POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SMART GAS AND SMOKE DETECTOR

NAME	REGISTRATION NO
NUR ALYA BATRISYIA BINTI MOKTAR LOTFI	08DEU20F1006

JABATAN KEJURUTERAAN ELEKTRIK

1:2022/2023

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This report submitted to the Electrical Engineering Department in fulfillment of the requirement for a Diploma in Electrical Engineering

JABATAN KEJURUTERAAN ELEKTRIK

1:2022/2023

CONFIRMATION OF THE PROJECT

The project report titled "Smart Gas and Smoke Detector" has been submitted,

reviewed and verified as a fulfills the conditions and requirements of the Project

Writing as stipulated

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Supervisor's name   : Pn. Emy Satira Azrin binti Mohamed Hakke

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Signature of Coordinator   :

Date   :

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE **:** **SMART GAS AND SMOKE DETECTOR**

 SESSION: **1:2022/2023**

1. I, **1. NUR ALYA BARISYIA BINTI MOKTAR LOTFI (08DEU20F1006)**

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2. I acknowledge that 'The Project above' and the intellectual property therein is the result of our original creation /creations without taking or impersonating any intellectual property from the other parties.

3. I agree to release the 'Project' intellectual property to 'The Polytechnics' to meet the requirements for awarding the **Diploma in Electrical Engineering** to me.

 Made and in truth that is recognized by;
 a) **Nur Alya Batrisyia binti Moktar Lotfi**)
 (Identification card No: - 020517-10-0134) ....…… …………
) **Nur Alya Batrisyia binti Moktar Lotfi**

 In front of me, **Emy Satira Azrin binti Mohamed Hakke** (Click here to enter text.))
 As a project supervisor, on the date:)
 Emy Satira Azrin binti Mohamed Hakke

ACKNOWLEDGEMENTS

ABSTRACT

Safety plays a major role in today's world and it is necessary that good safety systems are to be implemented in places of education and work. This work modifies the existing safety model installed in industries and this system also be used in homes and business premises. One of the preventive measures to avoid the danger associated with gas leakage is to install a gas leakage detector at vulnerable locations. A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. Gas Detector where it can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to fix or leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals. Containment into any area where the gas should not be present must be avoided. Because a small leak may gradually build up an explosive concentration of gas, leaks are very dangerous. Nowadays, existing gas detector is less effective in usage because the user can only detect the gas leakage when they test by using gas detector. It is dangerous since gas leakage must be identified from early of the leak. That is why the Smart Gas and Smoke Detector was invented to avoid the fire or explosion occur in the houses or premises. This kind of gas detector will detect the gas continuously as long as there is power supply. This project used Microcontroller Arduino UNO at the processor where it process the input from the sensor and to GSM module to communicate with the user by sending an alert through SMS. The benefit of these projects is to prevent the earlier stage of fire because of unattended cooking without a human supervision, could prevent the explosion because of gas leakage.

ABSTRAK

Keselamatan memainkan peranan utama dalam dunia hari ini dan sistem keselamatan yang baik perlu dilaksanakan di tempat pendidikan dan kerja. Kerja ini mengubah suai model keselamatan sedia ada yang dipasang di industri dan sistem ini juga digunakan di rumah dan premis perniagaan. Salah satu langkah pencegahan untuk mengelakkan bahaya yang berkaitan dengan kebocoran gas ialah memasang pengesan kebocoran gas di lokasi yang terdedah. Pengesan gas ialah peranti yang mengesan kehadiran gas di kawasan, selalunya sebagai sebahagian daripada sistem keselamatan. Pengesan Gas di mana ia boleh membunyikan penggera kepada pengendali di kawasan tempat kebocoran berlaku, memberi mereka peluang untuk membaiki atau pergi. Peranti jenis ini penting kerana terdapat banyak gas yang boleh membahayakan kehidupan organik, seperti manusia atau haiwan. Penahanan ke dalam mana-mana kawasan yang tidak sepatutnya terdapat gas mesti dielakkan. Kerana kebocoran kecil secara beransur-ansur boleh membina kepekatan gas yang meletup, kebocoran adalah sangat berbahaya. Pada masa kini, pengesan gas sedia ada kurang berkesan dalam penggunaan kerana pengguna hanya dapat mengesan kebocoran gas apabila mereka menguji dengan menggunakan pengesan gas. Ia berbahaya kerana kebocoran gas mesti dikenal pasti dari awal kebocoran. Sebab itulah Smart Gas and Smoke Detector dicipta bagi mengelak kebakaran atau letupan berlaku di rumah atau premis. Pengesan gas jenis ini akan mengesan gas secara berterusan selagi ada bekalan kuasa. Projek ini menggunakan Microcontroller Arduino UNO pada pemproses di mana ia memproses input daripada sensor dan ke modul GSM untuk berkomunikasi dengan pengguna dengan menghantar makluman melalui SMS. Faedah projek ini adalah untuk mengelakkan kebakaran peringkat awal kerana memasak tanpa pengawasan tanpa pengawasan manusia, boleh mengelakkan letupan kerana kebocoran gas.

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LIST OF SYMBOLS

NAME	SYMBOL
Arduino Uno R3	
GSM Module SIM900A	
Potentiometer	
MQ-135 Gas Sensor	

LCD Display 16x2	16 x 2 LCD MODULE JHD 162A Vss Vcc VEE RS R/W E DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7 LED+ LED- 1 16

LIST OF ABBREVIATIONS

ABBREVIATIONS	MEANING
GSM	Global System for Mobile communication
LCD	Liquid-crystal display
SMS	Short Message/Messaging Service
LPG	Liquefied petroleum gas
USB	Universal Serial Bus
LED	Light-emitting diode
PCB	Printed Circuit Board
PPM	Planned Preventative Maintenance
DC	Direct Current
EEPROM	Electrically Erasable Programmable Read-Only Memory
TTL	Time to live
GPRS	General Packet Radio Service
GND	Ground
VCC	Voltage Common Collector
IDE	Integrated Development Environment

CHAPTER 1

INTRODUCTION

1.1   Introduction

LPG (Liquefied Petroleum Gas) gas cylinders are the main need for the community to meet cooking or business needs. In addition, gas tube leaks often occur which are harmful to the user community and the surrounding environment. In the event of a leak, a strong gas smell will occur. In essence, an explosion can be avoided if there is an early prevention, when the gas exits or when a gas leak occurs.[5]

We know that fire attacks due to gas leakage in buildings, restaurants, etc are increased severely. If the gas knob is left open accidently for a few hours it only smells and does not catch fire, but it is kept open for a long time, and then if there is any ignition then the gas rapidly catches fire. The sensor in the circuit will sense the leakage, if the leakage is of high intensity it will put the alarm or the buzzer on so the owners will be alert so as to take precautions measures to minimize the possibility to catch fire or any loss to life or property. This is a robust Gas sensor suitable for sensing LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentrations in the air.[2]

The project entitled "Smart Gas and Smoke Detector", will be a great help in terms of preventing any danger caused by gas leakage. This project will be informed about the leakage via SMS alert.

1.2   Background Research

LPG is the terminology for Liquefied Petroleum Gas. The gas is made up of hydrocarbon gases comprising of Propane and Butane. LPG is prepared by refining petroleum or "wet" natural gas, and is almost entirely derived from fossil fuel sources, being manufactured during the refining of petroleum (crude oil), or extracted from petroleum or natural gas streams as they emerge from the ground.

As it is a gas, it does not pose ground or water pollution hazards, but it can cause air pollution. As its boiling point is below room temperature, LPG will evaporate quickly at normal temperatures and pressures and is usually supplied in pressurised steel vessels. LPG is also colourless and odourless. However, for safety reasons, an odorant is added to LPG for easy detection of any gas leakage.

LPG is heavier than air, unlike natural gas, and thus will flow along floors and tend to settle in low spots, such as basements. There are two main dangers from this. The first is a possible explosion if the mixture of LPG and air is within the explosive limits and there is an ignition source. The second is suffocation due to LPG displacing air, causing a decrease in oxygen concentration.

Lately, gas leakage problem is highly become current issues that be the main causes of fire burning. This project is produced to detect any leakage of cooking gas and it will alert the user about leakage. User will get the alert in SMS. By using this project it will reduce the accident of fire and explosion. It also helps the early detection of gas before the concentration of gas reaches the dangerous level.

1.3   Problem Statement

• The presence of gas and smoke leakage without us being aware of their existence.

• Unable to be alert the information about any source of fire or smoke leak when it occurs.

• Gas leakage can cause fire that will lead to serious injury or death and it also can destroy human properties.

1.4 Research Objectives

The main objective of this project is to reduce the risks of gas leakage by developing a "Smart Gas and Smoke Detector" system that automatically detects the leakage of the Liquefied Petroleum Gas (LPG) and smoke employing a gas sensor.

More specifically the principle objective of this research are:

1. To develop a system that can detect the presence of gas and smoke leakage.

2. To send information of any the cause of the fire or smoke and gas leakage into SMS so that users will be more alert.

3. To develop a system that can reduce serious injury or death and it also can destroy human properties.

1.5 Scope of Research

This system can be implemented in residential area, small industries and restaurant. Besides that, this system also exposes to the community about the important of the smart gas and smoke detector to be used because it can help to avoid any dangers of gas leakage that not only can give effect to the user but to the other person too. In addition, this project will be completed within 20 days, cost of developing project is RM230.00, hardware resources are available for two months.

1.6   Project Significance

One of the preventive measures to avoid the danger associated with gas leakage is to install a gas leakage detector at vulnerable locations. Gas leakage problem is highly become current issues that be the main causes of fire burning. This project is produced to detect any leakage of cooking gas and it will alert the user about leakage. Users will get the alert in SMS. By using this project, it will reduce the accident of fire and explosion. It also helps the early detection of gas before the concentration of gas reaches the dangerous level:

- Alert you when there is a gas leakage.

- Alert you in case of flame episode.

- Alert you in case of smoke.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

The smart gas and smoke detector I wanted to make was a disc-like shape. In addition, it is a little different from what is already on the market, for example, 5 below that I have already searched and researched. The 5 examples below are already on the market. I want to make a smart gas and smoke detector because it is different from other products that are able to see the readings on the LCD display of smoke and gas leaks and are able to send SMS to homeowners when the gas and smoke exceed 200 and above.

The results of the previous research I have done and the 5 examples I have listed below are what came up with the idea of making a smart gas and smoke detector that is slightly different from what is already on the market.

The different ones are sensors. I use the MQ-135 sensor because good sensitivity to harmful gases over a wide range of concentrations compared to the MQ-2 sensor it is less sensitive to harmful gases. Besides, long life and low cost. Also suitable for application to household air pollution alarm, industrial air pollution alarm and portable air pollution detector.

Then, there was one of the five examples of the research receiving an SMS but not knowing the level of gas and smoke readings when the level was in a dangerous state. The addition is the SMS will send a signal that the gas and smoke leaks are at dangerous levels if the gas and smoke exceed the level of 200 and above, then the signal will be sent to SMS to inform that the level is in danger and display on LCD display too.

2.2 **Motor Skill Challenges in Gas and Smoke Leakage (Literature Review Topic 1)**

The paper presented discusses that fire, being an important process that affects ecological systems across the globe has both positive and negative effects. Gas leaks in the home are usually the result of poorly fitted, bad maintenance or faulty appliances like cylinders, boilers and cookers. Numerous machines in your home may utilize flammable gas or propane to make warm, including water radiators, dryers, stoves and chimneys. As these apparatuses become more established, the seals that associate with the channeling can consume and cause a gas spill. Apparatuses such as stoves or clothing machines that utilization a start to light the gas for utilize can end up flawed and not touch off the gas. On the off chance that somebody neglects tighten the gas handle; the gas can escape into the home.

Over the years death rates by fire has increased tremendously. Fire consumes homes and commercial premises quickly, indiscriminately taking lives and ruining property. No one should have to be become a victim of fire, but the reality is that people do become victims every day. Fire accidents create serious health and safety hazards in developing countries, which also resulted into catastrophic situation. This huge loss is inestimably enormous, hence this paper the development of a GSM-based fire detector system. A cost-effective system that detects gas or smoke and sends alert information to a mobile phone for quick and immediate action thereby, avoiding unnecessary and costly industrial and domestic breakdown.

2.2.1 **Previous Research (Subtopic Literature Review Topic 1)**

This chapter extend the literature reviews that cater the information in accordance with the objectives of this project. The relevant information and other extra features were gathered as shown below.

2.2.1.1 (DETECTION OF GAS AND ALERT BY USING ARDUINO UNO & MQ2 SENSOR)

G.V.Surya bharat et al.[2] An Arduino based MQ2 sensor which will detect gas leakage. We know that fire attacks due togas leakage in buildings, restaurants, etc are increased severely. The sensor in the circuit will sense the leakage, if the leakage is of high intensity it will put the alarm or the buzzer on so the owners will be alert so as to take precautions measures to minimize the possibility to catch fire or any loss to life or property. This is a robust Gas sensor suitable for sensing LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentrations in the air. MQ2 is one of the commonly used gas sensors in MQ sensor series. It is a Metal Oxide Semiconductor (MOS) type Gas Sensor also known as Chemiresistors as the detection is based upon change of resistance of the sensing material when the Gas comes in contact with the material. Using a simple voltage divider network, concentrations of gas can be detected. MQ2 Gas sensor works on 5V DC and draws around 800mW. It can detect LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentrations anywhere from 200 to 10000ppm.[2] As we have seen the use of various gases in various fields, if there is any leakage of any such gases, then it can be detected and a harm can be minimized. It has a high response for LPG and natural gases. It also detects smoke but has a small sensitivity towards it. As any of these gases are detected the sensor will sense those and the buzzer alarm will be turned on. Alarm will inform the locals that there is a leakage of gas somewhere so that they will take steps to minimize the harm. If the problem rises even after the alarm and no steps are taken then owner of the place will be informed and if still no action is taken then emergency services will be informed so as to minimize the disaster.[2] The analog signal from MQ2 Gas sensor is further fed to LM393 High Precision Comparator (soldered on the bottom of the module), of course to digitize the signal. Along with the comparator is a little potentiometer you can turn to adjust the sensitivity of the sensor. You can use it to adjust the concentration of gas at which the sensor detects it. The sensor is connected to the input of the arduino with the help of connecting cables or jumper cables. Further the circuit goes towards output where the buzzer is connected. If we differ the delay value of the buzzer then we get a variation in the buzzer sound.[2] This can be applicable to detect various gases. Arduino is specially used in this design as it is easy to use in the circuit and the program upload is also very simple. That is why arduino is used. It is provided with 5V DC, which is an advantage that it won't require much power and is easy to install. In my project, I used the MQ-135 sensor because it can detect gas and smoke more effectively than the MQ-2 sensor.

2.2.1.2 (LPG LEAKAGE DETECTOR USING ARDUINO WITH SMS ALERT AND SOUND ALARM)

Rhonnel S. Paculanan et al.[3] The project entitled "LPG Leakage Detector using Arduino with SMS Alert and Sound Alarm", will be a great help in terms of preventing any danger caused by gas leakage. The purpose of this project is to detect the presence of LPG leakage as a part of a safety system. Apart from sound alarm, an SMS alert will inform the authorized person and the solenoid valve will be triggered to shut down the gas supply to prevent any harmful effects due to gas leakage. Descriptively, we use a gas sensor to monitor the LPG if the gas leak reaches beyond the normal level. This proposed project will trigger the sound alarm. In addition, the authorized person will be informed about the leakage via SMS alert and the gas supply will be automatically shut down. The people can be saved from a potential explosion caused by gas leakage. Scope are notices Methane leak, Butane leak, and LPG leak, or any such petroleum centered gaseous material. Generate Sound Alarm when gas outflow is noticed. Transmit SMS Alert to consent person. Displaying gas outflow status that signifies if the gas is in normal stage or not. Automatic closure of gas source using Solenoid controller.[3] Limitation are portable gas cooktop cannot be organized this proposed project. And LPG hand wheel cannot be controlled in this proposed project. To layout and acquire a project that will perceive gas outflow like Methane leaks, Butane leaks, and LPG leaks, Methane outflow or any such petroleum centered on gaseous substance that can be discovered using the MQ5 device, set up an SMS centered Alert method to send SMS alert missives to restrict mobile number enter inside the Arduino program. So, this project that will fabricate a sound alarm during gas outflow and rest the alarm once gas outflow is regulated and show status in an LCD using a 16×2 LCD component and rest the gas supply using Solenoid controller.[3]

2.2.1.3 (DESIGN OF A HOME FIRE DETECTION SYSTEM USING ARDUINO AND SMS GATEWAY)

Suwarjono Suwarjono et al.[7] Delay in coping with fires can cause in loss of human life or materials. Most of the fire cases occurred in residential houses. A house is an object that is vulnerable to fire because of its kind of activities. Human safety is an essential factor that must be considered and prioritized in a house fire. Therefore, residents of houses affected by disasters must receive information in the form of early warnings when a fire happens so that the human can be evacuated independently. Information about the fire location is necessary to provide information to the fire department for easier access to the fire location and prevent more significant losses. Research on the fire detection system that has been carried out uses two sensors for detection, the first is the DS18B20 sensor (temperature sensor), and the second is the MQ2 sensor (gas sensor).[7] These two sensors are media to provide input to the Arduino microcontroller. The results that are inputted from the two sensors provide information to Arduino at the location. In the event of an unnatural condition (increased temperature and gas detected), Arduino will process the data to produce an output in the form of an alarm sound and provide information to homeowners and firefighters via short messages sent via the GSM module. This mechanism is a faster solution to find out the potential for a fire to occur in a building/house.[7] This home fire detection system identifies the potential for a house fire, where the detection is carried out when receiving input from the DS18B20 temperature sensor and MQ2 sensor, then the data will be processed on the Arduino. If the heat exceeds the standard room temperature limit that has been determined, Arduino will instruct the GSM module to send a short message to the homeowner and the fire department regarding the potential that can cause a fire.[7] This makes it easier for firefighters and homeowners to carry out rescues, thereby reducing the potential for greater casualties. The short message-based fire detector uses another device in the form of a GSM shield module. This device will be used as a device installed in the house and assists in sending messages that house owners and firefighters will receive to carry out an early evacuation immediately. Based on the tests and outputs that have been carried out, it can be concluded that the design of an Arduino-based home fire detection system and SMS gateway can provide information on fires that occur quickly to homeowners and rescue fires to reduce losses and minimize possible fatalities.

2.2.1.4　(DESIGN OF GAS DETECTION SYSTEM BASED ON INTERNET OF THING)

Gunawan Gunawan et al.[5] The cause of the explosion of the gas cylinder was due to a leak in the hose, tube or regulator which was not properly installed. In the event of a leak, a strong gas smell will occur. This gas leakage detector is based on the Internet of Thing (IoT), which works to detect the existence of gas leaks and useful to prevent the occurrence of explosions and fires. The advantage of this tool in addition to sound alarm is also connected to the internet to give a warning via smartphone owned by the owner of the house or business owner so that gas leakage can immediately be known. This tool uses Arduino Uno as its processor and gas sensor that can detect various types of gas, especially LPG (Liquefied Petroleum Gas). Along with the development of science and technology, a security system was developed by providing an Early Warning System to give a sign if there was a smell of gas around the house. A designing and making of Arduino-Based LPG Leakage Management Systems Using Sensors MQ-2 With SMS Notification "found the author uses Arduino uno as a microcontroller and MQ-2 sensor as a tool for gas leak detection and also in previous journals sending messages via SMS, messages via SMS are now no longer in demand. Therefore, this system sends warning information through Telegram and Email which is controlled by Wemos D1 to the Android mobile owner of the LPG gas cylinder.[5] This detection system is placed close to LPG gas cylinders in the household or it can be in the kitchen in a restaurant. This system will detect gas with a gas content above 200 PPM and will not work when the gas content is below 200 PPM. This system detects LPG gas levels in the air using the MQ-5 sensor, if the sensor detects LPG gas, then the buzzer, the LED will turn on and the servo motor will open the roof along with the DC fan will spin out the LPG gas in the room, then sent notifications via Telegram and Email homeowners. If there is no LPG gas in the room, the servo motor will close the roof, then deactivate the DC fan, LED and buzzer and notifications to Telegram and Email will not be sent.[5] In my project, I use SMS as a warning/alert that gas and smoke levels are dangerous which is gas and smoke exceed the level of 500 and above.

2.2.1.5 (SENSOR-BASED GAS LEAKAGE DETECTOR SYSTEM)

Mohammad Monirujjaman Khan et al.[4] The detector incorporates a MQ-6 sensor (with gas detection range of 300–10,000 ppm) as the LPG gas sensor, PIC16F690 microcontroller as the control unit, LCD for displaying gas concentration, a buzzer as an alarm and a number of LEDs to indicate the gas leakage status. The microcontroller senses the presence of a gas when the voltages signal from the MQ-6 sensor goes beyond a certain level and gives an audiovisual alarm. An MQ6 semiconductor sensor is used. Sensitive material of the MQ-6 gas sensor is SnO_2, which has lower conductivity in clean air. When the target combustible gas exists, the sensor conductivity increases along with the rising gas concentration. The MQ6 gas sensor has a high sensitivity to Propane, Butane and LPG, and response to Natural gas. The sensor could be used to detect different combustible gasses, especially Methane; it hasa lowcost and is suitable for different applications. The MQ-6 can detect gas concentrations anywhere from 200 to 10,000 ppm. This system is based on the Arduino UNO R3 and MQ-6 gas sensor. When the sensor detects gas in the atmosphere, it will give digital output 1 and if gas in not detected the sensor will give digital output 0. Arduino will receive the sensor output as digital input. If the sensor output is high, then the buzzer will start tuning along with the LCD that will show that "Gas detected: Yes". If the sensor output is low then buzzer will not be tuning, and the LCD will show that "Gas detected: No".[4] The buzzer most commonly consists of a number of switches or sensors connected to control unit that determines which button was pushed or whether a preset time has lapsed, and usually illuminates a light on the appreciate button or control panel and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. If the system detects the level of gas in the air that exceeds the safety level it will activate the alarm which includes the buzzer to alert the users at home of the abnormal condition and to take any necessary action. In my project, if the sensor output is high, then the LCD will show that "Gas Level: 520 (>500)" and SMS will be sent. If the sensor output is low, the LCD will show that "Gas Level: 350 (<500)" and SMS will not be sent.

2.3 Control System (Literature Review Topic 2)

Control system means by which a variable quantity or set of variable quantities is made to conform to a prescribed norm. It either holds the values of the controlled quantities constant or causes them to vary in a prescribed way. A control system may be operated by electricity, by mechanical means, by fluid pressure (liquid or gas), or by a combination of means. When a computer is involved in the control circuit, it is usually more convenient to operate all the control systems electrically, although intermixtures are fairly common.

Open and Closed Loop Systems. Both can be found in the project management domain. But only the Close Loop control system can provide indicators of performance variances needed to take corrective actions to maintain the needed activities to arrive on or before the need date, at or below the planned cost, and with the needed capabilities. In open loop control systems, output is not fed-back to the input. So, the control action is independent of the desired output. In closed loop control systems, output is fed back to the input. So, the control action is dependent on the desired output.
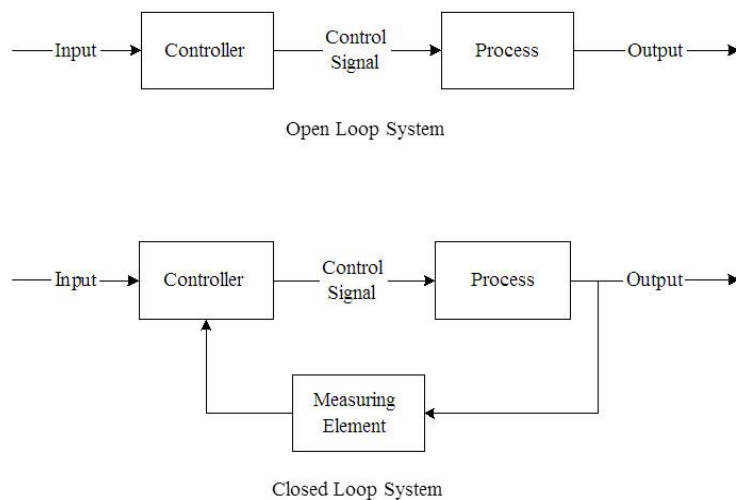
Figure 2. 1: Block diagram of open loop and closed loop system

2.3.1 Microcontroller

A microcontroller A microcontroller (MCU for microcontroller unit) is a small computer on a single VLSI integrated circuit (IC) chip. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program memory in the form of ferroelectric RAM, NOR flash or OTP ROM is also often included on chips, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general-purpose applications consisting of various discrete chips.
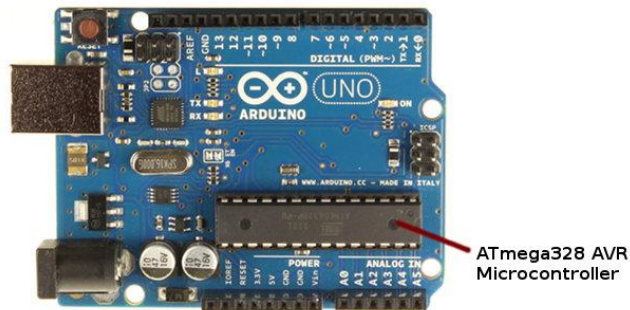
Figure 2. 2: Microcontroller Atmega328 in Arduino Uno

2.3.2 Programmable Logic Control (PLC)

A programmable logic controller (PLC), or programmable controller is an industrial digital computer control system that continuously monitors the state of input devices and makes decisions based upon a custom program to control the state of output devices such as assembly lines, machines, robotic devices, or any activity that requires high reliability, ease of programming, and process fault diagnosis.
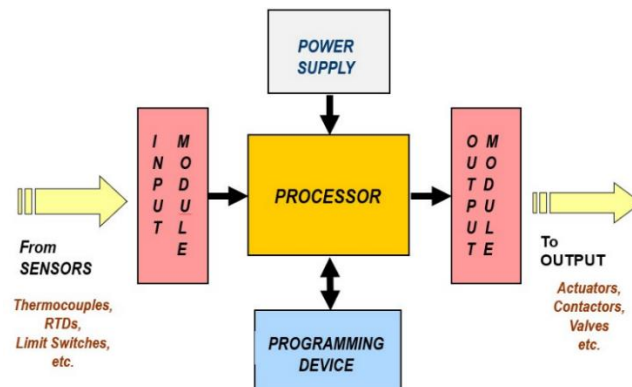
Figure 2. 3: Programmable Logic Control (PLC)

2.3.3 Arduino

Arduino is an open-source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded on to it from the easy-to-use Arduino computer program. The Arduino hardware and software was designed for artists, designers, hobbyists, hackers, newbies, and anyone interested in creating interactive objects or environments. Arduino can interact with buttons, LEDs, motors, speakers, GPS units, cameras, the internet, and even your smart-phone or your TV.

The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.
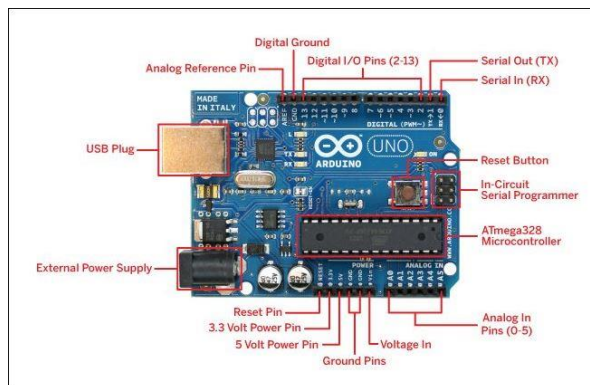
Figure 2. 4: Arduino Uno R3

2.4   Chapter Summary

This section focusing on two different section, the first is fine motor skill development in gas and smoke leakage. The second section is discovered about the technical part including the selection the type of controller. There are many of case study stated and related to our project regarding to improve gas detector.

CHAPTER 3

RESEARCH METHODOLOGY

3.1   Introduction

In order to realize this project as a product that ready to use with safety characteristic, a very comprehensive plan is undertaking. A step-by-step procedure is done so that the project can be completed in time. This includes collecting data of smoke, gas and fire. The design of the mechanical part, circuit design testing and verification are also emphasized.

3.2   Project Design and Overview.

As mentioned in the previous chapter, the designed controller is using a closed-loop system with Arduino as the main controller. The design of the controller circuit using Arduino realizes using Proteus Software and then convert to a PCB circuit. There will be a simulation of how the circuit going to working before constructing the real circuit. This is important to make sure the circuit that wants to connect functions well without any error or misunderstanding during circuit development. By using the software, it will easily guide to the connection of the circuit properly between the microcontroller pin and components.

This proposed project used the technology in telecommunication, where the evolution in telecommunication was applied in this project by using GSM module SIM900A. At the same time, a few circuit and software such as ARDUINO IDE compiler was used to be as a controller for all of the main and sub equipment. The MQ-135 gas sensor and the Arduino Uno R3 board, which act as microcontrollers via the GSM module SIM900A, are the main components and pieces of equipment used in this project. The potentiometer to adjust the contrast of the LCD display.

3.2.1 Block Diagram of the Project
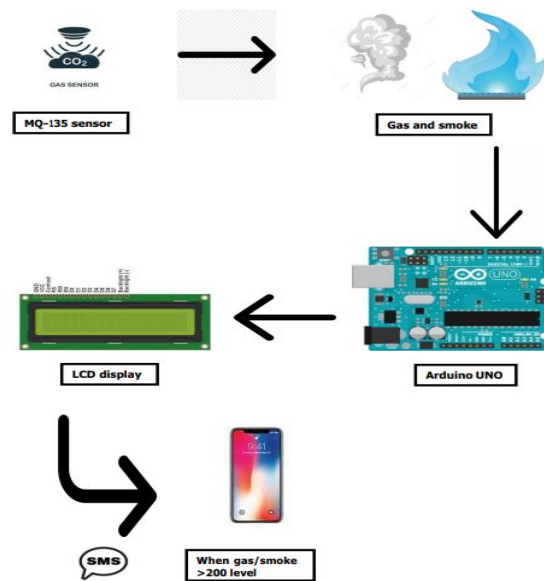
Figure 3. 1: Block Diagram

3.2.2 Flowchart of the Project 2

Figure 3. 2 shows the circuit diagram of the whole system. It is shows that consists of the MQ-135 sensor will detect gas and smoke leakage and send to SMS a signal that the gas and smoke leaks are at dangerous levels. If the gas and smoke exceed the level of 200 and above, then the signal will be sent to SMS to inform them that the level is in danger and display it on the LCD display too.
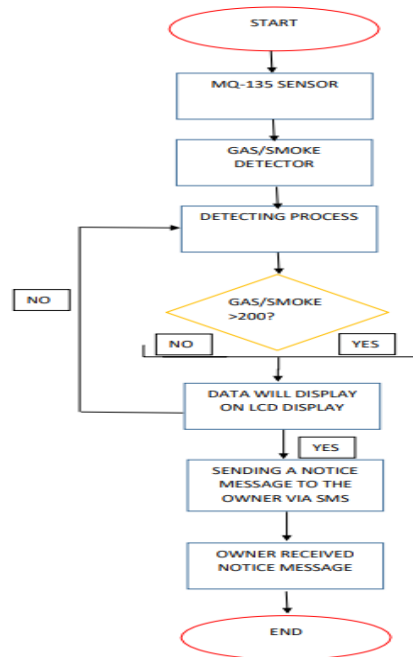
Figure 3. 2: Flow chart of operation of the system
Images may be subject to copyright

3.2.3 Project Description

Before uploading, insert SIM card in the GSM module. When the circuit is powered on after uploading code, the LCD displays the Gas Level in some analog numbers. It will display the status of whether the gas level is normal or excessive. Wait and see the LED on the GSM module to establish connection which is if connection is established successfully, the status/network LED will blink continuously every 3 seconds.

When the gas/smoke level exceeds 200 it will display SMS Sent status. This circuit triggers the alert system when smoke or gas leakage is detected. The circuit mainly uses the MQ135 Smoke/Gas sensor and Arduino to detect and smoke and gas leak. The sensor has excellent sensitivity combined with the quick response time. This low signal is monitored by the microcontroller and sends the signal to the GSM module Sim900A to send messages as "Excess Gas Detected. Open Windows" to a mobile number written in code.

3.3 Project Hardware

Hardware Products that we used. It consists of Arduino UNO microcontroller, MQ-135 sensor, GSM module, LCD display and potentiometer.

3.3.1 Schematic Circuit

Figure 3. 3 and Figure 3. 4 shows the overall circuit diagram of this project "Smart Gas and Smoke Detector" colored and colorless.
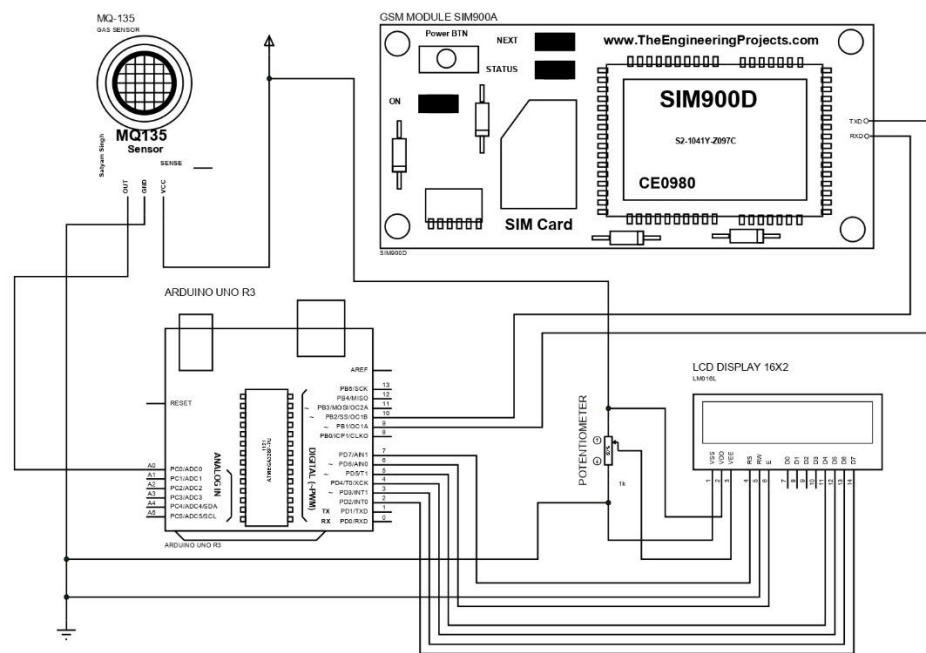
Figure 3. 3: Circuit Diagram
*Images may be subject to copyright
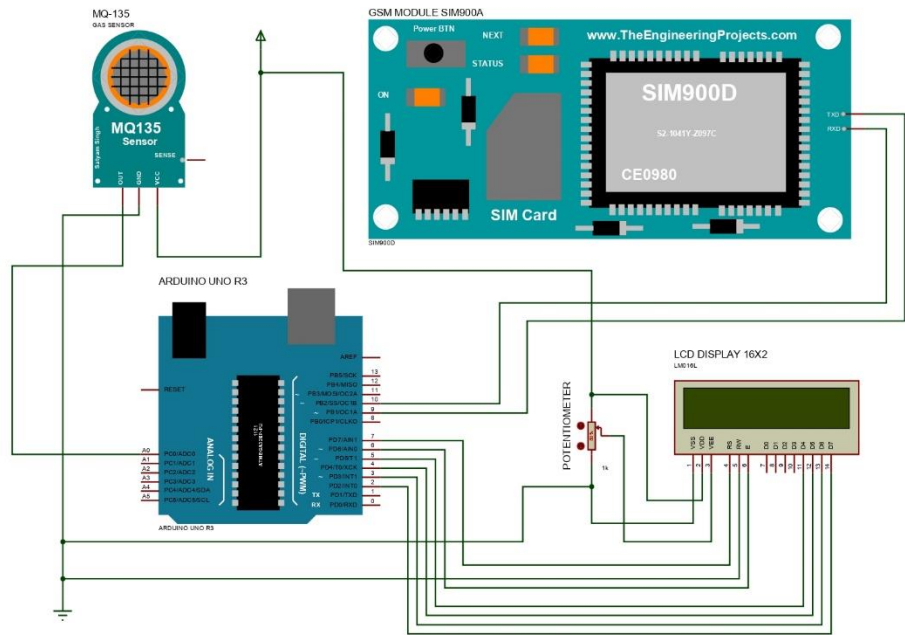
Figure 3. 4: Circuit Diagram

*Images may be subject to copyright

3.3.2   Description of Main Component

3.3.2.1   Arduino Uno R3

Figure 3. 5: Arduino Uno R3

The Arduino Uno is the microcontroller chip that is responsible for all function of our proposed project. It functions as the brain of this system. The microcontroller chip used is Arduino Uno manufactured by Arduino. The chip works to control the hardware and the interface with the transmitter part.[3]

Arduino is an open-source electronics platform, based on easy-to-use hardware and software. Over the years, it has been used for thousands of projects, from everyday circuits to complex scientific instruments. The entire Arduino project has started in 2004. when a Colombian student made a "Wiring" platform for his graduate thesis. In this way a new, low cost, and simple electronic device for fast prototyping was created. Arduino programs are written using a simplified version of C++, which makes it easier to learn. Arduino boards are very versatile and can be used for a variety of different applications. Some of them are: Uno, Due, Mega, Leonardo, Micro, Esplora etc. For the purpose of gas detection system, Arduino Uno was considered quite acceptable.[1]

Arduino Uno is the most frequently used variant, since it is very beginner friendly. It consists of 14-digital I/O pins, where 6-pins could potentially be used for the Pulse Width Modulation (PWM) outputs, 6-analog inputs, a reset button, a power jack, a USB connection, In-Circuit Serial Programming (ICSP) header etc., and – ATMega328 [2]. ATMega328 is a high performance AVR microcontroller with 8-bit RISC (Reduced Instruction Set Computer) architecture. It has low power consumption and can execute 131 instructions per single clock cycle. It has 32KB ISP (In-System Programming) flash memory with readwhile-write capabilities, 2KB SRAM, 1KB EEPROM and maximum operating frequency of 20MHz.[1]

3.3.2.2   MQ-135 Sensor

Figure 3. 6: MQ-135 Gas Sensor

MQ135 is one of the commonly used gas sensors in MQ sensor series. It is a Metal Oxide Semiconductor (MOS) type Gas Sensor also known as Chemiresistors as the detection is based upon change of resistance of the sensing material when the Gas comes in contact with the material. Using a simple voltage divider network, concentrations of gas can be detected. MQ135 Gas sensor works on 5V DC and draws around 800mW. It can detect LPG, Smoke, Alcohol, Butane, Hydrogen, Methane and Carbon Dioxide concentrations anywhere from 200 to 10000ppm.[2]

If the gas and smoke exceed the level of 200 and above, then the signal will be sent to SMS to inform that the level is in danger with a gas content above 200 PPM. Smoke detectors are very much needed, since they can help in reducing the number of fires or at least decrease the damage done. Having any smoke detector is better than having none. The best smoke detectors can detect smoke particles, flames and carbon monoxide.

Smart smoke detectors represent a cutting-edge technology for fire safety, since they can communicate through the apps and deliver alerts to a phone or some other device or system.[9]

Smoke detectors should always have a backup power source for the case of power loss. There are two basic types of passive smoke detectors: photoelectric and ionization.

The combination of these makes a dual sensor smoke alarm, which is recommended for maximum protection from both fast flaming and slower fires. Photoelectric alarms use light to detect smoke. They sense sudden scattering of light when smoke enters into the detectors chamber, which further triggers the alarm. This method of detection can detect fires that begin with long duration of smoldering aptly.[1]

3.3.2.3 GSM Module SIM900A

Figure 3. 7: GSM Module SIM900A

A GSM modem or GSM module is a hardware tool that uses GSM telephony technology to provide a data connection to a remote network. From a mobile phone network view, they look exactly like a normal cell phone, including the need for a SIM card identification on the network. GSM modems typically provide virtual TTL connectors at their commander level. They are often used as part of an embedded system.[11]

SIM900A Modem is built with Dual Band GSM/GPRS based SIM900A modem from SIMCOM. It works on frequencies 900/ 1800 MHz. SIM900A can search these two bands automatically. The frequency bands can also be set by AT Commands. The baud rate is configurable from 1200-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. SIM900A is an ultra-compact and reliable wireless module. This is a complete GSM/GPRS module in a SMT type and designed with a very powerful single-chip processor integrating AMR926EJ-S core, allowing you to benefit from small dimensions and cost-effective solutions.[10]

Specification:

• Dual-Band 900/ 1800 MHz

• GPRS multi-slot class 10/8GPRS mobile station class B

• Compliant to GSM phase 2/2+

• Dimensions: 24*24*3 mm

• Weight: 3.4g

• Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)

• Supply voltage range: 5V

• Low power consumption: 1.5mA (sleep mode)

• Operation temperature: -40°C to +85 °

3.3.2.4 LCD Display
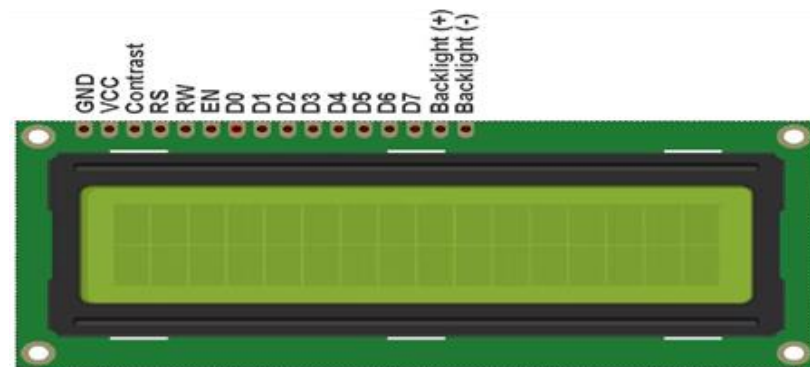
Figure 3. 8: LCD Display

When the circuit is powered on after uploading code, the LCD displays the Gas Level in some analog numbers. It will display the status of whether the gas level is normal or excessive. When the gas level exceeds it will display SMS Sent status.[10]

Liquid crystal display (LCD) are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden. For instance: preset words, digits, and seven-segment displays, as in a digital clock, are all good examples of devices with these displays.

3.3.2.5 Potentiometer

Figure 3. 9: Potentiometer

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat. The potentiometer is a resistor whose value for the resistance can be changed by turning its knob and is also known as variable resistor. This generic potentiometer normally has three pins; the pin in the middle is the output of the resistor whereas the other two pins can be used for giving supply and grounding the resistor.

The potentiometer is also an input device of Arduino that can be used for various purposes like controlling the brightness of LED or LCD by increasing or decreasing its resistance. In this write-up a potentiometer is interfaced with Arduino and its values are displayed on the LCD.

3.3.3 Circuit Operation

Based on Figure 3.3 of Circuit Diagram, supply pin VCC of MQ135 Sensor with 5V Power Supply of Arduino. Connect its Analog pin A0 to Analog pin A0 of Arduino. Connect pin GND to GND of Arduino. Similarly, connect the GSM Module with 5V Power Supply of Arduino. Pin GND of Sim900A Modem is connected to pin GND of Arduino. So, connect Tx & Rx to Pin No. 9 & 10 of Arduino respectively. Besides, connect the LCD display to pin no 7,6,5,4,3,2 of Arduino, which is pin RS, E, D4, D5, D6 and D7. Supply pin VDD and A with 5V Power Supply. Next, connect pin VSS, RW and K to pin GND of Arduino. Lastly, use a 10K of potentiometer to adjust the contrast. So, pin 1 of potentiometer connect to 5V power supply. Pin 2 which is output connect to pin V0 of LCD display. Pin 3 connect to GND of Arduino.

3.4   Project Software

3.4.1   Arduino IDE

Figure 3. 10: Arduino IDE

The Arduino IDE is a cross-program application created in Java and is originate from IDE for the deal with a programming language and the wiring project. It is proposed to establish programming to a performer and other new users unfamiliar with software enhancement. It includes code editor with feature such us syntax importance, automatic indentation, brace matching, and is also qualified of compiling and uploading a package to the board with a specific click.[3]

3.4.2 Short Messaging Services (SMS)
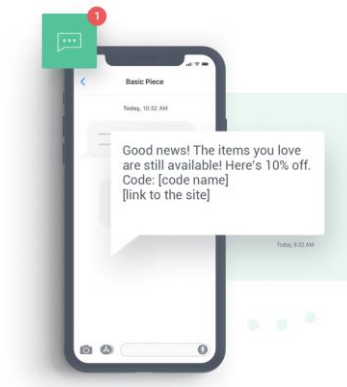
Figure 3. 11: SMS

Short Message/Messaging Service, commonly abbreviated as SMS, is a text messaging service component of most telephone, Internet and mobile device systems. It uses standardized communication protocols that let mobile devices exchange short text messages. An intermediary service can facilitate a text-to-voice conversion to be sent to landlines. The service allows users to send and receive messages of up to 160 characters (when entirely alpha-numeric) to and from GSM mobiles. Although most SMS messages are sent from one mobile phone to another, support for the service has expanded to include other mobile technologies, such as CDMA networks and Digital AMPS.

- GSM Module SIM900A is designed for wireless radiation monitoring through Short Messaging Service (SMS).

- When the gas level exceeds 200 and above, an SMS is sent to notify the user that excess gas has been detected.

3.4.3 Proteus 8 Professional
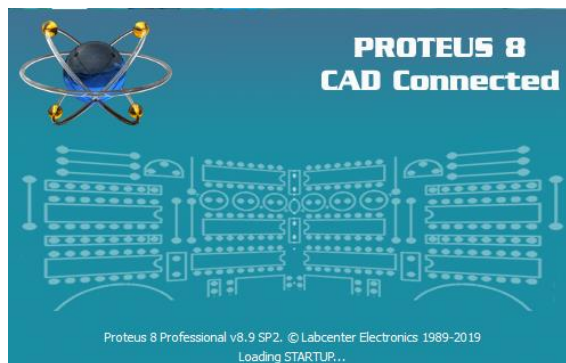
Figure 3. 12: Proteus 8 Professional

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards. The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB (Printed Circuit Board) layout design. It can be purchased in many configurations, depending on the size of designs being produced and the requirements for microcontroller simulation. All PCB Design products include an autorouter and basic mixed mode SPICE simulation capabilities.

- **Proteus** is used to simulate, design and drawing of electronic circuits. It was invented by the Labcenter electronic.

- By using proteus you can make two-dimensional circuits designs as well.

- With the use of this engineering software, you can construct and simulate different electrical and electronic circuits on your personal computers or laptops.

- Designing of circuits on the proteus takes less time than practical construction of the circuit.

- The possibility of error is less in software simulation such as loose connection that takes a lot of time to find out connections problems in a practical circuit.

- Circuit simulations provide the main feature that some components of circuits are not practical then you can construct your circuit on proteus.

- There is zero possibility of burning and damaging of any electronic component in proteus.

3.5   Prototype Development

Figure 3. 13: Front view of the project

Figure 3. 14: Backward view of the project

3.6   Sustainability Element in The Design Concept

In this sub-topic student should elaborate on the design criteria of their project either environmental design criteria, social design criteria use of sustainable design tool or economic design criteria.

Smart gas and smoke detector save lives. Smart gas and smoke detector play a vital role in reducing fire deaths and injuries. If there is a fire in your home, smoke spreads fast and you need this detector when the information send to SMS to give you time to get out.

CHAPTER 4

RESULTS AND DISCUSSION

4.1   Introduction

This section presents the results of the system through repeated testing. This chapter describes the analysis of data followed by a discussion of research findings. The findings relate to the research questions that guided the study. Data were analysed to identify. Describe and explore the relationship between Smart Gas and Smoke Detector and existing gas detector in the market.

After the whole design was constructed, it was put to test to see if it performs the design specifies of smoke detection and SMS communication to predefined phone numbers. In this prototype model, a dedicated SIM is provided for the Modem with predefined emergency phone numbers stored. The complete system on a PCB is housed in a PVC making the unit compact. The purpose of the analysis is to find public opinion about this product and improve the marketing.

4.2 Results and Analysis

Several tests were performed to test and observe the effectiveness of system performance on this project. The test was performed by directing smoke and some other items at the MQ-135 sensor. The test was performed using a variety of methods, namely prototype testing. Figures 4.4 to 4.7 is the method used for this system project.

This result shows the experimental analysis performed on the project system. The LCD display shows gas or smoke level. Once the MQ-135 sensor detects smoke or gas, the LCD display will display a smoke or gas level value of over 200. Next, an SMS is sent by the GSM Module to the user so that they can be aware of the fire. The LCD display will return to normal when gas or smoke are no longer detected.

4.2.1 Serial Monitor Display
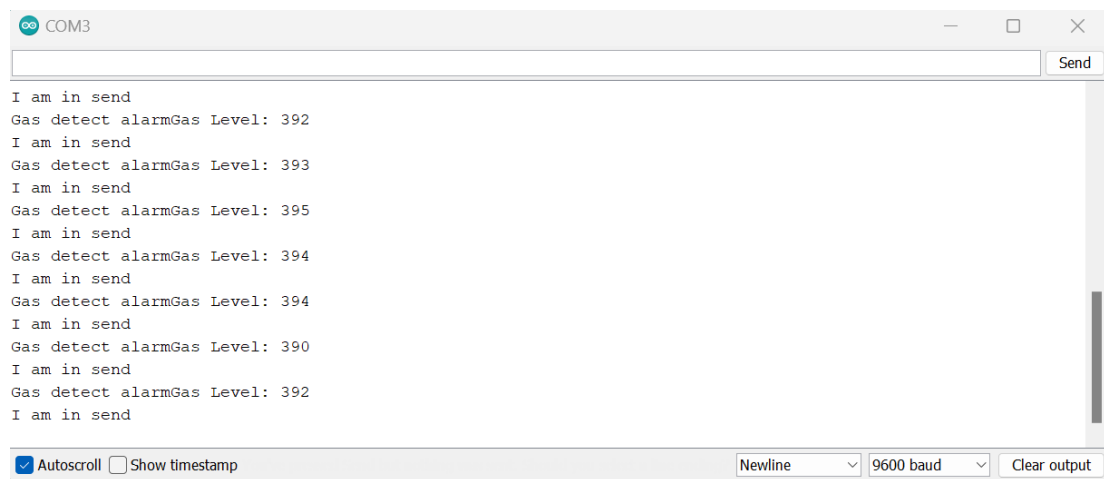
Figure 4.1: Serial monitor when gas/smoke is detected above the 200 level: Exceed level
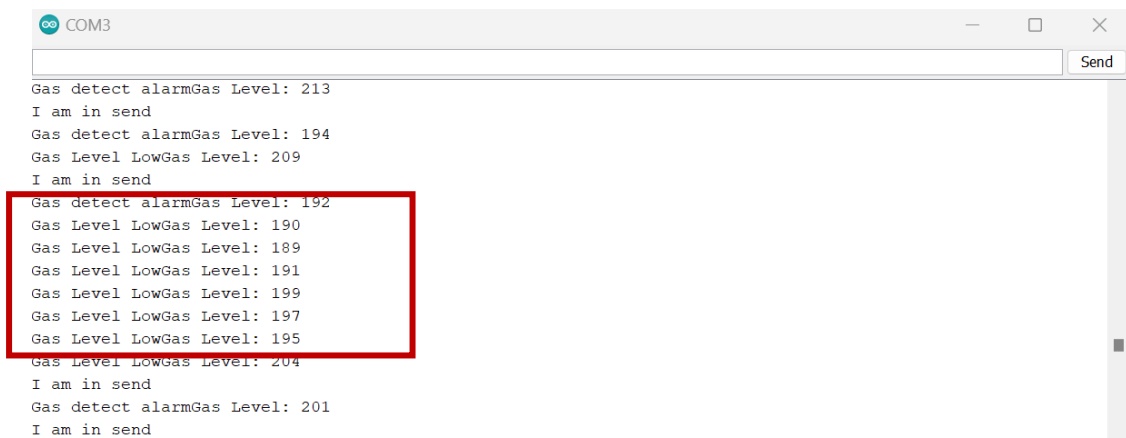
Figure 4.2: Serial monitor when gas/smoke is detected less than 200 level: Normal level
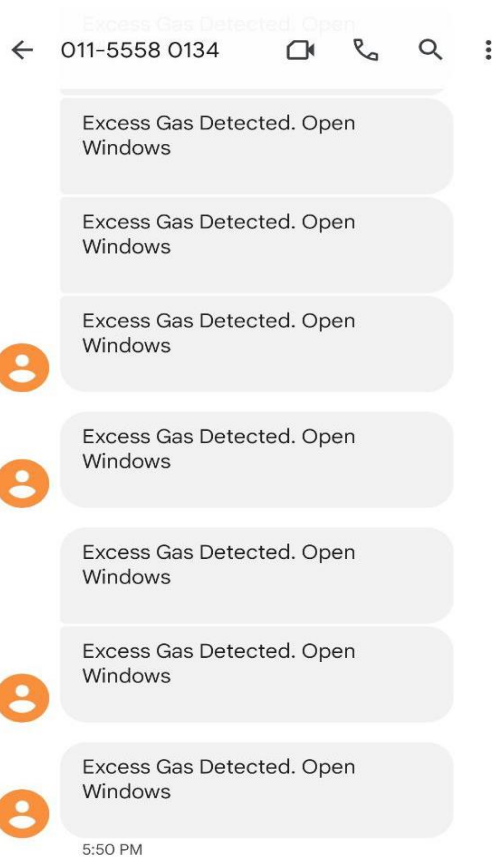
Figure 4.3: SMS send a messages

Figures 4.1 – 4.2 shows the output of the serial monitor when a parameter is detected. It contains the readings performed by the sensors and the sending of SMS using the GSM module. When the gas/smoke level exceeds 200, SMS will send a message as shown in Figure 4.3, which is: "Excess Gas Detected. Open Windows". While the gas or smoke is less than 200, the SMS will not send a message to the owner.

4.2.2 LCD Monitor Display

Figure 4.4: LCD display when gas is detected

Figure 4.5: LCD display when fire is detected
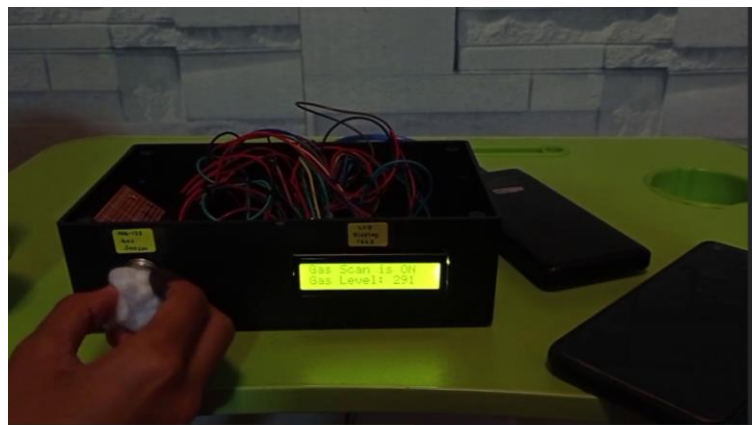
Figure 4.6: LCD display when alcohol is detected

Figure 4.7: LCD display when smoke is detected

From Figures 4.4 to 4.7, the desired output of the LCD correlates with the output of the serial monitor. When a gas leak or fire is detected, the LCD outputs the message indicating which parameter is detected. When the gas level or some items exceed 200 or above, the GSM module will send an SMS to the owner.

Table 4. 1: Data Analysis of different item

Item	Data	Result
Smoke	Gas Level: 257	Gas Level Exceed and send to SMS.
Gas	Gas Level: 350	Gas Level Exceed and send to SMS.
Fire	Gas Level: 239	Gas Level Exceed and send to SMS.
Alcohol	Gas Level: 611	Gas Level Exceed and send to SMS.

From Table 4.1, I have tested my project with 4 different items such as gas, smoke, fire also including alcohol. This is because the MQ-135 gas sensor can detect alcohol as well. In addition, the MQ-135 gas sensor is capable of detecting a variety of items. Furthermore, the data in the table shows that four items have levels that exceed 200. This will cause the result of each item will send an SMS to the owner.

Table 4. 2: System Responses for successive trials

Trial No.	Gas	Smoke	System Response	Remark
1	Yes	Yes	Gas level: 350 GSM module sent 6 SMS in 5 seconds	Success
2	Yes	No	Gas level: 201 GSM module sent 2 SMS in 7 seconds	Success
3	No	Yes	Gas level: 245 GSM module sent 5 SMS in 5 seconds	Success
4	Yes	Yes	Gas level: 369 GSM module sent 1 SMS in 10 seconds	Success
5	Yes	No	Gas level: 240 GSM module sent 3 SMS in 7 seconds	Success
6	No	Yes	Gas level: 205 GSM module failed to send SMS	Fail
7	Yes	Yes	Gas level: 278 GSM module sent 8 SMS in 8 seconds	Success
8	Yes	No	Gas level: 200 GSM module shut down	Fail
9	No	Yes	Gas level: 254 GSM module sent 3 SMS in 5 seconds	Success
10	No	No	Gas level: 89 GSM module does not send SMS	Fail

Table 4.2 summarizes the experiments performed by the system. It shows the system's response to each situation. In To be declared successful, the system needs to send at least two SMS if a gas leak fire is detected. During trial 8, the GSM module was switched off, therefore the system was restarted. During trial 10, no gas or smoke is produced and the gas or smoke level is less than 200, then the GSM module cannot send SMS. The allocation time for sending SMS is in the range of 5–10 seconds.

4.3   Discussion

From data collection to the actual processing of gas level data, this device runs smoothly. The MQ-135 sensor can detect the air quality in the immediate area while also detecting any gas leaks. The detected gas leaks are processed by the Arduino UNO and successfully sent as an alert message via the GSM module, which is a simple yet effective technology. Under Industry 4.0, this networking environment has a mechanism that allows for the transfer of necessary information, especially emergency at today's industry communication speeds.

Based on the results, I found that the gas or smoke in 10 trials was in the 100–300 level range. So, according to my project study, I can say that this project is able to detect fire quickly compared to previous studies. The previous study is in the literature review in chapter 2 at 2.2.1.5: (SENSOR-BASED GAS LEAKAGE DETECTOR SYSTEM), which states that the device can detect smoke or gas above the 500 level. So, the results of my project can detect gas or smoke more quickly, which is above the 200 level.

Thus, I have succeeded in developing a device that can detect gas or fire with a speed of over 200 and above. When the level exceeds 200, SMS can send messages in 5-10 seconds via the GSM module.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1   Introduction

This chapter presents the summary of the findings, conclusion and recommendations based on the data analysed in the previous chapter. There is a discussion on the suggestion for the project to be improved. Some limitations have been identified.

5.2   Conclusion

In this paper one possible solution for realization of detector system for recognizing presence of smoke or combustible gases is presented. System is tested in home conditions with exposing MQ-135 sensor to different types of gases. Output sensor voltage is monitored for smoke generated by burning papers and cigarettes and for available combustible gases as butane from lighter, stove LPG and alcohol vapors. Experiments prove high sensitivity of MQ-135 sensor making it a good choice in detector system basic sensor selection. By combining with other types of sensors, it is possible to create more complex detectors.

Thus, the conclusion is that we can be aware of any danger that can be caused by gas leakage and further catching fire and causing more damage and danger. Its SMS technique can also be used with GSM technology to send messages to emergency services. We can also use it to detect various other gases other than LPG and CNG. Therefore, the "Smart Gas and Smoke Detector" will help a lot in terms of preventing any danger caused by gas leakage and useful as part of safety to avoid the gas leak that can cause harmful result.

5.3   Suggestion for Future Work

This project has been improved from the existing gas detector. However, there are some improvements can be made to achieve a better result. Thus, it will make the project even better than the previous gas detector and more efficient. Smart Gas and Smoke Detector is the innovation from existing Gas Detector. This project is mainly for an individual who wants to keep their home safe from the risk of burning. The benefit of this project is to detect any leakage of cooking gas and it will alert the user about leakage.

As discussed in previous research work, it is clear that the result is not satisfactory and further research must be done. This project can be improved in future. This is because Smart Gas and Smoke Detector only can detect the gas and notify it to the user about the leakage but has not safety to extinguish the fire if the fire occur. It also cannot reduce the concentration of LPG. When the issues are obvious, so improvement must be made by suggesting to install sprinkle. Sprinkle is for in the case fire occur.

Other than that, there is an issue where gas detector is an electrical device that is dangerous when it is installed near to the LPG barrel. If electric shock occur it will cause electric spark that can cause fire. The wires are messy and too long to connect to other components such as Arduino UNO, gas sensor, LCD display and GSM Module. So, for the betterment of the project, it is encouraged to use Bluetooth. The sensor will stick to the LPG barrel by using magnet.

5.4   Chapter Summary

Detecting fires alternatively with gas sensors or gas sensor arrays can improve the detection performance with respect to time to alarm and nuisance robustness. Smart Gas and Smoke Detector is design to ensure safety and security to our home remotely. The most important requirements for gas sensors to be used in fire gas detectors (point detectors) are their long term stability, low price, low power requirements and limited cross sensitivities. At the end of the design, the information received from the sender at the receiving end show that the design was in a good working condition.

CHAPTER 6

PROJECT MANAGEMENT AND COSTING

6.1 Introduction

This project involves the cost of purchasing components and materials throughout its implementation. components involving cost are hardware Arduino, MQ-135 gas sensor, GSM Module, LCD display and potentiometer. All of these components are purchased through online purchase methods to make it easier as well as save on costs.

The overall gross budget estimate in the implementation of this project is RM 230.00 and other expenses is at RM 47.82 as shown in Table 6.1 According to this budget cost, this project can be considered as a less costly project compared to other projects that can cost over a thousand ringgit. The cost of the project is also in line with one of the key features of a good project developer that is low cost but have a high quality project.

6.2 Gantt Chart and Activities of the Project
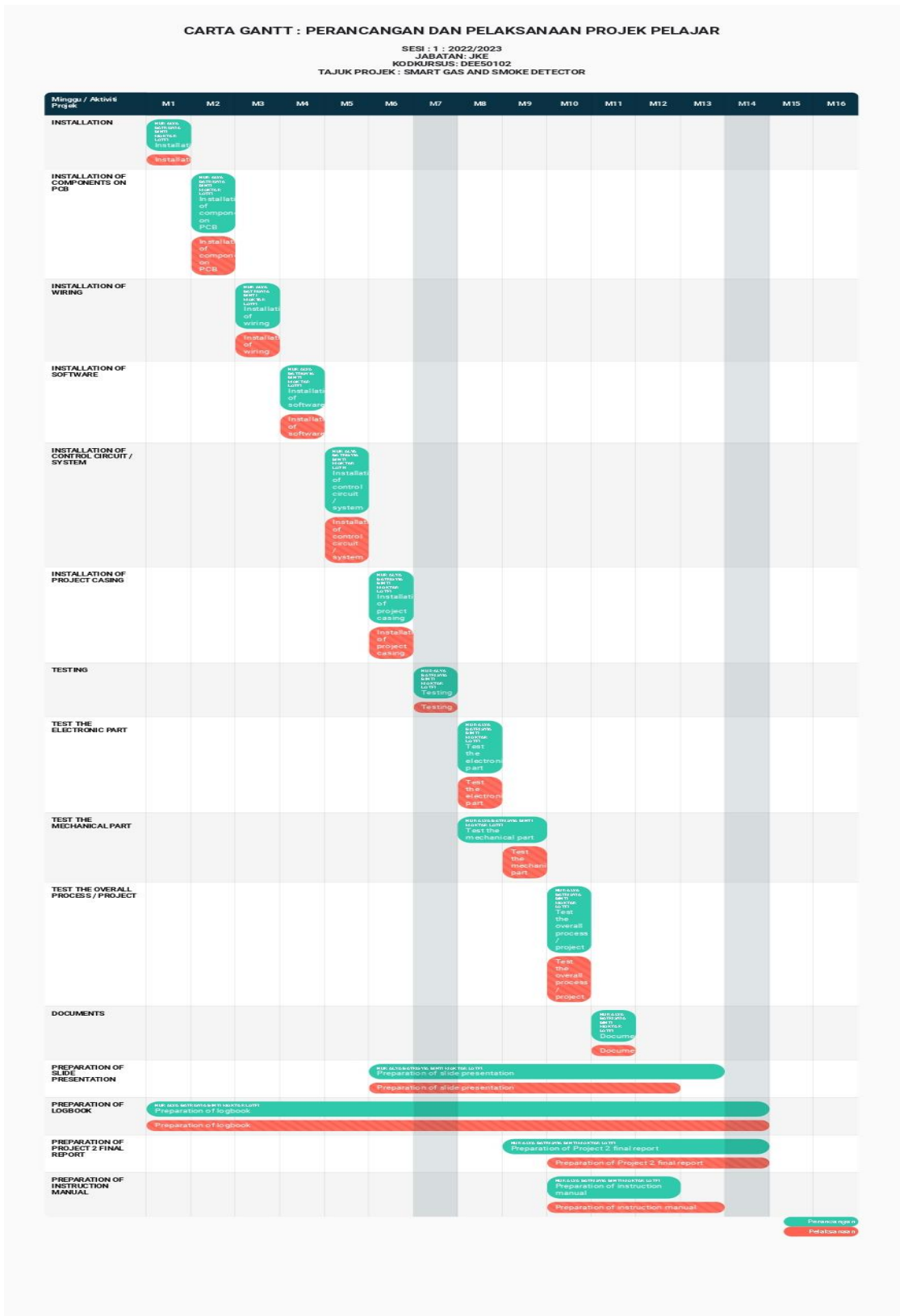
Figure 6.1: Gantt Chart

6.3   Cost and Budgeting

Table 6.1: List of Components and Materials

No.	Component and materials	The unit price	Quantity	Total
1	Arduino UNO set	RM 46.90	1	RM 46.90
2	MQ-135 sensor	RM 6.90	2	RM 13.80
3	GSM Module	RM 34.80	1	RM 34.80
4	LCD display	RM 17.83	1	RM 20.00
5	Jumper wires	RM 0.49	30	RM 14.70
6	Potentiometer	RM 0.99	2	RM 1.98
7	Other materials	RM 50.00	-	RM 50.00
			Total :	RM 182.18
	List of other costing			
1	Transportation			
2	Postage	RM 15.00	1	RM 15.00
3	Craft Work	RM 14.50	1	RM 14.50
4	Internet	RM 18.32		RM 18.32
5	Application			
			Total :	RM47.82
			Overall total	RM230.00

REFERENCES

[1] Petar Stančić, Aleksandra Stojković and Miljana Milić Member (2021). Arduino-Based Gas and Smoke Detector Realized Using MQ-2 Sensor. Journal of Gas and Smoke Detector, 1-4.

[2] G.V.Surya bharat, G.V.B.Swamy,Y.Sri Sesha Sai, A.S.S.V.J.Krishna Vamsi (2019). Detection of Gas and alert by Using Arduino UNO & MQ2 Sensor. Journal of Pramana Research, 1-4.

[3] Rhonnel S. Paculanan, Israel Carino (2019). LPG Leakage Detector using Arduino with SMS Alert and Sound Alarm. International Journal of Innovative Technology and Exploring Engineering (IJITEE), 1-5.

[4] Mohammad Monirujjaman Khan (2020). Sensor-Based Gas Leakage Detector System. Journal of Engineering Proceedings, 1-6.

[5] Gunawan Gunawan, Abdul Rahman, A Anwar, Marliana Sari (2018). Design of Gas Detection System Based on Internet of Thing. Journal of International Multidisciplinary Academic Conference (1st: 2018: Sabah) Proceedings, 23-30.

[6] Suresh Kumar Choudhary, Shubham Dadsena, Saiprasd Balraj (2019). Gas Leakage Detector using Arduino and GSM Module with SMS Alert and Sound Alarm. Journal of Circuits Today, 1-4

[7] Suwarjono Suwarjono, Izak Habel Wayangkau, Teddy Istanto, Rachmat Rachmat, Marsujitullah Marsujitullah, Hariyanto Hariyanto, Wahyu Caesarendra, Stanislaw Legutko and Adam Glowacz (2021). Design of a Home Fire Detection System Using Arduino and SMS Gateway. Journal of MDPI, 1-14

[8] Arif Afizuddin bin Mohd Iskandar (2018). Final Year Project (An LPG Leakage Detector) (1st ed.) [Online]. Available: https://eportfolio.utm.my/artefact/artefact.php?view=35008&artefact=375387

[9] Robotica DIY (2020). LPG Gas Leakage Detector with SMS Alert

(1st ed.) [Online]. Available: https://roboticadiy.com/lpg-gas-leakage-detector-with-sms-alert/

[10] Mr. Alam (2020). Gas Leakage Detector using GSM & Arduino with SMS Alert (1st ed.) [Online]. Available: https://how2electronics.com/gas-leakage-detector-gsm-arduino-sms- alert/

[11] Jojo (2016). Gas Leakage Detector using Arduino and GSM Module with SMS Alert and Sound Alarm (1st ed.) [Online]. Available: https://www.circuitstoday.com/gas-leakage- detector-using-arduino-with-sms-alert

[12] Sir Boat (2021). Gas and Smoke Detection with SMS Notification (1st ed.) [Online]. Available: https://sirboatengonline.com/gas-and-smoke-detection-with-sms-notification/

[13] Megan Hemmings (2018). What is a Jumper Wire? (1st ed.) [Online]. Available: http://blog.sparkfuneducation.com/what-is-jumper-wire

APPENDICES

APPENDIX A- DATA SHEET
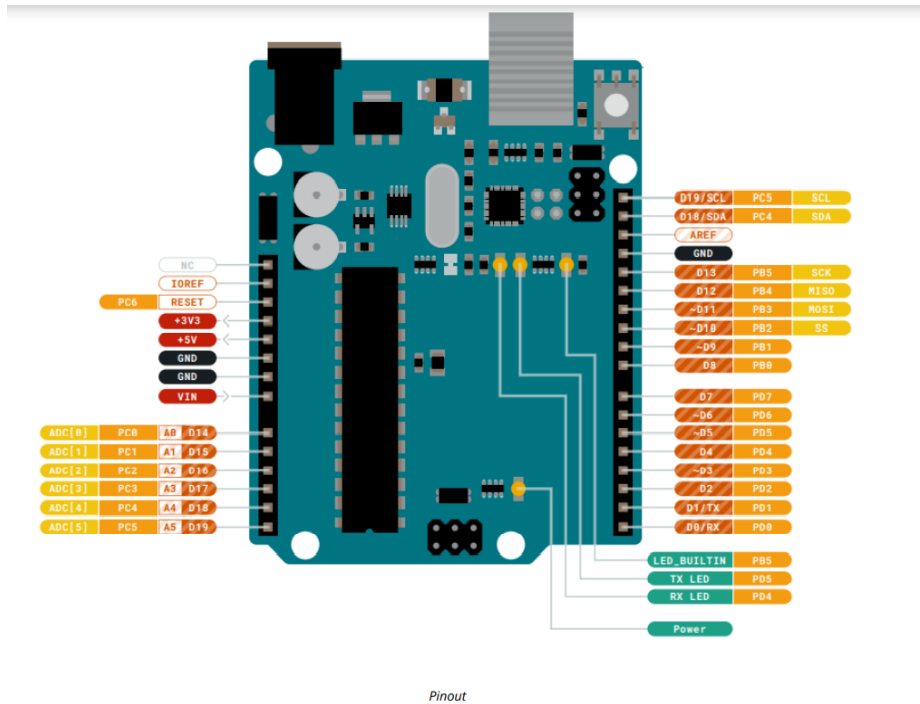
Figure 7. 1: Arduino Uno R3 datasheet

Pin	Function	Type	Description
1	NC	NC	Not connected
2	IOREF	IOREF	Reference for digital logic V - connected to 5V
3	Reset	Reset	Reset
4	+3V3	Power	+3V3 Power Rail
5	+5V	Power	+5V Power Rail
6	GND	Power	Ground
7	GND	Power	Ground
8	VIN	Power	Voltage Input
9	A0	Analog/GPIO	Analog input 0 /GPIO
10	A1	Analog/GPIO	Analog input 1 /GPIO
11	A2	Analog/GPIO	Analog input 2 /GPIO
12	A3	Analog/GPIO	Analog input 3 /GPIO
13	A4/SDA	Analog input/I2C	Analog input 4/I2C Data line
14	A5/SCL	Analog input/I2C	Analog input 5/I2C Clock line

5.2 JDIGITAL

Pin	Function	Type	Description
1	D0	Digital/GPIO	Digital pin 0/GPIO
2	D1	Digital/GPIO	Digital pin 1/GPIO
3	D2	Digital/GPIO	Digital pin 2/GPIO
4	D3	Digital/GPIO	Digital pin 3/GPIO
5	D4	Digital/GPIO	Digital pin 4/GPIO
6	D5	Digital/GPIO	Digital pin 5/GPIO
7	D6	Digital/GPIO	Digital pin 6/GPIO
8	D7	Digital/GPIO	Digital pin 7/GPIO
9	D8	Digital/GPIO	Digital pin 8/GPIO
10	D9	Digital/GPIO	Digital pin 9/GPIO
11	SS	Digital	SPI Chip Select
12	MOSI	Digital	SPI1 Main Out Secondary In
13	MISO	Digital	SPI Main In Secondary Out
14	SCK	Digital	SPI serial clock output
15	GND	Power	Ground
16	AREF	Digital	Analog reference voltage
17	A4/SD4	Digital	Analog input 4/I2C Data line (duplicated)
18	A5/SD5	Digital	Analog input 5/I2C Clock line (duplicated)

Figure 7. 2: Arduino Uno R3 datasheet

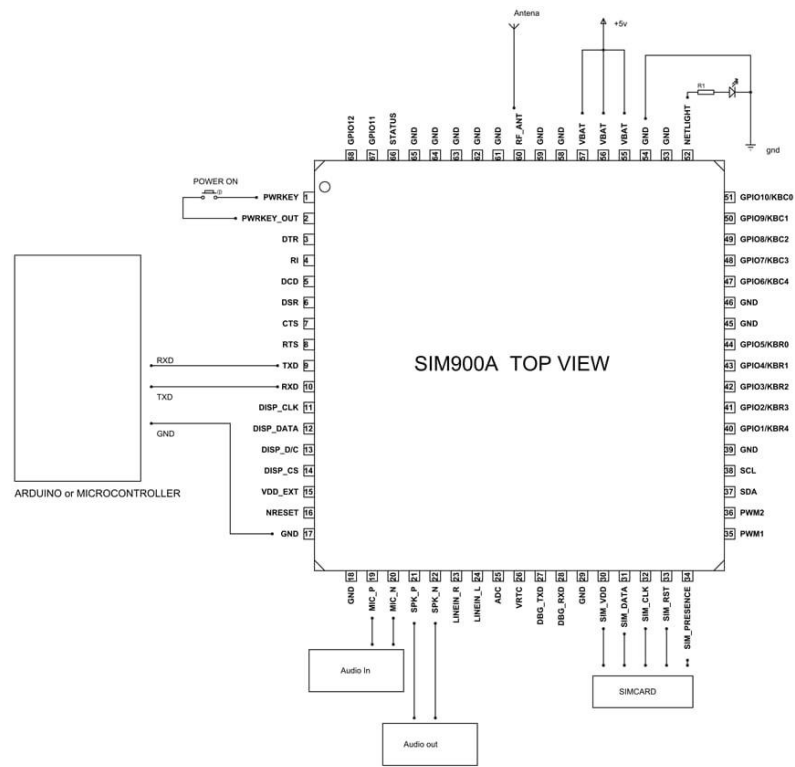Figure 7. 1: SIM900A GSM Module datasheet

APPENDIX B- PROGRAMMING

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(7, 6, 5, 4, 3, 2);

#include <SoftwareSerial.h>

SoftwareSerial mySerial(9, 10);

int gasValue = A0; // smoke / gas sensor connected with analog pin A1 of the arduino

/ mega.

int data = 0;

void setup()

{

randomSeed(analogRead(0));

mySerial.begin(9600); // Setting the baud rate of GSM Module

Serial.begin(9600); // Setting the baud rate of Serial Monitor (Arduino)

lcd.begin(16,2);

pinMode(gasValue, INPUT);

lcd.print (" Gas Leakage ");

lcd.setCursor(0,1);

lcd.print (" Detector Alarm ");

delay(3000);

lcd.clear();

}

void loop()

{

data = analogRead(gasValue);
```

```
Serial.print("Gas Level: ");

Serial.println(data);

lcd.print ("Gas Scan is ON");

lcd.setCursor(0,1);

lcd.print("Gas Level: ");

lcd.print(data);

delay(1000);

if ( data > 200) //

{

SendMessage();

Serial.print("Gas detect alarm");

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Gas Level Exceed");

lcd.setCursor(0,1);

lcd.print("SMS Sent");

delay(1000);

}

else

{

Serial.print("Gas Level Low");

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Gas Level Normal");
```

```
delay(1000);

}

lcd.clear();

}

void SendMessage()

{

Serial.println("I am in send");

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=\"+60182491454\"\r"); // Replace x with mobile
number

delay(1000);

mySerial.println("Excess Gas Detected. Open Windows");// The SMS text you want
to send

delay(100);

mySerial.println((char)26);// ASCII code of CTRL+Z

delay(1000);

}
```

```
PROJEK

#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);
#include <SoftwareSerial.h>

SoftwareSerial mySerial(9, 10);

int gasValue = A0; // smoke / gas sensor connected with analog pin A1 of the arduino / mega.
int data = 0;

void setup()
{
randomSeed(analogRead(0));
mySerial.begin(9600); // Setting the baud rate of GSM Module
Serial.begin(9600); // Setting the baud rate of Serial Monitor (Arduino)
lcd.begin(16,2);
pinMode(gasValue, INPUT);
lcd.print (" Gas Leakage ");
lcd.setCursor(0,1);
lcd.print (" Detector Alarm ");
delay(3000);
lcd.clear();
}

void loop()
{
data = analogRead(gasValue);

Serial.print("Gas Level: ");
Serial.println(data);
lcd.print ("Gas Scan is ON");
lcd.setCursor(0,1);
lcd.print("Gas Level: ");
lcd.print(data);
delay(1000);

if ( data > 200) //
{
SendMessage();
Serial.print("Gas detect alarm");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Gas Level Exceed");
lcd.setCursor(0,1);
lcd.print("SMS Sent");
delay(1000);

}
else
{
Serial.print("Gas Level Low");
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Gas Level Normal");
delay(1000);
}

lcd.clear();
}

void SendMessage()
{
Serial.println("I am in send");
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=\"+60182491454\"\r"); // Replace x with mobile number
delay(1000);
mySerial.println("Excess Gas Detected. Open Windows");// The SMS text you want to send
delay(100);
mySerial.println((char)26);// ASCII code of CTRL+Z
delay(1000);
}
```

Figure 7. 4: Programming of project

APPENDIX C- PROJECT MANUAL/PRODUCT CATALOGUE

Link: https://drive.google.com/file/d/1-In8Lec-7oEsmdJ-eJQ_IUsOtn27xpIx/view

Figure 7. 5: QR code for user manual

USER MANUAL :
# SMART GAS AND SMOKE
DETECTOR

INTRODUCTION:

LPG (Liquefied Petroleum Gas) gas cylinders are the main need for the community to meet cooking or business needs. In addition, gas tube leaks often occur which are harmful to the user community and the surrounding environment. In the event of a leak, a strong gas smell will occur. In essence, an explosion can be avoided if there is an early prevention, when the gas exits or when a gas leak occurs. The sensor in the circuit will sense the leakage, if the leakage is of high intensity it will put the alarm or the buzzer on so the owners will be alert so as to take precautions measures to minimize the possibility to catch fire or any loss to life or property.

The project entitled "Smart Gas and Smoke Detector", will be a great help in terms of preventing any danger caused by gas leakage. This project will be informed about the leakage via SMS alert.

WEIGHT: 500g++

SIZE: 195cm x 115cm x 60mm

BLOCK DIAGRAM:
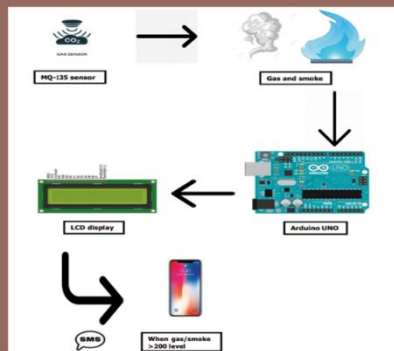
PICTURE OF PROJECT:

CODING (GOOGLE DRIVE):

Figure 7. 6: User manual

Step by step

STEP 1	Enter your number phone in the coding provided. (Make sure the number filled in is not the same as the SIM card number in the GSM module).
STEP 2	Insert your SIM card in the GSM module. (Make sure you have two sim cards in the GSM module and in your smartphone).
STEP 3	Wait and see the LED on the GSM module to establish connection which is if connection is established successfully, the status/network LED will blink continuously every 3 seconds.
STEP 4	Connect the Arduino to an electrical supply, such as a powerbank.
STEP 5	Light the smoke or gas at the MQ-135 gas sensor or place this device in a fire-risk area.
STEP 6	Look and pay attention to the reading of the gas level displayed on the LCD display.
STEP 7	If the gas level exceeds the reading of 200 and above, then SMS will send a message to your phone.

Figure 7. 7: User manual