Faculty of Electronic and Computer Technology and Engineering

DEVELOPMENT OF SANITIZER LIQUID ALCOHOL LEVEL SENSOR VIA LIGHT DETECTION

HANIS FARZANA BINTI JAMALUL RUDAD

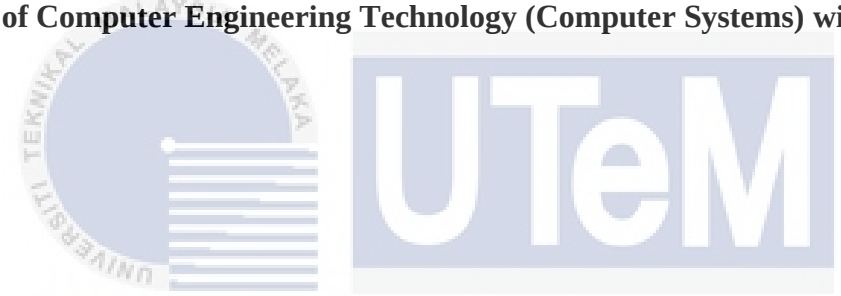
Bachelor of Computer Engineering Technology (Computer Systems) with Honours

2024

DEVELOPMENT OF SANITIZER LIQUID ALCOHOL LEVEL SENSOR VIA LIGHT DETECTION

HANIS FARZANA BINTI JAMALUL RUDAD

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Computer Engineering Technology (Computer Systems) with Honours



Faculty of Electronic and Computer Technology and Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2024

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI DAN KEJURUTERAAN ELEKTRONIK DAN KOMPUTER

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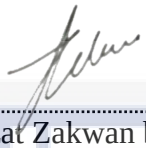
Signature : 

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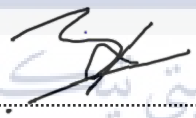
Signature : 

Co-Supervisor Name (if any) : Dr. Md Ashadi bin Md Johari

Date : 14 February 2024

DEDICATION

To my beloved mother, Hasnida binti Md Husain, and father, Jamalul Rudad bin Mohamed who gives a lot of support and motivation for me to continue and finished my studies

and

To my dedicated hardworking and respected Supervisor Mr. Muhammad Izzat Zakwan bin Mohd Zabidi and Co-Supervisor Dr. Md Ashadi bin Md Johari who never stop to helps in various ways if I needed their opinions and suggestions

and

To my beloved and lovely siblings Nur Rusyda Munirah, Muhammad Faiz, A'rif Syahmi, Sofea Amani and Ahmad Irfan Harith who helps me in many various ways

and

To my understanding and lovely friends throughout the journey of my degree life in 4 years for their sacrifices, encouragement, our happy and sad moments and to many more memories to create together before we took our own path after the degree life ends.

ABSTRACT

The use of hand sanitizer in this upcoming world after the whole world was affected by the spread of Coronavirus became an obligation to each human being all around the world. Hand sanitizers were known widely as an antiseptic and disinfectant for hand that comes in the form of liquid, foam, or gel that contains 60% to 95% alcohol which can kill many microorganisms, viruses, or bacteria. Past few years, hand sanitizer was one of the necessities for people and the sales of hand sanitizer were up by 300% in the United States. In the Malaysian market, hand sanitizer sales surged significantly during the COVID-19 era, according to recent reports, and hand sanitizer were widely used in a few sectors such as hospital, schools etcetera. During the pandemic era, hand sanitizers became a must-have item for personal hygiene and preventing viral transmission. The hospital were used alcohol-based hand sanitizer to kill germs on the healthcare worker's hands that usually use after they interact with the patients. Hand sanitizer was one of the mediums to replace hand washing with water for the healthcare worker because it is easy to reach and quick to clean their hands while it can improve hygiene compliance. Hand sanitizers were used to clean the germ on the skin but if you want to clean the visible dirty hand, hand sanitizer cannot hold it and we need to clean our hands at least 20 seconds with soap and water before eating or after attending the people with diarrhea. The perfect way to clean our hands using a hand sanitizer is by rubbing our hands together until dry and this process might take 20 seconds to complete. Hand sanitizer was invented back then in the mid-19th century and it is used in the hospital to reduce the transmission of infections. The formula solution of hand sanitizer back then and nowadays was a little bit different according to the development of alcohol that is being distributed and used from year to year.

ABSTRAK

Penggunaan hand sanitizer di dunia yang akan datang ini selepas seluruh dunia terjejas dengan penularan Coronavirus menjadi satu kewajipan kepada setiap manusia di seluruh dunia. Pembersih tangan dikenali secara meluas sebagai antiseptik dan pembasmi kuman untuk tangan yang datang dalam bentuk cecair, buih, atau gel yang mengandungi 60% hingga 95% alkohol yang boleh membunuh banyak mikroorganisma, virus, atau bakteria. Beberapa tahun kebelakangan ini, pembersih tangan adalah salah satu keperluan untuk orang ramai dan jualan pembersih tangan meningkat sebanyak 300% di Amerika Syarikat. Di pasaran Malaysia, jualan pembersih tangan melonjak dengan ketara semasa era COVID-19, menurut laporan baru-baru ini, dan pembersih tangan digunakan secara meluas dalam beberapa sektor seperti hospital, sekolah dan sebagainya. Semasa era pandemik, pembersih tangan menjadi barang yang mesti ada untuk kebersihan diri dan mencegah penularan virus. Pihak hospital menggunakan pembersih tangan berasaskan alkohol untuk membunuh kuman pada tangan pekerja kesihatan yang biasanya digunakan selepas mereka berinteraksi dengan pesakit. Pembersih tangan adalah salah satu medium untuk menggantikan cucian tangan dengan air untuk pekerja penjagaan kesihatan kerana ia mudah dicapai dan cepat membersihkan tangan sambil dapat meningkatkan pematuhan kebersihan. Hand sanitizer digunakan untuk membersihkan kuman pada kulit tetapi jika anda ingin membersihkan tangan kotor yang kelihatan, hand sanitizer tidak boleh memegangnya dan kita perlu membersihkan tangan sekurang-kurangnya 20 saat dengan sabun dan air sebelum makan atau selepas menghadiri orang ramai dengan cirit-birit. Cara terbaik untuk membersihkan tangan menggunakan pembersih tangan adalah dengan menggosok tangan sehingga kering dan proses ini mungkin mengambil masa 20 saat untuk diselesaikan. Pembersih tangan dicipta ketika itu pada pertengahan abad ke-19 dan ia digunakan di hospital untuk mengurangkan penularan jangkitan. Penyelesaian formula hand sanitizer dahulu dan kini sedikit berbeza mengikut perkembangan alkohol yang diedarkan dan digunakan dari tahun ke tahun.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my Supervisor, Mr. Muhammad Izzat Zakwan bin Mohd Zabidi and Co-Supervisor, Dr. Md Ashadi bin Md Johari for their precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM), tresurer and my lovely family for the financial support through the whole semester which enables me to accomplish the project. Not forgetting my fellow colleague, classmate, housemate, groupmate, family, siblings, and others for the willingness of sharing his thoughts and ideas and helps regarding the project.

My highest appreciation goes to my parents, and family members for their love and prayer during the period of my study. An honourable mention also goes to my parents Jamalul Rudad bin Mohamed and Hasnida binti Md Husain for all the motivation, mental and financial support and understanding through all the process. To my friends, housemates, and group members under the same supervision, thanks for the guidance, helps and understanding for me to finish my project throughout the whole semester smoothly from the very first day of finding the title until the day we had our presentations for our project.

Finally, I would like to thank all the staffs at the Faculty of Electronic and Computer Technology and Engineering, fellow colleagues and classmates, the faculty members, as well as other individuals who are not listed here for being co-operative and helpful.

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LIST OF SYMBOLS

m	-	Gradient
%	-	Percentage
c	-	Intercept
×	-	Multiple
√	-	Square Root
²	-	Power of 2

LIST OF ABBREVIATIONS

dBm	-	Power

CHAPTER 1

INTRODUCTION

1.1 Background

Hand sanitizer were a cleaning medium for the human that function as a cleaning product that can be used anytime when needed and be carried everywhere without any hustle because usually it comes in a small version like in a small, sprayed bottle that can be kept inside the pocket of your shirt or trousers. Alcohol concentrations usually used to form the hand sanitizer were isopropyl or ethanol and this is the active ingredient that acts as the killer for viruses and bacteria[1] The amount of alcohol concentration being used must be under control because if the amount alcohol concentration excessively high, it can be harmful and may cause skin irritation other than washing hands with water and soap.

1.2 Problem Statement

The hand sanitizer that has been seen in the market has many different kinds of alcohol levels in it. Some of the hand sanitizers in the market were high in the reading of the alcohol level and some were low in the reading of the alcohol level. Different people can handle different levels of alcohol in the hand sanitizer because some people could have different skin types which are normal skin types, dry skin types, and sensitive skin types. The high level of alcohol in the hand sanitizer can make people who have sensitive skin types an irritation because alcohol can cause dryness on the skin. People who have sensitive skin and are eczema prone can handle the right amount of alcohol in the hand sanitizer but to make it not harsh on sensitive skin it must contain moisturizing properties in it such as

essential oil. The use of hand sanitizers should be as a disinfectant to minimize the spread of virus. Hand sanitizer can kill germs that make us sick up to 99.99%, but there is some virus that hand sanitizer alcohol can kill where hand washing is needed. Other than that, hand sanitizer was more accessible than the sink where there are some places that did not have sink to wash our hands or when you need to clean your hands inside the vehicle. Besides that, the use of water and time also can be reduced if hand sanitizer were the medium to clean hands because no water is used when you clean your hands by using it. This project was created by using LED and LDR based sensors that work to detect the level of alcohol in the hand sanitizer that had been sold in the marketplaces. This project was built also to analyze the performance of sanitizer liquid sensor by using optical power. The optical power was focused on light because the LED white were used in this project to emit the light. The LED and LDR in this project were functioning as a sensor to detect the solution that being used. Next, this project also builds to optimize the best performance of the sensor in terms of stability, linearity, and sensitivity. The output of the project should be achieved in terms of the three graph that have been mentioned. Each of the graph have its own function to the expected result of project.

1.3 Project Objective

The aim of this project is to design an alcohol level sensor in hand sanitizer by using light detection. The objective is stated as below :

a) To create an LDR-based sanitizer liquid concentration sensor

b) To analyze the performance of sanitizer liquid sensors by using optical power.

c) To optimize the best possible sensor performance in terms of sensitivity, linearity, and stability

1.4 Scope of Project

This research is focused on developing an innovative Light Dependent Resistor (LDR)-based sensor that is specifically designed for monitoring sanitizing liquid concentrations. To provide precise concentration measurement, the sensor design will require rigorous component selection, circuit design, and the integration of optical elements. This project is concentrating on optical power analysis as a technique for evaluating sensor performance sets it apart. The sensor is sensitivity, linearity, and stability will be assessed systematically using rigorous testing techniques. Data collection and analysis throughout the testing phase will be critical for establishing a link between optical power and sanitizer concentration.

The optimization phase of the project is intended to fine-tune the sensor is functionality. This iterative process will involve finding and altering critical parameters that influence sensitivity, with the ultimate goal of achieving an optimal balance of accuracy and responsiveness. Strategic improvements to sensor design, circuitry, or optical elements will improve linearity and stability. The project will also feature the integration of data logging capabilities to allow for real-time monitoring of sensor outputs, with collected data subjected to extensive statistical analysis to evaluate the efficacy of the optimization efforts. The limitation in this project where the LED emit waves of the same frequency, but they are not in phase with one another. So, the LED were incoherent in emitting the light that affected the wavelength of light transmission.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Looking back to the beginning of pandemic era on the end of 2019 when the first outbreak was in Wuhan Chinese city, the universe was affected by Corona Virus on 30 January 2020. In Malaysia, the first reported cases confirmed were reported on 25 January 2020 among the travelers from China in Johor via Singapore. This outbreak was causing impact to all of the sectors in the universe whether economy, hospitality, tourism and many more. To make sure that this outbreak did not spread to others, we were commanded by Health Ministry to wear face mask or face shield when in a crowded public place or in a closed place because the virus can be spread through the air. We also were commanded to use hand sanitizer before and after touches everything because the virus also can spread by the touch.

The use of hand sanitizer can replace hand washing with water and hand soap. The use of hand sanitizer can make it easier for us to wash hand anytime and anywhere. Usually, hand sanitizer contains alcohol at least 60%, this can help to kill the certain germs on skin around us. It is also one of the best replacements to clean our hands besides using hand soap because hand soap usually does not contain high alcohol element in it. As you know, hand sanitizer cannot remove heavy metals such as lead and pesticides which are harmful chemicals. To make sure that our hands are clean from the germs and so on, we must wash our hands by using water and soap. In addition, hand sanitizer is a lot easier to carry around whether in form of liquid or gel that has been packed into a small bottle. The bottle makes it

easier by spraying the hand sanitizer or by squeezing the hand sanitizer. The bottle design also can prevent from the hand sanitizer from spilling everywhere.

2.2 Past Related Research

This chapter were focused on finding the related research, journal or article that had been done in the past. Literature review means to identify the research where all of knowledge about project can be found based on the context that necessary and fits in.

2.3 Literature Review

2.3.1 An Alcohol Concentration Monitoring System Based on MCU

The author of the article said about the alcohol concentration monitoring system based on MCU is an intelligent product where it uses sensing technology that had become mature with the rapid development in 20th century of information technology. In this technology, it designs an alcohol concentration monitoring system. The purpose of this project is that the alcohol concentration can be displayed in real time at any different environment, besides that its accordance with the threshold where it also can display the grading alarm system and so on. The good thing about this product is that it is a simple structure project design where it comes in a small size. It also very convenient to be carry it everywhere. The function of this product is to monitor the concentration of alcohol in the environment while it also can display the result of the test in numerical warning classification. The system was extraordinarily strong inform of interference because alcohol the alcohol sensor in this product were incredibly good in form of stability and selectivity. To make sure that this product was operated well, the alcohol level is detected by the gas sensor which is MQ-3 when the system is has been initialized. The other function of this product is as a hierarchical alarm. Other than that, there are the weaknesses of the product

where it takes slow response rate and the environmental temperature could affect the expected result taken[2].

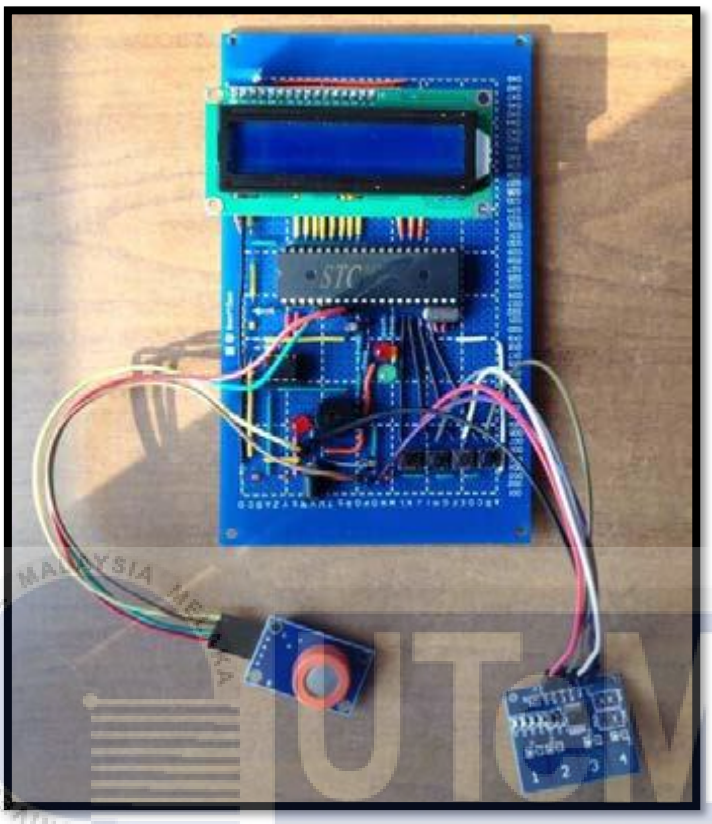

Figure 2. 1 The System Physical Map

2.3.2 An Alcohol Content detection Sensor

The author of Imperfection Method Based on Optical Fiber for Alcohol Content detection Sensor article said that when there is a high content of alcohol, it will cause the output power of the sensor to decreases, and when there are increases refractive index of alcohol content will causes the increasing in power loss while it will make lost in light intensity that being transmitted in the optical fiber based sensor. To make sure that this product produces the best characteristics of the sensor, power losses are needed in it. The best sensor that been used in this project is in gamma configuration because of it is sensitivity value. The best imperfection method in determining the characteristics of optical fiber-based

alcohol detection sensor is suitable because it has high sensitivity[3]. The product could have a simple design it in fabrication while the cost to make the product is in a low cost. The product also has high sensitivity in a process while taking the expected result. This product can also cause large power losses resulting when result taken. When there is a greater number of imperfections, the sensor sensitivity is much better.

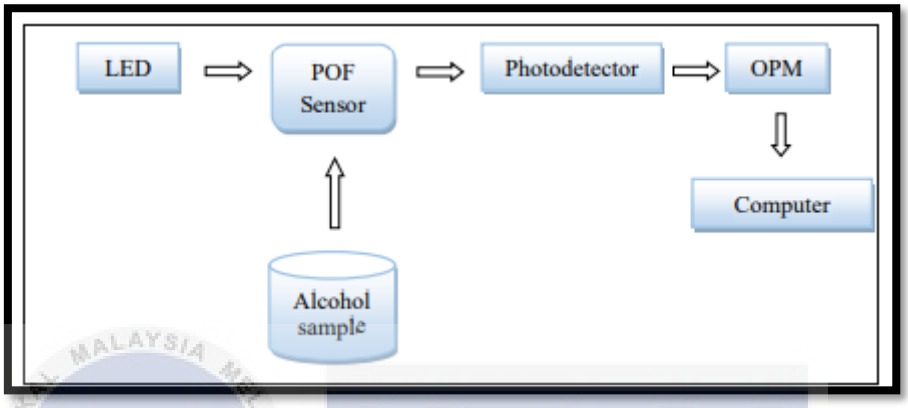

Figure 2. 2 The Schematic Circuit of The Alcohol Content Detection Sensor

2.3.3 The Dual-Polarized PCF-SPR Sensor for Alcohol Detection at Low Temperature

The author who writes about Dual-Polarized PCF-SPR Sensor for Alcohol Detection at Low Temperature where it observes numerical simulation. The observation processes were made at certain range of alcohol concentration which is on 15% 40%, 60%, and 70%. Each of the result values were proposed into the sensor. The results were taken proposed sensor where the sensor itself has sensitivity in detecting alcohol concentration at low temperature. In this project, it uses optical components which are optical fiber[4]. Optical fiber can be used in many fields such as on communication field. It also can give significant development. PCF-CPR is a sensing which also has a simple geometric structure. The main function of this project is to see the performance of dual-polarized PCF-SPR sensor

in detecting alcohol concentration. Some components inside the product were used as a data transmission medium while it also has significant development. Besides that, the product also has its advantages to the user. For this product, the component inside this product is in single-mode fiber and it comes in a small size where it can be difficult for older users.

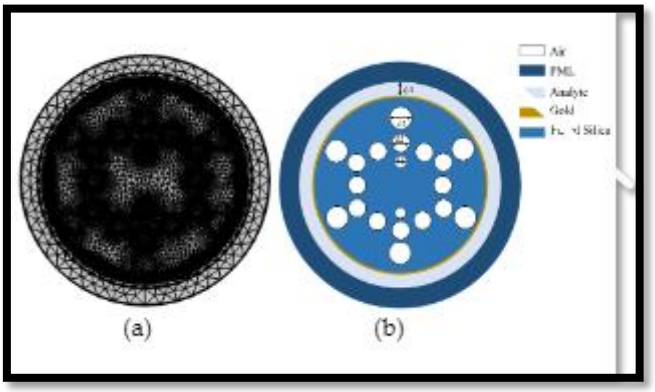

Figure 2. 3 The Geometric Structure of PCF-SPR Sensor

2.3.4 An Additive manufacturing for capacitive liquid level sensors

The author built a new manufacturing wave that concerns in the of additive manufacturing for capacitive liquid level sensors. In process of making the product, it uses material such as Material extrusion (MeX) to fabricate the sensor and many more. The design of the product was made with 3D printing. The sensor was manufactured in a very conductive track to obtain final capacitance value that can be readable by common laboratory instrument. The sensor functions in measuring the liquid level. In this project, it takes 2 different types of liquid which is distilled water and sunflower oil. Both of the liquids give very good sensitivity result taken respectively. The benefits of 3D printing manufacturing are that can fabricate the whole sensor where the process did not need any assembly task. By no assembly task, it can make cost and time saving. This is because they did not need to hire people to do the assembly work. The fabrication process was doing the all work by

themselves[5]. Other than that, the product also has its disadvantages whereas for this product, it requires further assembly task to get more results.

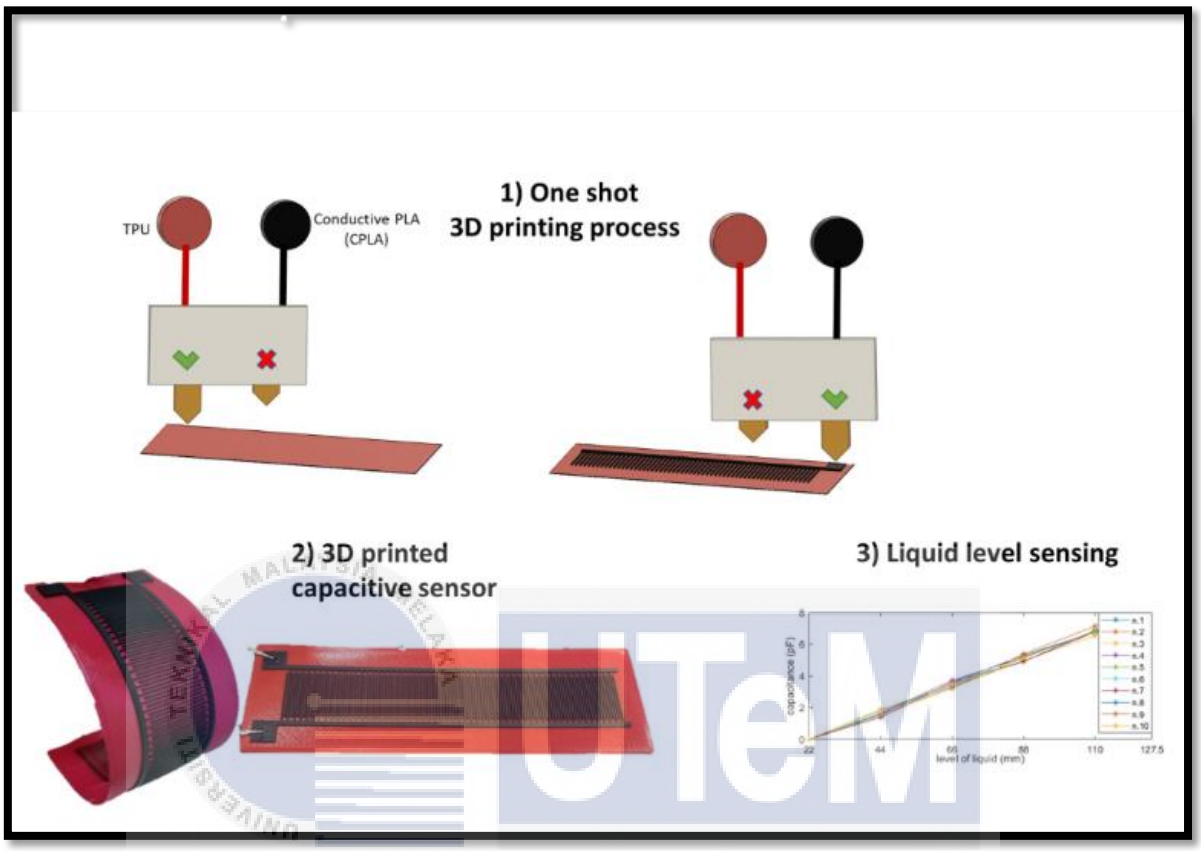

Figure 2. 4 The Workflow Process

2.3.5 Detecting Methanol in Hand Sanitizers

Author of Detecting methanol in hand sanitizers writes that because of the pandemic corona virus disease, the demand for hand sanitizer increased. There are different levels of methanol content in sanitizers but some of sanitizer with high contains of methanol has been restricted to using it. To detect the alcohol level inside the hand sanitizer, a device has been created. This device can detect methanol in hand sanitizer between 0.01 and 100%vol in two minutes. Features of the devices is that it can separates methanol selectively from the confounders by absorption[6]. The methanol was detected by chemo resistive gas sensor. According to (WHO) every hand sanitizer should have contains only ethanol or 2-propanol

for antisepsis. The handheld device detector can check the ingredients in hand sanitizer and the data analysis is user friendly. It also can provide the result on the smartphones where the data is saved on the cloud where the future communication can possibly be remote analysis. The component of the product is also commercially available that makes it easy to find at a very low cost and large numbers. The device also was user friendly because the detector came in small size while the data taken can be sent to the phone. The product have their advantages where it sensitive to humidity and temperature that can affected to the expected result taken.

Figure 2. 5 The Handheld Methanol Detector for Screening Hand Sanitizers

2.3.6 The Use of a Modest Alcohol Meter

The author writes about the Use of a Modest Alcohol Meter where during the pandemic era people should take care of healthy life behavior to reduce the transmission risk. One of the ways to reduce transmission is by washing hands. In everyday activities people cannot wash their hands frequently, but by using hand sanitizer it can help people to clean and wash their hands. Hand sanitizer contains alcohol that recommended by (WHO) that can clean bacteria on the hands. There is few types of hand sanitizer in the market which is alcohol-based and non-alcohol -based hand sanitizer, it also came inform of gel and spray. In disinfectant and antiseptic liquid alcohol is mostly used to disinfect and clean the skin, but if people with sensitive or injured skin are not recommended to use alcohol-based sanitizer because it can irritate the skin. Hand sanitizer that contains alcohol is flammable and it also can raise the digestive tract inflammation of virus infection. The recommended alcohol content should be between 60% that can prevent microbes, while isopropyl alcohol can be found at drugstore. The material to do this project was easy to get[7]. This device also can be established at every home by without ignoring the health protocol, but this product can be risky if it is incorrectly used by the people.

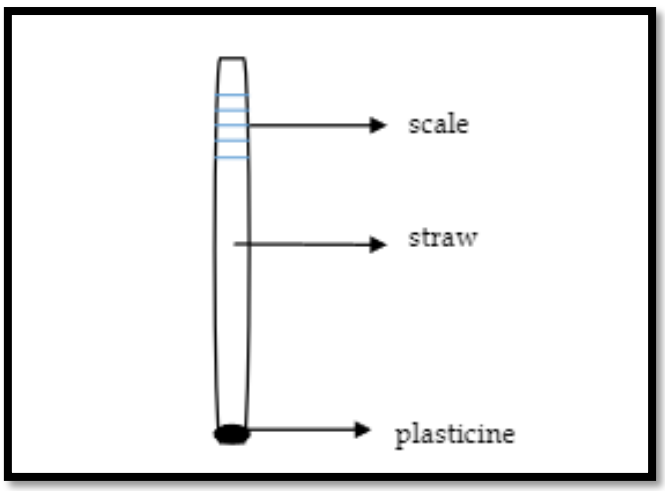

Figure 2. 6 The Modest Alcohol Meter

2.3.7 The Alcohol Detection Sensor- An Apprise

The writer who writes about Alcohol Detection Sensor- An Apprise where tells people that driver fatigue can lead to road accidents. Road accidents can create permanents consequence for human life. Many reasons can occur such as brake failure, misleading traffic signal and many more. This misfortune often happens to the victim due to drunken driving, that many people were amendments to punish drunken drivers. This device was created because traffic police cannot stand to check the car driver whether the driver is drunk or not. This effective system can help to check drunken drivers. The product used an alcohol sensor, ILS detector and many more related components. The existing system was taking a survey by detecting the alcohol content using the MQ3 alcohol sensor[8]. Then, when the result taken the value is sent to microcontroller GSM module where it can cut-off the fuel that can make the rate of accident depreciated. This product can analyze the detailed review and presented it on the existing system. Other than that, to get the result it is a very real-time monitoring that can take over several days.

2.3.8 The Design and Implementation of An Alcohol Meter

The author of Design and Implementation of An Alcohol Meter said that many drivers ignore the danger after drinking. Drunk drivers can cause traffic accidents all around the world. By now, a lot of people in the world had been killed by drunken driver. To reduce the number of accidents that are caused by drunk drivers, alcohol content inside the driver's body should have certain value by creating a device. To make sure that this can happen, a simple design of alcohol meter was created by using gas sensor, microcontroller, LCD to display the alcohol concentration and many more components[9]. The concentration measuring meter of alcohol result should be get between 50PPM to 5000PPM. The product

that has been created has its own advantages which is it very easy to use and the system build is low cost. It also has an advantage where the gas sensor needs to be heated first before measuring and external environment can affected the result taken.

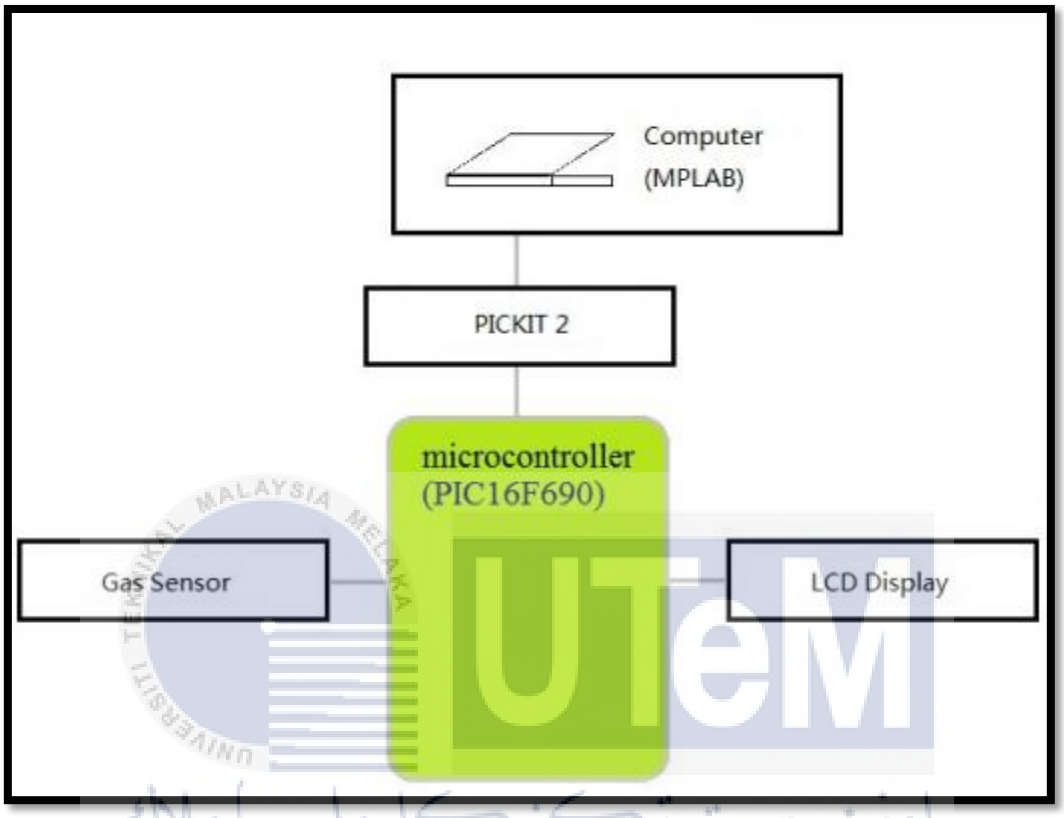

Figure 2. 7 The Block Diagram of System.

2.3.9 The Alcohol Detection and Monitoring System for Vehicles

The author who writes about Alcohol Detection and Monitoring System for Vehicles said that the project is to detect alcohol particles and then it will send message if the alcohol level is above the hazardous level. This project was using an alcohol detecting sensor inside the vehicles for drunk and driving cases. The output of the sensor is proportional to the content of the alcohol consumed. Alcohol sensors play significant in nowadays. To make sure safety factors, the sensor was embedded inside the car steering. The sensor will measure the alcohol content in his breath when the driver starts the ignition. When the concentration

level is hazardous, ignition will stop the car while it has wast application. The buzzer will be ringing and the GSM module will send message and the GPS can locate where the vehicle is located[10]. The good of this product is it can check drunken driving while it can reduce the amount of accident rates while the advantage of this product is it can only sense the concentration of alcohol level at a certain distance.

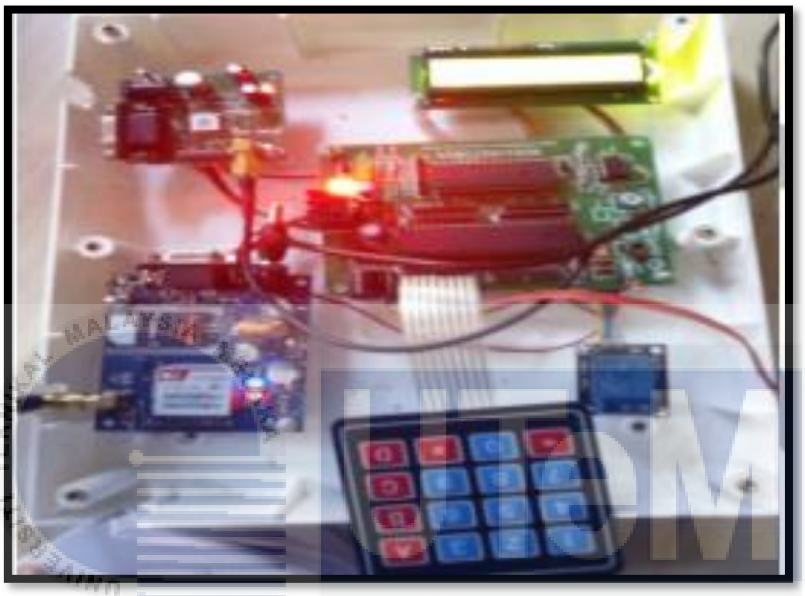

Figure 2. 8 The Project Result

2.3.10 An Alcohol Detection based Engine Locking System using MQ-3 Sensor

The author of Alcohol Detection based Engine Locking System using MQ-3 Sensor writes to make sure that the driving is safer than before by making a product using ATmega8 microcontroller and MQ-3 alcohol sensor. This product is made to give as an effective solution to develop an intelligent system for vehicles that can sense the various levels of alcohol in the breath of the driver. By real time environment, the driver condition is taking part in it. This is to make sure that the product can check the level of the alcohol is in permissible limit. If the alcohol level is beyond the permissible limit, the vehicle engine

system will turn off while the GPS captures location of the vehicles. The notification will be sent]d through the phone number that had been preregistered by using the GSM module. The best use of the product is it can minimize the number of road accidents all around the world but it may be crucial to put it inside the vehicle and it also has high data rate[11].

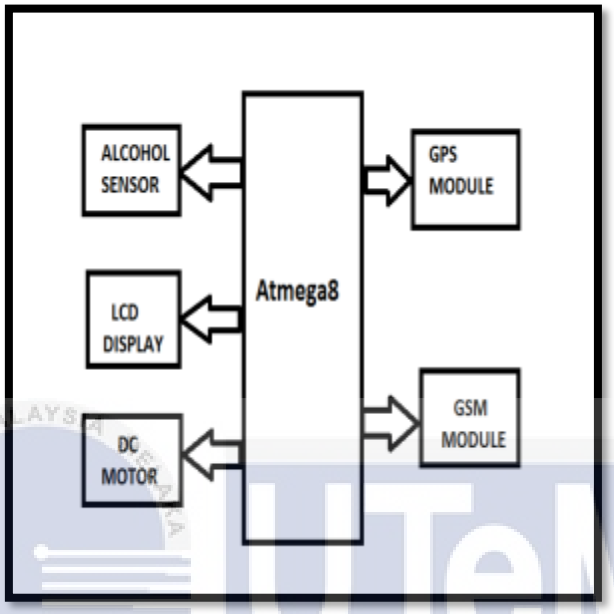

Figure 2. 9 Block Diagram of The Product.

2.3.11 The Microfiber-based Sensor for Measuring Uric Acid Concentrations

Author of Microfiber-based Sensor for Measuring Uric Acid Concentrations writes that microfiber sensor is demonstrated by using fiber optic displacement sensor (FODS). The sensor uses a single-mode fiber (SMF) tapered by using flame brushing technique that can enhance the evanescent field around the fiber core which will interact with uric acid. The tapered area will bend manually and it will set on the clamp vertically by facing mirror in the beaker. The range will be within linear range of the sensor displacement curve of 0 to 5000 μm. The microfiber sensor has good stability and repeatability. In this project, FODS is used because of its stability to measure the physical parameter. It also came in a low cost

and simple implementation. The product was built in a quite uncomplicated design while the production cost also less. It can operate well without forfeiting its sensitivity[12]. Besides that, the process is difficult to perform because it is time consuming and it also has limited exposed interaction in length.

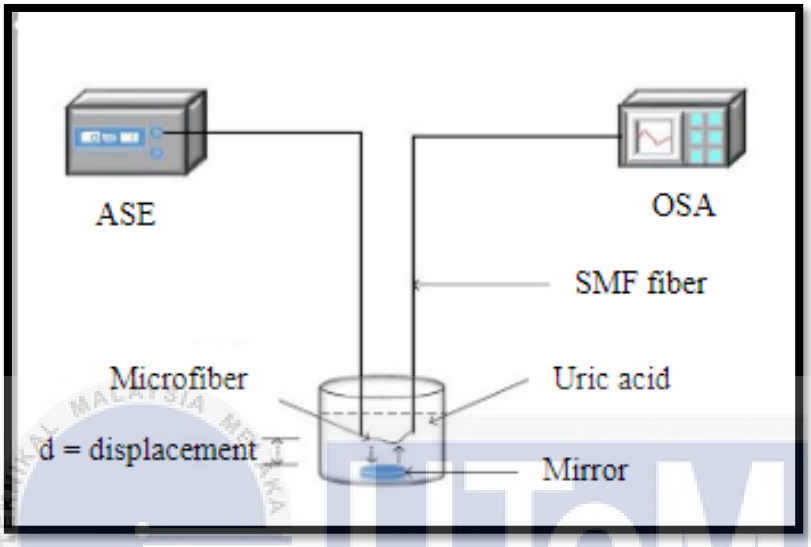

Figure 2. 10 The Experimental Setup

2.3.12 The Human Arm Movement Detection Using Low-Cost Sensors for Controlling Robotic Arm

The author of Human Arm Movement Detection Using Low-Cost Sensors for Controlling Robotic Arm writes that the project is about development of a wearable device that detects the human arm movement that can controlling the robotic arm remotely. The project was using potentiometer, flex sensor and so on. The microcontroller Arduino Nano was employed as processing unit that can process the analog signal form sensor then convert it into digital value that will be sent to the robotic via Bluetooth communication. The system gives good linearity between human arm and robotic arm movement[13]. The average error was taken of the whole sensor that represents the deviation from the ideal one. The robotic

arm was one type of robot that mimics human arm. It is used to replace human operators that can handle tasks in industries where it also can handle dangerous tasks. The robot was designed in a lightweight mechanical structure components while it can naturally move. Besides that, the robotic arm could have disadvantages where less arm, finger movement and detect motion.

Figure 2. 11 Prototype of Wearable Device

2.3.13 An Applying Sensor-Based Technology to Improve Construction Safety Management

The author writes about Applying Sensor-Based Technology to Improve Construction Safety Management said that the development of sensor-based technology was greatly improved in collection information, transmission and processing data also can serve as foundation of modernization construction safety management. After almost two decades sensor-based technology development, it transformed from experimental exploration to practical applications. The sensor-based applications have become the focus of the current

research. The sensor-based technology in this project can summarize the accuracy positioning of locating while it were introduced objectively and systematically[14]. To meet the ever-increasing requirements, integration of multiple techniques is capable. The advantages of applying the sensor-based technology are that it less expensive. It is also effective in data acquisition and can also do portable data processing. Besides that, the disadvantage of applying the sensor-based technology is it large in signal transmitter while it also blocked the signal and shortened the spread of the signal.

2.3.14 The Six-Degree-of-Freedom Sensor Fish Design and Instrumentation

Author of Six-Degree-of-Freedom Sensor Fish Design and Instrumentation writes that the (6DOF) is a sensor package that characterizes physical condition and stresses to fish when they pass through complex hydraulic environments. The sensor is used to detect and identify the location and operation where the condition are severe enough to injure or kill the fish. The 6DOF sensor fish is a device that develops better and can understand the physical conditions fish. The equation of motion was derived to understand the instrument selection and placement within the body device[15]. The sensor can provide situ measurement of 3Dacceleration and dimensional rotational velocity. It also can measure pressure and temperature at a sample frequency which is at 2000Hz. The good side about this product is quite accurate while it can prevent or lessen from human injury but the product also has disadvantages where can effect on acceleration and rotation error. This device also can send information on non-lethal exposure that can increase the fish risk.

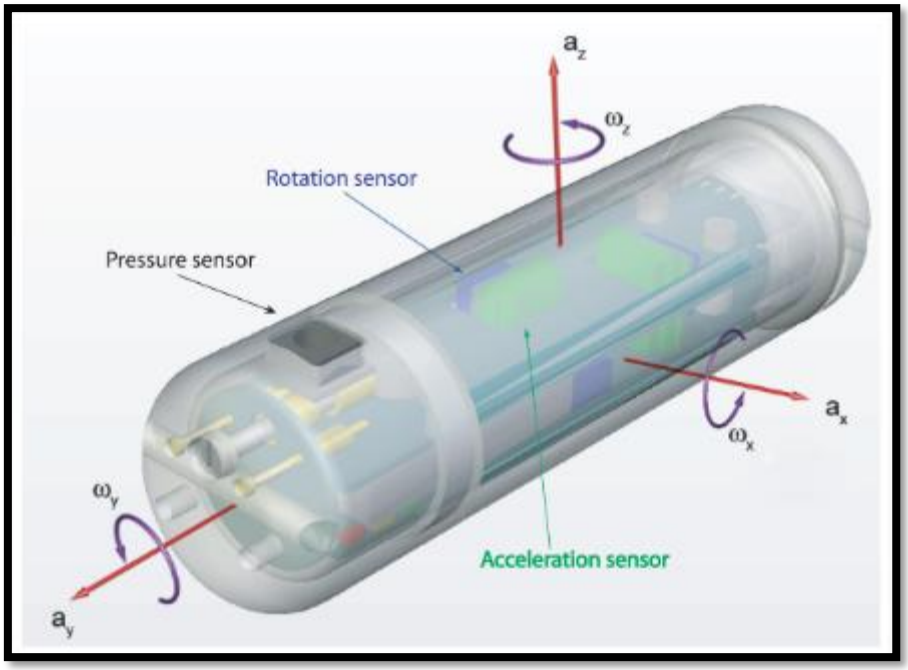

Figure 2. 12 The Sensor Fish

2.3.15 The Humidity and Temperature Using Arduino Based Microcontroller and Sensors

The author of Humidity and Temperature Using Arduino Based Microcontroller and Sensors writes that Arduino is a microcontroller that act as a tiny computer where it is a platform that can create and develop interacting object with required programming software on Arduino software IDE. Arduino is an open source hardware that has an ability to meet the need of real-time and controlling environment variables. It is inexpensive and easy to use for advance modification of microcontroller based on Arduino hardware and software that make it range of uses it wider[16]. Both of hardware and software of Arduino are open source where it makes easier for the people to take the idea that generated by other people work and modify it without any authorization. You can do anything you want with it. The project was built as a monitoring device that measures the temperature and humidity inside

a building. The temperature and humidity level were accessible measurement data and the accurate, but it may have measurement error and limitation error.

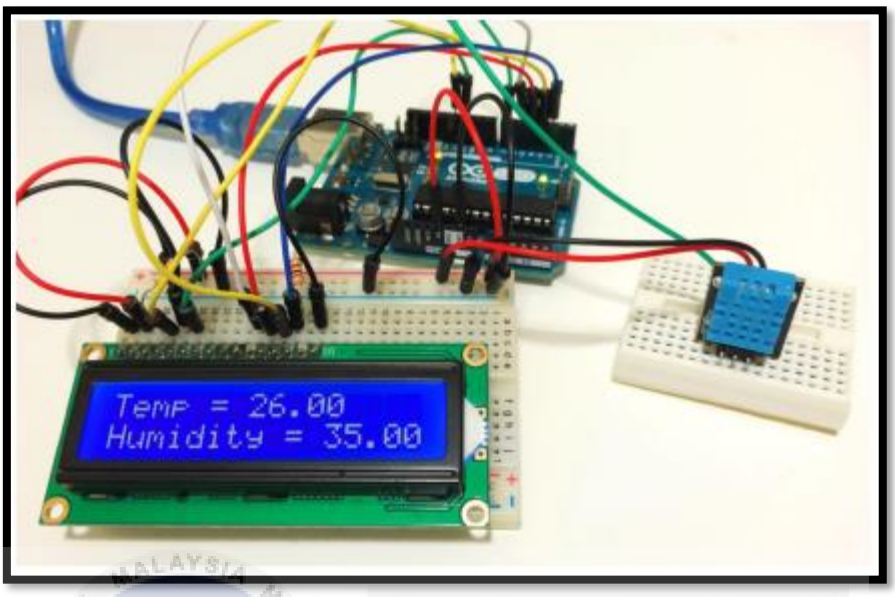

Figure 2. 13 The Project Temperature and Humidity Display in LCD

2.3.16 The Development of Wireless Light Control System Based on Arduino and CC1101

The author of Development of Wireless Light Control System Based on Arduino and CC1101 writes that the Internet of Things(IoT) drives the enhancement within Information and Communication Technology (ICT). It is used to improve the productivity, quality of life and safety. Nowadays, smart home applications have been applied IoT concept where user can monitor their properties through network connection. In this project, they design and implement a light controlling system via wireless sensor network by using Arduino board and CC1101-chip where it can support security system[17]. The user can control the light through their own mobile phone, personal computer, or tablet. The product

can increase home security and reduce electrical energy used by using it while, the device disadvantage is it need internet connection and electrical device to use it.

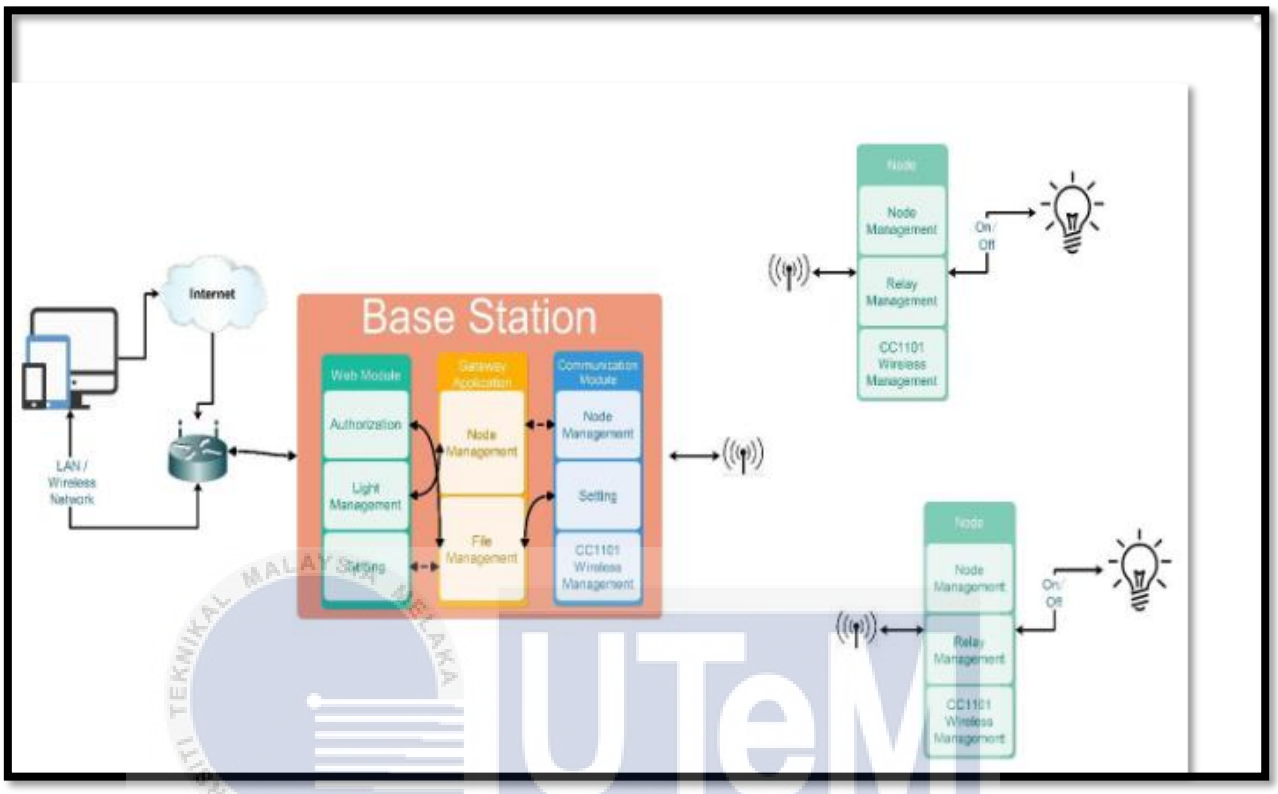

Figure 2. 14 The System Framework Design

2.3.17 The Intelligent Greenhouse Monitoring and Control System Based Arduino UNO Microcontroller

Hikma Shabani the author of Intelligent Greenhouse Monitoring and Control System Based Arduino UNO Microcontroller writes that due to the unpredictable control of crop climate conditions, there is a significant diminution in agricultural production. The products were designed using Arduino Uno, microcontroller, and other components. The product system can control and monitor greenhouse climate remotely via mobile application and GSM in a real-time manner. The environmental conditions were delivered in a timely

manner while the low-cost wireless sensor are used to monitor temperature, light and many more for the greenhouse. The system can closely monitor the condition of greenhouse at farming fields accurately while user also can send the control decision instantly that can help increase the crop production[18]. This product can save human energy while there is less field visit and more leisure time with family. Other than that, the products were not well-suited with the modern device and it also difficult and complex to implement.

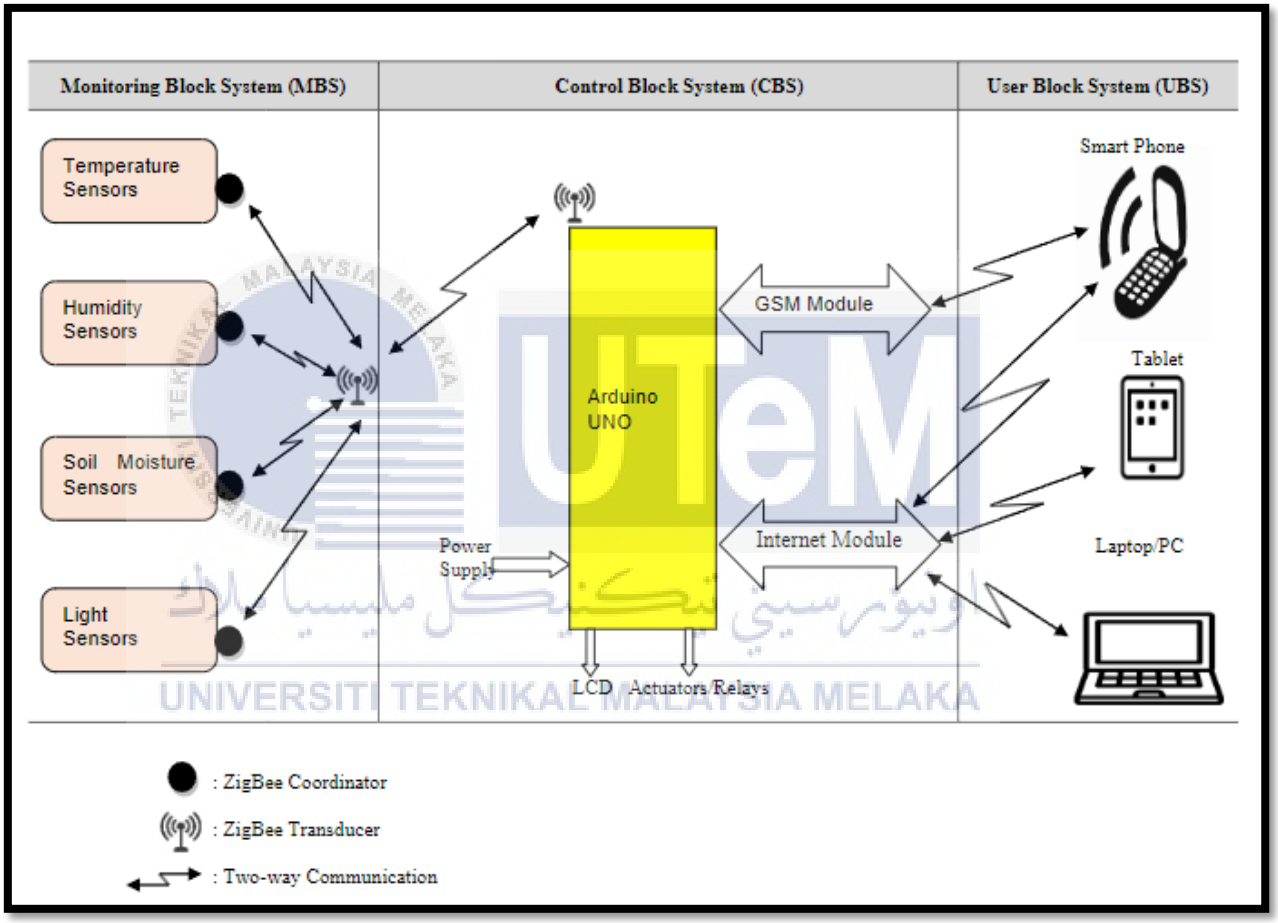

Figure 2. 15 The Functional System Block

2.3.18 The Development of Microstrip Monopole Antenna Integrated with Light Emitting Diode (LED)

The author who writes about Development of Microstrip Monopole Antenna Integrated with Light Emitting Diode (LED) where the objective of the design project is to have dual application in a single antenna which is the used is for wireless communication and illumination. This project was presented the integration of Microstrip Antenna with Light Emitting Diode (LED). The frequency is inversely proportional to increase the antenna size based on the result that had been taken. The LED is also a part of the antenna where it also can act as a conductance. The antenna was designed based on the monopole antenna at 3.6 GHz where to design it must be using Computer Simulation Technology (CST) with permittivity. When the product in the ON state the result that we will get is 3.75 GHz and when the product in OFF state the expected result that should we get is 3.88 GHz. The product was designed with an advantages and disadvantages. The advantage of the product is it only took low power consumption and it is environment friendly while the advantages of the product is it can interrupt the DC current and it is limited to a single application[19].

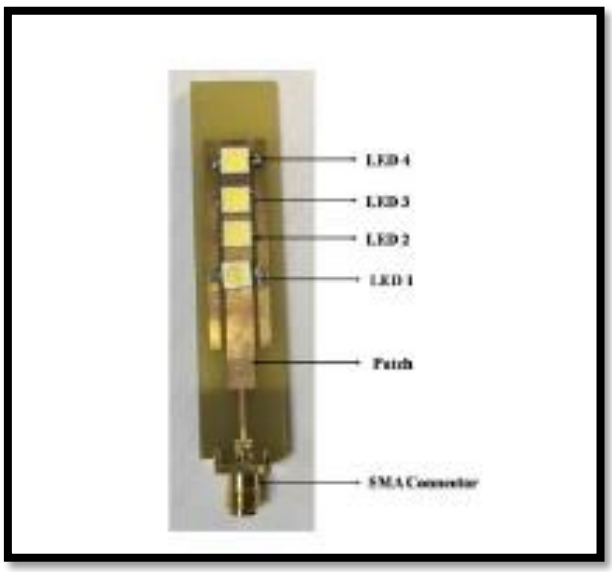

Figure 2. 16 The Product Structure Antenna with LED

2.3.19 The Integrated Stacked Microstrip Antenna with Light Emitting Diode (LED) for Wi-Fi Application

Author of Integrated Stacked Microstrip Antenna with Light Emitting Diode (LED) for Wi-Fi Application writes that the project was designed to investigate the Light Emitting Diode (LED) that integrated with stacked rectangular microstrip antenna. In this project, an antenna was designed at 2.45 GHz where it can support Wi-Fi applications. The LED were located at the top layer of the parasitic element while the on the second substrate the patch radiator were located. Besides that, on the bottom substrate the feed line and ground plane were located. The product is simulated and the result measure were compared to identify the feasibility of integrated antenna[20]. While the result was taken, the return loss ang gain were verified based on the performance of rectangular stacked microstrip antenna. The product design were stable at the frequency response and it also energy saving from being wasted, nut the product needed antenna improvement to make sure that the product can contribute well.

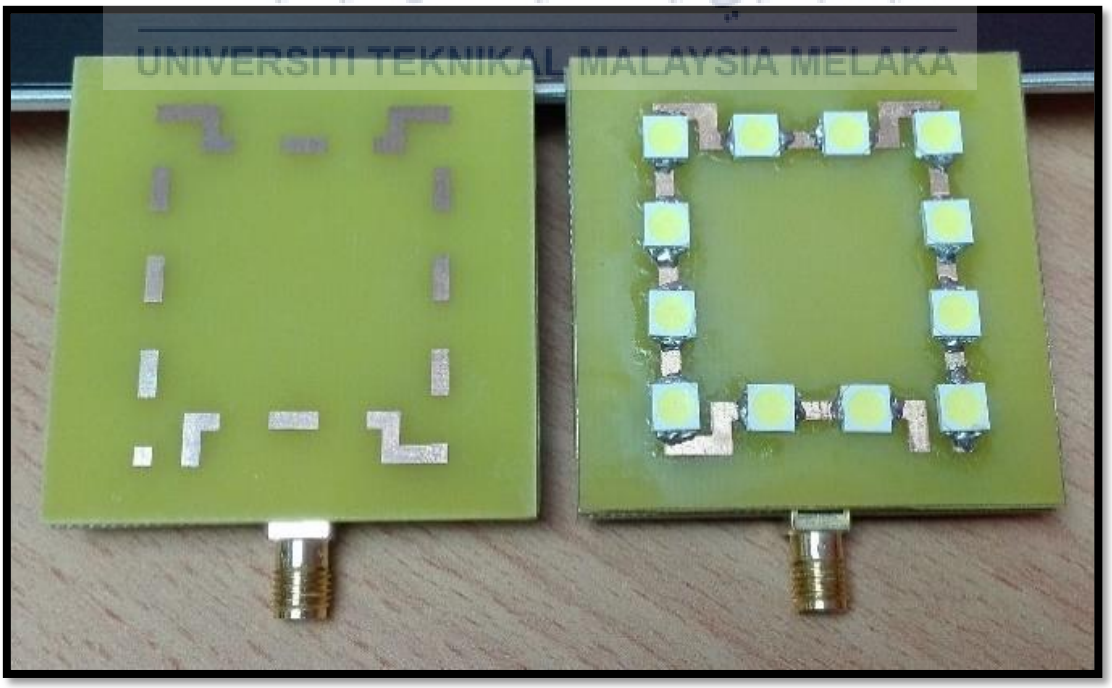

Figure 2. 17 The Fabricated Rectangular Antenna with LED

2.3.20 The Development of Experimental Simulator via Arduino-based PID Temperature Control System using LabVIEW

The author H. Muhammad Asraf that writes the Development of Experimental Simulator via Arduino-based PID Temperature Control System using LabVIEW were studied about the temperature control system that had been continued until nowadays even though it had already established in industrial process, household and so on by its growing application. A good control system can be designed to be relatively free from instabilities. In this project, Arduino were recommended as a tools that users can express their design creativity and can implement ideas on creating system for the temperature control. Arduino microcontroller and Virtual Instrumentation (VI) were implemented in this project and also LabVIEW software that been used to monitoring and controlling the heat element which is temperature that sensed by the thermocouple measuring device. The temperature was measured to the several setpoints while the error will occur when the temperature did not reach the original set point. The advantage of this product is it in a simplicity form while it can reduce the cost when buying the component. Beside the advantage of the product, there is the disadvantage where the product took longer time to reach the value that had been set to get the result[21].

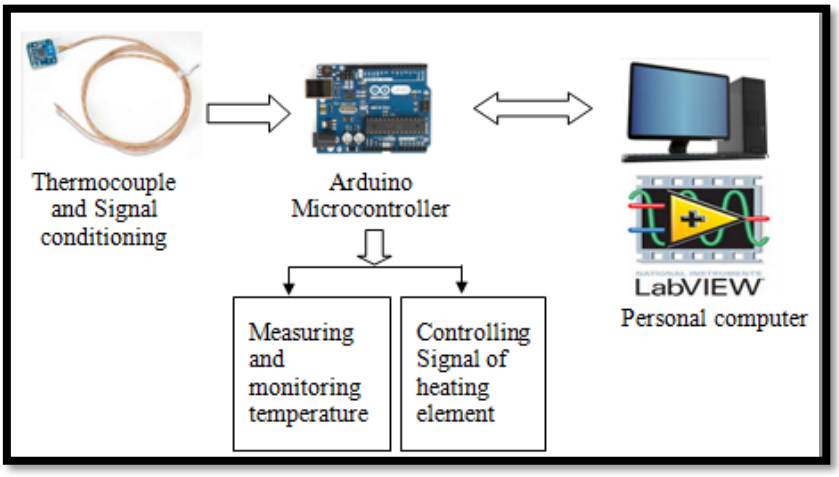

Figure 2. 18 Block Diagram of The System Project

2.4 Literature Review Table

Table 2. 1 Summary of Related Work

NO.	TITLE	AUTHOR	PLATFORM	COMPONENTS	PURPOSE	ADVANTAGE	DISADVANTAGE
1.	Alcohol Concentration Monitoring System Based on MCU	LU Qingru HUANG Hui CHEN Debin XIN Haiyan	Gas Sensor	touch sensor, gas sensor, analog digital converter, MCU, LCD display, keyboard module and sound and light alarm.	An alcohol concentration monitoring system is designed here. The concentration of alcohol can be displayed in different environments in real time. It can also display grading alarm and in accordance with the threshold which can be set, and so on	- Simple structure - Small size - Convenient carrying	- slow response rate - environment temperature
2.	Imperfection Method Based on Optical Fiber for Alcohol Content	Muhammad Yunus	Optical Fiber Technology	Alcohol, Sensor, Optical Fiber	An increase in the refractive index of alcohol content causes power losses to increase, resulting in lost light intensity being transmitted in optical fiber-based sensors.	- high sensitivity - simple fabrication - low cost	- large power losses resulting

	detection Sensor						
3.	Dual-Polarized PCF-SPR Sensor for Alcohol Detection at Low Temperature	Dedi Irawan	Optical Fiber Fabrication	PCF-SPR sensor; COMSOL multiphysics; Alcohol concentration; Low-temperature	Observations were made in the alcohol concentration range of 15%, 40%, 60%, and 70%. In the literature, we find the refractive index of each alcohol concentration and input its value into the proposed sensor. The proposed sensor shows that the sensor has a sensitivity in detecting alcohol concentrations at low temperatures of 91 nm/%.	- used as a data transmission medium - significant development	- single-mode fiber - small size
4.	Additive manufacturing for capacitive liquid level sensors	Gianni Stano	Additive Manufacturing	Additive Manufacturing · 3D-printed sensors · Capacitive sensor · Liquid level sensing	The present work aims at pushing the role of the inex-pensive MeX technology for the fabrication of capacitive sensors embedded into 3D-	- cost saving - time saving	- requires further assembly tasks

					printed structures: non-conventional tanks as well as soft structures actuated by means of fluids (fluidic actuators) can be 3D printed in the same fabrication cycle alongside with the proposed capacitive sensor for liquid level detection.		
5.	Detecting methanol in hand sanitizers	Andreas T. Güntner	Microcontroller	Chemistry Analytical Chemistry Chemical Composition Analysis	The device operation and data analysis are user-friendly, providing results on smartphones, where further communication to data clouds for remote analysis is possible. The device contains mostly commercially available components, thus can be	- user-friendly - low cost	- temperature and humidity sensitivity

					produced at low cost and large numbers.		
6.	The Use of a Modest Alcohol Meter	Maria Agatha Hertiavi	Experimental Research	alcohol meter; hand sanitizer; isopropyl alcohol	The manufactured alcohol meter could be used to examine the hand sanitizer percentage or the IPA-based alcohol percentage. Several hand sanitizer and IPA-based alcohol in the markets showed a lower percentage as suggested by the written text on the package. It made the ineffective use of hand sanitizer to wash hands.	- materials are easy to get - device could be established at home without ignoring the health protocol	- has strength IPA-based alcohol - risky if it is incorrectly used
7.	Alcohol Detection Sensor- An Apprise	Pranavan S	Automobile	Driver Fatigue, Infrared Sensor, Alcohol Sensor, ILS Detector, and	A detailed review is analyzed and presented below based on the existing system. According to the reflection of the survey, detect the alcohol content using	- detail review is analyzed. - presented on existing system	- real-time monitoring over several days

				Ignition Interlocking System	MQ3 alcohol sensor, send value to microcontroller, fuel supply will be cut-off, intimate a message using GSM module, the rate of accidents will be depreciated		
8.	Design And Implementation of An Alcohol Meter	Jianan Shi	MPLAB IDES	Gas sensor (TGS-822); Microcontroller (PIC16F690); A/D Converter; LCD display	The goal of the thesis is integrating a gas sensor (TGS-822) and a microcontroller (PIC16F690), by means of C programming language in its Integrate Development Environment (MPLAB IDE v8.80) of this series of microcontrollers. With a LCD display connected, the alcohol concentration is shown in the LCD display (TLC1602A).	- Long life and low cost - High stability and reliability over a long period	- affected by external environment - measuring range of the system is limited

					Range from 50PPM to 5000PPM		
9.	Alcohol Detection and Monitoring System for Vehicles	R.V.KOLEKAR	Microcontroller	GSM, GPS, LCD, Alcohol sensor (MQ3).	The output of the sensor is directly proportional to the content of alcohol consumed. Now a day alcohol sensor plays a significant This type of sensor in cars is a great safety factor which can be embedded in steering of the cars. When the driver starts the ignition, sensor measure the content of the alcohol in his breath and if the concentration is above the hazardous level then automatically it will stop the ignition of the car.nt in our	- checks drunken driving - reduce the accident rates	- limited distance sensing

					society and it has wast applications.		
10.	Alcohol Detection based Engine Locking System using MQ-3 Sensor	Priyanka Sahu	Microcontroller	Atmega8, MQ-3Sensor, GSM, GPS	An effective solution is provided to develop the intelligent system for vehicles which will sense the various levels of alcohol present in the breath of the driver and would respond accordingly.	- minimizing number of road accidents	- crucial - high data rate
11.	Microfiber-based Sensor for Measuring Uric Acid Concentrations	Saidin, N., Idris, N., Amaluddin, M., Irawati, N., Ralib, A., Harun, S.	Fiber Optic	Displacement sensor, Microfiber, Single-mode fiber, Uric acid concentration	The proposed sensor uses single-mode fiber (SMF) tapered using flame brushing technique to enhance the evanescent field around the fiber core to interact with the uric acid. The tapered area is bent manually and sets vertically on a clamp, facing the mirror in the beaker. It	- simple design - less production cost - operation without forfeiting its sensitivity	- complicated to perform - time consuming - limited exposed interaction length

					is placed within the linear range of a sensor's displacement curve of 0 to 5000 μm		
12.	Human Arm Movement Detection Using Low-Cost Sensors for Controlling Robotic Arm	Soetedjo, A., Somawirata, I., & Irawan, A.	Microcontroller	Human Arm Detection, Robotic Arm, Potentiometer, Flex Sensor,	The proposed system employs the simple and low-cost sensors consisting of seven potentiometers and one flex sensor. A small size Arduino Nano microcontroller is employed as the processing unit to process the analog signal from the sensor into the digital value which is then sent to the robotic arm via the Bluetooth communication.	- lightweight mechanical structure - naturally moving	- less arm movement - less finger detect motion
13.	Applying Sensor-Based Technology to Improve	Mingyuan Zhang, Tianzhuo Cao Xuefeng Zhao	Sensor Based Technology	construction; safety management; sensor-based technology; sensors	The development of sensor-based technologies has greatly improved information collection, data transmission	- less expensive - effective data acquisition	- large signal transmitter - blocked signal - short spread signal

	Construction Safety Management				and processing, which can serve as the foundation of the modernization of construction safety management. After nearly two decades of development, sensor-based technologies have facilitated the transformation from experimental exploration to practical applications. The applications of sensor-based technology in construction safety management have become the focus of current research.	- portable data processing	
14.	Six-Degree-of-Freedom Sensor Fish	Zhiqun Deng	Sensor	fish-friendly turbine; Sensor Fish; fish injury mechanism	The six-degree-of-freedom (6DOF) Sensor Fish device is an autonomous sensor package	- quite accurate - prevent human injury	- acceleration and rotation error

	Design and Instrumentation				that characterizes the physical conditions and physical stresses to which fish are exposed when they pass through complex hydraulic environments. It has been used to identify the locations and operations where conditions are severe enough to injure or kill fish. During the design process, a set of governing equations of motion for the Sensor Fish was derived and simulated to understand the design implications of instrument selection and placement within the body of the device.		

15.	Humidity and temperature using Arduino based microcontroller and sensors	Nagendra Dangi	Microcontroller	Arduino, sensors	Arduino, the open source hardware has shown ability to meet the need of accurate and real-time monitoring and controlling of environmental variables. The Arduino user community is a forum where many people can share their ideas, use each other's work and modify them to innovate and advance many different interacting objects. Arduino is use in a wide range of projects to develop objects that can interact with people or environment and internet.	- accessible measurement data - accurate data	- measurement error - limitation error
16	Development of Wireless Light Control	Yew Chin Sing, Rajemi M. F	Arduino Uno	Wireless Light Control; CC1101;	This paper showed that the user is able to control the light via any kind of browser that	- increase home security	- need internet connection - need electrical devices

	System Based on Arduino and CC1101			Arduino; WSN	runs on personal computer, mobile phone or tablet. Besides, this system is able to run on cross platform. The user is able to access the base station through any operating system, which includes windows, Mac OS, iOS, Linux and etc.	- reduce electrical energy used	
17.	Intelligent Greenhouse Monitoring and Control System Based Arduino UNO Microcontroller	Hikma Shabani, Norhuzaimin Julai, Musse Mohamud Ahmed Ahmad Helmi Che Rose	Arduino Uno Microcontroller	Intelligent Greenhouse; WSN; Multi-Hop; Large Coverage; Monitoring and Control System; Arduino Uno; Microcontroller; Proteus Toolkit.	The system user can monitor and control the greenhouse climate conditions remotely via web interface/mobile applications and GSM in a real-time manner. To deliver the environmental conditions in a timely manner, low-cost wireless sensor network	- save human energy - less field visits - more leisure time	- not well-suite with modern device. - complex and difficult to implement

					(WSN)is used to monitor the temperature, humidity, soil moisture and light of the greenhouse. The sensor network constitutes a multi-hop network structure for large coverage. The developed system is implemented and tested in laboratory conditions using Proteus toolkit.		
18.	Development of Microstrip Monopole Antenna Integrated with Light Emitting Diode (LED)	S.N.Kamarudin, M.T.Ali, S.Subahirand H.Yon	LED	Integration; Light Emitting Diode (LED); Microstrip Antenna; CST.	This paper presents the integration of Microstrip Antenna with Light Emitting Diode (LED). The objective of this design is to have a dual application in one single antenna, which is for wireless communication and	- low power consumption - environment friendly	- interruption DC current - limited to a single application.

					illumination Based on the result, the frequency is inversely proportional to the increase of the antenna size. The LED itself acts as a conductance for the antenna as it is also a part of the antenna. The antenna design is based on the structure of monopole antenna at 3.6 GHz		
19.	Integrated Stacked Microstrip Antenna with Light Emitting Diode (LED) for Wi-Fi Application	Hamizan Yon, Aziati H. Awang, M. T. Ali, S. Subahir, S.N. Kamaruddin , M.A.Aris	LED	CST; FR4 substrate; Light Emitting Diode (LED); Rectangular Microstrip Patch Antenna; Wi-Fi	Investigation of Light Emitting Diode (LED) integrated with a rectangular stacked microstrip antenna is presented in this paper. The antenna designed at 2.45 GHz to support Wi-Fi applications. The antenna is	- stable frequency response - energy saving	- antenna improvement

		Norfishah Ab Wahab			simulated by using Computer Simulation Technology (CST). The LEDs are located at the top layer as the parasitic element, while patch radiator located at the second substrate		
20.	Development of Experimental Simulator via Arduino-based PID Temperature Control System using LabVIEW	H. Muhammad Asraf, K.A. Nur Dalila, A.W. Muhammad Hakimand R.H. Muhammad Faizzuan Hon	Arduino Microcontroller	Arduino; Virtual Instrumentation(VI); LabVIEW; PID Controller; Heater	This paper proposes a PID control scheme implemented by using an Arduino microcontroller and Virtual Instrumentation (VI) software called LabVIEW for monitoring and controlling the temperature of a heating element which is sensed by thermocouple as the measuring device. The temperature is varied	- simplicity - reduced cost	- take longer time to reach the value

					accordingly to the several setpoint, and error will be generated when the measured temperature does not reach the originally set point.		

2.5 Summary

In this chapter, the findings of related information that being connected to the project were being carried out. As for the research that being carried out, there is existing research that related to the project. This chapter provided any information that related to the project where information that being explained can be one of the guide to do the project in form of hardware and software. The findings about components that being used in the project were to ensure that the component related to project can act as what have been explained. From the research findings, hand sanitizer with different levels of alcohol was widely used in various application such as healthcare, industrial and many more. Sanitizer were one of the cleaning medium that can helps to kill bacteria and germs in the surface area that it will be apply. Other than that, the other components that connected to the project were being implemented in this chapter where it tells how the component should be working.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Methodology is a process where to identify the specific procedure, process, and techniques where the data and information is being collected based on the method that is being used connected to the research. The project was built by using hardware and software components. The use of hardware for this project is to perform the program that has been created. The tools and flow of the project were clarified in this chapter where methods of the project were explained in detail from scratch until wrap-up.

3.2 Methodology

This thesis presents a new electronic device that can measure and calculate the value of alcohol content inside of the hand sanitizer that had been sold in the marketplaces. The alcohol inside the hand sanitizer was measured to ensure that the level of alcohol was suitable for daily use. There are many distinct types of alcohol in this world that have been introduced to us. There is alcohol that is being used in medical, food, beverages, fragrance and many more. The use of alcohol consumption should be monitored. It is because alcohol is one of the substances that can have a significant impact on its use according to certain classes. The alcohol that being use inside hand sanitizer were functioning as a virus and bacteria killer.

3.3 Milestone BDP 1

Milestone BDP 1 in Table 3.1 is a part where all of the project plan from the first week until last week of semester where the week of PSM 1 presentation. This BDP 1 table show what we have been doing from the first week until presentation week. The table contains the progress of what we are doing in week about the project task that had been given by supervisor. The table also shows on what week we need to submit our task and logbook.

Table 3. 1 BDP 1 Milestone

No.	Task	Start	End	Duration
1	PSM 1 briefing	20/3/2023	25/3/2023	6 Days
2	Research Finding	27/3/2023	1/4/2023	6 Days
3	Submit Research Findings	3/4/2023	8/4/2023	6 Days
4	Discuss about Project Component	10/4/2023	15/4/2023	6 Days
5	Submission Chapter 2 : Literature Review	17/4/2023	22/4/2023	6 Days
6	Submission Logbook progress 1	1/5/2023	6/5/2023	6 Days
7	Continue chapter 1 and 3	8/5/2023	13/5/2023	6 Days
8	Find Project Objective and Problem Statement	15/5/2023	20/5/2023	6 Days
9	Fix the Project Objective and Problem Statement	22/5/2023	27/5/2023	6 Days
10	Submission Chapter 3 : Methodology	29/5/2023	3/6/2023	6 Days
11	Submit Logbook progress 2	5/6/2023	10/6/2023	6 Days
12	Project progress discussion with SV	12/6/2023	17/6/2023	6 Days
13	Submit PSM1 report and preparation project presentation slide	19/6/2023	24/6/2023	6 Days
14	PSM1 presentation week	26/6/2023	1/7/2023	6 Days

3.4 Milestone BDP 2

Milestone BDP 2 in Table 3.2 is a part of the project plan from week first until last week of the semester before PSM 2 presentation being held. The table show the flow of progress that had been made the whole semester and also shows the task that been given by the supervisor that needs to be finished in a week. All of the content for the whole semester were listed on the table as what have been shown.

Table 3. 2 BDP 2 Milestone

No.	Task	Start	End	Duration
1	PSM 2 briefing	09/10/2023	14/10/2023	6 Days
2	Meeting with Supervisor	16/10/2023	21/10/2023	6 Days
3	Taking Solution Reading	23/10/2023	28/10/2023	6 Days
4	Plotting Graph	30/10/2023	04/11/2023	6 Days
5	Submission Claim Form	06/11/2023	11/11/2023	6 Days
6	Submission Logbook progress 1	13/11/2023	18/11/2023	6 Days
7	Continue Report on Chapter 4	27/11/2023	02/12/2023	6 Days
8	Edit Project Flowchart and doing some research	04/12/2023	09/12/2023	6 Days
9	Continue Chapter 3 and Project Gantt Chart	11/12/2023	16/12/2023	6 Days
10	Chapter 5 Progress	18/12/2023	23/12/2023	6 Days
11	Soldering Project Component	25/12/2023	30/12/2023	6 Days
12	Submit Logbook progress 2	01/01/2024	06/01/2024	6 Days
13	Submit PSM2 Report and Preparation Poster	08/01/2024	13/01/2024	6 Days
14	PSM2 Presentation Week	15/01/2024	20/01/2024	6 Days

3.5 Gantt Chart BDP 1

Table 3. 3 Gantt Chart for BDP 1

PROJECT PLANNING																				
PSM 1	**MARCH**		**APRIL**				**MAY**					**JUNE**				**JULY**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Project Proposed	PSM 1 BRIEFING					MID SEMESTER BREAK										REVISION WEEK	FINAL EXAM		SEMESTER BREAK	
Decide and choose project title																				
Find related journal, research for literature review purpose																				
Identify project synopsis, objective, and problem statement																				
Report Research and Software Research																				
Introduction																				
Literature Review																				
Project component review																				
Submission Logbook Progress from Week1 - Week6																				
Hardware and Software used																				
Methodology																				
Finalize for Hardware tools and Software used																				
Expected project result																				
Project Delivery																				
Complete the project report																				
Project report submission																				
Preparation project presentation slide																				
Project presentation																				

Expected Progress Actual Progress

3.6 Gantt Chart BDP 2

Table 3. 4 Gantt Chart for BDP 2

PROJECT PLANNING																				
PSM 2	OCT			NOV				DEC				JAN				FEB				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Construct Project Coding	PSM 2 BRIEFING						MID SEMESTER BREAK								REVISION WEEK	FINAL EXAM		SEMESTER BREAK		
Compile, Testing and Run Project Coding																				
Taking Result for Solution																				
Plotting Graph for Each of the Solution																				
Edit Gantt Chart, Milestone and Flowchart BDP 2																				
Editing Coding Flowchart																				
Report Editting																				
Component Soldering																				
Taking and Record Result Analysis																				
Testing Project Result Analysis																				
Complete the Project Report and Submit																				
Preparation Project Poster																				
Preparation Project Video Demonstration																				
Project Presentation																				

Expected Progress Actual Progress

3.7 Flowchart

3.7.1 BDP 1 Flowchart

The BDP 1 flowchart on Figure 2.19 below shows the flow when data are being researched for the program. The flow chart also shows the flow from the very first step to do the project, making the report, submitting the logbook, submit the report and many more things to do in the whole semester.

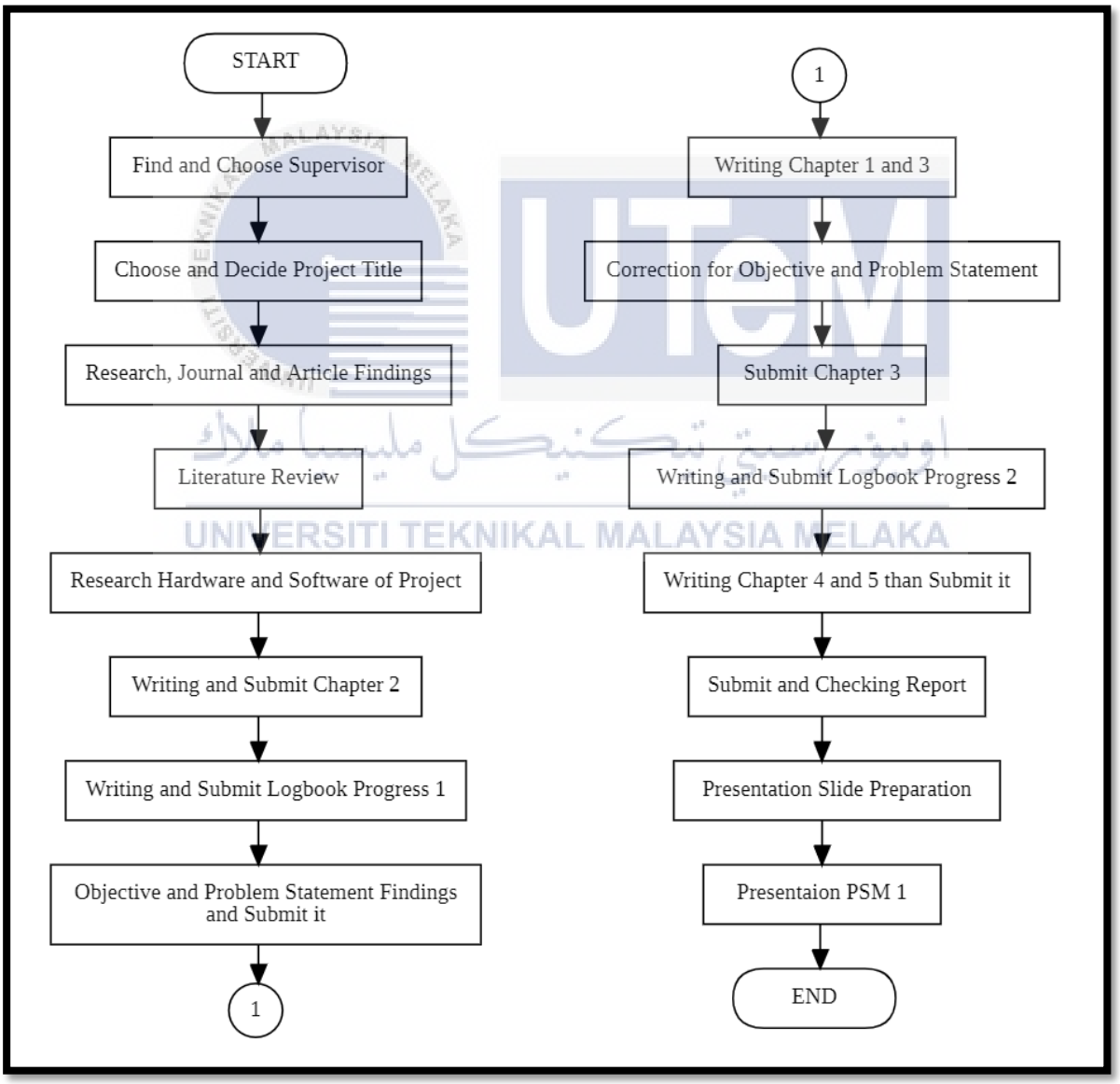

Figure 2. 19 BDP 1 Flowchart

3.7.2 BDP 2 Flowchart

The BDP 2 flowchart on below shows the flow of the project for the whole semester. The flow chart also shows the flow from the very first step to do the project, making the report, submitting the logbook, submitting the report, preparation project poster, video demonstration and many more task to do in one semester.

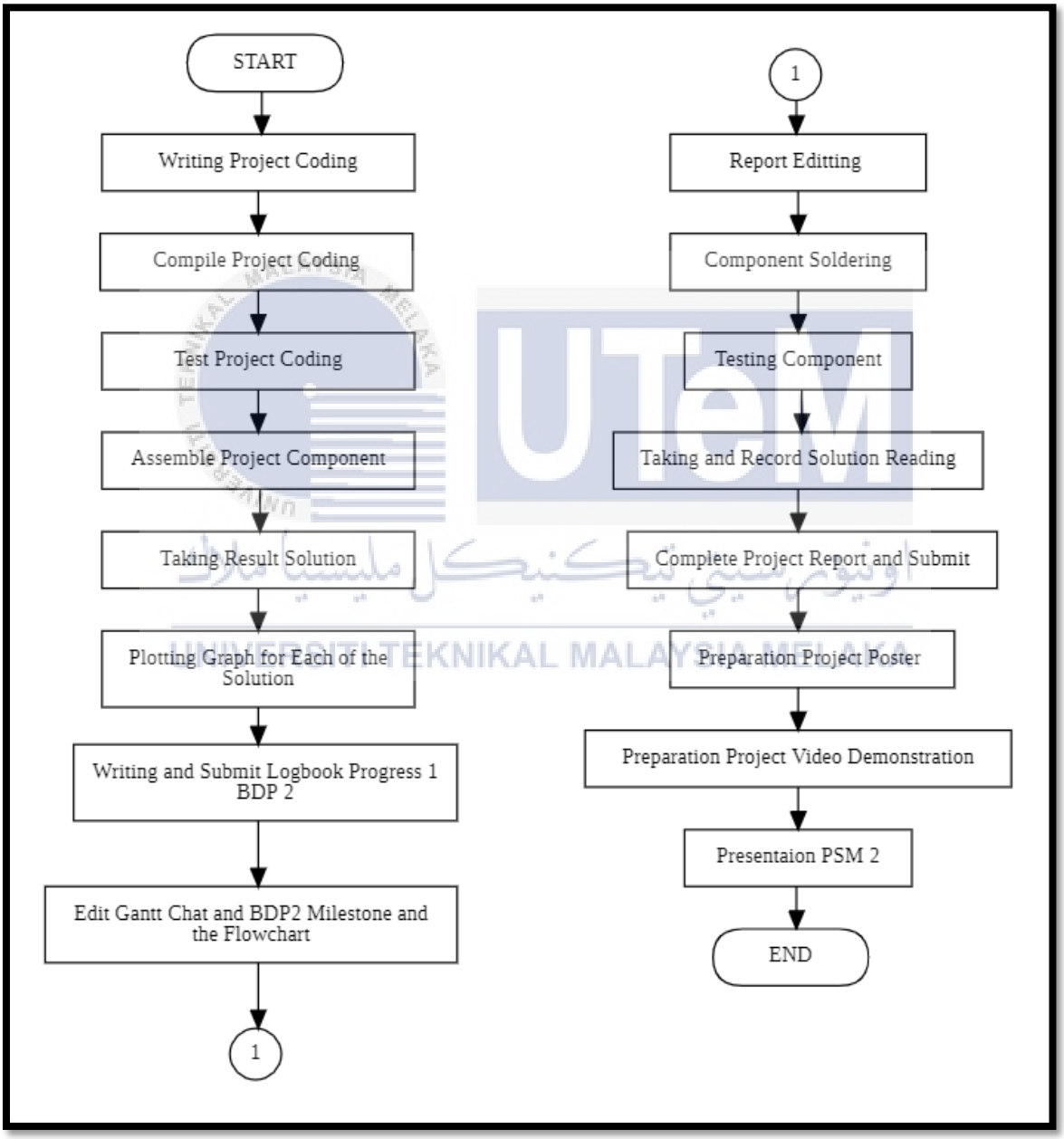

Figure 2. 20 BDP 2 Flowchart

3.7.3 Project Flowchart

The flowchart on Figure 2.20 below shows program flow that explain how the program works from the first step START until the last step END. Firstly, when the devices are in ON mode the LED will light up and LCD also will light up. Then, the LED transmit the light through the solution when the solution is put inside the beaker and being put in between the LED and LDR. If the LDR sensor detect the presence of solution it will display the value at the LCD. If the LDR sensor did not detect the presence of solution it will begin the process form the first.

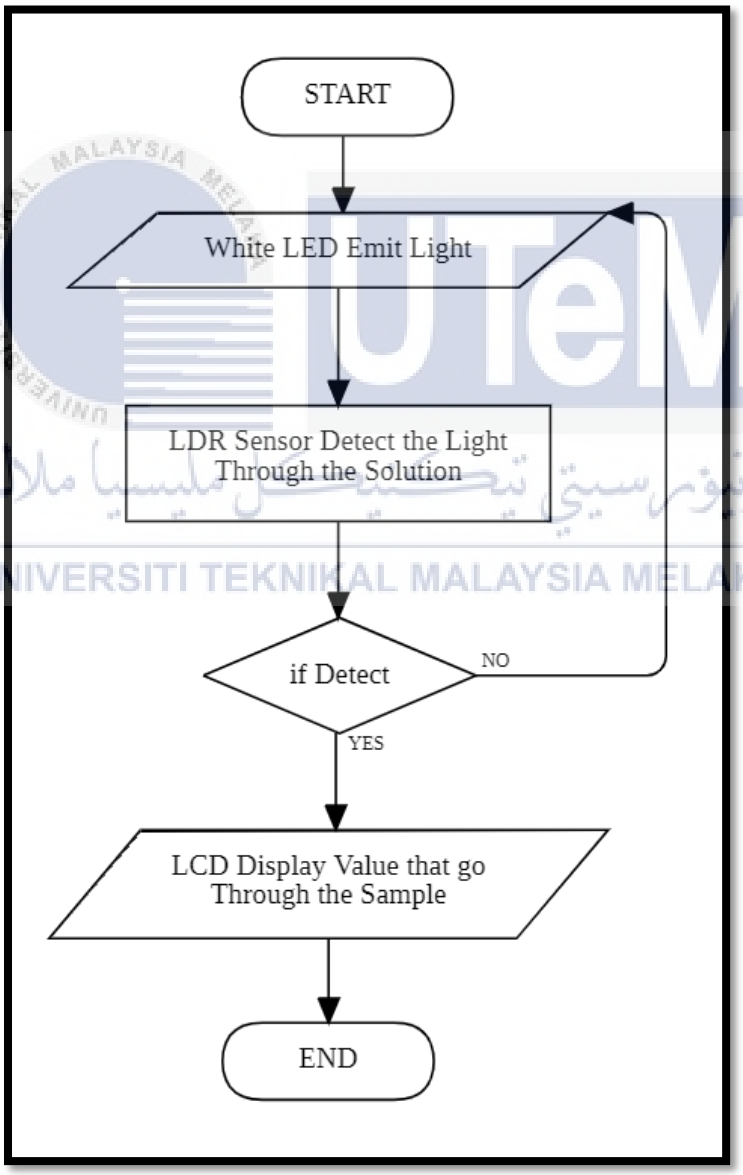

Figure 2. 21 Project Flowchart

3.8 Project Layout

Below are the project layout for the project where all of the component connections were connected to each other based on what have been discussed. The LCD, LDR sensor and LED were connected to the microcontroller which is Arduino UNO. All of the project flow were compiled in the Arduino UNO as it is the main component to make sure the project can run smoothly.

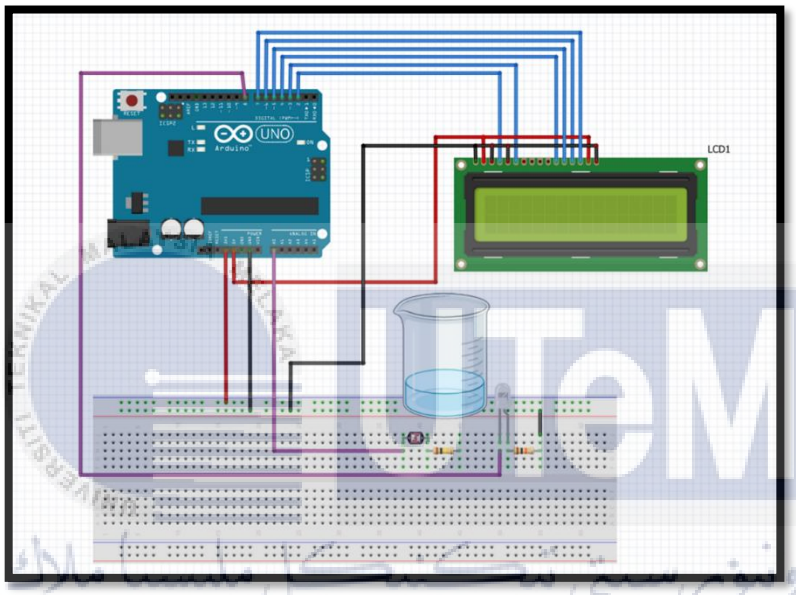

Figure 2. 22 Project Layout

3.9 Project Block Diagram

Based on block diagram figure below shows that each of the component that being used in this project. There is input, process, and output for the flow of project. As the input for the project comes from the white LED, LDR sensor and solution that being used. As the process block is the Arduino UNO which is as microcontroller and for the output block is if the value is detected, it will display the value on the LCD.

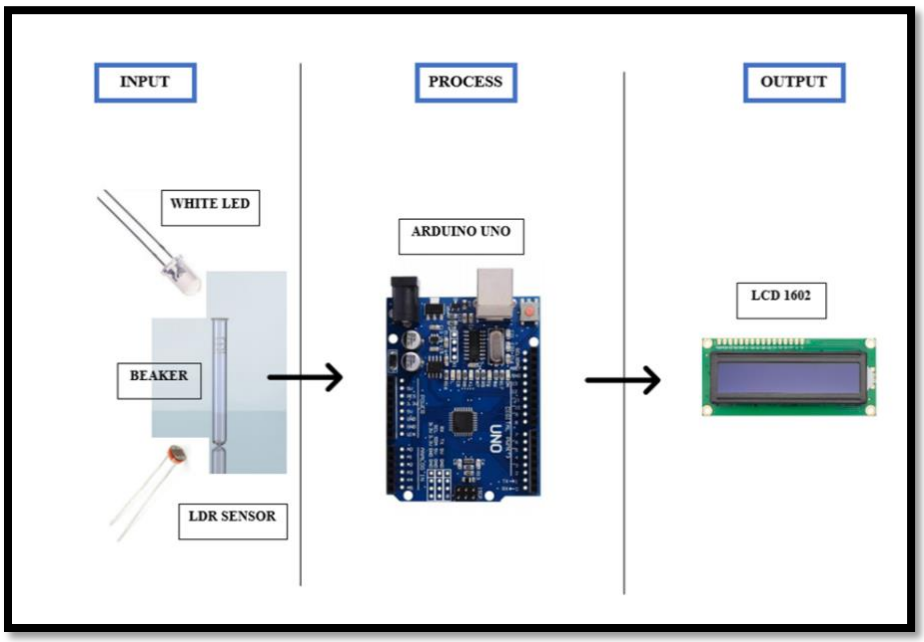

Figure 2. 23 Project Block Diagram

3.10 Project Prototype

Figure 2.24 below are the prototype of the project. All of the components are assembled into a box, LED and LDR are soldered into PCB board and LCD are also being placed on the top to ensure that all of the components do not clutter. The project were functioning by turning on the switch at the battery snap, then the prototype ready to read the solution that being placed.

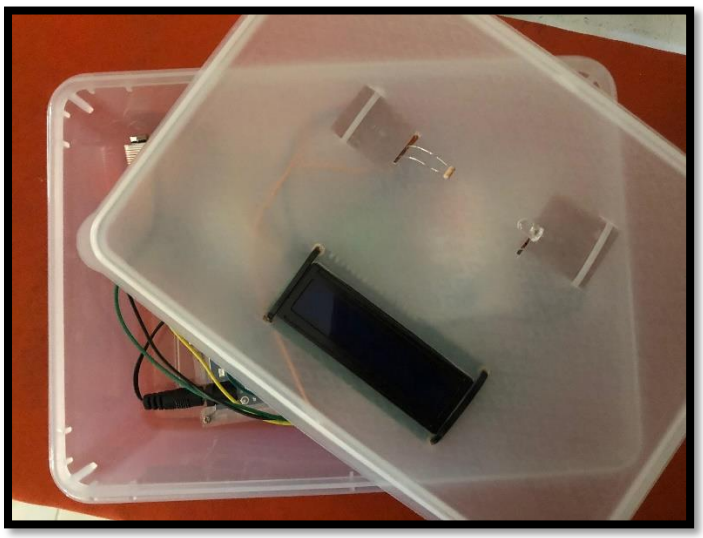

Figure 2. 24 Project Prototype

3.11 Project Component Cost

This is the list of the equipment in Table 3.5 below where estimation cost that will be used for the project. Each of the equipment has its own function in making the project can be carried successfully and smoothly.

Table 3. 5 Project Equipment and Estimation Cost

No.	Component	Unit	Price (RM)	Total Price (RM)
1.	Arduino UNO R3	1	42.90	42.90
2.	LED White 5mm	10	1.20	1.20
3.	LCD 1602 (Blue)	1	12.90	12.90
4.	Small Beaker (10ml)	1	2.50	2.50
5.	PCB Board	1	1.40	1.40
6.	Light sensor	1	1.00	1.00
7.	Battery	1	5.00	5.00
8.	Small plastic box	2	1.25	4.00
9.	Resistor (470Ω)(220Ω)	2	1.00	2.00
10.	Wire Jumper (Male-to-Male) (Male-to-Female)	80	8.62	8.62
11.	Battery Snap	1	3.80	3.80
12.	9V Battery	4	2.00	8.00
TOTAL				**93.32**

3.12 Equipment

This project will be using software and hardware in the making process. To make sure that this project was running well, we used the Arduino UNO alongside with the Arduino IDE software, LCD 16x2, LED (White), light sensor and battery. There is another component that will be used to make sure that the project is completely built and to ensure that the project can be run according to what it is supposed to do.

3.12.1 Arduino UNO

The Arduino UNO that shown in the Figure 2.24 below is a microcontroller that is an electronic component that use Atmega328 where it act as a controller. Arduino UNO was used in electronic project because it functions as a brain to the project because it is where all of the programming coding that being created were stored and run. Arduino UNO were mostly being used because it is the most standard board that being used to making the project.

Figure 2. 25 Arduino UNO with Cable

3.12.2 Arduino IDE

Arduino IDE that gives it long name (Integrated Development Environment) that shown in Figure 2.25 below were an application software that is used to program the Arduino IDE. This is where all of the programming coding were created because in this software, it provides user to write the coding. Then it also provide the compiler, library management and upload the process code to the Arduino UNO microcontroller.

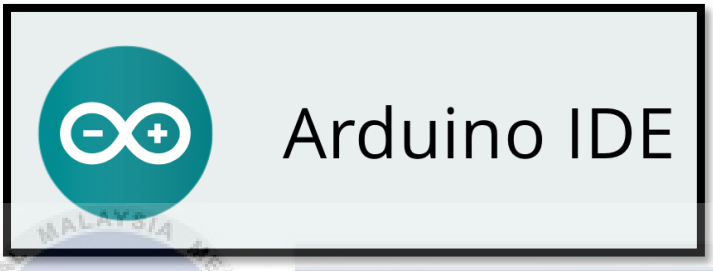

Figure 2. 26 The Arduino IDE Software

3.12.3 LCD I2C 16x2

The use of LCD I2C 16x2 in Figure 2.26 for this project is to display the result of project that had been run. It will display the value number of alcohol solution in the hand sanitizer based on the result that had been taken. It will also display the value of voltage or power or watt based on the programming coding that had been run and compiled through the Arduino IDE software and Arduino UNO component.

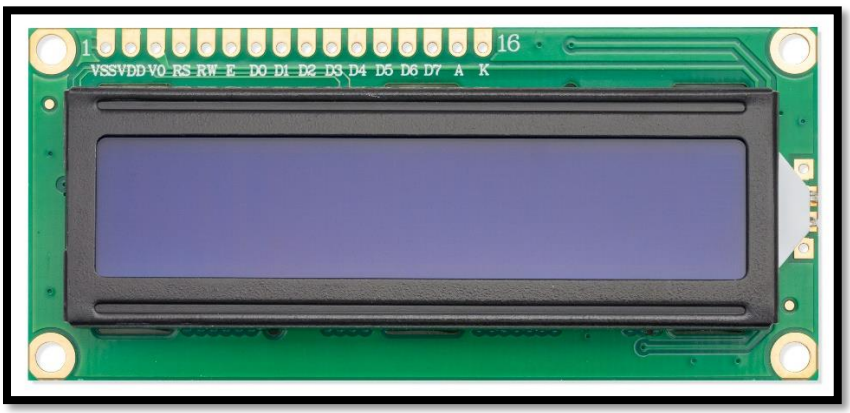

Figure 2. 27 The LCD I2C 16x2

3.12.4 LED (White)

The LED (White) in Figure 2.27 function in this project is to emit it light through the alcohol solution inside the beaker so that the sensor will receive the value of the alcohol solution that contains on hand sanitizer that being used. It will emit the light outside the one side of the beaker so that the sensor on the other side will detect the light that being emitted.

Figure 2. 28 The White LED

3.12.5 Light Dependent Resistor (LDR)

The light dependent resistor in the Figure 2.28 below acts as a receiver that will receive the data from the light emitted from the LED. This sensor will measure the intensity of the alcohol solution in the hand sanitizer and then it will convert into the electrical signal so that the microcontroller will receive the massage to display the result on the LCD.

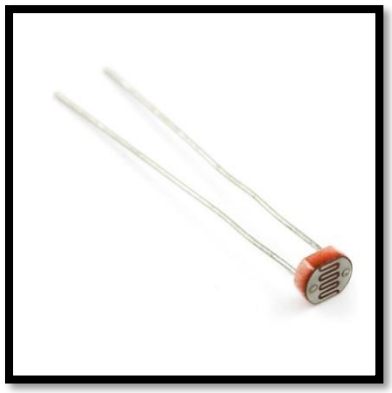

Figure 2. 29 The Light Dependent Resistor

3.12.6 PCB Board

The use of PCB board in Figure 2.29 on this project is to solder the electronic component into it. PCB board provide electrical connection that can support electrical components of the project circuit. Other than that, if the component were soldered into PCB board, it would make it easy to assemble it anywhere such as at the box and others.

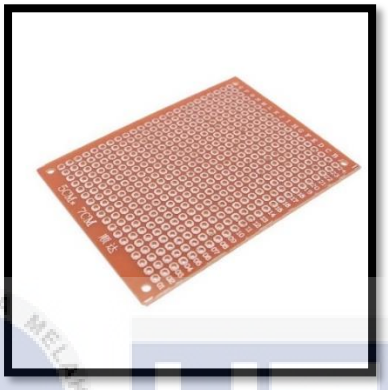

Figure 2. 30 The PCB Board

3.12.7 Battery Snap

The use of this battery snap in Figure 2.30 on this project is to hold the 9V battery at one and the other end wire are plugged in to the Arduino UNO board. It used to shield the 9V battery and protect the battery from dust and damage and also

Figure 2. 31 The Battery Snap

3.12.8 9V Battery

The use of 9V battery in Figure 2.31 on this project is to make sure that Arduino UNO can function well. If using supply less than 5V the board may be unstable and if using more than 12V it ay overheat and can damage the board. So, 9V is the best to make sure the project can function well.

Figure 2. 32 The 9V Battery

3.13 Summary

This chapter presents the proposed of methodology in order to develop a new electronic devices where it helps to detect the alcohol solution in hand sanitizer. Alcohol solution in hand sanitizer had its limit that helps to kills the germs. This chapter is also to create a project timeline where it is one of the medium that can ensure the project could be done in the range of time that had been set. Other than that, the project planning from the very first step until the last were presented in this chapter. The components that was being used for the project were explained in more detail with prices that make it easy to find the budget for buying.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

In this chapter, the expected result and analysis of the project will be presented. result of the project will be collected by making an experimental on the solution. In this case, hand sanitizer liquid solution was the main focus to run the experiment to get the result.

4.2 Result and Analysis

For this project, the results and analysis that are being taken and recorded should be as what has been discussed on PSM 1 before. As what has been obtained from the analysis that is being taken from the solution, 3 graphs are being plotted for each of the solutions. Each of the graphs was taken by different types of reading. As for the repeatability graph, the solution was taken by 3 times for each of the solutions and the value was taken by 20 times for each of 1 time. Then for the linearity graph, the readings were taken from the average value of the repeatability graph. The value was taken by adding the first reading for the 3 times and then dividing it by 3 to get the average value. Next, for the stability graph, the values that were recorded were taken by 1 hour. It is to make sure that the solution is stable and the value readings are stable for each of the solutions.

4.3 Sensor Performance of Alcohol Sanitizer Solution A

4.3.1 Repeatability Graph of Alcohol Sanitizer Solution A

For solution A, the repeatability graph were plotted by taking the reading by 20 times with different value reading. If there are more than 3 same value, the rest are not being recorded because we want to find the different value detected to the light that being emitted from white LED that can go through the concentration. If there were same value until 20 times, the graph plotted will not get as what should be it plotted. Below, the graph shows the solution A which gives different reaction value for each of the 3 reading taken. For the first reading, the values were detected from -0.9 untill -3.52. For second reading, the values were detected from -0.93 untill -1.32. Lastly for third reading, the values were detected from -0.99 untill -1.29.

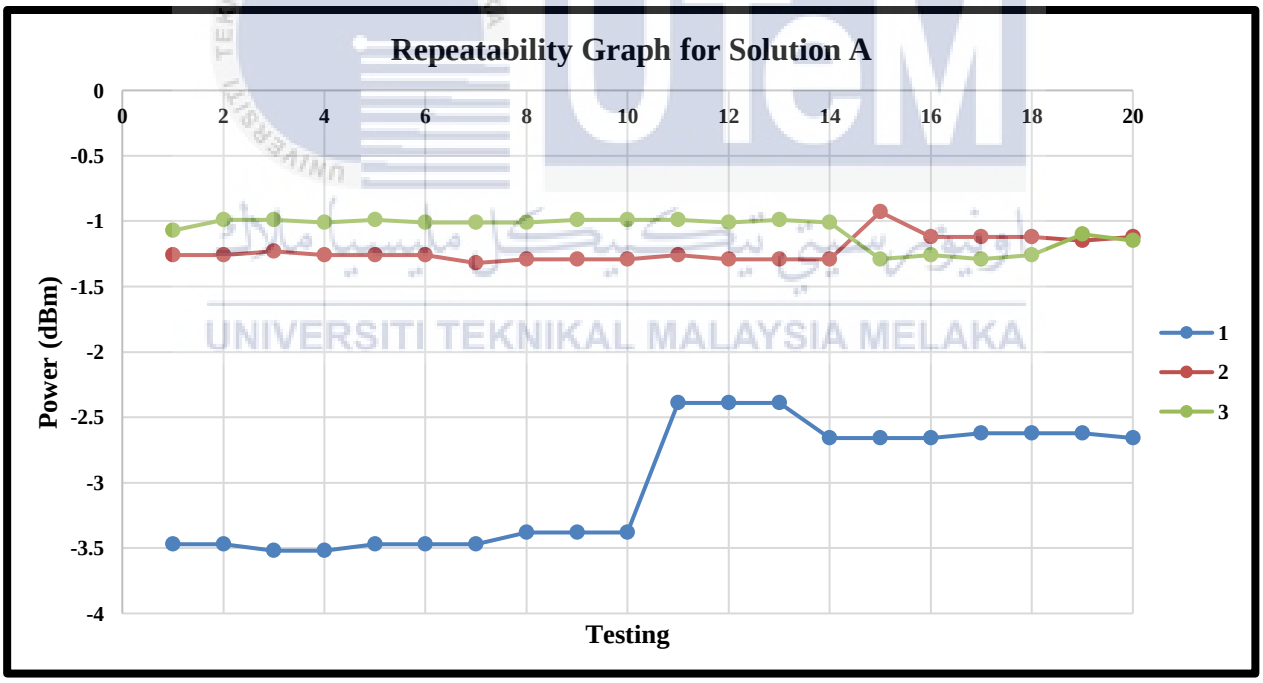

Figure 2. 33 Repeatability Graph Solution A

4.3.2 Linearity Graph of Alcohol Sanitizer Solution A

The linearity graph of solution A was plotted based on the average value of the repeatability graph. The average value of repeatability is calculated by adding the 3 values of 1 time and then dividing by 3 following the process by doing it until 20 times. As the value is calculated, it is the average value that is being used to plot the linearity graph. As the graph shows the linearity graph was an increasing trendline from -1.93 dBm to -1.64 dBm. The sensitivity performance of the solution that being got is 0.0206 dBm/%ppm and the linearity performance of the solution that being got is 80.21%. From the performance value shows that the sensor that was being giving it best to gives the best value.

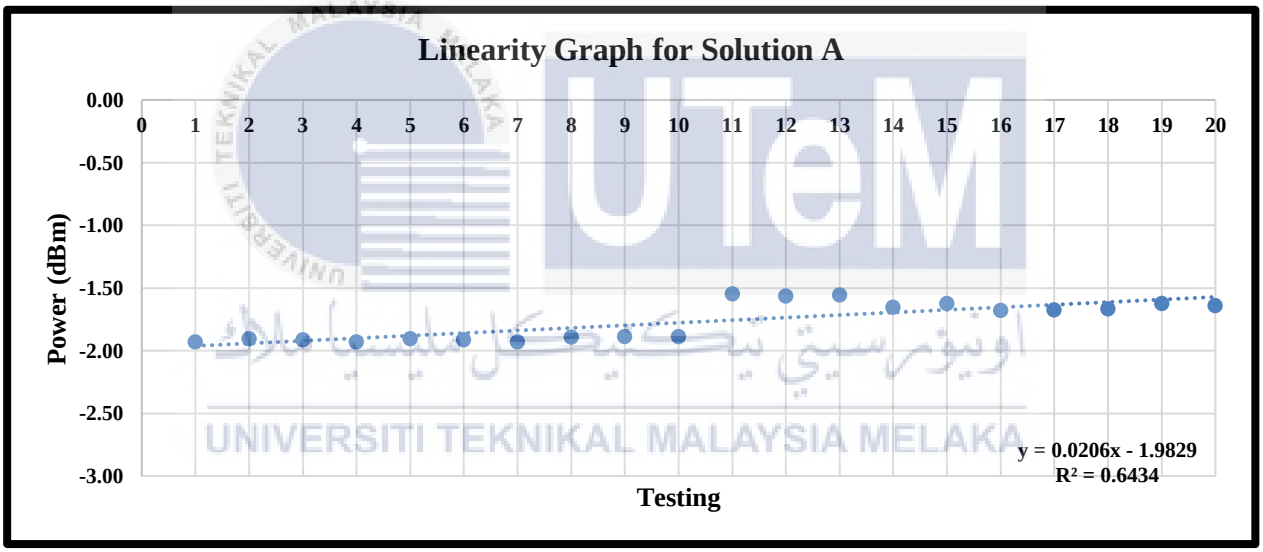

Figure 2. 34 Linearity Graph Solution A

4.3.3 Stability Graph of Alcohol Sanitizer Solution A

The stability graph for solution A is recorded from 1 hour below shows that at the early reading recorded, the reading of solution was not stable. The values were recorded by the LDR sensor detecting the light transmission from the white LED, and the values shown in the early phase were not stable. This is because of the reaction to the sensor that affects the ambient light

and surroundings. The stability value of solution A were stable at highest reading -4.66 and the lowest reading were at -4.72 in 1 hour.

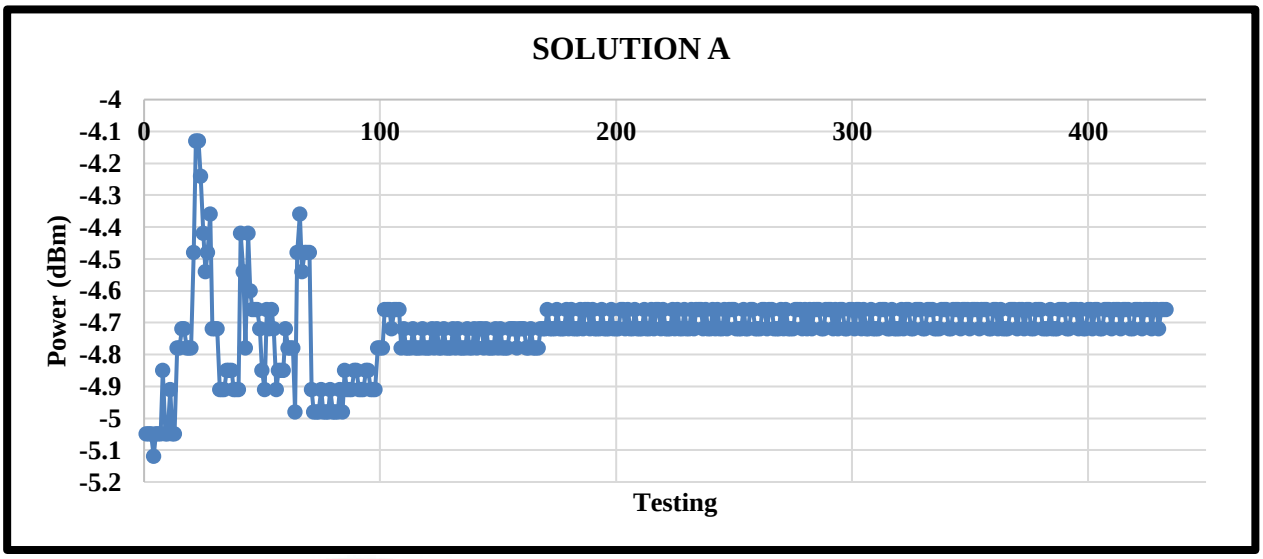

Figure 2. 35 Stability Graph Solution A

4.4 Sensor Performance of Alcohol Sanitizer Solution B

4.4.1 Repeatability Graph of Alcohol Sanitizer Solution B

For solution B, the repeatability graph were plotted by taking the reading by 20 times with different value reading. If there are more than 3 same value, the rest are not being recorded because we want to find the different value detected to the light that being emitted from white LED that can go through the concentration. If there were same value until 20 times, the graph plotted will not get as what should be it plotted. Below, the graph shows the solution B gives different reaction value for each of the 3 reading taken.. For the first reading, the values were detected from -0.9 untill -3.52. For second reading, the values were detected from -0.93 untill -1.32. Lastly for third reading, the values were detected from -0.99 untill -1.29.

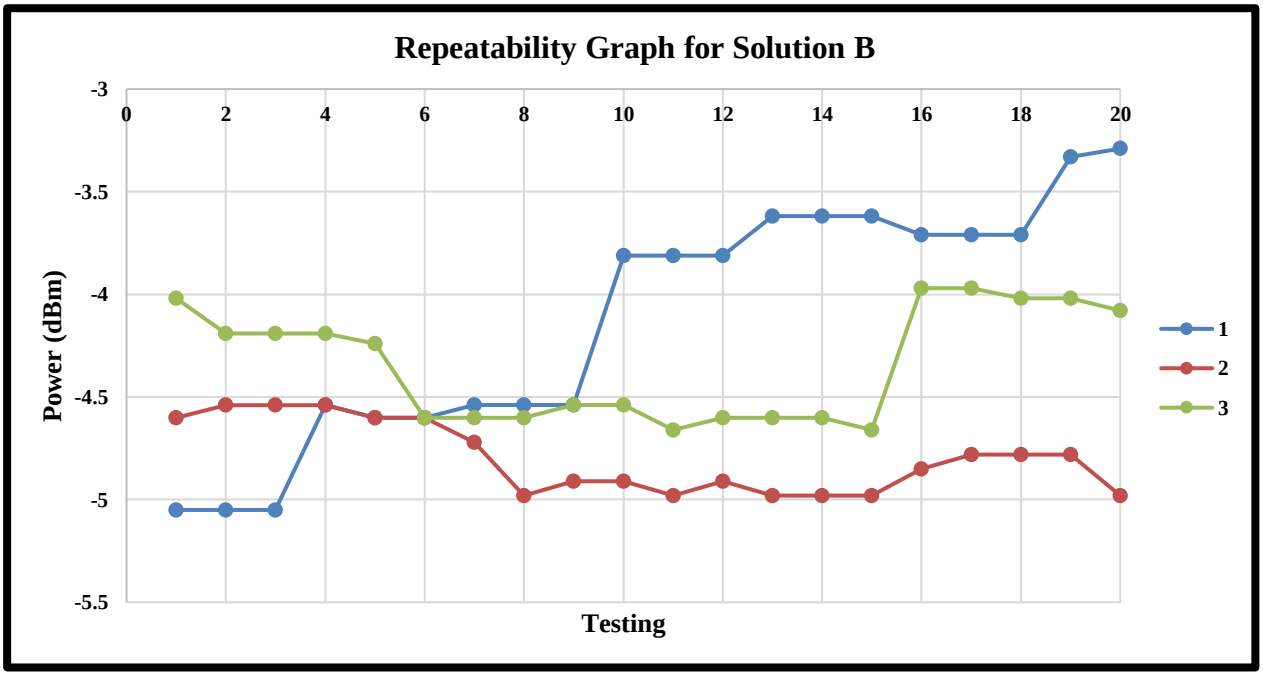

Figure 2. 36 Repeatability Graph Solution B

4.4.2 Linearity Graph of Alcohol Sanitizer Solution B

The linearity graph of solution B was plotted based on the average value of the repeatability graph. The average value of repeatability is calculated by adding the 3 values of 1 time and then dividing by 3 following the process by doing it until 20 times. As the value is calculated, it is the average value that is being used to plot the linearity graph. As the graph shows the linearity graph was an increasing trendline from -4.56 dBm until -4.12 dBm. The sensitivity performance of the solution that being got is 0.0272 dBm/%ppm and the linearity performance of the solution that being got is 82.28%. From the performance value shows that the sensor that was being giving it best to gives the best value.

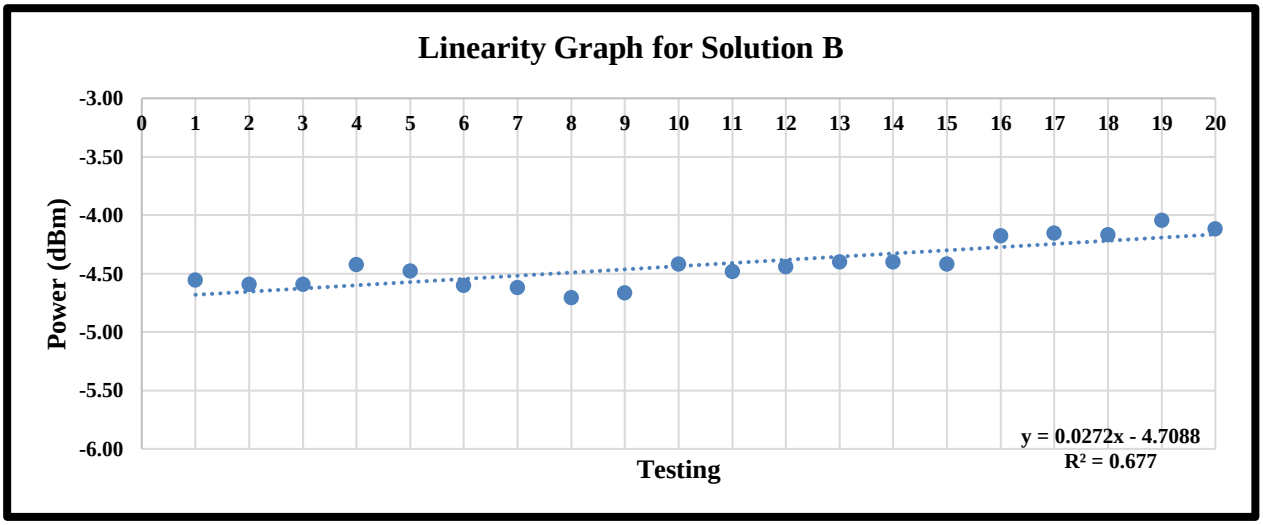

Figure 2. 37 Linearity Graph Solution B

4.4.3 Stability Graph of Alcohol Sanitizer Solution B

The stability graph for solution B is recorded from 1 hour below shows that at the early reading recorded, the reading of solution was not stable. The values were recorded by the LDR sensor detecting the light transmission from the white LED, and the values shown in the early phase were not stable. This is because of the reaction to the sensor that affects the ambient light and surroundings. The stability value of solution B were stable at highest reading -3.38 and the lowest reading were at -3.42 in 1 hour.

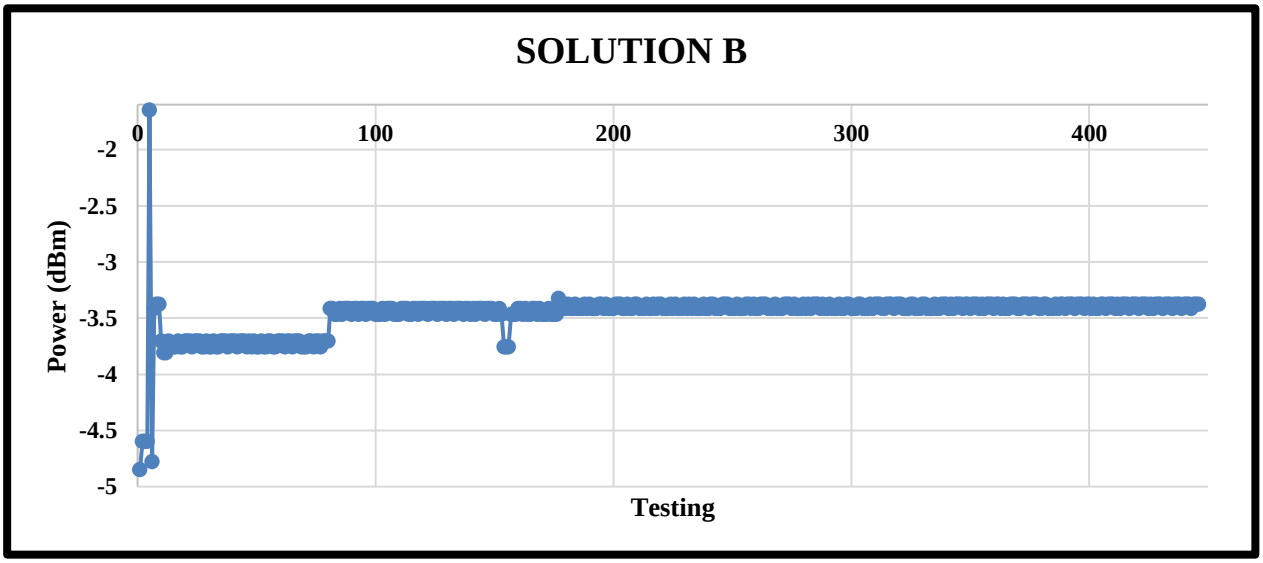

Figure 2. 38 Stability Graph Solution B

4.5 Sensor Performance of Alcohol Sanitizer Solution C

4.5.1 Repeatability Graph of Alcohol Sanitizer Solution C

For solution C, the repeatability graph were plotted by taking the reading by 20 times with different value reading. If there are more than 3 same value, the rest are not being recorded because we want to find the different value detected to the light that being emitted from white LED that can go through the solution. If there were same value until 20 times, the graph plotted will not get as what should be it plotted. Below, the graph shows the solution gives different reaction value for each of the 3 reading taken. For the first reading, the values were detected from -0.9 untill -3.52. For second reading, the values were detected from -0.93 untill -1.32. Lastly for third reading, the values were detected from -0.99 untill -1.29.

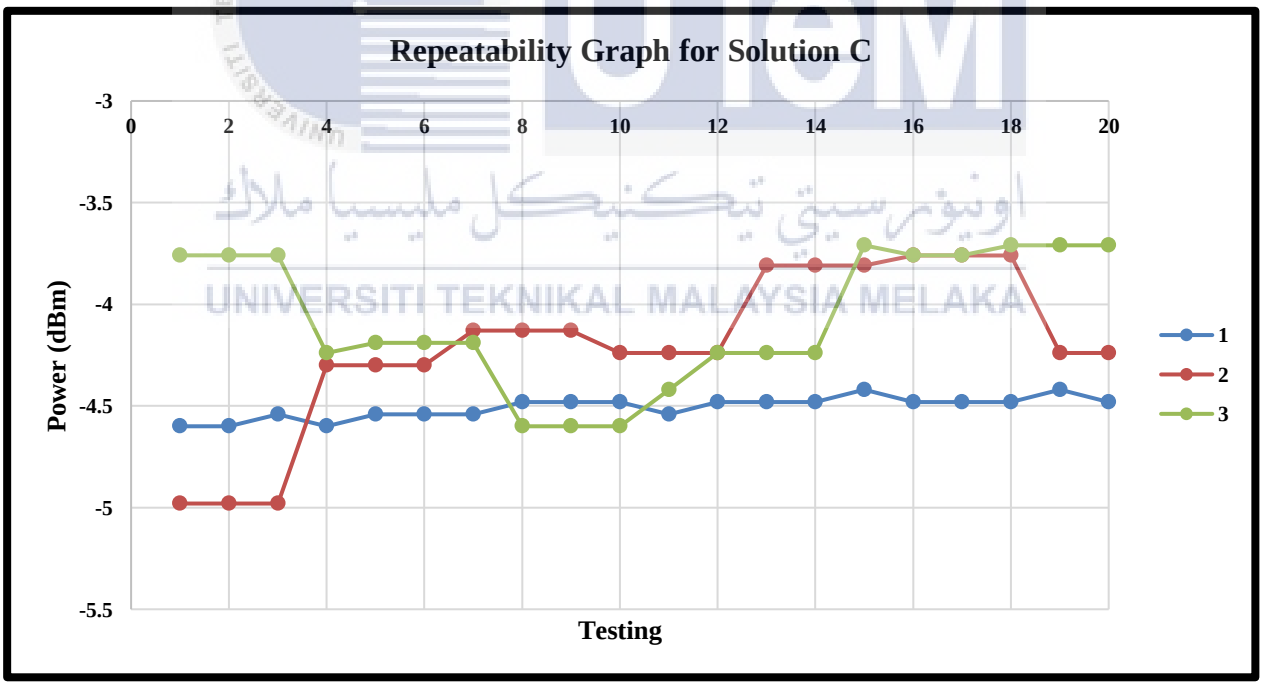

Figure 2. 39 Repeatability Graph Solution C

4.5.2 Linearity Graph of Alcohol Sanitizer Solution C

The linearity graph of solution C was plotted based on the average value of the repeatability graph. The average value of repeatability is calculated by adding the 3 values of 1 time and then dividing by 3 following the process by doing it until 20 times. As the value is calculated, it is the average value that is being used to plot the linearity graph. As the graph shows the linearity graph was an increasing trendline from -4.45 dBm to -4.41 dBm. The sensitivity performance of the solution that being got is 0.0241 dBm/%ppm and the linearity performance of the solution that being got is 83.19%. From the performance value shows that the sensor that was being giving it best to gives the best value.

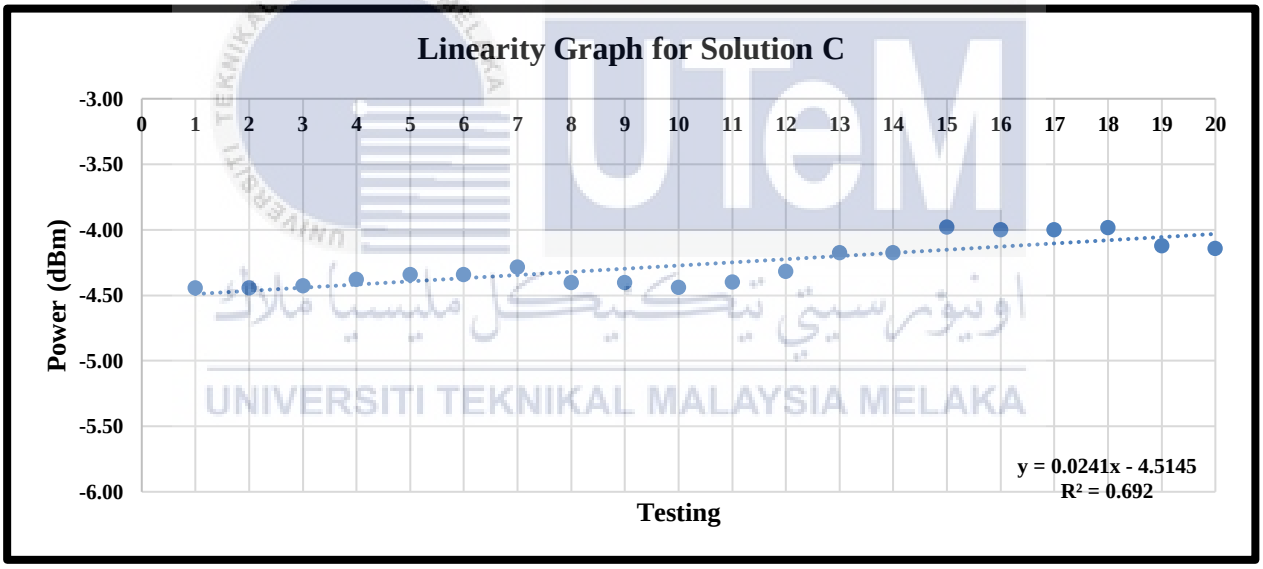

Figure 2. 40 Linearity Graph Solution C

4.5.3 Stability Graph of Alcohol Sanitizer Solution C

The stability graph for solution C is recorded from 1 hour below shows that at the early reading recorded, the reading of solution was not stable. The values were recorded by the LDR sensor detecting the light transmission from the white LED, and the values shown in the early phase were not stable. This is because of the reaction to the sensor that affects the ambient light

and surroundings. The stability value of solution C were stable at highest reading -4.13 and the lowest reading were at -4.19 in 1 hour on 1 phase and on 2 phase, the reading were stable at highest reading -4.08 and the lowest reading were at -4.13 in 1 hour. The reading had 2 phase of stability because of the reaction through the surrounding conditions.

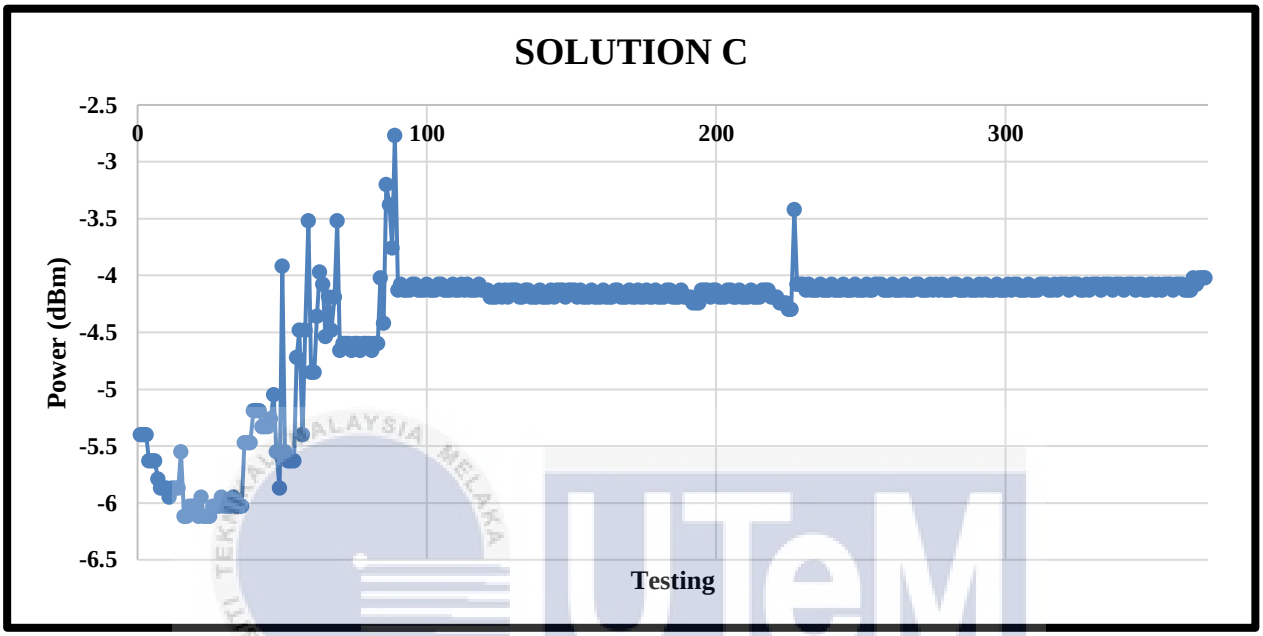

Figure 2. 41 Stability Graph Solution C

4.6 Sensor Performance of Alcohol Sanitizer Solution D

4.6.1 Repeatability Graph of Alcohol Sanitizer Solution D

For solution D, the repeatability graph were plotted by taking the reading by 20 times with different value reading. If there are more than 3 same value, the rest are not being recorded because we want to find the different value detected to the light that being emitted from white LED that can go through the solution. If there were same value until 20 times, the graph plotted will not get as what should be it plotted. As below, the graph shows solution D gives different reaction value for each of the 3 reading taken. For the first reading, the values were detected

from -0.9 untill -3.52. For second reading, the values were detected from -0.93 untill -1.32. Lastly for third reading, the values were detected from -0.99 untill -1.29.

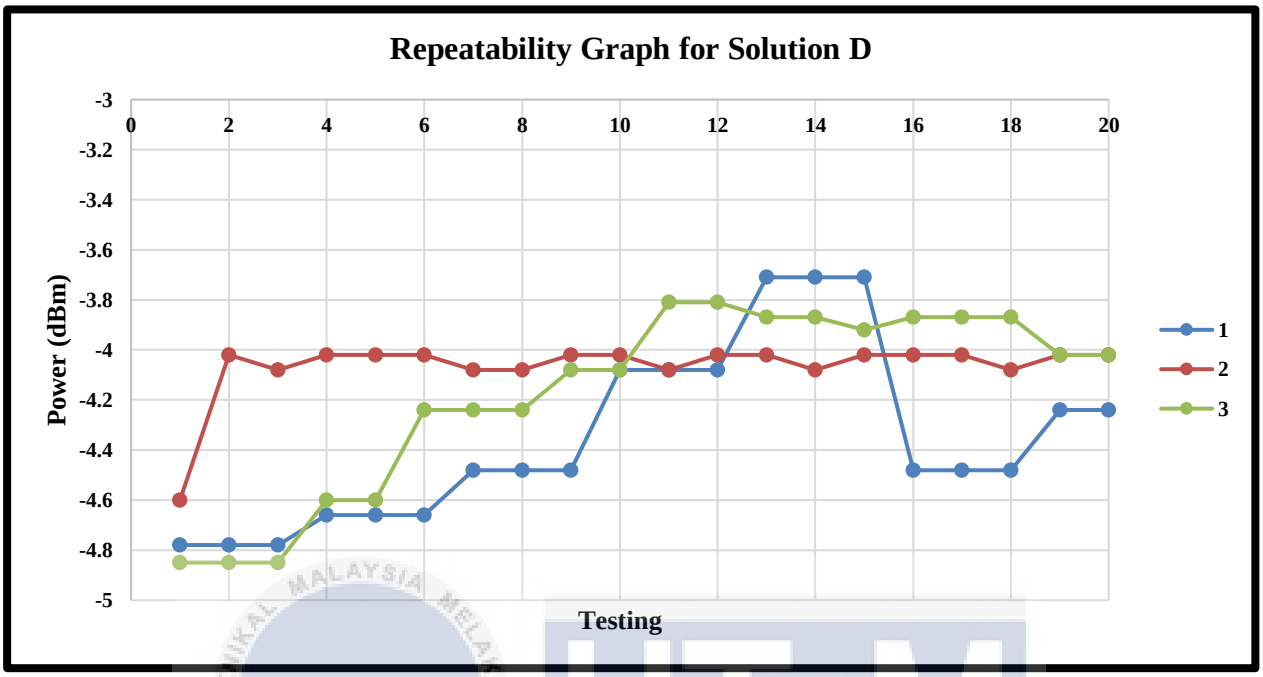

Figure 2. 42 Repeatability Graph Solution D

4.6.2 Linearity Graph of Alcohol Sanitizer Solution D

The linearity graph of solution D was plotted based on the average value of the repeatability graph. The average value of repeatability is calculated by adding the 3 values of 1 time and then dividing by 3 following the process by doing it until 20 times. As the value is calculated, it is the average value that is being used to plot the linearity graph. As the graph shows the linearity graph was an increasing trendline from -4.74 dBm until -4.09 dBm. The sensitivity performance of the solution that being got is 0.0323 dBm/%ppm and the linearity performance of the solution that being got is 78.04%. From the performance value shows that the sensor that was being giving it best to gives the best value.

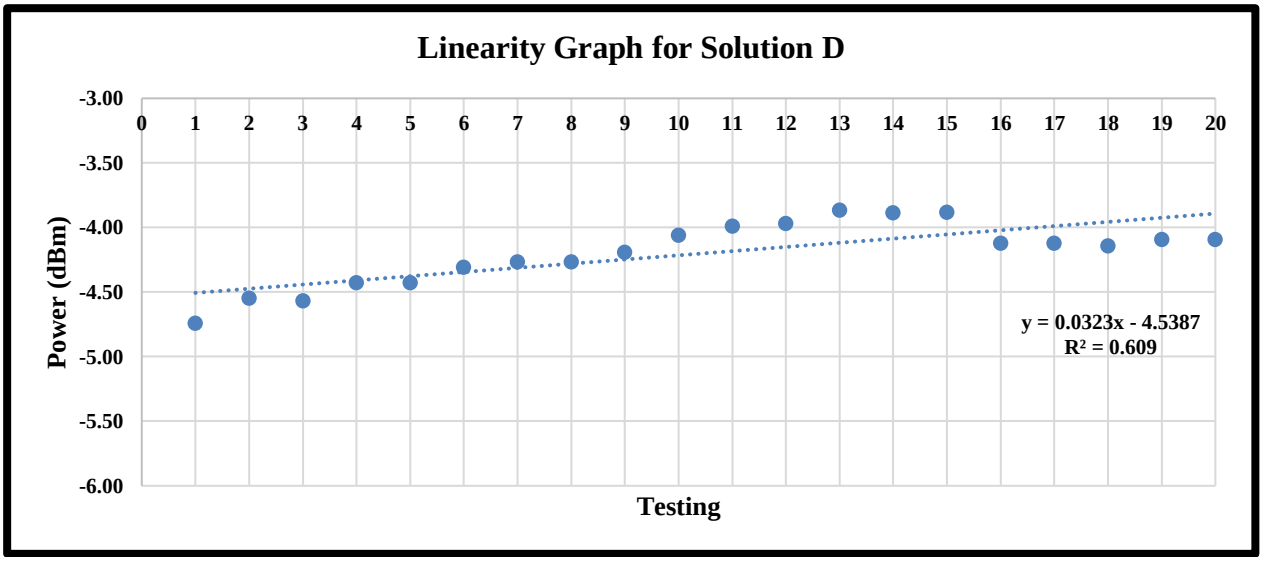

Figure 2. 43 Linearity Graph Solution D

4.6.3 Stability Graph of Alcohol Sanitizer Solution D

The stability graph for solution D is recorded from 1 hour below shows that at the early reading recorded, the reading of solution was not stable. The values were recorded by the LDR sensor detecting the light transmission from the white LED, and the values shown in the early phase were not stable. This is because of the reaction to the sensor that affects the ambient light and surroundings. The stability value of solution D were stable at highest reading -5.47 and the lowest reading were at -5.55 in 1 hour.

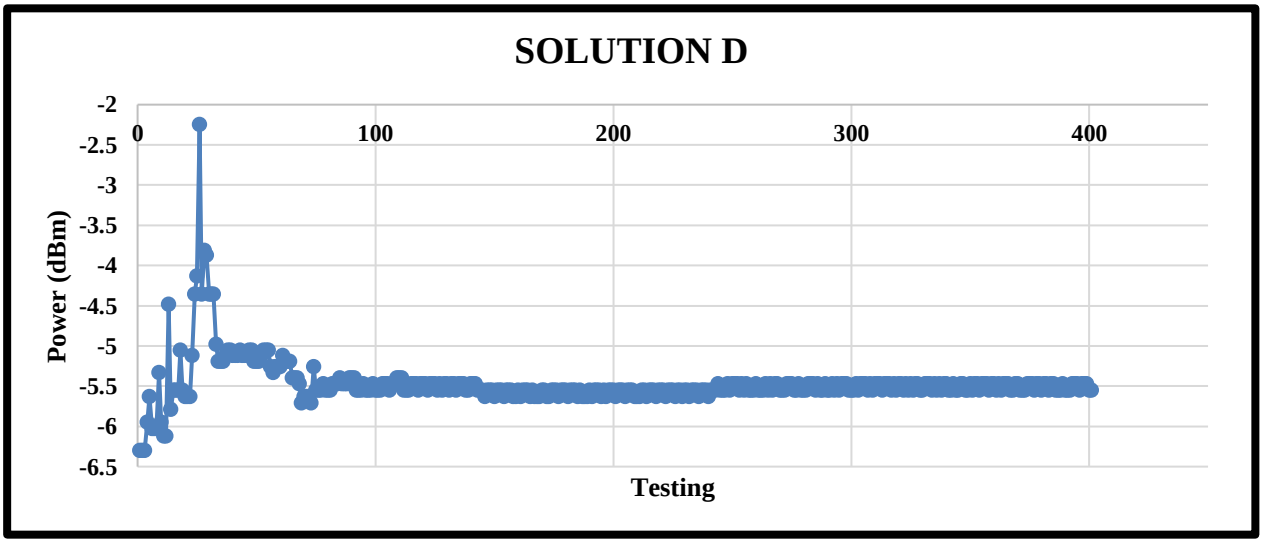

Figure 2. 44 Stability Graph Solution D

4.7 Sensor Performance of Alcohol Sanitizer Solution E

4.7.1 Repeatability Graph of Alcohol Sanitizer Solution E

For solution E, the stability graph were plotted based on the average reading from sensitivity graph. The stability graph were plotted by taking the reading by 20 times with different value reading. If there are more than 3 same value, the rest are not being recorded because we want to find the different value detected to the light that being emitted from white LED that can go through the solution. If there were same value until 20 times, the graph plotted will not get as what should be it plotted. As below, the graph solution E gives different reaction value for each of the 3 reading taken. For the first reading, the values were detected from -2.49 untill -3.66. For second reading, the values were detected from -3.47 untill -3.92. Lastly for third reading, the values were detected from -4.13 untill -4.98.

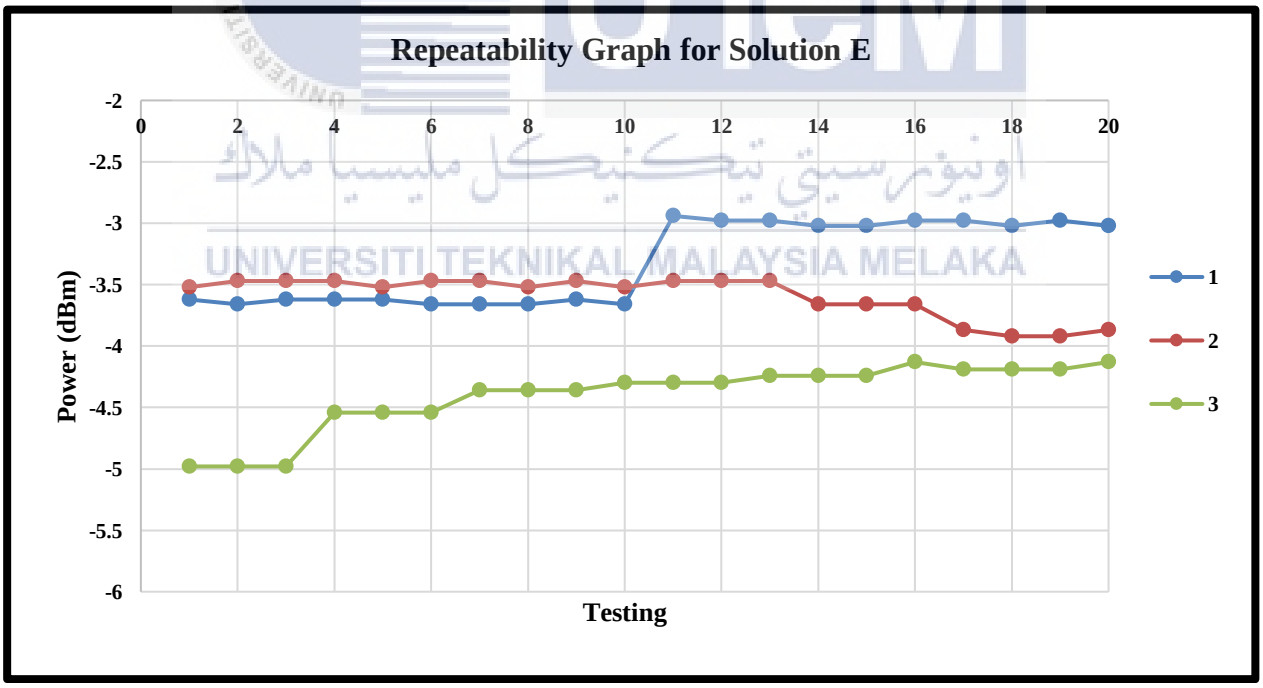

Figure 2. 45 Repeatability Graph Solution E

4.7.2 Linearity Graph of Alcohol Sanitizer Solution E

The linearity graph of solution E was plotted based on the average value of the repeatability graph. The average value of repeatability is calculated by adding the 3 values of 1 time and then dividing by 3 following the process by doing it until 20 times. As the value is calculated, it is the average value that is being used to plot the linearity graph. As the graph shows the linearity graph was an increasing trendline from -4.04 dBm to -3.67 dBm. The sensitivity performance of the solution that being got is 0.002 dBm/%ppm and the linearity performance of the solution that being got is 82.48%. From the performance value shows that the sensor that was being giving it best to gives the best value.

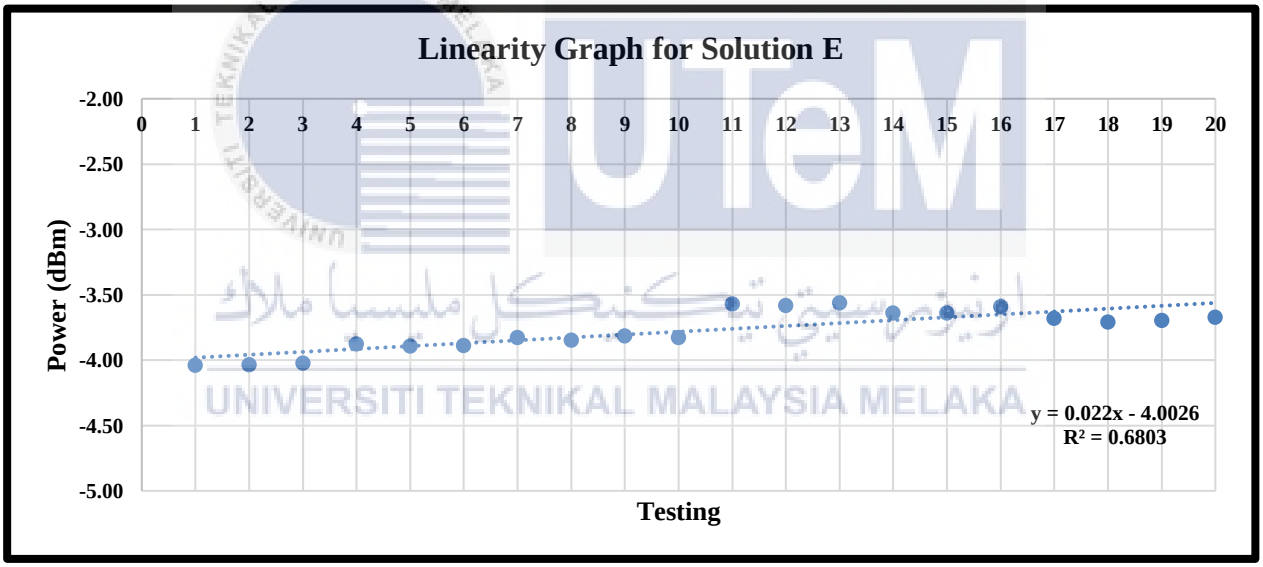

Figure 2. 46 Linearity Graph Solution E

4.7.3 Stability Graph of Alcohol Sanitizer Solution E

The stability graph for solution E is recorded from 1 hour below shows that at the early reading recorded, the reading of solution was not stable. The values were recorded by the LDR sensor detecting the light transmission from the white LED, and the values shown in the early phase were not stable. This is because of the reaction to the sensor that affects the ambient light

and surroundings. The stability value of solution E were stable at highest reading -5.87 and the lowest reading were at -5.95 in 1 hour.

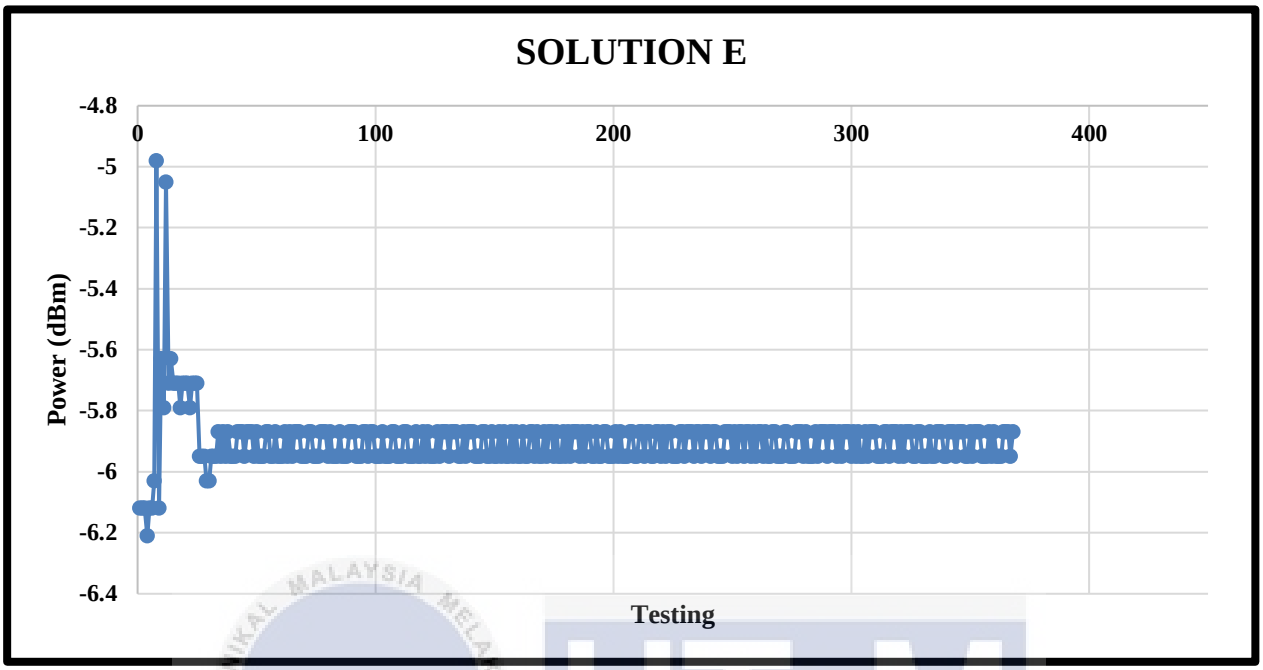

Figure 2. 47 Stability Graph Solution E

4.8 Power vs Solution Graph

The graph below shows the reaction of solution through the power from LED. The solution that being used is from five different brands and different types of concentration from thick to liquid. As what have been plotted in the graph, solution A were plotted in range of -1.55 to -1.93. Next, for solution B, the graphs were plotted in range of -4.04 to -4.71 and -3.87 to -4.45 for solution C. Solution D were plotted in the graph at -3.87 until -4.74. Lastly for solution E in the graph below that have been plotted, the range value is from -4.04 to -3.57. The graph below shows that solution gives sensor to detect the light transmission through it and sensor that being used were react through the light intensity from the white LED could give different value according to the environment.

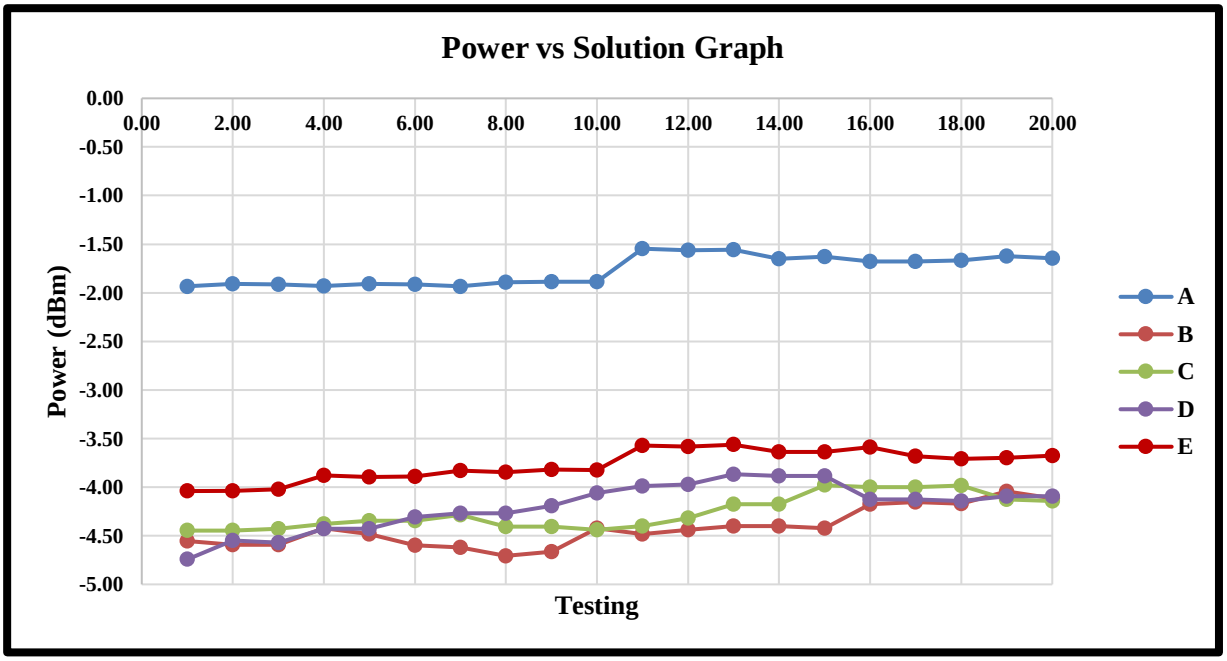

Figure 2. 48 Power vs Solution Graph

4.9 Summary

As had been reported in this chapter, it shows the different types of graph for each of the operation. Besides that, the result showed that alcohol concentration have different responses through the time taken when the stability is measured. The light transmission and sensor played an important role in getting good results. The result that being plotted on the graph shows that the reading might not be stable because of the use of sensor itself where its sensitivity can detect light from the environment when the experiment is being conducted in a room with a light on or the light that came from the nature.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.0 Conclusion

As a conclusion, this project thesis presents the method of making a device where it can analyze the liquid hand sanitizer alcohol concentration by using an LDR sensor and optical power. The purpose of this project were effectively producing the best result from what have been researched thoroughly. The information that being searched were limited to the findings because the past research were not focusing on detecting alcohol from the hand sanitizer. Aside from that, this is why the project were built where it can help people to detect an alcohol level from hand sanitizer where it can help by choosing the best hand sanitizer to use based on their skin conditions. The project objective is the main finding for this project beside to detect the alcohol level inside hand sanitizer, it also to find which are the best performance of the sensor in form of sensitivity, linearity, or stability. The sensitivity is where to find whether the alcohol concentration impact on user and stability is to find whether the alcohol concentration balanced, over or not. The linearity of alcohol concentration graph were to find whether the alcohol level in hand sanitizer were using an appropriate solution in it.

5.1 Chapter 2

In chapter 2 which is focused on literature review of the project. The function of literature review for this project is it really helped in the development process where it involves in project scope and objective. All of the project criteria were being searched for and found where the key to findings and identifying of another research, project and others information

related to the different studies that have been made. The advantages and disadvantages of project were focused on this chapter to find that the LDR sensor and LED can function in detecting the concentration that will be used.

5.2 Chapter 3

In chapter 3 which is methodology where it focuses on identifying the process and procedure of the project. The flow of project from the very beginning until last part was captured in this chapter. Other than that, the layout, block diagram and component that being used for the project were also listed in this chapter. It can help ensure that the project is completed according to the schedule that has been made while using the correct component. The first objective were achieved on this chapter where to create an LDR-based sanitizer liquid concentration.

5.3 Chapter 4

In chapter 4, where the result and discussion were being written. This chapter is focused on writing the results and discussion for the project. Results of the project were taken during the reading of the concentration were being measured. The concentration used to be measured was taken through 5 different types of sanitizer from different brands. Each of the brands gives a different response through the value reading detected by the sensor. This chapter achieved the second and third objective where to analyze the performance of sanitizer liquid sensor and optimized the best possible sensor performance in terms of sensitivity, linearity, and stability.

5.4 Future Works

As for future improvement for this project in detecting the concentration by using the white LED and LDR sensor could be enhance based on below :

a) The use of another LED color with the wider range of transmission of light that can go through the concentration such as red LED, blue LED and many more colors.

b) By using the other sensor than LDR sensor to detect the light that go through the concentration such as photodiode, phototransistor which are more accurate.

c) To improve the result taking analysis where the solution were plotted automatically by using IoT where the data plotted in excel when result process in being recorded.

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