.
7. LCD : Display the temperature and contain of air when the sensor detect the smoke.

3.2.2 Flowchart of the Project



3.2.3 Project Description

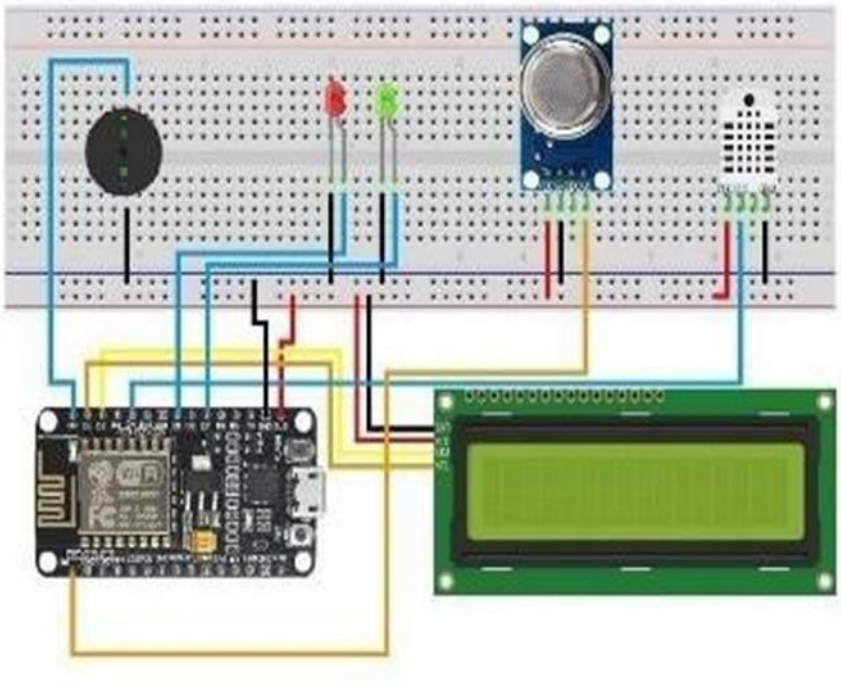
In this project, materials chose are based on their cost, size and ability. Arduino Uno is used because the price is affordable, the size is medium and we have learned to compiled source code for it. Next component is MQ-2 sensor, this sensor is capability to detect LPG gas and smoke, this sensor is able to detect butane and methane gas because butane and methane gas is one of LPG gases. For selecting Solenoid Air Valve, this valve has a small size and have low cost, so this valve is used to cut the gas flow in the pipeline. Other than that, Butane and Methane gas are used because the cost is cheaper than the other LPG.

3.3 Project Hardware

Figure 3.2 (MQ-2 Sensor)

It is a perfect sensor to identify the presence of an unsafe LPG leak in our domestic or in a service station, capacity tank environment and indeed in vehicle which employments LPG gas as its fuel. This unit can be effortlessly consolidated into an alert circuit/unit, to sound an alert or give a visual sign of the LPG concentration (Pandey, Verma, and Sahu 2017). MQ2 may be a gas module and it is appropriate to identify Hydrogen, LPG (Propane, Butane), smoke, Carbon Monoxide, and Liquor (Methane) It has high affectability and quick reaction time to degree and record the information (Omar et al. 2019).

3.3.1 Schematic Circuit



Component	Description
Lcd	• Display the smoke, humidity and temperature
Mq-2 Sensor	• To get the data of the smoke • Use vcc, gnd and ao to connect with Esp8266 wifi
LED red	• The led anode leg will be connected to pin D7 which is read as output • The led cathode leg will connect the resistor to the Gnd pin
Buzzer	• Wire +ve buzzer will connect to pin D6 • Wire -ve buzzer will connect to pin gnd
Arduino Uno	• As a component that processes the data in the circuit when coding has been entered into it

3.3.2 Description of Main Component

(MQ-2 Gas Sensor)

This sensor is used in our project because it contains the abilities to detect LPG gasses and smoke. This sensor will serve as an input in Arduino Uno and when there a gas detected, the sensor will send a data to buzzer, LED and solenoid valve through Arduino.

3.3.2.1 Component 1 (Buzzer)

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. In this project, buzzer function as an output in the circuit. When the input from button was pressed the buzzer will be sound.

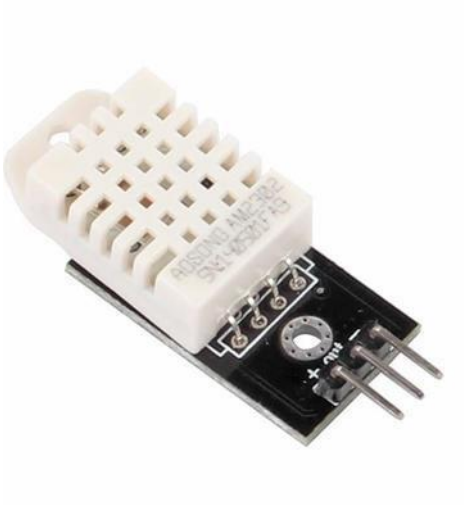
3.3.2.2 Component 2 (Arduino Uno)

Arduino Uno is an open-source firmware and development kit that helps as to prototype your IoT (Internet of Things) product within a few LUA scripts lines, and of course can always program it with Arduino IDE. In this project, Arduino Uno function as a component that processes the data in the circuit when the coding has been entered into it.

3.3.2.3 Component 3 (LED)

Red led is used as a light on when the smoke were detect.

3.3.2.4 Temperature and Humidity sensor



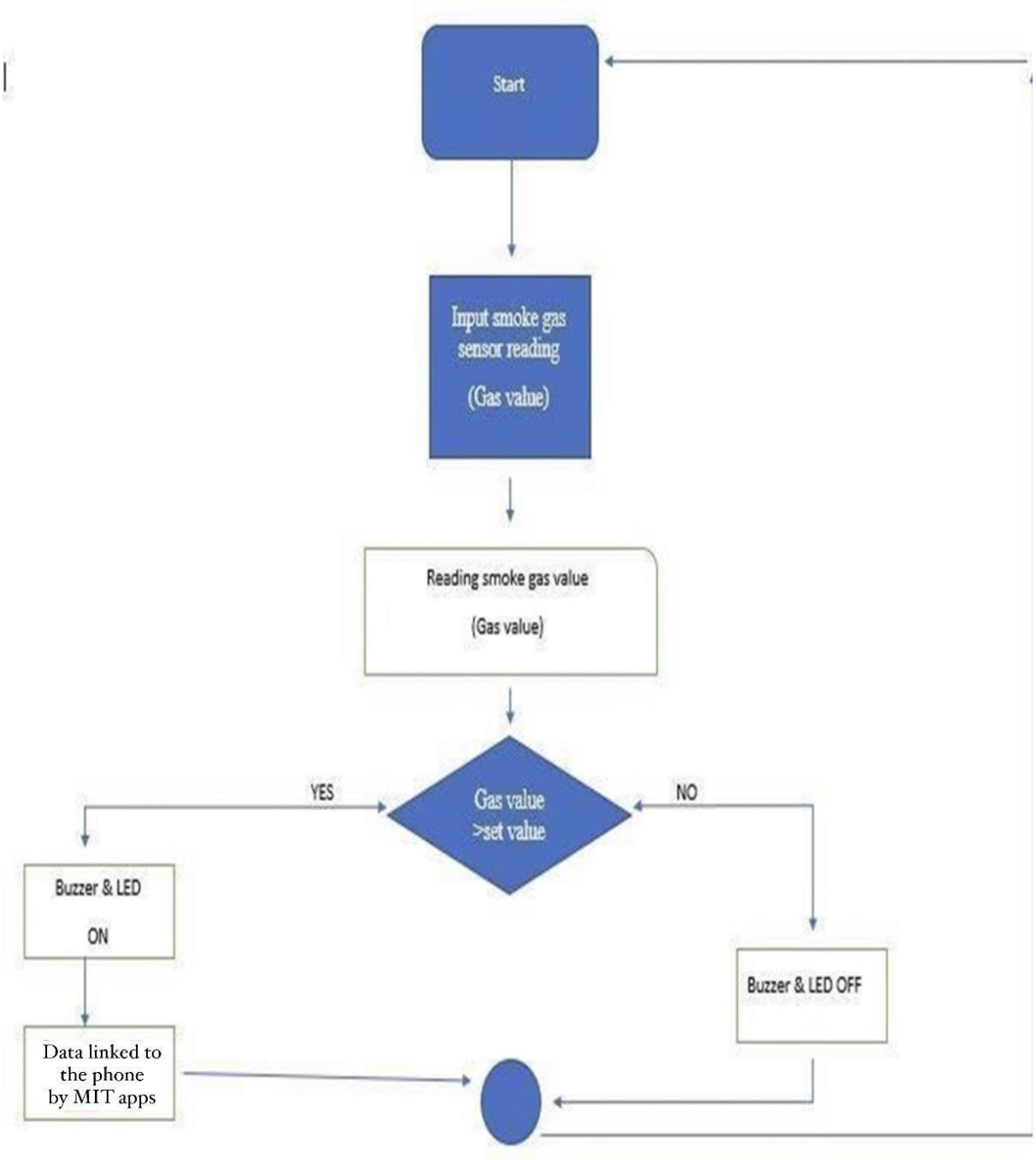
The DHT22 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requires careful timing to grab data.

3.3.3 Project Software

Figure 3.8 MIT App

MIT is an IoT platform for iOS or Android smartphones that is utilized to control Arduino, Raspberry Pi and more devices through the Internet. This application is utilized to make a graphical interface or human machine interface (HMI) by aggregating and giving the suitable location on the accessible gadgets. Blynk was intended for the Internet of Things. It can handle equipment distantly, it can show sensor data, it can store data, visualize it and do numerous other things.

3.4 Flowchart of the System



3.4.1 Description of Flowchart

As a result, when temporary respond is given to the MQ-2 sensor, the red LED will turn on and the green LED is turned off as long as there is gas applied to the sensor. This is because red LED functioned as alert system and green LED functioned as steady state. The threshold value for the sensor is 600. When the red LED turned on, the buzzer will automatically make a noise to alert surrounding people and the solenoid valve is automatically closed to block the gas. When there is no gas detected. The LED will turn green which means there is no gas leakage.

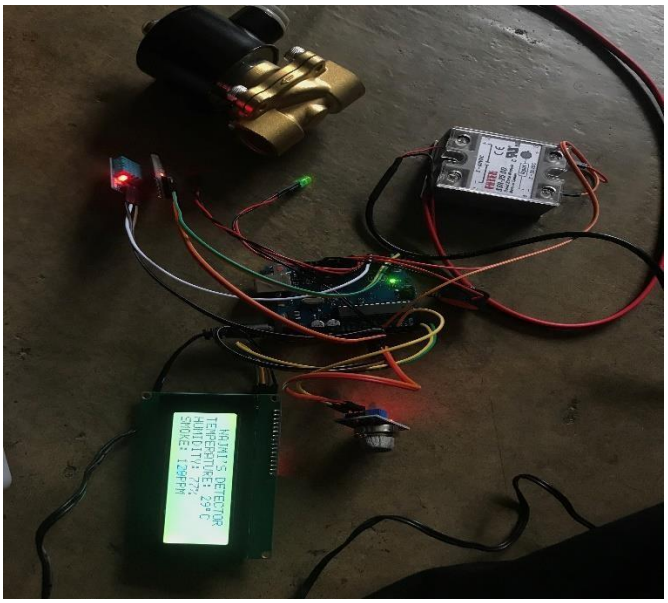
CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

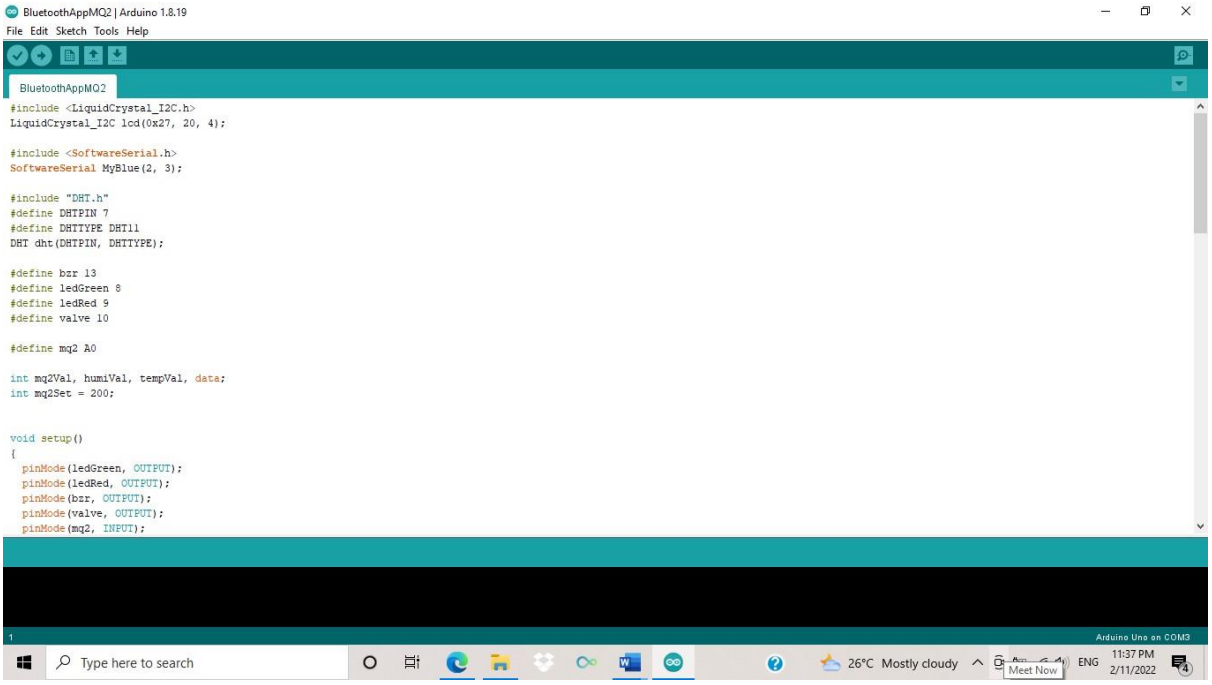
After a few weeks of completing this project work, I finally got the results from my project. This introduction aims to prove the success of the study findings through certain processes throughout the project creation. In this chapter, it describes the entire study conducted on hazardous gas detector using IoT which has been innovated with a slight addition of components. this can be elaborated in several parts such as the definition of terms or project operations.

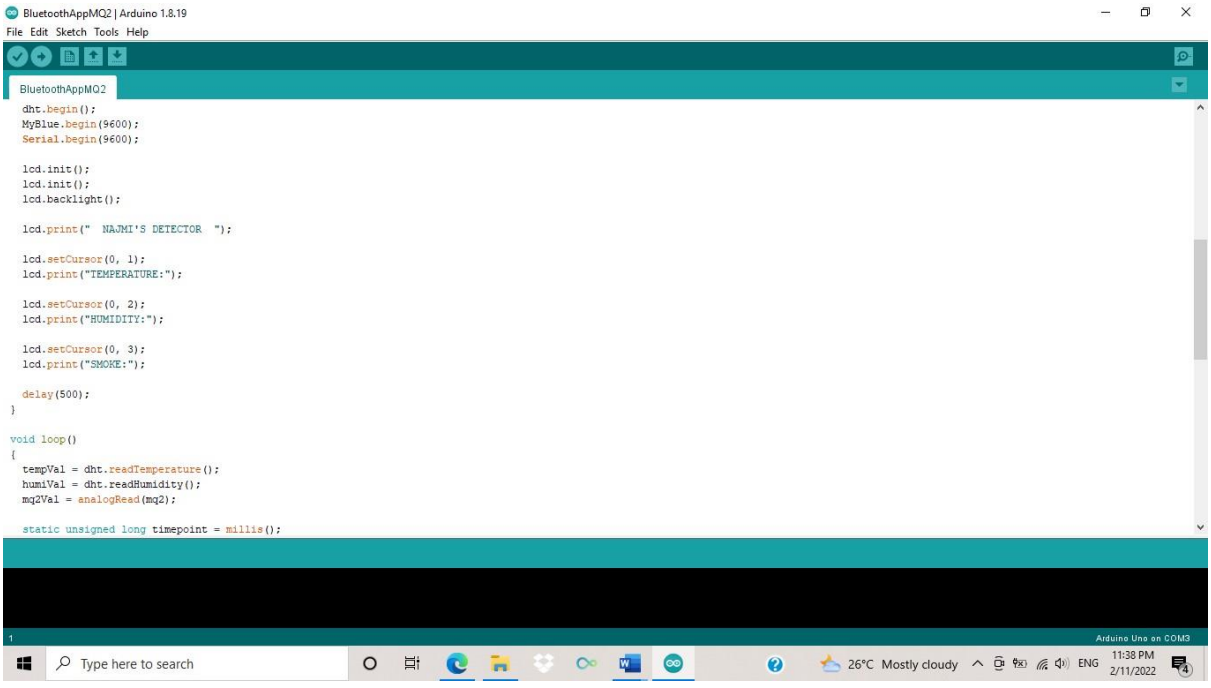
4.2 Result Analysis

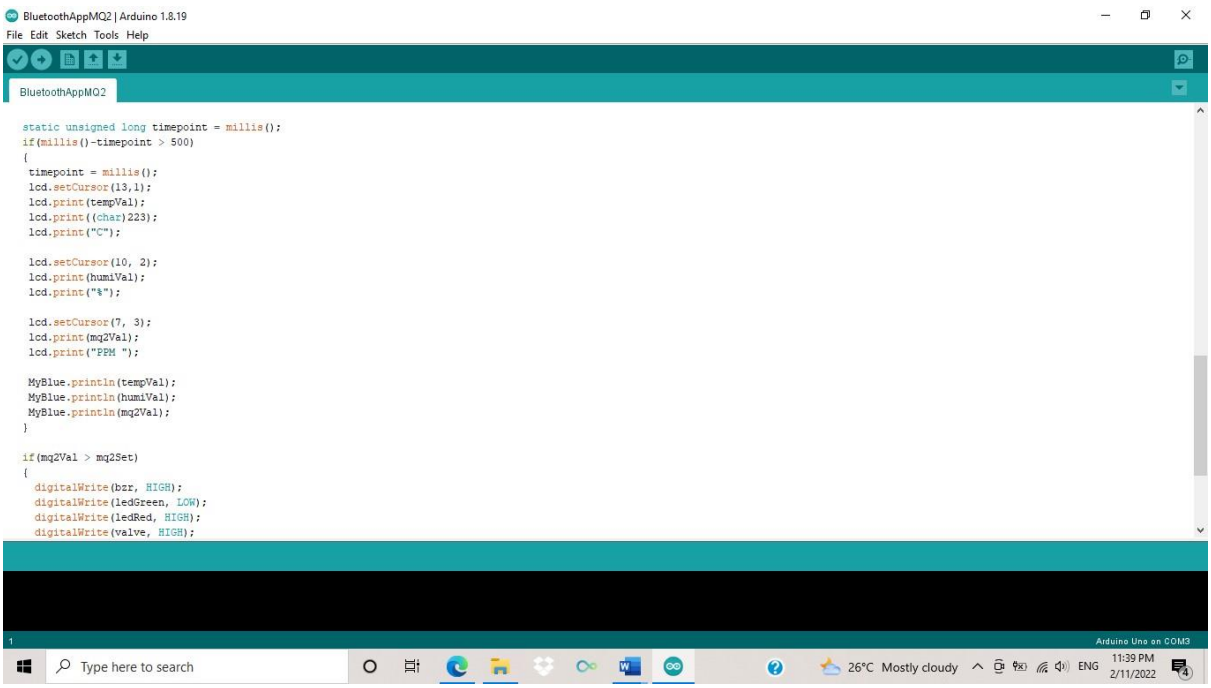


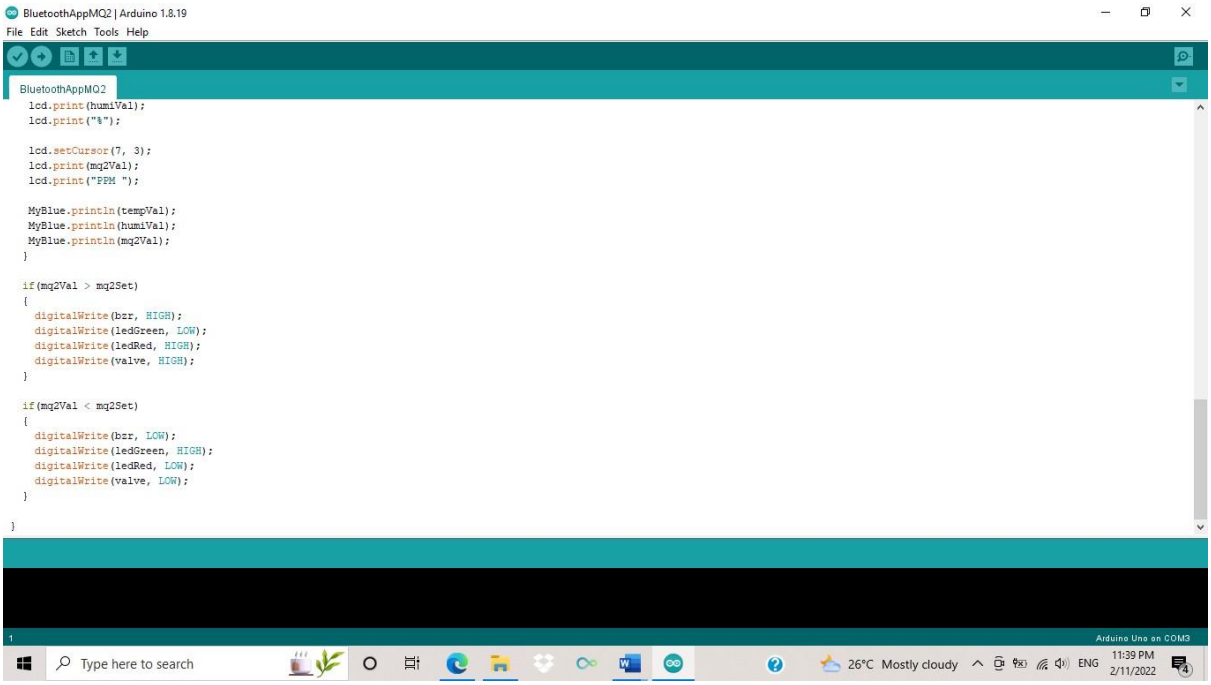
Finally, all components have been installed according to the schematic diagram and successfully work well. The results recorded by the gas detector have an important effect on the public. The gas detector works if there is air or smoke that exceeds the resolution set in the program, which is 200 ppm. It will produce a loud noise and the red led will light up, thus sending a data to the application.

4.3 Coding In Arduino

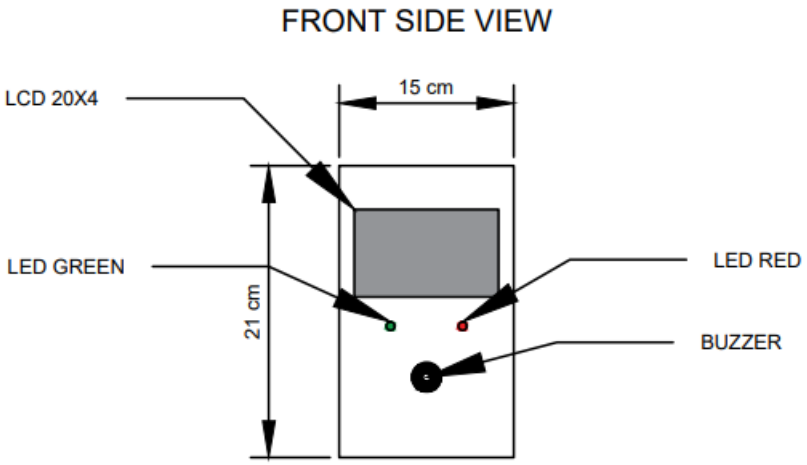


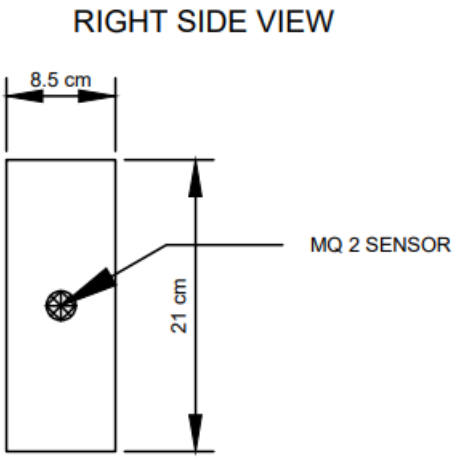


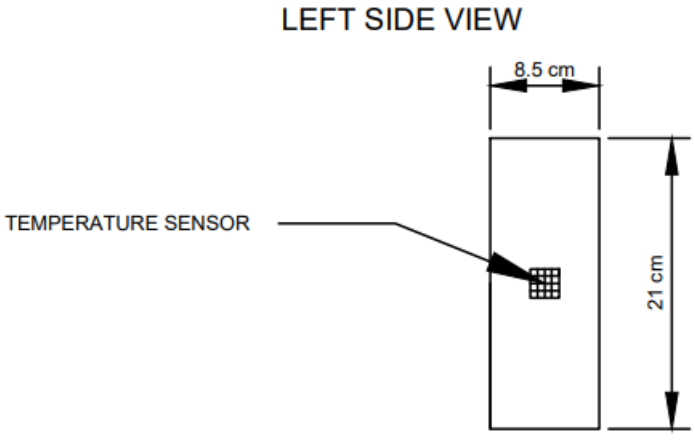

BluetoothAppMQ2 | Arduino 1.8.19
File Edit Sketch Tools Help
BluetoothAppMQ2
static unsigned long timepoint = millis();
if(millis()-timepoint > 500)
{
timepoint = millis();
lcd.setCursor(13,1);
lcd.print(tempVal);
lcd.print((char)223);
lcd.print("C");
lcd.setCursor(10, 2);
lcd.print(humiVal);
lcd.print("%");
lcd.setCursor(7, 3);
lcd.print(mq2Val);
lcd.print("PPM ");
MyBlue.println(tempVal);
MyBlue.println(humiVal);
MyBlue.println(mq2Val);
}
if(mq2Val > mq2Set)
{
digitalWrite(bzr, HIGH);
digitalWrite(ledGreen, LOW);
digitalWrite(ledRed, HIGH);
digitalWrite(valve, HIGH);
Arduino Uno on COM3
Type here to search
26°C Mostly cloudy
ENG
11:39 PM
2/11/2022


BluetoothAppMQ2 | Arduino 1.8.19
File Edit Sketch Tools Help
BluetoothAppMQ2
lcd.print(humiVal);
lcd.print("%");
lcd.setCursor(7, 3);
lcd.print(mq2Val);
lcd.print("PPM ");
MyBlue.println(tempVal);
MyBlue.println(humiVal);
MyBlue.println(mq2Val);
}
if(mq2Val > mq2Set)
{
digitalWrite(bzr, HIGH);
digitalWrite(ledGreen, LOW);
digitalWrite(ledRed, HIGH);
digitalWrite(valve, HIGH);
}
if(mq2Val < mq2Set)
{
digitalWrite(bzr, LOW);
digitalWrite(ledGreen, HIGH);
digitalWrite(ledRed, LOW);
digitalWrite(valve, LOW);
}
}
Arduino Uno on COM3
Type here to search
26°C Mostly cloudy
ENG
11:39 PM
2/11/2022

4.4 Project Model







The operation of this project is based on Arduino Uno. We use MQ-2 sensor to detect the gas, the concentration scope for the gas to be detected is from 200ppm to 1000ppm. When gas is detected by the sensor, it will send data through all other components such as solenoid valve, buzzer and LED. A warning notification also will be sent to our smartphones via the application. The way we connected the application is through the Bluetooth that has been put in the coding. In addition, as long as the sensor detect the gas, the buzzer, solenoid valve and the red LED will always turn on unless there are no gas detected. After the gas concentration has been reduced to safe level, the valve will open back, the buzzer will stop sound and the LED will switch to green.

4.5 Project Costing

No.	Component and material	Unit price (RM)	Quantity	Total (RM)
1	PVC Link	26	1	26
2	Cable feet	7	2	14
3	12c LCD 2004 (20x4) Yellow	19.80	1	19.80
4	MQ2-Gas Sensor	10	1	10
5	DHT11 Humidity & Temperature Sensor	9	1	9
6	16W Housing Connector	1.60	1	1.60
7	LED 6mm (Red)	0.20	3	0.60
8	LED 6mm (Green)	0.20	3	0.60
9	Buzzer DC 12v 22mm	2.40	1	2.40
10	Project Board GL6	6.50	1	6.50
11	Solenoid Valve 12v	80	1	80
12	Fotek Ssr 25DD	40	1	40

13	Bluetooth Module Master	28	1	26
14	Arduino Uno R3	68	1	68
15	2.1 mm DC socket	2	1	2
16	Switching Adaptor 9v	25	1	25
17	Adaptor 12v	32	1	32
Total				363.50

Table 1 Project Cost Budget

4.6 Chapter Summary

Estimating, budgeting, and controlling costs are all part of project cost management, with the ultimate goal of completing a project on time and on budget. This project can be finished on time and on budget if you follow the instructions in this chapter. The majority of the project was completed on time.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter's goal is to debate and conclude that any future work or analysis ideas for this project should be included. This chapter also includes some helpful advice for quickly generating any new project ideas. Every new generation of young people has to come up with new ideas in order to build a product that is more useful to customers.

5.2 Conclusion

1) **Real-time Notifications to your mobile devices** – Smart gas detectors will link to your phone through Bluetooth and provide you real-time information in the form of app notifications whenever once of the gas detectors detects smoke is activated.

2) Connected with the cellular phone by Bluetooth to send real-time messages to the emergency services and also to the users. This provides security in case of no WiFi connection

3) **Smart Gas Detectors will Trigger other Devices** – Gas detectors that aren't smart will merely detect smoke and sound an alert, however smart gas detectors will do so much more. They will not only detect fire signs, but will also communicate with other devices to turn on lights so you can find your way out; unlock doors to make evacuation easier; and even turn off heating and ventilation systems that could cause the fire to spread quickly.

In a summary, fire and smoke detectors are required in every enterprise, major commercial housing developments, and even singlefamily and multi-family homes. They are necessary not only to prevent the loss of human life and property, but also to put out fires in a timely manner

5.3 Suggestion for Future Work

Detectors of gas, smoke and smart fire prevention is the way of the future, and we'll have fire detectors that are connected to other household objects and technologies. This enables smoke detectors to not only function as stand-alone systems, but also to interface with other systems and devices to provide increased security and timely response.

5.4 Chapter Summary

It focuses on the system design conclusion in this chapter as well as a proposal for further investigation for this project. To determine if the project's goal will be met or not, as well as whether the project's objectives will be meet .recommendations. It will be easier to come up with new ideas for the project as a result of the suggestions .The next group of scientists to start a new project.

APPENDICES

PROGRAMMING

```
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 20, 4);

#include <SoftwareSerial.h>
SoftwareSerial MyBlue(2, 3);

#include "DHT.h"
#define DHTPIN 7
#define DHTTYPE DHT11
DHT dht(DHTPIN, DHTTYPE);

#define bzr 13
#define ledGreen 8
#define ledRed 9
#define valve 10

#define mq2 A0

int mq2Val, humiVal, tempVal, data; int
mq2Set = 200;
```

```
void setup()
{
  pinMode(ledGreen, OUTPUT);
pinMode(ledRed, OUTPUT);
pinMode(bzr, OUTPUT);   pinMode(valve,
OUTPUT);    pinMode(mq2, INPUT);

  dht.begin();
  MyBlue.begin(9600);
  Serial.begin(9600);
   lcd.init();
lcd.init();
lcd.backlight();

  lcd.print("  NAJMI'S DETECTOR  ");

  lcd.setCursor(0,                                    1);
lcd.print("TEMPERATURE:");

  lcd.setCursor(0,                                  2);
lcd.print("HUMIDITY:");

  lcd.setCursor(0,                                3);
lcd.print("SMOKE:");

  delay(500);
}
```

```
void loop()
{
  tempVal = dht.readTemperature();
humiVal = dht.readHumidity();   mq2Val
= analogRead(mq2);

  static unsigned long timepoint = millis();   if(millis()-timepoint
> 500)
  {    timepoint =
millis();
lcd.setCursor(13,1);
lcd.print(tempVal);
lcd.print((char)223);
lcd.print("C");

   lcd.setCursor(10, 2);
lcd.print(humiVal);      lcd.print("%");

   lcd.setCursor(7, 3);
lcd.print(mq2Val);
lcd.print("PPM ");

   MyBlue.println(tempVal);
   MyBlue.println(humiVal);
   MyBlue.println(mq2Val);
  }

  if(mq2Val > mq2Set)
  {
```

```
   digitalWrite(bzr, HIGH);
digitalWrite(ledGreen, LOW);
digitalWrite(ledRed, HIGH);     digitalWrite(valve,
HIGH);
 }

 if(mq2Val < mq2Set)
 {
   digitalWrite(bzr, LOW);
digitalWrite(ledGreen, HIGH);
digitalWrite(ledRed, LOW);     digitalWrite(valve,
LOW);
 }

}
```

BUYING PROCESS

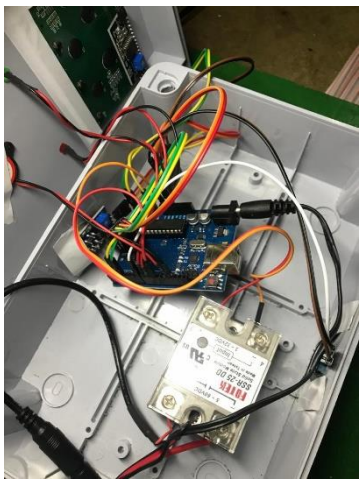
HITECTRONS SDN BHD
25 & 25A, JALAN SUTERA SATU,
TAMAN SENTOSA, 80150 JOHOR
BAHRU, JOHOR.
(221914-k) TEL 07-3344471

1. USB- MICRO CABLE 1MTR		
1 X 11.00	-	11.00
2. NodeMCU Lua V3 ESP8266 WIFI with CH340C		
1 X 18.00	-	18.00
3. PVC LINK 215MM(W) X 150MM(D) X 85MM(H)		
1 X 26.00	-	26.00
4. CABLE FEET		
2 X 7.00	-	14.00
5. IIC LCD1620 INTERFACE MODULE		
1 X 10.00	-	10.00
6. MQ2 GAS SENSOR		
1 X 10.00	-	10.00
7. DHT11 HUMIDITY/TEMPERATURE SENSOR		
1 X 9.00	-	9.00
8. LCD 16X2 YELLOW		
1 X 12.00	-	12.00
9. 1X16W HOUSING CONECTOR		
1 X 1.60	-	1.60
10. LED 5MM RED		
3 X .20	-	0.60
11. LED 5MM GREEN		
3 X .20	-	0.60
12. BUZZER DC 3-12V 22MM		
1 X 2.40	-	2.40
13. PROJECT BOARD GL6		
1 X 6.50	-	6.50
Sub Total		121.70
CASH		121.70
CHANGE		0.00

HITECTRONS SDN BHD
25 & 25A, JALAN SUTERA SATU,
TAMAN SENTOSA, 80150 JOHOR
BAHRU, JOHOR.
(221914-k) TEL 07-3344471

1. SOLENOID VALVE 2W-160-15 12VDC		
1 X 80.00	-	80.00
2. FOTEK SSR-25DD		
1 X 40.00	-	40.00
3. BLUETOOTH MODULE MASTER & SLAVE HC-05		
1 X 26.00	-	26.00
4. ARDUINO UNO R3 /C		
1 X 88.00	-	88.00
5. DHT11 HUMIDITY/TEMPERATURE SENSOR		
1 X 9.00	-	9.00
6. 2.1MM DC SOCKET W/CABLE MP-122M		
1 X 2.00	-	2.00
7. SWITCHING ADAPTOR 9V 2A		
1 X 25.00	-	25.00
8. ADAPTOR 12V 3A 3P		
1 X 32.00	-	32.00

PROGRESS OF THE PROJECT



FINISHING PROJECT

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3. Alshammari, B. F., & Chughtai, M. T. (2020, December 16). IoT Gas Leakage Detector and Warning Generator. https://www.etasr.com/index.php/ETASR/article/view/3712.
4. Sahu, L. K. (2017). Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor. https://www.ijedr.org/papers/IJEDR1702333.pdf.
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