GAS LEAKAGE DETECTOR USING ARDUINO AND GSM MODULE WITH SMS ALERT AND SOUND ALARM

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This report is submitted in partial fulfilment of the requirements for the Bachelor of Computer Science (Computer Networking)

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2017

DECLARATION

I hereby declare that this project report entitled
Gas Leakage Detector Using Arduino And GSM Module With SMS Alert And Sound Alarm

is written by me and is my own effort and that no part has been plagiarized without citations

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Date: 21 August 2017

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Date: 21 August 2017

DEDICATION

This thesis is dedicated to ALMIGHTY ALLAH who is the most merciful and helpful and my precious and my beloved parents, my mother, brothers and friends especially because they really help to complete this project thesis. There are people whom grooms me and teaches me the way of life for this unconditional love, moral and financial support and also for their care and prayers. May ALLAH always showered HIS blessing upon them.

ACKNOWLEDGEMENTS

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Finally, I must acknowledge as well everyone who directly or indirectly assisted, advised and supported me on doing this Final Year Project over the semester.

ABSTRACT

Liquefied Petroleum Gas (LPG) consists of mixture of propane and butane which is highly flammable chemical. It is odorless gas, due to which Ethanate oil is added as powerful odorant. Some people have low sense of smell, may or may not respond on low concentration of gas leakage. Due to leakage of LPG, it produces hazardous and toxic impact on human begins and also other living creatures. To over this predicament, we need quittance. There by, we speculate some solution to detect the LPG gas leakage and make alert to users of it. The gas sensor used in this project is MQ5 which are detect the present of alcohol and Liquefied Petroleum Gas (LPG). These sensors will detect the concentration of the gas according the voltage output of the sensor. To make the sensors operate in the alarm system and data monitoring system, Arduino was used as the microcontroller for the whole system. The circuit also includes GSM modules and buzzer. GSM module will send sms alert to mobile phone user when the gas leakage was detect. The buzzer will sound to give warning the user. A graphical user interface (GUI) was created using app inventor for end user monitoring purpose.

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CHAPTER I

INTRODUCTION

1.1 Project Background

LPG consists of mixture of propane and butane which is highly flammable chemical. It is odorless gas, due to which Ethanate oil is added as powerful odorant, so that leakage can be easily detected. There are other international standards like EN589, amyl Mercaptane and tetrahydrothiophene which are most commonly used as odorants. LPG is one of the alternate fuels used now days. LPG is also used as an alternate fuel in vehicles due to soaring in the prices of petrol and diesel.

Some people have low sense of smell, may or may not respond on low concentration of gas leakage. In such a case, some high security systems become an essential and help to protect from gas leakage accidents. Bhopal, Chernobyl, Okishima gas tragedy was an example of gas leakage accident in India, Russia and Japan. This was world's worst gas leakage industrial accident. Gas leakage detection is not only important but stopping leakage is equally essential. We designed a system which sniffs LPG leakage and emphraxis by the measures such as SMS message and Buzzer sound.

1.2 Problem Statement

PS	Problem Statement
1	Gas leakages accidents are a common problem especially in households and industries. If not detected and corrected at the right time, it can also be life threatening. Unlike a traditional gas leakage alarm system which only senses a leakage and sounds an alarm, the idea behind our solution is to turn off the main power and gas supplies as soon as a gas leakage is detected apart from sounding the alarm. Then, a alert message is sent to an authorized person to informing him about the gas was leakage.

Table 1.1: Problem Statement

1.3 Project Question

PQ	Project Question
PQ1	What is the purpose of making the gas leakage detector?
PQ2	How the gas leakage detector help the user safety?

Table 1.2: Project Question

1.4 Objective

PQ	PO	Project Objectives
PQ1	PO1	To test MQ5 gas sensor to detect gas leakage (like LPG leak, Butane leak, Methane leak) or any such petroleum based gaseous substance.
PQ2	PO2	To develop alert mechanism message and send message to specified mobile numbers.
PQ3	PO3	To test a buzzer give a sound alarm when gas leak was detected and stop the alarm once gas leak is under control.
PQ4	PO4	To display status in mobile application

Table 1.3: Project Objective

1.5 Project Scopes

Scope of this projects:

1. System can detect the leakage of LPG gas in a closed environment.
2. System will inform the user about the leakage of gas via SMS.
3. System will activate the alarm unit to inform neighbours about the gas leakage.

1.6 Expected Output

This gas leakage detector can be easily integrated into a unit that can sound an alarm or give a visual suggestion of the LPG concentration. The sensor has both admirable sensitivity and rapid response time. This sensor can also be used to sense other gases like iso-butane, propane, LNG and even cigarette smoke.

1.7 Project Contributions

Gas leakage is a major concern at homes, offices, industries etc. Many homes and industries had fallen victims of inferno due to unknown gas leakage at a hidden point. This is dangerous and requires high security to avoid life and property being destroyed. So to avoid this problem occur, gas leakage detector must install at vulnerable locations. The system is designed to prevent loss/death to occur through gas leakages and hence promote safety of life and property.

1.8 Report Organization

Chapter 1: Introduction

This chapter 1 will explain about the introduction of the project and also focusing on problem statement and the objective that will be achieve in this project. The project background, scope and other explanation about this project also in this chapter.

Chapter 2: Literature Review

This chapter will be discuss about the detail of this project and also include the current problem. The related and previous project about the formulation of the LPG gas leakage detector are also discuss in this chapter.

Chapter 3: Methodology

This chapter will be explaining in detail about the method that will be choose and used in this project. The milestone also will be include in this chapter.

Chapter 4: Analysis And Design

This chapter will be explaining and discussing about the design of the gas detector leakage using arduino and GSM module with sms alert and sound alarm and also software and hardware that will be used in this project.

Chapter 5: Implementation

This chapter will be explain about all the activity that involve in the developing the gas detector leakage and also the testing to make the gas detector leakage to work will be done in this chapter.

Chapter 6: Testing

This chapter will include all the testing progress that have been done in this project.

Chapter 7: Project Conclusion

This chapter will be the final chapter and all the summary and conclusion of the project will be made in this chapter. The improvement that can be made for this project in the future also be explain in this chapter.

1.9 Conclusion

Gas leakages in households and industries cause risk to life and property. A huge loss has to be incurred for the accident occurred by such leakages. A solution to such a problem is to set up a monitoring system which keeps on monitoring the leakage of any kind of flammable gases and protects the consumer from such accidents. The present paper provides a solution to prevent such accidents by not only monitoring the system but by also switching off the main power and gas supplies in case of a leakage. In addition to this, it activates an alarm as well as sends a message to the user.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss in details on the components and instruments used for this project in general. Besides that, there are couple more of past related project or paper work that is related to this project.

2.2 Related Work/Previous Work

Based on the Abishek, V And Aierselvam, M. (2013) in their project “Wireless Auto Power Trip during Gas Leakage” state that it’s a known fact that LPG leakage during domestic usage is a disaster, especially when we switch on any electric switch or appliances because it may produce a spark which causes sudden loud explosion of the gas filled room. In the recent times, there is an increase in such accidents and casualties related to it in our nation.So the main idea is to develop security system for detecting gas leakage in closed environment using sensors. So to avoid the explosion, the wireless systems will trip the of the power supply depending on the level gas once the gas leakage is detected.

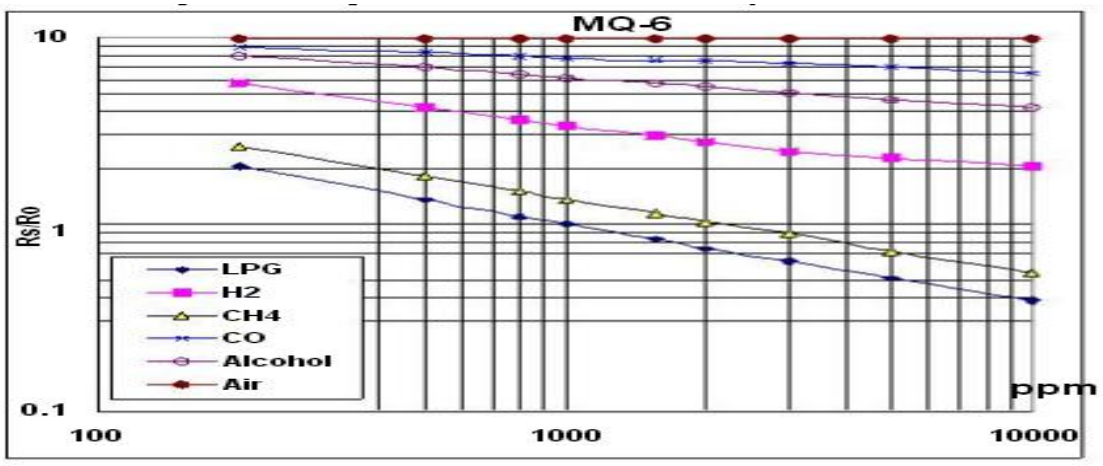

Figure 2.1 : Sensitivity characteristics of mq6 gas sensor.

Digambar Surse., Swati Talekar., Tejal Suryawanshi And Prof. Gaikar. (2016) in their project "Smart Gas Booking System & Leakage Detection" state that it is difficult to know the level of LPG gas cylinder. If LPG is going to finish without informing us it can create difficult condition for cooking etc. Our system design can help us to avoid such kind of problem in our daily life. Our design is based on ARM controller, it can track LPG emptiness all the time if LPG is very close to finish or at empty level then it can alert us by sending SMS to LPG Agency for ordering the LPG cylinder.

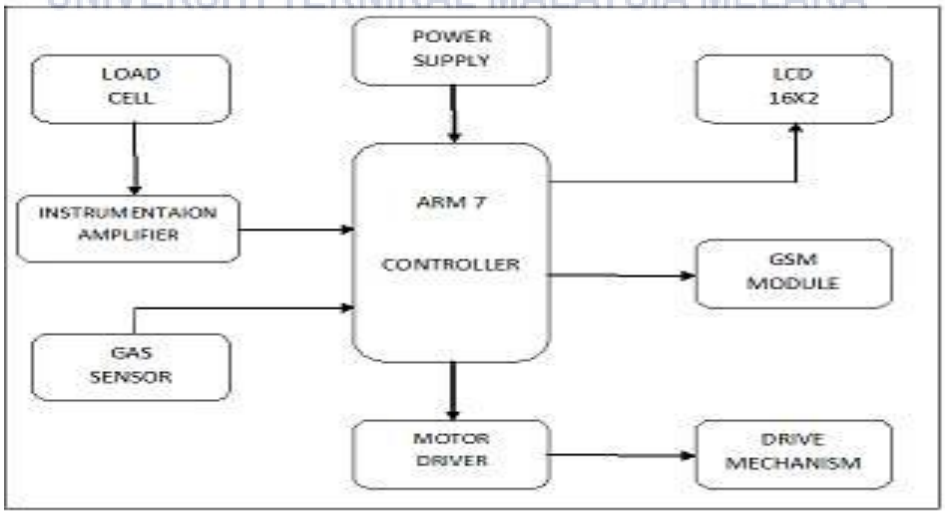

Figure 2.2 : Block Diagram

Padma Priya, K., Surekha, M., Preethi, R., Devika, T., And Dhivya, N. (2014) in their project “Smart Gas Cylinder Using Embedded System” state that The design of a wireless LPG leakage monitoring system is proposed for home safety. This system detects the leakage of the LPG and alerts the consumer about the leak by SMS and as an emergency measure the system will turn off the power supply, while activating the alarm. The additional advantage of the system is that it continuously monitors the level of the LPG present in the cylinder using load sensor and if the gas level reaches below the threshold limit of gas around 2kg so that the user can replace the old cylinder with new in time and automatically books the cylinder using a GSM module .The device ensures safety and prevents suffocation and explosion due to gas leakage. This project is implemented using ARM 7 processor and simulated using keil software.

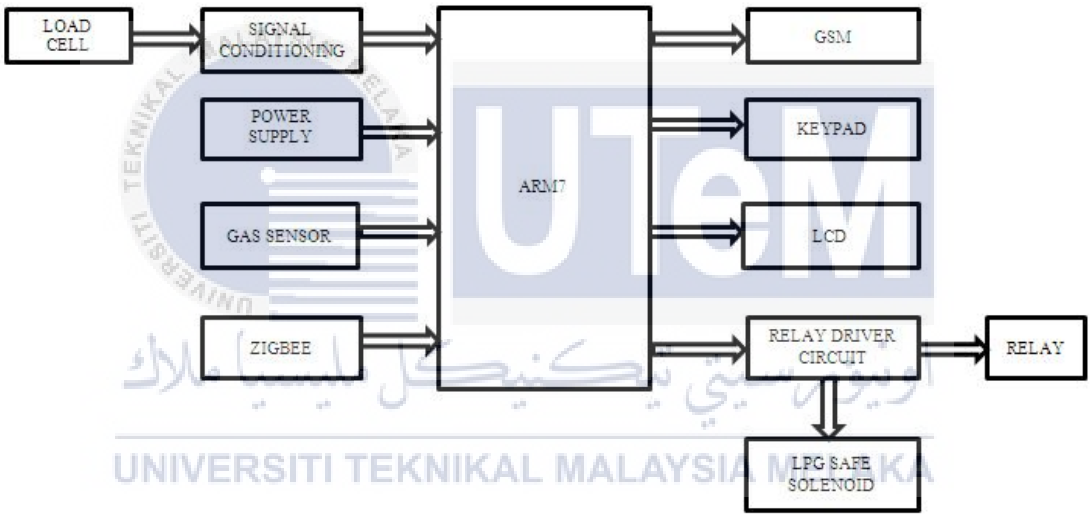

Figure 2.3 : Block diagram of ARM LPG leak detection and prevention system.

Ashish Sharma. (2009) in his project “Microcontroller Based LPG Gas Detector Using GSM Module” state that ideal gas sensor is used to detect the presence of a dangerous LPG leak in your car or in a service station, storage tank environment. This unit can be easily incorporated into an alarm unit, to sound an alarm or give a visual indication of the LPG concentration. The sensor has excellent sensitivity combined with a quick response time. The sensor can also sense iso-butane, propane, LNG and cigarette smoke. If the LPG sensor senses any gas leakage from storage the output of this sensor goes low. This low signal is monitored by the microcontroller and it will identify the gas leakage. Now the microcontroller is turn on LED and Buzzer. After few milliseconds delay, it also turn on exhaust fan for throwing gas out and continue send messages as “GAS LEAKAGE” to a mobile no written in c-code.

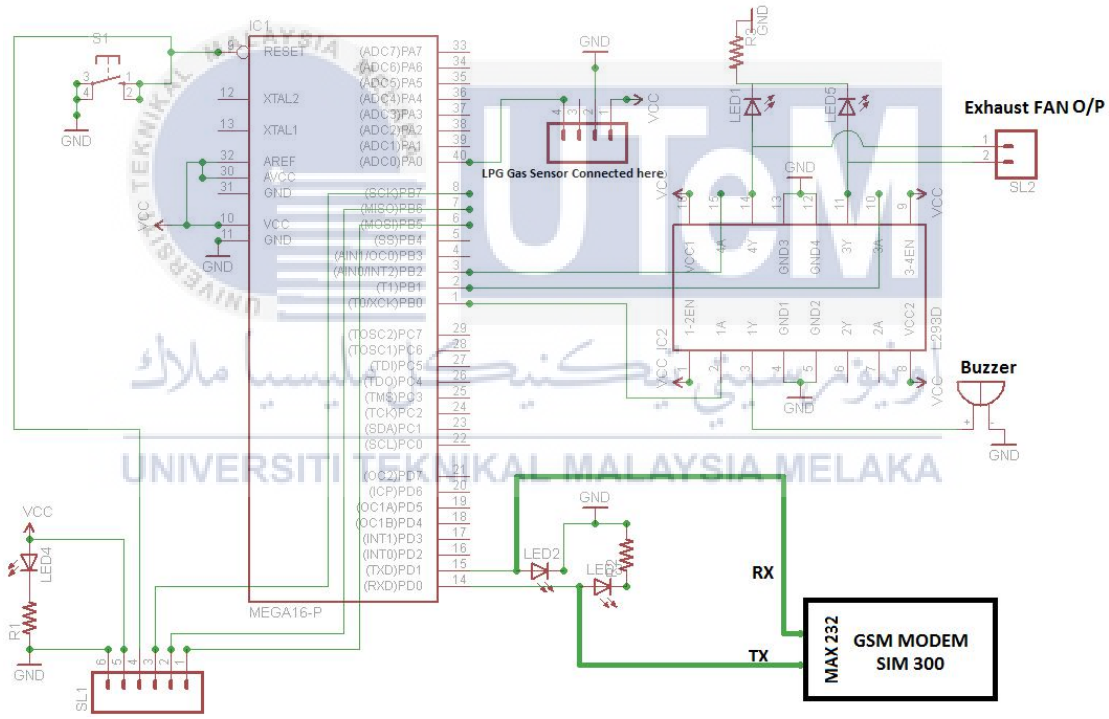

Figure 2.4 : Schematic Diagram

Prof. Amsaveni, M., Anurupa, A., Anu Preetha, R., Malarvizhi, C And Gunasekaran, M. (2015) in their project “Gsm based LPG leakage detection and controlling system” state that Gas leakage is a major problem with industrial sector, residential premises etc. One of the preventive methods to stop accident associated with the gas leakage is to install a gas leakage detection kit at vulnerable places. The aim of this project is to present such a design that can automatically detect, alert and control gas leakage. In this project, after the leakage of gas is detected, the valve is automatically closed, thereby stopping the leakage. Then the electric power supply is also shut down to prevent fire accidents. In particular, gas sensor has been used which has high sensitivity to gases like propane and butane. Gas leakage system consists of GSM module, which alerts the user by sending SMS.

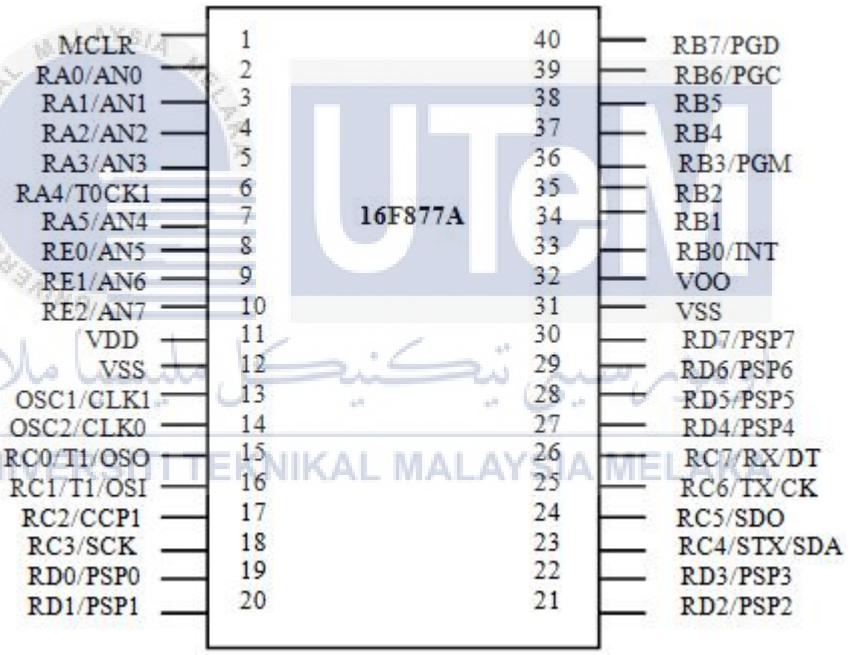

Figure 2.5 : PIC Microcontroller

2.3 Critical Review Of Current Problem And Justification

Table 2.1: Critical Review of Current Problem and Justification

Research Title/Product	Author	Purpose	Description	Method
'Wireless Auto Power Trip during Gas Leakage in *Research India Publications of Advance in Electronic and Electric Engineering, 3(3), 327-332.'*	Abishek, V And Aierselvam, M. (2013).	The proposed wireless gas leakage system is composed of two major modules: the gas leakage detection and transmission module, and the receiver module. The gas leakage detection and transmission module detects the change in concentration of LPG and natural gas and activates an audiovisual alarm when it exceeds a certain threshold. Furthermore, it sends another alarm message through a radiofrequency (RF) system to the receiver module. The receiver module is a mobile unit that could be placed	The wireless gas sensing and power trip system was implemented and its working depends on the distance of receiver and the concentration of the gas present in the air. Furthermore the system has a calibrated threshold concentration value so when again the concentration drops below the threshold value automatically the power trip will be reversed and the alarm will go off.	Use the RF receiver and a microcontroller (PIC-16F877A Or INTEL 8051).

		anywhere within the premises of the house so that the alarm can be detected and heard at a distance from the place of gas leakage.		
'Smart Gas Booking System & Leakage Detection in *International Journal of Innovative Research in Computer and Communication Engineering, 4(3), 3221-3226.'*	Digambar Surse., Swati Talekar., Tejal Suryawanshi And Prof. Gaikar. (2016).	The automatic gas booking system was proposed, designed and successfully implemented in this paper for human simplicity and gas leakage detection is useful in home safety and industrial applications. This system detects the leakage of the gas and alerts the owner about the leakage of gas by SMS, while activating the alarm. The system continuously monitor the weight of the gas cylinder and its display on LCD makes it an efficient home security system and also can be used	LPG gas leakage detection projects main idea is to implement security system for detecting leakage of gas in the house. Now days there are many cases related to gas leakage which cause innocent people lives and property damage. This system detects the leakage of the LPG and sounds the alarm to alerts the consumer also it send the SMS about the gas leakage. It can also turn off the main power supply. The presence of dangerous LPG leakage in the gas	Use the ARM (Advance RISC Machine) is an 16 bit/32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support.

		in industries and other places to detect gas leaks. This project is implemented using the ARM controller and simulated using the Keil software. The cost involved in developing the system is significantly low and is much less than the cost of gas detectors commercially available in the market.	vehicle (cars, van, auto), companies can be detected using the Ideal Gas Sensor. The system can be simply integrated into a unit that can sound an alarm. This system is very useful to avoid the hazardous.	
'Smart Gas Cylinder Using Embedded System in *International Journal Of Innovative Research In Electrical, Electronics, Instrumentation and Control Engineering, 2(2), 958-962.'*	Padma Priya, K., Surekha, M., Preethi, R., Devika, T., And Dhivya, N. (2014).	The design of a wireless LPG leakage monitoring system is proposed for home safety. This system detects the leakage of the LPG and alerts the consumer about the leak by SMS and as an emergency measure the system will turnoff the power supply, while	This system detects the leakage of the LPG and alerts the consumer about the leak by SMS and as an emergency measure the system will turn off the power supply, while activating the alarm. Along with gas leakage detection, this system gives a fully	This project is implemented using ARM 7 processor and simulated using keil software.

		activating the alarm. The additional advantage of the system is that it continuously monitors the level of the LPG present in the cylinder using load sensor and if the gas level reaches below the threshold limit of gas around 2kg so that the user can replace the old cylinder with new in time and automatically books the cylinder using a GSM module .The device ensures safety and prevents suffocation and explosion due to gas leakage.	automated approach towards the gas booking. Real time weight measurement of the gas and its display on LCD makes it an efficient home security system and also can be used in industries and other places to detect gas leaks.	
'Microcontroller Based LPG Gas Detector Using GSM Module in *Research of B.Tech., EL Engg.'*	Ashish Sharma. (2009.)	To detect the presence of a dangerous LPG leak in your car or in a service station, storage tank environment. This unit can be easily incorporated into an	This project use simple electro-circuit, convert change of conductivity to correspond output signal of gas concentration. MQ-5 gas sensor	Use the ATMEGA16 is a low-power, high-performance CMOS 8-bit microcomputer with 16K bytes of Flash programmable

		alarm unit, to sound an alarm or give a visual indication of the LPG concentration. The sensor has excellent sensitivity combined with a quick response time. The sensor can also sense iso-butane, propane, LNG and cigarette smoke.	has high sensitivity to Methane, Propane and Butane and could be used to detect both Methane and Propane. The sensor could be used to detect different combustible gas especially Methane, it is with low cost and suitable for different application.	and erasable read only memory (EPROM).
'Gsm based LPG leakage detection and controlling system in *The International Journal Of Engineering And Science, 112-116.'*	Prof. Amsaveni, M., Anurupa, A., Anu Preetha, R., Malarvizhi, C And Gunasekaran, M. (2015).	The proposed system takes an automatic control action after the detection of 0.001% of LPG leakage.This automatic control action provides a mechanical handle for closing the valve. We are increasing the security for human by means of a relay which will shutdown the electric power to the house. Also by using GSM, we are	The aim of this project is to present such a design that can automatically detect, alert and control gas leakage. In this project, after the leakage of gas is detected, the valve is automatically closed, thereby stopping the leakage. Then the electric power supply is also shut down to prevent fire accidents. In particular, gas	This project use PIC microcontroller consists of ADC. The type used is 16F877A. It has totally 40 pins. Its memory size is 16 bits.

		sending an alert message to the users and a buzzer is provided for alerting the neighbours about the leakage.	sensor has been used which has high sensitivity to gases like propane and butane. Gas leakage system consists of GSM module, which alerts the user by sending SMS.	

2.4 Proposed Solution/Further Research

Based on V. Abishekand M. Aierselvam(2013) in their project "Wireless Auto Power Trip during Gas Leakage". With the purpose of this project is detect the leakage of LPG gas using microcontroller which is similar with my project. The difference between this project and my project is in my project have GSM module that will inform the user about the leakage of gas via SMS.

2.5 Conclusion

As conclusion, by doing the literature review, I was able to make the summary of the current knowledge with the past knowledge so that I can make more investigation and also to identifying the advantages and also the disadvantages of the previous work. Finally, it also help me to make me decide of what I want to apply for completing my project and to make a critical analysis about it.

CHAPTER III

METHODOLOGY

3.1 Introduction

This chapter will explain about the methodology method that will be choose in the project development. The methodology will explain all the phase that involve to make sure the project will run smoothly according to what that has been planned and detect if problem occur. The project is divided into two parts which are hardware and software. For the software implementation, it involves writing code and programming the Arduino. Meanwhile, hardware implementation involves designing the circuit of the project. The project milestone and Gantt chart also will be shown in this chapter to make sure this project have a well planning of time.

3.2 Methodology

The methodology that will be used in this project is Waterfall Model because the progress will be seen as flowing steadily downward (like a waterfall) through the phases of Planning, Requirement, Design, Implementation, Testing, Maintenance and finally Documentation. Waterfall development model originates in the construction and manufacturing industries such as highly structured the physical environments in which after the fact that changes are prohibitively costly. This hardware-oriented model was simply adapted for software development because there was no formal software development software that existed at the time.

Planning

In this phase, problem with connection software and hardware, type of gas sensor to used, type of microcontroller and type of connection are listed. The plan of what tools that are need in this project also listed to make the project. In order to develop the gas leakage detector system need to be list in term of hardware and also software. The most important is make sure everything is well planned before starting the project.

Requirement

In this phase, all the information about type of gas sensor, type of microcontroller and type of connection that be to used are obtained. Another hardware and software that will be needed in this project also are listed. This phase constitute of everything that already been planned are achieve so that can be move to the next stage of the project.

Design

This stage will explained about this project that will be built from start to end. This phase also will have to make sure the design that has been made is approve and the design is well made before move to the next stage. The flowchart, Gantt chart and simple circuit with milestone are designed in this stage. Everything will be work accordingly based on the flowchart that has been made.

Implementation

This stage is similar to the developed stage because at this stage, the software are installed to build the connection between hardware and software and the hardware that will be used in this project are developed. Based from the design that are planned, all the setup has be made. Most important are to make sure the implementation stage are followed the time given from the milestone and not exceed the time.

Testing

This phase, the gas sensor will be tested to detect the incoming gas. The buzzer and GSM module will be alert after the gas sensor detect the incoming gas. This also test the connection wireless between hardware and software using bluethooth module.

Maintenance

The maintenance phase is to make sure that the system is always working to test and also the system can be used without any problem. Also make sure the gas sensor is work because easier to detect the problem with buzzer and GSM module alert. The checking from time to time is needed because to make a detection about the error and malfunction for this system.

Documentation

All the steps that have been involved in this project will be record in this phase and also will be documented in the report. With this, everything will be easy to refer if a problem is occur and also it will be documented. Finally keep track of what have been done and what is still not done.

3.3 Project Milestones

Flowchart is a formalized diagram representation of an algorithm, workflow, and manufacturing process, showing the steps as boxes of various kinds, and finally connecting them with arrow showing to the bottom. This diagrammatic represent illustrates of a solution model to a given problem. Flowchart also used in analyzing, designing, documenting or managing a process in a various fields.

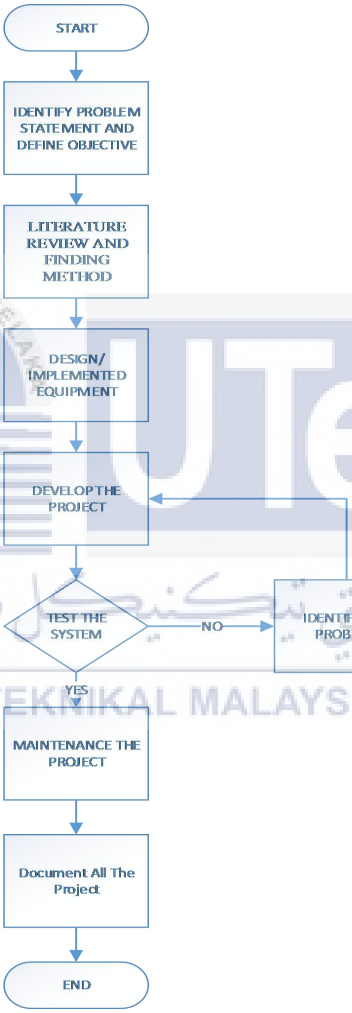

Figure 3.1: Flow Chart

A Gantt chart is a type of bar chart that illustrates a project schedule. Gantt chart also illustrate the start and finish dates of the terminal elements and also summary elements of a project. Terminal elements and summary elements comprises the work breakdown structure of the project. The modern Gantt chart also show the dependency relationship between activities and also it can be used to show the current schedule status using percent-complete shadings. This chart also used in information technology to represent data that has been collected.

Gantt chart for this mobile application is as follow:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Identify Problem and Define Objective															
Study And Research															
Design The Project															
Develop The Project															
Testing															
Maintenance The Project															
Document All The Project															

Table 3.1: Gantt chart for PSM1

	1	2	3	4	5	6	7	8
Describe activity in implementation phase								
Develop environment setup								
Testing								
Maintenance The Project								
Summarize the project								
Conclusion								
Document All The Project								

Table 3.2 : Gant Chart for PSM2

Below is the milestones that has been made for this system :

	Duration	Start	Finish
Identify Problem and Define Objective	2 weeks	20 February 2017	3 March 2017
Study And Research	2 weeks	6 March 2017	17 March 2017
Design The Project	3 weeks	20 March 2017	7 April 2017
Develop The Project	4 weeks	10 April 2017	5 May 2017
Testing	2 weeks	165May 2017	26 May 2017
Maintenance The Project	1 week	29 May 2017	2 June 2017
Document All The Project	15 weeks	20 February 2017	2 June 2017

Table 3.3 : Milestones for PSM1

	Duration	Start	Finish
Describe activity in implementation phase	2 weeks	3 July 2017	14 July 2017
Develop environment setup	2 weeks	10 July 2017	21 July 2017
Testing	2 weeks	24 July 2017	4 August 2017
Maintenance The Project	2 weeks	1 August 2017	11 August 2017
Summarize the project	1 weeks	7 August 2017	13 August 2017
Conclusion	1 week	13 August 2017	16 August 2017
Document All The Project	8 weeks	3 July 2017	16 August 2017

Table 3.4 : Milestone for PSM2

Based on the Waterfall Model, the figure below shown:

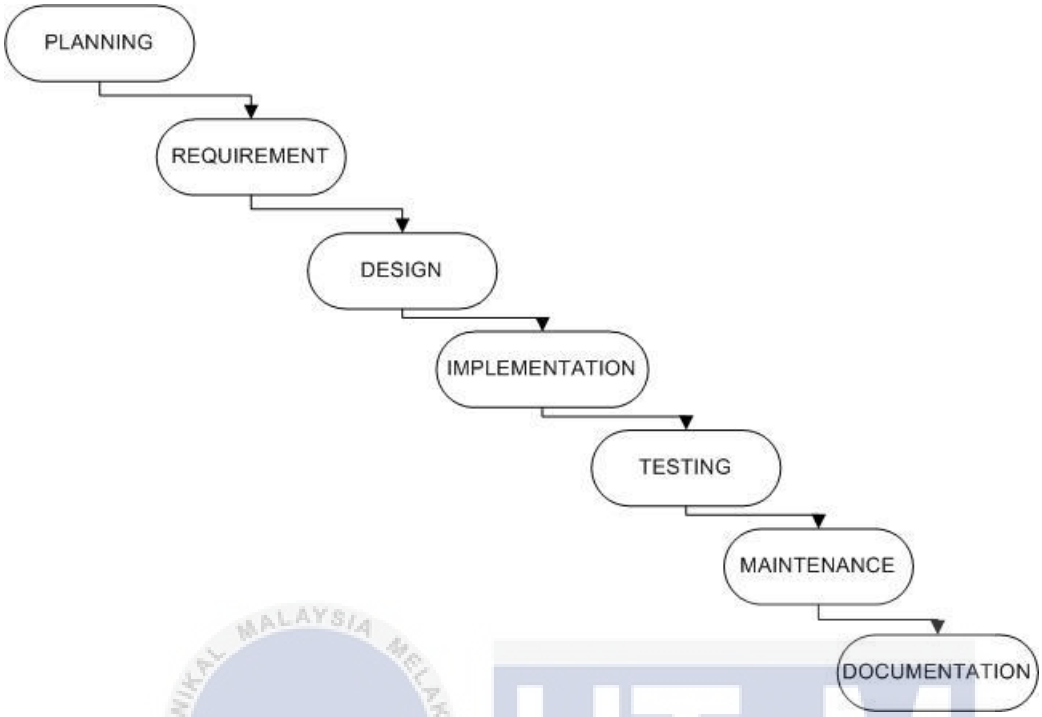

Figure 3.2: Methodology Waterfall

3.4 Conclusion

From what we can conclude from this chapter is the most important that must be aware is methodology and milestone before develop the system. This is because it will make the system to be planning well and also need to be organizes so that it can be done by the time that already be assigned. The project also will running smoothly and efficient based on the following time. Waterfall model are choose as the methodology for this project and the milestone of the project is needed to be developed. The design chapter will be explaining in the next chapter.

CHAPTER IV

ANALYSIS AND DESIGN

4.1 Introduction

This chapter will discuss about the project design and analysis. The data requirement will explain how the apps work meanwhile the functional requirement will show how the idea of the android apps function. The hardware and software that are required to develop the project also will be discuss and finally the sketch of the design for the interface of the mobile application also will be cover.

4.2 Problem Analysis

Gas leakages are a common problem in households and industries. If not detected and corrected at the right time, it can also be life threatening. Unlike a traditional gas leakage alarm system which only senses a leakage and sounds an alarm, the idea behind our solution is to turn off the main power and gas supplies as soon as a gas leakage is detected apart from sounding the alarm. In addition to this, a message is sent to an authorized person informing him about the leakage.

4.3 Requirement Analysis

4.3.1 Data Requirement

Input of this system is when the gas leakage was detect by the gas sensor, it will send the value of gas sensor to arduino. Arduino will read the gas sensor using analog reading input to know the concentration of gas. The concentration of gas is divided in three type of level according to their range. The first is normal gas is from 0-200 ppm unit. Second is medium gas is from 200-600 ppm unit. The last one is dangerous gas is more than 600 ppm unit. So the concentration of gas will define according their range.

Output of this system is when the gas leakage was detected, the buzzer will sound and led light also will turn on. The GSM module also will send alert message to the user to inform gas was leakage. This sytem also have mobile application that show the range of concentration. This mobile application will help the user to know the status of gas according to the range of gases.

4.3.2 Functional Requirement

In this project, the system will work when the gas leakage was detected. The gas was detect by gas sensor and it read as analog reading value to send the arduino. The arduino will receive the gas sensor value and range it according their level of concentration. The led will turn on and the buzzer also give the sound. The GSM module also send alert message to the user to inform the gas leakage was detected. User can know the status of gas by using the mobile application because it will show the concentration and status of gas.

4.3.3 Non-Functional Requirement

The mobile application that use this system need the wireless connection to connect the system. In this project, bluetooth module was develop to connect the mobile application with the system. But in real world, the bluetooth is not suitable as the wireless connection to connect the system because the range and speed of bluetooth is lower than internet. The bluetooth module is acts as simulation of connection wireless.

4.3.4 Others Requirement

4.3.4.1 Hardware Requirement

Arduino Uno

- Microcontroller ATmega
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limits) 6-20V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- Analog Input Pins 6
- DC Current per I/O Pin 40 mA
- DC Current for 3.3V Pin 50 mA
- Flash Memory 32 KB of which 0.5 KB used by boot loader
- SRAM 2 KB
- EEPROM 1 KB

GSM Module

- High Quality Product (Not hobby grade)
- Dual-Band GSM/GPRS 900/ 1800 MHz
- RS232 interface for direct communication with computer or MCU kit
- Configurable baud rate
- Wire Antenna (SMA connector with GSM Antenna Optional)
- SIM Card holder.
- Built in Network Status LED
- Inbuilt Powerful TCP/IP protocol stack for internet data transfer over GPRS.
- Normal operation temperature: -20 °C to +55 °C
- Input Voltage: 12V DC

Gas Sensor MQ5

- Concentration level for LPG is 200-1000ppm.
- Circuit voltage is 5V.
- Heating consumption less than 800mW.
- Load resistance adjustable.
- Wide detecting scope.
- High sensitivity to combustible gas in wide range.
- Fast response.
- Stable and long life.

LED

- Forward current 20 mA
- Reverse current 10 uA
- Operating temp 25 - 85 C
- Storage temp 30 - 85 C

Buzzer

- Sound volume 95dB @ 10cm (3.94'')
- Applying frequmecy 50 - 60 Hz
- Current consumption AC/DC 15 - 20 mA
- Rated insulation Voltage 500 VAC
- Degree of protection IP 40

Bluetooth Module

- Sensitivity (Bit error rate) can reach -80dBm
- Range ot output's power -4 -+6dBm
- Build in 2.4GHz antenna
- External 8Mbit Flash
- Lower power consumption
- Has high performance wireless transceiver system
- Low cost

4.3.4.2 Software Requirment

Arduino Software

- Called Arduino IDE (Integrated Development Environment)
- Used to write and upload the code to the physical board
- Uses a simplified version of C++, making easier to learn the program
- Provides a standard form factor that breaks the functions of the micro-controller into more accessible package

MIT App Inventor

- Online software that creates the mobile application
- Need the account to use this software
- Can build apk file when project is completed
- Uses a simple design to create the interface
- Use GUI of coding that make easier to understand the program

4.4 User Interface Design

1. Main Interface

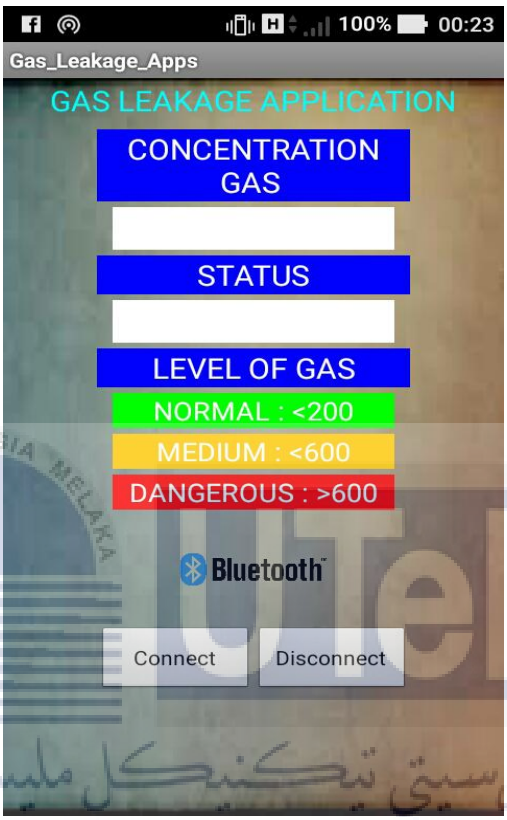

Figure 4.1 : Main Menu

This main menu is have button connect and disconnect bluetooth. User must connect bluetooth first to get the output of concentration and the status of gas. After uses this mobile application, user can disconnect the bluetooth.

2. Bluetooth Interface

Figure 4.2 : Bluetooth Interface

This interface show the device of bluetooth that have paired with the phone. So user must select the bluetooth device HC06 that is the bluetooth module to connect the system.

3. Main Interface with connection

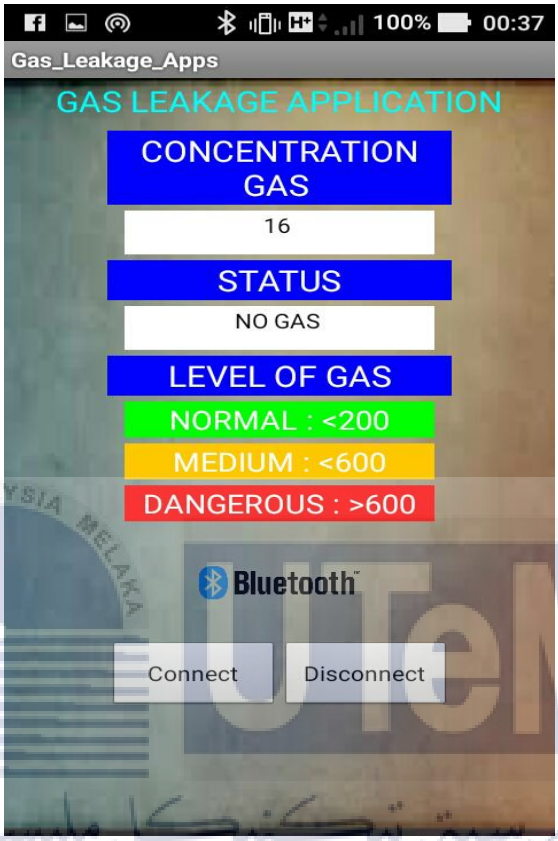

Figure 4.3 : Main interface with connection

This interface show the output when the bluetooth connection was connected. So this ouptut of concentration and status of the gas is initial because the gas not detected. The output will changes after the gas leakage is detected. The status of gas is based on the threshold of the research article Gas Level Detection and Leakage Monitoring System using a Specific Technique by I. Juvanna and N. Meenakshi (2014).

4. Main Interface Normal Gas

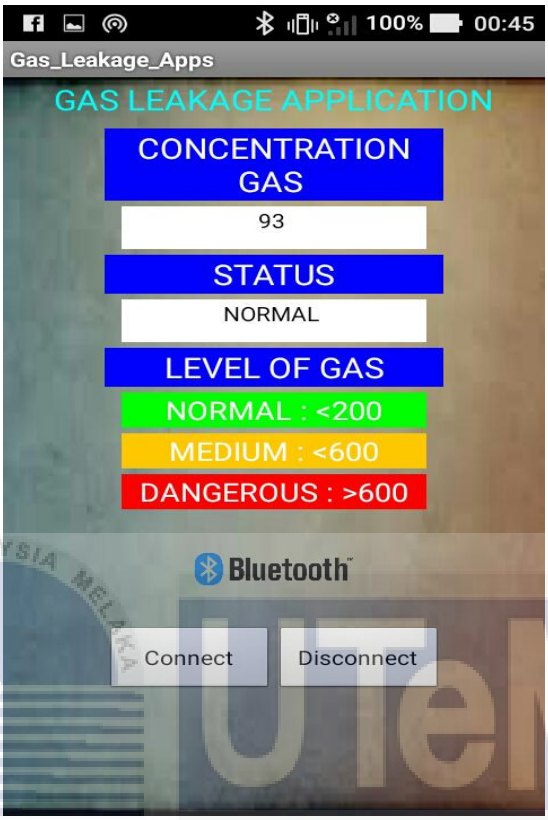

Figure 4.4 : Main Interface Normal Gas

This interface show the output of normal gas. When the concentration of gas is below 200 ppm, the status will show the normal gas. So user will know how the status of gas when gas leakage is occur.

5. Main Interface Medium Gas

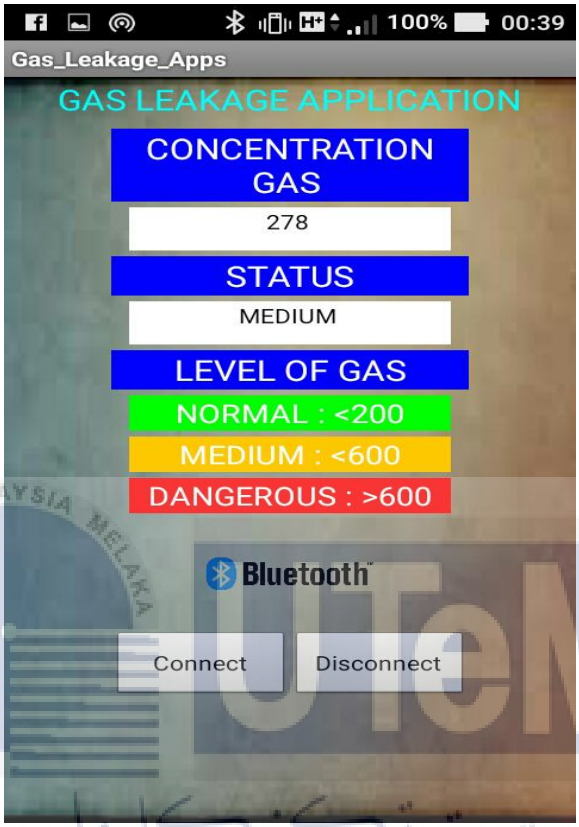

Figure 4.5 : Main Interface Medium Gas

This interface show the output of medim gas. When the concentration of gas is below 600 ppm, the status will show the medium gas. So user will know how the status of gas when gas leakage is occur.

6. Main Interface Dangerous Gas

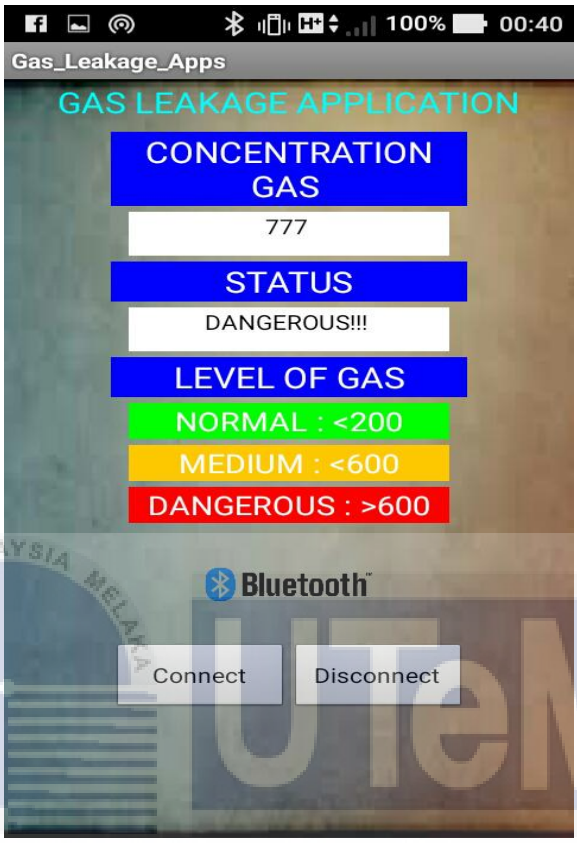

Figure 4.6 : Main Interface Dangerous Gas

This interface show the output of dangerous gas. When the concentration of gas is above 600 ppm, the status will show the dangerous gas. So user will know how the status of gas when gas leakage is occur.

4.5 Hardware Design

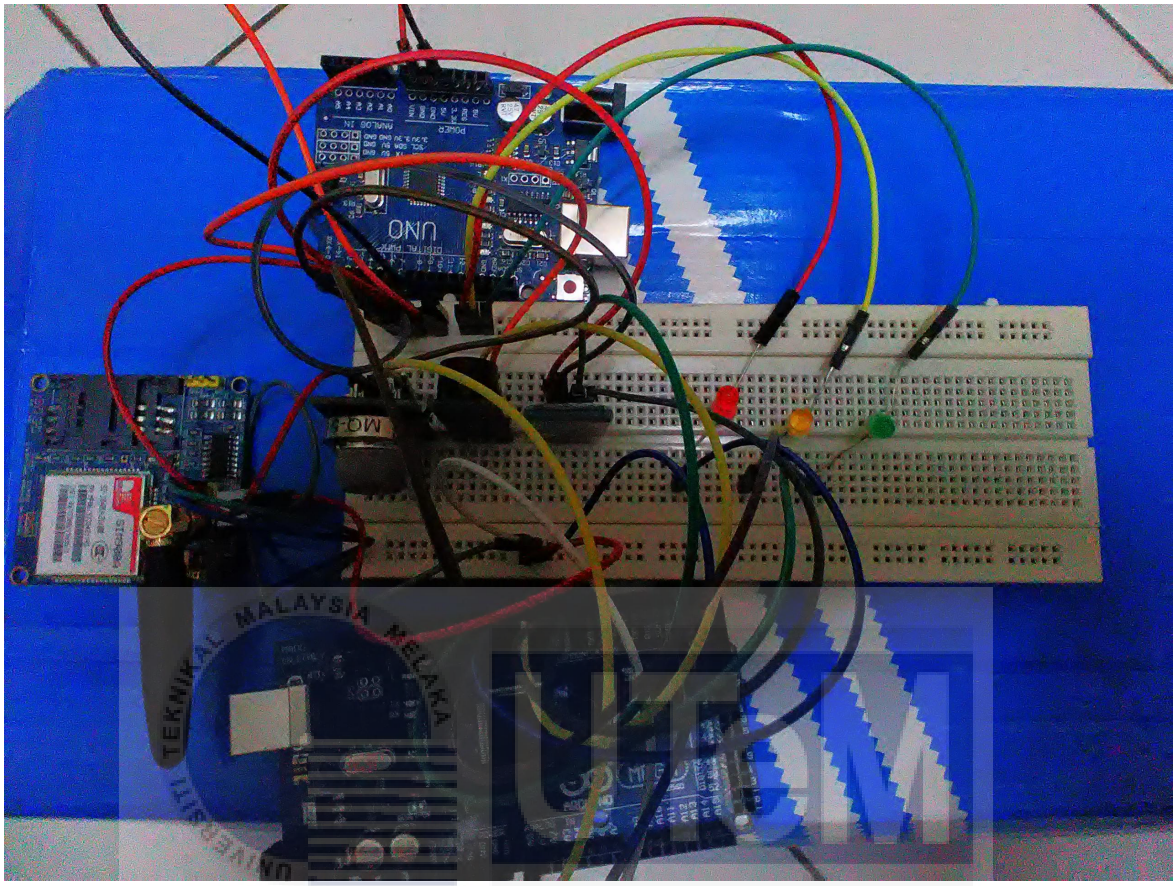

Figure 4.7 : Hardware Design

This design show the hardware that was implemented in breadboard to run the system. The led, gas sensor, bluetooth module and buzzer was used in this design. The GSM module was implement in this project.

4.6 Conclusion

The important step to be taken in this chapter are analysis and phase design before proceed to implementation phase because to get the full of the system flow about this project and explanation about the ideas of the project develop. The design for this chapter has been already approve and with this can be proceed to the next phase which is implementation phase. Developers also can make the identification about the need that are require in this phase and also show the process of the analysis that must have. Finally, the next phase will be explaining about implementation and the expected output about the project.

CHAPTER V

IMPLEMENTATION

5.1 Introduction

In this chapter will discuss about the project implementation. This will cover on how the implementation of the project to make it work. The environment setup will have all the explaination on how the project work. This chapter also will covered on how the software and hardware environment setup of the project.

5.2 Environment Setup

5.2.2 Software

1. Arduino Software

This software is called Arduino IDE(Integrated Development Environment). This software will write and upload the code to the physical board. The language of this program used is C++ that making easier to learn the program. This software also provides a standard form factor that breaks the functions of the micro-controller into more accessible package.

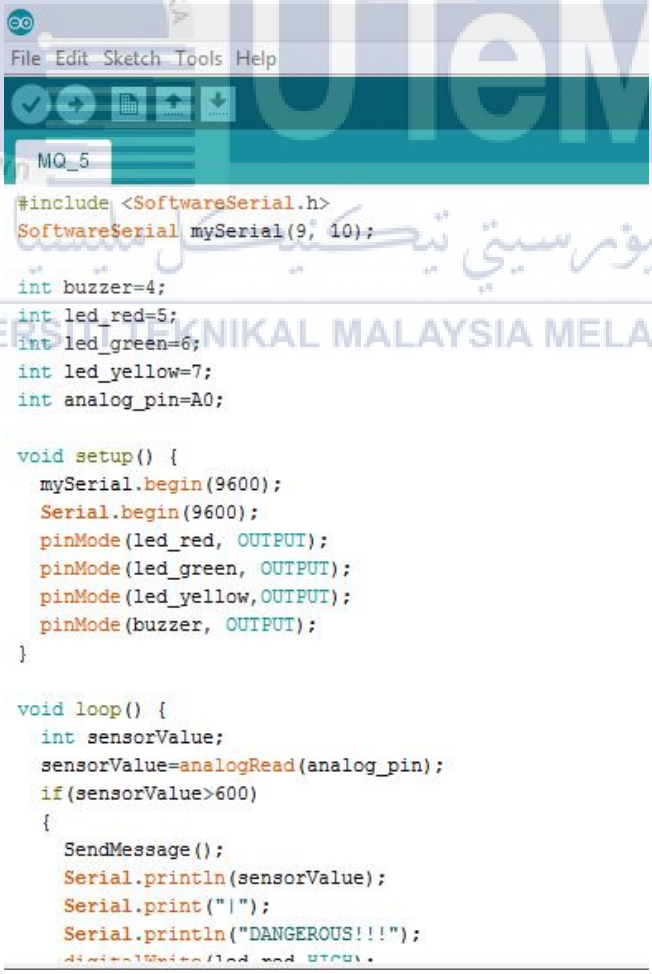

Figure 5.1 : Coding Declaration

File Edit Sketch Tools Help

Upload

MQ_5

```
void loop() {
  int sensorValue;
  sensorValue=analogRead(analog_pin);
  if(sensorValue>600)
  {
    SendMessage();
    Serial.println(sensorValue);
    Serial.print("|");
    Serial.println("DANGEROUS!!!");
    digitalWrite(led_red,HIGH);
    digitalWrite(led_green,LOW);
    digitalWrite(led_yellow,LOW);
    tone(buzzer,200);
    delay(1000);
   }
   else if(sensorValue>200 &&sensorValue<=600)
   {
    SendMessage();
    Serial.println(sensorValue);
    Serial.print("|");
    Serial.println("MEDIUM");
    digitalWrite(led_red,LOW);
    digitalWrite(led_green,LOW);
    digitalWrite(led_yellow,HIGH);
    tone(buzzer,200);
    delay(1000);
    noTone(buzzer);
```

Figure 5.2 : Coding Status Gas


```
 void SendMessage()
{
  mySerial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
  delay(1000);  // Delay of 1000 milli seconds or 1 second
  mySerial.println("AT+CMGS=\"+601123417617\"\r"); // Replace x with mobile number
  delay(1000);
  mySerial.println("GAS LEAKAGE DETECTED");// The SMS text you want to send
  delay(100);
   mySerial.println((char)26);// ASCII code of CTRL+Z
  delay(1000);
}
```

Figure 5.3 : Coding GSM

2. MITApp Inventor

This is online software that creates the mobile application. To use this software, the account is needed. This software can build apk file when project is completed. To create the program, it uses GUI coding and simple design to create the interface. It make easier to user understand the program.

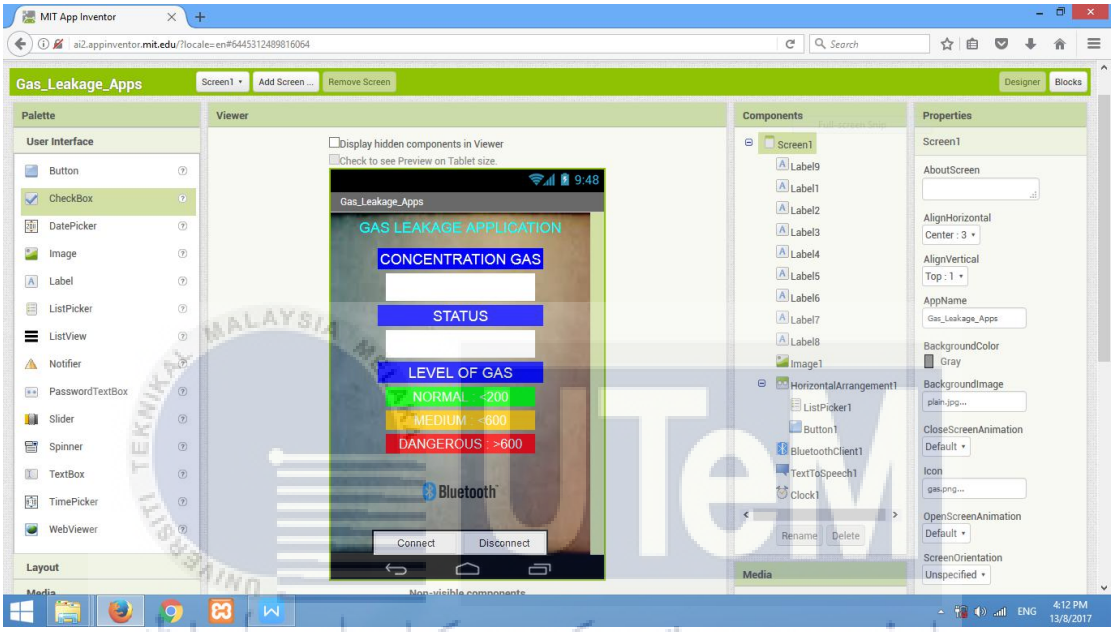

Figure 5.4 : MITApp Inventor Designer Interface

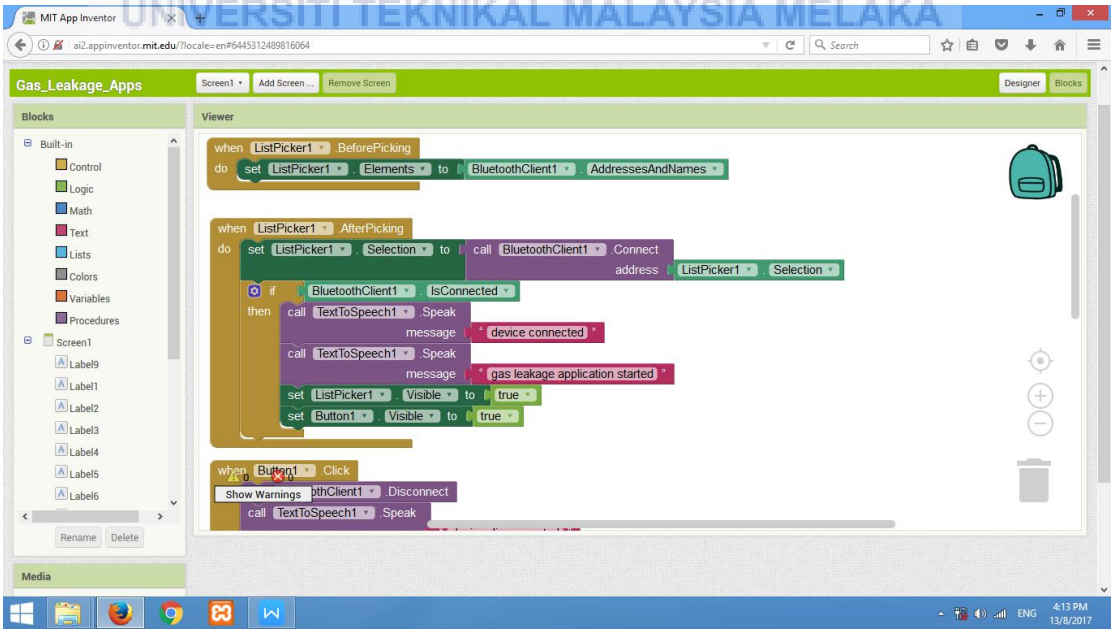

Figure 5.5 : MITApp Inventor Block Interface

5.2.3 Hardware

1. Arduino Board

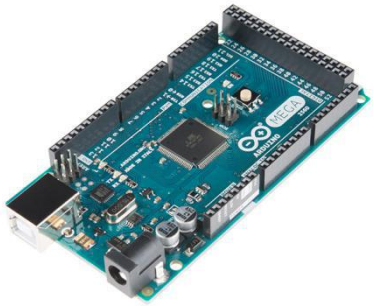

Figure 5.6 : Arduino Mega

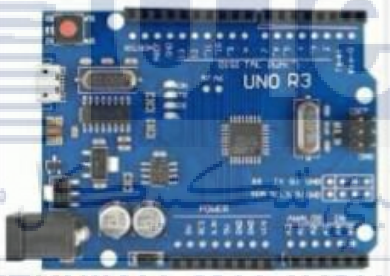

Figure 5.7 : Arduino Uno

In this project there are two type arduino board that used, arduino mega and arduino uno. Arduino mega is used to support the GSM module and arduino uno is control the buzzer and led when gas was detected by gas sensor.

2. GSM Module

Figure 5.8 : GSM Module Sim900a

The GSM module in this project act as alert mesage. It will send message to the user when the gas was detected. The coverage network is important to make GSM module work properly.

3. Gas Sensor MQ5

Figure 5.9 : Gas Sensor MQ5

This type of gas sensor is used to detect gas leakage (like LPG leak, Butanem leak, Methane leak) or any such petroleum based gaseous substance. It will range the concentration of level from 200ppm to 1000ppm and define the status of gases.

4. LED

Figure 5.10 : LED RGB

There are three led is used in this project. Each led have their own function. Led red will on when the gas status is danger, led yellow will on when the gas status is medium and led green will on when the gas status is normal.

5. Buzzer

Figure 5.11 : Buzzer

This buzzer is used to give a sound alarm when gas leak was detected and stop the alarm once gas leak is under control.

6. Bluetooth Module

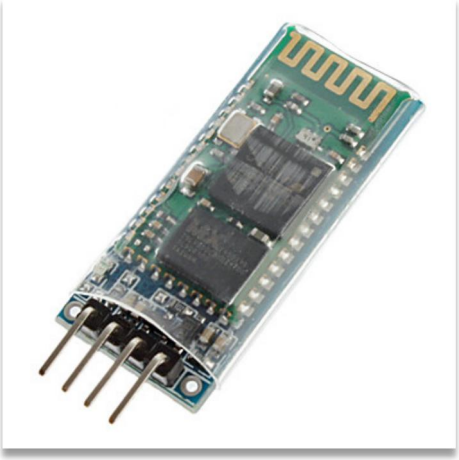

Figure 5.12 : Bluetooth Module HC006

This bluetooth module is used to connect the mobile application with the arduino board. In mobile application, it will display the status of the gases when it connected to the arduino board. So the user will know the status of gases when the gas leakage was detected.

5.3 Conclusion

In conclusion, this implementation phase to show about the making of this project work and also the environment setup with all the explanation needed to make the project complete and also to detect if the error occur. The next activity are testing phase which are to testing the gsm module as to make sure the gsm to running as planned.

CHAPTER VI

TESTING

6.1 Introduction

This chapter can only be executed after the implementation phase are done completely. After conducting the testing, it will help to identify all the possible drawbacks and all the other malfunction within it. In this chapter also will covered the test organization which consist of the person that involve to test the mobile application and hardware implementation, the classes of test and finally the test result.

6.2 Test Plan

6.2.1 Test Organization

The test that have been conduct in a group of people to test the mobile application and the hardware implementation through the testing process. This project can be used any user especialy for home user or industrial but for the testing phase it take different background of the people to produce the good quality of system.

Tester Name	Title/Position	Responsibilities
Mohamad Saifullah Adha	System Developer	Develop the mobile application and hardware implementation and make sure the system run without having any problem before delivered to the end user.
Muhammad Firdaus	Architecture	Use the system to check whether the design of the system is suitable or not for the end user.
Muhammad Safwan	Programmer	Testing using the mobile application and check whether the status of gas is same or not with the gas leakage detected in hardware implementation
Dr Fairuz Iskandar	Supervisor	Act as the end user and give the feedback about the apps to the developer for fix the bug or the error that occur.

Table 6.1: Test Organization

6.2.2 Test Environment

The test environment are conduct in home user by two ways which are user in home when gas leakage occur and user outside the home when gas leakage occur.

6.2.2.1 User In Home

The gas leakage was test when the user in home are successfuly because the gas detector detect the gas. The buzzer and led work properly and the gsm send the message to the user. The mobile application also can connect to the hardware and display the status of gases in mobile application.

6.2.2.2 User Not In Home

The gas leakage was test when the user in home are failure because the mobile application cant connect with the hardware to show the status of gases. This happent when the range of bluetooth is limited when the user is far away with the device. But another function such led, buzzer and gsm are work properly. In real life, the bluetooth is not suitable as the connectionless, but for the simulation bluetooth can be accepted.

6.2.3 Test Schedule

The testing schedule for test the system are in two time, first check the coverage network of GSM module and test the gas sensor. This will make sure the GSM module will send the message to the user when the gas leakage was detected.

6.3 Test Strategy

White-box testing
Testing the application by using the structure of the application coding
Also known as “Structural Testing”
Developer and testers will involve in this type of testing

Table 6.2: Test Strategy

The white-box test strategy are choose for this project because wanted to make sure the coding of the mobile application doesn’t have error so that the application will not crash.

6.3.1 Classes Of Test

There are three types of test for this project to make sure the system doesn’t have any error:

1. Bluetooth Connection Test

This test is check whether the bluetooth connection is connected or not with the device.

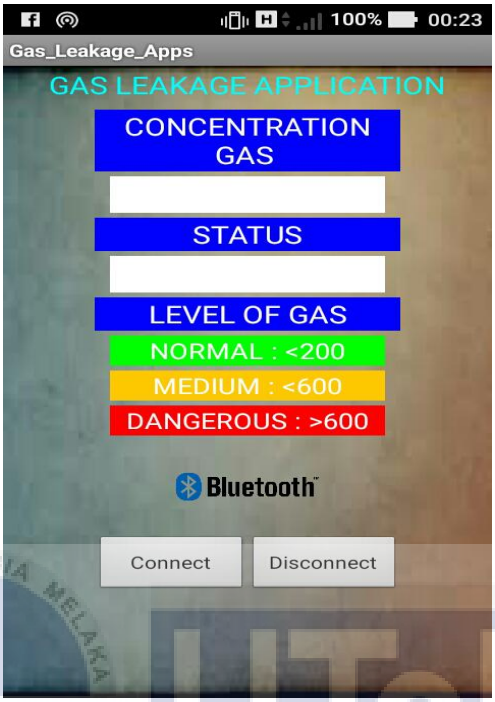

Figure 6.1 : Not Connected

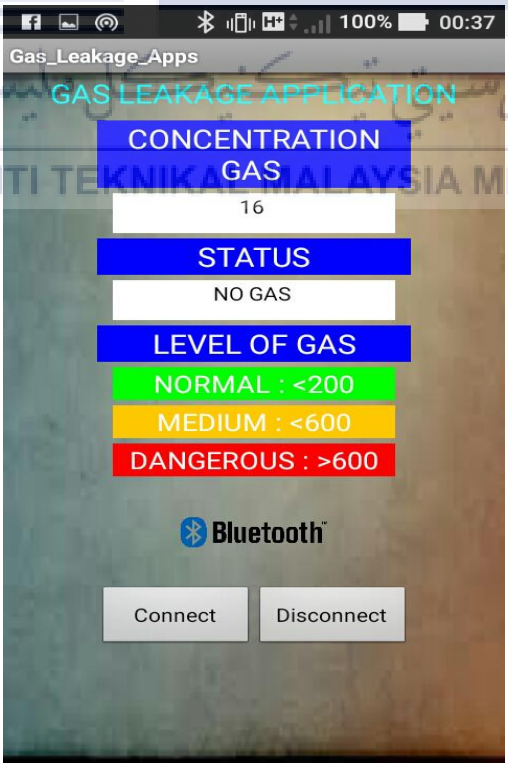

Figure 6.2 : Connected

2. GSM Test

This test for check the coverage network is strong or not. This is important because GSM will send the message to the user when gas was detected

Figure 6.3 : GSM send message

3. Gas Sensor Test

This test is conducted to check wether gas sensor can detect gas leakage occur.

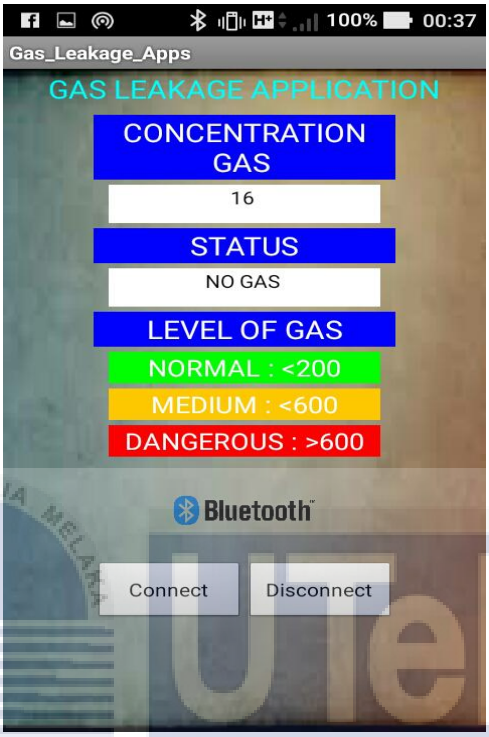

Figure 6.4 : No Gas Detected

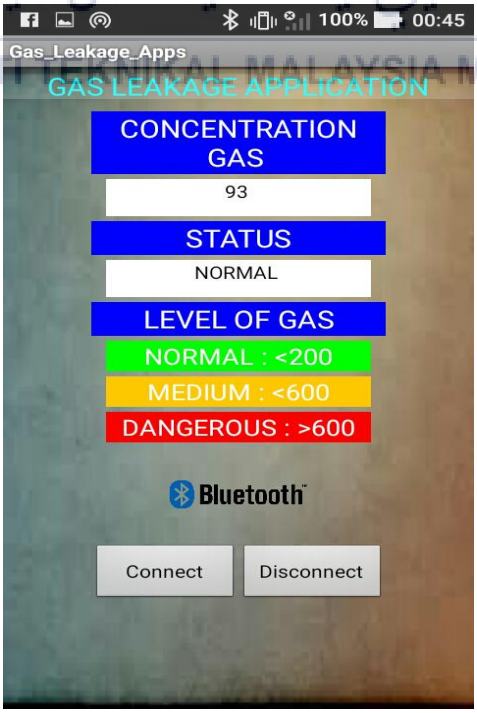

Figure 6.5 : Gas Detected

4. Functionality Testing

Environment	Result
User In Home	Success
User Not In Home	Fail

Table 6.3: Functionality Testing

The result when testing the mobile application for the user not in home are failure because the range of bluetooth module is limited.

6.4 Test Design

6.4.1 Test Description

The test description will covered about the identification test case and the expected result that will each scenario designed and documented.

Test	Mobile Application
Test Purpose	To check whether the error occur of mobile application coding
Test Environment	Android Version 4.4 (Kitkat)
Test Step	Connect mobile application via bluethooth with the bluethooth module **Positive testing** The mobile application will display the status when gas leakage detected **Negative testing** The mobile application not display the status when gas leakage detected
Expected Result	The mobile application will run without any crash or error

Table 6.4: Mobile Application Test Case

Application Test

Module Name: Bluetooth Connection

No	Test	Expected Output	Tester
1	Connected	Success	Developer
2	Not connected	Error	Developer

Table 6.5: Test Case Bluetooth Connection

Module Name: GSM Module

No	Test	Expected Output	Tester
1	Send the message in coverage area network	The message will send to the user	Developer
2	Send the message not in coverage area network	Error	Developer

Table 6.6: Test Case GSM Module

Module Name: Gas Sensor Module

No	Test	Expected Output	Tester
1	Test the gas sensor with any gas substance like LPG	Gas sensor will detected	Developer
2	Test the gas sensor with the smoke	Error	Developer

Table 6.7: Test Case Gas Sensor Module

6.4.2 Test Data

The test data are consist of real life data and synthetic data.

Real Data	Synthetic Data
The status of gas is depend on the concentration gas that stated in gas sensor datasheet.	The status of gas is depend on the range of concentration that already set by the developer.

Table 6.8: Test Data

6.5 Test Result and Analysis

Test Case ID	Tester	Result
1	Developer	Success
2	Supervisor	Success
3	Client	Success

Table 6.9: Test Result

The result of the test case are all success. The client which are the home user give a good feedback and also satisfy with the system.

6.6 Conclusion

In conclusion, the testing phase played an important part because without testing the fail or success the application will not be detected and also to make sure the objective of the project will be achieved. The future improvement also can be detected while doing the testing like what can be add and what can be remove to make sure the apps are perfect. The next chapter will be discuss about the conclusion of the project which will include the weakness, strength and also the contribution of the project.

CHAPTER VII

PROJECT CONCLUSION

7.1 Introduction

This chapter will discuss about the conclusion of the project that has been developed. This phase will covered the overall of this project which consist of the project contribution, project strength and weakness and finally the ways to improve the project in the future.

7.2 Project Summarization

The objective of this project and how the objective has been achieved are listed as below:

i. To test MQ5 gas sensor to detect gas leakage (like LPG leak, Butane leak, Methane leak) or any such petroleum based gaseous substance.

- The objective has been achieved when the gas sensor was detect the gas leakage (like LPG leak, Butane leak, Methane leak) or any such petroleum based gaseous substance.

ii. To develop alert mechanism message and send message to specified mobile numbers.

- The objective has been achieved by making GSM module send the message to specified mobile numbers when the gas leakage was detected.

iii. To test a buzzer give a sound alarm when gas leak was detected and stop the alarm once gas leak is under control.

- The objective has been achieved when the gas leakage was detected, the buzzer give a sound alarm and stop the alarm once gas leak is under control.

iv. To display status in mobile application

- The objective has been achieved because the mobile application display the status of gases according their range when the gas leakage was detected.

7.2.1 Project Weakness and Strength

WEAKNESS	STRENGTH
i. The GSM module will not send message to the user when the gas leakage was detected not in area coverage network. ii. The mobile application will not display the status of gases when the range of bluetooth connection is limited. iii. The gas sensor cant detect the concentration level above 1000ppm because it reach the maximum level.	i. The gas sensor can detect any substance of gases which easier to found in home user. ii. The design of the mobile applications are simple and easy for the user to understand on how to use it. iii. The mobile application can support all the version of the android smartphone.

Table 7.1: Weakness and Strength

7.3 Project Contribution

Gas leakage is a major concern at homes, offices, industries etc. Many homes and industries had fallen victims of inferno due to unknown gas leakage at a hidden point. This is dangerous and requires high security to avoid life and property being destroyed. So to avoid this problem occur, gas leakage detector must install at vulnerable locations. The system is designed to prevent loss/death to occur through gas leakages and hence promote safety of life and property.

7.4 Project Limitation

This mobile application can only operate in range of bluetooth connenction to show the status of gas leakage. The GSM module can send the message to the user if there are have coverage area of network where the gas was detected. The gas sensor can only detect the concentration below the 1000ppm acccording the gas sensor datasheet.

7.5 Future Works

The system can be upgrade in the future which consist of:

i. Wi-Fi module

- Replace the bluetooth module with the wifi module. The range of wifi module is larger than bluetooth module because it use the internet connection to connect between mobile application with the system.

ii. Fan

- Use the fan to absorb the gas when the gas was leakage. It will reduce the concentration of gases from harm the people.

iii. CCTV

- This cctv record video and show how the gas was leakage. The user can see in real time and can display the record video to find source of leakage.

7.6 Conclusion

The conclusion that can be made about this project are all the objective from the project have been successfully achieved. This system will help the user to inform when the gas leakage was detected. A solution to such a problem is to set up a monitoring system which keeps on monitoring the leakage of any kind of flammable gases and protects the consumer from such accidents. The present paper provides a solution to prevent such accidents by not only monitoring the system but by also switching off the main power and gas supplies in case of a leakage. In addition to this, it activates an alarm as well as sends a message to the user.

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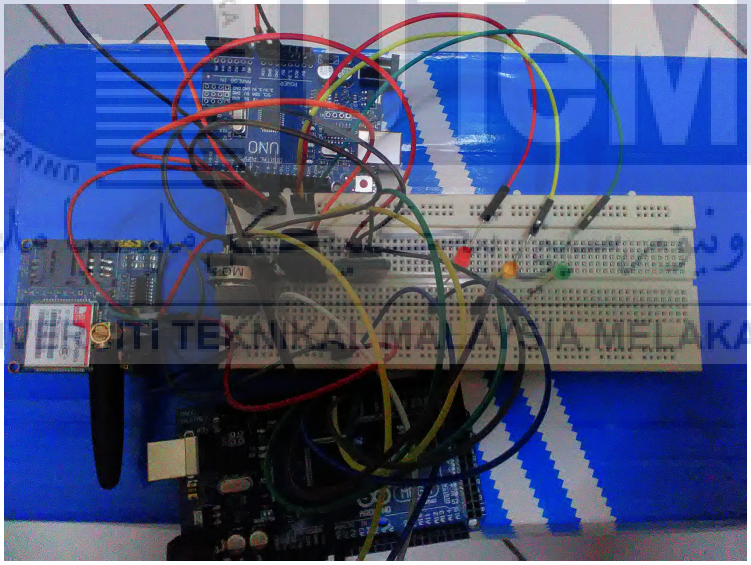
Prof. Amsaveni, M., Anurupa, A., Anu Preetha, R., Malarvizhi, C And Gunasekaran, M. (2015)'Gsm based LPG leakage detection and controlling system in *The International Journal Of Engineering And Science, 112-116.'*

APPENDICES

GAS LEAKAGE DETECTOR USING ARDUINO AND GSM MODULE WITH SMS ALERT AND SOUND ALARM

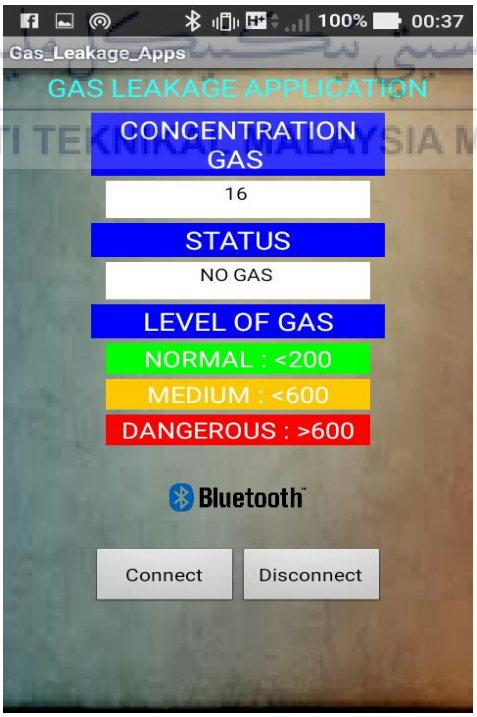
USER MANUAL

1. SUPPLY THE VOLTAGE MIN 5V TO ARDUINO UNO AND ARDUINO MEGA TO POWER ON THE SYSTEM.

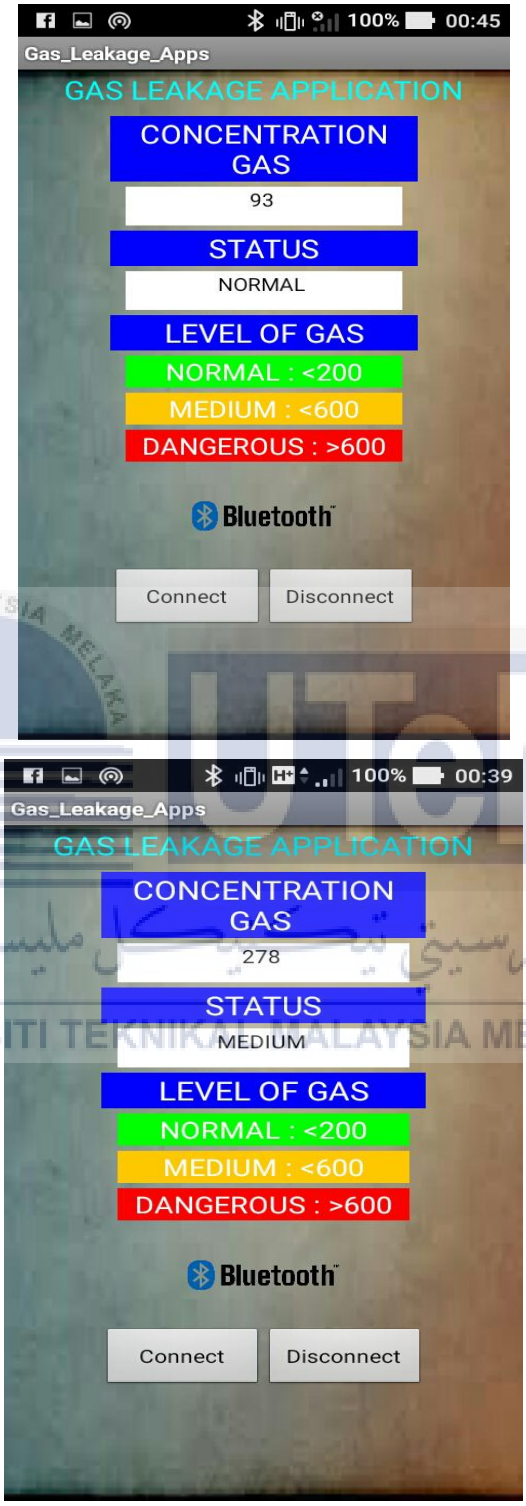


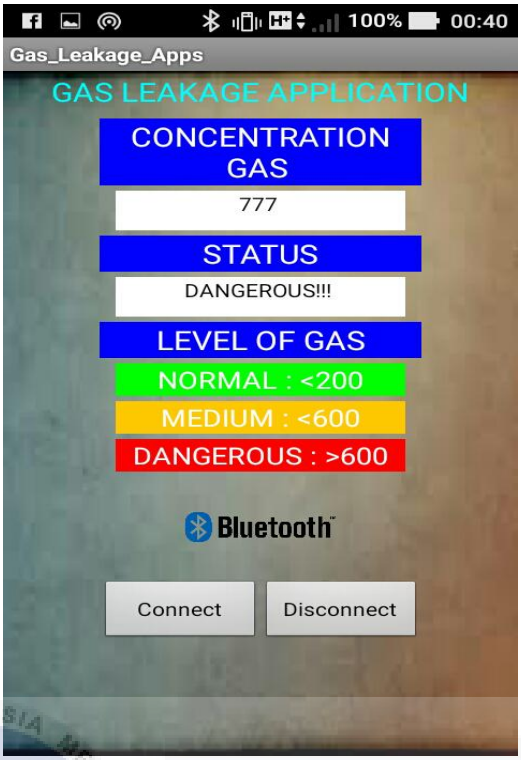
2. OPEN THE MOBILE APPLICATION AND CONNECT BLUETOOTH WITH THE BLUETOOTH MODULE HCOO6.

3. MOBILE APPLICATION WILL DISPLAY THE CONCENTRATION OF GAS AND STATUS OF GAS WHEN THE BLUETOOTH CONNECTION WAS CONNECTED.



4. CONCENTRATION OF GAS AND STATUS OF GAS WILL CHANGES DEPEND ON GAS LEAKAGE DETECTOR.





5. THE GSM MODULE WILL SEND THE MESSAGE TO THE USER WHEN GAS LEAKAGE WAS DETECTED.