UNIVERSITI TEKNOLOGI MARA

A WEB BASED SYSTEM FOR LOST AND FOUND ITEMS SYSTEM USING RFID AND EMAIL NOTIFICATION

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**Thesis submitted in fulfilment of the requirements for
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SUPERVISOR'S APPROVAL

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This project was prepared under supervision of the project supervisor; Mr. Jiwa Noris bin Hamid was submitted to the Faculty of Computer and Mathematical Sciences and was accepted in partial fulfilment of the requirements for degree of Bachelor of Science (Hons) Information Technology

Approved by

…………………………………

Mr. Jiwa Noris bin Hamid

Project Supervisor

JULY 17, 2020

I

STUDENT'S DECLARATION

I certify that this report and the project to which it refers is the product of my own work and that any idea or quotation from the work of other people, published or otherwise are fully acknowledged in accordance with the standard referring practices of the discipline.

Fatiehah iylia
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NUR FATIEHAH IYLIA BINTI MUHAMAD ILIAS

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JULY 17, 2020

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ABSTRACT

The project that develops is Lost and Found Items System using an RFID and an email notification. The main purpose of project development is to trace owner details and notify them via an email notification. Email is the right technology as a communication platform that secure platform than social media. The lost and found the system will involve with IoT based such as NodeMCU ESP8266 and RFID RC-522. The IoT stuff is used to scan the RFID tag/card to detect the owner of the losing items. Lost and found items station were located at HEP building in UiTM Arau branch. The main target user for this system is the student that can be in charge as the tester for this project. For the information, the system has two-part. The first part is the student must register their details at the station to get the tag/card which the tag/card need to attach at their items. The tag/card consists of owner details such as name, id, gender, email, number phone, second number phone, Telegram username, status items, date lost, and date return. The second part is the user can register an account in the user part to report any cases of missing or found items. Next, the survey conducted around 20 people of students and staffs using Google Form questionnaire. Lastly, the result of the study shows that most of the respondents agreed that the system is suitable to implement in UiTM Perlis.

Keyword: Lost and Found, email notification, web-based, NodeMCU ESP8266, RFID RC-522

TABLE OF CONTENTS

LIST OF FIGURES

XIII

LIST OF TABLE

LIST OF ABBREVIATIONS

Arduino IDE	Integrated Development Environment
CDMA	Code Division Multiple Access
COVID	Corona Virus Disease
CSS	Cascading Style Sheets
DBMS	Database Management System
DFD	Data Flow Model Diagram
ERD	Entity Relationship Diagram
GPS	Global Positioning System
GSM	Global System for Mobile Communication
HTML	Hypertext Markup Language
ID	Identification
IMF	Internet Message Format
IoT	Internet of Things
ISM	Insurance Service Malaysia
PHP	Personal Home Page
RFID	Radio frequency identification
RSSI	Received Signal Strength Indicator
SDLC	Software Development Life Cycle
SMS	Short Message Service
SMTP	Simple Mail Transfer Protocol
SQL	Structured Query Language
TDMA	Time Division Multiple Access
UiTM	Universiti Technology Mara
USB	Universal Serial Bus
WYSIWYG	What You See Is What You Get
XAMPP	Cross-Platform(X), Apache(A), MariaDB(M), PHP(P)
XML	Extensible Markup Language

CHAPTER 1

INTRODUCTION

The background of the research on web-based design, Radio Frequency Identification (RFID), and an email notification is discussed. It also gives details about the problem statement that the researcher has to deal with it. The research goals, scopes, and explanations that led to this study are also elaborate in this chapter.

1.0 Background Of Study

Managing and locating lost or missing items have many challenging tasks and can be a real chore (Bulut & Szymanski, 2017). McLaughlin & Colodny (2019) said that at least once, people will forget their item. For information, the lost personal thing will happen anywhere either at transportation, hotel, school, college, mall, etc. To support the issues, more than 400 000 items were lost, and just less than 40% were recovered every year in Switzerland on 2006 (Guinard, Baecker & Michahelles, 2008). It show that this issues is important to take note. Also, the recorded statistics indicate that individuals will spend an average of about 15-20 minutes per day searching for their misplaced or lost items (Bulut & Szymanski, 2017). Ahmad, Ziaullah, Rauniyar, Su, & Zhang, 2015 said in this era, time will become more valuable than ever before.

From observation, for those who lost items, they will spend more time finding it, such as they need to track the places that were visited, the owner tries to remember last time they saw the item, and search at all the locations that the owner been since the losing things. It shows that people will take the time to examine their details item place if they drop or misplaced it. Next, for those who found objects, they were viral the issue and description of things in social media such as Whatsapp, Facebook, Twitter, and so on (Loutit, 2017). Lastly, there are several ways to manage lost items such as by preparing boxes for lost and found

objects and make some mark at their things such as write names or phone numbers, and so on.

Therefore, the purpose of this study is to develop a web-based system for lost and found items using RFID and email notification. It can help people to manage their issues, such as detect the owner and notify them about the status items using RFID tags.

1.1 Problem Statement

Theoretically, people will lost their valuable things every day or every second such as wallet, book, bag, clothes, and umbrella. The losing items can happen anywhere, like in the school, college, public place, and home. According to Kimura (2018) found that at school, children recently losing items like school uniform garments. If people saw the garments, then they will put it in a lost and found box. But unfortunately, several garments not been collected because the owner does not receive any location status about the garments. Next, another way how those who lost items and those who discover things manage this situation by interacting with each other using electronic networks such as Whatsapp, Twitter, and Facebook (Loutit, 2017). So they will use it as a platform to communicate with each other (Hamad, 2017).

Unfortunately, social media is not a safe platform for finding lost items because there are many disadvantages, such as hacking, scammer, thief, fake account, and security issues. For example, if someone lost their wallet, then he or she will post the description of his or her purse into social media. He or she also attached their information details like a contact number, address, and name to the public and hoped if someone found those items, they will quickly contact them. But expose information details into social media is not safe because somebody not responsible will use it for something terrible purpose.

Moreover, researcher observation found that this situation also usually happens in the UiTM Arau branch. The owner was challenging to find their lost items

once they drop it. If someone found the lost items, they viral it in social media such as post it in the class group, club group, and contact list, hope that somebody who found those items will report it to the owner.

Therefore, the researcher proposes a web-based system for lost and found items using RFID and use email notification to solve the problem. RFID devices can store the details of the owner by using tags. The tags will contain the unique id number, and it will trace the details of the owner. So, it can make sure the details of the owner will not be able to expose to the public and keep it safe. The items need to be scan using an RFID scanner to get owner information. The scanner will store at the lost and found station only. Lastly, the researcher wants to use email notification platform to send a notification to the owner.

1.2 Research Objective

This research aimed to achieve these objectives:

1. To design and develop the Lost and Found Items System using NodeMCU ESP8266 and RFID RC-522.
2. To integrate RFID and email notification with the system.
3. To test the functionality of lost and found items system to the students.

1.3 Research Scope

In this project, it will involve the design that can develop a system based on web-based development for lost and found system that can trace owner details and notify them. The lost and found the system will involve with IoT based such as NodeMCU ESP8266 and RFID RC-522. Lost and found items station locate at HEP building in the UiTM Arau branch. The target user for this system is the student that can be in charge as the tester for this project. This project will use PHP and HTML related to developing this system. For database storage, it will use MySQL to store the data. This project also uses the RFID tag to read owner details of the items and also uses an email notification platform to notify the user.

1.4 Research Significance

This project is essential to carry out as it can improve the current system of lost and found items system because, before this, the owner of the items will use the traditional method to find missing items such as upload the lost objects in social media. Besides, it can make the owners' tasks make it easier and reduce the time needed to handle lost items. This project's research is significant because it can help the user for ease to find details about missing items. Lastly, this project improves with the help of using RFID technology with a microcontroller as the platform.

1.5 Summary

In this chapter has briefly discussed the background of the project, problem statements, objectives, research scopes, and research significance of the project.

CHAPTER 2

LITERATURE REVIEW

INTRODUCTION

This chapter will explain details about the project fields. It covered the aspects of lost and found items system, the technology used in the order such as RFID device, and email notification platform. To support and get some information or data, the researcher had reviewed some similar articles, journals, or related works.

2.1 Lost and Found Items

The problem of missing or misplaced things often rises day by day. People who lost the items will difficult to find their items back. Previous studies revealed that owner would waste their time to search the items around 16 to 55 minutes per day (Ahmad et al., 2015). Therefore, several surveys are conducted by various organizations and research to highlight the problem of lost and misplaced item's objectives. The question of these issues is the people difficult to find their items when they are losing it. Some of the lost items are valuable items like a wallet, handbag, clothes, phone, and an umbrella. Frequently, these issues happened at schools, universities, hotels, transportation, and so on. But typically, at school, they introduce a method where every student needs to remark their valuable items like to put a phone number, name, or address, and they also provide a box if someone found something useful. Therefore, a lot of solutions are being proposed in the market to solve these issues. Some of the solutions use GPS, and an RFID to detect the owner of the details and also used communication technology like SMS and an email notification to send information.

2.1.1 Current technology use to find lost items

2.1.1.1 Radio frequency identification system (RFID)

RFID allows for the classification of radio frequencies. RFID is used to label tags attached to the objects and connected them to EM fields. There are various methods of identification, but the most common form is a serial number, in which a person or object is identified, or any other data provided on a microchip. The chip that is attached to an antenna is called an RFID transponder or tag. RFID technology enables automatic identification of each object through radio waves. The RFID reader can recognize the object without direct line-of-sight (Shah & Singh, 2016), while the barcodes are line-of-sight technologies. RFID is used to identify the information from tags that will detect by the reader and send the data into the system. Usually, RFID is used in lost and found systems because it can make the process more comfortable, and it's a cheap cost (Fahim & ElBatt, 2016) and also an effective solution.

2.1.1.2 Global Positioning System (GPS)

Global Positioning System (GPS) is a global satellite navigation system that provides position, speed, and time synchronization for air, sea, and land travel using at least 24 satellites, a receiver, and algorithms. Kyes & Aarthi (2017) claimed that the satellite system has consisted of six orbital planes centred on the earth with four satellites each. GPS operates in almost all weather conditions at all times. Usually, GPS is used when it's related to the vehicle. For example, "A GPS-GSM Predicated Vehicle Tracking System, Monitored in A Mobile App based on Google Maps "is this system that uses GPS to track the vehicle if the users forget the position where he or she parks the car or the car is lost. The vehicle tracking system consists of a GPS antenna generating the coordinates, a GSM modem for receiving user

requests and transmitting the vehicle coordinates (i.e., latitude and longitude) generated by the GPS antenna via SMS (Mangla, Sivananda & Kashyap, 2017).

2.1.1.3 Global System for Mobile Communication (GSM)

GSM (Global Mobile Communication System) is a wireless mobile network that is commonly used in Europe and other parts of the world by mobile phone users. GSM issue variance of time division multiple access (TDMA) and is the most commonly used of the three digital mobile telephony technologies, which are TDMA, GSM, and code division multiple access (CDMA). GSM digitizes and compresses data, then transfers a channel to two other user data sources in their time slot and operates on either the frequency band of 900 megahertz (MHz) (Vamsikrishna, Kumar, Hussain & Naidu, 2015) or 1,800 MHz. According to Shah & Singh (2016), GSM is used because it has a SIM card slot to receive a network signal. In the project "RFID Based School Bus Tracking and Security System," parents will receive SMS notification about the current location and time of their child. So, the parent can monitor their kid location consistently every day when their kid took a school bus.

2.2 Technology

The researcher wants to use some technology to implement in the system. The technology will use Web-based applications, RFID devices, and email notification. This sub-topic will explain details about all the technology been used, which explains their advantages and disadvantages.

2.2.1 Web-based Application

A web-based application is also known as a web app. This program can access a network connection using HTTP and can run inside through a web browser such as Google Chrome, Mozilla Firefox, or Safari. However, the web-based application also can be client-based, which is it can be a small part of the program that needs users to download it at their desktop, but it needs to be done by using the internet over an external server. Web apps also have some advantages, which is no need to install additional software (Lvivity, 2018), and the developers do not need to write multiple versions for the same application in different operating systems. Lastly, the most popular web application is written in JavaScript or HTML5 or Cascading Styles Sheets (CSS).

2.2.1.1 Advantages of Web-based Application

Web apps also provide many advantages for the user who is anyone can use web applications as long as they have an internet connection. To run a web browser, the user can use an IBM-compatible or a Mac and can be running on Windows XP or Windows Vista. Even that, they also can use Internet Explorer or Firefox when certain applications need a specific Web browser said Nations (2019). Besides, web apps can be run on multiple platforms (Gibb, 2016) as long as the browser is compatible. Then, users can access the same version to eliminate any compatibility issues. Web apps also can save a space that this app does not install on the hard drive. It also can

minimize business and end-user costs because the business requires less support and maintenance and lower end-user system requirements.

2.2.1.2 Disadvantages of Web-based Application

According to Fox (2018), the disadvantages of web apps are internet reliance. Even internet access available in many locations, but if suddenly users lost internet connection, they are not able to access their web app. Then, web apps have some issues with browser support. Some users will not use the same browser. Therefore, they need to ensure their apps support across a variety of browsers. Based on Yeeply (2017) said that this web app could reach on all devices, but the website must program in a way that can show regardless of the device's operating system. If it's not a responsive website, the user may have a problem with displaying it on IOS, Windows Phone, or Android. Lastly, the user needs to spend money to develop a quality website in improving it. The importance is users need to have a quality corporate website to make their web apps work perfectly.

2.2.2 Radio frequency identification system (RFID)

Radio-frequency identification system (RFID) is an automatic technology that assists devices or computers in identifying objects, recording metadata, or controlling individual targets via radio waves. Connecting the RFID reader to the Internet terminal allows readers to identify, track, and monitor objects that are attached to tags globally, automatically, and in real-time, if necessary. It is known as the Internet of Things (IoT). RFID is often perceived as an IoT prerequisite. Besides, animated or inanimate items can also be located, tracked, controlled, and recognized by RFID tags (Robinette & Gernandt, 2016). Another information, RFID is now a standardized technology; its intrinsic advantages, which are unitary, identification, wireless communication, and low tag price, give it crucial practical benefits that drive fresh ideas and application developments. After that, the RFID reader involves a configured antenna module to scan a variety of tags. Lee,

9

2019 claimed that each tag plurality has a distinctive identifier (UID) and includes information about an object connected to the card.

Besides, Shah & Singh, 2016 revealed that there are two types of RFID tags that are active and passive. In passive RFID, there were not need an internal power supply. Then, RF signal only releases in response to a tag request, and active tags requiring a domestic power supply emitting a radio frequency signal. Although passive RFID is inexpensive, meanwhile, active RFID is expensive. RFID can become engaged in long-range meters, but passive works up to a few meters. Passive tags have a longer duration of life.
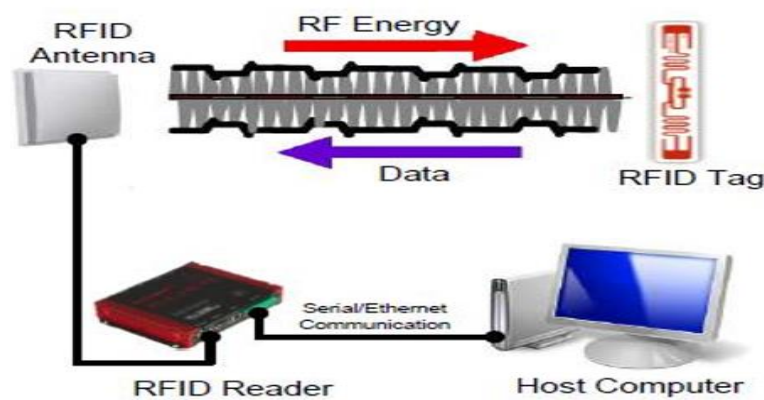
Figure 2.1 RFID Technology working on

Two primary components of the system are RFID tags (or transponders), and RFID readers (or interrogators) will be uses. The label uses radio waves that are tuned over the same frequencies to exchange information with the reader within the reading range. Figure 2.1 illustrates how the RFID system works. The RFID reader consists of a processor, antenna, transceiver, a host computer (i.e., via serial port or Ethernet) communication interface, and power supply. RFID tags are made up of three major components, a substratum, a circuit, and an antenna. A circuit is a call as an in-built chip that is used together with data storage to perform some precise work.

2.2.2.1 Advantages of RFID

The benefit of RFID is increasing asset visibility. RFID devices can help users to manage their problems like "you cannot handle what you cannot see." The main basis of benefit RFID is to help increases inventory and asset visibility. Which mean, RFID tags can help employees know the location and amount of items directly by using RFID tags. Next, other benefits are to mitigate risk, loss, and theft. RFID can help supply chain to quickly access the inventory information and location to keep track of the items are stored, replenished, and confirmation of delivery. Using this kind of technology will reduce the supply chain make a mistake by tracking the movement of each asset in the room, and it also can reduce the risk of distribution, loss, forgery, and theft (Lowry, 2014).

2.2.2.2 Disadvantages of RFID

According to Information Technology (2017), radio waves tend to reflect liquid and metal surfaces, which makes the tags unreadable, so when placed on metal or liquid objects or between the reader and the card, RFID tags cannot read well. For example, when there are many tags in a confined area, a collision occurs. The RFID tag reader simultaneously energizes multiple cards, all reflecting their signals to the reader. The results in a collision with the tag and the RFID reader cannot distinguish between incoming data. RFID reader collision results when one RFID reader's coverage area overlaps with another reader's coverage area. So, the same tags are causes of signal interference and multiple reads.

2.2.2.3 Radio-Frequency Identification Reader

The tool that needs to collect data from the RFID tag is called the RFID reader, then used to track objects. It is because of the use of radio waves that data is sent from card to reader (Techopedia, n.d.). There are various types of tags, especially, so communication can be a simple ping or multi-round

11

protocol complex. If the surrounding area works with a lot of marks, then the reader needs to do protection against collision. It is to ensure that there aren't contact problems. Also, because of the anti-collision protocols, RFID readers accept easy contact with multiple tags in serial order (Weis, 2010).

The readers will operate at different frequencies and have many functions. It also has its processing power and internal storage and can provide network connectivity. Readers could be a simple gateway to an external network, or they could store all relevant data locally (Weis, 2010).

Therefore, this project will use RFID-RC552 as a reader. The RC522 is a 13.56MHz RFID module based on the NXP semiconductor MFRC522 controller. The module can support I2C, SPI, and UART and usually is a ship with a key fob and an RFID card. It is widely used in attendance systems and other applications for the recognition of persons/objects. Then, RC522 is an RF module consisting of an RFID reader, an RFID card, and a key chain. The module operates 13.56MHz, which is an industrial (ISM) band and can be used without any licensing issue. The module usually works at 3.3V and therefore is widely used in 3.3V designs. It is generally used in applications where a unique ID is required to identify a particular person/object. Usually, RFID RC522 will be used in a project like automatic billing systems, attendance systems, verification/Identification systems, and access control systems.

Figure 2.2 The RFID-RC522 readers and tags.

2.2.2.4   NodeMCU ESP8266 Board

NodeMCU is focusing on the Esperessif Wi-Fi System-On-Chip ESP8266-12E, equipped with an open-source firmware, based on Lua. It's suitable for IoT devices and other wireless connectivity situations. NodeMCU ESP8266 has multiple GPIO pins on the board for connecting the board to other peripherals and capable of generating serial PWM, I2C, SPI, and UART communications. The module's interface is divided mainly into two parts, including both Firmware and Hardware, where the former runs on the ESP8266 Wi-Fi SoC and later on the ESP-12 module (Al Dahoud & Fezari, 2018). Figure 2.3 shows a NodeMCU ESP8266 Board.
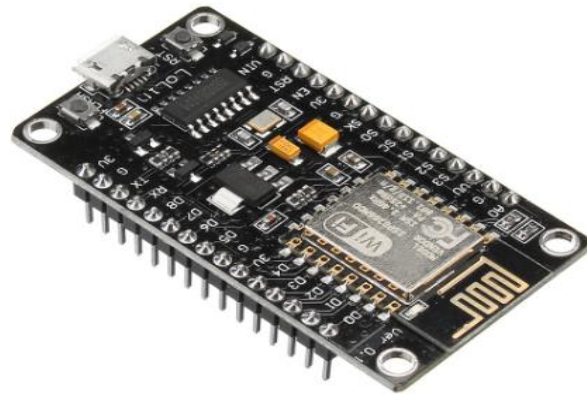
Figure 2.3 The NodeMCU ESP8266 Board.

2.2.3   Email

In a new era, email is a popular communication where email is the primary medium of electronic communication, and it is one of the cheapest (Sah & Parmar, 2017) and fastest platforms. According to Kumar, Vaisla & Kishore (2014), email is a part of application form in the platform on the internet. Based on the latest email statistic reports, the number of email account expected to reach 4.3 billion accounts (Jayakody & Dias, 2014) by the year 2016. Previous studies revealed that electronic mail (email) had become the preferred method of communicating textual, graphic, and other digital

information with the ubiquity of the internet and computer networks (Craddock, Chin, Cheng & Isaacs, 2015). Unlike standard postal mail, email may reach its destination within seconds or minutes of sending it, even if the recipient is around the globe. Also, an email can be sent to various recipients readily.

Furthermore, the researcher wants to introduce a little bit about the email concept. In the early 1970s, the email message already used, but the ideas of email do not change in this era. Even developments have occurred, but the main protocols are the same. There are two main classes of protocols that exist in email concepts, which are message format and its routing. In an email system, the message format depends on the Internet Message Format (IMF) standard. IMF has a goal in the framework of electronic mail that to provide a syntax for text messages sent between computer users. The second classes of the primary standard protocol are Simple Mail Transfer Protocol (SMTP). The main goal of SMTP is to transfer email accurately and efficiently between two components of an email system. Through SMTP, which is often connected with the domain name system, emails from end-user to end-user could be transferred. It is often linked to extensions providing various services.
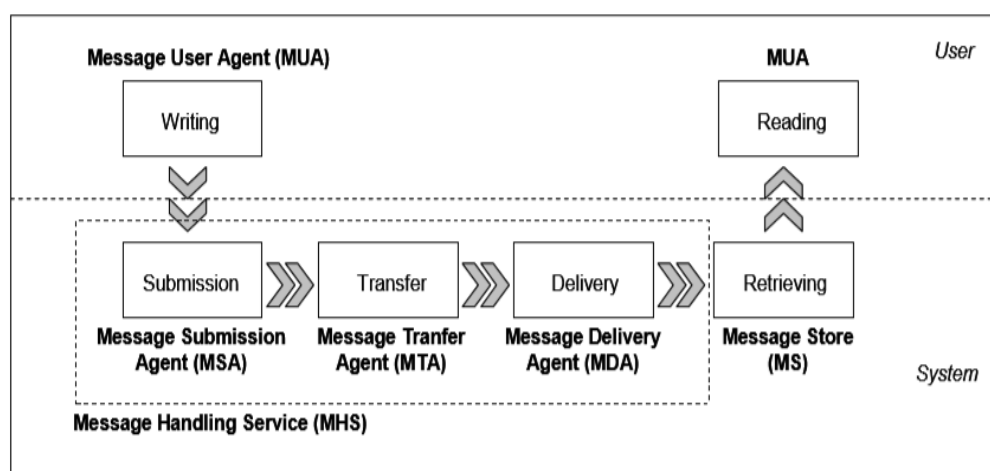
Figure 2.4 The Events and components in the email system

Cailleux, Bouabdallah & Bonnin (2014) claimed that in the email routing classes, two more other standards exist. Users can upload a message from

14

their mailbox via IMAP4 or POP3. A detailed and global Internet Mail Architecture description is given. Fig. 2.4 describes different components and events.

2.2.3.1 Advantages of Email notification

This sub-topic will discuss the advantages of using Email notification. Firstly, Email is a free tool, which is the user not have to pay more costs once (Vdovin, 2017) they online to send and receive messages. Email is simple, where it is easy to use, such as composting, receiving, and sending messages. It is simple and easy to access information, as long as they have an internet connection quickly. Next, users also can access their inbox and messages to send from one particular word to several receipts at one time. The important is Email can access the information and files that users can submit their data or keep their essential messages in case they need it in the future.

2.2.3.2 Disadvantages of Email notification

When Emails have advantages, it can also have disadvantages. The disadvantages are the cause of information can be overload if a lot of messages coming in, and the network has not integrated with the email alert system, especially when left an unread message. Disruptive also can happen in email. It can be disruptive to go through each email because it takes a little time. The use of an email alerting system reduces this disturbance. For a long time, email cannot be ignored. The thing about email is it needs to be maintained continuously. When the user ignores it, the user will receive more and more messages until your inbox is no longer manageable. Lastly, email messages may contain viruses and should be kept short and brief. It won't be accessible if the user sends messages too long.

2.2.4 Database

Today, most data must be processed and protected from unauthorized people who have always tried to access the information. There have been various threats and attacks that can endanger the info. Meanwhile, the data can be more critical because it can be used by unauthorized individuals (Malik & Patel, 2016) to access them, then manipulate the data and using it for the wrong purpose. It happened because it is possible to improve data security. The database structured represents columns, rows, and tables as a collection of data. The database enables the user to retrieve the data stored. Additionally, the database can be store any data related to our business, for example, can be stored user information, stock inventory, and so on.

2.2.4.1 Advantages of database

According to Singh (2015), a DBMS uses a variety of advanced techniques to store and retrieve data efficiently. The DBMS is particularly essential when the data is store on external storage devices. Then, the DBMS can enforce data integrity constraints if data is always accessible through the DBMS. For example, the DBMS can verify that the department budget before adding salary information for an employee. The DBMS can also implement access controls controlling which information is available to different user groups. By sharing the data with several users, centralizing data management can offer improvements. Next, to minimize duplication and fine-tuning data storage to make a recovery efficient, experienced professionals can be responsible for handling and knowing different user groups can use this data because they understand the nature of the information.

2.2.4.2 Disadvantages of database

One of the disadvantages of the database is the size. As DBMS is more significant software due to its features, it needs plenty of storage and memory (Thakur, 2016) to run the application efficiently. It will be able to a more significant size because every second, the data will be stored. Then, Castro (2018) claimed that a database contains or stores a large amount of data, especially for bigger organizations. As more information is added to the server, the data may be increase. All this situation will produce a large size of the database. The problem is the bigger of the database will make it difficult to handled and maintain. It also will become more complex to make sure user authentication across big data, at the same time, need to ensure data consistency.

2.2.5 Tool requirement

The requirement tool was essential to facilitate the design process. There were some tools, like Adobe Dreamweaver, MySQL, and Arduino IDE will be used.

Adobe Dreamweaver

Adobe Dreamweaver is a web page design software, mainly an HTML web and programming editor that is more fully-featured. The program provides a WYSIWYG (what you see is what you get) interface for creating and editing web pages. Dreamweaver supports a large number of markup languages, including HTML, XML, CSS, and JavaScript. It supports English, German, Spanish, Japanese, Chinese, Italian, French, Russian, and many more. Kyrnin (2018) revealed that Dreamweaver is designed for new users to help them to start the program and this software's advanced features that make possible from beginning web designer to professional in a short period.

MySQL

MySQL used structured query language (SQL) Oracle-based systems as a relatively open-source database management system. Today, MySQL has many leading business and consumer websites and web-based applications, such as Twitter and YouTube. They will be used for both PHP and HTML. Besides, most web scripting languages using PHP language (Christensson, 2007), and most server-based websites use MySQL to access the information from the database.

Arduino IDE

First and foremost, Arduino IDE stands for Integrated Development Environment is an official program developed by Arduino.cc, which is primarily used to write, compile, and upload the code into the Arduino System. Moreover, Arduino IDE is an open-source software mainly used to organize and write the code into the Arduino Module. For information, Arduino IDE is the official Arduino program that makes the compilation of code too easy to make the learning process wet even for a familiar person without a piece of previous technical knowledge. It is also easily accessible for operating systems such as MAC, Windows, Linux. It runs on the Java Platform, which comes with built-in functions and commands that play a vital role in debugging, editing, and compiling code in the environment. Several available Arduino modules including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro, and many others. The Arduino IDE contains a micro-controller on the board. The programmed in the form of a code and accepts information. The key code, known as a sketch, generated on the IDE platform, eventually creates a Hex file, which is then uploaded and transferred to the controller on the board. The IDE environment primarily includes two necessary parts: editor and compiler, where formerly the code is written, and subsequently, the code is compiled and imported into the Arduino module in question (The Engineering Project, 2018).
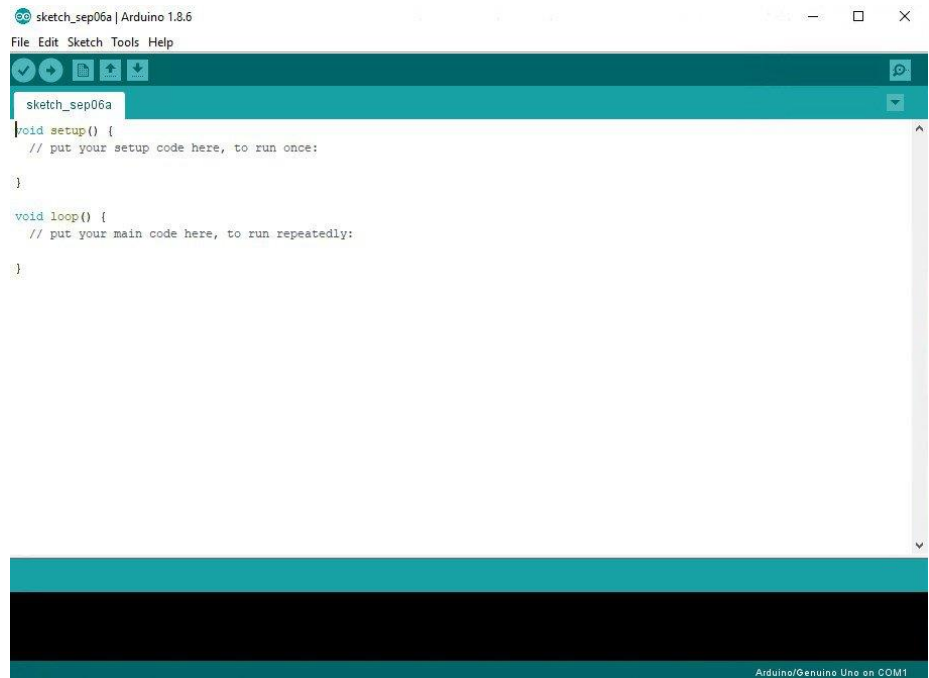
Figure 2.5 An Arduino IDE interface.

2.3 Related Work

There were ten systems or research papers related to the researcher project field. In this paper, the researcher wants to do the research function of system technology have been used.

2.3.1 EasyFind: A Mobile Crowdsourced Guiding System with Lost item Finding Based on IoT Technologies (Chen & Liu, 2019)

This system design an EasyFind, which is a mobile crowdsourced guiding system using smartphones for indoor to guide people to find lost items through the Internet of Things (IoT) technologies. The saying system can provide the fastest track with the shortest travel time to a destination based on the density of indoor people in each area. Furthermore, the EasyFind system can evacuate all people in the shortest total time of escape in emergency time by modelling indoor spatial and temporal mobility. In figure 2.6 shows how system architecture of the EasyFind system.
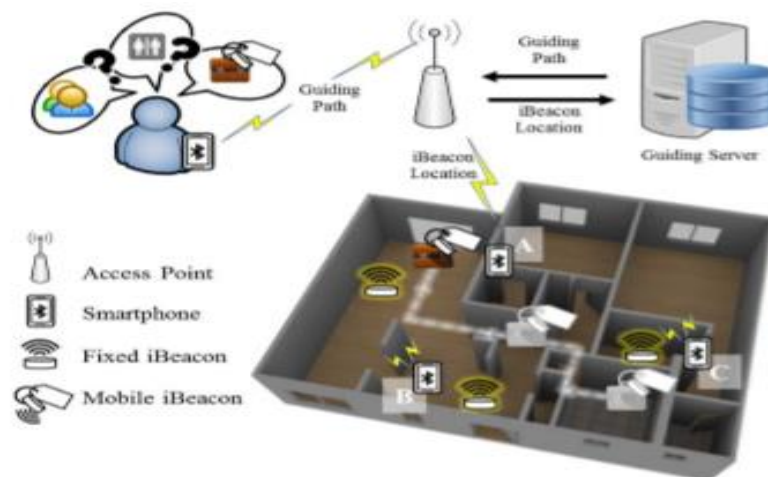
Figure 2.6 The system architecture of EasyFind system

Also, the EasyFind system can find lost items equipped with mobile beacon nodes through participatory sensing networks formed by mobile users with smartphones in static iBeacon nodes locations. To correctly locate the lost item, six object location cases handle to eliminate positioning errors with

20

different smartphone numbers detecting the lost item, and varying amounts of fixed iBeacon nodes close those objects-detecting smartphones.

An Android-based EasyFind system consists of IBeacon iB07-C2450 nodes, USBeacon B2010 nodes, notebook, and smartphones. It can see in figure 2.7.

Figure 2.7 The easy find hardware components

USBeacon B2010 nodes with 8051 microcontrollers are installed indoor and powered by USB chargers on the wall, while iBeacon iB07-C2450 nodes with TI CC254 Bluetooth 4.0 chip are equipped on the wallet and powered by coin battery CR2450 as shown in figure 2.8.

Figure 2.8 The static and mobile iBeacon nodes installation

They use the SAILS SDK to implement guidance for indoor destinations and to find lost items to support the vector-typed and rotatable map. The

indoor plan of the nearest set iBeacon node can be view on the touchscreen of the smartphone in the EasyFind App. In the pull-down menu of the EasyFind App, users can pick and ask for guidance route planning and object trajectory monitoring for target location guidance, friend location guidance, emergency evacuation guidance, and lost item finding.

Figure 2.9   System demonstration of EasyFind system

In general, through mobile users' smartphones, regularly send their mapped iBeacon locations to the EasyFind guiding server and report the detected mobile iBeacon IDs of lost items. The EasyFind guiding server responds to the requesting user's fastest guiding path from their current location to a target location, safe exit, or lost thing, as shown in figure 2.9.

2.3.2 RFID Based School Bus Tracking and Security System (Shah & Singh, 2016)

This project is to help parents to monitor their children's location in real-time using SMS. The use GPS module is to track the location and identify the identity of the child. In this project, they used an RFID card. The reader present will detect the RFID tag located in children's identity card on the bus, and then it will send a text message to the parents consisting of the current location and time of their children. In this way, the parents can keep a record of their kid's places. The developer also wants to propose a security

system that is a drunk and speed control mechanism and drive prevention system in this project.

In this project, they used a related technology, which is using RFID technology and GPS. RFID technology uses for identifying the identity of children. Then, they used a GSM module. In this project, they used the SIMCOM SIM300 modem. They used a Triband GSM / GPRS engine (SIM300) that works on DCS 1800 MHz, PCS1900 MHz, and EGSM900 frequencies for the global business sector. SIM300 has ten capabilities for multi-slot GPRS and supports CS-1, CS-2, CS-3, and CS-4, i.e., Schemes for coding GPRS. With dimensions of 40 mm x 33 mm x 2,85 mm, PDA phone, smartphone, and other cell phone devices fit using the SIM300.

In this project, PIC18F25K22 microcontroller and alcohol sensor is used. For the alcohol sensor, used MQ-3. MQ-3 because it was most sensitive to liquor and can detect a deviation in alcohol concentration in air. This sensor is cost-effective, and it can be used in tremendous applications. For microcontrollers, they use PIC18F25K22. It is an 8-bit microcontroller with 32 kb FLASH ROM, 2 kb EEPROM, and 1.2 kb RAM. PIC18F25K22 microcontroller show in figure 2.10.
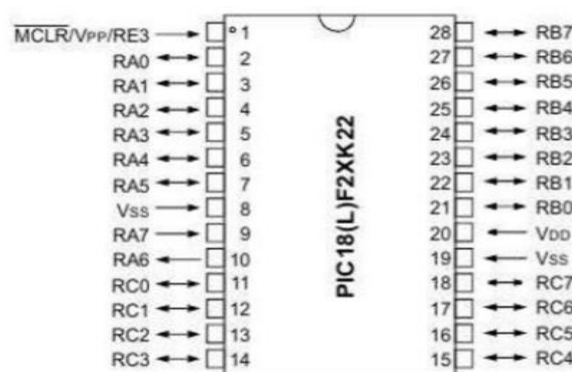

Figure 2.10   Diagram of PIC18F25K22 microcontroller

IR proximity sensor also used for this project. In general, IR proximity sensors are used to detect an object's presence, distance from a reference, or both. Proximity sensors use fields, beams, or changes in surrounding

conditions to enable object sensing within a usable range. It can see in figure 2.11 of the IR Proximity Sensor diagram.
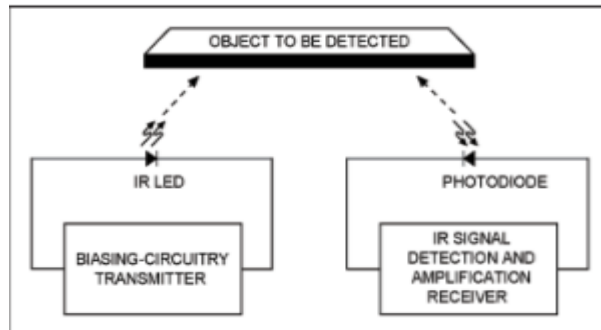

Figure 2.11   IR Proximity Sensor diagram

A combination of RFID, GPS, and GSM for safety and security purposes is essential. It can see in the RFID-based school bus tracking technology is most suitable because this alternative can be controlling and tracking pupils when commuting to and from school. Also, the cost of tagging RFID material is moderately low. A significant role is also have been played in the drunk and drive prevention program and the speed control system to make sure the children safely in their travel. In this way, the system can notify parents/guardians via text message once the child enters/leaves the varsity, allowing parents/guardians to trace the bus, helping to travel smoothly and safely to different destinations.

2.3.3   Active RFID Attached Object Clustering Method Based on RSSI Series for Finding Lost Object (Tanbo, Nojiri, Kawakita & Ichikawa, 2015)

In this paper, they proposed finding lost objects system using an active RFID clustering integrate with received signal strength indicator RSSI series. They thought that users could use the similarity between BLE tags to determine the location of missing items from their smartphone. Then, the system will alerts users about the position of a lost object by using the RSSI series from

24

the estimated tag group to determine which objects are close to the lost object.

Based on the experimental result, they conclude that the RSSI series is a suitable method for distance function to accumulate the match human intuition with nearby RFID tags. In this method, users not need additional tools for their smartphones like anchor nodes, dedicated receivers, or a site survey. RSSI can be an advantage for this system at low installation and financial costs.

Then, the proposed method could identify reading tags correctly under different environmental conditions. In previous studies, they found that RSSI is challenging to get accurate measurements under different ecological conditions. The causes of environmental factors are obstructions and multipath. Before this, many existing methods try to use the radio propagation model to get accurate RSSI measurement, but this method is successful because they are using a low-cost measure. Next, the excellent combination between linkage and correlation distance method is to get an accurate classification. The distance of correlation and the clustering of complete linkage allows for precise classification, even when fewer data are available. Therefore, also when the user is moving fast, this system can accurately estimate the tag groups. Lastly, the experimental results indicate that with fewer data points, the classification accuracy would decrease. They expect this issue to can solve by aggregating a large amount of data with a variety of devices through the use of cooperative sensing.

2.3.4 Vehicle Monitoring System using Internet of Things (Shrestha, Parajuli, Kafle, Bist & Puri, 2019)

This application is an android system focused on IoT for vehicle tracking assistance. The system is designed with the capabilities that allow the toll booths to record vehicle information when moving a vehicle through the toll booths. The toll booths consist of NodeMCU, GPS module, and RFID reader hardware integration that reads data from the tag mounted on cars and sends data to the cloud, which is continuously monitored by the government for various functionalities. Android technology helps the government to display vehicle logs as they pass the toll booths. If the driver is an illegal or unauthentic one, the government will investigate. The system will immediately alert the consumer about the status of the study and keep track of any vehicle registered. The government will have comprehensive statistics on cars passing through different toll booths with the aid of illustrative mathematical modelling.

Then, the users would be able to see the profile of their vehicle. They will be told by the government about the tax on their cars and also their reporting status. Using the Haversine algorithm, users will be able to get the closest check-post distance from their venue, so the guilty will easily be found. Users can show their last position checked, which is implemented using the Linear Search Modeling Algorithm. Users also would be able to receive location assistance at nearby locations. The framework uses our database infrastructure using Firebase. The structure is designed over hardware integration as the android application (.apk) and can be used to provide ongoing traditional transportation services with assistance. The project can be used for a large scale in the future by increasing the hardware's e capability and operating with a higher GPS range.

2.3.5   Inventory Management System for Warehouse (Gawande & Tambe, 2019)

This project is about the Component Tracking System. This project will be focused on an inventory management system where this system will use an RFID tag. The component of data will be saved into the cloud. Then, an RFID monitor is used as a scanner or detect in and out of stock of the element. This system also can find out the theft of part by sending warning notification to the admin via his mobile. To support this system, they used cloud computing as a cloud-like Google Drive and Google Spreadsheet. In this module, an Arduino Uno will be used with an RFID reader to read the RFID tags and send the data to the assigned desktop using Wi-Fi and ESP 8266. This paper describes a new approach that will improve the ease of inventory management system through learning together with IoT, RFID, Pc, Cloud, Mobile, and Server to build a secure and efficient inventory management system. They will conclude after evaluating that the program they are going to introduce would lead to automation in monitoring the components present at the Training Centre. The plan would also keep a digital record, such as timely reporting for all component categories. Therefore, the Manager or Supervisor must reduce the workload.

2.3.6 Airport Baggage Handling Using RFID and Cloud Technology (Malhotra, Sinha, Godara, Preethi & Angeline, 2018)

The proposed project focuses on developing a working model for a baggage handling system that uses RFID tag and cloud technology to monitor luggage, assist in luggage location, warn workers if baggage is not correctly loaded, and adjust the flight itinerary on the card. The main benefit of this system is that it takes less time because passengers are not expected to wait for their luggage to arrive on the conveyor belt instead of being diverted to various counters. Due to the unique identification number and to ensure high security. The experimental tests in a laboratory setting show that the proposed tag's reading score is 100% when the suitcases are sliding onto a conveyor belt in

front of two permitted RFID antennas, even when bags are filled with travel products. The wall containing the tag is facing down, in the bottom of a two-suitcase stack. It is environmentally friendly because it is paperless; there is no need for printing and paperwork, which is a crucial issue in the airline industry at the moment. Therefore, they aim to make air travel more passenger-friendly, less time-consuming, less trouble-free, less queuing, and more passenger health with the proposed design.

2.3.7 Temperature and Humidity Monitoring on IoT Based Shipment Tracking (Zaenurrohman & Alifah, 2018)

Monitoring and monitoring are done to ensure the quality of the products in the process of shipment. Additionally, the location of the vehicles is a track by GPS. Yet traditional temperature and humidity monitoring and regulation are performed manually. Furthermore, inaccurate measurement during the shipping process is influenced by the quality of the products, especially for packets of products and beverages. Imprecise monitoring has contributed as one factor that causes vehicle loss of power. It is proposed to incorporate shipping processes such as temperature, humidity, tracking, and monitoring systems based on the Internet of Things (IoT). Uses of the modules are Arduino Uno, RFID MFRC522, GPS Neo6 M, DHT11, and RTC DS1307. The performance of the system has adequately tracked humidity and temperature, and the bus range monitoring system is carried out using IoT-based Neo6M. The results of data analysis are transmitted to Clouduino at any time over the Internet network. Thus measurement and monitoring in real-time are visualized on the Web using Google Maps API. The results of the analysis show that the proposed method is performed well within two experimental procedures, such as static and mobility measurements. In static measures, the average of data transmission time interval value is 5.75 seconds from the planned 5-second interval, the average deviation value from the data transmission time interval is 0.75 seconds, and the average delay period between data transmission and reception is 0.3 seconds, respectively. Whereas the average data transmission time interval at dynamic

intervals is 6.22 seconds from the intended5-second interval value, the average deviation value from the data transmission time interval is 1.22 seconds, and the average delay period between data transmission and reception is 2.31 seconds, respectively.

2.3.8   The Design of Campus Lost and Found Platform Based on Digital Map Data (Jiang, Mao & Kang, 2019)

This paper proposes a framework focused on digital map data for online lost and found networks. The platform uses online map data service API to process lost and found information, and incorporates a push and reward feature to increase the excitement of people for returning the things they selected. Upon testing, the application is capable of registering and logging in user activities, releasing the loss of material content, as well as automatically and so on moving lost and found messages. The incorporation of digital map data into lost and found platforms has increased the success rate of lost and found, according to the statistics. For the future, the platform must be improved and enhanced for the order to enhance the platform's visual impact further, fluidity and practicability, and to increase the possibility of lost property recovery and user experience honestly and effectively. With the exponential growth of Internet technology, Internet technology has entered every area of human life. Rational use of Internet technologies can significantly enhance the quality of life of individuals. This network portal is dedicated to Internet use in the field of the lost and found in classrooms. As the site matures, it will be introduced to a full area to provide more people with lost and discovered high-quality services.

2.3.9 Design, Development and Usability Evaluation of an Online Web-based Lost and Found System (Bataineh, Bataineh & Al Kindi, 2015)

It can be a very stressful feeling to lost your personal belongings. With the installation of an effective and secure lost and found program, it can be a regular indecent, where all your misplaced things can find their way back to you safely. This work aims to resolve the problems that have been overlooked and discovered in educational campuses by automating all the manual measures involved in the process. As a result of this, a lost and forgotten online web-based program was developed, built, introduced, and evaluated. The developer also supported the main machine components and architecture. The advantages of the new program are: All university students, teachers, administrators, and employees can use the system online. The program automates all the measures involved in the reporting process of things lost and found on the campus. The program is user interface-friendly and easy to use and understand. Connection to the network is possible from anywhere on campus and off-campus. Another advantage is that unlike the manual method, this system is automated, where the person can put the extra physical effort to visit the lost and found office in search of their missing object. A full usability evaluation study focused on eye-tracking was developed, designed, and performed on the new system to measure aspects of its efficacy, performance, usefulness, and usability. An eye-tracking data was recorded and obtained from participants observed and then analyzed by the student community. The usability study findings suggest that users were very pleased with the system's features, as well as the consistency of its user interface design. Therefore putting such a new program in place would be a fantastic improvement for the educational sector.

2.3.10 Attendance and Information System using RFID and Web-Based Application for Academic Sector (Rjeib, Ali, Al Farawn, Al-Sadawi & Alsharqi, 2018)

Recently, student attendance has been seen as one of the key elements or issues that represent the academic accomplishments, and the success contributed to any university compared to conventional methods that impose time-consuming and inefficiency. Diverse automatic recognition systems, such as Radio Frequency Recognition (RFID), were more in vogue. There are some concerns, extensive work, and many applications that are developed to take full advantage of the technology and trigger. RFID is a wireless technology that uses RFID tags or marks to identify and monitor an item using radio waves to transfer data from an electronic card to the RFID reader. In addition to the programmable Logic Circuit (such as Arduino) and the web-based application, the current study focuses on the proposal of an RFID based attendance management system (AMS) and also an information service system for an academic domain. The proposed method seeks to monitor student attendance reporting. It offers student absentee tracking capabilities as well, supporting information services includes student grading points, daily schedule, lecture time and classroom numbers, and other guidance given by faculty department staff related to students. The planned attendance and information system is time-effective based on the results and eliminates reporting efforts as well as having no power consumption. Also, students attending RFID-based systems that have developed are evaluated and questioned concerning the functionalities and key results of the systems. Potential paths are focussed and established for further researchers.

2.3.11 Summary of comparison from related work

Title	Aims	Technology	Summary
EasyFind: A Mobile Crowdsourced Guiding System with Lost Item Finding Based on IoT Technologies	To design an EasyFind system for indoor people and to find lost items using IoT implements with a mobile crowdsourced guiding system.	iBeacon, Internet of Things (IoT), Crowdsourced Guiding, Indoor Navigation GPS, Mobile Device.	They used the SAILS SDK to implement guidance for indoor destinations and to find lost items to support the vector-typed and rotatable map. The indoor map of the nearest set iBeacon node can be viewed on the touchscreen of the smartphone in the EasyFind App.
RFID Based School Bus Tracking and Security System	To develop a tracking system for parents to track their children location using SMS.	Time Division Multiple Access (TDMA), Short Message Service (SMS), Integrated Circuit (IC), Radio Frequency Identification (RFID), Peripheral Interface Controller (PIC), Global System for Mobile Communication (GSM), Infrared (IR), Light Emitting Diode (LED), Global Positioning System (GPS), Electromagnetic(EM).	They used a GPS module to track the location and to identify children's identity using the RFID tag for sending a text message to the parents that consist of the current location and time of their children.

Active RFID Attached Object Clustering Method Based on RSSI Series for Finding Lost Object	To develop an active RFID object clustering system for finding lost objects based on the RSSI series.	RFID, Mobile Device, RSSI; clustering; distance function.	RSSI series is a suitable method for distance function to accumulate the match human intuition with nearby RFID tags. In this method, users not need additional tools for their smartphones like anchor nodes, dedicated receivers, or a site survey.
Vehicle Monitoring System using Internet of Things	To develop the toll booth system that consists of the hardware integration of the NodeMCU GPS Module and RFID reader passes to register the vehicle.	RFID, IoT, NodeMCU, Haversine algorithm, ESP8266, GPS Module.	The hardware integration, which is a reads the data from the tag placed on the vehicles and sends data to the cloud. They were also using the Haversine algorithm in their system and used firebase for their database service.

Airport Baggage Handling Using RFID and Cloud Technology	To develop an airport baggage tracking device using passive RFID tags and cloud technology.	RFID, Cloud technology, Airport-Baggage, Real-time location, Passive RFID	A model was developed that involves both the check-in process and the check-out process. The baggage's location is monitored in real-time and stored in the cloud. The passenger can get the baggage location anytime and wherever, using the unique ID.
Temperature and Humidity Monitoring on IoT Based Shipment Tracking	To maintain the quality of goods for the shipment process, monitoring and controlling are performed.	Arduino Uno, RFID MFRC522, GPS Neo6M, DHT11, and RTC DS1307	The LM35 analogue sensor will be used to test IoT-based temperature monitoring. Data from the temperature sensor is transmitted to the MQTT server, which is an open IoT data portal. Connection of the sensor node and MQTT server uses MCU node ESP8266.

The Design of Campus Lost and Found Platform Based on Digital Map Data	To Design of Campus Lost and Found Platform Based on Digital Map Data	Map data; Map API; Campus network platform; Android	The Baidu map API method will be used to develop documents that provide by the Baidu map because it needs to receive the map data access. They also used push messages notification to make users more alert about the message like QQ messages and WeChat messages.
Design, Development and Usability Evaluation of an Online Web-based Lost and Found System	To Design, Development and Usability Evaluation of an Online Web-based Lost and Found System	XAMPP, Dreamweaver, Adobe Photoshop, Adobe Image Ready, Tobii Studio, HTML, MSQL, PHP and JavaScript	Lost and Found system is a useful system that can help members of Zayed University easily to find lost items quickly.

Inventory Management System for Warehouse	The inventory management system is the purpose of the warehouse, where it is being used in the everyday life of a business that offers precision, productivity, and convenience.	Automation, RFID (Radio-Frequency Identification), Alarm generation, Machine Learning, Algorithm, Cloud Computing, Mobile Computing.	In Component Tracking System we will do a laboratory inventory management program in which the components will have an RFID tag. The part data can then be saved to the cloud. An RFID monitor with a scanner will be used to detect the component in and out stock and to detect the component's theft by seeding alerts that the admin will see on his screen.
Attendance and Information System using RFID and Web-Based Application for Academic Sector	To develop attendance and Information System using RFID and Web-Based Application for Academic Sector	RFID (radio-frequency identification), Arduino Uno, NFC, MySQL, PHP	The proposed system has two objectives; first, to register and manage attendance by RFID tag; second, to provide information to students such as the schedule, the time and number of classroom, and another student-related information that was displayed on the screen or LCD.

Table 2.1   Comparison work

Based on the summary of comparison for related works, I found that the technology had been used can be implemented in this project. The project

mostly used RFID readers like RFID RC522, NodeMCU ESP8266, and Arduino UNO and that projects are successful.

2.4 Summary

In conclusion, this chapter does some research on previous research in the lost and found system. From the investigation, the researcher found many articles or previous study that related to projects fields, and researchers can learn about past projects such as know their technology used, framework, and so on. Furthermore, the researcher also gains more information about what kinds of technology want to uses in the project.

CHAPTER 3

METHODOLOGY

This chapter is required to explain the flow and development of the project. Phases of the methodology helped to ensure the smooth of the project process without any problems. This section also discusses the methods used to accomplish the project's objectives, and the philosophy, tools, and resources used in this project will be explained.

3.1 SDLC Model

The methodology can describe as a series of phases were used to explain the project development process in detail. The activities have conducted the operation of the project were discussed more in the methodology part. The project was used as an SDLC model with multiple phases such as information gathering, project requirements, project designing, system development, and project documentation. The SDLC model is shown in figure 3.1 as below:
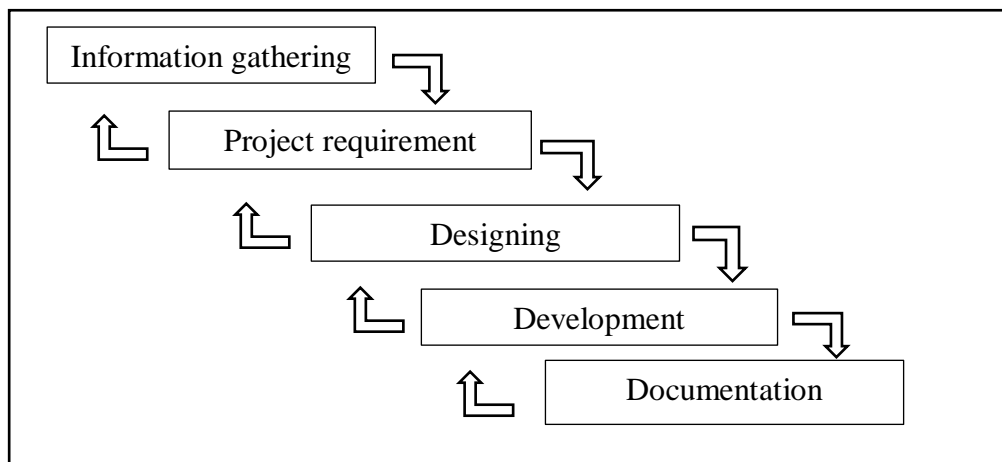
Figure 3.1 SDLC Model

3.2 Phase 1: Project Planning

For starting a project, the planning phase needs to finish first. It is the first step that acts as a scheme for the researcher. The main activity of this phase is to carry out and to identify the research area of study.

In identify the research area of study, it is involved with defining the problem statements, defining the objectives, and defining the scopes. Furthermore, it is also to determine the significances of the project. In this phase, the researcher survey the qualified and old related projects using several sources and techniques such as existing articles, journals, conferences, and similar work. By confirming all about the project scope, the final project title can identify.

The related data that can be used as a references guide in the research. The information is about the lost and found item system, IoT based, the RFID and email notification, the framework, and the programming language. This phase highlighted the main problem of lost and find an item where the user cannot do anything if they lost their thing. The outcomes from this phase are the background study, problem statements, objective, scope, and significance, and lastly, is the final title. In this phase, there is also a table of literature reviews. Figure 3.2 shows the planning phase of the project.

Phase	Activities	Techniques/ software	Deliverable

Project
Planning

Identify project title → Project title

Identify the research
area of study:

1. Define
   problem
   statement.
2. Define
   objectives.
3. Define scope.
4. Define
   significant.

Study the related
project.

Review
previous/related
project using
several sources
and technique
such as existing
article, journal,
conference and
related work.

Findings from
research study:

1. Background
   study
2. Problem
   statements
3. Objective,
   scope and
   significance

Figure 3.2 Project Planning

40

3.3   Phase 2: Project Requirement

In the requirement phase of the project, before designing and developing this project, the researcher must know the relevant hardware and software. It is shown in figure 3.3 that focuses on identifying the hardware and software required for this project.

Phase	Activities	Techniques/ software	Deliverable
Project Requirement	To identify project requirement like: 1. Hardware 2. Software	Finding hardware and software requirement based on research about the project fields such as from previous project, article, journal and etc.	The suitable hardware uses are laptop, handphone, RFID device. Software used are Microsoft Office word, MySQL, Dreamweaver, Adobe Photoshop,

Figure 3.3 Project Requirement

3.3.1   Hardware Requirement

This project is using a web-based application system. Then, to develop the project, we need to use a laptop. The laptop is used for documentation, research about the related project area, compile the document, and develop the system and compile all the coding of the system. After that, the researcher also wants to use an RFID device to store data about the owner information. All the characters of the hardware used as shown in table 3.1

NO	ITEM	DESCRIPTION
1	Laptop	- **Processor:** Intel(R) Core(TM) i5-5200U CPU @ 2.20GHz 2.20 GHz - **Installed memory(RAM):** 8.00 GB - **System type:** 64-bit Operating System, x64-based processor - **Operating system:** Window 10

2	RFID device	-**Tag: 1) RFID key chain tag**
		    Frequency: 125KHz
		    Size: 3*3*0.1CM
		    Material: ABS
		  2) RFID card
		    Frequency: 13.56 MHz
		    Size: 85.5*54mm
		    Material: PVC, Waterproof
		-**Reader:** RFID RC-522.
		Operating frequency: 13.56MHz
		NFC card size: 8.6 x 5.4 x 0.1cm
		Material: Plastic + electronic components
		Sensor module size: 6 x3 x 0.2cm

3	NodeMCU ESP8266	**NodeMcu Lua ESP8266 ESP-12E CH340G WIFI Network Development Board Module** **Chip Module:** CP2102 **Working temperature:** -40 ℃ ~ + 125 ℃ **Power input:** 4.5V ~ 9V (10VMAX), USB-powered **Current:** continuous transmission: approx. 70mA (200mA MAX), Standby: <200uA **Size:** approx. 45 x 25 x 6mm/1.77 x 0.98 x 0.23"
4	Handphone	**Model:** Vivo 1601 **Android version:** 6.0 **RAM:** 4GB **Processor:** 1.5GHz Octa-core

Table 3.1: Hardware Requirement

3.3.2 Software Requirement

During the development process, the software installed is Microsoft Office word for writing the project proposal report. Then, the MySQL is used for the database management, Dreamweaver was used to write code, Wireframe, or Balsamiq is used to create the interface of the system using a storyboard.

NO	ITEM	DESCRIPTION
1	Microsoft Office Word.	It was used to write the document of the project.
2	MySQL	It was used for a store database of the information items details, student details, and status of the items.
3	Dreamweaver	It was used as a platform to write the code for developing a system.
5	Adobe Photoshop	It was used for designing logos and images.
6	Wireframe, Balsamiq	It was used for creating a storyboard about the interface of the system.
7	Arduino IDE	Used to write, compile, and upload the code into the Arduino System.

Table 3.2: Software Requirement

3.4 Phase 3: Project Design

Phase 3 is a project design. This phase is about the design of the system. For this phase, the researcher chooses to use several techniques for designing the system such as Data Flow Diagram (DFD), Entity Relationship Diagram (ERD), sitemap, flowchart and storyboard. The storyboard technique is used to explain more details in this phase. The Data Flow Diagram, Entity Relationship Diagram, sitemap and flowchart were described in chapter 4 (may refer to chapter 4 pages 60).

3.4.1 Storyboard
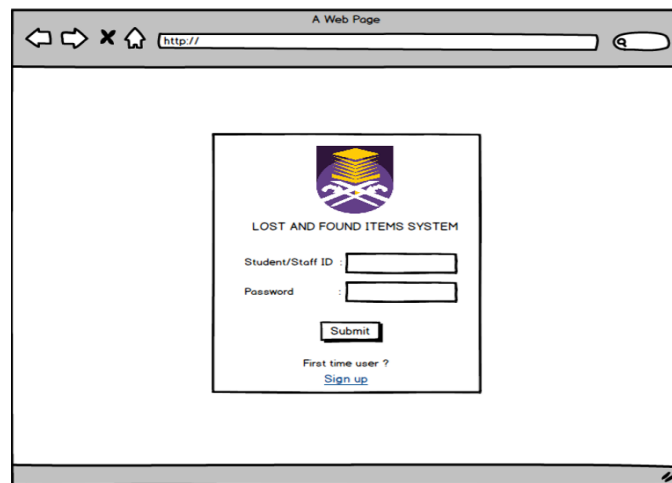
Figure 3.4 Login Page

In figure 3.4, students or staff need to log in to the system by key in their id and password.
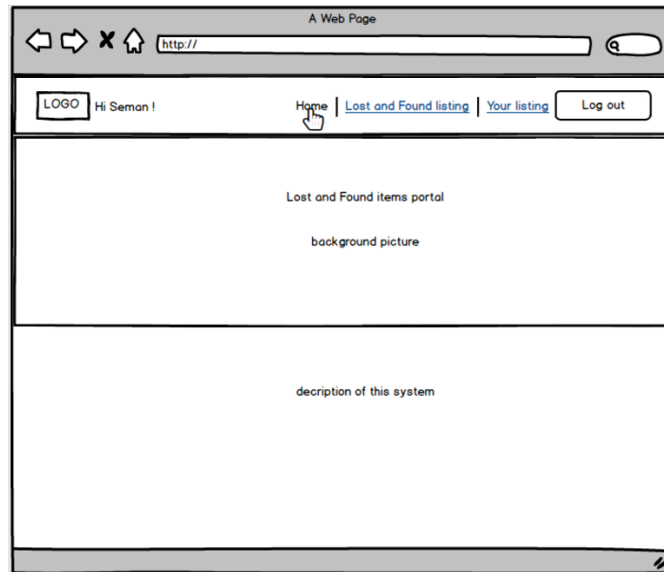
Figure 3.5 Homepage

In figure 3.5 The interface of the homepage of the system.
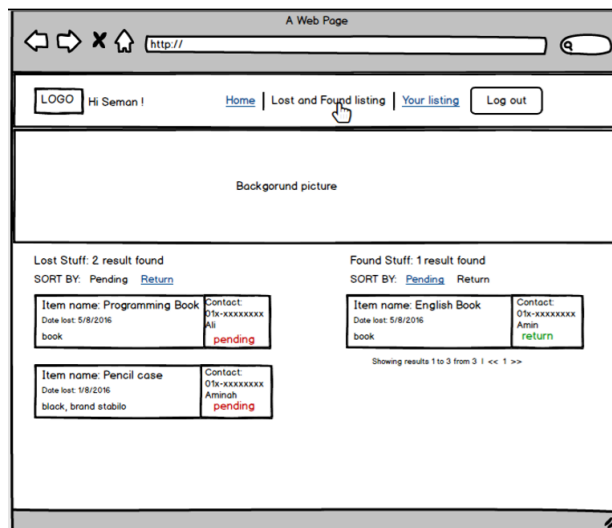
Figure 3.6 List data of lost and found items

Figure 3.6, the user can see the list of data about the items. This page divided into two parts, which are part lost and part found items.
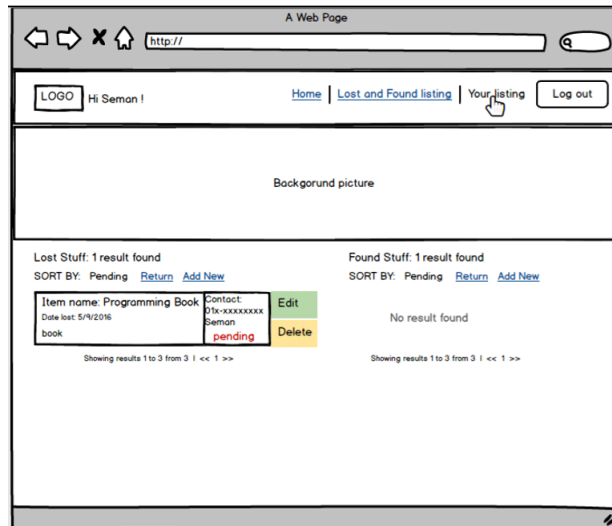
Figure 3.7 User listing

In figure 3.7 shows the user listing page where the user can see all the lost and found items listed. If they report something, the data will appear on the user listing page. On this page, also users can delete or edit the details of the data.
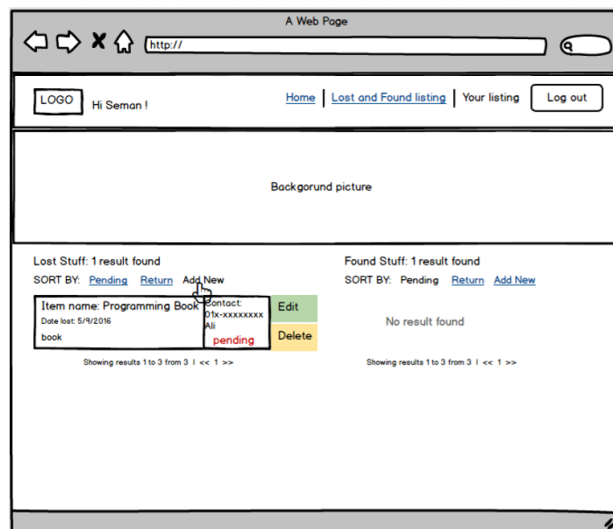
Figure 3.8   Add new items.

Figure 3.8 shows once the user click button adds new, the form of details add new will appear like in figure 3.9. In figure 3.9, users need to fill in this form, and this form also will appear once the user clicks button Edit to edit the details items. The user can delete the items from the list only.

46

Figure 3.9 Details form for adding new items.

Figure 3.10 Admin Homepage

Figure 3.11 Lost and found the listing.

47
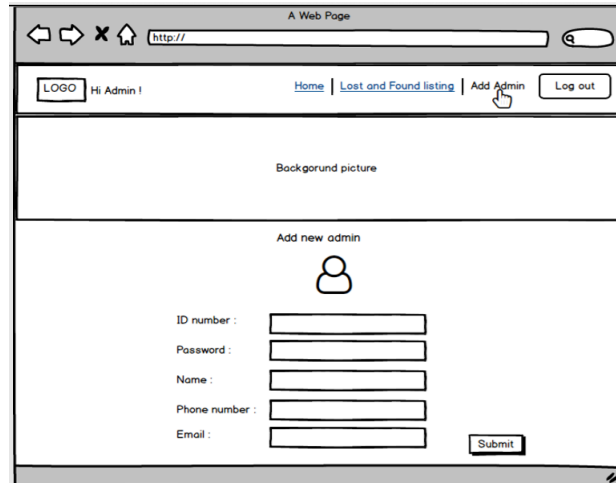
In figure 3.12, the admin can edit and delete the data.
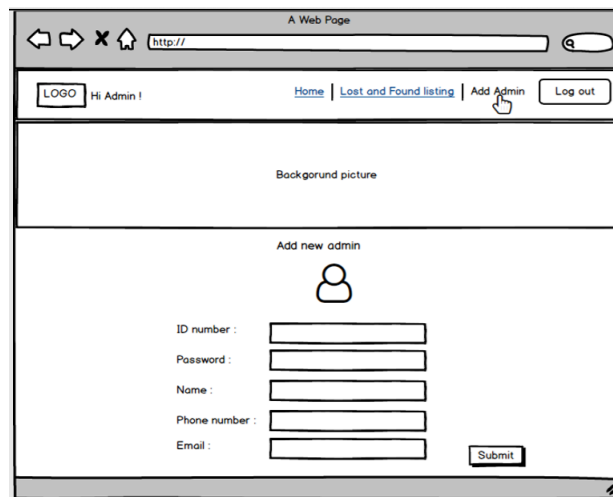
Figure 3.13 Add new admin.

On this page, admin can create a new admin using this form page.
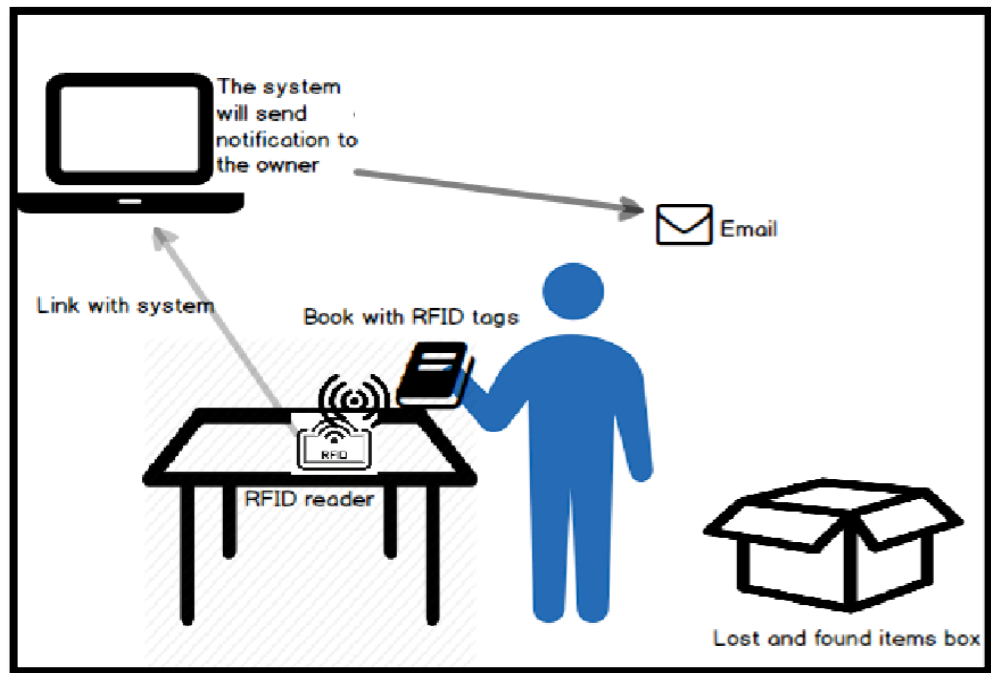
Figure 3.14 Process scan items using RFID tags

Figure 3.14 shows how the process looks like when someone found the items and put in lost and found items box at HEP building. In this process, things must be registered to get RFID tags. Once the staff scan the tag/card, the notification will send to the owner. Figure 3.15 shows the project design for the project.

PHASE	ACTIVITIES	SOFTWARE	DELIVERABLE
Design	Design : 1. Use Case diagram. 3. Entity Relationship Diagram (ERD)	Used: 1. Microsoft Office Word. 2. Balsamiq. 3. Modelio.	Result: 1. Use case diagram. 2. ER diagram. 3. Storyboard. 4. Process scan items using RFID tags

Figure 3.15 Project Design

3.5 Phase 4: Project Development

Phase 4 is project development phase. The researcher needs to design the system based on all the information that the researcher gather in all stage. The Web-based application tool needs to support development. The other devices also need to install to support this system, such as Dreamweaver was used for designing the system. For the database, the researcher was used the MySQL database to connect with the PHP language to store the data through PHP language code. The RFID device also will be used in this project to make the system useable. The RFID tags were used to store the information of the owner. When the things lost, it can trace by scanning the cards using RFID reader to get the owner details. After that, the system will send a notification to the owner using the email notification platform once the items already found. But, the system will send information if the things have the RFID tags only.

The testing stage will perform after the design is fully developed. The process ensures that the design achieves the objective, priorities, goals, user requirements, and usability of the system. The evaluation methods consist of usability tests and functionality tests. Such two kinds of testing are beneficial to evaluate the efficiency, functionalities, and the users' satisfaction towards the process. In the final stage of this step, this system will be testing. The development phase is significant to ensure that each stage is connected to the project.

3.6 Phase 5: Project Documentation

Phase 5 is the last stage, in which this phase involves the complete document of all periods in the project. This phase required the combine all the steps in a report. This process will show in figure 3.16.

PHASE	ACTIVITIES	SOFTWARE	DELIVERABLE
Documentation	Compile the project's related data, previous document, information and process.	Software used such as Microsoft Office Word for documentation and Microsoft Office Powerpoint for making presentation slide.	The final report of project and presentation slide.
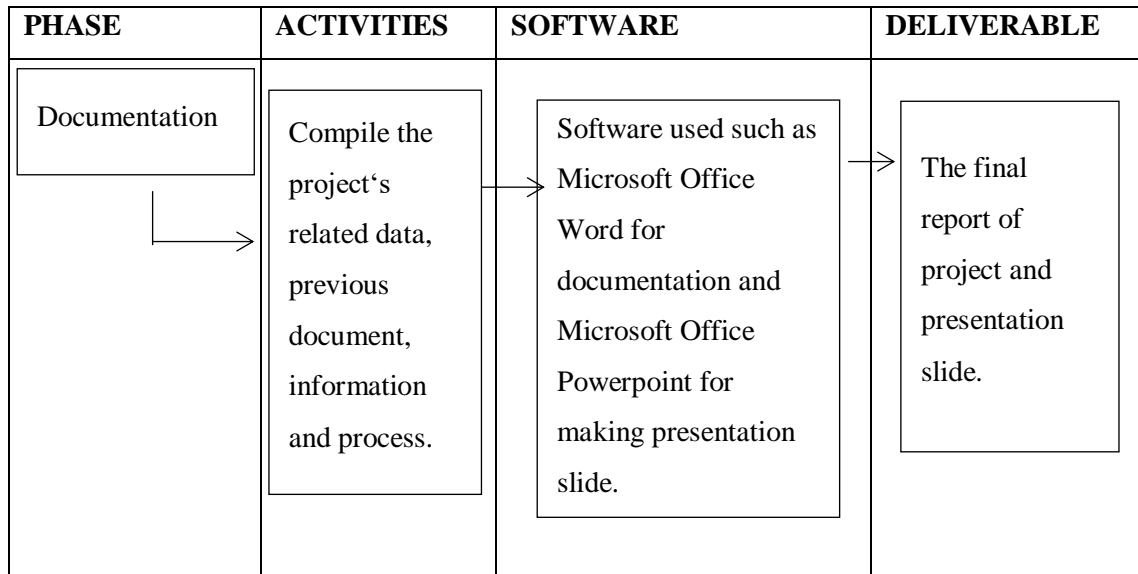
Figure 3.16 Project documentation

3.7 Summary

In conclusion, this chapter explained the details of the methodologies used for developing a web-based system for lost and found items using RFID and email notification. The method used for this study was the SDLC model. In this section, five phases will be discussing: knowledge collection, project specifications, design, production, and documentation. The steps, activities, techniques, and tools used to develop the system were also discussed in this chapter. Finally, all these phases included writing the reports and handing them over to the examiners.

CHAPTER 4

DESIGN AND IMPLEMENTATION

This chapter will focus on the development of this project in detail. It is crucial as it explains how to develop a plan that can make user's more comfortable managing their lost items well. Moreover, this chapter also describes the design process that consists of database design, hardware, and software requirement, and the screenshot of the interface design.

4.1   Hardware and Software Requirements

This part shows the details of hardware and software used in designing a prototype to generate this project. This section illustrates how the process of designing starts from the first phase until the application was complete.

4.1.1 Hardware Requirement

The hardware used to develop the Lost and Found Items system in this prototype are RFID-RC522 reader and tags, NodeMCU ESP8266 Board, breadboard, jumper wire, and USB cable.

4.1.1.1 Laptop

The Lenovo laptop with a 64-bit Operating system, the x64-based processor, is used to develop the system. The specification is Intel(R) Core(TM) i5-5200U CPU @ 2.20GHz 2.20 GHz, Window 10 and RAM was upgraded to 8GB.

4.1.1.2 Handphone

Vivo 1601 is a model handphone used to support this system. The processor is 1.5GHz Octa-core, the android version is 6.0 and RAM to 4GB.

4.1.1.3 RFID-RC522 Reader and tags

Figure 4.1 shows the reader module MF RC522 and RFID tags. This low-cost RFID Reader Module based on MF RC522 was used because it is simple to use and also can be used in a wide range of applications. MF RC522 is a read and write a card, key chain, and sticker chip which highly integrated. This machine uses chips for reading and writing on stickers. This MF RC522 feature is when the tag close to the node, the reader starts reading the card, and all tag information will show on the serial monitor.
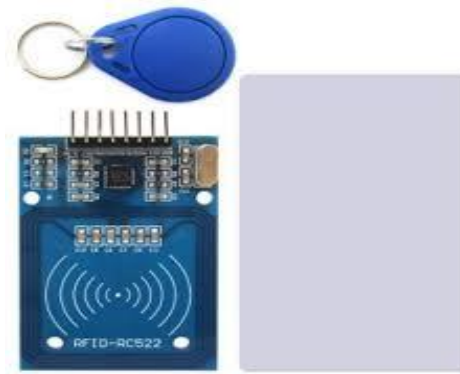
Figure 4.1 RFID reader and tags

4.1.1.4 NodeMCU ESP8266 Board

Figure 4.2 shows that NODEMCU which is a Wi-Fi SOC (system on a chip), an open-source development board, and firmware based on the commonly used Wi-Fi module ESP8266. It allows a researcher to program the ESP8266 Wi-Fi module easily with Arduino IDE. NodeMCU only a few lines of code that can set up a Wi-Fi link and

identify user-specific input and output pins, turning the ESP8266 into a Web server and much more. The sensor is the Ethernet module equivalent to Wi-Fi.

Figure 4. 2 NODEMCU module ESP8266

4.1.1.5 Breadboard

Figure 4.3 shows the breadboard—a Breadboard used in this project. A breadboard is a solderless device with electronics and test circuit designs for temporary prototype applications. Most electronic components can interconnect in electronic circuits by inserting their leads or terminals into the holes and then connecting them through wires where necessary. This breadboard has metal strips under the board, and it links the holes at the top of the board. Since components are not soldered, it can adjust the design of the circuit at any point without any difficulty. There are several holes on the plastic box, arranged in a particular fashion. A typical breadboard layout consists of two types of the region, which are bus strips and socket strips, also called pieces. Bus strips usually used to provide power supply to the circuit. It consists of two columns, one for power voltage and another for ground.
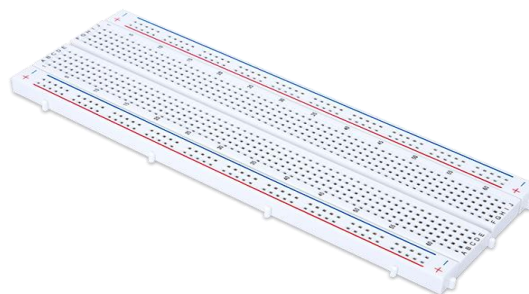
Figure 4.3 Breadboard

4.1.1.6 Jumper Wire

Figure 4.4 shows the jumper wire. In this project, the male to male jumper wire used. Usually, the jumper wires come in three versions: male to male, male to female, and female to female. At the endpoint of the cable, the wire is different based on the type of it. Male ends have a protruding pin and can plug into things, while female terms not used to connect thoughts into them. Male to male jumper wires are also the most commonly used. The jumper wires have a range of colours, but they have nothing to do with the colours—jumper wires used in this project to connect between devices and breadboard.

Figure 4.4 Jumper wire

4.1.1.7 USB cable

A USB port is a standard cable connection interface for personal computers and consumer electronics devices. It stands for "Universal Serial Bus". The project used a USB cable (2.0 type A connector and a USB 2.0 type B micro connector)to connect devices and laptops. Figure 4.5 shows the USB cable.

Figure 4.5 USB cable

4.1.2 Software Requirement

The software used to develop the Lost and Found Items systems are Xampp, Dreamweaver, MySQL, phpMyAdmin, and Arduino IDE. This software is essential because this system needs specific software to run like XAMPP, which one of the software that collaborates with Apache Web Server, MySQL, and PHP. It helps to run the web-based system and store database. To connect with the device, it used the Arduino IDE as the platform to connect devices with web-based. Below, the software will be explain more:

4.1.2.1 Xampp

XAMPP windows is a free and open-source web server cross-platform stack software kit built by Apache Friends, consisting primarily of Apache HTTP Server, MariaDB database, and PHP and Perl programming language script interpreters. It used to handle the indexes, user, and permission of databases, table, field connections. Because most real Web server implementations use the same components as XAMPP, it makes it easy to migrate from a local test server to a live server. It can see in figure 4.6.
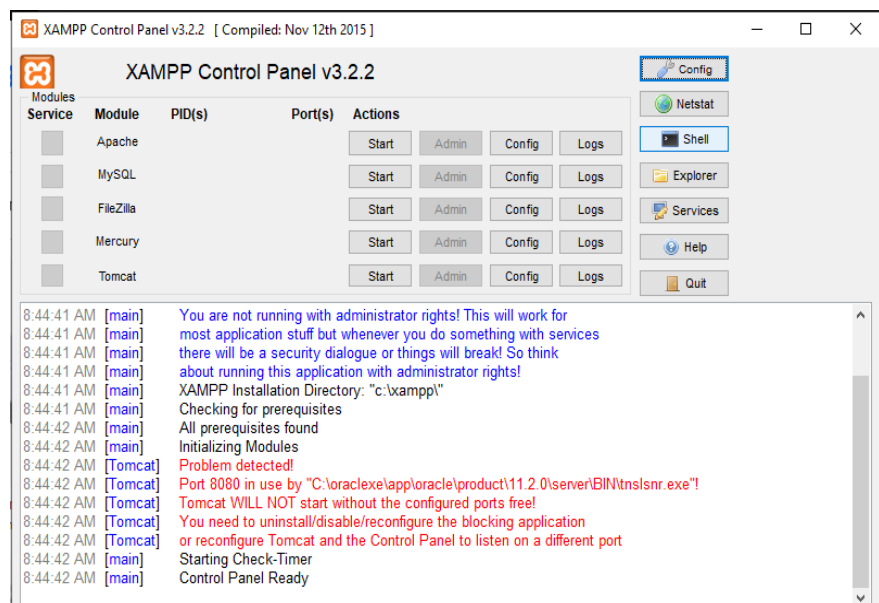
Figure 4.6 XAMPP

4.1.2.2 Dreamweaver CC 2019

Figure 4.7 shows the Adobe Dreamweaver CC 2019. Adobe Dreamweaver CC 2019 is the ultimate tool for designing and creating some of the most flexible and stylish websites that can quickly and seamlessly adapt with different predefined templates to the screen size. It is regarded as the industry-specific WYSIWYG HTML editor to render web design as easier for accessible. Some of Adobe Dreamweaver CC 2019's best features include code highlighting, auto-complete, file editing, and re-uploading, as well as the ability to link to FTP. In short, with lots of outstanding features, Adobe Dreamweaver CC 2019 is a fantastic platform to create a system. Besides that, its function is easy to understand, and we do not have to use full command because some of the application is available, and it can apply by clicking it.
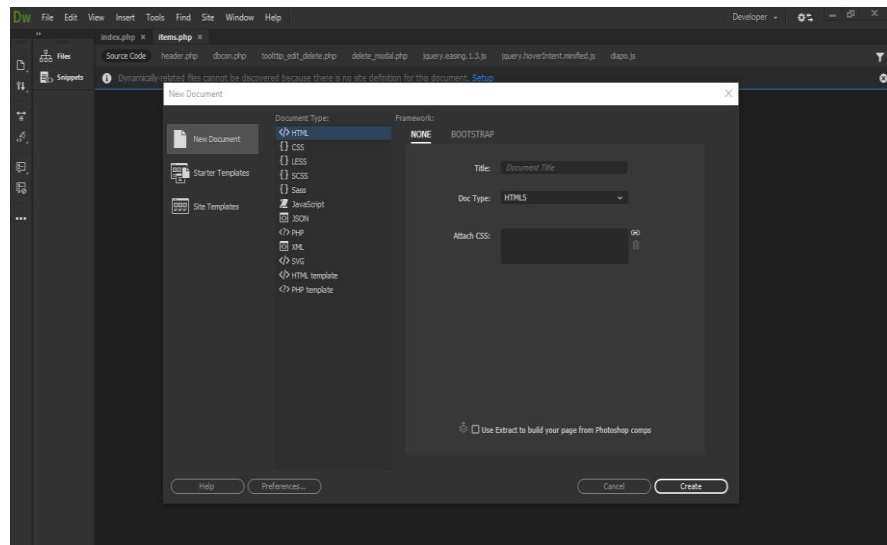
Figure 4.7 Adobe Dreamweaver CC 2019

4.1.2.3 MySQL

MySQL database shows in figure 4.8. MySQL is one of the most popular applications for databases, too. This software also supports the creation of a web application database, and one of the tools that combined with Apache Web Server and a programming language such as PHP. SQL syntax used for the language used in MySQL. This program is user friendly, quicker, and most importantly, the user can quickly understand how to use this database app.

Figure 4.8 MySQL database

4.1.2.4 phpMyAdmin

PhpMyAdmin is a free open source, MySQL, and MariaDB management tool. It has become one of the most popular MySQL administration tools, particularly for Web hosting services, as a portable web application mainly written in PHP. PhpMyAdmin supports a wide variety of MySQL & MariaDB operations. The user interface used to perform commonly used operations such as manage databases, tables, columns, relationships, indexes, users, permissions, etc. PhpMyAdmin has shown in Figure 4.9
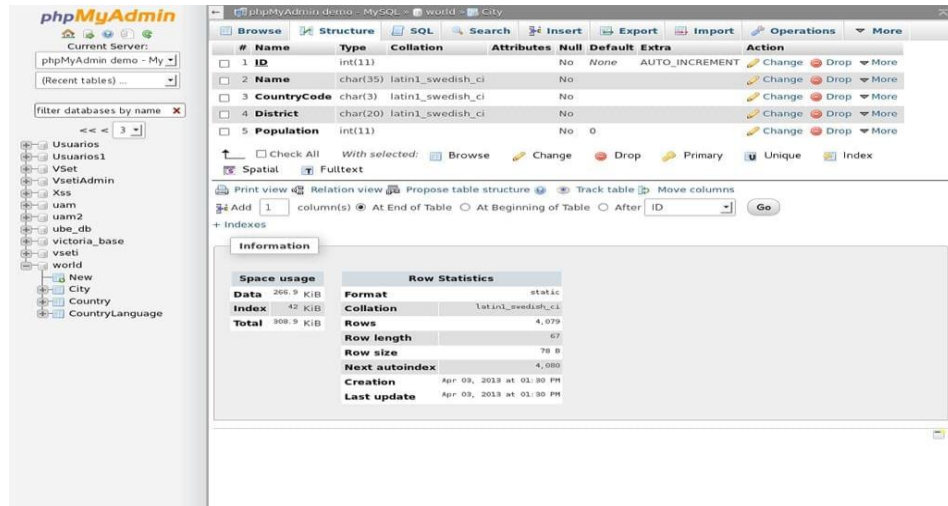
Figure 4.9 phpMyAdmin

4.1.2.5 Arduino IDE

Arduino IDE stands for Integrated Development Environment. It is an official software introduced by Arduino.cc, which mainly used to write, compile, and upload the code into the Arduino Device. Nearly all Arduino modules are compatible with this open-source software, which is readily available to install and start assembling the system. Figure 4.10 shows the Arduino IDE.
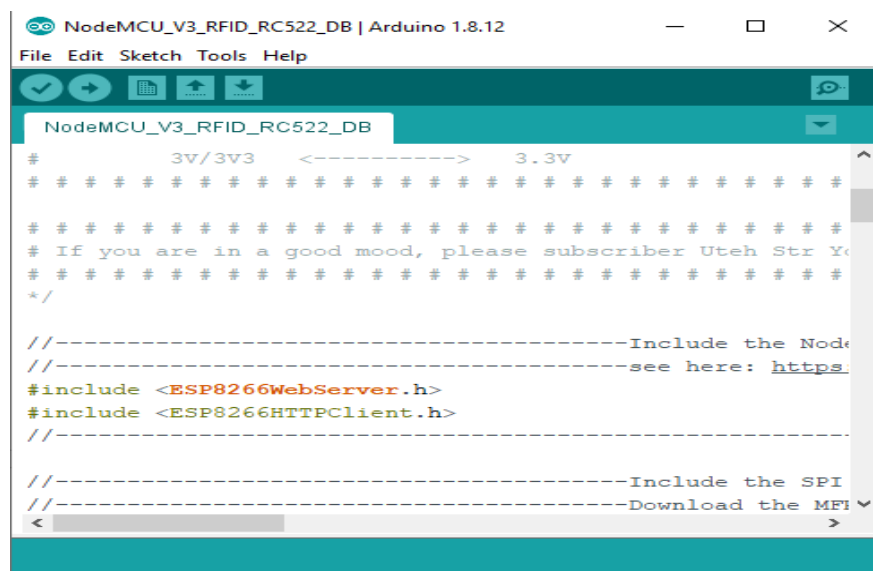
Figure 4.10 Arduino IDE

4.2 System Design

This section will clarify how the system could operate regarding this system's design process and database. In making the system, all components must link to each other. The design includes Data Flow Model Diagram (DFD), Entity Relationship Diagram (ERD), sitemap, and flowchart to show the details about this project.

4.2.1 Data Flow Model Diagram (DFD)

Figure 4.11 shows the Data Flow Model Diagram (DFD). Three entities include user, admin, and staff. The admin part, which is control over all of the system and registers a new team, while the staff has to in charge manage the system. Next, the user used the user part in this system to view all items cases without RFID tag, and they also can register new instances.
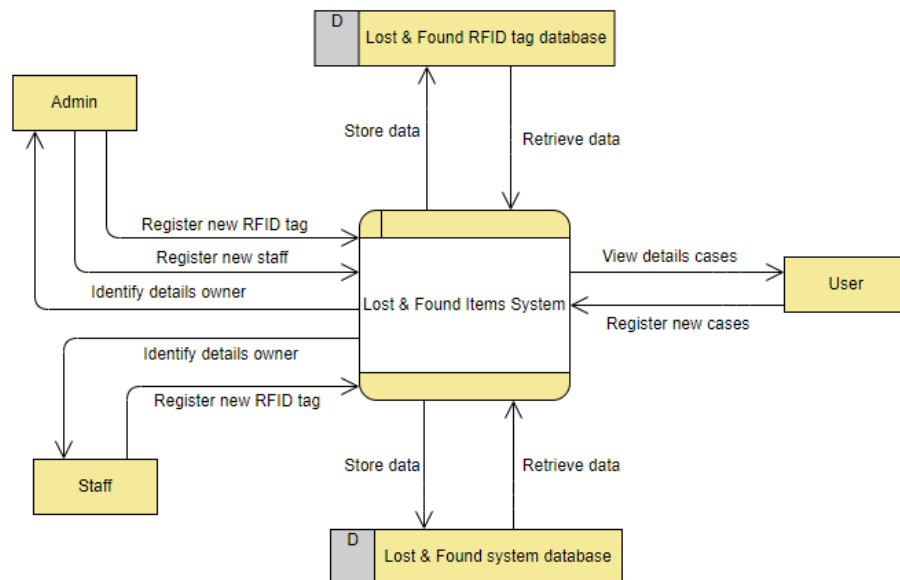
Figure 4.11 Data Flow Model Diagram (DFD)

4.2.2 Entity Relationship Diagram (ERD)

An entity-relationship diagram model is a graphical representation of the relationship between entities in a database structure. The ERD model extended the idea of a relational data model while presenting information in a highly organized database management framework to better plan the database. Figure 4.12 shows the Entity Relationship Diagram, and this ERD shows the database structure in the system. For example, it shows the connection between the system and admin, staff, user, and how this system stored the data.
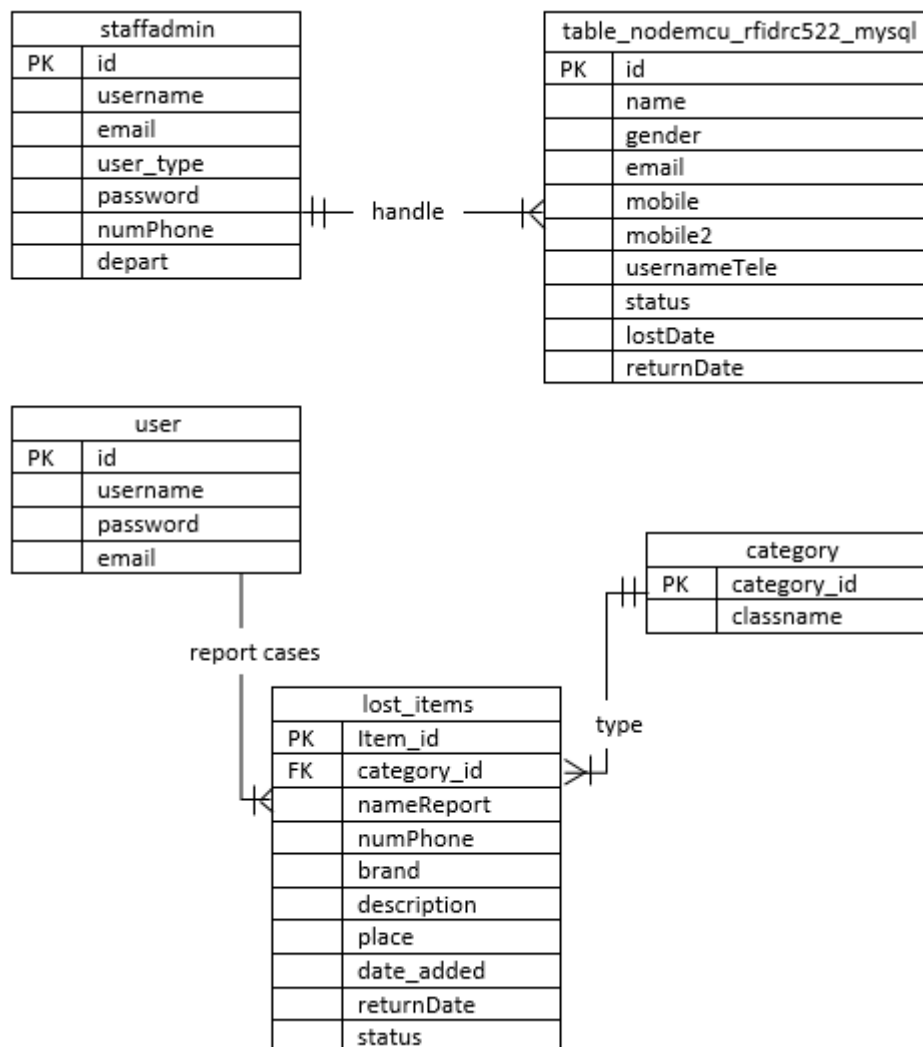
Figure 4.12 Entity Relationship Diagram

4.2.3 Design of Sitemap

A sitemap is a visually or textually modelling stuff, and interactively content that lets users move around the web. It has shown that hierarchically breaks down details about the sites into increasingly specific areas. This sitemap will ensure that users are guided in recognizing the site's correct direction and as guidance. It is because each element directly links to its site counterpart. For example, figure 4.13 shows the sitemap of the Lost and Found Items system in UiTM Arau, Perlis. It will guide the user to understand and know about the function of the system.
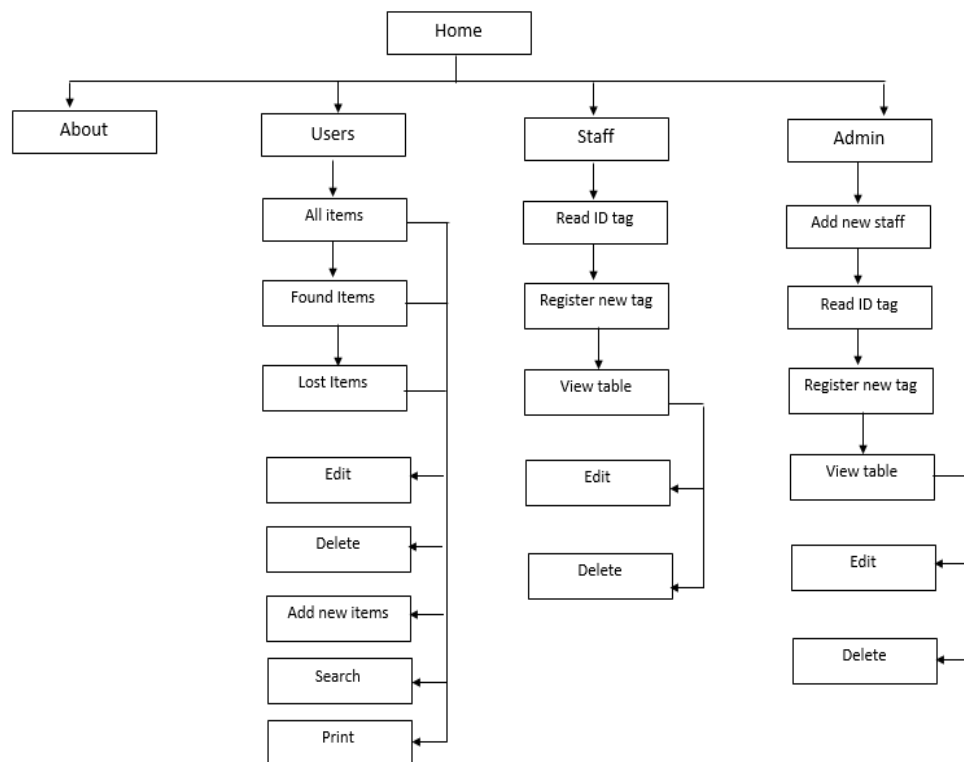
Figure 4.13 Sitemap

4.2.4 Flowchart

The flowchart in figure 4.14 shows the working flow on implementing a process to manage the lost and found items cases in UiTM Arau. The process started when someone found something they need to check whether the items have an RFID tag or not. If the things have the card, they need to bring it to the HEP to get the owner details. After that, the staff at HEP will scan the tag to get the owner details and notify them through email. Next, if they found that the items did not have any card, they need to sign in into the lost and found the system to report about the cases.
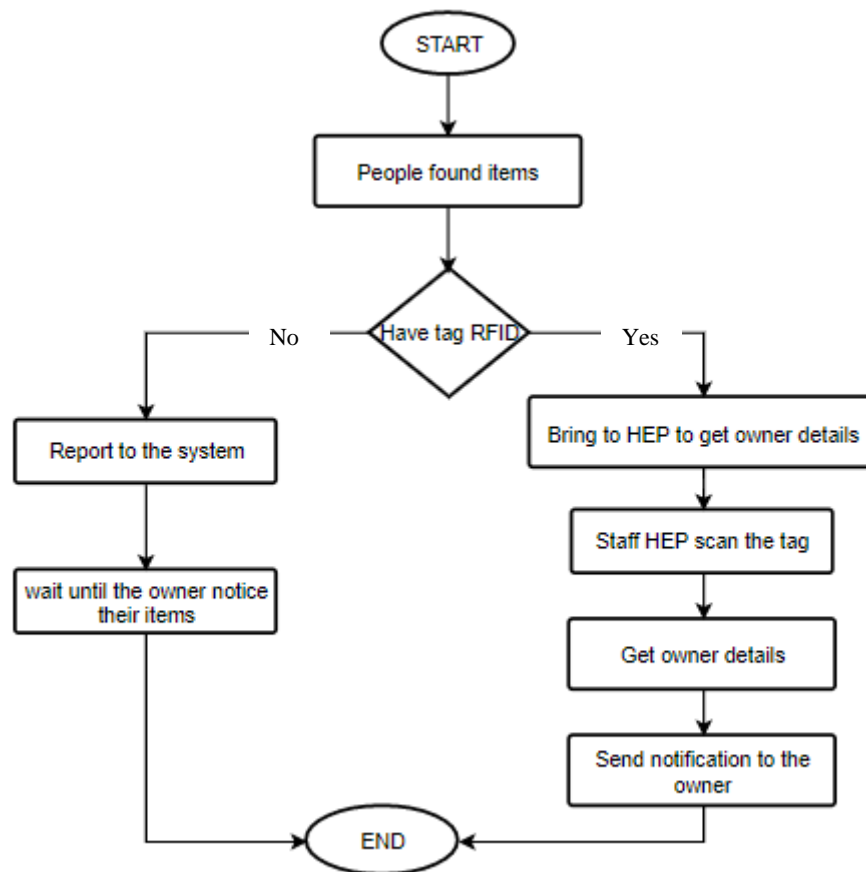
Figure 4.14 Flowchart

4.3 Interface Design

The user interface design is software design. The screen builds on the system's requirement to complete all of the system's operation. The architecture is user friendly, and the user should be able to understand the process function quickly.

4.3.1 Homepage

Figure 4.15 shows the home page interface design in the Lost and Found Items system. This home page shows the logo of the company, the name of the system, and a few button functions such as about, user and staff/admin button.
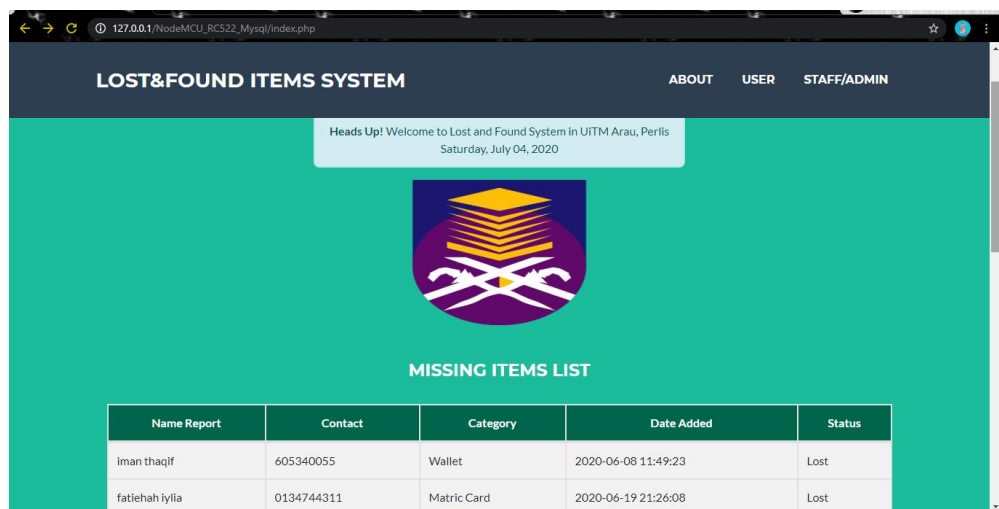
Figure 4.15 Homepage

4.3.2 About Page

Figure 4.16 shows the About page. This page summarizes the process of the system.
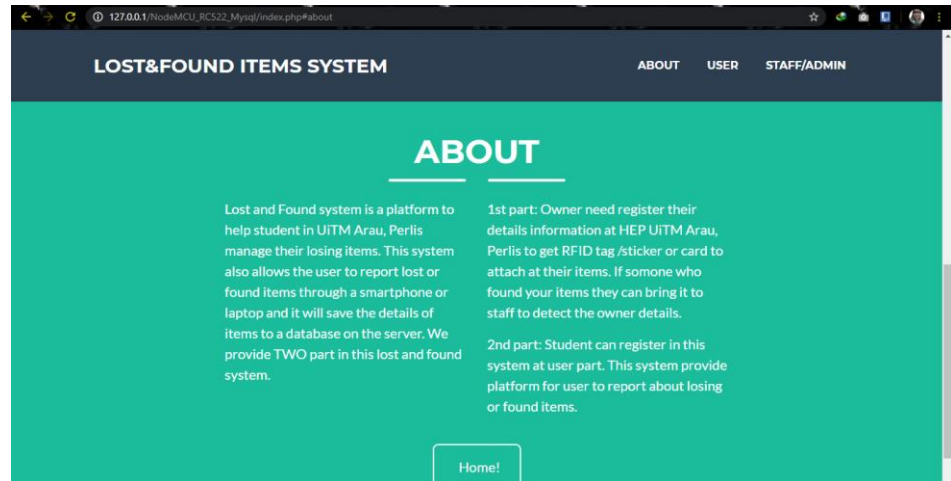
Figure 4.16 About page

4.3.3 Login Page
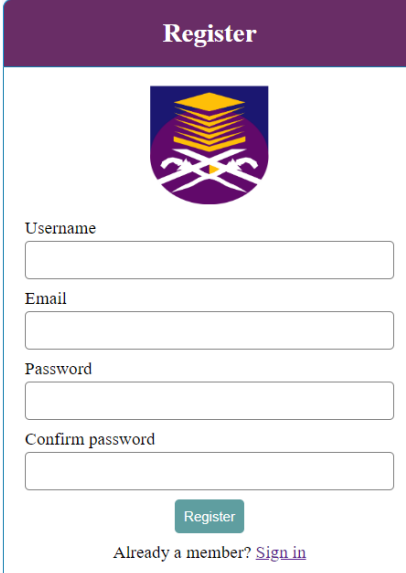
Figure 4.17 shows the login page for both user and staff/admin part. This form required the username and password to go to the next page. If users want to back to the home page, click the home link.

Figure 4.17 Login page

65

4.3.4 Sign up User

Figure 4.18 shows the signup page for the user—this page for a user who did not have an account to login to the system.

Figure 4.18 Signup page

4.3.5 User Page

The system has a few functions where this page shows the features for user parts. It explains the details the process has on the user part page.

4.3.5.1 All items page

All items page shows all the details items cases were stored in the database. On this page, the user can add new cases, edit or delete data. For example, if the user returns the losing items, they must change the status to return status. The user also can print the data. Figure 4.20 shows the code for all items page design.

LOST AND FOUND SYSTEM IN UiTM ARAU PERLIS

| All Items | Lost Items | Found Items | Log Out |

All Items List

+ Add Cases   Print

100 ▼ records per page   Search:

No.	Name Report	Contact	Category	Brand	Description	Last Place	Date Added	Return Date	Status	Action
12	Aminah	0134744311	Wallet	no	under table	DSS	2020-04-17 00:36:22	2020-04-29 14:00:00	Found	Delete Edit
14	Iylia	0134744311	Laptop	lenovo	color green	Bk12	2020-04-17 12:28:40	0000-00-00 00:00:00	Return	Delete Edit
15	fatiehah iylia	0134744311	Laptop	lenovo	color white	DSS	2020-04-17 12:44:40	0000-00-00 00:00:00	Found	Delete Edit
16	fatiehah iylia	0134744311	Key	no	dahlia1	Bk12	2020-04-17 13:11:36	0000-00-00 00:00:00	Found	Delete Edit
18	fatiehah iylia	0134744311	Smartphone	lenovo	sefgvevger	wecrertret	2020-04-27 09:56:50	0000-00-00 00:00:00	Lost	Delete Edit
19	new report	0134744311	Smartphone	lenovo	sefgvevger	wecrertret	2020-04-27 10:05:49	2020-04-27 08:00:00	Found	Delete Edit
20	fatiehah iylia	0134744311	Smartphone	lenovo	sefgvevger	wecrertret	2020-04-27 10:11:07	2020-04-27 15:00:00	Lost	Delete Edit

Figure 4.19 All items page

```php
<?php

$user_query=mysql_query("select * from lost_items where status != 'Archive")or die(mysql_error());
  while($row=mysql_fetch_array($user_query)){
  $id=$row['item_id'];
  $cat_id=$row['category_id'];

        $cat_query = mysql_query("select * from category where category_id = '$cat_id'")or die(mysql_error());
        $cat_row = mysql_fetch_array($cat_query);
  ?>
  <tr class="del<?php echo $id ?>">
  <td><?php echo $row['item_id']; ?></td>
  <td><?php echo $row['nameReport']; ?></td>
  <td><?php echo $row['numPhone']; ?></td>
  <td><?php echo $cat_row ['classname']; ?> </td>
  <td><?php echo $row['brand']; ?> </td>
   <td><?php echo $row['description']; ?></td>
   <td><?php echo $row['place']; ?></td>
   <td><?php echo $row['date_added']; ?></td>
   <td><?php echo $row['returnDate']; ?></td>
   <td><?php echo $row['status']; ?></td>
  <?php include('tooltip_edit_delete.php'); ?>
  <td class="action">
     <a rel="tooltip"  title="Delete" id="<?php echo $id; ?>" href="#delete_items<?php echo $id; ?>" data-toggle="modal"    c
     <?php include('delete_modal.php'); ?>
     <a  rel="tooltip"  title="Edit" id="e<?php echo $id; ?>" href="edit.php<?php echo '?id='.$id; ?>" class="btn btn-success

  </td>

  </tr>
  <?php  }  ?>
```

Figure 4.20 Design code

4.3.5.2   Lost page

The lost page only shows all lost items cases. The functions on the home page are the same on all items page and found page. The missing page design shows in figure 4.21.

LOST AND FOUND SYSTEM IN UiTM ARAU PERLIS

| All Items | Lost Items | Found Items | Log Out |

Lost Status List

+ Add Cases   🖨 Print

100 ▾ records per page								Search:	
No.	Name Report	Contact	Category	Brand	Description	Last Place	Date Added	Return Date	Status	Action
18	fatiehah iylia	0134744311	Smartphone	lenovo	sefgvevger	wecrertret	2020-04-27 09:56:50	0000-00-00 00:00:00	Lost	Delete Edit
20	fatiehah iylia	0134744311	Smartphone	lenovo	sefgvevger	wecrertret	2020-04-27 10:11:07	2020-04-27 15:00:00	Lost	Delete Edit

Showing 1 to 2 of 2 entries   ← Previous 1 Next →

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Figure 4.21 Lost page

68

Figure 4.22 shows the design code to classified status items.

```php
<?php $user_query=mysql_query("select * from lost_items where status = 'lost'")or die(mysql_error());
while($row=mysql_fetch_array($user_query)){
$id=$row['item_id'];
$cat_id=$row['category_id'];

    $cat_query = mysql_query("select * from category where category_id = '$cat_id'")or die(mysql_error());
    $cat_row = mysql_fetch_array($cat_query);
?>
```

Figure 4.22 Design code

4.3.5.3 Found page

LOST AND FOUND SYSTEM IN UiTM ARAU PERLIS

| All Items | Lost Items | Found Items | Log Out |

Found Status List

+ Add Cases   Print

100 ▼ records per page   Search:

No.	Name Report	Contact	Category	Brand	Description	Last Place	Date Added	Return Date	Status	Action
12	Aminah	0134744311	Wallet	no	under table	DSS	2020-04-17 00:36:22	2020-04-29 14:00:00	Found	Delete Edit
15	fatiehah iylia	0134744311	Laptop	lenovo	color white	DSS	2020-04-17 12:44:40	0000-00-00 00:00:00	Found	Delete Edit
16	fatiehah iylia	0134744311	Key	no	dahlia1	Bk12	2020-04-17 13:11:36	0000-00-00 00:00:00	Found	Delete Edit
19	new report	0134744311	Smartphone	lenovo	sefgvevger	wecrertret	2020-04-27 10:05:49	2020-04-27 08:00:00	Found	Delete Edit

Showing 1 to 4 of 4 entries   ← Previous 1 Next →

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Figure 4.23 Found page

4.3.5.4 Add page

In the add page, the user needs to fill in the form add new items to save into the database. For example, they need to fill in the name report, contact number, choose a category, brand, described the details of items, the last places they found or lost it, and status items.

Figure 4.24 Add page
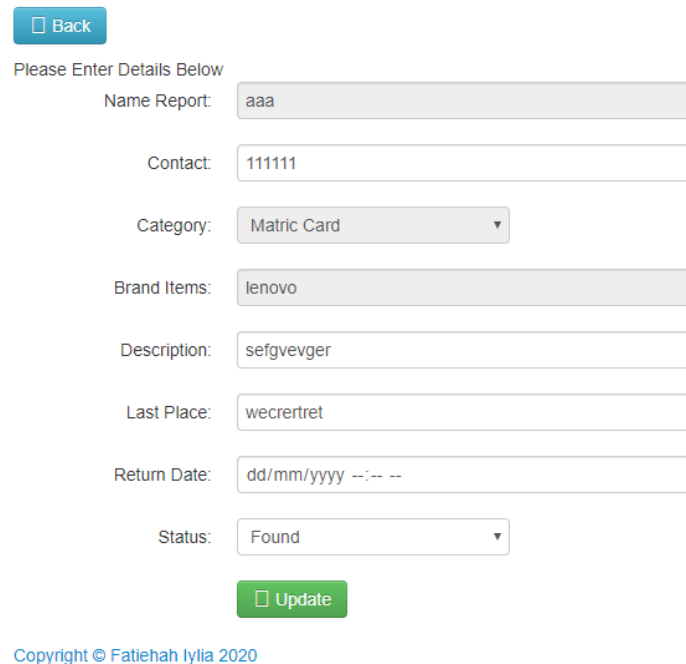
Figure 4.24 shows the design code to store data into the database. For date added users not need to add date manually because it will be store automatically when the items saved. Refer figure 4.19 to see the output.

4.3.5.5 Edit page

In the edit page, the user can edit a few columns. This page for user to change the contact number, description, last places, the status, or they want to add the return date after they return those items.

Figure 4.25 Edit page

4.3.5.6 Delete page

The delete page will appear after the user clicks the delete button. It will give a user message for confirmation to delete the data. Figure 4.26 shows the delete page.
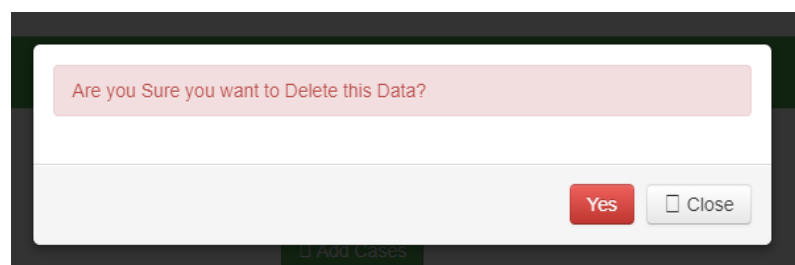
Figure 4.26 Delete page

71

4.3.5.7 Search Page

The system also provides a search function. It will easy for the user to search the data. Search function able to search name report, contact, category, description, last place, and status. Figure 4.27 shows a search page.

Figure 4.27 Search page

4.3.6 Staff/Admin Page

This page shows the functions of the admin and staff parts. The process details in the admin part were explained.

4.3.6.1   Read Tag ID

Figure 4.28 shows the design to read the RFID tag ID to get the owner details. After the staff scan the tag, the details of the owner will appear in figure 4.29. Figure 4.36 will show details of how the reader read the details from the RFID tag.

Figure 4.28 Read Tag ID

Figure 4.29 Details owner after reading tag ID

4.3.6.2 Lost and Found Data

Figure 4.30 shows the lost and found items table where this table retrieves from the database. It will help staff ease to edit and delete the data. After register the tag (refer figure 4.32), that data will see in this table.

Figure 4.30 Lost and Found Data

Figure 4.31 shows the PHP code to store the data in the lost and found items table.

```
<div class="row">
    <table class="table table-striped table-bordered">
      <thead>
        <tr bgcolor="#10a0c5" color="#FFFFFF">
          <th>Name</th>
          <th>ID</th>
          <th>Gender</th>
          <th>Email</th>
          <th>Mobile Number</th>
          <th>Second Mobile Number</th>
          <th>Status Items</th>
          <th>Action</th>
        </tr>
      </thead>
      <tbody>
      <?php
       include 'database.php';
       $pdo = Database::connect();
       $sql = 'SELECT * FROM table_nodemcu_rfidrc522_mysql ORDER BY name ASC';
       foreach ($pdo->query($sql) as $row) {
              echo '<tr>';
              echo '<td>'. $row['name'] . '</td>';
              echo '<td>'. $row['id'] . '</td>';
              echo '<td>'. $row['gender'] . '</td>';
              echo '<td>'. $row['email'] . '</td>';
              echo '<td>'. $row['mobile'] . '</td>';
              echo '<td>'. $row['mobile2'] . '</td>';
              echo '<td>'. $row['status'] . '</td>';
              echo '<td><a class="btn btn-success" href="user data edit page.php?id='.$row['id'].'">Edit</a>';
              echo ' ';
              echo '<a class="btn btn-danger" href="user data delete page.php?id='.$row['id'].'">Delete</a>';
              echo '</td>';
              echo '</tr>';
       }
       Database::disconnect();
      ?>
      </tbody>
    </table>
</div>
```
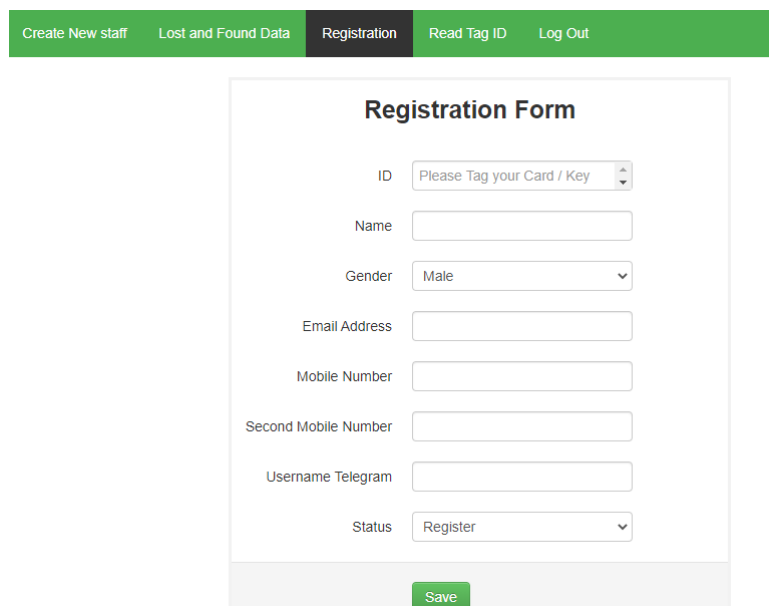
Figure 4.31 PHP code
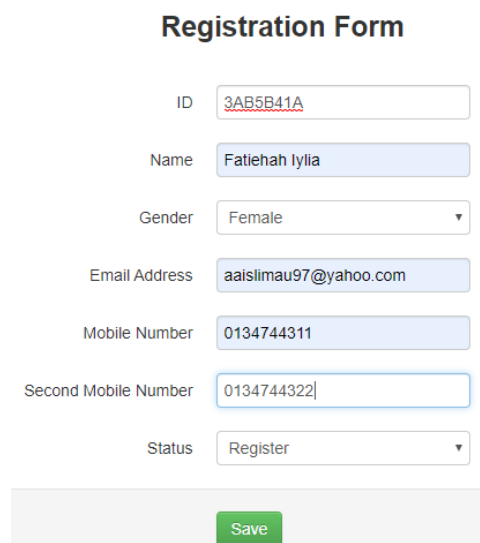
74

4.3.6.3 Register New Tag ID

A registration page is a form for register a new tag ID. The staff needs to scan the tag first because the system wants to trace the id tag number. After getting the ID number, the staff needs to fill the form requirement to store the owner of the details. The form details show below in figure 4.32.

Figure 4.32 Register New Tag ID

Figure 4.33 shows an example of a table after scanning the tag.

Figure 4.33 After scan tag ID

4.3.6.4 Edit

Figure 4.34 shows the edit page. The page can only edit for an email address, mobile number, second number, and the status.

Figure 4.34 Edit page

4.3.6.5 Delete

Figure 4.35 Delete page

4.3.6.6   Create new Staff

The difference between admin and staff, the staff, cannot add new staff. This page only appears if they sign in as admin. Other than this, another function was the same in the staff part. This form need username, email, user type, password, confirmation password, phone number, department/position, and to make sure the new user is admin or staff, they need to choose their status at the user type. Figure 4.37 shows the form to create a new staff.
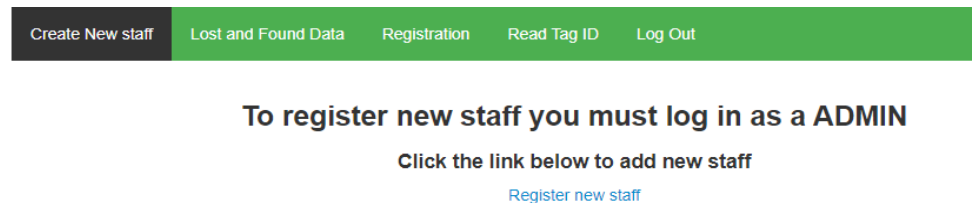

Figure 4.36 Create new staff page

Figure 4.37 Form create new staff

4.3.6.7 Send email notification part

After scan the RFID tag, the owner will get an email notification messages automatically like figure 4.38.

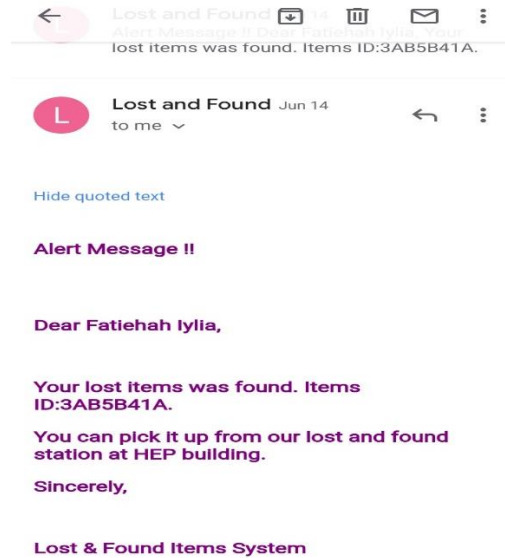Figure 4.38 Email notification message

4.3.7 Prototype Development

This part will show details in the setup device that used ESP8266 NODEMCU and the RFID RC522 reader as a sensor to read the RFID card/tag. Figure 4.39 shows the architecture design work in the system, and figure 4.40 shows the connection RFID RC522 reader to ESP8266 NodeMCU using a jumper wire.
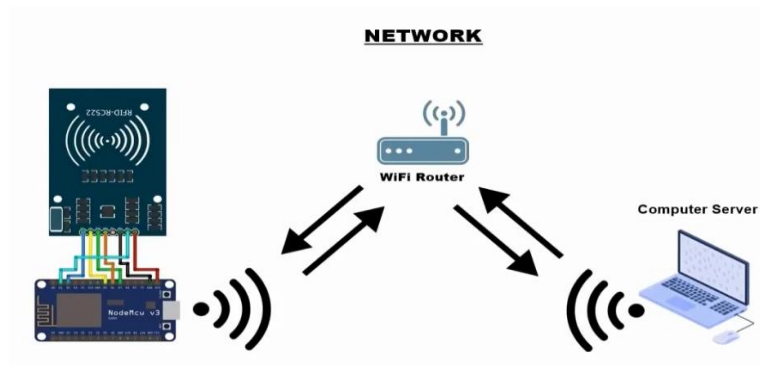
Figure 4.39 Architecture Design

INSTALLATION

NodeMCU ESP8266/ESP12E		RFID RC522
D2	<------>	SDA/SS
D5	<------>	SCK
D7	<------>	MOSI
D6	<------>	MISO
GND	<------>	GND
D1	<------>	RST
3V/3V3	<------>	3V/3V3

Figure 4.40 Connection RFID RC522 and NodeMCU using a jumper wire.
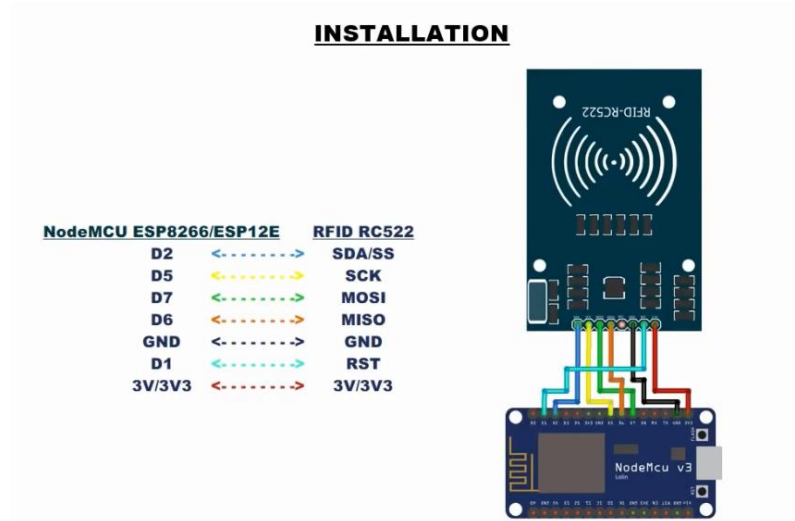
4.3.7.1 Setup

Figure 4.41 shows the components were used in this research are jumper wires, breadboard, ESP8266 NODEMCU Wi-Fi development board, RFID RC522 reader, USB cable, and RFID tags/card. The components used to read the owner details that stored in RFID tags/cards. The figure below showed the setup prototype for the connection between the components.
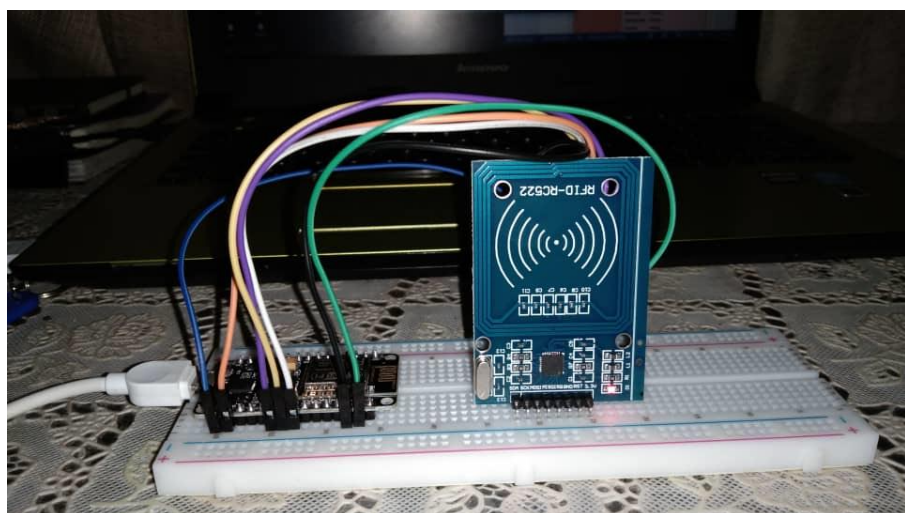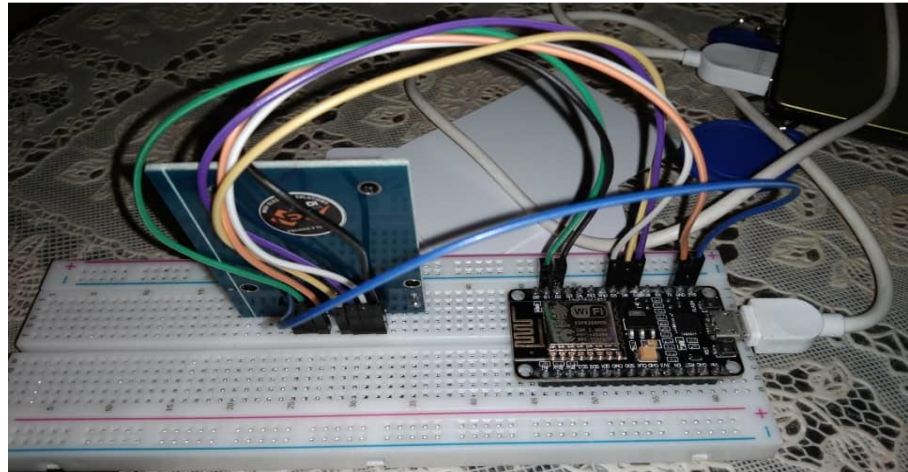
Figure 4.41 Setup prototype

The RFID RC522 connected to ESP8266 NODEMCU using a breadboard. In making the connection successfully, the component needs used jumper wire. When the RFID tags attached to the RFID reader, it will read the data from the sensor and ESP8266 NODEMCU. The sensor was connected to the computer, and then it will display the data on the computer. To support the device, the Arduino IDE was used as a platform to connect the system with the components. After attaching the tags, the data will display as in figure 4.43 below. Figure 4.42 below shows the connection between the parts to the computer.

Figure 4.42 Connection of components to computer
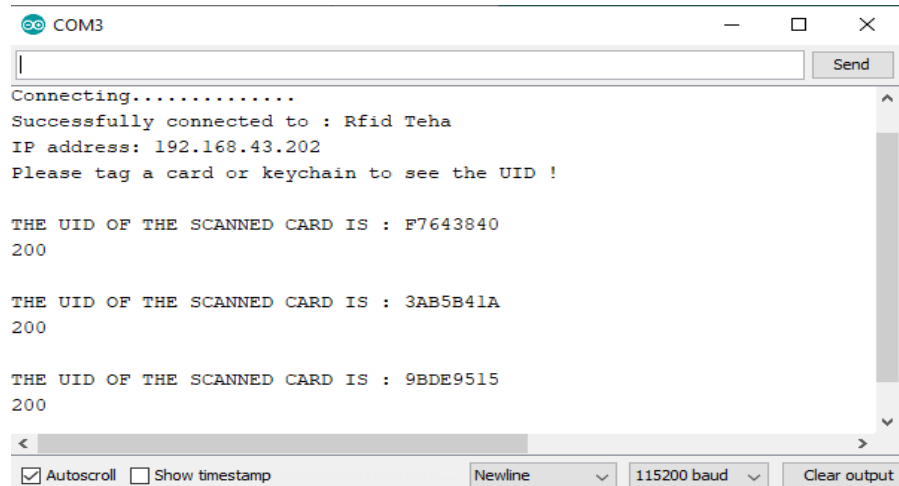
Figure 4.43 Output after reading tag in Arduino IDE

4.3.7.2 Code

These are some of the codes that were used to connect the devices. Figure 4.44 code in Arduino IDE that design to check output after attaching the tag refer figure 4.42. Next, figure 4.45 shows the code that connection between components and systems.

```
pinMode(ON_Board_LED,OUTPUT);
digitalWrite(ON_Board_LED, HIGH); //--> Turn off Led On Board

//----------------------------------------Wait for connection
Serial.print("Connecting");
while (WiFi.status() != WL_CONNECTED) {
  Serial.print(".");
  //----------------------------------------Make the On Board Flashing LED on the process of connecting to the wifi router.
  digitalWrite(ON_Board_LED, LOW);
  delay(250);
  digitalWrite(ON_Board_LED, HIGH);
  delay(250);
}
digitalWrite(ON_Board_LED, HIGH); //--> Turn off the On Board LED when it is connected to the wifi router.
//----------------------------------------If successfully connected to the wifi router, the IP Address that will be visited is displayed in the serial monitor
Serial.println("");
Serial.print("Successfully connected to : ");
Serial.println(ssid);
Serial.print("IP address: ");
Serial.println(WiFi.localIP());

Serial.println("Please tag a card or keychain to see the UID !");
Serial.println("");
```
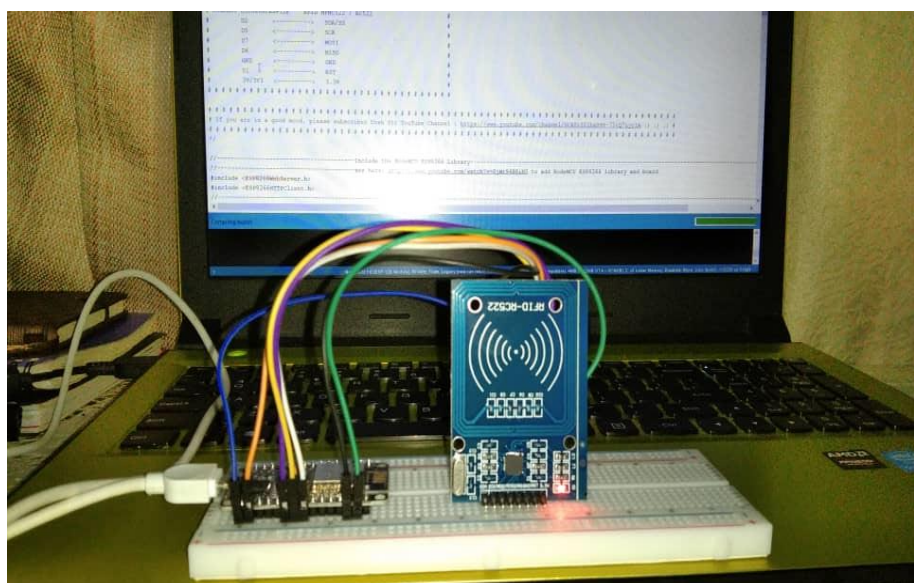
Figure 4.44 Output code

81

```
void loop() {
  // put your main code here, to run repeatedly
  readsuccess = getid();

  if(readsuccess) {
  digitalWrite(ON_Board_LED, LOW);
    HTTPClient http;    //Declare object of class HTTPClient

    String UIDresultSend, postData;
    UIDresultSend = StrUID;

    //Post Data
    postData = "UIDresult=" + UIDresultSend;

    http.begin("http://192.168.43.107/NodeMCU_RC522_Mysql/getUID.php");  //Specify request destination
    http.begin("http://192.168.43.107/NodeMCU_RC522_Mysql/admin/getUID.php");  //Specify request destination
    http.addHeader("Content-Type", "application/x-www-form-urlencoded"); //Specify content-type header

    int httpCode = http.POST(postData);   //Send the request
    String payload = http.getString();     //Get the response payload

    Serial.println(UIDresultSend);
    Serial.println(httpCode);   //Print HTTP return code
    Serial.println(payload);     //Print request response payload
```

Figure 4.45 Connection between component and system

4.4 Database Design

The database model management is the relational data model. The concept provides information to properly design the database in a tightly structured database design environment. Three entities were used in this system, which is administrators, staff, and users.

4.4.1 Database Structure

The system has six tables to store the data. The table category used to store the type of items. The lost_items table was used for store all data of things without RFID tags, staff admin, and user table have saved the information of the user's details, and lastly, table_nodemcu_rfidrc522_mysql table used to store the owner of the features in RFID tags. Figure 4.46 shows the database structure in the system.

Figure 4.46 Database structure

4.4.1.1 Table Admin

Figure 4.47 shows the table admin. This table was used to store id number, username, email, user type, password, number phone, and department/position.

Figure 4.47 Table admin

4.4.1.2 Table Category

Figure 4.48 below shows the table category. This table easy for staff to add a new category.

Figure 4.48 Table category

4.4.1.3 Table Lost Items Cases

Figure 4.49 shows table lost_items. In this table used to store item id, name report, number phone, category id, brand, description, place, date added, return date, and status.

Figure 4.49 Table lost items

4.4.1.4 Table Tag RFID

The table_nodemcu_rfidrc522_mysql was used to store data like name, id, gender, email, mobile number, second mobile number, and status.

Figure 4.50 Table_nodemcu_rfidrc522_mysql table

4.4.1.5 Table Users

Figure 4.51 shows the table users. The user's detail was stored in this table after they sign up the account. This table used to store id, username, email, and password.

Figure 4.51 Table user's detail

4.5 Summary

The chapter was described the development works to build the system of Lost and Found Items system at UiTM Arau, Perlis. It was clarified all the activities involved in the development works.

CHAPTER 5

RESULT AND ANALYSIS

The result and findings of this system are further explained in this chapter. The researcher has conducted a few testing techniques, which were usability test and functionality testing. The goals of the experiments are to assess efficacy of the system and to research the user engagement and device reactions. Then, the tests were also carried out to obtain responses and comments from the users in terms of the design, features, and flow of the lost and found items system. In the survey, the test was separated into two part, which were the functionality part and user acceptance part. In this testing, the students and staff were the ordinary people (work as clerk task) around Merbok, Kedah to evaluate the functionality of the system. The people around Merbok, Kedah, were choosen to replace UiTM Arau staff because of the situation nowadays. UiTM staff are not allowed to enter the university to do some evaluation and testing because of the COVID 19. The survey conducted 23 of students and staff. Lastly, the testing process was conducted using the Google Form questionnaire for all surveys.

5.1 Functionality Testing

Functional testing was carried out to test the system and RFID reader. The participants of this study have a basic web-based knowledge of RFID RC-522, NodeMCU ESP8266, and Web-based. Therefore, the expert who was the developer himself conducted the testing. The result of this phase is the standard features of Lost and Found Items system. The purpose of this test is to measure the device performance.

There were two parts of the work that had been performed in the testing. The first part of the test was about RFID reader's range of efficiency detection to tag/card. The RFID RC-522 and tag/card would position at certain distances in these experiments, and the reading of measurement would take for scale. These readings

would then be registered to determine the Lost and Found Things Program to be operated at the most appropriate distance.

The final aspect of the study is about the features of the Lost and Found Items System Interface. In which the system functionality was tested. It was also used to determine whether the system was being conducted as expected or a failure. The participants of this study consist of students and ordinary people (clerks).

5.1.1 The detection range of RFID reader

In this test, an RFID card/tag was tested for scanning by the RFID RC-522 reader. A standard ruler, as defined in figure 5.1, was placed next to the reader to test the reader's detection capability to an RFID card/tag.
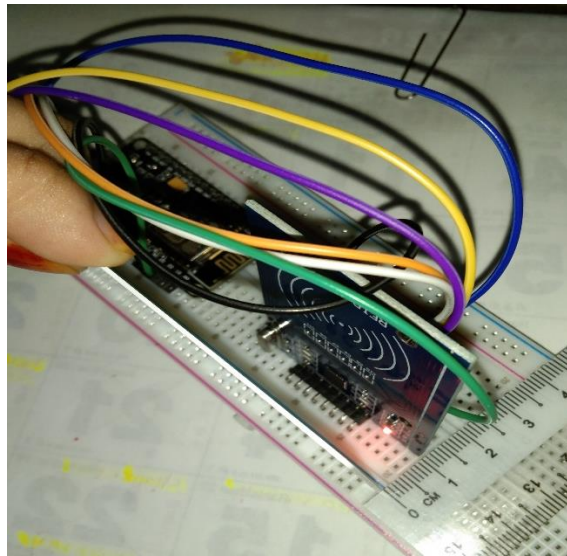
Figure 5.1 Detection range of the RFID reader

Next, Table 5.1 includes a list of RFID RC-522 readers to RFID tag/cards measured at various distances between 1.0 and 2.0 cm. The checklist was either successful or unsuccessful in the right column. The results were the same for all participants. The research began with 1.0 cm, and the reader was having trouble because it was too close to the tag/card. The reader was able to detect the tag/card. For the distance of 1.2 and 1.4 cm, the scanning tag/card was almost the same but it was much faster for the sensor. The length of 1.6 cm, meanwhile, was the maximum distance range for the reader

to detect the tag/card. The reader could detect the object, but it was not particularly accurate and consistent. The tag/card must be stable and not be moving so much that the reader could identify the tag/card until then. Finally, the reader could not detect the tag/card with a distance of 1.8 and 2.0 cm because it has a maximum of 1.6 cm. After considering the necessity of the project and with a further calculation for the reader to work for the best distance, the reader agreed to start reading in less than 1.6 cm to prevent the reader from not correctly detecting the tag/card.

A distance of RFID reader to RFID tag /card (cm)	No	Yes
1.0		✓
1.2		✓
1.4		✓
1.6		✓
1.8	✓	
2.0	✓	

Table 5.1 Distance of RFID reader to RFID tag /card (cm)

5.1.2 The functionality of Lost and Found Items System (IoT)

The main objective to test the system is to figure out either there is a system failure or it behaves as expected. Table 5.2 is a checklist of features for the device interface. The respondents who took this survey around 23 people; overall, the findings for all the participants were the same.

The participants were required to test all of the system buttons whether or not it can work successfully. In the program, all of the buttons were assigned to different tasks. For example, by clicking on it, the participants tested the save button and checked if the details could be successfully saved into the database or not. It is important to very whether the user is able to scan tag/card using an RFID scanner. Table 5.2 below shows the test results that all of the buttons can

function properly and successfully as planned. The system has been checked for observing how well the user will react to system operation.

Functionality System Interface	Yes	No
1) I can log in by using a username and password that registered after clicking the register button.	✓	
2) I can get an alert message after entering the wrong username and password.	✓	
3) I can enter all the personal information to register on the application after clicking the Register New Staff/Signup button.	✓	
4) By clicking the edit button, the details can be updated from the database.	✓	
5) By clicking the clear button, the details can delete from the database.	✓	
6) By clicking the save button, the details can be saved into the database.	✓	
7) I am able to scan the tag/card using the RFID reader, and the details will displays.	✓	
8) I can register a new tag/card, and it will be displayed in lost and found table.	✓	
9) After scanning the tag, I can send the notification to the owner of the items.	✓	
10) All the data will be stored in the database after adding, editing, and deleting.	✓	
11) The system can be different between staff and the admin account after I login in Login Staff/Admin Form.	✓	
12) I can log out from the application.	✓	

Table 5.2 Functionality System Interface

5.2 Network and Data Communication Testing

There was another testing conducted, which was to test the network and data communication performances. In this project, there were three testings, which were to check the data communication between RFID RC522 with NodeMCU, the internet connection, and the RFID RC22 reader and RFID tag /card.

5.2.1 Barriers on RFID Reader

Figure 5.2 shows the testing of the RFID reader by placing A4 paper in front of the reader as a barriers. To measure the various thickness levels, it would be tested by putting an A4 paper piece up to eight sheets. This is to check whether the RFID reader can or cannot detect a tag/card by placing obstacles on it.
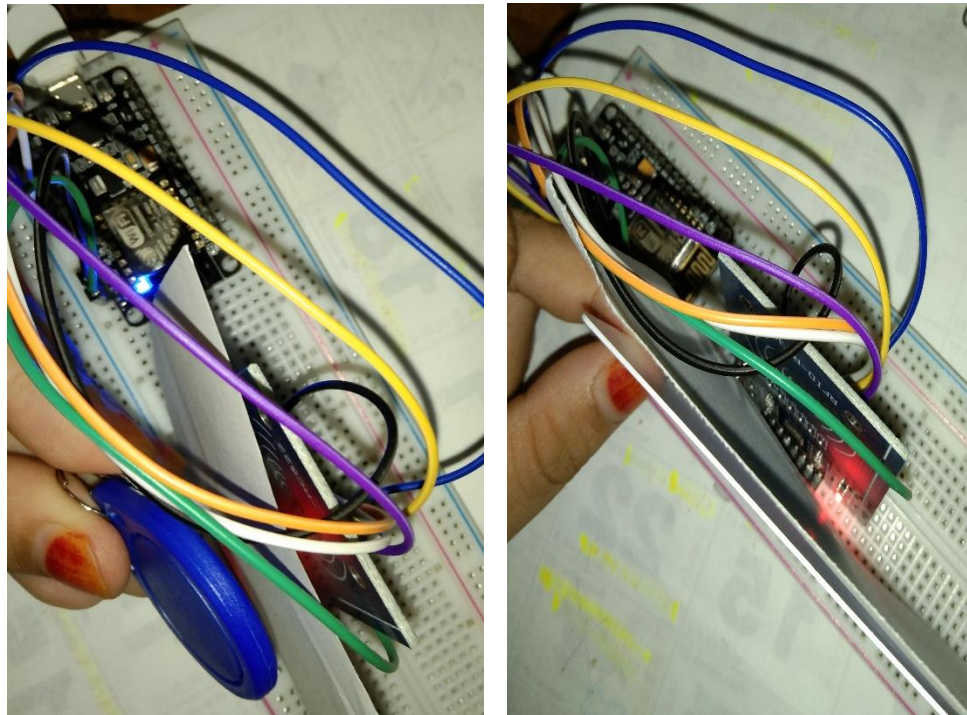
Figure 5.2 Testing of the RFID reader and A4 paper

Table 5.3 below, shows another number of A4 papers as barriers and different thickness levels to be tested on the RFID reader. To sum up, the RFID reader can detect or scan tag/card up to 7 sheets of A4 papers, but eight sheets of A4 papers and above, the RFID reader can no longer detect the tag/card. Thus, the RFID reader can scan cards only if the thickness of the barrier is 0.63 mm and lower. Otherwise, the reader will be unable to check the tag/card.

Barriers (A4 paper)	Thickness (mm)	Obstacle Detection	
		Yes	No
A piece	0.09	✓	
Two sheets	0.18	✓	
Three sheets	0.27	✓	
Four sheets	0.36	✓	
Five sheets	0.45	✓	
Six sheets	0.54	✓	
Seven sheets	0.63	✓	
Eight sheets	0.72		✓
Nine sheets	0.81		✓
Ten sheets	0.90		✓

Table 5.3 Result testing barriers A4 paper

5.3 Usability Testing of RFID reader and Lost and Found Items System

The second test is usability testing. The purpose of this test is to obtain feedback from students and staff to evaluate the flow of the Lost and Found Items interface system. This testing process conducted through the use of the Google Form questionnaire for this survey.

The participants were briefed at the early stage of the testing stage by giving the video about the system interface for the Lost and Found Items. Then, after the video was released, they were given a series of questionnaires. After that, participants needed to provide feedback about the system, such as suggestions,

opinions, and expectations. Finally, the analysis was made based on the feedbacks and inputs from the participants.

5.3.1 Usability Testing Analysis
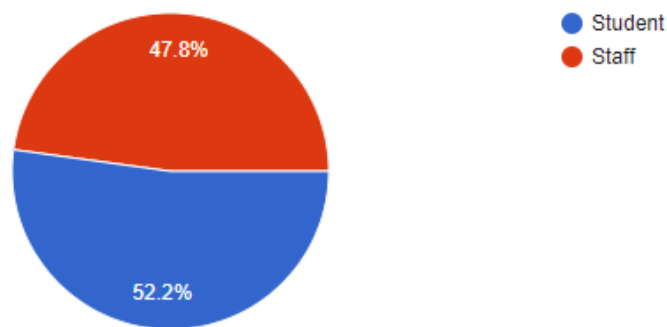
Figure 5.3 Pie chart of the respondents

Figure 5.3 shows the result of respondents which consists of students and staff. The graph in figure 5.3 shows 52.2% of 23 respondents were students, and 47.8% were staff that participated in this survey.

Table 5.4 shows the result of a survey on user acceptance testing for Lost and Found Items system. Most of them have agreed that this system is easy to be used and it is secure for them to understand the flow of the system with the functions given without much difficulty. Based on the result, the user have agreed that the operation is implemented in UiTM Arau. Not just that, the main objective of this survey is to know the level of users feeling whether good or bad when they use the system. The most important is that all of them understand the system, and table 5.4 shows good feedbacks from the respondents.

User Acceptance Testing		Neutral	Agree	Strongly agree
1	I will find it useful for Lost and Found Items system to manage losing items in UiTM Arau.	1	8	14
2	I will consider using the Lost and Found Items System in UiTM Arau because of the functions that the system has.	1	8	14
3	Lost and Found Items system is an effective solution in solving user problems when they lost/found items because the student can understand how to use the system without much difficulty.	1	11	11
4	The flow of Lost and Found Item system is clear and it is understandable to be used for managing lost items because all the functions used are easy to understand.	1	9	13
5	Lost and Found Items System is easy to implement in UiTM Arau.	1	11	11
6	My interaction with the Lost and Found Items system is clear and understandable as I can understand all the instructions given clearly.	1	11	11
7	Overall, I am satisfied with how easy the system is.	1	7	15

Table 5.4 Result User Acceptance Testing

5.4 Summary

The project has completed the two tests in this chapter, including users acceptance testing and functionality testing. Throughout this chapter, the Lost and Found Items system is successfully tested using the tests as mentioned, even the number of respondents is limited because of the COVID 19 and the results of the recorded responses have been analyzed and discussed.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

This chapter will conclude and address the conclusions about the whole project that had completed and provide some recommendations for the future work of this Lost and Found Items system using RFID and Email notification. Next, the outcome would then determine whether or not this study's goals accomplished.

6.1 Advantages of Lost And Found Items System Using RFID and Email Notification

First and foremost, the Lost and Found Items system using RFID and Email notification helps to manage lost and found items in UiTM Arau. Where before this, not have any platform for them to achieve their losing things except using the WhatsApp platform to viral the details items. Not just that, the Lost and Found Items system has several benefits for users, such as easy for users to manage losing things in the provided platform (lost and found items system). This system had two-part of users, which our students and staff. It can refer to in chapter 4. After that, they were using the system can ease for users with a register RFID tag because if those items found by someone, they need to bring the items to Lost and Found items stations which is HEP to detect the owner of the things and send an email notification to the owner. To support the system is suitable and needs to implement in UiTM Arau, the result in users' acceptance testing shows that 99% of the respondents agreed that the project would be useful to the users and is an effective solution in solving user problem when they lost or found items. Last but not least, RFID devices used for the development of the project are ease to store data owners and for email notification used to inform the owner about the losing items quickly.

6.2   Limitations

There are several limitations and problems in the system that needs to be improved.

 a) In the user part, the user can delete and edit data even they do not upload it.

 b) User cannot change their profile data like passwords because these systems did not provide user profile parts.

 c) In the Arduino IDE code, the system cannot change much Wi-Fi because I need to set a new IP address according to Wi-Fi used. Before this, I tried to turn a new Wi-Fi and IP address, but sometimes the IP address cannot read when I connected Arduino and system, and for information, I took three weeks to solve the solutions.

6.3   Recommendations

There are some recommendations and ideas suggested by respondents to improve this project in future work:

 a) The system can give an alert message and locate where the last place items lost.

 b) Provide a profile user part for easier changes password.

 c) Upgrade the system with an exciting theme.

 d) Users can change the password or forget a password using a link.

 e) Make the system look more attractive and add some feature in the student part.

 f) Improve at Admin part that can manage users such as delete or edit user data.

6.4 Conclusion

In conclusion, the lost and found items system was the system that helps the students in UiTM Arau to manage their losing items through the system with email notification. An email notification will alert the owner to pick up their items' at HEP building. This system can be advantageous to students because students do not have to viral their thing in any social media like WhatsApp, Twitter, Facebook or Instagram to find their items, but with using the system will able them to manage their problem wisely because they were using the system as a platform to report any issue about losing items. The system is suitable to implement in UiTM Arau based on the excellent feedback from the students and staffs in the survey.

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APPENDICES

APPENDIX A: USABILITY TESTING

Lost And Found Items System Using RFID And Email Notification

I am Nur Fatiehah Iylia Binti Muhamad Ilias, student of Bachelor of Computer Science (Hons.) Information Technology, UiTM Perlis. Currently, I am doing a final year project on Lost and Found items system using RFID reader and notification, in which are to develop the Lost and Found system using RFID reader and notification and to evaluate the functionality of the project.

As part of the requirement for the project, this project need feedback from the staff/user to evaluate the prototype for Lost and Found items system using RFID reader and notification. Thank you in advance for the willingness to participate in this evaluation process.

Demographic Background

1. Gender

    Male   Female

2. Occupation

    Staff   Student

3. Age

    18-25 years

    26-35 years

    36 years above

104

Usability Test of Lost And Found Items System Using RFID And Email notification

Below are the range for answering on the questions:

1 – Strongly Disagree

2 – Disagree

3 – Neutral (Neither Disagree nor Agree)

4 – Agree

5 – Strongly Agree

Usability Test of Lost And Found Items System Using RFID And Email notification						
No	Question	Criteria				
		1	2	3	4	5
1	I will find it useful for Lost and Found Items system to manage losing items in UiTM Arau.					
2	I will consider using the Lost and Found Items System in UiTM Arau because of the functions that the system has.					
3	Lost and Found Items system is an effective solution in solving user problems when they lost/found items because the student can understand how to use the system without much difficulty.					
4	The flow of Lost and Found Item system is clear and it is understandable to be used for managing lost items because all the functions used are easy to understand.					
5	Lost and Found Items System is easy to implement in UiTM Arau.					
6	My interaction with the Lost and Found Items system is clear and understandable as I can understand all the instructions given clearly.					
7	Overall, I am satisfied with how easy the system is.					

Do you have any comments or suggestions for improvement of this project? If yes, please do so on the below spaces.

_____

_____

_____

APPENDIX B :FUNCTIONALITY TESTING

Lost And Found Items System Using RFID And Email Notification

I am Nur Fatiehah Iylia Binti Muhamad Ilias, student of Bachelor of Computer Science (Hons.) Information Technology, UiTM Perlis. Currently, I am doing a final year project on Lost and Found items system using RFID reader and notification, in which are to develop the Lost and Found system using RFID reader and notification and to evaluate the functionality of the project.

As part of the requirement for the project, this project need feedback from the staff/user to evaluate the prototype for Lost and Found items system using RFID reader and notification. Thank you in advance for the willingness to participate in this evaluation process.

Demographic Background

1. Gender

☐ Male   ☐ Female

2. Occupation

☐ Staff   ☐ Student

3. Age

☐ 18-25 years

☐ 26-35 years

☐ 36 years above

Functionality Test of Lost And Found Items System Using RFID And Email
notification

Below are the range for answering on the questions:

1 – Yes

2 – No

Functionality Test of Lost And Found Items System Using RFID And Email notification			
No	**Question**	**Criteria**	
		1	**2**
1	I can log in by using a username and password that registered after clicking the register button.		
2	I can get an alert message after entering the wrong username and password.		
3	I can enter all the personal information to register on the application after clicking the Register New Staff/Signup button.		
4	By clicking the edit button, the details can be updated from the database.		
5	By clicking the clear button, the details can delete from the database.		
6	By clicking the save button, the details can be saved into the database.		
7	I am able to scan the tag/card using the RFID reader, and the details will displays.		
8	I can register a new tag/card, and it will be displayed in lost and found table.		
9	After scanning the tag, I can send the notification to the owner of the items.		
10	All the data will be stored in the database after adding, editing, and deleting.		
11	The system can be different between staff and the admin account after I login in Login Staff/Admin Form.		
12	I can log out from the application.		

APPENDIX C: FULL SOURCE CODE FOR ARDUINO

```
#include <ESP8266WebServer.h>
#include <ESP8266HTTPClient.h>
#include <SPI.h>
#include <MFRC522.h>
#define SS_PIN D2
#define RST_PIN D1

MFRC522 mfrc522(SS_PIN, RST_PIN);
#define ON_Board_LED 2
const char* ssid = "Rfid Teha";
const char* password = "12345678";
ESP8266WebServer server(80);
int readsuccess;
byte readcard[4];
char str[32] = "";
String StrUID;

void setup() {
  Serial.begin(115200);
  SPI.begin();
  mfrc522.PCD_Init();
  delay(500);

  WiFi.begin(ssid, password);
  Serial.println("");

  pinMode(ON_Board_LED,OUTPUT);
  digitalWrite(ON_Board_LED, HIGH);
  Serial.print("Connecting");
  while (WiFi.status() != WL_CONNECTED) {
    Serial.print(".");
```

```
    digitalWrite(ON_Board_LED, LOW);
    delay(250);
    digitalWrite(ON_Board_LED, HIGH);
    delay(250);
  }
  digitalWrite(ON_Board_LED, HIGH); connected to the wifi router.
  Serial.println("");
  Serial.print("Successfully connected to : ");
  Serial.println(ssid);
  Serial.print("IP address: ");
  Serial.println(WiFi.localIP());

  Serial.println("Please tag a card or keychain to see the UID !");
  Serial.println("");
}

void loop() {
  readsuccess = getid();
  if(readsuccess) {
  digitalWrite(ON_Board_LED, LOW);
    HTTPClient http;

    String UIDresultSend, postData;
    UIDresultSend = StrUID;

    postData = "UIDresult=" + UIDresultSend;
    http.begin("http://192.168.43.107/NodeMCU_RC522_Mysql/getUID.php");
    http.addHeader("Content-Type", "application/x-www-form-urlencoded");

    int httpCode = http.POST(postData);
    String payload = http.getString();

    Serial.println(UIDresultSend);
```

110

```
    Serial.println(httpCode);
    Serial.println(payload);
    http.end();
    delay(1000);
  digitalWrite(ON_Board_LED, HIGH);
  }
}
int getid() {
  if(!mfrc522.PICC_IsNewCardPresent()) {
    return 0;
  }
  if(!mfrc522.PICC_ReadCardSerial()) {
    return 0;
  }
  Serial.print("THE UID OF THE SCANNED CARD IS : ");
  for(int i=0;i<4;i++){
    readcard[i]=mfrc522.uid.uidByte[i]; //storing the UID of the tag in readcard
    array_to_string(readcard, 4, str);
    StrUID = str;
  }
  mfrc522.PICC_HaltA();
  return 1;
}
void array_to_string(byte array[], unsigned int len, char buffer[]) {
    for (unsigned int i = 0; i < len; i++)
    {
       byte nib1 = (array[i] >> 4) & 0x0F;
       byte nib2 = (array[i] >> 0) & 0x0F;
       buffer[i*2+0] = nib1  < 0xA ? '0' + nib1  : 'A' + nib1  - 0xA;
       buffer[i*2+1] = nib2  < 0xA ? '0' + nib2  : 'A' + nib2  - 0xA;
    }
    buffer[len*2] = '\0';
}
```

APPENDIX D: REPORT PROOFREADING

UNIVERSITI TEKNOLOGI MARA

CSP650 REPORT PROOFREADING

To whom it may concern:

We with this certify that the report described below was proofread by a professional English speaker/editor.

Student Name   : NUR FATIEHAH IYLIA BINTI MUHAMAD ILIAS

Matric No.   : 2018638784

Faculty   : Faculty Of Coputer And Mathematical Sciences

Programme   : Bachelor Of Information Technology (hons.) CS240

Report's title   : Lost And Found Items System Using Rfid and Email
Notification

Thank you.

_____
Name: MAJDAH CHULAN

APPENDIX E: REPORT SIMILARITY

F6 - REPORT SUBMISSION FORM

Instructions to the student:
1. *Ensure that the information needed in the form is completed before submission to the CSP600/ CSP650 lecturer.*
2. *Obtain the endorsement of the Supervisor that the report has been screened for plagiarism.*
3. *Please attach the original Plagiarism Report.*
4. *Only a completed form will be processed.*

STUDENT NAME	NUR FATIEHAH IYLIA BINTI MUHAMAD ILIAS	**STUDENT ID**	2018638784
PROGRAM	CS240 - Bachelor Of Information Technology (Hons)		
SUPERVISOR	JIWA NORIS BIN HAMID		
CO-SUPERVISOR (IF ANY)	-		
PROJECT TITLE	LOST AND FOUND ITEMS SYSTEM USING RFID AND EMAIL NOTIFICATION		
HANDOVER DATE	16 JULY 2020		
STUDENT'S SIGNATURE	*Fatiehah iylia*		

The student is required to get the endorsement of the Supervisor:
I certify that this Final Year Project report has been screened for plagiarism and the original plagiarism report is enclosed.

Similarity index: 11 **%**

Endorsed by:

SUPERVISOR: _____   DATE: 17 JULY 2020
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Note:
The maximum percentage of the similarity index for plagiarism checking is 30%.