Faculty of Electronic and Computer Engineering and Technology

THE DEVELOPMENT OF SMART AUTOMATION TISSUE DISPENSER USING ARDUINO UNO

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Bachelor of Computer Engineering Technology (Computer Systems) with Honours

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THE DEVELOPMENT OF SMART AUTOMATION TISSUE DISPENSER USING ARDUINO UNO

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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 Computer Engineering Technology (Computer Systems) with Honours.

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Supervisor Name : TS. NIZA BINTI MOHD IDRIS

Date : 21 Februari 2024

Signature : ....

Co-Supervisor Name (if any) : ....

Date : ....

DEDICATION

I dedicate this report with profound gratitude to my beloved mother, *Fazalina Zaima Bt Mohamed Isa*, and my father, *Mohd Talmizi B Wahab*. Your unwavering support and encouragement have been the guiding light throughout my academic journey. The sacrifices you made and your unshakeable belief in my abilities have been the driving force behind my success. I am genuinely thankful for the immeasurable love and inspiration you have provided.

ABSTRACT

The development of smart automation tissue dispenser using arduino uno is a project that can help people to minimize the uses of tissue paper. The project is also an improvement over a 'toilet paper' project that is often sold in convenience stores. The modification to be made is an automated tissue tool. This can prevent users from removing tissue in large quantities. This project uses arduino uno, serve motors, and ultrasonic sensor. The function of ir sensor is to detect every movement or touch occurs, is show the user want the tissue. In arduino coding, time is defined as a timer that limits the production of tissue within a given time to control the uses of tissue. A motor is used to move a tissue coil to rotate rolled at a specified time. We have made an improvements by using ultrasonic sensor to measure the tissue level detection to make it easier for the owner to refill the tissue when it is finish. This is how smart automation tissue dispenser operate. This project will helps people to use the tissue more easily in daily life.

ABSTRAK

Pembangunan dispenser tisu automasi pintar menggunakan arduino uno adalah projek yang dapat membantu orang ramai meminimumkan penggunaan kertas tisu. Projek ini juga merupakan penambahbaikan ke atas projek 'tisu tandas' yang sering dijual di kedai. Pengubahsuaian yang akan dibuat adalah alat tisu automatik. Ini boleh menghalang pengguna daripada mengeluarkan tisu dalam kuantiti yang banyak. Projek ini menggunakan arduino uno, servo motor, dan sensor ultrasonik. Fungsi sensor ir adalah untuk mengesan setiap pergerakan atau sentuhan berlaku, menunjukkan pengguna mahukan tisu. Dalam pengekodan arduino, masa ditakrifkan sebagai pemasa yang mengehadkan pengeluaran tisu dalam masa tertentu bagi menghadkan pengeluaran tisu. Motor digunakan untuk menggerakkan gegelung tisu untuk berputar pada masa yang ditetapkan. Kami telah membuat penambahbaikan dengan menggunakan sensor ultrasonik untuk mengukur tahap tisu untuk memudahkan pemilik mengisi semula tisu apabila ia telah habis. Ini adalah bagaimana dispenser tisu automasi pintar beroperasi. Projek ini akan membantu orang ramai menggunakan tisu dengan lebih mudah dalam kehidupan seharian.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Ts. Niza Binti Mohd Idris for their precious guidance, words of wisdom and patient throughout this project.

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My highest appreciation goes to my parents, and family members for their love and prayer during the period of my study. I express my gratitude to my family and friends for their unwavering encouragement, understanding, and patience during this academic journey. Their constant support has been a source of strength and motivation.

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δ	-	Voltage angle
	-	

LIST OF ABBREVIATIONS

V	-	Voltage
%	-	Percentage
	-	

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CHAPTER 1

INTRODUCTION

1.1 Background

The first tissue dispensers were simple cardboard boxes that held a stack of folded tissues. These boxes were designed to be placed on a tabletop or other flat surface, making tissues more convenient and accessible to users. When the mechanical tissue dispensers began to emerge. These dispensers used a crank or lever mechanism to dispense individual tissues, making them even more convenient and hygienic. However, these dispensers were still relatively large and bulky, making them unsuitable for use in public restrooms. Nowadays, automatic tissue dispensers are developed. These dispensers used sensors or other mechanisms to detect when tissue was needed and dispense the appropriate amount. While early versions of these dispensers were often unreliable and expensive, advances in technology have made them more common and affordable in recent years.

1.2 Problem Statement

Traditional manual tissue dispensers in public restrooms are inefficient, wasteful, and unsanitary. Users often take more tissue than they need, leading to unnecessary waste and increased maintenance costs. Although tissue is a recyclable item, waste and littering will cause pollution.[1] This will cause natural disasters to occur, such as floods due to the amount of garbage thrown away caused by human waste. Additionally, manual dispensers require users to touch them, increasing the risk of spreading germs and viruses. Besides there is no one to monitor the tissue dispenser, it causes a problem to the needy when it sis empty. A smart tissue dispenser solution is needed to address these issues, providing a more efficient, hygienic, and sustainable option for dispensing tissue in public restrooms.

1.3 Project Objective

The aim of this project is to design a smart automation tissue dispenser that can automatically dispense tissue paper without any physical contact. The Smart Automation Tissue Dispenser can help reduce the spread of germs and improve hygiene in public restrooms, offices, and other public places. The IoT-enabled system can also help monitor the dispenser's usage, detect when it needs to be refilled, and optimize the dispensing process for better user experience.

❖ There are 3 main objectives for this project:

a) **To Create a Touch-Less Dispensing System:** Develop a touch-less and automated tissue dispenser system that minimizes the need for physical contact, thus promoting hygiene.

b) **To Monitor and Refill Efficiently:** Design a system that can monitor tissue paper levels and automatically signal when a refill is needed, improving user convenience, and minimizing downtime.

c) **To Optimize Tissue Paper Usage:** Implement a system that dispenses the appropriate amount of tissue paper per use, reducing waste and cost while ensuring user satisfaction.

1.4 Scope of Project

The scope of a smart tissue dispenser project can vary depending on the specific goals and requirements of the project. However, a typical project might include the following:

a) Design and Prototype: Design the smart tissue dispenser prototype and test the functionality and usability of the dispenser.

b) Sensor Integration: Smart tissue dispensers rely on sensors to detect when tissue is needed and dispense the appropriate amount.

c) Connectivity and analysis: Smart Automation tissue dispensers are connected to the internet or other networks, allowing them to transmit data to the apps.

d) Testing and Validation: It will need to be tested and validated to ensure that it meets the desired specifications and is safe and reliable for users.

e) Interface Design: Need to develop an intuitive and user-friendly interface for controlling the smart tissue dispenser. This may involve designing a touch screen and display.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In today's technologically advanced culture, we are always working to develop products that will make their daily routines easier. Since technology makes everything simpler, technological gadgets are made to improve the quality of human existence. These findings support the growth of technology, which has produced numerous instruments for facilitating human tasks and even taking over for people in some roles. People want to accomplish things quickly now that there is technology available, and one such thing is to use the Internet of Things (IoT). The Internet of Things (IoT) idea attempts to increase the advantages of permanently linked internet access. One of the cutting-edge technologies that will assist people in becoming more sophisticated in the future is the Smart Automation Tissue Dispenser. The project's objective was to enhance heavily used toilets where hygiene was valued [2]. You may maintain proper hygiene by just touching the paper that you are using. The dispenser only releases one towel at a time to reduce usage. Reduced draw force and noise level were the main objectives as part of performance optimisation [3]. The other goal of this research is to create a control tool that can be used to monitor a tissue dispenser using a smartphone. It will use a Wi-fi network for control instructions so that it can be used anywhere that there is access to a Wi-fi signal network, and it will use an ESP8266 microcontroller from an Arduino Nodemcu as its processor.

2.2 Working Principle of Arduino

Open-source microcontroller platform Arduino was first presented in 2005. It offers a simple and economical approach for professionals, students, and amateurs to build gadgets that employ sensors and actuators to interact with the environment. The microcontroller-based Arduino platform makes it simple to programme, erase, and reprogramme at any moment. Using Arduino shields, Arduino can also connect to the internet and transmit and receive data. The platform is made up of the hardware Arduino development board and the software Arduino IDE, which support C or C++ code development [4]. The Arduino IDE may be used to programme either the 32-bit Atmel ARM or the 8-bit Atmel AVR microcontrollers that are utilised in Arduino. The arduino board comes in a variety of forms. The kind of Arduino Board and the Board's clock speed are displayed in Table 2.1. Little research is needed in order to use the appropriate Arduino board for the project. Specifications and features vary amongst Arduino boards [5].

Table 2.1 Type of Arduino Board

Arduino Type	*Clock Speed*	*Microcontroller*
Arduino Uno	16 MHz with auto-reset	Atmega328
Arduino Nano	16 MHz with auto-reset	Atmega328
Arduino Mega 2560	16 MHz with auto-reset	Atmega2560
Arduino Leonardo	16 MHz with auto-reset	Atmega32u4
Arduino Fio	8 MHz with auto-reset	Atmega328
Lily PadArduino	8 MHz with auto-reset	Atmega328
Arduino NG	16 MHz with auto-reset	Atmega8

We utilised an Arduino Uno R3 Board as the microcontroller for this project. The ATmega328P, the centrepiece of the Arduino UNO, is seen in Figure 2.1. It contains a USB connector, a power jack, an ICSP header, six analogue inputs, a 16 MHz ceramic resonator, 14 digital input/output pins, six of which may be used as PWM outputs, and a reset button. Everything required to support the microcontroller is included; all that is required to get going is the insertion of a USB cable, an AC-to-DC converter, or a battery. Without being unduly anxious that you'll make a mistake, you may experiment with your UNO; in the worst case, you can replace the chip for a few bucks and start over. We are familiar with Arduino's operating system, hardware/software capabilities, and applications, both actual and planned. There are countless new concepts that may be developed with Arduino's IDE (software). We now understand how to create unique tools that can be utilised to create and put into practise fresh concepts. With an Arduino, there are countless opportunities to study and develop new ideas, from wearable technology to space exploration [6].

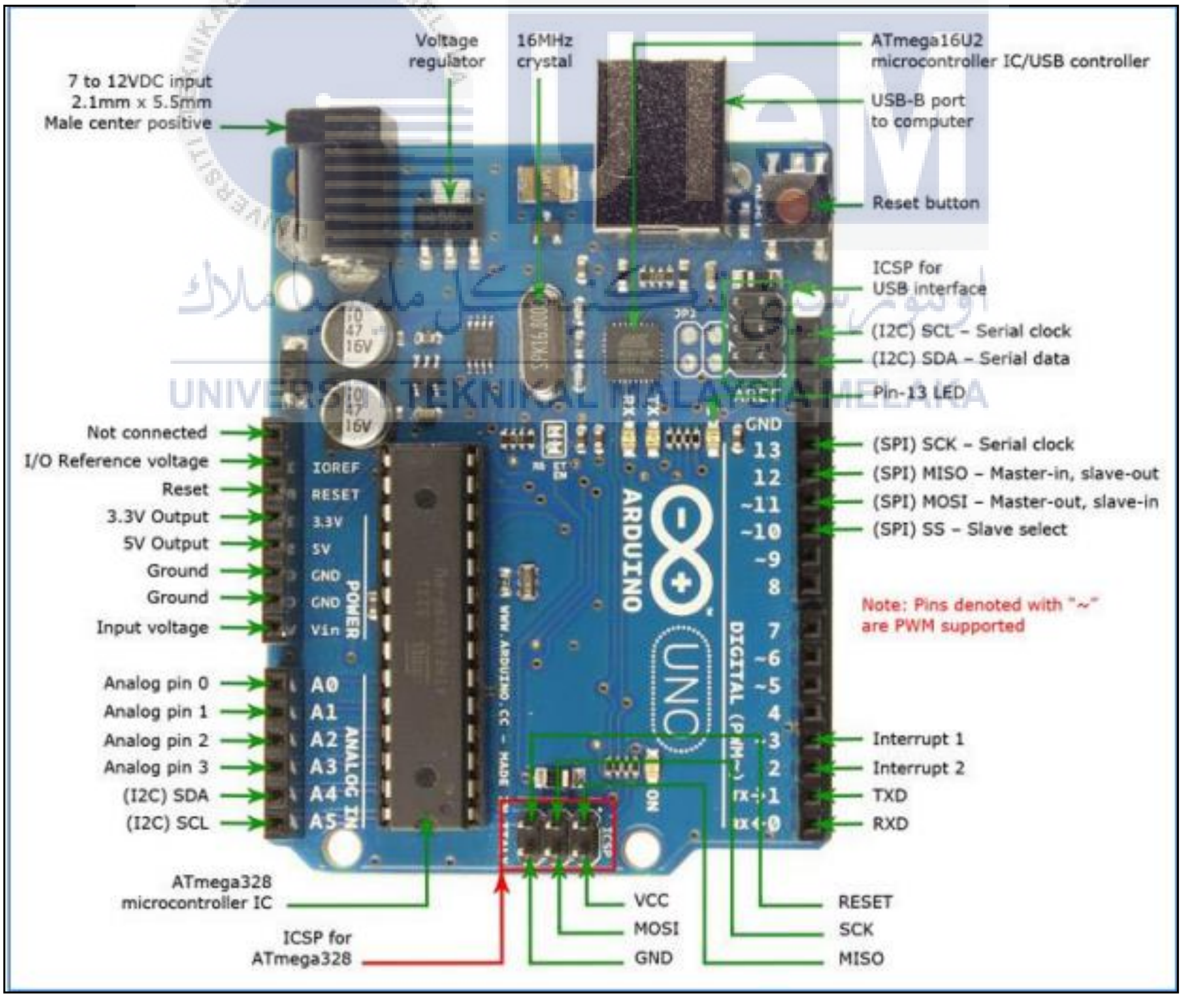


Figure 2.1 Main component in Arduino Uno

2.3 MG995 Metal Gear Servo Motor

One of the key parts of this project is the servo motor. An actuator with the capacity to be precisely controlled in terms of rotational and angular position is referred to as a servo motor. The MG995 servo motor that I utilize for the project is seen in Figure 2.2. Steel Gear A high-speed standard servo known as a servo motor is used in RC models such RC automobiles, helicopters, and airplanes. It can spin around 180 degrees (60 in each direction). delivers 12kg/cm at 6V and 10kg/cm at 4.8V. It is a digital servo motor that more quickly and effectively accepts and processes PWM signals.

Figure 2.2 MG995 Metal Gear Servo Motor

Servo motors are controlled by a series of pulses known as pulse width modulation (PWM). The PWM signal determines the shaft position, and depending on the desired position, the pulse duration will revolve the rotor either clockwise or anticlockwise. Theoretically, every 20 milliseconds (ms), the servo controller anticipates a sequence of pulses, the width of which determines the angle at which the motor rotates. The correlations between servo motor pulse width and angular rotation are shown in Table 2.2. Using Arduino, which functions as a "DAQ" to receive the voltage feedback from the servo motor, a measurement was made in order to determine the relationship between voltage and angular value [7].

Table 2.2 Process parameter and their level

Angular Rotations (AR)	Pulse Width (PW)
$0° \leq AR \leq 90°$	$1ms \leq PW \leq 1.5ms$
$90° \leq AR \leq 180°$	$1.5ms \leq PW \leq 2ms$

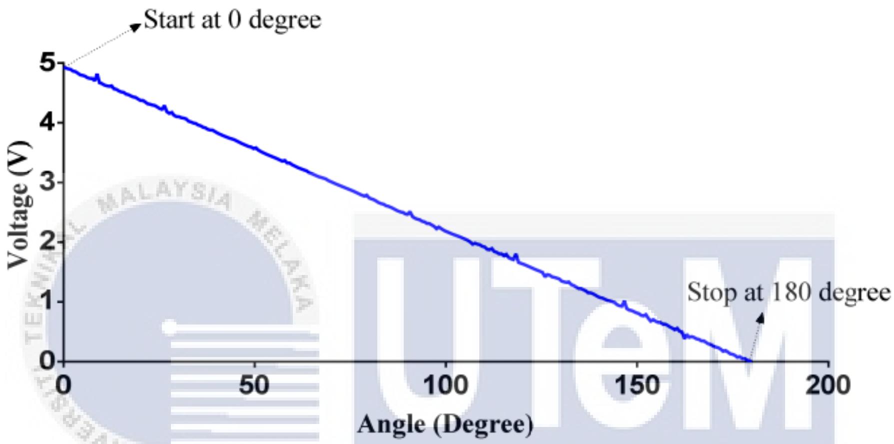


Figure 2.3 Measured values of voltage (V) against angle (degree)

Figure 2.3 demonstrates that the angular position decreases as the voltage rises. As a result, this kind of feedback will unquestionably enhance the performance of servo motors when it is feasible to concurrently monitor the target angular position and the actual angular position [8]. In conclusion, positional rotation servos with position feedback are a must for every closed-loop electronic system. The advantages include being able to accurately regulate the angular position and getting real-time input on the system's actual location. The voltage feedback from the built-in potentiometer is accurate enough to indicate the motor's real angular location.

2.4 NodeMCU ESP8266

The open-source ESP8266 System-on-a-Chip (SoC) serves as the foundation for the NodeMCU (Node MicroController Unit). The ESP8266, which was developed and produced by Espressif Systems, includes the CPU, RAM, networking (Wi-Fi), as well as a contemporary operating system and SDK. It's a terrific option for all sorts of Internet of Things (IoT) applications as a result of this. Figure 2.4 depicts the pin arrangement for the ESP8266 NodeMCU.

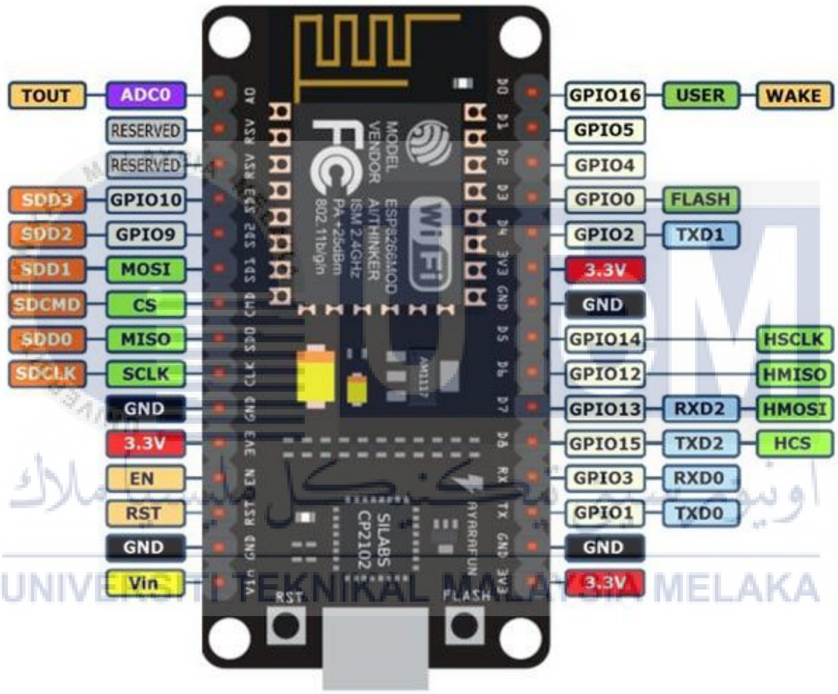


Figure 2.4 NodeMCU ESP8266 pin configuration

For their Internet of Things project, numerous projects employ the ESP8266. A new way of life has emerged as a result of the technological era's fast transition. IoT technology has been made available on the national market by a number of Indonesian telecom access providers. As a result, a sizable workforce will be required in this new era to create and maintain the IoT systems in many industries [9][10]. This demonstrates the significance of IoT for the coming generation. For instance, in a smart kitchen inventory, a smart compartment is needed to detect how many items are kept within. As a result, a compact cabinet with nine sections that are each equipped with a distinct sensor is constructed [11]. To connect to the server, NodeMCU (ESP8266) is utilized. The block diagram for the Smart Kitchen Inventory is seen in Figure 2.5.

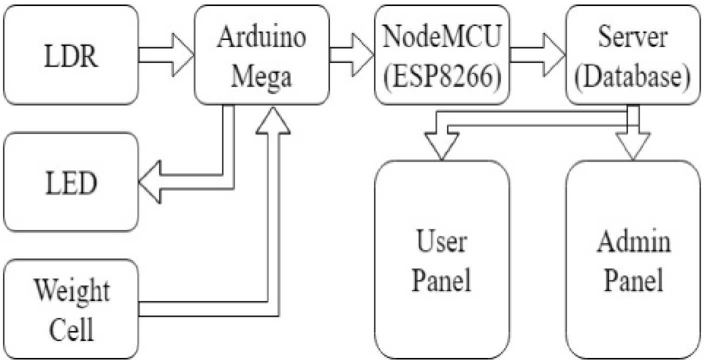


Figure 2.5 Block Diagram Smart Kitchen Inventory

Another example Internet of Things project uses the ESP8266 NodeMCU. ESP8266 module-based internet of things for automated garage doors. The goal is to create garbage door gaters using the Internet of Things (IoT) and microcontroller-controlled technologies. Android garage door controllers that have been installed on smartphones will send commands to the ESP8266. The project's block diagram is shown in Figure 2.6. I will use all of the samples to construct my own Internet of Things project [12].

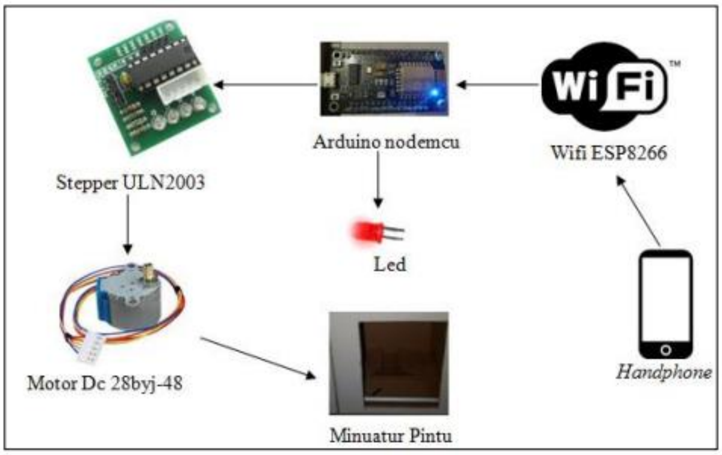


Figure 2.6 Block Diagram Automation Garage Door

2.5 Sample Project of Automatic Water/Soap Dispenser and Self-Tissue Dispenser

Dr. Mohd Zain Ismail and Pengiran Mohd Huszaizzi Pengiran Hussin proposed the Automatic Water/Soap Dispenser and Self-Tissue Dispenser. The project's objective is to build a touchless soap and water dispenser for hand washing. It also has a self-tissue dispenser that users may use after washing their hands. Ultrasonic sensors, which are technological devices that use ultrasonic sound waves to estimate target distances, are used by all touchless systems. The major components used in the Automatic Water/Soap Dispenser and Self-Tissue Dispenser project are the Ultrasonic Sensor, Arduino UNO, Water Pump, Soap Pump, Servo Motor, and Battery 12V Power Supply. An ultrasonic sensor to measure the amount of soap present, a NodeMCU microcontroller to establish a Wi-Fi connection, and a LiPo battery to power both the NodeMCU and the ultrasonic sensor are all necessary for the Soap Monitoring System to operate properly. As long as a smartphone can connect to Wi-Fi and download the Blynk application, it may be utilised with the system, regardless of whether it runs Android or iOS.

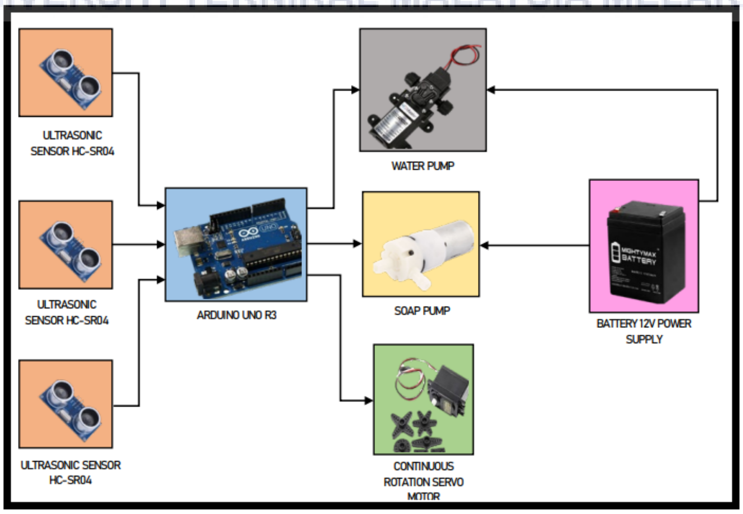


Figure 2.7 Block Diagram of Automatic Water/Soap and Tissue Dispenser

In Figure 2.7 shows the purpose of each component as well as details on how it was applied to the project. The microcontroller utilised in this project is the Arduino Uno, which controls system functions. When the ultrasonic sensor detects the movement of hands, the water, soap, and self-tissue dispensers will activate and the Arduino will receive and transmit commands to do so. The water pump and soap pump are directly powered by a battery-operated 12V power supply to run the water dispenser and soap dispenser.

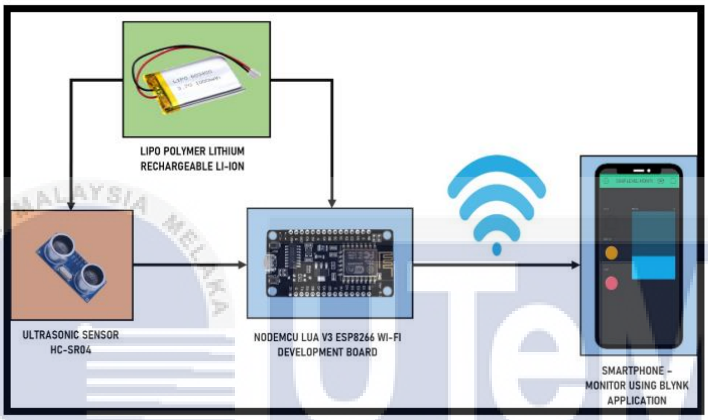


Figure 2.8 Block Diagram of Soap Monitoring System using Blynk Application

Figure 2.8 displays the components of the soap monitoring system utilising the Blynk application. A microprocessor and connection to a Wi-Fi network are provided by the ESP8266 Wi-Fi module for the Blynk application, which tracks water use on a smartphone. The distance to the water is measured and calculated using an ultrasonic sensor. The LiPo battery powers the ESP8266 and ultrasonic sensor [13].

2.6 A Sample Project of Arduino Based Smart Irrigation System Using IoT

R.Nandhini, S. Poovizhi, Priyanka Jose, R. Ranjitha, and Dr. S. Anila suggested the Arduino-based smart irrigation system using the internet of things. Automated irrigation systems are needed to address both over- and under-irrigation. Over-irrigation is a result of improper distribution or management of chemicals and waste water, which causes water contamination. In this system, a variety of sensors, including pressure, pH, soil moisture, DHT11, and PIR (intruder detection system) sensors, are connected to the input ports of the Arduino microcontroller. The LCD displays the values that the sensors have detected. If the measured value exceeds the threshold values defined in the programme, the pump will automatically turn ON/OFF using the relay circuit, which is attached to the driver circuit and helps switch the voltage. The farmer will be updated on the status of the field via the GSM module and the website. Using this technology, the farmer may get information about the condition of the land at any time and from any location [14].

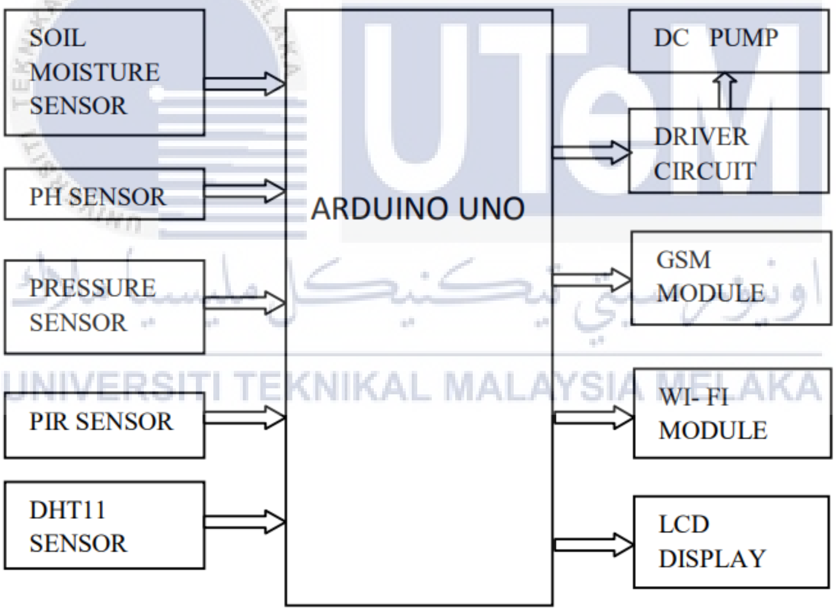


Figure 2.9 Block Diagram of Automated Irrigation System

The microcontroller in this case is an Arduino UNO. On the ATMEGA 328P, a microcontroller board known as the UNO is built. The ATMEGA 328P has 32kB of flash memory for code storage. A USB connector, an ICSP circuit, 6 analogue inputs, 14 digital input and output pins, a quartz crystal running at 16 MHz, and a reset button are all included on the board. The UNO may be programmed using the Arduino software. The ESP8266 Wi-Fi module, a self-contained System on Chip with an integrated TCP/IP (Transmission Control Protocol/Internet Protocol) protocol stack, enables any microcontroller to connect to any WiFi network. Each ESP8266 module comes pre-programmed; all that's required to enable Wi-Fi capabilities is to attach it to an Arduino-based project. Figure 2.10 above show the final result of the project.

This module's robust on-boarding procedure and substantial storage allow it to be integrated with sensors and other application-specific devices. This technique is suggested for effective automated irrigation systems and may offer a useful tool for water conservation planning and irrigation scheduling that can be extended to other agricultural crops with comparable traits. A servo motor is used to disseminate the water evenly, ensuring that the plant absorbs the maximum amount of water possible [15].

Figure 2.10 Result of Automated Irrigation System

2.7 A Sample Project of Auto Tissue Dispenser

For their final year project at Polytechnic Sultan Salahuddin Abdul Aziz Shah, Mohamad Hakim Bin Mohd Ginen, Nur Syaza Syakira Bt Md Marisa, Nurul Athira Bt Salim I @ Salim, and Nur Aqilah Syarafana Bt Roestam A. Sani developed the Auto Tissue Dispenser. Their creation seeks to decrease the production of toilet paper and provide a siren as a warning when the supply is already running low. The automated tissue project selection's objective is to minimise the overall amount of toilet paper that one person consumes, and the buzzer will notify the cleaning crew when there is insufficient toilet paper. We have been reimagining the current toilet paper by installing sensors to restrict the manufacture of toilet paper in an effort to decrease the quantity of toilet paper used per person. We are also introducing something new by incorporating a bell to notify the cleaning crew that the toilet paper is already used up and has to be replenished right away [16].

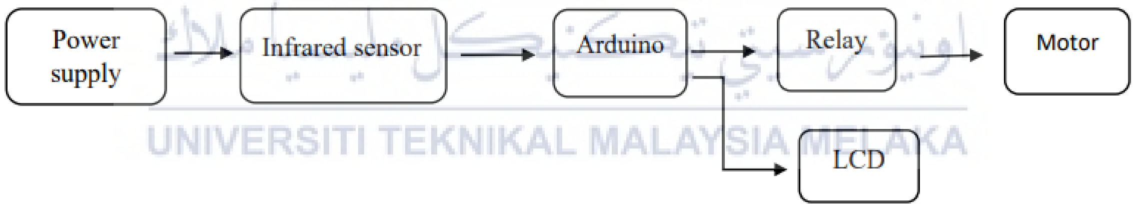


Figure 2.11 Block Diagram for Auto Tissue Dispenser

The project is using the power supply, the project is turned ON in accordance with the block diagram in Figure 2.11. The project will begin to function when the infrared sensor detects a hand and provides a digital input to the Arduino. The Arduino board will serve as the project's brain, controlling the motor by sending a signal to a relay. The tissue will then start rolling, or the LCD will tell you to wait five seconds. This is how auto tissue dispensers operate [17].

2.8 A Sample Project of Smart Home and Security System using Arduino

Siddharth Wadhwani, Uday Singh, Prakarsh Singh, and Shraddha Dwivedi suggested an arduino and IoT-based smart home automation and security system. This paper presents a strategy for home automation and security. The sensors will be connected to Arduino. The condition of our home appliances will be uploaded to a cloud platform via a wireless module. Our system and mobile device ought to be connected via the same wireless network. The user-controlled sensors will be able to be activated or deactivated by our sensors. The flex sensor will control the appliances by detecting the motions of our fingers. The magnetic sensor will improve door break-in security. Cloud computing solutions like Thinkspeak allow users to examine all of this data. This essay will give an example of how IoT applications might make our life easier. The Arduino UNO is made up of relays, a DC motor, a Flex Sensor, a Wi-Fi module, magnetic sensors, flame sensors, accelerometers, Motor Driver ICs, 7805 power supplies, the Arduino IDE, and an LDR (light dependent resistor) [18].

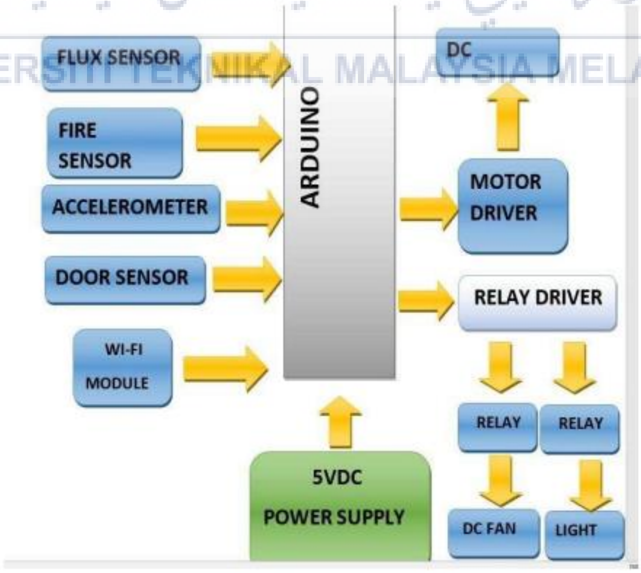


Figure 2.12 Block Diagram for Smart Home Automation and Security System

Numerous social benefits are made possible by the Internet of Things (IoT), and our article may highlight the strength of the IoT's capacity to provide services for the creation of numerous apps and support for their deployment on a public platform. In order to implement IoT, this design provides a sensible and economical technique for sensing, monitoring, and controlling systems in the context of domestic and industrial standards [19].

2.9 A Sample Project of Smart Hand Sanitizer Dispenser

Low Yee San, Raed Abdullah, and Zafirah Izni Binti Zainudin. The main objective of this project is to develop an intelligent hand sanitizer dispenser based on palm image processing with enhanced Internet of Things capabilities that dispensing the right quantity of sanitizer. The project's research issue is the hand sanitizer dispenser, which is normally a manual dispenser. As a result, the hand sanitizer dispenser will get dirty. How often people use hand sanitizer is also influenced by individual actions. They could also waste it if they use too much of it. The system is also capable of alerting and monitoring. The liquid level of the hand sanitizer is tracked using Node-RED.

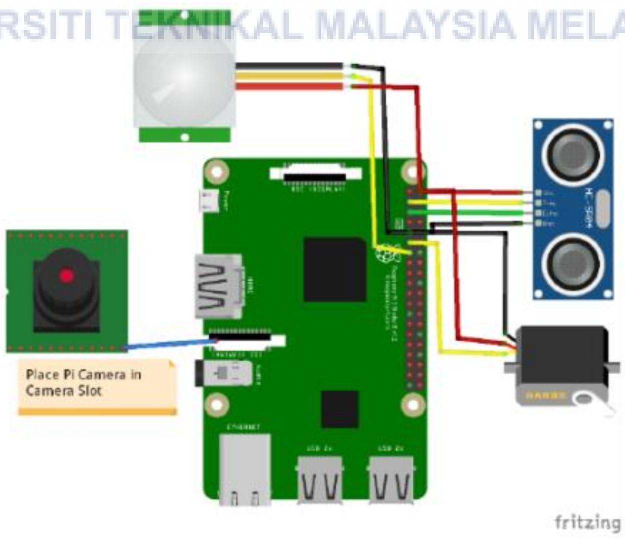


Figure 2.13 Smart Hand Sanitizer Dispenser Schematic Diagram

An alarm system is also designed to remind the owner to replenish the hand sanitizer. Additionally, when a PIR sensor detects the presence of individuals nearby, a message urging them to use hand sanitizer is broadcast through a speaker. The major objective of the system is to make hand sanitizer purchases more affordable. The amount of hand sanitizer that is administered is based on the size of the hand, therefore it may take some time to use it all up. The customer can therefore save money while also aiding in the prevention of this dangerous illness. A PIR sensor detects human presence and provides a signal to the person who is nearest to it to remind them to use the hand sanitizer. A servo motor distributes the hand sanitizer. An alert system is also devised to remind the owner to replenish hand sanitizer. However, a high-spec CPU is needed to train the cascade for the detection since so many negative and positive images are needed to identify the desired item [20]. The approach undoubtedly assists in adopting hand hygiene without any difficulties because hand sanitizer use is required in order to enter any area. Due to its touch-less feature, which completely eliminates any possibility of cross-contamination, it is considerably safer and more advisable [21].

2.10 A Sample Project of Distance Sensing with Ultrasonic Sensor and Arduino

Distance Sensing with an Ultrasonic Sensor and an Arduino was suggested by N. Anju Latha, B. Rama Murthy, and K. Bharat Kumar. An ultrasonic distance sensor is used in this project to measure the object's distance, and the sensor's output is linked to a signal conditioner before being processed by an Arduino microcontroller. The measured findings are shown on liquid crystal screens. The conclusions are saved to a computer. A servo motor is attached to the sensor to determine the polar distance around it up to 1800 revolutions. This program may also offer the accurate distance and is used to detect boundaries. The measured distance is displayed on the LCD screen. The objective of the project was to design and implement an ultrasonic distance meter. Target identification and target distance estimation are two functions that the here-described apparatus is capable of. The apparatus calculates the distance with the required precision and resolution. It is a helpful way for measuring distance without making touch. The tool is applicable in a wide range of industries. It may be used in robotics and automation, automobile reversing systems, manufacturing lines, snow depth measurement, and tank water level sensing. For precise measurements, this equipment will also be employed in the disciplines of mechanical and civil engineering [22].

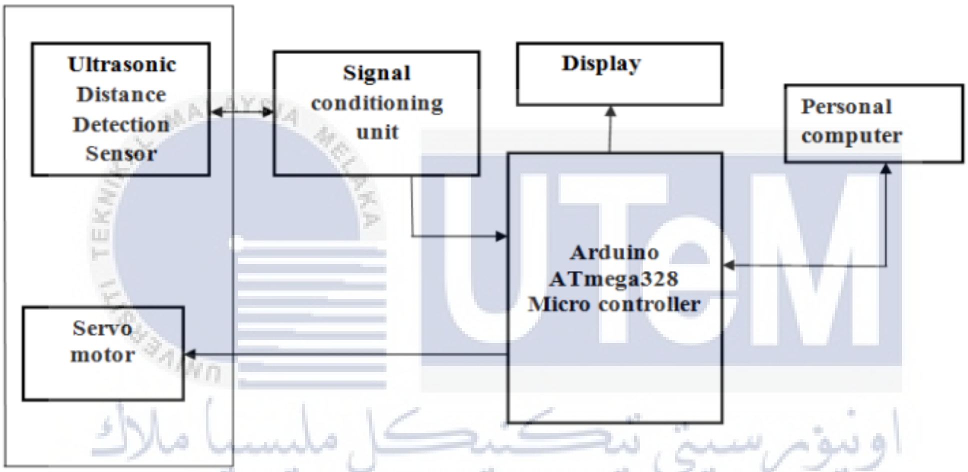


Figure 2.14 Block diagram of Ultrasonic Distance Detection with Arduino

2.11 A Sample Project of An Intelligent Tissue Dispenser System

An Intelligent Tissue Dispenser System was proposed by Mohd Irfan Hakim bin Md Noor, Wan Aezwani Wan Abu Bakar, and Mustafa Man. The four (4) key steps of the iTDS approach are depicted in Figure 2.15.Building the communication framework for an intelligent tissue dispenser system is the aim of Phase 1, with emphasis on choosing the optimal microcontroller, battery, and sensor. The goal of Phase 2 is to create a middleware that enables JSON (JavaScript Object Notation)-based communication between two different apps. In this phase, a new algorithm and data integration model will also be developed for the intelligent tissue dispenser system (iTDS). The creation of an iTDS data visualisation dashboard is the main goal of Phase 3. In order to trigger timely replenishment of tissue packs before they reach the "empty" condition, the objective is to continually monitor and visualise the tissue dispenser's level status. In order to prepare for next advancements and commercial success, the goal is to determine the appropriate design and packaging for the iTDS [23].

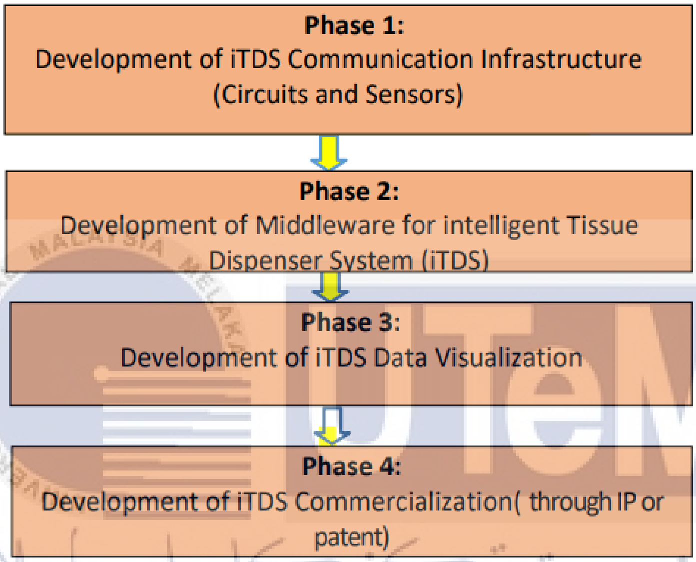


Figure 2.15 iTDS Methodology

The Intelligent Tissue Dispenser System (iTDS) was developed in line with Malaysia's Industry Revolution 4.0 (IR4) initiative, which seeks to incorporate IoT technology into everyday life, particularly in public hygiene systems. The time-consuming manual inspection and tracking of exhausted tissues in a dispenser may be greatly decreased or eliminated by introducing iTDS. However, there are still two obstacles to be overcome: creating the iTDS device (ultrasonic sensor) for connection to the automatic tissue dispenser, and figuring out how to provide the system with long-lasting battery power. To assist us in achieving these objectives, we are actively looking for partnership with the IoT design sector.

2.12 Comparison of Sample projects that related with project in terms of the Main Component, Method, Advantages, and Disadvantages

Table 2.3 Comparison of the sample projects

Article Title and Author	Main Component	Method	Advantages	Disadvantages
"The Auto Tissue Dispenser" by (Mohamad Hakim Bin Mohd Ginen, Nur Syaza Syakira Bt Md Marisa)	Arduino, IR Sensor, Relay, DC Motor, LCD, Buzzer and Adapter.	Make touch-less tissue dispenser to limit the number of toilet paper utilization used by a person and the buzzer will inform the cleaning workers that the toilet paper is already exhausted.	The advantage of this project is they uses LCD to show the user the condition of the tissue.	Cannot inform the cleaning worker if he is not there or close to the tissue dispenser.
"Automatic Water/Soap Dispenser and Self-Tissue Dispenser" by (Dr. Mohd Zain Ismail, Pengiran Mohd Huszaizzi Pengiran Hussin)	Arduino Uno R3, Node MCU, Ultrasonic Sensor, Water and Soap Pump, and Power Supply	To make a touch-less system that allows dispensing soap and water to wash hands. Just place the hand under the faucet and the water will flow automatically.	The advantage of this system is that the water and soap flow simultaneously. Can be easily used by elderly people.	More expensive than the manual soap to wash hands.
"An Intelligent Tissue Dispenser System" by (Mustafa Man, Wan Aezwani Wan Abu Bakar)	NodeMCU (ESP8266), Ultrasonic Sensor, and AA Battery pack.	Presents IoT technology for hygiene application to address the utilization of toilet tissue. The iTDS device relies on the microcontroller and sensor in order to operate the intended task.	The advantage of this system is they can monitor condition of the tissue in web page.	Very complicated to make alone.

2.13 Summary

Since my project is about Smart Automation Tissue Dispenser the are many components that I use to make the project work like what I want. With all the sample projects that I have read and learned there are many ways to compile all the components together. Most of the sample project use Arduino as their microcontroller on the project. It is very related to my project that uses Arduino Uno as the microcontroller for the project. We can learn with all the samples given how to compile Arduino uno with other components such as sensers, servo motor and wife module. To some extent it will make me more knowledge to combine all the sensors with the right way. Furthermore, all the sample projects may give me more ideas and will cause me to be more confident to do the project due to having several references that can help my project to be done.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The approach or process utilized to carry out the project in further detail is called a methodology. It also includes a thorough theoretical review of the approaches used in a particular field of study. It includes the theoretical examination of the body of procedures and rules related to a field of knowledge. This stage is crucial to the implementation of the project in order to guarantee that it is finished by the target deadline. In order to ensure that the project runs well, methodology is crucial. The technique also makes it simpler for someone to understand the project being carried out because it includes all the organizational procedures yet, the project takes longer to finish as a result.

3.2 Methodology

In today's fast-paced world, optimizing efficiency and streamlining processes has become paramount. With our Automation Tissue Dispenser, you can automate and simplify the entire process. By automating the tissue dispensing process, you eliminate the need for manual intervention, reducing the risk of contamination and improving hygiene standards. The Automation Tissue Dispenser incorporates intelligent sensors and user-friendly controls to ensure precise and controlled tissue delivery. In this section we going to see the process flow and equipment to build the automation tissue dispenser, including the testing process as well.

3.3 Elaboration of Process Flow

3.3.1 Flowchart

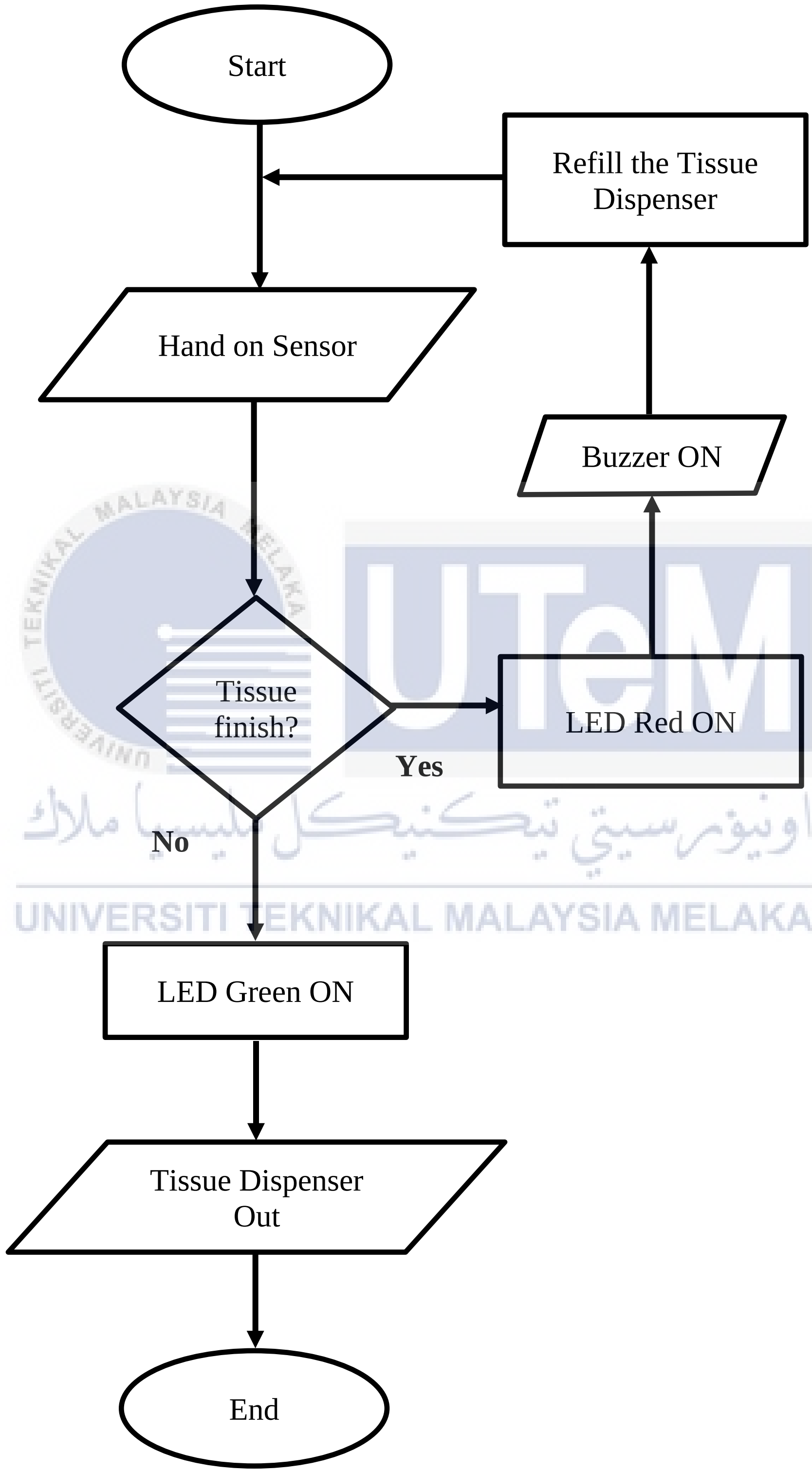


Figure 3.1 Flowchart Automation Tissue Dispenser

3.3.2 Block Diagram

Input:	Ultrasonic Sensor
Microcontroller:	Arduino UNO R3, ESP8266 NodeMCU
Output:	Servo Motor, Buzzer, LED, Blynk

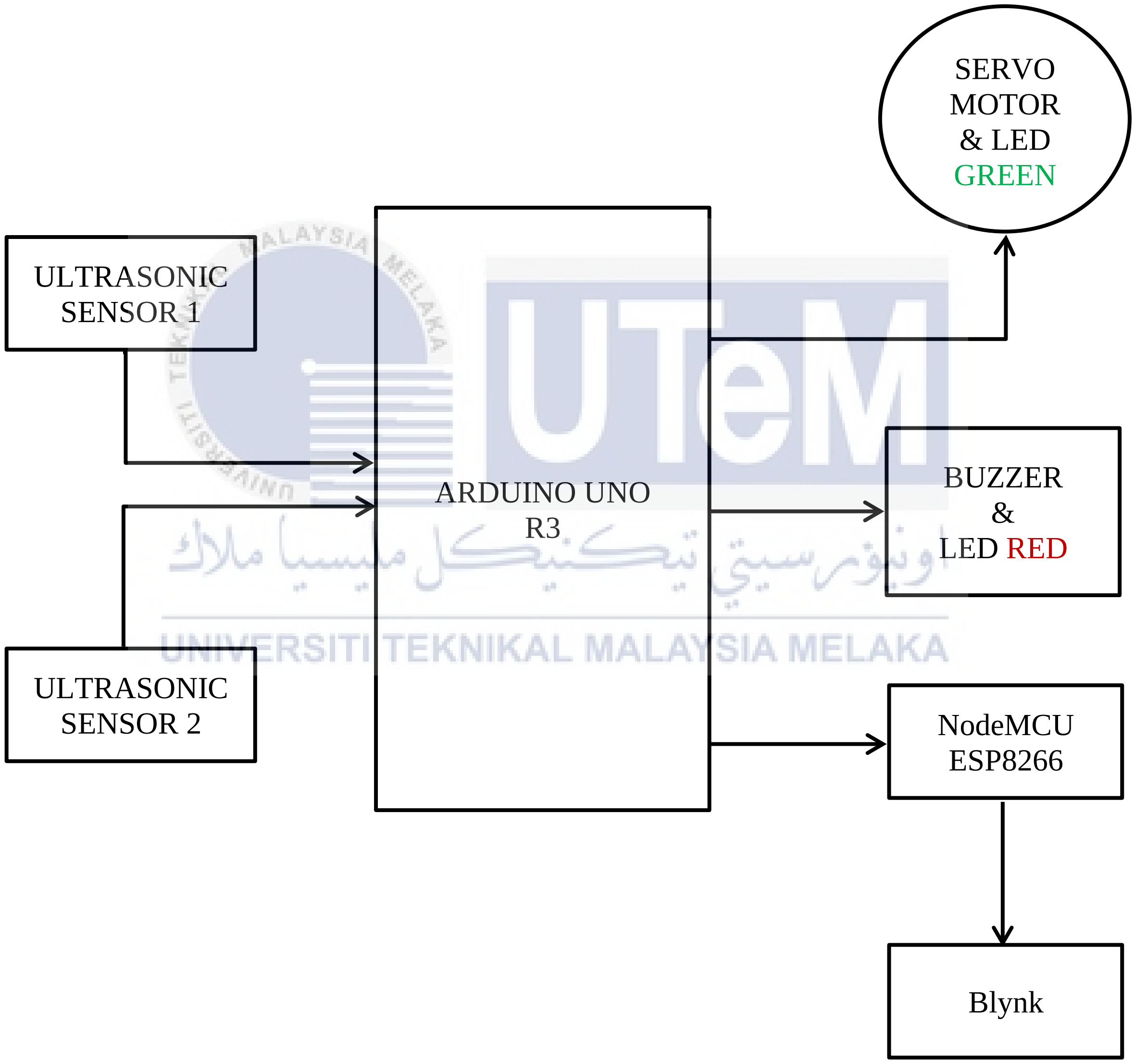


Figure 3.2 Block Diagram Automation Tissue Dispenser

The Automation Tissue Dispenser operates through the following procedure. Firstly, a power supply is required to operate the Arduino, which is the central control unit of the dispenser. An adapter with a voltage range of 7-12V is used for this purpose. The microcontroller used in the dispenser is Arduino Uno R3. It serves as the brain of the system, controlling the motor or servo that dispenses the tissue and facilitating communication with the Internet of Things (IoT) platform.

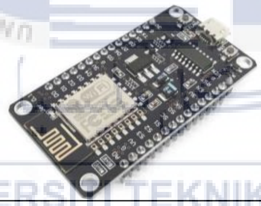
Next, for motion sensor we use two ultrasonic sensor in this project. The first ultrasonic sensor is use to detects the presence of a user's hand, triggering the dispenser to dispense tissue paper. On the other hand, the second ultrasonic sensor measures the amount of tissue remaining in the dispenser, allowing for monitoring of tissue levels. If the red LED is ON, it indicates that the tissue supply is depleted, and the buzzer is activated simultaneously and if the green LED is ON, it signifies that the tissue is not depleted and also illuminates when the motion sensor detects the user's hand.

The servo motor is in charge of managing the tissue dispenser's movement, guaranteeing accurate and regulated tissue dispensing. The Automation Tissue Dispenser also has an ESP8266 NodeMCU-based IoT networking module. It improves the dispenser's functionality and remote control skills by enabling the receipt of commands through a mobile application. The ESP8266 NodeMCU will use the ultrasonic sensor's output to communicate data to the program.

3.4 Equipment Requirements

3.4.1 Hardwave Equipment

Table 3.1 Hardware Components

No	Item	Component Image	Description	Quantity use
1.	Arduino UNO R3		Arduino UNO R3 Compatible with USB Cable, ATmega328 16U2	1
2.	DC Power Supply Adapter		DC 5V 2A Power Adapter Supply AC to DC	1
3.	Servo Motor		MG995 MG996r SG90 9g MG90s S3003 Metal 360 Degree	1
4.	NodeMCU ESP8266		The module acts as the communication bridge between the Arduino Uno and the Firebase database	1
5.	LED		LED LEDs 3MM 5MM Light Emitting Diode Bulb DIY STEM RBT PROJECT	2
6.	Buzzer		DC3-24V SFM-20B Active Piezoelectric Buzzer Long Continous Beep Tone Buzzer	1
7.	Ultrasonic Sensor		Ultrasonic Sensor HC-SR04 HC SR 04 HCSR04 Ultrasound Range Finder Distance Measure Measurement Module Arduino Robotics	2

3.4.2 Software Equipment

Arduino is the software requirement I've chosen. You may create code and upload it to Arduino boards using the Arduino IDE. It has a text editor where you can write your code, a compiler that turns it into instructions that a computer can understand, and an uploader that sends the created code to the Arduino board. An additional feature of the IDE is a serial monitor for communicating with and troubleshooting the Arduino board. The Arduino IDE's platform is seen in Figure 3.3. Although the Arduino IDE's programming language is based on C/C++, it streamlines the process by offering a collection of libraries and functions created expressly for managing the Arduino microcontroller. These libraries simplify the interaction with numerous sensors, actuators, and other devices by abstracting the low-level details.

Figure 3.3 Arduino IDE Platform

Blynk is a versatile platform designed for Internet of Things (IoT) development, with its cornerstone being the Blynk app. Functioning as a pivotal component, the Blynk app allows users to craft personalized mobile interfaces for their IoT projects. Compatible with both iOS and Android, the app interfaces with the Blynk Cloud, a service that acts as an intermediary between the mobile application and a variety of supported hardware platforms and microcontrollers. In Figure 3.4 show that some features in Blynk apps.

Users can seamlessly integrate hardware such as Arduino, Raspberry Pi, ESP8266, ESP32, and others into their projects. Through an intuitive drag-and-drop interface, users can employ widgets like buttons, sliders, displays, and graphs to create a graphical control interface within the app. This interface is then linked to the hardware through the Blynk library, which facilitates real-time communication between the mobile app and the IoT device, allowing users to remotely monitor and control their projects.

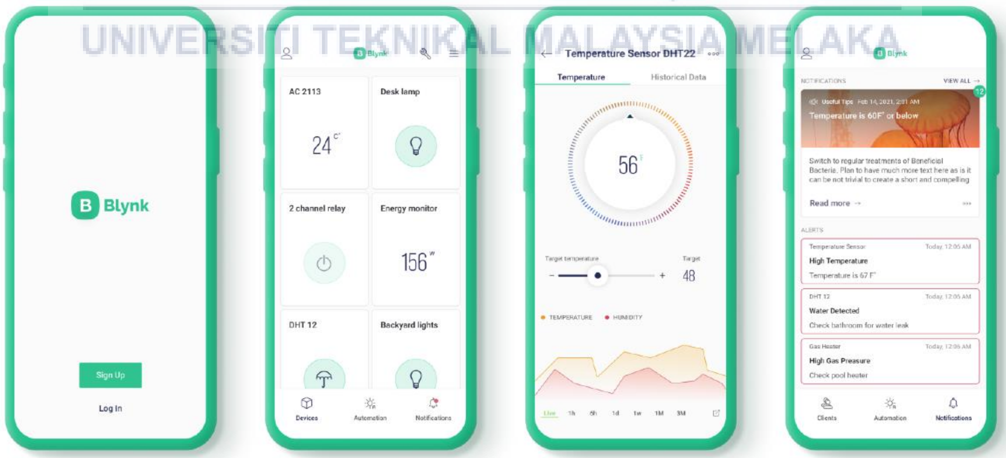


Figure 3.4 Blynk Apps Features

3.5 Experimental/ Study design

3.5.1 Simulation

- IR Sensor and Servo Motor

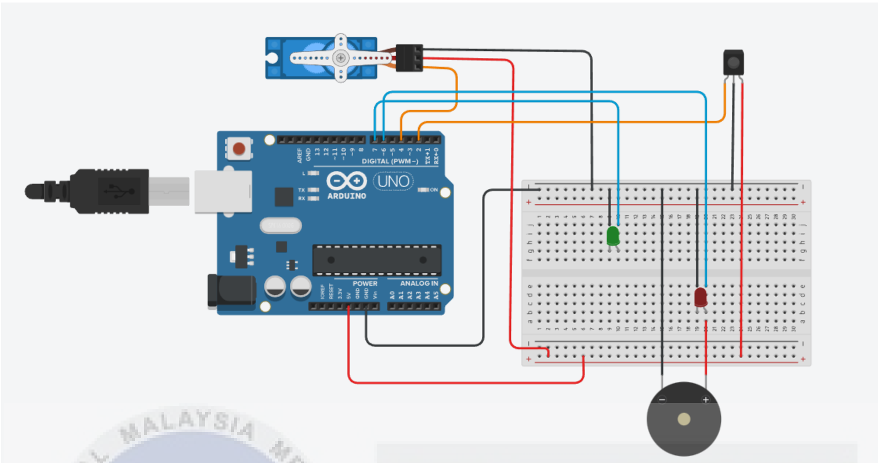


Figure 3.5 Simulation IR Sensor and Servo Motor using TinkerCad

In Figure 3.5 show the simulation of Servo Motor and IR sensor. In the simulation, show the way how we going to connect the IR Sensor with servo Motor. IR sensor will detect the move from the user after that the ultrasonic will give the signal either the tissue is out or not. If the tissue is not finish the the servo motor will turn ON and give the user the tissue based on the code that have been set. When the ultrasonic give signal to the servo motor, LED Green will turn ON to show the user that the tissue is out. But when the ultrasonic give signal that the tissue is finish, the LED red will turn ON and the buzzer will turn ON. It show that the tissue is finish. So that how the IR sensor and Servo Motor will operate.

- Ultrasonic Sensor and LCD I2C

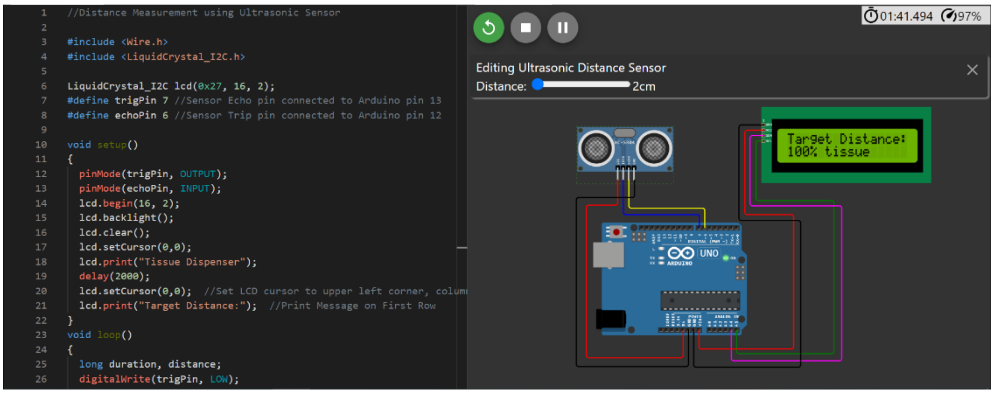


Figure 3.6 Output show 100% of Tissue

In this simulation we use ultrasonic sensor and LCD to show the way how we going to measure the volume of the tissue. Ultrasonic sensor use 5V to operate, connect the ultrasonic with arduino Uno. After that the ultrasonic sensor will detect the object infront it. We set the code in arduino to calculate the distance between the object with the ultrasonic sensor. As show in figure 3.6, the distance is 2cm and the output on the LCD show is 100% tissue. That means the volume of the tissue is still full.

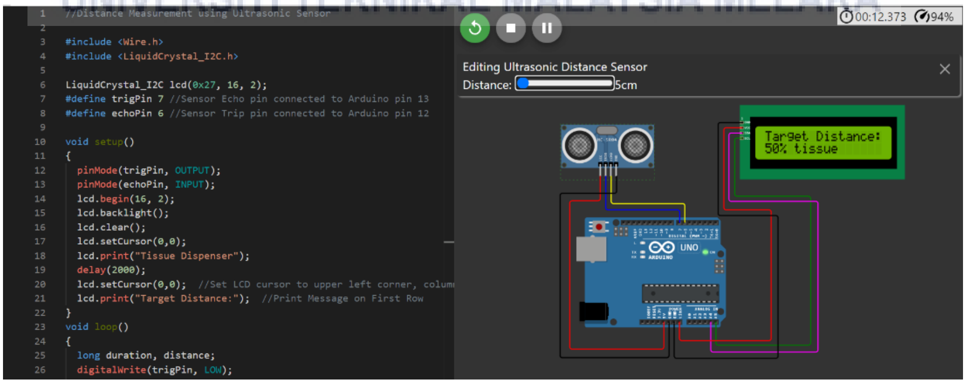


Figure 3.7 Output show 50% of Tissue

The output in Figure 3.7 is show, the distance is 5cm and the output on the LCD show is 50% tissue. That means the volume of the tissue is half .

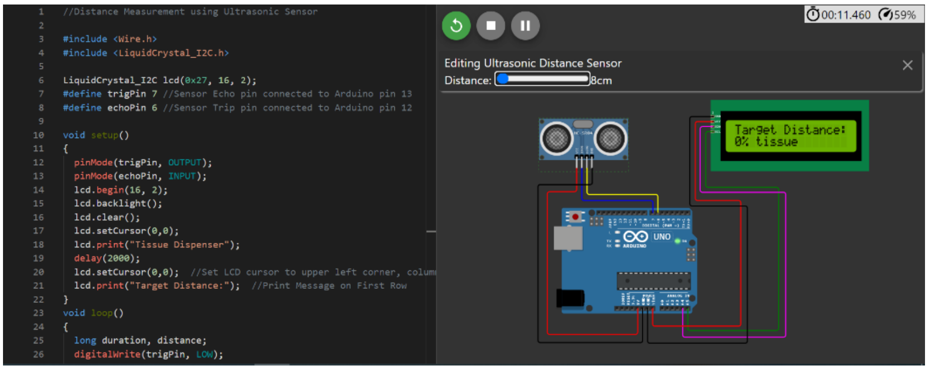


Figure 3.8 Output show 0% of Tissue

In Figure 3.8 show the distance is 8cm and the output on the LCD show 0% tissue. That means the volume of the tissue is 0 or the tissue is already finish and need to refill.

Based on the simulation involves the integration of an IR sensor, a servo motor, an ultrasonic sensor, an LCD, and LEDs to create a tissue dispenser system. When the IR sensor detects movement, indicating that the user needs tissue, the ultrasonic sensor is triggered to determine the tissue volume. If the tissue is not finished, the servo motor is activated to dispense tissue based on a predefined code. The green LED turns on to indicate that tissue is being dispensed successfully. If the ultrasonic sensor detects that the tissue is finished, it sends a signal to the servo motor. In this case, the red LED turns on, along with the buzzer, indicating that the tissue is depleted and needs to be refilled.

In conclusion, the simulation showcases a system that utilizes IR and ultrasonic sensors, a servo motor, LEDs, a buzzer, and an LCD to create an automated tissue dispenser. The IR sensor detects user movement, and the ultrasonic sensor measures the tissue volume. The servo motor dispenses tissue when needed, and the LEDs and LCD provide visual feedback on the tissue status. The system effectively alerts the user when the tissue is finished and requires refilling.

3.5.2 Coding

- Hardware code

```
#include <Servo.h>

#define trigPin2 11       // Sensor 2 Trigger pin connected to Arduino pin 11
#define echoPin2 12       // Sensor 2 Echo pin connected to Arduino pin 12
#define redLedPin 2       // Pin to control the red LED
#define greenLedPin 3     // Pin to control the green LED
#define buzzerPin 7       // Pin to control the buzzer
#define servoPin 4        // Pin connected to the servo motor
#define inputPin 8        // Pin connected to the input from the first code

Servo myservo;
int servoPos = 90;

void setup() {
  pinMode(trigPin2, OUTPUT);
  pinMode(echoPin2, INPUT);
  pinMode(redLedPin, OUTPUT);
  pinMode(greenLedPin, OUTPUT);
  pinMode(buzzerPin, OUTPUT);
  pinMode(inputPin, INPUT_PULLUP); // Use INPUT_PULLUP to enable the  on PIN_8
  myservo.attach(servoPin);
  myservo.write(servoPos); // Move the servo to the center position (90 degrees)
}

void loop() {
  long duration2, distance2;
  int inputState = digitalRead(inputPin); // Read the state of the input from the first code

   // Measure distance using Sensor 2
   digitalWrite(trigPin2, LOW);
   delayMicroseconds(2);
   digitalWrite(trigPin2, HIGH);
   delayMicroseconds(10);
   digitalWrite(trigPin2, LOW);
   duration2 = pulseIn(echoPin2, HIGH);
   distance2 = (duration2 / 2) / 29.1;

   // Check the state of PIN_8 and set LED colors accordingly
   if (inputState == HIGH) {
     digitalWrite(redLedPin, LOW);      // Turn off the red LED
     digitalWrite(greenLedPin, HIGH);   // Turn on the green LED
   } else {
     digitalWrite(redLedPin, HIGH);     // Turn on the red LED
     digitalWrite(greenLedPin, LOW);    // Turn off the green LED
   }

  // Check distance from Sensor 2 and operate the servo motor
  if (distance2 <= 5 && inputState == HIGH) {
    myservo.write(180);  // Move the servo to the anticlockwise extreme position (180 degrees)
    delay(2000);         // Wait for 2 seconds
    myservo.write(90);   // Move the servo back to the center position (90 degrees)
    delay(1000);         // Wait for 2 seconds
  }
  if (distance2 <= 5 && inputState == LOW) {
    // Turn ON the buzzer for 1 second
    digitalWrite(buzzerPin, HIGH);
    delay(1000);
    digitalWrite(buzzerPin, LOW);
```

```
  } else {
    // Turn OFF the buzzer if the condition is not met
    digitalWrite(buzzerPin, LOW);
  }

  delay(250); // Pause to let things settle
}

```

Figure 3.9 Coding for Arduino Uno

- Software Code

```
#include <NewPing.h>

#define BLYNK_TEMPLATE_ID "TMPL6PNGOrZ2D"
#define BLYNK_TEMPLATE_NAME "TISSUE MONITOR"
#define BLYNK_FIRMWARE_VERSION "0.1.0"
#define BLYNK_PRINT Serial

char auth[] = "jKz0d6N5UY60oiLFDj1RaM-mrml9rk-i";  // Your Auth Token from the app
char ssid[] = "FyberMaxis"; // Your WiFi network name
char pass[] = "1sampai8"; // Your WiFi password

#define BUTTON_VIRTUAL_PIN V4
#define YELLOW_LED_VIRTUAL_PIN V0
#define GREEN_LED_VIRTUAL_PIN V1
#define RED_LED_VIRTUAL_PIN V2
#define DISTANCE_GAUGE_VIRTUAL_PIN V3

#define LED1_PIN D1
#define LED2_PIN D4
#define LED3_PIN D3 // Added a pin for the yellow LED
#define TRIGGER_PIN D6
#define ECHO_PIN D7
#define D2_PIN D2 // Added a pin for D2

#include "BlynkEdgent.h"

bool buttonState = false;
NewPing sonar(TRIGGER_PIN, ECHO_PIN);

void setup()
{
  Serial.begin(115200);
  delay(100);

  BlynkEdgent.begin();
  pinMode(LED1_PIN, OUTPUT);
  pinMode(LED2_PIN, OUTPUT);
  pinMode(LED3_PIN, OUTPUT); // Initialize the yellow LED pin
  pinMode(D2_PIN, OUTPUT); // Initialize pin D2 as an output
}

void loop()
{
  BlynkEdgent.run();

```

```
  if (Blynk.connected()) {
    Blynk.syncVirtual(BUTTON_VIRTUAL_PIN);
  }

  unsigned int distance = sonar.ping_cm();
    int gauge_percentage;

    if (distance >= 10) {
      gauge_percentage = 0;
    } else if (distance >= 1) {
      gauge_percentage = 100 - (distance - 1) * 10;
    } else {
      gauge_percentage = 100;
    }

  Blynk.virtualWrite(DISTANCE_GAUGE_VIRTUAL_PIN, gauge_percentage);

  // Control the LEDs and virtual LED pins based on the distance
  if (distance == 7) {
    // Distance is equal to 7 cm, turn on Yellow LED and set virtual pin to ON
    Blynk.virtualWrite(YELLOW_LED_VIRTUAL_PIN, HIGH);
    Blynk.virtualWrite(GREEN_LED_VIRTUAL_PIN, LOW);
    Blynk.virtualWrite(RED_LED_VIRTUAL_PIN, LOW);
  } else if (distance >= 8) {
    // Distance is below 8 cm, turn on Green LED and set virtual pin to ON
    Blynk.virtualWrite(YELLOW_LED_VIRTUAL_PIN, LOW);
    Blynk.virtualWrite(GREEN_LED_VIRTUAL_PIN, LOW);
    Blynk.virtualWrite(RED_LED_VIRTUAL_PIN, HIGH);
  } else {
    // Distance is more than 2 cm, turn on Red LED and set virtual pin to ON
    Blynk.virtualWrite(YELLOW_LED_VIRTUAL_PIN, LOW);
    Blynk.virtualWrite(GREEN_LED_VIRTUAL_PIN, HIGH);
    Blynk.virtualWrite(RED_LED_VIRTUAL_PIN, LOW);
  }

  // Control the LEDs based on the button state (as in your original code)
  if (buttonState) {
    digitalWrite(LED1_PIN, HIGH);
    digitalWrite(LED2_PIN, LOW);
    digitalWrite(LED3_PIN, LOW);
  } else {
    digitalWrite(LED1_PIN, LOW);
    digitalWrite(LED2_PIN, HIGH);
    digitalWrite(LED3_PIN, LOW);
  }

  // Control pin D2 based on the distance
  if (distance >= 8) {
    digitalWrite(D2_PIN, LOW); // Turn D2 on when the distance is 5 cm
  } else {
    digitalWrite(D2_PIN, HIGH); // Turn D2 off when the distance is not 5 cm
  }
}

BLYNK_WRITE(BUTTON_VIRTUAL_PIN)
{
  buttonState = param.asInt();
}
```


Figure 3.10 Coding for ESP8266 NodeMCU

3.6 Summary

This chapter presented the process flow of the Automation Tissue Dispenser, flowchart and the block digram of the component how will there operate. We also show the equipment description of the hardware and the software that we use for build the project. In this chapter we put the arduino code and demonstrate in simulation. We use Thinkercad to simulation the IR sensor and Servo Motor. The results of the simulation show that IR sensor will give signal to servo motor when the sensor detect movement. After get the signal the servo motor will turn ON and the tissue out. We also use Wokwi to simulate the Ultrasonic sensor and LCD. Based on the simulation, show that the longer the distance between ultrasonic and tissue, the less the amount of tissue on the holder. All the simulation result is use to help us when build the real prototype of The Smart AutomationTissue Dispenser using Arduino Uno.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

The automated tissue dispenser provides consumers with several advantages. The fact that this gadget encourages cleanliness and lowers the risk of infection is one of its main advantages. Due to the device's automated tissue dispensing, users are spared from touching potentially infectious surfaces. The simplicity of installation and maintenance of the robotic tissue dispenser is another advantage. The tissue box may be quickly replenished as necessary, and the gadget is simple to attach on a wall using screws or sticky tape. The gadget is also strong and long-lasting, which makes it a cost-effective option over time.

4.2 Data Analysis

In today's world, there is a growing demand for smart and automated devices that can make our lives easier and more convenient. One such device is the smart automation tissue dispenser. This device uses sensors to detect when a user is nearby and then dispenses a tissue automatically. The project also will help the workers to monitor the tissue easily. The purpose of this data analysis is to evaluate the performance of a smart automation tissue dispenser and to gain valuable insights and make informed decisions regarding its performance and usability. Specifically, the analysis aims to:-

1. Determine the effective detection range of the sensor in detecting user hand presence.
2. Assess the time taken for the tissue paper to dispense after sensor activation.
3. Evaluate the effectiveness of the indicator and Blynk app in monitoring tissue level.

1. **Determine the effective detection range of the sensor in detecting user hand presence.**

For determine the effective detection range of the sensor in detecting user hand presence, a series of trials were conducted. Ten trials were performed at each distance of 10cm to 0cm. In this test we use ruler to set the distance and one box as example of the user hand. For each trial, have a participant stand at one of the marked distances. After that, record the distance and whether the sensor detected the box. If the sensor detect tick on the detect box but if not detect tick on undetect box. Repeat the trial for each marked distance, making sure to have different participants for each tial. We also use buzzer to the test the detection. If the sensor detect the box the buzzer will turn on.

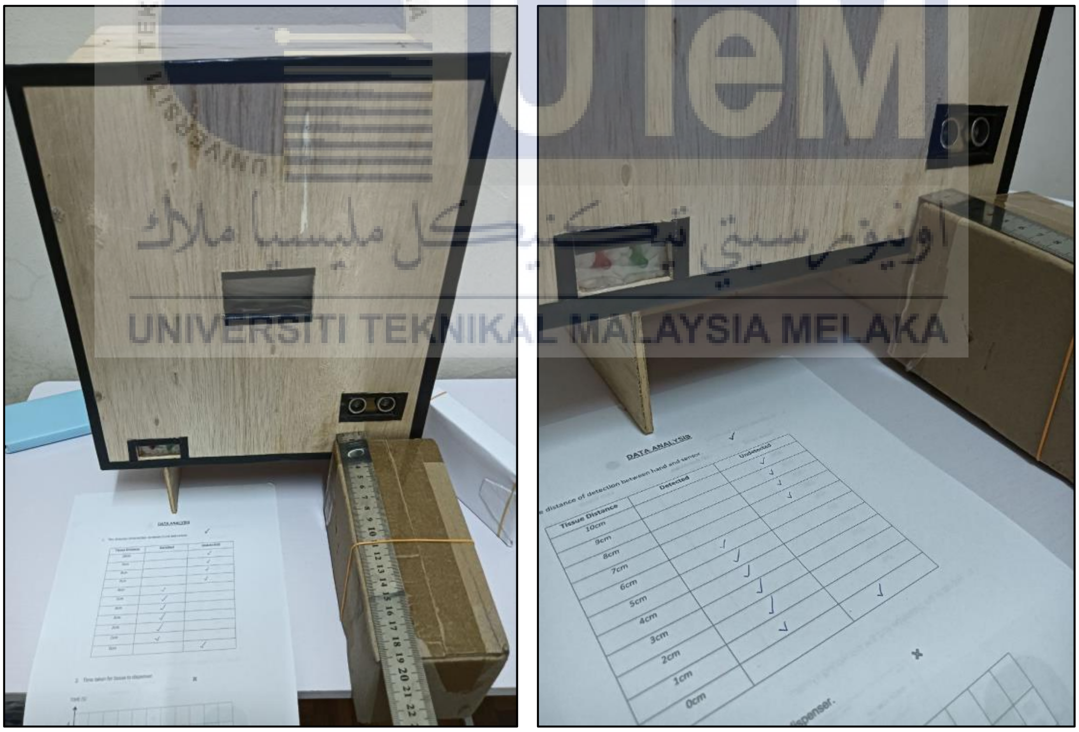


Figure 4.1 Preparation for Data Analysis 1

Table 4.1 Output Data Analysis 1

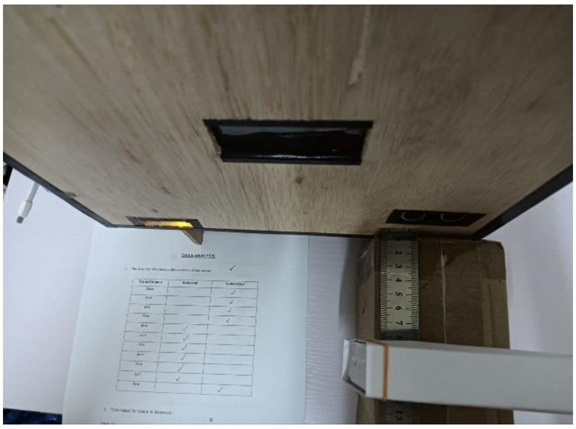
Output Image	Description
 Figure 4.2 Testing 1 with 8cm	- In the figure, show that the ultrasonic sensor is undetect the box at range 8 cm. - The prototype will not dispend the tissue out because the sensor is not detect the box.
 Figure 4.3 Testing 2 with 6cm	- In the figure, show that the ultrasonic sensor is detect the box at range 6 cm. - The prototype will dispend the tissue out because the sensor is detect the box.
 Figure 4.4 Testing 3 with 2cm	- In the figure, show that the ultrasonic sensor is detect the box at range 2 cm. - The prototype will dispend the tissue out because the sensor is detect the box.

Table 4.2 Results Data Analysis 1

Tissue Distance	Detected	Undetected
10cm	-	✓
9cm	-	✓
8cm	-	✓
7cm	-	✓
6cm	✓	-
5cm	✓	-
4cm	✓	-
3cm	✓	-
2cm	✓	-
1cm	✓	-
0cm	-	✓

Based on preliminary testing, the expected effective detection range of the sensor is around 2cm to 6cm. However, the actual range may vary depending on factors such as the environment, the angle of the hand, and the speed of movement. The conclusion of the data from the trials will help determine the effective detection range of the sensor and inform the placement of the dispenser in real-world settings.

2. Assess the time taken for the tissue paper to dispense after sensor activation.

Next for the assess the time taken for the tissue paper to dispenser after sensor detect activation we use stopwatch to measure the time taken for the tissue to dispend. The procedure is firstly, position the assistant at a specific distance from the sensor. Start the stopwatch as soon as the assistant places the box in front of the sensor. After that, observe the tissue dispenser and wait until the tissue paper is fully dispensed. Stop the stopwatch once the tissue paper is fully dispensed. Record the elapsed time from the stopwatch. Repeat the test for 10 times and make the graph for the output.

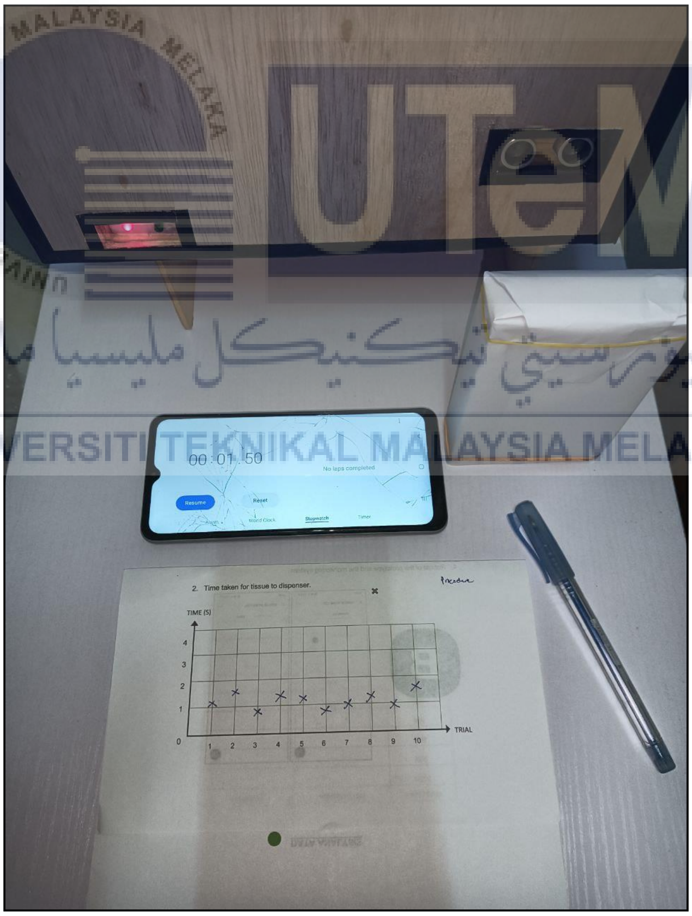


Figure 4.5 Preparation for Data Analysis 2

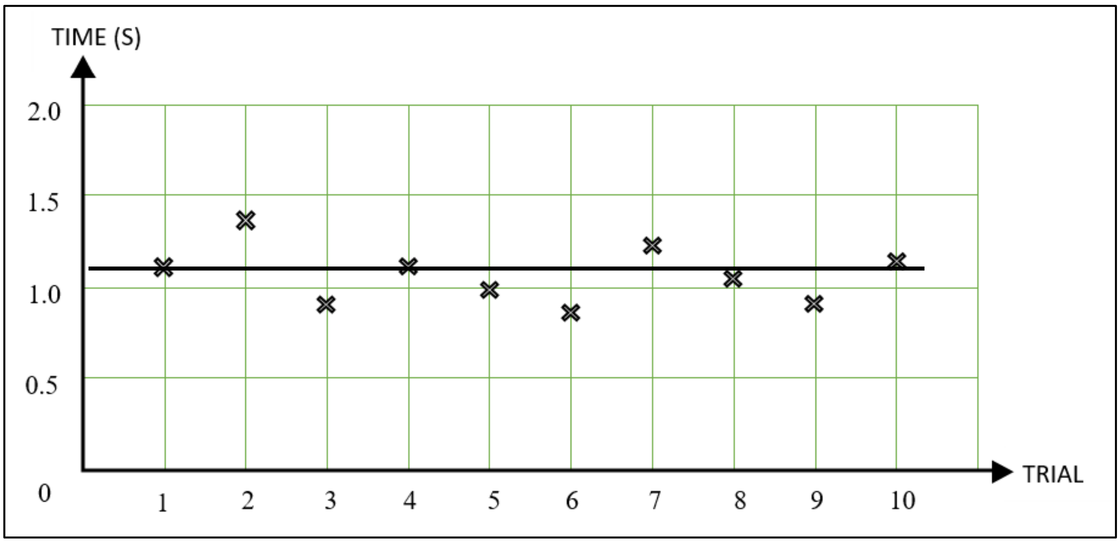


Figure 4.6 Result Data Analysis 2

Based on the scatter graph above it shows the time taken for the tissue paper to dispense after sensor activation for 10 times trials. The horizontal axis (X- axis) represents the times trial for the sensor to the hand, and the vertical axis (Y- axis) represents the time taken for the tissue paper to dispense in seconds. The graph shows a positive consistensy of the time to dispensing the tissue. The graph also shows that the dispensing time is generally consistent at 1 to 1.1 second. We can conclude that the average of time taken to tissue to dispend is 0.98 second for 10 trials. However the distance of the hand and sensor also will be cause for tissue to dispend. Overall, the graph indicates that the smart automation tissue dispenser has a fast dispensing time at short distances.

3. **Evaluate the effectiveness of the indicator and Blynk app in monitoring tissue level.**

To evaluate the effectiveness of Blynk App indicators and applications in monitoring tissue levels. One of the ways we do analysis is that we identify and record what changes to the output of LED prototype and LED in the Blynk App when we change the tissue volume according to the measurements we have set. So the procedure for the test is need to make 4 tissue sizes that have been measured and record the tissue percentage. After that put 0% tissue on the tissue holder and observe and record on the table what is the output of the LED on the prototype and on the blynk Apps. Repeat the procedure and change the volume of the tissue 40%, 50%, and 90% and recoed the output and add on the table.

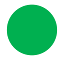
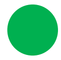
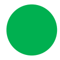
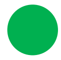
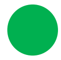
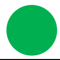
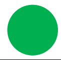
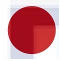
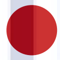
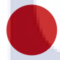
Figure 4.7 Preparation for Data Analysis 3

Table 4.3 Output Data Analysis 3

Output Image	Description
 Figure 4.8 Output for 90%	- In Figure 4.8 , show that the volume of the tissue is 90%. - The prototype LED green is ON and the Blynk App show that the percentage of the tissue is 90% and the LED green in ON show the condition of the tissue is good. - At this point if the ultrasonic sensor detect hand, the prototype will dispend the tissue out.
 Figure 4.9 Output for 50%	- In Figure 4.9, show that the volume of the tissue is 50%. - The prototype LED green is ON and the Blynk App show that the percentage of the tissue is 50% and the LED green in ON show the condition of the tissue is still good to use. - At this point if the ultrasonic sensor detect hand, the prototype will dispend the tissue out.

 Figure 4.10 Output for 40%	- In Figure 4.10, show that the volume of the tissue is 40%. - The prototype LED green is ON and the Blynk App show that the percentage of the tissue is 40% and the LED yellow in ON show the condition of the tissue is get ready to refill. - At this point if the ultrasonic sensor detect hand, the prototype will dispend the tissue out.
 Figure 4.11 Output for 0%	- In Figure 4.11, show that the volume of the tissue is 0%. - The prototype LED red is ON and the Blynk App show that the percentage of the tissue is 0% and the LED red in ON show the condition of the tissue is empty - At this point if the ultrasonic sensor detect hand, the prototype will not dispend the tissue out and the buzzer will ON, it show to the use that tissue is already empty.

Table 4.4 Results Data Analysis 3

Tissue Level	LED Condition	LED Blynk
100%		
90%		
80%		
70%		
60%		
50%		
40%		
30%		
20%		
10%		
0%		

The conclusion of this test is the tissue level indicator and Blynk app show demonstrated effectiveness in monitoring the remaining tissue supply within the dispenser. The accuracy of the indicator consistently matched the actual tissue level, ensuring reliable real-time updates throughout the monitoring period. Moreover, the Blynk app maintained a stable connection with the tissue dispenser, ensuring uninterrupted access to tissue level information.

4.3 Results

In this chapter, we will see the outcomes and results of the discoveries derived from the implementation of the smart automation tissue dispenser using Arduino Uno. The objectives aimed to revolutionize conventional tissue dispensing systems. This chapter serves as the narrative culmination of our endeavors, unveiling the answers to key questions that guided our project. From hardware intricacies to software complexities, we unravel the performance metrics and user-centric aspects that underscore the success of our innovative dispenser.

This section reveals the complicated arrangement of parts that make up the physical core of our smart automated tissue dispenser, providing an inside look at how it functions. The Arduino Uno microcontroller, which is painstakingly set up to decipher signals and coordinate exact tissue distribution activities, is at the core of this inventiveness. With the addition of several carefully placed sensors and servo motor, our dispenser can react to both user input and external stimuli. This section gives a thorough explanation of each component, delves into the Arduino Uno setup, including pin configurations and programming details, and ends with a graphic schematic that captures the harmonious interaction of hardware components that power our clever and effective tissue dispenser.

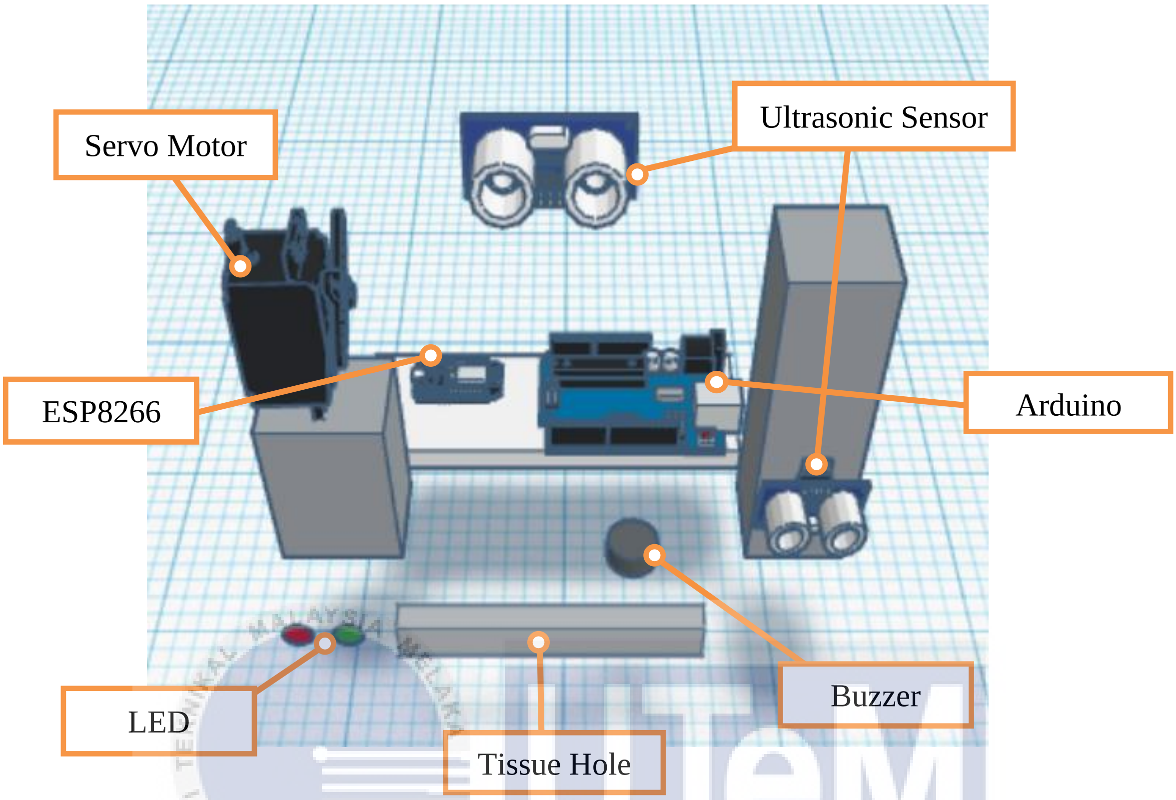


Figure 4.12 Component connection with label

In this segment, we delve into the brains of our smart automation tissue dispenser, demystifying the programming and code that powers its intelligence. The heart of our system lies in the programming of Arduino Uno. We explain how we coded it to understand signals from sensors and control the dispenser accurately. The code structure is laid out in a way that ensures smooth coordination between different components, enabling the dispenser to respond intelligently to user needs.

We provide a detailed overview of how our system processes information from sensors, such as detecting when someone needs a tissue, and translates this into precise actions by the dispenser. The logic behind these processes is broken down, offering insights into the decision-making steps embedded in the code. To enhance understanding, we include relevant snippets of our code, showcasing key sections that handle sensor inputs and dispenser control. These snippets serve as a practical reference, giving readers a tangible sense of how the theoretical concepts discussed are translated into actual programming.

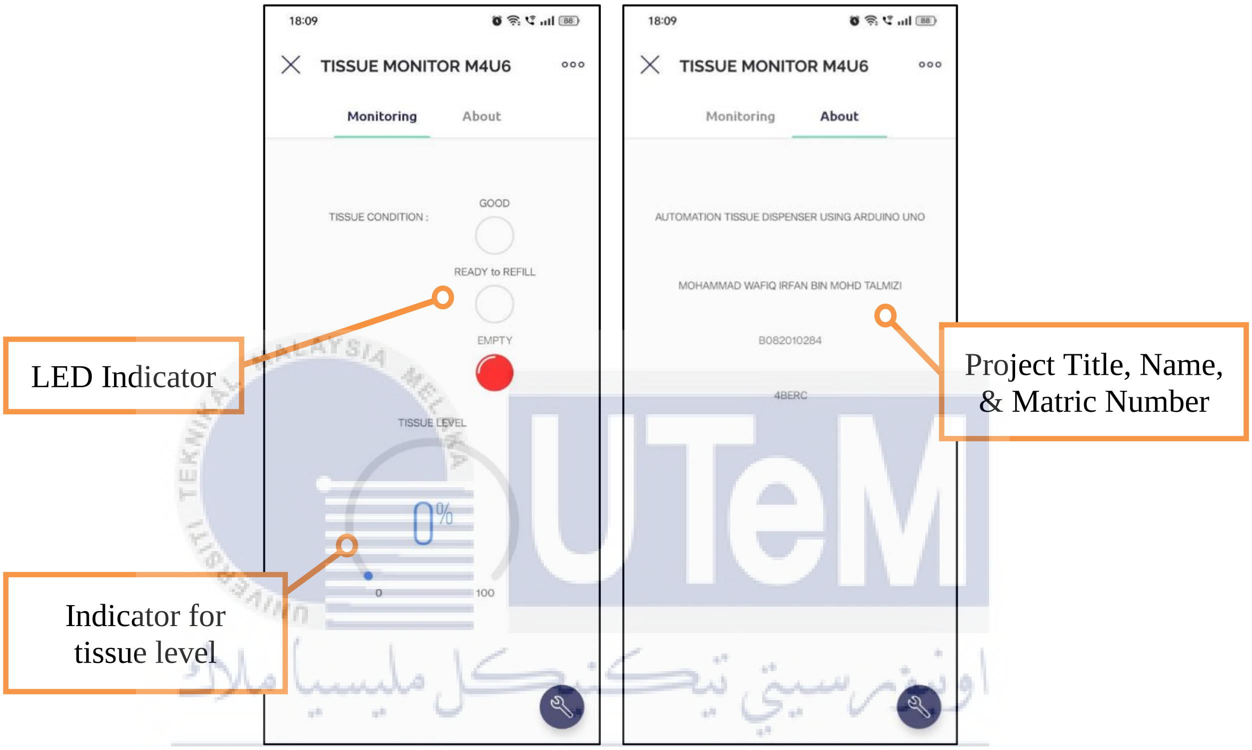


Figure 4.13 Blynk Interface (GUI)

This section provides insights into the design and functionality of the user interface (UI) incorporated into our smart automation tissue dispenser and captures valuable feedback from user testing. If your project includes a user interface, explain its layout, design elements, and how it interacts with users. Describe the buttons, displays, or any other elements users interact with to control or receive information from the dispenser.

Emphasize the user-friendly aspects of the interface, ensuring it aligns with the overall goal of simplifying the tissue dispensing process. Share the results of usability testing conducted to evaluate how easily and effectively users can interact with the dispenser through its interface. This could involve scenarios where users initiate dispensing, adjust settings, or troubleshoot issues. Report any positive aspects noted during testing, such as intuitive navigation or clear instructions, and address any areas where users may have encountered difficulties.

In envisioning the future of our smart automation tissue dispenser, we identify potential enhancements and reflect on areas for improvement. Propose innovative features or improvements that could augment the capabilities of the system. This might include incorporating additional sensors for enhanced user interaction, integrating connectivity features for remote monitoring and control, or exploring sustainable materials for dispenser construction. Consider advancements that align with evolving user needs and technological trends.

For the conclusion, as we draw the curtains on our exploration into the realm of smart automation, we summarize the pivotal findings and underscore the achievement of our project objectives. Highlight the most significant discoveries and outcomes of the project. This could include the successful integration of hardware and software components, positive testing results, and user feedback. Emphasize any unexpected insights gained during the project that contribute to the overall success and uniqueness of the smart automation tissue dispenser.

4.4 Prototype Design

4.4.1 Prototype Design using TinkerCad

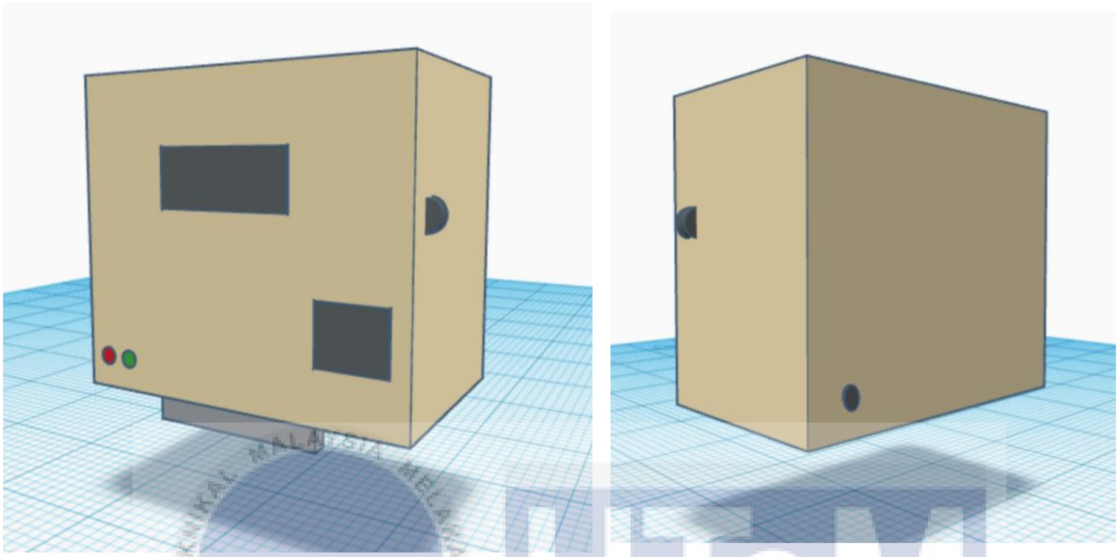


Figure 4.14 Prototype of Automation Tissue Dispenser

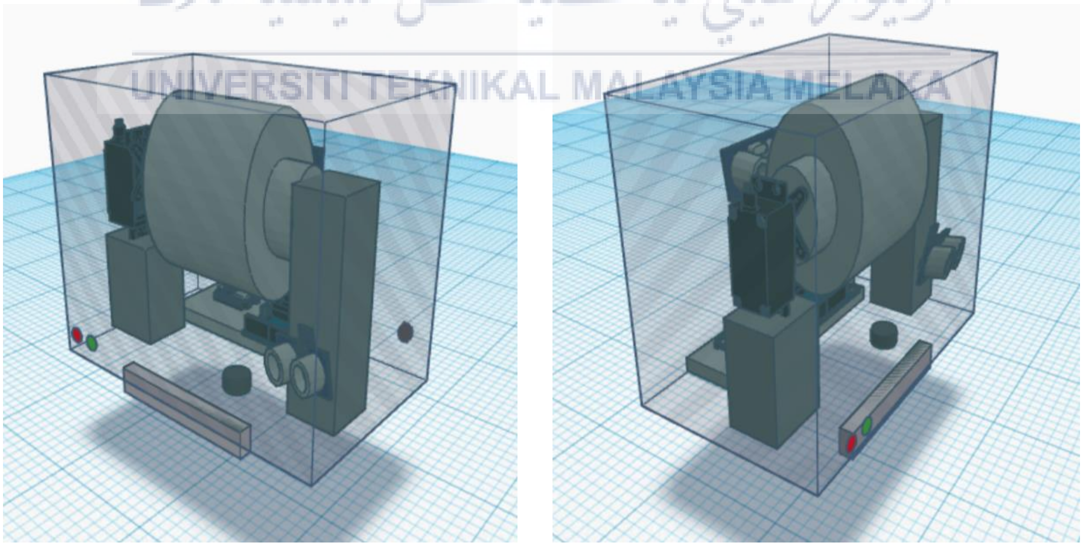


Figure 4.15 View inside of the prototype

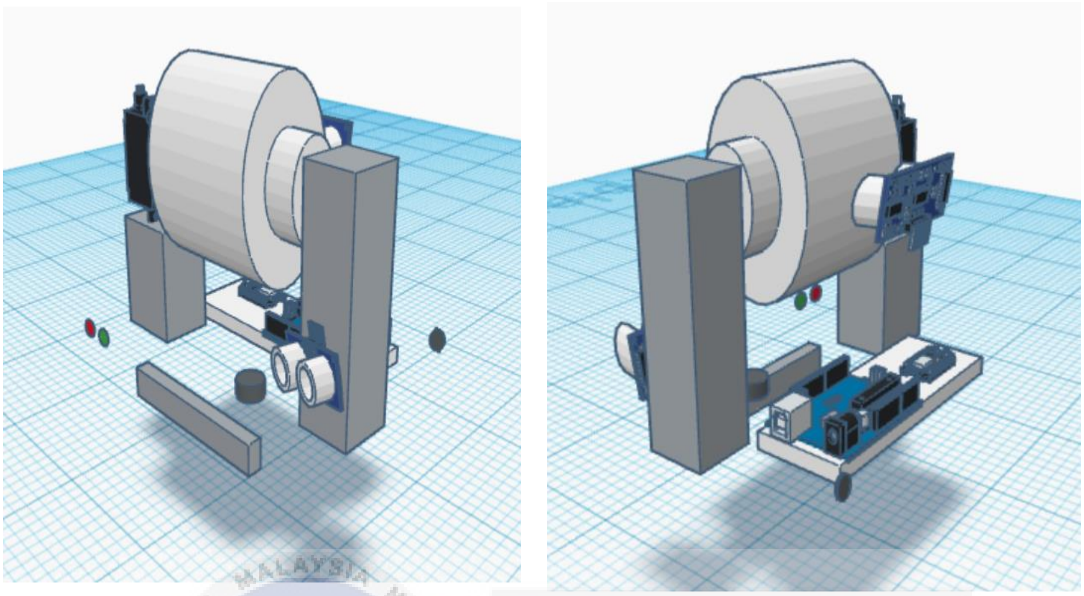


Figure 4.16 View inside of the prototype without cover

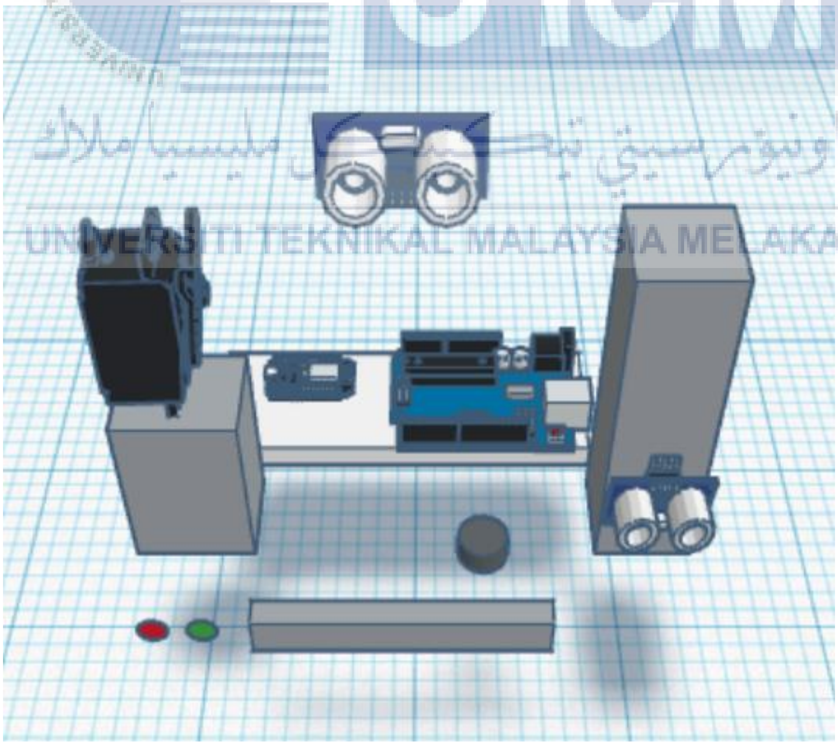


Figure 4.17 View upside of the prototype

4.4.2 Actual Prototype Design

Figure 4.18 Face of the Prototype

Figure 4.19 View inside of the Prototype

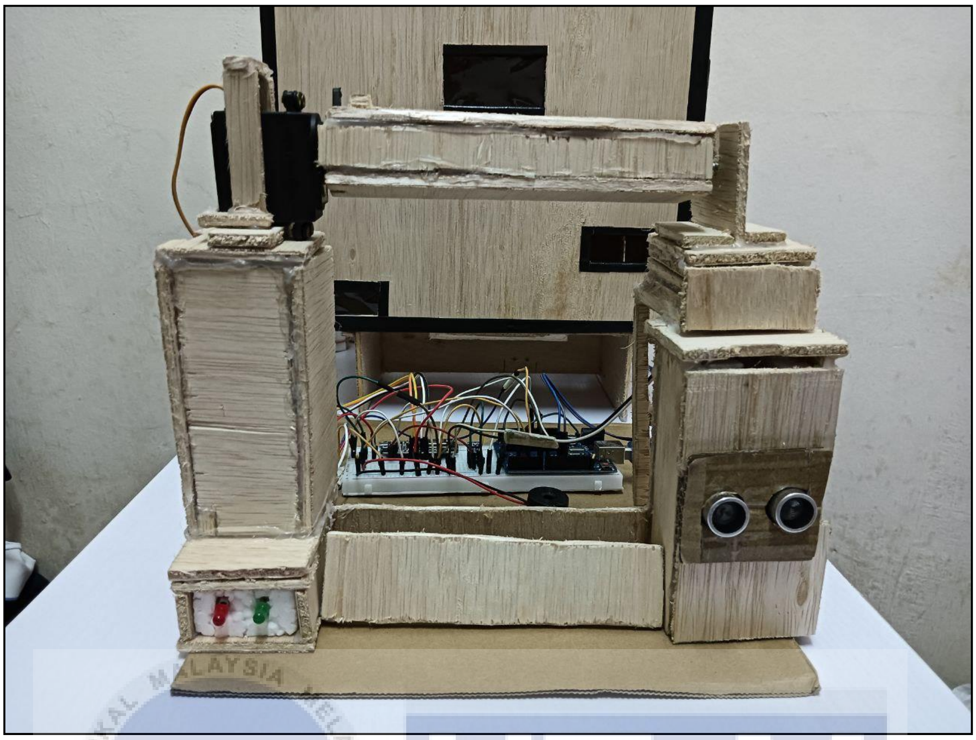


Figure 4.20 Component connection on Prototype

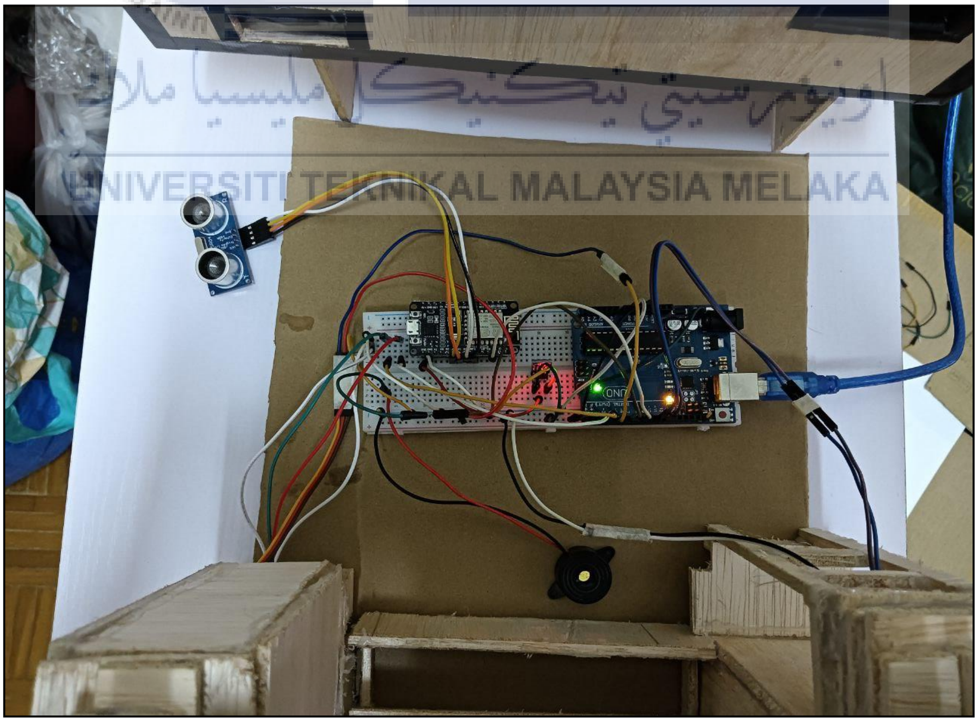


Figure 4.21 Component connection from upside view

4.5 Summary

In this chapter, we conducted a comprehensive exploration of our smart automation tissue dispenser project, beginning with a detailed look at the hardware implementation. The dispenser's physical core was unveiled, featuring an intricate assembly of components centered around the Arduino Uno microcontroller. Moving to the software implementation, we navigated the brains of our system, detailing the programming and code structure of the Arduino Uno. The system's ability to process sensor inputs and control the dispenser mechanism was elucidated, complete with relevant code snippets and algorithms for practical understanding. Testing and validation procedures were then outlined, showcasing the rigorous measures taken to ensure the proper functioning of our smart tissue dispenser. Challenges faced during testing were transparently reported, along with creative solutions, and quantitative data such as response times and accuracy metrics were presented to substantiate the system's performance.

For projects featuring a user interface, we discussed its design and functionality, sharing insights from usability testing and user feedback. This user-centric approach highlighted the importance of an intuitive interface in the overall success of the project. Looking towards the future, we proposed potential enhancements and features to further improve the system, acknowledging and addressing limitations observed in the current design. The conclusion wrapped up our findings, emphasizing the successful fulfillment of project objectives through the seamless integration of hardware and software, validated through testing and user feedback. The inclusion of visuals, including charts, graphs, images, and diagrams, served to enhance the clarity of our results throughout the chapter, providing readers with a holistic understanding of the intricacies and achievements of our smart automation tissue dispenser project.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Our journey into the realm of smart automation has culminated in the creation of a groundbreaking tissue dispenser, seamlessly bridging the gap between convenience and resourcefulness. This chapter served as the epicentre of our endeavours, unveiling the intricate workings of this innovative contraption, and celebrating its success in achieving our revolutionary goals. Delving into the physical intricacies, we revealed the meticulous orchestration of components that power the dispenser. The Arduino Uno, maestro of our invention, deciphered signals and coordinated tissue distribution with the grace of a seasoned conductor. Sensors, meticulously placed, and a servo motor, the loyal lieutenant, transformed user input and external stimuli into precise actions.

This intricate dance of hardware, captured in a comprehensive schematic, became the foundation of our intelligent dispenser. Unmasking the brains behind the operation, we explored the programming code that breathed life into our invention. The Arduino Uno, now a seasoned programmer, expertly interpreted sensor signals and meticulously controlled the dispenser's actions. Each line of code, carefully crafted, orchestrated a smooth symphony of component interaction, enabling the dispenser to respond intelligently to user needs. Code snippets, like insightful backstage passes, offered a glimpse into the decision-making processes embedded within the system, solidifying our understanding of its inner workings.

Striving for intuitive interaction, we crafted a user interface that mirrored the simplicity of our core design. Buttons and displays, user-friendly and strategically placed, facilitated effortless control and dispensed tissues with a touch. Usability testing, the ultimate critic, applauded the interface's intuitiveness, confirming that our goal of seamless interaction had been achieved. Our users, once bewildered by tissue-dispensing woes, now navigated the interface with the confidence of seasoned veterans. With the foundation laid, we dared to dream of the dispenser's next act. Additional sensors, we envisioned, could anticipate user needs even before they arose. Remote monitoring, a futuristic touch, promised convenience and efficiency like never before.

Sustainable materials, whispering to our environmental conscience, could transform the dispenser into a beacon of eco-friendly innovation. These advancements, mere whispers on the horizon, beckoned us to continue our journey, pushing the boundaries of smart automation and redefining the humble tissue dispenser once again. As we draw the curtains on this chapter, we stand proudly upon the achievements of our project. Our smart automation tissue dispenser, conceived as a mere spark of an idea, has blossomed into a reality that revolutionizes everyday experience. The successful integration of hardware and software, the positive testing results, and the resounding praise from users, all sing in unison of a victory well-earned.

Unexpected insights, gleaned throughout the process, have further fortified our creation, making it not just innovative, but also uniquely our own. This, then, is not the end, but the beginning of a new era, where every tissue dispensed whispers a tale of ingenuity and reminds us that even the smallest inventions can hold the power to transform the ordinary into something extraordinary.

In addition, the automation tissue dispenser can help the maintainers to know when it's time for them to refill the tissue and it can help the users before or at the time when the use of tissue is very needed. Based on results of the simulation that have been in the done using two simulation platform Thinkercad and Wokwi. It shows that this project can operate as we want and can deliver the output as we want. Overall, the study described in this thesis was successful in advancing knowledge about the significance of a system-wide estimating approach for a smart automation tissue dispenser. In conclusion, a Smart Automation Tissue Dispenser will both save the user from using unnecessary tissue and make it simple and effective for the staff to manage the tissue supply.

5.2 Future Works

The future improvements of the Smart Automation Tissue Dispenser:

1. Improve the design based on research and user feedback, considering user interface, aesthetics, maintenance, and durability.
2. Combine the hardware and the software code in system.
3. Engage engineers and manufacturers to build the prototype, integrating components like sensors, connectivity modules, and actuators.
4. Assemble the prototype, test it rigorously for safety and functionality.
5. Deploy the prototype in real-world settings to gather user feedback and make necessary improvements.
6. Refine and optimize the prototype based on user trials, focusing on design, functionality, and user experience.
7. Prepare for mass production by establishing efficient manufacturing processes and ensuring scalability.

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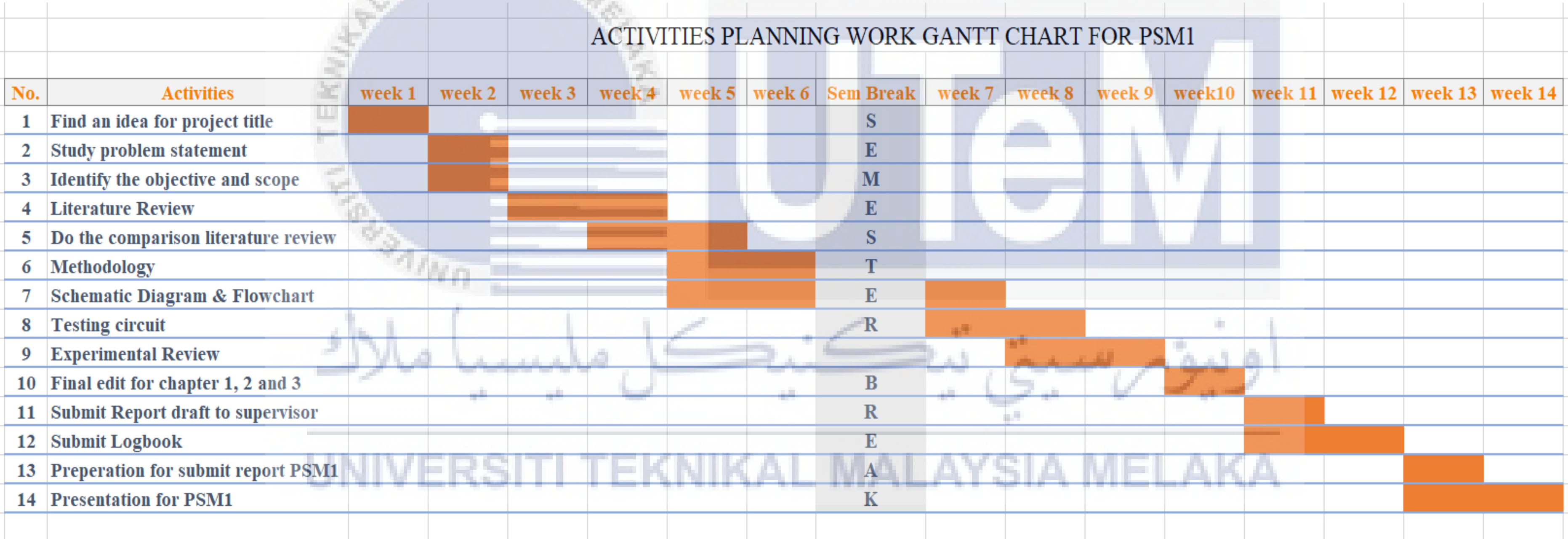
APPENDICES

Appendix A Gantt Chart for BDP1



Appendix B Gantt Chart for BDP2

ACTIVITIES PLANNING WORK GANTT CHART FOR PSM2																	
No.	Activities	week 1	week 2	week 3	week 4	week 5	week 6	week 7		week 8	week 9	week10	week 11	week 12	week 13	week 14
1	Do correction on the prototype based of Panel comment								S							
2	Continue build the prototype								E							
3	Meet Supervisor and discuss about the project								M							
4	Discuss about the Data Analysis with Supervisor								E							
5	Submit Claim form for PSM								S							
6	Present to Supervisor								T							
7	Collect the Data Analysis 1								E							
8	Collect the Data Analysis 2								R							
9	Collect the Data Analysis 3															
10	Do Final test on the prototype								B							
11	Add the Data Analysis and Result in PSM2 Report								R							
12	Submit PSM2 Report to Supervisor								E							
13	Preperation for Presentation PSM2								A							
14	Submit PSM2 Report and Logbook								K							

Appendix C Bill of Material (BoM)

Table 5.1 Bill of Material (BoM)

NO	ITEM	DESCRIPTION	QUANTITY	COST/ITEM	COST
1.	Arduino UNO R3	Arduino UNO R3 Compatible with USB Cable, ATmega328 16U2	1	RM39.80	RM39.80
2.	DC Power Supply Adapter	DC 5V 2A Power Adapter Supply AC to DC	1	RM13.90	RM13.90
3.	Servo Motor	MG995 MG996r SG90 9g MG90s S3003 Metal 360 Degree	1	RM16.90	RM16.90
4.	Jumper	Female to Male (FM) 40pcs Dupont Jumper Wire DIY Breadboard Rainbow Cable	1	RM3.60	RM3.60
5.	NodeMCU ESP8266	The module acts as the communication bridge between the Arduino Uno and the Firebase database	1	RM19.90	RM19.90
6.	Meduim Breadboard	Wire size: 29-20 AWG wires - Size: ~165mm x 54mm x 9mm PACKAGE INCLUDES 1 x MB-102 830 Point Solderless Breadboard	1	RM3.90	RM3.90
7.	LED	LED LEDs 3MM 5MM Light Emitting Diode Bulb DIY STEM RBT PROJECT	2	RM1.20	RM2.40
8.	Buzzer	DC3-24V SFM-20B Active Piezoelectric Buzzer Long Continous Beep Tone Buzzer	1	RM2.40	RM2.40
9.	Ultrasonic Sensor	Ultrasonic Sensor HC-SR04 HC SR 04 HCSR04 Ultrasound Range Finder Distance Measure Measurement Module Arduino Robotics	2	RM3.20	RM6.40
				TOTAL COST	**RM 109.20**