Faculty of Electrical and Electronic Engineering Technology

The Design of IOT Automatic Hand Sanitizer with Water Level Sensor

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Bachelor of Computer Engineering Technology (Computer Systems) with Honours

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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 Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this project report entitled The Design of IOT Automatic Hand Sanitizer with Water Level Sensor is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : *shangetha*

Student Name : SHANGETHA D/O MAHADEVAN

Date : January 26, 2023

APPROVAL

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

Signature : Ts. Niza Binti Mohd Idris

Supervisor Name :

Date :

Signature :

Co-Supervisor :

Name (if any)

Date :

DEDICATION

To my beloved mother, Eagavalli, and father, Mahadevan,

and

To my supervisor Ts. Niza Binti Mohd Idris

ABSTRACT

Automatic Hand Sanitizer With Water Level Sensor (Automatic Hand Sanitizer With Water Level Sensor) is an automatic system that reduces the spread of viruses and the use of human resources. This device will provide high-intensity hand cleaning when placing the palm on its detector. The pump will stop when there is no command received from the detector with the object. Technological progress will make humans easier and happier and safer. Automatic systems are preferred over manual systems. The research results show that the Automatic Hand Sanitizer with water level sensor can control covid infection from spreading because the automatic hand sanitizer provides a solution for saving manpower and avoiding contact which is achieved by detecting the palm of the hand using an infrared sensor and then turning on the relay and the sanitation pump will pump. In addition, this tool can also ensure that the hand sanitizer container always has contents. When the hand is brought close to the hand sanitizer dispensing point, a buzzer will sound indicating that the hand sanitizer pump is activated. After receiving a signal, the device will dispense hand sanitizer in the required quantity in the form of gel or foam. Automatic Hand Sanitizer With Water Level Detection Device can also ensure that the hand sanitizer container always has its contents.

ABSTRAK

Pembersih Tangan Automatik Dengan Alat Pengesan Paras Air *(Automatic Hand Sanitizer With Water Level Sensor)* adalah sistem automatik yang mengurangkan penyebaran virus dan penggunaan tenaga manusia. Alat ini akan memberikan pembersihan tangan dengan intensiti tinggi apabila meletakkan tapak tangan di tempat pengesannya. Pam akan berhenti apabila tiada penerimaan arahan dari alat pengesan dengan objek. Kemajuan teknologi akan menjadikan manusia lebih mudah dan gembira serta lebih selamat. Sistem automatik lebih disukai daripada sistem manual. Hasil penyelidikan menunjukkan *Automatic Hand Sanitizer with water level sensor* dapat mengawal jangkitan covid dari merebak kerana pembersih tangan automatik menyediakan penyelesaian untuk penjimatan tenaga manusia dan menggelakkan sentuhan yang dicapai dengan mengesan tapak tangan menggunakan pengesan Infra merah dan kemudian menghidupkan relay dan pam sanitasi akan mengepam. Selain itu, alat ini juga dapat memastikan bekas pembersih tangan sentiasa mempunyai kandungan. Apabila tangan didekatkan pada tempat pengeluaran pembersih tangan, buzzer akan berbunyi yang menunjukkan bahawa pam pembersih tangan diaktifkan. Setelah mendapat isyarat, alat tersebut akan mengeluarkan pembersih tangan pada kuantiti yang diperlukan dalam bentuk gel atau buih. Pembersih Tangan Automatik Dengan Alat Pengesan Paras Air juga dapat memastikan bekas pembersih tangan sentiasa ada kandungannya.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Ts. Niza Binti Mohd Idris from the Department of Electronics & Computer Engineering Technology for her precious guidance, words of wisdom, and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) and my parents for the financial support through PSM 1 which enables me to accomplish the project. Not forgetting my classmates for their willingness of sharing their thoughts and ideas regarding the project.

My highest appreciation goes to my parents, (my mother, Mrs Eagavalli, and my father, Mr Mahadevan) and family members for their love and prayer during the period of my study. An honorable mention also goes to elder brother, Dinesh Mahadevan for all play a role in completing this project.

Finally, I would like to thank all the staff at UTeM, colleagues and classmates, the Faculty members, as well as other individuals who are not listed here for being cooperative and helpful.

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mA - Milliamps (mA)

V - Voltage

LIST OF ABBREVIATIONS

- Internet of Things
- Passive Infrared
- Centimeter

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CHAPTER 1

INTRODUCTION

1.1 Background

During pandemic of COVID-19, technologist are focusing on provide device or system to reduce the spread of the virus such as temperature scanner and disinfection machines. Apart from that, hand sanitizer is in great demand around the world during the COVID-19 pandemic since it is one of the most effective ways to prevent the transmission of illnesses and reduce the chance of becoming ill. When individuals are on the go, hand sanitizer is more handy, and the Centers for Disease Control claims that sanitizers should lower the quantity of germs in various settings. One of our Standard Operating Procedures (SOP) is to sanitise our hands at every entrance and leave of the premises. Hand sanitation is a legal requirement for anybody who enters a building. People will always use and touch the same container of hand sanitizer since there is a SOP. People who come into contact with contaminated surfaces or items and subsequently touch their eyes, nose, or mouth might get COVID-19. This might enhance the chances of a human being contracting the virus. People may become infected with the virus if they contact the contaminated surface of an empty hand sanitizer bottle because they are unable to sterilise their hands, then people are considered as not comply with the requirement. The hand sanitizers containers are sometimes empty as the worker or the owner did not realize of the level of hand sanitizer in respective containers. People are really

concern on contact points or parts.

1.2 Problem Statement

We have a standard hand sanitizer container on the premises that we must squeeze or pump , but people are avoiding using it because they don't want to touch the hand sanitizer bottle that has been handled by multiple people.

Some establishments require a staff to stand at the door and serve out hand sanitizer to each visitor or client.

Some premises do not realize that the hand sanitizer is run out which make people to not sanitize their hand before entering the premise. Some people are taking too long to get the hand sanitizer. It will cause the next person to skip sanitizing their hands as they lost their patience to wait for their turn.

1.3 Project Objective

1. To design the system for automatic hand sanitizer with water level sensor
2. To produce the system detect the presence of hand palm near the nozzle
3. To analyse the performance of sensor on detecting hand palm and water level

1.4 Scope of Project

The project focuses on designing automatic hand sanitizer with water level sensor which can analyse the system response to the presence of hand palm

and the performance of sensor on detect the water level. The proposed system required the integration of both software and hardware.

1. Hardware : Arduino Uno, Infrared(IR) sensor, buzzer, breadboard, jumper wires, motor water pump, Ultrasonic sensor.

2. Software : Arduino IDE, Blynk app

The prototype allows the automated distribution of hand sanitizer and detect water level by sensor. It can be used at anywhere required to sanitize hand.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss mainly on the research related development of Automatic Hand Sanitizer. The research related on this project development provides the author the best understanding regards project involved. Some article had been closely studied to analyse automated hand sanitizers and evaluate the advantages and disadvantages that they may provide.

2.2 Previous Development

Research article from the previous development will be explain about the description of block diagram, concept, method and hypothetical researches about security as well as notification system using Arduino ESPWiFi module and IoT emphasize and analysed. Finding knowledge, significant data, and any relevant hypotheses that support the idea of a "IOT Automatic Hand Sanitizer With Water Level Sensor" is the goal of this chapter.

2.3 Review On IOT In Automatic Hand Sanitizer

IoT (Internet of Things) refers to physical things that can connect to a network and exchange information among themselves without requiring human contact. Users can gather information from a number of sources, including humans and

machines, using this, which is known as the "Infrastructure of the Information Society." An object that has received an IP address to enable data transfer over a network is referred to as an IoT object. An item can become a part of the IoT system by adding electronic components like sensors and software. IoT is distinct from the Internet in that it allows common objects with embedded circuits to connect and communicate with one another using the Internet's current infrastructure.[13]

Peter T Lewis spoke to the Federal Communications Commission about the idea of the Internet of Things (FCC). The Internet of Things has expanded tremendously since then. There are currently more than 12 billion connected devices in use, and by the end of 2020, estimates predict that number will rise to 50 billion. With the aid of precise sensors, seamless connectivity, and real-time data collecting and analysis, IoT infrastructure has aided in the execution of efficient decisions. Both manufacturers and consumers have benefited from the Internet of Things.

Manufacturers have learned how their products are used and how they function in the real world and have increased their revenue by providing value-added services that improve and lengthen the life-cycle of their goods or commodities. On the other hand, consumers can mix and manage multiple devices for a more customised and sophisticated experience.

When it comes to automatic Hand Sanitizer , there’s a lot to keep in mind. Automatic hand sanitizer has undergone a significant transformation in recent years and it is expected to continue to do so in the near future. Previously, automatic hand

sanitizer structures were characterised as having system that could go check if the sanitizer liquid is getting low, but a smart automatic hand sanitizer can do much more. As a result, the main purpose is to create a device that will notify the owner by sending a message to their smartphones.[13]

This highlights the importance of using existing infrastructure in the development of the proposed automatic hand sanitizer framework. As a result, this system aims to keep the owner up to date on refill the sanitizer liquid whenever the liquid level below 20%. The price of these automatic hand sanitizer devices for poor populations was taken into consideration during development. Society benefits from their availability and ease of use because they may be easily purchased by lower income groups seeking to improve their well-being.[13].

2.4 Review On the Components Used in Iot For Hand Sanitizer

2.4.1 Arduino ESPWiFi Module

Figure 2.1 Arduino ESPWiFI Module

Figure 2.1 shows the Arduino ESPWiFi Module, which provides the ability to wirelessly connect the Arduino to the internet as a significant feature.With the help of the WiFi Shield, an Arduino board may connect to the internet using 802.11 wireless requirements. A network (IP) stack that supports both TCP and UDP is provided by the Atmega 32UC3 processor, which is also a part of this WiFi shield. Finally, drawings that connect to the internet are produced using the WiFi library.

2.4.2 MKR 1000 WiFi

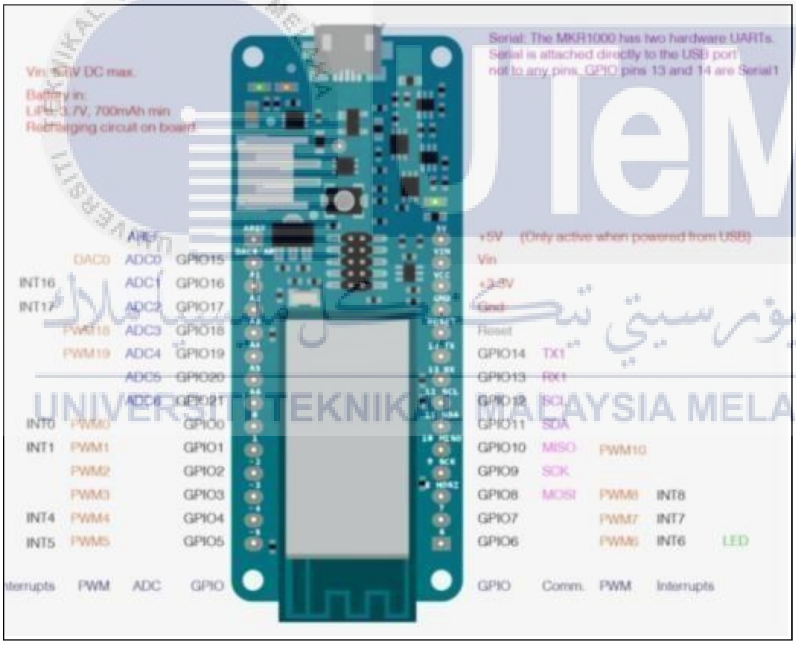


Figure 2.2 MKR 1000 WiFi

Figure 2.2 shows the MKR 1000 WiFi, most straightforward entry point for fundamental IOT and pico-network application design. A low power WINC1500 WiFi board and SAMD21 Cortex were used in the development of the MKR1000. You can

use it to perform any IoT task. In comparison to other IoT boards, it is more preferable due to the bigger number of pins and its features.

2.4.3 Arduino Uno R3

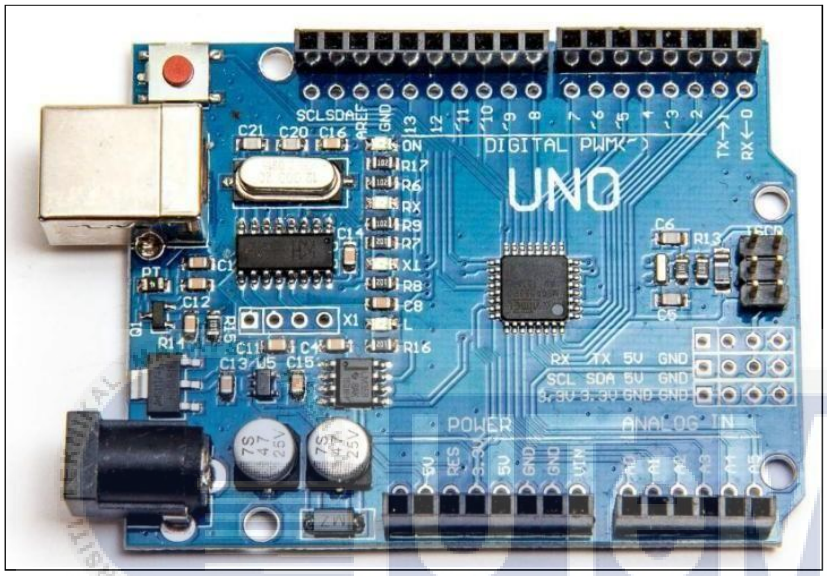


Figure 2.3 Arduino Uno R3

Figure 2.3 shows the Arduino Uno R3, which is Built-in to this board is the ATmega328P processor . The I/O pins on this board can be used by the consumer to communicate with other circuits and boards. In addition to a USB link connector, a power supply connection, an ICSP header, and a reset button, there are fourteen I/O pins attached. The user's desktop computer or laptop can be linked to the board using a USB cable. The IoT-based Arduino Uno R3 module is the least expensive and comes with a wide range of online libraries and tools.

2.4.4 Arduino Pro Mini 328

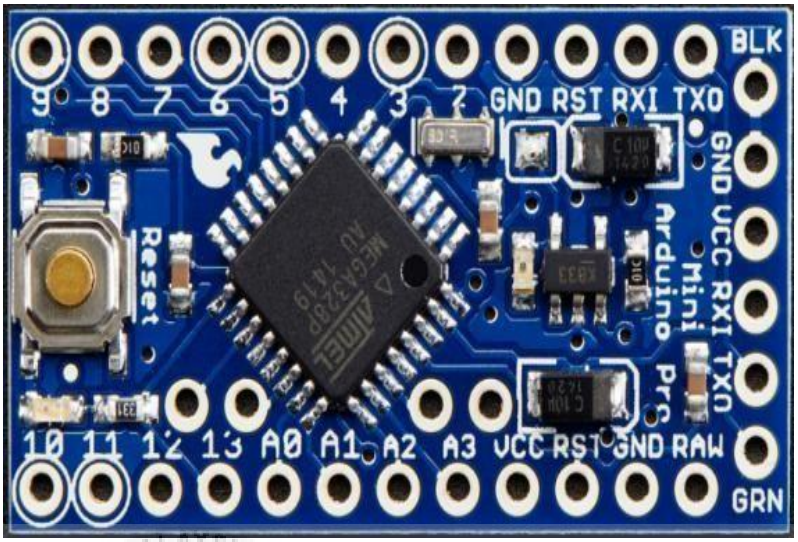


Figure 2.4 Arduino Pro Mini 328

Figure 2.4 shows the Pro Mini 328, this is a different top-notch microcontroller board made by the Arduino company. This micro board, which only supports low-power applications up to 5 volts, includes a 16MHz bootloader. However, the absence of built-in connections and ports is a drawback of the board. The user must therefore solder the link as a result. This microcontroller board is a wonderful choice for anyone on a limited budget.

2.4.5 Quark D2000

Figure 2.5 Quark D2000

Figure 2.5 shows the Quark D2000 microcontroller, it has more I/O controls than other microcontrollers and is among the most powerful ones available. Based on an Intel microprocessor from 1986, this microcontroller was created. This device has a 32-bit microprocessor that operates at 32MHz and has 8K SRAM and 32K FLASH. Finally, this board is extremely versatile because it only requires a 3.3 volt DC supply.

2.4.6 Teensy 4.0

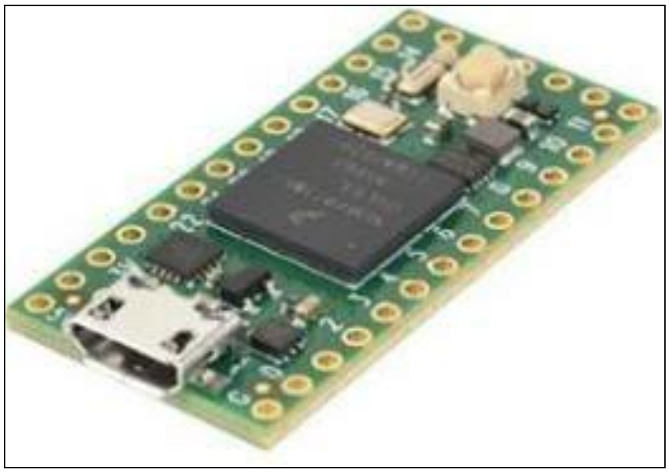


Figure 2.6 Teensy 4.0

Figure 2.6 shows Teensy 4.0. With a 600MHz processor, the Teensy 4.0 microcontroller board. The quickest and most modern board currently available is this one. Compared to other boards, this one is compact and useful for a range of tasks. The Arduino IDE can be used to programme all commands, which are transmitted through two USB ports. The microcontroller is connected to a computer or laptop using a USB cable. Finally, this board has 1024k RAM, compared to the Arduino Uno's 16k.

2.4.7 Launchpad MSP430

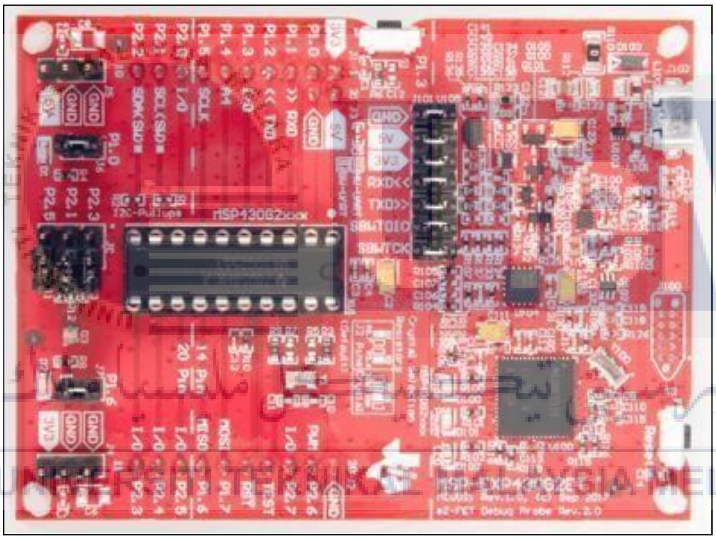


Figure 2.7 Lauchpad MSP430

Figure 2.7 shows The Launchpad MSP430, which is a useful microcontroller for on-board emulation and debugging with Energy Trace. As an alternative to the Arduino Uno R3, this board is a low-power microcontroller with 4k RAM. The main selling point of this board is the inclusion of Energia, an IDE for coding and debugging that is more user-friendly and comparable to Arduino's IDE.

2.4.8 Raspberry Pi 4

Figure 2.8 Raspberry Pi 4

Figure 2.8 shows the Raspberry Pi 4, which was introduced to the world in the year 2019. The quickest microcontroller board ever made is this one. This microcontroller comes with an integrated wireless LAN, Bluetooth 5.0, two USB 2.0 and USB 3.0 connectors, two Micro HDMI connections, and a Gigabit Ethernet port. With its 4GB RAM, users can design effective and sophisticated electronic projects, and it can supply up to 1.2A current for USB devices. It has a range of RAM configurations, from 1GB to 4GB.

2.4.9 Raspberry Pi Zero W

Figure 2.9 Raspberry Pi Zero W

Figure 2.9 shows the Raspberry Pi Zero W, which is a microcontroller that can connect to the internet via wireless Bluetooth and LAN. The same features seen on the original Pi Zero are also included on this board. This board comes with a 512MB RAM and a 1GHz single-core CPU. The Raspberry Pi Zero W is a great tool for creating embedded Internet of Things projects.

2.4.10 Raspberry Pi Pico

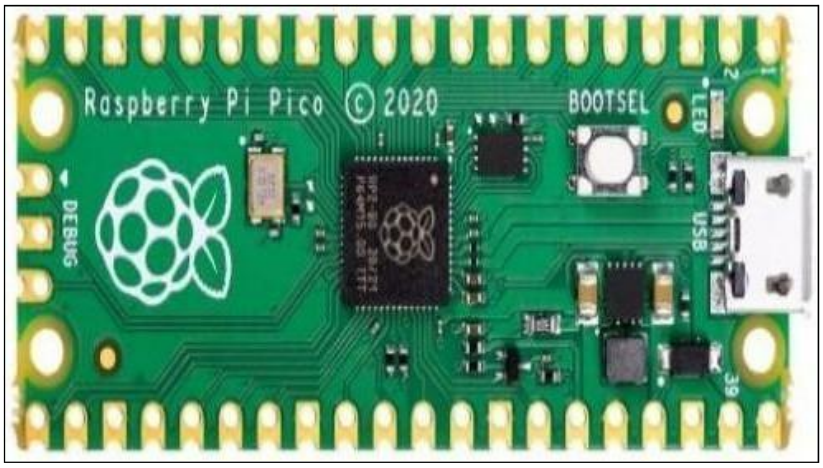


Figure 2.10 Raspberry Pi Pico

Figure 2.10 shows the Raspberry Pi Pico, which is the Raspberry Pi Foundation's first microcontroller. Low-cost computer named the Pi Pico makes use of RP2040 custom processor. On this board, there are numerous adjustable I/O options, including SPI, I2C, and Programmable I/O. (PIO). A dual-core Arm Cortex-M0+ processor, 264KB of internal RAM, and up to 16MB of off-chip Flash support are all included in this microcontroller.

2.5 Review on IOT platforms used in Hand Sanitizer

2.5.1 Blynk

Figure 2.11 The Blynk logo

Figure 2.11 shows the Blynk logo.An easy-to-use drag-and-drop dashboarding programme was created by Blynk and is compatible with iOS and Android devices.This helps interfacing of multiple hardware like Raspberry Pi, Arduino Boards, ESP8266 wifi modules, Nodemcu's etc. It also provides different ways of communication like Bluetooth, USB, GSM and Wi-Fi to connect your hardware devices.

2.5.2 Cayenne My Device

Figure 2.12 The Cayenne - My Device logo

Figure 2.12 shows the Cayenne - My Devices logo.It is a tool for creating Internet of Things (IoT) applications based on platforms like Arduino, Raspberry Pi, ESP8266, and Serial, WiFi, and Lora devices. It also features a MQTT API for connecting to any MQTT client that would be appropriate in this situation. Users may choose their preferred controller and will receive instructions on how to connect it to their preferred IoT link as well as a system token.

2.5.3 Particle

Figure 2.13 The Particle logo

Figure 2.13 shows the Particle logo. Particle provides both hardware and software for IoT projects. The platform includes all of the tools users would require to finish an IoT project. The website also provides SIM cards for mobile devices, networking gear, and a device cloud network. The website also provides tutorials and information on a range of subjects.

2.6 Comparison of Size, Weight and Cost of different component for IoT

Name	Size(mm)	Weight(g)	Cost (RM)
Arduino ESPWiFi Module	68.6 x 53.4	25	38.00
Arduino MKR 1000 WiFi	61.5 x 25	32	178.42

Arduino Uno R3	68.6 x 53.4	25	17.82
Arduino Pro Mini 328	18 x 33	5	10.27
Launchpad MSP430	68 x 56	46	181.36
Quark D2000	87 x 64	320. 35	128.20
Raspberry Pi 4	85.6 x 56.5	46	155.00
Raspberry Pi Zero W	65 x 30 x 5	9	46.00
Raspberry Pi Pico	21 x 51	8.99	17.90
Teensy 4.0	17.78 x 35.56	10	129.00

Table 2.1 Comparison of Size, Weight and Cost of different component for IoT

2.7 Related Previous Works

2.7.1 Design of Automatic Sanitizer Dispenser Machine Based Ultrasonic Sensor

In this paper explains the design of touch-less sanitizer machine to reduce the risk due to contact. This paper was published by a group of researchers (Ashish Gupta and Rajesh Kumar) . The system can sense the proximity with the help of ultrasonic sensor

and sends signal to microcontroller. The controller processes the sensor data and actuates the pump and solenoid valve. The sanitizer liquid dispenses through mist nozzle. [4]

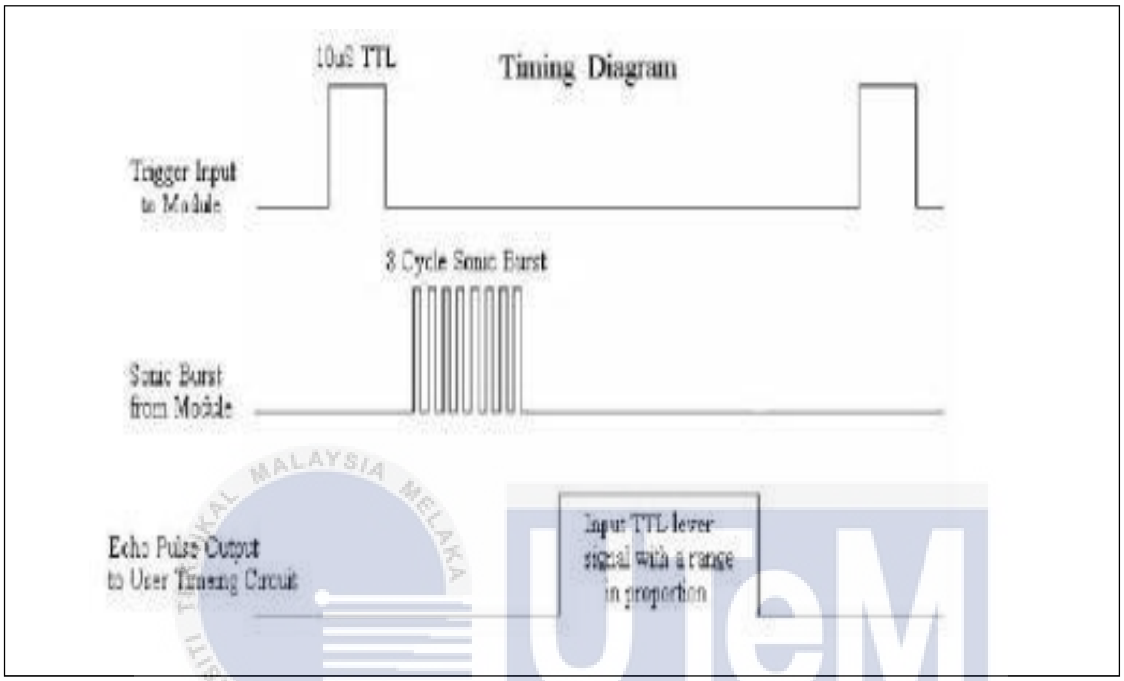


Figure 2.14 Timing diagram for ultrasonic sensor SR04

Figure 2.14 shows the timing diagram for ultrasonic sensor SR04. The ultrasonic sensor need to supply a short 10uS pulse to trigger input to start the ranging, the module will send out an 8 cycle burst of ultrasound at 40kHz and raise its echo. A booster pump increase low water pressure and flow. [4]

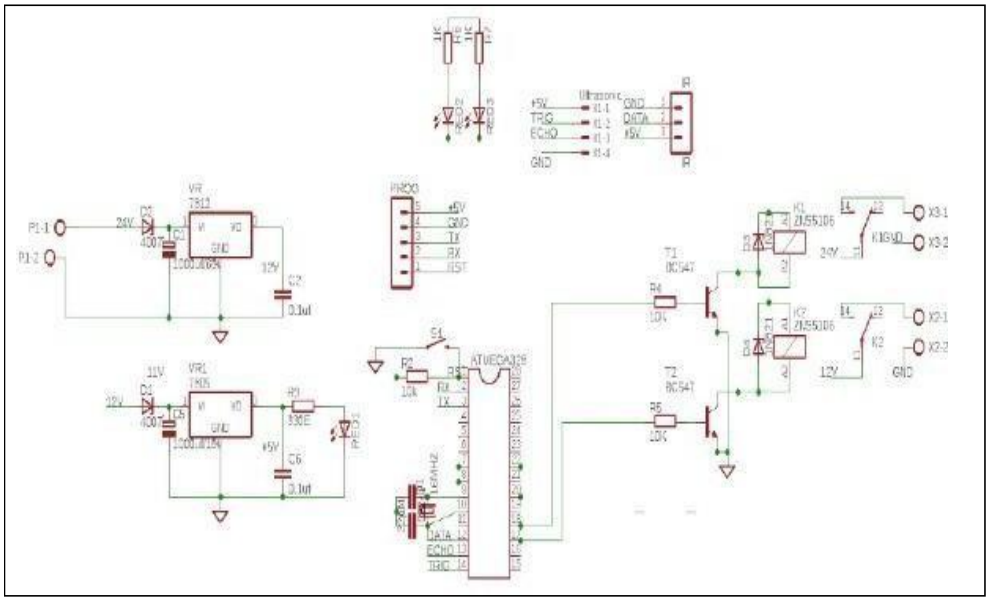


Figure 2.15 Schematic of the sanitizer dispensing machine circuit

Figure 2.15 above shows the schematic design of the system. The two main components of this sanitizer dispensing machine are Ultrasonic ranging module and transmitters. When the sensor module sends a strong signal to the controller, the pump is triggered to draw water from the storage compartment and send it as a mist to the nozzle. The pump is run by the programme for three seconds. Additionally, the application allows for changes to the time per user.[4].

2.7.2 Design of Automatic Hand Sanitizer with Temperature Sensing

In this article, the researcher has stated about design of automatic hand sanitizer with temperature sensing by using software and hardware. We have two systems that function in conjunction with each other. First, the automatic sanitizer, then the contacting temperature sensing. An ultrasonic sensor and a PIR sensor are included into the Arduino to detect human/object range and motion, respectively.On the other hand, the ultrasonic sensor has a range of less than 30cm, thus any movement near(30cm) the device will

trigger the spray pump 2, and the sanitizer will reach the hand through a short pipe. Sanitization occurs simultaneously with sensor activation, ensuring that the area is clean and devoid of viruses, germs, and other infectious organisms. The temperature sensor detects the person's body temperature as soon as it is touched, and the temperature is displayed in Fahrenheit on the LCD display[10].

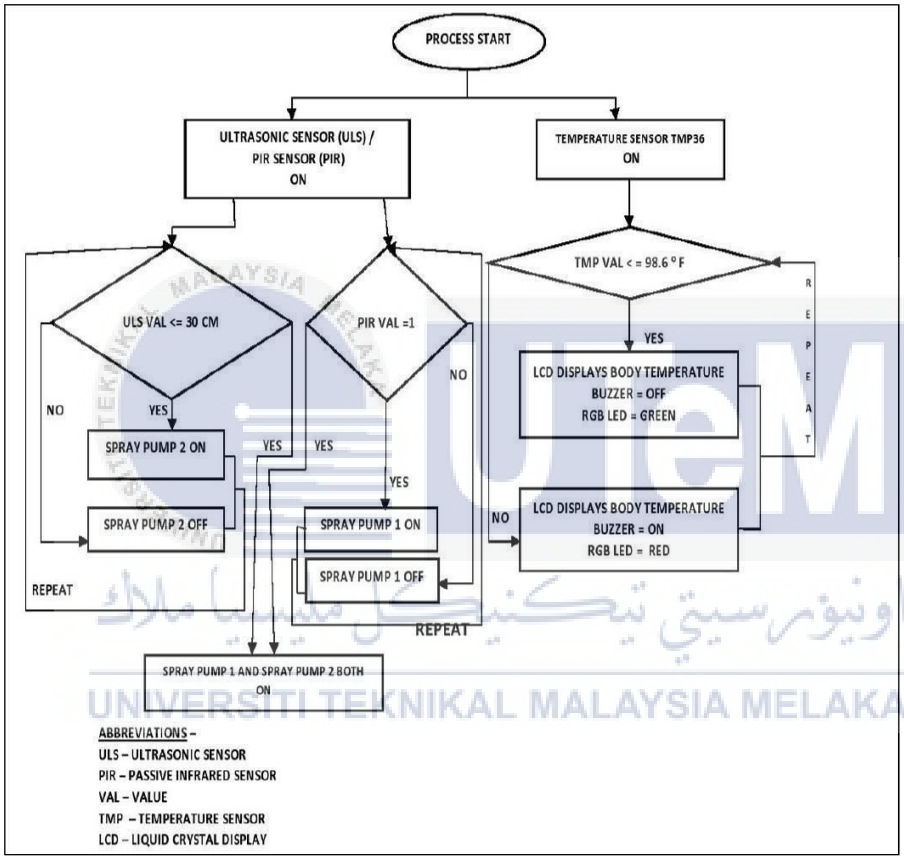


Figure 2.16 Visualization of flowchart

The device circuit is said to be created in software and simulated accordingly. While figure 2.16 visualization of flowchart the hardware, power distribution to each module can be a problem. To solve this, relays must be installed to drive the spray pump and submersible pumps, ensuring that the sensors, lcd, and other minute modules receive enough power from the Arduino microcontroller's inbuilt 10 V and 3.3 V ports. It may be

made at home for a very low cost and installed everywhere, including offices, educational institutions, public transportation, and conventional businesses.

2.7.3 Design and Implementation of a Smart Hand Sanitizer Dispenser with Door Controller using ATMEGA328P

This paper focused on the development and implementation of a low-cost touch-free smart hand sanitizer dispenser with door controller, which incorporates an ultrasonic sensor, LCD display, and servo motor, all of which are Microcontroller-based. To identify the presence of a hand, the researchers are utilising an ultrasonic sensor (HC-SR04). There are two components to this system: hardware and software. A relay, a servo motor, a saleae logic 16 (Logic Analyzer), an LCD display, an ultrasonic sensor, an electromagnetic lock, a 14V DC power supply, a 9V and 5V DC regulator, LEDs, resistors, capacitors, and diodes were all included in the hardware. Saleae logic 1.2.18 and the Arduino IDE make up the software portion. [2]

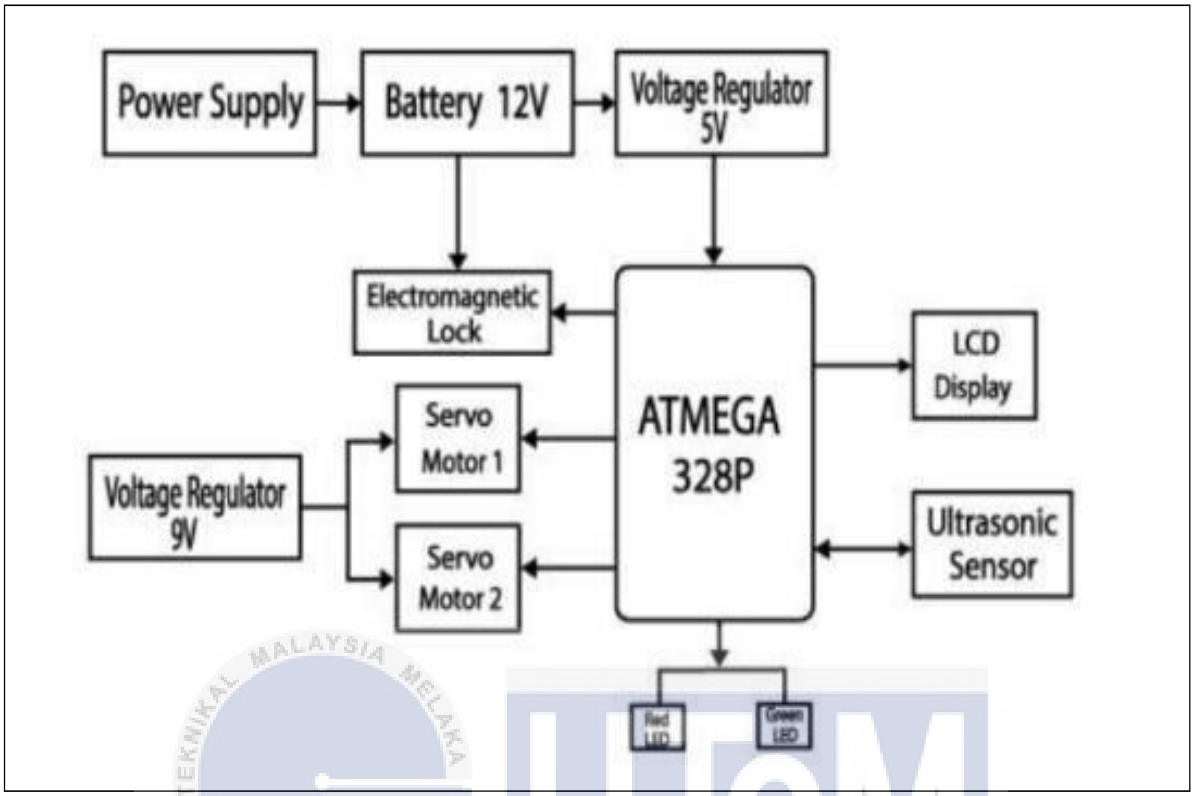


Figure 2.17 Smart Hand Sanitizer Dispenser with Door Controller block diagram

Figure 2.17 shows the process flow of the system. The HC-SR04 ultrasonic sensor was utilised by this system to identify the presence of a hand. It will activate the first servo motor to travel from 0 degrees to 180 degrees in order to pour the liquid on the hand when it recognises the existence of a hand that is shorter than 10 cm. Before returning to 0 degrees, it will wait two (2) seconds. When the temperature drops to zero degrees, the entry door will automatically open, the electromagnetic lock will deactivate, a green LED will illuminate, and the LCD display will read "The Entrance Door is Open." [2].

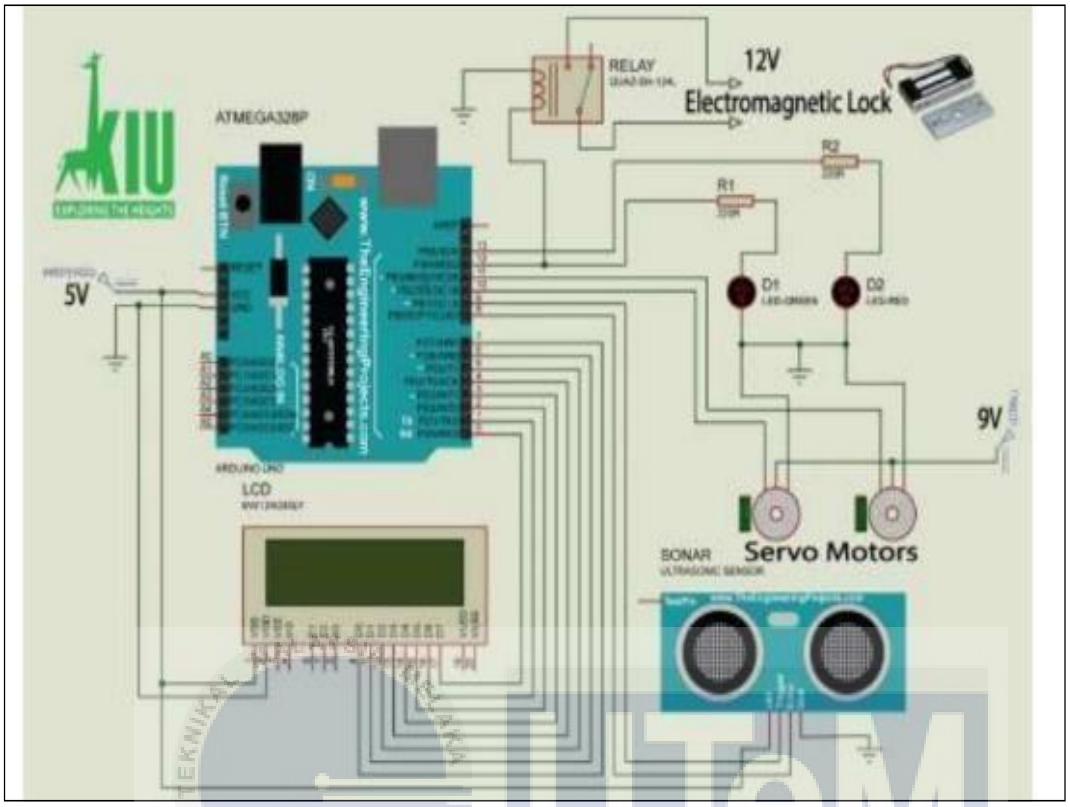


Figure 2.18 Smart Hand Sanitizer Dispenser with Door Controller circuit diagram

Figure 2.18 shows the system's circuit architecture.ATMEGA328P, Ultrasonic sensor, electromagnetic lock, LCD display, relay, servo motor are the main components of the protection device.The ultrasonic sensor, servo motor, electromagnetic lock, LCD display, and LEDs are just a few of the external electronics equipment in this system that are controlled by a microcontroller. For the system to function effectively, the power source provides the voltage and current needed. After the electromagnetic lock directly taps into the 12V DC power source, the regulated DC power supplies for the microcontroller and servo motor are powered at 5V and 9V, respectively. The ultrasonic sensor recognize a hand when it is present (HC-SR04). When it detects the presence of a hand, it triggers the first servo motor to pour the liquid over the hand. The second servo

motor unlocks the entrance door as soon as the electromagnetic lock de-energizes, illuminating a green LED and flashing the words "The Entrance Door is Open" on the LCD display. [2]

2.8 Comparison of previous projects in term of the main component, method, advantages, and disadvantages of different automatic hand sanitizer

Author	Components	Method	Advantages	Disadvantages
(Ashish Gupta, Rajesh Kumar) [4] Novel design of automatic sanitizer dispenser machine based on ultrasonic sensor	• Arduino IDE • Atmega-328	• This system included a ultrasonic sensor which can sense the proximity with the help of send signals to micro controller.The controller processes the sensor data and actuates the pump and solenoid valve. The sanitizer liquid dispenses	• Time required is less • Reduce the risk due to contact • The power consumption is low	• More expensive than the manual Sanitizer

		through the nozzle. [4].		
(Abhinandan Sarkar) [10] Design of the Automatic Hand Sanitizer with Temperature Sensing	3 Arduino UNO R3 4 Ultrasonic Range Finder 5 DC Motor 6 LCD 16 x 2 7 PIR Sensor 8 Piezo Buzzer	• This system introduces an automatic hand sanitizer and temperature sensing system, to keep the hand sanitized without a contact with the sanitizing machine. The temperature sensor on touching gives the body temperature of the person [10].	[1] Fast functioning [2] Very low cost [3] Can install anywhere (Offices, School, Public Transport)	• While prototyping the hardware some power distribution to each module can be a hindrance
(Enerst Edozie, Wantimba Janat , Zaina Kalyankolo) [2] Design and Implementation of	• ATMEGA328P • Ultrasonic Sensor • Electromagnectic Lock • Relay	• The design includes an automated hand sanitizer and temperature sensing system, an ultrasonic sensor is used to check the presence of hands below	• Low cost user friendly system • Implementing the hand hygiene without any challenges	• Required regular and timely maintenance

a Smart Hand Sanitizer Dispenser with Door Controller	• Servo motor	the outlet of the sanitizer machine. It will continuously determine how far away it is from the sanitizer outlet before instructing the microcontroller to activate the servo motor. [2].		
(JuhuiLee,Jin-Young Lee , Sung-Min Cho) [5] Automatic Hand Sanitizer System Compatiblewith Various Containers	• Arduino Uno • IR Sensor • DC Motor • 9V Battery	• An automatic hand sanitizer system was designed, which will be presented in two stages describing the instrument structure and control parts. This work focused on using the elasticity of pumps and improving people's access to devices. [5].	• Low cost • Easy to operate	• Batteries do run down will need to be replaced at a cost of atleast a few RM per dispenser

(Muhammad Imam Syahputra, Ummul Khair, Arnes Sembiring) [3] Automatic Hand Sanitizer Dispenser	• Arduino Uno • Ultrasonic Sensor • DC Water Pump	• In the manufacture of this automatic hand sanitizer, when bring the hand closer to the sensor with a vulnerable distance ,if the sensor captures the object's signal from a predetermined distance, the pump will automatically pump the hand sanitizer out automatically [3].	• Can minimize other people to directly touch the tools provided • Low cost • Easy to operate	• Requires timely cleaning

Table 2.2 Comparison of previous projects in term of the main component, method, advantages, and disadvantages ofdifferent automatic hand sanitizer

2.9 Summary

Based on the problem statement that has been identified, there are various new ideas that are effective and can be used in innovating old products to new ones to solve problems faced by consumers. As such, ideas that provide benefits need to be triggered in order to address problems while working. Once new product ideas and sketches are finalized, there are a number of functions that need to be added in producing better and user-friendly techniques. Until today, there is any product which is distribute hand sanitizer with water level sensor for storing the sanitization liquid. Components such as Arduino, Infrared Sensor, Motor Pump, Buzzer and Breadboard option will be considered in making Automatic Hand Sanitizer with Water Level Sensor. Other than that, the size of container to store hand sanitizer liquid in prototype also will be considered.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will provide precise and detailed descriptions and justifications of component, theoretical approaches, project design, and method. As a result, the flow chart's progress will be depicted to provide a clear and better explanation. The material employed in the project, as well as procedural information on the circuit connection setup method, will be discussed. Similarly, software development will be explored.

3.2 Experimental / study design

Quantitative data analysis and data recording will be done for the project "Development of IoT Automatic Hand Sanitizer." Information with a specific value, amount, or range is known as quantitative data.The component to be analyse is the IR Sensor to determine the suitable distance for the IR Sensor to optimise the system functionality.

3.3 Hardware requirement

The most typical collection of parameters established by any system or software application is the physical component, commonly known as hardware.

3.3.1 Arduino Uno

Figure 3.1 Arduino Uno

Referring to figure 3.1 The Arduino Uno is an open-source microcontroller board created by Arduino.cc that is based on the Microchip ATmega328P microprocessor. Using open-source hardware and software, the Arduino project, corporation, and user community create single-board microcontrollers and microcontroller kits for the creation of digital devices. In Arduino boards, a variety of microprocessors and controllers are employed. The boards contain input/output (I/O) pins for digital and analogue circuits that can be connected to breadboards, expansion boards, and other devices. The boards provide serial communications ports that are used to load software, including Universal Serial Bus on some variants. Programming microcontrollers using the C and C++ programming languages as well as the Arduino language's standard API is possible with the Processing-inspired Arduino programming language, which is utilised with a modified version of the

Processing IDE.

Pin Category	Pin Name	Details
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: ground pins.
Reset	Reset	Resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in the range of 0-5V
Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

Table 3.1 The Pin Category, Pin Name and Details of Arduino Uno

Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

Table 3.2 The specifications of Arduino Uno

3.3.2 Infrared (IR) Sensor

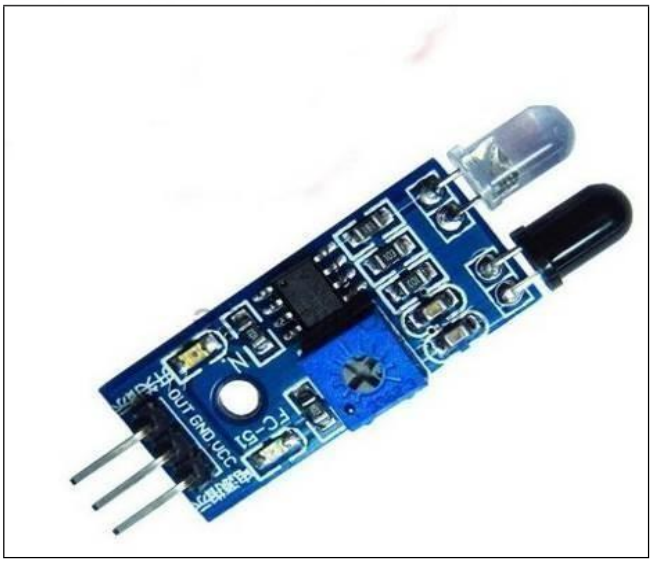


Figure 3.2 Infrared Sensor (IR)

Electrical devices that detect and quantify infrared radiation in their environment are known as Figure 3.2 infrared (IR) sensors. Astronomer William Herchel made an unintended discovery of infrared light. He observed that the temperature just beyond the red light was the highest when he tested the temperature of each colour of light.Infrared radiation is emitted by everything that generates heat (anything with temperature over roughly five degrees Kelvin).

Infrared sensors are divided into two categories: active and passive. Infrared radiation is produced and detected by active infrared sensors. A light emitting diode (LED) and a receiver make up active infrared sensors. When an item approaches the sensor, the LED's infrared light bounces off it and is recognised by the receiver. Active infrared sensors are often employed in obstacle detection systems as proximity sensors.Passive infrared (PIR) sensors do not emit infrared radiation; they simply detect it.Passive infrared sensors are made up of the following components:

- Two pyroelectric material strips
- An infrared filter is a type of filter that is used to reduce the amount of light that enters the (that blocks out all other wavelengths of light)

Figure 3.2 Infrared sensor is device that measures infrared radiation in its surrounding environment.PIR sensors are commonly used in motion-based detection systems, such as home security systems. The difference in IR levels between the two pyroelectric components is measured when a moving object generating infrared radiation approaches the detector's detecting range. The sensor then transmits an electrical signal to a computer inside the device, which causes an alert to be triggered.

Board Size	3.2 x 1.4cm
Working Voltage	3.3 to 5V DC

Operating Voltage	3.3V: ~23 mA, to 5V: ~43 mA
Detection Range	2cm - 30cm
Active Output Level	The output is “0” (Low) when an obstacle is detected
Vcc	3.3 to 5 Vdc Supply Input
Power LED	Illuminates when power is applied
Obstacle LED	Illuminates when an obstacle is detected
IR Emitter	Infrared emitter LED
IR Receiver	The infrared receiver that receives signal transmitted by Infrared emitter.

Table 3.3 The specifications of the IR Sensor

3.3.3 Pump (12V DC)

Figure 3.3 12V DC Pump

Figure 3.3 12V DC pumps come in a number of designs, each with its own set of features, advantages, and uses.DC (direct current) pumps are more handy and portable than AC (alternating current) pumps because they may operate directly from a battery.Because AC systems often require a controller to govern speed, they are easy to handle and control.

Pumps that run on DC are also known to be quiet. Because AC systems often require a controller to govern speed, they are easy to handle and control. DC pumps are also more energy efficient. AC pumps, on the other hand, are often intended for faster speeds and longer bursts of power. In addition, they have a longer operational life than DC pumps.

3.3.4 Buzzer

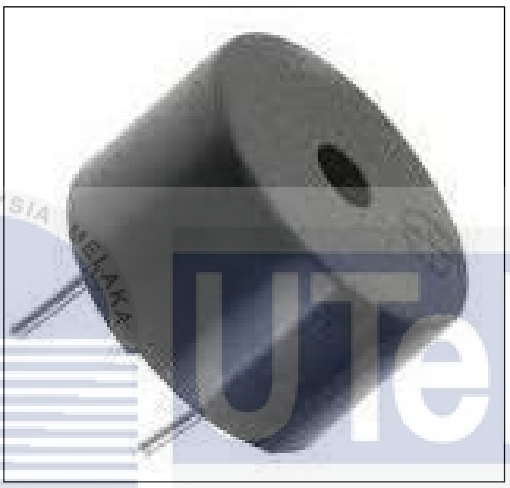


Figure 3.4 Buzzer

Refer to figure 3.4 a piezo buzzer is another name for an arduino buzzer. It's just a little speaker that can be directly attached to an Arduino. It may be programmed to produce a tone at a specific frequency. By reversing the piezoelectric action, the buzzer produces sound.

3.3.5 Ultrasonic Sensor

Figure 3.5 Ultrasonic sensor

Refer to figure 3.5 Ultrasonic sensors employ sound waves to gauge your distance from an item, and they offer data that is more accurate and trustworthy. Ultrasonic sensor is more accurate for accurate numerical representation of distance. Ultrasonic sensors employ sound waves to send and receive data over time.

3.4 Description of Software

All the software used to develop the prototype is discussed in the following subsections. By managing the input and output of hardware components during system development, the software supports the hardware component.

3.4.1 Arduino Integrated Development Environment (IDE) software

Figure 3.6 Arduino IDE

The figure 3.6 Arduino IDE is a text editor that is created in the C and C++ programming language. It's a general free open-source software that's simple to programme and compile. The basic feature makes it possible for those with no prior programming experience to develop code. The Arduino IDE is frequently used to write and modify code for various Arduino micro controller boards. The Arduino IDE is required for writing and importing code to the Arduino Uno in the project.

3.4.2 Blynk application

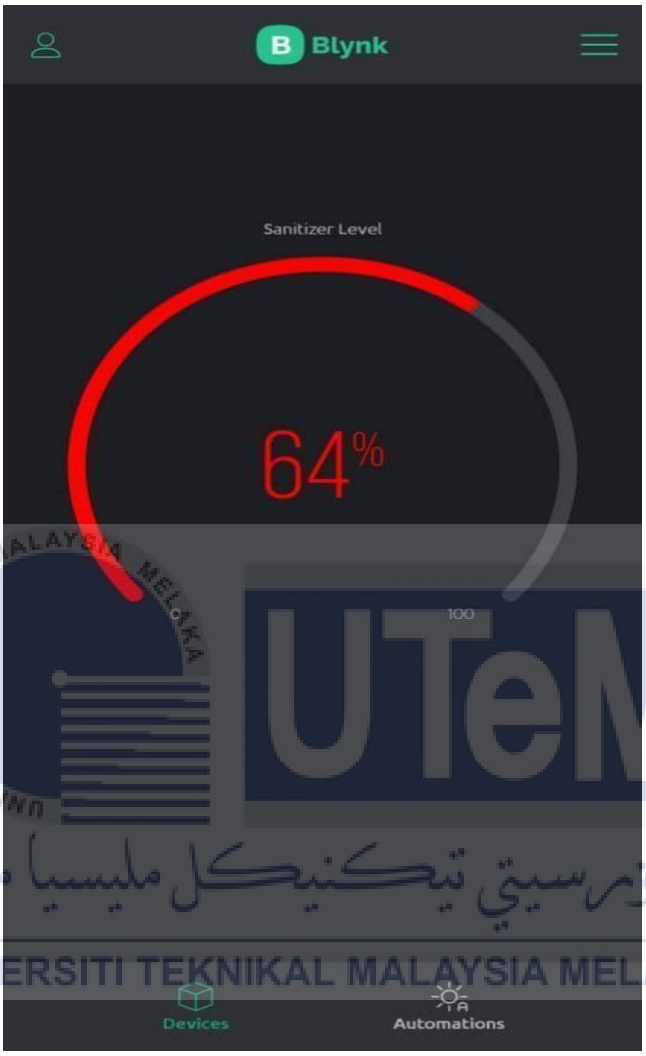


Figure 3.7 Blynk Application Interface

Figure 3.7 shows the Blynk application interface. Users may quickly create user interfaces for managing and controlling hardware projects from an iOS or Android device with the help of the Blynk platform. A project dashboard can be created by placing buttons, sliders, graphs, and other widgets on the computer. The widgets allow the user to show sensor data and turn on and off pins.

3.5 Block diagram of the project

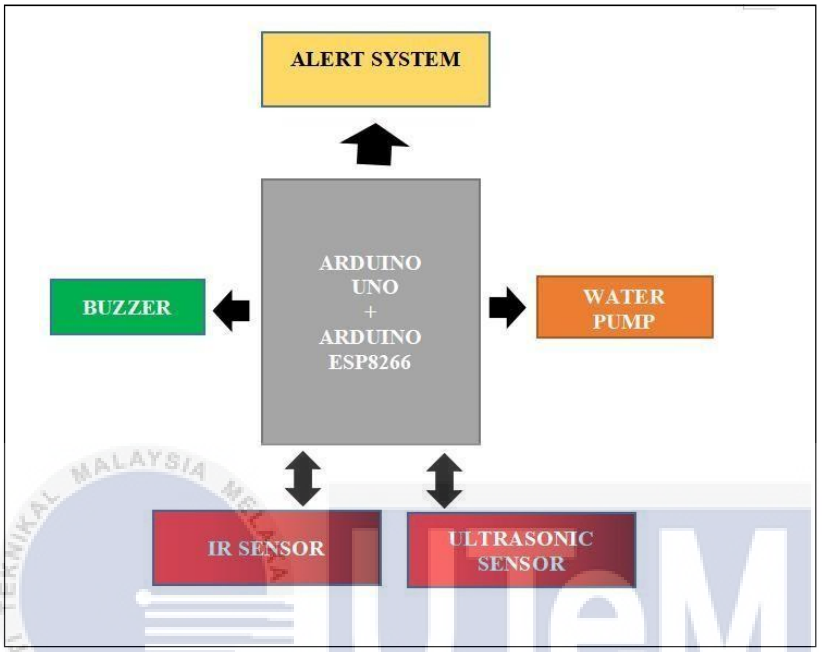


Figure 3.8 The Block diagram of the project

Figure 3.8 shows the block diagram of the project which consists of Arduino Uno, ESP8266, IR sensor, a buzzer , and an Ultrasonic sensor. This project will be used to monitor whenever place hand under the spray nozzle, the IR sensor will detect the presence of hand and trigger input signal to arduino. Once receive signal from IR sensor, arduino will trigger relay to turn on the water pump to start dispensing sanitizer. In other hand, the ultrasonic sensor which mounted on container will measure distance and sends signal to Esp8266 WiFi module. The WiFi module will convert the distance to percentage and trigger the buzzer when condition of liquid level equal to 0% and will off the buzzer when liquid level above 0%. User also will notified in phone to refill the sanitizer liquid by the WiFi module. The percentage of sanitizer level can be monitored via blynk app time to time.

3.6 Planning

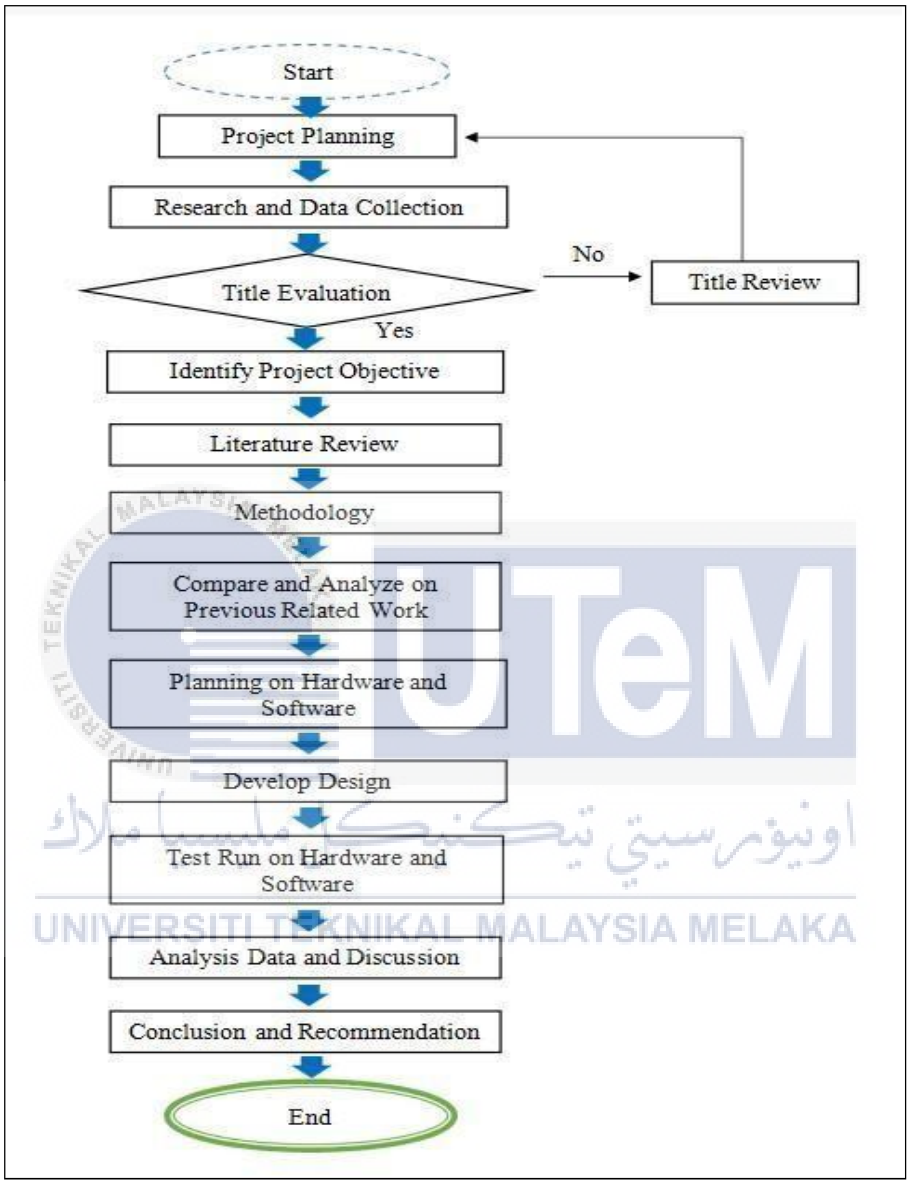


Figure 3.9 Project Flow Chart

Referring figure 3.9 to Project planning is a type of project management that comprises using schedules like Gantt charts to plan and track project progress. The goal of the project is to build a low-cost automated hand sanitizer that employs a water level sensor as a sensor.

3.8 Design

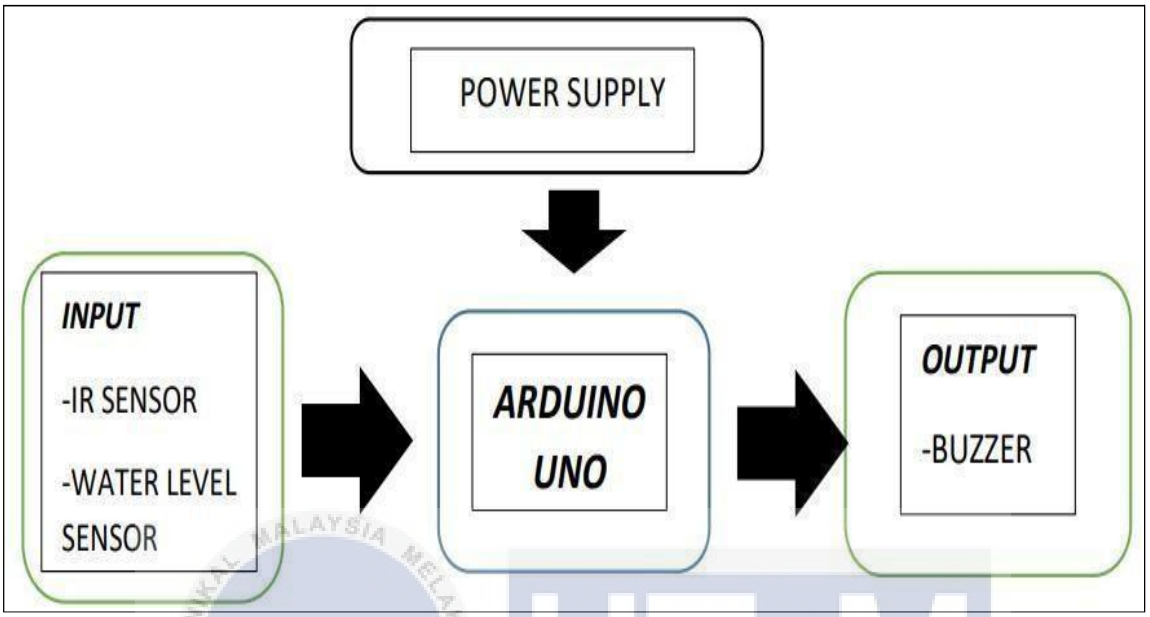


Figure 3.10 Design Illustration

The diagram illustrates the Automatic Hand Sanitizer with Water Level Sensor. The infrared sensor detects the hand motion and send data to the Arduino. The water level sensor detects the amount of sanitizer. When the water level is below 5cm the buzzer will make sound.

3.9 Project Software

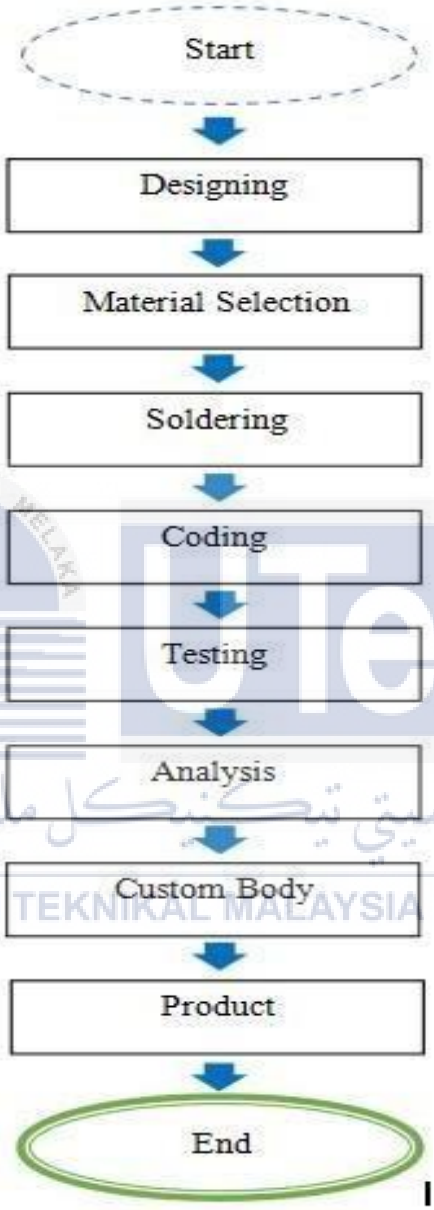


Figure 3.10 Flow Chart for Software of Project

Figure 3.10 shows the flow chart for software of the Project. A flow chart is a diagram that shows how a worrkflow or procedure works. It's a visual illustration of a step-by-step approach to completing the project's mission.

3.10 Cost of project

No	Components	Quantity	Price (RM)
1	Arduino UNO	1	25.50
2	ESPWiFi Module	1	24.80
3	Infrared Sensor	1	6.40
4	Water Pump Motor	1	16.80
5	Jumper Wire Cable	20	5.00
6	Black Junction box	1	8.90
7	5V buzzer	1	1.25
8	Compressor	1	2.00
9	AC to DC Power Adapter 12V	1	7.00
10	Relay Module	1	3.90
11	Ultrasonic Sensor	1	4.90
12	Copper Spray Nozzle	1	4.90
Total			**111.35**

Table 3.1 The quantity and prices of each components for the project

The cost is highly relevant because the main purpose of the project is to generate a low-cost functioning automatic hand sanitizer with water level sensor. The cost of the project is shown in Table 3.1.

3.11 Summary

Multiple methodology has been studied to ensure the outcome prototype is suitable at recent time use. This project's hardware and software selections are justified. The Arduino Uno and Arduino ESP8266 make a great pair, and they're both inexpensive. The Blynk application serves as an excellent IoT platform because to the abundance of online examples and tutorials. The block diagram describes how each system component works. This system's flowchart is simple to read and comprehend.The way to fix all the required components or parts are studied as it is an important step for make the simple and best prototype.

CHAPTER 4

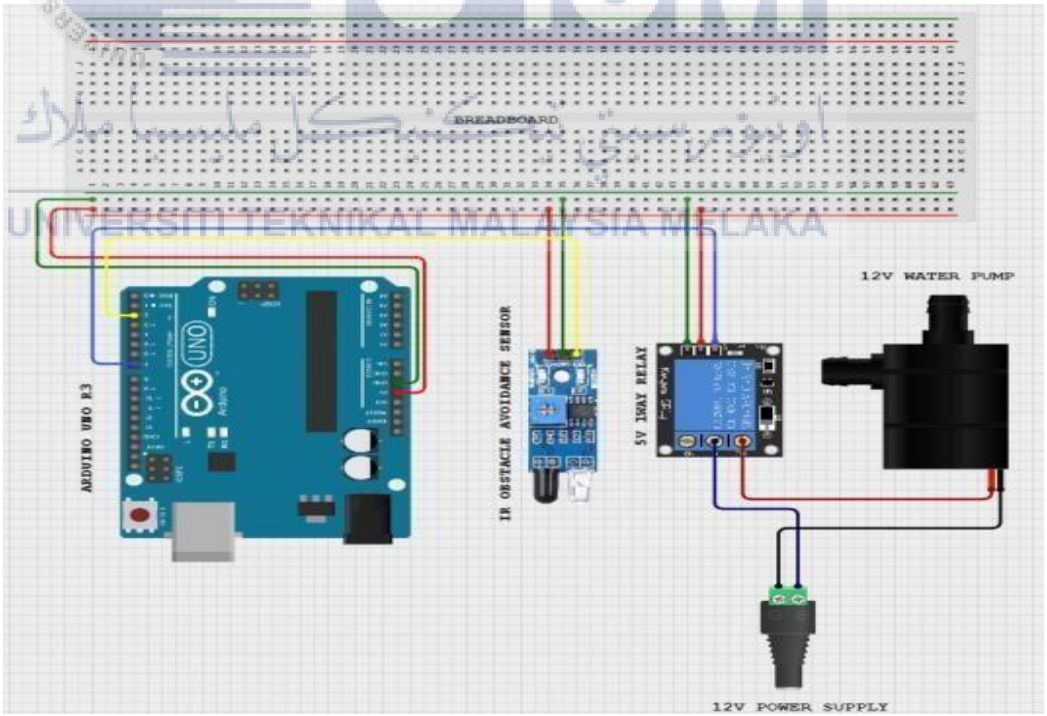
RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter aims to preview the findings and offer commentary on the data gathered while the study was in progress. Testing and analysis are part of this process to assess the data's correctness and precision. This chapter is to make sure that all of the project's goals are achieved.

4.2 Circuit Design On Tinkercad

I



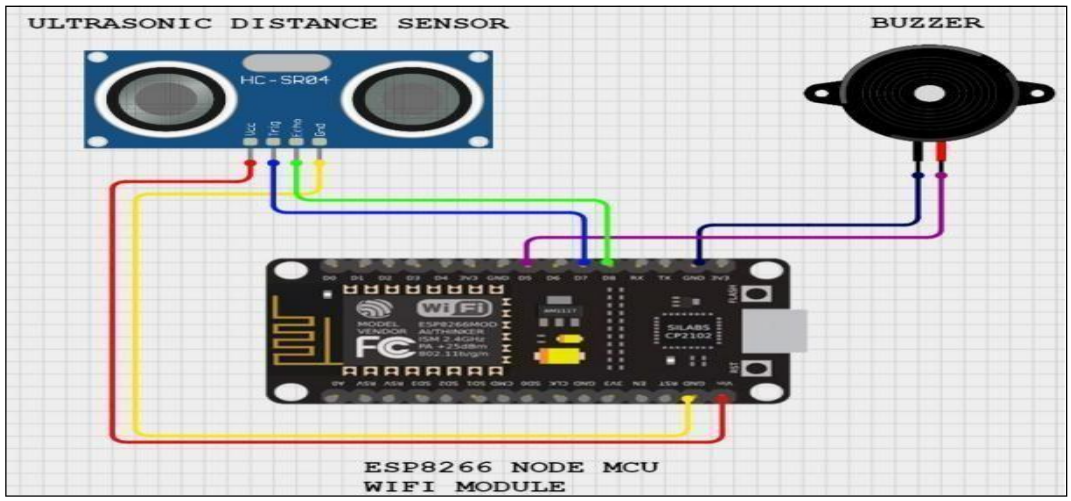


Figure 4.1 The circuit design of the project

Figure 4.1 shows the circuit design of IOT Automatic Hand Sanitizer with the water level sensor on Tinkercad. This circuit contains all the necessary components for the project to run with the WiFi Module. This circuit will be used as a reference when constructing the hardware.

4.3 Project Implementation In a Model Of Hand Sanitizer

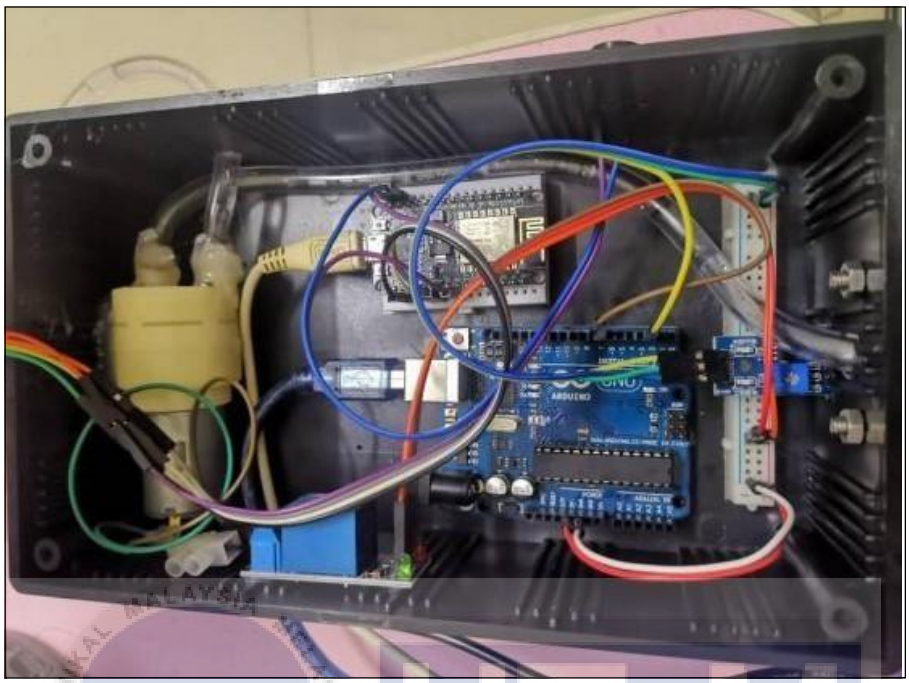


Figure 4.2 Model hand sanitizer with the implementation of the project

Figure 4.2 shows a model hand sanitizer with the placement of each components of the project. This model hand sanitizer will display a better visual understanding of the system.Furthermore, it will be easier to check the connection whenever there's a problem occur.

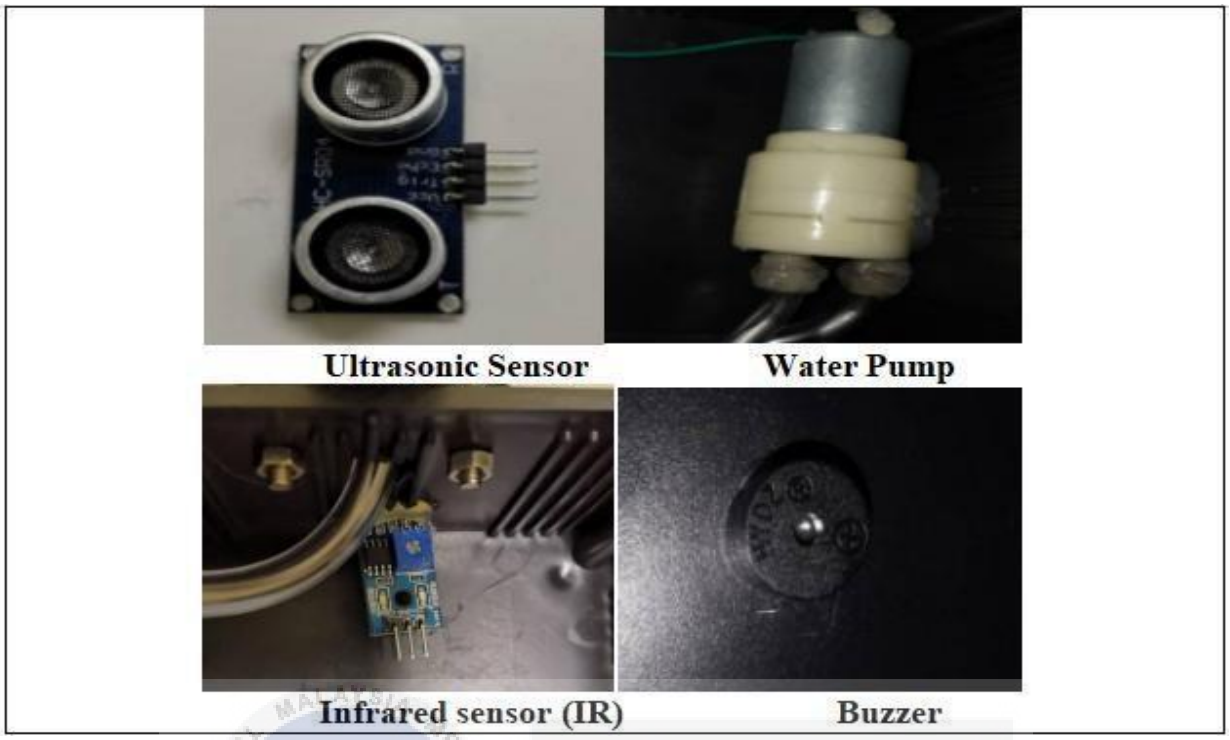


Figure 4.3 Main components in the model of hand sanitizer

Figure 4.3 shows the main components in the model of hand sanitizer. The Arduino Uno will run the coding for the system. Next, the IR sensor are placed in under spray nozzle for hand detection. Finally, the buzzer is place in and will triggered by Arduino whenever the water level sensor detects low volume of hand sanitizer liquid.

4.4 Hand Sanitizer System Interface

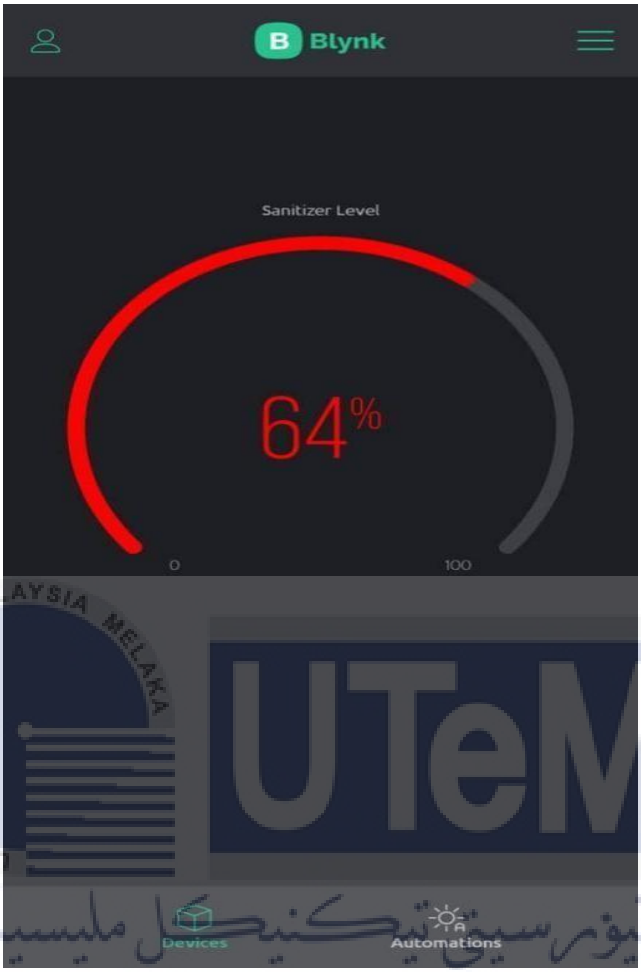


Figure 4.4 Hand sanitizer system interface

Figure 4.4 shows the hand sanitizer system interface on the Blynk app. This interface allows to remotely control connected devices and visualize data from them.The device dashboard consists of widgets that allow controlling and monitoring the device. Next, the Notification widget was used to send notifications in phone to refill the santizer liquid. Finally, every often notifications and alerts offers a way to pre-configure and integrate alerts into the device logic.

4.5 Testing and Troubleshooting

4.5.1 Testing the notification system on Blynk Application

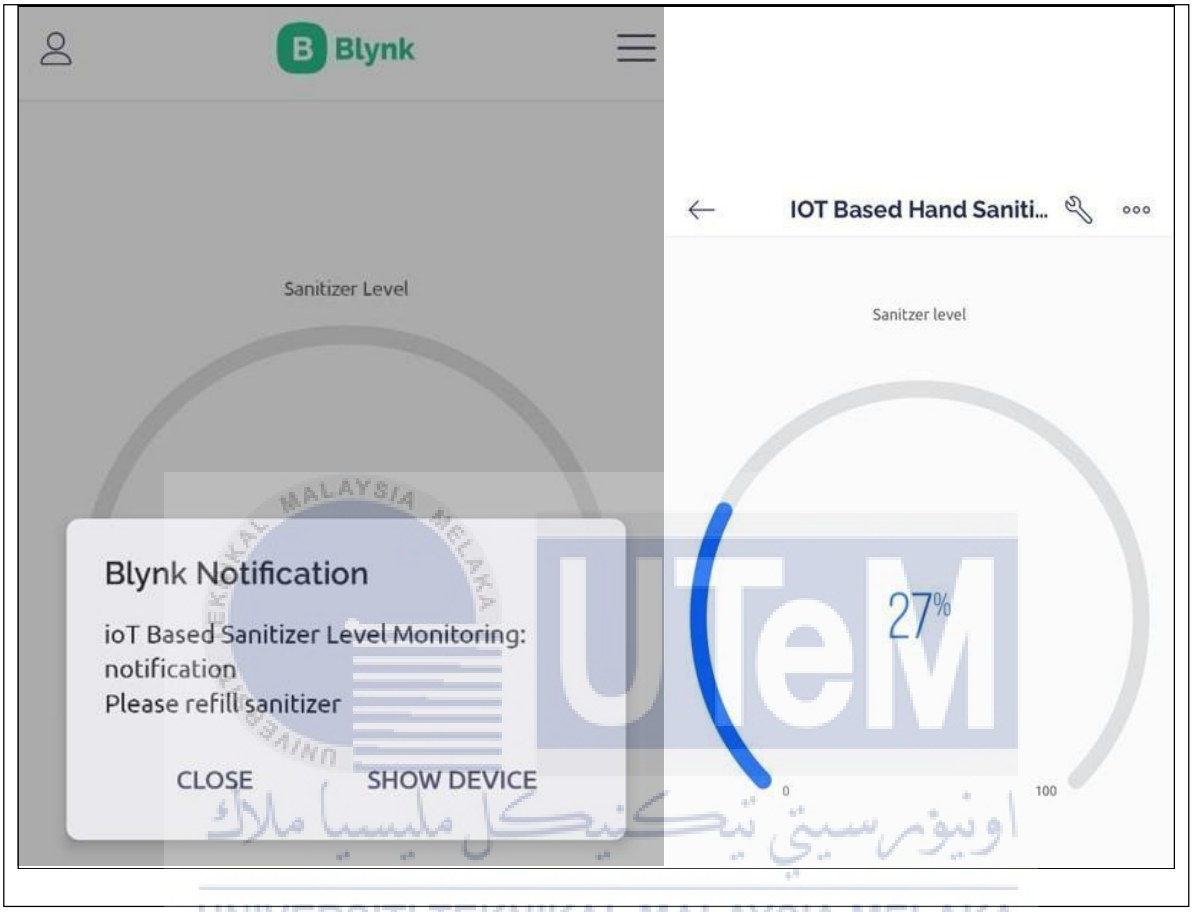


Figure 4.5 Test the notification widget

Figure 4.6 shows a pop up message of “Please refill sanitizer” when condition of liquid level below to 20%. User also will get notified in phone to refill the sanitizer liquid by the WiFi module. The percentage of sanitizer level can be monitored via blynk app time to time.

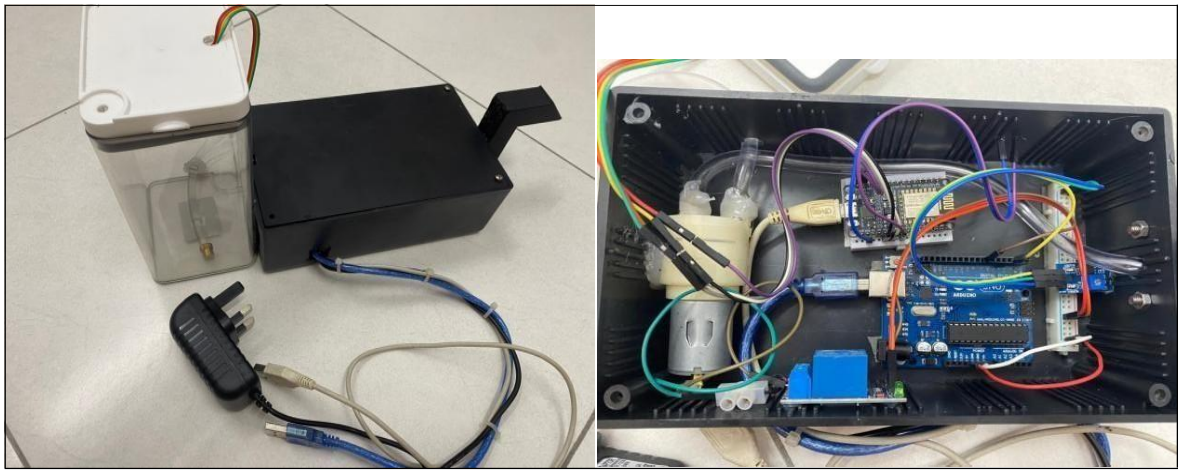


Figure 4.6 Hand sanitizer Prototype

Figure 4.6 shows the tool has been designed and made in prototype form. Where this tool will work in accordance with what has been designed and programmed through Arduino , namely when the Infrared sensor detects the presence of the hand.

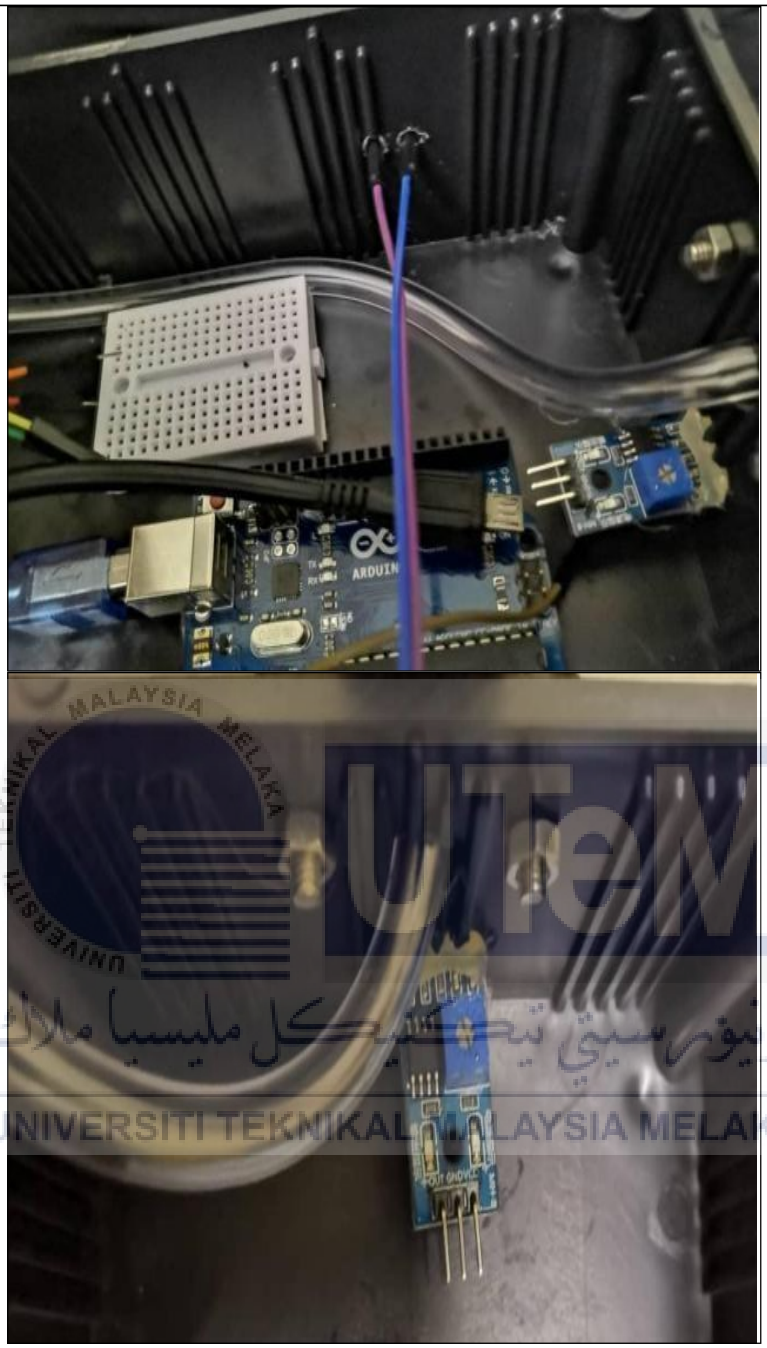


Figure 4.7 Image of Infrared Sensor

Figure 4.7 shows the infrared sensor that is located on the prototype. In this tool, In this tool, this sensor functions as input, namely when the sensor detects the presence of the hand, this process of this tool working. The data received from infrared sensor is

received by the Arduino microcontroller and according to the Arduino program, turn on the servo motor for the processs.

4.5.2 Project Analysis

Hand sanitizer container			
No.	**Number of Attempts**	**Distances (Cm)**	**Average time to receive a notification (Miliseconds)**
1	3	1	88
2	3	2	87
3	3	3	85
4	3	4	86
5	3	5	83
6	3	6	87
7	3	7	85
8	3	8	85
9	3	9	86
10	3	10	85
11	3	11	88
12	3	12	85
13	3	13	88
14	3	14	85

Table 4.1 Distance versus the average time to receive a notification for the container

The data analysis is recorded for the ultrasonic sensors from different distance from the container versus the average time to receive a notification from the Blynk application.

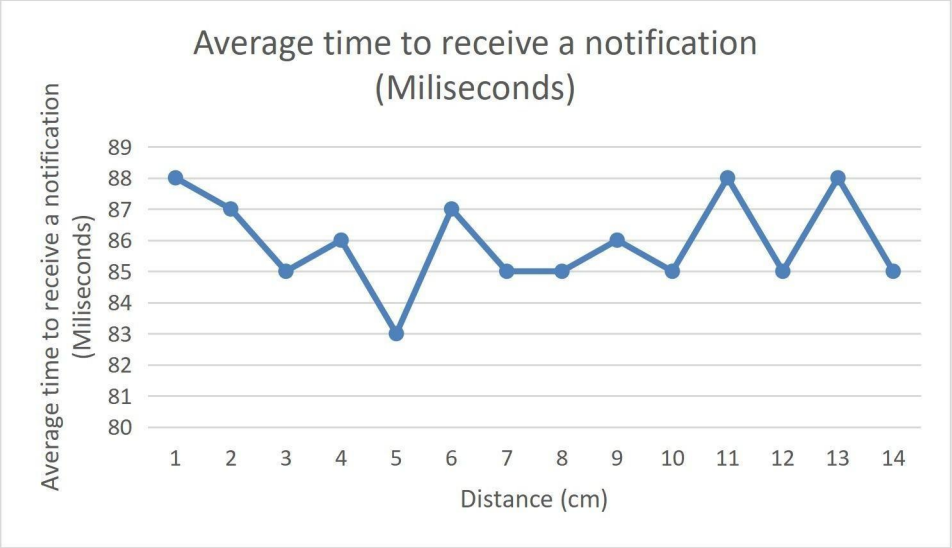


Figure 4.8 Graph of the data analysis from the hand sanitizer container

Figure 4.12 shows the graph of the distance versus the average time to receive a notification for the hand sanitizer container. The data from Table 4.1 was used to create the graph.

Infrared (IR) sensor			
No.	**Number of Attempts**	**Distances (Cm)**	**Rate of hand detection (100%)**
1	3	0.5	0
2	3	1.0	0
3	3	1.5	10
4	3	2.0	20
5	3	2.5	40
6	3	3.0	60
7	3	3.5	75
8	3	4.0	80
9	3	4.5	100
10	3	5.0	100
11	3	5.5	75
12	3	6.0	50
13	3	6.5	20
14	3	7.0	0
15	3	7.5	0

Table 4.2 Distance versus the rate of hand detection (100%)

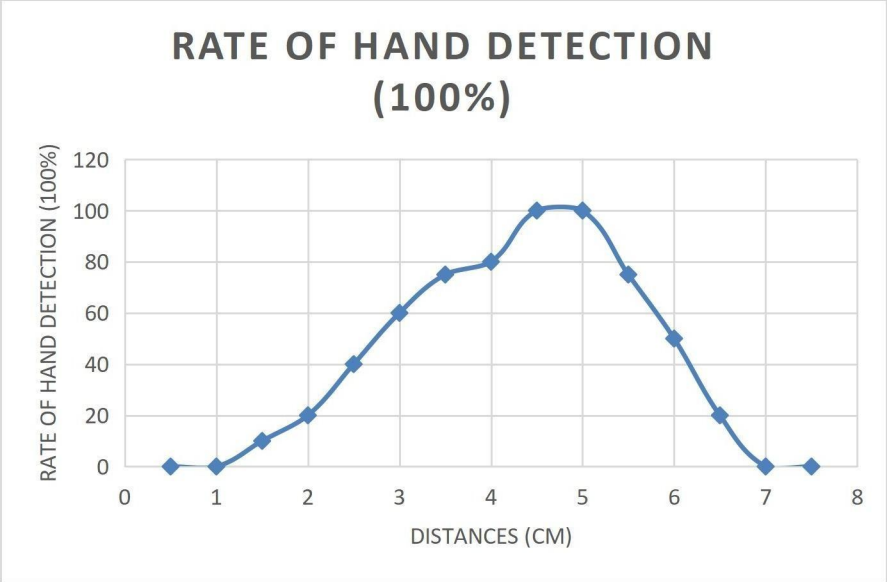


Figure 4.9 Graph of the data analysis for rate of hand detection

Figure 4.13 shows the graph of the distance versus the rate of hand detection. The data from Table 4.2 was used to create the graph. From the analysis above, it can be concluded that, when distance of the hand around 4.5cm to 5.0cm , it has high hand detection rate which is 100%. However, when the distance gets further which is from 5.0cm to 5.5cm, the hand detection rate decreases which is from 100% to 75% and at this rate the Infrared sensor unable to detect hand accurately.

4.6 Discussion

This section would address the entire progression of this project which is the development of an IoT-based hand sanitizer and the issues that have been encountered. From the Blynk application, the Notification widget and were used to create the monitoring system. The Notification widget will receive a message displaying which to refill the sanitizer. The issue that occurs when using the Notification widget is not receiving any messages from the Blynk app due to a slow internet connection.

Next, a distance and hand detector circuit which consists of an Arduino Uno, IR Sensor, Ultrasonic Sensor, and ESP8266 Wifi module was built to study the reaction time of the system to send a notification. The issue that was encountered during the analysis was the Ultrasonic Sensor has a problem detecting small objects from a far distance. After troubleshooting the following issues, the hand sanitizer system was able to run successfully. The user will receive a notification displaying which refill the sanitizer and the user will also know when the intrusion happened on the monitoring system. When conducting a study on the reaction time of the system to send a notification , the system will send a notification within 1 seconds from the of 1 to 14 centimeters. Not only that, the suitable distance for the IR sensor to optimise the system functionality was able to be analysed. Thus, the project's objective was successfully achieved.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The entire performance of the development of an IoT-based hand sanitizer system is concluded in this chapter. This chapter discusses about the overall development of the hand sanitizer system in term of the significance of the project, the achivement of the project objectives and the problem faced during the project. In addition, giving suggestion to future work in the term of , how to further improve and develop the system in more efficiency.

5.2 Conclusion

The purpose of this project is to develop an IoT-based hand sanitizer system that allows the user to receive a notification on which to refill the sanitizer liquid on the user's smartphone. The first objective which is to design automatic hand sanitizer system that water level sensor to get accurate measuring for measuring the level of sanitizer level.

The second objective which is to study the reaction time of the system to send a notification also been accomplished by using a distance and motion detector circuit. The system will send a notification within 1 seconds from the range of 1 to 14 centimeters. This circuit was helpful to gather the necessary data for the second objective and third objectives.

Finally, the last objective which is to analyse the suitable distance for the sensor to optimise the system functionality was accomplished when carrying out the second objective. The suitable distance for the system to function fully is to place the sensors between the ranges of 1 to 14 centimeters from hand sanitizer container. The project has been observed and shown that the system is stable.

5.3 Recommendations

A few recommendations are needed for future projects on the development of an IoT-based automatic hand sanitizer. The recommendations for creating an affordable IoT-based automatic hand sanitizer system that is fully wireless. The limitation of this project is that it still required a wires connection from the microcontroller to the other components due to the budget of the project. Next, the recommendation that would be suggested is to have an alternative way to connect to the system without using WiFi. This is due to sometimes the notification will be received late due to the slow internet.

5.4 Project Potential

With changing lifestyles and preferences of consumers and ever-increasing health hazards owing to the recurrence of viral infections, there has been a growing need for getting instant and active protection against germs. It is an innovative way to control the spread of corona virus by using such machine without any contact. Believe that accomplish the objectives of the project that is the automatic hand sanitizer is easy to put at any place, It is easy to maintain and refiled and less touch needed when use the hand sanitizer. The result can detect the motion of the hand and dispense the sanitizer automatically. The functioning of the automatic dispenser seems to be quite simple and effective as one simply needs to wave their

hands near the infrared sensor and instantly the sanitizer gets ejected from the bottle into the awaiting palms.These sanitizers are generally used in restaurants, hospitals , educational institutions, households, and several other places. Morevover, most of the industrial conglomerates have been offering foam sanitizers coupled with gel sanitizers to kill most of the germs and leave a feeling of softness for the hands.

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APPENDICES

Appendix A Coding of the Project

Arduino Coding

```
#define irsensor 2;
#define Relay 7;
void setup() {
  pinMode(2,INPUT);
  pinMode(7,OUTPUT);
  Serial.begin(9600);
}
void loop (){
  if (digitalRead(2)==1)
  {
  Serial.print(digitalRead(2));
  digitalWrite(7,HIGH);
  delay(10);
  }
     else{ digitalWrite(7,
  LOW);delay(10);
 }
}
```

Blynk Coding

```
#define BLYNK_TEMPLATE_ID "TMPLrdcrUzL2"
#define BLYNK_DEVICE_NAME "IOT Based Hand Sanitizer"
#define BLYNK_AUTH_TOKEN "unJ6M3VISYtWr3oLlXtaGSGOHHpmcf_T"

#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>


char auth[] = BLYNK_AUTH_TOKEN;

char ssid[] = "Shangetha";  // type your wifi name
char pass[] = "shan571997"; // type your wifi password
#define trig D7
#define echo D8
#define buzzer D5
#define NOTIFICATION_TEXT          "Please refill sanitizer"
#define NOTIFICATION_LOG           "notification"
int MaxLevel = 14;
int Level1 = (MaxLevel - 1 );

BlynkTimer timer;

void
 sendSensor(){ digitalWri
 te(trig, LOW);
 delayMicroseconds(4);
 digitalWrite(trig, HIGH);
 delayMicroseconds(10);
 digitalWrite(trig, LOW);
 long t = pulseIn(echo, HIGH);
 int distance = t / 29 / 2;
 Serial.println(distance);
 int blynkDistance = (MaxLevel - distance);
```

```
if (blynkDistance <= 0)
```

```
  blynkDistance = 0;
    blynkDistance = map(blynkDistance,0,MaxLevel-3,0,100);
    Blynk.virtualWrite(V0, blynkDistance);



    if (Level1 <= distance)
    { digitalWrite(buzzer,
    HIGH);
    Blynk.logEvent(NOTIFICATION_LOG, NOTIFICATION_TEXT);
  }else if (Level1 >= distance)
    {digitalWrite(buzzer, LOW);
  }
}
void
  setup(){ pinMode(trig,
  OUTPUT);
  pinMode(echo, INPUT);
  pinMode(buzzer, OUTPUT);
  Serial.begin(115200);
  Blynk.begin(auth, ssid, pass);
  //dht.begin();
  timer.setInterval(2500L, sendSensor);
}

void
  loop(){ Bly
```

Appendix B Gantt Chart