Faculty of Electronic and Computer Technology and Engineering

DEVELOPMENT OF WASTE FOOD MANAGEMENT SYSTEM AND DONATION APPS

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Bachelor of Computer Engineering Technology (Computer System) with Honours

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DEVELOPMENT OF WASTE FOOD MANAGEMENT SYSTEM AND DONATION APPS

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A project report submitted
in partial fulfillment of the requirements for the degree of
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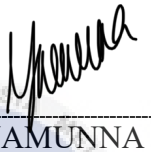
I declare that this project report entitled “Development of Waste Food Management System and Donation Apps” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature	:	
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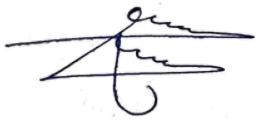
Signature : 

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DEDICATION

With profound appreciation and sincere gratitude, would like to thank my family who's support have made this academic journey more meaningful. I extend my deepest thanks to my Final Year Supervisor Dr.Jamil Abedalrahim Jamil Alsayaydeh for the guidance, expertise, and invaluable insights throughtout this journey. Beyond thankful to everyone who was with me this far to complete this thesis.

ABSTRACT

The Waste Food Management System and Donation Apps linked with Traditional Food Composting project has the overarching goal of addressing the critical problem of food waste while also advancing the cause of sustainable living and taking responsibility for one's community. This comprehensive solution provides a platform for donors to contribute excess food, which can then be accessible without difficulty by receivers in need through the use of an app that is favourable to donors. Concurrently, the project makes use of time-honoured techniques for the composting of food scraps, with the goals of reducing waste and producing nutrient-dense compost for agricultural applications. Together, the Waste Food Management System and the Donation App offer a platform that makes communication between givers and receivers of food donations simple and effective. Donors can quickly and simply provide whatever excess food they have for donation, and receivers can browse through the options and choose those that best meet their requirements. This procedure lessens the amount of wasted food by redistributing edible food to people who could make use of it, so preventing it from being thrown away in landfills. Traditional methods of food composting are incorporated into the project in those instances where the food in question is not appropriate for donation. Food that has been prepared incorrectly or is no longer edible is sent to composting facilities, where it is broken down into its component parts to produce compost. This compost is a useful resource for agricultural purposes since it adds important nutrients to the soil and encourages more environmentally responsible methods of crop production. This initiative tackles various facets of the issue of food waste by merging the management of waste food, the act of donating food, and the more traditional process of composting food. Not only does this reduce the negative effects on the environment, but it also helps people in need by effectively redistributing any food that is in excess. In addition, the application of traditional food composting ensures an ethical and environmentally appropriate handling of inedible food waste. The Waste Food Management System, the Donation App, and the project to Traditional Food Composting give a full solution to the problem of food waste. The project helps to a more sustainable and socially responsible approach to food management by streamlining donation processes and integrating composting methods into existing procedures. In order to achieve a more sustainable future, it places an emphasis on the significance of lowering waste production, providing assistance to communities who are struggling, and fostering the adoption of practices that are kind to the environment. The survey's apps had wide user satisfaction variances, as seen by the standard deviation of 24.25. FoodSharePro lead with 24.29%.

ABSTRAK

Sebagai sebahagian daripada projek Komposing Makanan Tradisional, Sistem Pengurusan Limbah Makanan dan Aplikasi Donasi bertujuan untuk menangani isu penting limbah makanan sambil menggalakkan cara hidup berkelanjutan dan mengambil tanggungjawab sosial. Melalui aplikasi yang menguntungkan untuk pemberi, penyelesaian lengkap ini membolehkan pemberi menyumbang makanan berlebihan, yang kemudiannya boleh diakses dengan mudah oleh penerima yang memerlukan. Untuk mengurangkan sisa dan menghasilkan kompos nutrien yang padat untuk aplikasi pertanian, projek ini menggunakan teknik kompos makanan sisa yang terkenal. Sistem Pengurusan Bahan Makanan dan Aplikasi Donasi berfungsi bersama untuk menyediakan platform yang memudahkan komunikasi antara pemberi dan penerima sumbangan makanan. Penyumbang boleh menyediakan apa-apa makanan berlebihan yang mereka ada untuk menyumbang dengan cepat dan mudah, dan penerima boleh melihat pelbagai pilihan dan memilih yang paling memenuhi keperluan mereka. Makanan yang boleh dimakan dibahagikan semula kepada mereka yang boleh menggunakannya, menghalang ia daripada dibuang ke tempat sampah, yang mengurangkan jumlah makanan yang terbuang. Jika makanan yang dimaksudkan tidak sesuai untuk sumbangan, kaedah kompos makanan tradisional dimasukkan ke dalam projek. Makanan yang telah disiapkan dengan salah atau tidak lagi boleh dimakan dihantar ke kemudahan kompos. Di sana, ia dibahagikan kepada bahagian-bahagian yang berbeza dan digunakan untuk membuat kompos. Pertanian mendapat manfaat daripada kompost ini kerana ia menambah nutrien penting kepada tanah dan menggalakkan kaedah pengeluaran tanaman yang lebih bertanggungjawab terhadap alam sekitar. Dengan menggabungkan pengurusan sisa makanan, tindakan menyumbang makanan, dan proses kompos makanan yang lebih tradisional, inisiatif ini menangani pelbagai isu sisa makanan. Ini bukan sahaja mengurangkan kesan buruk terhadap alam sekitar, tetapi ia juga membantu mereka yang kurang bernasib baik membahagikan semula makanan yang berlebihan. Selain itu, menggunakan kompos makanan tradisional memastikan pengendalian makanan yang tidak boleh dimakan secara moral dan berpatutan dengan alam sekitar. Penyelesaian lengkap kepada isu sampah makanan ialah sistem pengurusan sampah makanan, aplikasi donasi, dan projek kompos makanan tradisional. Dengan menyederhanakan proses sumbangan dan menggabungkan teknik kompos ke dalam prosedur yang sedia ada, projek ini menyumbang kepada pendekatan pengurusan makanan yang lebih berkelanjutan dan bertanggungjawab secara sosial.

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CHAPTER 1

INTRODUCTION

1.1 Background

Shortage of access to food is generally recognised as the root of hunger in the globe as opposed to a shortage of food. On the earth, a third of food produced is lost or squandered. Right now, there is enough food production to sustain everybody on the Earth. An apps that will be able to provide a forum for individuals and organisations to donate remains to those in need. This app's primary objective is to manage donations and connect donors with those in need. The two components of this system are donors and riders as volunteer. The vast majority of people today have smartphones with active internet connectivity, a requirement for this product to function properly.

By diverting food from landfills and recuperating nutrients, waste food management systems can reduce food waste. These systems include, among others, composting, anaerobic digestion, and conversion into animal fodder. Although such systems can aid in the prevention of food waste, they are typically not scalable, offer limited accessibility, and are frequently not cost-effective. This constraint led to the creation of donation applications, which offer a promising a solution to the problem of waste food.

Donation apps facilitate the connection between food donors, such as restaurants, grocery stores, and caterers, and the local charities and food banks that redistribute the food to those in need. These applications can reduce food waste, alleviate starvation, and offer the chance to reduce greenhouse gas emissions associated with food waste. Waste food management systems and donation apps are essential for addressing food insecurity and reducing waste food. These applications are user-friendly, scalable, and economical, making them promising solutions to the food waste problem.

1.2 Problem Statement

The appropriate management of discarded food is an urgent and crucial issue in the present day. Globally, thirty percent of the food produced for human consumption is wasted or lost. This enormous annual loss not only damages the environment but also exacerbates the food shortage problem. Unfortunately, approximately 20% of the global population lacks access to adequate and nutritious sustenance. As there is an urgent requirement for an efficient waste food management system that can collect and distribute excess food from households, restaurants, and other sources to those in need. Donation applications have emerged as possible means of streamlining the process of connecting food donors with those in need. These applications have the potential to streamline and accelerate the donation process, making it simpler for individuals and businesses to donate excess food. However, the development of such a system presents obstacles that must be overcome, including food safety, logistics, and privacy concerns. When working with donated food, food safety is of utmost importance. To ensure that donated food is safe for consumption, precise guidelines and regulations must be implemented to prevent the distribution of contaminated or expired food. In addition, accumulating, storing, and distributing donated food presents significant logistical challenges. Coordination, transportation, and storage facilities must be efficient in order to preserve the quality and freshness of donated food. Another crucial aspect that must be addressed in a food donation system is confidentiality. Donors and riders may be concerned about the confidentiality of their personal information and data. Establishing confidence and guaranteeing the security and confidentiality of user data are crucial for promoting participation and engagement. A well-designed food waste management system that effectively overcomes these obstacles can have a significant impact despite these obstacles. By efficiently managing food waste and connecting surplus food with those in need, such a system has the potential to simultaneously alleviate starvation and reduce food waste. It requires collaboration between diverse stakeholders, including individuals, businesses, and government agencies, to develop a sustainable solution that prioritizes safety and efficiency while maximizing food redistribution. By leveraging technology and nurturing collaboration, we can create a system that not only promotes sustainable practices for a better future but also ensures a more equitable distribution of food.

1.3 Project Objective

The primary goal of this project aims to propose an idea which combines software with waste food management system and donation apps together with hardware of traditional food composting system. The aim aims to cut down on food waste by connecting people, restaurants, supermarkets, and additional foods -related businesses with local food banks, shelters, and non-profit organisations capable of distributing excess food to those in need. The objective of this project are listed as below :

i. Assist in collecting the leftover food and distribute among the needs.

ii. NGOs or volunteers helps poor communities and strays that have to battle against malnutrition and starvation.

iii. Reduce food waste and aid in sustaining the impoverished.

1.4 Scope of Project

The project's overall objective would be to prevent food waste, reduce starvation and malnutrition, and encourage social responsibility and sustainable living practises. The scope of this project are as follows :

i. Developing software for a food waste management system that can monitor food inventory in order to reduce food waste and improve efficiency.
ii. Developing a mobile application that connects food donors with food banks, charities, and people in need.
iii. Implementing a donation system in which food donors can readily donate excess food to those in need, such as the strays, homeless and low-income families.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Waste food management system and donation apps would contribute to a comprehensive understanding of the topic. Waste food has emerged as a topic of concern on a global scale as a result of the considerable impacts it has both on the environment and on society. Waste food management and the need for effective solutions would involve analysing the current data on waste food and investigating the environmental, economic, and social effects of waste food. In recent years, there has been a substantial amount of focus placed on food waste as a concern, and several initiatives possessed been put into place to reduce waste food. Examine the numerous waste food management system currently in place which would include an analysis of the various food waste management strategies, such as decomposition, recycling, and donation. One such project is the creation of several methods for the management of wasted food and other donation apps. Explore the application of technology in waste food management system and the evolution of donation apps that enable individuals and businesses to donate surplus food to those in need. This would entail analysing the features and functionality of various donation apps to determine how they can be used in order to lessen food waste and help the community. The goal of these systems is to lessen the quantity of food that is discarded by making it easier for individuals and corporations in the food industry to provide extra food to people who are hungry. Waste food management system and donation apps have the ability to greatly cut down on food waste and the environmental problems that are linked with it. According to research, these systems have the potential to prevent surplus food from being thrown away in landfills, lower emissions of greenhouse gases, and offer sustenance to those who are in need.

2.2 Past Related Project Research

The authors had successfully illustrated their framework in the thesis, according to several articles. A number of related studies and projects in developing waste food management system and donation apps have been reported, as follows :

2.2.1 “Waste Food Management and Donation App” by Vanashree Mhatre, Shweta Chavan, Snehal Gamare & Prof.Varsha Slunkhe.

Atharva College of Engineering, Mumbai developed the need for food donations is necessitated by the steep increase in waste. In a country as densely populated as India, waste food is a major issue. Waste food is a significant contributor to food scarcity, as evidenced by the fact that many individuals toss edible foods in the trash. This issue involves not only waste food but also monetary waste. It causes numerous environmental issues, such as pollution, which in turn contribute to climate change and global warming [1]. Waste food is a sign not only of pollution or starvation, but also of numerous economic issues. This product is an android-based application for non-profit organisations; it is a platform for donating leftover food to those in need. This app created a relationship between contributor and volunteer from an NGO, with the donor adding all food information, including food variety and the place it is served, cooking instructions, and date of expiration or time.

2.2.1.1 Basic Concept of Mobile Applications

This mobile application aims to reduce restaurant food waste by donating uneaten food to non-profit organisations. NGOs will supplement a request in the event that hotels have excess food. This demand is sent to the manager of the restaurant for this establishment. The NGO Manager subsequently grants the request, which is then given to an NGO employee in light of delivery and delivered to the eatery. NGOs can be given the hotel's leftover meals at the end of the day. The administrator is able to determine the history of restaurants and non-profits regarding remaining foods. Owners of orphanages

and senior living facilities can rate a food item, thereby assisting others in selecting the food. Using the scrkit_learn library, the NLP algorithm, and Python, the sentiment of each owner-provided review is stored. This research has examined the issue of waste food, which has numerous negative economic and social consequences. However, waste food can be prevented or at least reduced through the use of political regulations and technology. The utilisation of mobile application technology is advantageous for waste food management. The objective of the app is to promote improved food management. Using mobile technology, this proposed solution should reduce food waste by facilitating group food sharing. This is the initial step in designing an improved system to reduce daily waste food.

2.2.2 Food Waste Management Android App by Sonali, Utkarsh Kumar & Dr.Yogesh Kumar

In this article which was proposed by Sonali, Utkarsh Kumar and Dr.Yogesh Kumar is access to food, as opposed to food scarcity, is the most well-known reality about world hunger. One-third of the world's total food supply is discarded as waste. Currently, the world produces enough food to sustain every person. In an effort to aid those in need, we have developed an android-based application that will provide a platform for individuals and organisations to donate their remains. This android application-based project's primary objective is to manage donations and connect donors with those in need [1]. This application intends to produce a shared a platform for cooperation for lodgings and dining places, non-governmental organisations, and also volunteers. This system consists of four modules: administration, non-profit organisations, volunteers, and donors. The majority of people today use smart phones with active internet connectivity, which is a requirement for this product to function.

2.2.2.1 Proposed System on Android-based Application

The suggested system is an application that runs entirely on Android and acts as a platform for users to donate and distribute their surplus food to those in need. This application can be an effective way for residents of a country like India to donate excess food in a convenient manner. This system is composed of four modules: admin, NGOs, volunteer, and user. Non-governmental organisations, volunteers, and consumers must register on by supplying their information to the application. All data will be accessible to the administrator, who will be responsible for authorising or rejecting all requests. The administrative official can authorise all registrations and logins, in addition to the donation pickup. Using Android Studio 4.0.3, Java, and XML, the proposed android-based application is developed. This application also employs the Firebase authentication and real-time database technologies. In addition, we have used the Google Map API to retrieve the user's current location in the backend and locate that location on Google Map. When a user registers and indicates a desire to donate or receive, the information is stored in a real-time database [2]. This information is retrieved whenever the recipient or donor

desires to donate or receive the item. The user is then directed to Google Map in order to locate the delivery or pick up location. The user interface of this application will be kept logical and uncomplicated.

2.2.2.2 System Architecture Based on MVC Model Version

The proposed system's device architecture adheres to the MVC model version that employs the strategy of concern separation. The 3-tier architecture follows a standard operating procedure which is Data tier, Client tier, and Server tier. The business logic of the programme is located in the Server stratum, which also makes use of online services like the Google Maps Distance Matrix API. The Data tier contains the entirety of the application's data. The Client stratum includes techniques that facilitate the establishment of server-side connections. It is accountable for finding the device using GPS or the internet in addition to fulfilling the needs. It is based on Java and uses XML for layouts.

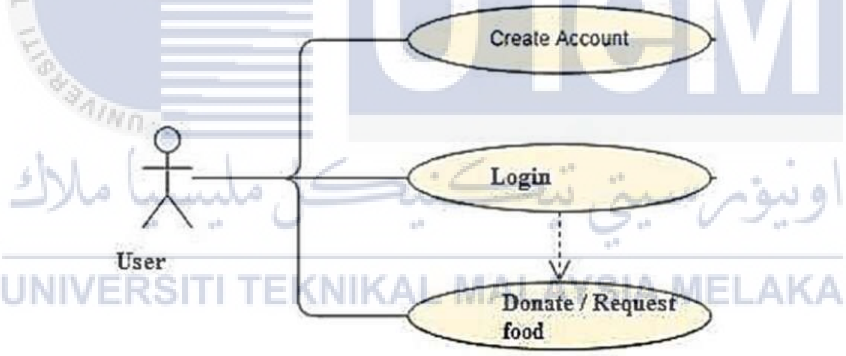


Figure 2.1 : Module Activity Diagram

The proposed Android-based application eliminates manual communication issues, supply chain management problems, and difficulties in contacting likely locations. A primary advantage of this system is that it reduces the amount of human labour and time required per donation. Fighting malnutrition, starvation, and famine can be greatly aided by this technology. In addition to resolving, it can also help with the economy and the depletion of natural resources, as well as the problem of waste food such as purified water and fuel, as well as ecological degradation. This suggested background paper explains a

revolutionary decision-support tool that makes it easy to implement the best sustainable solution and a range of extra food management options. The primary motivation for devising this system was to reduce food waste and redistribute surplus food to individuals in need. This paper describes the relationship between various modules and how this process might be used in a software-based guidance tool.

2.2.3 Web-based Application for Food Waste Management by Ms.R.Uma, S.Ranjith, Kaja Mohaidheen & S.R.Dharaneesh

This project titled "Web-based Application for Food Waste Management" by Ms.R.Uma, S.Ranjith, Kaja Mohaidheen and S.R.Dharaneesh based on the idea of collecting excess or food that was donated by establishments like hotels, restaurants, and wedding venues and distributing it to the impoverished via NGOs. NGOs will gather any leftover or surplus meals from the locations to be distributed to the destitute. This web-based food waste management solution can help with the collection and distribution of surplus food served at weddings, restaurants, hotels, and other social, political, and religious gatherings to those who are in need. By means of this application, organizations that are non-governmental and aiding impoverished communal efforts to combat starvation and malnourishment can submit a request regarding the supply of excess or surplus meals served in restaurants [2]. Following the request approved, NGOs can retrieve the meal for distribution from the event site. Donors will be helped in decreasing food waste and feeding the hungry and needy by this web-based tool for managing food waste.

2.2.3.1 Implementation of Website Achieved with Various Features.

The suggested framework includes the correct implementation of a website is accomplished using a number of features. Through the information provided by the administrator, NGOs (Non-Governmental Organisations) and donors can readily locate each other in the proposed system. It includes a distinct logistics login for individuals whom may gather food packets and donate funds from donors to non-governmental organisations. Knowing how much extra food is produced daily by restaurants is useful. Regularly giving extra or leftover food to those in need also helps.

2.2.3.2 Working Principle

This web-based application of managing waste food consists of Admin, Donor, NGO, and Logistics (delivery system) are the four modules. Every module comprises website logging in and registering. Registrations among donors and NGOs becoming examined by the manager in order to stop fraud, fraudulent requests, and fraudulent supplies. After verification, both parties will submit donation and need requests. Admin may observe requests, products, and facilitate communication between they through trading information regarding the accessibility, nature, and volume of food provided by Donors to NGOs. If non-profit organisations need to manage their excess or surplus food, they can view the restaurants' past and send them a request.

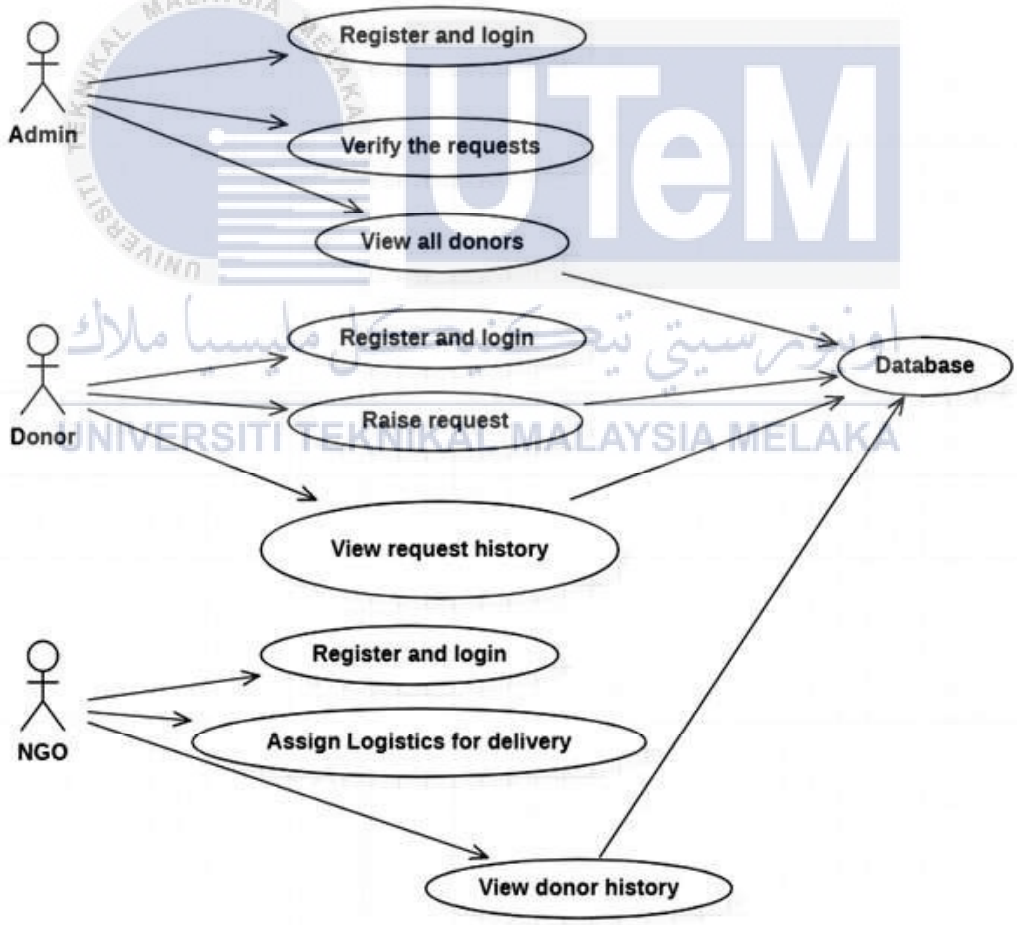


Figure 2.2 : Use Case Diagram

This project titled "Web-based application for food waste management" provides a comprehensive a description of how an online resource that supports donors and non-governmental organisations. This webpage supports the collection and distribution of leftover/excess food from donors to those in want. This on the web programme is functional and responsive to users, using correct database retrieval. In addition, all user logins have access to a help menu that is responded by the administrator [3]. Thus, this website includes a variety of features to facilitate the efficient consumption of surplus food by those in need.

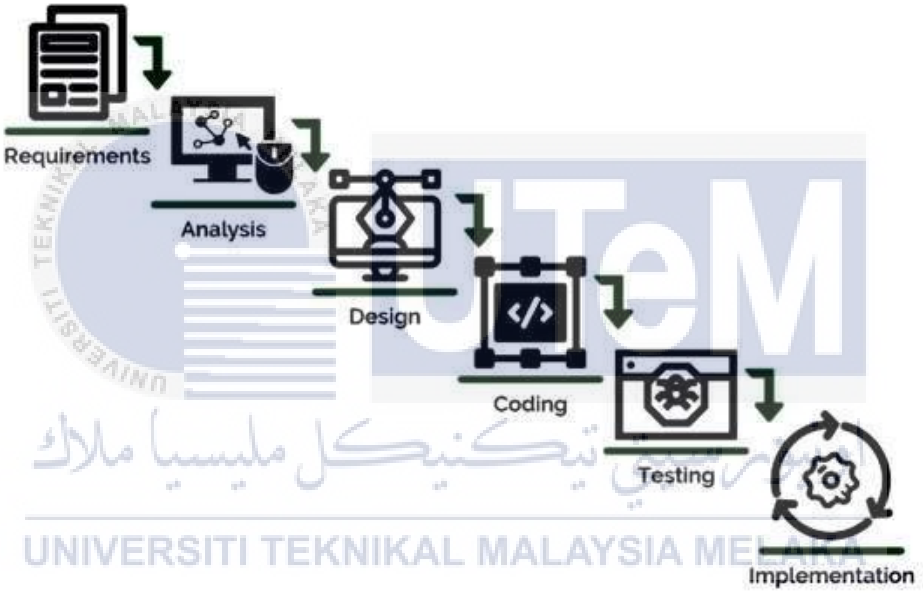


Figure 2.3 : Workflow Diagram

2.2.4 An Android and Web Based Food Donation Application to Reduce Food Waste by Vernekar Yogesh Vinayak, Gautum Rohit Mohanlal, Pawar Abhinav Kiran, Sathe Gaurav Ganpat & Prof.Rukare Gayatri

According to Vernekar Yogesh Vinayak, Gautum Rohit Mohanlal, Pawar Abhinav Kiran, Sathe Gaurav Ganpat & Prof.Rukare Gayatri, the misuse of food at each stage of the food lifecycle has become a severe environmental, social, and economic problem considering how much food waste is generated in the United States continues to rise. Every day, a substantial amount of food is squandered in hotels and restaurants. The waste produced by banquet halls, party halls, etc. is also enormous. In a country where a large portion of the population lacks access to essential amenities and goes without food for a day, such waste is intolerable. It is ironic that hundreds of orphanages are devoted to assisting people from disadvantaged societies by providing them with sustenance and shelter at the very least. Food sharing is a process in which individuals and organisations commit to ensuring that food is shared instead of wasted. It is a fundamental form of participation that is notable for its central role in shaping an individual's life narrative, social structure, and cooperative behaviour. The edible food that is discarded could be used for human consumption. Throwing aside edible food that could be consumed by another person is a waste of resources. NGOs collect food from benefactors and redistribute it to community centres. The strategy entails nongovernmental organisations collecting food refuse and donating it to those in need, taking into account the variety and origin of the food. The method aids non-governmental organisations in collecting food refuse from donors and donating it to those in need.

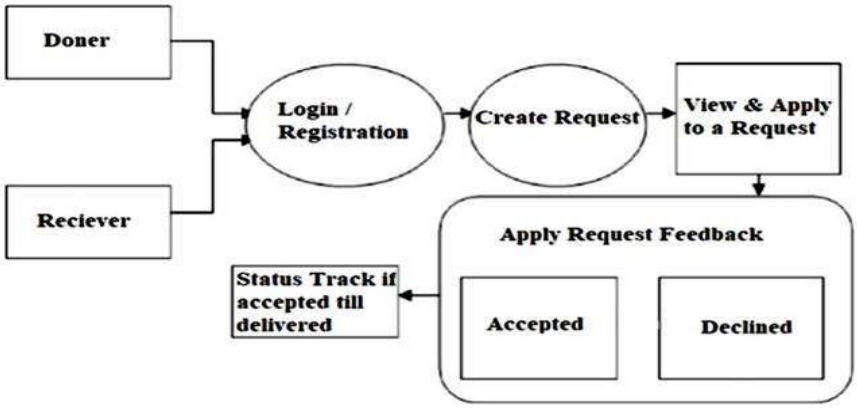


Figure 2.4 : Block Diagram

In this approach, either the Donor or the Recipient can register via App or Website. They will be able to access the system after registering. Individuals/restaurants can create donation requests after logging in, while NGOs can request food donations. Following the creation of requests, they will be displayed on the dashboard page able to peruse already listed requests and either register for listed donations or respond to NGOs' requests for donations. After submitting a request application, the request is processed and sent to the request creator for approval [4]. After confirmation, the status of an item is monitored throughout its lifecycle until it is delivered. The application attempts to bridge the divide between NGOs and Donors. It functions to distribute the surplus food to those who are struggling to find food [3]. Consequently, connecting individuals in need with donors by utilising NGOs as an intermediary. As well as aiding in the decrease in food waste through its distribution to the destitute.

2.2.5 MySusCof App: Developing and Putting into Practice a Mobile Application to Encourage Food Waste Reduction by Rainer Haas, Hakan Asan, Onur Dogan, Claus Rainer Michalek, Ozlem Karaca Akkan, and Zeki Atil Bulut

MySusCof App was designed composed of Rainer Haas, Hakan Asan, Onur Dogan, Claus Rainer Michalek, Ozlem Karaca Akkan, and Zeki Atil Bulut to ensure that nearly half of all waste food is caused by consumers. Numerous Sustainable Development Goals (SDGs) cannot be achieved without consumer-focused interventions, particularly SDG 12.3. There are numerous causes of food waste, all of which can be avoided by modifying the ways that grownups consume. Mobile apps are thought to be promising instruments for altering consumer behaviour and promoting use of sustainable food sources [4]. This research investigates the creation and perceived quality of MySusCof, a food waste reduction app for users. Consumer data was gathered using the uMARS scale. Two studies that fit the study's parameters were carried out. to investigate the application's to evaluate the mobile application's user response and development process. The findings demonstrate the importance of gamification components with hedonic, social, and practical components for user engagement and perceived impact [5]. In terms of the functional and hedonistic value of mobile applications and their function in driving behaviour modification, the unique discoveries further improved the user experience. This research acts in the capacity of manual for later designers of portable programmes meant to encourage customers to eat sustainably.

2.2.5.1 Hedonistic, Practical, and Hybrid Mobile Apps

Considering their core, mobile applications are divided into the hedonistic or experimental and the utilitarian or goal-oriented groups. Designing a mobile application can be done in one of three ways such as utilitarian, hedonistic, or hybrid. applications for social networking and entertainment promote hedonic or experience-based outcomes, while banking and productivity applications, for example, support utilitarian or targeted results. Customers use utilitarian apps mostly for information. For instance, whereas hedonic mobile apps are employed, these programs focus on tasks., logical, and regarded

as relevant to work for shopping and other similar activities, amusement, and game playing. Regarding MySusCof is an app that categorised as a hybrid application. that offers practical advantages of details provision on ways to decrease food waste and hedonic/experimental results by including game components like assessments and benefits. Acquiring bonus points that the type of praise. In order to ensure that the MySusCof application provides both utilitarian and hedonic features, a hybrid approach was implemented using a gamification technique.

2.2.5.2 The DSDM Method for Creating Mobile Apps

A typical issue when developing computer programs or an app, is that end-user assessment occurs after the software or app has been completed and not during the stage of design. Changes made after the design process is complete are often expensive and have a negative impact on how usable the final product is. As a result, The SUSCOF group chose employing an iterative design methodology, creating a model for the MySusCof mobile application, testing its usability, and then incorporating the findings into an enhanced version prior to the application was released. This methodology utilises DSDM as a prototype for developing application. The evolution of an application requires input from both specialists and end consumers. During the development process, a usability test was employed to collect feedback from end users. Three phases are assigned to each project. by DSDM: pre-project, during the project, and after the project.

2.2.5.3 Benefits and Principles of DSDM Process

Early participation of customers, cyclical innovation, and consumer opinions, a self-coordinating team, and adaptability to alter are the benefits of the DSDM method. Some of the DSDM guiding principles include user participation, team empowerment, regular delivery, attending to present business requirements, gradual and iterative development, shifts that are reversible, premium scope being rectified prior to the undertaking begins, UX evaluation throughout the lifecycle, as well as successful and productive communication. The development of an application needs advice from experts

as well as end customers. During the development process, a usability test was employed to collect feedback from end users.

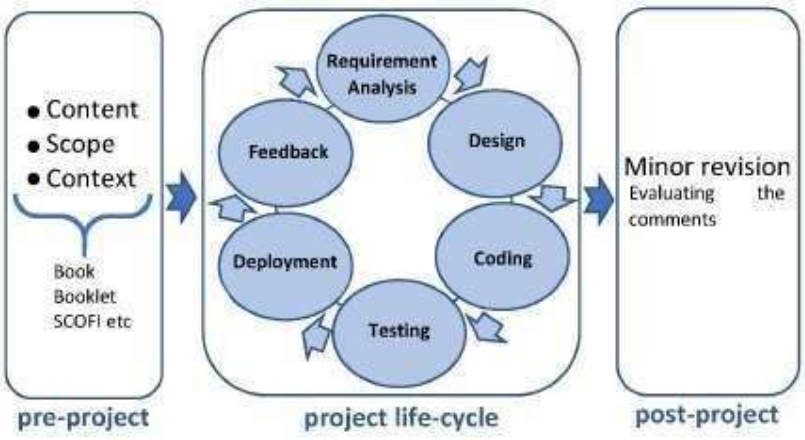


Figure 2.5 : Project Implementation Process

In terms of the overall perceived quality among the produced smartphone application related to enduring food usage, both utilitarian and hedonistic values were found to be at high levels, however Informational elements, practical factors, and functionality were ranked greater than hedonistic features. This illustrates that the main importance of utilitarian values designed to guarantee the perception of software caliber. Conversely, it was discovered that a hybrid software that included both hedonic and utilitarian elements able to attain elevated degrees of behavioural intention. Gamification components must be implemented in order to increase the app's hedonic value. These findings lend credence to the notion that one of the best combinations for enhancing mobile application usability, user interaction and motivating users to change their behaviour may be a hybrid mobile app with gamification components. These results indicate that one of the best strategies for persuading users to adopt a more sustainable approach to food consumption may be a mix mobile an application having practical and gamification components.

2.2.6 Food-For-All Web Application for Donation Management by Yasith Chandula, Akila Kavinda, Thushal Shaminda, Sachintha Gunaratne, D.I. De Silva and Dulanji Cooray.

There are more than 829 million undernourished individuals in the world. Due to the covid-19 pandemic and other crises, the number of famished people has increased dramatically. Deficiency in food frequently results in malnutrition, to which infants and women are particularly susceptible. People use mobile phones and computers in their daily lives; our application is accessible from both mobile devices and computers. Poverty is the most prevalent cause of food insecurity. Through our app, individuals may create demands when they are familiar with someone and donations based on their financial capabilities in need of assistance, and organisations can organise efforts to raise money and stop starvation and promote sustainable strategies for overcoming food insecurity [5]. The entire platform is managed by an administrator to prevent the publication of hoaxes and irrelevant information. Our application's overarching objective is to end starvation, assist those to end food insecurity, develop a sustainable agricultural system for those who are in need.

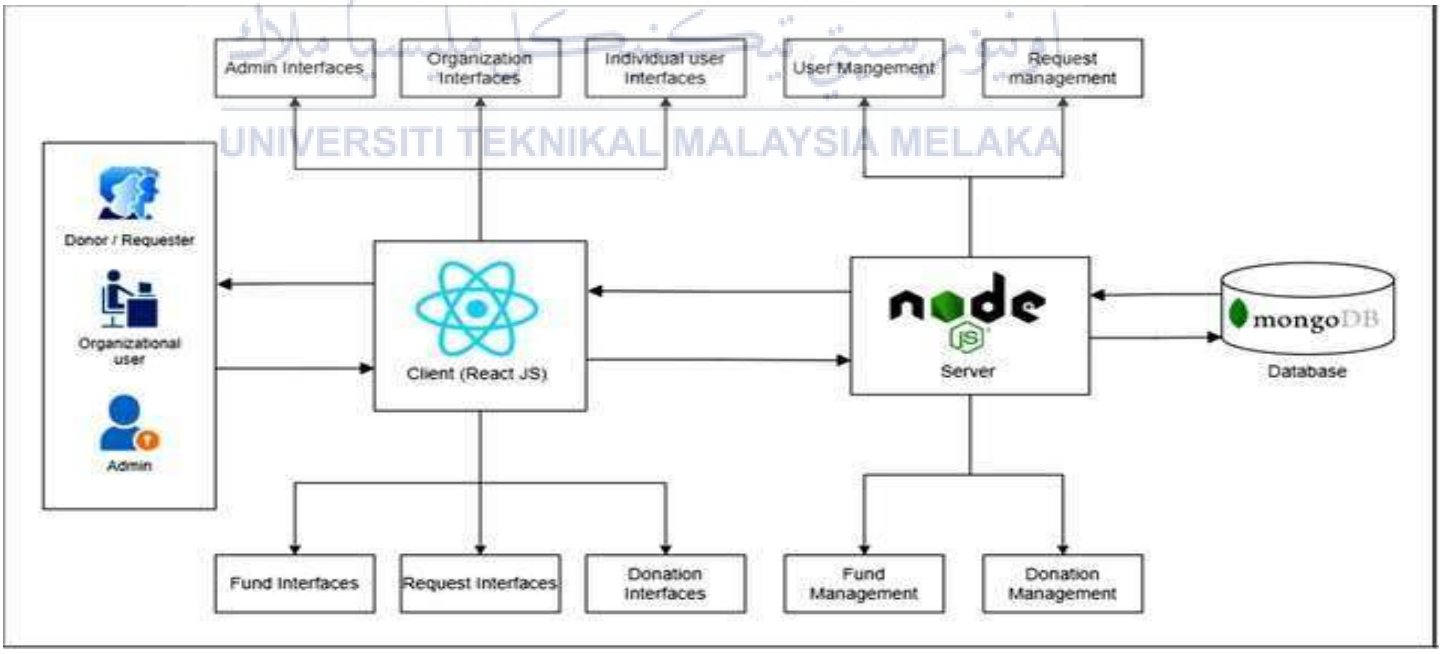


Figure 2.6 : System Overview

Based on Figure 2.6, the system overview displays the application's underlying technologies. The client-side implementation utilised ReactJS. The UI library is Bootstrap, and third-party libraries were utilised to develop features such as report generation and API connections. The server's infrastructure is built with NodeJS and ExpressJS. The server implementation utilised MVC architecture. The image uploads are managed by Cloudinary server. The system's database is MongoDB. Data from the application was kept on the cloud. using MongoDB. Users need to be signed in, in order to access the system. After successfully logging in, users can access the system's features. There are primarily three user functions within this system. Organisation, Requester, Donor, and Administrator in order for the organisation to access the system, the organisation to sign up for the system and provide the required information. Admin should then examine the details. If the administrator has approved the organization's information, only that organisation can log into the system. After logging in, Organisation is able to create fundraising programmes. The fundraising programmes must also be verified by the administration. If the administrator has approved the fundraiser programme, it will be visible to all other users. Donors must register with the system before contributing to the aforementioned fundraiser programmes. Additionally, if the user was logged in as a requester, they were able to post donation requests. They are visible to everyone else.

This donation management system was created to ensure food security for all those who struggle to acquire food [6]. This system will encourage donors to donate more by fostering a sense of trust, as the system administrator will monitor and evaluate numerous user actions. For example, each organisation will be evaluated prior to registration. Then, only approved organisations will be permitted to post fundraiser programmes. Each fundraising programme will be evaluated by the administration. Therefore, it is difficult to commit a violation in this system. Donors can therefore contribute to the fundraising programmes without hesitation. For this system, the MERN stack was used as the underlying technology. Used ReactJS for the front end and ExpressJS and Node.js for the back end. The MongoDB database stores all the data. Utilised libraries include Axios, mongoose, and express. The user interface is styled with Bootstrap, material iconography, and additional external CSS. The interfaces are

straightforward and intuitive. We utilised side navigations, menus, assorted icons, and buttons to facilitate navigation and comprehension.

The 'Food for All' web application has been effectively implemented, according to the research findings. This project's primary objective was to create a platform to connect donors and requesters, assist organisations in promoting their initiatives, and ultimately contribute to the development of sustainable agriculture. As a whole, the system allows users to Among other options, you can create donations, submit requests for donations, make fundraisers, and contribute to fundraisers. As a result, the suggested approach will help in the fight against hunger and offer a great start for this project for those eager to help the less fortunate.

2.2.7 Food Wastage Reduction Through Online Food Management System Donations for Orphanages by Pritom Kumer Rajvor, Md. Shafiqul Islam Shovon, MiniraAkter, Farzana Nawrin and Suraiya Yasmin

This research was done by Pritom Kumer Rajvor, Md. Shafiqul Islam Shovon, MiniraAkter, Farzana Nawrin and Suraiya Yasmin is to feed the hunger, which is a pressing issue in the world today, and food waste is increasing exponentially. A system for managing surplus food for orphanages (SFO) is available online administers surplus food for the hungry individuals who lack sufficient food to survive. The objective of this study aims to create a internet-based gateway called "Surplus Food for Orphanage" that facilitates exchange of messages between food donors and recipients. This work describes a fresh webpage that shall facilitate the donation of used items and excess food to those in need. This website allows donors to create an account. After successful registration, Donors can log into their accounts to view this webpage. Donors will fill out a registration form with the name of the food item, the amount of food they would like to contribute, their location, and contact details. To the administrator, a notification is sent. By enrolling on this website, charity can access the restaurant or donor post. [6]. Then, the The food provider can be contacted by the charity, collect the extra food that the donor has left over, and give it to the underprivileged. This strategy will encourage food donors to donate to orphans more frequently and help reduce food waste.

This research project's system was hosted online. The coding language PHP (Personal Home Page) and interpreter used for website development. This is a web-based application built with the Zend Framework that needed to be online connection. It also covered the design and implementation of prototype development. In addition, The suggested method's use case and project workflow diagrams are shown. This website facilitates an internet-based system for donating food. The webpage is presented as an efficient way to donate items to various organisations over the internet. Numerous restaurants and organisations are willing to donate surplus food to those in need. Numerous organisations wish to provide necessities such as clothing, food, money, literature, etc, but there is no reliable origin from which they can do so. Through This online gateway, donors can post a request to donate food items, and organisations, such as charities, can read the article and get in touch with the donor through the website.

People who wish to provide their excess food can use this complimentary platform to do so. [7]. Donors and those seeking sustenance must register via the sign-up option in order to access this website, which requires an internet connection. After completing registration, both donors and recipients will have access to this website.

2.2.7.1 Use Case Diagram and Project Workflow

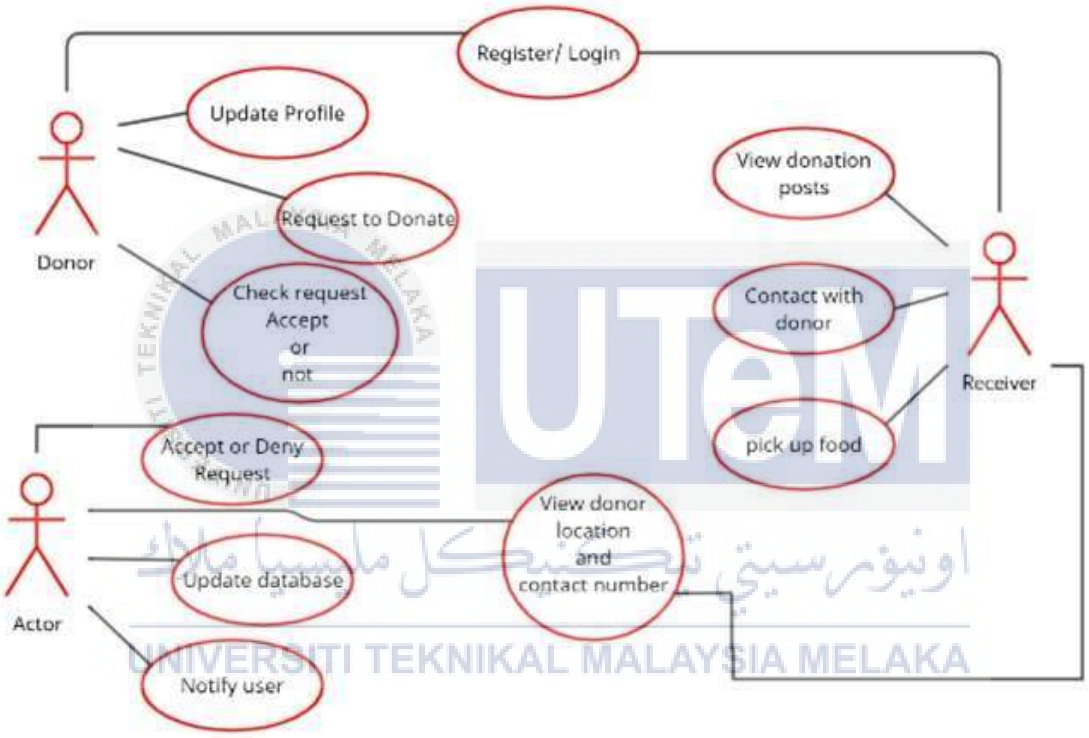


Figure 2.7 : Use Case Diagram

2.2.8 Food Waste Management by Madiha Saba, Pooja, Dr. Priyadarshini. Patil.

According to Madiha Saba, Pooja, Dr. Priyadarshini. Patil, in a country where the commercial status has progressed to the point where tonnes of nutritious food is discarded at every stage of the market, food waste is widespread. An approximated 25% of available delicious food is lost to waste. Food is an essential energy-intensive product group and resource. Every restaurant has perfectly excellent food at the end of the day that they cannot sell. A substantial quantity of this food is wasted and discarded in the dumping zone. How can this cuisine be used to effectively satisfy a person's hunger? What if there were a platform that connected establishments with organisations like NGOs? With this platform, not only will NGOs be able to feed more needy people, but restaurants will also have a viable channel for distributing or disposing of excess food [4]. It's a win-win situation where businesses can contribute meaningfully to a sustainable environment while charities combat food insecurity. In order for this to occur, both NGOs and restaurants will need to register with the platform and communicate information about how much food is remaining; NGOs will then be able to collect the food from the restaurants closest to them. NGOs serve as food collectors, acquire and redistribute food from donors to community centres (needy people), with the following two outputs in mind such as the strategy connects donors and NGOs in order to assist them in launching a programme for the decrease in waste food and the enhancement of unsold food. The approach facilitates the internet-based pairing of food-donors and non-governmental organisations.

The system that reduces restaurant and function food waste by donating leftovers to non-profit organisations. NGOs will submit a request in the event that restaurants have leftover meals. This proposal is sent to the restaurant manager of the establishment in question. The NGO Manager then authorises the request and assigns it to a single member of the organization's employees for takeaway and reactions to the eatery. The dining establishment with the information provided by the NGO, the manager is able to monitor the recipient of the food until he collects it. NGOs can be given the restaurant's leftover meals at the end of the day.

The sustainability approach serves to avoid a chasm between the NGO and Donor. The strategy aims to provide food refuse to food-insecure individuals who are impoverished. The approach unites these two in such a way that the NGOs can persuade the "food to be wasted" without difficulty, and the hotels, restaurants, party-lobbyists discover these organisations. It will serve a greater purpose and be a tremendous service to humanity if it can provide food to those in need with no additional effort [8]. This method serves to improve the public image of hotels and restaurants that serve food, as well as to save money. It decreases food waste and reduces environmental impacts. On the other hand, it aids destitute individuals in acquiring nourishment in order to endure.

2.2.9 Food Waste Management by Dhruv Panchal, Parth Gandhi, Mrunmayee Dalvi, Atharva Naik, Shubhangi Chintawar.

To develop an app for smartphones that cuts down on food waste at parties, restaurants, and in the garbage. Dhruv Panchal, Parth Gandhi, Mrunmayee Dalvi, Atharva Naik, Shubhangi Chintawar created the application that includes food donation collection and direct contact with adjacent non-governmental organisations [2]. For Donation of Food, the following information must be provided: food details, location where excess food is available, food category, and food quantity. Urgent Alerts sent to nearby NGOs, orphanages, and volunteers for collection. According to a recent survey, 1.3 billion tonnes of food are thrown away. While only one-third is consumed. This application decreases the quantity of food waste. It also facilitates direct communication with NGOs and volunteers regarding food availability.

In countries like India, 795 million of the world's 7.6 billion people are malnourished or lack sufficient sustenance to live a healthy life. That is roughly one out of every nine persons on the planet. The causes may include, firstly, a global food shortage and, secondly, a phenomenon of vast food waste. In light of these factors, the world today produces 1.5 times more food per person, enough to feed approximately 10 billion individuals. As a result, we can conclude that food made specifically for human consumption is being intentionally or unintentionally squandered, despite the fact that there are so many people on the planet. Waste food is a moral problem that affects everyone. According to estimates from the Food and Agriculture Organization (FAO) of the United Nations, around one-third of the food produced each year for human use is wasted or lost. Every item of food that is missed is wasted. opportunity in order to lessen global hunger and increase global food availability. Grain, vegetable, poultry, and meat supplies as well as drinks that were meant for human use but are now thrown in landfills even if they are edible are considered food waste. Due to commercial practises and ineffective stock management, and neglect, the food tossed away is either spoiled or expired. This is occurring in developed, developing, and underdeveloped nations, with each making a greater contribution than the others.

2.2.9.1 Basic Flow of Algorithm

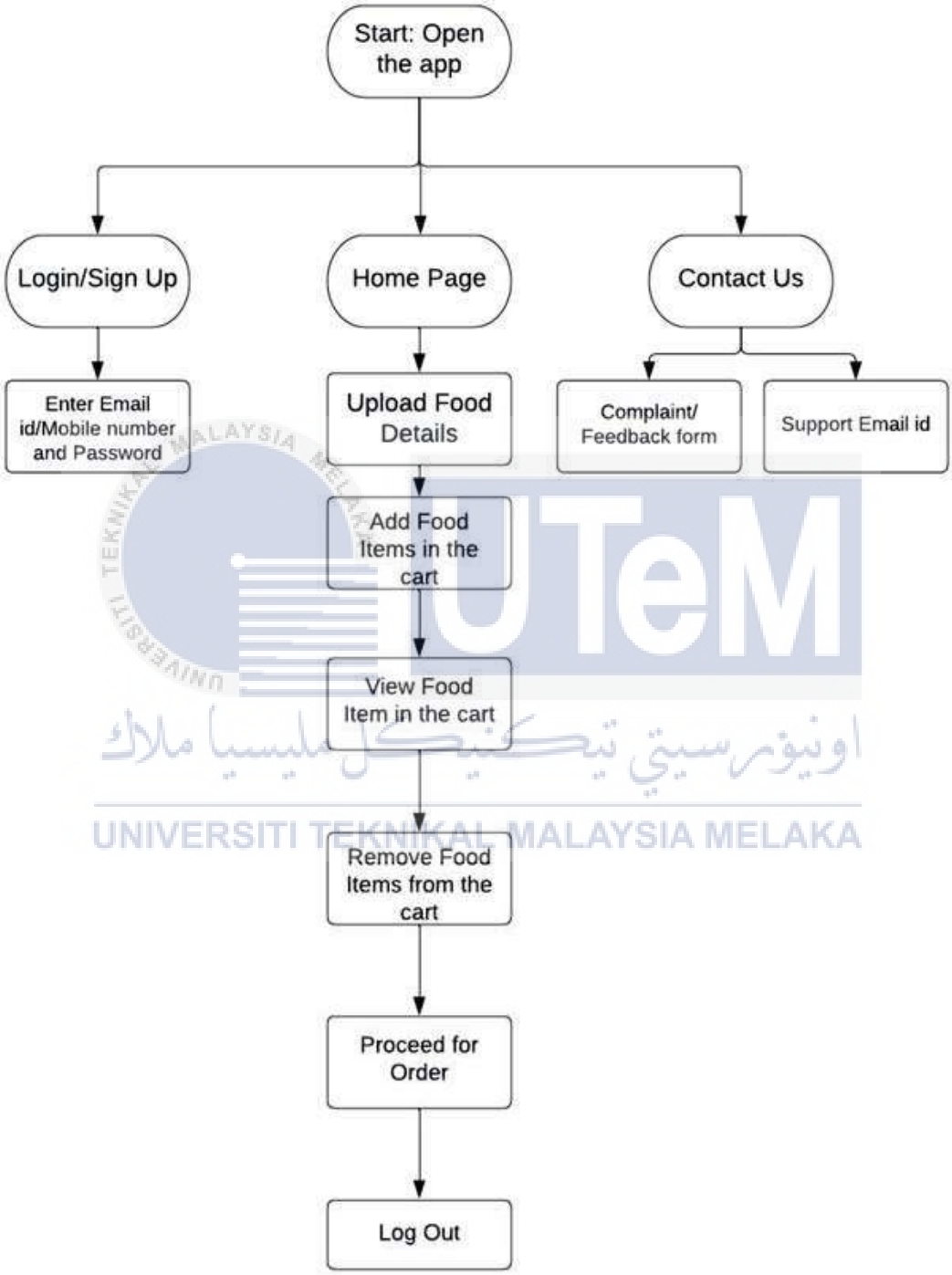


Figure 2.8 : Project Architectural Flow

Figure 2.8, depicts the overall project flow. Here, the user activates the mobile application and is immediately presented with a Login/Sign Up interface. On this page, users must logon with their Email Id or Mobile Number and password or register for an account. After successfully logging in, the user is directed to the homepage. The Home Page contains the Upload Details, View Details, Contact Us, Connect to an NGO, and Logout links. After clicking the Upload Details button, the user is directed to complete out the form with details such as Name, Email Address, Contact Number, Food Type (Vegetarian/Non-Vegetarian), Quantity of Food, and City. After selecting the View Details button, the available food details are displayed to the user. After selecting the Contact Us button, the user is able to send us an email with their questions and comments, as well as dial our phone number. After selecting the Connect to NGO button, the user can contact the listed NGO directly. When the Logout button is clicked, the account is logged out [9].

This initiative titled "Food Waste Management System" is a mobile application that provides a comprehensive overview of the implementation of an application that is beneficial to both Donors and NGOs. The application facilitates the collection and distribution of leftover or excess food from donors to those in need. This application is functional and user-responsive, with database retrieval working as intended. Also, all user logins have access to a help menu containing FAQ. Thus, this application includes a variety of features for the efficient consumption of wasted food by those in need.

2.2.10 Sustainable Management of Online to Offline Delivery Apps for Consumers' Reuse Intention: Focused on the Meituan Apps by Yongrok Choi, Lige Zhang, Jahira Debbarma and Hyoungsuk Lee.

Our daily lives have undergone significant change as a result of the COVID-19 epidemic, especially in the food business. By using a sample population from China's "Meituan Waimai" app users in the "online-to-offline (O2O) delivery of food industry," elements that affect the desire to reuse. investigative wares. Because of the increasing The urbanization process of China's large cities, which contributed to Meituan's first commercial success, the company plans to diversify into China's third and fourth tier of cities. If sustainable governance is not present, this might not be sustainable. We used a model based on structural equations with five factors that determine service quality: cost, accuracy, speed, safety, and convenience) to assess the online and offline governance of O2O company. Intention to reuse and customer satisfaction operate as both distinct but mediating variables in turn. The primary conclusions are stated below. First, speed and efficiency were not the best service attributes for mediating consumer pleasure, indicating that the early success might not be long-lasting. The Chinese vendors of O2O services ought to put in more effort. to customize financial incentives and foster a positive perception of delivery time. Second, additional characteristics strongly support satisfaction, indicating as O2O suppliers should take market input and customer opinions into account.

The following are the contributions made by this study. We will start by looking at Meituan Waimai, the industry leader in O2O food delivery. Consequently, The study will aid in comprehending the needs and perceptions of Chinese customers in relation to the food delivery industry. Additionally, they used service quality, which is widely used in this field of research, as an independent factor. Going one step further, we separated service quality into online and offline domains. The process of food delivery takes a number of steps. of steps involving app utilisation and offline shipping services. In light of this, the empirical findings of this study may suggest which factors ought must be highlighted [10]. Finally, we will discuss the function of "customer satisfaction" as a factor that mediates. This outcome might perhaps assist CEOs in the O2O food delivery

sector, the development of pertinent marketing strategies. More over a year has passed since the start of the COVID-19 outbreak. The consequence of this is an increase in the number of individuals using food delivery applications, and it is clear that competition in the O2O food delivery industry will intensify. In order to secure the long-term effectiveness of enterprises, the O2O delivery of food sector should establish a service-oriented strategy. In this situation, we experimentally investigated how customer happiness and willingness to repurchase were impacted by the O2O app's service quality.

2.2.11 Waste Food Management and Donation Apps by Harshada Mhaske, Siddhi Kengar, Arti Singh.

According to this research by, Harshada Mhaske, Siddhi Kengar, Arti Singh where the current knowledge, technology is constantly evolving and growing. Our main goal is to help individuals who are in need. Many people who desire to donate donations to worthy organizations can use the idea behind this project. In addition, many organizations frequently require supplies like clothing and food grains, literature, and utensils. This mobile application aims to lower waste by providing food leftovers to individuals or groups in need. If a giver has any extra food, the hungry will increase their request. The donors' register receives this request. The subsequent request is approved by the Available Donor. By designating someone to deliver to get food from the contributor and distribute it to the underprivileged, we will handle the distribution system. The second delivery method option consists of individuals who want to help distribute donated food in the neighbourhood. For instance, they can provide food to hospitals, orphanages, retirement communities, and government-run schools [11]. The Food Bank is the third option. We can send food to a food bank where it will be taken care of if we receive it at odd hours. Safety and cleanliness are upheld at food banks. Food cannot spoil or decompose, thus neither can happen.

2.2.11.1 Working of Application

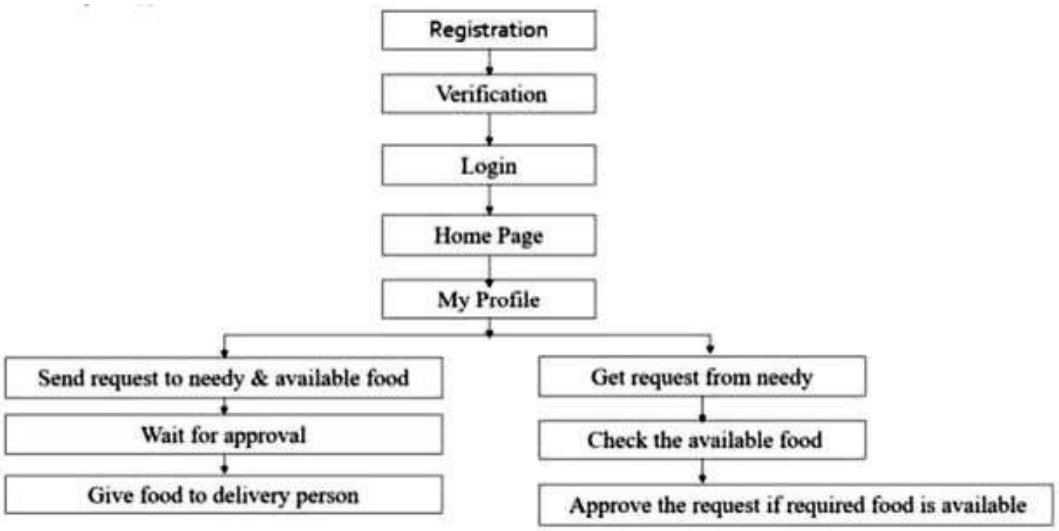


Figure 2.9 : User is Donor

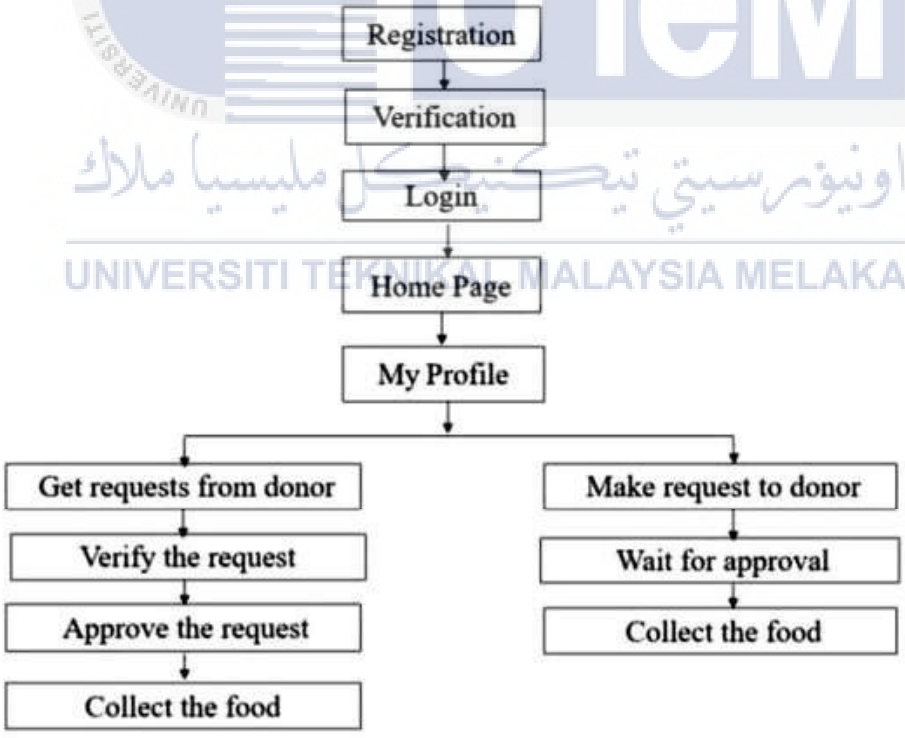


Figure 2.10 : User is Volunteer

The future scope of the initiative could be an application that reduces food waste. Thus, it can be a way for us to progressively cut down on food waste [8]. This application is also useful for providing nutritious sustenance to individuals and organizations in need.

2.2.12 A Mobile Platform for Food Donation And Delivery System Using Ai And Machine Learning by George Zhou, Marisabel Chang and Yu Sun.

In the past year, as a result of the turmoil as a result of the Covid-19 outbreak, a growing the number of households and people have experienced inadequate access to food because of job loss, illness, or another monetary difficulty. Numerous households in Orange County and around the world rely on sources of free food, such as food pantries. We found that food banks needed to be made more accessible and effective. by administering specific surveys to food insecure families. As a result, we developed a software application that employs using AI to find specific items that people have requested and permits volunteers to view these requests and retrieve the requested items send them directly to people's homes from food pantries. This paper describes the process by which this concept was developed and implemented, as well as the qualitative evaluation of the approach. Regardless of multiple constraints, the software application enabled a far higher frequency of receiving high-quality goods for individuals and families.

2.2.12.1 Overview of the App

One of three user kinds will be available to PantryGo users when they sign up [10]. The first category in the Foodbank is the profile. Those in charge of running the specific food pantry, or the managers of Foodbanks, will use this profile. By displaying information about their location, inventory, and operating hours on their foodbank profile, users can save time, effort, and confusion for volunteers and clients alike. The client or consumer profile makes up the second category. When a person or family needs food help from the food pantry, they will use this profile. Users can give their location and other personal information if they so choose. Additionally, a food pantry that is automatically stocked with the required products may be selected, and a grocery list with those things can be created. The third profile of a user is Volunteer. For liability and security purposes, this person will be able to enter personal information about their volunteer that other users may view. The volunteers will be able to check the details of the delivery, such as the location and pick-up times, and select from requests made by clients that day. The food

bank's inventory will automatically adjust when consumers choose products, and the manager can make adjustments based on available inventory. Additionally, the food bank profiles will be able to observe incoming customer requests. The main elements and functionality of the app are shown in Figure 1.

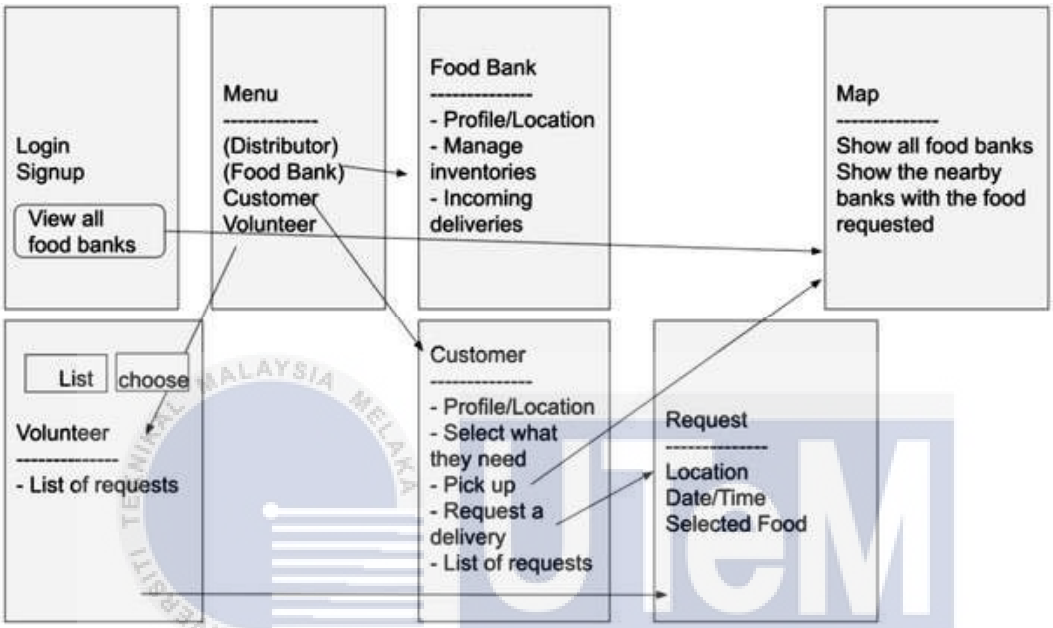


Figure 2.11 : Overview of the App

An app to enhance food pantry reach and accessibility owing to the pandemic's rising need for resources and distribution, which is driving more unemployment. The app connects families and people who run food pantries and volunteers who use artificial intelligence to provide the precise food they need right at their door. This enables families to with diseases, restricted mobility, long distances, several occupations, or time restraints to use their local food pantry's free supplies. Two trials used food waste and volunteer involvement to assess this application's efficacy. The first trial compared food waste following a week of both the food pantry's operation and its absence app [12]. Use of the food pantry increased right away, and food waste decreased. By distributing extra food to food pantries and households experiencing food insecurity, the software can also assist eateries and supermarkets in lowering food waste and their carbon footprint. The second trial surveyed volunteers before and after the application was introduced. When offered

the chance to become a delivery driver, volunteers were far more willing to participate, demonstrating the app's capacity to recruit young volunteers and community collaboration. These two trials show that the solution is applicable, successful, and efficient.

2.2.13 E-Sharing : Developing a Web Based Online Donation System by Hadeel Ibrahim Alzahrani, Zahraa Al Thnayyan, Sahar Al-Qalaleef, Fatimah Al Talaq, Muneerah Alshabanah, Daniah Alrajhi, Mutasem K. Alsmadi.

According to this research that was developed to feed many people today eat one meal a day. It is a big issue in developing nations. Food is wasted daily. Children and underprivileged people need books and clothes. We can fix this by donating take leftover meals to charities, those in need and our outdated stuff. That requires a platform. It could be a website or web app. numerous Saudis can donate, and numerous NGOs support the poor and needy [8]. But the connecting gap isn't blurred enough. Users need a simple, fast, intuitive, and secure way to donate online with a click. This project creates a mechanism for online charitable donations. Where the humanitarian webpage collects and distributes clothes, toys, and school supplies to needy children. Volunteers will deliver donations to disadvantaged households for free under the planned approach. SQL Server and UML for databases implementation, VB.net and ASP.net were used to design and develop the proposed work.

Figure 2.12 : Homepage of NemahKeep.

In Saudi Arabia, there are a large number of individuals who are able to make donations, as well as a large number of Nongovernmental Organizations (NGOs) that assist the poor and needy. However, the connection distance is not as transparent as it should be. There must be a straightforward, quick, user-friendly, and secure method for such internet contributions to enable one-click donations from users. Designing and building an online donation system based on the Web is the aim of this project [13]. Where the website will gather altruistic contributions and give them to kids who are in need of things like clothes, presents, and school supplies. Those who would like to deliver free donations to the homes of the impoverished can volunteer under the proposed scheme. The Unified Modeling Language (UML), Visual Basic and ASP.net for programming, and SQL Server for database implementation were used in the conception and development of the proposed work.

2.2.14 Feed Hungry, Feel Happy by Yadnesh Chaudhari, Niraj Rawat, Tejas Nikhar, Prof. Saumya Salian

This research was carried out to observe the significant increase in the amount of food that is wasted increases the need for charitable contributions. In the current environment, restaurants, weddings, social events, school cafeterias, and a multitude of other social events squander food on a daily basis in a disproportionate manner. Individuals, while some websites have made an attempt to assist people in donating food, it is still possible to personally contribute food by going to each charity several times in an effort to reduce food waste. The replacement online application that makes up the proposed system offers a venue for food donations to any and all groups or individuals that are in need. It is shown that the system works well as an online way to donate goods to charities, etc. It exemplifies how food waste could be avoided. The article explains the current contribution method, the way the product works to improve society, and the reasons behind developing an associate application of this kind. Using this method, charities and hotels/restaurants can create a common collaboration platform [9]. Organizations who have excess food will be contacted by charities, and a report that shows how much food each restaurant has donated can be produced and used to give reward points to specific restaurants. The Food Donor and Food Receiver modules are crucial to the system. Food Donors are any organization, school, or institute that wants to donate food and create a replacement food donation request, while Food Receivers are any charities that are in need of food. The Third Party Merchandiser, Admin, and Premium User modules are also extremely important. The site will generate a request for a replacement food contribution, and after it is approved, an email will be delivered.

2.2.14.1 Working of Application

This application consists predominantly of three actors: Donor, Receiver, and Administrator. The Donor performs System operations such as Registration and Login. The Donor may be any organization that needs to provide sustenance and submits its request through the portal. This notice is displayed within the portal as a notification to alternative users (NGOs). This message is stored in the database's (MongoDB) backend.

Food Recipients may be NGOs or charitable organizations, and they can check the portal for food donation requests and accept them if necessary. The administrator can also monitor and update the data. The Administrator and Recipient will each read the Donor's Order. The remaining discarded food will be paid to an organic compost producer who will create organic compost that can be used for trees. This initiative can bridge the interval between meals conservation and food manufacturing. The suggested application will lessen food waste and fulfill other requirements for charitable organizations, such food goods. [14]. Currently, the proposed system is working to prevent the critical food waste that occasionally occurs in India. The system is anticipated to continually update and improve, thereby enhancing the application's efficacy and utility.

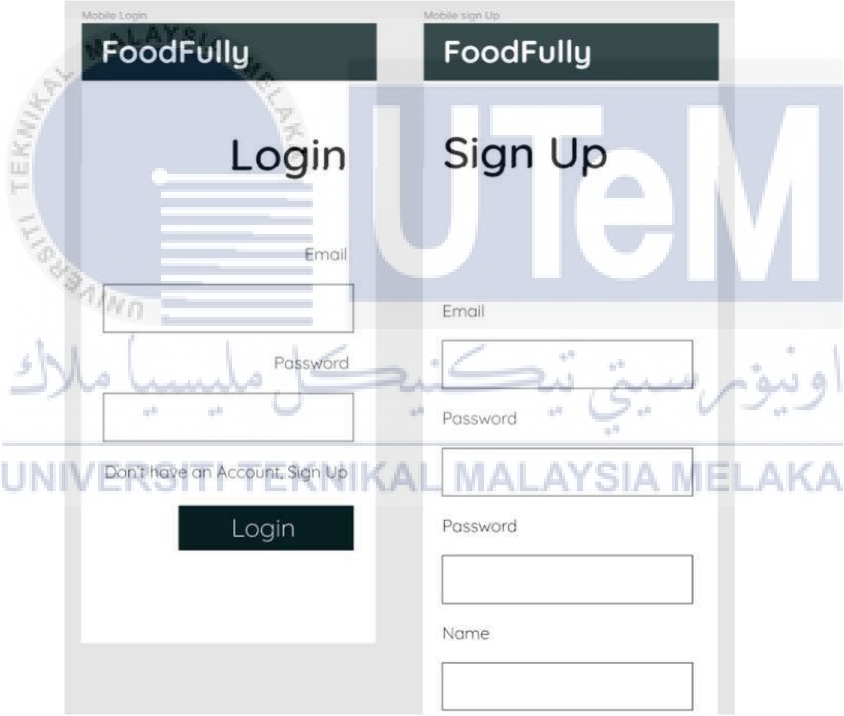


Figure 2.13 : Mobile Login or Signup Page

Certainly, the creation of this product opens several new research avenues. This product has a broad extent of application due to its live creation. Additionally, this product offers numerous benefits to both the business and the community. By moving it online, it will be easier for many people throughout the city to donate food daily. Hundreds of

thousands of tons of food are either lost or squandered, while many individuals suffer from malnutrition. A plausible initiative is the establishment of a food donation portal through which large retail chains and likely other organizations will donate food. This food is collected and delivered to non-profit organizations serving those in need.

2.2.15 Mobile Application for Food Donation by T. Manogna, Rahul, H. Akhileshwar, Ms. G. Menaka, Dr. B. Ramji.

In the technological universe as a whole, mobile phones play an important role in nearly every area. This application by with daily releases of new mobile phone models, technology and applications are also expanding. Android is an open-source platform for the development of new applications, as consumers expect new technologies and mobile applications [12]. This application demonstrates interaction linking donor to volunteer and recipient to volunteer, while segregating donor and receiver. This application includes the donation's history, its current status, and the benefactor, recipient, and volunteer's profiles. This Android application utilizes the information provided by donors, such as food type, and mobile phone number to locate and collect food. Then, our NGOs and volunteers acquire the food and distribute it to those in need. This application's primary user types are donor, recipient, and volunteer. Donors must enter into their account and fill out the details of the food that will be given, including food type, quantity, and time of readiness. Receivers should log in with their credentials. Then, they will see a list of volunteers in their city who have available food, and they will be able to request food by specifying quantity and variety of food. Volunteers should sign-in to their account. Then, they will observe the collection of all donations and the distribution of all food. All information, including user information, food information, food requests, etc., is saved in the main database.

In the past, there was a great deal of food waste because there were no applications to donate the leftover food. No one has the time to donate food to the needy these days, as everyone is too busy with employment. We propose an Android application. This application places volunteers (primarily NGOs) in charge and the food on the table. They collect food from donors and deliver it to recipients (foodless persons, slum dwellers, orphanages, nursing homes, and animals). The primary objective is to develop an application to reduce food waste and give it to underprivileged people.

2.2.15.1 Model of Project Architectural

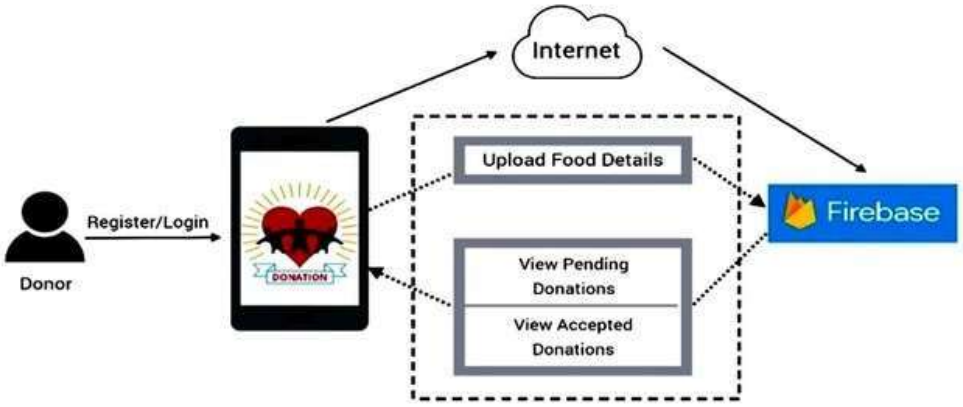


Figure 2.14 : Model of Donor

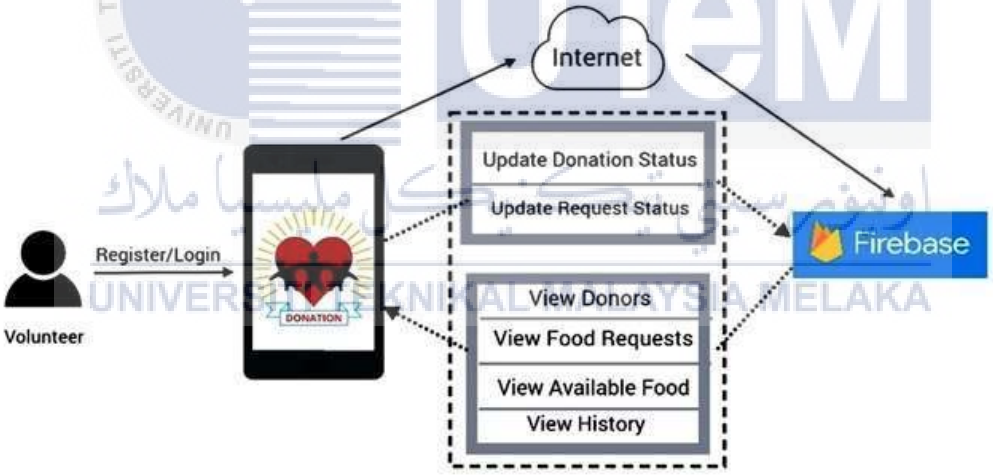


Figure 2.15 : Model of Volunteer

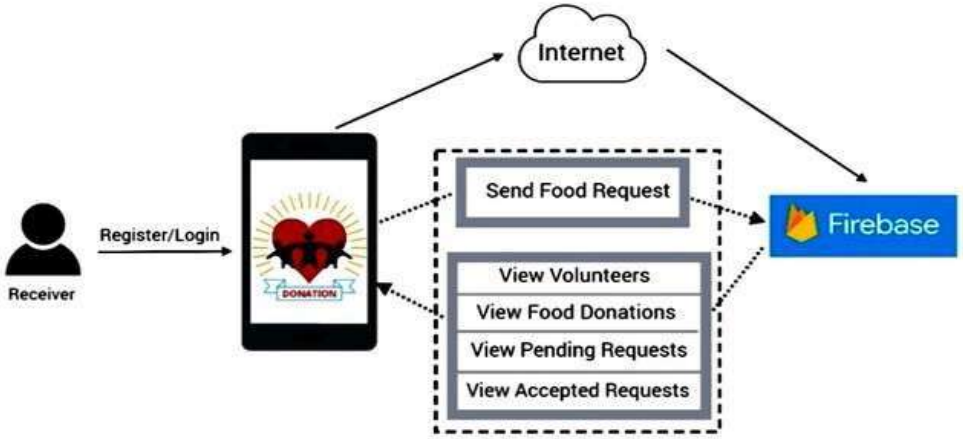


Figure 2.16 : Model of Receiver

The principal aim of this initiative is to reduce waste food by creating an application for food donation rather than disposal. This application will be designed so that inputting food item details does not require a substantial amount of time from users. This application addresses the issue of wasted food by donating it to those in need. It is intended for random users who wish to donate but lack the opportunity or time to donate food to orphanages, senior centers, the homeless, or even neglected animals. This application attempts to facilitate user interaction between donor, volunteer, and recipient [15]. The Donor interacts with the Volunteer, and the Recipient interacts with the Volunteer. Furthermore, The Donor and the Receiver do not communicate directly with one another..

2.2.16 Zero Hunger: Smart Food Donation System using IoT by Juhi Patil, Gayatri More, Pooja Mahale, Nikita Harale and Vijaylaxmi Bittal.

Regarding the coronavirus scenario, food shortages caused hunger, and the Coronavirus lockdown claimed many lives; taking into account this continuous issue, we are working to find a long-term solution for this. 'Zero Hunger' is the system that we are working to implement. A food waste reduction-based invention that moves excess food from public capacity cafés, birthday party show halls, etc. to people who oversee NGOs is using ML and IoT innovation with the goal of ending food waste and hunger. Food waste is the most significant issue that has raised environmental and social consciousness in recent years. Among the most important problems that have been around for decades is hunger. Although there are many potential reasons of this issue, there are also many workable remedies. After conducting a thorough examination, we have determined that technology can help us to address this problem. In order to ascertain which of the organization's everyday requirements are satisfied and which are not, surveys were carried out along with a few research articles. Using this technique, excess food from restaurants, weddings, canteens, public events, big meetings, etc. is gathered and given to non-governmental groups in an effort to reduce food waste. To ensure quality, this system will use Internet of Things sensors. Furthermore, a number of groups have said they would want to request necessities like food, clothing, etc. Still, there's no way to meet their requirements. Next, a system for supplying food to individuals has been created. They just need to provide food to the extent of their ability, and the system will fulfill their request if food is provided to their folks in need.

2.2.16.1 System of Architecture

In this system, there are three applications: donor, administrator, and volunteer. The donor must register by supplying personal information and selecting the type of donation (regular or occasional) prior to utilizing smartphone authentication to log in. The NGO will get a request from the donor after their registration is complete. The donor

may also donate products. Any organization or individual who wants to give food may do so by submitting a request through the system as a Donor. To other NGOs (administrators), this message will appear as a system notification. Food requests will be verified by the system and, if needed, accepted by the food receiver, a non-profit organization. The NGO will then designate the volunteer, who will then receive a notification and use the GPS API to travel to the location of the donor in order to receive food. The volunteer will then examine quality control using an Internet of Things device, such as a food moisture sensor. In addition, a volunteer will examine the food's shelf life to determine whether the quality is satisfactory. If food is still edible following a check of its shelf-life, volunteers will retrieve it, and the system will be notified [16]. The machine will determine which favela is nearest to where food donations may be made using the k-NN algorithm. Food and secure food will be separated by this project. Along with meeting other demands, like feeding underprivileged organizations, the planned application will cut down on food waste.

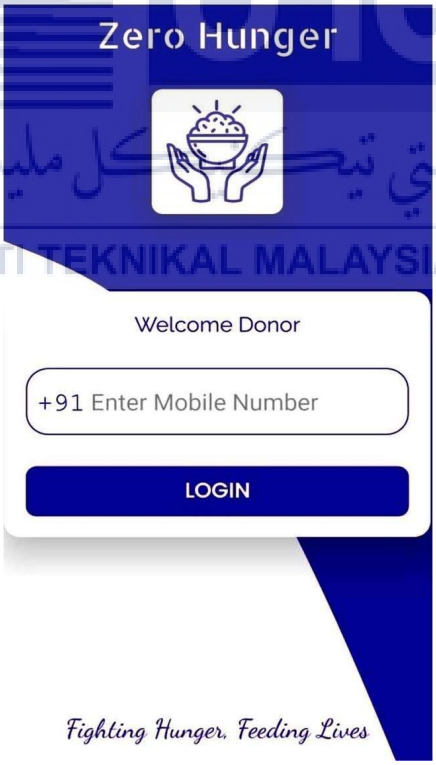


Figure 2.17 : Login Page

Food waste is the largest issue facing our civilization. We will thus try to create this mechanism in order to address this problem. A great number of people find it difficult to eat twice a day. As a result, we are building a method to distribute the food that is wasted during public gatherings; NGOs and orphanages will greatly benefit from this approach.

2.2.17 Two-Stage and Conventional Co-Composting of Green Waste and Food Waste Supplemented with Phosphate Rock and Sawdust: A Comparative Study by Edgar Ricardo OviedoOcana, Angelica Maria Hemandez-Gomez, Marcos Rios, Anauribeth Portela, Viviana Sanchez-Torres, Isabel Dominguez and Dimitrios Komilis

The delayed breakdown of green waste (GW) is caused by the presence of slowly degradable chemicals in the substrate, according to the authors' study. The decomposition of organic matter and the quality of the finished product can both be enhanced by the inclusion of additives and bulking ingredients. Nevertheless, there are other approaches that may be used, such as two-stage composting and the gradual breakdown of green waste. This study assesses the impact of a two-stage composting process on the green waste and kitchen trash co-composting process with sawdust and phosphate rock, as well as the quality of the end product. Two (triplicate) protocols—two-stage and conventional decomposition—were used in a pilot investigation. The identical composition (wet weight) of 46% green trash, 19% processed food waste, 18% unprocessed food waste, 13% sawdust, and 4% phosphate rock was used in both treatments. In contrast to two-stage composting, which takes six days to complete, organic matter broke down more quickly throughout the mesophilic and thermophilic stages of conventional composting, and thermophilic temperatures were sustained for longer periods of time. Nonetheless, during the chilling and maturation periods, the two treatments displayed identical temperature, pH, and electrical conductivity behaviour's, and the final products did not statistically vary. According to the study's findings, other complementary tactics need to be investigated in order to further enhance GW composting [21].

2.2.17.1 Development of Pilot-Scale Composting Experiment

A pilot-scale composting experiment with two regimens was used to assess the impact of TSC on the co-composting process and final product quality of GW, FW, PR, and SW. As opposed to Treatment B (TB), which used the traditional (one-stage) composting procedure, Treatment A (TA) involved two stages of composting (TSC). The experimental units for both regimens totaled three hundred kilogrammes. The physical composition (% w/w) of GW found from maintaining green spaces on a university

campus was composed of 35% leaves, 26% grass clippings, 20% soil extract, 9% tree branches, 3% fruit, 1% roots, and 6% non-biodegradable elements. Materials that cannot decompose naturally, including plastics and stones, were taken out before the experiment was set up. A week or two was spent with the GW. A university restaurant that serves about 3000 meals a day provided sourceseparated UPFW and PFW, which were gathered by composite sampling. Three days were spent in the testing area with both substrates at room temperature. Suppliers from the area provided PR and SW. To create particles that were between five and seven centimeters in size, GW and FW were manually crushed with a machete. Scooping thereafter, the components were hand mixed and blended using shovels. In Bucaramanga, Colombia, with an average ambient temperature of 24 degrees Celsius, the experiment was carried out on the campus of Universidad Industrial de Santander. The experiment setting was made in an enclosed space with a concrete floor. To preserve comparable environmental conditions throughout the studies, all locations were run simultaneously. The procedure for conducting TSC was as follows, in line with earlier research [17]: the mixture was initially contained in wooden containers measuring 0.55 x 1.30 x 1.25 m [17]. Four 1-meter-tall perforated pipes and holes with a diameter of five centimeters were included in the containers to ensure the process's necessary aerobic conditions. At the end of this phase, the first thermophilic phase was completed. After being taken out of the containers, the material was piled into conical mounds for the second step. After the material reached room temperature, the process came to an end. In the second step, a second thermophilic phase was predicted. After the material was taken out of the containers on the tenth day of the process, the second stage began. Traditional composting was accomplished in 1 m-tall conical heaps [22].

2.2.17.2 Process of Monitoring After the Preparation of Piles

Monitoring metrics included temperature, pH, moisture, oxygen concentration, volatile solids (VS), germination index (GI), electrical conductivity (EC), and self-heating. After bulk preparation, monitoring got underway right away. A digital thermometer K-Type HI935005N, measuring 60 centimeters and having a high degree of precision (2%), was used to record the temperature every day on the compost pile's

centroid. This allowed for daily determination of the compost pile's core temperature. For pH, EC, moisture, and VS measurements, a 200 g sample was created by combining four subsamples that were taken from different parts of each compost pile. Over the course of the monitoring period, pH and EC were monitored at least twice weekly after being checked at least three times per week during the first two weeks. After mixing a 1:10 mixture of the sample and distilled water, an aqueous extract was produced, and these parameters were evaluated potentiometrically. We measured with an EC ionometer and a sensIONTM + MM374 pH metre. Until day 42, this parameter was measured three times a week. After that, it was measured twice a week until the procedure was completed. Using a muffle furnace set at 550 degrees for four hours, a desiccated sample was burned to reveal the VS. The amount of ash was used to calculate the total organic carbon, or TOC. The piles were observed until day 73, when one of them reached the room temperature of 24 °C. Whether moistened piles led to temperature increases was tested by on-site self-heating studies before the trial ended. Also, the substance's stability was assessed using the 1.5 L Dewar vessels self-heating test by Brinton et al. To determine how maturity evolved along the process, germination tests were employed. Utilizing the method established by Varnero et al., the germination index was computed. Following three hours of shaking and filtering, a new sample was extracted using distilled water at a compost-to-water ratio of 1:10 (w/v). Next, ten radish (Raphanus sativus) seeds were placed on filter paper in nine-centimeter Petri dishes with ten milliliters of extract. As a control, distilled water was used in all three of the investigations. Day 47, Day 53, and Day 60 were used for this assessment. By physically rotating the two treatments, oxygen was introduced into the heaps. A daily rotating frequency was applied to both treatments through the eighth day of the therapy. Subsequently, rotation was performed in accordance with the process criteria (i.e., every two days until day 25, every three days until day 37, and then once a week until day 73). As needed, the oxygen concentration (OC) was measured with a CM37 probe (that is, once per week until day 37 and twice a week until the procedure's conclusion).

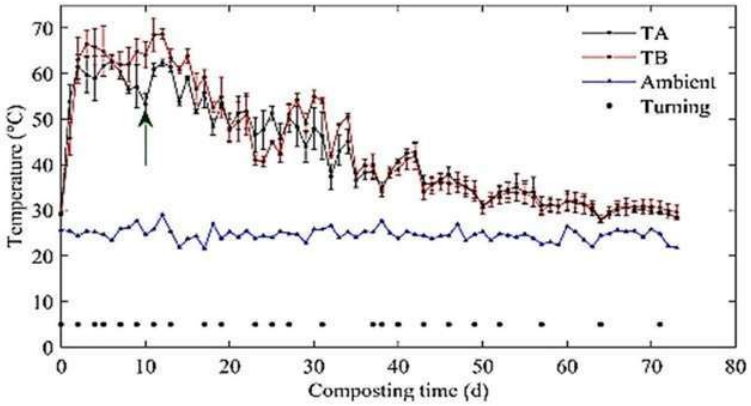


Figure 2.18 : Profile of Temperatures

This study evaluated the effects of two-stage composting on the co-composting of food waste and green waste with sawdust and phosphate rock, as well as the procedure and quality of the finished product. The findings showed that similar process conditions were seen in two-stage methods. Composting and traditional composting (with regard to temperature, electrical conductivity, volatile particles, and length of process). The two interventions produced identical results in terms of statistics. Comparing traditional composting to two-stage composting, the former was defined by a lower lignin content (30.3% for TA and 28.7% for TB) and a lower nutrient content (NTotal: 1.76 % for TA and 1.5% for TB; PTotal: 4.75 % for TA and 4.19 % for TB). The study's conclusion is that in order to improve GW decomposition, more complementary methodologies need to be investigated.

2.2.18 Dehydrated Food Waste for Composting by Aziz Khalida, Veknesh Arumugam, Luqman Chuah Adbullah, Latifah Abd Manaf and Muhammad Heikal Islmail.

Due to the significant implications on economic expenses and environmental harm, the disposal of food waste has received recent attention on a global scale. Utilising meal scraps with a lot of moisture causes the greatest environmental harm since it produces more greenhouse gases. gas emissions, smell, and leachate. For environmental sustainability and safety, lowering the food's moisture content residue is crucial, and drying technologies play a big part in this process. The most cost-effective drying option, as highlighted in the first portion of our analysis, is solar drying. Due to a number of drawbacks, such as the difficulty to monitor the finished product's quality and the impossibility to control the temperature of the sun's rays, it hasn't been generally advocated for managing food waste. Rapid Food waste can be prevented from hydrolyzing and deteriorating by thermally drying it to remove moisture. Cabinet dryers with a conventional tray and thermal dryers such as the GAIA GC-300 dryer perform better than solar drying. In the second part of this review, it is emphasised that although though dehydrated food waste products have low pH levels (4.7–5.1), high electrical conductivity (EC) values (4.83–7.64 mS cm1), and a high nutritional content, their low pH makes them unsuitable for direct application as plant fertiliser. Composting dry food waste solves many problems, including phytotoxins, anoxia, salinity, and water repellency, hence it is best to do so before using it on plants. For the practical purpose of decomposing dried organic waste, trench compost relies solely on soil-decomposing bacteria and insects.

2.2.18.1 Waste Food

The food that is taken from restaurant and residential kitchens cannot be consumed. According to research conducted by the United States Department of Agriculture (USDA), 21% of the fresh food offered in restaurants was not eaten. Typically, 4–10% of the food served in restaurants is wasted. the food before receiving customer assistance. Consumables that go bad are included in the subcategory of food waste, which comes under food loss. Food waste and food loss are difficult distinctions to make. Food loss happens often in the food value chain, before it reaches the customer.

It can happen during growing, gathering, purifying, and transporting [18]. However, improper management of the supply chain results in food waste. Food Waste is usually associated with preventable food loss. The fundamental reasons and driving forces behind food waste, however, are what distinguish food waste from food losses in today's world. At every stage of the food supply chain (FSC), food is wasted or lost. For example, a significant amount of edible food mass is lost or degraded during post-harvest preparation, distribution, and consumption. In middle-class and wealthy nations, there is a considerable wastage of food by both producers and consumers. But in underdeveloped nations, food is lost at the start of the food supply chain.Europe and North America have the greatest per-person rates of food waste (95–115 kg/year), while Sub-Saharan Africa and South/Southeast Asia have the lowest rates (6–11 kg/year). More than 40% of food is wasted in developing nations after the produce is gathered and cooked. Nearly 40% of food waste, however, originates from the retail and consumer sectors in developed nations. Twenty-two million tonnes of food are lost by customers in affluent countries, which is about the same as the total amount of food accessible in sub-Saharan Africa. Priority was given to the environmental and social effects of food surplus and waste. For inclusion in the scope of food security and abundance, food waste that is avoidable and unavoidable, the following three ideas were offered. III. Waste management and prevention The choices are rated based on the hierarchy of food waste. The framework recommends composting after all preventative steps have been tried, or converting food waste into animal feed. The next best alternative, if recycling is not possible, is anaerobic digestion of food waste. The only choice left is to dispose of rubbish in landfills after all other possibilities have been explored. Food waste policy framework [23].

On food that customers have thrown away. These wastes, often referred to as postconsumer food waste, typically include home foods that are tossed along with garden debris. The most common dining establishments include hotels, buffets, and restaurants, where this food waste is frequently seen in large quantities. In addition to not being eaten, leftovers were both physically and financially unsustainable because of how food production affects the environment. Many There are biodegradable food leftovers and residues produced by houses and businesses, such as the food industry, hotel sector, and households. Food waste is divided into seven subcategories: cereals, fish and aquaculture,

oils and pulses, fruits and vegetables, meats, roots and tubers, and dairy products. From agriculture and food production waste, functional compounds can be recovered. Analytical chemistry principles must therefore be understood in order to separate and isolate these compounds from food leftovers. It is necessary to remove specific macromolecules before purifying and encapsulating the target compounds. Two parts of a macromolecule can be retrieved by using this downstream procedure. This stage is not required because proteins are macromolecules. The substance of concern is a protein. Food waste requires substantial processing and investigation before it can be used. A thorough examination of the kind, volume, exploitation possibilities, and end-users of food waste is required to support the investment. It's also important to consider how unique production processes affect the environment. Finally, over-modification of food may be harmful to consumer health.

2.2.18.2 Classes of Waste Food

Waste food and leftovers are the two types of wasted and abandoned food. Food waste can be broken down into its component parts. found that food waste such vegetable, fruit, and vegetable seed fragments made up the majority of kitchen trash [24]. Coffee grinds and other inedible items were included in this categorization. Moreover, food waste includes goods that are thrown away during manufacture, transportation, and when they expire at supermarkets, eateries, and institutions. Food residues make up leftovers most of the time.

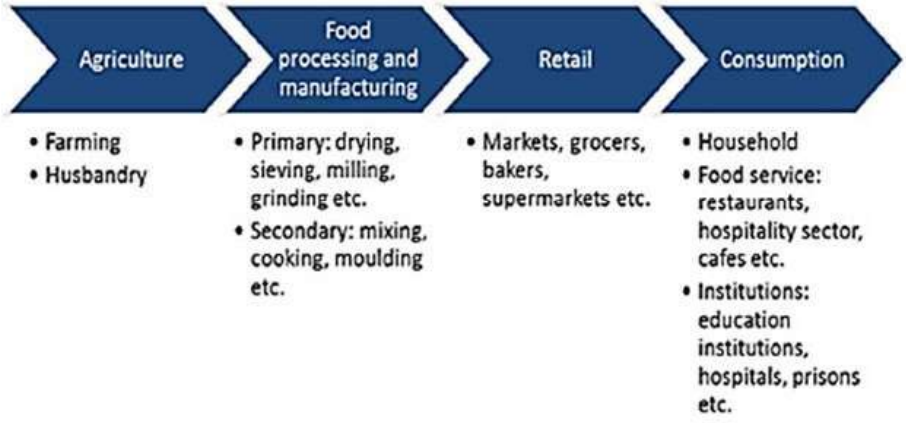


Figure 2.19 : Waste Food and Lost in the Food Supply Chain

2.2.18.3 Characteristics of Waste Food

Across the world, food waste is a significant source of substrate recovery and energy. Season, source of collection, and place of origin have all had an impact on food waste figures across time, accounting for 24% of the variations. Several types of solid waste were demonstrated to have certain features. Less than 30% of canned items, spent coffee, leftover fruit and vegetable material, salad dressing, and waste from cooking preparations are solid waste, nevertheless all samples were thrown away despite this fact. Large amounts of rapidly hydrolyzable lipids and carbohydrates are present in supports with excellent biodegradability. Bio-methane was created at higher rates on high-fat substrates than low-fat ones. 60–80% of a typical kitchen waste is composed of water, 3-5% detritus, 40–60% carbohydrates, 18–30% volatiles, 10–30% protein, 15–40% fat, and 45–65% carbon emissions. Wheat meals, which are high in volatile matter and carbohydrates (88–92%), provide twice as much protein and water as fish and meat meals. The nutritional value of food waste was discovered in 2012 by researchers in America. The contents of food waste collected over an average day were 1,217 kcal, 146.4 g of carbohydrates, 32.8 g of protein, 286.1 g of calcium, 85.0 g of magnesium, 450.3 g of phosphorus, 880.2 g of potassium, 264.2 g of sodium, and 3.9 g of zinc. In many food waste categories, the possibility of byproducts with additional value was evaluated. Figures 6A and 6B provide an overview of the advantageous byproducts of fruits, vegetables, animals, and dairy food. Differentiating one's valuation approaches requires optimising a number of factors. For example, the feedstock's physical and chemical characteristics, such as moisture content, volatile materials and nutrient structure, pH, size, and configuration, influence anaerobic digestion and the generation of biogas. Microorganisms facilitate anaerobic digestion of organic compounds. By means of several metabolic pathways, the bacteria efficiently convert complex organic compounds into methane [25]. By changing the organic waste component, biogas was produced during the anaerobic digestion procedure. It includes methane, carbon dioxide, and other gases in addition to 60–65% petrol. The organic portion of a range of wastes,

including domestic, commercial, and municipal heavy garbage, was utilised as a substrate for biogas energy recovery. It was possible to use the digested state as fertiliser and reduce the amount of pathogens, odour, and silt. With source and type separation, it is possible to decrease composition variability based on time and source, hence improving the accuracy of food waste retrieval.

2.2.18.4 Method of Drying

Both industrialised and developing countries have used drying technology to improve municipal food waste utilisation for use as sustainable energy sources, lessen dependency on fossil fuels, and improve the cleanliness of trash disposal facilities. Both industrialised and developing nations have used drying techniques to boost food waste efficiency in an effort to reduce the need for fossil fuels on-site, make trash safer, and harness solid wastes for environmental vitality. The most popular drying techniques included sun, microwave, freeze-drying, and thermal.

2.2.18.5 Method of Applying Freeze

The freeze-drying method is widely used to dehydrate fruits and vegetables of superior quality. The essential composition and configuration of the goods are preserved during the freeze-drying process thanks to the solid state of water, low temperatures, and the moisture sublimation process. They also have a high porosity, a reduced bulk density, and enhanced rehydration. Extracting, freezing, and exposing a liquid formulation solvent to low pressure is necessary before the solvents sublimate. Finally, the unfrozen solvent must be removed using a desorption method. Due to the occurrence of two similarly crucial processes, namely freeze, during which nearly everything solvent is converted into a frozen solid, and drying, which can be separated into two stages: sublimation (primary drying) and desorption (secondary drying), in which the combination removes nearly all solvent (frozen or unfrozen). Consolidating food through freezing is the first stage in the freeze-drying process. Ice crystal size and production depend on the freezing rate; slow freezing is more than equivalent to ice crystals. In the food industry, only high-

value items can be freeze-dried. Coffee, prepared food components (vegetables and fruits, meat and fish), and aromatic botanicals. During lengthy human spaceflights, the MEADOW processor Freeze Drying Solid trash has managed a large volume of solid trash. The two drying methods that were studied the most were vacuum and freeze drying. A Peltier condenser collects waste water vapour in either mode and transforms it back into comparatively clean water. There is less water activity in the dehydrated waste product than what is required for bacteria to maintain their metabolic activity. To ensure stability, the treated waste needs to be maintained and stored in a manner that inhibits the absorption of water. Freeze-drying is a successful method for reducing food waste, as numerous studies have shown. They asserted, however, that freeze-drying was an ineffective method of trash disposal because of its high cost. Nonetheless, the exceptional situation will aid in waste minimization.

2.2.18.6 Method of Microwave Drying

An effective drying technique for a number of goods, including fruits, vegetables, convenience meals, and dairy products, is microwave drying. Polar molecules in the material convert variations in converting electromagnetic energy into heat energy during the microwave drying process. The bipolar molecules' interaction heats the material, and by employing this orientation strategy, the material generates enough heat to evaporate the mass's moisture.. Additionally, the entire pressurising gradient created by the swift mobility of the bipolar molecules accelerates the movement of vapour and liquid water to the material's surface, resulting in rapid drying without overheating the surrounding air. electromagnetic radiation that is present at 2450 MHz or 915 MHz is used to support a specific kind of volumetric heating in the microwave drying process. A dielectric component's loss reaction causes power, moisture, and signal intensity to interact quickly. It is an efficient dehydration approach since a large decrease in dropping time is often accompanied by an enhancement in the substance's quality. The sample's mass, shape, size, simple thermal power, composition, and dielectricity all play a role in microwave heating. The use of microwaves for drying is a novel approach that may quickly and effectively dry food waste. Using microwaves has a number of benefits over traditional

drying methods, including faster drying and less energy usage. Additionally, raw materials' pore structure is improved by microwave drying. Alternative fuels for energy production and transportation may be produced by decomposing food waste in a microwave reactor. Additionally, microwave dehydration is an effective way to cut down on food waste and has helped with the thermal decomposition of waste.

2.2.18.7 Method of Sun Drying

Traditional sun drying relies on ambient air pressure and direct sunlight radiation. In the majority of poor countries, agricultural products are normally dried using open-air (solar drying) techniques. Agricultural products can be preserved and conserved using this low-cost technique. Direct and indirect solar dryers fall into two groups. The word "sun drying" refers to direct solar drying, in which The sun's rays immediately heat the product, and variations in air density cause natural air circulation to eliminate moisture. The material being dried releases moisture when warm air is carried over it and regularly through a solar collector in indirect solar dryers. The best carbon-free energy source ever discovered is the sun. Using free solar energy to dry things in the sun could also reduce drying costs. This product is less dependable since it is susceptible to bacterial discharge, pollen, birds, and rains while it is sun-drying. In addition to the dryness and paucity of nutrients, the capacity to exercise in UV light causes unwanted changes in pigmentation.

2.2.18.8 Method of Thermal Drying

One of the best ways to raise the calibre of materials is thermal drying. Periodic drying can be accomplished with this approach. The design of dryers must therefore take into account the thermal and physical characteristics of items, for instance, heat transmission, moisture dispersion, and water activity. It has become crucial to use main energy sources. Thermal drying comes in three different flavours, including three types of drying: low, hot, and atmospheric. Low-temperature manipulation reduces the risk of corrosion and has minimal startup and ongoing costs, although it is slow and useless in

some climates. Normally, the air is heated to a temperature of 1 to 61 degrees Celsius. Low air drying is the most efficient way to preserve ascorbic acid, on the other hand, and is a choice for drying brittle materials, mainly green vegetables. The most popular industrial drying technique has historically been hot air drying. Heat is transported from heated the crop's air through convection, while Evaporation of liquid into the air. The examination of fruit waste and prospective physiological results of bioactive substances can both be completely utilised by hot air drying. The process of heat and mass transmission beneath the temporary structure is intricate and is influenced by a number of internal feeding and physicochemical variables as well as exterior characteristics including temperature, flow, and drying humidity. Hot air is frequently employed as a heat transfer medium during the drying process. Utilising mass and heat transfer, air is forced into a closed structure. The most affordable dryer is atmospheric drying, which retains air uniformly over perforated racks in the dryer chamber where food waste is distributed. To reduce leachate and greenhouse gas emissions, food waste is dried using inexpensive thermal dryers like both the cabinet drier with a Schematic and a conventional container. The cabinet dryer's capacity to save energy as temperature and ventilation rise is its main advantage. According to the findings, food waste dried in just 120 minutes and used between 119.62 and 59.41 kWh of energy when it was dried @ 70°C and 2 m/s of air speed. Due to the accessibility, effectiveness, and affordability of thermal drying procedures for solid industrial products, they were chosen over other drying processes in a comparison study.

2.2.18.9 Trench Composting of Dehydrated Waste Food

Trenching is one method of burying compost in the garden. Plant roots can effectively supply nutrients to the soil in this way. Additionally, it encourages the development of vast root systems that supply water. Trenching creates low-floor locations with soil that is rich in nutrients for the vegetation. More nitrogen is maintained throughout, despite the slower rate of composting than in a well-managed backyard. Organic matter is completely broken down in trench compost by soil bacteria and insects. Since it is concealed from view, the substance receives its water and soil-derived oxygen

beneath it. Furthermore, Soil particles trap decomposing nitrogen, preventing it from releasing methane and foul odours. Since composting began due to trash, pathogens have been discovered in the finished goods. Trench compost is an excellent option in this case for dry waste. The maximum temperature of 54 °C is reached by a trench system in 15 days, which it maintains for five days before beginning to cool on day 21. This procedure takes roughly 30 days to complete. Comparable to composting in pits is composting in trenches. Excavation of a trench or hollow is necessary for composting in a pit. This method can be used to successfully conceal organic elements that are decomposing. It is especially efficient against thermite attacks because the bulk of species dwell above ground. By enhancing the soil's quality, air retention, nutrient content, and moisture level by the application of trench compost, plants can grow robust and tall. In terms of disturbance and variability brought about by human activities, urban soil differs noticeably from other soil types [36]. The amount of organic carbon in the soil has increased noticeably since the addition of organic waste, along with alterations to the physical and chemical characteristics of the soil and the creation of sizable amounts of organic carbon. Garden produce's mechanical characteristics are crucial for improving product quality, extending its shelf life after harvest, and reducing product waste. In recent years, attempts to produce superior goods and steadily improved soil quality included the use of organic fertilisers [26]. Before using dehydrated food waste as an organic soil fertilizer, it needs to be composted, according to earlier studies. Comparing composting techniques, trench compost was suggested for thoroughly dried organic waste. Utilising food waste residues as biofertilizers could be an environmentally friendly solution to the present global challenge of disposing of food waste. Dehydrating food waste is crucial and contributes to its reduction throughout the time when the storage process is being handled, according to the researchers' findings [35]. Although sundrying is the most economical drying technique, although it is not frequently advised to reduce food loss since it is challenging to control the quality of the completed product and the warmth of the sun's rays. Thermal drying can swiftly dry food waste without sacrificing quality as an alternative to solar drying. Dehydrators for food waste are a biological solution that effectively reduces waste volume. A non-biological option is provided by thermal dryers, like the Cabinet dryer with GAIA GC-300 dryer with a standard outlet. Previous studies have demonstrated the potential of dry food waste as a raw material for

composting due to its high nutritional content and similarity to wet food waste. Dehydrated food waste has 48.3% carbon, 3.26% nitrogen, 0.23% sulphur, a carbon-nitrogen ratio of 14.8%, 4.7–5.1 mild acidity, and 4.83–7.64 mS cm-2 of electrical conductivity. Composting this type of dry organic material involves combining it with other organic trash, even if it is difficult to employ dried food waste in the composting process with a moisture level below the advised range of 50–65 percent. For instance, creating a compost pile that is nutrient-rich by mixing unprocessed meals that is high in moisture and low in carbon with garden waste that is high in nitrogen. The results of the composting process at two distinct humidity levels—44 and 66%—were displayed. Prior to composting, changing the moisture content could reduce emissions of greenhouse gases and environmental impact. The overall estimated methane emission has dropped from Initially, 35 g CH4-C kg-1 was reduced to 0.04 g CH4-C kg-1. In order to lessen leachate, odor, and greenhouse gas emissions, the assessment advised dehydrating food waste to the proper moisture content before composting.

2.2.19 Decentralized Composting of Food Waste : A Perspective on Scientific Knowledge by Antoni Sanchez.

Antoni Sanchez studied that composting is an efficient and environmentally friendly approach for dealing with a wide range of organic wastes. The variety of technological solutions available, from large-scale facilities to small composters, is a unique feature of composting. Which it enables the self-management of organic wastes and produces compost that the producer may utilize, interest in composting at home or on a large scale has been expanding tremendously in recent years. However, several inquiries into the caliber of the compost produced or the effects of home composting on the environment are still in the formative stages and offer scant information. According to the most recent scientific research, the key aspects of household and community composting are thoroughly examined in this paper, with an emphasis on their benefits and potential drawbacks. Analysis is focused on the effectiveness of the composting process, with temperature stratification being one of the primary issues with small amounts of organic waste. The compost's consistency and/or maturity are used as metrics to assess its quality, leading to the conclusion that home compost and industrial compost can be identical in both respects. Home compost is not always completely sanitized, though. The most researched category in terms of its effects on the environment is gaseous emissions, particularly greenhouse emissions, which are typically modest. Finally, preliminary comments on the effects of pandemics on household composting come to the conclusion that this tactic could be a good substitute for creating more resilient cities [35].

2.2.19.1 Home Composting

Home composting, sometimes referred to as domestic or backyard composting, is one of the various composting techniques and is the small-scale composting method composters. Although the volume might vary, the most typical range is between 300 and 1000 L. When composting at home, the waste is typically produced by the operator, and is typically made up of food scraps and garden waste [27].

2.2.19.2 Vermicomposting as a Complement of Home Composting

Decomposition facilitated by microorganisms and macroorganisms. Vermicomposting, also known as worm composting, produces a nutrient-dense organic soil amendment with a variety of beneficial microorganisms. Vermicomposting has been the subject of extensive research regarding process performance, biology, reactor types, etc. In this way, it is important to observe that vermicomposting is typically applied to agricultural waste and manure rather than food waste. In actuality, articles on food waste vermicomposting on a household or community scale are scarce, and a mixture of residues is sometimes used. Although these studies are somewhat intriguing, it is challenging to incorporate them into a decentralized home decomposition system. Another group of works examines the use of vermicompost as an organic amendment, which is generally beneficial for plant growth [33]. Regarding the procedure, the majority of studies concur that the end product of vermicomposting is an excellent organic fertilizer with a high nutrient content for agriculture. In the process, it is essential to design reactors that minimize the self-heating of waste that can damage earthworms, such as tray reactors with low waste loads and moderate heights. Occasionally, vermicomposting and composting are combined; however, most vermicomposting and home composting experiments are conducted on a large scale using either culinary waste or agricultural waste. In an intriguing research, home composting and vermicomposting technologies were evaluated to determine the quality of FW compost [19]. The authors concluded that both technologies were viable alternatives for diverting a portion of biowaste into a high-quality product, despite the fact that residential composting produced more greenhouse gas emissions. Organic waste management has the potential to be a widely implemented strategy in constructing national and regional programs [28]. A significant reason for this expansion is the reality that home composting has evolved from a pastime to a science-based technology. Environmentally and economically, domestic and community composting appears to be superior to industrial composting in the majority of environmental categories, making it an attractive strategy for waste management programmes.

2.2.20 The Effectiveness of Biochar in Composting of Food Waste by Juplin Kinti, Lydia Dundun Francis and Sunita Jobli

This study was about food waste is a significant waste produced daily by various sectors and activities, and they fall into three different categories: edible food waste, inedible food waste, and food loss. The Malaysia Solid Waste and Public Cleansing Management Act 2007 (Act 672), among other laws, specifies that food waste must be destroyed, burned, deposited, or decomposed. The food waste composting procedure is viewed as an alternative solution to the food waste problem. In composting, an environmentally favourable biochemical process, food waste is managed in a sustainable manner. Decomposition has a greater effect on the environment and the economy than other waste processes after anaerobic digestion. management methods such as incineration, as demonstrated by Life Cycle Assessment (LCA) studies. Naturally, during the decomposition process, a multitude of microorganisms decompose complex organic matter into simpler substances and, ultimately, a valuable compost. Typically, Composting takes four to eight months, although there are ways to speed up the process, like periodic tuming and shredding of feedstock. Worms, natural minerals, vanous compounds, and nitrogen-activating chemicals can significantly reduce this timeframe. Due to its unique physiochemical properties, the use of additives such as biochar to enhance the composting process has grown in popularity over the past few years. Carbon-rich biochar is produced through the pyrolysis of biomass. The biochar's physiochemical properties depend on the feedstock composition and pyrolysis temperature. Biochar is utilized as a bulking agent and plays a crucial part in giving compost materials aerobic conditions during the composting process [32]. Likewise, as the process progresses, the biochar's functional group absorbs the compost's volatile essential catlons and amons. In addition, a common solvent such as water is absorbed by the microporous structure. This study focuses on the rarely discussed in the field of science mechanism of organic waste mineralization and degradation in a form of biochar.

2.2.20.1 Method of Feedstock Preparation

Biochar was gathered from Satoyama Farm Sdn Bhd and food waste was gathered from the cafeteria of Block M at Universiti Teknologi MARA (UiTM), Kota Samarahatu, Sarawak. Food waste materials that are not biodegradable, like plastic, rubber bands, wooden sticks, and chicken bones, were removed [20]. The food waste was then allowed to air dry for an hour in order to achieve the 70% moisture content required for the composting process, as per standard criteria set forth by the EPA (2014) and Brinton (2000). Food waste was manually chopped using scissors until the particle size was around 5 cm for laboratory analysis. Biochar was pulverized using a mortar and filtered [29]. To make about 4 kg of compost, 3 kilogram of food waste and 1 kg of biochar were well mixed in the beaker at a ratio of 3:1. To promote aeration of the compost and for smooth turning of the mix bar, the mixed compost was placed on the composter reactor's mixing chamber and then evenly distributed throughout the composter reactor. Twenty days passed throughout this decomposition analysis. Up until day 20 of the trial, samples were collected for compost studies every five days. A sample of 15-20 g from a composter reactor was analyzed to determine its final composition of carbon, hydrogen, nitrogen, and oxygen. Every five days, the temperature was also recorded. According to this study's findings, temperature rises gradually, peaking at about 56,000 degrees Celsius on day five, and it takes less time for thermophilic phase to be reached for active breakdown [30]. The C/N ratio of household garbage rose from 30.85 to 42.03 after biochar was added, which is the ideal value for organisms that will decompose the waste. For aerobic operations, the range of 37.78 to 52.28 percent oxygen is suitable.

2.3 Summary of Literature Review

Table 2.1 : Comparison of Past Related Project Research

NO.	TITLE	SUMMARY
1.	Waste Food Management and Donation App	Waste food management and donating apps are discussed, but traditional food composting is not.
2.	Food Waste Management Android App	Focuses on a food waste management Android app without mentioning cooperation with traditional food composting.
3.	Web-based Application for Food Waste Management	A web-based food waste management program without food composting integration.
4.	An Android and Web Based Food Donation Application to Reduce Food Waste	Describes an Android and web-based food donation program to reduce food waste but does not integrate traditional food composting.
5.	Reduction of Food Wastage Through Donation Using Online Food Management System for Orphanage	Refers to food waste reduction through an orphanage's online food management system but not traditional food composting.

Table 2.2 : Comparison with Others Work

Apps	Number of Users (Out of 20)	Percentage
FoodSharePro	18	75%
ShareTheMeal: Charity Donate	8	40%
Olio - Share More, Waste Less	4	20%
Foody Bag - Save on Food	3	15%
nosh - Reduce food waste	2	10%
Your Food - No Waste Inventory	2	10%
Feeling Blessed - Donation App	1	5%

2.4 Summary

As the global population rises, the waste food management has become a more pressing concern. The use of donation applications that allow businesses and individuals to donate excess food to those in need is one method for reducing food waste. By using traditional food composting systems, food refuse can be converted into nutrient-rich compost for gardening and farming.

Several investigations have examined the efficacy of these waste food management strategies. According to one study, donation apps can help reduce food waste and enhance food security by connecting businesses with excess food to individuals in need. However, the study also found that there are disadvantages to using donation apps, such as the logistics of transporting food and the need for businesses to store and handle food correctly.

An additional study compared the environmental impact of food composting systems to that of food disposal in landfills. Composting waste food can reduce carbon dioxide emissions, conserve water, and improve soil health, according to the study. The study also revealed that not all composting methods are equally effective and that implementing largescale composting programs presents logistical challenges.

It is possible to gain insight into the popularity of various food management and donation apps by comparing them to the work of others. With 75% user engagement, FoodSharePro stands out among other apps and is clearly effective.

According to the literature, a synergistic strategy that combines conventional composting systems with donation applications may provide a comprehensive answer to the problems of food waste reduction, food security, and the environment. However, success depends on things like community involvement, infrastructure, and local laws. This integrated approach seems to hold promise for efficiently handling food waste in the context of an expanding world population.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Waste food management systems and donation applications use a straightforward methodology to combat food waste and hunger. This includes conducting research and planning, designing user-friendly interfaces, engaging food donors and riders as volunteers organisations, promoting user adoption, optimising operations, ensuring compliance with food safety regulations, and assessing the impact. By adhering to this methodology, these applications generate efficient platforms that connect food donors and riders as volunteers, thereby facilitating the accumulation, storage, and redistribution of excess food.

3.2 Methodology

Waste food management systems and donation apps, and food composting address food waste issues and provide sustainable solutions. These strategies minimize waste and maximize resource use. Technology-driven food waste management and donation apps efficiently gather, store, and redistribute leftover food. Traditional food composting relies on natural food waste breakdown to create nutrient-rich soil enrichment. Both reduce waste, promote sustainability, and the environment.

3.3 Functional Modules of the System

To guarantee a flawless user experience, the waste food management and donation program includes essential functional modules. For both donors and riders, User Management manages registration, login, and profiles. The Donation Management module simplifies the essential features, making it simple for users to browse, pick, and keep track of their donations. Since Firebase is the main database, an Admin module is not required, and user-related chores are managed well.

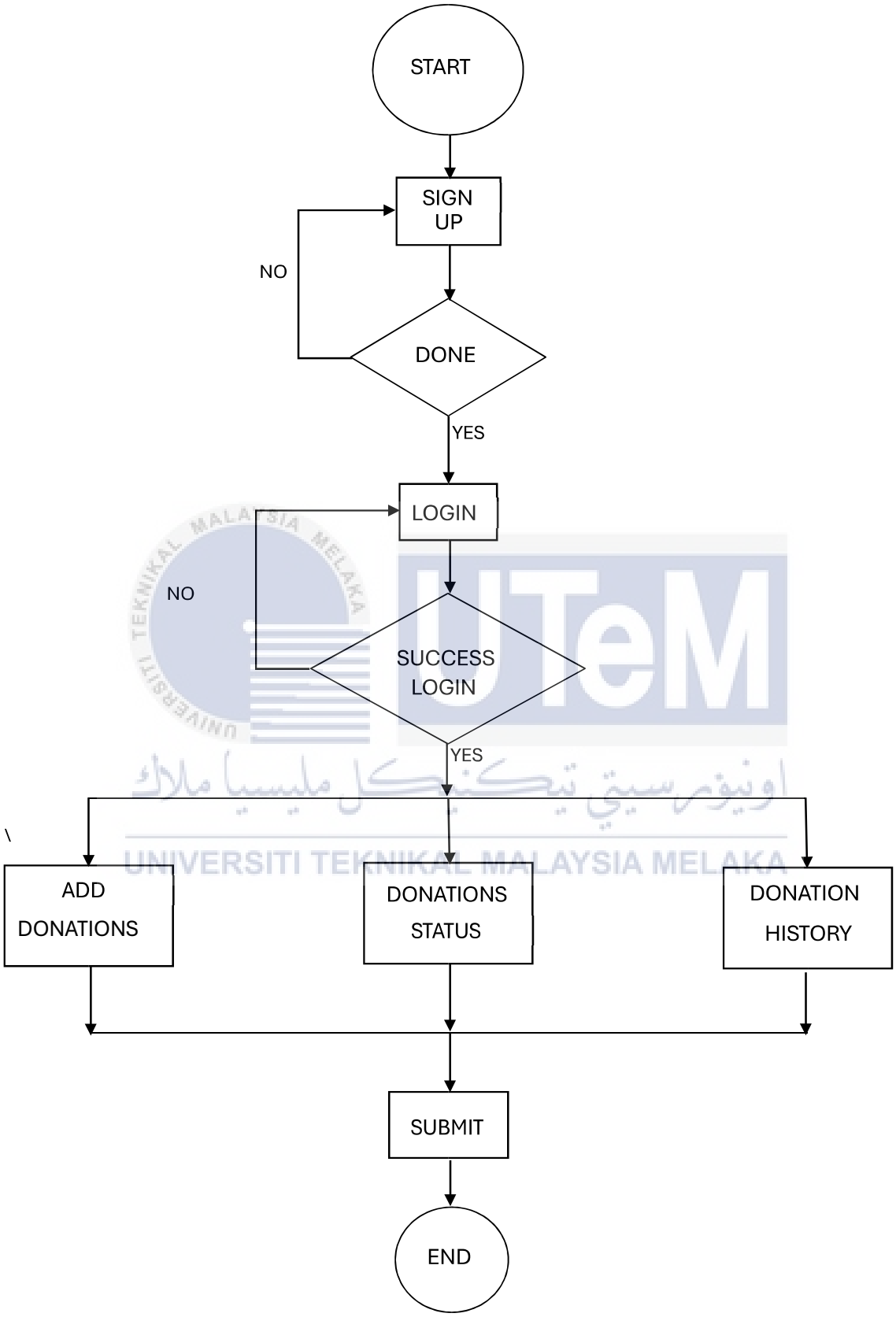


Figure 3.1 : Flowchart of Donor

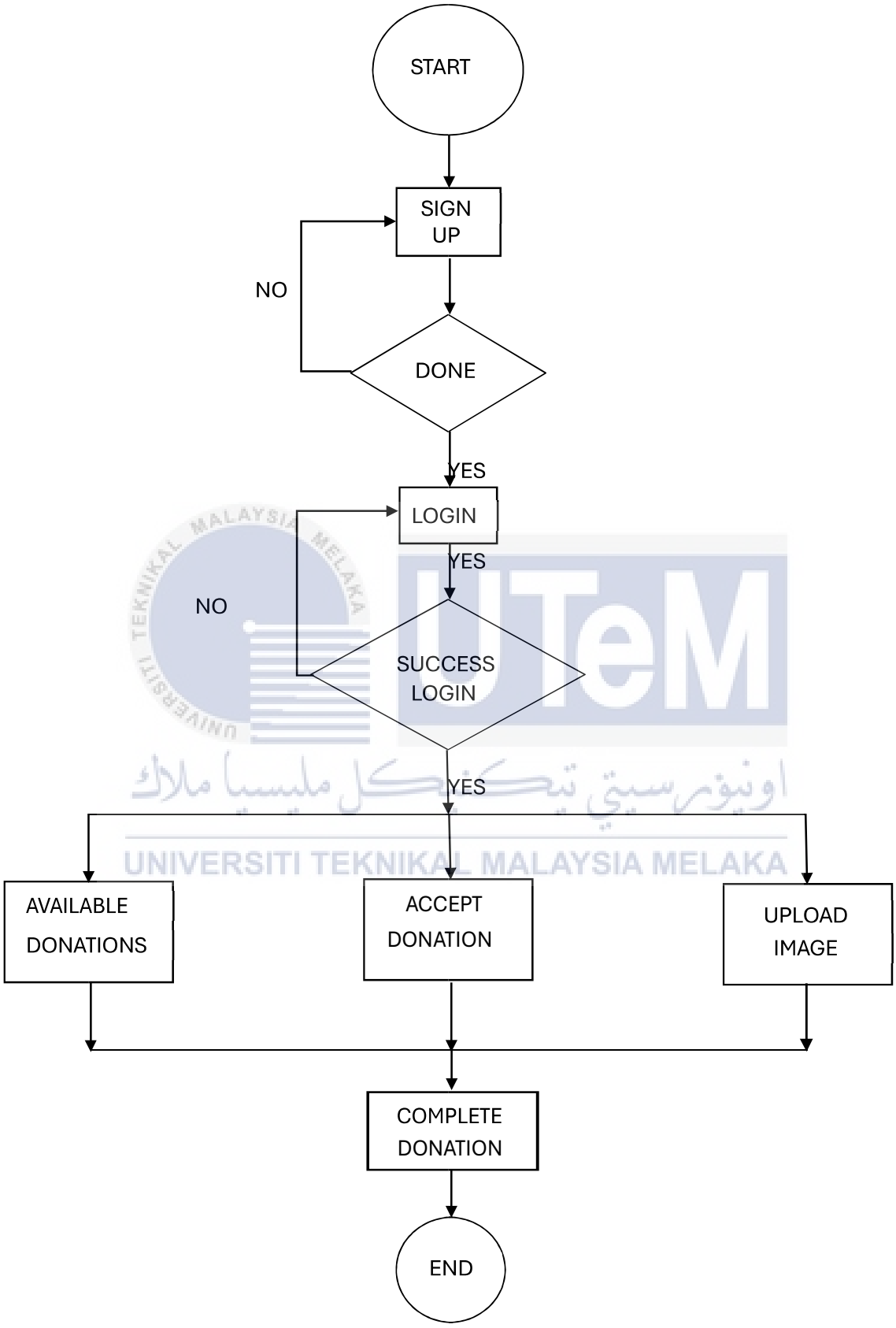


Figure 3.2 : Flowchart of Rider (Volunteer)

3.3.2 The Use Case Diagram of the System

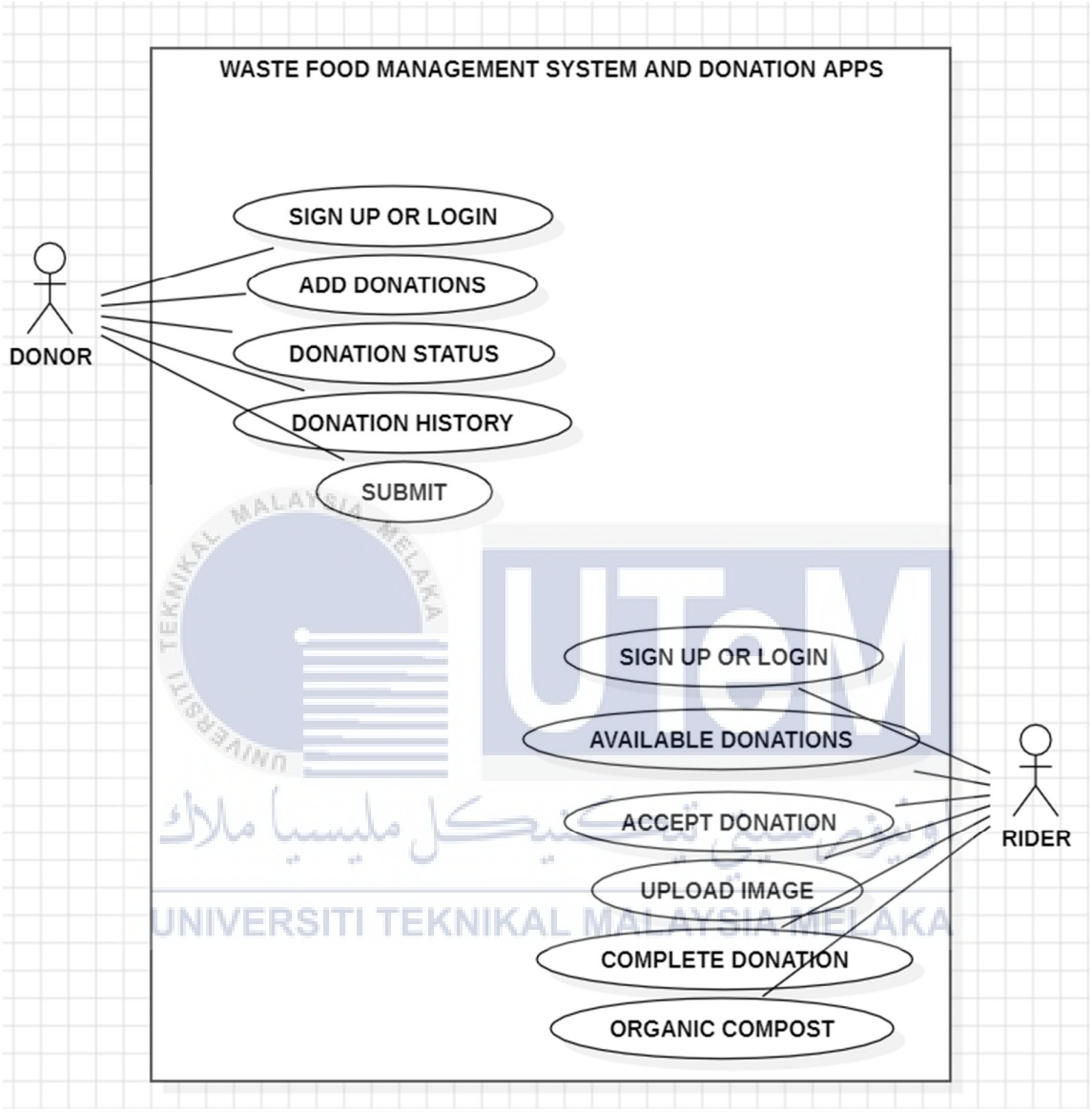


Figure 3.3 : Use Case Diagram of the System

3.4 System Requirements

System Requirements are categorized as two parts. One is software component, and the other is hardware component.

3.4.1 Software Components

Together, these software components form a functional and efficient waste food management system and donation apps. The implementation and integration of these components will depend on the app's specifications and layout. User Interface and Database. These simplified descriptions provide a high-level overview of the essential software components required to develop a waste food management system and donation apps.

3.4.1.1 Android Studio IDE

Figure 3.4 : Android Studio IDE

Android Studio is an IDE for creating Android applications. It gives developers everything they need to build, debug, and deploy Android apps. Android Studio aids app developers. Its user-friendly interface and strong features expedite development. Android Studio lets developers create code, design user interfaces, test apps on emulators or actual devices, and package apps for the Google Play Store. It supports version control systems, autocompletion code editors, layout editors for app interfaces, and debugging. Android Studio interfaces with the Android SDK and gives access to Android app development

libraries and resources. Developers need Android Studio to efficiently create high-quality Android apps.

3.4.1.2 Google Firebase Console

Figure 3.5 : Google Firebase Console

Google's Firebase is a platform that offers pre-built tools and services for use in the building of mobile applications. A analytics, cloud storage, hosting, real-time databases, user authentication, and a great deal more are some of the features that are included. Firebase streamlines the process of developing mobile applications by providing pre-configured backend services. As a result, developers are free to concentrate on the functionality of their apps rather than spending time configuring servers or managing infrastructure.

3.4.2 Hardware Components

These hardware components and instruments are frequently employed in conventional food composting techniques. It is important to note, however, that waste food management systems and donation apps typically concentrate on the digital aspect of managing and coordinating food donations, pickups, and distributions, as opposed to directly involving composting hardware.

3.4.2.1 Compost Bins (Polyfoam Box)

Figure 3.6 : Compost Bins (Polyfoam Box)

Compost bins and containers are specialised containers that contain and regulate the composting process. They are available in various sizes and materials, including plastic, wood, and metal. Compost containers are used to collect and decompose kitchen scraps and garden waste. They create a controlled environment in which microorganisms and nematodes can naturally decompose waste. The end result is nutrient-rich compost that can be used to enhance the quality of soil for gardening or landscaping. Compost containers help control odours, prevent pests, and contain and organise the compost.

3.4.2.2 Compost Turning Tools

Figure 3.7 : Compost Turning Tools

Compost turning tools mix and aerate piles. Oxygen helps helpful bacteria thrive and decompose organic material. Compost mixing and turning tools are specialised.

They're mechanical or handheld. Compost turning tools aerate and evenly decompose organic materials. These instruments mix the compost pile to spread oxygen, moisture, and heat. Compost turning tools avoid compaction, which can slow decomposition. They help break down bigger items and mix organic waste. Turning the compost pile using these instruments breaks down organic waste, speeds up composting, and reduces odours. Using a pitchfork or mechanised compost turning tools can turn the mound. Aerating and decomposing organic waste into nutrient-rich compost requires compost turning tools.

3.4.2.3 Soil Tester

Figure 3.8 : Soil Tester

It measures soil moisture, pH, temperature, and sunlight intensity. A 4-in-1 soil tester improves soil understanding. It shows the soil's pH, moisture, temperature, and sunshine. A 4in-1 soil tester can provide vital soil data. This helps you choose watering, pH levels, planting times, and plant locations. In summary, a 4-in-1 soil tester assesses and improves soil health for successful gardening and plant care.

3.4.2.4 Sifting Screens

Figure 3.9 : Sifting Screens

Sifting screens use mesh or perforated surfaces to sort things by size. Sifting screens filter larger particles from smaller ones like sieves. They have a mesh or perforated frame. Sifting screens size-sort materials. When poured onto the screen, smaller particles flow through the perforations while larger particles stay on top. Gardening, building, and mining employ sifting screens. Gardening with them removes rocks and debris. They sort gravel and sand in construction. They help mines separate minerals from rock. Sifting screens make it easier to sort materials by size, retaining only the necessary particles.

3.5 Functional Requirements

The waste food management system and donation apps integrated with traditional food composting is carefully taken into account while designing the functional requirements for the donating app. Users should use Firebase for user registration and verification, securely registering using distinct email addresses, whether they are riders or donations. Users can update and manage their profiles with the app's powerful profile management functionality, which uses registered credentials for authentication. Donors can browse, pick, and track contributions using the Donation Management module. They can also specify weight categories for precise gifts. Transparent communication between users is facilitated by real-time notifications. Riders can provide funders with visual

confirmation of their completed donations by uploading photographs of them. The incorporation of Google Maps improves address input accuracy, and a donation history feature guarantees that contributors may follow the contributions they make. Most importantly, the waste food management system works in tandem with conventional food composting to promote the use of coffee grounds, yard trash and leftover fruit and vegetable scraps. Conventional composters can exchange knowledge and promote community development. All of these aspects work together to improve donor-recipient coordination, decrease food waste, support sustainable practices, and foster accountability and teamwork in waste management.

3.6 Cost and Budget

Table 3.1 : Cost and Budget for the System

NO	ITEM	QUANTITY	EXPECTED PRICE (RM)
1.	Compost Bin (Polyfoam Box)	1	10.00
2.	Compost Turning Tools	1	5.00
3.	Soil Tester	1	30.00
4.	Sifting Screens	1	50.00
TOTAL			95.00

According to Table 3.1, the estimated total cost is RM 95.00. Online prices for anticipated commodities are gather from www.shopee.com.my. In contrast, the necessary software is open source and readily accessible online all the time.

3.7 Summary

The donation app and waste food management system are developed using a methodical approach. As soon as the project's goals, scope, and issue statement were first established, they emphasised how vital it was to reduce food waste. To comprehend the current waste management systems, donation platforms, and conventional food composting techniques, a great deal of research was done. The project successfully implemented traditional food composting gear, establishing the foundation for an all-encompassing waste management strategy. With an emphasis on efficient and user-friendly features, Android Studio served as the focal point of the software development process. The functional requirements for the project were well defined and included elements like picture processing, Google Maps integration, Firebase integration, communication capabilities, donation functionalities, and user administration. The technique consistently upheld its commitment to preventing food waste, advocating for sustainable practices, and fostering accountability and teamwork in the context of waste management.

CHAPTER 4

RESULT AND ANALYSIS

4.1 Introduction

In the continuous fight against food waste, the waste food management system and donation app, along with conventional food composting methods, show promise. Through an easy-to-use interface, the system efficiently connects food donors and rider as volunteers, streamlining the food donation procedures. Positive user feedback highlights the system's capacity to manage excess food and enable donations in an effective manner. By combining traditional food composting with organic waste, compost is created in a way that is more environmentally friendly. This dual strategy, which combines technology and conventional methods, aligns with the project's main objective of preventing food waste in daily life.

4.2 Results and Analysis

The Waste Food Management System and Donation App project has demonstrated its success through a rigorous examination, showing its dual focus on both donor and rider aspects. By enabling donors to select, categorize, and assign weights for leftover food gifts and suggesting appropriate vehicles for distribution, the app expedites the donation process. Google Maps integration improves the rider experience for prompt and effective pick-ups. Features that let donors view photos that riders have posted and view their donation history guarantee transparency. The project's software execution is firmly grounded in the methodical hardware development by BDP1 and the smart integration of traditional food composting techniques. Waste Food Management System and Donation App, showcasing it as a user-friendly, transparent, and efficient system that tackles food waste in its entirety.

4.3 Results on Android Studio Software

In addition to the initial hardware emphasis, the Waste Food Management System and Donation Apps projects produced successful results from their focus on software development on Android Studio. The app's donor and rider features were executed with precision, improving user satisfaction, and reducing food waste. Remaining food items can be easily chosen, categorized, and weighted by donors. The integration of Google Maps streamlines the donation procedure by enabling contributors to furnish accurate addresses for expedient retrieval.

A thorough donation history tracking system that offers real-time updates on the status of donations (pending, accepted, or delivered) is one of the software's donor-centric features. Additionally, the inclusion of photos that riders upload following the completion of their donation acts as a visual confirmation for donors, guaranteeing openness and process satisfaction. The waste reduction initiative is encouraged to be continued by this user-friendly interface.

The software facilitates effective donation management for riders by letting them view available donations according to the types of registered vehicles they drive and location as well. A structured and dynamic approach to distribution is encouraged by the system. The ability for riders to complete donations without having to upload images satisfies pragmatic needs and highlights the main objective of reducing food waste.

An encrypted and authenticated registration process is guaranteed by the integration of Google Firebase, which is essential for user authentication. Along with providing an additional layer of security, the email verification system is an essential part of the onboarding procedure. The project's success is based on this strong software infrastructure, which also promotes trust among stakeholders and users.

In conclusion, the project's software development phase produced a user-focused, open, and effective Waste Food Management System and Donation App. The project is positioned as an effective solution in the collective effort to reduce food waste in daily life. These factors demonstrate a well-coordinated and adaptive approach.

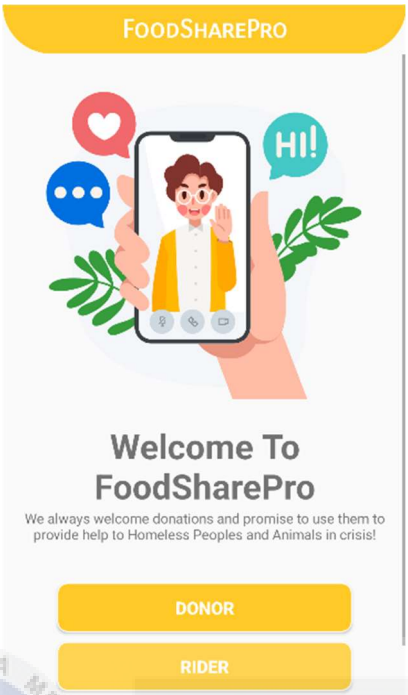


Figure 4.1 : Main Page

According to the Figure 4.1, which is the Main Page shows on a welcome message to the app and the user is able to click on “Donor” or “Rider” based on their preferences. This layout will appear only once during as the first time user.

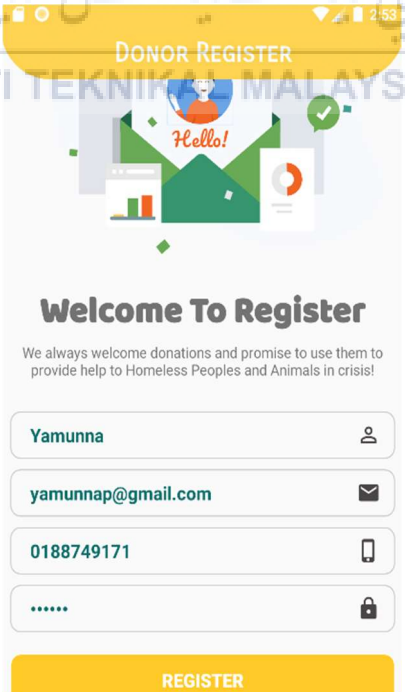


Figure 4.2 : Donor Register Page

On Figure 4.2, new Donor needs to register the new account. So that, from next time onwards the Donor will be able to log in to their registered account.

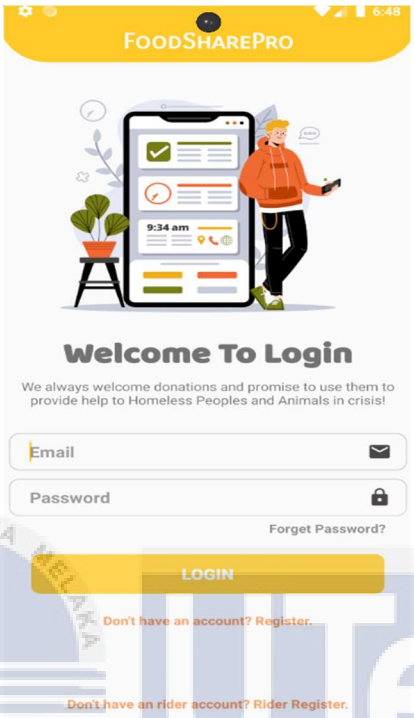


Figure 4.3 : Login Page

Basically, in the Figure 4.3 is the Login Page for both Donor and Rider. First, as for the Donor once after the first process of login, the Donor will receive email verification to verify the account.

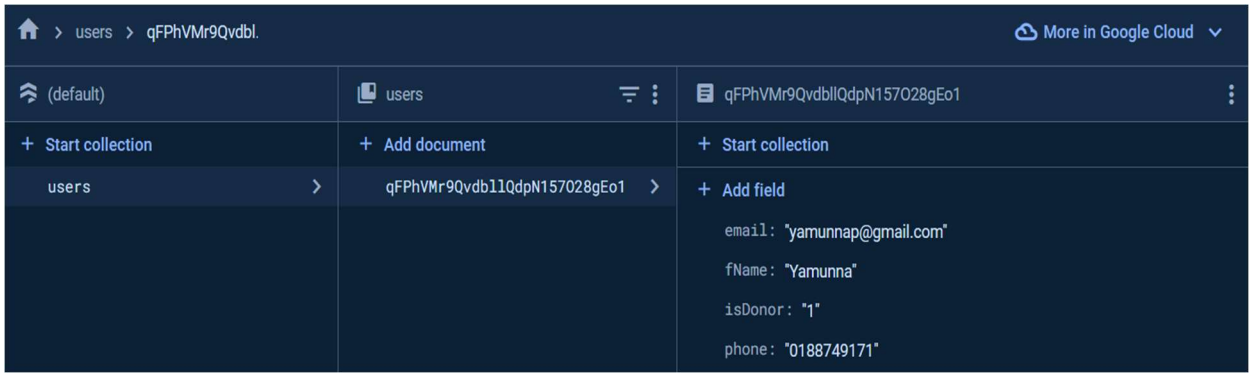


Figure 4.4 : Firebase Database

In this Figure 4.4, new registration as a Donor or Rider will be collected through Firebase Database as shown above. Basically, this is a new registration on a Donor.

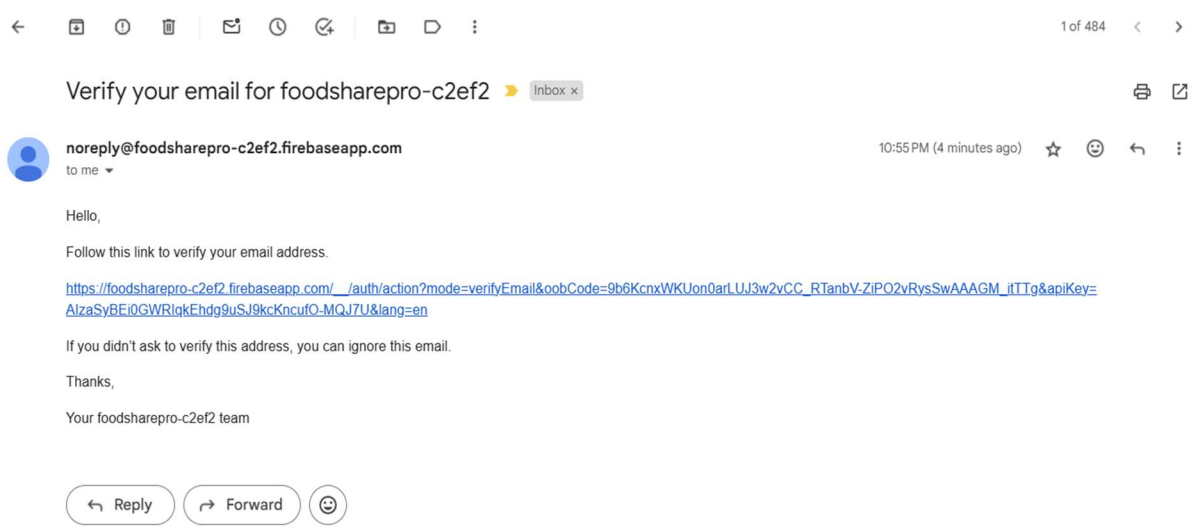


Figure 4.5 : Link to verify the account

According to the Figure 4.5, basically an email address only can be used once as a Donor or Rider depends on the user's requirements and preferences. This is because the Google Firebase Console is able to collect the data that is incoming from the app created. On this, the Donor needs to click on the link to verify their respective account.

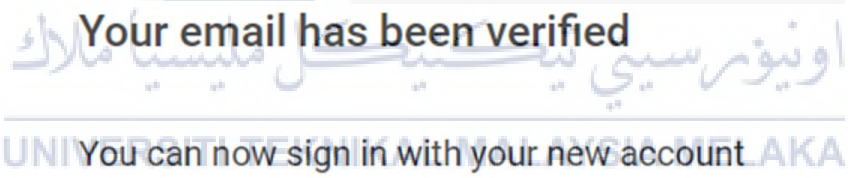


Figure 4.6 : Verified Email

In the Figure 4.6, on a new window this will be popped out to the Donor to make sure that their account is verified by the email.

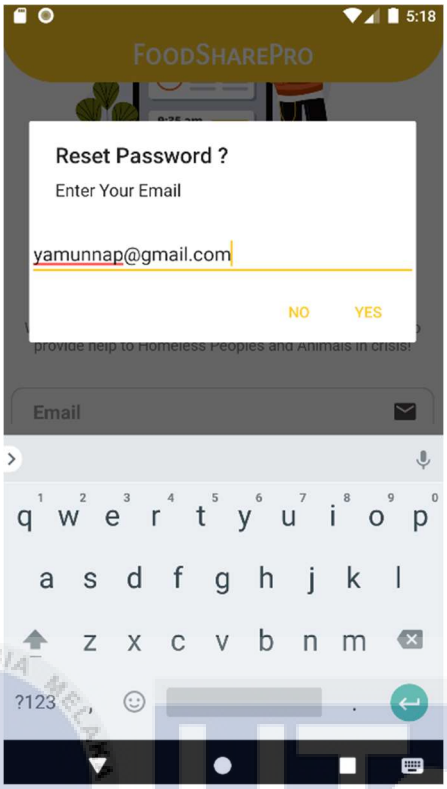


Figure 4.7 : Reset Password on Login Page

According to the Figure 4.7, if it's a Donor or Rider both is able to reset their password on the Login Page. In this, Donor is resetting the password which requires registered email address and click yes to do it so.

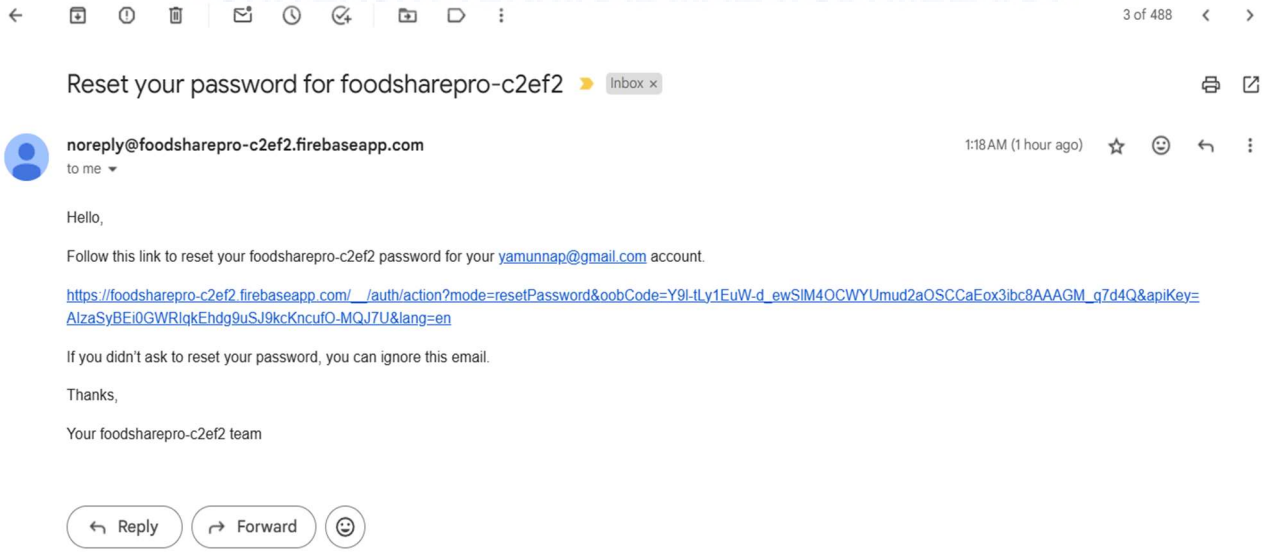


Figure 4.8 : Link to Reset Password

In this Figure 4.8, the Donor needs to click on the link and a new window will appear to change their respective password.

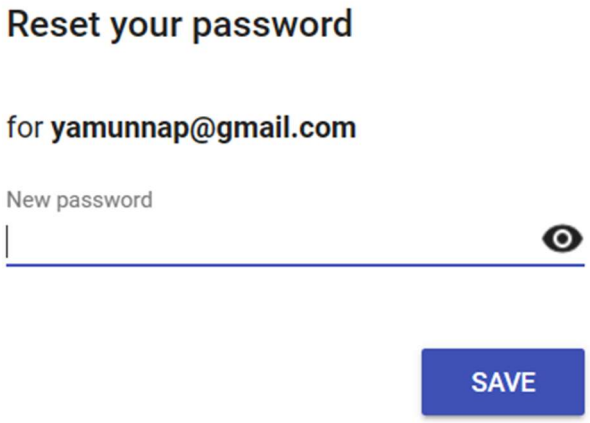


Figure 4.9 : Reset your Password Page

According to this Figure 4.9, the Donor can set their new password according to their own preferences and click Save.

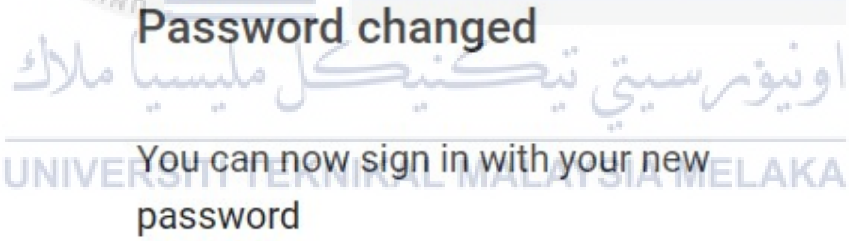


Figure 4.10 : Password Changed Page

In this Figure 4.10, once the above process as in Figure 4.9 is completed. This page will pop out in a new window such as above.

Figure 4.11 : Donor's Main Page

Figure 4.11, shows the Donor's Main Page where the Donor is able to add their respective donation by clicking on Donation Button. Once after done with their donation process, the Donor is able to check their status by clicking on the Status Button time to time. Next is the History Button where can view their history once it's completed. As the last button is click the Logout Button and the Donor is logged out from the app. Then, the Navigation Pane Button beside the app's name is shown as in the Figure below. The other options is just for the Donor to know what the app actually does in a simple explanation. So, the Donor will understand easily and make it even more user-friendly.

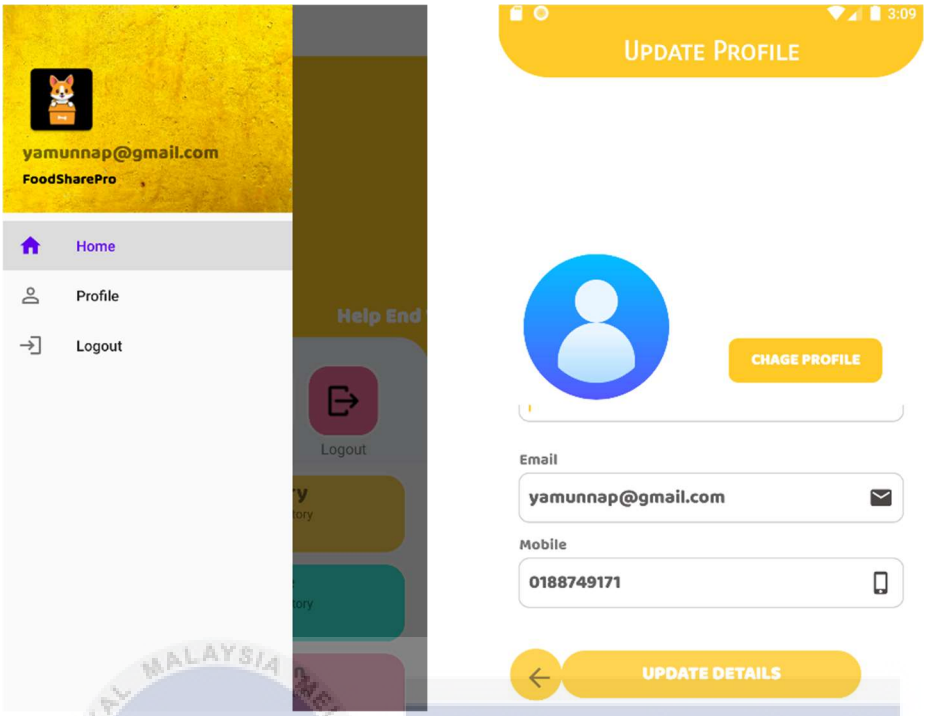


Figure 4.2 : Donor's Navigation Pane Page

In this Figure 4.12 shows that the Donor is able to click on Home, Profile and Logout as well. The Donor is able to update their profile settings as figure above.

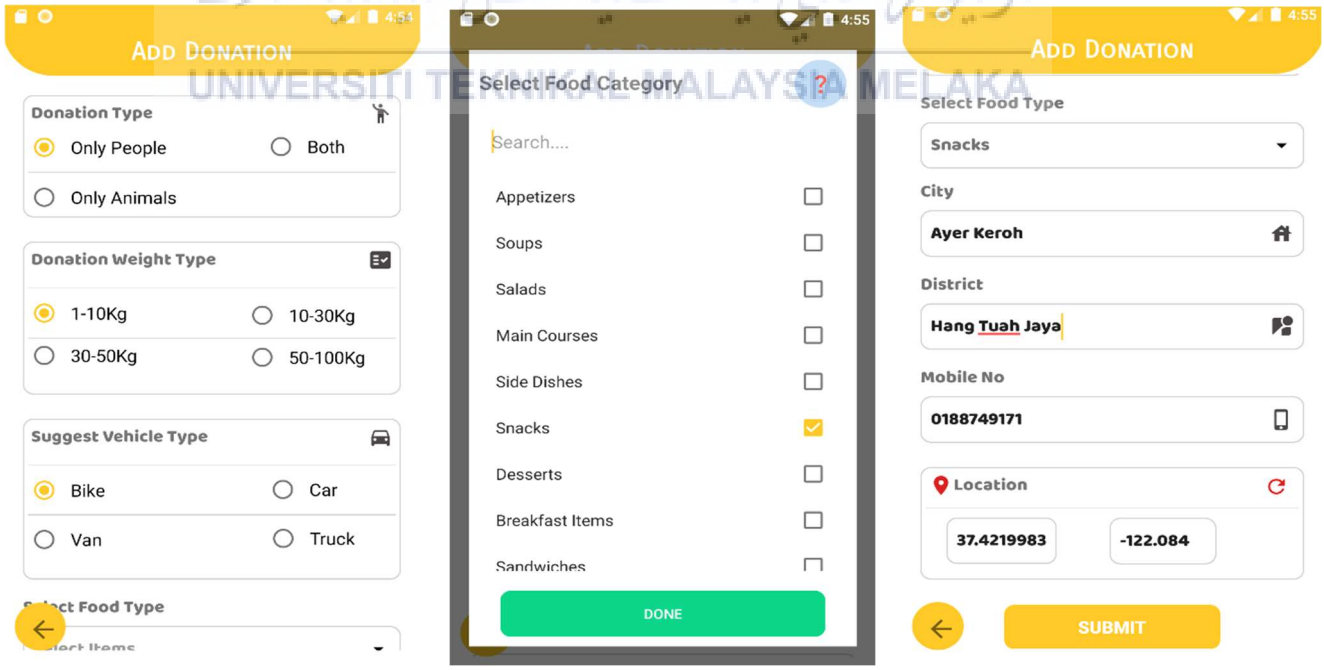


Figure 4.13 : Donor's Donation Page

Basically, from this Figure the Donor is required to fill it up according to their respective requirements and preferences. Such as select the Donation Type, Donation Weight Type, Vehicle type, Select Food Type by clicking on the category list and click on Done Button. Then, fill up the City and District wants to donate, Mobile No will be filled up by its own since the Donor already create account and set it while registration and click on Submit Button.

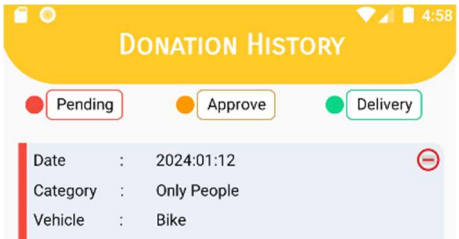


Figure 4.14 : Donor's Donation History Page

According to this Figure 4.14, the Donor is able to view their history on this page time to time to make sure whether the process is still pending, approve or delivery. So, basically this page will change accordingly to the Rider's process.

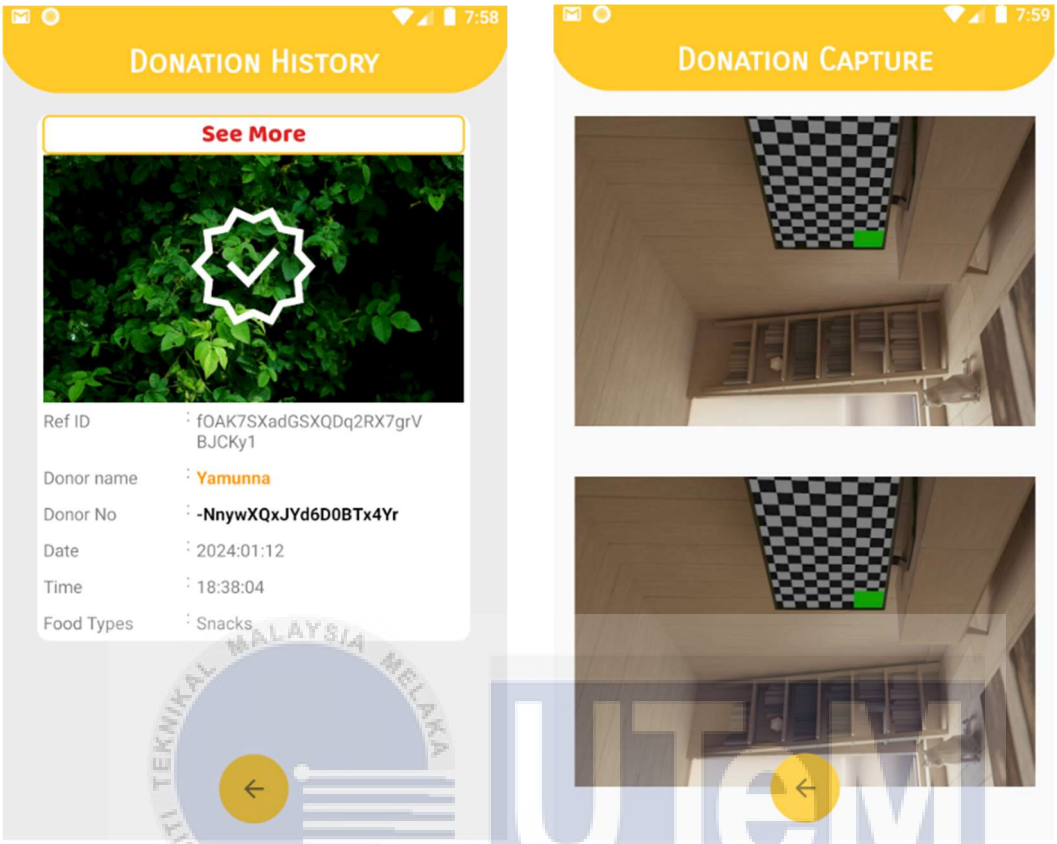


Figure 4.15 : Donor's Donation History and Capture

On this page, the Donor is still able to view the history of donation process but this page was mainly created to see on the Rider's Delivery is once completed. The Donation Capture can be viewed by clicking on See More. This is a sample picture of the prove and satisfaction of the Donor by Rider.

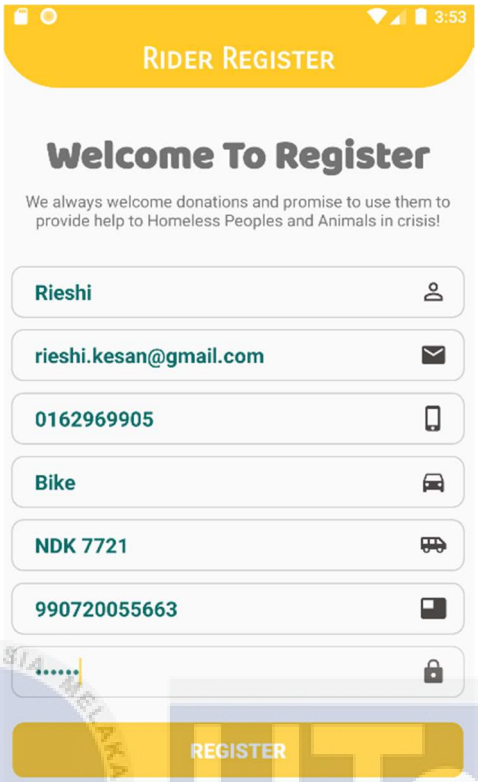


Figure 4.16 : Rider Register Page

On Figure 4.16, new Rider needs to register the new account. So that, from next time onwards the Rider will be able to log in to their registered account.

Figure 4.17 : Firebase Database

In this Figure 4.17, new registration as a Rider will be collected through Firebase Database as shown above. Basically, this is a new registration on a Rider.

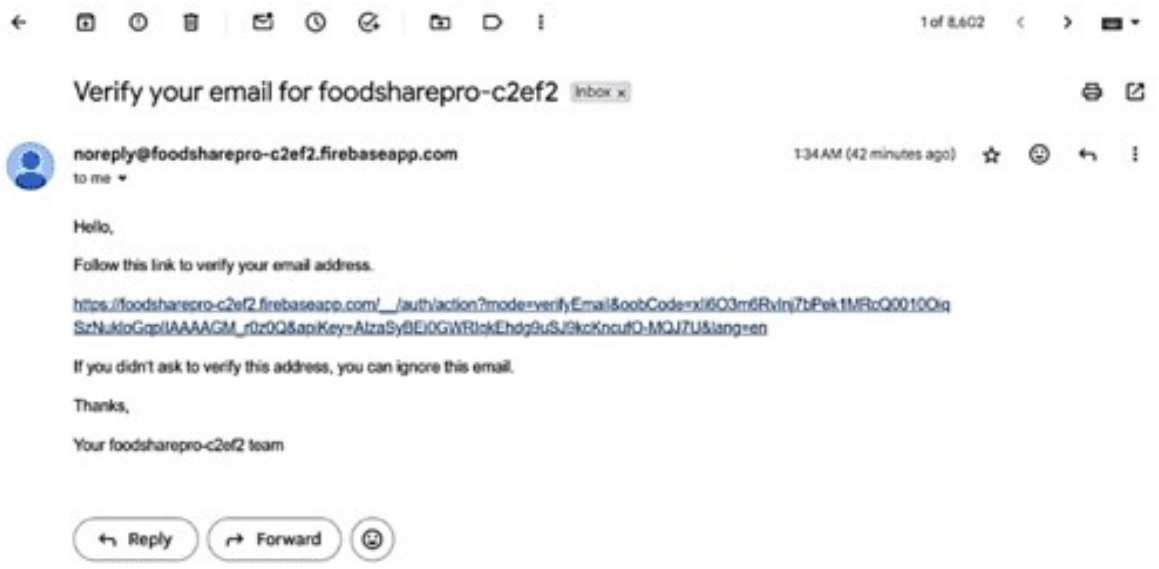


Figure 4.18 : Link to verify the account

According to the Figure 4.18, the Rider needs to click on the link to verify their respective account.

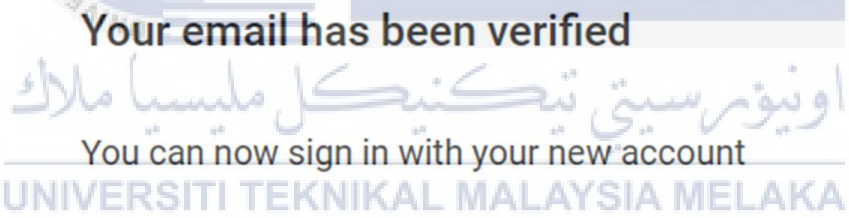


Figure 4.19 : Verified email

In the Figure 4.19, on a new window this will be popped out for the Rider to make sure that their account is verified by the email.

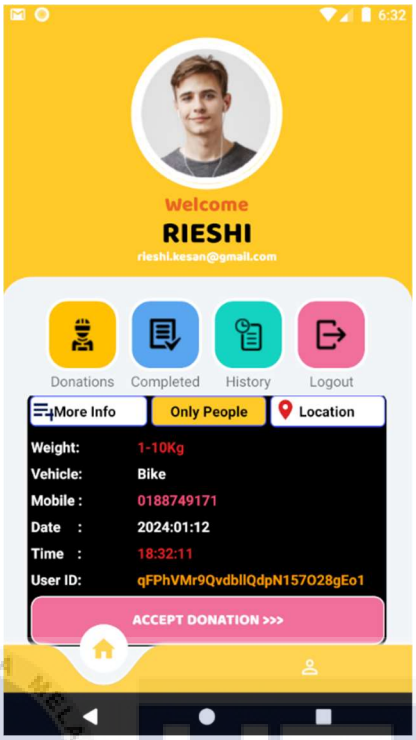


Figure 4.2 : Rider Register Page

Figure 4.20, shows the Rider's Main Page where the Rider is able to click on Accept Donation only according to their vehicle type and location as well.

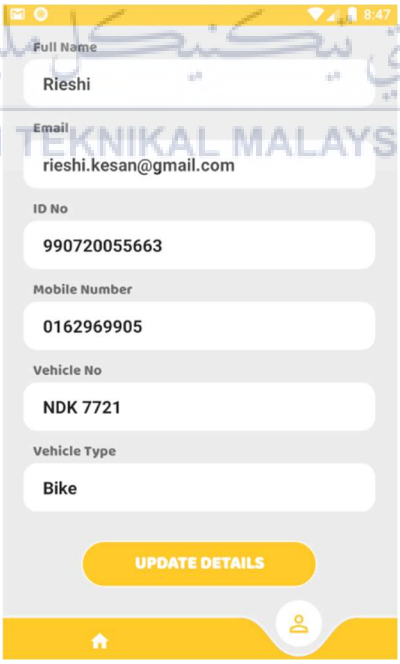


Figure 4.21 : Rider Update Profile

This is Figure 4.21, where the Rider update their profile settings as figure above.

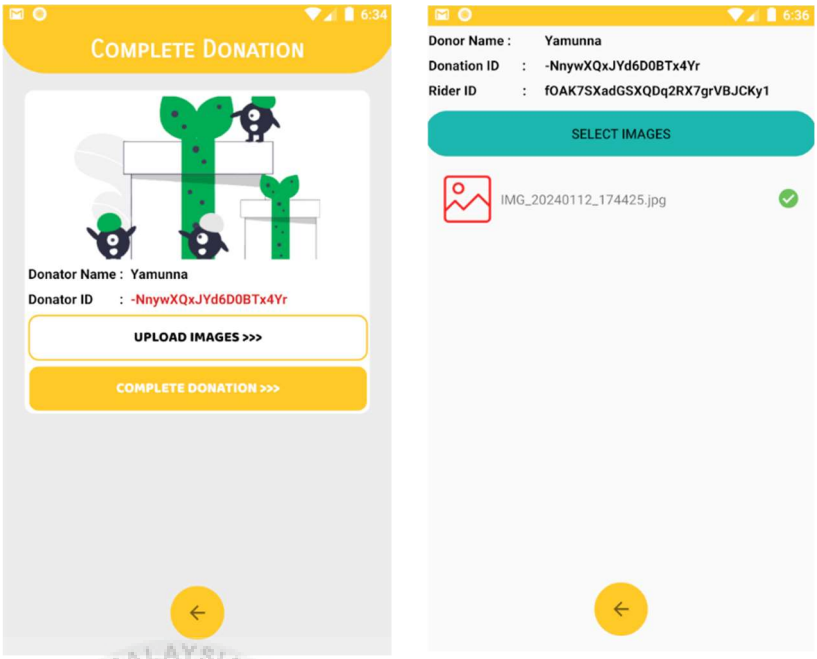


Figure 4.22 : Complete Donation

As for the above Figure, the Rider can just Complete Donation or even can upload images of the delivery done by them by clicking on the Upload Image Button. Then, the Rider needs to snap picture and select the image to upload it. Then, click Complete Donation as in Figure 4.21 shows, the uploaded image can be viewed by the Donor.

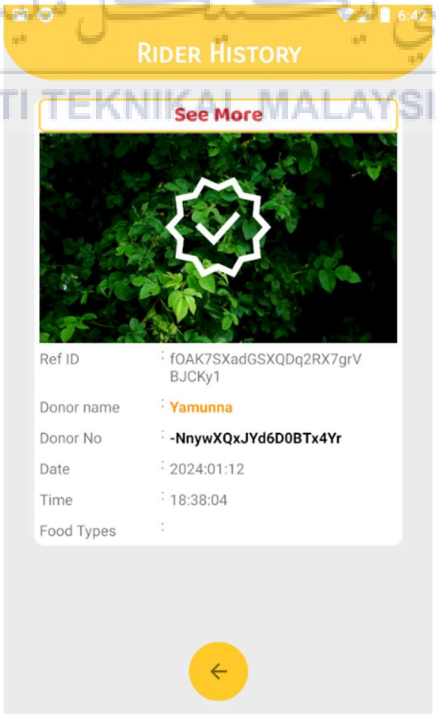


Figure 4.23 : Rider History Page

On this page as in the Figure above, Rider can click on the History Button at the Main Page and view this page with proper Ref ID, Donor name, Donor No, Date and time as well.

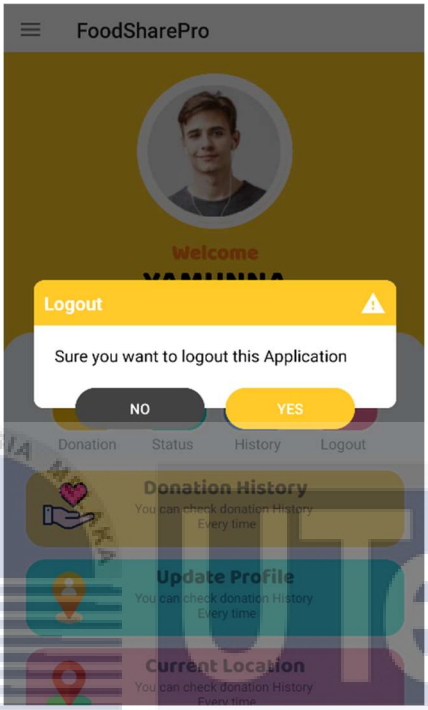


Figure 4.24 : Logout

According to this Figure, for Donor or Rider this page is same function. When they click on Logout Button this alert message will appear and Donor or Rider needs to click on Yes Button so that, they will be able to logout from the app.

4.4 Results on Traditional Food Composting on Hardware

The development of food composting hardware has advanced significantly in the project's early phases. Understanding the value of a functional composting system, the project has conducted extensive research and analysis to determine and install necessary hardware. In order to facilitate the breakdown of organic waste into nutrient-rich compost, this hardware development includes the purchase and installation of composting bins, thermometers, and aeration systems. A composting environment is ensured by the thoughtful placement of composting bins and the strategic monitoring and maintenance of ideal temperatures through the use of thermometers. The incorporation of aeration systems facilitates the breakdown process even more. Together, these hardware elements lay the groundwork for a conventional food composting system, which is in line with the project's objective of developing a food waste management system with a drastically lower environmental impact. This phase's progress in developing food composting hardware demonstrates a dedication to sustainability and environmental responsibility, setting up the project for success in accomplishing its main goals.

Figure 4.25 : Week 1 of Food Composting

Figure 4.26 : Week 2 of Food Composting

Figure 4.27 : Week 3 of Food Composting

Figure 4.28 : Week 4 of Food Composting

Figure 4.29 : Organic Compost

4.5 Analysis of Results

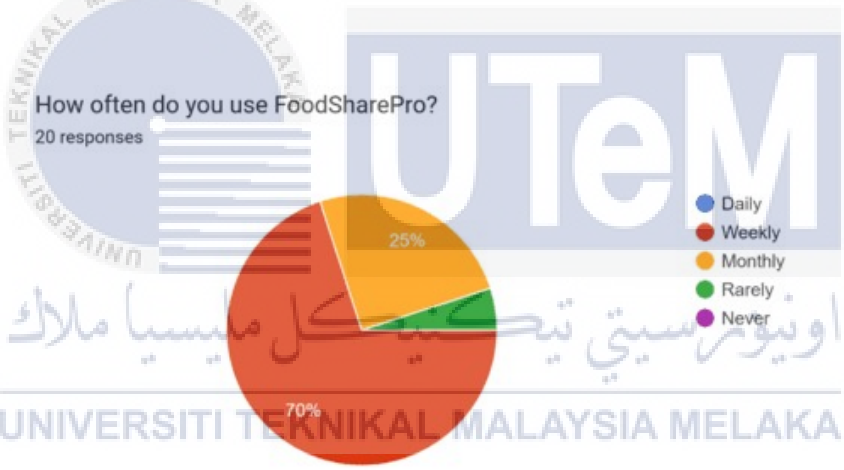


Figure 4.30 : How often do you use FoodSharePro?

In Figure 4.30, on “How often do you use FoodShare Pro”. Around 70 % of the participants voted Weekly, 25 % of the participants voted for Monthly and 5% of the participants voted for Rarely.

Figure 4.31 : What features do you find most beneficial in FoodSharePro?

Based on Figure 4.31, the participants gave their respective comments as the above Figure for "What features do you find most beneficial in FoodSharePro?".

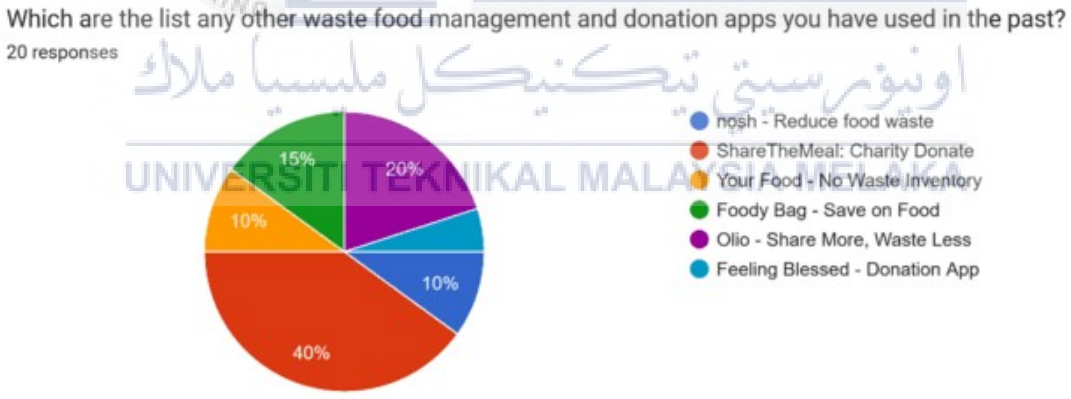


Figure 4.32 : Which are the list any other waste food management and donation apps you have used in the past?

As for Figure 4.32, “Which are the list any other waste food management and donation apps you have used in the past?”. Around 40% of the participants voted for ShareTheMeal, 20% of the participants voted for Olio, 15% of the participants voted for Foody Bag, 10% for Your Food and nosh. The least is 5% of the participants voted for Feeling Blessed.

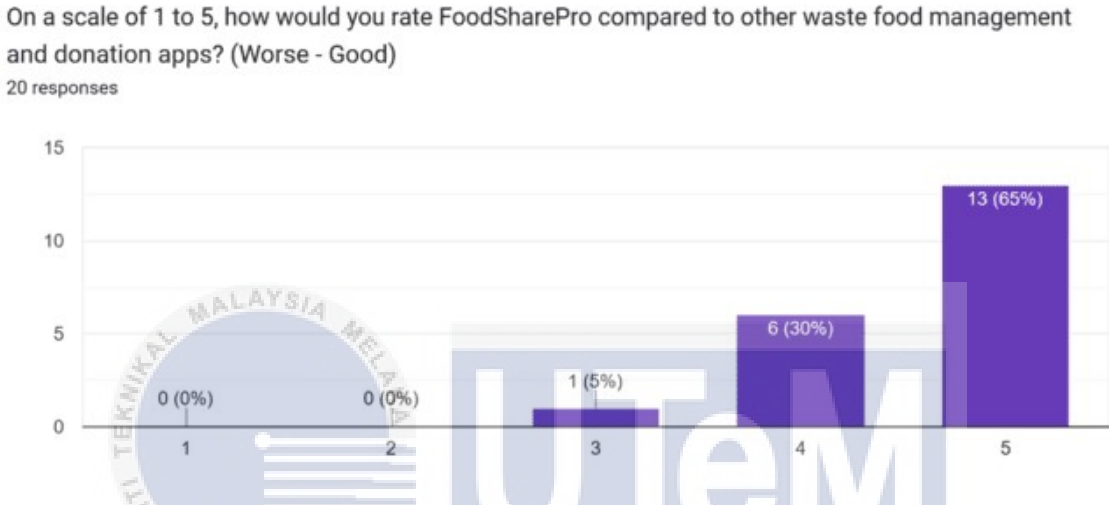


Figure 4.33 : On a scale of 1 to 5, how would you rate FoodSharePro compared to other waste food management and donation apps? (Worse-Good)

From Figure 4.33, “On a scale of 1 to 5, how would you rate FoodSharePro compared to other waste food management and donation apps? (Worse-Good)”. 13 participants with 65% voted with the scale of 5, 6 participants with 30% voted with the scale of 4, 1 participant with 5% voted with the scale of 3 and the scale of 1 and 2 is 0% with 0 participants.

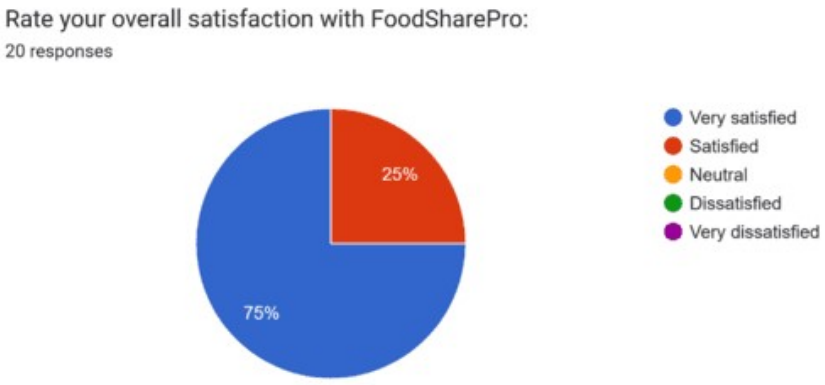


Figure 4.34 : Rate your overall satisfaction with FoodSharePro

According to the Figure 4.34, “Rate your overall satisfaction with FoodSharePro”. Out of 20 responses 75% falls on category of Very satisfied and 25% falls on category of Satisfied.

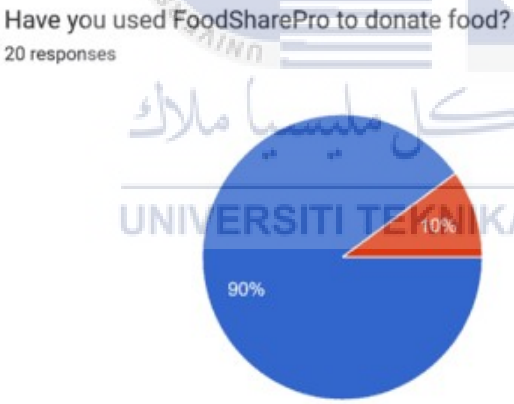


Figure 4.35 : Have you used FoodSharePro to donate food?

On Figure 4.35, “Have you used FoodSharePro to donate food?”. From this we can observe that 90% of the participants voted for Yes and 10% of the participants voted for No.

Figure 4.36 : If yes, please share your experience with the donation

From this Figure, “If yes, please share your experience with the donation process” each and every response received by the participants are very much different according to their requirements and preferences.

Table 4.1 : Data Comparison between other apps.

	Mean	Standard Deviation
Number of Users (Out of 20)	$= \frac{Sum\ of\ All\ Values}{Total\ Number\ of\ Values}$ $= \frac{18+8+4+3+2+2+1}{7}$ = 7.43	$= \frac{\sqrt{\sum(X-Mean)^2}}{Number\ of\ Values}$ $= \frac{\sqrt{\begin{matrix}(18-7.43)^2+(8-7.43)^2+\\(4-7.43)^2+(3-7.43)^2+\\(2-7.43)^2+(2-7.43)^2+\\(1-7.43)^2\end{matrix}}}{7}$ = 6.10
User Satisfaction Percentage	$= \frac{Sum\ of\ All\ Percentages}{Total\ Number\ of\ Percentages}$ $= \frac{75+40+20+15+10+10+5}{7}$ = 24.29	$= \frac{\sqrt{\sum(Percentage-Mean)^2}}{Number\ of\ Percentage}$ $= \frac{\sqrt{\begin{matrix}(75-24.29)^2+(40-24.29)^2+\\(20-24.29)^2+(15-24.29)^2+\\(10-24.29)^2+(10-24.29)^2+\\(5-24.29)^2\end{matrix}}}{7}$ = 24.25

Performed a thorough analysis of the user base and satisfaction rates for each app in the study comparing on waste food management and donation apps. It was discovered that there was some variation in the number of users across FoodSharePro, ShareTheMeal, Olio, Foody Bag, nosh, Your Food, and Feeling Blessed. The mean number of users was found to be roughly 7.43, with a standard deviation of 6.10. With a mean user satisfaction percentage of 24.29%, FoodSharePro led the pack, but the survey's apps showed wide variations in user satisfaction, as evidenced by the standard deviation of 24.25.

CHAPTER 5

CONCLUSION

5.1 Conclusion

To sum up, the second phase of the project's ongoing development and integration of the waste food management system, donation apps, and conventional food composting techniques represent a comprehensive and long-term approach to addressing the urgent problems pertaining to waste food. The preliminary results and analysis highlight the importance of this comprehensive strategy.

The waste food management system's integration of cutting-edge technologies, such as data analytics and intelligent sensors, shows the project's dedication to accuracy and effectiveness in tracking and monitoring food waste. By providing actionable insights, this data-driven approach enables organizations, homes, and businesses to make well-informed decisions and put into practice efficient waste reduction plans. The donation apps that are easy to use are essential in enabling the smooth redistribution of excess food by linking contributors with nearby charitable organizations and civic associations. By ensuring that eatable food reaches those in need, this not only reduces food waste but also supports the larger effort to combat food insecurity.

Additionally, incorporating conventional food composting methods is in line with eco-friendly waste management strategies. These techniques significantly lessen the environmental impact of food waste while promoting soil health by turning organic waste into nutrient-rich compost.

A comprehensive approach to reducing food waste can be achieved by combining the three components: traditional food composting, donation apps, and waste food

management systems. This all-encompassing strategy promotes fairness in food distribution, reduces waste generation, and maximizes food recovery. The goals stated in the first conclusion are in line with the promising remedy offered by the for the issue of global food waste is ongoing development of these interconnected systems.

The project has the potential to have a revolutionary effect on waste management and agricultural sustainability, even though more study and application are required to improve and optimize these systems. The project is at the forefront of efforts to create a more resilient and sustainable future because of its dedication to integrating traditional methods with technology.

5.2 Potential for Commercialization

The project's potential for commercialization has grown considerably in the second phase. Encompassing waste food management system and donation apps, and traditional food composting methods is enormous in the sustainability and waste management industries. With its advanced technologies and data driven approach, the waste food management system can be commercialised as a comprehensive software solution for businesses, institutions, and households seeking to reduce food waste. This system offers real-time monitoring, analytics, and waste reduction strategies as a subscription-based service. Furthermore, the user-friendly donation app has considerable commercial appeal. It can be marketed as a platform that connects food donors with local charities and community organisations, expediting the donation process and combating food insecurity. This application can generate revenue through business partnerships and collaborations. In addition, the incorporation of traditional food composting techniques allows for the commercialization of composting apparatus, such as composting bins, thermometers, and aeration systems, aimed at both individual consumers and businesses. These hardware solutions can be marketed as ecofriendly and sustainable options, appealing to consumers and businesses who are environmentally conscious. The project's comprehensive approach and integration of technology and traditional practises offer promising commercialization opportunities for waste management, donation platforms, and composting equipment.

5.3 Future Works

By pursuing these future efforts, the project can achieve greater impact, widespread adoption, and long-term sustainability in its efforts to reduce food waste, facilitate food donation, and promote traditional food composting practises.

i. Waste food management system and donation app software can be optimised to improve user experience and functionality. Improve the UI, data analytics, and waste tracking and prediction algorithms.

ii. After the original system is developed and confirmed, scaling up can begin. This involves expanding the waste food management system and donating apps to more cities and regions. This expansion requires strategic alliances, expanded hardware deployment, and strong infrastructure support.

iii. Working with corporations, non-profits, and government agencies can increase impact and sustainability. Partnerships can improve food donation logistics, waste collection, and conventional food composting acceptance.

iv. Waste food management and donation apps, and traditional food composting systems need ongoing monitoring, evaluation, and feedback. Regular assessments can uncover areas for improvement, address difficulties, and incorporate new features and technology.

v. Teaching the public about food waste, composting, and individual actions is crucial. To promote appropriate trash management, future work should focus on education, awareness campaigns, and community engagement.

REFERENCES

[1] Journal, I. (n.d.). *"Waste Food Management and Donation App."* (PDF) "Waste Food Management and Donation App" | IRJET Journal - Academia.edu.

[2] Bhardwaj, S., Kumar, U., & Kumar, D. Y. (2022). Food Waste Management Android App. *SSRN Electronic Journal*.

[3] Uma, R., Ranjith, S., Mohaidheen, I. K., & Dharaneesh, S. R. (2022, May 25). *Web – based Application for Food Waste Management – IJERT*. Web – Based Application for Food Waste Management – IJERT.

[4] Vernekar, Y. V., Gautum, R. M., Pawar, A. K., Sathe, G. G., & Rukare, G. (2022). An Android and Web based Food Donation Application to Reduce Food Waste. International Journal of Advanced Research in Science, Communication, and Technology (IJARSCT), 2(2), 253-568.

[5] Haas, R., Aşan, H., Doğan, O., Michalek, C. R., Karaca Akkan, Z., & Bulut, Z. A. (2022, July 26). Designing and Implementing the MySusCof App—A Mobile App to Support Food Waste Reduction. *Foods*, *11*(15), 2222.

[6] Yasith Chandula, Akila Kavinda, Thushal Shaminda, Sachintha Gunaratne, D.I. De Silva, & Dulanji Cooray. (2022, October 31). Food-For-All Web Application for Donation Management. *International Journal of Engineering and Management Research*, *12*(5), 90–98.

[7] Kumer Rajvor, P., Islam Shovon, M. S., Akter, M., Nawrin, F., & Yasmin, S. (2021, February 1). REDUCTION OF FOOD WASTAGE THROUGH DONATION USING ONLINE FOOD MANAGEMENT SYSTEM FOR ORPHANAGE. *International Journal of Engineering Applied Sciences and Technology*, *5*(10).

[8] Saba, M. (2022, July 31). Food Waste Management. *International Journal for Research in Applied Science and Engineering Technology*, *10*(7), 3487–3491.

[9] Panchal, D., Gandhi, P., Dalvi, M., Naik, A., & Chintawar, S. (2023). Food Waste Management. International Research Journal of Modernization in Engineering Technology and Science, 5(2), 2224.

[10] Yongrok Choi, Lige Zhang, Jahira Debbarma, & Yongrok Choi. (2021). Sustainable Management of Online to Offline Delivery Apps for Consumers' Reuse Intention: Focused on the Meituan Apps. Sustainability, 13(7), 3593–3593.

[11] Mhaske, H., Kengar, S., & Singh, A. (2022). "Waste Food Management and Donation App." International Journal of Advance Research and Innovative Ideas in Education, 8(3), 17203-17212. ISSN(O): 2395-4396.

[12] George Zhou, Marisabel Chang, & Yu Sun. (2021). A Mobile Platform for Food Donation and Delivery System using AI and Machine Learning. Information Technology Trends.

[13] Hadeel Ibrahim Alzahrani, Zahraa Al Thnayyan, Sahar Al-Qalaleef, Fatimah Al Talaq, Muneerah Alshabanah, Daniah Alrajhi, & Mutasem K. Alsmadi. (2020). E-Sharing : Developing a Web Based Online Donation System. International Journal of Scientific Research in Science and Technology, 237–248.

[14] Yadnesh Chaudhari, Niraj Rawat, Tejas Nikhar, & Saumya Salian. (2021). Feed Hungry, Feel Happy. International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 358–363.

[15] T. Manogna. (2021). Mobile Application for Food Donation. International Journal for Research in Applied Science and Engineering Technology, 9, 1195–1197.

[16] Juhi Patil, Gayatri More, Pooja Mahale, Nikita Harale, & Vijaylaxmi Bittal. (2021). Zero Hunger: Smart Food Donation System using IoT. International Journal of Advanced Research in Science, Communication and Technology, 292–305.

[17] Hyun Young Hwang, Seong Heon Kim, Jaehong Shim, & Seong-Jin Park. (2020). Composting Process and Gas Emissions during Food Waste Composting under the Effect of Different Additives. Sustainability, 12(18), 7811–7811.

[18] Aziz Khalida, Veknesh Arumugam, Luqman Chuah Abdullah, Latifah Abd Manaf, & Muhammad Heikal Ismail. (2022). Dehydrated Food Waste for Composting: An Overview. Pertanika Journal of Science and Technology, 30(4), 2933–2960.

[19] Antoni Sánchez. (2022). Decentralized Composting of Food Waste: A Perspective on Scientific Knowledge. Frontiers in Chemical Engineering, 4.

[20] Juplin Kinti, Lydia Dundun Francis, & Sunita Jobli. (2019). The Effectiveness of Biochar in Composting of Food Waste. Journal of Engineering and Applied Sciences.

[21] Teresa Gea, Angelica Maria Hernandez-Gomez, Marcos Ríos, Anauribeth Portela, Viviana Sanchez-Torres, Isabel Domínguez, & Dimitrios Komilis. (2021). A Comparison of Two-Stage and Traditional Co-Composting of Green Waste and Food Waste Amended with Phosphate Rock and Sawdust. Sustainability, 13(3), 1109–1109.

[22] M. A. Vázquez, Ramón Plana, C. Pérez, & Manuel Soto. (2020). Development of Technologies for Local Composting of Food Waste from Universities. International Journal of Environmental Research and Public Health, 17(9), 3153–3153.

[23] Jae–Han Lee, Deogratius Luyima, Chang Hoon Lee, Seong-Jin Park, & Taek Keun Oh. (2020). Efficiencies of unconventional bulking agents in composting food waste in Korea. Applied Biological Chemistry, 63, 1–7.

[24] Aisha Al-Rumaihi, Gordon McKay, Hamish R. Mackey, & Tareq Al-Ansari. (2020). Environmental Impact Assessment of Food Waste Management Using Two Composting Techniques. Sustainability, 12(4), 1595–1595.

[25] Kishneth Palaniveloo, Muhammad Azri Amran, Nur Azeyanti Norhashim, Nuradilla Mohamad-Fauzi, Fang Peng-Hui, Low Hui-Wen, … Shariza Abdul Razak. (2020). Food Waste Composting and Microbial Community Structure Profiling. Processes, 8(6), 723–723.

[26] Pritam Activity during Composting and Plant Growth Impact: A Review. Journal of Pure and Applied Microbiology. https://doi.org/10.22207/jpam.16.1.53Priyadarshi Rath, Kajari Das, & Sumitra Pattanaik. (2022). Microbial

[27] Pei Sze Lew, Nik Nor Liyaik Ibrahim, Suryani Kamarudin, Norashikin M. Thamrin, & Mohamad Farid Misnan. (2021). Optimization of Bokashi-Composting Process Using Effective Microorganisms-1 in Smart Composting Bin. Sensors, 21(8), 2847–2847.

[28] Chin Ko Yeh, Chitsan Lin, Hsueh Chen Shen, Nicholas Kiprotich Cheruiyot, Mary Ellen Camarillo, & Chung Lung Wang. (2020). Optimizing Food Waste Composting Parameters and Evaluating Heat Generation. Applied Sciences, 10(7), 2284–2284.

[29] Wee Choon Tan, Lim Eng Aik, Teoh Thean Hin, Wong Yau Jye, Ahmat Zaki Jamaludin, Muhamad Nur Nai'man Nordin, … Tan Poh Choon. (2021). Conceptual design for smart organic waste recycling system. Journal of Physics, 2051(1), 12042–12042.

[30] Gina Kennedy, Rebecca Kanter, Sinee Chotiboriboon, Namukolo Covic, Treena Delormier, T. Longvah, … Harriet V. Kuhnlein. (2021). Traditional and Indigenous Fruits and Vegetables for Food System Transformation. Current Developments in Nutrition, 5(8).

[31] B Zaman, N Hardyanti, & P Purwono. (2021). Fast composting of food waste using thermal composter. Iop Conference Series, 896(1), 12013–12013.

[32] Hemlata N.Bhandare, Priya Prabhu Bhadekar, Saniya Musa Hakim, Komal Jaydipl Mane, & Sukanya Fulchand Salunkhe. (2023). Food Donation and Food Waste Management Website. Zenodo (Cern European Organization for Nuclear Research). doi:10.5281/zenodo.7731077

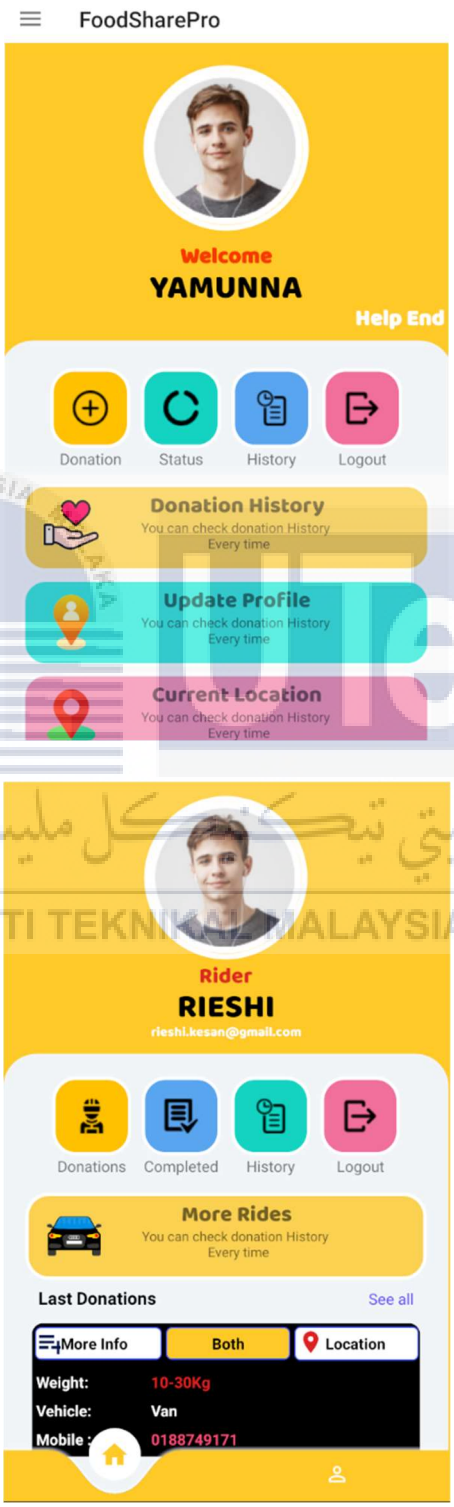
[33] Prof. Devachand Chaudhari. (2023). Waste Food Management and Donation App. International Journal for Research in Applied Science and Engineering Technology, 11(5), 4120–4123. doi:10.22214/ijraset.2023.51847

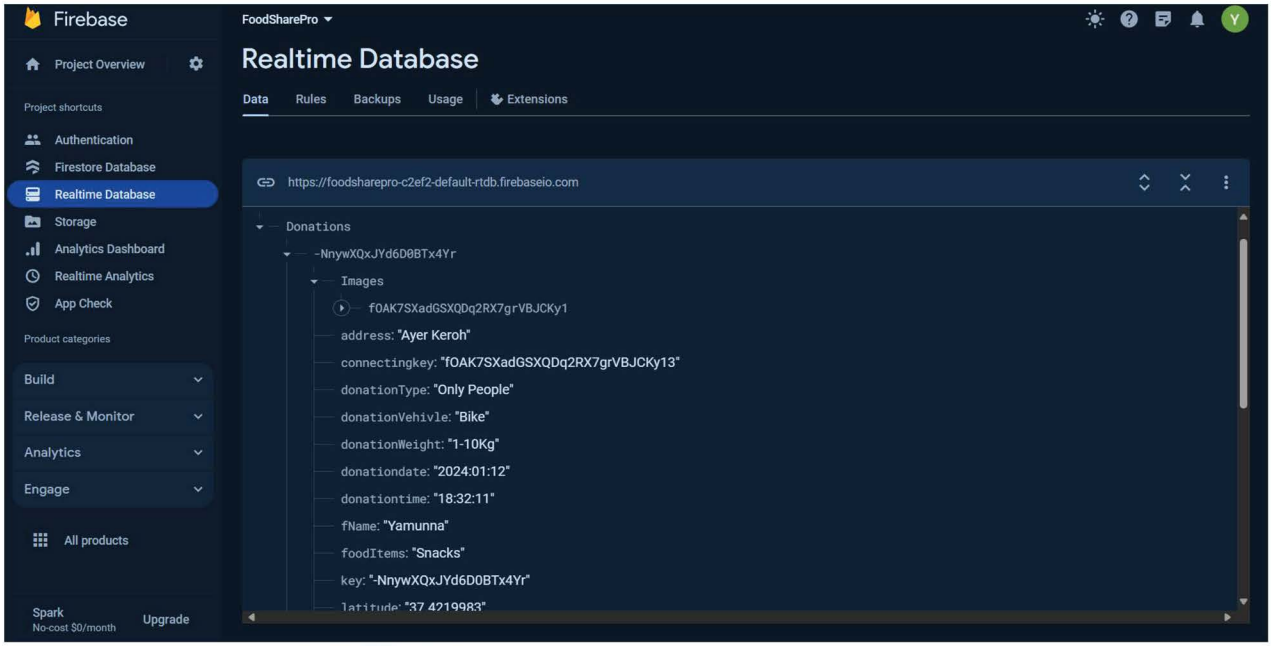
[34] Aziz Khalida, Veknesh Arumugam, Luqman Chuah Abdullah, Latifah Abd Manaf, & Muhammad Hussain Ismail. (2022). Dehydrated Food Waste for Composting: An Overview. Pertanika Journal of Science and Technology, 30(4), 2933–2960. doi:10.47836/pjst.30.4.33

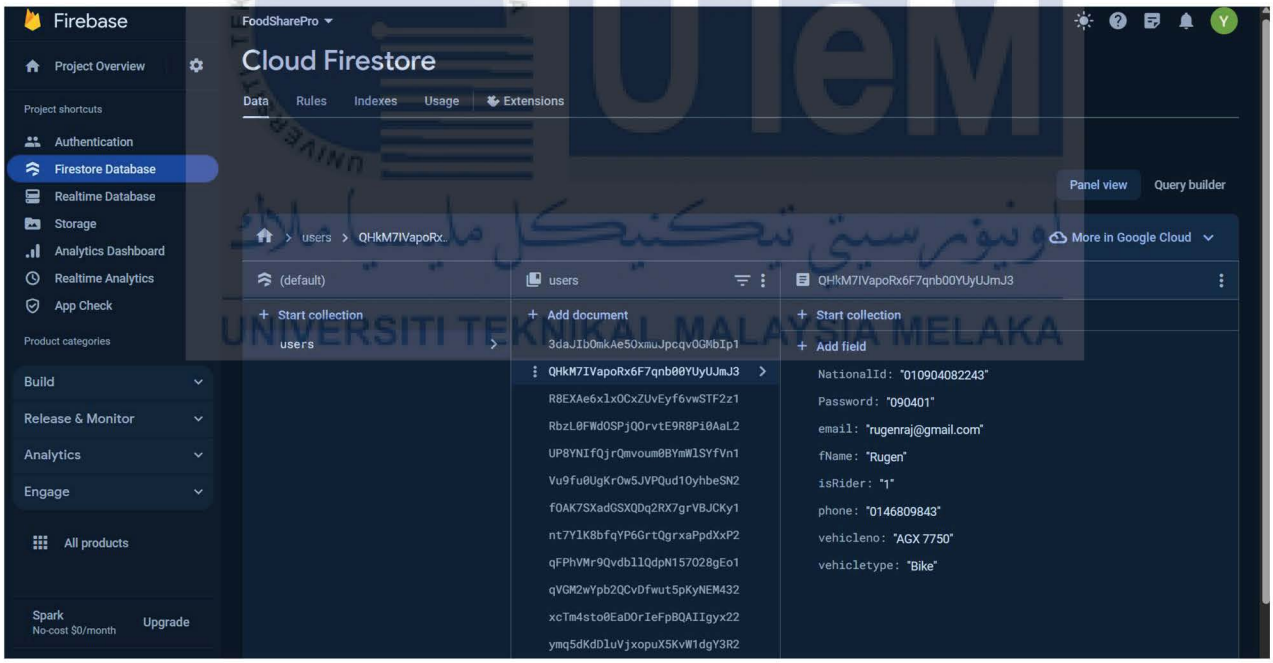
[35] N N H N Amiruddin, N A Rozamri, F Baharudin, & I N Mohamad. (2023). A Study on household food waste management and composting practice. Iop Conference Series, 1205(1), 12018–12018. doi:10.1088/1755-1315/1205/1/012018

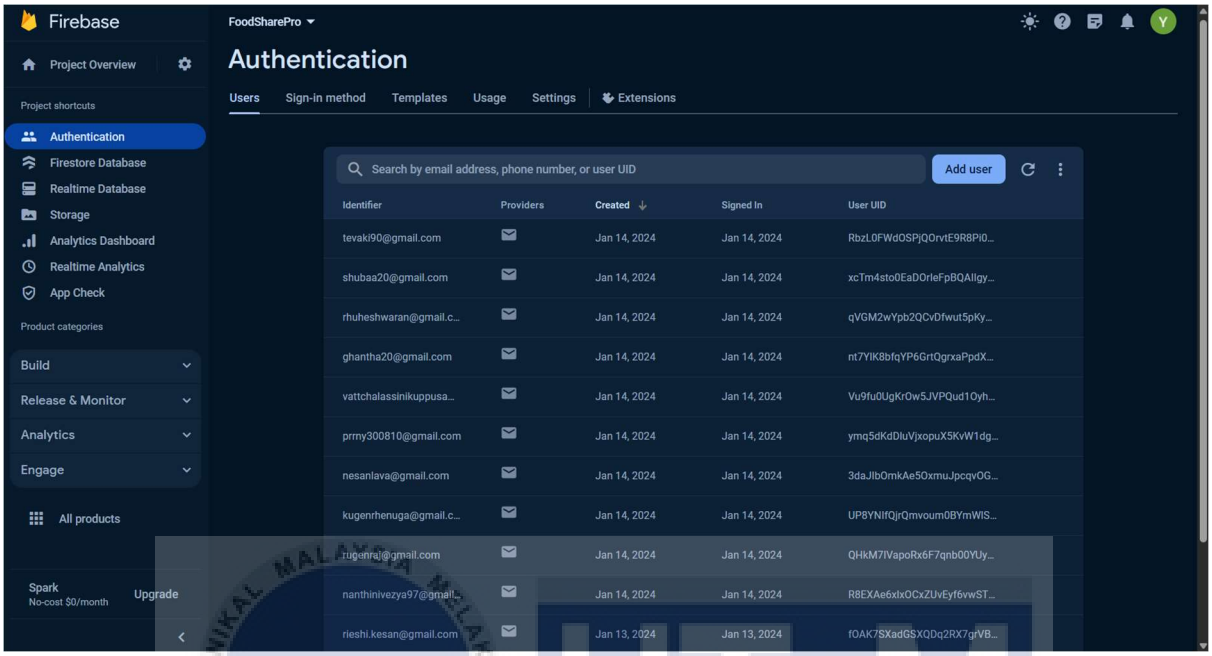
APPENDICES

APPENDIX A









APPENDIX B

BDP 1 – GANTT CHART

TASKS / WEEKS	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
Briefing with JK PSM FTKEE														
Title Selection and Registration														
Proposal														
Finding Research Paper														
Planning on Hardware														
Chapter 1 : Introduction														
Chapter 2 : Literature Review														
Preparation on Hardware - Week 1														
Preparation on Hardware - Week 2														
Progress Work 1 Evaluation														
Chapter 3 : Methodology														
Preparation on Hardware - Week 3														
Briefing with JK PSM FTKEE														
Preparation on Hardware - Week 4														
Chapter 4 : Preliminary Result														
Chapter 5 : Conclusion														
Checking Final Report														
Progress Work 2 Evaluation														
Compile and Turnitin														
Slide Presentation														
BDP 1 Presentation														

BDP 2 – GANTT CHART

TASK / WEEKS	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
Briefing with JK PSM FTKEE														
Implementation of Development of Application														
Implementation of Interface														
Implementation of Database														
Progress 1 Evaluation														
Implementation of Interface testing														
Implementation of Database testing														
Prepare and assemble of Hardware														
Progress 2 Evaluation														
Progress of Report														
Submit Draft Report and Turnitin Report														
Prepare for poster for presentation														
BDP 2 Presentation														