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**FACULTY OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF COMPUTER ENGINEERING**

**DESIGN AND IMPLEMENTATION OF A FOOD  
WASTE MANAGEMENT APPLICATION  
(FOOD DONATION PLATFORM)**

*A dissertation submitted to the Department of Computer Engineering, Faculty of Engineering and Technology, University of Buea, in Partial Fulfilment of the Requirements Award of Bachelor of Engineering (B.Eng) Degree in Computer Engineering.*

**By:**

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**2022/2023 Academic Year**

# **Design and Implementation of a Food Waste Management System (Food Donation Platform)**

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***Dissertation submitted in partial fulfilment of the Requirements for the award of Bachelor of Engineering (B.Eng.) Degree in Computer Engineering.***

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### **Certification of Originality**

We the undersigned, hereby certify that this dissertation entitled “**DESIGN AND IMPLEMENTATION OF A FOOD WASTE MANAGEMENT SYSTEM(FOOD DONATION PLATFORM)** ” presented by GROUP 5 MEMBERS has been carried out by him/her in the Department of Computer Engineering, Faculty of Engineering and Technology, University of Buea under the supervision of **Dr NKEMENI Valery**.

This dissertation is authentic and represents the fruits of his/her own research and efforts.

Date\_\_\_\_\_

Student

Supervisor

\_\_\_\_\_

\_\_\_\_\_

**Head of Department**

\_\_\_\_\_

## **Dedication**

This project is wholeheartedly dedicated to our beloved parents, who have been our source of inspiration and gave us strength when we thought of giving up, who continually provide their moral, spiritual, emotional, and financial support.

To our supervisor, friends and classmates who shared their words of advice and encouragements to finish this project.

And lastly, we dedicate this work to the almighty God, for the guidance, power of mind, protection and skills for giving us a healthy life.

## **Acknowledgement**

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We are grateful to have had the pleasure to work as a team for this project.

## **Abstract**

Food waste management is a critical issue that requires attention from each individuals, households, restaurants and hotels. This report reviews research on food waste management systems, including technological platforms, IoT, and social innovations.

The creation of a food waste management system is an exciting endeavor with the potential to significantly impact the reduction of food waste. In this paper, the project's objective is to develop a smart mobile application that enables households, hotels and restaurants to provide extra food to those in need. The application can also increase public awareness of food waste and inspire people to act differently. The project can use mobile technology to achieve the Sustainable Development Goal of reducing food waste by 50 % by 2035. The project can also assist with particular food waste, cost savings, and improved healthier eating.

The study concludes that the proposed food waste management system has the potential to significantly reduce the amount of food waste generated in our society and promote sustainable waste management practices.

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## **List of Abbreviations**

**CAPS** - Computer Assisted Program System

**ER** - Entity Relationship

**GHI** - Global Hunger Index

**IoT** - Internet of Things

**NGO** – Non-Governmental Organization

**UML** – Unified Modelling Language

**US** – United States



# CHAPTER ONE: GENERAL INTRODUCTION

## 1. Background and Context of the Study

### 1.1. Definition

Food waste can be described as all the food that is dumped or otherwise left to rot away that could have been salvaged one way or the other. This could be caused by many factors which could be conscious or accidental.

### 1.2. Problem Description

Food waste is a major issue that affects the environment, economy, and society.

Nearly one-third of all the food produced around the world is never eaten. By some estimates, we waste **1.3 billion tons** worldwide every year. On the other hand, according to these same estimates **20%** of the world population face acute food shortage and all this waste has a huge economic, environmental and social impact.

In an article co-authored by **Harold L. Feukam in the Science Direct journal**, it was reported that an estimate of 16% of households are experiencing food insecurity in Cameroon. Based on the 2015 Global Hunger Index (GHI), Cameroon was classified in a state of “serious” severity of food insecurity with a score of 24.2 (World Food Program, 2017).

### 1.3. Causes of Food Wastage

- It begins on the farm and can be driven by a whole host of factors beyond the grower’s control. Weather, pests, disease, low market prices or high labor costs all lead to food left in the field. Food that may look perfectly ripe and edible in the field may be too ripe by the time it reaches the consumer, so it’s never harvested.
- It’s not just consumers that are picky about their produce. Market-based quality or grade standards also play an unintentional role in food waste.
- Buying more than what is needed, overstocking shelves, inaccurately predicting shelf life or damaging products, poor storing practices, etc. These factors could, at the consumer level, lead to expired or otherwise neglected food that end up in the trash.
- Restaurants also waste food by mismanaging inventory, poor menu choices or oversized portions.

All these factors, and many others, influence the amount of food that ends up being thrown away, which could have been prevented if the proper measures were put in place and effectively implemented.

#### **1.4. Solutions to Food Wastage**

- Proper establishment of a plan before buying food.
- Food recycling: Food recycling efforts are already underway but the technologies and methods used should be bettered. Starch-rich foodstuffs such as crisps, bread, biscuits, and breakfast cereals can, for instance, be recycled into high quality feeds for livestock.
- Farms can evaluate food losses during processing, distributions and storage and adopt best practices. Farms can sell fresh but unmarketable products to food banks at a reduced rate.
- Businesses such as grocery stores, restaurants and institutional food services can evaluate the extent of their food waste and adopt best practices. Examples include supermarket selling damaged or nearly expired food at discounted prices or offering “half-off” promotions instead of “buy-one-get-one-free” promotions.

These solutions being known, researchers and developers have created apps that aim to reduce food waste. These apps can raise awareness of food waste, support individuals, restaurants and hotels to change waste behaviors, redistribute leftovers, and change cultural and social norms about food waste.

## **2. Problem statement**

The idea behind this project is to reduce or even avoid the waste of food stuffs in our society. This will permit those who have food stuffs and who are no longer in need to upload to this platform. The food stuffs uploaded can be free or at a discount price. This can permit others to search for available food stuffs.

## **3. Objectives of the Study**

### **3.1. General Objective**

Assess the environmental value of food waste pre-processing technologies such as composters, and evaluate whether these technologies encourages food waste recycling or reduce the environmental impact of food waste.

### **3.2. Specific Objectives**

Develop a functional mobile application which will aid in the reduction of food wastage.

## 4. Proposed Methodology

Food waste is a significant problem globally, and mobile applications can play a crucial role in reducing it. Here are some steps to consider when designing and implementing a food waste management application:

- **Understanding of the market and industry:** Before the application was designed, research was made on the market and industry that is the targeted audience in order to understand the current trends, user needs, competition and also add innovations to outsmart competitors. This research helped us to identify the gaps in the market and design an application that meets the user's needs.
- **Identification of the sources and causes of food waste:** There are different sources and causes of food waste, such as over-purchasing, poor menu planning, and lack of cooking skills. These sources and causes were identified so as to help design an application that addresses these issues.
- **Development of user-friendly interfaces:** The application was made easy to use and navigate. It has simple and intuitive interfaces that allows users to quickly access the features they need. All this was achieved by making use of UML diagrams to pin-point different features needed by the users of the system.
- **Incorporation of features that address food waste:** The application has features that help users reduce food waste, such as uploading food stuffs they don't need, expiration date tracking.
- **Testing and iteration:** Once the application was developed, it was tested with few users and feedback was taken. This feedback was used to improve the application and make it more effective in reducing food waste in our society.

Overall, designing and implementing a food waste management application requires a thorough understanding of the market and industry, identifying the sources and causes of food waste, developing a user-friendly interface, incorporating features that address food waste, making use of UML diagrams to get the basic use cases needed by the system and testing and iterating to improve the application.

## 5. Research Questions

- What are the best strategies for reducing food waste in the agricultural supply chain?
- What are the different food waste apps available in the market, and what features do they offer?

- Can smartphone apps help individuals reduce their personal food waste, and reduce their financial expenses?
- What is the impact of food waste management apps on reducing food waste, and how effective are they in changing users' food waste behavior?

## 6. Research Hypothesis

Statement of expectation or prediction that will be tested by research

- A mobile app that raises awareness of food waste and supports behavior change can help reduce personal food waste.
- A mobile app that incites users to redistribute leftover food to others can help reduce food waste and change cultural and social norms about food waste.
- An app that encourages users to reducing food waste can help increase intention to change food waste behavior.

## 7. Significance of the Study

Food waste management mobile applications are becoming increasingly important due to their potential to reduce food waste and ensure sustainable management of leftover foods.

Here are a few justifications for the significance of these programs:

1. **Reduce food waste:** With ReUseEats, which enables users to manage expiration dates, buy goods at lower prices, and trade or share them with those in need.
2. **Enhance awareness:** This app can increase awareness on food waste for individuals and households, help them to alter waste behaviors, disperse leftovers, and modify cultural and social norms about food waste.
3. **Save Money:** Organizations can cut costs on inventory and supplies by reducing food waste.
4. **Aid those in Need:** Using ReUseEats may help people who are in need get more food, reducing food insecurity.
5. **Increase conservation:** By reducing food waste, these apps can help boost conservation and reduce the negative influence of food spend on the environment.
6. **Improve Food Distribution:** For retailers and distributors, ReUseEats can assist in improving food supply and storage.

Ultimately, food waste management mobile applications have the potential to make a substantial effect on reducing food waste and improving conservation.

## 8. Scope of the Study

This study is focused on reducing the amount of food produce that end up in the dumpsters or otherwise laid to waste. This project covers all types of food from raw to processed (or cooked). This study aims to provide an alternative to consumers who desire to participate in

reducing the amount of food that goes to waste and promote sharing rather than dispose. This will be achieved by providing the users with a platform where they can meet.

#Extent to which your research area will be explored, and the parameters the study will operate

## 9. Delimitation of the Study

This project does not cover the actual transaction process, but is simply limited to providing a medium for meeting like-minded individuals or organizations.

- We won't handle transactions.
- We don't keep record of transactions.

## 10. Definition of Keywords and Terms

Here are some definitions of keywords and terms related to food waste management system:

- **Food waste:** Food materials originally intended to be used to feed humans and animals that are discarded, lost, or uneaten.
- **Waste management:** The process of collecting, transporting, processing, recycling, and disposing of waste materials.
- **Food waste disposal:** The final stage of food waste management, which involves the safe and proper disposal of waste materials.
- **Food waste reduction:** The practice of reducing the amount of food waste generated in the first place, through different measures.
- **Food waste management policies:** These are policies put in place to reduce the amount of food waste generated and to ensure that the waste is properly managed.



# CHAPTER TWO: LITERATURE REVIEW

## 1. Introduction

This reviews stems from increasing concerns about resource conservation, food security, alarming nature of food wastage as stipulated in. In brainstorming for this mobile application, we considered covering reuse of food for human consumption and observing load of trash for a period of time noting the percentage observed to be wasted food and comparing that to actual weights of dumpsters.

Some operational strategies that could also be implemented aside the application for reducing food wastage are utilizing preparation waste for the creation of other menu items and also buying and preparing the right amount of food each day.

Also, barriers faced to the implementation of food waste management application was lack of resources both financial and materials in order to implement strategies. Secondly, consumers have a strong impact on the implementation of strategies, playing both as drivers and barriers.

## 2. General Concepts on Food Wastage and Food Waste Management App

Here are some general concepts on food wastage:

Food waste is the term used to define food that was not consumed for any reason and has been left to get wasted. It includes the leftover on plates, throwing the uneaten cooked food, peels of vegetables, the bit of inappropriately cooked food, spoiled food, unsold food, or any edible that was not consumed.

Disposal is the less favorable and final option available in the food waste management hierarchy, which involves the disposal of unavoidable food waste into landfills.

Wasted food is a major global environmental, social, and economic challenge. When food is produced but unnecessarily wasted, all the resources used to grow the food – water, energy, fertilizers – and the resources used to transport it from farms to our tables, are wasted as well. Reducing food loss and waste could benefit families, the environment, and the world, now and in the future. Wholesome food that is currently wasted could help feed families in need. Safe and wholesome food that is currently thrown away could help feed hungry people and reduce food insecurity today. Reducing food waste can save or make money. When food is wasted, so too is the land, water, labor, energy, and other inputs that are used in producing, processing, transporting, preparing, storing, and disposing of the discarded food. Greenhouse gases generated from food rotting in landfills could be reduced to help mitigate climate change.

Several initiatives have been proposed to address food waste and loss issues and support stakeholders throughout the food chain. However, the literature still lacks a review paper that compiles methods, practices, and solutions to reduce food waste. Food waste management apps aim to reduce food waste and put in contact users in need. The impact of food waste management apps on reducing food waste has been investigated, and some studies have shown that they can raise awareness of food waste and support individuals to change waste behaviors.

### 3. Related Works

- **ResQ:** ResQ is available in 22 European cities. For example. They offer meals at a reduced price that would otherwise have been thrown out. You can check the deals through the ResQ app. The app is available for download on Google PlayStore and IOS AppStore.
- **SavingFood:** A project funded by the "Horizon 2020 European Union funding for Research & Innovation", Saving Food is developing a CAPs platform that aims to offer a socially & environmentally responsible solution to tackle food waste by facilitating the redistribution of surplus food for the benefit of vulnerable groups in our society.
- **Ulaanbaatar Community Food Waste Recycling Project:** A program funded by the Japan Fund for Poverty Reduction in Mongolia. This program is aimed providing recycling solutions for food waste.

### 4. Partial Conclusion

Based on this literature review, it is evident that food waste is a significant problem that impacts the environment, economy, and our society. Several studies and researches have been conducted to reduce food waste, including the use of mobile apps. The importance of developing sustainable waste management behaviors were highlighted here. While some studies have examined the association of food delivery apps and food waste, others have focused on IoT and big data technologies for reducing food waste.

Overall, this review provides valuable insights into the challenges and choices for food waste valorization and the need for effective food waste management policies.

# CHAPTER THREE: ANALYSIS AND DESIGN

## 1. Introduction

In this analysis and design of a food waste management mobile app, we will explore the features and process of developing the app.

In this paper, we propose a mobile application called **ReUseEats** which will help reduce food waste in the society by linking those in need and those that have. The features of our mobile app is shown in **section 3**.

The app will be designed to help households, hotels and restaurants manage their food inventory, reduce waste and redistribute excess food at low cost or for free to the needy.

More details of each part will be discussed in the following sections.

## 2. Proposed Methodology

Here are some steps to consider when designing and implementing a food waste management application:

- **Requirements collection:** Stakeholders came together during several brainstorming sessions, where each of us proposed the possible functionalities that could be implemented for this app. These functionalities were then sorted and the chosen functionalities were separated into functional and non-functional requirements.
- **Design of user-friendly interfaces:** The application should be easy to use and navigate. It should have a simple and intuitive interface that allows users to quickly access the features they need. For this to be done, we made use of UML diagrams to pin-point different features needed by the users of the system.
- **Design of a functional database:** The application should have a functional and secure database that holds all the user informations and uploaded food stuffs.
- **Incorporation of features that address food waste:** The application should have features that help users reduce food waste, such as inventory management, and expiration date tracking.
- **Testing and iteration:** Once the application was designed and developed, it was tested by few users and feedback was gathered. This feedback was used to improve the application and make it more effective in reducing food waste in our society.

The designing and implementing of ReUseEats required a thorough understanding of the market and industry, identifying the sources and causes of food waste, developing a user-friendly interface, incorporating features that address food waste, making use of UML diagrams to get the basic use cases needed by the system and testing and iterating to improve the application.

### 3. Design

#### 3.1. Requirement Analysis

During this phase, the functionalities obtained were separated into two categories: the functional and the non-functional requirements.

##### 3.1.1. Functional requirements

1. **Create an account:** On arrival on the app, the user is required to fill his or her personal information such as name, telephone number, location.
2. **Login:** The user is expected to login using the credentials provided during the account creation.
3. **View available food items:** Upon successful login, the user is presented a list of available food item such that the cheapest are shown first by default.
4. **Upload or Remove food Items:** Users have the possibility to upload a picture of the food item he/she wants to sell or give away. If for one reason or another, the user should have the possibility to delete the post.
5. **Search Options:** The user should have the possibility to display the various food items according to what he searched.
6. **View Other Profiles (users):** Through a post, a user should be able to access the profile of the seller from where he/she could obtain the contact, review/rating, with the location.
7. **Notifications:** Each user in the system should be able to receive notifications each time a new food stuff is uploaded in the system.
8. **Report Other Users:** Through a rating system, users should be able to comment (report or appreciate) the services of another user.
9. **View and Manage Users:** The app's administrator should be able to view the activities, that is, number of users, number of daily posts, the uploaded and deleted pictures.
10. **Taking Sanctions:** The administrator is able to sanction user reported for misconduct or users whose ratings have a certain low standard.

##### 3.1.2. Non-functional requirements

1. **Light Weight:** The installation package should be light and once installed, it should occupy as little space as possible.
2. **Less data Usage:** Given the availability of internet resources within the country, the app should use as little data as possible.

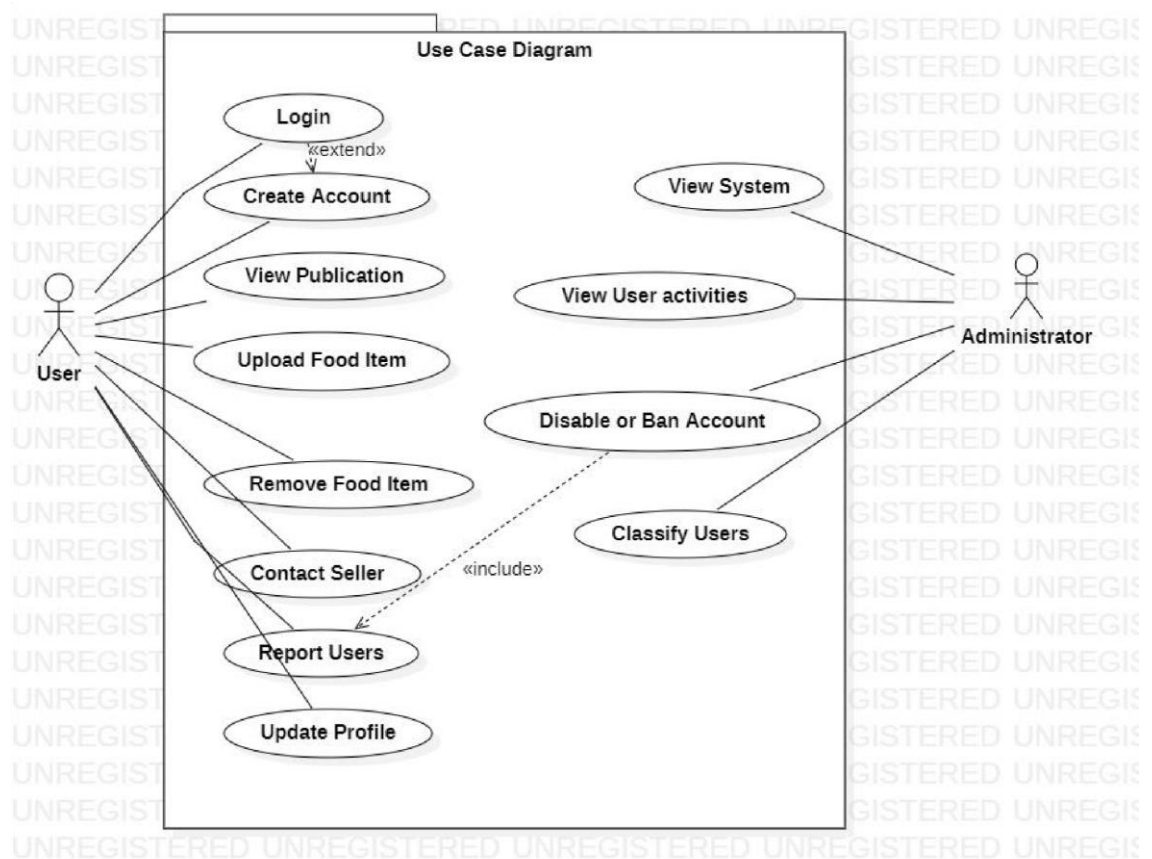
3. **User Friendly:** The interface should be intuitive for the user, that is, it should be easy to learn and use.
4. **Promotion:** The app should have a platform for advertisement where users or third parties could promote their services.

### 3.2. Detailed Design

In this phase, we made use of UML diagrams so as to show all the operations that takes place between the user and the interactive system.

#### 3.2.1. Use Case Diagram

The main actors within the system are: user and admin.



*Figure 1. Use case diagram*

#### Textual Description

##### a. Login

Description: Allows the user to access the system and interact with other users in the system.

Pre-condition: The user should have created an account before accessing the system through login.

Post-condition: After logging into the user's account, the user is taken to the home page.

Main Flow: create account, login.

**b. Create account**

Description: Allows the user to create a login and be a registered user.

Pre-conditions: This use case starts when the user accesses the system feature that enables him to create an account by entering information that is maintained in the user's account.

Post-conditions: After the account is created, the user logs in normally by entering the required credentials.

Main Flow: enter personal information, create account.

**c. View food stuff**

Description: The available food items from users are displayed for other users.

Pre-condition: The user should login first before the user can view food items.

Post-condition: after viewing the food items the user can choose and access the various profiles.

Main Flow: Enter login credentials, view food stuff.

**d. Upload food stuff**

Description: The user can upload food items to his/her profile for other users to view.

Pre-condition: The user should login first before he/she can upload food items to the system.

Post-condition: After uploading the food items, other users can view the food items.

Main Flow: enter login credentials, upload stuff.

**e. Remove food stuff**

Description: Here after uploading the food item, he/she can remove the food item from the system.

Pre-condition: The user should upload a food item.

Post-condition: Other users cannot view the removed food items.

Main Flow: enter login credentials, homepage, upload food stuff, remove food stuff.

**f. Contact seller**

Description: Other users can contact a user if interested with a particular food item on that user's profile through email or telephone number.

Pre-condition: A user should have a food item uploaded on his/her profile in the system.

Post-condition: after a food item is no more available the user removes the concerned food item.

Main Flow: Enter login credentials, view food stuff, view user profile.

**g. Report other users**

Description: when a user does not follow the terms of the transaction, the other user can report that user.

Pre-condition: when a food item has been uploaded that is when other users can access the profile for a possible transaction.

Post-condition: the admin goes on to implement the necessary punishment.

Main Flow: enter login, enter homepage, enter user profile then access report.

**h. View the system**

Description: Here, the admin views the system.

Pre-condition: The admin must login in to the system.

Post-condition: view the various services the system offers.

Main Flow: enter login credentials, view the system.

**i. View user activities**

Description: The various activities of the users are viewed by the admin such as creating an account.

Pre-condition: Users should exist in the system.

Post-condition: The admin can have an estimate of the number of users, uploaded images and traffic in the system.

Main Flow: enter login credentials, then view the various activities through the admin's dashboard.

**j. Barn/disable users**

Description: The admin punishes users by disabling users or barning the user's account.

Pre-condition: users must have disobeyed transactional rules a certain number of times.

Post-condition: The concerned user won't be able to access his/her account for a period of time or definitely.

Main Flow: enters login credentials, enters the admin dashboard.

### 3.2.2. Class-Diagram

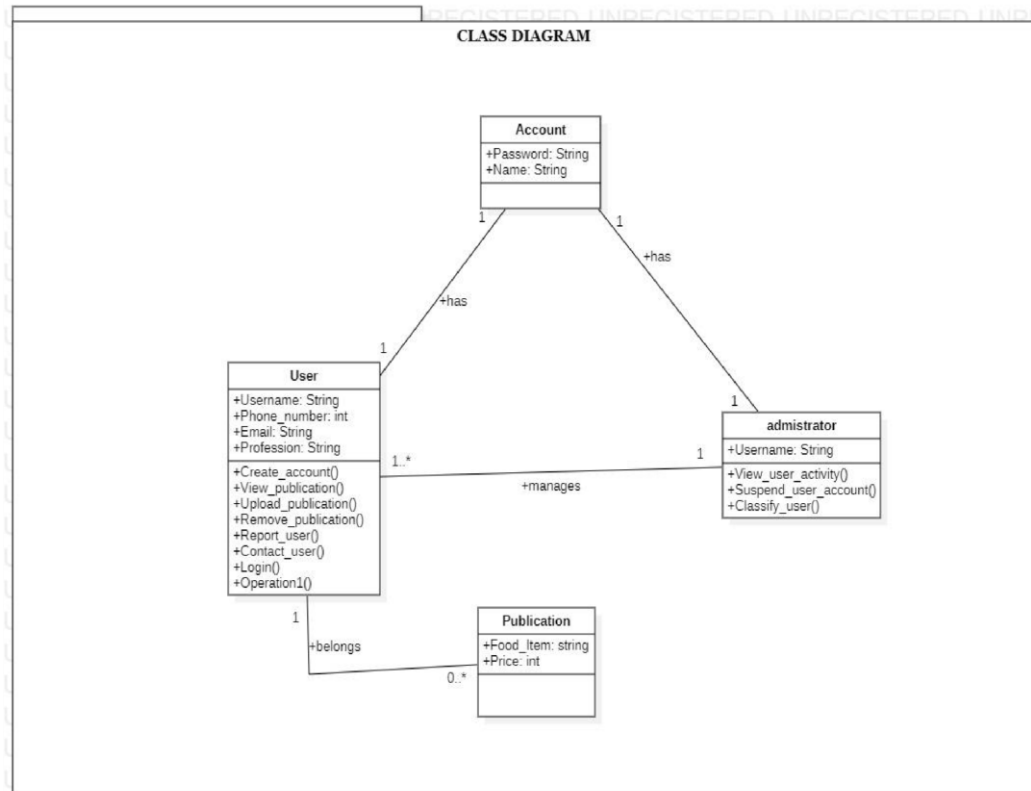


Figure 2. Class diagram

### 3.2.3. Sequence Diagrams

#### i. Create account

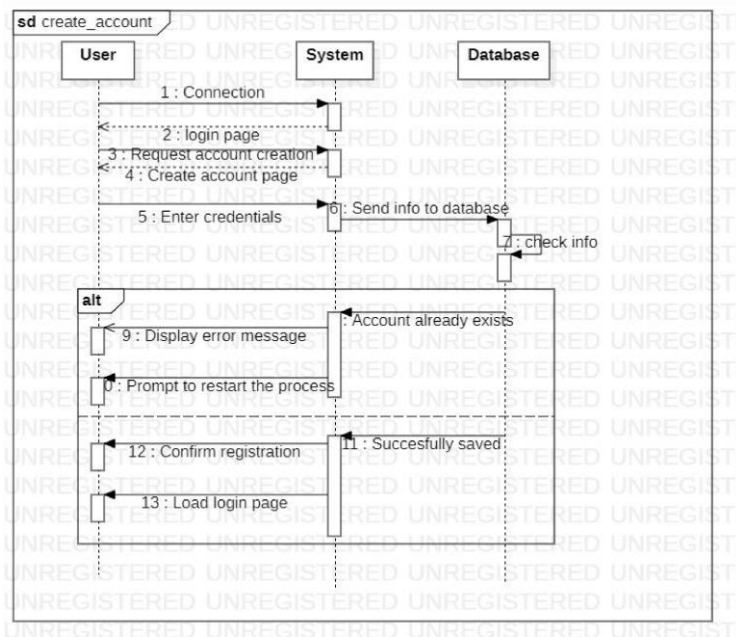
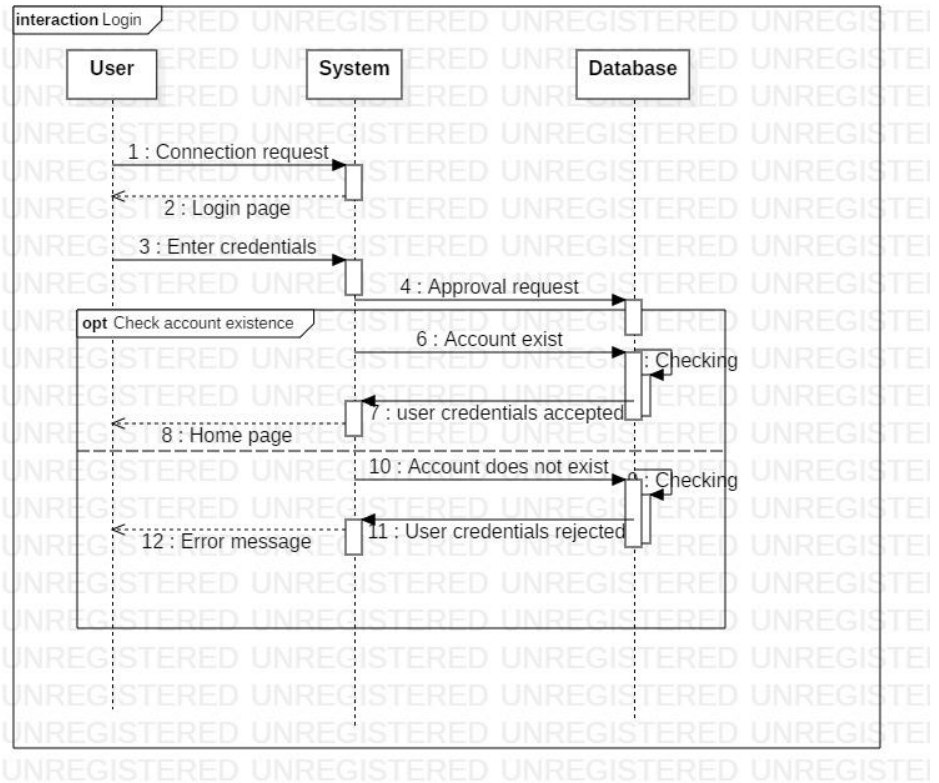


Figure 3. Create account sequence diagram

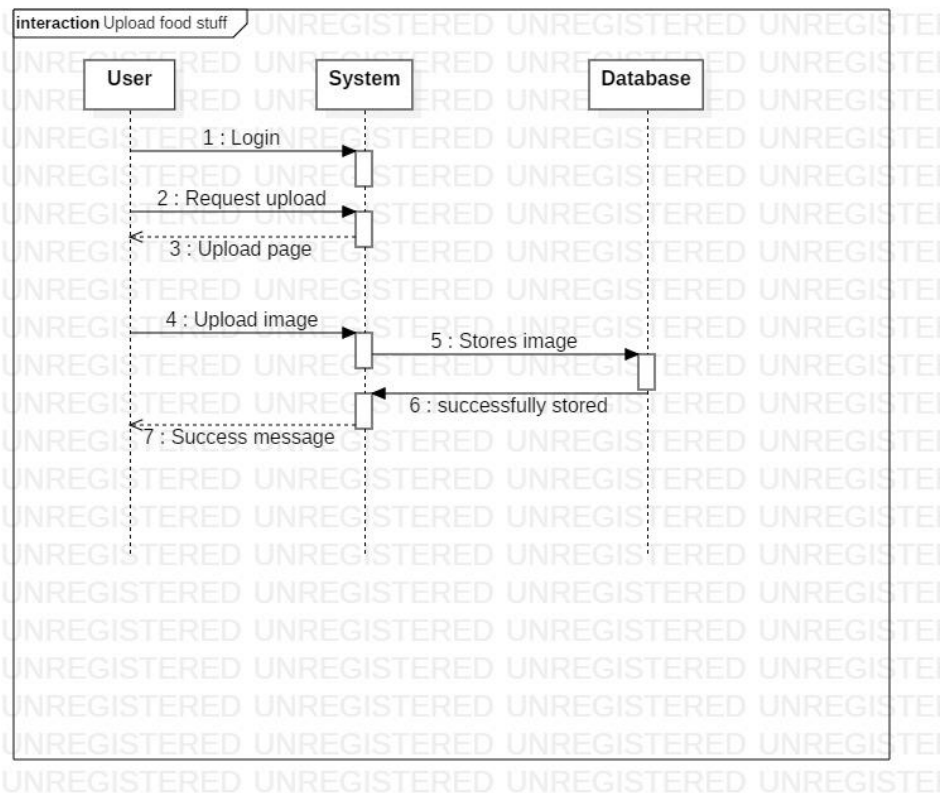


## ii. Login



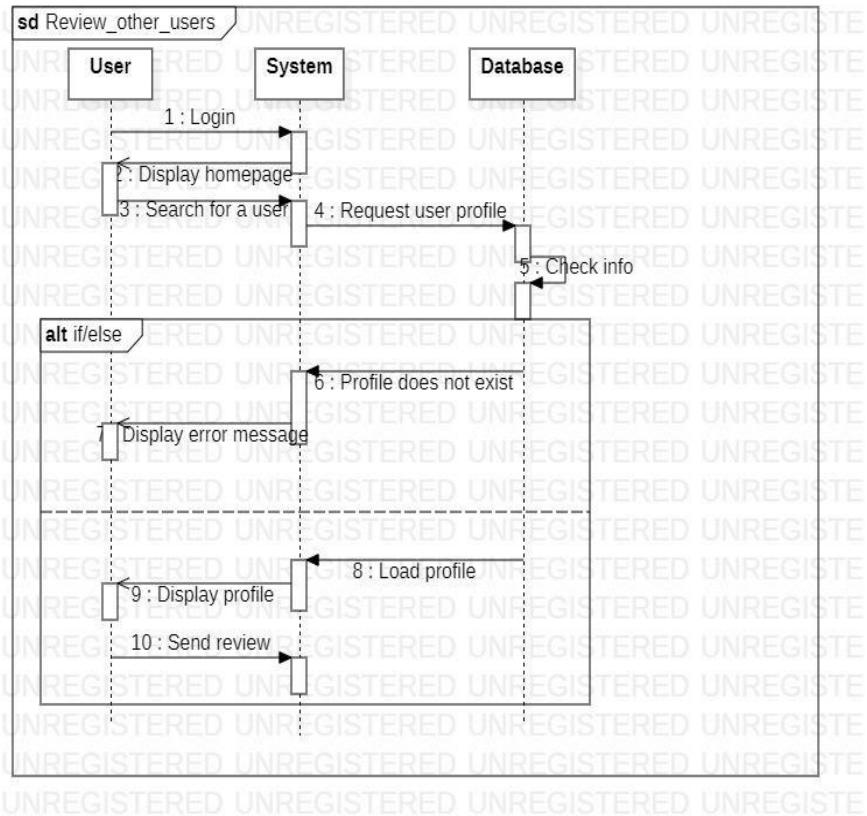
*Figure 4. Login Sequence diagram*

## iii. Upload food Item



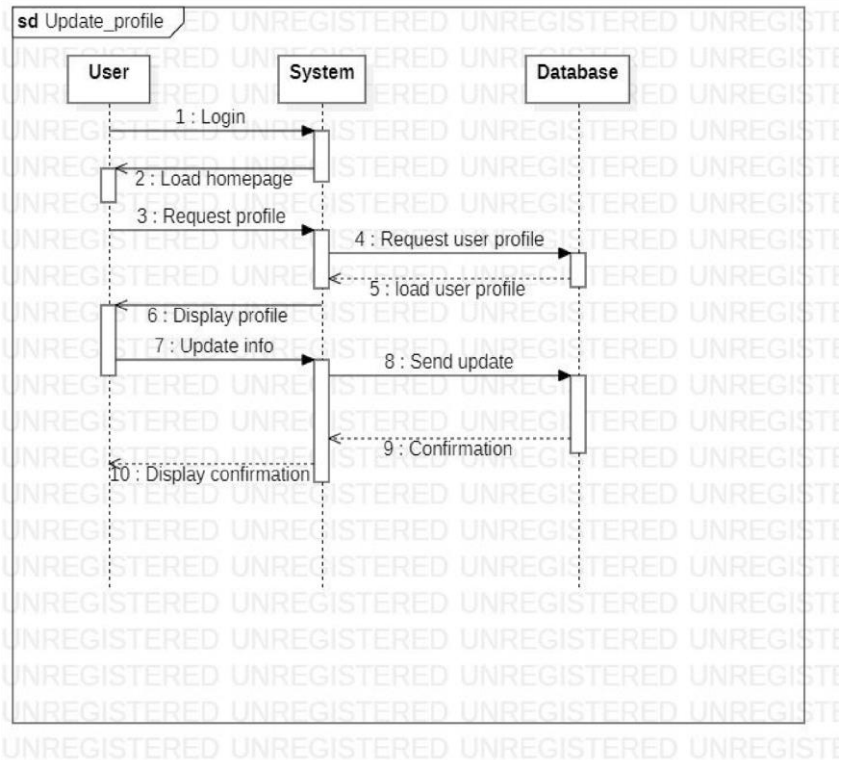
*Figure 5. Upload food stuff sequence diagram*

iv. **Review Other Users**



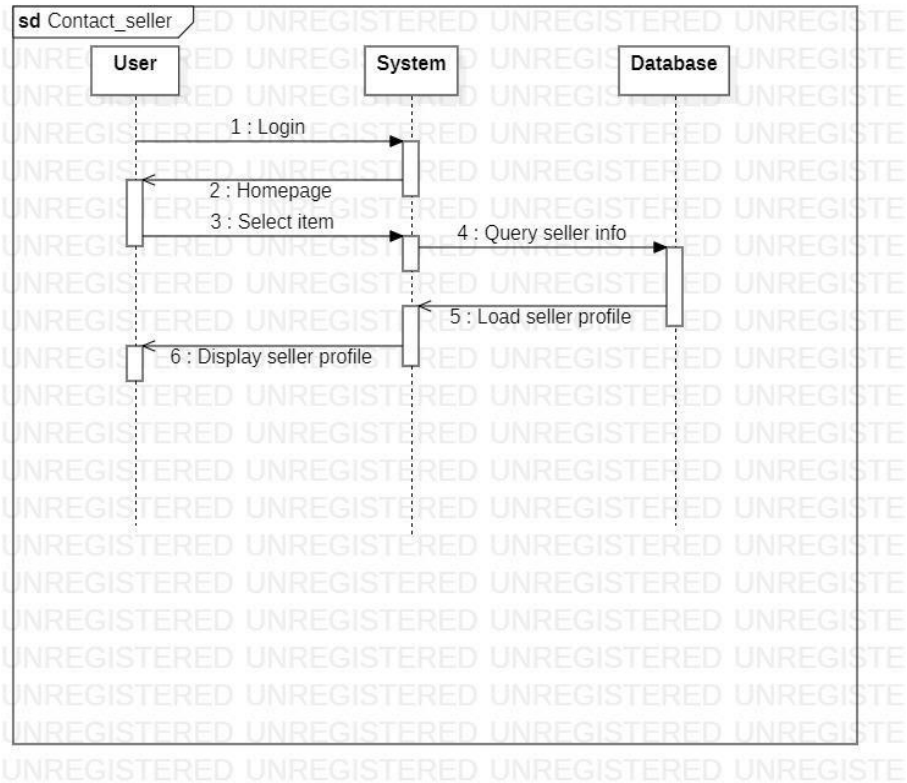
*Figure 6. Review users sequence diagram*

v. **Update Profile**



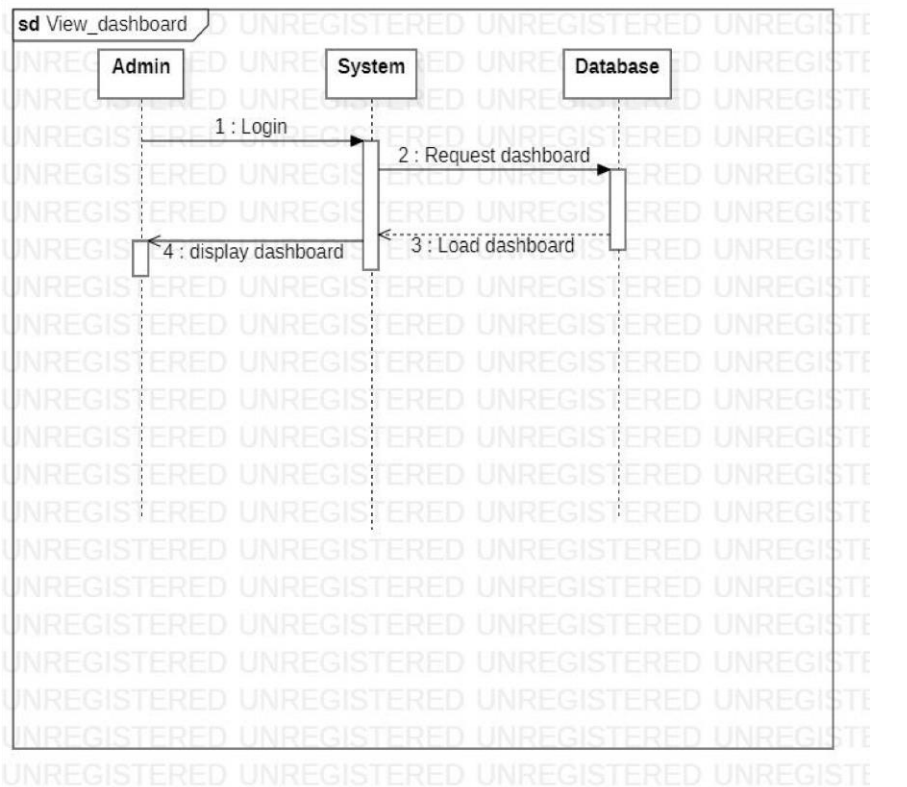
*Figure 7. Update profile sequence diagram*

vi. **Contact Seller**



*Figure 8. Contact seller sequence diagram*

vii. **View Dashboard**



*Figure 9. View dashboard sequence diagram*

### 3.2.4. Data-Flow-Diagram

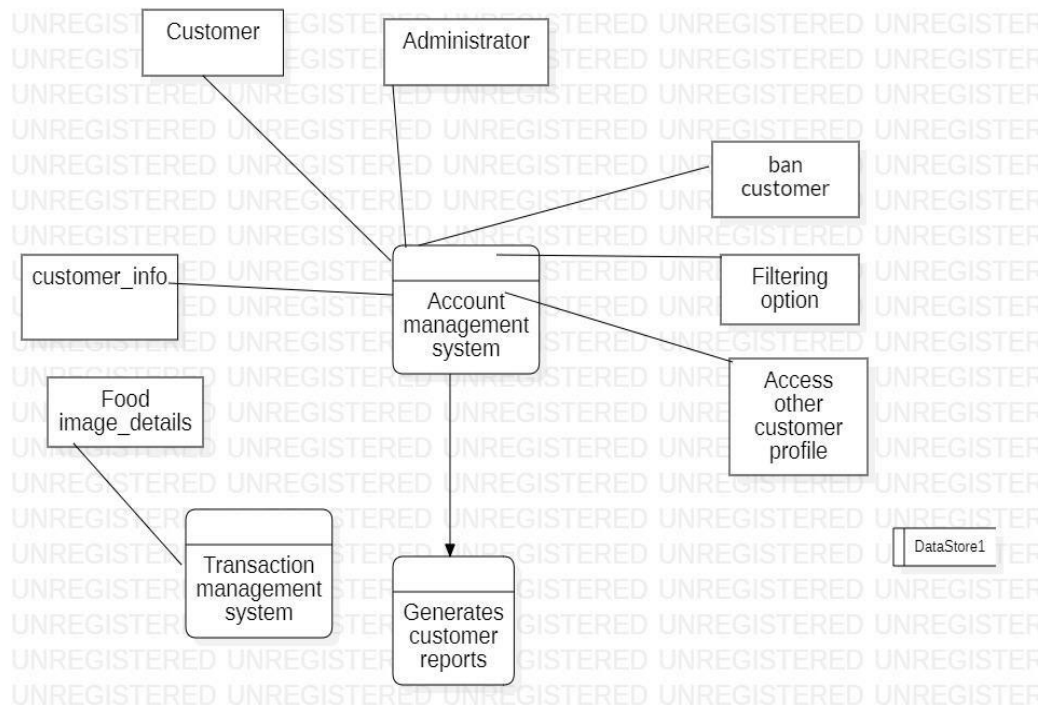


Figure 10. Data flow diagram

### 3.2.5. Activity-Diagram

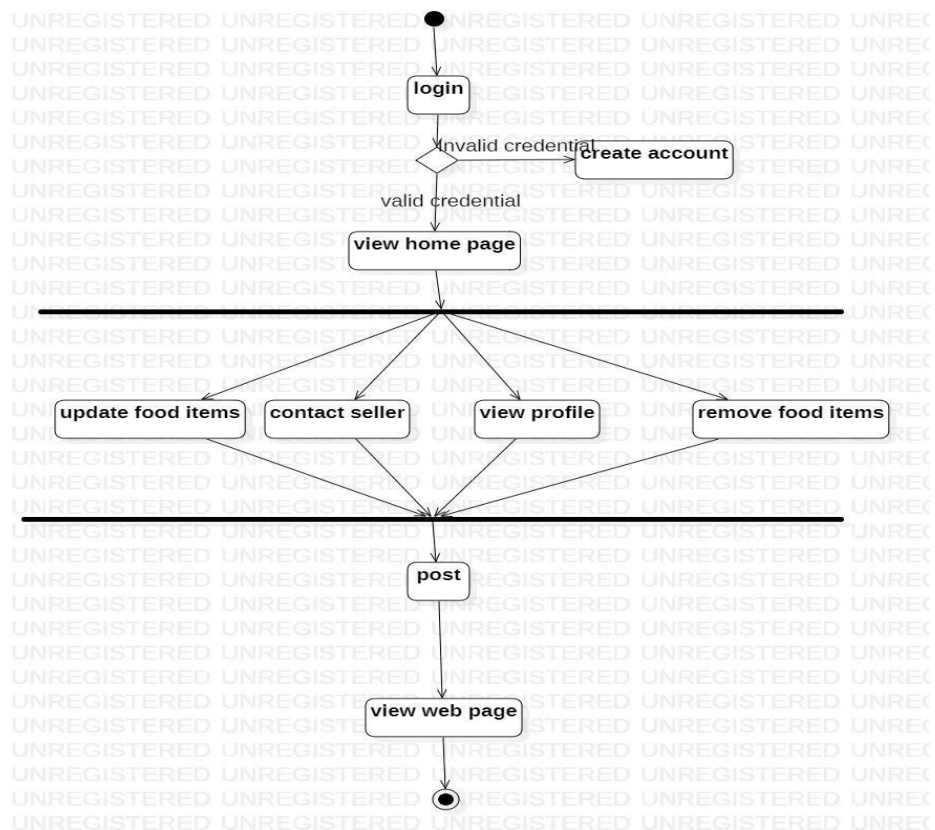


Figure 11. Activity diagram

### 3.2.6. Entity Relationship Diagram

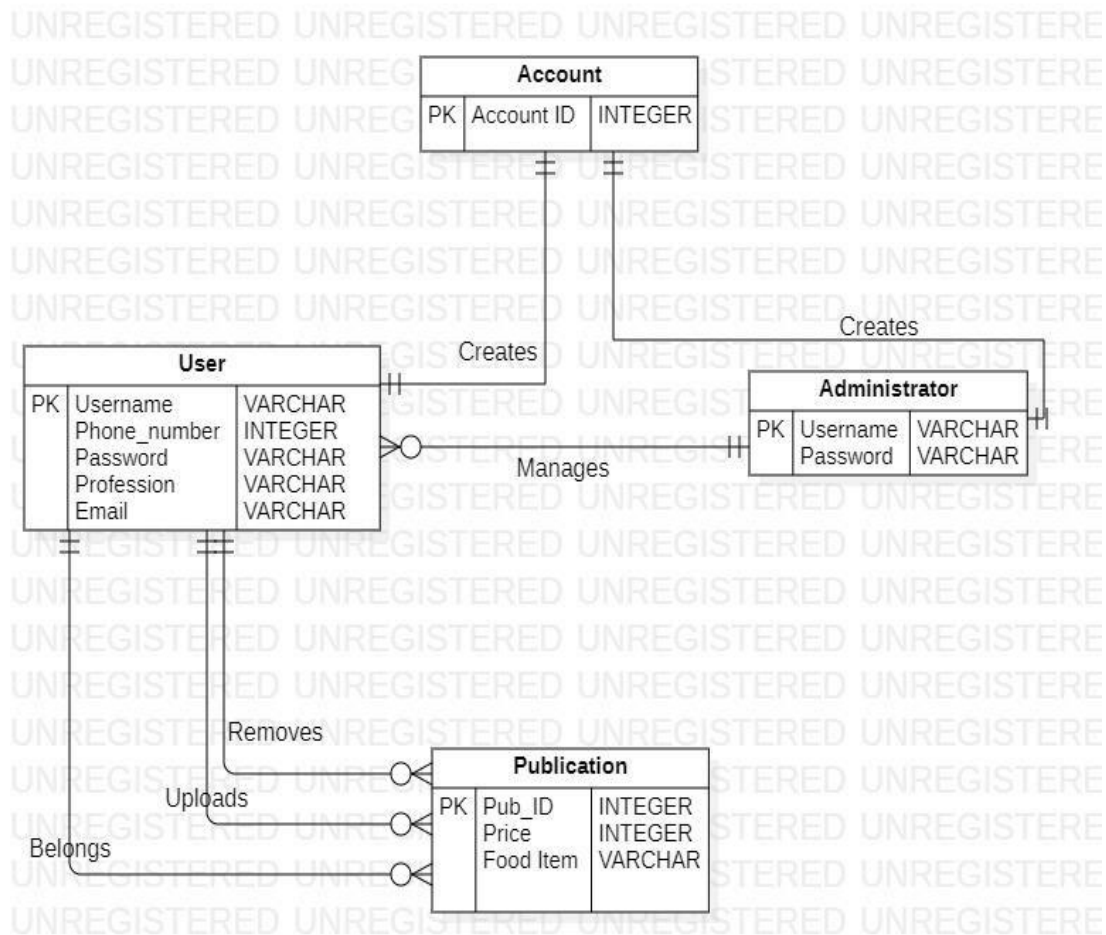


Figure 12. ER diagram

## 4. Global Architecture of the Solution

### 4.1. Scope

ReUseEats, is a food waste management application developed to reduce food waste in the society. This hybrid application links those in need and those that have. The application gives the possibility for users to upload food items on the platform for a discount price or for free.

Interested users contact the seller and arrange a meet-point through the application by accessing the seller's profile.

### 4.2. Features

ReUseEats was designed taking into consideration the following features:

- The visual hierarchy is designed such that the food item is seen first before its description (text).
- The font used is the **Akaya Kanadaka Regular** which is a google font.

- Our color palette is **green and its tints** which indicates the ecological nature of ReUseEats. This was associated to the neutral colors **white** and **black**.



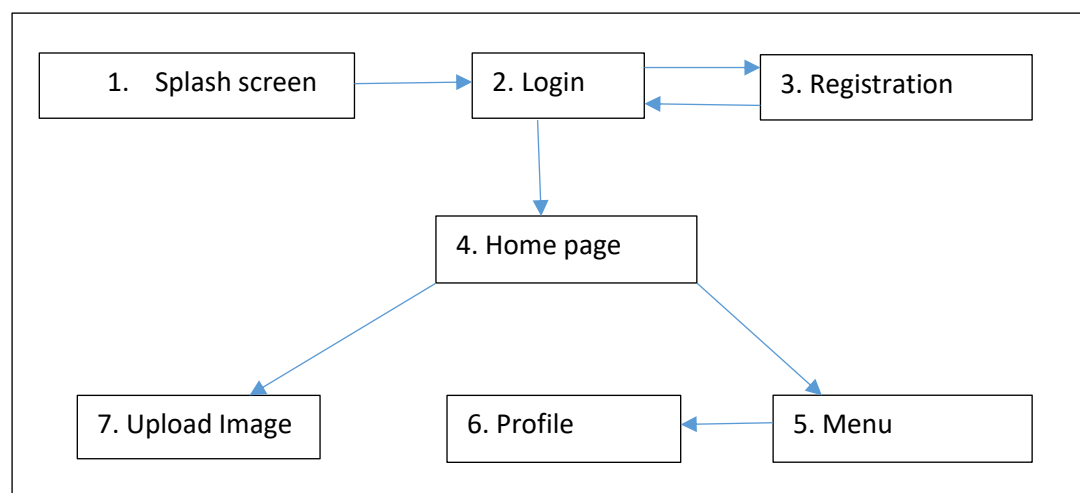
*Figure 13. Color palette*

- Its basic unit is **food Items listing**.
- This basic unit known, the flow it follows is the “**F**” **pattern** since the food items are displayed up through down.

With these features known, the interfaces were actually designed as shown in **section 4.4**.

### 4.3. Flow of Interfaces

The flow of the interfaces, that is the specifics of each interaction is as follows:



*Figure 14. Interfaces flow*

## 4.4. Interfaces Design

Our different interfaces will be showcased below;

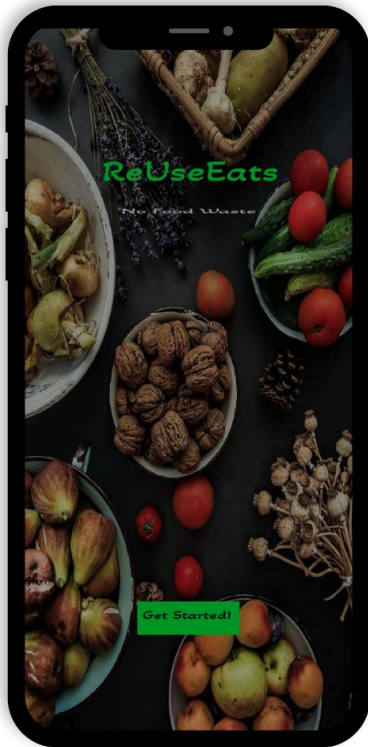


Figure 17. Splash screen



Figure 16. Login page



Figure 15. Registration page

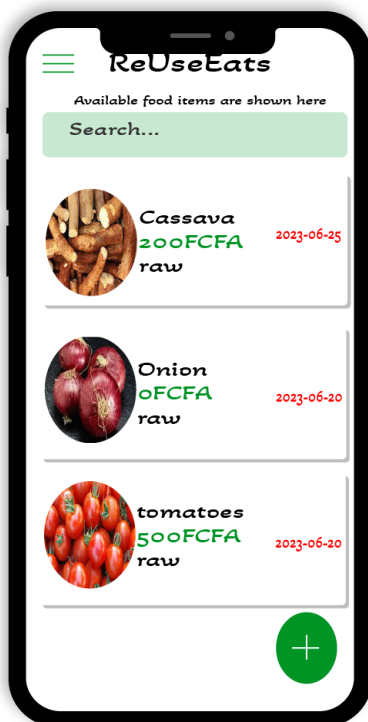


Figure 20. Home page

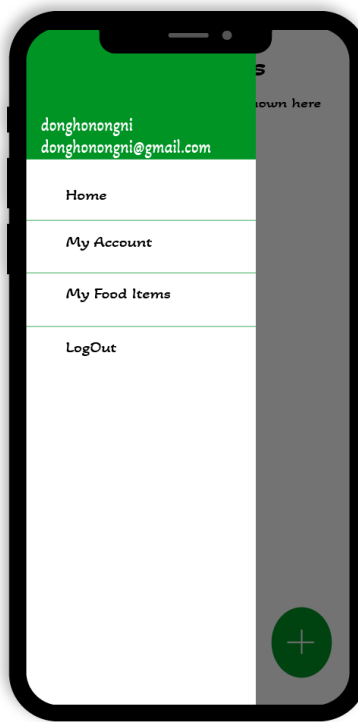


Figure 19. Menu page

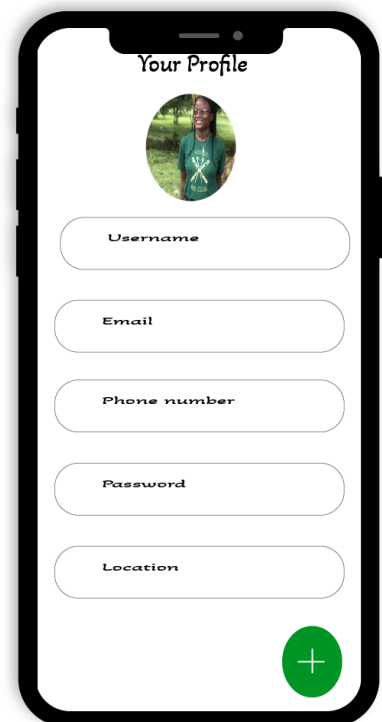



Figure 18. Profile page



Please Fill the Food Item Information

Food Name

Prices

Quantity Exp. Date

Quantity Expiring Date

Select the food category


☐ Cooked ☐ Raw ☐ F&V

Choose a picture for the food item

Select Picture

Upload

*Figure 22. Upload item page*



Reset Your Password

Email address

Reset

*Figure 21. Forgot password page*



## 4.5. Database Design

With the help of the ER diagram in **section 3.2.6**, we proceeded to creating the relational schema containing the various tables with their primary keys, foreign keys as well as their various attributes and datatypes as shown below:

- Account (AccountID, UserID\*)
- Administrator (Username, password, AccountID\*)
- User (user\_name, password, Phone\_number, Password, Profession, Email, Username\*)
- Upload (pub\_id, Price, food\_item, user\_name\*)
- Removes (pub\_id, price, food\_item, user\_name\*)

For our database architecture, a distributed database approach was used. Since the system will deal with a huge number of users, data access time using a distributed approach will be considerably shorter because the data is retrieved from the nearest database file.

Also, in case of faultiness in one of the databases users can still access the other database files.

Using the steps mentioned above, from extracting the ER model from the class diagram, developing the relational schema and proceeding to the implementation of the schema using sql code in firebase, our database is up and functional.

## 5. Description of the Resolution Process

The resolution process of a food waste management system involves a series of steps that begin with the identification of food waste and end with its proper disposal or utilization. Here is a description of the resolution process:

1. **Identification:** The first step in the resolution process is the identification of food waste. This can be achieved through the use of sensors and data analytics that provide real-time data on food waste generation.
2. **Prevention:** Once food waste has been identified, the next step is to prevent it from occurring in the first place. This can be achieved through measures such as better inventory management, portion control, and improved food handling practices.
3. **Minimization:** If food waste cannot be prevented, the next step is to minimize it. This can be achieved through measures such as composting, recycling, and donation.
4. **Recovery:** If food waste cannot be minimized, the next step is to recover it. This can be achieved through measures such as anaerobic digestion, which converts food waste into biogas and fertilizer, or the use of food waste as animal feed.
5. **Disposal:** If food waste cannot be recovered, the final step is to dispose of it properly. This can be achieved through measures such as landfilling or incineration, although these options should be considered a last resort.
6. **Monitoring and Evaluation:** Finally, the effectiveness of the food waste management system must be monitored and evaluated to identify areas for improvement. This involves tracking the amount of food waste generated and diverted from landfills and evaluating the success of the composting, recycling, and food recovery programs.

Throughout the resolution process, it is important to continuously monitor and evaluate the effectiveness of the food waste management system. This can be achieved through regular data analysis, customer feedback, and benchmarking against industry standards. Additionally, collaboration and partnerships with local governments, businesses, and non-profit organizations can help to increase the reach and impact of the food waste management system.

## 6. Partial Conclusion

The different features and requirements analyzed at this stage enabled us to come out with the design of the various interfaces for ReUseEats. The design took into account the personal interests of the users such as providing a platform environment where they will feel safe and peaceful to navigate fluently through the different interfaces.

# CHAPTER FOUR: IMPLEMENTATION (or REALIZATION) AND RESULTS

## 1. Introduction

This phase being the most time consuming part of the project, each member was assigned a role and a task so that easier collaboration between team members, more structured project timeline and daily workflow was ensured.

As we move through this phase, the steps used to accomplish and outcome our final product (**ReUseEats app**) are detailed.

## 2. Tools and Materials Used

For the materialization of each of the task and phases, we used:

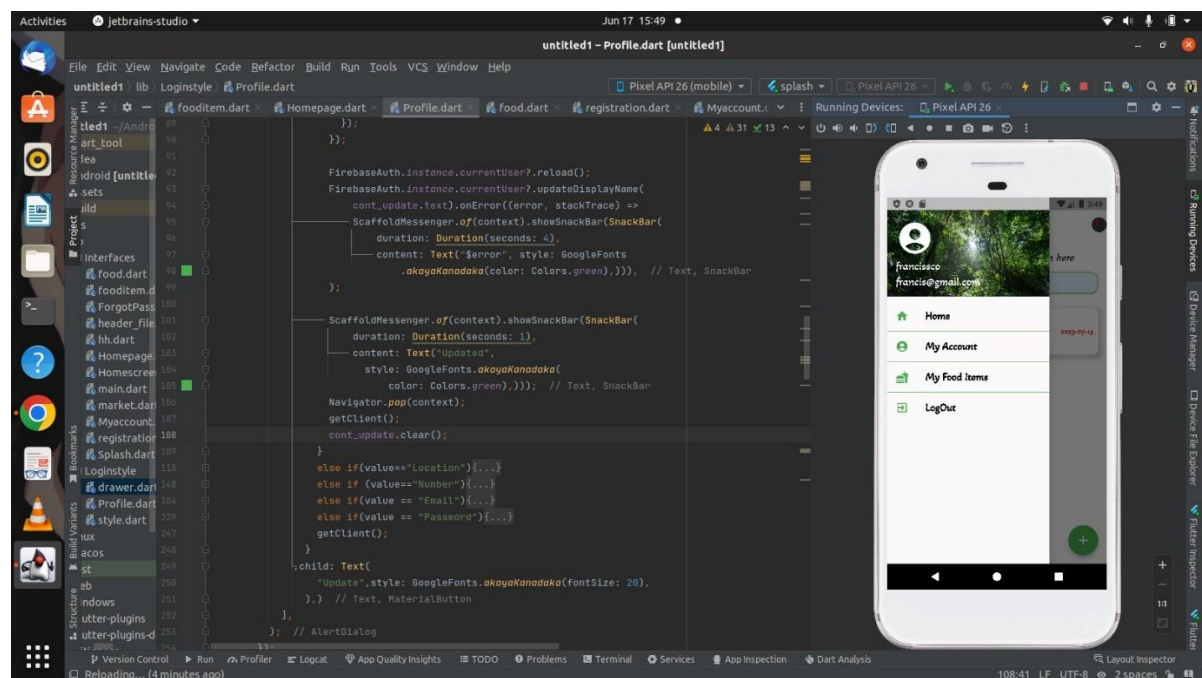
- **Star UML** for the UML diagrams design
- **Adobe Illustrator** for designing the different interfaces
- **Flutter framework in android studio** for the implementation(actual coding)
- **Firebase** as the database management tool.

## 3. Presentation and Interpretation of Results

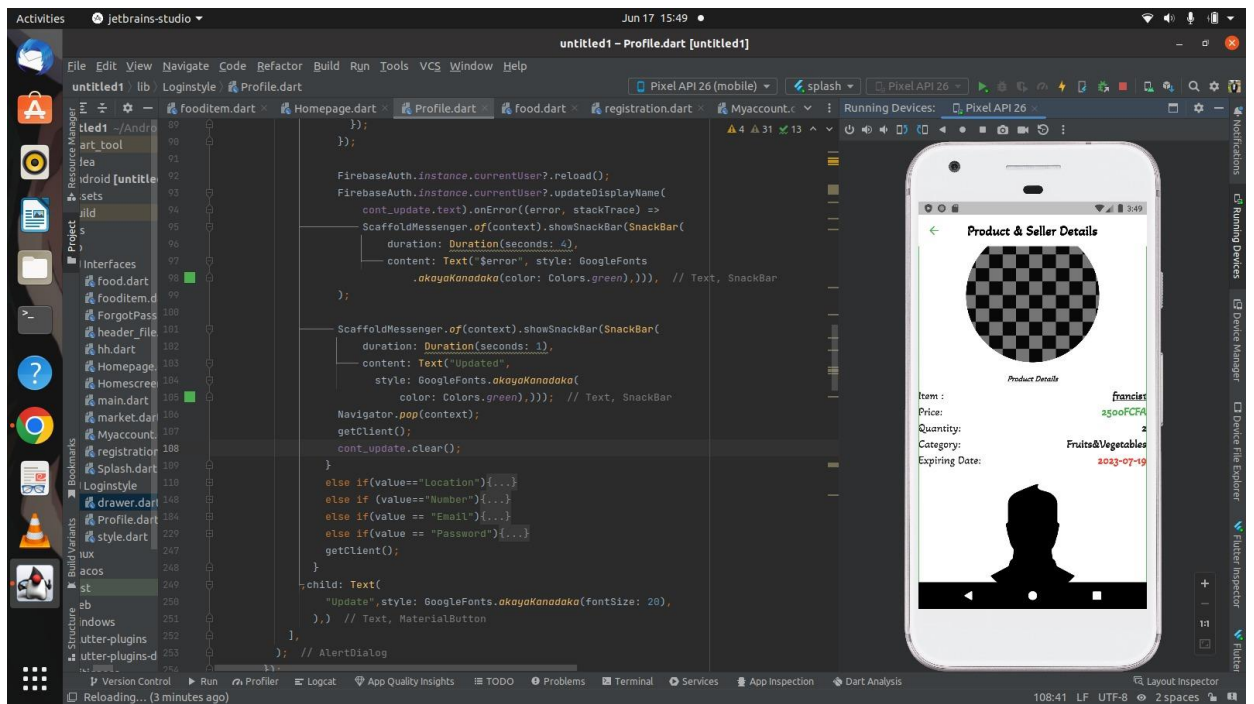
From the design discussed in **chapter three**, these functionalities were implemented into actual code so as to yield a functional mobile app.

The different interfaces were implemented such that the user has the possibility of moving through the different interfaces fluently.

A sample of the implementation of some interfaces are shown below:

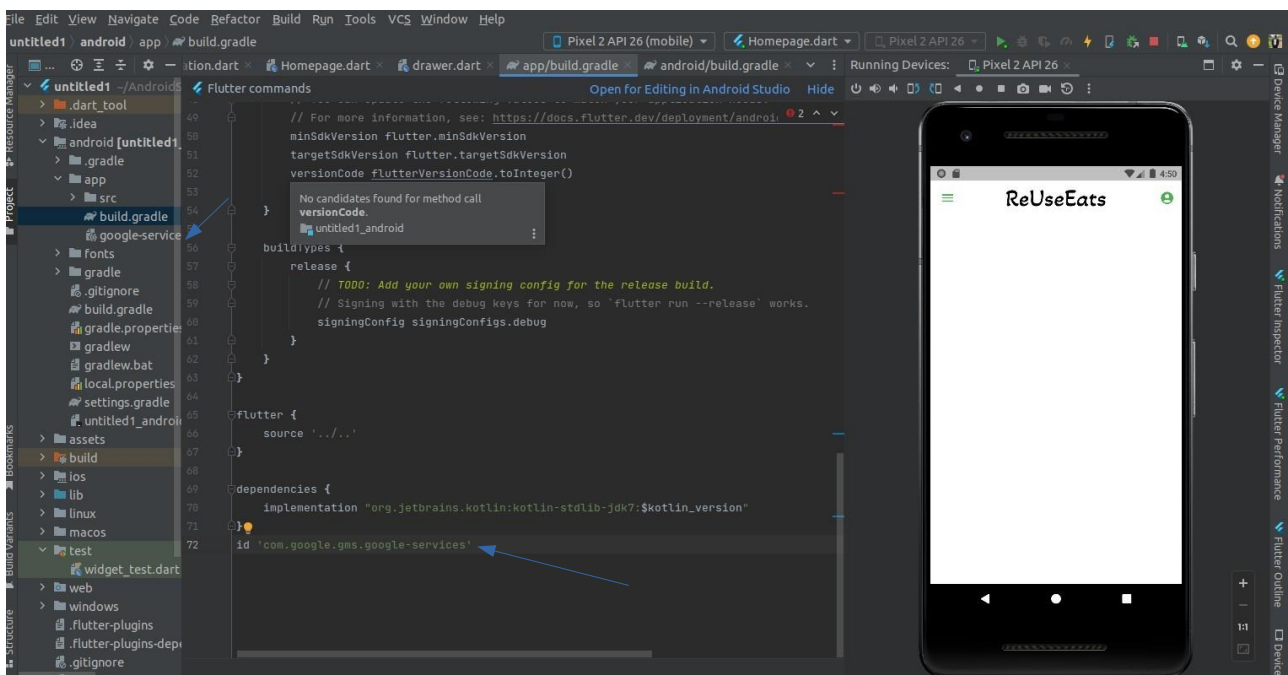


*Figure 23. Implementation of the Menu page*



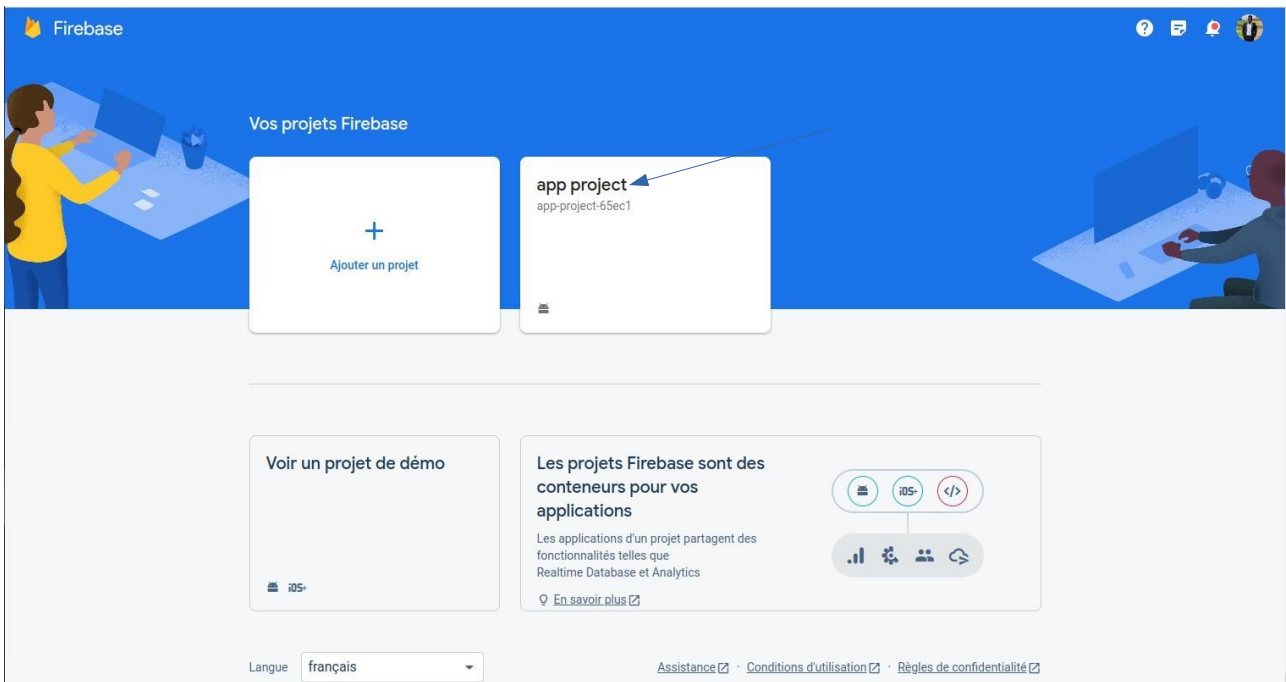
**Figure 24. Implementation of the Display of the product and seller details**

Our project in Android studio was connected to firebase by downloading a **json file** from firebase and copying it to the root directory of our project. After that the required dependencies were added.



**Figure 25. Connection of our project to the database**

Firebase was then reloaded and our project appeared showing that it was connected.



*Figure 26. Functional database*

All the interfaces and functionalities of ReUseEats were implemented similarly, together with a functional database which yielded a functional final product.

#### **4. Evaluation of the Solution**

This involves analyzing the implemented functional and non-functional requirements and comparing them with those obtained from the SRS document. The evaluation process was conducted based on the use cases and usability criteria by Nielsen. The functional requirements were in phase with the implemented functional requirements where as for the non-functional, requirements such as light weight and promotion, what was implemented was not compliant with the intended task at hand.

#### **5. Partial Conclusions**

Based on the implementation of this app, personal food waste and expenses will potentially be reduced while also having a positive impact on the environment.

## CHAPTER FIVE: CONCLUSION AND FURTHER WORKS

### 1. Summary of findings

A food waste management mobile app assists in reducing food waste and ensures the sustainable management of leftover food in a better and more efficient way. The app help users to donate or sell at a discount price their excess food, and people in the neighborhoods can access the list and get the contact of the user to take the food. This app aids in increased awareness of food waste at the individual, restaurants and hotels levels.

### 2. Contribution to engineering and technology

Food waste management system has a significant commitment to engineering and technology. Here are some ways in which engineering and technology can reduce food waste:

Reduced food waste in food production by designing and integrating cleaner, higher technical manufacturing environments.

Create tools to help the kindness and food service industry choose the best food waste management strategies.

Create food waste management apps that link food retailers to food-distribution organizations ( NGOs ) and guarantee the better and more effective management of leftover food.

Follow a circular economy in foods executive that reduces the profligate waste of food in the international system

Create executive solutions to lessen food supply chain inefficiencies, such as poor logistics and facilities, a lack of technology, and other factors that contribute to food loss and waste.

Utilize technology to stop and lessen food waste in industrial kitchens, such as those used in catering, cafeterias for schools, and restaurants.

### 3. Recommendations

A food waste management system being an important tool for reducing the negative environmental impacts of food waste, here are some recommendations for such a system:

1. **Education and Awareness:** One of the most important aspects of any food waste management system is educating people about the importance of reducing food waste. This can be achieved through awareness campaigns, workshops, and educational programs that highlight the various negative impacts of food waste on the environment and society.
2. **Tracking and Monitoring:** To effectively manage food waste, it is important to have a system in place that tracks and monitors the amount and type of food waste generated. This can be achieved through the use of technology such as sensors and data analytics that provide real-time data on food waste generation.

3. **Recycling and Composting:** Recycling and composting are important ways to reduce the amount of food waste that ends up in landfills. A food waste management system should include provisions for recycling and composting, which can be achieved through partnerships with local composting facilities and recycling centers.
4. **Donation and Redistribution:** Another effective way to reduce food waste is through donation and redistribution. A food waste management system should include provisions for donating excess food to local food banks and charities, as well as redistributing excess food to those in need.
5. **Continuous Improvement:** Finally, a food waste management system should be regularly evaluated and improved upon to ensure its effectiveness. This can be achieved through regular data analysis, customer feedback, and benchmarking against industry standards.

By incorporating these features, a food waste management system application can help reduce food waste and ensure the sustainable management of leftover food in a better and more efficient way.

#### 4. Difficulties Encountered

- The time frame given to learn the programming language was too short making it difficult to provide the best that could be.
- Given the slow internet speed we faced a problem of obtaining all the dependencies for our projects.
- Having all collaborators meet always posed a problem due some unforeseen circumstances.
- Rampant power outages in the area caused it difficult to work sometimes.
- Given that most of our PCs failed to comply with the hardware specifications needed to develop this mobile app, we faced a lot of time setbacks.

#### 5. Further Works

Further work that can improve the effectiveness of a food waste management system includes:

1. **Collaboration and Partnerships:** Collaboration and partnerships with local governments, businesses, and non-profit organizations can help to increase the reach and impact of a food waste management system.
2. **Behavioral Change:** Changing people's behavior is critical to reducing food waste. A food waste management system should include strategies to promote behavioral change, such as incentives and rewards for reducing food waste.
3. **Innovation and Technology:** New technologies and innovations can help to improve the effectiveness of a food waste management system. For example, the use of artificial

intelligence and machine learning can help to optimize food waste management processes and reduce waste.

4. **Circular Economy:** A food waste management system should be designed with a circular economy in mind, where waste is minimized and resources are reused and recycled. This can be achieved through the use of closed-loop systems and circular supply chains.
5. **Policy and Regulation:** Finally, policy and regulation can play a critical role in reducing food waste. Governments can incentivize businesses and individuals to reduce food waste through tax breaks, subsidies, and other policy measures.



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- <https://savingfood.eu/>
- <https://www.adb.org/sites/default/files/project-documents/51102/51102-001-pam-en.pdf>