GREEN REUSE : A GAMIFIED RECYCLE MANAGEMENT SYSTEM

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Bachelor of Computer Science (Graphic &. Multimedia Technology) with Honours

UNIVERSITI MALAYSIA PAHANG

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ABSTRAK

Projek Gamifikasi Mudah Alih Green Reuse bertujuan untuk menambah baik sistem kitar semula kaedah lama menjadi lebih baik dan lebih cekap. Kaedah kitar semula tradisional menyusahkan pelanggan kerana ia memerlukan kerja manual dan boleh menyebabkan kesilapan kerana kekurangan kepakaran dalam pengasingan bahan-bahan buangan. Mereka cenderung untuk menyimpan atau membuang bahan-bahan kitaran. Pembuangan bahan buangan yang tidak betul boleh mencemarkan alam sekitar, memudaratkan kesihatan manusia. Kebanyakan bahan buangan seperti plastic, kaca dan logam tidak terbiodegradasikan oleh mikroorganisma ini boleh mencemarkan alam sekitar kita. Hasilnya, aplikasi ini telah dibangunkan untuk Komuniti Fakulti Komputeran untuk membantu pengguna dalam pengasingan yang betul bagi sisa toksik , kaca, plastic dan logam untuk mendorong pengguna untuk membawa ke pusat kitaran semula. Apabila datangnya waktu untuk mengambil tindakan alam sekitar, orang ramai kadang-kala merasa berputus asa dan tidak bermotivasi. Oleh itu, gamifikasi boleh menjadi alat yang berkuasa untuk mengubah emosi negatif menjadi positif. Gamifikasi boleh memotivasikan orang ramai dengan mencipta emosi positif.

ABSTRACT

The Green Reuse Gamified Recycle Management System aims to improve the old method recycling system into a better and more efficient one. The traditional recycling method is inconvenient for customers because it necessitates manual labor and can lead to mistakes due to a lack of expertise in waste separation. They tend to store or dispose of waste. Improper waste disposal can pollute the environment, harming human health. Most electronic waste contains toxic lead, mercury, and lithium. As a result, this application has been developed for the FKOM Community in order to assist users in the correct separation of waste material and to motivate users to bring their recyclables or waste to a recycling center. Users can also get points for recycling, which they can then use to get a voucher. With this method, the user is more actively involved in waste disposal.

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LIST OF ABBREVIATIONS

FKOM   Faculty of Computing

UMP   Universiti of Malaysia Pahang

EKSA   Ekosistem Kondusif Sektor Awam

UAT   User Acceptance Test

CHAPTER 1

INTRODUCTION

1.1   Introduction

The world has become a lot more global in the last few decades. Everything seems to be technological and innovative in this era of globalization. The term "gamification" is relatively new and has led to the demand for gamification skyrocketing during the last several years. Gamification is defined as the process of game-thinking or game elements such as rewards, points and achievements in order to engage users and motivate. According to the 2011, Deterding et al define it as the use of game design elements in non-game activities(Deterding et al., 2011). A game is an interactive, goal-oriented activity in which players can interfere with one another (Crawford, 2003). The term "gamification" was first used in 2008 (Tretola et al., 2015).

Gamification has recently attracted much attention in a field related to the recycling industry to change user behavior. According to the 2012b Nicholson refers to BLAP gamification as it emphasizes levels, leaderboards, achievements, badges, and points (Nicholson, 2012). These elements are the foundation of gamification applications. Gamification can be used to encourage interaction, learning, challenging tasks, goal achievement, critical reflection, and improve user behavior in a better way (Kapp, Blair, & Mesch, 2014). Structured gamification and content gamification are the two types of gamification. Structural gamification uses game design elements to motivate learners without changing the content. This can be done by having clear goals, rewards for achievement, challenges, and leaderboards. In content gamification, elements like challenges, feedback loops, and storytelling are used to make content more game-like without turning it into a game.

Recycling is a learning experience for the society that will teach them about environmental stewardship. This application encourages the fkom community to become motivated and involved in recycling programs. Therefore, this project aims to educate society about recycling through Green Reuse Gamified Recycle Management System and raise awareness within the fkom community.

1.2 Problem Statement

The majority of the community seems to be unconcerned about recycling. Even though the government and private sector have introduced various methods and campaigns, the amount of waste recycling remains low. Most people do not know how to properly dispose of their waste and should learn this basic knowledge daily to raise environmental awareness. Unfortunately, the amount of waste material keeps increasing because Malaysians do not take part in the 3R program seriously and do not understand the proper ways of recycling specific categories of waste. They tend to store or dispose of waste. Traditional learning method is less effective when compared to game-based learning, which is more effective in motivating consumers to be innovative and engaged in recycling activities. Applying game elements to create awareness about waste management can increase consumers' motivation and learning can be more fun.

Besides that, another problem is the poor attitude of the Malaysian community toward waste recycling. Many trade-in programs are offered for consumers to donate their unwanted fabric, plastic, paper or metal, but some people simply throw them away because they cannot be reused. Improper waste disposal can cause environmental pollution, which can negatively affect human health. Most waste contains toxic chemicals such as lead, mercury, and lithium that are dangerous to human health such as the heart, brain, and liver, a new concept of learning through gamification concepts has been created with Green Reuse Gamified Recycle Management System in order to instill discipline in good recycling habits.

Another problem is that some of them assume they are not getting benefits from recycling because they clean all of the recyclables items and sorting them and pack them neatly without getting paid by the factory. According to the survey of this project that is conducted among the community in fkom, ump pekan (FYP1_Survey1 - Google Drive, 2013), the best way to boost recycling among people is to reward those who give

recyclable materials by paying cash, points, badges or shopping coupons. Hence, Gamified Recycle Management System is the best alternative to promote recycling habits and awareness among society in fkom by giving reward points to those who bring every waste item to the collection center. They can recycle every piece of recycling material as long as it is recyclable materials.

1.3   Objective

The objectives of the project are:

i)   To study existing Green Reuse Gamified Recycle Management System for society.

ii)   To design and develop a Green Reuse Gamified Recycle Management System.

iii)   To test and evaluate the functionality of the developed Green Reuse Gamified Recycle Management System.

1.4   Scope

The scope of the project was focused on within the FK community. This study aimed to create a new concept of an waste recycling system within the FK community by incorporating gamification elements such as points, badges, leaderboards, challenges.

The user of this application are:

Admin :

i)   The EKSA admin is in charge of managing recycling categories such as paper, plastic, glass, aluminium and others, and register committee.

ii)   In the admin dashboard, admin are able to view for different type of recyclables waste with the total quantity which the data are always up-to-date.

iii)   The admin has full access to the system, including the ability to accept orders, cancel orders or view orders. If the requirements do not match, the administrator is able to reject the request.

Committee:

i) Covers the recycling process including the collection, sorting and processing such as fill in community's relevant information in the system.

ii) The committee are allows to key in the quantity of materials such as paper, plastic, glass, aluminium, and others in the Green Reuse Gamified Recycle Management System.

iii) The committee are able to accepting request, decline requests or view of the pending request.

iv) The committee are able to view the user's receipt of the recyclables material.

v) Points and star rating will be transfer to community account, once the admin or committee accepted the request.

FKOM Community :

i) The community has to register new account to access the system.

ii) The community can choose the specific type of waste they want to recycle and specify the quantity of waste and place the chosen recyclable waste to the cart for further processing.

iii) The community can track and monitor the status of their recycling waste request in the system.

iv) Collection is available in Faculty of Computing, UMP Pekan only.

v) The community will be earned with a star and points once they successfully completing the challenge with specific target.

vi) The community can track their progress on the leaderboard which display the higher user's name along with the collected points from highest to lowest.

Development Scope:

i) It contains game elements such as points, leaderboard , badge , friendly competition and challenges.

ii) It contains multimedia elements such as text and graphics.

iii) Using Visual Studio Software.

iv) Languages - Server-Side Scripting (PHP Language), Client-Side Scripting (JavaScript)

v) Styling - CSS

vi) HTTP Server - PhpMyAdmin

vii) Software - MySQL server, visual studio 2019, Figma, Draw.io

1.5 Significance

i. Eksa Admin

The administrator is responsible for managing the entire system, including registration new committee, manage waste categories, manage different type of material, and track and monitoring the recycling data in admin dashboard.

ii. Committee

Committee who is responsible to handle the recycling process such as accepted, pending or decline the recycling status and will be in charge of organizing and managing the waste disposal.

iii. Society/Faculty of Computing Community

Society can be staff, friends or lecturer can also take part in waste recycling. They can learn about waste separation by sorting components based on categories. They can recycle as much waste materials as they want to and have fun recycling and each product limit to 50 kg/unit (maximum). Bring the sorted recyclables to drop-off center. Once the status accepted, the user will earn points and star as a reward each time they donate the recyclables material. This new method can increase their engagement in recycling and teach them how to dispose of waste properly.

1.6   Thesis Organization

This thesis is divided into five chapters. Chapter 1 provides a general description of the project including an Introduction, Problem Statement, Objectives of the thesis, Scope of the project, Significance and Thesis Organization.

Chapter 2 discusses the literature review on the existing system of Green Reuse Gamified Recycle Management System. This chapter explains the comparison between the existing system.

Chapter 3 discusses the usage of the methodology in this project. The methodology that would be used for this project is the Agile model.

Chapter 4 discusses the project's development and testing of the project. In this chapter, the project's outcomes were briefly discussed.

Chapter 5 will conclude and summarises the project's final outcome. In this chapter, the limitations and future work have been thoroughly discussed which can benefit Green Reuse Gamified Recycle Management System.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

Chapter 2 examines the available application of recycling. Three existing recycling mobile applications were thoroughly explained and compared. The comparison will concentrate on the Graphical User Interface (GUI), Operating System (OS), type of connection, the language provided, target audiences, size of the application, function of the application, and the benefits and drawbacks of the application. This comparison of the existing system proposes the system's strength and effectiveness so that it can be used as a guideline to build an application that is more efficient than the existing system.

2.2   Review Of Existing Systems

Three existing recycling mobile applications will be examined in this chapter. These three applications are BinBin Recycle, Reward4Waste, and Waste Management Control. Each of these mobile applications differs in terms of the game element, functionality, and interface.

2.2.1 Application 1 – Bin Bin Recycle

BIN BIN RECYCLE is a simple mobile application that allows users to send requests collection of recyclables materials and the collectors will come to collect non-hazardous waste from their place. This application is only available in the App Store. The BIN BIN RECYCLE application is free to download and install on iOS. Figure 2.1 shows the logo of BIN BIN RECYCLE. This application was developed by KAI MUN LOOI.

Once launching the application, they will access the welcome screen as shown in figure 2.2. The user has to tap the Get Started button to continue. On the about us interface, there are four (4) steps that users should follow. Step one: The user should fill up their details including contact, home address, and also take the picture of the recycling product. Step two: The customer service will contact the user to manage the time and date for pick up. Step three: The collector will come and collect the recyclable waste from the doorstep. Step four: Customers can also check each recyclable item's rates within the app such as newspapers, scrap paper, plastic, glass bottles, cardboard, steel, and several other materials as shown in figure 2.3.

When the user wants to proceed to recycle, they can simply click the "Recycle Now" button and there is a fill space in which the user must enter their name, phone number, email, and address as well as attaches the picture of the product as shown in figure 2.4. Once completed fill in all the details, they can submit the form to manage for pick up and collectors will come to collect the recycled product from their doorstep. The users will get the cash based on the weight of the recycled materials

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Figure 2.1   Logo of Bin Bin Recycle

Figure 2.2   Welcome screen

Figure 2.3   About us

Figure 2.4　　Recycling form

2.2.2 Application 2- Reward4waste

REWARD4WASTE is a recycling app that gives rewards to people who participate in recycling. Through the Reward4Waste app, users will earn rewards for recycling. This application is extremely simple and convenient to use, as it encourages users to recycle more and then earns them rewards points for doing so. This 'Reward4Waste' app is available for free download on Android in Google Play and iOS in Apple App Store. Figure 2.5 shows the logo of the Reward4Waste app. The app was developed by REWARD4WASTE LTD to assist in increasing local recycling rates and raising public awareness of the importance of proper recycling.

Figure 2.6 shows the application login interface. The user needs to sign in or create a new account to allow them access to the app. On the home screen, users can see how many points they earn as well as the total of items that have been recycled by users. However, it also shows the total of recycled items in Whitehead where the local people can earn rewards in the Reward4Waste app as shown in figure 2.7. Reward4Waste enables users to redeem SPAR vouchers by using the collected reward points and it only can be used at Spar Edward Road or else donate to one of four local charities which are Hope House, Whitehead Primary School PTA, Keep Northern Ireland Beautiful or donate to Angle Wishes where user can select an amount to donate in between 100 points, 200 points or 500 points as shown in figure 2.8.

Reward4Waste accepts all recyclable materials and re-use items of various sizes, materials, and shapes, including cans, glass, plastic milk bottles and so on. Each recyclables material has its own unique code where users can simply scan the digital recycling bin as well as the recyclable items into the Reward4Waste app to collect the points. The user will earn 10 or 20 Reward Points for recycling each item, with 100 points equal to £1 means 5.52 in Malaysian Ringgit.

Figure 2.5   Logo of Reward4Waste

Figure 2.6   Login Interface
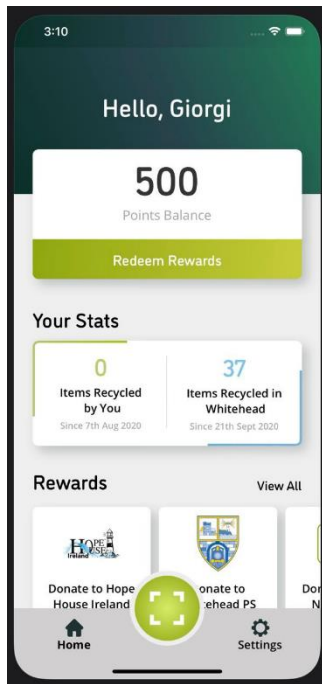
Figure 2.7   Home Screen
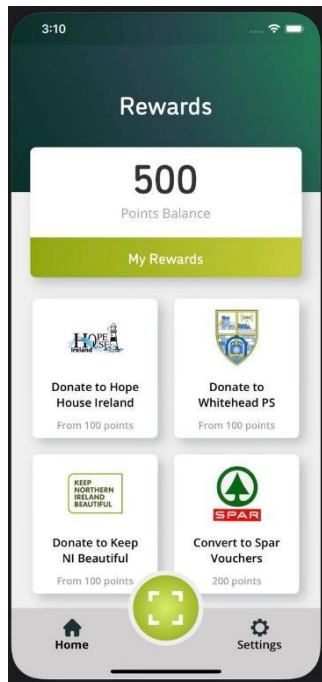
Figure 2.8   My Rewards

2.2.3 Application 3 – Waste Management Control(Wmc)

To combat COVID-19 bars, stores and supermarkets are using plastic in everything to prevent the spread of the virus. This Waste Management Control(WMC) app encourages consumers to sort their recyclables and participate in challenges to collect inorganic waste such as plastic, paper, cardboard, aluminum and metal that would otherwise be discarded as trash. All of the materials will add value to the environment because they can be reused and recycled into new items. Users can download Waste Management Control(WMC) app that is now available for iOS and Android. Figure 2.9 shows the logo Waste Management Control(WMC) app that is simple for clients to remember easily about the brand when they first see the logo. This application is developed by S B Technology. This Waste Management Control(WMC) app are available in two languages which are English and Arabic, and the user can select the language they are most comfortable with.

Waste Management Control's login form page is simple and shows consumers the small WMC logo at the top of the login as shown in figure 2.10. The user must sign in with their email and password or if they are a new customer, they can click on sign up to create an account that will allow them to log in to the app. After entering their email and password, they will be taken to the main screen where they will be able to proceed with their recyclable materials. Figure 2.11 shows the home screen of Waste Management Control(WMC) app where consumers can view their collection points based on their recycled waste. Furthermore, if a user has any questions or concerns about waste separation, they can contact customer service by clicking on the customer service icon.

The Waste Management Control(WMC) app allows consumers to choose one of the five categories of waste that can be recycled. Once clicked on the selected item and then clicking the tick symbol, it will bring users to the term and condition which user must agree in order to proceed with the waste collection as shown in figure 2.12. This agreement includes the rules and guidelines that users need to read carefully before proceeding. After ticking the agreement, there are three steps that must be completed as shown in figure 2.13. Firstly, users must fill in their details including Name, Phone number, Email dan Home Address. Second, users can manage the date and time for pick up. If users would like to add any notes regarding the waste, they may leave the notes in the text box. Lastly, users can choose the type of rewards such as my wallet, products or

donate my waste and click the done button. The recycle collectors will contact the user to arrange for the collection of recyclable materials.

In Figure 2.14 shows My History of waste that has been recycled by user. Users can view their history regarding how many resources they recycled and the number of points earned. This app allows users to invite their friends to participate in waste segregation.

Figure 2.9   Logo Waste Management Control(WMC)
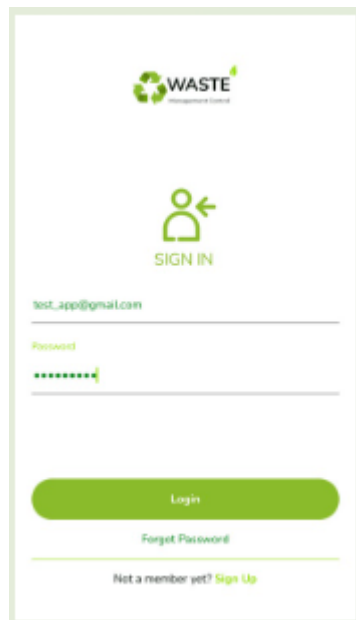
Figure 2.10   Login Interface

Figure 2.11   Home Page

Figure 2.12   Term and Conditions
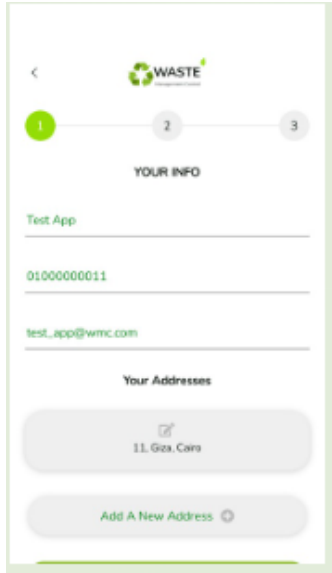
Figure 2.13   Personal Info
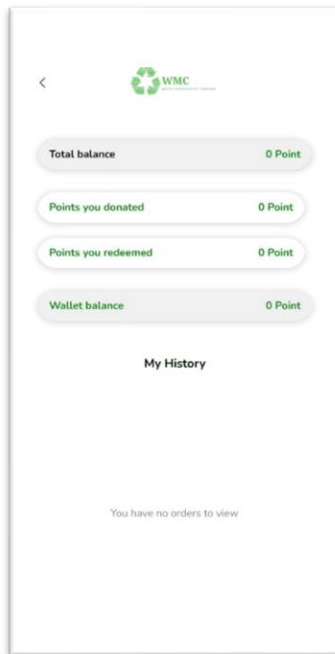
Figure 2.14   My history

2.3   Comparisons Of Three Existing System

Based on the comparison of three applications such as BinBin Recycle, Reward4Waste, and Waste Management Control, this can be concluded that each of the applications has its own advantages as well as disadvantages.

In terms of the Graphical User Interface, Reward4Waste and Waste Management Control have a nicer interface compared to BinBin Recycle which has a bad design interface that makes for a bad user experience. These three mobile applications need an internet connection to access the apps. To download all three applications directly to the device, the user needs either a Wi-Fi or cellular data network. Reward4Waste and Waste Management Control can be downloaded from either the Google Play Store or the App Store and that means BinBin Recycle applications are only available for the iOS platform. The target audience of the three apps is the community who want to participate in recycling and at the same time, they can earn rewards through the apps. The type of game elements implemented in these three applications includes points, reward vouchers, feedback, social interaction, and cash.

The main function of the BinBin Recycle application is to collect recyclable waste from households and pay them for the waste. Customers are paid cash immediately and they can use the app to make requests for pickups. This app also provided a list of the rates for each item, so users can make some money from recycling with this information. Users are required to upload an image of their recycled product in order to make a request for collections and 5 kg of waste is the minimum to recycle. Furthermore, the app displayed the user's current location in real-time. However, this application does not provide a clear view of how much money the customers have earned through the recycling service.

Reward4Waste application also provides a barcode feature that allows users to scan the unique codes on products and any registered bin and consumers will receive a deposit or rewards for their good recycling habits. To redeem the rewards, users must collect points through recycling in order to unlock the rewards. Consumers can also view the available rewards by clicking on the "View All" text. Once users have reached the reward points they can redeem the vouchers or donate their points to charity. Users can

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also view their "My Rewards" to see how much they have redeemed or donated. The application lacks information on how to sort or pack the materials, which may be a problem for some citizens who are not familiar with recycling.

Waste Management Control is a facility that recycles waste. The primary operation of the company is the collection of inorganic waste from customers. Users can choose the type of waste based on categories and click the "tick" icon to proceed to the next step. The app also provides information on how to properly dispose of waste and recycle in the right way to guide people to learn what can and cannot be recycled. It also allows users to request collections, select pick-up times and dates, and provide them with a real-time map or simply type their address in the text box. There will be rewards given when users start to recycle, users can choose either points, gifts, or donate their points to charity. The application's weakness is that there is no list of items' prices for the user to check the current market price when recycling. Besides, the text used in terms and conditions are too fixed, making it difficult for the user to read.

Table 2.1   Comparison of existing system

Application Name	BINBIN RECYCLE	REWARD4WASTE	WASTE MANAGEMENT CONTROL
Graphical User Interface	The interface is quite simple and poorly organize	The interface has a good design interface.	The interface is simple and uses product-related colors.
Mobile OS	iOS	iOS and Android	iOS and Android
Connection Type	Online	Online	Online
Language	English	English	English and Arabic
Game Element	Reward users by cash	Points, or vouchers	Points
Target Audience	Society	Society	Society
Size of Application	33.1 MB	86.5 MB	86 MB

Main Function	1. Users were able to access the app by clicking a "Get Started" button. 2. Add a " Recycle Now" button to help users access recycle item forms. 3. Provide a camera icon for users to upload the recycled product. 4. Provided the "Submit Now" button for the user to submit the information. 5. Provided a GPS location tracker that displays the user's current location.	1. Provided barcode scanning features for users to scan the registered bin and unique codes item. 2. Provided "Redeem Rewards" button that allows users to redeem rewards such as SPAR vouchers or donate points to charity.	1. Provided a login button for users to access through the app. 2. In case the user forgets their password, there is a "Forgot Password" option. 3. Provide a Home button to allow users to return to the home page. 4. Provide a Personal button where users can manage their personal information and view the history of collecting waste. 5. Provide a call services icon for users to contact and inquire about recycling collection. 6. Provide two languages option which is English and Arabic.
Advantages	1. Provided the step on how to fill up all the details before	1. Users can view the total number of points collected and total items recycled by the user	1. User can view their collected points on the home page based on the weight of the material recycled.

	proceeding with the waste collection. 2. Provided pictures of items that can be recycled . 3. Show the pricing of recyclable material based on current market conditions. 4. The icon camera is provided for users to upload their recycled products. 5. Users earn real money.	as well as the number of items recycled on Whitehead. 2. Users can view all the rewards by clicking the "View All" text. 3. User can redeem the reward according to the points balance. After redeemed the points will be deducted. 4. User can scan the product into the Reward4Waste app. 5. Provide an information button so that users can read the information in more detail.	2. Categorized the type of waste. Categories include paper waste, and plastic waste, metal waste, aluminum waste and cardboard waste. 3. Provide guidelines and rules for waste segregation. 4. Users can set a pick-up time and date, as well as leave notes if they have any questions about the collection time or waste collection. 5. A user's reward options include My wallet, Products and charitable donations. 6. Allows users to share and invite their friends to join Waste Management app
Disadvantages	1. No clear instructions and the process of separating waste is difficult to understand. 2. User can obtain the image from other sources.	1. Does not provide an informative guide about recycling. 2. No achievement board 3. Does not provide the item rate.	1. Does not provide the item rate. 2. The terms and conditions text is too much and difficult to read.

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	3. Not provided the total cash that the user earns from recycling.		

CHAPTER 3

METHODOLOGY

3.1   Introduction

It is necessary to develop the appropriate methodology to ensure that the system will function properly. There are various methodologies that can be applied such as WaterFall Model, Agile Model, Rapid Application Development (RAD), and many more. The phases of the Agile model consist of requirement, design, development, test, and deployment. For this project, the methodology used is the Agile model to create the Green Reuse Gamified Recycle Management System.

3.2   Project Management Framework

The Agile methodology is a type of project management process in a software development life cycle. There are five stages of the agile development lifecycle which are requirement, design, development, test, and deployment. Agile development emphasizes teamwork over the product. The manager is in charge of making sure that the agile team is chosen based on their skills, expertise, and abilities so that the project can run smoothly.

In the Agile methodology, a project is broken down into small that are treated as separate projects. Communication and collaboration are vital at every phase in agile methodologies to ensure team members know their role, resources, and deadline, which speeds up the development process because every developer works hard to complete their part in developing a complex project. Agile development is great for small projects because we can finish them quickly. It allows for early customer involvement but not during project implementation.
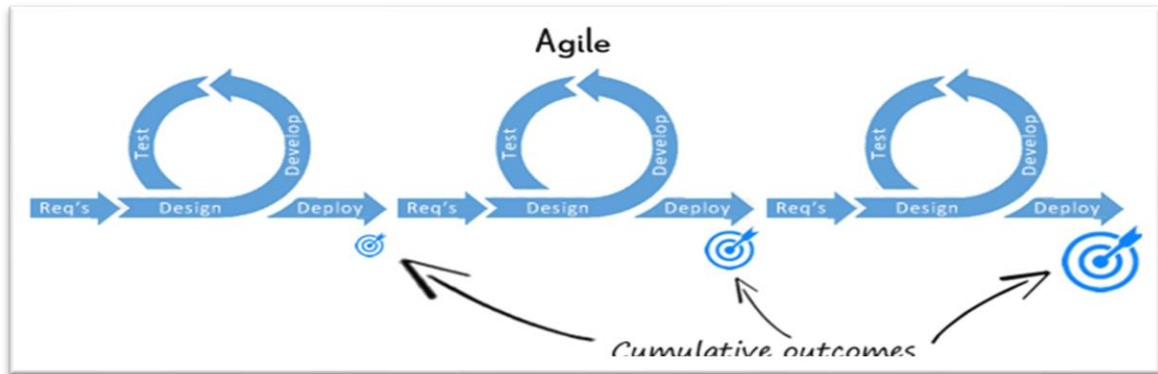
Figure 3.1   Agile Methodology
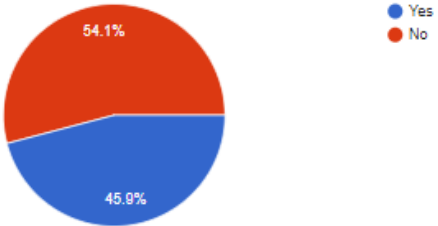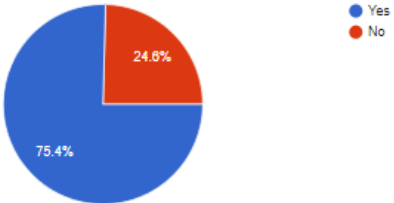
3.2.1   Requirement Phase
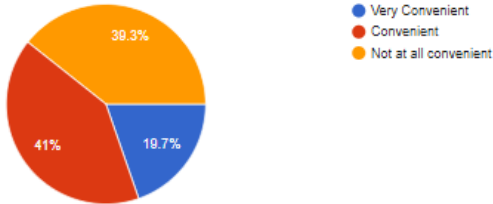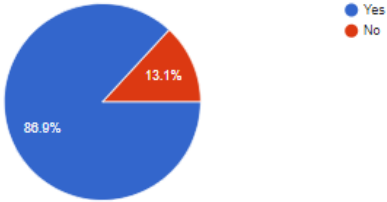
In this first phase, the client FKom Community expectations for Green Reuse Gamified Recycle Management System were defined in detail including the FKom Community's requirements, objectives, and problem statement. Requirements can be gathered from communities in area FKom UMP Pekan who are involved in the Green Reuse Gamified Recycle Management System. This means that the client will participate in defining the project's requirements, ensuring that the developer understands the scope of work to be completed, and minimizing development time. During this phase, we will use Google Forms to collect data from FKom Community who participate in recycling through the application as shown in Figure 3.1. The questionnaire will be used to create a quick design based on FKom Community's preferences. The planning and requirements must be evident to ensure the project runs smoothly. All the tasks should be divided and assigned based on how well the developers can adapt and be self-sufficient.

3.2.1.1   User Requirement

The surveying from google form for the Green Reuse Gamified Recycle Management
System is described or stated in Table 3.1

Table 3.1   Survey for FK Community requirement

Surveying for Pekan Community	Explanation
Have you ever recycle e-waste before? 61 responses 54.1% (No) 45.9% (Yes)	According to the survey, 28 out of 61 respondents have recycled e-waste before, while 54.1 percent (33 responses) have not.
Do you know that some components of electronic devices contain toxic/hazardous material? 61 responses 24.6% (No) 75.4% (Yes)	In this survey, 15 respondents do not know about toxic/hazardous materials in electronic devices and simply dispose of them without knowing how to recycle them. On the other hand, 75.4% (46 responses) responded 'Yes' know that e-waste contains toxic substances that can harm the. human health.

How convenient do you find the drop-off center?

61 responses

- Very Convenient
- Convenient
- Not at all convenient

39.3%
41%
19.7%

According to the question ask how convenient do you find the drop-off center? There are three options which are very convenient, convenient and not at all convenient. 41% answered conveniently while 39.3 percent said it was not convenient at all. However, 19.7 percent of the responses, which consisted of 12 responses said it was very convenient.

Should there be a reward within E-waste Mobile Gamification app for people who recycle e-waste materials?

61 responses

- Yes
- No

13.1%
86.9%

53 (86.9%) respondents agreed that Green Reuse Gamified Recycle Management System should provide rewards for people who participate in recycling e-waste so that people will recycle more to collect the rewards. However, the rest 8(13.1%) respondents answered 'No'.

3.2.1.2   Project Requirement

The functional, non-functional and user requirements are described in this session.

3.2.1.3   Functional Requirement

1.   The system shall allow admin to register the committee in the system and login using a username and password.

2.   The system shall allow FK community to register and login using username and password

3.   The system shall allow community to manage recycling process such as select type of waste and add item in to the cart for next processing.

4.   The system should allow community to view their achievement.

5.   The system shall allow the community to view their recycle waste status after the committee or admin accepted or rejected the request.

6.   The system must allow the committee has the right to manage the recycle waste status such as accept, pending or cancel .

7.   The system shall allow the community to keep track their progress in the leaderboard.

8.   The system shall allow community to monitor their progress bar on the specific user dashboard.

3.2.1.4   Non-Functional Requirement

1. **Operational Requirements :** The system will run on responsive website.
2. **Performance Requirements :** The system should let the customer track their progress quickly in the leaderboard.
3. **Availability Requirements :** The system should be accessible during the day.

3.2.1.5   Limitations

The following are some limitations that the user may encounter once the system is connected to the internet:

I. **Internet connection:** If the internet connection is lost or is disabled, the system may be unable to function. This is because the system is a web-based application that can only be seen with an internet connection.

II. **User Registration:** The system is built for specific user groups, so only registered users can use it.

III. **Cost:** Cost in developing for this system.

3.2.2   Design Phase

During the design phase, the design team should begin to transform the requirements into detailed system design specifications to meet the client's needs. In this design phase, the requirements gathered in the requirement phase will be implemented. The elements that need to be focused on and designed are the user interface, storyboard, context diagram, use case diagram, UML diagram, gamification guideline and data flow to ensure that users understand how the proposed system will work.

3.2.2.1   Proposed Design

The Proposed Design is a decision-making document that outlines the design from the user's point of view. It should be described in terms of the project's requirements in the proposal.

3.2.2.2   Context Diagram (CD)

Figure 3.2 shows the Context Diagram for this system. This system involves three main entities (Community , Committee and Eksa).
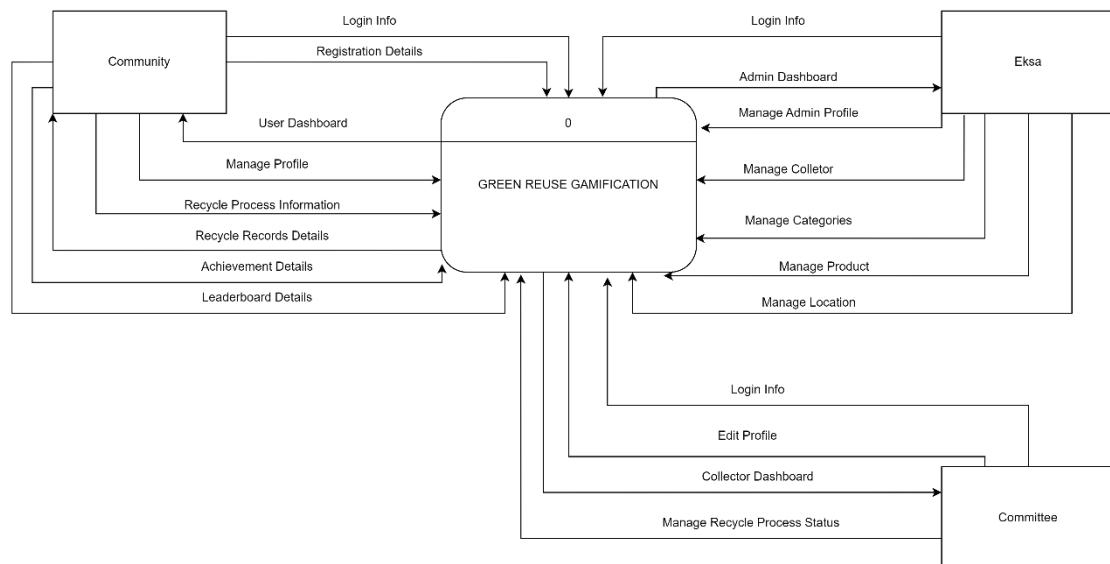
Figure 3.2   Context Diagram (CD)

According to the context diagram in Figure 3.2, this diagram describes the process and the relationship that the Eks has with the community entity as well as the interaction between the Eksa and the committee. The diagram also shows community and committee relations. There are three external entities which will be interact with the system which are administrator, community and committee. The community , committee and Eksa must login with their username and password. Registration is required for first-time Community of the system. Once successful, the community will be redirected to the main page. Community can manage their profile, view dashboard and manage recycling process. Community also can view their level in leaderboard section as well as view recycle records in the system. Beside that community also can view their ranking in the leaderboard and view user dashboard as well as their collected points in progress bar.

Next, the committee manages recycling and can approve or reject community requests. When a community sends a request to recycle their waste, the request goes to the person in charge of collecting at that center. If the requirements are not met, the committee may reject the request. After acceptance, the community receives points and stars. The acceptance page lists all approved requests. In addition, the administrator(EKSA) is able to login into the system, manage admin profile, manage collector profile, manage category, manage product, manage drop-off location and view admin dashboard.

3.2.2.3   Use Case Diagram
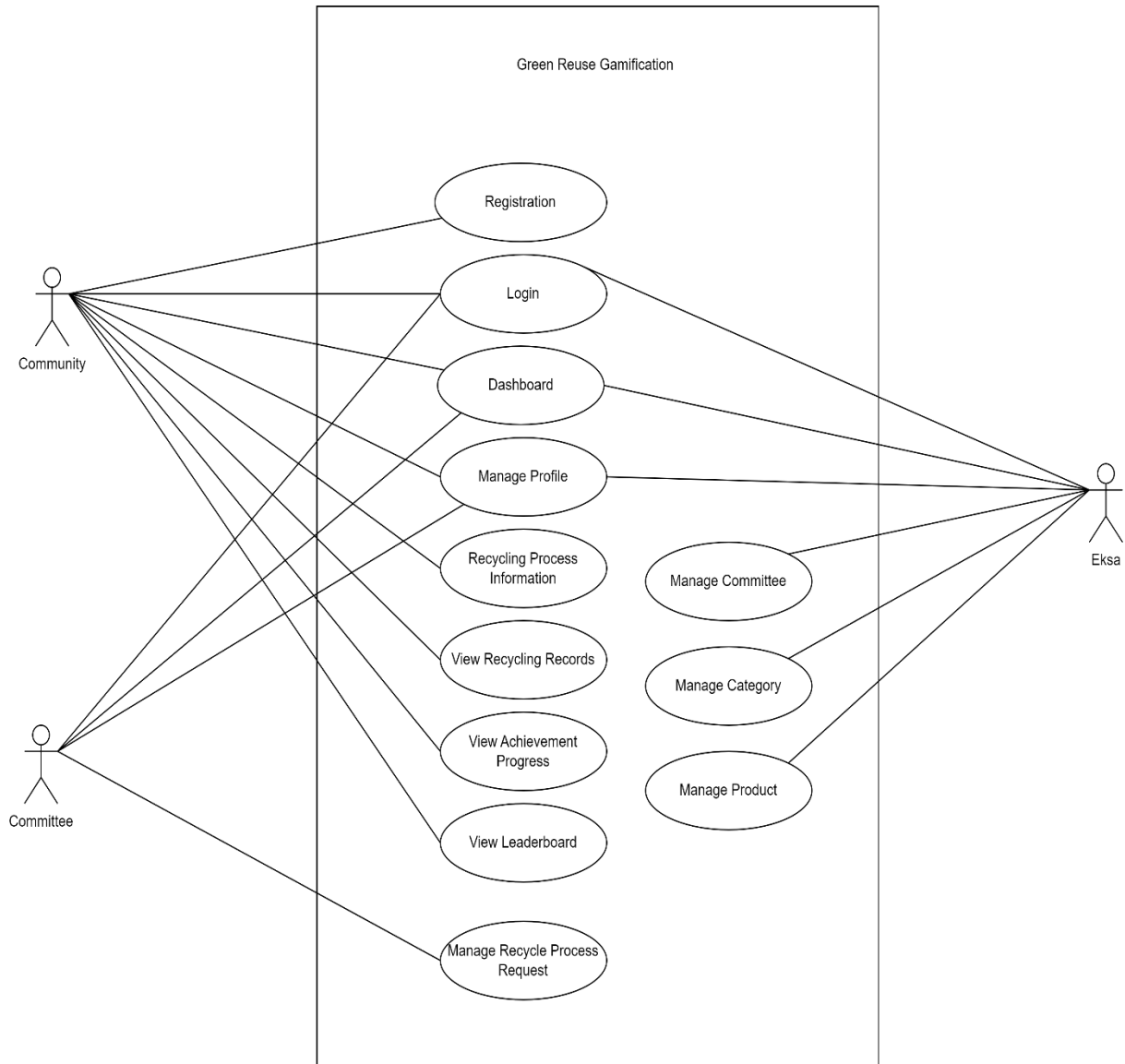
Figure 3.3   Use Case Diagram
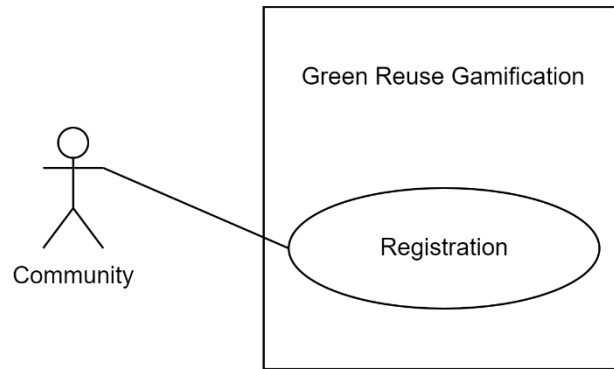
Figure 3.4   Use Case Diagram for Registration

Table 3.2   Use Case Description for Registration Module

Use Case ID	UC1
Brief Description	A new community is required to create an account. They have to fill in all the required information to log in.
Actor	Community
Pre-Conditions	None

Basic Flow	**[B1: Register Module]**
	   1. The community clicks the sign-in button.
	   2. The community will be directed to the create account page.
	   3. The community inputs personal information.
	   4. The community submits the registration form.
	   5. Use case ends.

Alternative Flow	If the community accidentally leaves any text field blank, the system will prompt an error message.
Exceptional Flow	None
Post-Conditions	The community can login and use the system
Constraints	None
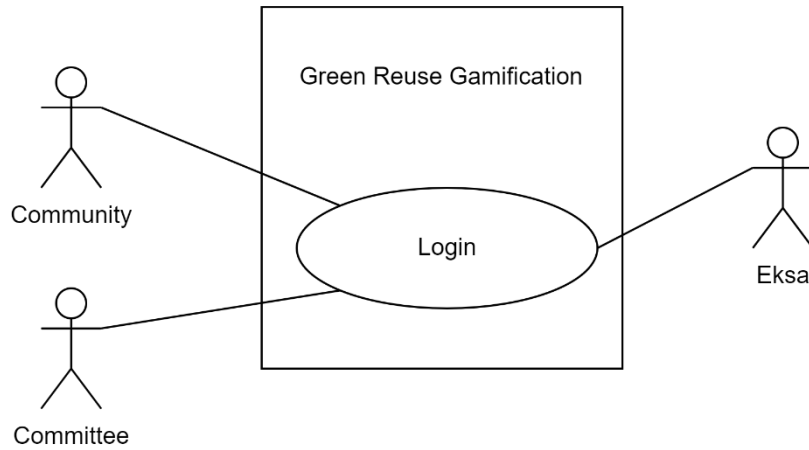
Figure 3.5   Use Case Diagram for Login

Table 3.3   Use Case Description for Login

Use Case ID	UC2
Brief Description	This use case is for community , committee and eksa to login into the system
Actor	Community, Committee and Eksa
Pre-Conditions	It is compulsory for user to have their own username and Password and must have an internet connection
Basic Flow	**[B1: Login Module]** 1. The app displays a login form. 2. The community, committee and admin(Eksa) key-in his/her username. 3. The community, committee and admin(Eksa) key-in his/her password. 4. The community, committee and admin(Eksa) clicks the Login button. 5. The system verifies authentication. 6. Only registered community, committee and admin(Eksa) can directed to main page. 7. Invalid passwords and usernames prevent the user from accessing the system. 8. Use case ends.
Alternative Flow	If the user's access attempt fails, they will not be taken to the main system.
Exceptional Flow	None
Post-Conditions	The users are able to access the Green Reuse Gamified Recycle Management System.
Constraints	The system was focused on FKom, UMP Pekan area.

Figure 3.6   Use Case Diagram for Dashboard

Table 3.4   Use Case Description for Dashboard

Use Case ID	UC3
Brief Description	This use case is for community , committee and eksa to view their dashboard.
Actor	Community, Committee and Eksa
Pre-Conditions	The users already login with the application.
Basic Flow	**[B1: Dashboard Module]** 1. The use case begins when users go to dashboard menu. 2. The system shows a dashboard page designed for a particular user and user type. 3. Use case ends.
Alternative Flow	None
Exceptional Flow	None
Post-Conditions	The users are able to access the Green Reuse Gamified Recycle Management System.
Constraints	The system was focused on FKom, UMP Pekan area.

Figure 3.7   Use Case Diagram for User Profile

Table 3.5   Use Case Description for User Profile

Use Case ID	UC4
Brief Description	This use case is for community , committee and eksa to update or view their profile.
Actor	Community , Committee And Eksa
Pre-Conditions	The users already login with the application.

Basic Flow	**[B1: Profile Module]**
	1. The use case begins when users go to profile menu.
	2. The system shows the profile page
	3. The users can do the following option:
	    a) Edit profile information.
	       [**A1:** Edit/Update profile information]
	    b) View profile information.
	       [**A2:** View profile information]
	4. Use case ends.

Alternative Flow	A1: Edit profile information 1. The users select the information to be update 2. The user clicks the <<Edit>> icon. 3. The user edit the information. 4. The users click <<Update>> button. 5. The system display the updated information. 6. The use case continues.
Exceptional Flow	None
Post-Conditions	The profile information is success and updated.

Constraints	The system was focused on FKom, UMP Pekan area

Figure 3.8   Use Case Diagram for Recycling Process Information

Table 3.6   Use Case Description for Recycling Process Information

Use Case ID	UC5
Brief Description	This use case explains how the community manage recycling process.
Actor	Community
Pre-Conditions	The community must log in to the system.

Basic Flow	**[B1: Manage Recycling Module]**
	
	1. The use case starts when the Community login into the system.
	2. The Community click on <<Products>>button.
	3. The Community can choose the product category such as fabrics, metal and paper.
	4. The system display the material composition of different types of recyclables.
	5. The Community enter the total in KG/Unit.
	6. The Community click on <<Add Order>> button.
	7. The items have been added to the system.
	8. The Community can do the following option.
	   1. Add new item
	    [**A1:** Add new product]
	   2. Update item's quantity
	    [**A2:** Update quantity]
	   3. Delete the items

	[**A3:** Delete item]
	9. The system display the material composition of waste information.
	10. The Community clicks on <<Checkout>> button.
	11. The Community will be directed to the recycling form, where they must fill out all required information and click <<Place Recycle>>.
	12. The system auto generated receipt.
	13. Use case end.
Alternative Flow	**[A1: Add New Product]** 1. The Community clicks the <<Continue Recycle>> button. 2. The system will directed back to the type of waste page. 3. The Community can add new items. 4. The use case continues. **[A2 : Update Quantity]** 1. The Community enter new value of quantity. 2. The Community clicks on <<Update>> button. 3. The system displays the new value and new grand total of item. 4. The use case continues. **[A3: Delete item]** 1. The Community has the option to delete either a single item or all of the items. 2. The Community clicks on <<Delete>> icon or <<Clear Cart>> icon. 3. The system has removed the item from the cart table. 4. The use case continues.
Exceptional Flow	None
Post-Conditions	The recycle process is success and updated.
Constraints	The system was focused on FKom, UMP Pekan area

Figure 3.9   Use Case Diagram for View Recycling Records Module

Table 3.7   Use Case Description for View Recycling Records Module

Use Case ID	UC6
Brief Description	This use case provides the customer capability to view recycling records.
Actor	Community
Pre-Conditions	The community already login with the application.
Basic Flow	**[B1: View Recycling Records Module]** 1. The use case starts when the communities are login to the system. 2. The community r clicks on <<Recycle Record>> button. 3. The system displays the records of recycling. 4. Use case ends.
Alternative Flow	None
Exceptional Flow	None
Post-Conditions	The list of records is success and updated.
Constraints	The list of records will be accessible only to specific community.
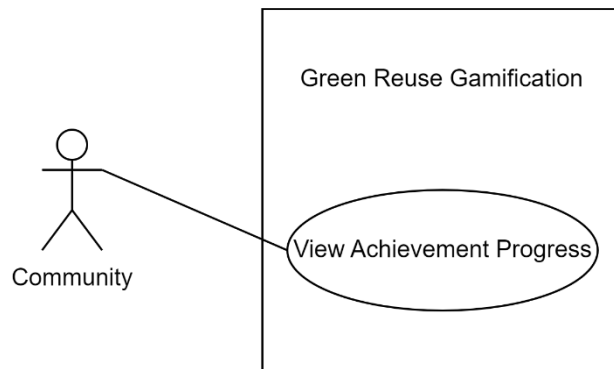
Figure 3.10   Use Case Diagram for View Achievement Module

Table 3.8   Use Case Description for View Achievement Module

Use Case ID	UC7
Brief Description	This use case explains how community view their achievement.
Actor	Community
Pre-Conditions	The community already login to system.
Basic Flow	**[B1: View Achievement Module]** 1. The use case starts when the community clicks on the achievement menu. 2. The system retrieves the data from the cart database. 3. The system displays the total number of star received and the quantity of a specific waste for a particular month. 4. Use case ends.
Alternative Flow	None
Exceptional Flow	None
Post-Conditions	The list of achievement is success and updated.
Constraints	The list of achievement will be display on particular month.
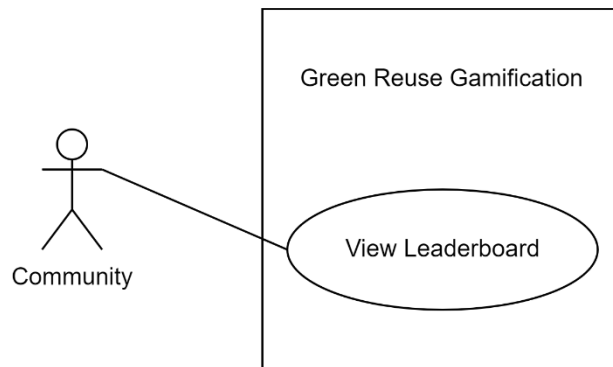
Figure 3.11   Use Case Diagram for View Leaderboard Module

Table 3.9   Use Case Description for View Leaderboard Module

Use Case ID	UC8
Brief Description	This use case explains how community views leaderboard.
Actor	Community
Pre-Conditions	The community must log in to the system.
Basic Flow	**[B1: View Leaderboard Module]** 1.The use case starts when the community clicks on the leaderboard menu. 2.The system retrieves the community data from the database. 3.The system displays the list of the community's ranking in the leaderboard page. 4.Use case ends.
Alternative Flow	None
Exceptional Flow	None
Post-Conditions	The user can see their ranking from leaderboard page.
Constraints	None
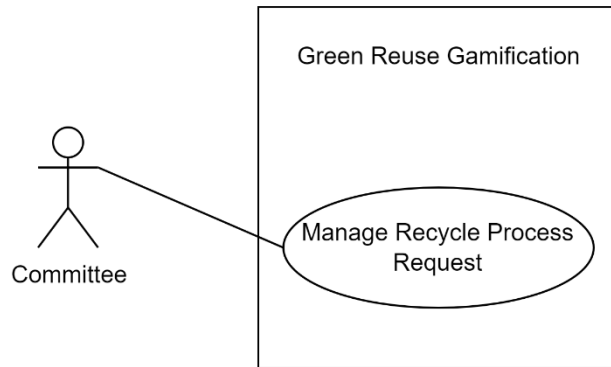
Figure 3.12   Use Case Diagram for Manage Recycling Process Module

Table 3.10   Use Case Description for Manage Recycling Process Module

Use Case ID	UC9
Brief Description	This use case explains how committee manages recycling process .
Actor	Committee
Pre-Conditions	The committee already log in to the system.

Basic Flow	**[B1: Manage Recycling Process Request Module]**
	
	The use case starts when the committee clicks on the <<Order Status>> menu.
	
	    2. The committee has the following option:
	
	        1. Pending status
	
	            [**A1:** Pending Order]
	
	        2. Accept status
	
	            [**A2:** Accept Order]
	
	        3. Cancel status
	
	            [**A3:** Cancel Order]
	
	Use case ends.

Alternative Flow	**A1: Pending Order** 1. The committee clicks << Pending>> button. 2. The system display the pending status order. 3. The committee can choose either accept or cancel the order. 4. The use case continues. **A2: Accept Order** 1. The committee select the <<Accept>> button. 2. The committee can choose to cancel if the requirement not fullfill. 3. The use case continues. **A3: Cancel Order** 1. The system shows the cancel order. 2. The use case continues.
Exceptional Flow	None
Post-Conditions	None
Constraints	Only the committee can perform this module.

Green Reuse Gamification

Eksa

Manage Committee

Figure 3.13   Use Case Diagram for Manage Committee

Table 3.11   Use Case Description for Manage Committee

Use Case ID	UC10
Brief Description	This use case provides the admin to manage the committee.
Actor	Eksa (Administrator)
Pre-Conditions	The admin must log in to the system.

Basic Flow	**[B1: Manage Collector Module]**
	1. The use case starts when the admin click on the <<Users Login>> button.
	2. The admin has the following option:
	    a) View all the user profile.
	       [**A1:** View All of the system user]
	    b) Add new collector
	       [**A2:** Add collector]
	3. Use case ends.

Alternative Flow	**A1: View All of the system user** 1. The admin clicks <<All users>> button. 2. The system display user's information. 3. The use case continues. **A2: Add collector** 1. The admin create the committee data by inserting all related information. 2. The admin clicks <<Save>> button. 3. The data has been saved in the system. 4. The use case continues.

Exceptional Flow	None
Post-Conditions	None
Constraints	The admin has a privilege to add, delete, edit the committee's data from data storage.
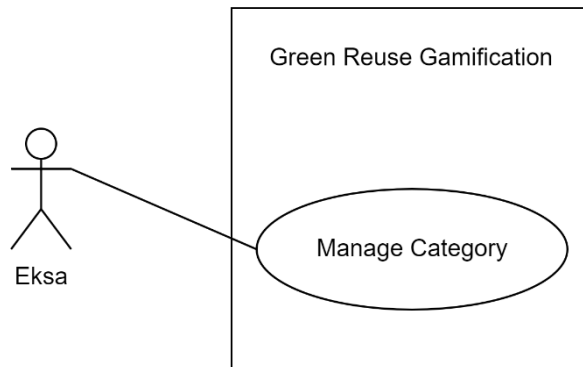
Figure 3.14   Use Case Diagram for Manage Category

Table 3.12   Use Case Description for Manage Category

Use Case ID	UC11
Brief Description	This use case explains how the admin manage the product category in the system.
Actor	ADMIN
Pre-Conditions	1. The admin must log in to the system.

Basic Flow	**[B1: Manage Category Module]**
	    1. The use case starts when the Admin login into the system.
	    2. The admin clicks on <<Category>> button.
	    3. The admin can do the following option:
	        a) View list of category.
	            [**A1:** View all of the category]
	        b) Add category.
	            [**A2:** Add category]
	    4. Use case end

Alternative Flow	**A1: View all of the category**
	    1) The admin clicks << All Categories >> menu.
	    2) The system display list of the categories.

	3) The use case continues.
	A2: Add Category
	1) The admin clicks << Add Category >> menu.
	2) The admin fills in the information details about the recycling product category and clicks << Add New Category >> button.
	3) The system display page list of categories.
	4) The use case continues.
Exceptional Flow	None
Post-Conditions	None
Constraints	Only admin has the right to manage the category.
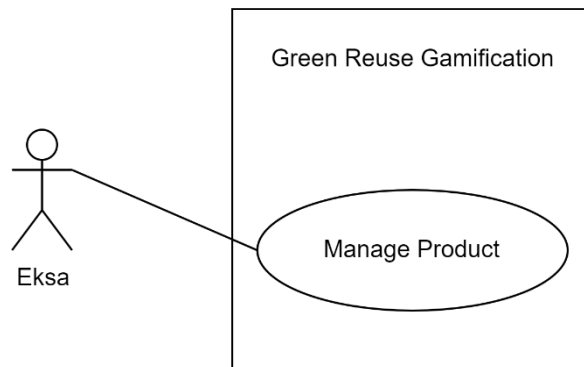
Figure 3.15   Use Case Diagram for Manage Product

Table 3.13   Use Case Description for Manage Product

Use Case ID	UC12
Brief Description	This use case explains how the admin manage the recycling product in the system.
Actor	ADMIN
Pre-Conditions	1.The admin must log in to the system.

Basic Flow	**[B1: Manage Category Module]**
	1. The use case starts when the Admin login into the system.
	2. The admin clicks on <<Product>> button.
	3. The admin can do the following option:
	      a) View list of category.
	      [**A1:** View all of the product]
	
	      b)Add category.
	      [**A2:** Add product]
	4.Use case end

Alternative Flow	**A1: View all of the product** 1. The admin clicks << All Product >> menu. 2. The system display list of the product. 3. The use case continues. **A2: Add Product** 1.The admin clicks << Add Product >> menu. 2. The admin fills in the information details about the recycling product category and clicks << Add New Product >> button. 3. The system display page list of product. 4. The use case continues.
Exceptional Flow	None
Post-Conditions	None
Constraints	Only admin has the right to manage the product.

3.2.2.4   Activity Diagram

An activity diagram is a diagram that illustrates how the system works. With the help of this diagram, the algorithm of the application can be explained in a way that is clear and easy to understand.
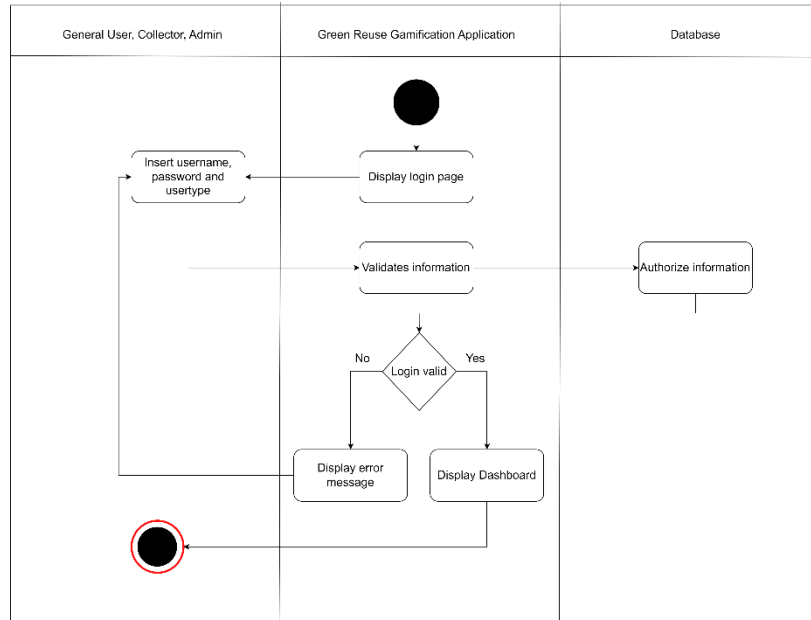
Figure 3.16   The activity diagram of login and sign in for customer
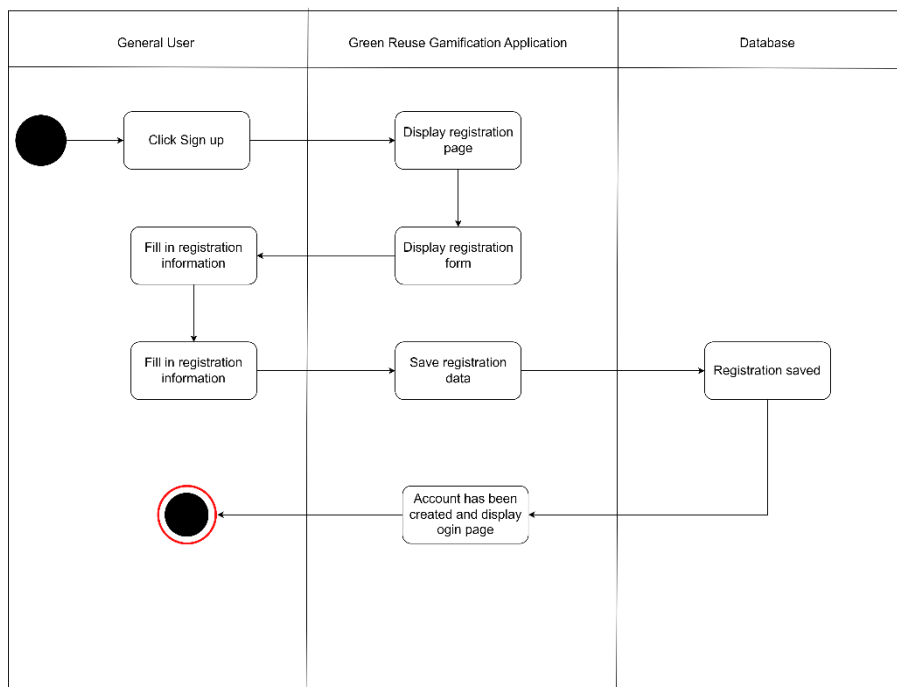
Figure 3.17   The activity diagram of registration page

48
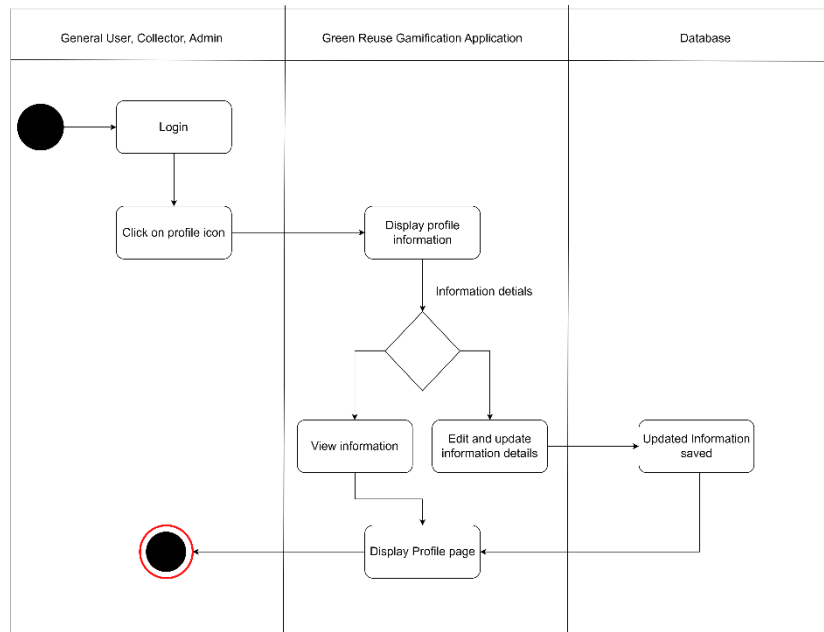
Figure 3.18   The activity diagram of system user's profile
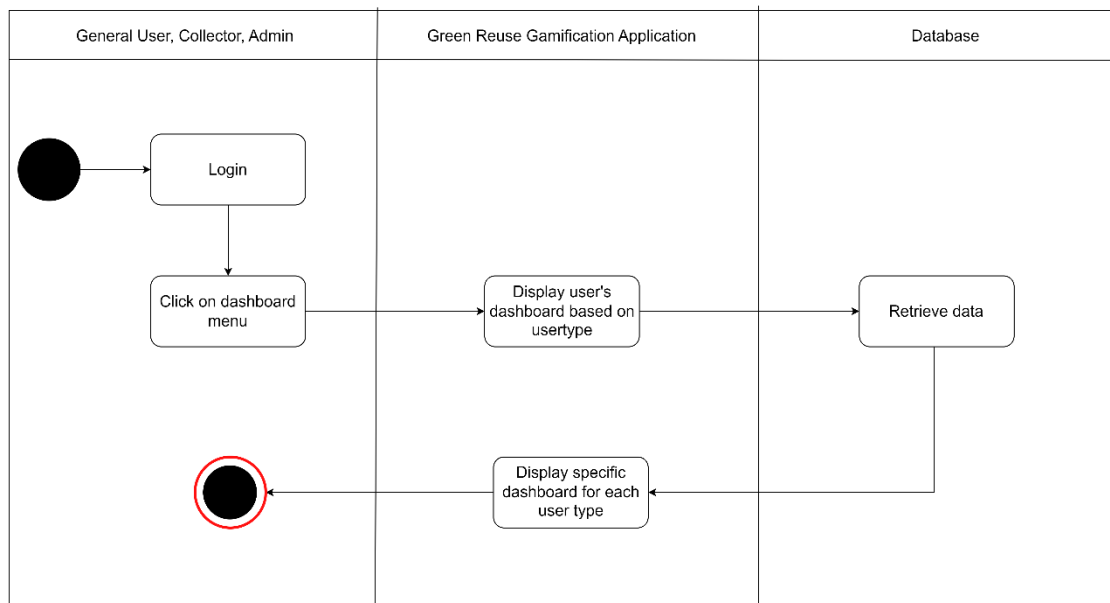
Figure 3.19   The activity diagram of specific dashboard for each user type
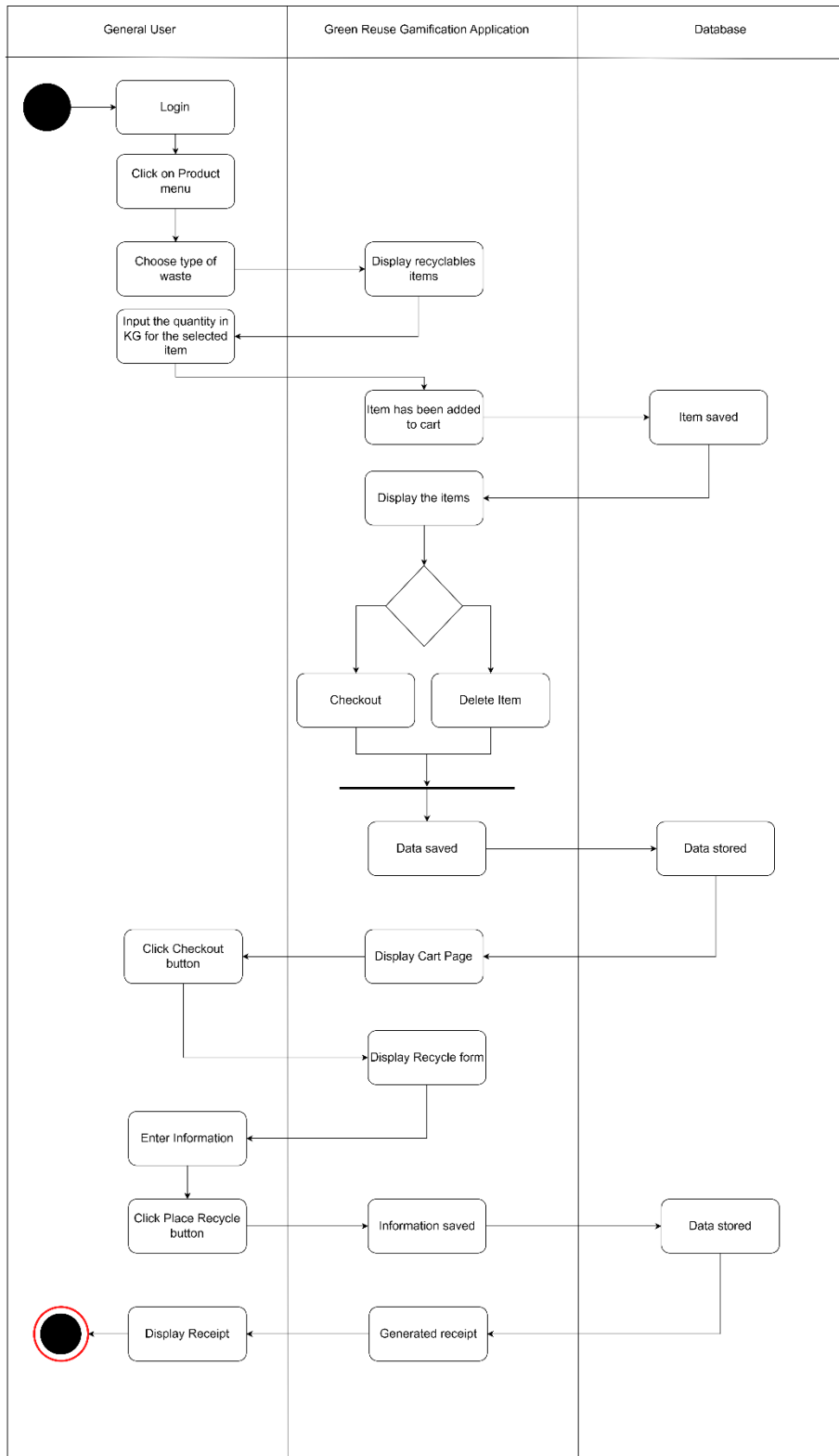
Figure 3.20   The activity diagram of recycling process page
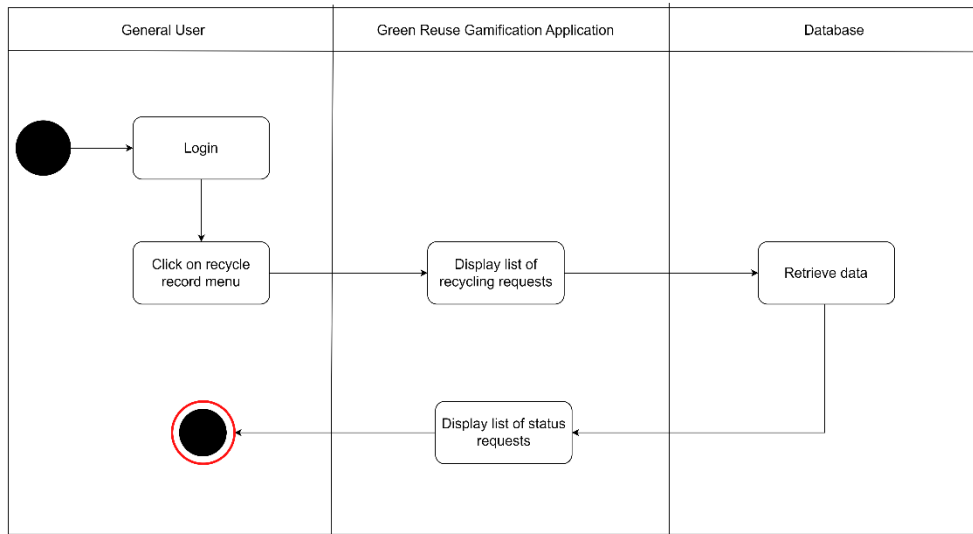
Figure 3.21   The activity diagram of recycling record page
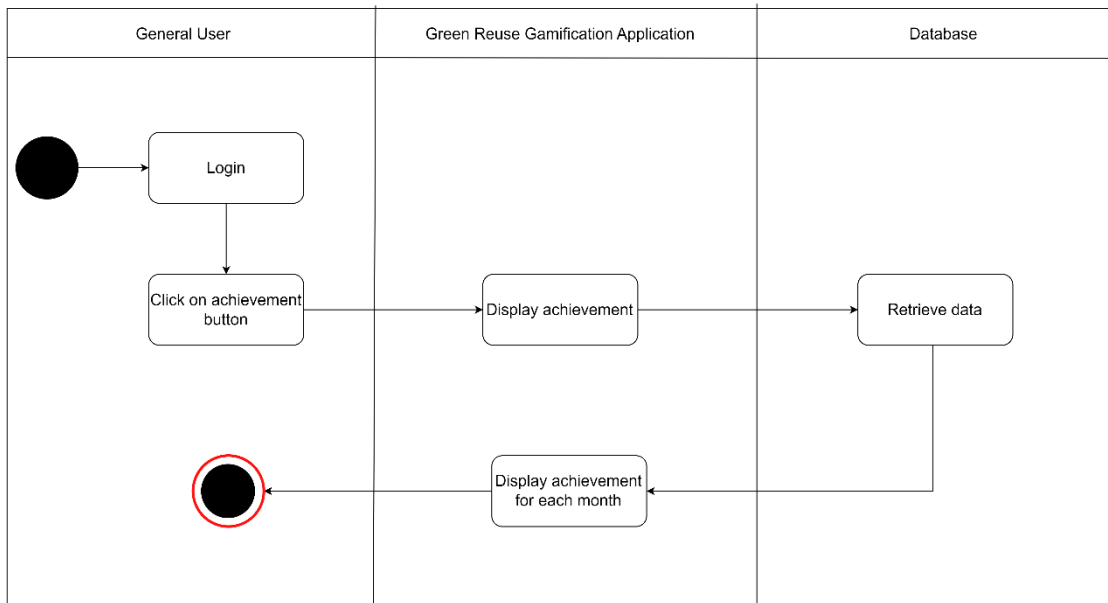
Figure 3.22   The activity diagram of achievement page
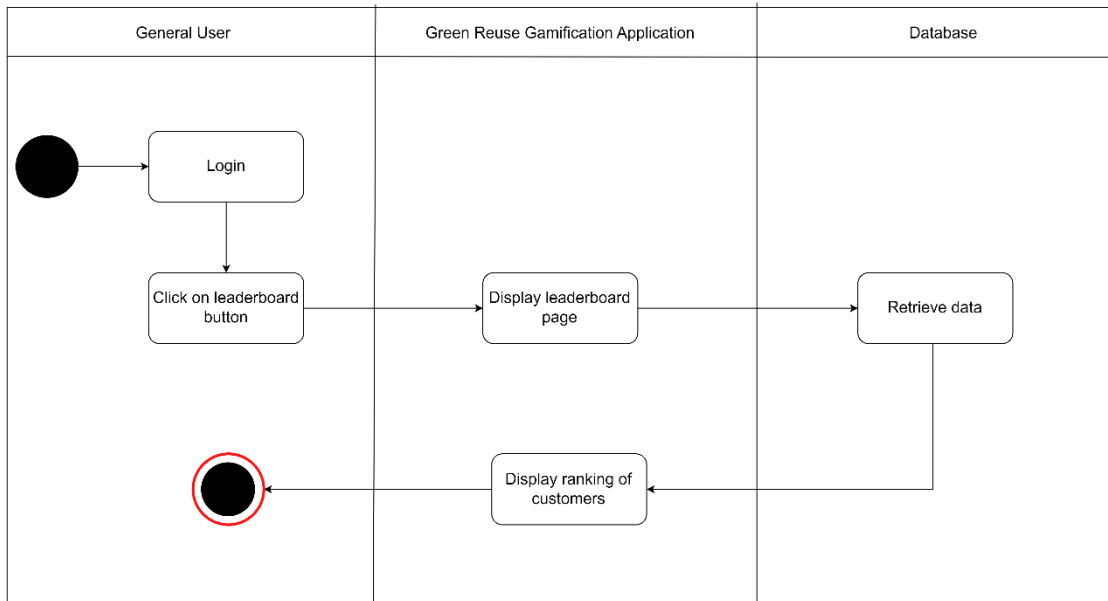
Figure 3.23   The activity diagram of customer's leaderboard page
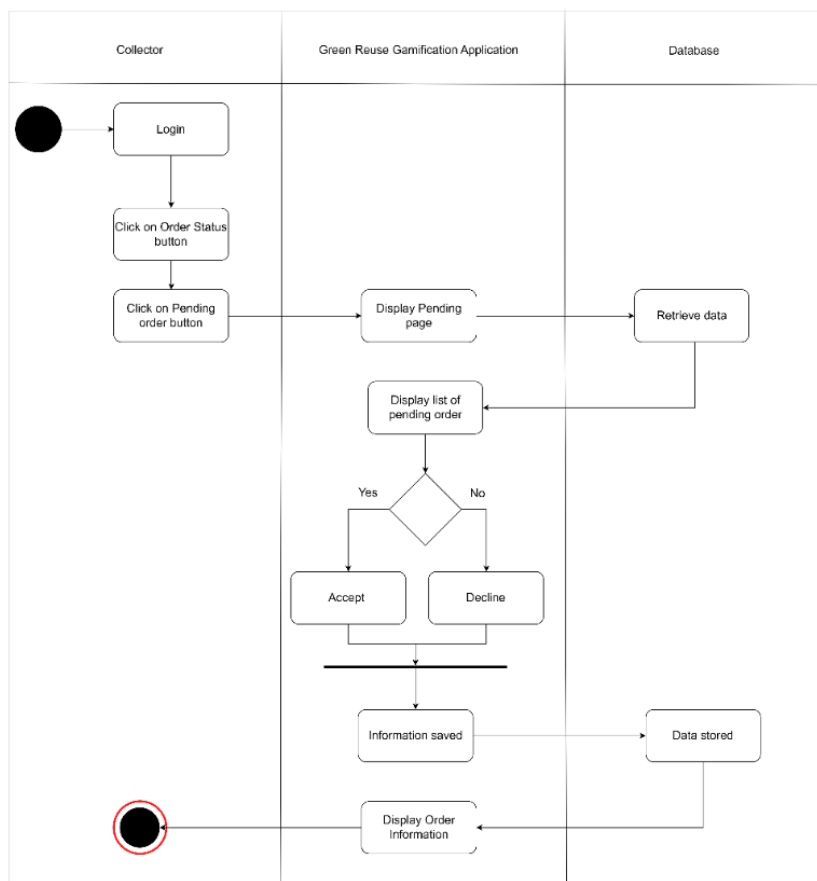
Figure 3.24   The activity diagram of collector's managing recycling request page
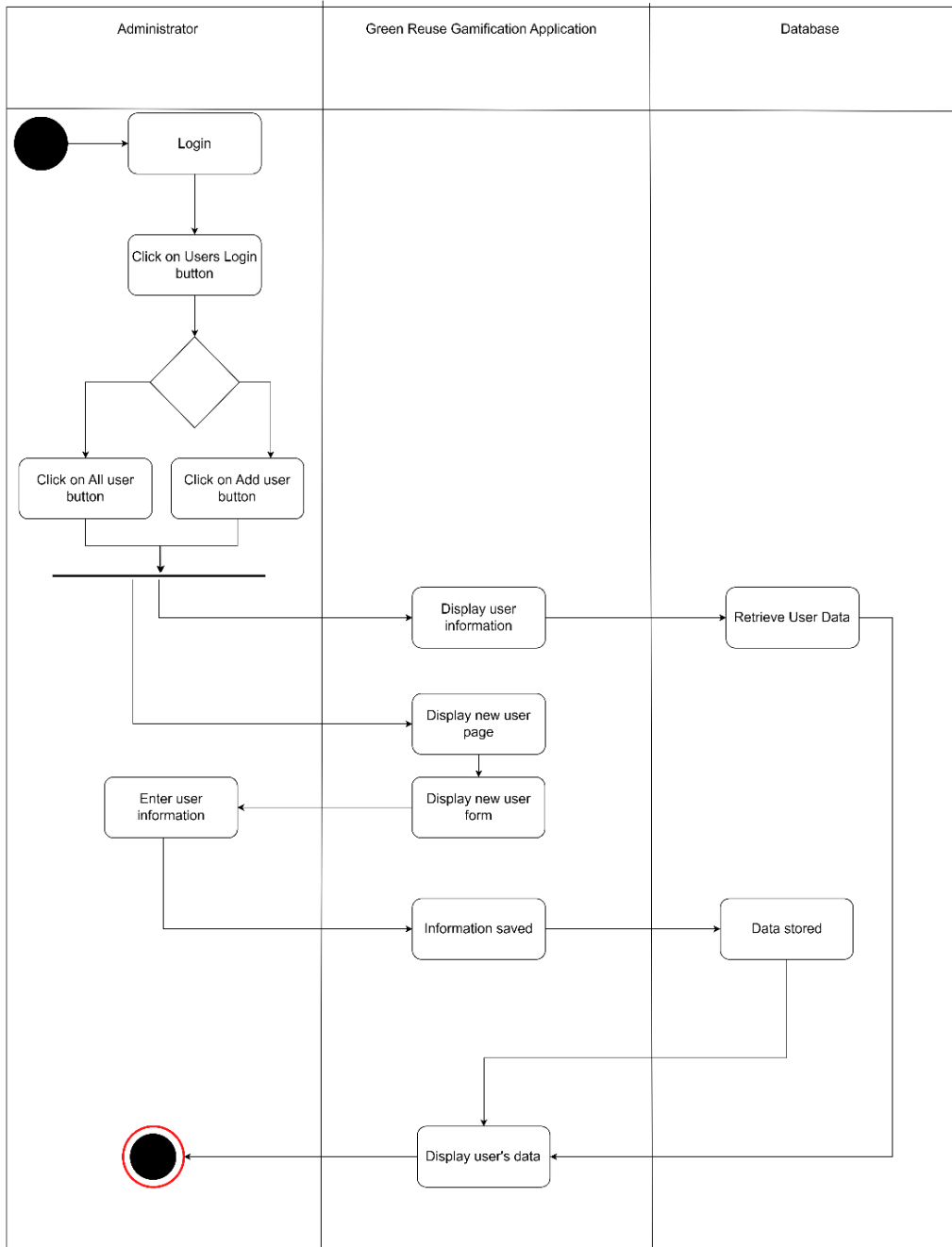
Figure 3.25　　The activity diagram of admin's managing collector page
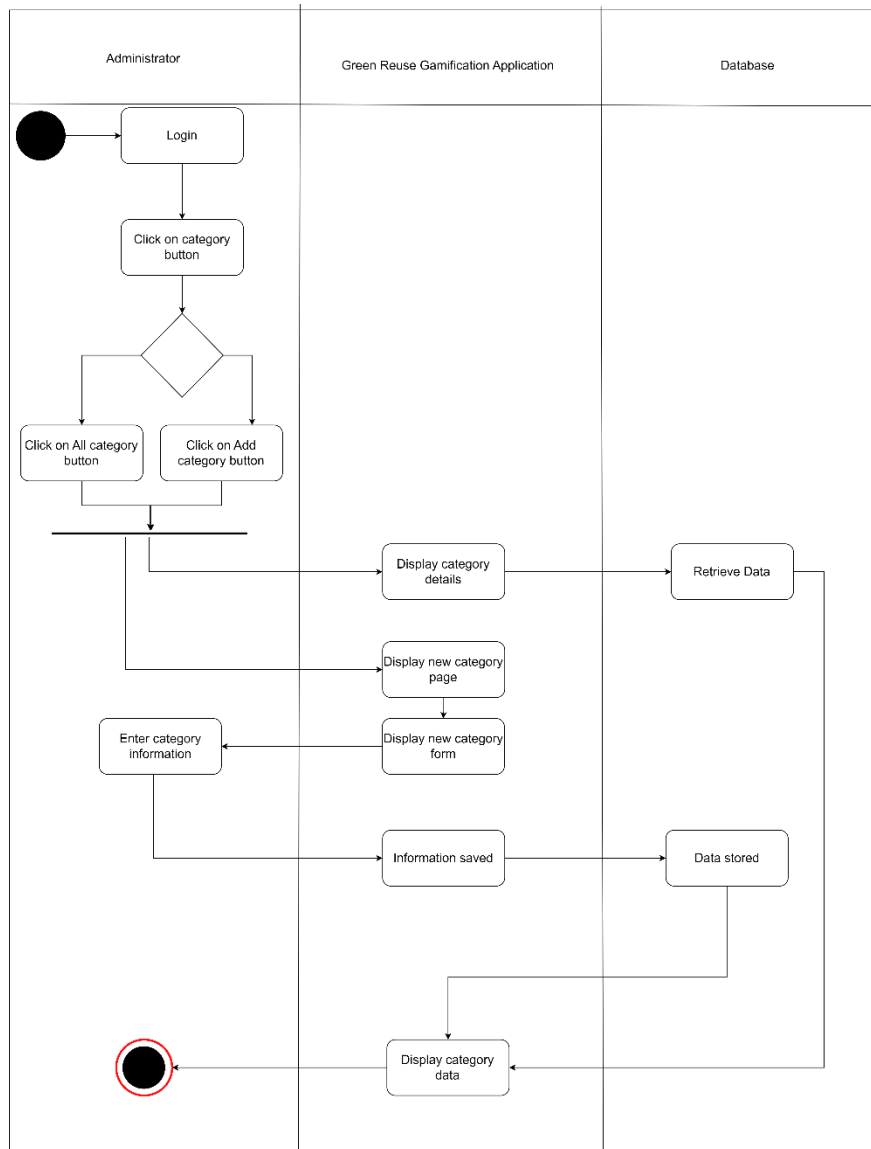
Figure 3.26   The activity diagram of admin's category page
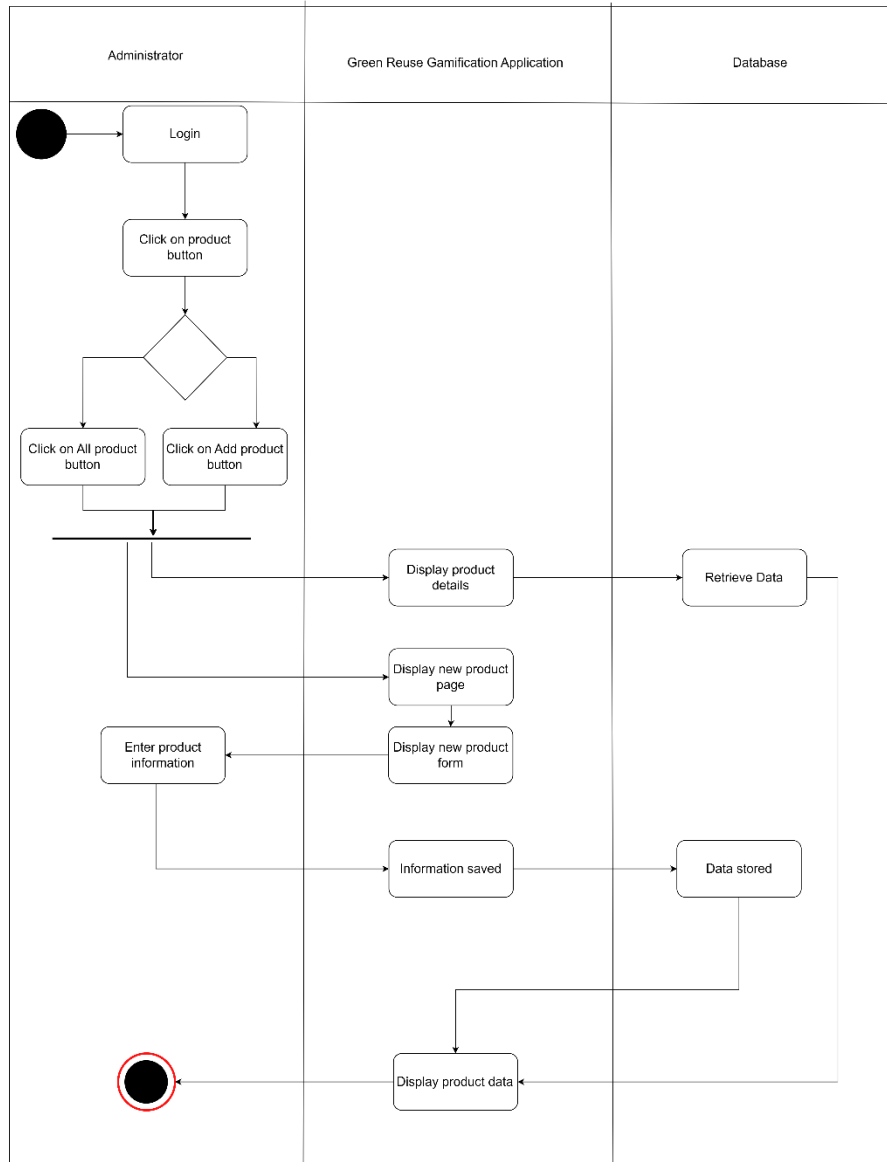
Figure 3.27   The activity diagram of admin's product page
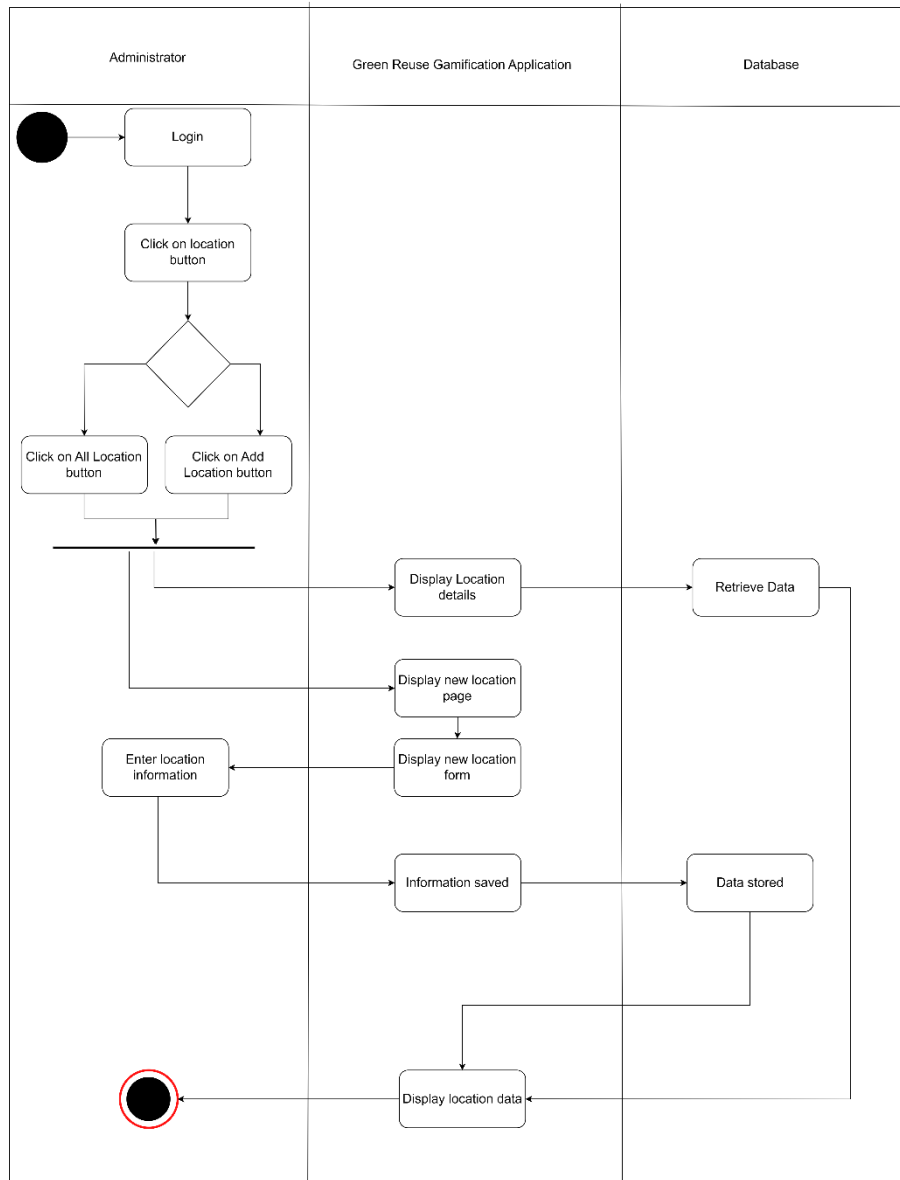
Figure 3.28   The activity diagram of admin's location page

3.2.3   Development Phase

The work begins after the team defines the requirements and design activity of the proposed system. The following phase of the SDLC is the development of the software. In this phase, developers begin writing code based on the requirements and the design that were stated in the previous stages. Visual Studio will be used in this project for scripting the code. The installation process begins with downloading the visual studio and designing the layouts of the Green Reuse Gamified Recycle Management System in HTML and CSS. Once the user creates a new account, data will be stored in MySQL. During this development phase, the main focus of the development team is on coding and unit testing to bring the product to market.

Table 3.14   Table Hardware Requirements

No.	Hardware	Purpose
1	Laptop	As a tool for documenting and developing the Green Reuse Gamified Recycle Management System process
2	Mobile Android Device	As a tools to run and test the system

Table 3.15   Table Software Requirement

No.	Software	Purpose
1	Visual Studio	Used to scripting the PHP, HTML,Javascript and CSS code.
2	Microsoft Word	As a tools for documentation and report.

3	Draw.io	Online tools use to design the diagram which are context diagram, flowchart, use case diagram and activity diagram
4	XAMPP	Act as localhost to test the admin environment
5	MySQL	For storing and generating data.
6	Figma	Used to design the interface and prototype of the application.

3.2.4 Testing Phase

Before the software is released to customers, the testing team must begin testing the system to ensure it is bug-free and conforms to the requirements documented during the requirements phase. If there is an error found on the login page, the testers will notify the developers about the problem which the developers will fix and create a new version that need to be tested again. User Acceptance Test (UAT) and Functionality Acceptance Test (FAT) surveys will be used to test products for end users. The FK community is the target user for the application deployment, and they will be given instructions on how to use the application.

3.2.5 Deployment Phase

Once the Green Reuse Gamified Recycle Management System is bug-free and fully tested. The application is ready for deployment at the client site, where the society in the FKom, UMP Pekan area will be able to use the software. The development team will be there to help and provide ongoing support to make sure the system runs smoothly if there are new bugs found they will fix. The user manual will be provided for the new customers along with the training and demo to ensure they are familiar with the app.

3.2.5.1 Entity Relationship Diagram (Erd)
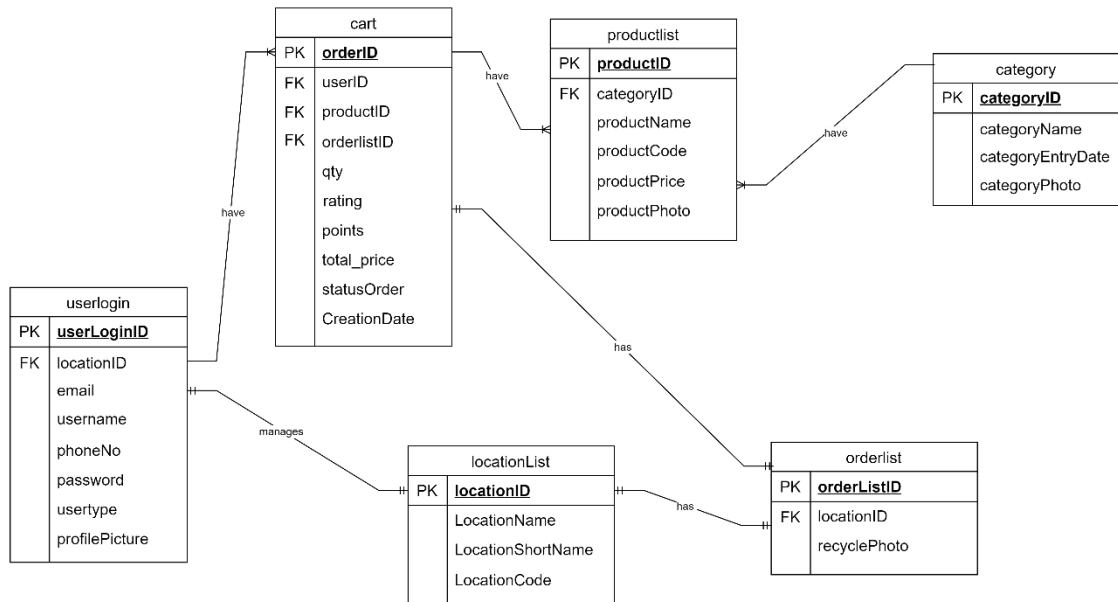
Figure 3.29   Entity Relationship Diagram

3.2.5.2   Data Dictionary

Table userlogin

Field Name	Description	Data Type	Constraint
userLoginID	Customer id, Collector id and Admin id	int(10)	PK, NOT NULL
locationID	Location for Collector	int(11)	FK
email	Email for Customer, Collector and Admin	Varchar(255)	
username	Username for Customer, Collector and Admin	Varchar(255)	
phoneNo	Phone number for Customer, Collector and Admin	Varchar(20)	
password	Password for Customer, Collector and Admin	Varchar(255)	
usertype	User type for Customer, Collector and Admin	Varchar(255)	
profilePicture	Picture for Customer, Collector and Admin	Varchar(100)	

Table locationlist

Field Name	Description	Data Type	Constraint
locationID	Location ID	Int(11)	PK, NOT NULL
LocationName	Location Name	Varchar(50)	
LocationShortName	Location Short Name	Varchar(10)	
Location Code	Location code	Varchar(5)	

Table category

Field Name	Description	Data Type	Constraint
categoryID	Category ID	Int(10)	PK
categoryName	Category Name	Varchar(50)	
categoryEntryDate	Category Date	Varchar(10)	
categoryPhoto	Category Photo	text	

Table productlist

Field Name	Description	Data Type	Constraint
productID	Product ID	Int(10)	PK
categoryName	Category Name	Varchar(50)	FK
productName	Customer id	Varchar(6)	
productCode	Transfer point	Int(10)	
productPrice	Price for product	Double(20,2)	
productPhoto	Product Photo	text	

Table Categories

Field Name	Description	Data Type	Constraint
category_id	Unique number ID for categories	Int(6)	PK
category_name	Category name	Varchar(6)	
category_description	Category description	Varchar(30)	

Table Product

Field Name	Description	Data Type	Constraint
product_id	Product id	Varchar(6)	PK
category_id	Category id	Varchar(6)	FK
product_name	Product name	Int(6)	
product_type	Type of product	Varchar(30)	

product_quantity	Quantity of product	Int(6)	
product_rate	Item rate	Int(6)	

Table orderlist

Field Name	Description	Data Type	Constraint
orderListID	Order ID	Int(10)	PK
locationID	Location ID	Int(10)	FK
recyclePhoto	Recycle Photo	text	

Table cart

Field Name	Description	Data Type	Constraint
orderID	Cart ID	Int(11)	PK, NOT NULL
userID	User Login ID	Int(10)	FK
productID	Product ID	Int(30)	FK
orderlistID	Order List ID	Int(19)	FK
receiptID	Last Name for Customer	Varchar(55)	
qty	Quantity of the product	Double(20,2)	
rating	star rating	Int(11)	
points	Rating's point	Int(11)	
total_price	Grand total of the products	Double(20,2)	
statusOrder	Order status	Varchar(50)	
CreationDate	Creation Date of the order	timestamp	

3.3   Proposed Design

The platform has a simple sign-up and sign-in interface for the user. It's designed to make it easy for the user to log in or sign up.
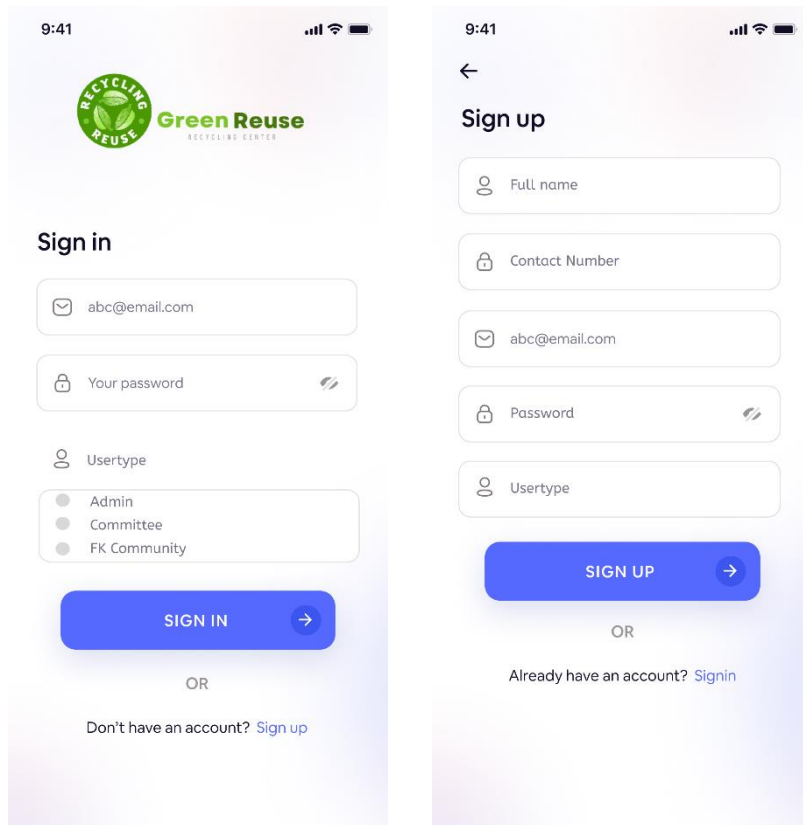
Figure 3.30   Sign In and Sign Up

The sidebar menu for users includes various options such as dashboard, products, recycle records and reports which also encompass achievements and leaderboard.
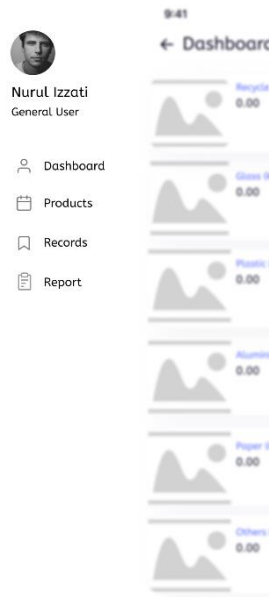
Figure 3.31   Community's Sidebar

After login, the user is taken to the homepage. The app's home page is designed to be easily navigated. When users log in to the system for the first time, this is the dashboard they are presented with.

Figure 3.32   Community's Dashboard

Figure 3.33 depicts the dashboard page, on which customers can view their progress as well as their achievement for each month in this page.
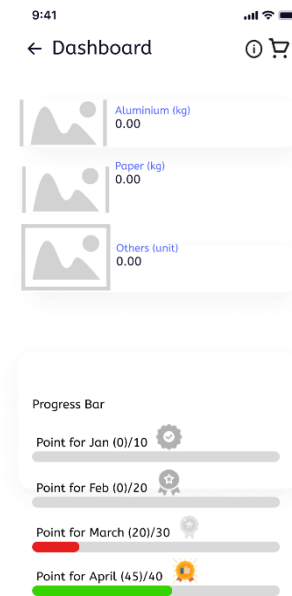
Figure 3.33   Dashboard screen

Upon clicking the dropdown menu under the "Product" section, users will be presented with a list of recycle categories, including Others, Aluminium, Paper, Glass and Plastic. The product page will then display items based on the specific type of waste selected by the user.
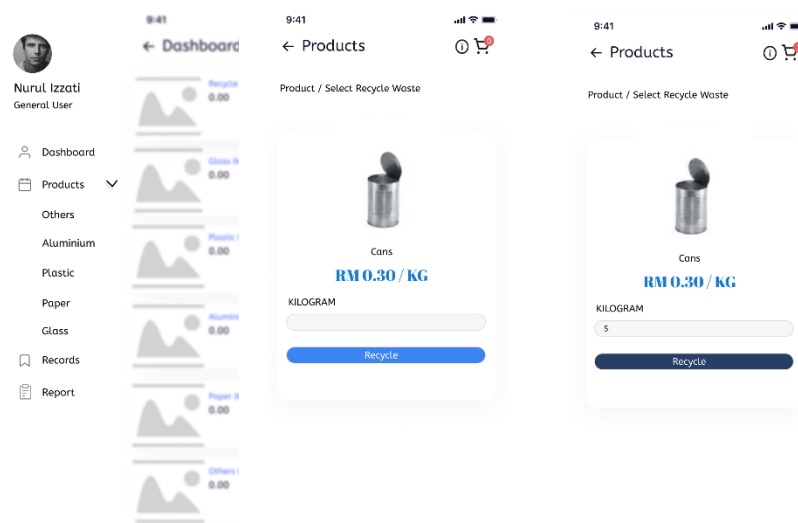
Figure 3.34   Product Section

After entering the total weight of the waste in kilograms, the product will be added to the cart. On the cart page, users have the ability to update the quantity of items, delete specific items from the cart and add more items.
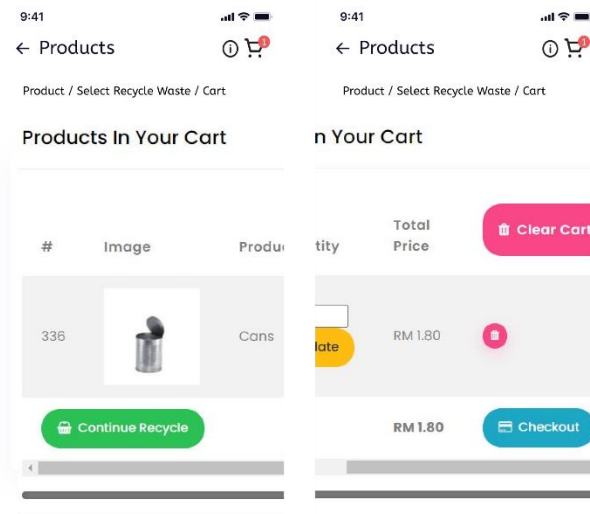
Figure 3.35   Cart page

Upon clicking the checkout button, users will be redirected to the checkout page where they are required to fill out a form. The form will include fields for necessary information and will allow users to upload a picture of their recyclable waste as proof. Once the form is completed, users can submit it to committee to approve. Subsequently, a receipt will be generated.
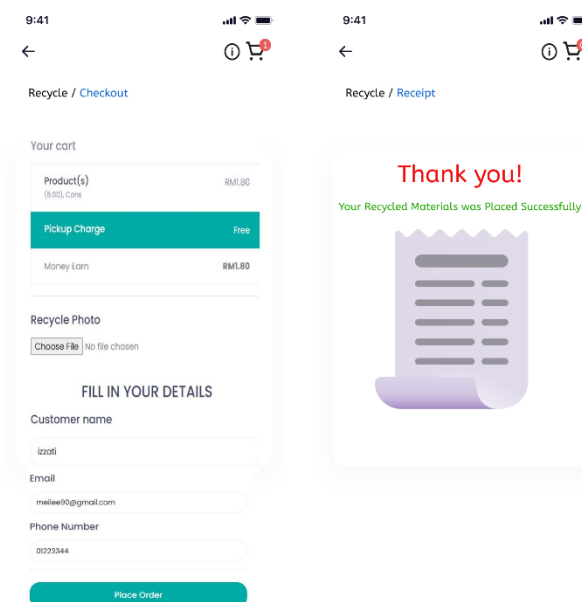
Figure 3.36   Form Registration and Receipt

Once the administrator approves the user's request, they will receive a notification in the recycle record section indicating whether their recyclable waste has been accepted or not. Users will also have the ability to view their achievements in the system.
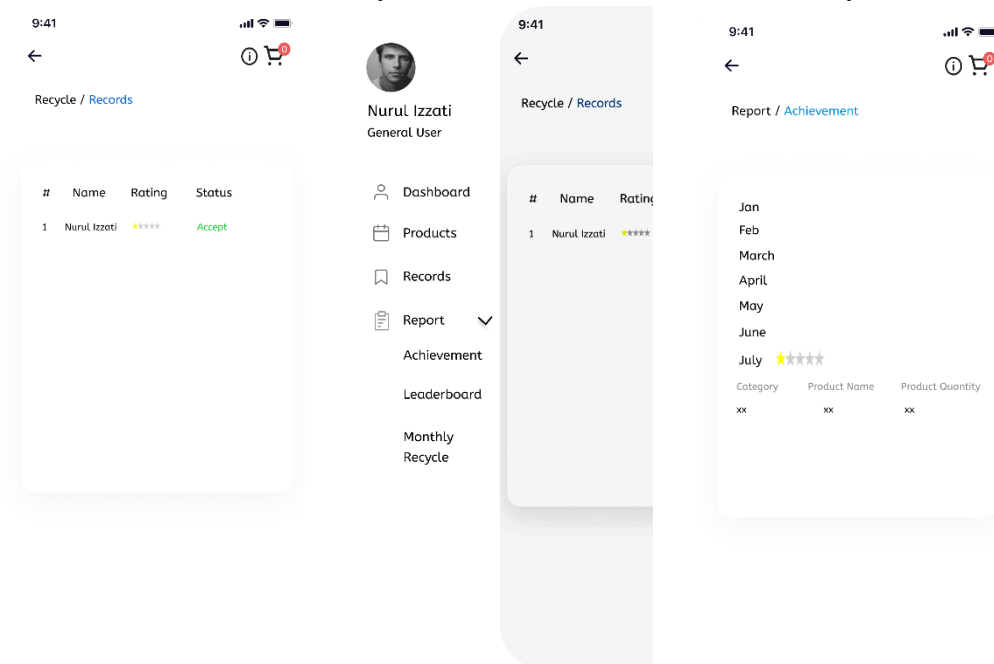
Figure 3.37   Recycle record page and Achievement page

The leaderboard page is intended to serve as a form of competition for recycling users, as this is a method of encouraging people to recycle. This section displays the scores and levels of users, allowing users to compare their own performance with other players.
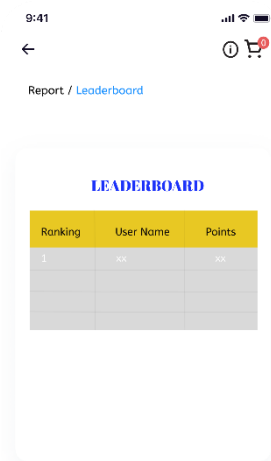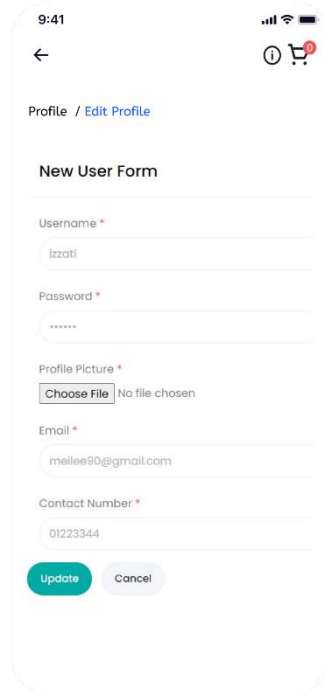
Figure 3.38   Leaderboard Page

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Here, users can manage their profiles. Users can edit their first name, last name, email and even contact number on this page. The function of the update button is to update the data that has been entered by the user. The user will receive a successful message, meaning that the data has been saved and updated in the database.

Figure 3.39   Profile page

Here is the login interface for the admin. The interface is simple and easy to access. The admin needs their username and password to log in to the app.
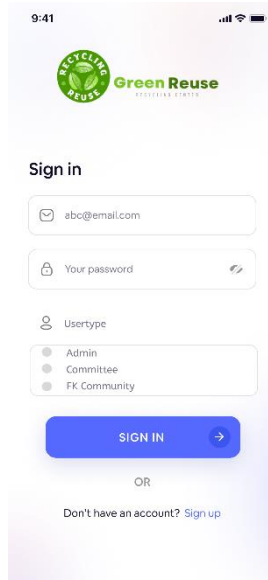
Figure 3.40   Login page for admin

Once logged in, the homepage will be displayed. The administrator can also view the Fkom community's total number of items recycled. The total will be updated based on the number of recycled items. The admin can also view the community's ranking in leaderboard.
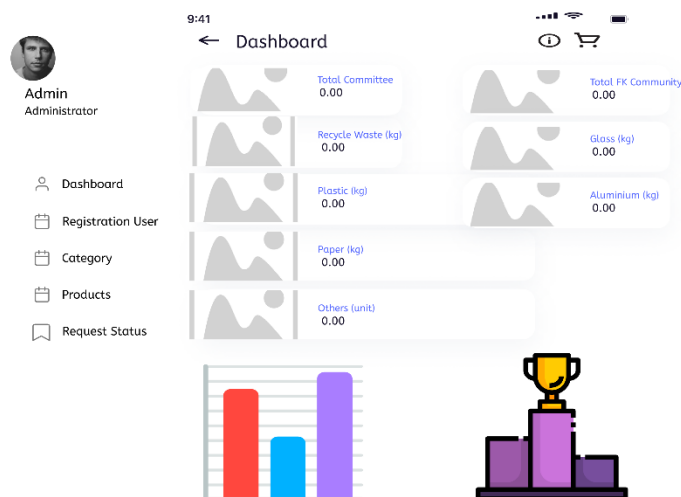
Figure 3.41   Home page for admin

Administration is the person in charge in recycling management. The administrator will assign the product based on the specific waste category as shown in Figure 3.42.
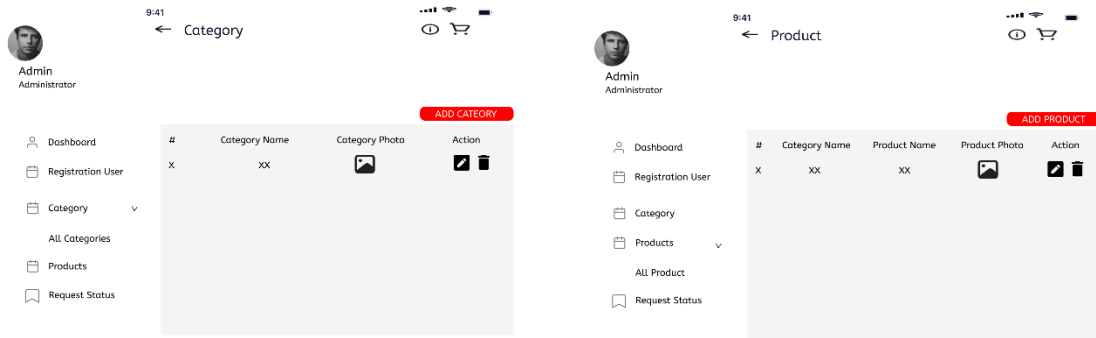
Figure 3.42   Category and Product Page

The administrator also has right to accept or reject the customer's request if certain information is unclear or unrelated to the recycling process.
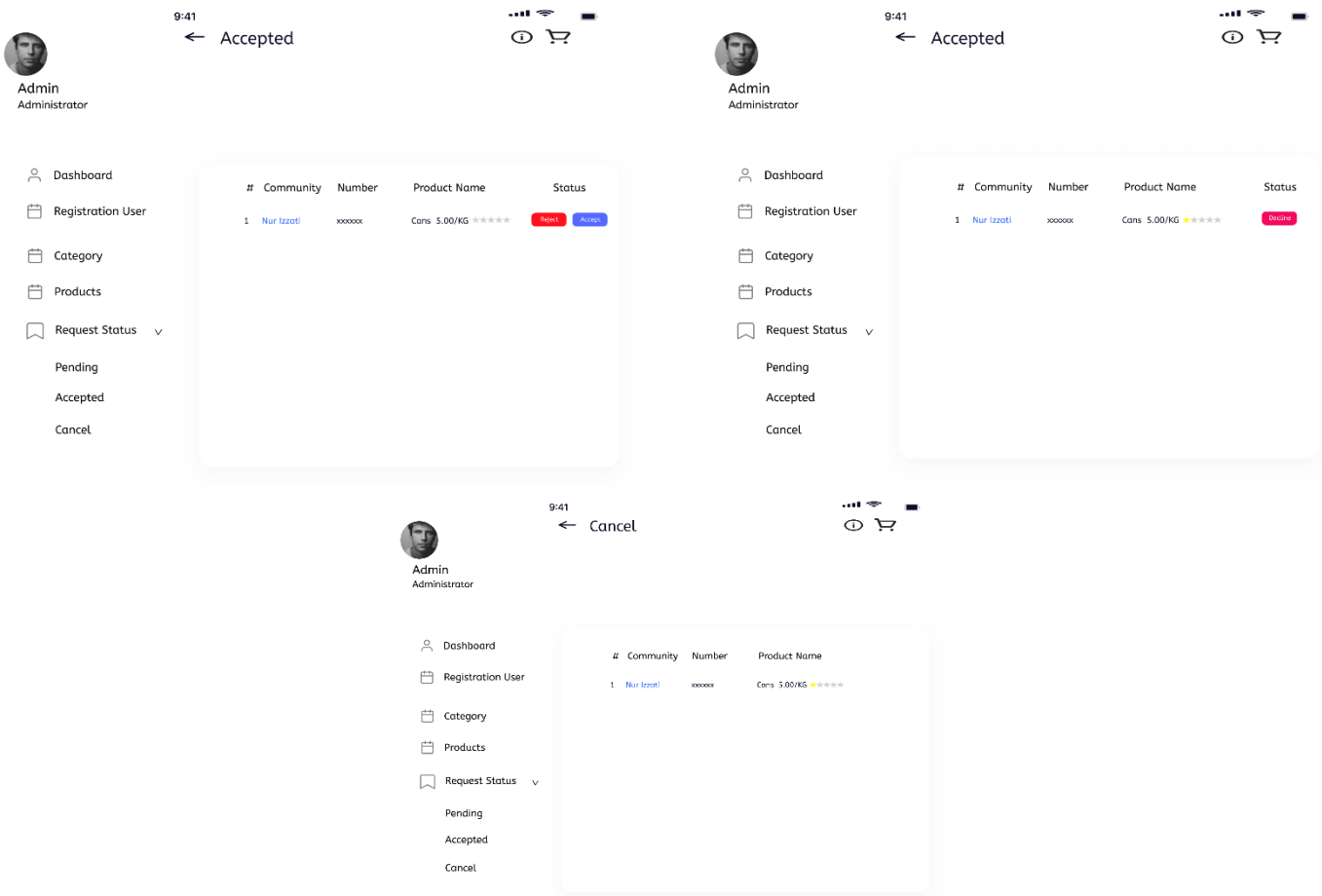
Figure 3.43   Request Status

Here is the login interface for the Committee. The interface is simple and easy to access. The committee needs their username and password to log in to the app.
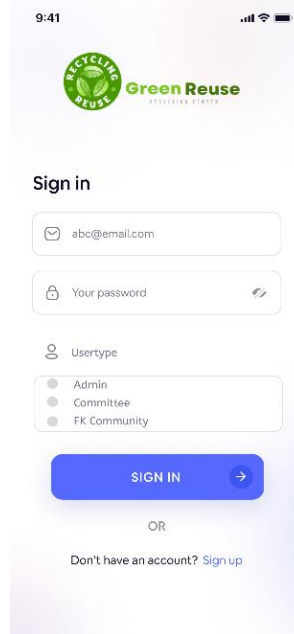
Figure 3.44   Login Page for Committee

Once the committee members sign into the system, they will have access to a dashboard specifically designed for them. This dashboard will feature a bar chart that depicts the quantity of recyclable waste by month, providing a visual representation of the data. Additionally , another bar chart will display the distribution of recyclable waste by type, allowing the committee members to easily analyze and understand the different types of waste being recycled.
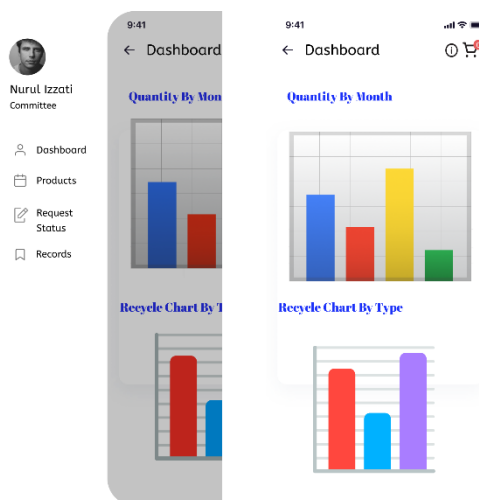
Figure 3.45   Committee's Dashboard

The committee members also have ability to make a recycle request on behalf of the community. This feature allows them to initiate and submit recycling requests., contributing to the overall recycling efforts of the community.
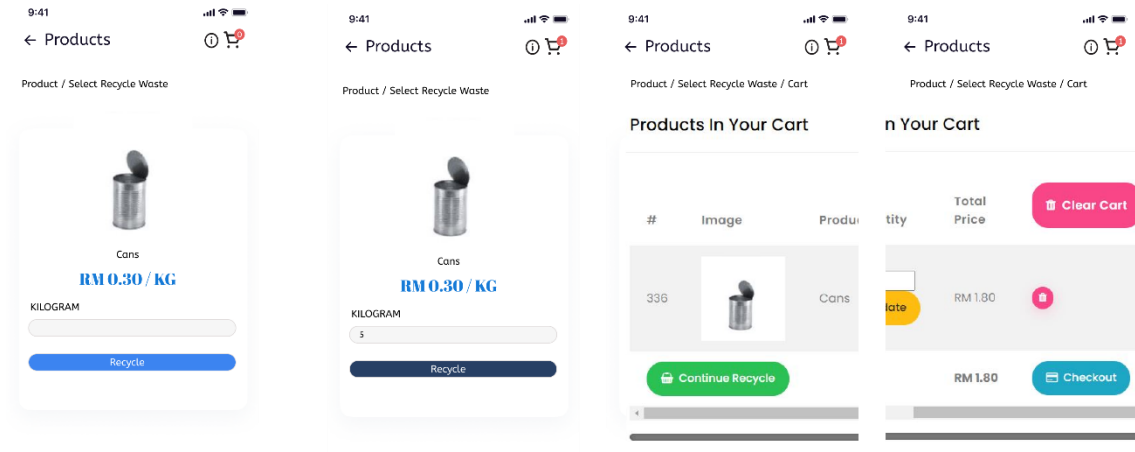
Figure 3.46   Product Page and Cart Page

The receipt will display the details that the committee members entered in the form. This includes information such as type and quantity of recyclable waste, and community details and additional notes. The receipt serves as a record of the request and confirms the details for future reference.
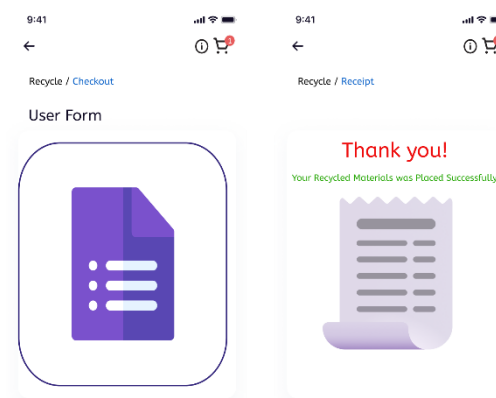
Figure 3.47   Request Form and Receipt

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The committee members have the capability to manage both the requests for recyclable waste from the community and their own internal requests. This management functionality allows the committee to review, track and prioritize incoming requests, as well as assign resources or take necessary actions.
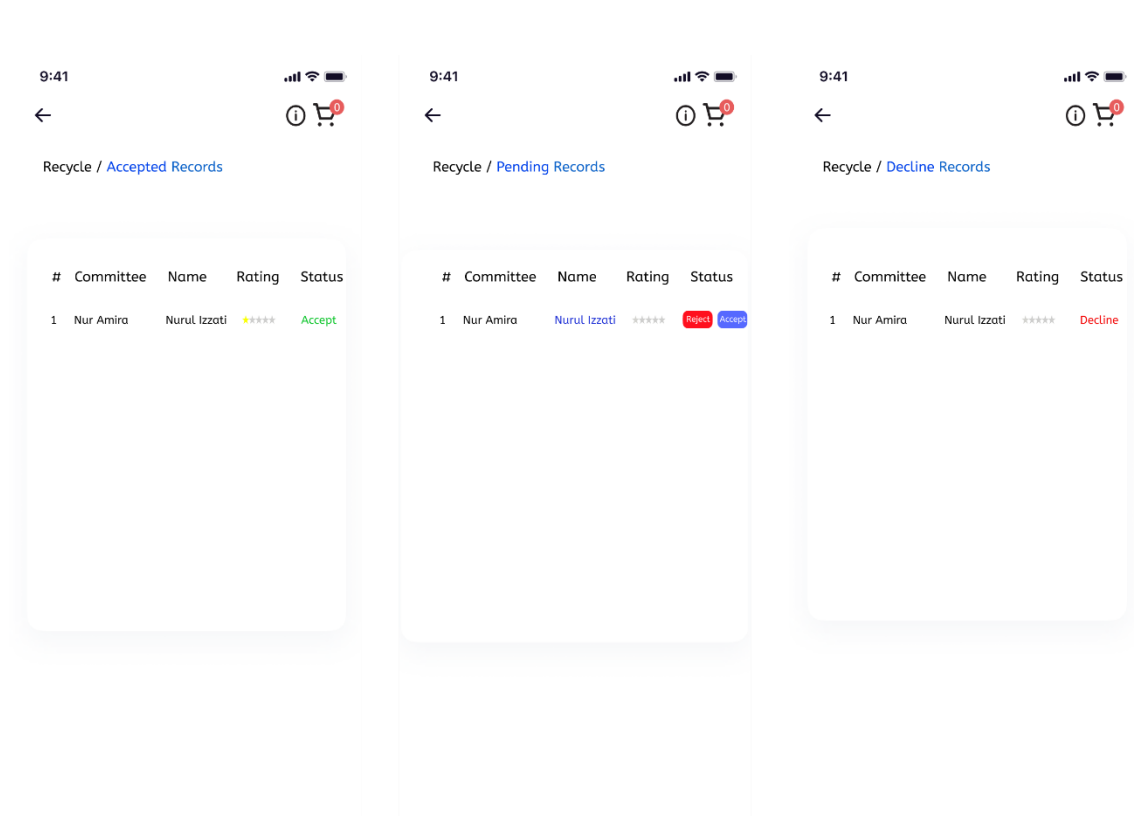
Figure 3.48   Request Action for the Committee

3.4 Evaluation

Following the conclusion of the system design, implementation will commence. Initially, the database's framework will be constructed during the development stage. The server side and client side were also developed to facilitate interaction among customers, collector and admin. Few unit tests are executed during the testing phase to test the system. This is to ensure the reliability of the system.

Two different testing methods will be used in this project to evaluate how satisfied users are with the proposed application. Formative to evaluates the system's functionality. It is testing for developer and a user known as User Acceptance Testing. Testing will be done by Faculty of Computing Community. As a developer, it is imperative that the developer carry out this test in order to make sure that the functionality of the system is operating as intended.

Next, the usability testing questionnaire will be tested by members of the EKSA committee for the summative evaluation.The purpose of this testing is to collect user acceptance and satisfaction ratings for the application.

3.5   Potential use of proposed solution

Green Reuse Gamified Recycle Management System is a web-based system aimed at making it easier for the FKom Community to recycle materials. This recycling app uses gamification to motivate users. The purpose of the application is to make recycling more fun and rewarding experience for users by incorporating gamification elements like points, badges, leaderboards, rewards and challenges. By applying gamification elements it encourages users to take an active role in recycling initiatices, to track their progress and engage in friendly competition with others. This application also shows users achievements based on how much they recycle. When they recycle a certain number of items or reach a certain goal, they will be rewarded stars as for their hard work.

Committee are in charge of managing the recycling process as well as looking over the customer request. The collector has the right to either accept or cancel the request based on the requirement.

The responsibility of overseeing the recycling process is assumed by the administrator of the recycling application anmely EKSA. The operations of the application are overseen by EKSA which possesses the authority to assign collectors for the purpose of performing pick-up and collection tasks.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

Chapter 4 will discuss the development, implementation and testing of Green Reuse Gamified Recycle Management System. This responsive website is implemented for Community of FKom and EKSA who are responsible for managing the recycling of the waste in the FKom, UMP Pekan region. The tools used to develop the gamified Green Reuse Gamified Recycle Management System include the code editor Visual Studio Code, the database server MYSQL, and the scripting languages PHP and Javascript as well as implement gamification elements to encourage and motivate users to recycle waste. The website undergoes testing to identify and fix any issues that may have cropped up during its creation.

4.2 Development Tools

Table 4.1 shows the tools that are used to develop the Green Reuse Gamified Recycle Management System.

Table 4.1   Tools used for developing the system.

No	Tool	Purpose
1	Microsoft Visual Studio	For scripting
2	Canva	To create and edit image
3	Xampp	Local server
4	MySQL	Used to store and manage database

4.3   Implementation

This section detailed the development and implementation of the system. This project employed various several software tools such as VS Code, Bootstrap, XAMPP, Mysql, CSS and HTML.

4.3.1   Designing Logo

Designing the application's logo is an initial step that must be completed before system development can begin. Canva is just one of the many free online tools that are available to help design a simple but appropriate logo for this application.

This logo uses the recycling symbol, text, and green color scheme to encourage recycling and promote an environmentally friendly. Figure 4.1 shows the example of editing logo in Canva.
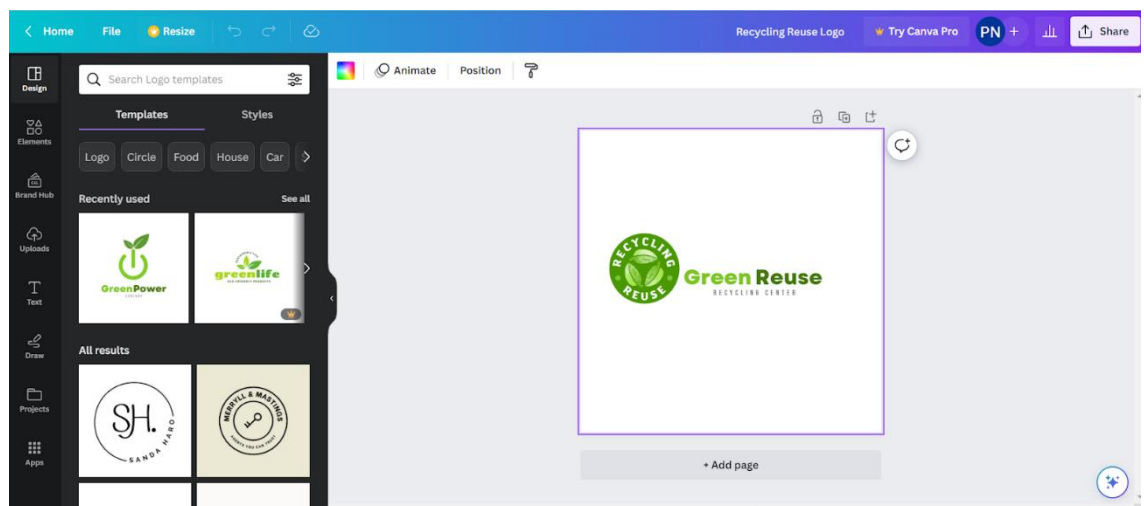
Figure 4.1   Example of editing a recycling logo in Canva

4.3.2 Creating Database

In this project xampp is used to run localhost as a local server and execute PHP pages in order to simulate how a website will perform on a live server and test the performance of a website. This enables testing of the website before deployment on the live server. Figure 4.2 and Figure 4.3 shows the XAMPP control panel and database in the PhpMyAdmin interface of the project.
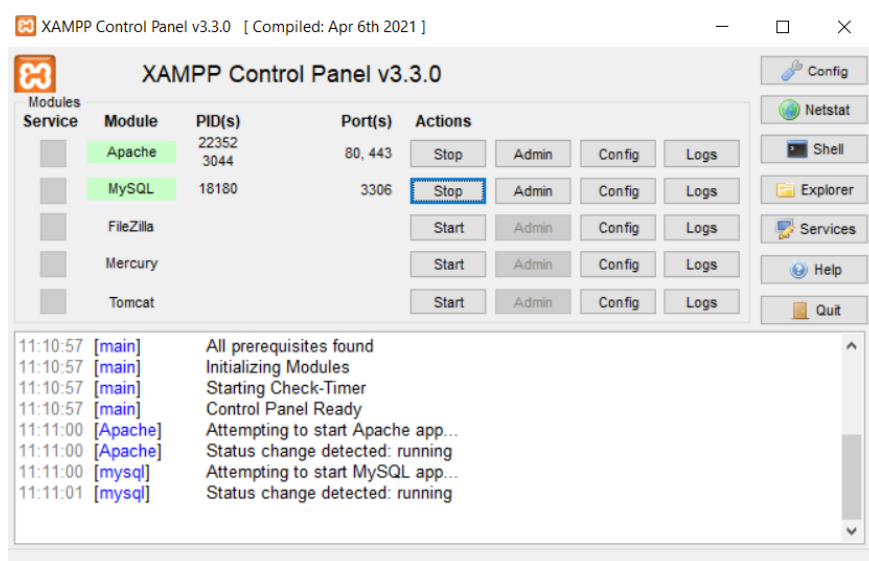
Figure 4.2   Xampp Control Panel
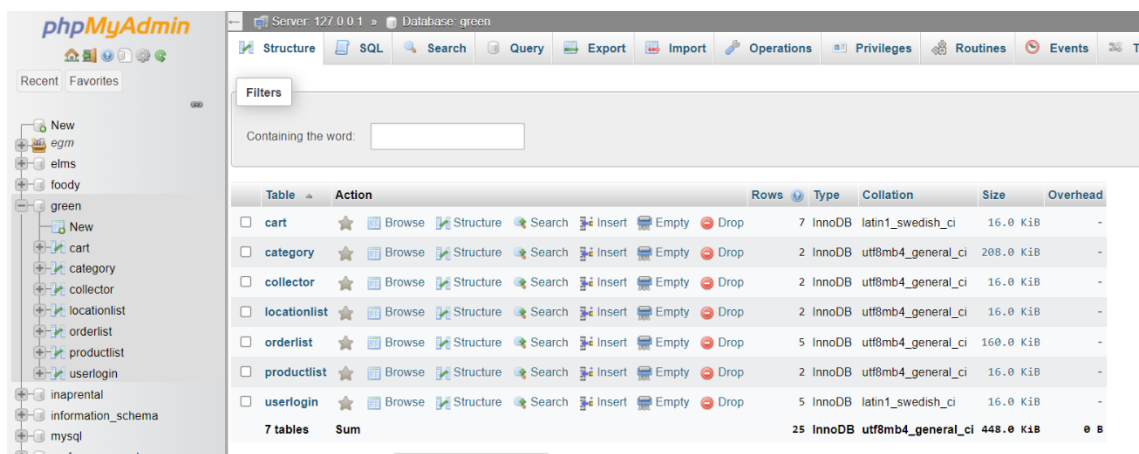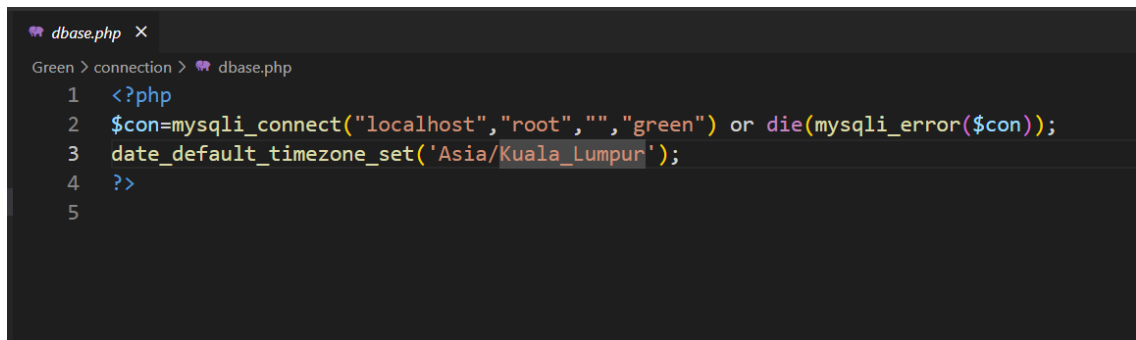
Figure 4.3   PhpMyAdmin interface

4.3.3 Create Database Connection File In Php

Create a separate database connection file and name it dbase.php and save it. By creating a separate database connection file is because to reuse that code in all of other files that require the database access. Additionally, it can help prevent errors that could arise from duplicate the database connection code in multiple files. Figure 4.4 shows the database connection file.


```php
<?php
$con=mysqli_connect("localhost","root","","green") or die(mysqli_error($con));
date_default_timezone_set('Asia/Kuala_Lumpur');
?>
```
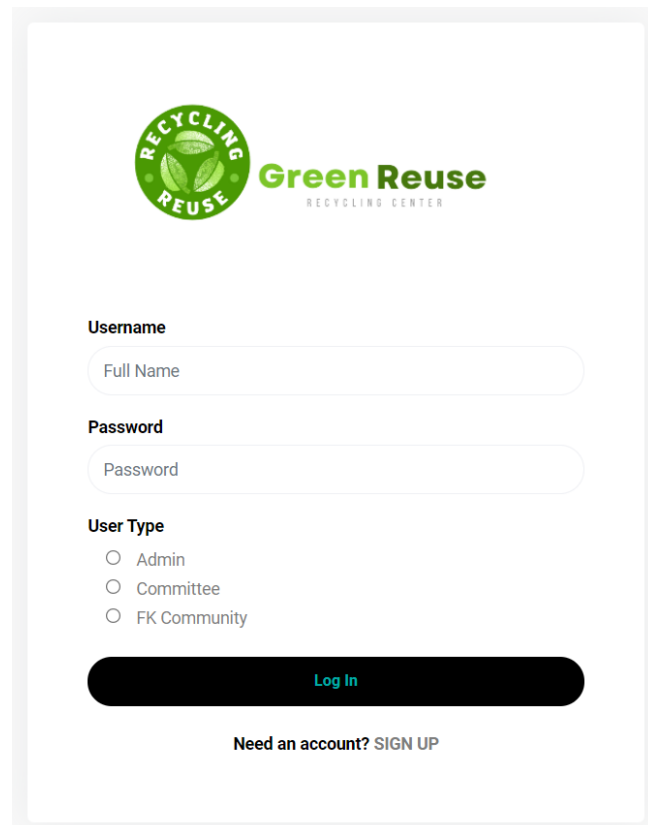
Figure 4.4   Database connection file

4.4   Implementation Process

The next step is to begin the system development process after designing the system's logo and implementing its corresponding database. This system has three types of users which are super admin, collectors and general user. The objective of this system is to incentivize people to get involved in recycling practices with the help of gamification techniques. Overall, the most effective approach to getting people to recycle with gamification is to make it fun, educational and rewarding. This method can help foster a recycling culture.

4.4.1 Login Page

Figure 4.5 shows the login page of Green Reuse Gamified Recycle Management System. The login page will be utilised by three distinct user categories which are super admin, collector and general user. User need to login in order to enter the system. There is a login form that user need to fill in and log in to enter the system.

Figure 4.5   The login page of Green Reuse Gamified Recycle Management System.

4.4.2 Registration Page

Figure 4.6 shows the sign up page to Green Reuse Gamified Recycle Management System. First-time users must create accounts before they are able to log in the system. On the registration page, users must fill out a sign up form with their username, contact number, email, password and user type.

Figure 4.6　　Sign up page

4.4.3 Homepage

After users have successfully logged in to the system according to the user type, they will automatically be redirected to the homepage as shown in Figures 4.7, 4.8 and 4.9.
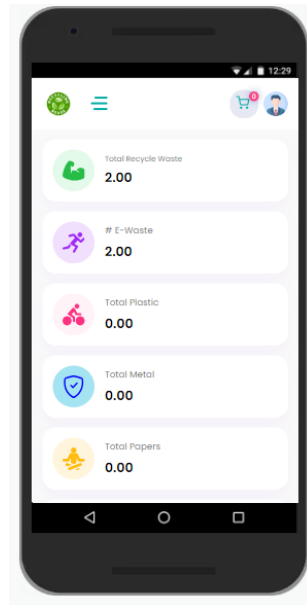
Figure 4.7   Homepage for Community
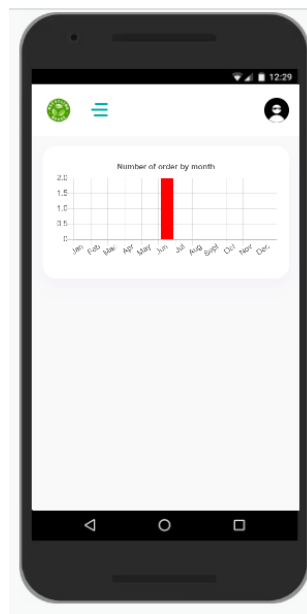
Figure 4.8   Homepage for Committee
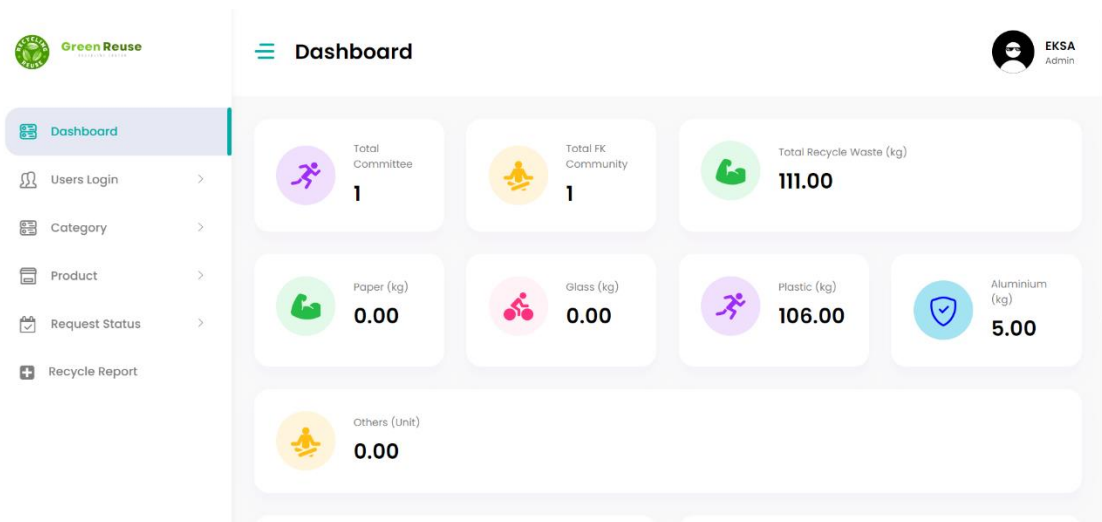
Figure 4.9   Homepage for super admin

4.4.4   Admin Page

Dashboard Page

The super administrator has complete authority over the Green Reuse Gamified Recycle Management System including being able to manage collectors, categories, products, and locations as shown in Figure 4.10 below. This level of control lets the Super Admin monitor the system. The dashboard allows the Super Admin to keep track the total number of users who are actively using the system, which aids the super administrator in accessing the system level of acceptance .
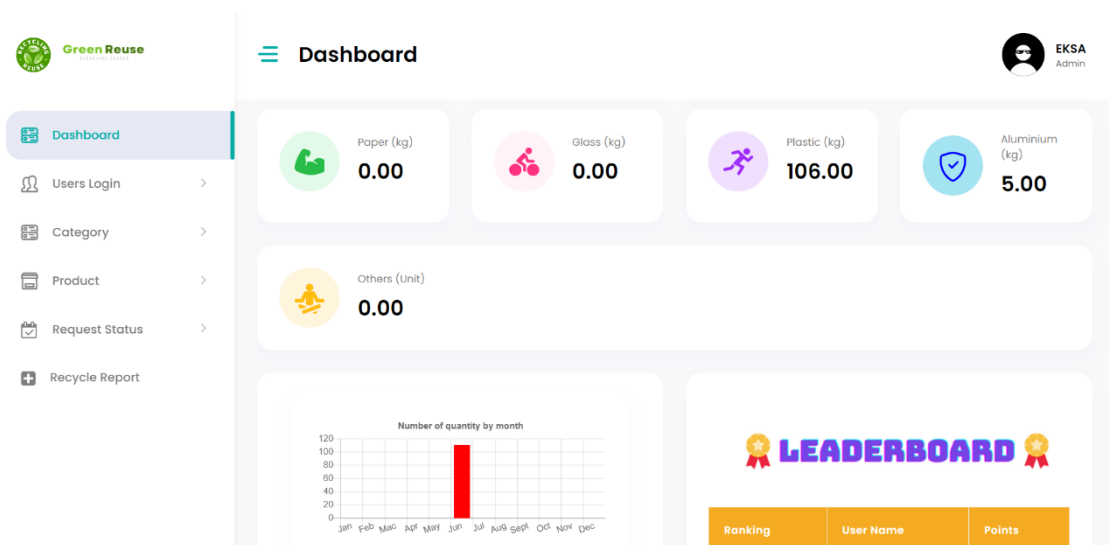
Figure 4.10   Super Admin's Role

<u>Collector Registration Form</u>

Figure 4.11 shows the registration form for collectors. The super admin is in charge of assigning and registering new committee who are in charge of collecting and sorting recyclable material.

Figure 4.11   Registration form for committee.

Once the committee have been assigned and registered, the super admin will be able to view the information about the committee and perform actions such as updating and deleting any committee that has been selected as shown in the Figure 4.12 and Figure 4.13.

Figure 4.12   Committee's information

Figure 4.13   Update Collector Information

When super admin click the " update " button, a message indicating that the record has been updated pop up as shown in Figure 4.14.

Figure 4.14   Updating Message

Manage Categories, Product And Location

Figure 4.15   Category Form

Figure 4.16   Product Form

4.4.5   User Page

Dashboard Page

Figure 4.17 display the user's recycling progress. The user dashboard provides users with the ability to keep track of their recycling progress including the quantity of waste that has been recycled. This can assist users in tracking their environmental impact and encouraging people to recycle more. There are four modules which are "Dashboard", "Products", "Recycle Record", and "Report".
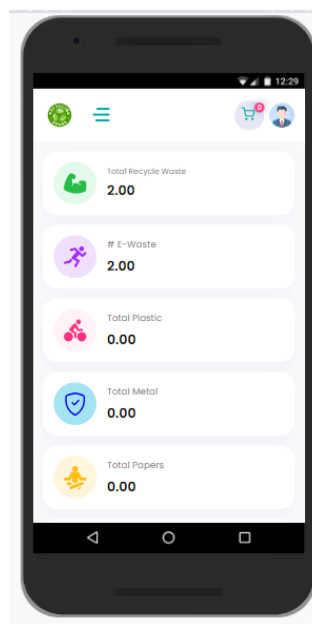
Figure 4.17   Recycling Progress

Product Module

The user has the option to choose between two types of recycling: E-Waste and Aluminium. If the user choose "e-waste" category, they can choose between a laptop or mobile phone and enter the quantity of waste in kilograms. After selecting a category and entering the amount of waste in kilograms, the user can start the order placement process by clicking the "Add Order" button as shown in Figure 4.18.
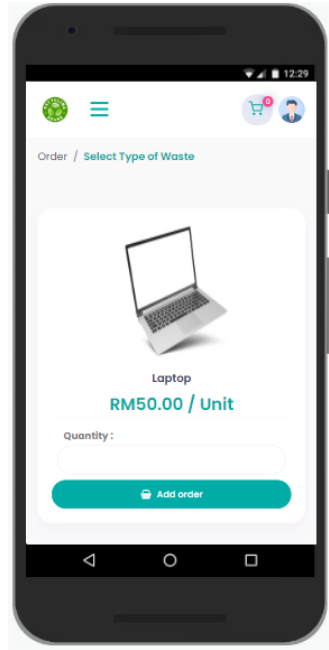
Figure 4.18   E-waste

When a user places a recycled item , it is added to the cart after they click the "Add Order" button. The total number of orders that the user has put in the cart will then be shown on the cart icon as shown in Figure 4.19.
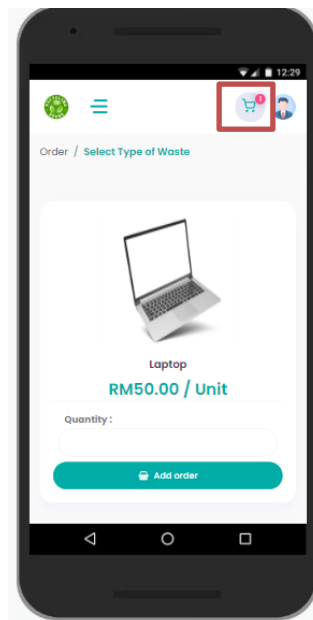
Figure 4.19   Cart Icon

As can be seen in Figure 4.210 the selected items are placed into the recycle cart. Products selected by the user are automatically added to the recycle cart. To make updates, the user can change the quantity of each item and click "Update" to save the new values. As shown in Figure 4.21. The final product price will change in response to the user's selection.
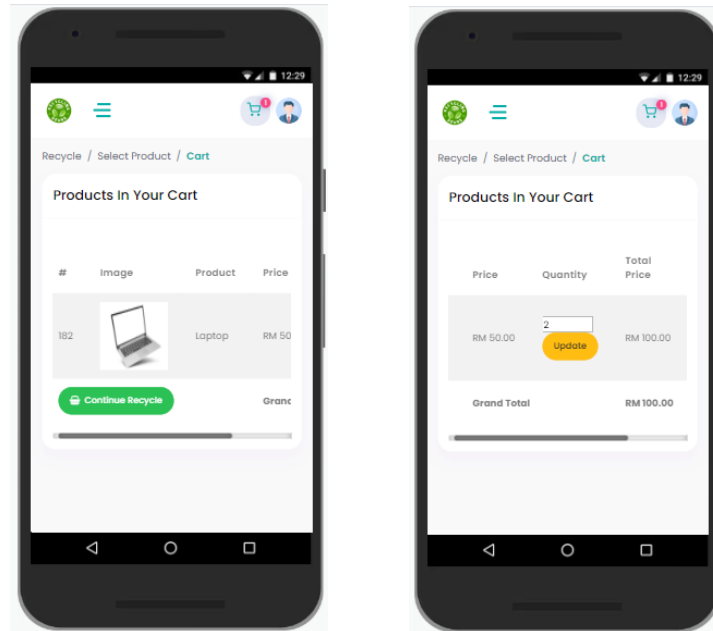
Figure 4.20   Products in the recycle cart
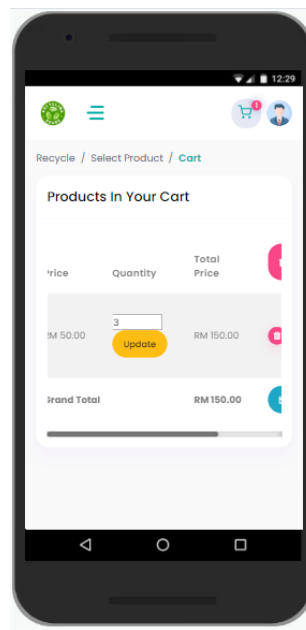
Figure 4.21   Update quantity

Figure 4.22 shows the checkout form. The user will be taken to a form where they can provide their information after clicking the "Checkout" button. This page will display the user's profile information as well as the product details for the items in the user's recycle cart. In addition, the user will be asked to choose a recycling location from which they can pick up the recyclable material. This step is essential because it makes sure that the recyclables are picked up from a single location and then transferred to the proper recycling facilities.
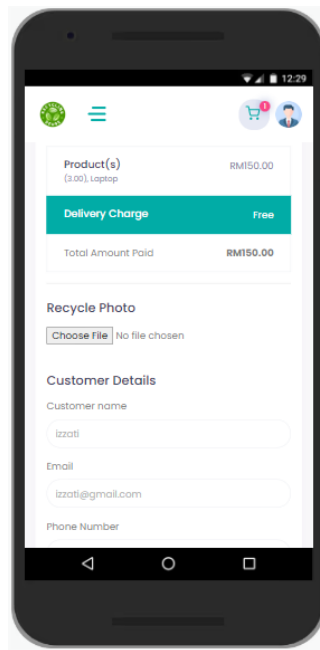
Figure 4.22   Checkout Form

A success message is shown in Figure 4.23 after the user clicks the "Place Order" button. The notification states that the order was successfully placed.
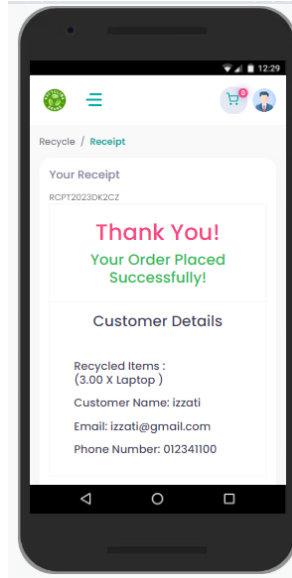
Figure 4.23   Successfully Message

Recycle Record Module

Figure 4.24 shows the recycling status. After placing their recycling order, users can check the status of their order on this page. The order status may show whether the collector has approved, denied, or delayed the order.
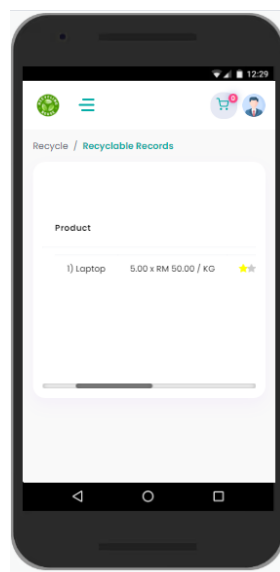
Figure 4.24   Recycling Status

Figure 4.25 shows the achievement progress. Monthly achievement are represented by stars. These stars are awarded based on the amount of recyclables of waste that is recyclable. If the amount of recyclables is equal to or greater than 5, the user receives 1 star. If the quantity is 10 or greater, they receive 2 stars. Likewise, if the quantity is equal to or greater than 20, they receive 3 stars. Higher thresholds generate more stars, showing users how well they recycle progress visually.
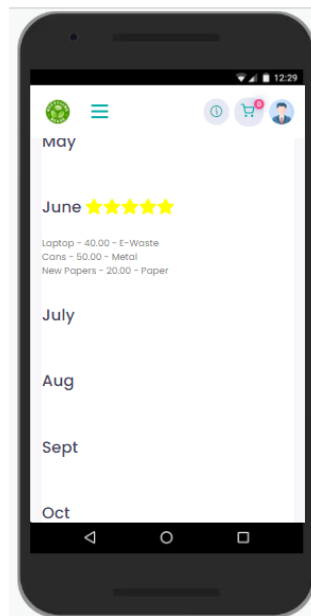
Figure 4.25   Achievement Progress

<u>Leaderboard Module</u>

This module ranks users based on how much recyclable waste they bring in as shown in Figure 4.26 below. This creates a sense of competition and encourages users to try to get to the top. It encourages people to recycle more and shows how much they care about the environment.
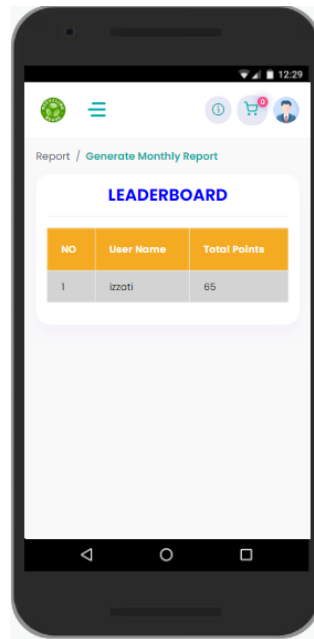
Figure 4.26   Leaderboard Module

<u>Report Module</u>

Figure 4.27 shows the monthly report. The report is for monthly recycling for a specific month range. The user can choose a specific month to generate the recycling .
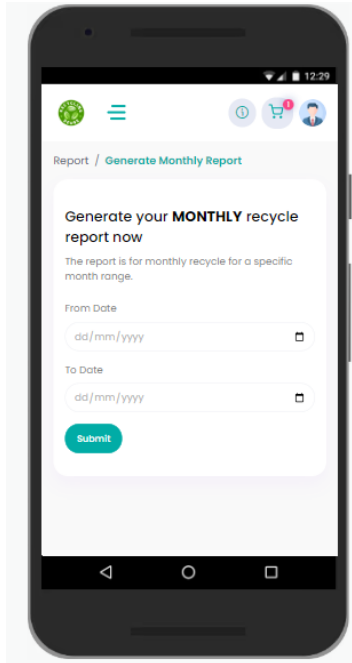
Figure 4.27   Monthly Report

Figure 4.28 shows the recycling report for the month of June. This report details the quantity of recyclable materials that were collected and processed during that time period.
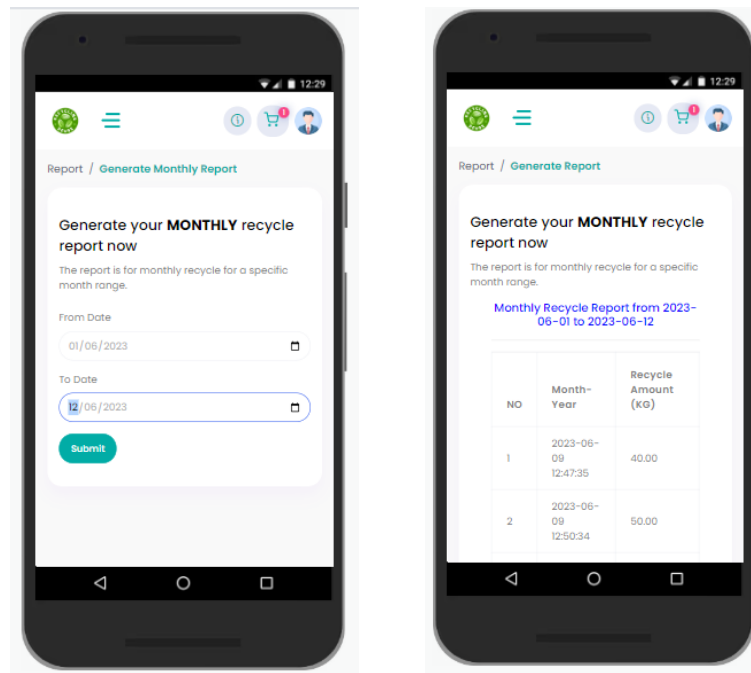
Figure 4.28   Monthly Recycling Report

4.5   Coding

The languages used in development are PHP and JavaScript. The scripts are created and edited in Visual Studio Code.

Figure 4.29   Coding for login page

Figure 4.30   Coding for sign up

```
<div class="col-sm-3">
    <div class="card avtivity-card">
        <div class="card-body">
            <div class="media align-items-center">
                <span class="activity-icon bgl-secondary  mr-md-4 mr-3">
                    <svg width="40" height="37" viewBox="0 0 40 37" fill="none" xmlns="http://www.w3.org/2000/svg">
                        <path d="M1.64826 26.5285C0.547125 26.7394 -0.174308 27.8026 0.0366371 28.9038C0.222269 29.8741 1.07449
                        30.5491 2.02796 30.5491C2.15453 30.5491 2.28531 30.5364 2.41188 30.5112L10.7653 28.908C11.242 28.8152 11.6682
                        28.5578 11.9719 28.1781L15.558 23.6554L14.3599 23.0437C13.4739 22.5965 12.8579 21.7865 12.6469 20.8035L9.26338
                        25.0688L1.64826 26.5285Z" fill="#A02CFA" />
                        <path d="M31.3999 8.89345C33.8558 8.89345 35.8467 6.90258 35.8467 4.44673C35.8467 1.99087 33.8558 0 31.3999
                        0C28.9441 0 26.9532 1.99087 26.9532 4.44673C26.9532 6.90258 28.9441 8.89345 31.3999 8.89345Z" fill="#A02CFA" />
                        <path d="M21.6965 3.33297C21.2282 2.85202 20.7937 2.66217 20.3169 2.66217C20.1439 2.66217 19.971 2.68748
                        19.7853 2.72967L12.1534 4.53958C11.0986 4.78849 10.4489 5.84744 10.6979 6.89795C10.913 7.80079 11.7146 8.40831
                        12.6048 8.40831C12.7567 8.40831 12.9086 8.39144 13.0605 8.35347L19.5618 6.81357C19.9837 7.28187 22.0974 9.57273
                        22.4813 9.97775C19.7938 12.855 17.1064 15.7281 14.4189 18.6054C14.3767 18.6519 14.3388 18.6982 14.3008 18.7446C13.5161
                        19.7445 13.7566 21.3139 14.9379 21.9088L23.1774 26.1151L18.8994 33.0467C18.313 34.0002 18.6083 35.249 19.5618 35.8396C19.8951
                        36.0464 20.2621 36.1434 20.6249 36.1434C21.3042 36.1434 21.9707 35.8017 22.3547 35.1815L27.7886 26.3766C28.0882 25.8915 28.1683
                        25.305 28.0122 24.7608C27.8561 24.2123 27.4806 23.7567 26.9702 23.4993L21.3885 20.66L27.2571 14.3823L31.6869 18.1371C32.0539
                        18.4493 32.5054 18.6012 32.9526 18.6012C33.4335 18.6012 33.9145 18.424 34.2899 18.078L39.3737 13.3402C40.1669 12.6019 40.2133
                        11.3615 39.475 10.5684C39.0868 10.1549 38.5637 9.944 38.0406 9.944C37.5638 9.944 37.0829 10.117 36.7074 10.4671L32.9019
                        14.0068C32.8977 14.011 23.363 5.04163 21.6965 3.33297Z" fill="#A02CFA" />
                    </svg>
                </span>
                <div class="media-body">
                    <p class="fs-14 mb-2">Total General User</p>
                    <span class="title text-black font-w600">
                        <?php
                        $conn = mysqli_connect("localhost","snorhnet_panita","panita@12345","snorhnet_reuse");
                        $generalUser = "SELECT * FROM userlogin WHERE usertype = 'General User'";
                        if ($result = mysqli_query($conn, $generalUser)) {
                            $generalUserCount = mysqli_num_rows($result);
                            echo $generalUserCount;
                        }
                        ?>
                    </span>
                </div>
                <input type="hidden" id="general-user" value="<?php echo $generalUserCount ?>">
            </div>
        </div>
        <div class="effect bg-secondary"></div>
    </div>
</div>
```

Figure 4.31   Coding for admin dashboard

*Note: Total number of users, general users, super admin and collectors used a similar script to count the registered users, but with some user type changes.

```
totalRecycle = parseInt(document.getElementById("totalRecycle").value);
totalPending = parseInt(document.getElementById("totalPending").value);
totalEwaste = parseInt(document.getElementById("totalEwaste").value);
totalPlastic = parseInt(document.getElementById("totalPlastic").value);
totalMetal = parseInt(document.getElementById("totalMetal").value);
totalPaper = parseInt(document.getElementById("totalPaper").value);

const labels = ["Total Recycle Waste", "Total Pending", "Total E-waste", "Total Plastic", "Total Metal", "Total Paper"];
const data = {
  labels: labels,
  datasets: [
    {
      label: "",
      data: [totalRecycle, totalPending, totalEwaste, totalPlastic, totalMetal, totalPaper],
      backgroundColor: [
        "rgba(255, 99, 132)",
        "rgba(255, 159, 64)",
        "rgba(255, 205, 86)",
        "rgba(75, 192, 192)",
        "rgba(54, 162, 235, 1)",
        "rgba(255, 206, 86, 1)"
      ],
      borderWidth: 1,
    },
  ],
};

const config = {
  type: "bar",
  data: data,
  options: {
    scales: {
      yAxes: [
        {
          ticks: {
            beginAtZero: true,
          },
        },
      ],
    },
    legend: {
      display: false
    }
  },
};
```

Figure 4.32   Coding for recycle chart

```
<form class="form-valide" action="insertdb.php" method="post" enctype="multipart/form-data">
    <div class="row">
        <div class="col-xl-6">
            <div class="form-group row">
                <label class="col-lg-4 col-form-label" for="val-username">Username
                    <span class="text-danger">*</span>
                </label>
                <div class="col-lg-6">
                    <input type="text" class="form-control" id="val-username"
                        name="username" placeholder="farhan00" required>
                </div>
            </div>
            <div class="form-group row">
                <label class="col-lg-4 col-form-label" for="val-password">Password
                    <span class="text-danger">*</span>
                </label>
                <div class="col-lg-6">
                    <input type="password" class="form-control" id="val-password"
                        name="password" placeholder="Your Password here" required>
                </div>
            </div>
            <div class="form-group row">
                <label class="col-lg-4 col-form-label" for="val-phoneNo" >Contact Number
                    <span class="text-danger">*</span>
                </label>
                <div class="col-lg-6">
                    <input type="phoneNo" class="form-control" id="val-phoneNo"
                        name="phoneNo" placeholder="Your Number here" pattern="[0]{1}[1]{1}[0-9]{8-9}" required>
                </div>
            </div>

            <div class="form-group row">
                <label class="col-lg-4 col-form-label">Profile Picture
                    <span class="text-danger">*</span>
                </label>
                <div class="col-lg-6">
                <input type="file" name="profilePicture" class="form-control-file" accept=".jpg, .png" required>
                </div>
            </div>
        </div>
        <div class="col-xl-6">
            <div class="form-group row">
                <label class="col-lg-4 col-form-label" for="val-email" required>Email <span
                        class="text-danger">*</span>
                </label>
                <div class="col-lg-6">
                    <input type="text" class="form-control" id="val-email"
                        name="email" placeholder="farhan00@gmail.com" required>
                </div>
            </div>
            <div class="form-group row">
                <label class="col-lg-4 col-form-label" for="val-skill" >User Type
                    <span class="text-danger">*</span>
                </label>
                <div class="col-lg-6">
                    <select class="form-control default-select" id="val-usertype"
                        name="usertype" required>
                        <option value="">Please select</option>
                        <option value="Collector">Collector</option>
                    </select>
                </div>
            </div>
            <div class="form-group row">
                <label class="col-lg-4 col-form-label" for="val-skill" required>Pick-up Area
                    <span class="text-danger">*</span>
                </label>
                <div class="col-lg-6">
                <select class="d-block default-select w-100" name="locationID" required="">
                <option value="">Select Location..</option>
                 <?php
                    $conn = mysqli_connect("localhost","snorhnet_panita","panita@12345","snorhnet_reuse");

                    $query = "SELECT * FROM locationlist";
                    $query_run = mysqli_query($conn, $query);
                        //check if the db is available or not in mysql
                    if(mysqli_num_rows($query_run) > 0) // call function mysqli num rows then it will show the output
                    {
                        //called loop, item can declare anything
                        foreach($query_run as $row) {
                 ?>
                    <option value="<?= $row['locationID']; ?>" ><?= $row['LocationName']; ?></option>
                 <?php }
                    }
                 ?>
                </select>
                </div>
            </div>
            <div class="form-group row">
                <div>
                    <button type="submit" class="btn mr-2 btn-primary">Submit</button>
                    <button type="reset" class="btn btn-light">Cancel</button>
                </div>
            </div>
        </div>
    </div>
</form>
```
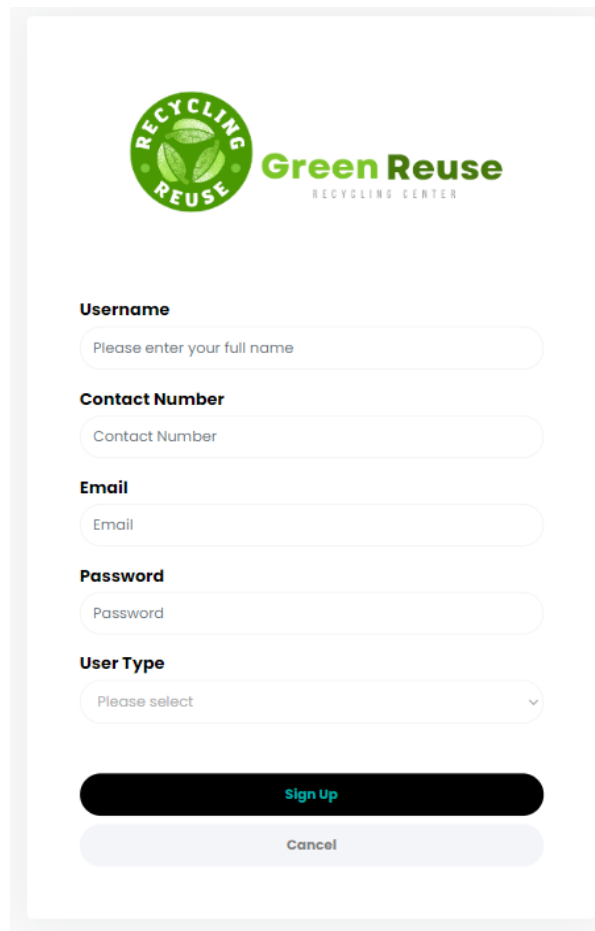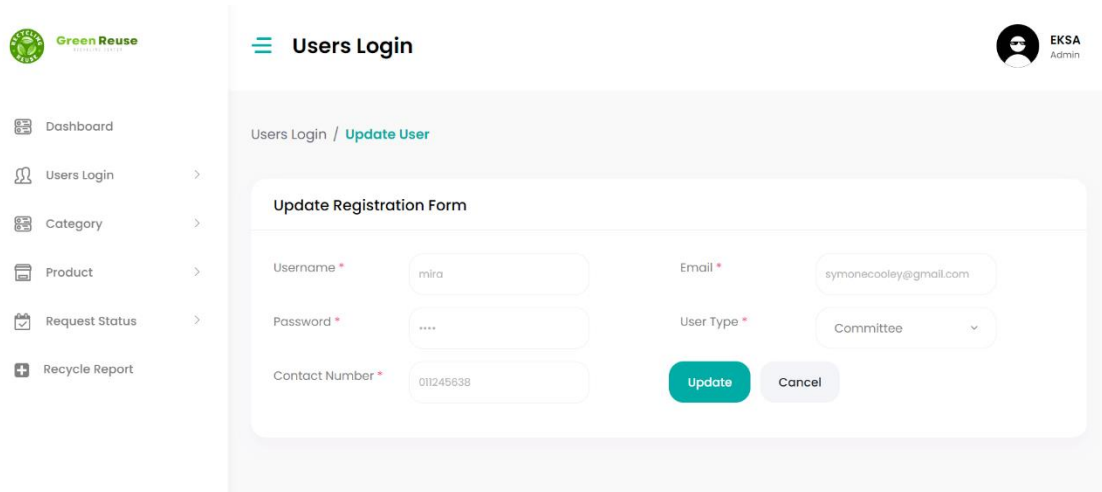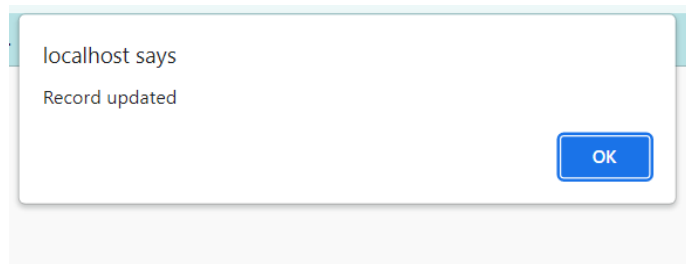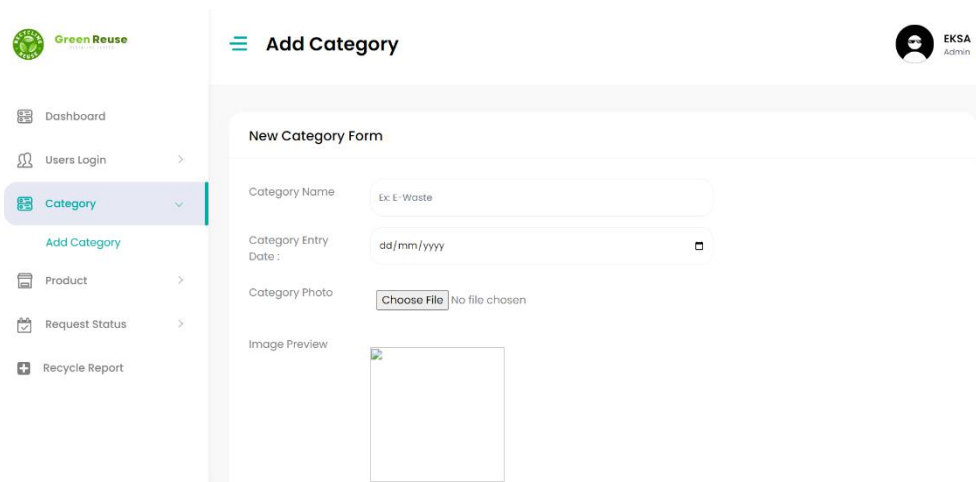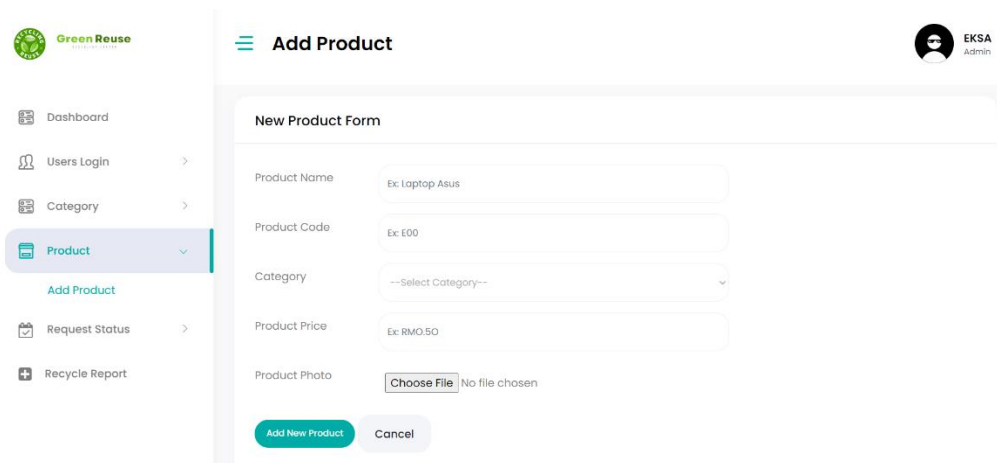
Figure 4.33   Coding for registration committee

```
//Insert new category
if (isset($_POST["newCategory"])) {

    //new method upload photo
    $file_location  = $_FILES['image']['tmp_name'];
    $file_type      = $_FILES['image']['type'];
    $file_name      = $_FILES['image']['name'];

    move_uploaded_file($file_location,"../../images/category/$file_name");

    $insert_query = "INSERT INTO category(categoryName, categoryEntryDate, categoryPhoto)
                                  values ('$categoryName','$categoryEntryDate','$file_name')";
    $insert_result = mysqli_query($con, $insert_query) or die(mysqli_error($con));

?>
    <script>
        window.alert("New Category has been added in the database");
    </script>
    <meta http-equiv="refresh" content="1;url=rcd_ui.php">
<?php } ?>
```

Figure 4.34   Coding for add new category

*Note : Coding for add new product are similar to the process of coding to add new category , but the only difference is that the table name changed.

```
<?php
require '../../connection/dbase.php';
session_start();

        // servername => localhost
        // username => root
        // password => empty
        // database name => green
        $conn = mysqli_connect("localhost","snorhnet_panita","panita@12345","snorhnet_reuse");

        // Check connection
        if($conn === false){
            die("ERROR: Could not connect. "
                . mysqli_connect_error());
        }

        // Taking all 3 values from the form data(input)
        $categoryName =  $_REQUEST['categoryName'];
        $categoryEntryDate =  $_REQUEST['categoryEntryDate'];
        $categoryPhoto = $_FILES["categoryPhoto"]["tmp_name"];
        // $blob = addslashes(file_get_contents($categoryPhoto));
        //new method upload photo
        $file_location  = $_FILES['categoryPhoto']['tmp_name'];
        $file_type      = $_FILES['categoryPhoto']['type'];
        $file_name      = $_FILES['categoryPhoto']['name'];

        move_uploaded_file($file_location,"../../images/category/$file_name");
        //$categoryPhoto = $_REQUEST['categoryPhoto'];
        $categoryID = $_REQUEST['categoryID'];

        // Performing insert query execution
        // here our table name is college
        $sql = "UPDATE `category` SET `categoryName` = '".$categoryName."',
        `categoryEntryDate` = '".$categoryEntryDate."',`categoryPhoto` = '".$file_name."'
        WHERE `categoryID` = '".$categoryID."'";

        if ($conn->query($sql) === TRUE) {
            echo '<script>alert("Record updated");window.location.href="rcd_ui.php";</script>';
            die();
        } else {
            echo "Error: " . $sql . "<br>" . $conn->error;
            die();
        };

        // Close connection
        mysqli_close($conn);
        ?>
```

Figure 4.35   Coding for update category

```php
<?php
require '../../connection/dbase.php';
session_start();

    // servername => localhost
    // username => root
    // password => empty
    // database name => green
    $conn = mysqli_connect("localhost","snorhnet_panita","panita@12345","snorhnet_reuse");

    // Check connection
    if($conn === false){
        die("ERROR: Could not connect. "
            . mysqli_connect_error());
    }

    // Taking all 5 values from the form data(input)
    $email =  $_REQUEST['email'];
    $username = $_REQUEST['username'];
    $password =  $_REQUEST['password'];
    $phoneNo =  $_REQUEST['phoneNo'];
    $locationID =  $_REQUEST['locationID'];
    $usertype = $_REQUEST['usertype'];
    $userLoginID = $_REQUEST['userLoginID'];

    // Performing insert query execution
    // here our table name is college
    $sql = "UPDATE `userlogin` SET `email` = '$email', `username` = '$username', `password` = '$password', `usertype` = '$usertype' , `locationID` = '$locationID'
    WHERE `userLoginID` = '$userLoginID'";

    if ($conn->query($sql) === TRUE) {
        echo "<script>alert('Record updated');window.location.href='rud_ui.php';</script>";
        die();
    } else {
        echo "Error: " . $sql . "<br>" . $con->error;
        die();
    };

    // Close connection
    mysqli_close($conn);
?>
```

Figure 4.36   Coding for update committee information

```php
<?php
$orderNumbers = [];
$sqlc = "SELECT MONTH(CreationDate) as month, qty
FROM cart
JOIN orderlist ON orderlist.orderlistID = cart.orderlistID
WHERE statusOrder = 'Accept' AND locationID = ".$_SESSION["locationID"];
$resultc = mysqli_query($con, $sqlc);
while($rowc = mysqli_fetch_assoc($resultc)){
    if(!isset($orderNumbers[$rowc["month"]])){
        $orderNumbers[$rowc["month"]] = $rowc["qty"];
    }else{
        $orderNumbers[$rowc["month"]] = $orderNumbers[$rowc["month"]] + $rowc["qty"];
    }
}

for($i=1; $i<=12; $i++){
    if(!isset($orderNumbers[$i])){
        $orderNumbers[$i] = 0;
    }
}

ksort($orderNumbers);

?>
<script>
var xValues = ["Jan", "Feb", "Mac", "Apr", "May", "Jun", "Jul", "Aug", "Sept", "Oct", "Nov", "Dec"];
var yValues = [<?php echo implode(",", $orderNumbers); ?>];
var barColors = ["red", "green","blue","orange","brown","red", "green","blue","orange","brown","gree","yellow"];

new Chart("myChart", {
type: "bar",
data: {
    labels: xValues,
    datasets: [{
    backgroundColor: barColors,
    data: yValues
    }]
},
options: {
    legend: {display: false},
    title: {
    display: true,
    text: "Number of order by month"
    }
}
});
</script>
```

Figure 4.37   Coding for dashboard committee

```
<tbody>
    <?php
    $userid=$_SESSION['userLoginID'];
    $locationid=$_SESSION['locationID'];
    $sql = "SELECT cart.*, orderlist.*,userlogin.* FROM cart
    INNER JOIN orderlist ON cart.orderlistID = orderlist.orderListID
    INNER JOIN userlogin ON cart.userID = userlogin.userLoginID
    WHERE orderlist.locationID = '$locationid'
    AND cart.statusOrder='Pending'
    GROUP BY orderlist.orderListID";
    $result = mysqli_query($con, $sql);

    if($result->num_rows > 0){
      $counter = 1;
      while($row=mysqli_fetch_assoc($result)){

    ?>
        <tr>
            <td class="align-top"><?php echo $counter++; ?></td>
            <td class="align-top"><?php echo $row["username"]; ?></td>
            <td class="align-top"><?php echo $row["phoneNo"]; ?></td>
            <td class="align-top">
                <table>
                <?php
                $grandTotal=0;
                $sql2 = "SELECT * FROM cart
                INNER JOIN productlist ON cart.productID = productlist.productID
                WHERE cart.orderListID = ".$row["orderListID"];
                $result2 = mysqli_query($con, $sql2);
                while($row2=mysqli_fetch_assoc($result2)){
                    echo "<tr>";
                    echo "<td>".$row2["productName"]."</td>";
                    echo "<td>".$row2["qty"]."/ KG / Unit x RM ".$row2["productPrice"]." </td>";
                    echo "</tr>";

                    $grandTotal = $grandTotal + $row2["total_price"];

                }
                ?>
                </table>
            </td>

            <td class="align-top"><?php echo "<img src='../../images/recycle_photo/$row[recyclePhoto]' style='width: 200px; height: 200px'/>"; ?></td>
            <td class="align-top"><p class="<?php echo $class = 'text-warning'?>"><?php echo $row["statusOrder"]; ?></td>
            <td class="align-top">
                <?php echo "<a class='btn btn-success' href='updateOrderStatus.php?id= ".$row['orderListID']."&status=Accept'> Accept</a>";?><br/><br/>
                <?php echo "<a class='btn btn-danger' href='updateOrderStatus.php?id= ".$row['orderListID']."&status=Decline' > Decline</a>";?>
            </td>
        </tr>
        <?php }} ?>
</tbody>
```

Figure 4.38   Coding for pending order

```
<tbody>
    <?php
    $userid=$_SESSION['userLoginID'];
    $locationid=$_SESSION['locationID'];
    $sql = "SELECT cart.*, orderlist.*,userlogin.* FROM cart
    INNER JOIN orderlist ON cart.orderlistID = orderlist.orderListID
    INNER JOIN userlogin ON cart.userID = userlogin.userLoginID
    WHERE orderlist.locationID = '$locationid'
    AND statusOrder='Accept'
    GROUP BY orderlist.orderListID";
    $result = mysqli_query($con, $sql);

    if($result->num_rows > 0){
      $counter = 1;
      while($row=mysqli_fetch_assoc($result)){

        //set color
        if($row['statusOrder'] == "Pending")
            $color = "warning";
        else if($row['statusOrder'] == "Accept")
            $color = "success";
        else if($row['statusOrder'] == "Decline")
            $color = "danger";

    ?>
        <tr>
            <td class="align-top"><?php echo $counter++; ?></td>
            <td class="align-top"><?php echo $row["username"]; ?></td>
            <td class="align-top"><?php echo $row["phoneNo"]; ?></td>
            <td class="align-top">
                <table>
                <?php
                $grandTotal=0;
                $sql2 = "SELECT * FROM cart
                INNER JOIN productlist ON cart.productID = productlist.productID
                WHERE cart.orderListID = ".$row["orderListID"];
                $result2 = mysqli_query($con, $sql2);
                while($row2=mysqli_fetch_assoc($result2)){
                    echo "<tr>";
                    echo "<td>".$row2["productName"]."</td>";
                    echo "</tr>";
                }
                ?>
                </table>
            </td>

            <td class="align-top">
                <?php echo "<a style='color:#0072bc;'  href='viewOrder.php?id= ".$row['orderListID']."&status=View> ".$row['statusOrder']."</a>"; ?>
            </td>
            <td class="align-top">
                <?php echo "<a class='btn btn-danger' href='updateOrderStatus.php?id= ".$row['orderListID']."&status=Decline' > Decline</a>";?>
            </td>
        </tr>
        <?php } } ?>
</tbody>
```

Figure 4.39   Coding for accept order

```
<tbody>
    <?php
    $userid=$_SESSION['userLoginID'];
    $locationid=$_SESSION['locationID'];
    $sql = "SELECT cart.*, orderlist.*,userlogin.* FROM cart
    INNER JOIN orderlist ON cart.orderlistID = orderlist.orderListID
    INNER JOIN userlogin ON cart.userID = userlogin.userLoginID
    WHERE orderlist.locationID = '$locationid'
    AND statusOrder='Decline'
    GROUP BY orderlist.orderListID";
    $result = mysqli_query($con, $sql);

    if($result->num_rows > 0){
        $counter = 1;
        while($row=mysqli_fetch_assoc($result)){

    ?>
        <tr>
            <td class="align-top"><?php echo $counter++; ?></td>
            <td class="align-top"><?php echo $row["username"]; ?></td>
            <td class="align-top"><?php echo $row["phoneNo"]; ?></td>
            <td class="align-top">
                <table>
                <?php
                $grandTotal=0;
                $sql2 = "SELECT * FROM cart
                INNER JOIN productlist ON cart.productID = productlist.productID
                WHERE cart.orderListID = ".$row["orderListID"];
                $result2 = mysqli_query($con, $sql2);
                while($row2=mysqli_fetch_assoc($result2)){
                    echo "<tr>";
                    echo "<td> ".$row2["productName"]."</td>";
                    echo "</tr>";


                }
                ?>
                </table>
            </td>
            <td class="align-top"><?php echo "<img src='../../images/recycle_photo/$row[recyclePhoto]' style='width: 200px; height: 200px/>"; ?></td>
            <td class="align-top"><p class="<?php echo $class = 'text-danger'?>"><?php echo $row["statusOrder"]; ?></td>

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

Figure 4.40   Coding for cancel order

```
<?php
//Insert new menu
require '../../connection/dbase.php';
session_start();


$conn = mysqli_connect("localhost","snorhnet_panita","panita@12345","snorhnet_reuse");

if($conn === false){
    die("ERROR: Could not connect. " . mysqli_connect_error());
}
extract($_POST);
$username = $_REQUEST['username'];
$email = $_REQUEST['email'];
$phoneNo = $_REQUEST['phoneNo'];
$password = $_REQUEST['password'];
$profilePicture = $_FILES["profilePicture"]["tmp_name"];
$userLoginID= $_REQUEST['userLoginID'];

// file upload simplified version
$file_location = $_FILES['profilePicture']['tmp_name'];
$file_type     = $_FILES['profilePicture']['type'];
$file_name     = $_FILES['profilePicture']['name'];

move_uploaded_file($file_location,"../../profile-pictures/collector/$file_name");
$sql = "UPDATE userlogin SET username = '$username', email = '$email', phoneNo = '$phoneNo', password = '$password', profilePicture = '$file_name'
WHERE userLoginID = '$userLoginID'";

if ($conn->query($sql) === TRUE) {
    echo '<script>alert("Record updated");window.location.href="userprofile.php";</script>';
    die();
} else {
    echo "Error: " . $sql . "<br>" . $conn->error;
    die();
}

mysqli_close($conn);
?>
```

Figure 4.41   Coding for update profile

```php
<!-- progress bar -->
<div class="col-xl-12 col-lg-12 col-sm-12">
    <div class="card">
        <div class="card-header">
            <h4 class="card-title">Progress Bar</h4>
        </div>
        <div class="card-body">
        <?php
        //simplified progress bar code for each month
        $userid = $_SESSION['userLoginID'];
        $specificTarget = 0;

        for($i=1; $i<=12; $i++)
        {
            //set max point
            $maxPoints = 100;
            $specificTarget += 10; // assign target here, auto increase target by 5 for each month
            $percentageFormat = 0;

            //month name
            if($i==1)
                $month = "Jan";
                else if($i==2)
                    $month = "Feb";
                    else if($i==3)
                        $month = "Mar";
                        else if($i==4)
                            $month = "Apr";
                            else if($i==5)
                                $month = "May";
                                else if($i==6)
                                    $month = "June";
                                    else if($i==7)
                                        $month = "July";
                                        else if($i==8)
                                            $month = "Aug";
                                            else if($i==9)
                                                $month = "Sept";
                                                else if($i==10)
                                                    $month = "Oct";
                                                    else if($i==111)
                                                        $month = "Nov";
                                                        else if($i==12)
                                                            $month = "Dec";

        $sqlR = mysqli_query($con, "SELECT *, SUM(points) AS totalPoints
                                    FROM cart
                                    WHERE userID = '$userid'
                                    AND statusOrder = 'Accept'
                                    AND MONTH(CreationDate) = '$i'");
        $rowR = mysqli_fetch_array($sqlR);

        if($rowR['totalPoints'] == 0)
        {
            $totalPoints = 0;
            $percentageFormat = 0;
        }
        else
        {
            $totalPoints = $rowR['totalPoints'];
```

Figure 4.42   Coding for progress bar

4.6   Testing

Upon completion of the implementation process, the next step includes the testing of the system. The process of testing is a major impprtance in the development of system as it plays a crucial role in the identification of errors and the improvement of the overall quality of the system. The process of User Acceptance Testing (UAT) is employed to validate whether the system satisfies the user's requirements, whereas Usability Testing is conducted to collect user feedback on the system's user-friendliness. There are three categories of users in this system which are FK Community, Committee and Admin (Eksa). The FK Community , Committee and Admin is a tester who takes part in a UAT to test the functionality while Usability Testing Quenstionaire will be tester by Committee and Admin. Refer User Acceptance Test(UAT) and Usability Testing Quesntionnaire that is attached on **Appendix B** for further references.

		A	B	C	D	E		
PU	Q1	5	5	5	5	5	5	5
	Q2	5	5	5	5	5	5	
	Q3	5	5	5	5	5	5	
PEU	Q4	4	4	3	3	4	3,6	3,8
	Q5	4	4	4	3	4	3,8	
	Q6	4	4	4	4	4	4	
ITU	Q7	4	4	3	3	4	3,6	4
	Q8	4	4	4	4	4	4	
	Q9	4	5	4	4	4	4,2	
	Q10	4	5	4	4	4	4,2	
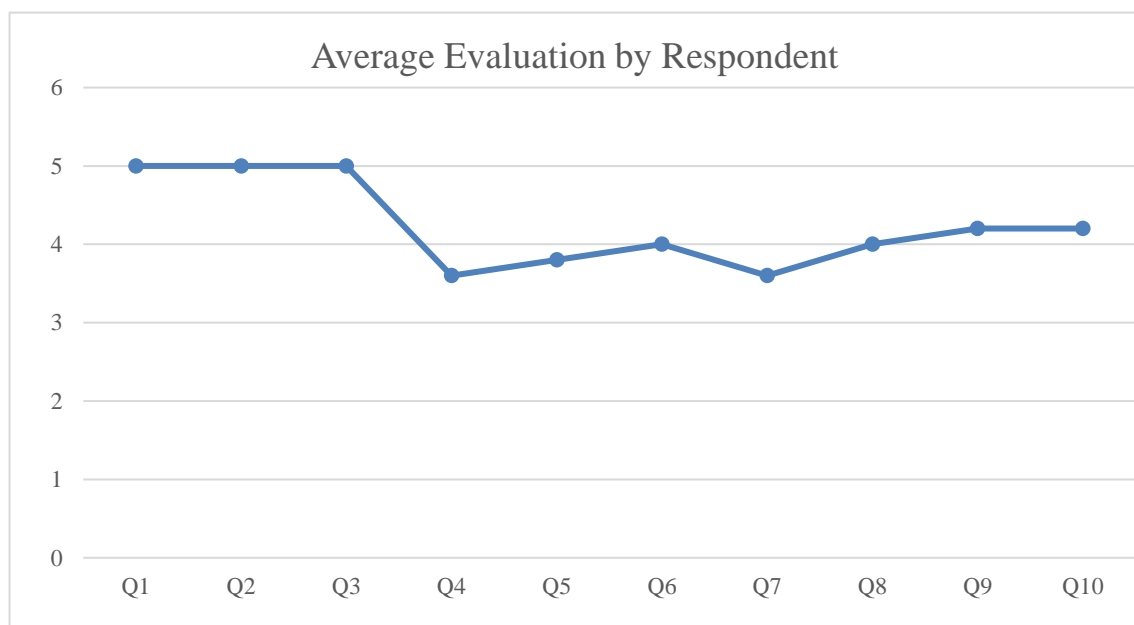
Perceived Usefulness (PU) Category:

For Q1,Q2,Q3 all persons A,B,C,D, and E strongly agree that they perceive the usefulness of the Gamified Recycle Management System. This implies that the surveyed individual perceive the Gamified Recycle Management concept as valuable and beneficial. They likely believe that incorporating gamification elements into the recycling process can enhance engagement, motivation and effectiveness in managing and promoting recycling practices.

Perceived Ease Of Use (PEU) Category:

For Q4, Q5, persons A,B and C agree that the Gamified Recycle Management System concept being surveyed is easy to use. On the other hand, persons D and E are undecided about the ease of use.

For Q6 all persons A,B,C,D and E agree that they have the necessary skills and experiences to use the Gamified Recycle Management System

Behavioural Intention to Use (ITU) Category:

For Q7 , persons A, B, and C agree that they have the intention to use the Gamified Recycle Management System being surveyed. Persons D and E are undecided about their intention to use.

For Q8 (ITU, Q8), all persons A, B, C, D, and E agree that they have the intention to use the Green Reuse Gamified Management System would be positive experience for them.

For Q9 (ITU, Q9), persons A, C, D, and E agree that they would be willing to recommend the Green Reuse Gamified Management System to others who are interested in engaging in recycling activities and possess a strong motivation for environmental sustainability.

For Q10 (ITU, Q10), persons A, C, D, and E agree that they have the intention to use the Green Reuse Gamified Recycle Management System in the future.

CHAPTER 5

CONCLUSION

5.1   Introduction

To sum up, the Green Reuse Gamified Recycle Management System was created according to the requirements provided and a comparison of other systems. The Software Development Life Cycle(SDLC) method is used to developed the system in a structured and organised way.

The web-based Green Reuse Gamified Recycle Management System uses the gamification concept. Gamification elements like points, badges, rewards, leaderboards boost user motivation and engagement. While performing recycling activities, it gives users fun experience as they can earn points, unlock badges and compete on the leaderboard.

5.2   Constraints

Because of the complexity of the system workflow, it may be difficult for me to understand how the various components of the system interact with one another.

During the development phase, some requirement and scope of the system get revised thus changes are necessary to make improvement and need extra time to allocation. This adjustment involve adding new features and modifying functionality.

In addition, understanding and writing MySQL queries statement was difficult for me because I am unfamiliar with the database management and I had to ask my friends for help on these parts. Howerver, I manage to gain new knowledge regarding database managing system.

5.3   Future Work

There are certain features that can be updates and improved for the Green Reuse Gamified Recycle Management System.

I. Implement geolocation functionality. This feature allows the app to show the nearby recycling centers, drop-off points or specific recycling initiatives.

II. Multi language website. Currently, the system only available in English. In the future, The system will be able support in multi-languages for the web-based system as users are more comfortable using their native language which enchances user accessibility.

III. Gamification elements like points, rewards, leaderboard and ranks can boots user engagement and interaction with the recycling app. Gamification boosts user engagement, participation and enjoyment in many areas including recycling.

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APPENDIX A
GANTT CHART

PROJECT TITLE : GREEN REUSE : A GAMIFIED RECYCLE MANAGEMENT SYSTEM

CD20122 PANITA A/P PREPAN

	07/02/2022
	12/06/2023
	1

TASK	START	END
Phase 1 Requirement		
Brainstorm the several ideas	07/02/22	13/02/22
Study on Gamification	14/02/22	16/02/22
Define the title of the project	17/02/22	18/02/22
Define the problem, objective and scope and identify target user of the project	19/02/22	24/02/22
Study on three existing system related to gamification	25/02/22	03/03/22
Define the tools to be used	04/03/22	05/03/22
Define the suitable methodology to be used in the project	06/03/22	10/03/22
Create questionnaire for survey	11/03/22	12/03/22
Define the project requirement (Functional and Non-Functional)	13/03/22	15/03/22
Define constraints and limitation of the project	16/03/22	17/03/22
Evaluation	18/03/22	18/03/22
Phase 2 Design		
Planning on the proposed design of the application	19/03/22	21/03/22
Study the methodology	22/03/22	24/03/22
Analysis Context Diagram	25/03/22	27/03/22
Analysis Use Case Diagram	28/03/22	30/03/22
Analysis Activity Diagram	01/04/22	03/04/22
Design Application overview	03/04/22	05/04/22
Identify hardware and software used	05/04/22	05/04/22
Design Storyboard	06/04/22	08/04/22
Design User Interface using figma	08/04/22	10/04/22
Demo prototype to supervisor	11/04/22	11/04/22
Submit PSM1 report and prepare video presentation	12/04/22	15/04/22
Presentation PSM1	16/04/22	18/04/22
Phase 3 Development		
Develop Gamified Recycle Management System	03/05/23	05/05/23
Create login and sign up user interface	06/05/23	08/05/23
Create dashboard page for customer, collector and admin	10/05/23	15/05/23
Create Progress bar, bar chart	16/05/23	25/05/23
Create Leaderboard, Achievement, Recycle Record Page	03/06/23	05/06/23
Phase 4 Test		
Perform the report	06/06/23	08/06/23
Correction and revised	08/06/23	08/06/23
Submission Chapter 4	09/06/23	11/01/23
Phase 5 Deployment		
Deploy system in the server	10/06/23	10/06/23
Finish all chapter report	10/06/23	12/06/23

Appendix for Functionality Test (User Acceptance Testing)

Participate Name	Date	Signature

Table 5.1   Test Case - User Category 'Admin'

Project Name	GREEN REUSE GAMIFIED RECYCLE MANAGEMENT SYSTEM			
Name of Tester **(Admin)**				
Test	Test Case	Pass	Fail	Comments
Login Page & Sign up Page :				
1	Login Button			
2	User Type Radio Button			
Dashboard Page :				
1	Admin Profile Button			
2	Update Profile Button			
3	System user data is displayed			
4	Recycle Chart is displayed and regularly updated			

5	User's Leaderboard is displayed and regularly updated			
Users Login Page :				
1	Users Login Dropdown Button			
2	All User Button			
3	Edit User Profile Button			
4	Update User Profile Button			
5	Delete User Profile Button			
6	Add User button			
7	Submit Collector's Data Button			
Category Page :				
1	Category Dropdown Button			
2	All Categories Button			
3	Edit Category Button			
4	Update Category Button			
5	Delete Category Button			
6	Add Category button			

7	Add New Category Button			
Product Page :				
1	Product Dropdown Button			
2	All Categories Button			
3	Edit Category Button			
4	Update Category Button			
5	Delete Category Button			
6	Add Category button			
7	Add New Category Button			
Location page:				
1	Location Dropdown Button			
2	All Location Button			
3	Edit Location Button			
4	Update Location Button			
5	Delete Location Button			
6	Add Location button			
7	Submit New Location Button			

Participate Name	Date	Signature

Table 5.2   Test Case - User Category 'FK Community'

Project Name	GREEN REUSE GAMIFIED RECYCLE MANAGEMENT SYSTEM			
Name of Tester **(FK Community)**				
Test	Test Case	Pass	Fail	Comments
Login Page & Sign Up Page				
1	Login Button			
2	User Type Radio Button			
3	Create Account Button			
4	Profile Upload Button			
5	Sign Up Button			
Dashboard Page :				
1	User Profile Button			
2	Update Profile Button			
3	Info Icon Button			
4	Progress bar displayed and updated			

5	Badge icon display once user achieve target			
Products Page:				
1	Product Dropdown Button			
2	Glass Button			
3	Plastic Button			
4	Paper Button			
5	Quantity Input Text			
6	Add Order Button			
7	Cart Icon Button			
Cart Page:				
1	Clear Cart Button			
2	Update Quantity Button			
3	Delect a single item button			
4	Continue Recycle Button			
Checkout Page :				
1	File Upload Button			
2	Place Order button			
Recycle Record Page :				
1	Status Changes			

2	Star Received			
Achievement Page :				
1	Star Display on particular month			
2	5 star represent qty >=40 4 star represent qty >=30 3 star represent qty >=20 2 star represent qty >=10 1 star represent qty >=5			
Leaderboard Page:				
1	Leaderboard button			
2	Shows User's Points Ranking			

Participate Name	Date	Signature

Table 5.3   Test Case - User Category 'Committee'

Project Name	GREEN REUSE GAMIFIED RECYCLE MANAGEMENT SYSTEM			
Name of Tester **(Committee)**				
Test	Test Case	Pass	Fail	Comments
Login Page				
1	Login Button			
2	User Type Radio Button			
Dashboard Page :				
1	Collector Profile Button			
2	Update Profile Button			
3	Bar Chart displayed and updated			
Pending Page:				
1	Accept Button			
2	Decline Button			

	Accept Page:			
1	Status Accept Button			
2	Update Quantity Button			
3	Decline Button			
	Cancel Page :			
1	Display cancel order data			

Appendix for Functionality Test (User Acceptance Testing)

Participate Name	Date	Signature
Muhammad Fahmi Bin Mohd Razi	8/6/2023	

Table 5.4   Test Case - User Category 'ADMIN'

Project Name	GREEN REUSE GAMIFIED RECYCLE MANAGEMENT SYSTEM			
Name of Tester **(Admin)**	Muhammad Fahmi Bin Mohd Razi			
Test	Test Case	Pass	Fail	Comments
Login Page & Sign up Page :				
1	Login Button	/		
2	User Type Radio Button	/		
Dashboard Page :				
1	Admin Profile Button	/		
2	Update Profile Button	/		
3	System user data is displayed	/		
4	Recycle Chart is displayed and regularly updated	/		

5	User's Leaderboard is displayed and regularly updated	/		
Users Login Page :				
1	Users Login Dropdown Button	/		
2	All User Button	/		
3	Edit User Profile Button	/		
4	Update User Profile Button	/		
5	Delete User Profile Button	/		
6	Add User button	/		
7	Submit Collector's Data Button	/		
Category Page :				
1	Category Dropdown Button	/		
2	All Categories Button	/		
3	Edit Category Button	/		
4	Update Category Button	/		
5	Delete Category Button	/		
6	Add Category button	/		

7	Add New Category Button	/		
Product Page :				
1	Product Dropdown Button	/		
2	All Categories Button	/		
3	Edit Category Button	/		
4	Update Category Button	/		
5	Delete Category Button	/		
6	Add Category button	/		
7	Add New Category Button	/		
Location page:				
1	Location Dropdown Button	/		
2	All Location Button	/		
3	Edit Location Button	/		
4	Update Location Button	/		
5	Delete Location Button	/		
6	Add Location button	/		
7	Submit New Location Button	/		

Participate Name	Date	Signature
Nur Syazatul Zulaika	8/6/2023	Nur Syazatul Zulaikha

Table 5.5   Test Case - User Category 'FKOM COMMUNITY'

Project Name	GREEN REUSE GAMIFIED RECYCLE MANAGEMENT SYSTEM				
Name of Tester **(FK Community)**	Nur Syazatul Zulaika				
Test	Test Case	Pass	Fail	Comments	
Login Page & Sign Up Page					
1	Login Button	/			
2	User Type Radio Button	/			
3	Create Account Button	/			
4	Profile Upload Button	/			
5	Sign Up Button	/			
Dashboard Page :					
1	User Profile Button	/			
2	Update Profile Button	/			
3	Info Icon Button	/			

4	Progress bar displayed and updated	/		
5	Badge icon display once user achieve target	/		
Products Page:				
1	Product Dropdown Button	/		
2	Glass Button	/		
3	Plastic Button	/		
4	Paper Button	/		
5	Quantity Input Text	/		
6	Add Order Button	/		
7	Cart Icon Button	/		
Cart Page:				
1	Clear Cart Button	/		
2	Update Quantity Button	/		
3	Delect a single item button	/		
4	Continue Recycle Button	/		
Checkout Page :				
1	File Upload Button	/		
2	Place Order button	/		

Recycle Record Page :				
1	Status Changes	/		
2	Star Received	/		
Achievement Page :				
1	Star Display on particular month	/		
2	5 star represent qty >=40 4 star represent qty >=30 3 star represent qty >=20 2 star represent qty >=10 1 star represent qty >=5	/		
Leaderboard Page:				
1	Leaderboard button	/		
2	Shows User's Points Ranking	/		

Participate Name	Date	Signature
Noor Fazrina Binti Mohammad Fadzir	8/6/2023	

Table 5.6   Test Case - User Category 'COMMITTEE'

Project Name	GREEN REUSE GAMIFIED RECYCLE MANAGEMENT SYSTEM			
Name of Tester **(Committee)**	Noor Fazrina Binti Mohammad Fadzir			
Test	Test Case	Pass	Fail	Comments
Login Page				
1	Login Button	/		
2	User Type Radio Button	/		
Dashboard Page :				
1	Collector Profile Button	/		
2	Update Profile Button	/		
3	Bar Chart displayed and updated	/		
Pending Page:				
1	Accept Button	/		

2	Decline Button	/		
Accept Page:				
1	Status Accept Button	/		
2	Update Quantity Button	/		
3	Decline Button	/		
Cancel Page :				
1	Display cancel order data	/		

Appendix for Usability Testing Questionnaire

Participant Name	Date	Signature	Comment

Technology Acceptance Model (TAM) Survey Result for Green Reuse among Faculty of Computing Community						
No.	Question	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1.	How likely are you to use this Green Reuse system to improve your knowledge in the separation of waste for environmental sustainability?					
2.	How effective do you think this Gamified Recycle Management System can be in helping you reach your awareness objectives?					
3.	Do you believe that utilizing this Gamified Recycle Management System will enhance your ability to grasp waste separation concepts and motivate you towards adopting recycling behaviors for the sake of environmental sustainability?					

4	How easy is it for you to navigate and use this Green Reuse Gamified Management System?					
5	To what extent do you think this Green Reuse Gamified Management System is intuitive and easy to learn?					
6	Do you think that you have the necessary skills and experience to use this Green Reuse Gamified Management System effectively?					
7.	How easy is it for you to navigate and use this Green Reuse Gamified Management System ?					
8.	To what extent do you believe that using this Green Reuse Gamified Management System would be a positive or negative experience for you?					
9.	Would you be willing to recommend this Green Reuse Gamified Management System to others who are interested in engaging in recycling activities and possess a strong motivation for environmental sustainability?					
10.	How likely are you to use this Green Reuse Gamified Recycle Management System in the future?					

Participate Name	Date	Signature	Comment
RUZAINAH	15/6/23		

No.	Question	Strongly Disagree	Disagree	Undecided	Agree	Strong Agree
	Technology Acceptance Model (TAM) Survey Result for **Green Reuse among Faculty of Computing Community**					
1.	How likely are you to use this Green Reuse system to improve your knowledge in the separation of waste for environmental sustainability?					✓
2.	How effective do you think this Gamified Recycle Management System can be in helping you reach your awareness objectives?					✓
3.	Do you believe that utilizing this Gamified Recycle Management System will enhance your ability to grasp waste separation concepts and motivate you towards adopting recycling behaviors for the sake of environmental sustainability?					✓
4	How easy is it for you to navigate and use this Green Reuse Gamified Management System?				✓	
5	To what extent do you think this Green Reuse Gamified Management System is intuitive and easy to learn?				✓	
6	Do you think that you have the necessary skills and experience to use this Green Reuse Gamified Management System effectively?				✓	
7.	How easy is it for you to navigate and use this Green Reuse Gamified Management System ?				✓	

8.	To what extent do you believe that using this Green Reuse Gamified Management System would be a positive or negative experience for you?				✓	
9.	Would you be willing to recommend this Green Reuse Gamified Management System to others who are interested in engaging in recycling activities and possess a strong motivation for environmental sustainability?				✓	
10.	How likely are you to use this Green Reuse Gamified Recycle Management System in the future?				✓	

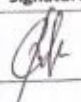| Participate Name	Date	Signature	Comment
CHAIRUN NICEAE ABDULLAH	15/6/2023	*(signature)*	Not user friendly - difficult to navigate between functions

Technology Acceptance Model (TAM) Survey Result for

Green Reuse among Faculty of Computing Community

No.	Question	Strongly Disagree	Disagree	Undecided	Agree	Strong Agree
1.	How likely are you to use this Green Reuse system to improve your knowledge in the separation of waste for environmental sustainability?					✓
2.	How effective do you think this Gamified Recycle Management System can be in helping you reach your awareness objectives?					✓
3.	Do you believe that utilizing this Gamified Recycle Management System will enhance your ability to grasp waste separation concepts and motivate you towards adopting recycling behaviors for the sake of environmental sustainability?					✓
4	How easy is it for you to navigate and use this Green Reuse Gamified Management System?				✓	
5	To what extent do you think this Green Reuse Gamified Management System is intuitive and easy to learn?				✓	
6	Do you think that you have the necessary skills and experience to use this Green Reuse Gamified Management System effectively?				✓	
7.	How easy is it for you to navigate and use this Green Reuse Gamified Management System ?				✓	

8.	To what extent do you believe that using this Green Reuse Gamified Management System would be a positive or negative experience for you?				✓	
9.	Would you be willing to recommend this Green Reuse Gamified Management System to others who are interested in engaging in recycling activities and possess a strong motivation for environmental sustainability?				✓	
10.	How likely are you to use this Green Reuse Gamified Recycle Management System in the future?				✓	

Participate Name	Date	Signature	Comment
Muhd Famul	15/6/23	*(signature)*	

Technology Acceptance Model (TAM) Survey Result for

Green Reuse among Faculty of Computing Community

No.	Question	Strongly Disagree	Disagree	Undecided	Agree	Strong Agree
1.	How likely are you to use this Green Reuse system to improve your knowledge in the separation of waste for environmental sustainability?					✓
2.	How effective do you think this Gamified Recycle Management System can be in helping you reach your awareness objectives?					✓
3.	Do you believe that utilizing this Gamified Recycle Management System will enhance your ability to grasp waste separation concepts and motivate you towards adopting recycling behaviors for the sake of environmental sustainability?					✓
4	How easy is it for you to navigate and use this Green Reuse Gamified Management System?			✓		
5	To what extent do you think this Green Reuse Gamified Management System is intuitive and easy to learn?			✓		
6	Do you think that you have the necessary skills and experience to use this Green Reuse Gamified Management System effectively?				✓	
7.	How easy is it for you to navigate and use this Green Reuse Gamified Management System ?			✓		

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8.	To what extent do you believe that using this Green Reuse Gamified Management System would be a positive or negative experience for you?				✓	
9.	Would you be willing to recommend this Green Reuse Gamified Management System to others who are interested in engaging in recycling activities and possess a strong motivation for environmental sustainability?				✓	
10.	How likely are you to use this Green Reuse Gamified Recycle Management System in the future?				✓	

Participate Name	Date	Signature	Comment
MUHAMMAD TAIHL L MOHAMAD BEFFIN	15/6/2023		Banyak button dorg confuse

Technology Acceptance Model (TAM) Survey Result for

Green Reuse among Faculty of Computing Community

No.	Question	Strongly Disagree	Disagree	Undecided	Agree	Strong Agree
1.	How likely are you to use this Green Reuse system to improve your knowledge in the separation of waste for environmental sustainability?					/
2.	How effective do you think this Gamified Recycle Management System can be in helping you reach your awareness objectives?					/
3.	Do you believe that utilizing this Gamified Recycle Management System will enhance your ability to grasp waste separation concepts and motivate you towards adopting recycling behaviors for the sake of environmental sustainability?					/
4	How easy is it for you to navigate and use this Green Reuse Gamified Management System?			/		
5	To what extent do you think this Green Reuse Gamified Management System is intuitive and easy to learn?				/	
6	Do you think that you have the necessary skills and experience to use this Green Reuse Gamified Management System effectively?				/	
7.	How easy is it for you to navigate and use this Green Reuse Gamified Management System ?			/		

8.	To what extent do you believe that using this Green Reuse Gamified Management System would be a positive or negative experience for you?				/	
9.	Would you be willing to recommend this Green Reuse Gamified Management System to others who are interested in engaging in recycling activities and possess a strong motivation for environmental sustainability?				/	
10.	How likely are you to use this Green Reuse Gamified Recycle Management System in the future?				/	

Participate Name	Date	Signature	Comment
Romalisan	15/6/2?	*(signature)*	- Improve the category, the price - the navigation from one function to another

Technology Acceptance Model (TAM) Survey Result for

Green Reuse among Faculty of Computing Community

No.	Question	Strongly Disagree	Disagree	Undecided	Agree	Strong Agree
1.	How likely are you to use this Green Reuse system to improve your knowledge in the separation of waste for environmental sustainability?					/
2.	How effective do you think this Gamified Recycle Management System can be in helping you reach your awareness objectives?					/
3.	Do you believe that utilizing this Gamified Recycle Management System will enhance your ability to grasp waste separation concepts and motivate you towards adopting recycling behaviors for the sake of environmental sustainability?					/
4	How easy is it for you to navigate and use this Green Reuse Gamified Management System?				/	
5	To what extent do you think this Green Reuse Gamified Management System is intuitive and easy to learn? .				/	
6	Do you think that you have the necessary skills and experience to use this Green Reuse Gamified Management System effectively?				/	
7.	How easy is it for you to navigate and use this Green Reuse Gamified Management System? *same as no 4*				/	

8.	To what extent do you believe that using this Green Reuse Gamified Management System would be a positive or negative experience for you?				/	
9.	Would you be willing to recommend this Green Reuse Gamified Management System to others who are interested in engaging in recycling activities and possess a strong motivation for environmental sustainability?					/
10.	How likely are you to use this Green Reuse Gamified Recycle Management System in the future?					/