[SMART ATTENDANCE SYSTEM TO PREVENT SPREADING OF PANDEMIC DISEASES]

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This report is submitted in partial fulfillment of the requirements for the Bachelor of [Computer Science (Computer Networking)] with Honours.

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
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DECLARATION

I hereby declare that this project report entitled

[SMART ATTENDANCE SYSTEM TO PREVENT SPREADING OF PANDEMIC DISEASES]

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT : _____ Date : 2/9/2021_

(NURUL AFIFAH BINTI AHMAD MAHIN)

I hereby declare that I have read this project report and found this project report is sufficient in term of the scope and quality for the award of Bachelor of [Computer Science (Computer Networking)] with Honours.

SUPERVISOR : _____ Date : 9/9/2021

(TS. DR. NORHARYATI BINTI HARUM)

DEDICATION

First of all, this dedication is for my Creator, Allah S.W.T that give me the strength to complete this project. This thesis is dedicated to my supervisor, Dr. Norharyati Binti Harum that always assist me in completing this project. To my beloved parents, Ahmad Mahin Bin Abdul Ghani and Rosnawati Binti Abu Yamin which always support me especially in term of emotion and moral during completing this project. To my friends, that always give me guidelines and show me the way when the problem occur during the progress of the project. Without them, this project can't be completed in the time scheduled. Lastly, to the people around me that always give me moral support most of the time.

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ABSTRACT

This report is focuses on Smart Attendance System that is developed to fit in the pandemic disease of COVID-19. In this developed system, RFID tag and body temperature will be scanned before employee enter the office. This system will have an error handling code where only registered RFID tag and temperature below than 37.5 ℃ is allowed to enter the office and record attendance. The attendance record will be stored in database and can be viewed and monitor by the administrator of the system using web browser. The administrator is allowed to add the registered RFID tag for the attendance system. The user of employee will have a notification about their status of attendance using LCD monitor display and LED. Hence, this project will help the organizations or company to detect the symptoms of COVID-19 only at their office. It will also help preventing any COVID-19 cluster inside an office.

ABSTRAK

Laporan ini memfokuskan pada Sistem Kehadiran Pintar yang dibangunkan agar sesuai dengan penyakit pandemik COVID-19. Dalam sistem yang dibangunkan ini, tag RFID dan suhu badan akan diimbas sebelum pekerja memasuki pejabat. Sistem ini akan mempunyai kod pengendalian ralat di mana hanya label RFID yang didaftarkan dan suhu di bawah 37.5℃ dibenarkan memasuki pejabat dan mencatat kehadiran. Catatan kehadiran akan disimpan dalam pangkalan data dan dapat dilihat dan dipantau oleh pentadbir sistem menggunakan penyemak imbas web. Pentadbir dibenarkan menambahkan tag RFID yang didaftarkan untuk sistem kehadiran. Pengguna pekerja akan mendapat pemberitahuan mengenai status kehadiran mereka menggunakan paparan monitor LCD dan LED. Oleh itu, projek ini akan membantu organisasi atau syarikat untuk mengesan gejala COVID-19 hanya di pejabat mereka. Ia juga akan membantu mencegah sebarang kluster COVID-19 di dalam pejabat.

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CHAPTER I

INTRODUCTION

1.1 Introduction

On 30th January 2020, the World Health Organization has declared a Public Health Emergency of International concern as a virus called COVID-19 started attacking people in Wuhan, China. During a very short period of time, the number of people infected by the virus is growing not only in China but it is spreading across the world. The virus is declared as a pandemic on 11th March 2020 (Listing of WHO's response to COVID-19, 2021). Many countries have declared lockdown by their Prime Minister and started to figure out the symptoms of the virus and ways to prevent the virus to be infected from one person to another person. The symptoms and ways of has prevention been defined by the doctors from all across the countries. One of the common symptoms is fever, where the body temperature of those having fever will increase above 37.5 ℃ (COVID-19 Symptoms, n.d.).

In Malaysia, fully lockdown of Movement Control Order (MCO) 1.0 has prevented all of the industries to stop working and stay at home. In two months, the number of cases has drop to 0 cases per day. A few weeks later, the number of cases went higher per day and the country could not effort to generate much income and people has started to losing job. MCO 2.0 follows by MCO 3.0 are then implemented by the government, where only selected industries are given permission to work and others can start work from home (WFH). Though, during MCO 2.0 and MCO 3.0 implementation, cases from working-places are increasing (Operasi kilang punca Covid-19 meningkat, 2021). The operational of some industries such as essential factory need to be assisted with smart application that can reduce covid-19 cases.

In this project, a new attendance system is developed to fit in the current world pandemic of COVID-19. The current system of attendance system only included RFID tag to

record the employee attendance. In this new developed system, an infrared thermometer is included with the RFID tag to record the employee attendance. As stated earlier, the most common symptom of COVID-19 is by having a fever. Most of pandemic diseases have symptom of high fever such as having a body temperature higher than 37.5 ℃. Hence, with the new developed system, it will help an organization to detect the symptoms of COVID-19 to avoid workers with the symptom coming to the workplace.

The new developed attendance system will scan body temperature of employee and checks their temperature. If the temperature is above 37.5 ℃, they are prohibited from record any attendance. The system will only allow the registered employee with temperature lower than 37.5 ℃ to record attendance and enter the office building. Hence, this project will also help preventing any COVID-19 cluster inside a working place such as factories and offices.

The attendance system consists of two components; interface for the user of employee and the administrator of the system. As for the employee, they can see their current attendance record using LCD monitor display with a green and red LED. The LCD monitor display will show their body temperature and status of attendance while the functionality of LED will turn on green as indication of success and red for indication of failure. As for administrators, they will monitor their workers' attendance and body health record in a web browser. From the web browser, they can monitor and update the data inside the system using a graphical user interface which make it a lot easier. The developed attendance system will keep the records in a database system. Hence, the data will have a large storage to keep all of the information. In addition, it will also help the integrity of the data.

1.2 Problem Statement (PS)

The current attendance system that we have nowadays only include of scanning RFID tag only. The body temperature of employee that attend to the office remains unknown. This will only cause danger to all the employee inside the office as we does not know which employee has the symptoms and may get it infected with other workers. Besieds, this can also cause a cluster among the workers as they can continously spread the virus without them knowing.

Table 1.1 Summary of Problem Statement

PS	**Problem Statement**
PS_1	The current attendance system that we have nowadays only include of scanning RFID tag only and the employee does not know if any other workers have the symptoms of COVID-19 as there are no scanning of body temperature.

1.3 Project Question (PQ)

There are many questions that can relate with attendance system. These questions will lead to objectives. The project question is regarding to the problem statement as stated in Table 1.1.

Table 1.2 Summary of Project Question

PS	**PQ**	**Project Question**
PS_1	PQ_1	How to build the new attendance system that includes body temperature with RFID tag?
	PQ_2	How to develop a smart attendance system that can validate data input from user and alert the user?
	PQ_3	How to validate the functionality of the new developed system?

1.4 Project Objective (PO)

The objective for this project is defined from the problem questions. These objectives will be a guideline in order to implement the smart attendance system. The project objective is listed as the following:

Table 1.3 Summary of Project Objectives

PS	PQ	PO	Project Objective
PS_1	PQ_1	PO_1	To analyze the existing attendance of RFID system
	PQ_2	PO_2	To develop an attendance system that have body temperature check module to prevent spreading of pandemic disease
	PQ_3	PO_3	To validate the functionality of the new developed attendance system

1.5 Project Scope

The attendance system is developed to be placed before enter the workspace area inside the office. The user which is employee must scan their body temperature and RFID tag before start working. There are many organizations or company that can use the attendance system regardless which industries they are from. The Administrator can also monitor and update the data in the attendance system. The system includes the detection RFID tag and body temperature system using RFID sensor and infrared thermometer using Arduino IDE and Node-RED application, notification to multi-user using LCD monitor display and LED for user and web browser for administrator. The data storage of the system is kept in MySQL database.

1.6 Project Contribution (PC)

By having this project, it will help the organizations or company to detect the symptoms of COVID-19 only at their office. It will also help preventing any COVID-19 cluster inside an office.

Table 1.4 Summary of Project Contribution

PS	**PQ**	**PO**	**PC**	**Project Contribution**
PS_1	PQ_1	PO_1	PC_1	Help the organizations or company to detect the symptoms of COVID-19 only at their office and will also help preventing any COVID-19 cluster inside an office.
	PQ_2	PO_2		
	PQ_3	PO_3		

1.7 Conclusion

In conclusion, this chapter helps to conclude the project background on developing a new smart attendance system. Based on the problem statement, project question, project objective and project contribution of the smart attendance system during pandemic disease, this developed project will help organizations or company to detect the symptoms of COVID-19 only at their office. It will also help preventing any COVID-19 cluster inside an office. The administrator of the system can also monitor and update the attendance system using web browser. The records of attendance system will be store in a database. Hence, this project will have a lot of space storage and this will also help the integrity of data.

The next chapter will be focusing on the literature review that will cover about the model approached and related work about the framework, enhancing the framework and system integration of the attendance system.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

Technology is growing rapidly in this era. There are many IoT device is developed today to help build a system or application that can help user in daily life. It also helps user in managing and monitoring a system. By comparing the attendance system that are developed now that years ago are very inspiring to see how IoT has changed our life. IoT technology will continuously became useful and more functional as the day passed. As we all know, RFID sensor has widely used in many organizations and industries to help user in managing and monitoring a system such as attendance system. The sensor will capture the unique ID on the RFID tags to capture the attendance. But as the day passed, we can realize that we can integrate the attendance system into something more powerful and useful.

This chapter is the study about the literature review. The first topic that will be covered is the previous work regarding to RFID based attendance system. The previous work will be analyzed and table of problem and solution will be tabulate based on the previous work in critical review. Ten previous works has been selected to be analyzed and from the table in critical review, propose solution will be proposed to overcome the problem. The last subtopic for this chapter is the conclusion which will conclude the overall of this chapter.

2.2 Related Work/Previous Work

2.2.1 RFID Based Attendance System

This paper (Hasan U. Zaman, 2017), state RFID technology is an automatic wireless identification system that works by the help of active and passive cards and a reader. As for the RFID tag is described as a transponder which transmits information through radio frequency. It serves mainly two purposes which is record an attendance for entry and leave time and also its work is for authentication and authorization purpose. The attendance will be recorded along with time and date and store in an internal SD card and finally send the data to API application which is Thingspeak and it is also uses Wi-Fi connection in the system. The paper use Arduino Mega as a hardware microcontroller to carried out the project.

2.2.2 Smart Monitoring System using RFID Technology

RFID is known in the world start in the year of 1940. It was a radar define and used. The advancements of radio innovation are tackles with RFID innovation. This paper (Ashlin Jinushia R., 2020), describe RFID System Architecture has three different segments which is tags, antenna and reader. The tags are used to tack the system with enhanced chip and radio waves and has its own unique id. Antenna is used for transmitting data through radio waves by users while reader is used to read data that is transmitted. The paper uses Arduino Uno as a hardware microcontroller to carried out the project and Compiler-Arduino Version 1.6.8 and language embedded c as the software component needed to complete the project. The project is implemented using the fitting of COM port in the pc and output is displayed on LCD display.

2.2.3 Smart Attendance Management System using Radio Frequency Identification

The technique used to develop the attendance system is by saving data capture by the RFID is directly connected to excel sheet. All the attendance data will be linked and saved in excel sheet. From this paper (Inturi Meghana, 2020), RFID sensor is the lowest sensor in cost to develop an attendance system compare to biometric, face recognition, motion detector and

NFC. The software used to keep the attendance data is by using PLXDAQ. It will send data directly to excel sheet. Database is not used in this system as stated because it is considered as double excel sheet as they need to download the data from database and Arduino Uno is used as a microcontroller to build the system.

2.2.4 RFID-based Attendance Management System

The technique used to develop the attendance system is by storing data into database and the data is stored, processed and presented in a meaningful form such MS Excel file, texts, graph and many more. This paper (H.K Nguyen, 2017), explains the other methods that can be used to capture attendance system data but RFID is the simplest and cost effective. This system uses Wi-Fi wireless technology that enable to send data remotely. By using Wi-Fi technology, we can connect any sensor from anywhere to the server. The Wi-Fi module used is MRF24WBoMA and MCU Cortex-M3 is used as a microcontroller to develop the system.

2.2.5 Radio Frequency Identification Based Attendance System

RFID Technology is described as to read and store the data. This paper (Sonali Gaitonde, 2020), also describes the benefits of using RFID Technology then barcode scanner. One of them is that barcode scanner needs to be align with the reader while RFID tags can be placed in front of the reader in any alignment to read the data. The technique of proposed system is using database to maintain the proper log of the data received from the tags. The chosen database management is PhpMyAdmin and mySQL database as it is easy to use because there are no APIs are involved. In this system, Djanggo Framework is used as user interface. The hardware of the system used is MFRC 522 due to lower range, high frequency and lesser input voltage. Microcontroller of Raspberry Pi 2b+ is used as it has the connection to the internet and has many IO pins than Arduino Uno. Besides that, Nokia 5110 LCD Display and red, yellow and green LED is used.

2.2.6 RFID Based Attendance System

Radio Frequency Identification (RFID) technology is gaining momentum nowadays with many applications in various fields such as offices, agriculture and transportation. This technology is an automatic identification technology used for retrieving from or storing data into RFID tags without physical contact. In this proposed attendance system (Ajai Joshi, 2020), the recorded data is kept in internal SD card and the data is finally kept inside the EEPROM of Arduino Uno microcontroller. The data recorded with time and date of the day along with user name and user ID. The hardware used for the RFID tags is MFR522 RFID sensor and the time and date of the system is captured using RTC module. There is also I2C Display of LCD is used to provide a simple GUI for the user to know that their card is read and attendance is taken and store inside the EEPROM.

2.2.7 Student Attendance System using RFID

In this project (R.Nivetha, 2020), Radio Frequency Identification (RFID) is used for tracking and identification of the objects in the particular zone. The MFRC522 sensor is used to transmit the information of the students between the reader and RFID tag. The system uses Arduino Uno as microcontroller to build the system while the software used is PLX-DAQ which parallax data acquisition that can help to store the student data inside the excel sheet. A buzzer, red led, green led and LCD Display is used to be user friendly to the student as indication of their card and attendance is accepted by the sensor or otherwise. The excel sheet data provide the student number, date, name, card ID, time in and time out.

2.2.8 IoT Based Smart Attendance Monitoring System using RFID

This paper (Unnati Koppikar, 2019), indicates that it is hard to maintain an attendance system for a long term. Hence, this paper is proposed an ease of way to maintain monitor the attendance system. By designing a user-friendly IoT based attendance system, student or employees can record their attendance at ease. As a result, the accuracy of attendance record also saves the valuable time of students and employee. The system works as MFRC522 sensor will capture the attendance and will kept the data inside database. The recorded data can be

viewed with a website that integrated with the information inside the database. The microcontroller used in Arduino uno. Other hardware used is a red led and green led which is to indicate the authorize RFID tags. The system also enabled to add, search, edit the user information using a website.

2.2.9 Radio Frequency Identification (RFID) Based Employee Attendance System Management

This research focuses their research limited on to entry employee profile and attendance of employee. The objective of this paper (Rompas, 2018), is to design an attendance system by using RFID technology that can help the institutions of Faculty of Engineering, Universitas Negeri Manado to improve the effectiveness in performing employee absenteeism data by minimizing the possibility of errors that will occur and reducing fraud in data collection so that information security can occur. The method used in this research are divided by three parts which is RFID tag and RFID reader module. Next part is the USB port 2.0 used by computer to communicate with the RFID reader and the last part is the control unit and display section which is the user interface for the user to use the system. Both of the units are made by VB.Net programming language application along with its database.

2.2.10 An Attendance System Design based on RFID Technology

The technique used for this system is by using Arduino, MFR522 and WIFI to design network card reader, the system stored data through Access database and designed the upper computer program by the background by the LabVIEW 2016. This system has the advantages of low cost, simple operation, simple interface and easy maintenance. This paper (Li, 2019), focuses on building an employee attendance. For the hardware selection of the system is using the latest version of Arduino UNO R3 development board as it has high performance and low power consumption based on AVR enhanced. Next is RFID sensor picked is MFR522 that provides low-cost, low-voltage, small size and has the ability to read or write the chip. For WIFI communication ESP8266 are used as it has low power consumption, stable performance and high integration. Lastly, LCD I2C display are used to minimized the use of I/O pins but

provide the same functionality among the others versions of LCD display. Arduino serial data is converted into parallel data and sent to LCD display.

2.3 Critical review of current problem and justification

From the criteria, objective and technique listed, research and study have been conducted in order to find it weakness and flaws. All of the weakness must be avoided to ensure the system works in a long term and more organize manner. The results of the study will help new investors in developing new and integrated product of the attendance system. The summary of the finding is tabulated.

In table 2.1, the purpose, problem and possible solution of each paper is discussed in detail. In table 2.2, each paper equipment and technology such as microcontroller, communication technology, data storage and sensor used is discussed and based on the information collected, a proposed solution is identified and used for this project.

Table 2.1 Problem and solution proposed based on the previous work

RFID Based Attendance System			
Research Title/Product	**Purpose**	**Problem/Open Issue**	**Possible Solution/Proposed Solution**
RFID Based Attendance System By: Hasan U. Zaman, Jannatul Siffat Hossain, Tasnim Tamanna Anika, Deboshree Choudhury (2017)	Describes on how RFID works in attendance system. It also discussed the benefits of using RFID than the existing system that uses barcode.	The data of the attendance is kept in SD card then uploaded to the Thingspeak API application. This will require a lot of memory and the SD card will continuously change repeatedly after the memory per SD card is run out of space.	There is no need of SD card to keep the data of attendance. All of the data will be kept in database server and display in the GUI display.
Smart Monitoring System using RFID Technology By: Ashlin Jinushia R., S. Senthilkumar, S. Bhuvaneswari, Eric Clapton (2020)	Describes the advancement of RFID innovation adjusted from the year 1940 – 2010 where RFID start to become an innovative application since then. It describes how does it works on attendance system.	The output display of the data is available on LCD only. There is no PC interface of the output.	Create a GUI display for easy monitoring the attendance system instead of depending on LCD display

Smart Attendance Management System using Radio Frequency Identification By: Inturi Meghana, J.D.N.V.L Meghana, Ramesh Jayaraman (2020)	The technique used in this paper is by saving the data capture by the RFID in excel sheet with PLXDAQ software. There is no database used as it directly store the data in excel.	The excel sheet shown in the figure shows the only data capture is date, time and RFID UID only which will be hard to keep all the data in excel without the any names. The access control for the RFID tag is identified in the coding program inside Arduino. This will cause space memory process of Arduino to keep tabs on the RFID tag once the number of users of these tags is increasing.	Create a database that can ease the management of the attendance system and link the RFID UID tag with the user names so it can easily be identified during monitoring the system.
RFID-based attendance management system By: H.K Nguyen, M.T. Chew (2017)	The technique used to develop the attendance system is by storing data into database and the data is stored, processed and presented in a meaningful form such MS Excel file, texts, graph and many more.	The Java GUI database shown in the figure state that the data that is kept in the system is only RFID UID, time and date of the recorded data.	Add information of user name with the RFID UID tag inside the database so that the process of monitoring the system is running smoothly.

Radio Frequency Identification Based Attendance System By: Sonali Gaitonde, Mayuresh Shelar, Riddhi Pandey, Gaurav Tuntune (2020)	The technique used in this system is using a PhpMyAdmin and my SQL database to keep the proper log of the recorded data. It also uses Djanggo user interface to present the data.	The display of GUI interface of the user is being redirected to phpMyAdmin database page. It does not show the recorded data in GUI format of a website.	Dynamically update and display the recorded attendance on website instead of redirecting to phpMyAdmin database page
RFID Based Attendance System By: Ajai Joshi, Aman Ahmad, Arpit Saxena, Poonam Juneja (2020)	Principle objective of this paper is to make a system that will take the attendance of authorized individuals (Student/Employee) and record the data along with date and time to store it inside an SD card and finally store also inside EEPROM	Not suitable to use for long term attendance system as all the data will kept in a different SD card once it runs out of space	Create a database for the attendance system so that it has unlimited data storage and saves many attendance records

Student Attendance System using RFID By: R.Nivetha, M. Kavipriya, R. Pavithra, C. Jeyanthi, V. Santhana Lakshmi (2020)	The purpose of this paper is to transmit the information of student between the reader and RFID tag then store inside excel sheet	Can store limited number of attendances inside the Arduino Uno microcontroller.	Create a database for the attendance system so that it has unlimited data storage and saves many attendance records
IoT based Smart Attendance Monitoring System By: Unnati Koppikar, Shobha Hiremath, Akshata Shiralkar, Akshata Rajoor, V.P. Baligar (2019)	The proposed system of this paper is to provide a system that is easy to handle and very convenient for any organization, time-saving, user friendly and reliable to use	There is no health check monitoring embedded with the current attendance system.	Embedded a sensor to capture user temperature to ensure all of the students or employee that go to work or school is in a good health and condition

Radio Frequency Identification (RFID) Based Employee Attendance System Management By: G D P Maramis* and P T D Rompas (2018)	Design an attendance system by using RFID technology that can help the institutions of any employments industries to improve the effectiveness in performing employee absenteeism data	There is no health check monitoring embedded with the current attendance system.	Embedded a sensor to capture user temperature to ensure all of the students or employee that go to work or school is in a good health and condition
An Attendance System Design based on RFID Technology By: Lijuan Shi Li (2019)	Develop a network attendance management system that design a network card reader to store stored data through Access database with interface of LabVIEW 2016	There is no health check monitoring embedded with the current attendance system.	Embedded a sensor to capture user temperature to ensure all of the students or employee that go to work or school is in a good health and condition

Table 2.2 Comparison of Functionality with previous project and solution proposed

Author/Year	Microcontroller	Communication Technology	Data Storage	Data Representation	RFID Sensor	Temperature Sensor
Hasan U. Zaman, Jannatul Siffat Hossain, Tasnim Tamanna Anika, Deboshree Choudhury (2017)	Arduino MEGA	Wi-Fi	SD Card	• Thingspeak API • 16X2 LCD Display	RFID Reader	-
Ashlin Jinushia R., S. Senthilkumar, S. Bhuvaneswari, Eric Clapton (2020)	Arduino Uno	Radio waves	Database	16X2 LCD Display	MFRC522	-
Inturi Meghana, J.D.N.V.L Meghana, Ramesh Jayaraman (2020)	Arduino Uno	Wired connection	Arduino Uno memory	Microsoft Excel	MFRC522	-
H.K Nguyen, M.T. Chew (2017)	LM356950-Cortex-M3	Wi-Fi	Database	Java GUI Application	TRF7960-TheRFID reader IC	-
Sonali Gaitonde, Mayuresh Shelar, Riddhi Pandey, Gaurav Tuntune (2020)	Raspberry Pi 2B+	Wi-Fi	Database	• phpMyAdmin • Django • Nokia 5110 Lcd Display • LED	MFRC522	-
Ajai Joshi, Aman Ahmad, Arpit Saxena, Poonam Juneja (2020)	Arduino Uno	Radio waves	• SD Card • EEPROM Arduino	• 20X4 LCD Display • LED	MFRC522	-

R.Nivetha, M. Kavipriya, R. Pavithra, C. Jeyanthi, V. Santhana Lakshmi (2020)	Arduino Uno	Wi-Fi	Arduino Uno memory	• Microsoft Excel • LCD I2C Display • LED	MFRC522	-
Unnati Koppikar, Shobha Hiremath, Akshata Shiralkar, Akshata Rajoor, V.P. Baligar (2019)	Arduino Uno	Radio Waves	Database	• Web Application • LED	MFRC522	-
G D P Maramis* and P T D Rompas (2018)	Not stated	Middleware	Database	Stand-alone Application	Not stated	-
Lijuan Shi Li (2019)	Arduino Uno	Wi-Fi	Database	• LabVIEW • LCD I2C Display • LED	MFRC522	-
Proposed Solution	Arduino Uno	Wi-Fi	Database	• Web Application • LCD I2C Display • LED	MFRC522	Available (MLX-90614)

2.4 Proposed solution/Further Project

Based on table 2.1, there are a lot of problems that will occur in previous work in a long term such as based on the (Hasan U. Zaman, 2017) and (Ajai Joshi, 2020), internal SD will run out memory to save the attendance data. In (Ashlin Jinushia R., 2020), the system will be hard to monitor all the attendance at once if there depends on only LCD display. Next, in (Inturi Meghana, 2020) and (R.Nivetha, 2020), will cause of Arduino will run out of memory if there store all the authorized user tag of RFID or attendance data inside the Arduino. In (H.K Nguyen, 2017), will also hard to be monitor as it did not state which RFID UID belong to which user name. In (Sonali Gaitonde, 2020) , it did not have a systematic GUI display as it keeps on redirected to phpMyAdmin to view the recorded data.

From the problem above, solutions that can be proposed is to create a database to keep all of the attendance data and information also creating a GUI display that integrate the database data to be represented in a browser and organize manner.

Further project that can be carried out on all article especially on article eight, nine and ten (Unnati Koppikar, 2019), (Rompas, 2018) and (Li, 2019), but also improving the problem stated with the other articles is by adding a small embedded temperature sensor into the system. These additional features will help to monitor user's health before going inside the building. Hence, this will prevent the one who is cold or under the weather to enter the building. This features functionality is to prevent other's user to be infected by the flu.

Based on table 2.2, further project is identified from each previous project paper. The technology and equipment used for the project is analyzed and considered to be used in this project. The best equipment and technology chosen and temperature sensor is added as an integration of the new built smart attendance system.

Hence, this proposed solution will help not only to manage the attendance system in an organize manner but also to prevent from the spreading of virus COVID-19 among the workers. In addition, this new developed attendance system will also help the organizations or company to detect the symptoms of COVID-19 only at their office and also help preventing any COVID-19 cluster inside an office.

2.5 Conclusion

In this chapter, we can summarize the purpose, weakness and solution based on previous project. We can also make a further development based on previous project while improving the problem of the previous work. In this chapter, we also learn the importance to create a database for the system and present the data in GUI format for an ease long term of attendance system.

CHAPTER III

METHODOLOGY

3.1 Introduction

This chapter will focus on the methodology that will be used for the project. Firstly, project methodology will be discussing about the prototyping model used for the project and the stages involved in the model. It consists of six phases which is requirement gathering, quick design, building prototype, customer evaluation, refining prototype and engineer product. Then, a project schedule and milestone for the project will be tabulated in table as a guideline to develop the project. Lastly, the whole topic of the chapter will be summarized in conclusion.

3.2 Prototyping Methodology

The purpose of project methodology is to allow for controlling the entire management process through effective decision making and problem solving while ensuring the success of specific processes, approaches, techniques, methods and technologies. Methodology provides a skeleton for describing every step in the depth of a project to ensure the implementation of the project went smoothly. There are many types of software development methodology model such as agile, lean waterfall and iterative.

For this project, prototyping model is used as project methodology. Prototyping model is a software development model in which prototype is built, tested and reworked until an acceptable prototype is achieved. It also creates base to produce the final system or software. There are six phases included for prototyping project which is requirement gathering, quick

design, build prototype, customer evaluation, refining prototype and engineer product. For this project, we developed until the fourth stage which is customer evaluation. The flow of the phases will be describe using a figure and each of the phases will be explain.

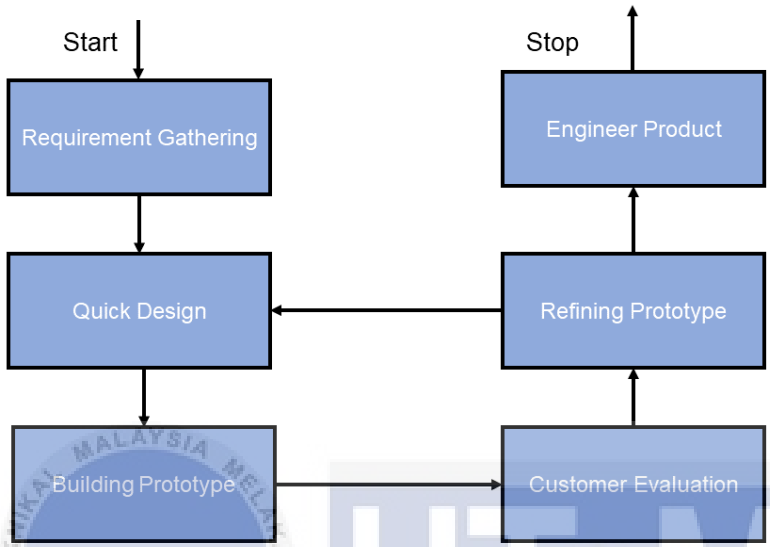


Figure 3.1 Prototyping model

3.2.1 Requirement Gathering

A prototyping model starts with requirement analysis. For the first phase, the requirements of the system are defined in detail. In order to make a complete and working of smart health care attendance system, the requirement that is used are listed below:

3.2.1.1 Hardware and Software Requirement

i. Hardware

- Arduino Uno R3
- ESP8266-ESP01 Wi-Fi Module
- ESP8266 Adapter Breakout Module
- RFID MFRC522
- RFID Tag 13.56 MHz
- Ultrasonic Sensor

- Infrared Thermometer MLX-90614
- LCD I2C 1602 Display
- Casing LCD I2C 1602 Holder Module
- Resistor of 330 Ohm, 1k Ohm, 2k Ohm, 10k Ohm
- Electrolytic Capacitor of 1000 microfarad
- Ceramic Capacitor of 0.1 microfarad
- HT733-A Low Power Consumption LDO
- Casing LCD I2C 1602 Holder Module
- Potentiometer
- LED
- Buzzer
- Jumper Wires
- Breadboard

ii. Software

- Arduino IDE 1.8.13
- Node-RED
- Mosquitto Broker
- XAMPP
- Sublime Text 3

3.2.1.2 User Requirement

i. Read the body temperature of employee

ii. Read the RFID tag of employee

iii. Validate temperature data such only employee lower than 37.5℃ can get their attendance recorded

iv. Validate RFID tag such only the registered RFID tag can get their attendance recorded

v. Get the employee attendance data consists of date, temperature, time in and time out of an employee

vi. Monitor and update the data of employee, attendance of employee and admin of the system

3.2.2 Quick Design

For the second stage, a simple design of smart health care attendance system is created. The purpose of the first design is to give the brief idea of the project implementation such as how the project supposed to be implemented. The design includes of physical and logical design of the project. Physical network design will be designed first, then followed by the logical design. For the physical design, the connection between devices is shown as follows:

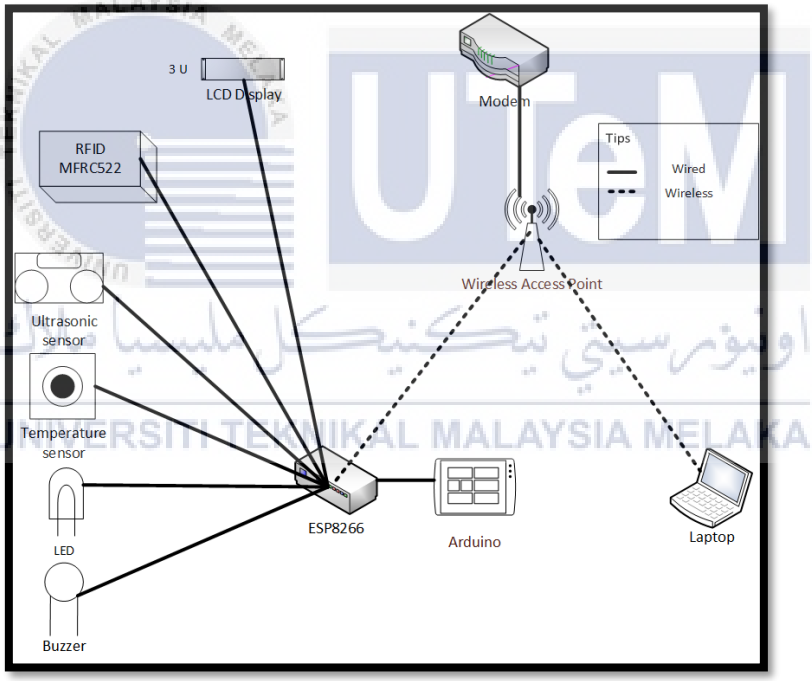


Figure 3.2 Physical Design of attendance system

3.2.3 Building Prototype

In this phase, an actual prototype is designed based on the information gathered from quick design. All of the hardware will be configured and required software will be installed. The first software must be installed is Arduino IDE. It is used to write the programming of hardware using Arduino microcontroller. Then, installation of Node-RED as programming tool APIs. Next, installation of Mosquitto as MQTT broker to act as a server that receives all messages from clients and then routes the messages to the appropriate destination clients. Lastly, the software that needs to be installed is XAMPP and phpMyAdmin. XAMPP is used to start MySQL and Apache service running to provide a localhost of phpMyAdmin database.

3.2.4 Customer Evaluation

For this phase, the proposed system is present to evaluator for an initial evaluation. It helps to find out the strength and weakness of the working model. The comment and suggestion are collected from the evaluation is refined and analyzed. In this project, system usability testing will be conducted in terms of performance and functionality testing. For the performance testing, evaluation of the attendance system itself is working as the requirement of the project such as success rate and user satisfaction. Meanwhile, functionality testing should verify either attendance system is working as intended and measures the ease of use by asking user to perform the task whether they did succeed or having difficulties. In addition, a system usability scale will also be conducted. System usability testing (SUS) is a questionnaire that is used to evaluate the usability of the attendance system. The questionnaire are used as a quantitative method to evaluate and get actionable insights on the usability of the developed attendance system.

3.3 Project Milestone

In this project, project schedule and milestone will the guideline for the project implementation. Both project schedule and milestone are important as it will ensure the implementation of project is run smoothly within a specified timeline such as when the project is estimated to fully developed. Hence, it will be helpful as the project will not run behind schedule. Table below shows the milestones designed for the project.

Table 3.1 Milestones for smart attendance system

Activity	Responsibility	Date Start	Date End
PSM I			
Gathering the requirements	Student	Week 1	Week 2
Analyze the requirements	Student	Week 1	Week 2
Design the project	Student	Week 3	Week 5
Gathering the hardware	Student	Week 3	Week 9
Building prototype	Student	Week 6	Week 14
Progress Prototype Evaluation	Student and supervisor	Week 8	Week 14
User (supervisor and evaluator) evaluation	Student, supervisor and evaluator	Week 15	Week 15
PSM II			
New design based on evaluation	Student	Week 1	Week 2
Progress Prototype Evaluation	Student and supervisor	Week 2	Week 6
Building full project	Student	Week 3	Week 5
Testing full project	Student	Week 4	Week 6
User (supervisor and evaluator) evaluation	Student, supervisor and evaluator	Week 7	Week 7

Table 3.2 Gantt Chart for PSM1 and PSM2 for this project

Week / Method	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Requirement Gathering and analysis																						
Quick Design																						
Building Prototype																						
User Evaluation																						
Refining Prototype																						
Engineer Product																						

3.4 Conclusion

As conclusion, project methodology is very helpful in developing a project as it able to standardize, structure and organizing work. The prototyping model is used in this project is a straight forward model that is easy to understand and execute by the developer. By following the phases of prototyping model, it helps the developer to achieve better system development and customer satisfaction as user is actively involved in the development of project.

CHAPTER IV

ANALYSIS AND DESIGN

4.1 Introduction

This chapter will discuss about the analysis and the design of the project. The subtopic will be detailed discuss is requirement analysis and high-level design. Requirement analysis will be discussed is about the requirement such as data requirement, functional requirement, hardware and software requirement needed for the project. In high level design, the topic included is system architecture, user interface design and database design. Flowchart of the system also will be defined. The last subtopic will conclude in this chapter is conclusion.

4.2 Requirement Analysis

4.2.1 Data Requirement

The input of the device is RFID tag and body temperature of the employee. The input of RFID tag is taken when the employee attend and leave the office building while body temperature is only taken when the employee attend to the office. Once the device reads the data, it needs to determine whether the RFID tag is registered in the system and body temperature is lower than 37.5℃. If both of the requirements are fulfilled, multiple alert and notifications are sends to user through buzzer, LED and LCD monitor display. As for buzzer, it will produce an alert whenever any input device is scanned. As for LED, it will turn on as red or green and last but not least, user will get a string of notification through LCD monitor display.

The input of the system is administrator can add, update, search and delete the registered administrator of the system. Administrator can also add, update, search and delete the registered employee from the attendance system. Lastly, administrator can only edit and delete data attendance of employee of the attendance system. The output of the system is administrator can monitor the employee attendance data through web browser. After all requirement are fulfilled by the employee, data are sent to the web browser to be monitored. The system will store data attendance such date, RFID No, temperature, time in and time out of the employee as an output.

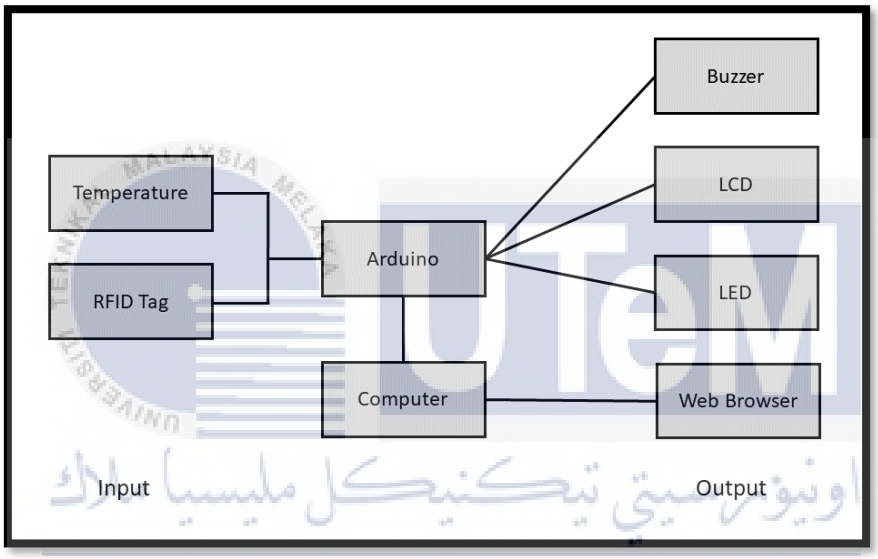


Figure 4.1 Block Diagram of attendance system

4.2.2 Functional Requirement

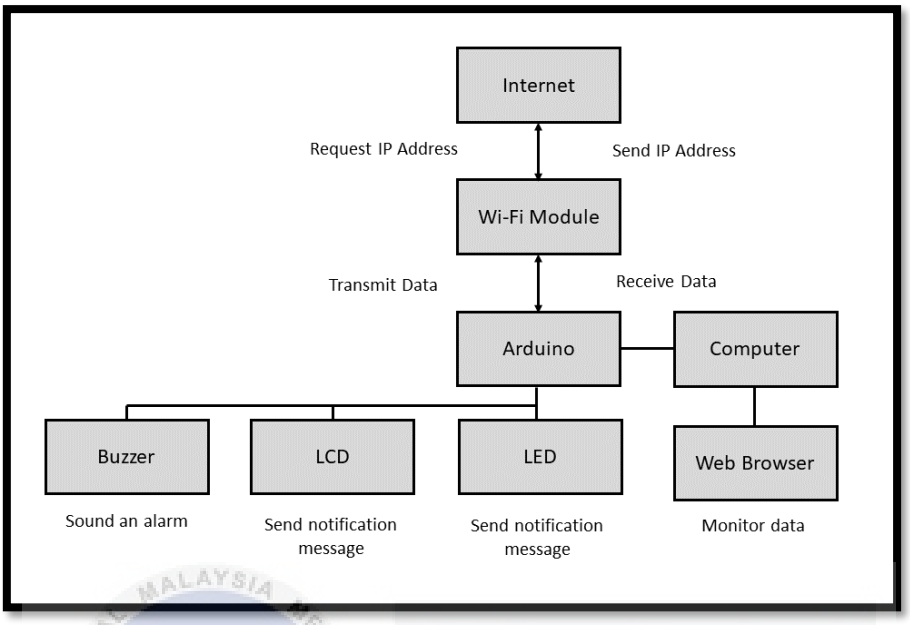


Figure 4.2 Context Diagram of attendance system

In the diagram above, Arduino must connect to the Wi-Fi module to connect to Internet so that the device can run its function. Once body temperature and RFID tag is detected, the alarm will sound. After the input data fulfil the requirement such body temperature must below 37.5℃ and RFID tag is registered by the admin, notification will be sent to user through LCD and LED. On the other side, admin can monitor the data through web browser.

4.2.3 Hardware and Software Requirements

4.2.3.1 Hardware Requirement

In order to complete this project, the requirement is defined. There are some requirements that must be used such as the hardware and software. Proper hardware must be used in order to detect body temperature and RFID tag and also be able to send the notification to the user.

i. Arduino Uno R3

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. The functionality of Arduino is it has an extensive support community, which makes it a very easy way to work with embedded electronics and sensor for the project.

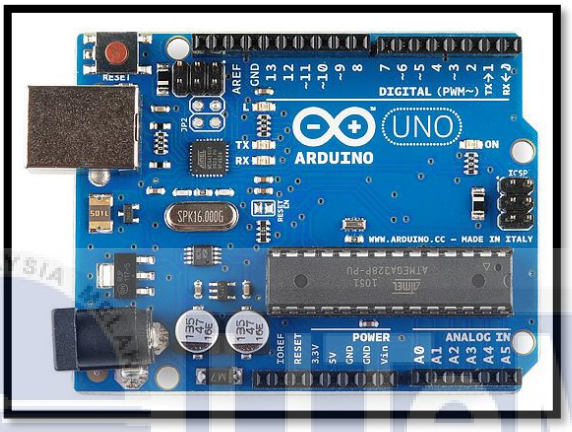


Figure 4.3 Arduino Uno R3

ii. ESP8266-ESP01 Wi-Fi Module

ESP8266-ESP01 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to Wi-Fi network. Hence, it is embedded into Arduino Uno R3 to gives the ability for the device to communicate to home network.

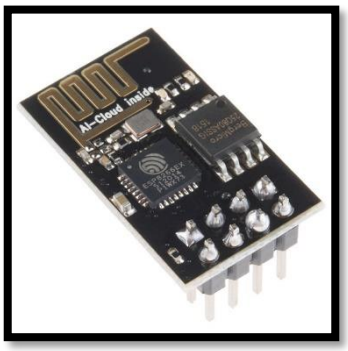


Figure 4.4 ESP8266-ESP01 Wi-Fi Module

iii. ESP8266 Adapter Breakout Module

Adapter of the breakout module of ESP8266 is needed as it helps the Wi-Fi module to give the stability of connection. This is due to the ESP8266 Wi-Fi module is not breadboard friendly. Hence, the use of the adapter breakout module is needed to helps gives the stability of connection.

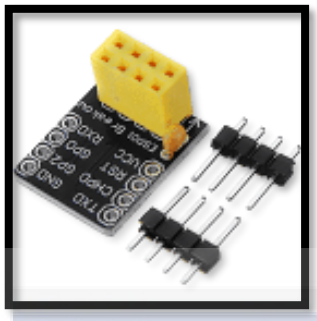


Figure 4.5 ESP8266 Adapter Breakout Module

iv. RFID MFRC522

RFID MFRC522 is used as a sensor to detect the RFID tag. This sensor uses 3.3V power supply as the working voltage.

Figure 4.6 RFID MFRC522

v. RFID Tag 13.56 MHz

RFID tag is used as the employee card to get access of the attendance system. It has 13.56 MHz Mi-Fare 1K RFID that allow read and access of RFID tag.

Figure 4.7 RFID Tag 13.56 MHz

vi. Ultrasonic Sensor

Ultrasonic sensors measure distances based on transmitting and receiving ultrasonic signals. It is used to locate user's hand distance from the temperature sensor to detect temperature sensor at specific distance range.

Figure 4.8 Ultrasonic Sensor

vii. Infrared Thermometer MLX-90614

The body temperature sensor used for this project is infrared thermometer MLX-90614. This is a non-contact temperature measurement. It captures employee temperature in degree Celsius.

Figure 4.9 Infrared Thermometer MLX-90614

viii. LCD I2C 1602 Display

LCD I2C 1602 Display is used to send notification to the user indicate the current status of their attendance such as seeing their scanned body temperature, reading the RFID tag and the success of their time in and time out.

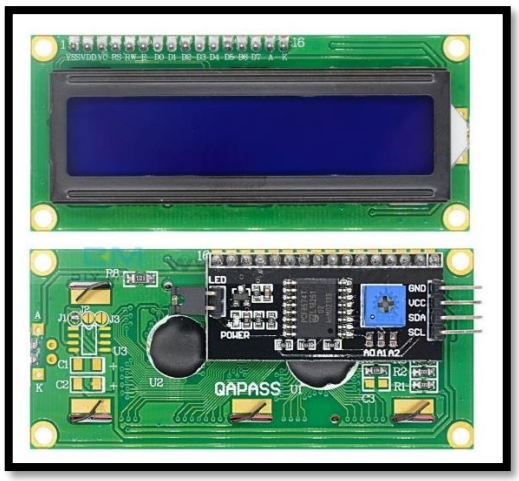


Figure 4.10 LCD I2C 1602 Display

ix. Casing LCD I2C 1602 Holder Module

The holder module is needed as it helps the I2C LCD monitoring display to give the stability of connection. This is due to the I2C LCD monitoring display is not breadboard friendly. Hence, the use of the holder module is needed to helps gives the stability of connection.

Figure 4.11 Casing LCD I2C 1602 Holder Module

x. Resistor of 330 Ohm, 1k Ohm, 2k Ohm, 10k Ohm

The use of resistor in this project is to limit amount of current flow in a circuit. It is used in LED and Wi-Fi module. For LED, we use resistor to avoid the LED from over-driven and burn out while in Wi-Fi module is to limit the current flow of receiving the data from the Wi-Fi module.

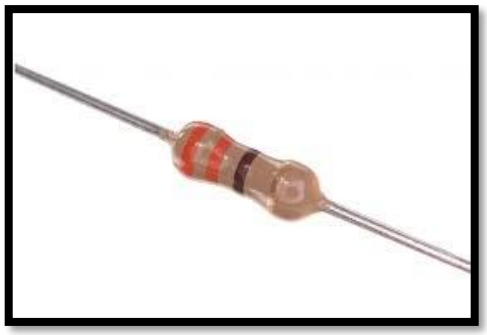


Figure 4.12 Resistor

xi. Electrolytic Capacitor of 1000 microfarad

Electrolytic capacitor of 1000 microfarad is used to smooth the voltage receive from the voltage regulator of 3.3V.

Figure 4.13 Electrolytic Capacitor

xii. Ceramic Capacitor of 0.1 microfarad

Ceramic Capacitor of 0.1 microfarad is used to smooth the voltage receive from the voltage regulator of 3.3V.

Figure 4.14 Ceramic Capacitor

xiii. HT733-A Low Power Consumption LDO

HT733-A is used to convert 5V power supply from Arduino to 3.3V for the working voltage of Wi-Fi module as the 3.3V power supply from Arduino will not be enough for the module to work as it consume too much power. Hence, this hardware gives a stable voltage regulator. It is also used for RFID MFRC522 as it also needs 3.3V power supply for working voltage.

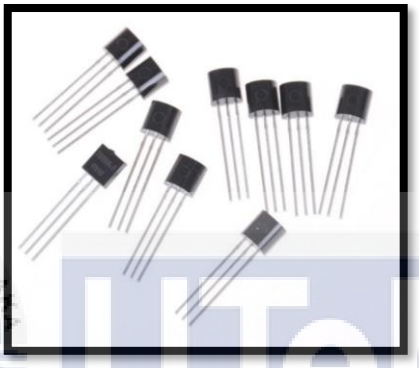


Figure 4.15 H7733-A Low Power Consumption

xiv. Access Point

Access point is needed as the project needs to request an IP Address for the Wi-Fi module to be able to transmit data and receive data from and to Arduino Uno R3. For the home network, it uses Maxis Fiber Internet to request the IP Address.

Figure 4.16 Access Point

xv. Potentiometer

Potentiometer is used as a voltage divider to change the output voltage of the voltage supply. It is use to control the backlight intensity of LCD monitor display.

Figure 4.17 Potentiometer

xvi. LED

LED is used to send notification to the user indicate the current status of their attendance such as the RFID tag exist and the indication of success of inserting time in or time out of the employee data.

Figure 4.18 LED

xvii. Buzzer

Buzzer is used to sound alarm to the user indicate that the input of body temperature or RFID tag is scanned by the device. This allows user to easily know whenever input data is scanned and waiting for process such as reading card and check if temperature is below 37.5℃.

Figure 4.19 Buzzer

xviii. Jumper Wires

Jumper wires is used to establish connection with other devices such as Arduino, body temperature sensor and RFID sensor. Jumper wires used are male to male and male to female.

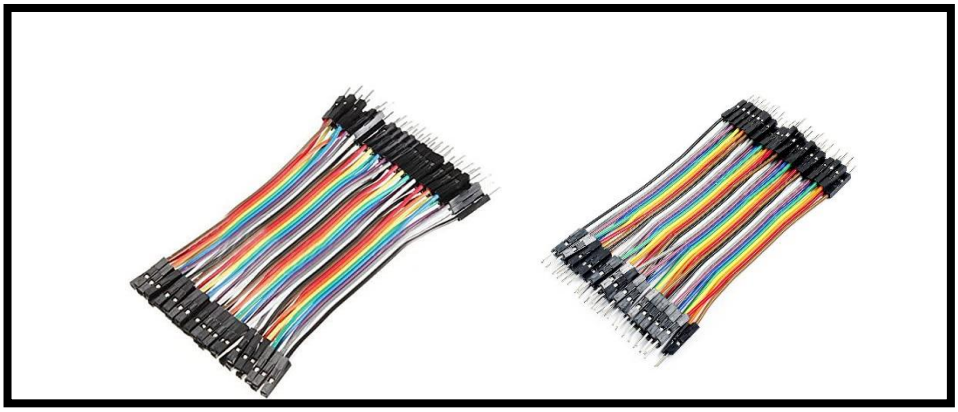


Figure 4.20 Jumper Wires

xix. Breadboard

Breadboard is used as a base to connect all the connection of the devices used such as body temperature sensor, RFID tag, jumper wires, LED and LCD monitor display.

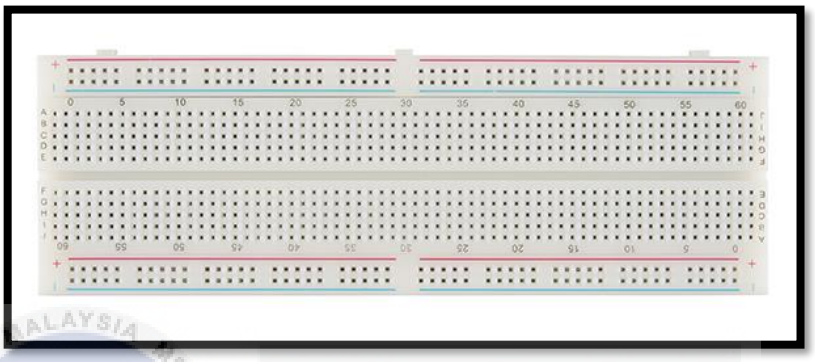
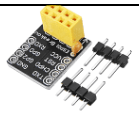


Figure 4.21 Breadboard

4.2.3.1 Summary of Hardware Requirement

Table 4.1 Summary of Hardware Equipment

Hardware	Functionality	Picture
Arduino Uno R3	A microcontroller that is used with embedded electronics and sensor for the project	
ESP8266-ESP01 Wi-Fi Module	Give the ability for the device to communicate to home network	
ESP8266 Adapter Breakout Module	Give the stability of connection	
RFID MFRC522	Detect the RFID tag	
RFID Tag 13.56 MHz	It has 13.56 MHz Mi-Fare 1K RFID that allow read and access of RFID tag	
Ultrasonic sensor	Locate user's hand distance from the temperature sensor to detect temperature sensor at specific distance range	
Infrared Thermometer MLX-90614	Captures employee temperature in degree Celsius	
LCD I2C 1602 Display	Send notification to the user indicate the current status of their attendance	
Casing LOCD I2C Holder Module	To give the stability of connection LCD I2C 1602 Display	

Resistor of 330 Ohm, 1K Ohm, 2k Ohm. 10k Ohm	To avoid the LED from over-driven and burn out To limit the current flow of receiving the data from the Wi-Fi module.	
Electrolytic Capacitor of 1000 microfarad	Smooth the voltage receive from the voltage regulator of 3.3V	
Ceramic Capacitor of 0.1 microfarad		
HT733-A Low Power Consumption LDO	Convert 5V power supply from Arduino to 3.3V for the working voltage of Wi-Fi module as the 3.3V power supply from Arduino will not be enough for the module to work as it consume too much power. It is also used for RFID MFRC522 as it also needs 3.3V power supply for working voltage	
Access Point	To request an IP Address for the Wi-Fi module to be able to transmit data and receive data from and to Arduino Uno R3.	
Potentiometer	It is use to control the backlight intensity of LCD monitor display.	
LED	Send notification to the user indicate the current status of their attendance	
Buzzer	Sound alarm to the user indicate that the input of body temperature or RFID tag is scanned by the device	
Jumper Wires	Establish connection with other devices	

Breadboard	Used as a base to connect all the connection of the devices	

4.2.3.2 Software Requirement

i. Arduino IDE 1.8.13

Arduino IDE is one of the software used in the project. The language used in Arduino IDE is C and C++. The script is written in Arduino IDE is to detect temperature, RFID tag and connect to home network wirelessly. It also uses PubSubClient library to connect to MQTT and communicate with the devices in Arduino Uno R3.

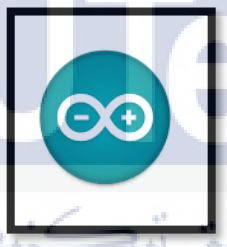


Figure 4.22 Arduino IDE

ii. Node-RED

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. For this project, we are using the MQTT connection from Arduino Uno R3 to be connected with Node-RED to send and receive the data. From there, Node-RED are used as a medium to configure, develop and create multiple extensions to be connected with the data given by the Arduino such it is also connected with the Mosquitto Broker, Apache, MySQL and phpMyAdmin.

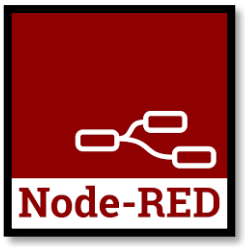


Figure 4.23 Node-RED

iii. Mosquitto Broker

Mosquitto Broker is a server that receives all messages from the clients and then routes the messages to the appropriate destination clients. The broker is installed in the computer that uses windows operating system. It receives the message from Arduino Uno R3 and Node-RED then routes the message between them. Hence, this allowed the transmission data between Arduino Uno R3 and Node-RED.

Figure 4.24 Mosquitto Broker

iv. XAMPP

XAMPP is an abbreviation where X stands for Cross-Platform, A stands for Apache, M stands for MySQL, and the Ps stand for PHP and Perl. For this project, it allows an open source of Apache HTTP Server to be access on local computer. It also allows a MySQL database and phpMyAdmin as an Administration UI for MySQL inside local computer. Hence, the administrator can do process such as view, add, update, search and delete data in attendance system.

Figure 4.25 XAMPP

v. Sublime Text 3

Sublime Text is sophisticated text editor for code, markup and prose. It helps to manage programming codes that is written. The view of the Sublime Text is very organizing. In the project, it is used as a programing tools to writes the code for Apache HTTP Server.

Figure 4.26 Sublime Text 3

4.4 High-Level Design

Connection between the computer and Arduino is defined. In order for the device to work, wireless communication is used. Notification about the attendance will be send through LCD monitor display and LED. An alarm will also sound through buzzer. Finally, the administrator can monitor the attendance data through web browser that in the same network as home network using devices such as computer, laptop and smartphone.

In figure below, shows the process flow of sending and read data of the smart attendance system.

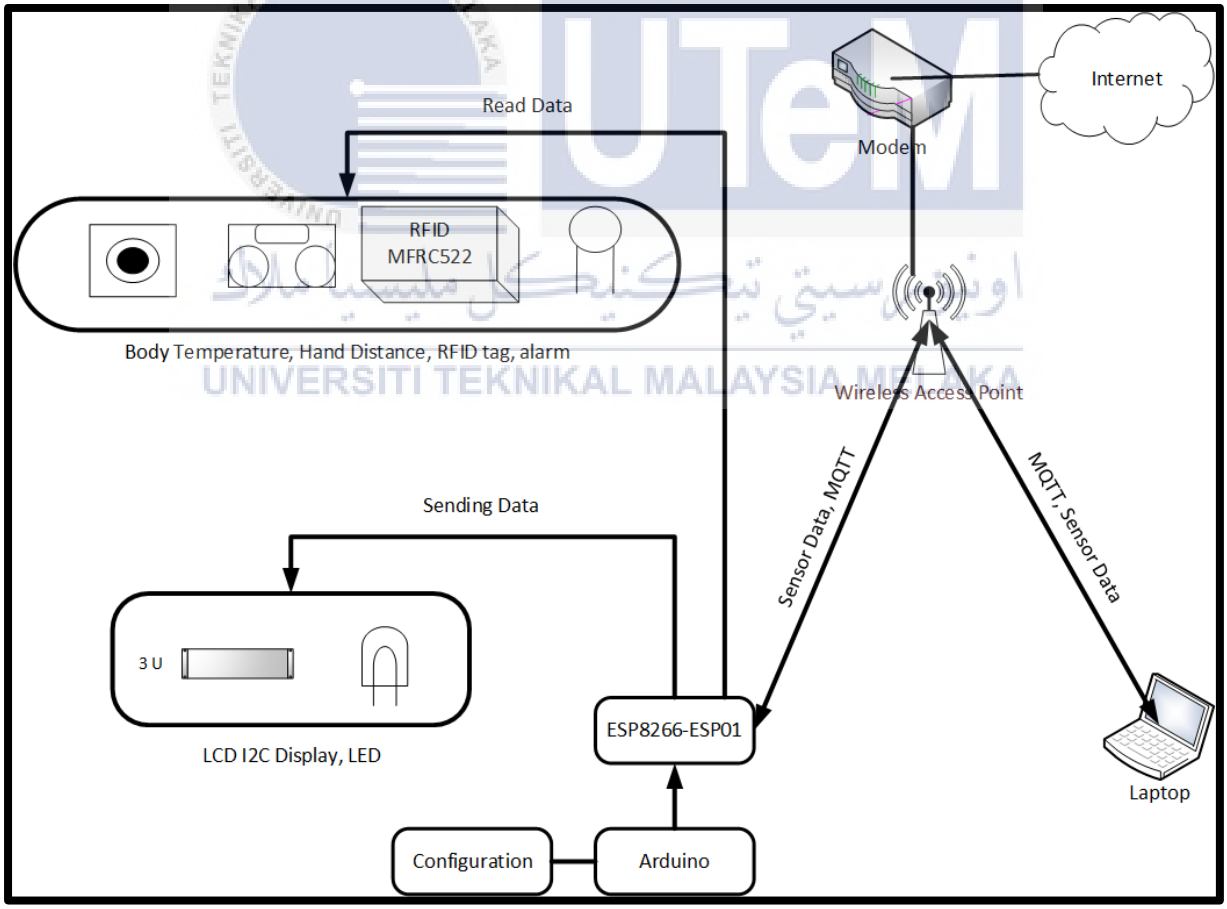


Figure 4.27 Process Flow

4.4.1 System Architecture

i. Physical Design

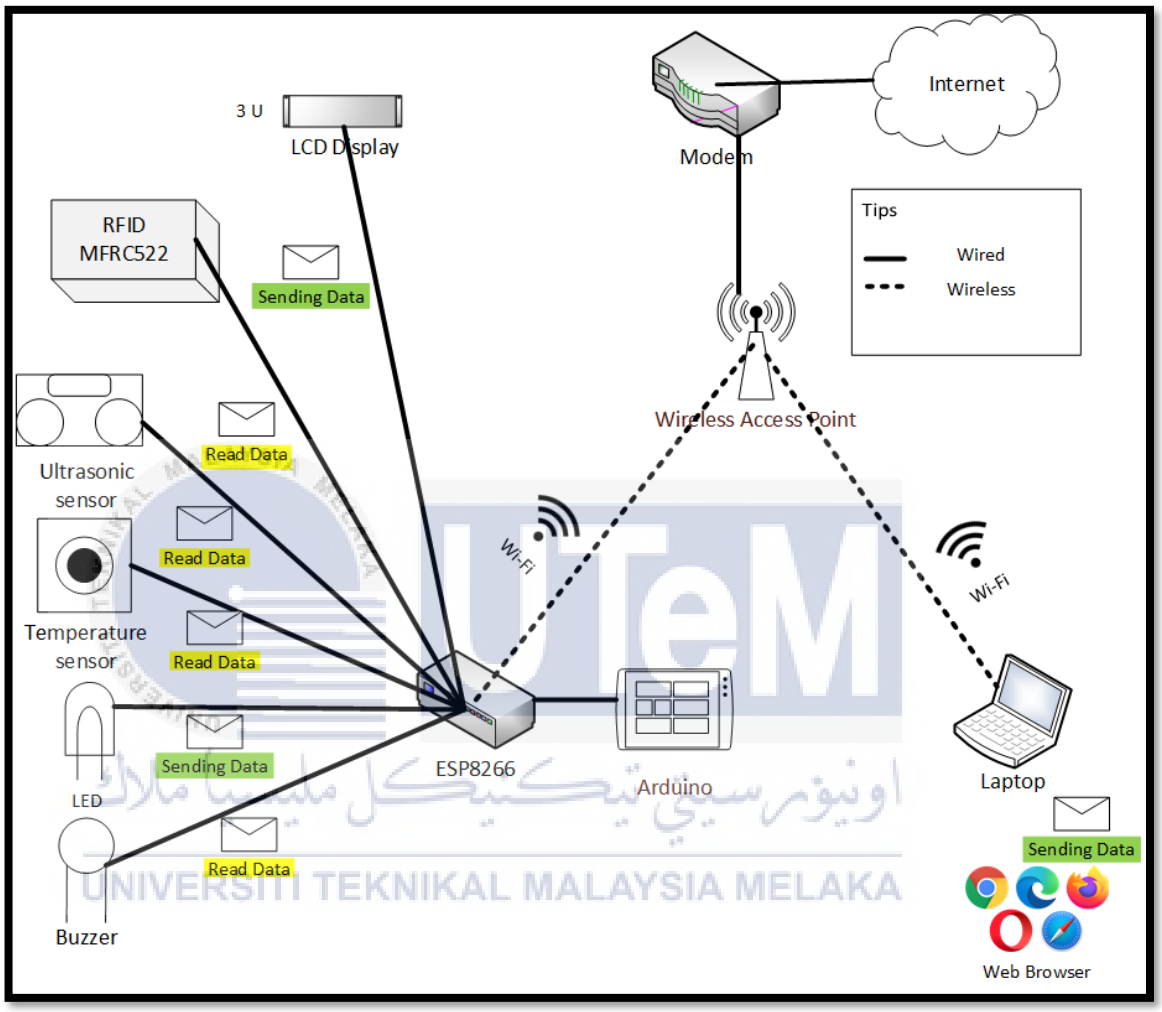


Figure 4.28 Physical Design of attendance system

In developing this project, a connection from a laptop and ESP8266 is connected wirelessly with Wireless Access Point through modem and internet. Thus, this connection allows both devices getting IP Address and communicate with each other. In addition, it allows all devices that are connected with Arduino to be able to send and receive messages. Buzzer, temperature sensor, Ultrasonic sensor and RFID sensor data is read as an input then message is route within the network to be received. Based on the input given by the sensors, a new message is created then it sends to LCD display and LED to show the indication of the employee attendance.

ii. System Design

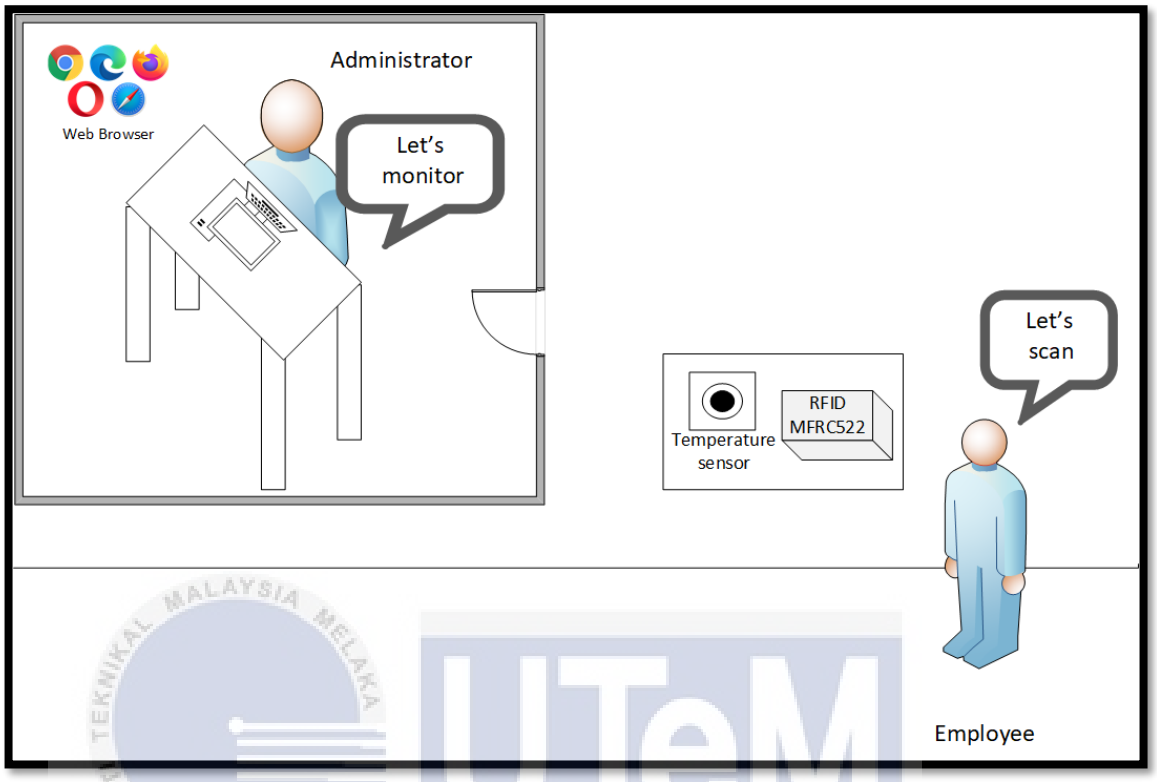


Figure 4.29 System Design

Administrator can monitor, update, add and delete the data in the attendance system via web browser

4.4.2 User Interface Design

i. Flowchart

Flowchart use simple generic symbols and arrows to define relationships. This project flowchart is detailed as follows:

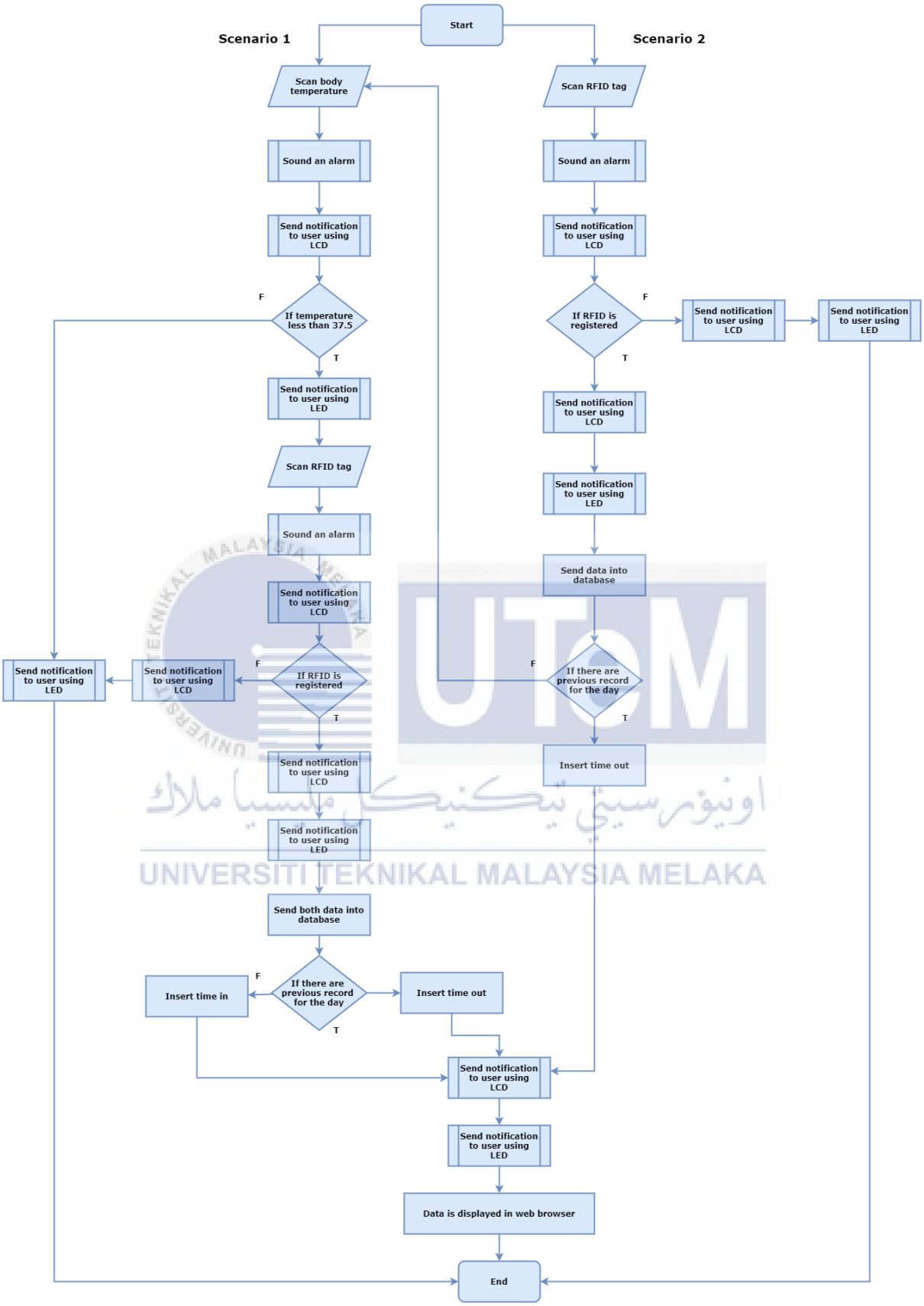


Figure 4.30 Flowchart of attendance system

The figure shows two scenarios in the flowchart of the attendance system. The attendance system is separated in two flows which is defined based on how employee do the task of recording their attendance data.

Based on the scenario 1, employee that scan body temperature will have to hear the alerted from buzzer when they scanned as indication of sensor is reading their data. Then, notification from LCD monitor display will show them their body temperature. If the temperature is higher than 37.5℃, a notification from red LED will light up. There will be no further action. If the temperature is lower than 3.75℃, a green LED will light up then employee can start scanning their RFID tag. As scanning, an alert from buzzer will be heard as indication sensor is reading the data. The LCD monitor display will also send notification to employee as indication of reading the data. If RFID tag is not registered in the system, LCD monitor will print message that says the RFID does not exist. Then, a red LED will light up and there will be no further action. If the RFID is registered, LCD monitor will print message RFID data exist. Then, green LED will light up and both data of temperature and RFID tag will be sent to the database. If there is no record attendance for the day, the attendance of time in will be inserted otherwise the record of time out will be inserted without overriding the existing data of temperature that is taken during their time in. Then, LCD monitor will display a time in or time out is inserted. Finally, a green LED will light up as indication of succeed process.

Based on scenario 2, employee that scan RFID tag will have to hear the alerted buzzer when they scanned as indication of sensor is reading their data. The LCD monitor display will also send notification to employee as indication of reading the data. If RFID tag is not registered in the system, LCD monitor will print message that says the RFID does not exist. Then, a red LED will light up and there will be no further action. If the RFID is registered, LCD monitor will print message RFID data exist. Then, a green LED will light up and the data is sent to database. If there are previous record for the day, a time out of the employee is recorded, LCD monitor will display a time out is inserted then a green LED will light up as indication of succeed process otherwise the system will not go into further action. The employee needs to scan their body temperature and RFID tag again. As the employee scan the temperature, employee will have to hear the alerted from buzzer when they scanned as indication of sensor is reading their data. Then, notification from LCD monitor display will show them their body

temperature. If the temperature is higher than 37.5℃, a notification from red LED will light up. There will be no further action. If the temperature is lower than 37.5℃, a green LED will light up then employee can start scanning their RFID tag. As scanning, an alert from buzzer will be heard as indication sensor is reading the data. The LCD monitor display will also send notification to employee as indication of reading the data. If RFID tag is not registered in the system, LCD monitor will print message that says the RFID does not exist. Then, a red LED will light up and there will be no further action. If the RFID is registered, LCD monitor will print message RFID data exist. Then, a green LED will light up and both data of temperature and RFID tag will be sent to the database and time in and temperature of the employee will be recorded and LCD monitor will display a time in is inserted. Then, a green LED will light up as indication of succeed process.

ii. Output Design

An extension from Node-RED using Mosquitto Broker has allow the application to send any data to Arduino. It sends notification to the user through LCD monitoring display and LED. In addition, an extension from application XAMPP has allow Node-RED to store data into database and update, display and delete any data from the attendance database. Hence, administrator has access to all the data in attendance system.

a) User/Employee

- Using LCD monitor display

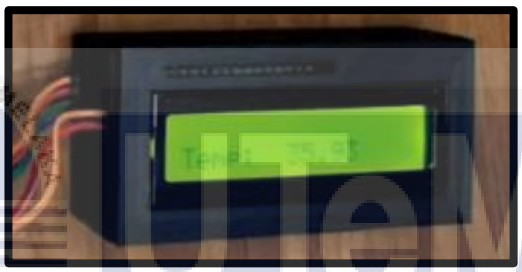


Figure 4.31 LCD monitor display

Diagram above shows message body temperature of user is being displayed in LCD monitor display. The same method is used to display the exist of RFID tag, non-exist RFID tag, insert of time in and time out.

- LED

Figure 4.32 LED

Diagram above shows a light of green LED that indicate a success. LED is also an output for user to know whether is the process is done such as success of inserting time in or out, success of identify the input data of RFID tag and

temperature is valid or invalid. Red LED will indicate as failed process while green is a succeed process.

b) Administrator

- Homepage

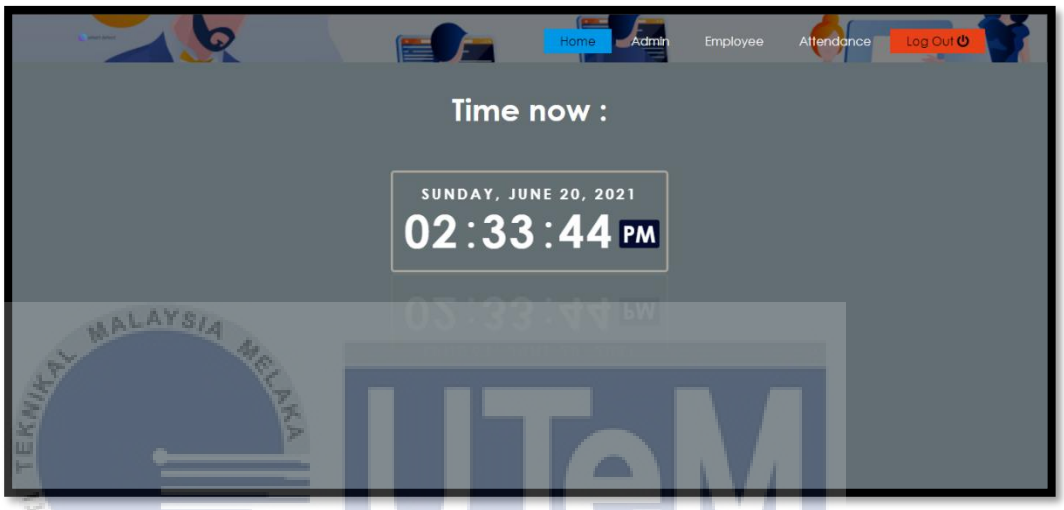


Figure 4.33 Homepage

The figure shows the homepage page for administrator. This page is to capture real time clock of attendance system. It captures the day, date, year, and time according to Malaysia time.

- Admin Page

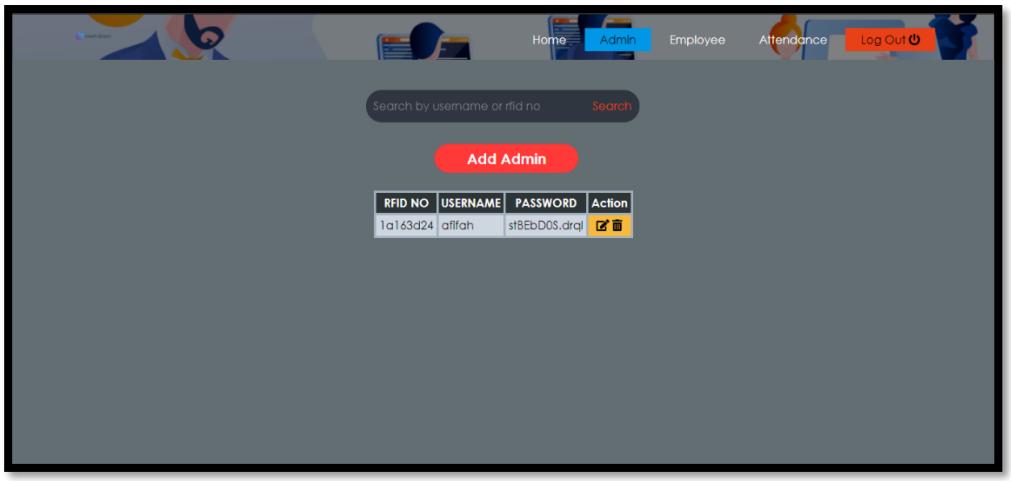


Figure 4.34 Admin Page

The figure shows the admin page for administrator. This page is to display the admins of the system. The other functionalities of the page are add, update and delete admin. For the update part, only the owner session of admin can update their own information.

- Employee Page

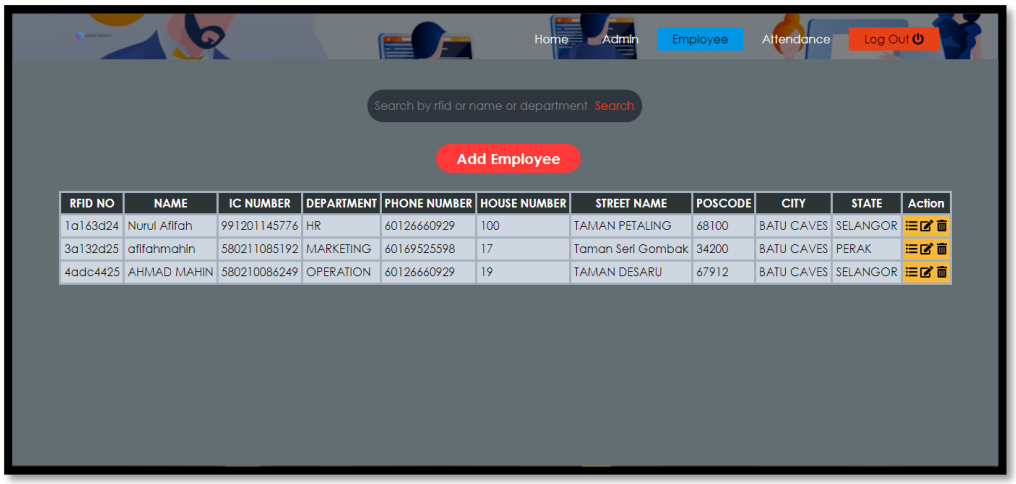


Figure 4.35 Employee Page

The figure shows the employee page for administrator. This page is to display the employee of the system. The other functionalities of the page are add, update and delete employee. Employee that are not registered in the system will not have an access to the attendance system.

- Attendance Page

Figure 4.36 Attendance Page

The figure shows the attendance page for administrator. This page is to display the attendance data of the system. The other functionalities of the page are update and delete attendance data.

4.4.3 Database Design

4.4.3.1 Conceptual and Logical Database Design

i. ERD Diagram of attendance system

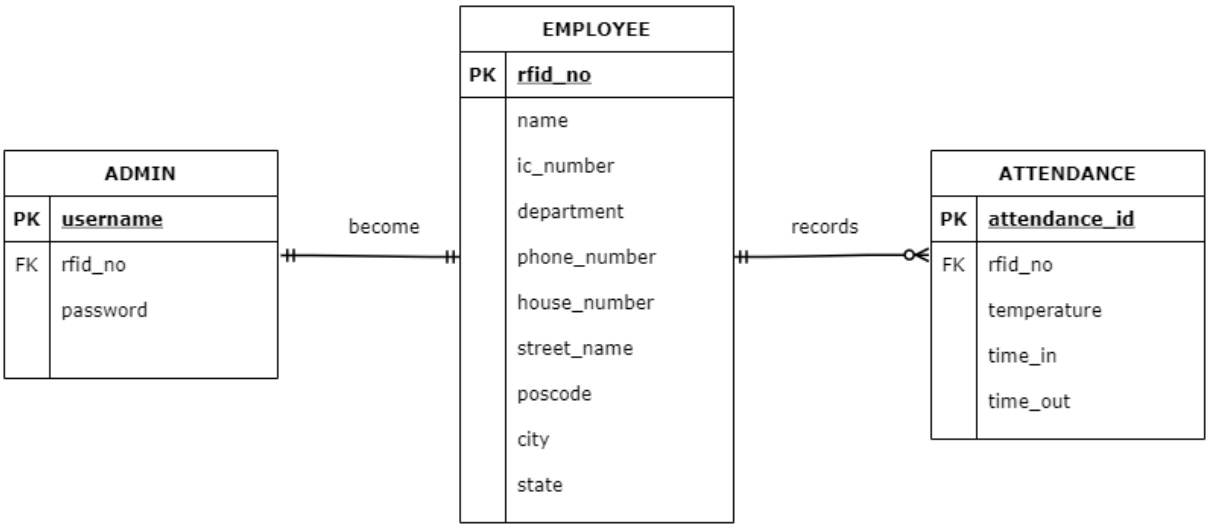


Figure 4.37 ERD Diagram

ii. Business Rule

1. One **EMPLOYEE** can record many **ATTENDANCE.**
2. Many **ATTENDANCE** can be recorded for each **EMPLOYEE.**
3. Each **EMPLOYEE** can have only one registered **ADMIN** account.

iii. Data Dictionary

Table 4.2 Table Admin

ADMIN									
ATTRIBUTE NAME	**CONTENTS**	**DATA TYPE AND SIZE**	**FORMAT**	**RANGE**	**REQUIRED**	**DEFAULT VALUE**	**UNIQUE**	**PK or FK**	**FK REFERENCED TABLE**
username	username	VARCHAR(16)	Xxxxxxxx					PK	
rfid_no	rfid number	VARCHAR(8)	Xxxxxxxx		Yes				FK
password	password	VARCHAR(16)	Xxxxxxxx	8-16	Yes				

Table 4.3 Table Employee

EMPLOYEE									
ATTRIBUTE NAME	**CONTENTS**	**DATA TYPE AND SIZE**	**FORMAT**	**RANGE**	**REQUIRED**	**DEFAULT VALUE**	**UNIQUE**	**PK or FK**	**FK REFERENCED TABLE**
rfid_no	department id	VARCHAR(8)	Xxxxxxxx					PK	
name	department name	VARCHAR(100)	Xxxxxxxx		Yes				
ic_number	identification number	VARCHAR(12)	999999999999		Yes				
department	department	VARCHAR(50)	Xxxxxxxx		Yes				
phone_number	phone number	VARCHAR(11)	Xxxxxxxx		Yes				
house_number	house_number	INT(5)	99999		Yes				
street_name	street name	VARCHAR(50)	Xxxxxxxx		Yes				
poscode	poscode	INT(5)	99999		Yes				
city	city	VARCHAR(50)	Xxxxxxxx		Yes				
state	state	VARCHAR(32)	Xxxxxxxx		Yes				

Table 4.4 Table Attendance

ATTENDANCE									
ATTRIBUTE NAME	**CONTENTS**	**DATA TYPE AND SIZE**	**FORMAT**	**RANGE**	**REQUIRED**	**DEFAULT VALUE**	**UNIQUE**	**PK or FK**	**FK REFERENCED TABLE**
attendance_id	attendance id	INT(5)	99999					PK	
date	department name	DATE	0000-00-00		Yes				
rfid_no	rfid number	VARCHAR(8)	Xxxxxxxx		Yes				FK
temperature	temperature	DOUBLE	00.00		Yes				
time_in	time in	TIME	00:00:00		Yes				
time_out	time out	TIME	00:00:00		Yes				

4.5 Conclusion

As conclusion, analysis and design is very important in order to complete this project and build fully functional of attendance system. In requirement analysis, hardware and software needed to detect body temperature and RFID tag such as Arduino Uno R3 and Mosquitto Broker is determined along with data and functional requirements. Besides that, flowchart of the project is also defined as it will be use as the guideline to implement the project. Hence, analysis and design will be referred when building the project.

CHAPTER V

IMPLEMENTATION

5.1 Introduction

This chapter will discuss on the implementation of the project. Hardware and software development environment setup will discuss about the hardware and software development requirements and installation. The software configuration setup will cover the configuration that is used to complete this project. Finally, the conclusion of the chapter will be summarized.

5.2 Hardware and Software Development Environment setup

The development environment setup of Smart Attendance System will involve hardware and software requirements. All of the setup will be states step by step and clearly shown. The hardware and software requirements are already stated in Chapter 4 and will be explain further for the connection in the section below.

5.2.1 Hardware Development Environment Setup

In this project, the hardware used are already stated in Chapter 4. The following hardware are combined to perform as a complete attendance system. Table below shows the details on how it connected using microcontroller of Arduino Uno R3.

Table 5.1 Details of each Pin Numbers

Hardware	Wire	Pins
RFID MFRC522	3.3V	3.3V
	RST	9
	GND	GND
	MISO	12
	MOSI	11
	SCK	13
	SDA	10
Infrared Thermometer MLX-90614	VIN	5V
	GND	GND
	SCL	A5
	SDA	A4
Ultrasonic Sensor	VCC	5V
	TRIG	A2
	ECHO	A3
	GND	GND
ESP8266-ESP01 Wi-Fi Module	VCC	3.3V
	CHPD	3.3V
	TXD	2
	RXD	3
	GND	GND
LCD I2C 1602 Display	GND	GND
	VCC	5V
	SDA	A4
	SCL	A5
Red LED	ANODE	4

	CATHODE	GND
Green LED	ANODE	5
	CATHODE	GND
Buzzer	ANODE	8
	CATHODE	GND

Based on the table, a schematic diagram of the hardware is provided in figure 5.1.

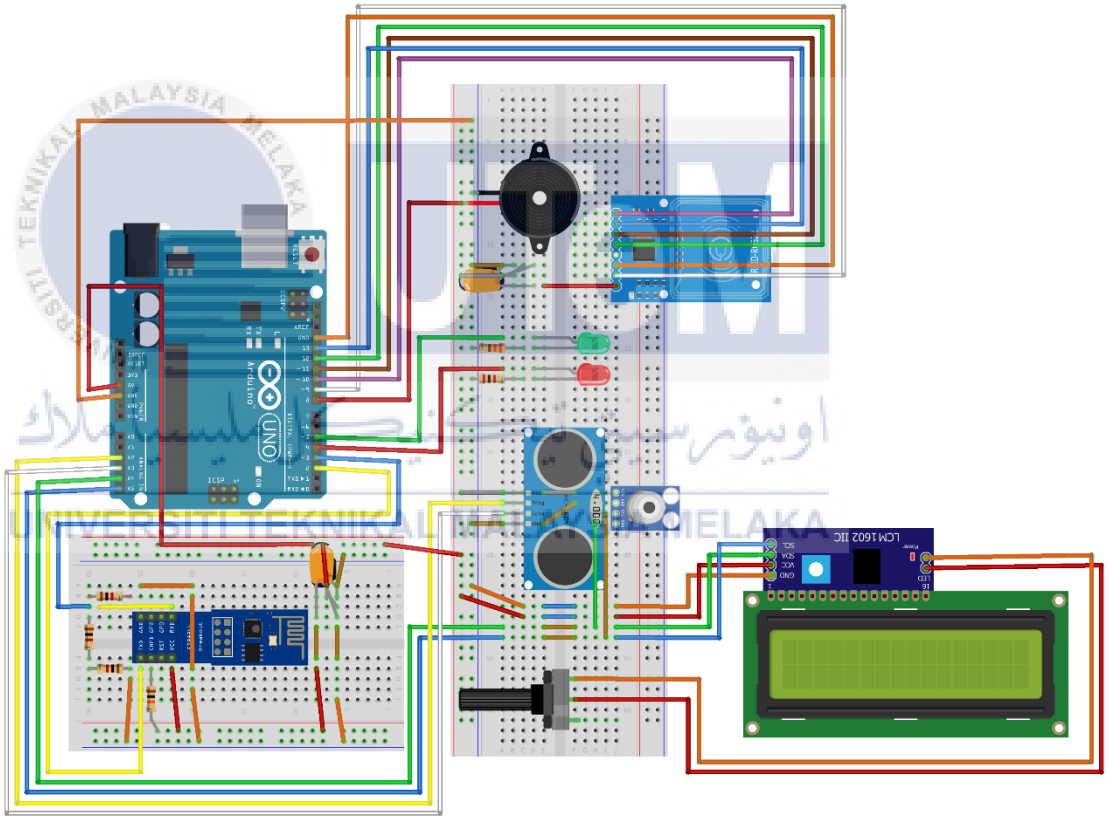


Figure 5.1 Schematic Diagram

Next, we are going to install the hardware. Figure below, shows the complete hardware setup after following the details of the provided table on how it is connected.

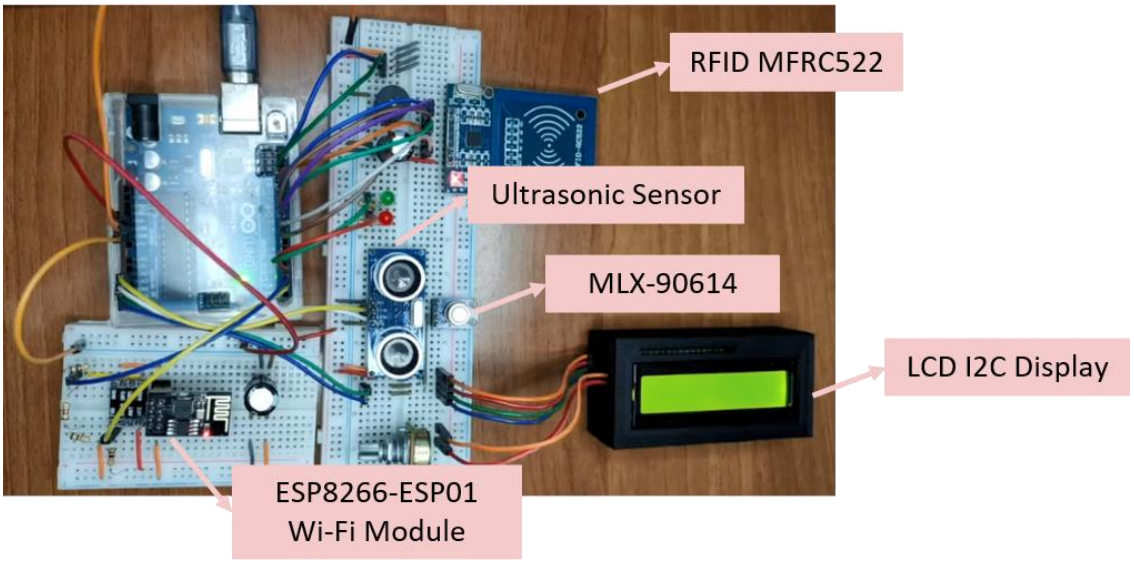


Figure 5.2 Hardware Installation

5.2.2 Software Development Environment Setup

As defined in Chapter 4, there are several software needed to be installed for this project such as Arduino IDE, Node-RED, Mosquitto Broker, XAMPP and Sublime Text 3. All of the software will be used to ensure the project is fully functional. In this topic, it will explain the deployment of this system using figure 5.3.

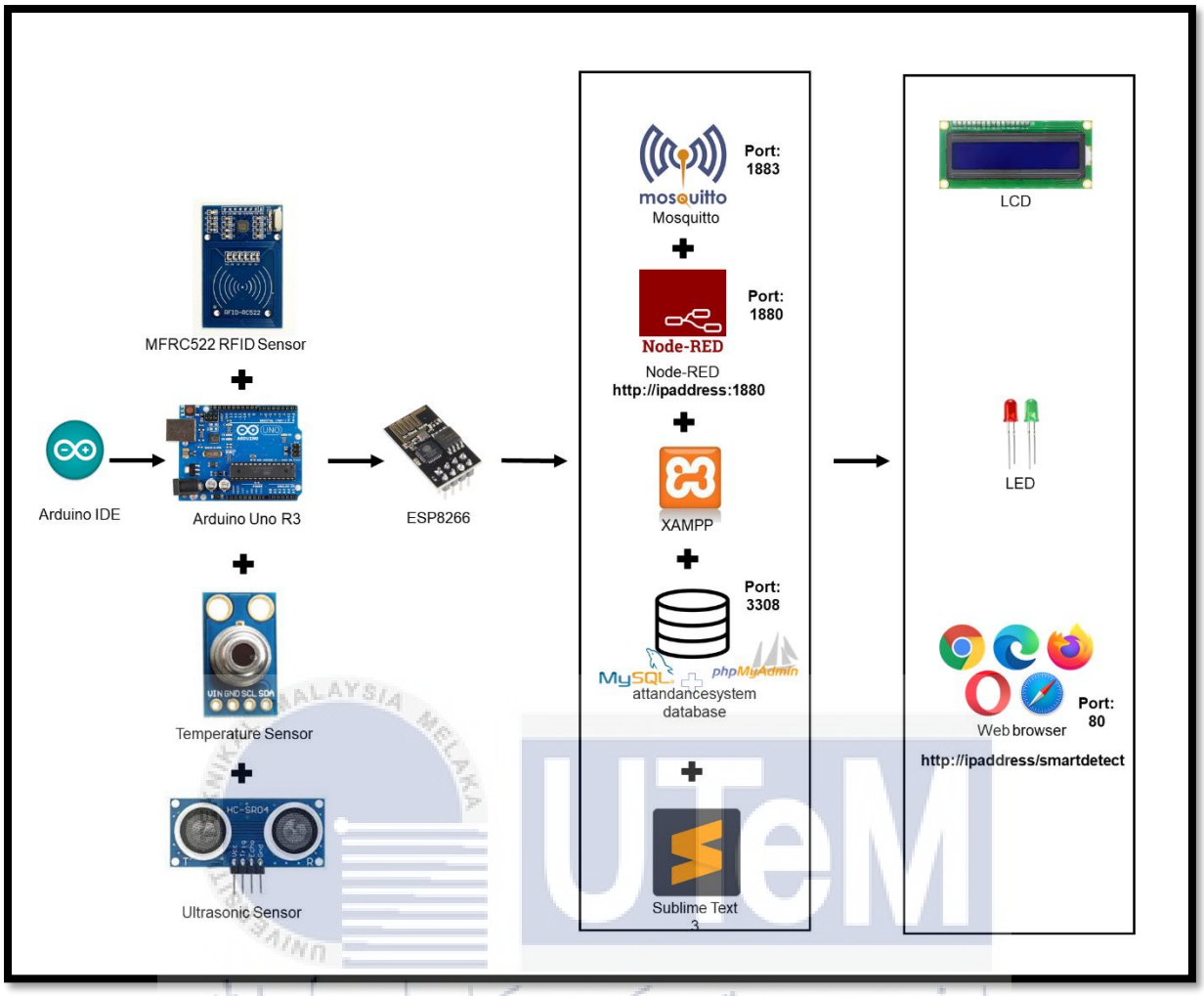


Figure 5.3 System Deployment

The figure above shows the system deployment of Smart Attendance System. The Arduino IDE is a platform to write the code that allow the hardware to work. The Arduino IDE will transfer the data through ESP8266 Wi-Fi module to connect to home network. The data is passed to Mosquitto software then together with other software such as Node-RED, XAMPP, MySQL database and Sublime Text 3 will process the data and represent the data through LCD monitor display, LED and web browser. The transmission of data also uses Mosquitto software.

5.3 Software Configuration Setup

5.3.1 Mosquitto configuration

Mosquitto files need to be configured to allow the transmission of data from Arduino IDE and Node-RED. The port must be allowed to listen to port 1883 and change the allow_anonymous to true to allow connection outside than localhost of the machine.

```
# listener port-number [ip address/host name/unix socket path]
#afifah ubah
listener 1883

# Defaults to false, unless there are no listeners defined in the configuration
# file, in which case it is set to true, but connections are only allowed from
# the local machine.
#afifah ubah
allow_anonymous true
```

Figure 5.4 Edit configuration of mosquitto.conf

5.3.2 Arduino IDE configuration

In order to detect body temperature and RFID tag, we must configure the Arduino IDE. Then, configure it to send and receive the data through MQTT using Mosquitto.

5.3.2.1 Coding define library used

Library must be defined before using the object inside the class.

```
#include <WiFiEsp.h>
#include <WiFiEspClient.h>
#include "WiFiEspUdp.h"
#include "SoftwareSerial.h"
#include <PubSubClient.h>
//#include <ArduinoJson.h>

#include <SPI.h>
#include <MFRC522.h>

#include <Wire.h>
#include <Adafruit_MLX90614.h>

#include <Wire.h>
#include <LiquidCrystal_I2C.h>
```

Figure 5.5 Define library used

5.3.2.2 Coding define pins, object and setup

The code snippet below, is where the class of object is defined. The Arduino pins are also declared before it being used to program the sensor.

```
IPAddress server(192,168,1,107);          //MQTT Broker addredss
char ssid[] = "afiffmahin";               // your network SSID (name)
char pass[] = "01224443070126660929";     // your network password
//char brokerUser [] = "username mqtt"
//char brokerPass[] = "passwd mqtt"

int status = WL_IDLE_STATUS;              // the Wifi radio's status

WiFiEspClient espClient;                  // Initialize the Ethernet client object
PubSubClient client(espClient);
SoftwareSerial soft(2,3);                 // RX, TX

const byte redPin = 4;                          // red led
const byte greenPin = 5;                        // green led
const byte buzzPin = 8;                          // buzzer

#define SS_PIN 10                         // rfid
#define RST_PIN 9                         // rfid

MFRC522 mfrc522(SS_PIN, RST_PIN);         // Create MFRC522 instance class
char message_buff[100];
char message_temp[8];

float ta;                                 // Temperature ambient
float to;                                 // Temperature object

const byte trigPin = A2;                    // ultrasonic sensor
const byte echoPin = A3;                    // ultrasonic sensor

long duration;                          // ultrasonic sensor
int distance;                           // ultrasonic sensor

Adafruit_MLX90614 mlx = Adafruit_MLX90614(); //define this sensor as an object

LiquidCrystal_I2C lcd(0x27, 16, 2);         // Set the LCD address to 0x27 for a 16 chars and 2 line display
                                            // define this sensor as an object

void callback(char topic, byte* payload, unsigned int length);  // Callback function header

void setup()
{
  pinMode(redPin,OUTPUT);                   // Initialize redPin pinMode
  pinMode(greenPin,OUTPUT);                 // Initialize redPin pinMode
  pinMode(buzzPin, OUTPUT);                 // Initialize buzzPin pinMode
  pinMode(trigPin, OUTPUT);                 // Initialize trigPin pinMode
  pinMode(echoPin, INPUT);                  // Initialize echoPin pinMode
  Serial.begin(9600);                       // initialize serial for debugging
  soft.begin(9600);                         // initialize serial for ESP module
  WiFi.init(&soft);                         // initialize ESP module
  SPI.begin();                              // Initialize SPI bus
  mlx.begin();                              // Initialize MLX90614
  mfrc522.PCD_Init();                       // Initialize MFRC522 card
  lcd.begin();                              // Initialize the LCD
  lcd.backlight();                          // Turn on the blacklight to print message.

  lcd.print("Smart Attendance");
```

Figure 5.6 Define pins, object and setup

5.3.2.3 Coding connect to home network

The code snippet below, is the configuration where ESP8266 Wi-Fi module attempt request of IP Address to home network. Once the connection is established, then only we can connect to MQTT Mosquitto.

```
73  if (WiFi.status() == WL_NO_SHIELD)      // check for the presence of the shield
74  {
75    Serial.println("WiFi shield not present");
76    // don't continue
77    while (true);
78  }
79
80                                          // attempt to connect to WiFi network
81  while ( status != WL_CONNECTED) {
82    Serial.print("Attempting to connect to WPA SSID: ");
83    Serial.println(ssid);
84    status = WiFi.begin(ssid, pass);        // Connect to WPA/WPA2 network
85  }
86
87  // you're connected now, so print out the data
88  Serial.println("You're connected to the network");
89  Serial.print("Your connected ESP8266 address is :");
90  Serial.println(WiFi.localIP());
91
```

Figure 5.7 Connect to home network

5.3.2.4 Coding connect to MQTT Mosquitto Broker

The code snippet below, is the configuration to attempt MQTT connection. Once the connection is established, then only we can send and receive data from Node-RED application through the MQTT connection.

```
92  //connect to MQTT server
93  //client.(server, port, callback, client
94  client.setServer(server, 1883);
95  client.setCallback(callback);
```

Figure 5.8 Connect to MQTT Mosquitto Broker

5.3.2.5 Coding sending data to MQTT Mosquitto Broker

The code snippet below, is the configuration of reading the data of body temperature and RFID tag. It then sends the data to Node-RED through MQTT connection.

i. Configuration of loop read and transmit data to MQTT

```
175 void loop()
176 {
177   // put your main code here, to run repeatedly:
178   if (!client.connected())
179   {
180     reconnect();
181   }
182
183   //client.loop();
184
185   readRFID();
186   readTemp();
187
188   client.loop();
189
190 }//end of void loop
191
```

Figure 5.9 Loop read and transmit data to MQTT

ii. Configuration of detection of RFID tag and sending to MQTT

```
void readRFID()
{
  //----------------------ANOTHER VOID LOOP PUBLISH RFID TOPIC-------------------------------------------

  // Look for new cards
  if ( ! mfrc522.PICC_IsNewCardPresent()) {
    return;
  }
  // Select one of the cards
  if ( ! mfrc522.PICC_ReadCardSerial())return;
  Serial.print("Card UID:");//Dump UID
  String rfidUid = "";
  for (byte i = 0; i < mfrc522.uid.size; i++) {
    rfidUid += String(mfrc522.uid.uidByte[i] < 0x10 ? "0" : "");
    rfidUid += String(mfrc522.uid.uidByte[i], HEX);
  }

  Serial.println(rfidUid);
  Serial.println("");
  rfidUid.toCharArray(message_buff, rfidUid.length() + 1);
  client.publish("rfid", message_buff);

  mfrc522.PICC_HaltA(); // Halt PICC
  mfrc522.PCD_StopCryptol();// Stop encryption on PCD

  digitalWrite(buzzPin, HIGH);
  delay(1000);
  digitalWrite(buzzPin,LOW);

   delay(1000);

}//end of void readRFID
```

Figure 5.10 Read RFID tag and transmit data to MQTT

iii. Configuration of detection temperature and sending to MQTT

```
void readTemp()
{
  //----------------------ANOTHER VOID LOOP PUBLISH RFID TOPIC-----------------------------------------
  analogWrite(trigPin, 0);
  delayMicroseconds(2);

  analogWrite(trigPin, 255);
  delayMicroseconds(10);

  duration = pulseIn(echoPin, 255);
  distance = duration*0.034/2;

  //Serial.print("Distance: ");
  //Serial.println(distance);
  delay(1000);

  if(distance<=4)
  {
    to = 1 + mlx.readObjectTempC(); //Measure in Celcius. If want to measure in Farenheit. .readObjectTempF );
    ta = mlx.readAmbientTempC();
    //log to serial port
    Serial.println("Object:" + String(to) + "C, Ambient:" + String(ta) + "C");
    dtostrf(to, 6, 2, message_temp); //Convert float to char so it can publish. MQTT only accept char
    client.publish("temperature", message_temp);
    delay(1000);

    digitalWrite(buzzPin, HIGH);
    delay(1000);

  }

}//end of void readTemp
```

Figure 5.11 Read temperature and transmit data to MQTT

5.3.2.6 Coding receive data from MQTT Mosquitto Broker

The code snippet below, is the configuration of receiving the data from Node-RED through MQTT connection. It then prints any receiving message to the Arduino such as LED and LCD monitor display.

i. Configuration print any receive data in serial monitor of Arduino IDE

```
99  //print any message received for subscribed topic
100 void callback(char* topic, byte* payload, unsigned int length)
101 {
102   Serial.print("Message arrived [");
103   Serial.print(topic);
104   Serial.print("] ");
105
106   for (int i=0;i<length;i++)
107   {
108     Serial.print((char)payload[i]);
109   }
110
111   Serial.println();
```

Figure 5.12 Print data received from MQTT

ii. Configuration of receive data of red LED

```
112   //---------------------ANOTHER VOID CALLBACK TOPIC-----------------------------------------------
113
114   if (strcmp(topic,"redLED")==0)              // Topic: redLED
115   { // whatever you want for this topic
116
117     if ((char)payload[0] == '1')              // on (1)
118     {
119       digitalWrite(redPin, HIGH);
120       delay(600);
121       digitalWrite(redPin, LOW);
122       delay(600);
123     }
124   }
```

Figure 5.13 Print data of red LED received from MQTT

iii. Configuration of receive data of green LED

```
126   //---------------------ANOTHER VOID CALLBACK TOPIC-----------------------------------------------
127
128   if (strcmp(topic,"greenLED")==0)            // Topic: greenLED
129   { // whatever you want for this topic
130
131     if ((char)payload[0] == '1')              // on (1)
132     {
133       digitalWrite(greenPin, HIGH);
134       delay(600);
135       digitalWrite(greenPin, LOW);
136       delay(600);
137     }
138   }
```

Figure 5.14 Print data of green LED received from MQTT

iv. Configuration of receive data of LCD monitor display

```
156    //----------------------ANOTHER VOID CALLBACK TOPIC-----------------------------------------------
157
158   if (strcmp(topic,"lcd_01")==0)              // Topic: lcd
159   { // whatever you want for this topic
160
161     lcd.clear();
162     lcd.setCursor(0,1);
163     for (int i=0;i<length;i++)
164     {
165       Serial.print((char)payload[i]);
166       lcd.print((char)payload[i]);
167     }
168   Serial.println();
169   delay(1000);
170   lcd.clear();
171   }
172
173 }//end of void callback
```

Figure 5.15 Print data of LCD received from MQTT

5.3.2.7 Coding reconnect to MQTT Mosquitto Broker if lose connection

The code snippet below, is the configuration of reconnecting to MQTT Mosquitto Broker. Every time the connection is interrupted, it will reconnect. Once connection it is established, it will print out “Hello World” to any subscribed topic of MQTT. Then, it will allow any subscribed and publish topic to be transmitted.

```
void reconnect()
{
  // Loop until we're reconnected
  while (!client.connected())
  {

    Serial.print("Attempting MQTT connection...");
    // Attempt to connect, just a name to identify the client
    if (client.connect("arduinoClient") ) //ArduinoClient is a device id
    {
      Serial.println("connected");
      // Once connected, publish an announcement...
      client.publish("command","hello world");
      // ... and resubscribe
      client.subscribe("redLED");
      client.subscribe("greenLED");
      client.subscribe("buzzer");
      client.subscribe("lcd_01");
    }

    else
    {
      Serial.print("failed, rc=");
      Serial.print(client.state());
      Serial.println(" try again in 5 seconds");

      // Wait 5 seconds before retrying
      delay(5000);
    }
  }
}//end of void reconnect
```

Figure 5.16 Reconnecting to MQTT

5.3.3 Node-RED configuration

Node-RED application has mostly all of the configuration of the implementation of the attendance system. It receives and transmit data through MQTT Mosquitto. It also creates an extension of Apache HTTP Server, MySQL, phpMyAdmin through XAMPP application. Hence, it makes it easier to configure the system.

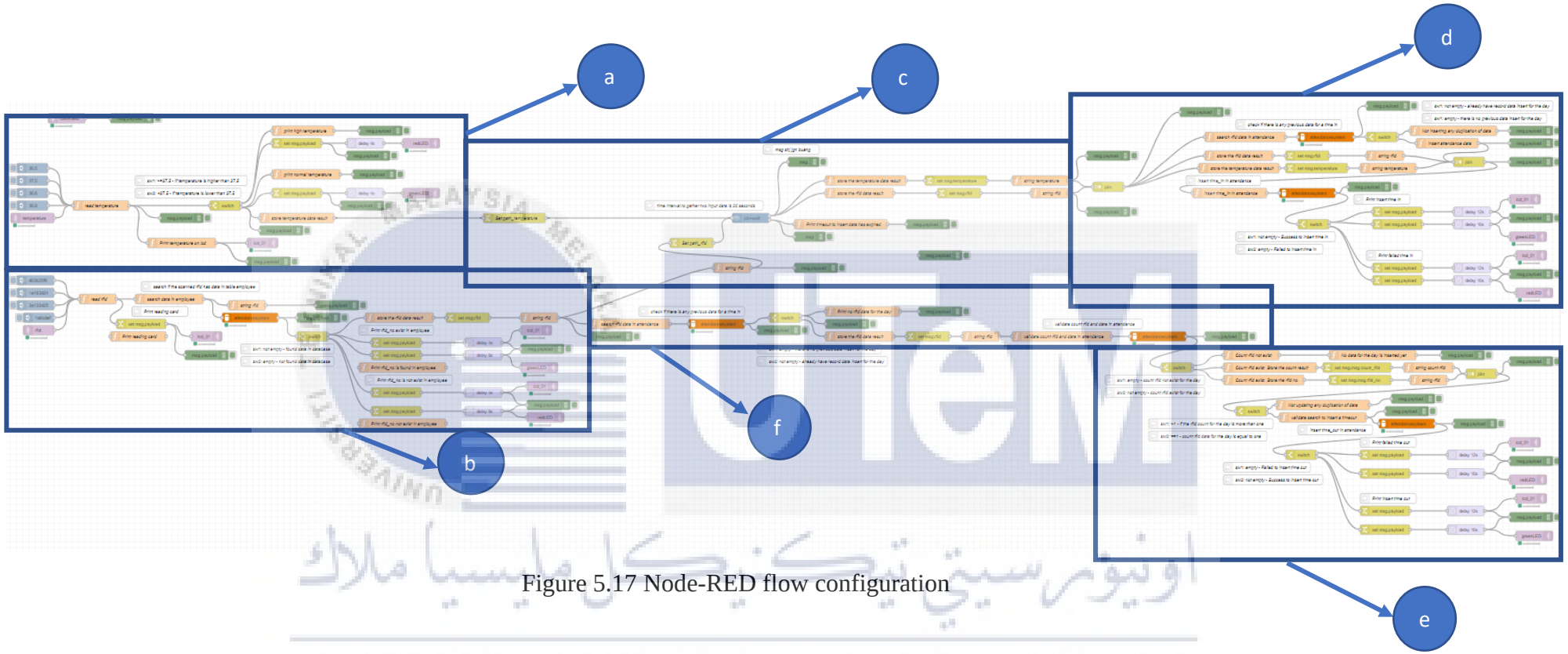


Figure 5.17 Node-RED flow configuration

a) Input processing of temperature sensor

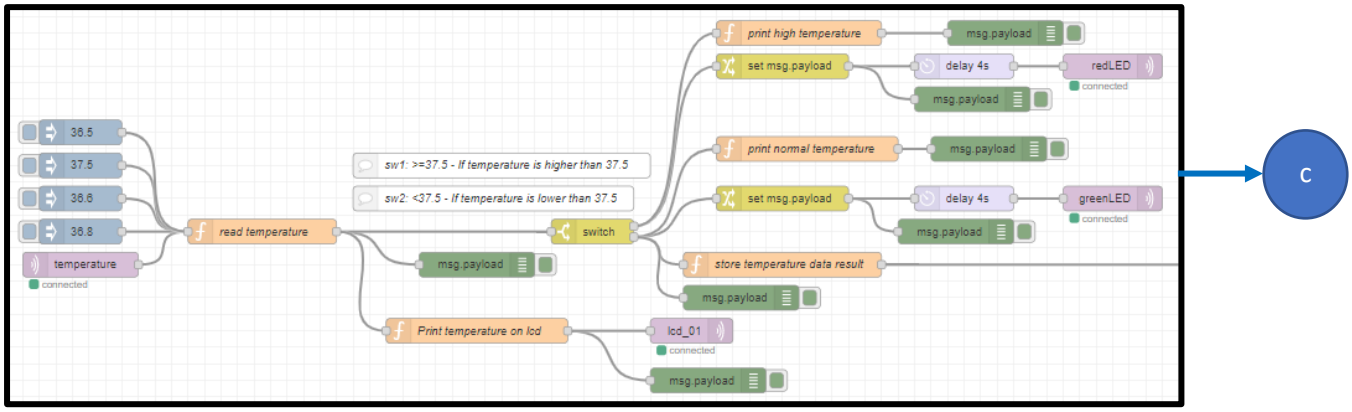


Figure 5.18 Input processing of temperature sensor

The code snippet shown above is the configuration of receiving body temperature data from Arduino through MQTT connection. It then prints out the temperature to LCD monitor display. If the temperature is higher than 37.5℃, red LED will light up but if temperature is lower than 37.5℃, green LED will light up.

b) Input processing of RFID Sensor and validate data existence of tag

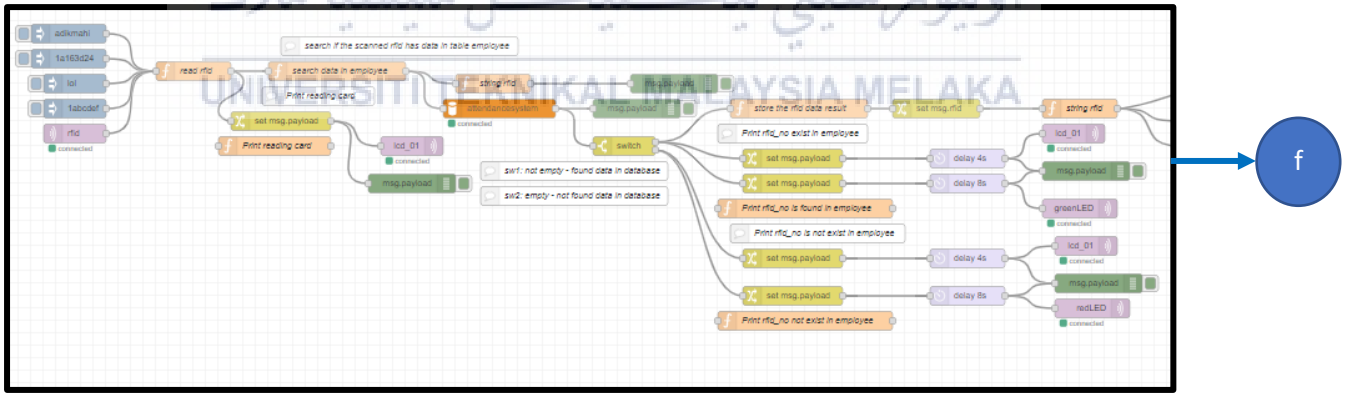


Figure 5.19 Input processing of RFID and validation existence

The code snippet shown above is the configuration of receiving the RFID tag data from Arduino through MQTT connection. It then prints out message “Reading Card” to LCD monitor display. If RFID tag is not registered by the admin, a message of “RFID not exist” to LCD monitor display and red LED will light up but if RFID tag is registered by the admin, a message of “RFID Data Exist” and green LED will light up.

c) Input processing of both temperature sensor and RFID Sensor

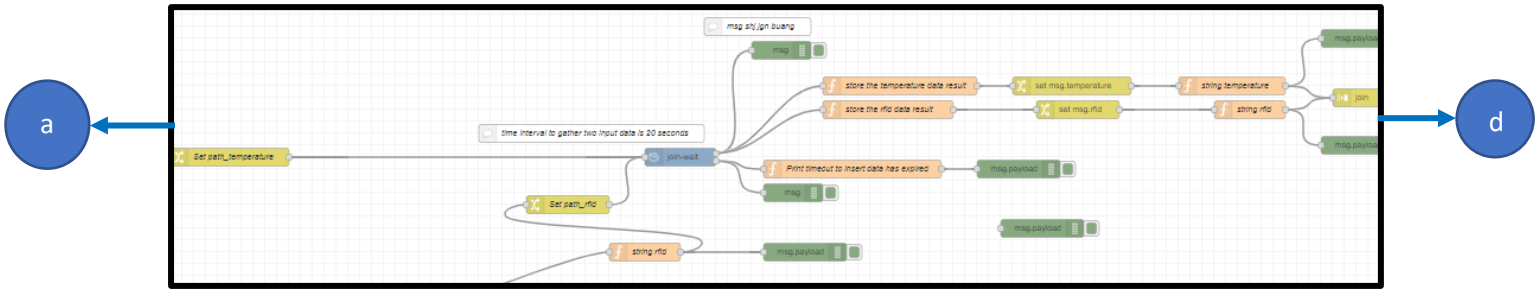


Figure 5.20 Input processing of both temperature and RFID

The code snippet shown above is the configuration of after temperature and RFID tag fulfil the requirement of lower than 37.5℃ and card is registered by the admin. Both data is sent to attendance system database to be inserted.

d) Insert time in of attendance

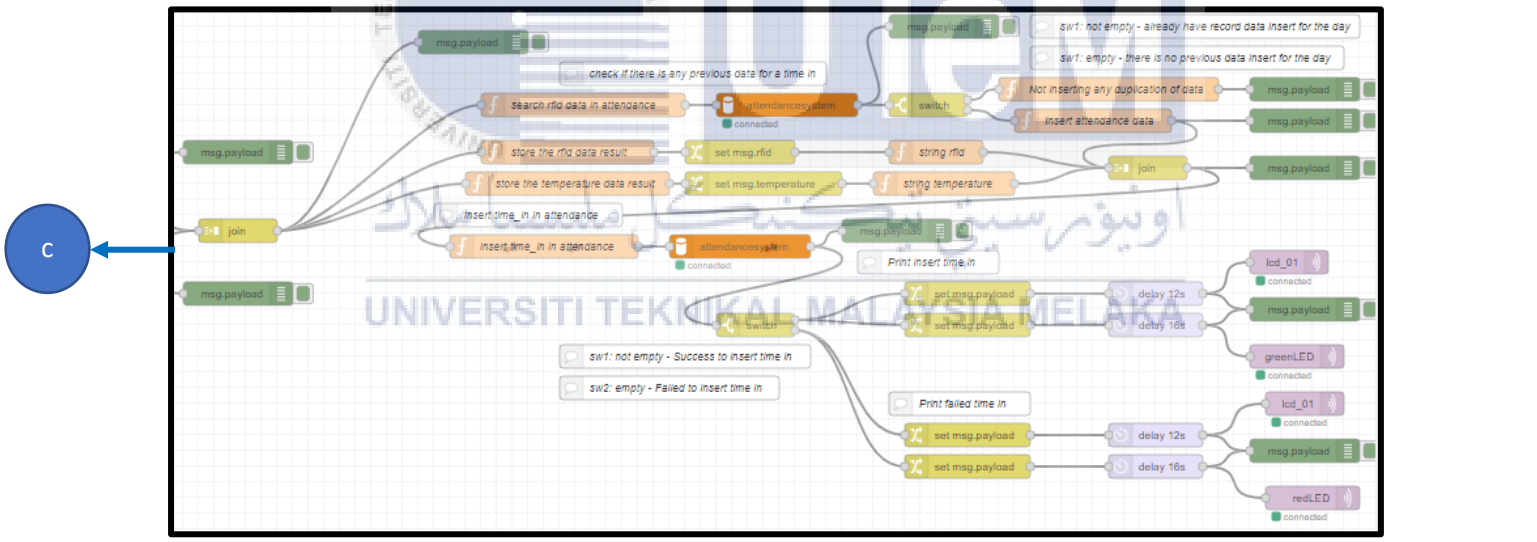


Figure 5.21 Insert time in of attendance

The code snippet shown above is the configuration of inserting time in for employee. It inserts the date, RFID tag, temperature and time in data of attendance. Before inserting the data, it will make sure there is no duplication of data is inserted of the same employee twice during the day.

e) Insert time out of attendance

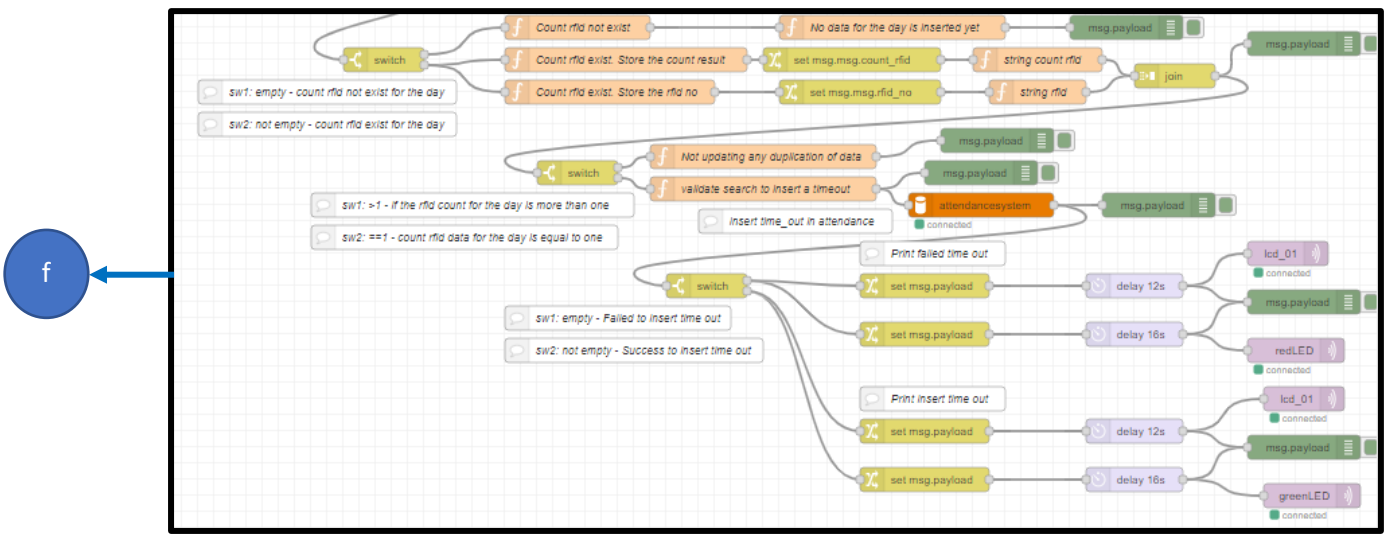


Figure 5.22 Insert time out of attendance

The code snippet above is the configuration of inserting time out for employee. It updates the table of attendance by inserting time out. Before inserting the timeout, it will make sure there is no duplication of data is inserted of the same employee twice during the day.

f) Search RFID tag record in database

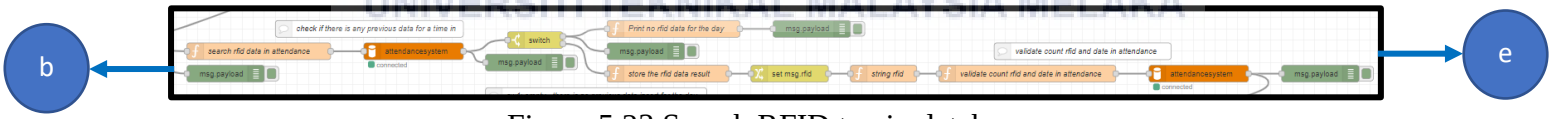


Figure 5.23 Search RFID tag in database

The code snippet shown above is the configuration of finding records of RDID tag in database. It allows the system to identified either the scanned tag is already has a previous data of time in of the day. Hence, there will only need to send RFID tag information to insert time out.

5.3.4 Web Browser Configuration

Web browser will only be seen by the administrator of the system. The browser has the functionality of add, update, display and delete records of the system. The administrator can monitor the system anywhere within the same network using computer. It has many configuration files as it is a full management system. In figure below, a screenshot of all file will be shown. The configuration is done using Sublime Text 3. The language used to build the system is HTML5, php, MySQL, CSS and JavaScript.

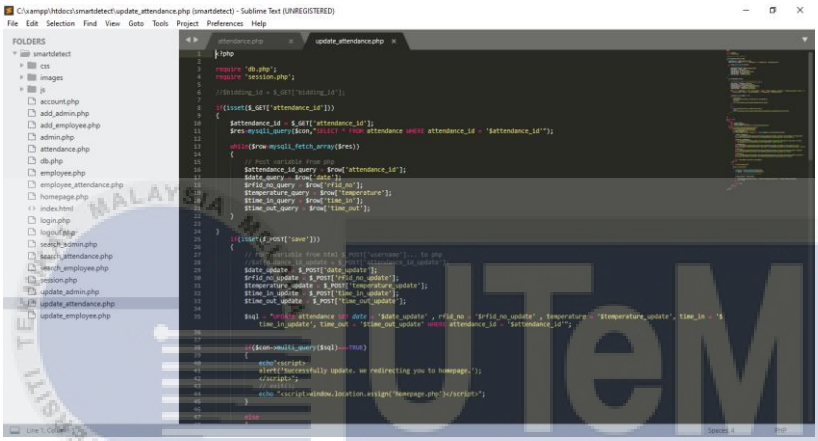


Figure 5.24 Web browser configuration

5.4 Conclusion

This chapter cover the implementation of the project. Overall configuration of hardware and software is discussed in detail. The configuration is tested once it is implemented in order to avoid any error which will cause the project multifunction. All of the hardware and software mentioned are used for the implementation of the attendance system. This configuration in this chapter will ensure the attendance system will works efficiently.

CHAPTER VI

TESTING

6.1 Introduction

In this chapter, the testing method of the project will be discussed. The purpose of testing is to verify the system work as it supposed to. The first part of this chapter is test plan which will explain about the testing activities. Next, test strategy will be discussed follows by the test design. Test description will focus on specific test in detail. It will cover the temperature detection test, RFID tag detection test, wireless communication test, MQTT communication test and database and Apache connection test. Then, result and analysis will be discussed which covers functionality test, performance test and system usability scale (SUS). The last part of this chapter is the conclusion which will summarize overall of the whole chapter.

6.2 Test Plan

The basis of testing is discussed in test plan. There are three types of test plan which is test organization, test environment and System Usability Scale (SUS). The test plan will also explain about the testing activities planned for the project.

6.2.1 Test Organization

This test is done by the developer. Developer will test the project according to its functionality. Developer is in charge for this test organization because only developer knows how the device work.

6.2.2 Test Environment

The structure of the testing will be determined. Test requirement are crucial and will be decided in the test environment. Testing of the project will face certain problem if the test environment did not manage appropriately.

6.2.3 System Usability Scale (SUS)

A set of questionnaires is made and feedback from end user is collected. End user is met using various online platform with the developer such as WebEx, Microsoft Teams, Google Meet and Discord to test the result of the project. At the end of the testing, end user is required to give a feedback using online platform questionnaire which is google form. Hence, System Usability Scale (SUS) will provide data from the end user whether the project meets user satisfaction or needs to be improved.

6.3 Test Strategy

In this part, the flow of the testing will be determined. The test strategy that is carried out in this project is how all the hardware communicate with each other to form a smart attendance system such providing both Graphical User Interface (GUI) for both employee and administrator and carried out it functions to scan body temperature and RFID tag. Firstly, microcontroller is turned on and end user needs to scan temperature and RFID tag. Then, Graphical User Interface (GUI) for user is displayed using LED and LCD I2C Display to indicate the current status of attendance and at the same time is also displayed at the web browser of administrator. Hence, the test of the project is successful.

6.4 Test Design

Test design discusses about the test identification, test cases and expected result of each scenario which are designed and documented. During the testing, all device and module will be tested. The test description discusses functionality and performance test. Table 6.1-6.5 shows the result of testing.

6.4.1 Test Description

Specific test such as temperature detection test, RFID tag detection test, wireless communication test, MQTT communication test and database and Apache connection test.

Table 6.1 Temperature Detection Test

Test	Temperature Detection Test
Test Purpose/ Test Functionality	To be able to detect body temperature
Test Environment	To test this project, user's hands need to be located less than 4cm from the sensors
Hardware Needed	i. Ultrasonic Sensor ii. MLX-90614 Temperature Sensor iii. Buzzer
Test Setup/Execution Test	1. Run Arduino IDE 2. Write coding to upload into the Arduino Uno 3. Click Upload
Expected Result	When user's hand is located less than 4cm, a body temperature is detected and buzzer will sound an alarm

Table 6.2 RFID Tag Detection Test

Test	RFID Tag Detection Test
Test Purpose/ Test Functionality	To be able to detect RFID card
Test Environment	To test this project, user's RFID tag need to be placed above the sensor
Hardware Needed	i. RFID MFRC522 ii. Buzzer
Test Setup/Execution Test	1. Run Arduino IDE 2. Write coding to upload into the Arduino Uno 3. Click Upload
Expected Result	When user's RFID card is located above the sensor, the sensor will read the card UID and buzzer will sound an alarm

Table 6.3 Wireless Communication Test

Test	Wireless Communication Test
Test Purpose/ Test Functionality	To be able to connect to home network
Test Environment	To test this project, the home network's WPA SSID and password must be identified and it must support wireless connection to devices
Hardware Needed	i. ESP8266-ESP01 Wi-Fi Module
Test Setup/Execution Test	1. Run Arduino IDE 2. Write coding to upload into the Arduino Uno 3. Click Upload
Expected Result	DHCP IPv4 address will be assign to the device after it connected to the home network

Table 6.4 MQTT Communication Test

Test	MQTT Communication Test
Test Purpose/ Test Functionality	To be able to transmit data between Arduino and Node-RED
Test Environment	To test this project, Mosquitto Broker configuration must allow to listen to devices and devices must connected to the same network
Hardware Needed	i. Ultrasonic Sensor ii. MLX-90614 Temperature Sensor iii. Buzzer iv. RFID MFRC522 v. LCD I2C Display vi. LED
Test Setup/Execution Test	1. Edit mosquito.conf 2. Run mosquito as daemon in local machine 3. Run Arduino IDE 4. Write coding to upload in the Arduino Uno 5. Click Upload 6. Run Node-RED 7. Edit Node-RED configuration 8. Click Deploy 9. Scan temperature or RFID tag
Expected Result	Once MQTT is connected, when a body temperature or RFID tag is detected, a buzzer will sound an alarm and at the same time data from Arduino Uno is transmitted and also can be seen from Node-RED and Arduino Uno. Data from Node-RED can also be transmitted and allow LCD I2C Display and LED from Arduino to publish an output.

Table 6.5 Database and Apache Connection Test

Test	Database and Apache Test
Test Purpose/ Test Functionality	To be able to connect to MySQL database and Apache
Test Environment	To test this project, the port needed must be not be in used by other application
Hardware Needed	-
Test Setup/Execution Test	1. Run XAMPP 2. Click Start on Apache and MySQL service 3. Open web browser and type “localhost”
Expected Result	XAMPP main page should appear and full access to database is granted

6.5 Result and Analysis

In this part, the result from testing will be discussed in detail. Analysis of the result also will be covered in this part.

6.5.1 Functionality Test

Functionality test will be handled to check functionality of the devices. Test that will be performed is temperature detection test, RFID tag detection test, ESP8266-ESP01 wireless communication test and database and Apache connection test

6.5.1.1 Temperature Detection Test

Temperature detection test is done by referring to the table above. The result of the test is shown below. In figure 6.1-6.2 shows the temperature detection on hardware and data displayed on Arduino’s serial monitor.

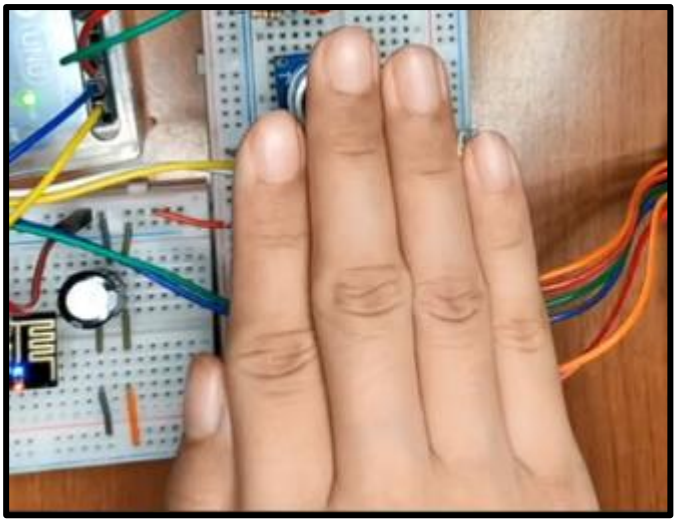


Figure 6.1 Detecting temperature

```
14:37:49.945 -> Object:35.49C, Ambient:31.65C
```

Figure 6.2 Successfully detecting body temperature

6.5.1.2 RFID Tag Detection Test

RFID tag detection test is done by referring to the table above. The result of the test is shown below. In figure 6.3-6.4 shows the RFID tag detection on hardware and data displayed on Arduino's serial monitor.

Figure 6.3 Detecting RFID

```
15:07:55.634 -> Card UID:1a163d24
```

Figure 6.4 Successfully detecting RFID tag

6.5.1.3 ESP8266-ESP01 Wireless Communication Test

ESP8266-ESP01 wireless communication test is done by referring to the table above. The result of the test is shown below. In figure 6.5-6.6 shows the condition of hardware is turned on and data displayed on Arduino's serial monitor.

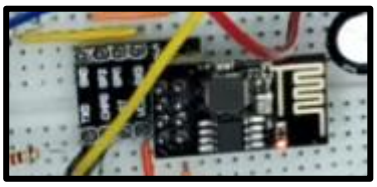


Figure 6.5 Wi-Fi module is turned on

```
14:29:56.918 -> [WiFiEsp] Initializing ESP module
14:30:00.579 -> [WiFiEsp] Initilization successful - 1.5.4
14:30:01.791 -> Attempting to connect to WPA SSID: afiffmahin
14:30:06.851 -> [WiFiEsp] Connected to afiffmahin
14:30:06.897 -> You're connected to the network
14:30:06.897 -> Your connected ESP8266 address is :192.168.1.100
```

Figure 6.6 Successfully connected to home network

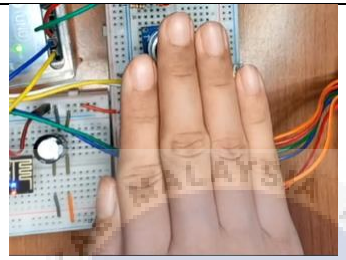
6.5.1.4 MQTT Communication Test

Once temperature and RFID tag is able to detect and device are connected to home network that are same with Mosquitto, then only data transmission will be send through wireless communication which are Wi-Fi and MQTT. The expected result from the test is done by referring to the table above. The result of the test is shown below.

```
14:41:06.060 -> Attempting MQTT connection...[WiFiEsp] Connecting to 192.168.1.111
14:41:06.246 -> connected
```

Figure 6.7 Successfully attempting MQTT connection

Table 6.6 Functionality Test of MQTT Communication

Activity		Hardware	Arduino	Node-RED
Data transmission from Arduino to Node-RED	Sending scanned temperature data		14:37:49.945 -> Object:35.49C, Ambient:31.65C	7/28/2021, 2:37:50 PM node: e577f1da.3294b temperature : msg.payload : string[6] " 35.49"
	Sending scanned RFID tag data		15:07:55.634 -> Card UID:1a163d24	7/28/2021, 3:07:55 PM node: baf0b2c2.1e308 SELECT * FROM employee WHERE rfid_no = '1a163d24'; : msg.payload : string[8] "1a163d24"
Data transmission from Node-RED to Arduino	Sending message to LCD I2C Display		14:37:53.100 -> Message arrived [lcd_01] Temp: 35.49 14:37:53.147 -> Temp: 35.49	7/28/2021, 2:37:50 PM node: 56747aef.a22da4 temperature : msg.payload : string[12] "Temp: 35.49"
	Sending message to LED		14:37:55.198 -> Message arrived [greenLED] 1	7/28/2021, 2:37:50 PM node: b2dd5551.95a488 temperature : msg.payload : number 1

6.5.1.5 Database and Apache Connection Test

Database and Apache connection test is done by referring to the table above. The result of the test is shown below.

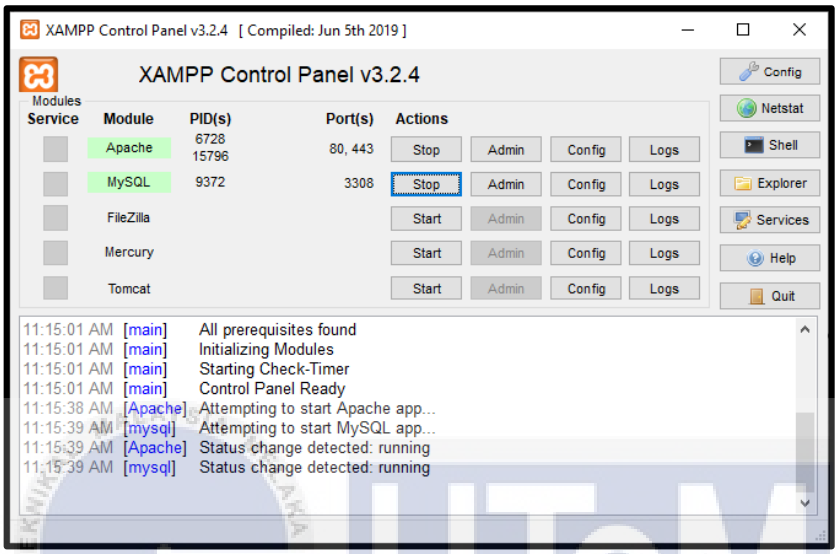


Figure 6.8 Start Apache and MySQL service

Once Apache and MySQL database is successfully start, the number of ports used and PID identifier for the services will be shown. Hence, the connection is established. To access to the services, type “localhost” on web browser and click on phpMyAdmin to have access to the database as shown in figure 6.9 and 6.10.

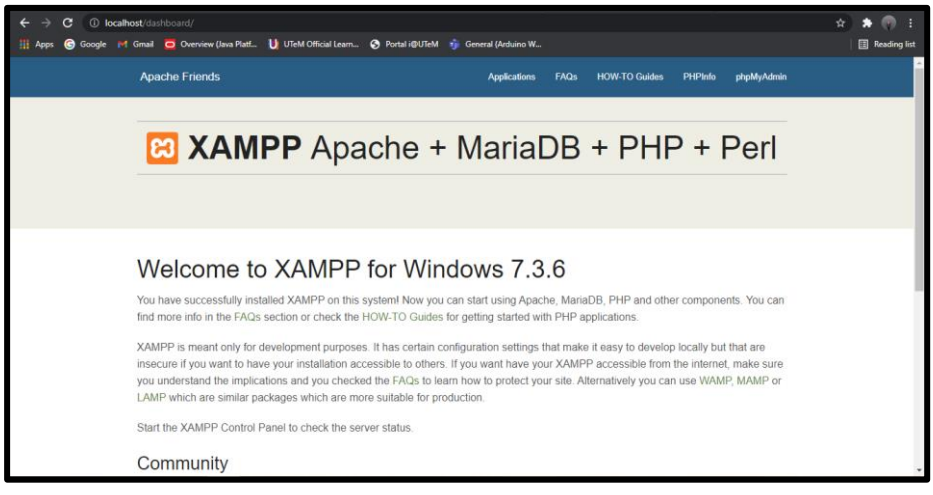


Figure 6.9 Accessing localhost

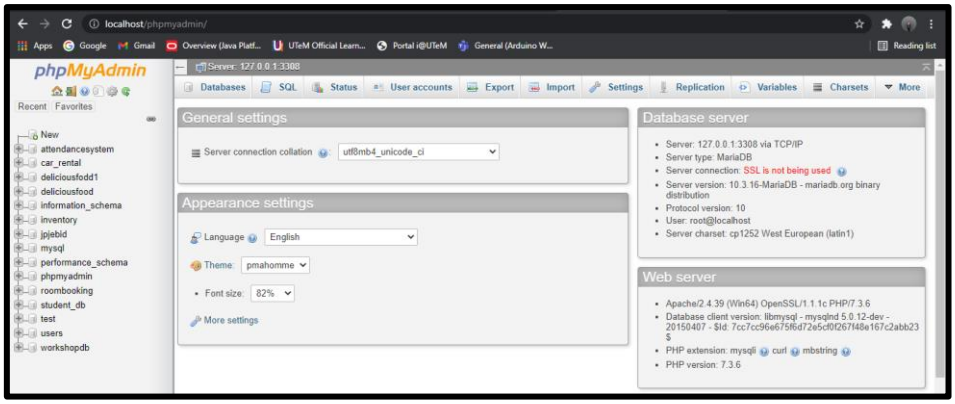


Figure 6.10 Accessing phpMyAdmin

6.5.2 Performance Test

In this test, an error handling of data from hardware is being analyse and controlled so a new data will not be inserted to the system if any requirements are not met by the employee.

6.5.2.1 Temperature Higher than 37.5

In this test, body temperature that is detected is higher than 37.5°C will receive a notification and red LED then attendance will not be registered. In figure 6.11-6.13 shows an hot object is scanned with body temperature and notification is received by the LCD I2C Display and red LED is light up.

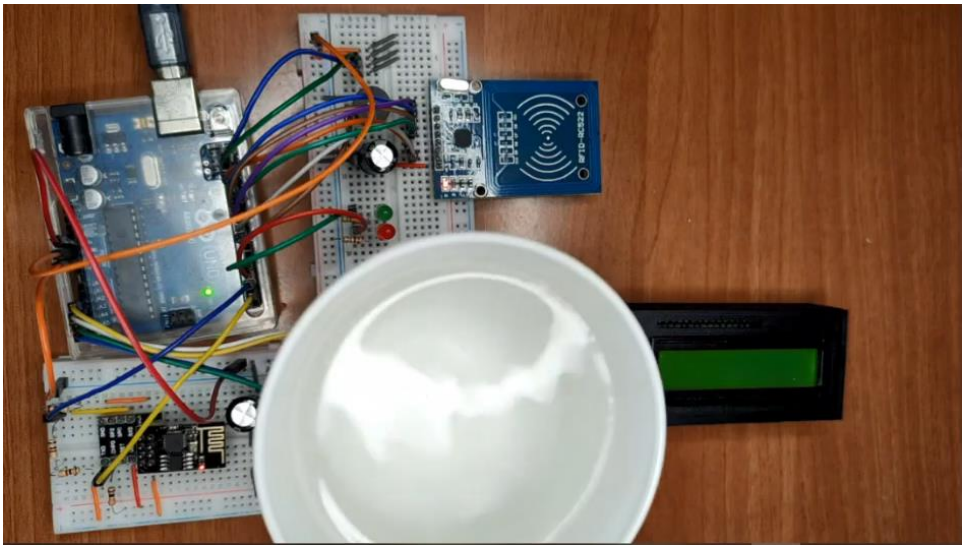


Figure 6.11 Scanning hot object

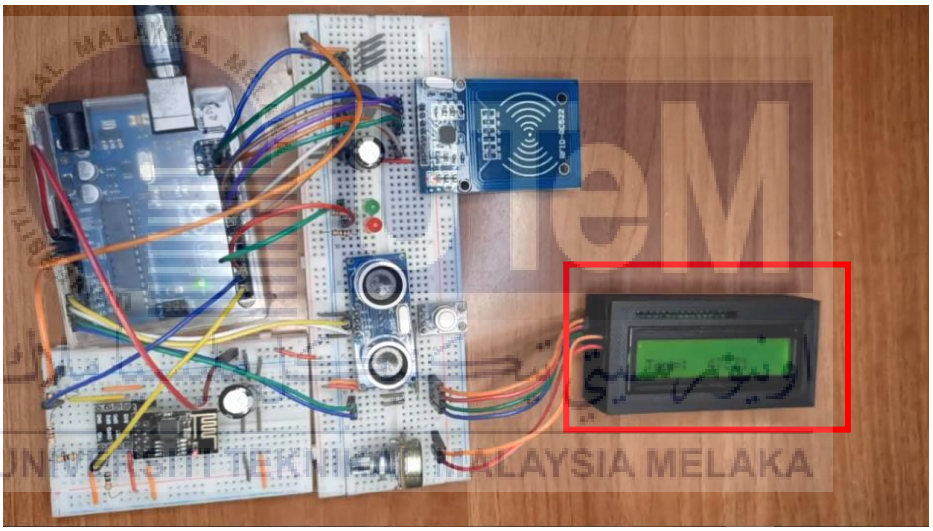


Figure 6.12 Notification of temperature

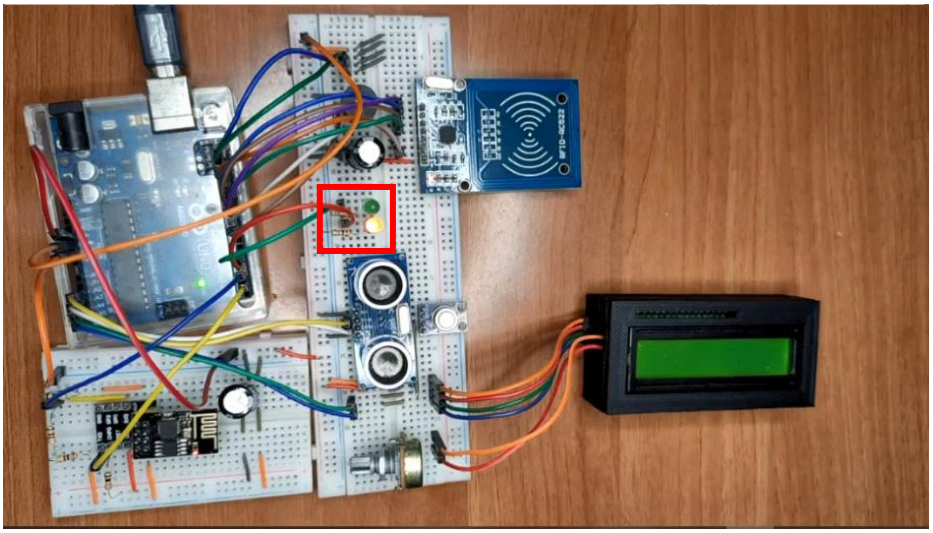


Figure 6.13 Red LED is light up

6.5.2.2 RFID Tag is not registered

In this test, RFID tag that is detected is not registered in the system by administrator will receive a notification and red LED then attendance will not be recorded. In figure 6.14-6.17 shows an unregistered RFID tag is scanned and notification is received by the LCD I2C Display and red LED is light up.

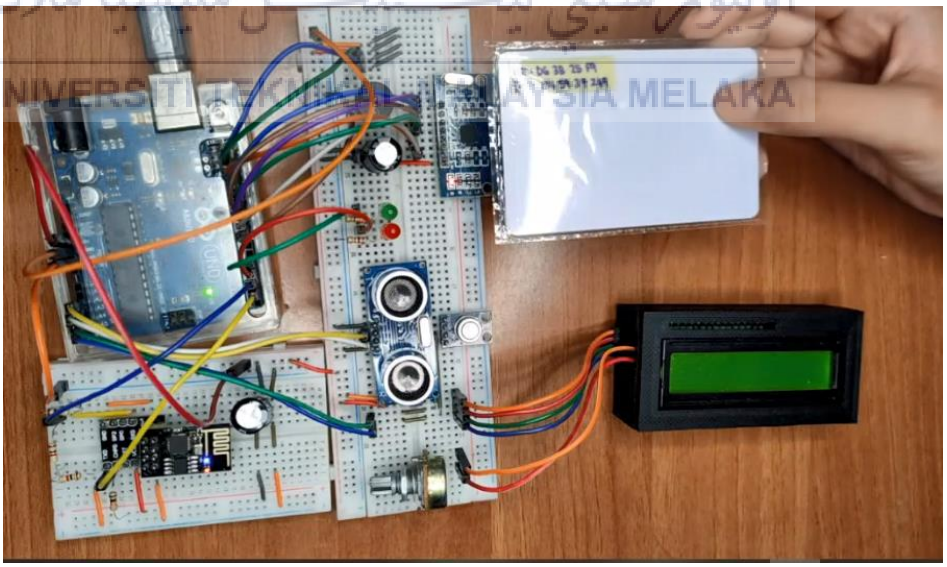


Figure 6.14 Scanning unregistered card

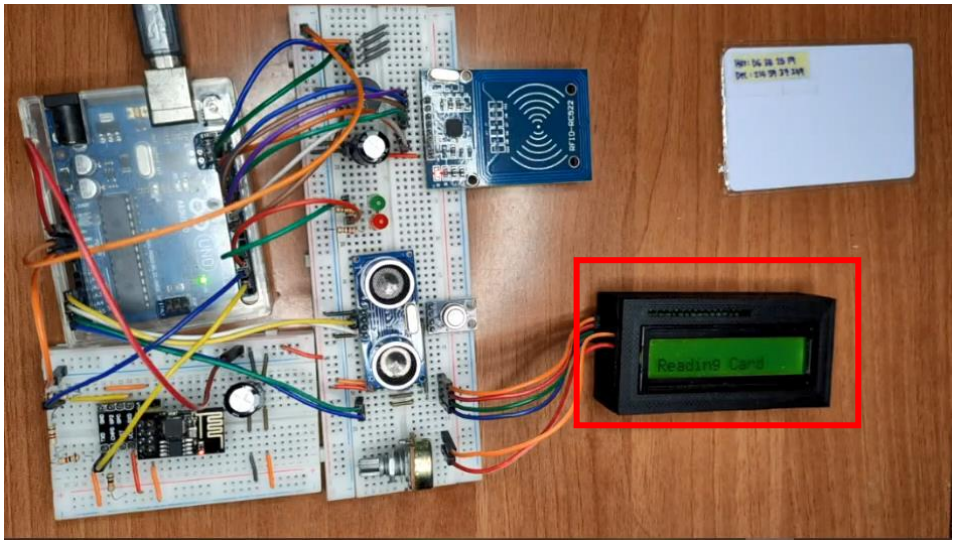


Figure 6.15 Notification of reading card

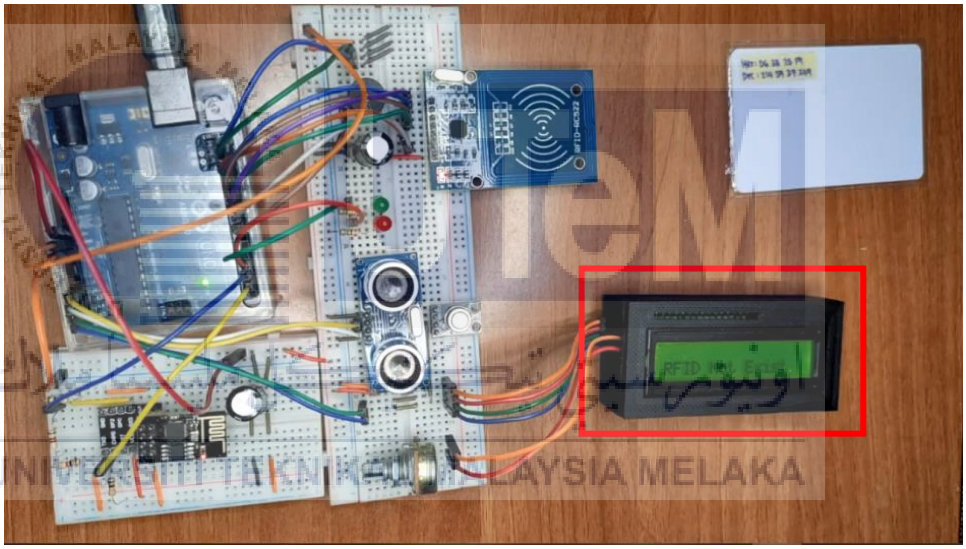


Figure 6.16 Notification of RFID not exist

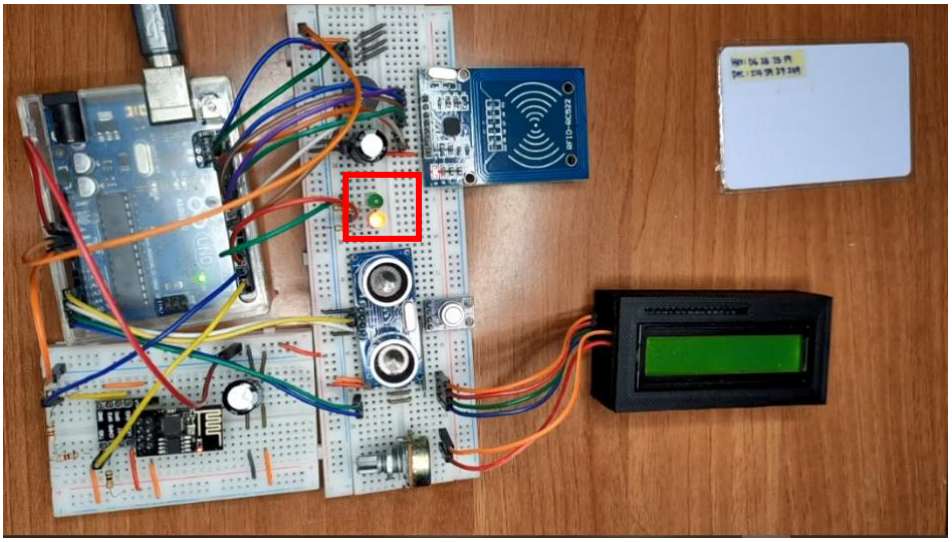


Figure 6.17 Red LED is light up

6.5.3 System Usability Scale (SUS)

For this testing method, a respondent of sixteen feedback of smart attendance system is recorded. The feedback is on two type of testing which is website and prototype. The website test is conducted for admin or security guard or administration staff while the prototype is made for employee. During this period of pandemic, testing activities is done through online platform such WebEx, Microsoft Team, Google Meet and Discord. For the website, tester of the system is given permission to control the developer's computer using feature that is provided on the online platform while the tester of prototype is given a live prototype demonstration of the project. After testing activities is done, tester is given a google from to answer the feedback. The test is taken from a various background of knowledge such gender, age, state and knowledge of Information Technology (IT). Figure 6.18-6.20 will show information of gender, age and state.

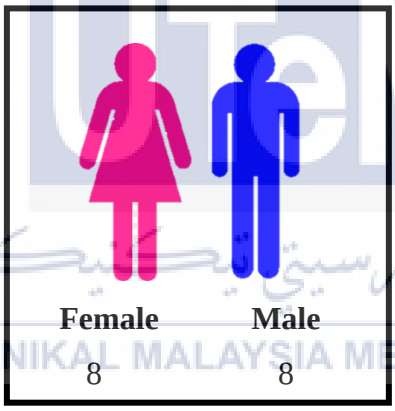


Figure 6.18 Gender Information

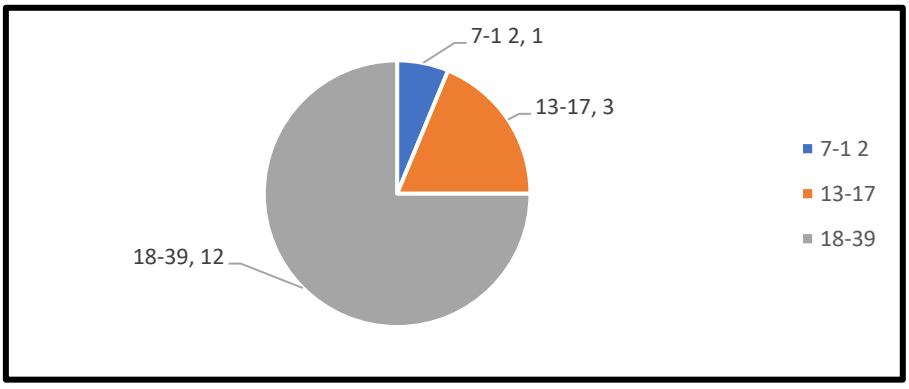


Figure 6.19 Age Information

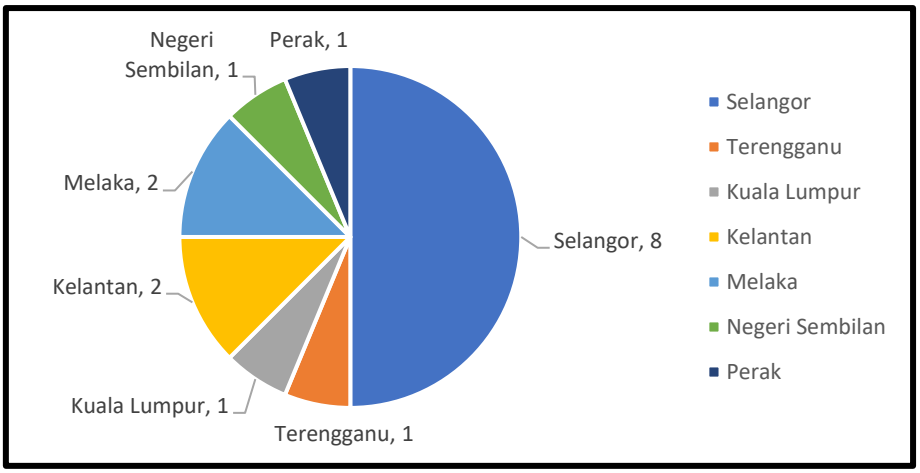


Figure 6.20 State Information

For the feedback on the google from, a set of ten question is asked (Thomas, n.d.), which is listed in figure 6.21 as follows:

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

Figure 6.21 Set of questions

All of the feedback's answer is given from a range of Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree. All of the data is tabulated in histogram chart in figure 6.22.

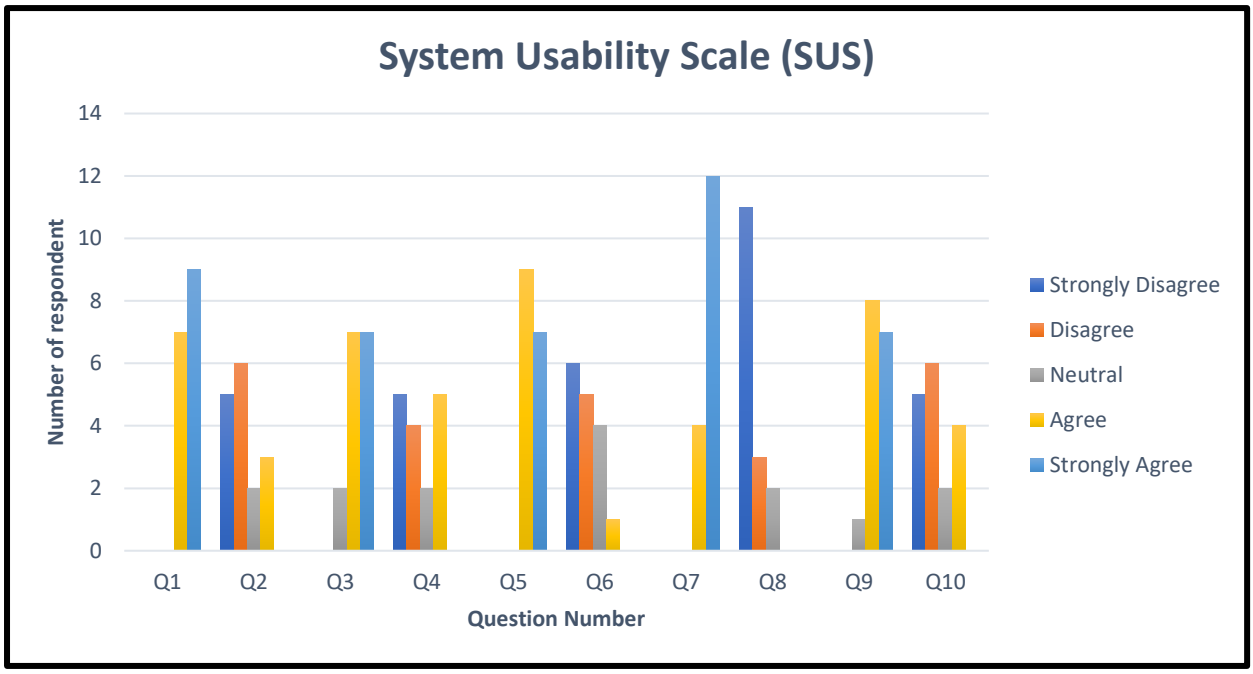


Figure 6.22 Data of System Usability Scale (SUS)

From all the data collected from figure above, calculation score of System Usability Scale (SUS) is counted. The formula used is as follows:

1. For each of the odd numbered questions, subtract 1 from the score.
2. For each of the even numbered questions, subtract their value from 5.
3. Take these new values which you have found, and add up the total score. Then multiply this by 2.5.

Table 6.7 Shows a tabulated data calculation of System Usability Scale (SUS). The grade for the smart attendance system is A as it higher than 80.3.

Table 6.7 Calculation of System Usability Scale (SUS)

Number of respondents	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	SUS Raw Score	SUS Final Score
1	4	3	3	4	4	4	5	1	4	2	26	65
2	5	1	3	1	5	1	5	1	5	1	38	95
3	4	2	4	2	4	2	5	1	4	2	32	80
4	5	2	5	2	5	2	5	1	5	4	34	85
5	5	4	5	4	4	3	5	3	5	3	27	67.5
6	4	2	4	1	4	2	4	2	4	2	31	77.5
7	4	3	4	4	4	3	4	2	3	3	24	60
8	4	1	4	1	4	1	4	1	4	1	35	87.5
9	5	1	5	1	5	1	5	1	5	1	40	100
10	4	2	4	2	4	2	4	2	4	1	31	77.5
11	4	4	4	4	4	3	5	3	5	4	24	60
12	5	2	5	3	5	2	5	1	5	2	35	87.5
13	5	2	5	4	5	1	5	1	4	4	32	80
14	5	4	4	1	5	3	5	1	4	2	32	80
15	5	1	5	3	4	1	5	1	4	1	36	90
16	5	1	5	2	5	1	5	1	5	2	38	95
											Average:	**80.47/100**

6.6 Conclusion

As the conclusion, the testing phase is very crucial in order to verify whether this project is successful or not. It is also a phase that will ensure the entire project is being are running well and smoothly without error. Test plan covers about the activities involved in the test while test strategy give us the perfect guide to perform the test. From test design, we can use it as the guideline in performing specific test for this project. As for the result and analysis, we can conclude that the device can detect the body temperature and RFID tag when it is around.

CHAPTER VII

PROJECT CONCLUSION

7.1 Introduction

In this chapter, it will conclude the overall chapter for this project. This chapter will discuss about project summarization in terms of the project objective, project strength and project weakness. The project contribution, limitation and future work will also be discussed in this chapter.

7.2 Project Summarization

7.2.1 Project Objective

There are three project objective that is used in completion of the project which is:

i. To analyze the existing attendance of RFID system.
ii. To develop an attendance system that have body temperature check module to prevent spreading of pandemic diseases.
iii. To validate the functionality of the new developed attendance system.

7.2.2 Project Weakness and Strength

7.2.2.1 Project Weakness

In this project, there are several weaknesses that are found during implementation of project such as this project require a strong internet connection as it is used during data transmission of MQTT connection. If the connection is unstable, there are possibility data

transmission between Node-RED and Arduino will not be received. Hence, the transmitted data will not be inserted in database and employee may not get notification from LCD I2C Display and LED. The next weakness of the project is the accuracy of body temperature is not accurate as the one bought in pharmacy store. The code in Arduino needs to be modified to meet the nearest accuracy since it needed a few centimetres far from the ultrasonic sensor to be able to capture attendance.

7.2.2.2 Project Strength

In this project, there are several strengths that are found. The first strength is this project helps to prevent the spreading of pandemic inside workplace by help from preventing a body temperature higher than 37.5℃ from entering the workplace. Hence, this project helps to detect symptoms of COVID-19 inside the workplace. Besides, this project allows administrator to monitor employee's health from time to time as the employee's temperature data is included inside the database. Next, one of the strengths for the project is that employee and administrator of the system has its own Graphical User Interface (GUI) such administrator will have a webpage interface system to monitor attendance data while employee will have an LCD I2C Display and LED as indication of their attendance status. This project also be able to track and prevent an unregistered card of RFID tag to get any attendance data. Hence, there will be no misidentify among employee.

7.3 Project Contribution

By having this project, it will help the organizations or company to detect the symptoms of COVID-19 only at their office. It will also help preventing any COVID-19 cluster inside an office. A body temperature that is higher than 37.5℃ is one of the symptoms of the pandemic. This project helps to identify the safety of the workplace by not allowing any employee that higher than 37.5℃ to go to work. Hence as stated, this project helps any organization or company to detect the symptoms of COVID-19 only at their office.

7.4 Project Limitation

There are several limitations of the project such as this project requires strong internet connection to allow transmission of data is received smoothly between Arduino and Node-RED. Next, the accuracy of body temperature is not accurate as the code in Arduino needs to be modified to meet the nearest accuracy since it needed a few centimetres far from the ultrasonic sensor to be able to capture attendance.

7.5 Future Work

In the future, there are several upgrades that can be implemented in this project for better function. Below is the upgrade that can be implemented for this project in the future:

i. Integrate the current hardware with a gate. The main entrance will be locked and unlocked based on employee input. Employee that met the requirements needed can go to their workplace as the main entrance will be unlocked otherwise the main entrance will remain locked.

7.6 Conclusion

In conclusion, this project is successful since it meets all the objective stated in 7.2.1. This chapter is the summarization of the whole chapter of the project the smart attendance system to prevent spreading of pandemic diseases. In the project weakness and strength, we can conclude that there are several weaknesses that must be fixed in future to provide a better performance. The strength of this project is also determined which gives a lot of advantages by being the user of the system. In addition, project contribution and project limitation are also identified and discussed in detail. However, this project still needs an upgrade to provide better performance for the user of the system.

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APPENDICES

CHAPTER VI TESTING

- Implementation of System Usability Scale (SUS)