Faculty of Electrical and Electronic Engineering Technology

Development of Gas Leakage Detector with SMS Alert system Using GSM Module and Arduino

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Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

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A project report submitted
in partial fulfillment of the requirements for the degree of
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2023

DECLARATION

I declare that this project report entitled "Development of Gas Leakage Detector with SMS Alert system Using GSM Module and Arduino" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date : 11.1.2023

APPROVAL

I approve that this Bachelor Degree Project 2 (PSM2) report entitled "Development of Gas Leakage Detector with SMS Alert system Using GSM Module and Arduino" is sufficient for submission.

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APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours.

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DEDICATION

To my beloved mother, SITI FATIMAH BINTI YAHAYA, my family, my fellow lecturer and my fellow friends.

ABSTRACT

The use of LPG gas is very widespread in industrial use as well as at home. Therefore, safety should also be taken seriously because LPG gas is flammable and explodes, causing property destruction and loss of life. The rate of accidents of explosions and fires of LPG is increasing from year to year. Therefore, the use of gas leak alarm is very relevant to reduce the occurrence of accidents caused by gas leakage. The goal of this project is to detect the presence of hazardous gases such as LPG and the ability to reduce the rate of gas entry into a space as well as provide warnings in the form of short messages to customers' mobile phones. When this procedure occurs, the MQ6 gas sensor will detect the presence of LPG gas and send a signal to the Arduino to process the data. Next, the alarm siren is immediately activated, the gas valve is closed and the fan is turned on automatically to reduce the presence of gas in a room. In addition, a warning message will also be sent by the GSM SIM900D to the customer's mobile phone about a gas leak that occurred and the LCD will display a reading of the situation when the incident occurred. The results and analysis of this project have been carried out and shown in the report.

ABSTRAK

Penggunaan gas LPG adalah sangat meluas dalam kegunaan industri mahupun di rumah. Justeru, keselamatan juga harus dipandang sirius disebabkan gas LPG ini bersifat mudah terbakar dan meletop hingga menyebabkan kemusnahan harta benda dan meragut nyawa. Kadar berlakunya kemalangan letupan dan kebakaran gas LPG ini semakin meningkat dari tahun ke tahun. Oleh itu, penggunaan penggera kebocoran gas adalah sangat relevan bagi mengurangkan berlakunya kemalangan yang disebabkan oleh kebocoran gas. Matlamat projek ini adalah untuk mengesan kehadiran gas berbahaya seperti LPG dan keupayaan untuk mengurangkan kadar kemasukkan gas ke dalam sesuatu ruangan serta memberi amaran dalam bentuk mesej ringkas ke telefon bimbit pelanggan. Apabila prosedur ini berlaku, sensor gas MQ6 akan mengesan kehadiran gas LPG dan menghantar isyarat kepada Arduino untuk memproses data. Seterusnya, siren penggera segera diaktifkan, injap gas ditutup dan kipas dihidupkan secara automatik bagi mengurangkan kehadiran gas di dalam sesuatu ruangan. Di samping itu, mesej amaran juga akan dihantar oleh GSM SIM900D ke telefon bimbit pelanggan mengenai kebocoran gas yang berlaku dan LCD akan memaparkan bacaan situasi ketika kejadian tersebut berlaku. Hasil dan analisis tentang projek ini telah dijalankan dan ditunjukkan dalam laporan.

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First and foremost, I would like to express my gratitude to my supervisor, Dr A.K.M Zakir Hossain, for his precious guidance, words of wisdom and patient throughout this project.

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LIST OF ABBREVIATIONS

V	-	Voltage
PPM	-	Parts-per-million
LPG	-	Liquidfied gas petroleum
GSM	-	Global system for mobile communication
SMS	-	Short message service
LED	-	Light-emitting diode
LCD	-	Liquid crystal display

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CHAPTER 1

INTRODUCTION

1.1 Background

Liquefied Petroleum Gas, or LPG, is a blend of gas streams that includes Butane and Propane. LPG is formed through the usage of fossil resources, where it is extracted from gasoline or natural gas streams as they erupt from the earth, or are generated during the distillation of fuel.[1]

The LPG does not pollute the earth or water because it is a gas, but it may pollute the air. The LPG is frequently delivered in pressured steel tanks since it drains because its heating rate is below cellar temperature. fast at normal temperatures and pressures. The LPG also has no color and no odor.[2] But even so, LPG carries an odorant for safety precaution if there is a gas leak that may be easily detected. Unlike natural gas, the LPG is denser than air, so it will stream along with surfaces and slip into the low district like underground bunkers. Besides, there are two critical factors linked with LPG and the primary is the chance of a detonation if the LPG and vapor mixture is within detonation bounds and combustion.[3] Next, hypoxia is the second factor that occurs when LPG substitutes air resulting in a fall in oxygen concentration. Gas leakage has recently been a hot topic, and it is one of the leading causes of fires.[1], [4] This project is designed to detect any LPG leaks and notify the user of the problem. The user will receive an SMS alert. This initiative will help to reduce the probability of spontaneous combustions it guides premature sensing devices before the gas intensification reaches an unsafe level.[3]

1.2 Problem Statement

Liquefied Natural Gas (LPG) is almost like a natural gas commonly used all over the world[2]. In a home or hotel, LPG is utilized for cooking and it also is utilized in several gas-related industries.[5] Although the method for installing an LPG-based system is highly strict, there is no way to ensure that the system would not leak. Even though humans have some flaws. Humans are unable to indicate the existence of biogas as instantly as sensors. As a result, the installation of a gas sensing system is necessary for legit controlling the volatile substance. In some situations, gas leaks can produce fires that devastate people's belongings and cause catastrophic injury or death due to the massive volume of the fire because of the delayed received notification about the fire by the fire station. The existing devices on the market serve as gas detectors since they only detect gases and sound an alarm[4]. However, even if the sensor is activated while the user is away from home or premises, they will be unaware that a gas leak has occurred.

As a result, this project will be able to fix the problem. This is because the project "Development of Gas Leakage Detector with SMS Alert System Using GSM Module and Arduino" can detect the presence of LPG and provide more reliable information by sending an SMS alert to the owner[1].

1.3 Project Objective

The study's aim is:

1. To construct a technique for identifying the appearance of LPG.
2. To design and simulate the prototype of the proposed LPG detector.
3. To benchmark the results with the current trends.

1.4 Scope of Project

a) The project scope is to develop a technique for detecting natural gas appearances. It may help to prevent fires and explosions caused by the leakage of gas and it also may identify the leakage of gases in their early stages. The main aim of this project will be exclusively on the building and it is capable of detecting LPG gas. The sensor used in this project could trace any type of combustible gas, especially LPG. This project used a microcontroller of Arduino UNO as the CPU that analyzed the sensor's data before sending it to the GSM module where it will communicate with the user by sending an SMS alert while applying safety procedures to decrease the presence of LPG gases in the building.

Chapter 1 (Introduction) - Background, Problem Statement, Objective, Scope Of Project.

Chapter 2 (Literature review) - Introduction, Previous Project Research, Comparison Previous Research Paper, Summary.

Chapter 3 (Methodology) – Introduction, Methodology, Flow Chart, Block Diagram, Hardware Implemantation, Software Project, Summary.

Chapter 4 (Results and analysis) – Introduction, Results, Discussion, Summary.

Chapter 5 (Conclusion and recommendation) – Conclusion.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This initiative aims to identify any LPG spills in manufacturing or household utensils. With ongoing research moving toward the benefits of lowering the rate of gas leakages, the lack of a system to monitor and manage gas leakages in households has become a significant problem[2]. This chapter evaluates many attempts at solving a similar problem. Different studies have attempted various techniques to eliminate the issue described before, and some of the strategies used have been assessed. Following a study of what many researchers have done, a brilliant potential solution will be built based on some of the elements used by other researchers.

Since then, many methods and equipment have been created to measure, analyze, and notify the leaking of various gases such as LPG. As a result, an efficient strategy to monitor and regulate LPG leakage which might be utilized for household purposes is required.

2.2 Previous Project Research.

This chapter will provide a review of previous research and existing projects that have been created using reference sources and guidelines such as journals, the internet, article writing, blogs, and scientific studies to gain an understanding of project design, conception, and any information that may be useful in improving the project. Several researchers have built and innovated projects with different concepts and designs. This chapter also covers the research that is relevant to this project.

2.2.1 A SECURITY ALERT SYSTEM USING GSM FOR GAS LEAKAGE.

LPG is a volatile group of chemical gases used as gasoline in a wide variety of uses due to its beneficial features. Unfortunately, since gases are denser than air and do not diffuse easily, there is a serious issue with their spilling into the environment. Gas leakage into the air might also result in an explosion. To avoid this problem, the hazardous gas detection approach for recognizing highly hazardous leakage employs multiple devices. Whenever a toxic chemical is spotted, these devices generally emit an audio warning to notify authorities.

The main purpose of the leak detection device is to consistently trace leakage of gas in the air by implementing an MQ5 gas sensor, which has numerous benefits such as a long lifetime, cheap cost, reliability, and high sensitivity to LPG. In addition, the MQ5 gas sensor has an enhanced combustion awareness. The sensitivity of the gas sensor enhances when volatile gases are found within the surroundings and the resistance of the sensor varies in proportion to the combustible gas concentration[3]. Once the volume of gas in the air achieves a certain proportion, the audiovisual alarm, which comprises an LED and a buzzer is activated and the GSM module will transmit a message to the subscriber. When there is a gas leak, the GSM module is utilized to deliver brief messages. Every cell phone address can be added, whereby an SMS with the above text should always be despatched. Even though the subscriber was never at home, this wireless module is designed to remind them and in the event of a crisis, a digital sound siren is generated to advise individuals at the residence[3]. The detector is intended to communicate with a microcontroller and evaluate leakage in the air on an ongoing basis, gives the microcontroller these facts, which then sends an SMS to the customer and activates the LED, Buzzer, and the notification will be shown on the screen. The LPC2148 controller is applied in this project, and its major role is to send a message via the GSM module even though the user is never at home, they would be reminded when the percentage of gas in the air surpasses the safety standards[3]. This

item was intended to power on the LED and engage the buzzer to alert the residents and show the message on the LCD that was connected to the controller. The GSM modem is controlled using AT instructions. The protection circuit is safe since it has an exhaust fan and does not create a spark. A driving circuit is built using a relay to command the extractor fan and when the gas consolidation is over the allowable limits, the operator activates the exhaust system, which exhausts the gases, and is interfaced to the LPC2148 microcontroller[3]. When the gas leakage surpasses a specific level, the system software developed in Embedded C language may receive data from the sensor, transfer the data, and send a message to the user's phone, as well as activate LEDs and buzzers to immediately inform the guests at home and display the notification on an LCD monitor. It is employed in numerous sectors due to its low power consumption, ease of use, and dependability.

The entire system was introduced and tested by applying a small supply of LPG just next to the sensor system. If somehow the gas volume in the environment surpasses the legal standard, the major contributor is the verbal alert which sends a Text to the subscriber via a GSM modem to notify users at residence to develop a solution. Finally, we can use this device to notify consumers if a gas leakage exceeds a specific level by delivering a signal and activating the alarm, and implementing appropriate precautions to stop the gas leakage.

2.2.2 GSM-BASED GAS LEAKAGE DETECTION SYSTEM.

LPG is an extremely combustible gas made primarily of gaseous fuels. that is extensively equipment used mostly for heat generation. In this circumstance, gas leak security systems become critical, since they aid in the prevention of gas leakage incidents[4]. In the literature, an implanted sensor used to monitor and notify harmful gasses was presented, in which the sensor has already been turned on instantly whereas gas consolidation is higher than the usual threshold. This study presents a low-cost, high-

accuracy system that not only detects gas leaks but also alerts and shuts down major power and gas supply, as well as sending an SMS[4]. The GSM module sends the subscriber an SMS as an alarm. MQ-6 has been utilized to offer a high-accuracy gas sensor.

The system's functioning is broken into three basic phases. Throughout the first process, the gas detector MQ-6 senses gaseous escape. This detects gas and uses ADC where the information is sent to the microcontroller[4]. It transmits an activation signal to any external devices it is connected to. Many tasks were completed in the final step, including the activation of the buzzer and the display of a message on the screen, as well as the activation of the GSM module, which sent a warning SMS to the user. As a result of the stepper motor driving the affiliated stepper motor, the main power and gas supplies are turned off. Finally, when the gas leak has been repaired, with the aid of the reset button, the system was effectively halted and the entire system progressed to the first step. An electronic device that monitors gas emergence is the MQ6 detector. Once the gas device monitors a gas appearance, the microcontroller automatically addresses the data sent to the GSM to inform the subscriber by sending a message via SMS to their handphone[4]. One SIM card is required for the GSM module. This module can take any network SIM card and, like mobile phones, has a unique identifying number. These modules are powered by a 12V DC source and have the ability to send SMS and audio messages. The microcontroller memory stores these SMS or voice messages. The stepper motor is powered by a 12V DC external source and its main function is to turn off the electricity and the gas furnish. The main power supply is turned off by a single motor where when the motor turns 60 degrees, it is linked to the main control in this mode, the electricity has been cut off instantly. The major gas flow will be shut off by the other generator. The main gas knob is physically attached to a stepper motor, such that when the motor turns 180 degrees, the knob closes automatically. At 434 MHz, an RF communication system using ASK with a receiver[4].

The receiver obtains input and dispatches it over RF. The receiver module accepts data from a transmitter module that is located far away and the RF module was used with a set of four-channel Encoders HT12E & HT12D[4]. The encoder extracts serial impulses from parallel impulses and then serially commits over the frequency band. After the receiver has decoded the signal, the decoders are employed to acquire the original signals as an output. On the corresponding LEDs, these outputs are visible.

A little volume of LPG gas was used to test this system near the sensor. The MQ-6 notice the LPG, it thus gives a command to the microcontroller. The microcontroller then generates an indication to any external devices which are attached to it. With the assistance of a stepper motor, the main electric and gas source is cut off equally and the GSM module sends an SMS. The system refreshes itself after the reboot switch is applied, and the entire order reinstalls to its original position.

In conclusion, the leakage is detected in this system by the MQ-6, which provides an impulse to the microcontroller, which then transmits waves to other exterior linked mechanisms. If a Philips microcontroller is used instead of an AT89C51, the microcontroller's efficiency and memory may be enhanced by modifying the configuration of the GSM module, text could have been sent. For SIM card replacement, we must perform software adjustments[4].

2.2.3 GSM-BASED GAS LEAKAGE DETECTION AND CONTROLLING SYSTEM.

LPG is formed among several hydrocarbons where the spill manages to generate eruption. As a result, the leakage must be managed to safeguard individuals from harm[6]. The semiconductor sensor detects the leaking of LPG gas. After detecting 0.001% LPG leakage, the suggested system conducts automated control action and offers to shut the faucet using

a mechanized mechanism[5]. The relay is installed that automatically turns off the electricity in the residence and warns the subscribers via GSM. The siren is raised to notify the neighbors about the leakage.

LPG gas is often detected using semiconductor sensors. This project makes use of an MQ6 semiconductor sensor. The MQ6 is very responsive in detecting various flammable gases ranging from a high distance. Next, ADC is built inside the PIC 16F877A microcontroller to digitalize the gas-triggered output gain by the microcontroller paired with exterior devices[5]. The ventilation fan is operated if any presence of combustible gas is recognized, and the cylinder valve is automatically closed by a stepper motor to stop the gas spill. The relay is activated to turn off the home or industry's electric power supply. When a leak is detected, the buzzer sounds an alert. An SMS is sent to the subscriber over GSM to inform them. The controlling action is carried out by the PIC microcontroller. The GSM module is mostly used for communication. The microcontroller detects a gas leak and shuts it off while also alerting the surrounding area. The user must then be informed of the information concerning the leakage. GSM is used for this purpose. The appropriate code must be put into the microcontroller, which is linked to GSM[5]. A driving circuit is used to power the stepper connect to the cylinder's faucet. The microprocessor causes the motor to rotate when there is a gas leak[5]. As a result, the valve is closed, and the gas leaking is stopped.

The LPG leakage detector works each time the MQ6 identifies the appearance of LPG. The microcontroller receives its analog output and orders the ventilation fan to power-up cause the presence of gas in the room is declined. The cylinder faucet is automatically sealed by the stepper motor. The leaking of gas is halted as a result of this procedure. The house's electricity supply is turned off via the relay. The gas leak is indicated by the buzzer, which sounds an alert. The user is then notified through SMS via the GSM module and the result

shows that the spill of gas is recognized and is over around 2 seconds means it can detect less percent of leakage[5].

2.2.4 GSM-Based Gas Leakage Detection and Alert System.

The leak of gases becomes one of the priority causes of the fire that manage to be averted. Gas detection systems work by sensing the leakage of LPG where the LED and alarm are turned ON to vigilant people who are in the radius of the flammable gas spill and by sending a warning text to the subscriber through their cellphone[4].

MQ2 is used to detect large-scale hazardous gases connected to the microcontroller to spawn a brief message as a response to the GSM module each time MQ2 is functioning. After that, the mechanical unit is provided to fend off any further spread of combustible gases by cutting off the gas source using a motor and the GSM will automatically send a caution text to the subscriber. The project was designed to accommodate the multiple components that make up the total device power requirement where a 24V dc source is required for the stepper motor and in the power supply unit. To charge the battery that powered the created gas detection and alarm system, half-wave rectification was used[4]. In this case, an IN4007 diode was used, and a capacitor CO with a value of 1000F was used for smoothing. The PIC16F877A microcontroller was used in this project. To create a clock and offer frequency stability to the microcontroller, a crystal oscillator was employed and the type of GSM modem used is what determines which crystal is used. The GSM modem utilized has a baud rate of 115.2kb/s[4].

In this project, the SIM900 modem is used and requires a voltage between 3 and 3.9 volts and is attached to the SIM card to transmit messages. Each pin on the microcontroller is powered by a 5V supply. Because the modem works at 3.9V (maximum), it cannot be directly connected to the microcontroller to avoid harm[4]. The usage of light-emitting

diodes provides a visual alarm and is used as indicators. The LEDS are set up so that when the produced gadget is turned on, just the last five LEDs light up, while the first three will illuminate during the incident, alerting those nearby to the situation. A stepper motor breaks down a whole cycle into tiny increments fit for handling the faucet. Only the microcontroller requires programming and execution to execute the necessary functionalities using assembly language.

As a result, the MQ2 sensor is the focus of this investigation where LPG is used in this detection system. Various amounts of compounds were defined and implemented to evaluate the sensor performance by analyzing the sensor's reaction time to identify the presence of the substance. The GSM module's capacity to deliver a warning text to the predetermined number is tested and interacts efficiently with the registered number, relaying information from the gas leakage detection and warning system's signal processing module to subscribers[4]. If the reason for the leak is due to an inadvertent or purposeful opening of the head, the device will identify and avert any additional leaking. Simultaneously, a brief SMS is delivered over GSM networks to the subscribers by cell phone about the leaks.

2.2.5 LPG LEAKAGE DETECTION AND PREVENTION SYSTEM WITH GSM ALERT.

Solid gas or LPG are commonly used on a huge scale in industry, heating, household appliances, and automotive fuel because they are flammable gases that burn rapidly, cleanly, and have a minimal environmental impact, but they may cause an unintended disaster.

The project focuses on various household appliances like gas leaks and temperature control, which humans are unable to devote time to due to their daily hectic schedules. The project also made use of Arduino, which is made up of Atmega328 ICs and can be programmed using the Arduino IDE software and connecting connections[1]. The MQ6 gas

sensor is the first step of the project, it is used to detect gas leaks and if it identifies any gas centralization, the reading will be shown on an LCD. The set gas limit is 450ppm in the Atmega328. MQ6 detects when the gas concentration crosses a certain level, and the load cell is enabled. The weight of elements such as fluid pressure is calculated using a load cell. The pressure on the LPG gas will be calculated in this project and if it crosses the barrier, the Arduino will send a command to the buzzer and solenoid valves to turn on and off where Arduino is connected[1]. With the aid of the GSM module, the defined limit of the cylinder's weight is crossed, and the load cell sends a message to the customer. The temperature will now be the subject of the second phase in this similar technique. The LM35 sensor will be used to measure temperature[1]. With the help of the buzzer, the LM35 detects it and shuts on or off the gate valve. GSM module is used to send messages to the subscriber.

2.2.6 DESIGN & IMPLEMENTATION OF LPG GAS DETECTOR USING GSM MODULE.

The project's goal is to create a system that can detect any leakage of gas and then give a warning short text to the subscriber by GSM. The alarm and status display will start operating to inform the situation to the public, as well as cut off the gas supply valve. The system alarm system will turn OFF automatically once the presence of gas decreases below the specified value and the valve is opened again for operations.

2.2.7 GSM-BASED GAS LEAK MONITORING SYSTEM.

The Global System for Mobile Communication (GSM) module is intended to identify and analyze gas leaks in reasonably close ranges. In this study, the detection of gas excites many measures such as alarm systems, control devices, and communication systems based on the GSM module.

2.2.8 A SMART GAS LEAKAGE MONITORING SYSTEM FOR USE IN HOSPITALS.

A device that identifies gas leaks and notifies the user over the GSM network. An LPG gas leakage detector generates an alert message to the Arduino Uno Microcontroller in the system. The alert message is displayed on a liquid crystal display (LCD) monitor and a buzzer occurs to notify the public.

2.2.9 WIRELESS SENSOR NETWORK ON LPG GAS LEAK DETECTION AND AUTOMATIC GAS REGULATOR SYSTEM USING ARDUINO.

The majority of LPG explosions are caused by undiscovered gas leakage. Detecting gas leaks, eliminating them, and avoiding fires are the aims of the project. Gas leaks might occur as a result of a poor valve assembly or a damaged pipe. The WSN system is powered by a gas sensor MQ-6 and a Bluetooth HC-05 wireless module.

2.2.10 DEVELOPMENT OF WIRELESS SENSOR NETWORK SYSTEM FOR LPG GAS LEAKAGE DETECTION SYSTEM.

The report outlines the implementation of a wireless sensor network for detecting LPG gas leaks. An Arduino Nano microcontroller, a gas sensor, and an XBee are included in the suggested design. A GSM module served as a link between the microcontroller and the cellphone device. The device may be installed anywhere and operated by a cellphone that supports the SMS service.

2.3 Comparison Of Previous Research Papers.

No	Research Title	HARDWARE /SOFTWARE	ADVANTAGES	DISADVANTAGES
1	A SECURITY ALERT SYSTEM USING GSM FOR GAS LEAKAGE	Embedded C language, MQ5 gas sensor, LPC2148 microcontroller, GSM modem	• Low cost. • Circuit equipped with protection.	• The gas leakage is not stopped because the gas valve is not shut OFF. • No heat sensor.
2	GSM-BASED GAS LEAKAGE DETECTION SYSTEM	GSM modem, MQ6 gas sensor, stepper motor(ULN2003A), AT89C51 microcontroller,	• Stop the gas supply. • Able to send voice messages. • Low cost. • Stop the power supply.	• No circuit protection. • No ventilation system. • No heat sensor.
3	GSM-BASED GAS LEAKAGE DETECTION AND CONTROLLING SYSTEM.	MQ6 gas sensor, 16F877A microcontroller, sim300 GSM module.	• Equipped with a ventilation system. • Stopped the gas leakages. • Low cost.	• No circuit protection. • No heat sensor.
4	GSM-Based Gas Leakage Detection and Alert System.	SIM900 GSM modem, DC stepper motor, MQ2 gas sensor, PIC 16F877A.	• Equipped with cut-off gas supply. • Low cost.	• No circuit protection. • No ventilation system. • No LCD shows a reading of the gas.
5	LPG LEAKAGE DETECTION AND PREVENTION SYSTEM WITH GSM ALERT	Arduino UNO, GSM modem, MQ6 gas sensor, LM35 temperature sensor.	• Low cost. • Equipped with temperature sensor.	• No ventilation system. • No heat sensor. • No cut-off of the gas supply.
6	DESIGN & IMPLEMENTATION OF LPG GAS	PIC16F877A MICROCONTROLLER, MQ6 AND MQ5	• Used two types of the gas sensor.	• No heat sensor.

	DETECTOR USING GSM MODULE.	GAS SENSOR, LCD, BUZZER.	• Equipped with a ventilation system. • Equipped with the gas cut-off system.	• Cannot detect the gas in the higher range. • No circuit protection.
7	GSM BASED GAS LEAK MONITORING SYSTEM	ARDUINO UNO, SIM900 GSM MODULE, LCD, MQ2 GAS SENSOR,	• Equipped with a ventilation system. • LCD shows the gas reading.	• No heat sensor. • No gas supply cut-off. • No circuit protection.
8	A SMART GAS LEAKAGE MONITORING SYSTEM FOR USE IN HOSPITALS	ATmega328P Arduino microcontroller, LCD, BUZZER, ARDUINO IDE, MQ9, AND MQ2 GAS SENSOR, GSM MODULE.	• Equipped with two types of gas sensors. • Able to change the sensitivity of the gas sensor. • Able to activate manually.	• No ventilation system. • No gas supply cut-off. • No heat sensor.
9	WIRELESS SENSOR NETWORK ON LPG GAS LEAK DETECTION AND AUTOMATIC GAS REGULATOR SYSTEM USING ARDUINO	ARDUINO UNO AND IDE, MQ6 GAS SENSOR, BLUETOOTH HC-05, BUZZER, LED, LCD.	• Wireless system. • Equipped with a ventilation system. • System connected by Bluetooth.	• No gas supply cut-off. • Cannot send warning messages to subscribers.
10	DEVELOPMENT OF WIRELESS SENSOR NETWORK SYSTEM FOR LPG GAS LEAKAGE DETECTION SYSTEM.	ARDUINO NANO, MQ2 GAS SENSOR, GSM MODULE, ARDUINO IDE, ARDUINO UNO.	• Wireless system.	• No ventilation system. • No gas supply cut-off. • No alarm.

Table 2.1 Comparison between researched journals.

2.4 Summary.

According to the research, Arduino act as the main microcontroller which means its controls all the activities in the circuits. When the gas sensor detected the presence of the gases, the microcontroller will automatically send a signal to the dc stepper motor to rotate and close the knob of the gases[6]. Then, the microcontroller also will trigger the GSM Module to transmit a text to the subscribers about the leakage accidents. At the same time, the alarm and LED will automatically turn on during this situation. [7]

CHAPTER 3

METHODOLOGY

3.1 Introduction

The main goal of the methodology is to describe the flow of the project concerning several outlines while providing techniques, preparations, electrical components, and data collection for the project. Issuing warnings about gas leaks is a major objective in this designed project[6]. The project aims to detect any dangerous gas leaks such as LPG in addition to issuing alerts via alarms and sending warning messages to customers. It has been revealed that the use of gas leak detector alarms can prevent unwanted incidents from occurring. In general, gas leakage alarm systems are now seen as more modern with the addition of other functions that also emphasize the safety aspect[2]. In general, every model of gas leak alarm system must meet two things namely accuracy and effectiveness. The term accuracy refers to the ability of a gas leak alarm system to detect dangerous gas leaks in a short period[8]. In addition, effectiveness refers to the ability of the model to send emergency messages to customers while performing additional functions to reduce the percentage of accidents.

3.2 Methodology.

The project demonstrates the ability of gas leak detector alarms in detecting the presence of hazardous gases and sending missed call and warning messages to customers while performing additional functions to reduce the percentage of emergencies[9]. The essence of the approach used for this project is a gas sensor which is used to detect the presence of gas such as LPG if the reading rate of the gas exceeds the set safe level which in

turn will send data to the microcontroller to activate the whole system. Appropriate applications or software will be used to test the simulation circuit before doing it in a real circuit such as the Arduino IDE where it is the correct coding platform before being incorporated into the Arduino Uno[1]. The encoding for this system is divided into several parts namely the MQ6 Gas sensor, GSM Module, and Arduino Uno where the encoding is uploaded without error and compiled into one encoding and runs smoothly without any problems

3.3 Flow Chart.

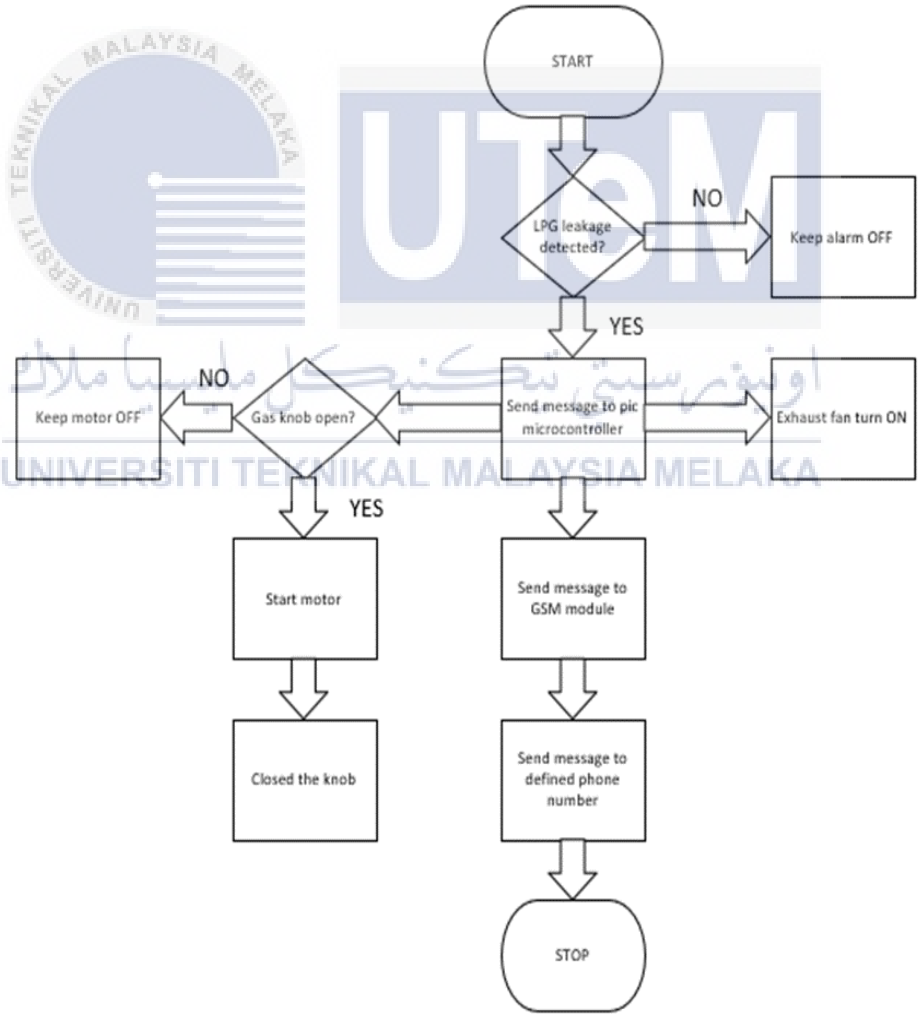


Figure 3.1 Flow chart of gas leakage detector

Based on the flow chart, if the MQ6 detects the LPG, the alarm will automatically turn ON to alert the public and it will give a signal to the Arduino microcontroller. Next, the microcontroller will generate a signal to turn ON the exhaust fan and activate the servo motor. If the gas knob is open, the servo motor will be activated to shut off the gas knob. If the gas knob is already closed, the servo motor will remain silent. After that, the microcontroller also will give a signal to the GSM module to generate a short text to be transmitted to subscribers about the emergency.

3.4 Block Diagram.

Block diagrams are used to create a brief overview of one or many things, entities, or concepts, with lines connecting them to show the control subjects or actions displayed by the blocks connected between them. The use of block diagrams is often used in hardware, electrical, and software design in giving a simple picture of the process flow causing them to be often used in engineering. The following is the project block diagram:

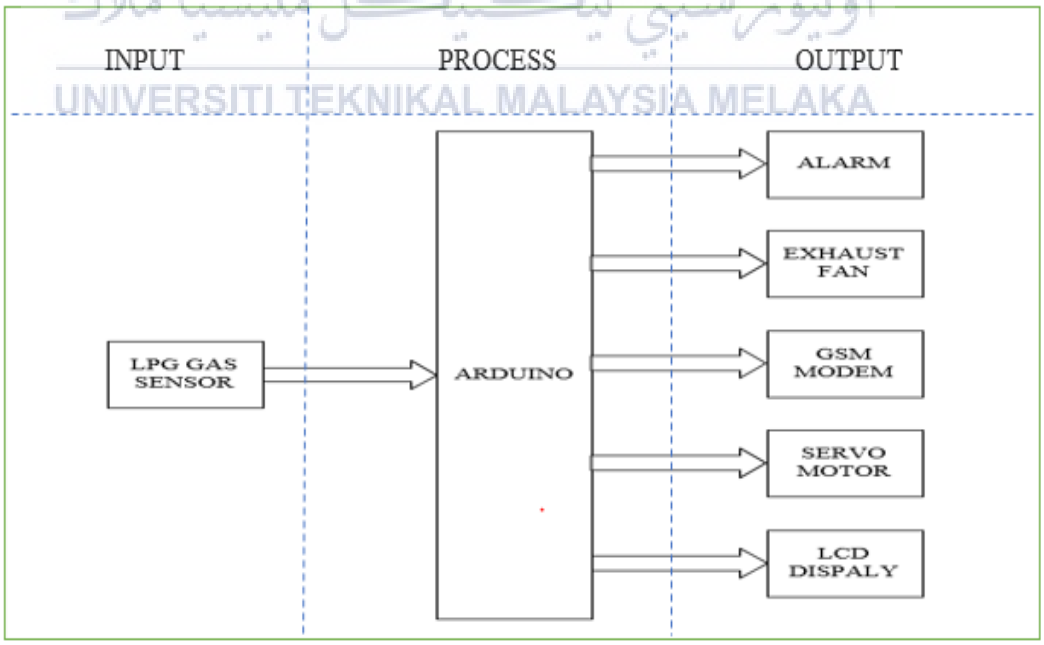


Figure 3.2 Block diagram of gas leakage detector

Based on the block diagram, the MQ6 gas sensor act as an input where it detects the LPG and gives a signal to Arduino to be processed. Next, the Arduino will generate and transmit the signal to the LCD, alarm, exhaust fan, servo motor, and GSM modem as the output to complete the system.

3.5 Hardware Implementation.

3.5.1 Arduino UNO.

Arduino Uno is a board of microcontrollers that has 14 digital I/O pins where 6 of them are the output of PWM. It also has 6 analog inputs and the input voltages are recommended in the range of 7-12V with a limit of 6-20V. Next, it is also equipped with a 16 MHz ceramic resonator with a USB connection and a power jack with an ICSP header also attached with a reset button. It's very well for its ability to handle immensely complicated tasks.

Figure 3.3 Arduino UNO

3.5.2 MQ6 Gas Sensor.

The MQ6 is a gas sensor that is simple to use and can detect LPG in the range of 200 to 10,000 parts per million. The MQ6 is extremely sensitive to LPG but less so to alcohol and smoke. To safeguard the system from an accident is utilized to sensor LPG gas in the range of 200 to 10000ppm[5]. MQ6 is also a rapid reaction gas sensor, detecting LPG gas in less than 10 seconds.

Figure 3.4 MQ6 Gas sensor

3.5.3 Buzzer Alarm.

The alarm act as an alert system to alert the people in the surrounding area about the leakage once they receive the signal from Arduino UNO about the leakage when the MQ6 detects the presence of LPG gases.

Figure 3.5 Buzzer alarm

3.5.4 Power Supply.

The power supply is designed to account for the many components that make up the total device's power requirements. A 12V dc source is required for the stepper motor. The power supply is 220/12V of voltage with 2A in the center tap of the transformer. The battery that powered the created gas detection and alarm system was charged using half-wave rectification.

Figure 3.6 Power Supply

3.5.5 GSM MODULE SIM 900A.

The SIM900A GSM Module is the most up-to-date GPRS/GSM module on the market. The majority of embedded applications use Arduino and microcontrollers. The module uses GPRS/GSM technology to connect with a mobile sim card. It receives and transmits mobile phone calls and SMS messages using various frequency bands. It also gave a better signal.

Figure 3.7 SIM900A GSM MODULE

3.5.6 SERVO MOTOR.

A servo motor is able to spin with great accuracy. This type of motor usually equipped with a control circuit that gives input on the present role of the drive shaft where this reviews allow servo motors to circulate with absolute accuracy. A servo motor is applied when you choose to oscillate an item at a specific point or range.

Figure 3.8 SERVO MOTOR

3.5.7 The LCD Display.

The LCD display is designed for E-blocks and is equipped with 16 characters with 2-line. The alphanumeric LCD display is connected to a single 9-way D-type connector and the data bit is required in serial format. A 5V power supply is needed to activate the LCD.

Figure 3.9 LCD

3.6 Software Project.

3.6.1 Arduino IDE.

The Arduino software features a code editor, a message box, a text terminal, and a toolbar with buttons for common functions and menus. The function is to link the Arduino with Genuine hardware and apply programs to them.

Figure 3.10 Arduino IDE

3.6.2 Proteus 8.

Proteus is an electrical circuit simulation, creation, and simulation application where it is used to build 2D circuit simulations to test the effectiveness of the circuit before testing on the actual circuit. The software also allows us to build and simulate various types of electrical and electronic circuits.

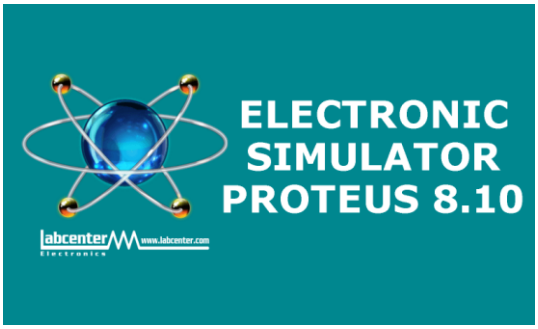


Figure 3.11 Proteus 8

3.7 Summary

This chapter presents the proposed methodology in order to develop a new, effective and integrated approach in estimating large scale/system wide TL of medium voltage (MV) network. The primary focus of the proposed methodology is in accomplishing a simple, less rigorous and effective estimation in such a way that it would not cause a significant loss of accuracy of the results. The methods also intended to use the generally available and limited data of the network and load from the power utilities. The ultimate intend of the method is not to obtain highest accuracy, but, for efficiency, easy to use and manipulate and practicality of deployment on a large scale distribution network.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction.

In this chapter, the results of the Development of a Gas Leakage Detector with SMS Alert system Using GSM Module and Arduino are shown where the MQ6 gas sensor is used and managed to detect the presence of gases and the GSM 900A is used to transmit the warning messages to the subscribers. Meanwhile, the alarm also will automatically switch ON and the LCD will show "GAS LEAKS!!!, NOT SAFE HERE". Besides, the servo motor will start functioning to close the main gas valve and the exhaust fan automatically operates to reduce the presence of gases. In this experiment, it is approved that the Arduino Uno is the most compatible microprocessor in this project.

4.2 Results and Analysis

4.2.1 Software Results.

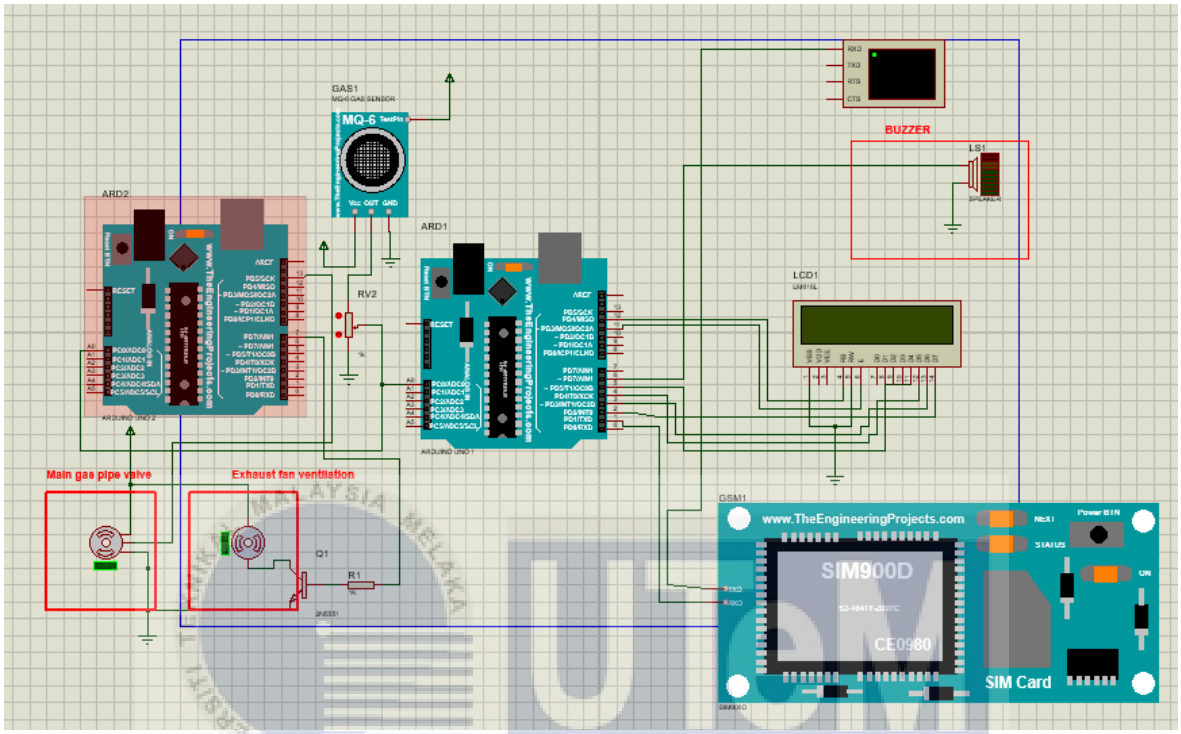


Figure 4.1 Proteus simulation circuit

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <SoftwareSerial.h>
SoftwareSerial SIM900A(9,10);
//I2C pins declaration
LiquidCrystal_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7, 3, POSITIVE);
//#include <Servo.h>
//Servo myservo;
//int pos = 0;

int gas_sensor;
int fan = 7;
int buzzer = 6;
unsigned long pm0 = 0;
const long i0 = 1000;
int detection_unit = 100;

void setup()
{
Serial.begin(9600);
SIM900A.begin(115200);   // Setting the baud rate of GSM Module
```

```
pinMode(fan, OUTPUT);
pinMode(buzzer, OUTPUT);
//myservo.attach(3);
lcd.begin(16,2);//Defining 16 columns and 2 rows of lcd display
lcd.backlight();//To Power ON the back light
//lcd.backlight();// To Power OFF the back light

//Write your code
lcd.setCursor(0,0); //Defining positon to write from first row,first column .
//        012345678912
lcd.print("  LEAK GAS  "); //You can write 16 Characters per line .
delay(1000);//Delay used to give a dynamic effect
lcd.setCursor(0,1);  //Defining positon to write from second row,first column .
//        012345678912
lcd.print("  DETECTOR  ");
delay(5000);

lcd.clear();

}

void loop()
{
  //lcd.clear();
  unsigned long c0 = millis();
  if (c0 - pm0 >= i0) {
  pm0 = c0;

  gas_status();


  }

}

//void fan()
//{
//  for(int i=0; i<360; i++)
//  {
//     for (pos = 0; pos <= 180; pos += 1) { // goes from 0 degrees to 180 degrees
//    // in steps of 1 degree
//    myservo.write(pos);              // tell servo to go to position in variable 'pos'
//    delay(15);                       // waits 15ms for the servo to reach the position
//  }
//  for (pos = 180; pos >= 0; pos -= 1) { // goes from 180 degrees to 0 degrees
//    myservo.write(pos);              // tell servo to go to position in variable 'pos'
//    delay(15);                       // waits 15ms for the servo to reach the position
//  }
//  }
//}
```

```
void gas_status()
{
  gas_sensor = analogRead(A0);
  Serial.print("Gas : ");
  Serial.println(gas_sensor);
  lcd.setCursor(0,0); //Defining positon to write from first row,first column .
  //        012345678912
  lcd.print("GAS : "); //You can write 16 Characters per line
  lcd.setCursor(6,0); //Defining positon to write from first row,first column .
  //        012345678912
  lcd.print(gas_sensor); //You can write 16 Characters per line .

  if (gas_sensor > detection_unit)
  {
   Serial.println("FAN : ON");
   digitalWrite(fan, HIGH);
   digitalWrite(buzzer, HIGH);
   lcd.setCursor(0,1); //Defining positon to write from first row,first column .
   //        012345678912
   lcd.print("FAN : ON  "); //You can write 16 Characters per line

   while(1)
   {
   SIM900A.println("ATD+60124645406;"); // ATDxxxxxxxxxx; -- watch out here for
semicolon at the end!! -> tukar nombor disini
   Serial.println("Calling  "); // print response over serial port
   delay(15000);
   SIM900A.println("ATH");
   Serial.println("Hangup Call");
   delay(1000);
   SendMessage();

   break;
   }



  }
  else
  {
   Serial.println("FAN : OFF");
   digitalWrite(fan, LOW);
   digitalWrite(buzzer,LOW);
   lcd.setCursor(0,1); //Defining positon to write from first row,first column .
   //        012345678912
   lcd.print("FAN : OFF"); //You can write 16 Characters per line
  }
  delay(1000);
  lcd.clear();
```

```
}

 void SendMessage()
{
  Serial.println ("Sending Message");
  SIM900A.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
  delay(1000);
  Serial.println ("Set SMS Number");
  SIM900A.println("AT+CMGS=\"+60124645406\"\r"); //Mobile phone number to send
message -> tukar nombor di sini
  delay(1000);
  Serial.println ("Set SMS Content");
  SIM900A.println("Gas Leak Detected !!");// Messsage content
  delay(100);
  Serial.println ("Finish");
  SIM900A.println((char)26);// ASCII code of CTRL+Z
  delay(1000);
  Serial.println ("Message has been sent ->SMS Selesai dikirim");
}
```

Table 4.1 Arduino 1 coding

```
#include<Servo.h>
Servo myservo;
int pos = 0;
int val;
#include <Wire.h>
#include <LiquidCrystal.h>
int Contrast=75;
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
#include <SoftwareSerial.h>
SoftwareSerial mySerial(9, 10);
byte tx = 1;

const int Buzzer = 6;
const int DC_Motor = 7;

int gasC_1 = 0;
int smkC_1 = 0;

const int SensorPin1 = A0;
const int SensorPin2 = A1;

String textForSMS;
void setup()
{
  analogWrite(6,Contrast);
  lcd.begin(16,2);
```

```
  delay(100);
  pinMode(tx, OUTPUT);
  myservo.attach(13);
  pinMode(Buzzer, OUTPUT);
  pinMode(SensorPin1, INPUT);
  pinMode(SensorPin2, INPUT);
  pinMode(Buzzer, OUTPUT);
  pinMode(DC_Motor, OUTPUT);

  mySerial.begin(9600);
  Serial.begin(9600);
}
void loop()
{
```

Table 4.1 Arduino 2 coding

In this chapter, the results of the Development of a Gas Leakage Detector with SMS Alert system Using GSM Module and Arduino are shown where the MQ6 gas sensor is used and managed to detect the presence of gases and the GSM 900D is used to transmit the warning messages to the subscribers. Meanwhile, the alarm also will automatically switch ON and the LCD will show "GAS LEAKS!!!, NOT SAFE HERE". Besides, the servo motor will start functioning to close the main gas valve and the exhaust fan automatically operates to reduce the presence of gases. In this experiment, it is approved that the Arduino Uno is the most compatible microprocessor in this project.

The figure above shows the simulation by using Proteus. For this project, the potentiometer act as the presence of gases. If the value of the potentiometer is increased, the presence of gases also increased.

Figure 4.2 The LCD

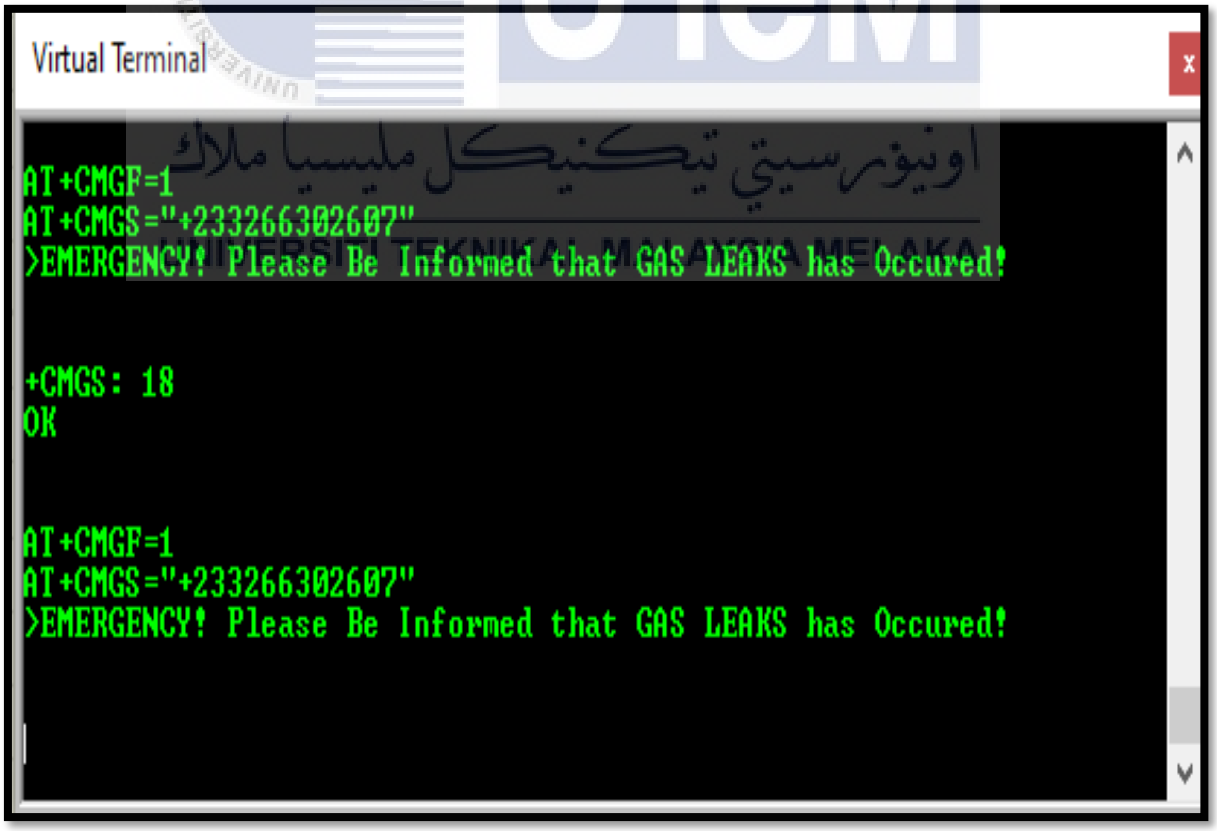


Figure 4.3 Virtual terminal

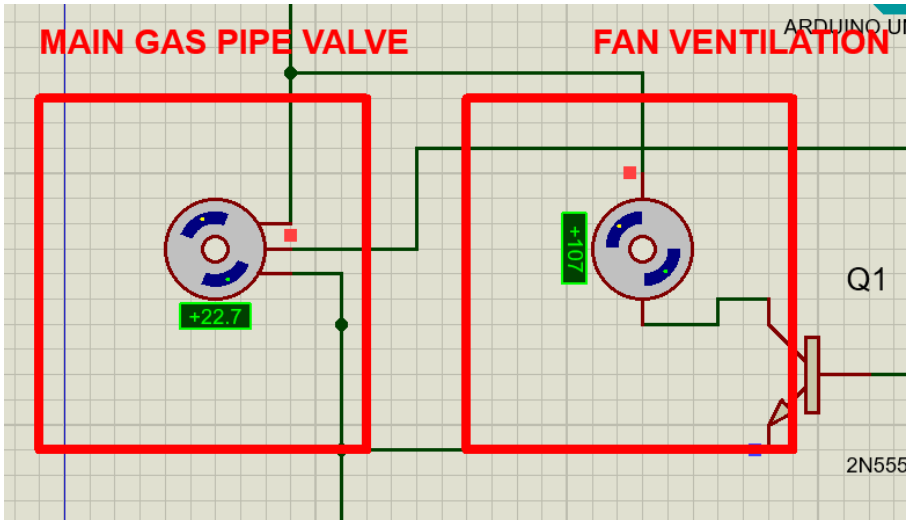


Figure 4.4 The motor

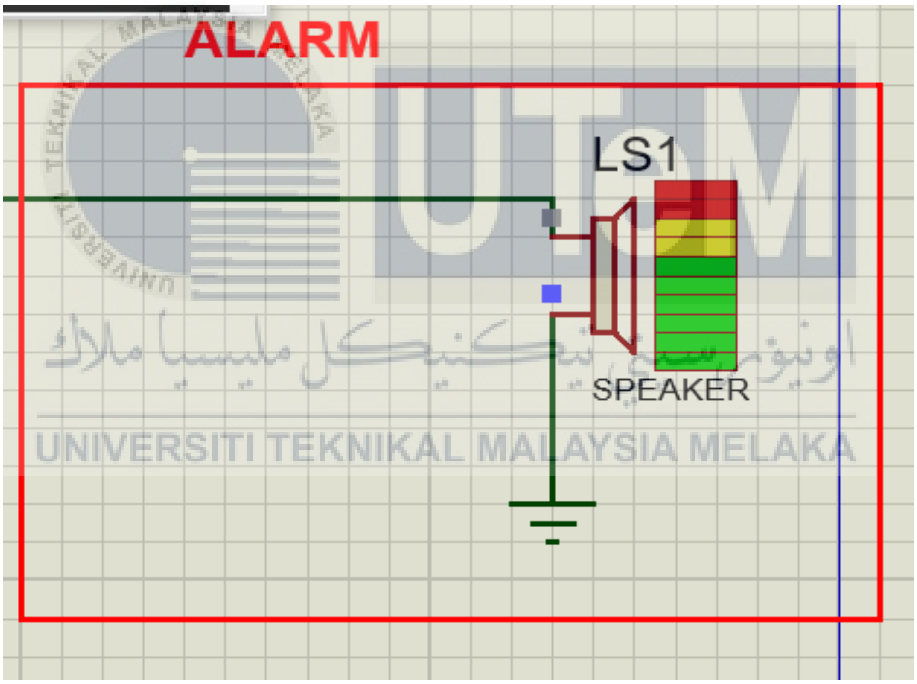


Figure 4.5 The alarm

The figure above shows the LCD will display output if the presence of gases is detected. Based on the virtual terminal, it is shown that the message is successfully transmitted by the GSM 900D Module and received by the subscribers. The motor also manages to rotate and act as a pipe valve while the other is exhaust fan ventilation. The alarm also automatically turns ON every time the gas is detected.

4.2.2 Hardware results.

Since the situation is based on the kitchen, the MQ6 gas sensor will detect the presence of LPG . When LPG presence readings is exceeds the safe levels which 100ppm as shown on the LCD screen, the servo motor will automatically turn ON to closed and cut off the attachment of the gas pipe to the gas tanks. Next, the GSM module will generates a missed call and spam message to the user to warn them about the gas leaks. Besides, the 5V DC fans will act as ventilation system to reduce the presence of LPG. At the same time, the buzzer also will automatically switch ON during the situation to alert the surrounding about the gas leaks.

Figure 4.6 Front view model.

Figure 4.7 Upper view model.

Figure 4.8 GSM 900A inserted with Umobile simcard.

Figure 4.9 GSM 900A inserted with Maxis simcard.

Figure 4.10 GSM 900A inserted with Celcom simcard.

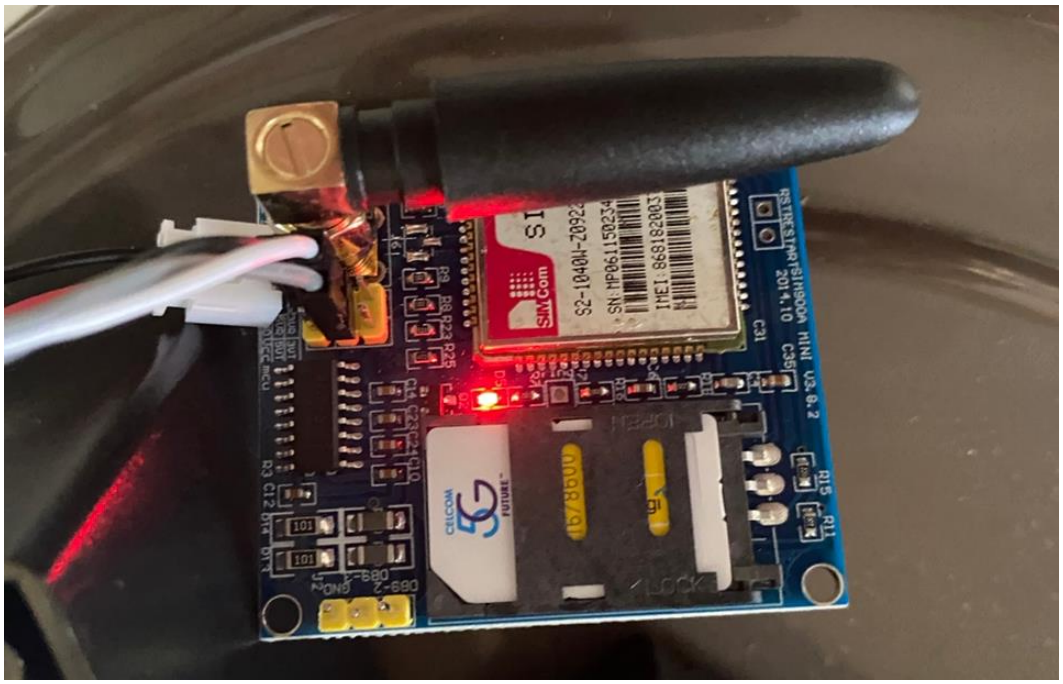


Figure 4.11 GSM 900A inserted with Digi simcard.

Figure 4.12 Gas reading below safe level

Figure 4.13 Gas reading exceed safe level

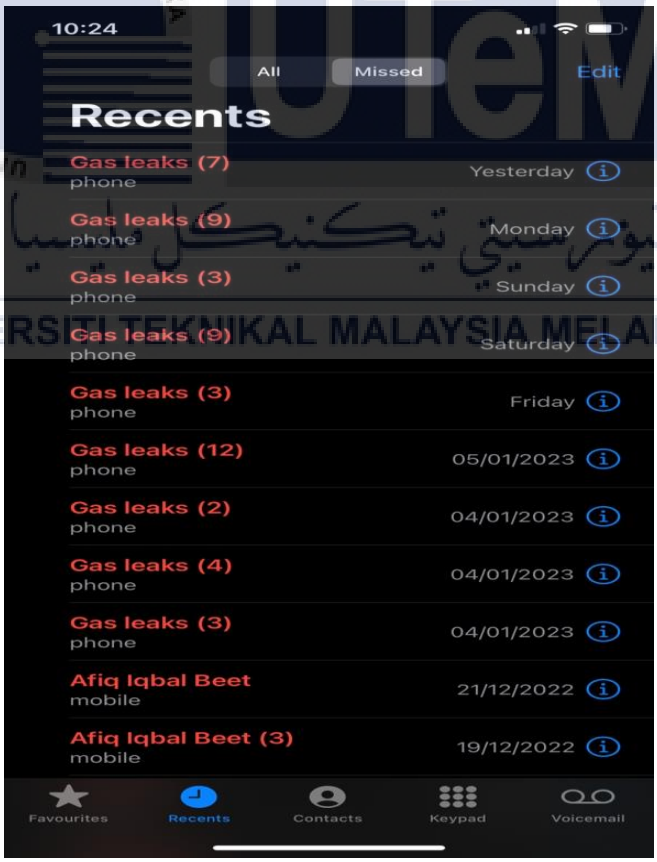
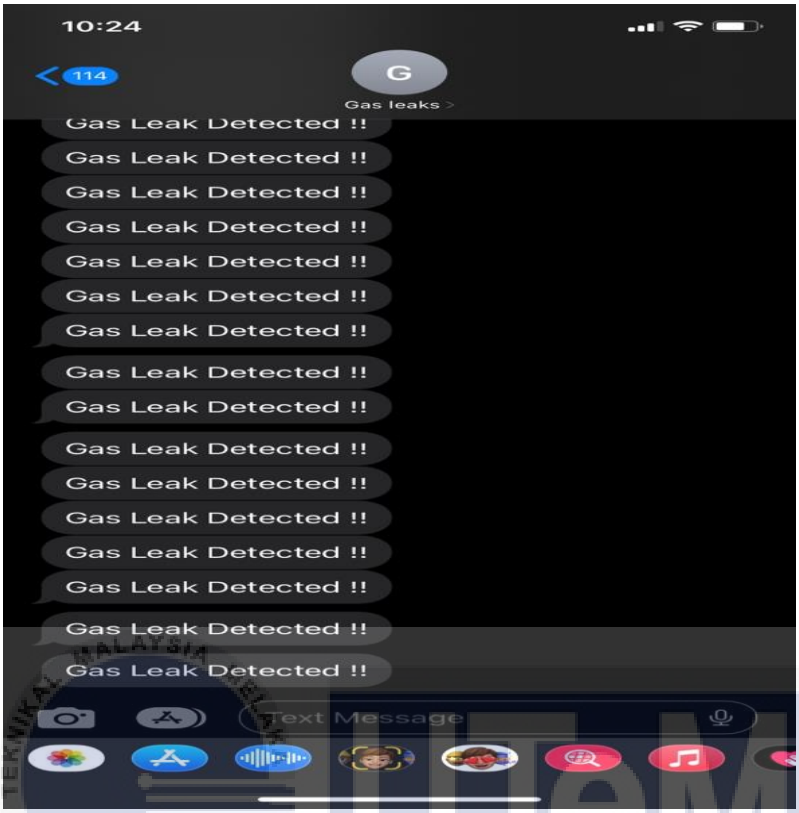


Figure 4.14 Missed call notification



4.15 SMS notification

4.2.3 Analysis results.

A few analysis have be done and tested to justify about the effectiveness of this project in identify the reading of LPG presence and the type of telco sim card which is supported by the GSM to generates missed calls and SMS.

Gas Reading (MQ-6)	Results		
	Gas Leakage YES/NO	GSM SIM900A "Notification"	Exhaust Fan, Buzzer & Servo Motor
≥ 50ppm	NO	NO	OFF
≥ 60ppm	NO	NO	OFF
≥ 70ppm	NO	NO	OFF
≥ 80ppm	NO	NO	OFF
≥ 90ppm	NO	NO	OFF
≥ 100ppm	YES	YES	ON
≥ 120ppm	YES	YES	ON
≥ 130ppm	YES	YES	ON
≥ 140ppm	YES	YES	ON
≥ 150ppm	YES	YES	ON

Table 4.3 Gas condition and system results

Types of telco sim card	Ability of GSM in generate missed calls and SMS
Umobile	YES
Maxis	YES
Celcom	YES
Digi	NO

Table 4.4 Type of telco sim card and ability of GSM in generate missed calls and SMS

4.3 Discussion.

The result is show that the gas leak that occurred has been successfully detected. Thus, the detection system has an efficient system that successfully detects the presence of gas whenever the gas exceeds the safe level which is over 100ppm detected by MQ6 and the system will automatically generate a missed call and emergency texts transmitted to customers while performing other activities such as DC fan and servo motor will switch ON in order to decrease the presence of gases while buzzer will act to alert the public about the leakage of the gas. The type of sim card also play their role since not every telco sim designed is supported by the GSM.

4.4 Summary

In this chapter, the case studies presented the demonstration of the capability of the MQ6 gas sensor while performing other activities to reduce the presence of gases. The GSM 900A module in this project is triggered each time the gas is detected and will transmit a missed call and message to notify the subscriber about the emergency.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In conclusion, gas leakage detectors are frequently used in industries but it also suitable to be installed at home since LPG also are used in a household[10]. Based on previous studies, the implementation of gas leakage sensors in the household is little. Since there have been several reports of buildings catching fire as a result of LPG leaks, the early phase well before the explosion should be prevented.

The purpose of this project is to identify the presence of LPG and will notify the subscriber about the leakage by sending a short text[6]. Besides, this project is also attached with other functions to decrease the presence of detected gas such as exhaust ventilation fan and automatically shut off the main valve of the gas pipe. The alarm is also attached in this project to warn the public about the leakage.

Finally, the implementation of this project may help to decrease the percentages of fire and explosions that happen because of the LPG leaks either in industries or in the home.

5.2 Future Works

For future improvements, “Development of Gas Leakage Detector with SMS Alert system Using GSM Module and Arduino” estimation results could be enhanced as follows:

i) Wider range of possible gas sensor able to detect the presence of LPG.

ii) Able to detect more hazardous type of gases.

iii) Manage to attach with many other activities that helps in reducing the presence of hazardous gases.

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Booking Syst em for LPG wit h Leakage and Fire Sensing Sanct uary IJAERS Journal AUT OMAT IC LPG LEAKAGE DET ECT ION AND HAZARD PREVENT ION FOR HOME SECURIT Y sut anvi vasupalli IRJET-Smart Home Syst em Using Service Robot and Wireless Sensor Net work IRJET Journal GSM BASED GAS LEAKAGE DETECTION SYSTEM." [Online]. Available: www.ijtra.com

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APPENDICES

Gantt Chart for PSM 1:

WEEKS	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
Activities														
PSM 1 Briefing with SV														
Start searching journal														
Progress Work 1														
Project Research														
Research on literature review														
Report Preparation														
Progress Work 2														
PSM 1 Report Submission														
PSM 1 Presentation														

Gantt Chart for PSM 2: