UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SMART GAS LEAKAGE ALERT SYSTEM USING GLOBAL SYSTEM FOR MOBILE WITH A SHORT MESSAGE

This report submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Bachelor of Electronic Engineering Technology) (Industrial Electronic) (Hons.)

by

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DECLARATION

I hereby, declared this report entitled “Smart Gas Leakage Alert System Using Global System For Mobile With A Short Message” is the results of my own research except as cited in the references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours. The member of the supervisory is as follows:

……

(Ir. Nik Azran Bin Abdul Hadi)

ABSTRAK

Motif utama produk ini adalah untuk pengesan kebocoran gas LPG menggunakan GSM SIM900A dengan sistem penggera. Sensor gas yang digunakan dalam produk ini adalah sensor gas MQ2 yang dapat mengesan gas LPG iaitu Gas Petroleum Cecair dan Asli. Sensor MQ2 gas ini berfungsi dengan mengesan kepekatan gas yang terkeluar, mengikut keluaran voltan sensor tersebut dan menghantar sistem pesanan ringkas kepada peguna. Arduino UNO telah digunakan sebagai pengawal mikro untuk keseluruhan system dan membuat sensor beroperasi dalam sistem penggera dan motor,. Litar ini juga termasuk , paparan LCD dan motor arus terus. Motor tersebut akan menutup bekalan gas automatik segera apabila kebocoran dikesan oleh sensor gas MQ2.

ABSTRACT

Nowadays, gas leakage incidence is increasing. Peoples at home or industry unable to get know the leakage of gas so it causes some loss to them in term of property and money. So here is the reason for this project is created to automatic gas leakage detection using GSM with alarm system. To detect the leakage of gas MQ2 gas sensor was used in this project. After the gas leakage was detected it will send an alert to the user. Arduino UNO is microcontroller for this project, which will control the entire system of this project. In addition, this project also has a , LCD display and a DC motor. The motor will close the supply of gas automatically immediately once the leakage was detected by the sensor.

DEDICATION

To my beloved

parents

Hithayatullah Bin Mohamed Abdullah &Halima Beevi

siblings,

Fairoz Khan ,Hussain

Thankful for your supporting advice and the best wishes

ACKNOWLEDGMENTS

During the time I do this project, there is many people I have meet which they give me some support and being my advisor to make this project at this stage. Firstly, I want to thanks to my project supervisor, Mr. IR Nik Azran Bin Abdul Hadi, for his support, and ideas given all through the task. Furthermore, I am also very thankful to my family who has been so helpful and bolsters to me by giving a recommendation and a few thoughts to enhance my project. A debt of gratitude is in order for their consolation, love and enthusiastic backings that they had given to me. Besides, my incredible gratefulness committed to my 4BETE course mates, especially to my group mate and the individuals who include specifically or in a roundabout way with this project. Their perspectives, tips, backing, and help with different conditions are valuable without a doubt.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

A/D	-	Analog to Digital
AC	-	Alternating Current
App	-	Application
AVR	-	Aboriginal Voices Radio
CO		Carbon Monoxide
DC	-	Direct Current
GND	-	Ground
GPRS		General Packet Radio Service
GPIO		General Purpose Input Output
GSM	-	Global System for Mobile communications
I/O	-	Input Output
LCD	-	Liquid Crystal Display
MCU	-	Microcontroller
MHZ	-	Mega Hertz
OSHA		Occupational Safety and Health Administration
OUT	-	Output
PC	-	Personal Computer
PIN	-	Personal Identification Number
PIR	-	Passive Infrared Radiation
PUK	-	Personal Unblocking Code
SIM	-	Subscriber Identification Module
SMS	-	Short Messaging Service
TCP/IP	-	Transmission Control Protocol/Internet Protocol
USB	-	Universal Serial Bus
V	-	Voltage

CHAPTER 1
INTRODUCTION

1.0 Introduction

This section consists of the project background, problem statements, objectives, the work scope, and thesis outline.

1.1 Project Background

In the late day event of household dangers because of the very inflammable LPG gas spills and the subsequent flame mischances have achieved disturbing rates. Such life debilitating household risks are found to happen every now and again. The significant explanation behind this being absence of appropriate cautioning. Such issues have been the inspiration to outline a framework that gives an earlier alarm on LPG gas spillage before it could break out into a flame. The point is to outline a financially savvy and low power, expending cation framework that gives a complete security alarm to the general population in case of gas break or smoke alongside the sign of their focus levels. It additionally dissects the level of risk and makes a legitimate move to keep away from the flame utilizing transfer component enacted by method for remote correspondence. The proposed way is an expansion of an electronic system composed particularly for gas spill. To solve and reduce such problems, a system is developed using GSM technologies and an application is introduced in research work. This project is Arduino UNO microcontroller based. A Gas sensor is utilized to distinguish dangerous gas leakage in the kitchen or close to the gas warmer. This sensor identifies 100 to 3000ppm of Natural Gas and LPG. Besides, this unit additionally can identify the least amount of smoke and liquor as

well. It can be effectively designed as a cation framework as well. This part can be used as an attention to caution an aware or provide a graphic sign or notice of the LPG focus. The device has excellent effect joined with a snappy response period. Recognized is informed of the approved individual utilizing cell system called GSM. In this anticipate there are basically two units, GSM modem and Arduino UNO as microcontroller unit. GSM modem can be designed with standard GSM AT charge set for sending and accepting SMS and getting modem status. Depending on the Gas sensor output Arduino UNO microcontroller can send message to the approved individual furthermore, depending after the message got the microcontroller unit will control the gadgets and recognizes the gadget status to the client as SMS.

1.2 Problem Statements

i. Gas leakage detectors are big in size and very difficult to own.
ii. The gas leakage detector can't send alerts to the user in a short time can cause damage.
iii. User unable to handle the gas leakage without personally checking on the place.

1.3 Objectives

The objectives of the project are:

i. To develop a compact LPG gas leakage prototype.
ii. To reduce the damage of gas leakage accident to prevent fire.
iii. To solve the possible gas leakage without manual checking.

1.4 Work Scope

To develop a system which can detect gas leakage such as LPG, Natural Gas, Alcohol and Smoke which allow user to detect gas leakage in their home more easily and quickly. Their hardware development and integration of hardware and software in order to achieve the objectives of the project. The scope of this project focused on a gas leakage security system that will alert the user once it detected. In this project, the Arduino UNO works as microcomputer and is programmed using Python language. The gas sensor is used to detect the LPG gas sensor. The SMS will send to the user once the sensor detects the leakage. At the same time, it will alert with to with LED notification in the incident place. Finally, new attempt in this project is closing the supply of gas once the leakage happens.

1.5 Thesis Outline

There are five chapters in this report. The first chapter is all about the project background, problem statements and objectives of the project and the scope of work. While in chapter 2 is all about literature review. It's more about discussed the previous researches that have been conducted by other students or other researchers and differentiate the products in the market. Last but not least, in chapter 3 is it will more in block diagram, the software development and hardware of the project, flowchart the project are discussed.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Chapter 2 is discussed more about the difference in the components and instruments can be used for this project. Furthermore, there are some of past related projects or research's about related to this project.

2.1 Related Project

There is a related project of identifying of gas leakage detector project, which titled as "Carbon Monoxide Detection and Autonomous Countermeasure System for a mill use Wireless sensor and Actuator Network", in an institute in Pakistan. The University name is University of Engineering and Technology from Peshawar (Jan et al. 2010). The focal controller is a top of the line computer which is connected to the TelosB remote sensor module by means of USB and to the actuator circuit by means of RS232. The CO sensor device is connected by a TelosB hub and link with Zigbee remote availability to the central controller. The CO focus was recorded and later sends to the computer.

Figure 2.2 Gas concentration based on the sensor replacement(Somov et al. 2011).

Figure 2.2 above shows the result of the system operation the concentrations of CO. It depends on the time of sensor senses the gasses. The kitchen room gave is at the top in highest reading, which is between 1300 and 1400 in the analysis of the graph. At the same time, we also can see that bedroom with close door has a zero percentage of CO concentration.

2.2 Hazardous Gas

The explanation of dangerous gas is well-defined as those chemical present in the workroom which are accomplished by causing harm. From the classification of the hazardous gas, the chemical term refers to dust, mixtures and common materials such as paints, fuels and solvents. Agreeing to the drawback of the LPG gas, OSHA mentioned that leaks above 1000ppm of LPG gas will root a hazard to the human breathing system. Therefore, this value is used as the inception value for the project. Beside it, the alcohol gas threshold value was chosen to be the partial rate of the graph of the gas sensor.

2.2.1 Liquefied Petroleum Gas

Liquefied petroleum gas (LPG), is known as just propane or butane, are burnable mixes of hydrocarbon gasses which used fuel as a piece of cooking rigging. Generally, it likewise uses in vehicles and some warming machines. Recent years back, there was a gigantic number of expanded utilization of condensed petroleum gasses (LPG) and normal gas (comprises for the most part of methane) to take care of the expanding demand for vitality and supplant oil or coal because of their ecological detriments. LPG and characteristic gas blaze neatly and are less hurtful to the earth. They have been broadly utilized as a part of the industry, warming, home apparatuses, and engine fuel. Despite the fact that LPG and normal gas are natural neighborly, they can represent a genuine risk on the off chance that they spill. They are ordinarily put away in pressurized steel barrels in fluid frame and vaporize at typical temperatures. LPG is heavier than air, in this way it streams along the floor and settle in low focuses which makes it hard to scatter. On the off chance that hole happens, LPG and regular gas bubble into the air and supplant oxygen which can bring about suffocation. In addition, the ignition may happen and cause a blast. Subsequently, the recognition of gasses has acquired enthusiasm for later years, particularly in fields of well being, industry, environment, and emanation control (Grattan, 1995).

Family security is turning into an issue because of the expansion utilization of LPG and common gas for warming and home machines. In Jordan (a creating nation), other than the tremendous utilization of LPG in industry, a large portion of the cooking is utilized LPG, and more than half of the warmers use LPG (Jaber et al., 2003).

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2.3 Global System For Mobile Communication

In the created microcontroller based monitoring association, there must be a system going about as the data bearer which the information is the pace and area data to and from the checking base station. This character of information bearer is favored in light of the fact that it is just about the most far reaching communication system in all over the nation furthermore to assemble the system versatile for future developments. The exceptionally helpful properties of GSM systems are the Short Messaging Systems as known as SMS (Chen and Liu 2010). GSM is a telecommunication network, which means that cell phones connect to it by searching for cellphones in the immediate locality. There are five different cell sizes in a GSM system,which are full scale, miniaturized scale. The range region of specific chamber varies as per the procedure atmosphere. Large scale cells as chambers everywhere the ignoble station reception apparatus remains set up proceeding a opposite or a working overhead usual top surface. Miniaturized scale cells will be cells whose reception apparatus height is below the medium house highest level and they are ordinarily used as a part of town zones. Picocells are little cells, which the scope, breadth is a pair of dozens meters and they are essentially used classified. Femtocells are chambers envisioned for use in lodging zones or tiny commercial circumstances and subordinate with the management dealer's scheme done a web connotation. Umbrella cells are connected to shelter followed districts of minor chambers and seal in crevices in possibility among those cells. The GSM system utilized by cell phones gives an easy, long achieve, a wireless communication channel for applications that call for availability as opposed to high information rates. Set up along the mechanical capability and the given vehicle, custom-made administration interims can be set. A bit of the administration understanding is the start of a GSM modem in the vehicle as demonstrated Figure 2.4. On board administration application can then inform the carport when the vehicle draws close to its administration interim. The administration division will plan an arrangement and advise the customer(Allen et al. 1975). A Worldwide system for Mobile (GSM) is more known as second era telecom framework standard that was worked to deal with the crack issues of the main cell structures. Beforehand it was known as Group Special Mobile. They chamber took up the task of demonstrating an ordinary Mobile

2.4 Microcontroller

There are two types of microcontroller were researched which is Raspberry PI and Arduino UNO.

2.4.1 Raspberry PI

The Raspberry Pi is a minimal effort, Visa measured PC that attachments into a PC screen or TV, and utilizations a standard console and mouse. It is a fit little gadget that empowers individuals of all ages investigate processing, and to figure out how to program in dialects like Scratch and Python. It's fit for doing all that you'd anticipate that a desktop PC will do, from perusing the web and playing top quality video, to making spreadsheets, word-handling, and playing recreations. Raspberry PI is also known as pocket PC with Linux working framework introduced to it. This is not expensive and it more supports youngsters for learning, programming, testing and advancement. Looking like motherboard, raspberry pi has every one of the parts to associate inputs, yields and capacity(Agrawal & Singhal 2015).

The Raspberry Pi is a little and generally modest, credit card estimated PC. It was created with the aim of starting an enthusiasm for software engineering related subjects and abilities in youngsters and raising the expertise level of potential software engineering undergrad candidates for third level instruction(Byrne et al. 2015).

The Raspberry Pi can cook for an extensive variety of programming and coding opportunities from straightforward programming coding to more unpredictable equipment ventures. The suggested working system is Raspbian, in view of the Debian Linux conveyance, assembled particularly for the Raspberry Pi equipment. This conveyance accompanies an extensive variety of programming instruments preinstalled including Scratch and Python. The Raspberry Pi additionally incorporates various General Purpose

Input Output (GPIO) pins that give a straightforward approach to interface with equipment inputs, for example, sensors and catches and equipment yields, for example, Light Emitting Diodes (LED's) and servo engines. The Raspberry Pi has a substantial online group creating instructional exercises, tasks and assets, making it conceivable to find, investigate and even experiment with a great many diverse application from programming to equipment advancement. The mix of an adaptable equipment and programming stage joined with a fantastic group makes the Raspberry Pi a conspicuous decision of hardware to use with both understudies and educators alike. Raspberry pi set up and utilize, furnishes educators with a stage from which to offer understudies the chance to learn registering while in the meantime apply 21st century learning aptitudes trying to show and impart their figuring out how to their companions and partners.

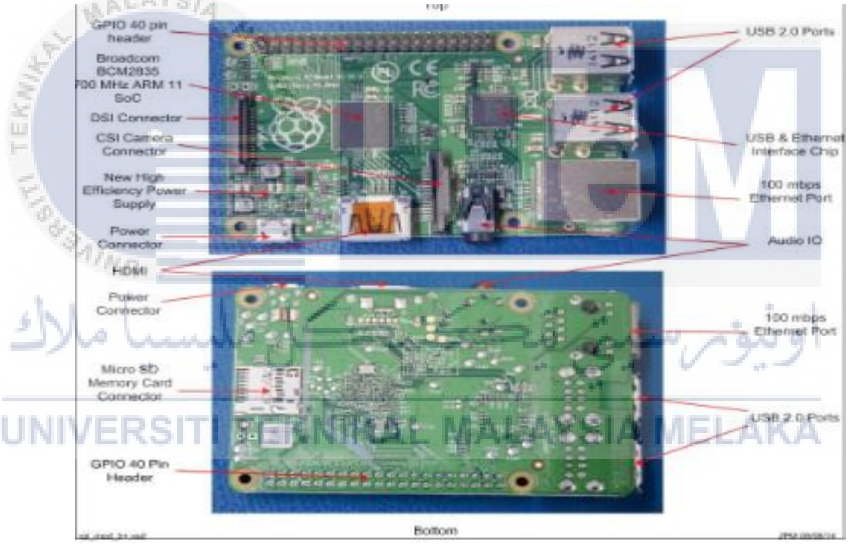


Figure 2.4 Raspberry PI Board(Shinde & Mane 2015)

2.5 Subscriber identity module

A subscriber identification module (SIM) is an incorporated circuit chip that is proposed to safely store the international mobile subscriber identity (IMSI) number and its related key, which are utilized to distinguish and validate endorsers on portable telephony gadgets, (for example, cell telephones and PCs). It is additionally conceivable to store contacts on numerous SIM cards. SIM cards are constantly utilized on GSM telephones; for CDMA telephones, they are required for more current LTE-proficient handsets. SIM cards can likewise be utilized as a part of satellite telephones.. "SIM cards" are intended to be transferable between various cell phones. The principal UICC shrewd cards were the measure of credit and bank cards; the advancement of physics littler cell phones has incited the improvement of littler SIM cards, where the span of the plastic transporter is diminished while keeping electrical contacts the same. A SIM card contains its exceptional serial number (ICCID), international mobile subscriber identity (IMSI) number, security confirmation and figuring information, short lived information distinguished by the close-by system, a once-over of the organizations the customer has admitted to, and two passwords: personal identification number (PIN) for standard use, and a personal unblocking code (PUK) for PIN opening.

Figure 2.6 SIM Card

CHAPTER 3

METHODOLOGY

3.0 Introduction

This chapter will describe about the flow of the project in building the proposed project. The proposed project is named “Smart gas leakage alert system using global system for mobile with a short message”. Beside it, minor software and hardware developments are involved in this project. This chapter also discusses about the methodology of the research, design of the system, system flow, hardware development, and software which will be used in this project.

3.1 Research Methodology

The change of this project will include a specific or particular methodology where the undertaking advancement is partitioned into three stages. The three phases are literature review, development and application of Python programs, and system analysis after integrating.

Firstly, the literature review based on hazardous gas, GSM, the microcontroller that are available in the current market, which is between Raspberry Pi and Arduino UNO , and also the past work or research conducted by past undergraduates student or different method of impalement. Secondly, the phase includes the software and hardware progression and usage in several product. Then, this phase is developed for hardware such as LPG gas sensor, LCD display, LED, and . Here, the hardware is merged with the software using the Arduino programming so that the desired output will be achieved. After that, Arduino programming will be used to send an SMS to the client. Once the software and hardware are created, both the software and

hardware are coordinated. Thus, the performance of the system will be analyzed and confirmation will be done.

3.2 Design of the system

This entire system is designed utilizing components that are compatible with Arduino Yún. Figure 3.2 demonstrates the block diagram of the designed system.

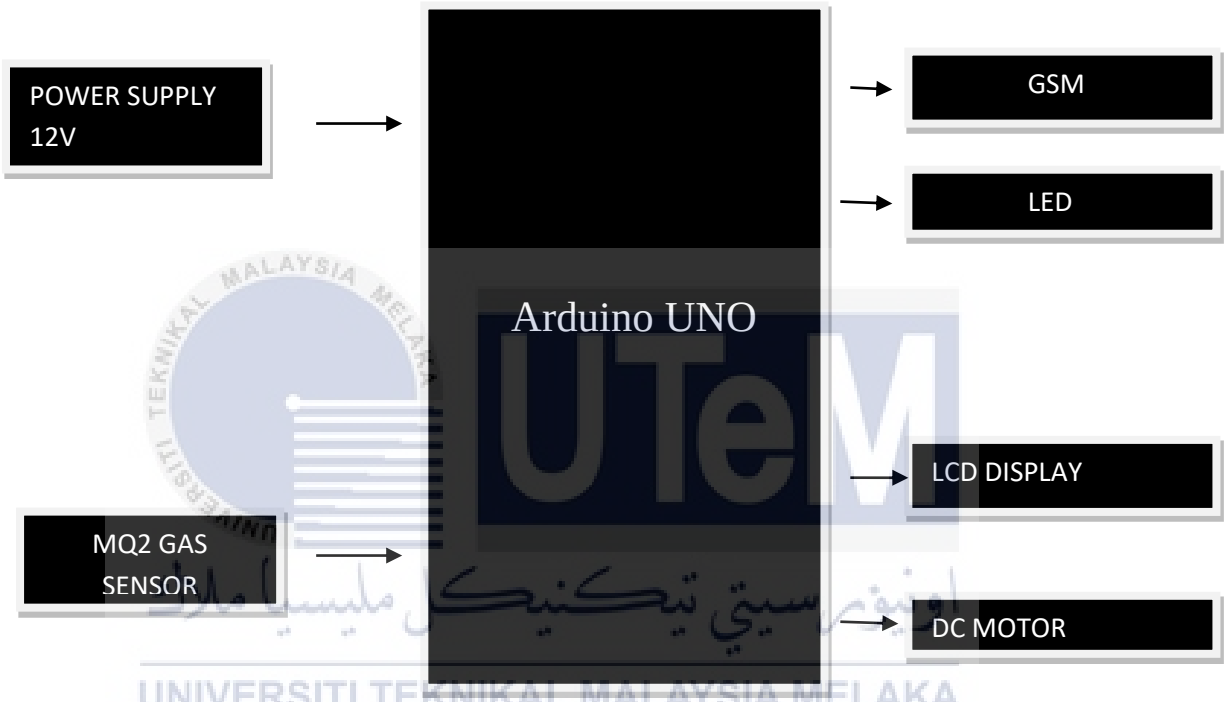


Figure 3.1 Block diagram of the proposed system

3.3 Hardware Development

There are several parts in this system that require hardware development. The parts involved in the system architecture are Arduino UNO, MQ2 gas sensor LCD display, DC motor and also the GSM module SIM900A .

3.3.1 Arduino UNO

The Arduino UNO is a easiest and current trendy microcontroller board based on the ATmega328P. It has 14 digital input/output pins of which 6 can be used as PWM outputs, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and lastly a reset button. Furthermore, it contains everything needed to support the microcontroller, simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) Of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
Length	68.6 mm
Width	53.4 mm
Weight	25 g

Table 3.1 : Specification of Arduino UNO

3.3.2 Gas Sensor

Gas Sensor (MQ2) is the gas sensor was decided to use in this proposed project. This MQ module is used to detect LPG gas leakage at home and also industry. Beside it is used for detecting LPG gas, natural gas and minimum percentage of alcohol and smoke. It's known its high sensitivity and fast response time to detect the leakage of gas. The sensitivity of the sensor can be adjusted by the potential meter which it already inside the module which located at the back of the sensor. In this gas sensor, there is both digital and analog out. Smart Gas Leakage Alert System Using Global System For Mobile With A Short Message is using analog output to see the threshold value in serial monitor. This sensor also can be calibrated at the time needed.

Figure 3.2: MQ2 Gas sensor

Item	Parameter	Min	Typical	Max	Unit
VCC	Working Voltage	4.9	5	5.1	V
PH	Heating consumption	0.5	-	800	mW
RL	Load resistance		Adjustable		
RH	Heater resistance	-	31±10%	-	Ω
Rs	Sensing Resistance	10	-	60	kΩ
Scope	Detecting Concentration	200	-	10000	ppm

Table 3.2 : Specicfication of MQ2 Gas Sensor

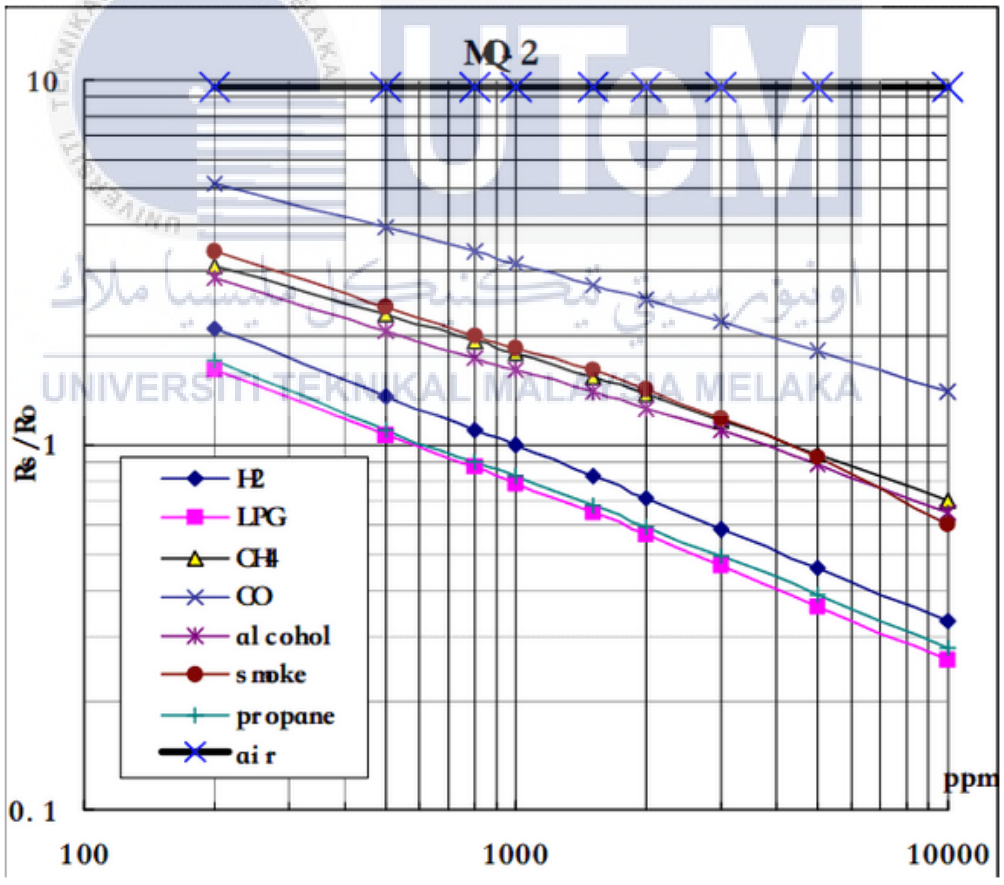


Figure3.3. Concentration of MQ2 Gas Sensor

3.3.3 DC Motor

This DC or direct current motor deals with the importance, when a current conveying conductor is put in a magnetic field, it encounters a torque and tends to move. In this project, DC motor is very important because it will close the supply of the gas after leakage was detected.

Figure 3.4: DC Motor

3.3.4 GSM Module SIM 900A

SIM900A GSM/GPRS Module is a dual-band module. The incidences of this module are EGSM 900MHZ and DCS1800MHz. Furthermore, this module also has GPRS multi-slot class 10/8(optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. This module is known for power saving designed technique. During sleep mode, the current consumption is low as 1.0mA. TCP/IP protocol and extended TCP/IP AT commands was integrated which are very useful for data transfer applications.

Commnunication Interface	RS232 port and LVTTL port
	It supports all AT commands
	It supports all RTS/CTS hardware flow control
	It supports around 1200bps ~ 115200bps
	It supports all debug port
Audio	3.5mm phone jack for microphone and earphone
Antenna	SMA port
Voltage	5V – 24V DC
Power	12 - 90mA@12V

Table 3.3 Specification of SIM900A

Figure 3.5 GSM SIM900A Module

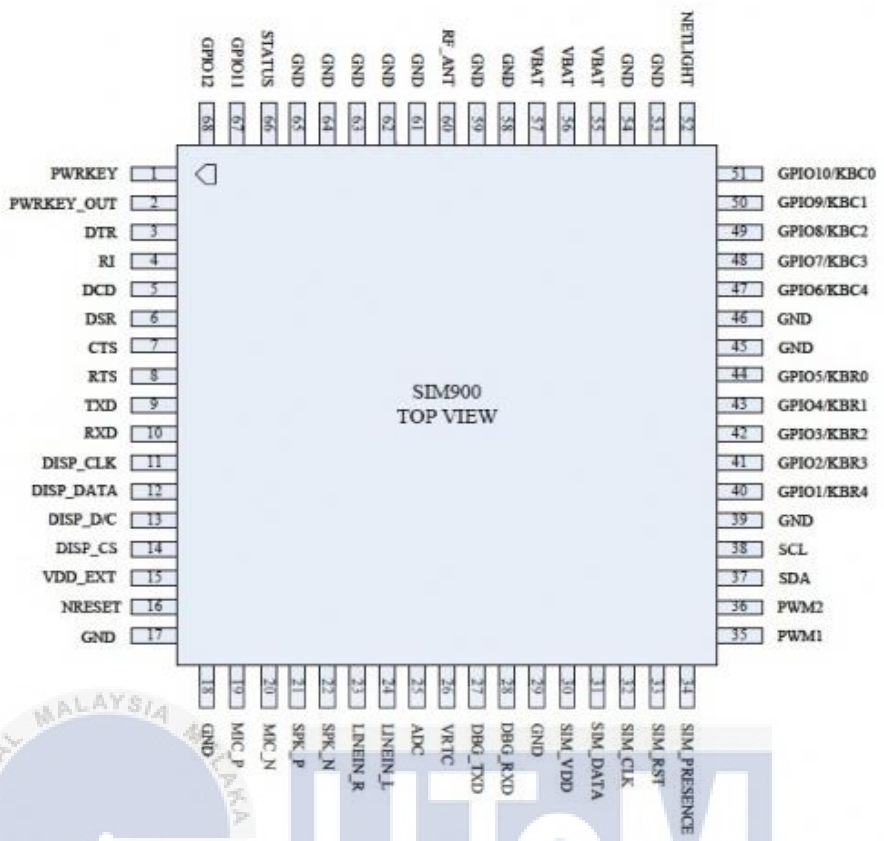
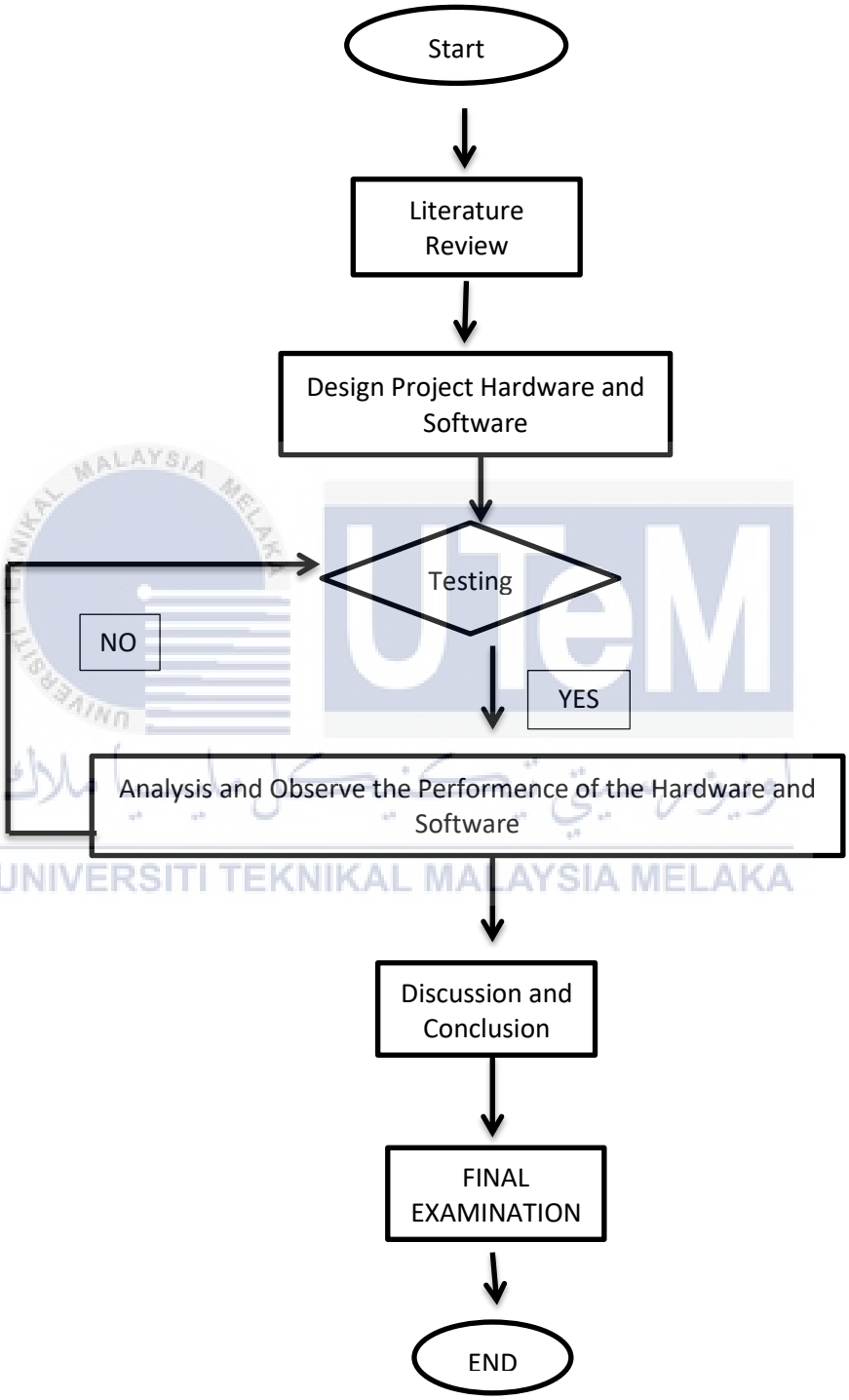
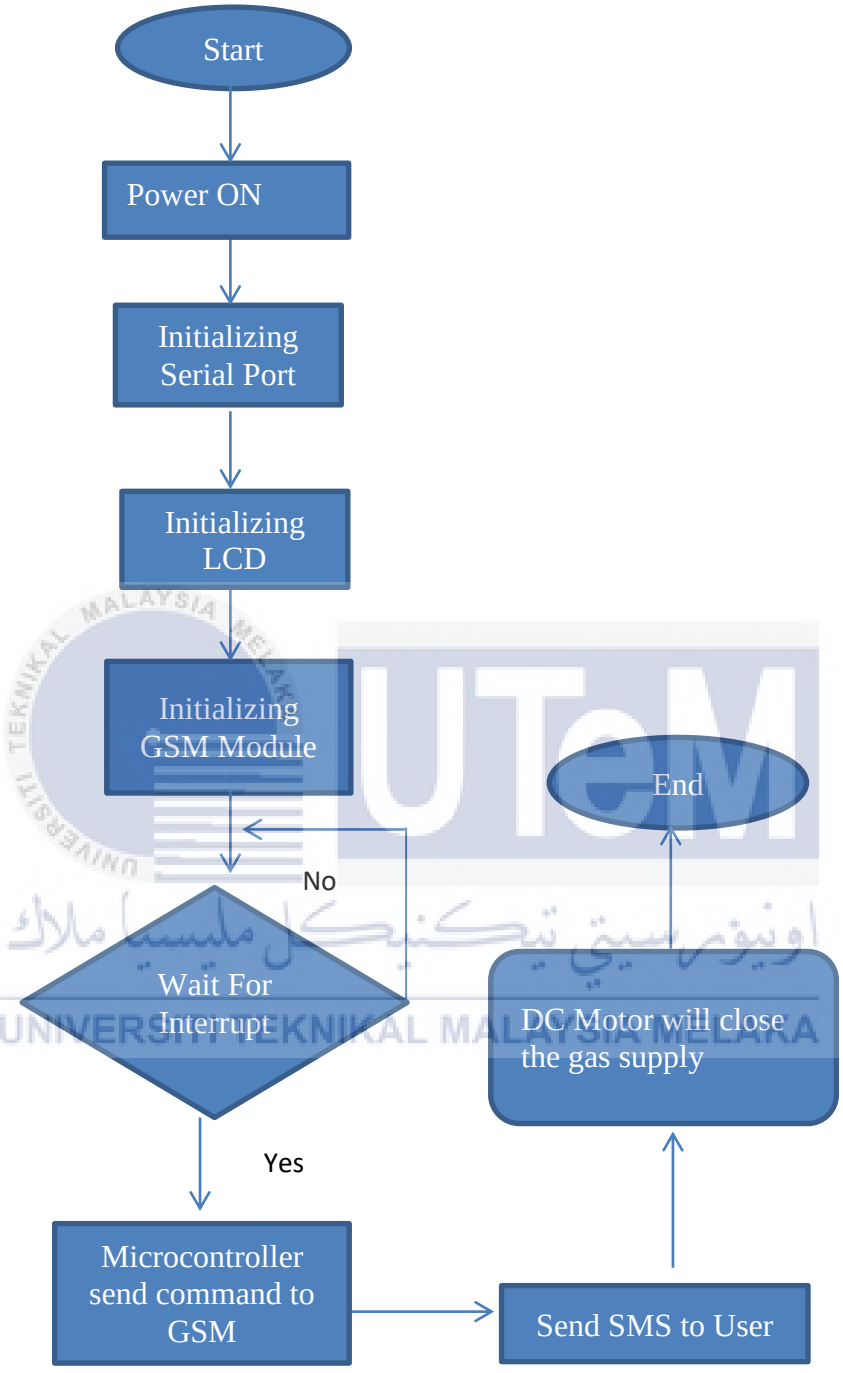


Figure 3.6 PINOUT SIM900A

3.4 Project Flowchart



3.4.1 Project Working Flowchart



3.5 Work Process

The prototype of Smart Gas Leakage Alert System Using Global System for Mobile with a Short Message is design and development to complete one integrated system. This prototype consists of three MQ2 gas sensors, GSM SIM 900A, Arduino UNO, LCD and push button. Before implement at the strip board the simulation was designed using the Proteus software. So that's it, can be prevent error of soldering or arrangement of components on the beard board or strip board.

3.5.1 Soldering Work Process

After testing in the breadboard, the next important is to solder. The component which has to solder in Smart Gas Leakage Alert System Using Global System for Mobile with A Short Message is LCD, variable resistor, and switch. Strip board was used in this process. Furthermore, several wire connecter and female connecter used to connect the connectivity within the components as shown in figure 3.7.

Figure 3.7: Soldering work process

3.5.2 Designing Prototype

The prototype of Smart Gas Leakage Alert System Using Global System for Mobile with a Short Message is designed by using the plywood material. Firstly, the size of plywood was cut based on the design was planned the size of the plywood is 1m x 0.8m. It used as a basement of the project. Thus, at top of right side of the plywood four holes were created to locate the DC motor and the valve as shown in figure 3.8.. The holes were created by using a hand drilling machine which using the ideal drill bit for plywood.

Figure 3.8: Drilling the plywood

3.5.3 Test and Troubleshoot

After soldering process, before power up the circuit continuity test must do to prevent short circuit and to check whether proper soldering of electrical and electronics components or sockets. The procedure to do the continuity test is by using a digital multimeter. Next, place the probe at where to check continuity test. The digital multimeter will give beep sound if there is continuity between the components is detected. If there is no sound occurring it means circuit is open condition. If there is any short circuit on PCB board, Desoldering the lead by using sucker or it can be named as Desoldering vacuum and soldering it back in actual place.

3.6 Circuit Connection

Figure 3.9 shows the circuit simulation of the system. Smart Gas Leakage Alert System Using Global System for Mobile with a Short Message consists of three MQ2 gas sensors, DC Motor, GSM SIM900A, LCD. Before the connection made in PCB board a simulation is done using Proteus 8 Professional software to demonstrate wire connection n and acts as reference model when it apply to actual electric components. There is a 13 output pin in Arduino UNO and it is fully used. Transmitter and receiver pins of GSM module are connected to 0 and 1 to Arduino pins respectively. While the gas sensors are connected to analog pin A0, A1, A3 on Arduino UNO. One push button is used and connected to pin 13 on Arduino UNO. In this system, to give a DC Motor 12V motor driver L298N were used. The motor driver pin was connected to pin 6, 4 and 2 in ArduinoUNO.

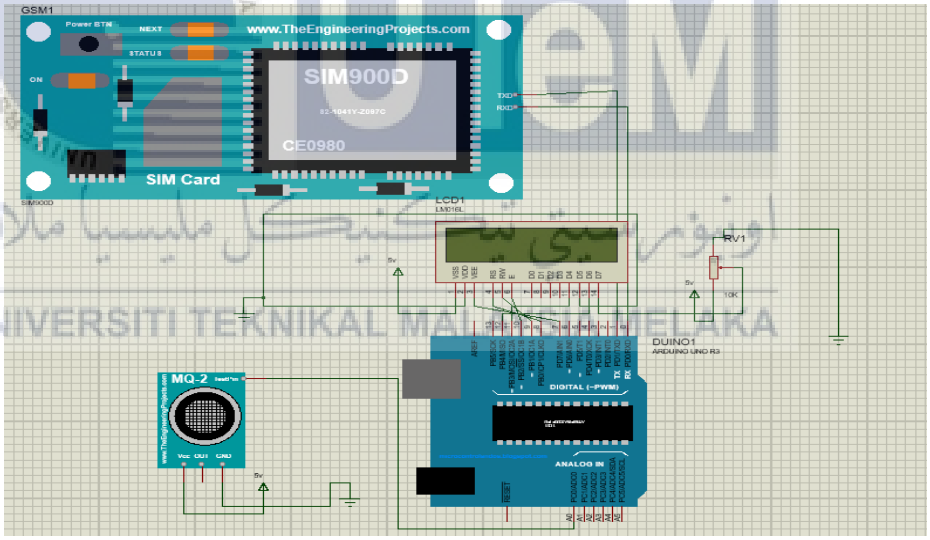


Figure 3.9: Simulation of the system

CHAPTER 4

RESULT AND DISCUSSION

4.0 Introduction

This chapter discusses about data collected from the prototype of Smart Gas Leakage Alert System Using Global System for Mobile with a Short Message. The data are taken from different types of places in order to examine the accuracy and consistency of the system. Table and figure method are used to interpret data that collected from the prototype of this project.

4.1 Survey

A simple survey with 107 respondents was done to determine the gas leakage effects and the solution. 3 the most significant question which related to this system is presented from 6 questions asked in the survey. The survey was conducted online using google form. The data were collected from people who appreciate the system. Around three days needed to complete the survey of 107 respondents. The data taken was converted into a pie chart to get the visualize data. Figure 4.1 and 4.2 shows the survey results done with 107 respondents.

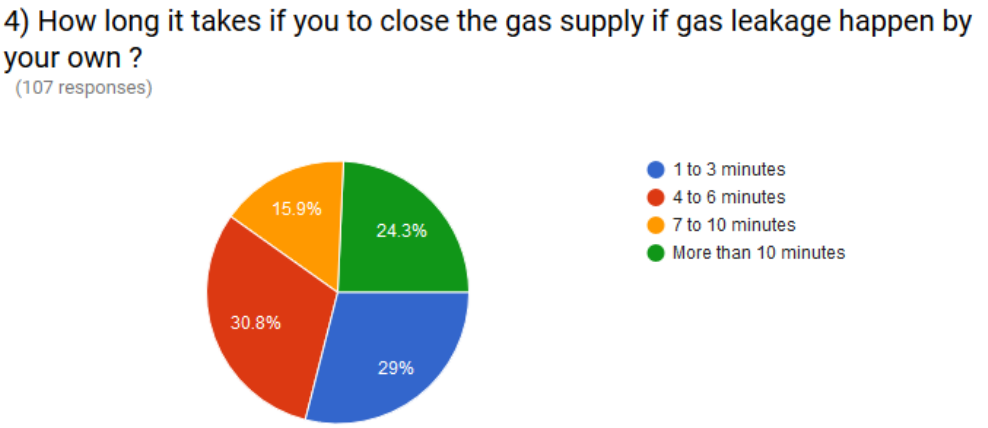


Figure 4.1: Actions by respondents when meet with the gas leakage.

Most of the people take 4 to 6 minutes to close the gas supply manually when gas leakage is happened as shown in figure 4.2. The second most of the time people take is 1 to 3 minutes to close the gas supply. Some of them take more than 10 minutes to identify the leakage and close it properly. It may increase the number of gas leakage accident.

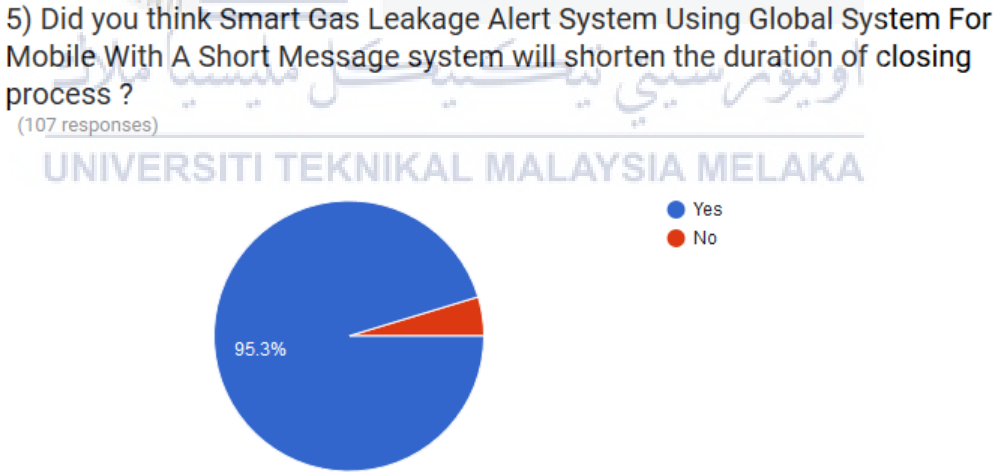


Figure 4.2: Percentage of people agree that Smart Gas Leakage Alert System Using Global System for Mobile with a Short Message will shorten the duration of the closing process.

The result of the question shown in figure 4.3 indicates that 95.3% of the people agreed the Smart Gas Leakage Alert System Using Global System for Mobile with a Short Message system will shorten the duration of closing the gas supply. It means they face difficulties in closing the gas supply if there are not in physical place or the gas was installed in difficult places. Therefore, this will cause, extend the time to people to come back to their home when the leakage happens if they are not in the physical place. Smart Gas Leakage Alert System Using Global System for Mobile with a Short Message system will overcome this issue and makes convenient for the all kinds of people.

4.2 Functionality of Sensor

Functionality of sensor has been examined before it integrated with Arduino mega in order to determine its accuracy, or to detect the presence of something.

4.2.1 Calibration MQ2 Gas Sensor

In this system, two MQ2 gas sensor has been used which located sensor in front. Each sensor inspects calibration in order to determine accuracy of the gas sensor. To calibrate the sensor we have to run it together with Arduino UNO with the program coding It will take several minutes to calibrate The voltage divider of the sensor formed by the gas sensor resistor which is Rs and Rl. The function of calibration is to calculate the value of Ro by specimen and averaging the readings when the sensor is placed in clean air. After Ro is resulting, the concentration of target gas could be calculated by using Rs/Ro ratio as the input. Table 4.1 shows the output result of sensor to determine the accuracy of the sensor.

Table 4.1: Output result of calibration of MQ2 gas sensor

LPG:0ppm	**CO:0ppm**	**SMOKE:0ppm**
LPG:0ppm	CO:0ppm	SMOKE:0ppm
LPG:0ppm	CO:0ppm	SMOKE:0ppm
LPG:0ppm	CO:0ppm	SMOKE:0ppm
LPG:0ppm	CO:0ppm	SMOKE:0ppm
LPG:3ppm	CO:100ppm	SMOKE:147ppm
LPG:156ppm	CO:7303ppm	SMOKE:1568ppm
LPG:324ppm	CO:13356ppm	SMOKE:1843ppm
LPG:286ppm	CO:8489ppm	SMOKE:1118ppm
LPG:152ppm	CO:3234ppm	SMOKE:499ppm
LPG:1ppm	CO:5ppm	SMOKE:3ppm

4.2.2 MQ2 Gas Sensor Sensitivity Range

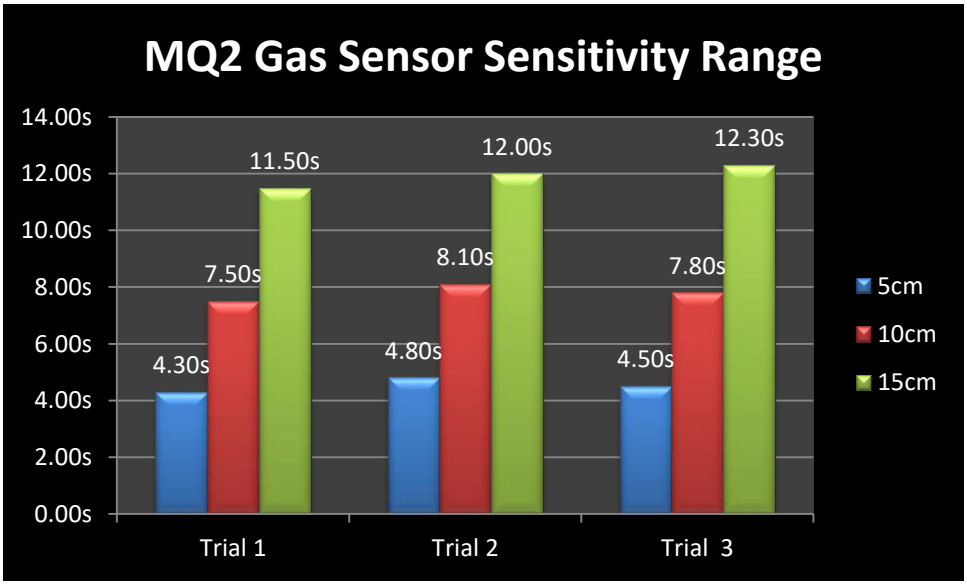
This analysis is taken to measure the sensitivity range of MQ2 gas sensors. Both sensors were placed on a surface and measurements taken in three times in each location. Firstly, the sensor was placed at a distance of

5cm , 10cm and 15cm respectively. In 5cm the gas sensor able to sense the threshold value 200ppm at 4.3 seconds in the first trial and 4.8 seconds in the second trial and 4.5 seconds in the third trial. In 10cm the time taken is different in first the trial and second the trial, which is 7.5 Seconds and 8.1 seconds while in the third trial it took 7.8 seconds. The delay cause of the air may affect the time of gas detect against distance. In 15cm the time taken is more lengthier compare to 5cm and 10cm. In all trials it took 11.5 seconds, 12 seconds and 12.3 seconds respectively. Table 4.2 and figure 4.3 shows the results of MQ2 gas sensor sensitivity range. The gas sensor could not sense the LPG gas leakage if the sensor located in 20cm distance.

Table 4.2: Result of MQ2 Gas Sensor Sensitivity Range

	Trial 1	Trial 2	Trial 3
5cm	4.3 seconds	4.8 seconds	4.5 seconds
10cm	7.5 seconds	8.1 seconds	7.8 seconds
15cm	11.5 seconds	12.0 seconds	12.3 seconds

Figure 4.3: Result of MQ2 Gas Sensor Sensitivity Range



4.3 Reset Switch Button

One manual push button has used in this system to reset the system back to initial condition. Table 4.3 shows the output result of the push button to determine whether it work properly or not.

Table 4.3: Output result of push button

PB	Data 1	Data 2	Data 3
0	X	X	X
1	√	√	√

denoted

PB :- Push Button

0 :- Original position

1 :- Press the push button

√ :- High output (5V)

X :- Low output (0V)

4.4 GSM Measurement Recorded

GSM module is the medium of this system where the SMS notification will be sent to the user once the gas leakage is occurring. The GSM analysis was done by a collection of data records of reading of time required to send SMS also collected from 5 different places around Mallaca.It takes around two days to record the data completely.

4.4.1 Time Recorded to Send SMS

Time taken to send SMS has been gathered from 5 popular places in Mallaca to measure the productivity of the system. Every place gathers different information to figure the regular time taken to the particular area. Table 4.3 shows the time taken to send SMS at Bukit Beruang which require average around 12.02 Seconds.

Table 4.4: Time taken to send SMS at Bukit Beruang area.

Test	Time taken to send SMS, (Seconds)
1	12.6
2	12.2
3	12.1
4	12.1
5	11.1
Average	12.02

Table 4.4 shows the time taken to send SMS at rooftop at Melaka Mall (car park) which takes 10.5 second. The time taken to send SMS more quicker compare to Bukit Beruang because the radio base station (Telecommunication Tower) located in the car park at Melaka Mall as shown in figure 4.1. This is prove that location near to the radio base station is required lesser time to send the SMS.

Table 4.5 shows the time taken to send SMS at Malacca city (Banda Hilir) which takes around 11.2 seconds. It is a normal range to send SMS in the GSM coverage area. This area is a tourist attraction in Malacca and full with a crowd, so that the coverage in that area during that time is busy cause of a bit late time required to send the SMS.

Table 4.6: Time taken to send SMS at Malacca City (Banda Hilir)

Test	Time taken to send SMS, (seconds)
1	10.9
2	11.1
3	11.3
4	11.1
5	11.5
Average	11.2

Table 4.6 demonstrates time taken to send SMS at rural areas in few miles from Durian Tunggal which takes 12.36 seconds. It takes longer time to send SMS compare to another location. It is because rural areas normally located far away from the radio base station tower and it causes delays in sending SMS.

Table 4.7: Time taken to send SMS at rural areas at Durian Tunggal

Test	Time taken to send SMS,(seconds)
1	12.7
2	12.8
3	12.5
4	12.2
5	11.6
Average	12.36

At last, table 4.7 indicates the time taken from GSM to send SMS in Bukit Katil residential areas which takes 10.44 Seconds. Residential areas normally located near to the radio base station coverage so that duration of SMS sending is faster compared to other places.

Table 4.8: Time taken to send SMS in residential area at Bukit Katil

Test	Time taken to send SMS,(seconds)
1	10.8
2	10.2
3	10.3
4	10.9
5	10.0
Average	10.44

4.4.2 Comparison Of Time Taken Between Locations

Figure 4.5 shows that variation of time taken to sending SMS with different types of location. Rural areas at Durian Tunggal necessitate extra time, which is 12.36 seconds for sending SMS compare to another location. It due to normally rural areas covered with low telecommunication signal compares to another location. While, Bukit Katil, Malacca only takes 10.44 seconds, which is lesser time than others because the data was taken near the radio base station (Telecommunication tower) at the residential area which

located at mosque nearby. The second place which took lesser time is Melaka Mall indoor parking it takes around 10.50 seconds time taken to sending SMS. Both Bukit Beruang areas and Banda Hilir at Malacca City take almost the same time to send SMS which is 12.3 and 12.0 seconds respectively.

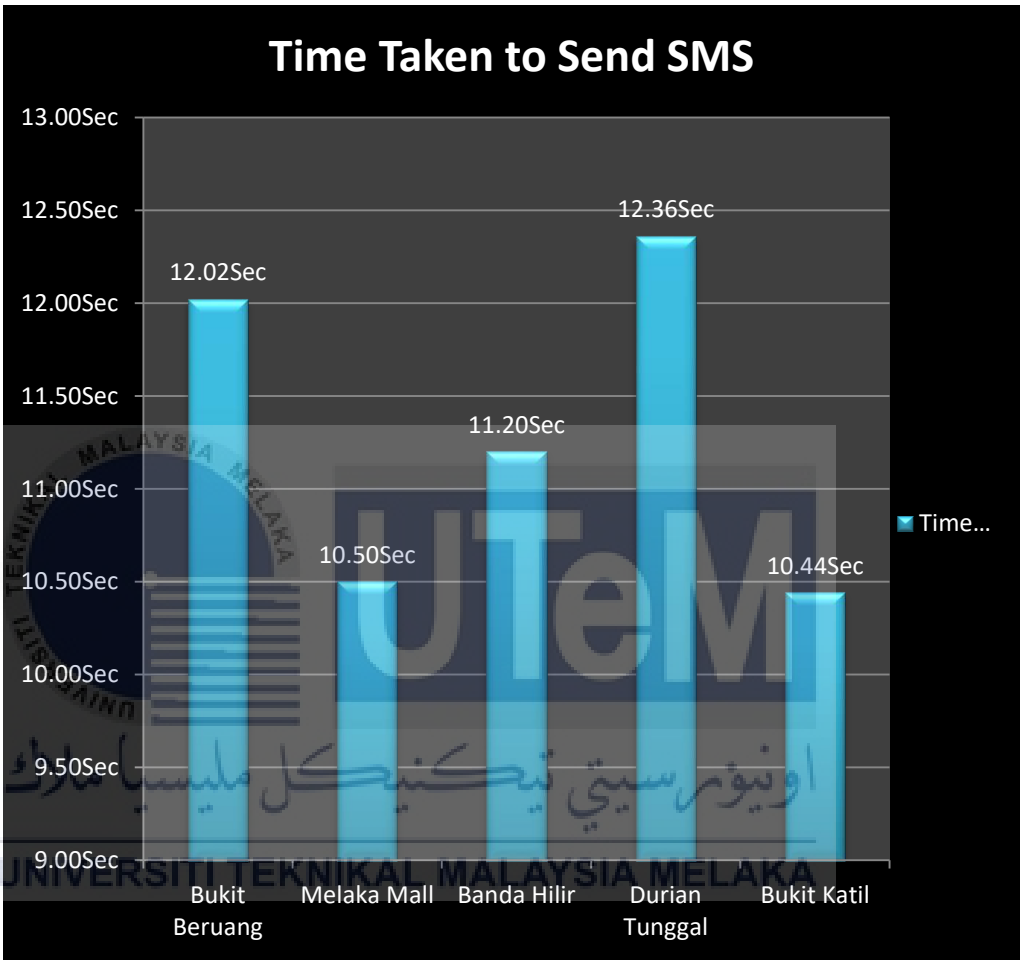


Figure 4.5: Variations of time recorded in the location

4.5 Analysis of L298N Motor Driver

The driver output voltages were tested into two situations. The first is with the motor and next without the motor. After the analysis the output voltage values are entirely dissimilar between these two conditions. When the motor driver is not attached to the motor, the yield voltage hugely increases once PWM increase. But when the motor driver is attached to the motor, the output voltage slowly and gradually rises once PWM rise.

Table 4.9: Analysis of L298N motor driver output voltage with and without motor

	PWM	L298N Driver Output Voltage (V)
Without Motor	0	0
	23	6.40
	36	6.89
	52	7.60
	76	8.51
	90	8.92
	108	9.85
	128	10.12
	154	10.74
	176	11.16
	206	11.57
	227	11.75
	255	11.87
With Motor	0	0
	28	0.10
	37	0.12
	50	1.30
	67	3.23
	78	4.25
	89	5.53
	101	6.00
	125	7.32
	140	7.85
	163	8.57
	185	9.08
	226	10.14
	246	10.63
	255	10.83

4.6 The Function Of System

The MQ2 gas sensor will sense the LPG gas when there is any gas leakage. Whenever the sensor active, it will send input to the Arduino UNO (microcontroller) to inform a leak has occurred. Then, SMS is sent to the user which registered and automatically close the gas valve. Then after user arrive at physical place and fix the leakage reset button must be pressed to back in the initial condition.

The received SMS will consist a text " Gas Leakage at home (Attention Required)" as shown in Figure 4.16.

Figure 4.6: Receive SMS when gas leakage occurs

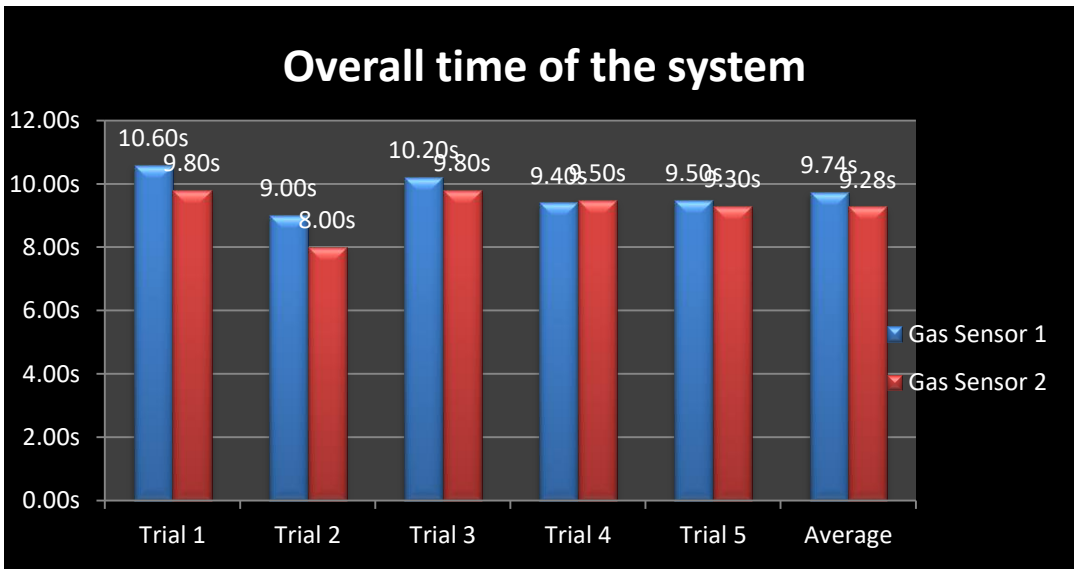
4.7 Overall Time Taken of the Project

This analysis is taken to measure overall process time of this system. The two gas sensor was placed in 15cm distance from each other. Five times time taken for each sensor and measure the time, including sending SMS and automatically closing the valve. Each trial had been done after five minutes after each trial. The average time of the system is 9.28 Seconds to 9.74 Seconds. The analysis shown more detail in Table 4.8 and Figure 4.4.

Table 4.10: Overall Time taken off the system

	Gas Sensor 1	Gas Sensor 2
Trial 1	10.6 Seconds	9.8 Seconds
Trial 2	9.0 Seconds	8.0 Seconds
Trial 3	10.2 Secondsonds	9.8 Seconds
Trial 4	9.4 Seconds	9.5 Seconds
Trial 5	9.5 Seconds	9.3 Seconds
Average	9.74 Seconds	9.28 Seconds

Figure 4.7: Overall Time Taken of the system



CHAPTER 5

CONCLUSION AND FUTURE WORK

5.0 Introduction

In this chapter, discusses the overall process of Smart Gas Leakage Alert System Using Global System for Mobile with a Short Message. Then, recommendation and suggestion will be given to improve and develop the system is more efficient in the future and to be useful for the people all around the world.

5.1 Conclusion

Smart Gas Leakage Alert System Using Global System for Mobile with a Short Message act as much needed product for people now days, which is capable of sending SMS to user during emergency gas leakage situations. In this system, the SMS will deliver to the user with text info “Gas Leakage at HOME”. So that, user can easily get to know the gas leakage at their home. Not only that, this product also can automatically shut down the supply of gas immediately once the gas leakage detected. As a result, the process time for this project is shorter than manually it can make user more easy and safe even they are not in the physical place. The output of this system varies that depends on the environment and Telco tower coverage. In rural area, the process of sending SMS to the user can be delayed a bit comparable to city center and residential area in the main city of all states. However, this system reduced the dependency of a human because it can automatically close the supply of gas supply after a gas leakage was detected. For an example,if a user at outside, they

unable to get know if there is any gas leakage in their home and they unable to react if they do know the gas leakage is occurring.

5.2 Future Work

In overall, the Smart Gas Leakage Alert System Using Global System for Mobile with a Short Message has many advantages over current technology that used. However, there are some upgrade need to do with the design where replaces the supply of the system with battery so that it can use as rechargeable device. Beside it, the valve should replace with better gas valve and design with according to the product needed. Furthermore, the sensor must be changed to MQ5 gas sensor which more detects LPG gases compare to MQ2 gas sensor. The medium of the system also can be upgraded from GSM to wifi module to save money to send SMS. Finally, the last suggestion is to implement the gas leakage system together with gas stove so can it can be easier to reach all over the user and it can be a safe system for everybody.

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APPENDICES

A: Coding:

```
#include <SoftwareSerial.h>
#include <LiquidCrystal.h>
LiquidCrystal lcd( 12 , 11 , 10 , 9 , 8 , 7 );
SoftwareSerial mySerial(9, 10);
int pinButton = 13;
int buzzer = 3;
int smokeA0 = A5;
int smokeA1 = A4;
int smokeA2 = A3;
int enableA = 6;
int pinA1 = 4;
int pinA2 = 2;
int y =0;
// Your threshold value
int sensorThres = 200;//150;

boolean selepasDetect = false;

void setup()
{
  pinMode(smokeA0, INPUT);
  pinMode(buzzer, OUTPUT);
  pinMode (enableA, OUTPUT);
  pinMode (pinA1, OUTPUT);
  pinMode (pinA2, OUTPUT);
  pinMode (pinButton, INPUT);

  Serial.begin(9600);
  lcd.begin(16, 2);
  delay(500);

  selepasDetect = false;
}

void loop()
{
```

```
int analogSensor = analogRead(smokeA0);
int analogSensor1 = analogRead(smokeA1);
y=analogSensor1+20;
int analogSensor2 = analogRead(smokeA2);
lcd.setCursor(0, 1);

//  Serial.print("Pin A5: ");
//  Serial.println(analogSensor);
//  Serial.println ("Enabling Motor A");
analogWrite (enableA, 191);

int stateButton = digitalRead(pinButton);
//  Serial.print ("stateButton = ");
//  Serial.println (stateButton);


if (selepasDetect == false) // belum detect
{
  // Checks if it has reached the threshold value
  if (stateButton == 0) // 0 = button tekan
  {

    Serial.println ("Reverse");
    digitalWrite (pinA1, HIGH);
    digitalWrite (pinA2, LOW);
    //5s backwards
    delay (800);
  }
  else // 1 = button lepas
  {
    digitalWrite(buzzer, LOW);
    lcd.setCursor(0, 0);
    lcd.print(analogSensor);
    lcd.print(" ");
    lcd.print(y);
    Serial.println ("Stop");
```

```
  analogWrite (enableA, 0);
  delay (1000);
}


Serial.print ("analogSensor = ");
Serial.println (analogSensor);
Serial.print ("analogSensor1 = ");
Serial.println (y);

// gas detected
if (analogSensor > sensorThres || y> sensorThres )
{
  digitalWrite(buzzer, HIGH);
  delay(1000);
  lcd.setCursor(0, 0);
  lcd.print("Gas lEAKAGE - ON");
  Serial.println("AT");
  Serial.println ("Forward");
  digitalWrite (pinA1, LOW);
  digitalWrite (pinA2, HIGH);
  delay (500);
  Serial.println ("Stop");
  analogWrite (enableA, 0);
  delay (500);


  Serial.println("AT+CMGF=1");

  delay(1000);

  Serial.println("AT+CMGS=\"+60166161422\""); //CHANGE TO DESTINATION NUMBER

  delay(1000);
  Serial.print("Gas Leakage at HOME (attention required)");
```

```
      Serial.write(26);

      delay(5000);
Serial.print("Wait over...");
      selepasDetect = true;
    }
  }
  else // gas detected
  {
    if (stateButton == 0) // 0 = button tekan
    {

      Serial.println ("Reverse");
      digitalWrite (pinA1, HIGH);
      digitalWrite (pinA2, LOW);
      //5s backwards
      delay (5000);

      selepasDetect = false;
    }
    else // 1 = button lepas
    {
      lcd.clear();// do nothing
    }

  }
}
```

B: Calibration Coding:

```
/*****************Demo for MQ-2 Gas Sensor Module V1.0*****************************
Support:  Tiequan Shao: support[at]sandboxelectronics.com

Lisence: Attribution-NonCommercial-ShareAlike 3.0 Unported (CC BY-NC-SA 3.0)

Note:    This piece of source code is supposed to be used as a demostration ONLY. More
         sophisticated calibration is required for industrial field application.

                                                    Sandbox Electronics    2011-04-25
************************************************************************************/

/***********************Hardware Related Macros*********************************/
#define         MQ_PIN                       (0)     //define which analog input channel you are going to use
#define         RL_VALUE                     (5)     //define the load resistance on the board, in kilo ohms
#define         RO_CLEAN_AIR_FACTOR          (9.83)  //RO_CLEAR_AIR_FACTOR=(Sensor resistance in clean air)/RO,
                                                     //which is derived from the chart in datasheet

/***********************Software Related Macros*********************************/
#define         CALIBARAION_SAMPLE_TIMES     (50)    //define how many samples you are going to take in the calibration phase
#define         CALIBRATION_SAMPLE_INTERVAL  (500)   //define the time interal(in milisecond) between each samples in the
                                                     //cablibration phase
#define         READ_SAMPLE_INTERVAL         (50)    //define how many samples you are going to take in normal operation
#define         READ_SAMPLE_TIMES            (5)     //define the time interal(in milisecond) between each samples in
                                                     //normal operation

/**********************Application Related Macros**********************************/
#define         GAS_LPG                      (0)
#define         GAS_CO                       (1)
#define         GAS_SMOKE                    (2)

/*****************************Globals***********************************************/
float           LPGCurve[3]  =  {2.3,0.21,-0.47};   //two points are taken from the curve.
                                                    //with these two points, a line is formed which is "approximately equivalent"
                                                    //to the original curve.
                                                    //data format:{ x, y, slope}; point1: (lg200, 0.21), point2: (lg10000, -0.59)
float           COCurve[3]  =  {2.3,0.72,-0.34};    //two points are taken from the curve.
                                                    //with these two points, a line is formed which is "approximately equivalent"
                                                    //to the original curve.
                                                    //data format:{ x, y, slope}; point1: (lg200, 0.53), point2: (lg10000,  -0.22)
float           Ro           =  10;                 //Ro is initialized to 10 kilo ohms

void setup()
{
  Serial.begin(9600);                               //UART setup, baudrate = 9600bps
  Serial.print("Calibrating...\n");
  Ro = MQCalibration(MQ_PIN);                       //Calibrating the sensor. Please make sure the sensor is in clean air
                                                    //when you perform the calibration
  Serial.print("Calibration is done...\n");
  Serial.print("Ro=");
  Serial.print(Ro);
  Serial.print("kohm");
  Serial.print("\n");
}

void loop()
{
   Serial.print("LPG:");
   Serial.print(MQGetGasPercentage(MQRead(MQ_PIN)/Ro,GAS_LPG) );
   Serial.print( "ppm" );
   Serial.print("    ");
   Serial.print("CO:");
   Serial.print(MQGetGasPercentage(MQRead(MQ_PIN)/Ro,GAS_CO) );
   Serial.print( "ppm" );
   Serial.print("    ");
   Serial.print("SMOKE:");
   Serial.print(MQGetGasPercentage(MQRead(MQ_PIN)/Ro,GAS_SMOKE) );
   Serial.print( "ppm" );
   Serial.print("\n");
   delay(200);
}
```

```
/****************** MQResistanceCalculation *************************************
Input:   raw_adc - raw value read from adc, which represents the voltage
Output:  the calculated sensor resistance
Remarks: The sensor and the load resistor forms a voltage divider. Given the voltage
         across the load resistor and its resistance, the resistance of the sensor
         could be derived.
****************************************************************************/
float MQResistanceCalculation(int raw_adc)
{
  return ( ((float)RL_VALUE*(1023-raw_adc)/raw_adc));
}

/***************************** MQCalibration ****************************************
Input:   mq_pin - analog channel
Output:  Ro of the sensor
Remarks: This function assumes that the sensor is in clean air. It use
         MQResistanceCalculation to calculates the sensor resistance in clean air
         and then divides it with RO_CLEAN_AIR_FACTOR. RO_CLEAN_AIR_FACTOR is about
         10, which differs slightly between different sensors.
****************************************************************************/
float MQCalibration(int mq_pin)
{
  int i;
  float val=0;

  for (i=0;i<CALIBARAION_SAMPLE_TIMES;i++) {            //take multiple samples
    val += MQResistanceCalculation(analogRead(mq_pin));
    delay(CALIBRATION_SAMPLE_INTERVAL);
  }
  val = val/CALIBARAION_SAMPLE_TIMES;                   //calculate the average value

  val = val/RO_CLEAN_AIR_FACTOR;                        //divided by RO_CLEAN_AIR_FACTOR yields the Ro
                                                        //according to the chart in the datasheet

  return val;
}


/*****************************  MQRead *********************************************
Input:   mq_pin - analog channel
Output:  Rs of the sensor
Remarks: This function use MQResistanceCalculation to caculate the sensor resistenc (Rs).
         The Rs changes as the sensor is in the different consentration of the target
         gas. The sample times and the time interval between samples could be configured
         by changing the definition of the macros.
****************************************************************************/
float MQRead(int mq_pin)
{
  int i;
  float rs=0;

  for (i=0;i<READ_SAMPLE_TIMES;i++) {
    rs += MQResistanceCalculation(analogRead(mq_pin));
    delay(READ_SAMPLE_INTERVAL);
  }

  rs = rs/READ_SAMPLE_TIMES;

  return rs;
}

/*****************************  MQGetGasPercentage **********************************
Input:   rs_ro_ratio - Rs divided by Ro
         gas_id      - target gas type
Output:  ppm of the target gas
Remarks: This function passes different curves to the MQGetPercentage function which
         calculates the ppm (parts per million) of the target gas.
****************************************************************************/
int MQGetGasPercentage(float rs_ro_ratio, int gas_id)
{
  if ( gas_id == GAS_LPG ) {
     return MQGetPercentage(rs_ro_ratio,LPGCurve);
  } else if ( gas_id == GAS_CO ) {
     return MQGetPercentage(rs_ro_ratio,COCurve);
```

```
  }

  return 0;
}

/*****************************  MQGetPercentage ***********************************
Input:   rs_ro_ratio - Rs divided by Ro
         pcurve      - pointer to the curve of the target gas
Output:  ppm of the target gas
Remarks: By using the slope and a point of the line. The x(logarithmic value of ppm)
         of the line could be derived if y(rs_ro_ratio) is provided. As it is a
         logarithmic coordinate, power of 10 is used to convert the result to non-logarithmic
         value.
************************************************************************************/
int  MQGetPercentage(float rs_ro_ratio, float *pcurve)
{
  return (pow(10,( ((log(rs_ro_ratio)-pcurve[1])/pcurve[2]) + pcurve[0])));
}
```

C: Survey Questions:

QUESTIONS RESPONSES 107

Smart Gas Leakage Alert System Using Global System For Mobile With A Short Message

The Smart Gas Leakage Alert System Using Global System For Mobile With A Short Message is designed to suit of household dangers because of the very inflammable LPG gas spills. This product is necessary to every household because it will detect gas leakage and deliver SMS to user immediately and automatic close the supply of gas.

1) Do you think gas leakage is dangerous ? *

- Yes
- No

2) Do you think SMS alert during gas leakage occur is effective? *

- Yes
- No

3) Do you think automatic closing the supply of gas if gas leakage happen is effective?

- Yes
- No

4) How long it takes if you to close the gas supply if gas leakage happen by your own ? *

- 1 to 3 minutes
- 4 to 6 minutes
- 7 to 10 minutes
- More than 10 minutes

5) Did you think Smart Gas Leakage Alert System Using Global System For Mobile With A Short Message system will shorten the duration of closing process ? *

- Yes
- No

6) Did you think this system will overcome your burden during emergency situation?

- Yes
- No

D: Gantt Chart