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Online Food Excess Reduction Platform

Case study: DRC/Goma

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DECLARATION

I, N'SAPU MWABILWA SHADRACK, declare that this dissertation, ONLINE FOOD EXCESS REDUCTION PLATFORM, is my own. I further declare that I have not previously submitted this work, or part of it, for examination at INDENPENDANT UNIVERSITY OF KIGALI for another qualification or at any other higher education institution.

Student's Name: ……

Signature: ……

Date: ……

APPROVAL

This is to approve that this Dissertation entitled ONLINE FOOD EXCESS REDUCTION PLATFORM was carried out by N'SAPU MWABILWA SHADRACK under my guidance, mentoring, and supervision.

Supervisor's Name: ……

Signature: ……

Date: ……

DEDICATION

To my parents Pierre Mwabilwa and Judith Mwange

To my siblings, relatives, classmates, and colleagues.

ACKNOWLEDGEMENTS

I am deeply grateful to Almighty God for His unwavering protection, guidance, and blessings throughout this journey. His grace has been my constant source of strength, knowledge, wisdom, and determination.

I extend my heartfelt gratitude to the visionary leader behind the establishment of our esteemed institution of higher learning, ULK, Professor Dr. RWIGAMBA BALINDA. His dedication to education and commitment to excellence have laid the foundation for our academic pursuits.

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May God bless each and every one of you abundantly for your contributions, prayers, and support. This achievement would not have been possible without your unwavering faith and belief in me.

With sincere gratitude,

N’SAPU MWABILWA SHADRACK

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Abbreviations and Acronyms

CCS: Cascading Style Sheets

DFD: Data Flow Diagram

FAO: Food and Agriculture Organization

FNEB: National Federation of Biology Students

FE: Food Excess

FW: Food Waste

HTML: Hyper Text Markup Language

NGOs: Non-governmental organization

OOADM: Object-Oriented Analysis and Design Methodology

PHP: Hypertext Preprocessor

SQL: Structured Query Language

UI: User Interface

US: United States

UX: User experience

ABSTRACT

Tons of food are wasted and thrown away in the world. The problem of food Excess is big and touches different areas of the environment, society and economics. To this end, there is an aspiration for creative means demanding that technology helps to eliminate food Excess and makes the food system sustainable. This research brings on a web platform, which has the main function of saving food that otherwise would end up in the trash or feeding the needy. Corporations can donate waste food to the platform if they wish, but it is also open to the public.

The Food Excess Reduction Platform functions as an interactive digital system through which donors and receivers of food commodities are linked thus making the transfer of the donation of resources a significantly more simplified process. Pushing of the whole process of distribution is the central idea behind the app. Key features of the platform are the donation listing algorithm, matchmaking algorithm, communication tools, and logistics support, all of which aim at improving the efficiency and effectiveness of food redistribution initiatives.

The research methodology is extensive and consists of requirement gathering, design, development, testing, and deployment of the platform. Through employing agile methodologies in the design phase, the central part of the development process is the iterative design and conducting of user feedback to ultimately guarantee the platform serves its stakeholders smoothly.

The Food Excess Reduction Platform is evaluated by means of quantitative and qualitative methods such as the tally of the number of successful transactions, the measurement of the reduction in greenhouse gas, and the enhancement of the food supply chains for the vulnerable groups in the area. We have come to the conclusion that the platform is an effective tool in reducing food Waste, lessening pollutions, and enhancing the food security of the inhabitants.

All in all, the work makes a new addition to the literary domain of Waste food reduction and it also reveals the power of technology in addressing these complex problems. Digital platforms are passed by enabling them to make a more sustainable and fair food system and at the same time by preserving nature.

CHAPTER I: GENERAL INTRODUCTION

1.1 General Introduction

Food Excess refers to edible food that becomes spoiled, lost, or left uneaten. The root causes of this issue often stem from poor management in the stages of production, processing, and distribution. Globally, an estimated 1.3 billion tons of food is Wasted each year—representing nearly one-third of all food produced for human consumption.

Food wastage occurs at every point along the supply chain. In developing nations, a significant portion of food Waste happens during production, while in developed countries, each person Wastes around 100 kilograms of food annually, mostly during the consumption stage. This widespread Waste poses serious environmental challenges, contributing to greenhouse gas emissions. Decomposing food releases methane, a powerful greenhouse gas, and the wastage of food also squanders essential resources such as water, land, and energy that were used to produce it.

In response to this, many countries and regions have introduced various regulations and initiatives to curb food Waste. These efforts may involve stricter food labeling standards, tax incentives, or public awareness campaigns. In the private sector, businesses like grocery stores and restaurants have adopted better inventory management techniques and donation programs to tackle the problem.

Furthermore, a substantial amount (52%) of food Waste occurs during social events like weddings and birthday celebrations. Despite economic growth and increased food production, food Waste remains a pressing concern for global food security. To reduce Waste and help those in need, it's essential to find more efficient ways to collect waste food from events and redistribute it to organizations such as orphanages and old age homes. Currently, people often donate Waste food by manually delivering it to various organizations.

1.2 Background of the project

The Online Food Excess Reduction Platform is a potentially powerful tool for minimizing food Waste. This system connects food donors with recipients such as food banks and soup kitchens, helping to ensure that waste food is not Wasted but instead redistributed to those in need.

This project aims to explore the potential of such a platform to reduce food Waste by reviewing relevant literature on food Waste and online donation systems.

It will also present a case study focusing on the implementation of an online food excess reduction platform in DRC/Goma. The project will conclude by analyzing the challenges and opportunities associated with using these platforms to combat food Waste.

Several countries have already begun applying similar systems. For instance, India, where food Waste is a significant issue, has developed websites and apps like Feeding India and GiveIndia, which aim to reduce food Waste by allowing individuals to donate food or funds and volunteer for various initiatives. In Bangladesh, an innovative organization called Bidyanondo has launched the "One Taka Meal" project, which provides affordable meals to street children, alongside other charitable services like clothing donations and educational support.

These platforms aim to bridge the gap between food donors—such as restaurants—and charitable organizations, allowing waste food to be efficiently collected and distributed. By creating a space where donors can create accounts and log in to offer their Waste food, these websites provide a streamlined method for reducing Waste while supporting those in need, such as orphans, street children, and other vulnerable groups.

In addition, the growing urban population, tourism, and the food service industry are expected to increase food services and, consequently, food Waste (Knorr et al., 2018; Satterthwaite et al., 2010; Eurostat, 2018). These sectors also offer opportunities for redistribution, ensuring that edible food remains within the food system (Knorr et al., 2018). The food service industry, which employs a significant workforce (Eurostat, 2018), also faces growing responsibilities regarding Waste management and sustainability.

In Finland, for example, the food service sector plays a crucial role in providing daily meals, particularly through communal services such as school lunches. Research by the Finnish National Education Board (FNEB, 2014) shows that all school children receive free lunch at school canteens. Furthermore, many citizens eat at workplace cafeterias or student canteens (Vikstedt et al., 2012). Despite available research on food Waste in the Nordic region, comprehensive data on the amounts and quality of Waste in the food service sector remains scarce.

Although previous studies have measured food Waste in school canteens by examining plate leftovers, more research is needed to quantify total food Waste across the entire food service sector. For instance, Stenmarck et al. (2016) estimated that the European food service sector produces approximately 10.5 million tonnes of food Waste annually, equating to about 21 kg per person.

Another study in Sweden quantified Waste in 30 communal food service outlets over three months (Eriksson et al., 2017), while research in Switzerland examined two outlets over five days (Betz

et al., 2015), and similar studies in the United States and Britain evaluated food Waste in school cafeterias (Wilkie et al., 2015; Soares Pinto et al., 2018).

In Finland, Silvennoinen et al. (2015) found that around 20% of food produced in the service sector was Wasted, particularly in buffet-style outlets, where serving Waste was the most significant category. To improve Waste management practices, the Restaurant Forum RF in Finland conducted a study to estimate food Waste amounts, origins, and types in buffet line outlets, providing valuable insights into monitoring processes and the barriers to reducing Waste.

As more food service establishments seek to measure and reduce food Waste, future research should focus on standardizing data collection and refining Waste measurement methodologies to address existing gaps

1.3 Problem Statement

Food excess in the Democratic Republic of Congo is a significant issue, with around 40% of the country's food production going uneaten, amounting to over 365 million pounds wasted daily. This occurs despite the fact that one in ten Congolese people face food insecurity, lacking reliable access to nutritious food. The wastage is driven by inefficiencies in production, distribution, and storage, leading to substantial economic losses and missed opportunities to combat hunger. Additionally, the environmental impact is severe, as food waste is a major contributor to greenhouse gas emissions, exacerbating climate change. Addressing this issue is crucial for both food security and environmental sustainability.

1.4 Objectives of project

1.4.1 General objective

The aim, in general, will be to develop and implement this online platform with the aim of improving food security by reducing food loss. Donors of food can be easily connected to recipients, thus making waste food redistribution efficient and, at the same time, reducing a possible loss that may be incurred. The project will aim to contribute to regional economic development, environmental sustainability, and social well-being, in general, through the control of food Waste.

1.4.2 Specific objectives

The primary goal of this study is to develop and evaluate an Online Food Excess Reduction System that efficiently collects excess food from donors and distributes it to those in need. The system aims to minimize food waste and ensure that waste food is effectively utilized.

1.5 Research Questions

This study was directed by specific objectives of developing an Online Food Excess Reduction System; hence, research questions were interlinked to the preset objectives:

i) **User Module Design:**
   a) How should the user module be designed to allow easy registration and submission of food donations by donors?

ii) **Administrator Module Functionality:**
   a) What functions are required in the administrator module to manage food donors?

iii) **Donor Module Management:**
   a) What is the best approach to managing the donor module to ensure efficient food pick-up?

iv) **System Effectiveness Evaluation:**
   a) How effectively does the system match food donations with the needs of recipients?

v) **User Experience and Issue Resolution:**
   a) What common issues do users (donors, administrators, and delivery personnel) experience when interacting with the system, and how can they be resolved?

vi) **Ensuring Food Safety and Quality:**
   a) What practices should be implemented to ensure food safety and quality during the donation, collection, and delivery processes?

vii) **User Engagement and Participation:**
   a) What strategies can be used to increase user engagement and participation in the food donation process?

viii) **Technological Integration and Optimization:**
   a) What technological advancements can be incorporated to improve system functionality and efficiency

1.6 Scope of the project

The scope of the Online Food Excess Reduction System project is clearly defined to ensure that all stakeholders have a clear understanding of the project's boundaries, objectives, and limitations. This section will outline the business need, expected outcomes, constraints, assumptions, and the specific scopes of content, geography, and time.

1.6.1 Content Scope

The Online Food Excess Reduction System is designed to facilitate the collection and distribution of Waste or leftover food from donors to needy individuals and organizations. The key components and features of the project include:

- **User Module (receiver):**
  - Registration and login functionality for donors.
  - Interface for NGOs and for donors to submit food donation details, including type and quantity.
  - Ability for donors to track their donations.
- **Administrator Module:**
  - Management of food donation listings.
  - Charities to view and select available food donations.
  - Tracking of food distribution requests and completions.
- **Donor Module:**
  - Registration and login functionality for delivery personnel.
  - Interface to view and manage pickup and drop-off assignments.
  - Real-time tracking of delivery status.

The system will also include a centralized database to store user information, donation details, and distribution records, ensuring seamless integration and data management across all modules.

1.6.2 Geographical Scope

The initial deployment of the Online Food Excess Reduction System will be limited to a specific geographic region to ensure manageable implementation and testing.

This region will include by Urban Areas, Suburban Areas and Pilot, In Urban Areas; Major cities and towns where there is a higher concentration of potential food donors such as restaurants, hotels, and marriage halls, as well as a significant number of needy individuals and organizations. Suburban Areas: Surrounding suburban areas that can benefit from the extended reach of the system.
Pilot Regions: A select few regions identified for the pilot phase to test and refine the system before broader implementation. Depending on the success and feedback from the initial deployment, the geographical scope may be expanded to include more regions or potentially scaled nationwide.

1.7 Project methodology

The methodology for developing the Online Food Excess Reduction System consists of three key components: data collection, software development, and system analysis and design. Data will be gathered through surveys, interviews, focus groups, observations, and secondary data analysis to understand user needs and challenges. The Agile software development methodology will be employed, focusing on iterative development, user feedback, and continuous improvement. Sprint planning, daily stand-ups, and regular reviews will ensure the system is built in manageable increments, allowing for flexibility and collaboration throughout the project to meet its objectives effectively.

1.8 Significance of the Project

The significance of the Online Food Excess Reduction System project lies in its potential to address a critical social and environmental issue: food Waste. This section outlines the importance of the project, its anticipated impact on the field of food Waste management, and how various stakeholders will benefit from it.

1.8.1 Personal Interest

As individuals working on this project, we will gain valuable experience and knowledge in software development, project management, and social responsibility. This project will:

Enhance Skills: Enable team members to develop and enhance their technical and project management skills.
Foster Social Responsibility: Encourage a sense of social responsibility and community service among team members.
Career Advancement: Provide a meaningful project experience that will be beneficial for future career opportunities in technology and social impact fields.

1.8.2 Institutional Interest

Institutions involved in this project, such as universities, research centers, and NGOs, will benefit in several ways:

Reputation Building: Enhance the institution's reputation as a leader in addressing critical social and environmental issues.
Research Contributions: Contribute to academic research on food Waste management and the development of innovative solutions.
Community Engagement: Strengthen the institution’s engagement with the community and its commitment to social responsibility.

1.8.3 Public Interest

The broader community and public will significantly benefit from the successful implementation of the Online Food Excess Reduction System. The project will:

Reduce Food Waste: Substantially decrease the amount of food Wasted by redirecting waste food to those in need.
Aid Needy Individuals: Provide essential food resources to needy individuals and families, improving their quality of life.
Support NGOs and Charities: Enhance the operational efficiency of NGOs and charities by providing a reliable platform for sourcing food donations.
Environmental Impact: Contribute to environmental sustainability by reducing the carbon footprint associated with food Waste.

1.9 Organization of the Project

The organization of the Online Food Excess Reduction System project is structured to ensure effective planning, development, and implementation. The project is divided into several chapters, each focusing on different aspects of the project. Below is an overview of the organization of the project:
Chapter 1: General Introduction in this chapter introduces the project, providing context and outlining the foundational elements of the study.

Background of the Study; Provides an overview of the issues related to food Waste and the need for the project. We have also Problem Statement: Clearly defines the problem the project aims to address. Purpose of the Study; Explains the main goals of the project. Objectives of the Study; Lists the specific, measurable objectives the project aims to achieve. Research Questions; Presents the key questions the research will answer. Scope of the Project; Defines the boundaries and limitations of the project. Project Methodology; Describes the methods used for data collection and system development. Significance of the Project / Interest**;** Explains the importance and impact of the project. Limitations of the Project: Discusses the factors that may limit the project's generalizability.
Chapter 2: Literature Review in this chapter reviews existing literature relevant to the project, providing a theoretical foundation.

Introduction: Introduces the chapter and its importance. Definition of Concepts: Defines key terms and concepts used in the study and analysis of Existing related literature.

Chapter 3: System Analysis and Design: Expand on the specific methodologies used for system analysis (e.g., requirements gathering, use case diagrams, data flow diagrams).and detail the system architecture and design, including the proposed technology stack and system components.

So, in the Chapter 4: System Implementation: Provide a detailed account of the development process, including coding, testing, and debugging. Discuss the challenges encountered during implementation and how they were addressed. Include screenshots or demonstrations of the system's functionality.

Conclusion and Recommendations: Offer a comprehensive summary of the project's achievements and limitations. Provide specific recommendations for future research, system enhancements, or policy implications. Discuss the broader impact of the project on Food Excess Reduction and food security.

CHAPTER II: LITERATURE REVIEUW

2.1 Introduction

This chapter presents a detailed review of existing literature concerning the Online Food Excess Reduction System. Its goal is to define key concepts, evaluate prior research and systems, identify knowledge gaps, and showcase the innovations introduced by this project. The literature review forms a solid foundation for understanding the study's context and importance, ensuring a well-informed approach to developing the system.

According to Roodhuyzen et al. (2017), food Waste has garnered significant attention over the past few decades, with numerous studies addressing the topic using varied definitions and approaches. Scholars have used different terms, such as "food wastage" (Grandhi & Singh, 2016), "food loss" (Beretta et al., 2013; Kummu et al., 2012), and "food Waste" (Garrone et al., 2014) in their research.

Some studies suggest defining food loss and Waste based on the food's final destination within the supply chain, focusing on whether food is removed or retained. Other research considers food as Wasted when it is sent to unproductive uses, such as incineration or landfills, while excluding food that is composted or repurposed from the definition of Wasted food (Roodhuyzen et al., 2017; Bellemare et al., 2017).

Another approach defines food loss and Waste by considering whether the food includes inedible parts. For instance, banana peels and bones may be classified as inedible, but the concept of edibility can vary between cultures (Blichfeldt et al., 2015; WRAP, 2018). What is considered inedible in one region may be seen as an edible part in another, highlighting how cultural and socio-economic contexts influence the definitions of food loss or Waste.

Some researchers look at food Waste from a nutritional perspective, suggesting that overnutrition—consumption beyond human metabolic needs—can be classified as food Waste (Blair & Sobal, 2006). Others focus on food Waste as a decrease in the quality and quantity of food throughout the supply chain (FAO, 2013; Roodhuyzen et al., 2017).

2.2 Definition of Concepts

To provide clarity and foster a common understanding, this section defines the key terms and concepts central to the research topic and objectives.

1. Food Waste: This refers to food that is discarded or goes uneaten. It includes both food loss, which occurs during production, post-harvest, and processing, and food Waste, which happens at the retail and consumption stages (FAO, 2011).
2. Food Donation: The act of providing waste or leftover food to individuals or organizations in need, typically facilitated by food banks, charities, or similar platforms.
3. Sustainable Development: Defined as development that satisfies present needs without jeopardizing the ability of future generations to meet theirs, addressing economic, social, and environmental dimensions (Brundtland Commission, 1987).
4. Undernutrition: A condition caused by inadequate food or nutrient intake, which leads to health complications, especially among vulnerable populations (WHO, 2020).
5. Obesity Epidemic: The widespread rise in obesity, characterized by Wasteive body fat accumulation, posing significant health risks (Caballero, 2007; Franklin et al., 2012).
6. Agile Methodology: A flexible, iterative approach to software development that focuses on collaboration, customer feedback, and continuous improvement (Beck et al., 2001).
7. Object-Oriented Analysis and Design (OOAD): A system analysis and design method that uses object-oriented concepts such as classes, objects, inheritance, and polymorphism (Booch, 1994).

2.3 Analysis of Existing Literature

This section reviews the current body of literature related to Online Food Excess Reduction Platform, existing solutions, and their limitations, as well as the technological and social innovations proposed by the new system.

2.3.1 Food Waste Management and Online Donation System

This thesis, submitted by Mohammad Nahidul Islam, Mohammad Khaled Chowdhury Naim, Md. Fahad Hossen, and Mohammad Zahidul Islam to the Department of Computer Science and Engineering, Sonargaon University (SU), has been accepted as meeting the requirements for the partial fulfillment of the Bachelor of Science in Computer Science and Engineering degree, approved for its style and content in September 2023.

The research objectives concerning food waste management and the online donation system can be summarized as follows:

- To identify the causes of food Waste across various sectors, including households, restaurants, and grocery stores.
- To develop and assess strategies aimed at reducing food Waste at different stages of the food supply chain.
- To design an online donation platform that facilitates easy food donations to those in need.
- To evaluate the effectiveness of the online donation system in minimizing food Waste and addressing hunger.
- To identify the challenges and opportunities associated with implementing food Waste management and online donation systems.

The research specifically focuses on the following topics:

- The economic, environmental, and social impacts of food Waste.
- The role of technology in reducing food Waste.
- The barriers to and incentives for food donation.
- Best practices for managing food Waste and facilitating food donations.
- The impact of food Waste management and online donation systems on food security and sustainability.

2.3.1.1 Existing Gaps and their Solutions

Various systems currently tackle food Waste through donations, yet they face challenges like inefficiencies in connecting donors with recipients, low user engagement, and logistical hurdles.

- **Mobile Apps**: Platforms such as *Too Good to Go* and *Food Rescue Hero* link consumers with Waste food from restaurants and grocery stores at discounted rates. These apps help minimize food Waste while offering savings to consumers.
- **Online Platforms**: Digital platforms facilitate the donation process by matching food donors with recipient organizations. Some utilize algorithms to pair donors with nearby charities in real time.
- **Anaerobic Digestion Technologies**: These systems transform organic food Waste into biogas, which can be used for energy production or converted into renewable natural gas.
- **Simplicity**: To ensure widespread adoption, systems must be user-friendly, allowing individuals to easily navigate and engage with the platform.

While these systems have made strides in reducing food Waste, challenges remain in terms of efficiency, scalability, and user engagement. The *Online Food Excess Reduction System* seeks to address these gaps using advanced technology, real-time tracking, and a seamless user interface.

Despite the growing use of Food Excess Reduction Platforms (FERPs), there is limited empirical research on the factors contributing to their success (Mazzuchelli et al., 2021). Most studies concentrate on isolated cases, lacking a comprehensive view of these platforms. Moreover, there is a significant research gap concerning the role of digital and green technologies in reducing food Waste (Morone et al., 2018; UNEP DTU Partnership and United Nations Environment, 2021). As this is a relatively new field, it is crucial to deepen our understanding of how these solutions integrate into the broader efforts to combat food Waste (Cane and Parra, 2020).

2.3.1.2 Technological Innovations

The Online Food Excess Reduction System introduces several innovations to enhance current solutions:

- **User Donors**: The system enables each user to act as a donor, simplifying the interaction between senders and recipients.
- **User Engagement Features**: By incorporating gamification and offering incentives, the platform boosts participation from donors, volunteers, and recipients.
- **Comprehensive Modules**: Distinct modules for users, administrators, and receiving personnel improve coordination and streamline the donation process.
- **Web Integration**: The platform ensures accessibility and convenience through web-based interaction, allowing users to easily engage with the system.

2.3.1.3 Addressing Identified Gaps

This project addresses the limitations of current systems by tackling key challenges:

Behavioral Challenges: Shifting consumer behavior and industry practices to reduce food Waste is often difficult and time-consuming, as habits related to food consumption and disposal are deeply ingrained.

Resource Intensity: Comprehensive food Waste management requires substantial resources, including investments in technology, infrastructure, and personnel.

Regulatory Hurdles: Regulations around food safety, liability, and donation can create legal complexities that sometimes hinder Food Excess Reduction efforts.

Cultural and Social Factors: Cultural norms, such as portion sizes and societal expectations, influence food Waste, making these factors difficult to address through policy and awareness campaigns.

Logistical Challenges: Coordinating the collection and redistribution of waste food, particularly perishable items, poses logistical difficulties, requiring efficient coordination and transportation resources.

The review of literature underscores the need for an effective system to manage food Waste. The proposed Online Food Excess Reduction System fills these gaps with innovative solutions that will have a significant impact on food Waste management and distribution. For more information on the research and findings, refer to the study by de Almeida Oroski and da Silva (2022), published in Waste Management & Research.

CHAPTER III: SYSTEM ANALYSIS AND DESIGN

3.1 Introduction

This chapter offers a comprehensive analysis and design of the Online Food Excess Reduction System. System analysis entails collecting factual data, understanding the underlying processes, identifying key issues, and proposing viable solutions to enhance system performance. By evaluating user requirements and conducting an in-depth review of the current system, a new system design is proposed. This phase, essential to system development, translates the logical system design into a physical framework, ensuring that all components function cohesively to achieve the project's goals.

3.2 Analysis of the Current System

3.2.1 Problem of the Current System

The current food Waste management system faces several challenges that hinder its effectiveness in reducing food Waste and distributing waste food to those in need:

i. **Inefficiencies in Matching Donors with Recipients:** The existing system struggles to efficiently match food donors with recipients, leading to delays and Wasted resources.
ii. **Lack of Real-Time Coordination:** Without real-time tracking and coordination, the system cannot ensure timely pickups and deliveries of food donations.
iii. **Limited User Engagement:** Current platforms fail to engage users effectively, resulting in low participation rates from both donors and volunteers.
iv. **Scalability Issues:** Many Food Excess Reduction initiatives lack the scalability needed to expand their reach to new regions or handle larger volumes of donations.
v. **Logistical Challenges:** High costs and logistical complexities, such as transportation and storage, further constrain the effectiveness of food recovery efforts.
vi. **Technical Limitations:** Existing platforms often lack the technical infrastructure and capabilities needed for efficient operation, requiring partnerships and collaborations to fill these gaps.

3.3 Analysis of the New System

3.3.1 Introduction

The new system aims to address the shortcomings of the current food Waste management system by implementing advanced technological solutions and a user-centric design.

This section outlines the requirements and functionalities needed for the new system, ensuring it meets the project's objectives and provides a robust, efficient platform for food Waste reduction.

3.3.2 System Requirements

The detailed investigation of the system requirements is carried out in accordance with the objectives of the proposed system. This involves a thorough study of the various operations performed by the system and their relationships within and outside the system. Data collection methods include interviews, on-site observation, and questionnaires.

Functional Requirements:

i. **User Registration and Authentication:** Allow users (donors, administrators, delivery personnel) to register and authenticate their identities securely.
ii. **Donation Management:** Enable users to submit, view, and manage food donations, including specifying type and quantity.
iii. **Real-Time Matching and Coordination:** Implement algorithms to match food donations with the nearest recipients and coordinate pickup and delivery in real-time.
iv. **Tracking and Notifications:** Provide real-time tracking of donations and deliveries, with notifications for users at each stage of the process.
v. **User Engagement Features:** Integrate gamification and incentives to encourage user participation and retention.
vi. **Reporting and Analytics:** Generate reports and analytics on food donations, distributions, and system performance for continuous improvement.

Non-Functional Requirements:

i. **Scalability:** Ensure the system can handle increased volumes of donations and expand to new regions without performance degradation.
ii. **Reliability:** Maintain high system uptime and reliability to support continuous operations.
iii. **Security:** Implement robust security measures to protect user data and ensure secure transactions.
iv. **Usability:** Design an intuitive and user-friendly interface to facilitate easy interaction for all users.
v. **Performance:** Optimize system performance to handle real-time data processing and ensure quick response times.

vi. **Compliance:** Ensure the system complies with relevant laws and regulations related to food safety, data protection, and nonprofit operations.

The proposed system's design and requirements focus on addressing the existing challenges and leveraging technological advancements to create an efficient, scalable, and user-friendly platform for reducing food Waste and aiding those in need.

3.3.3 Function Diagram

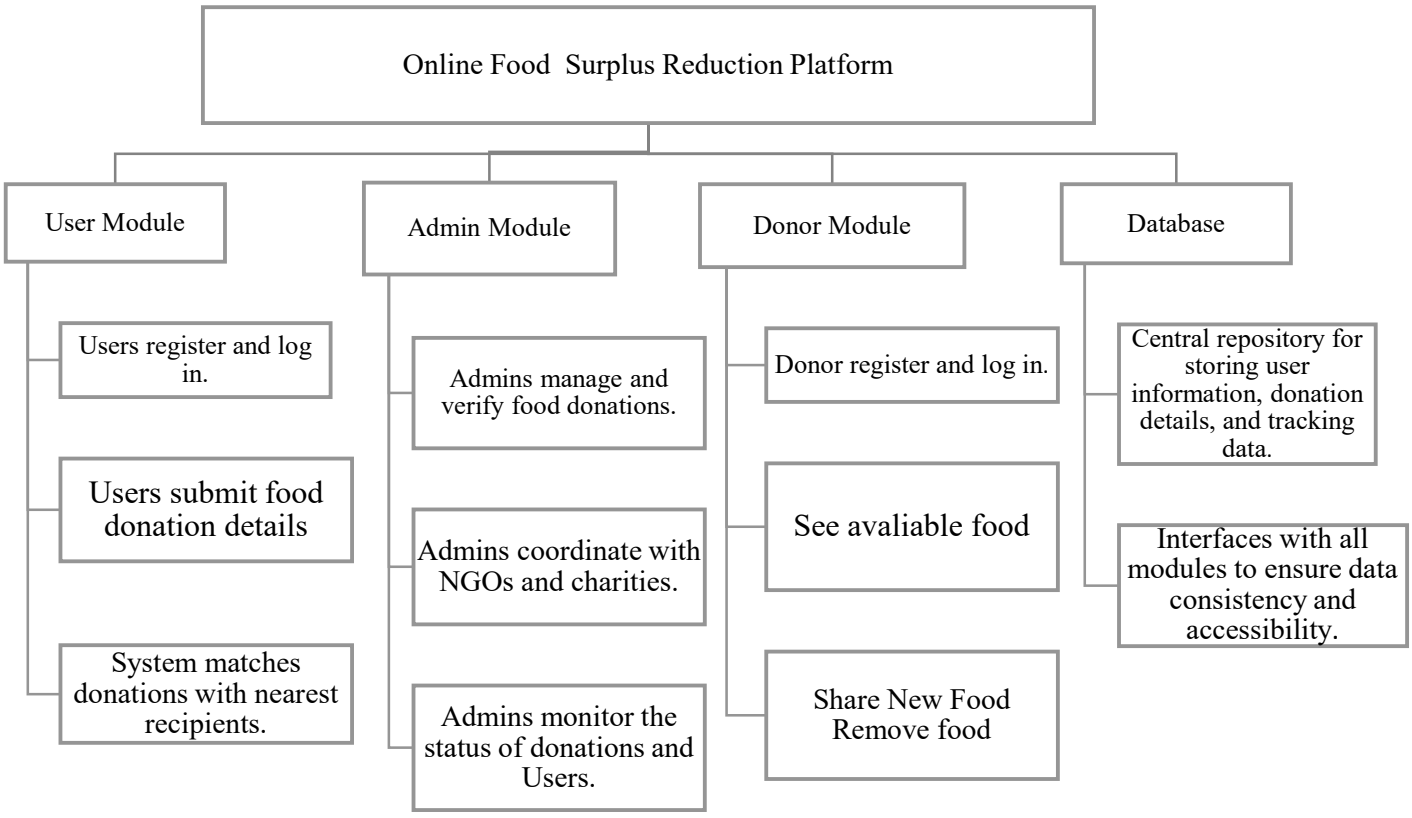


Table 1 Function Diagram of Online food excess reduction platform

3.3.4 Methodological approach

This section outlines the specific methodologies employed for analyzing the current system and designing the new system. A combination of qualitative and quantitative techniques will be utilized to ensure a comprehensive understanding of the system's strengths, weaknesses, and opportunities for improvement.

3.3.4.1 Data Collection Methods

Data collection is the methodological process of gathering information about a specific subject. It's crucial to ensure your data is complete during the collection phase and that it's collected legally and ethically. If not, your analysis won't be accurate and could have far-reaching consequences. (Harvard business school, catherine cote,2021).

For my part I will use those methods:

Document Analysis: Existing reports, policies, and procedures related to food Waste management will be thoroughly reviewed to identify current practices and challenges.

Interviews: In-depth interviews will be conducted with key stakeholders, including food donors, recipients, and administrators, to gather insights into their experiences and perspectives.

Surveys: A structured questionnaire will be distributed to a representative sample of stakeholders to collect quantitative data on food Waste patterns, donation behavior, and system usage.

Observations: On-site observations of food donation and distribution processes will be conducted to understand the operational flow and identify potential inefficiencies.

Analysis Techniques

- **SWOT Analysis:** A SWOT analysis will be conducted to identify the strengths, weaknesses, opportunities, and threats associated with the current system.
- **Gap Analysis:** The identified gaps between the current system and the desired system will be analyzed to determine the specific requirements for the new system.
- **Requirements Elicitation:** User requirements will be gathered through interviews, surveys, and workshops to ensure that the new system aligns with user needs.
- **Functional Decomposition:** The system will be broken down into smaller, manageable components to facilitate the design process.
- **Data Modeling:** Data requirements will be identified and modeled to support system functionalities.

Design Methodology

- **User-Centered Design:** The design process will prioritize user needs and experiences, focusing on creating a user-friendly and intuitive interface.
- **Iterative Design:** A cyclical approach will be adopted, involving continuous testing, evaluation, and refinement of the system design.
- **Prototyping:** Low-fidelity prototypes will be developed to visualize and test design concepts with users.

3.3.4.2 Software Development Methodology

The selection of an appropriate software development methodology is critical to the successful implementation of the Online Food Excess Reduction System. This section outlines the chosen methodology, Agile, and provides a rationale for its adoption. Agile was selected for its flexibility, iterative approach, and emphasis on collaboration, making it ideal for managing evolving project requirements and incorporating user feedback throughout the development process.

Agile Methodology: A Collaborative Approach

For this project, the Agile methodology has been selected as the preferred software development approach. Agile SDLC focuses on collaborative decision-making and product development through short cycles, or sprints. It is an iterative and incremental model designed to address the limitations of traditional linear models like Waterfall.

Agile emphasizes iterative development, adaptability, and collaboration among cross-functional teams (SCRUM study® on July 29, 2024). This methodology is ideal for projects with evolving requirements, such as the Online Food Excess Reduction System, where user feedback and changing needs are anticipated.

Core Principles of Agile

The Agile methodology is grounded in the following core principles:

- ✓ **Individuals and interactions** over processes and tools
- ✓ **Working software** over comprehensive documentation
- ✓ **Customer collaboration** over contract negotiation
- ✓ **Responding to change** over following a plan

Agile Framework: Scrum

To implement the **Agile methodology** effectively, the **Scrum framework** will be adopted. Scrum is a widely used Agile framework that offers a structured approach to project management (**2024 Atlassian**). The key elements of Scrum include:

- **Product Owner:** Responsible for defining the product vision and managing the product backlog.
- **Scrum Master:** Facilitates the Scrum process, ensuring the team adheres to Agile principles (**2024 Atlassian**).

- **Development Team:** A self-organized group responsible for delivering the product incrementally (**Scrum.org, March 3, 2016**).
- **Sprints:** Time-boxed iterations (typically two to four weeks) where the team delivers a potentially shippable product increment (**Narijaona Rabiaza, June 7, 2023**).
- **Daily Scrum:** A brief daily meeting for the team to align activities and plan for the day.
- **Sprint Review:** A session to review completed work and gather feedback from stakeholders.
- **Sprint Retrospective:** A meeting for the team to reflect on the sprint and identify areas for improvement.

Application of Agile to the Project

The Agile methodology will guide the development of the **Online Food Excess Reduction System** in the following ways:

- **Iterative Development:** The system will be developed in incremental iterations, enabling continuous improvement based on user feedback.
- **Cross-Functional Teams:** Developers, designers, and domain experts will collaborate closely throughout the project.
- **Prioritization:** The product backlog will be organized by user value and business impact.
- **Flexibility:** The project plan will remain adaptable to accommodate changes in requirements or priorities.
- **Continuous Testing:** Testing will be integrated into each sprint to ensure product quality (**QA Madness Blog, Ref: Software Testing in Scrum Is Not What You Think It Is**).

By adopting the Agile methodology and the **Scrum framework**, the project team aims to deliver a high-quality system that addresses user needs while effectively managing risks and uncertainties.

Note: The specific implementation of Agile may vary depending on the complexity of the project and the dynamics of the team, but the outlined framework serves as a general guide for applying Agile to this project.

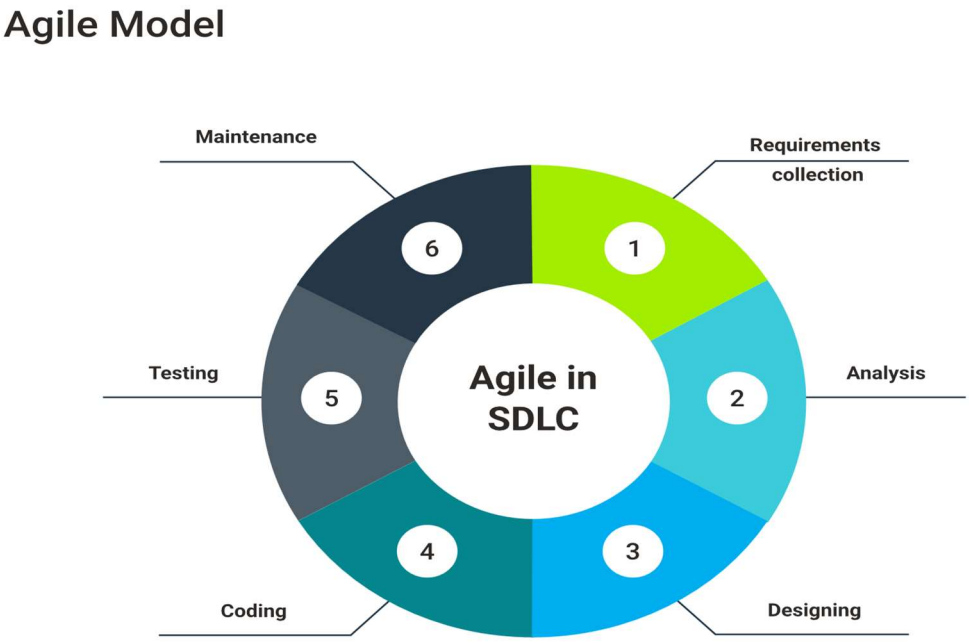


Figure 1 The Agile in software development life cycle model phases

3.3.4.3 System Analysis and Design Methodology

The development of the **Online Food Excess Reduction System** follows a structured approach to ensure a thorough and organized analysis and design process.

The **Structured Systems Analysis and Design Method (SSADM)** has been chosen as the primary methodology, due to its focus on clear documentation, rigorous analysis, and its phased approach to system development.

SSADM provides a well-defined framework that guides the project from an initial feasibility study through to the final delivery of the system. By adhering to its stages, the project aims to:

- Clearly define system requirements and objectives.
- Develop a comprehensive understanding of current system processes.
- Design a new system that effectively addresses the identified challenges.
- Implement the system efficiently and effectively.

i. Data Flow Diagrams (DFDs)

DFDs will be used to visually represent the flow of data through the system. They will be created at different levels of detail to provide a clear understanding of the system's processes and data transformations.

- **Level 0 DFD:** This will provide a high-level overview of the system's major processes and data flows.

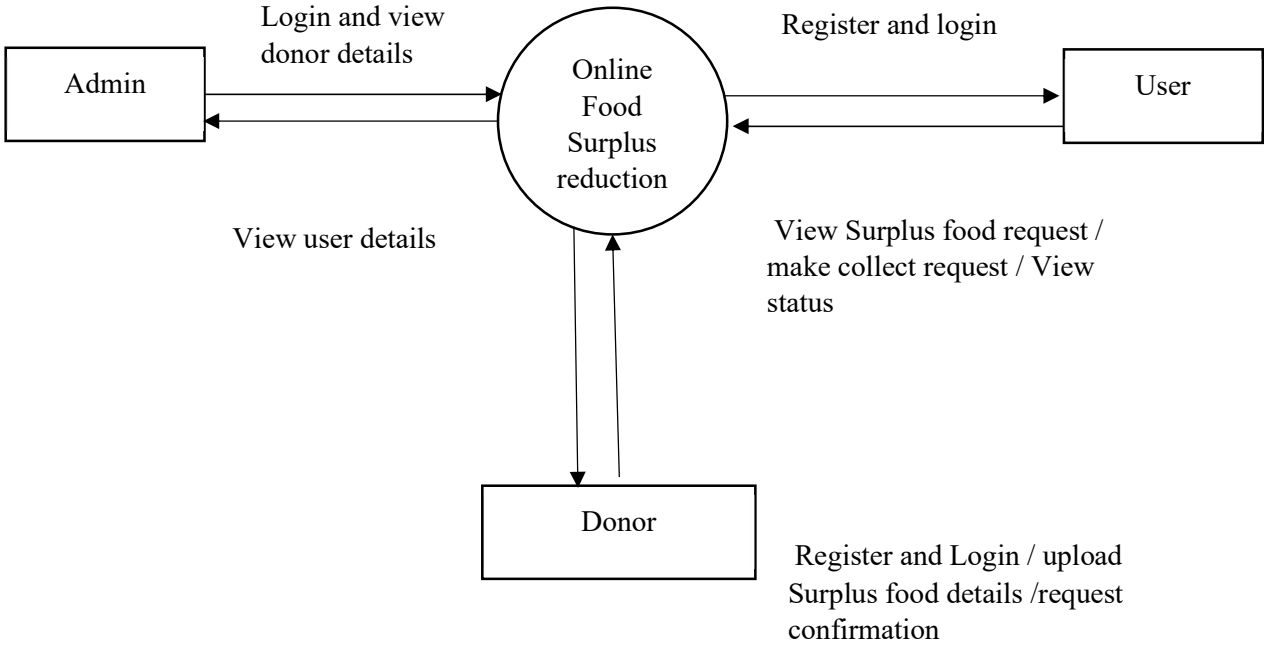


Figure 2 Level 0 DFD

- **Level 1 DFDs:** These will be created as needed to further decompose complex processes and provide more detailed information.

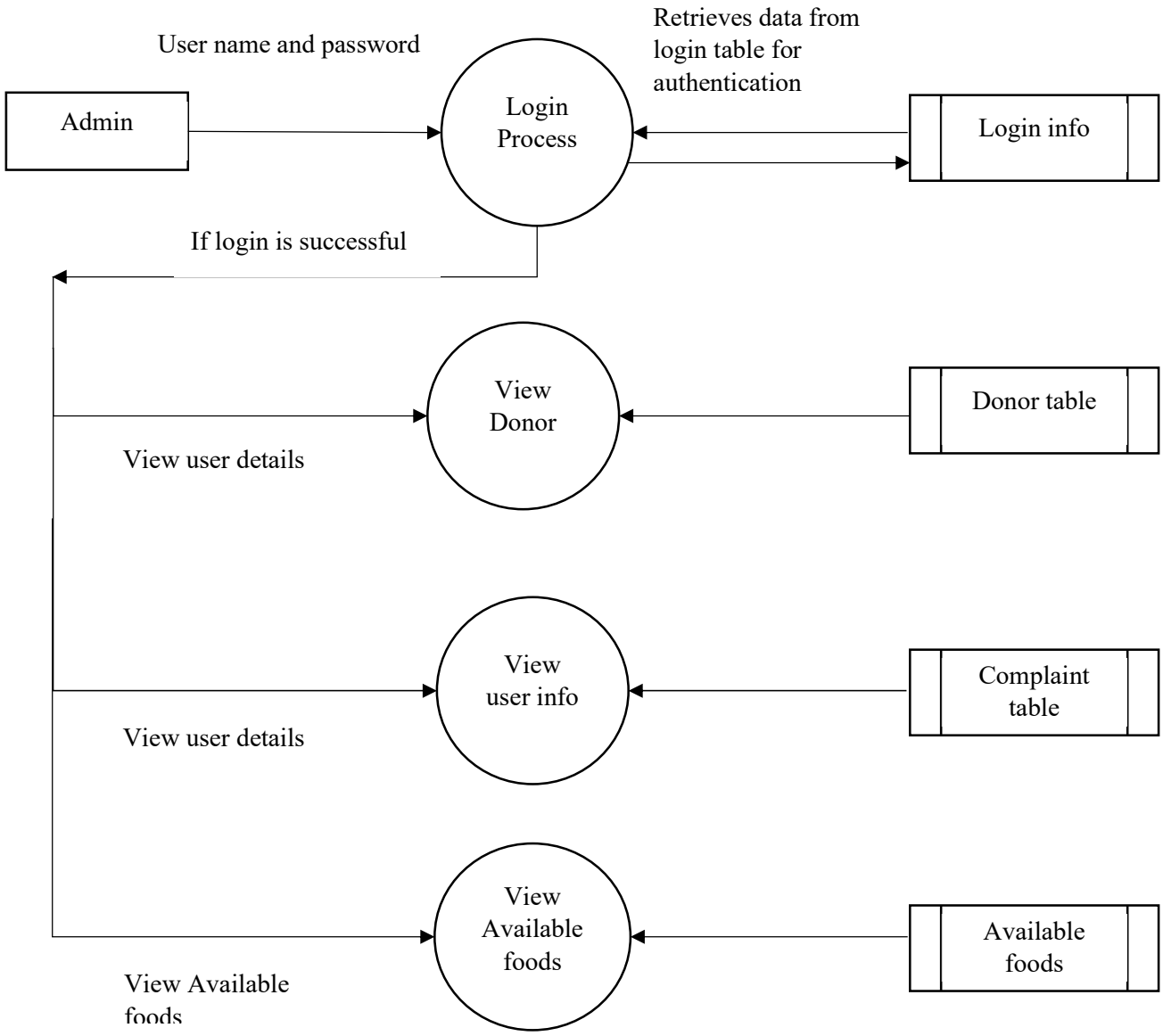


Figure 3 Data Flow Diagram level 1

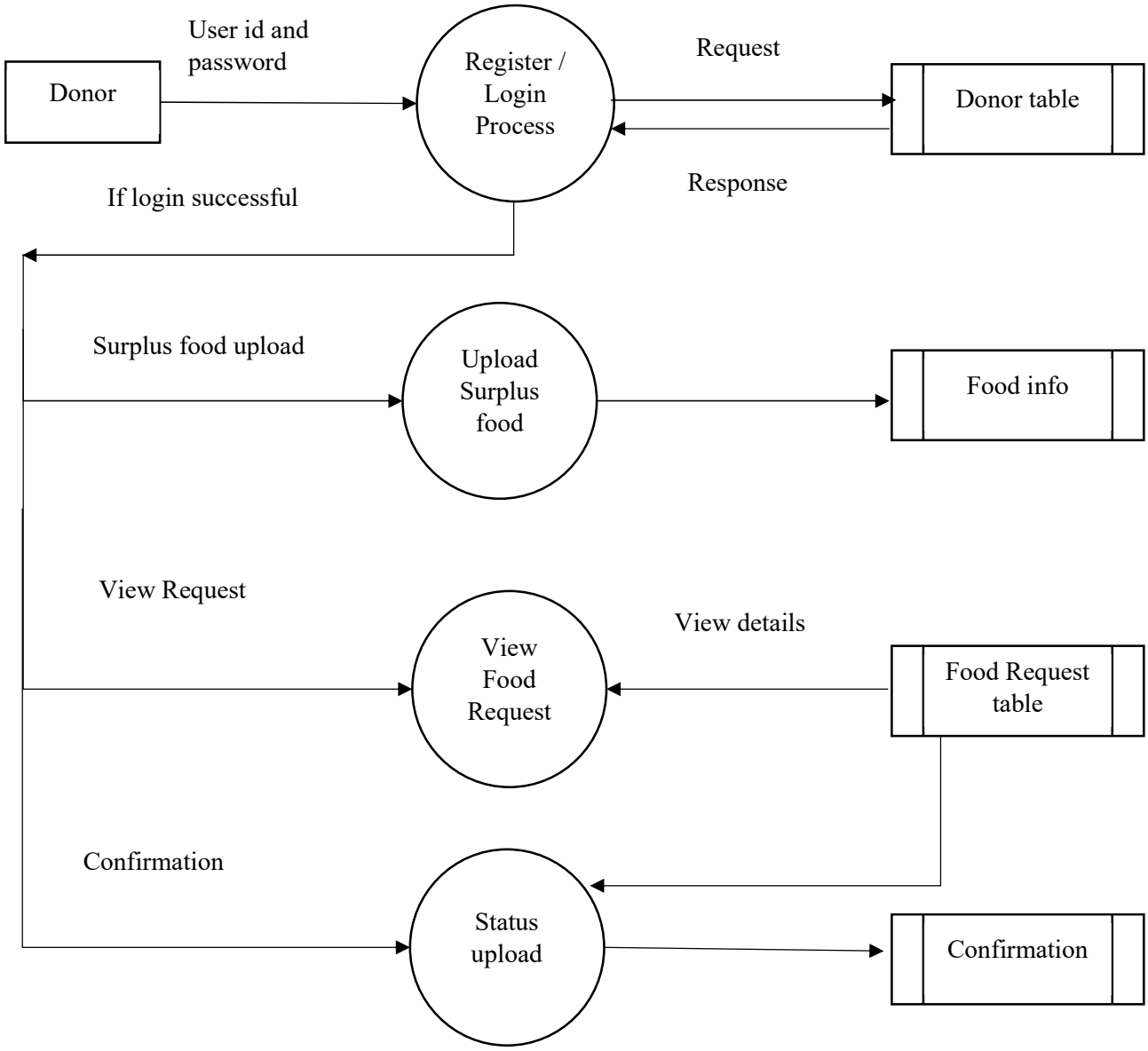


Figure 4 LEVEL 2

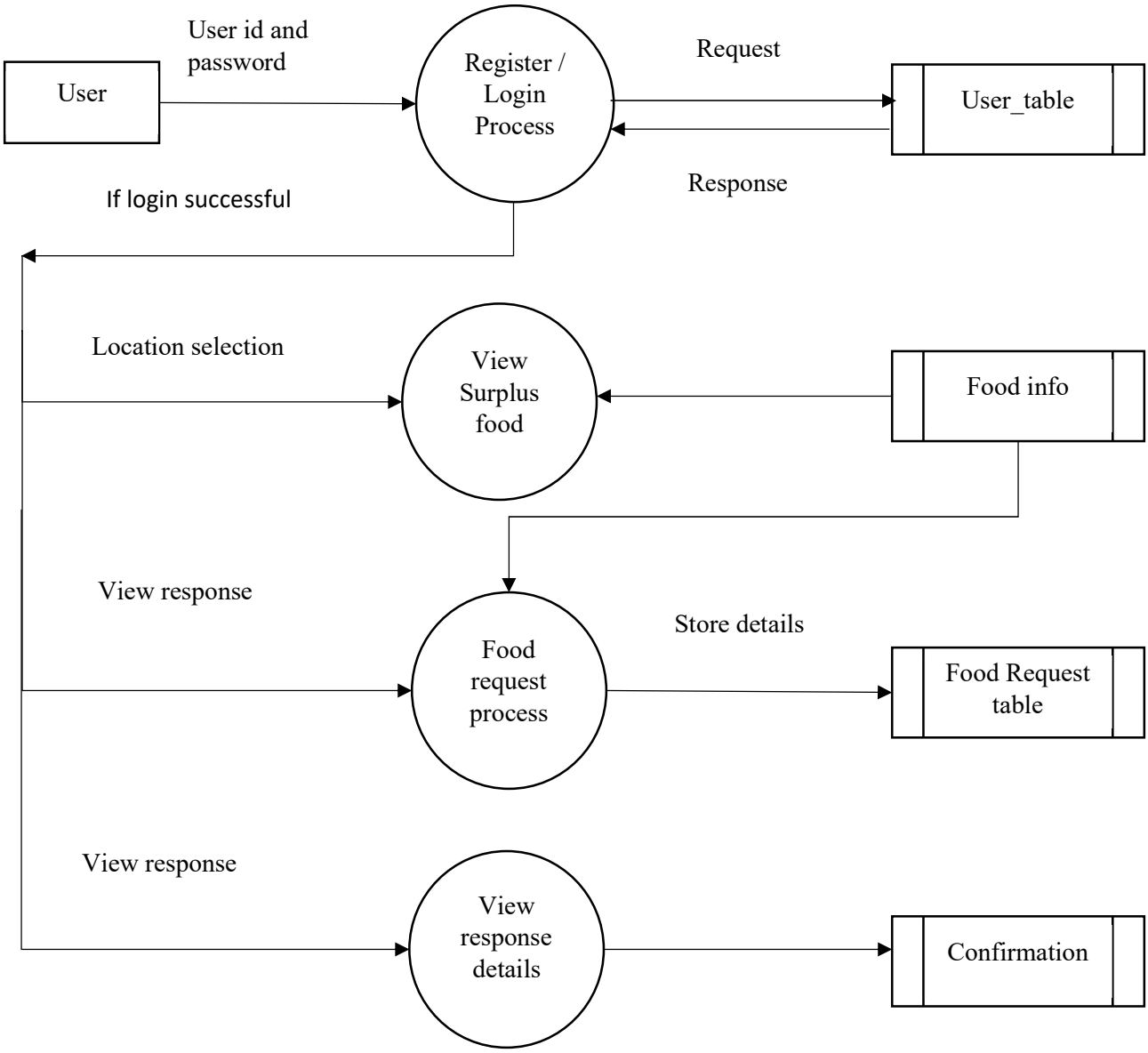


Figure 5 Data Flow Diagram level 3

ii. Entity-Relationship Diagrams (ERDs)

The Entity–Relationship (ER) model describes the interrelated entities within a specific domain of knowledge. A basic ER model comprises entity types, which categorize the entities of interest, and defines the relationships that exist between instances of these entity types (Chen, Peter, 2018).

In software engineering, ER models are often used to represent the entities a business must track to perform its operations. As an abstract data model, the ER model outlines the structure of data or information, which is typically implemented in a relational database (Chen, Peter, 2018).

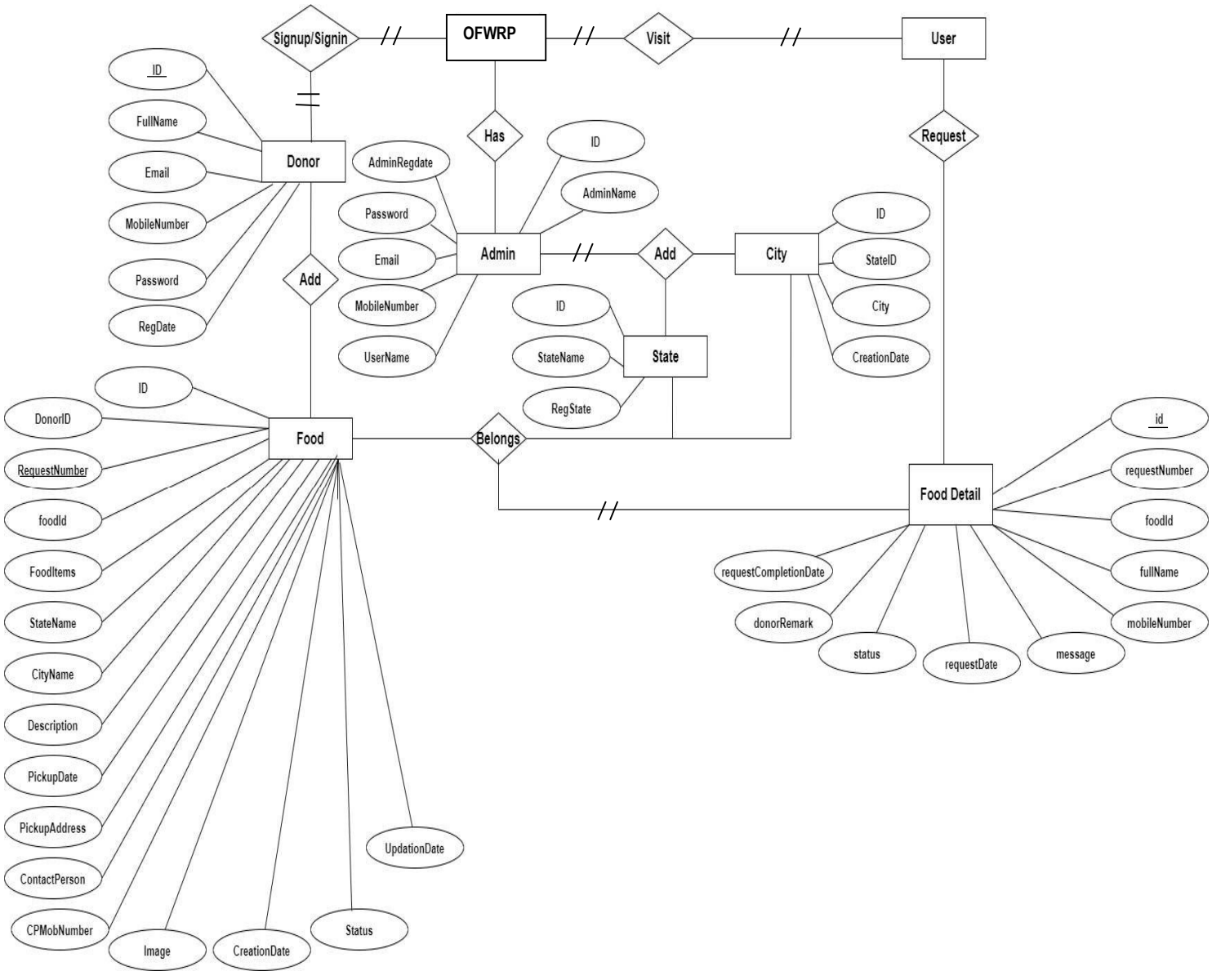


Figure 6 ERD

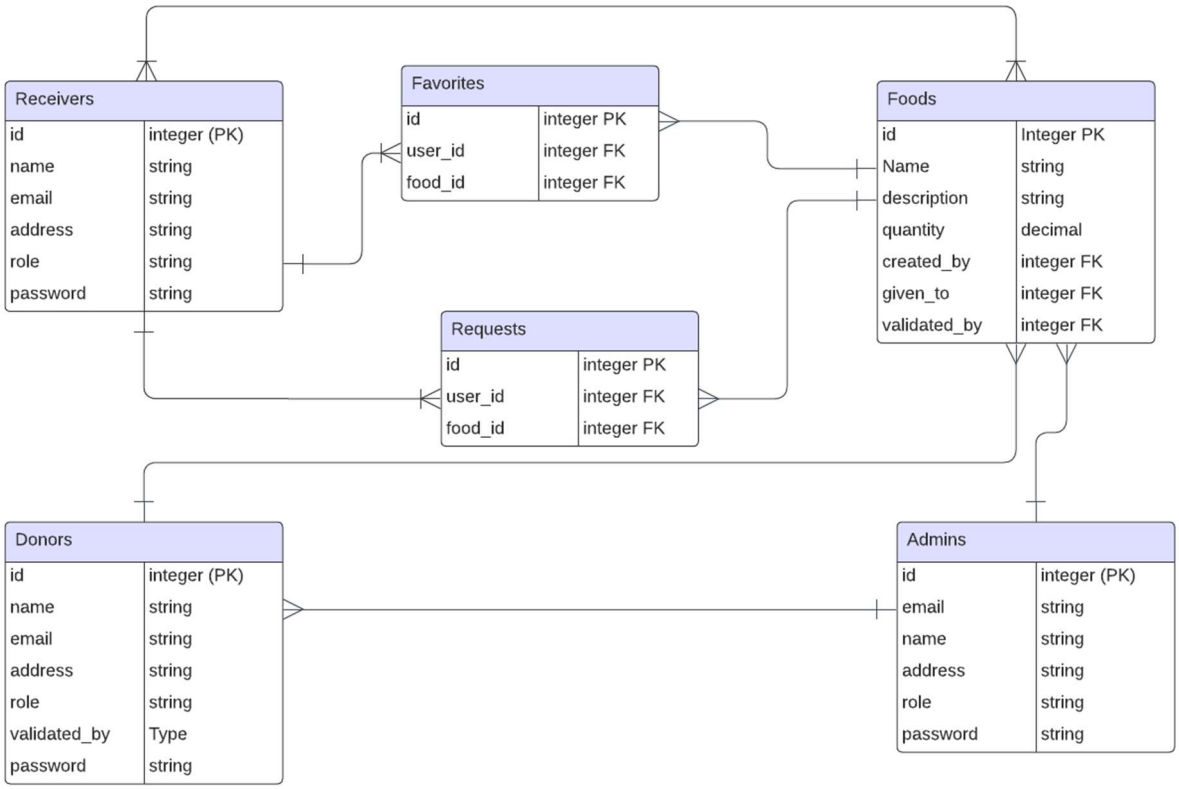
iii. Data dictionary

A **data dictionary**, or **metadata repository**, is defined by the **IBM Dictionary of Computing** as a "centralized repository of information about data, such as meaning, relationships to other data, origin, usage, and format." **Oracle** similarly describes it as a collection of tables containing metadata.

The term can refer to several closely related concepts within databases and **database management systems** (**Ramez Elmasri, Shamkant B. Navathe, 2015**). Researchers often use a data dictionary to understand how a specific data item fits into the overall structure, what values it may hold, and how it relates to real-world terms.

For this system, the database includes the following tables: **Login, User, Donor, Food Info, Food Request, and Confirmation Table**. Each of these tables contains specific attributes that describe and organize the data relevant to the system.

Table 2 Structure of database



CHAPTER IV: SYSTEM IMPLEMENTATION

4.1 Implementation and Coding

4.1.1 Introduction

In this chapter, we move into the system implementation phase, where the theoretical design transitions into a fully functioning system through coding. At this stage, all the functionalities, performance standards, and features detailed in previous sections are brought to life. The coding process follows the chosen methodologies, ensuring that the system operates smoothly and meets all the intended user requirements.

4.1.2 Description of Implementation Tools and Technology

The development of the Online Food Excess Reduction System integrates a variety of technologies across the frontend, backend, and database layers to ensure that the platform is responsive, efficient, and user-friendly.

Backend Technologies:

- **Ruby:** A dynamic, object-oriented programming language used for server-side development.
- **Ruby on Rails:** is a backend web application framework providing a robust structure for scalable and efficient development.
- **PostgreSQL:** By default-a powerful, free relational database system to store user information, donations, and transactions.

API:

- **RESTful API:** Constitutes a prevalent architectural framework that enables interaction between the frontend and backend components, thereby permitting the retrieval and modification of data.

Frontend Technologies:

- **HTML:** For building the structure and layout of web pages.
- **CSS:** Provides styling to the web pages, ensuring a visually appealing user interface.
- **JavaScript:** Enables the development of interactive features and dynamic elements for web pages.

- **React:** is a JavaScript library for building rapid and composable user interfaces.
- **Tailwind CSS:** is a utility-first CSS framework that speeds up your frontend styling.
- **Redux & Redux Toolkit:** State management library used to manage application state across components in React so that data flow remains predictable and consistent.

4.1.3. Screen shorts and source codes

Here is our Project Screenshot Start. Here we will be able to see Project Screen, Admin Registration Page, Admin Dashboard and the actions, Donor Registration page, Donor Dashboard and actions, etc.

Admin Login Page

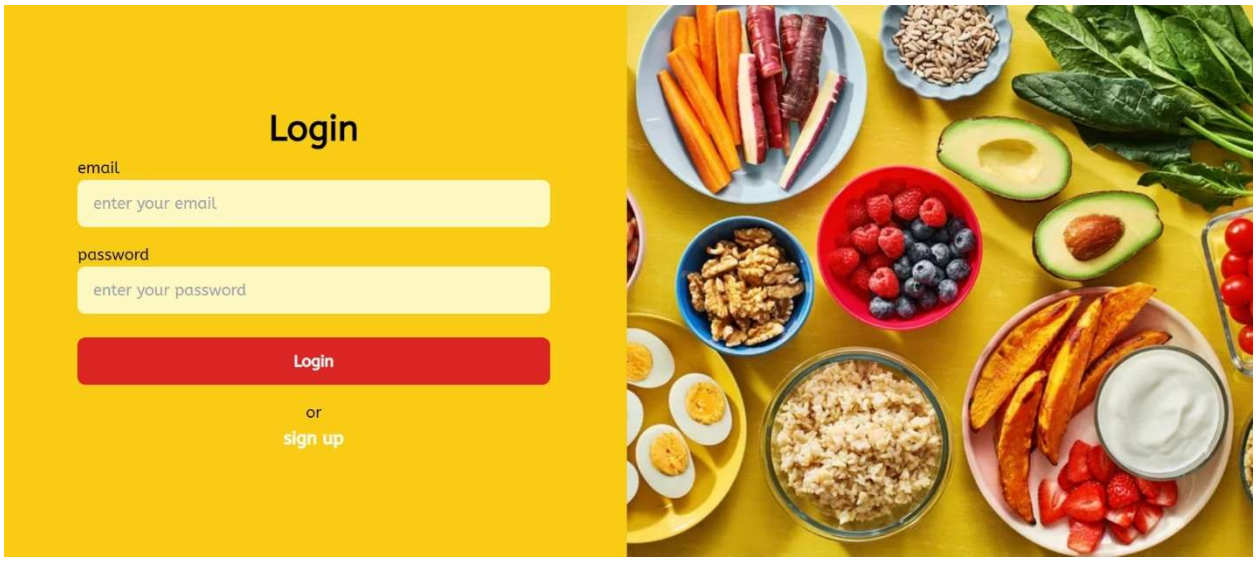


Figure 8 Admin login page

Donor Details from Admin

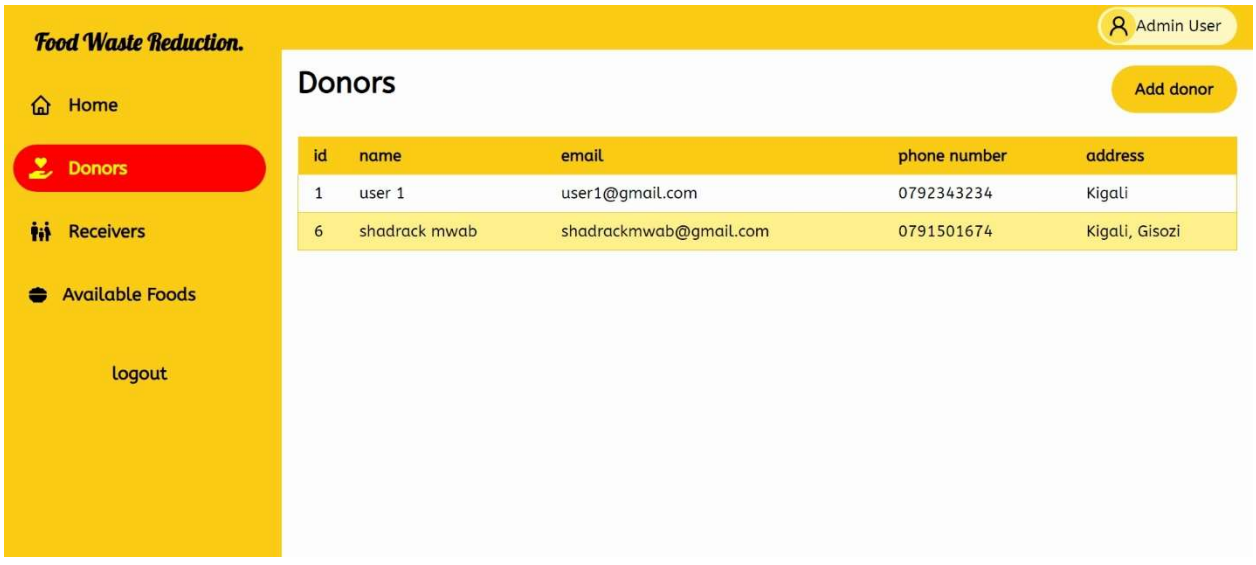


Figure 9 Donor Details from Admin

Available Food List from Admin point of view

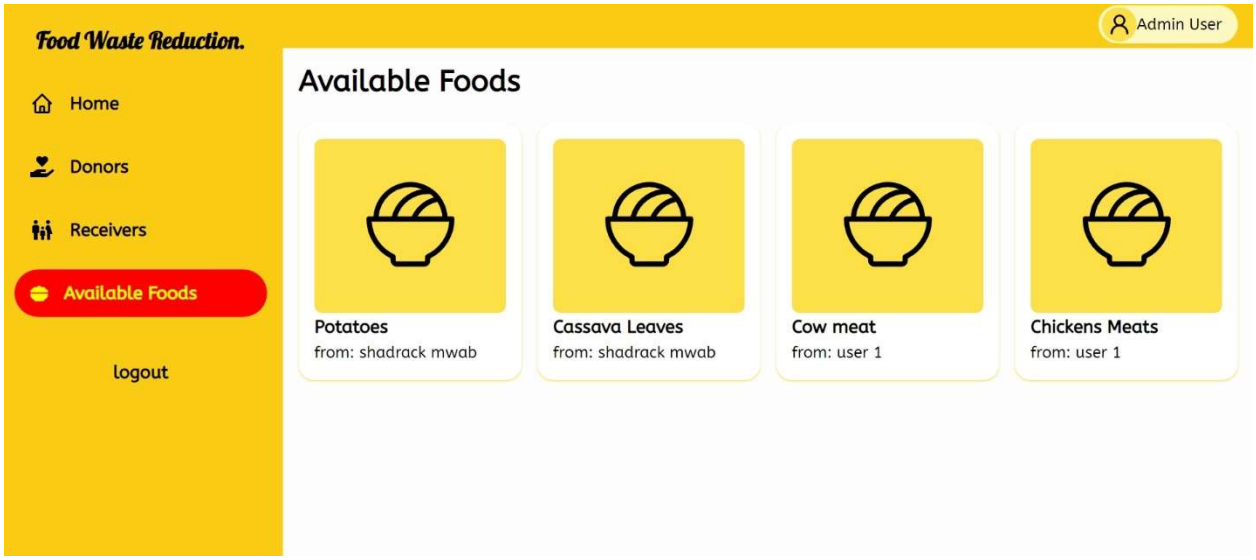


Figure 10 Available Food List from Admin point of view

Signup Page

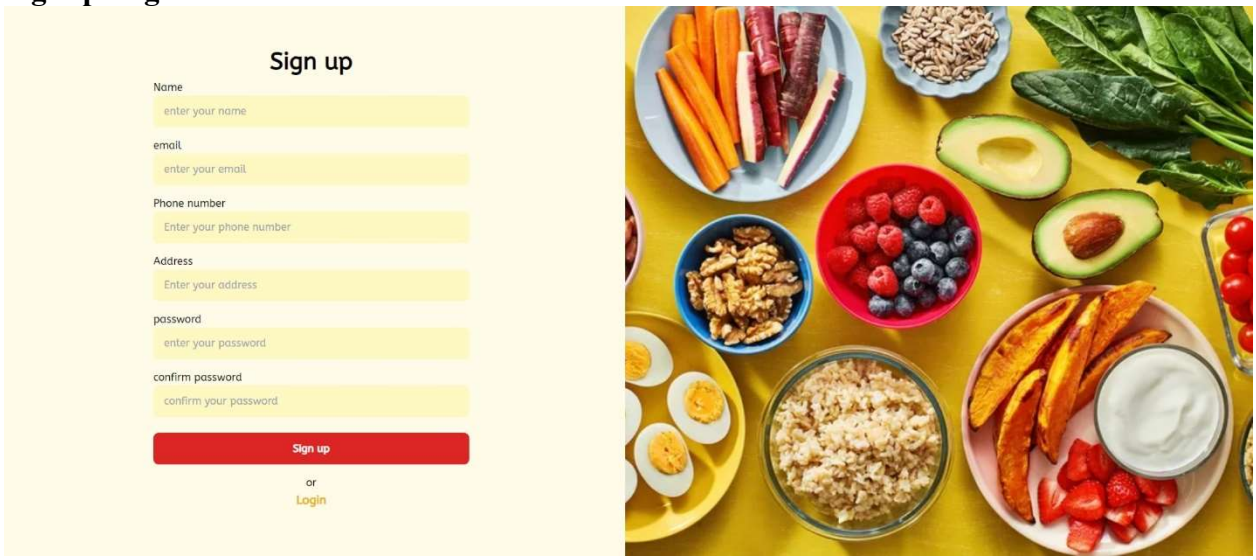


Figure 11 Signup Page

Home page (User) Available Foods

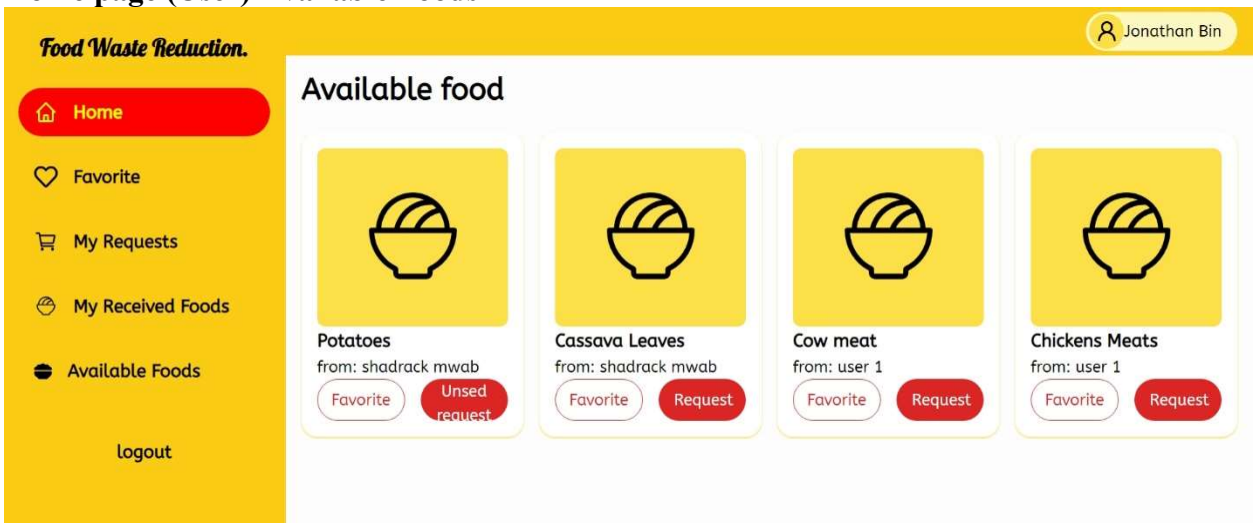


Figure 12 Available Foods

Donor Dashboard

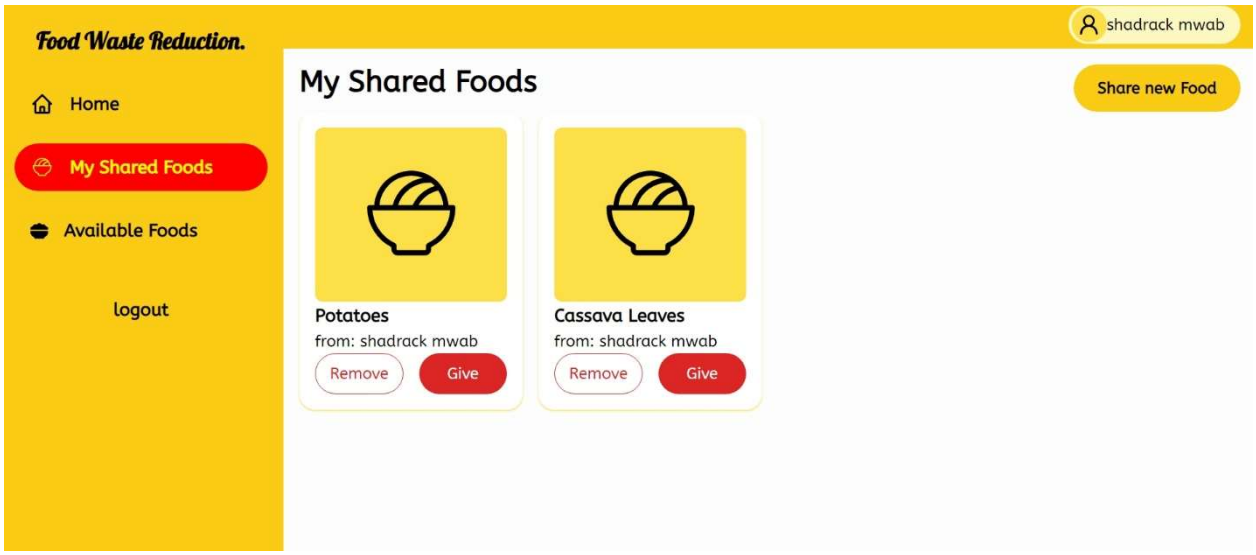


Figure 13 Donor Dashboard

Share new Food

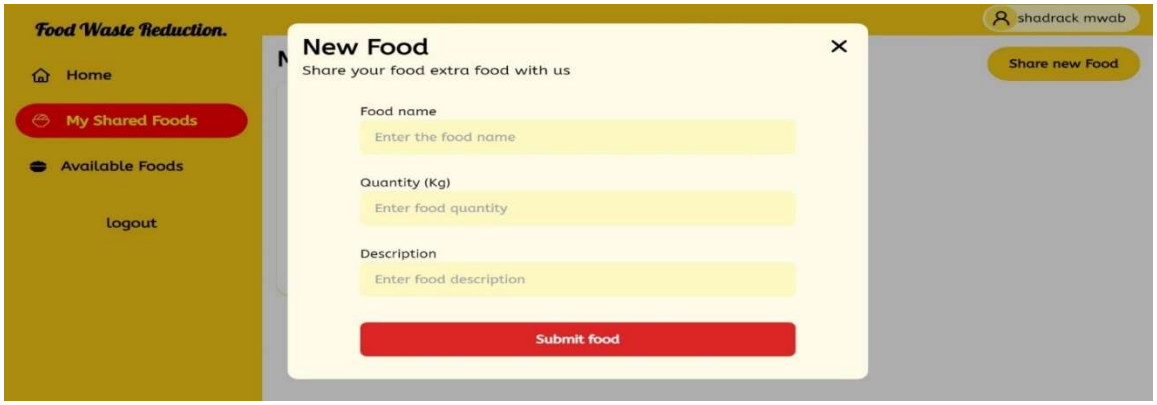


Figure 14 Share new Food

Donated Food Detail

Figure 15 Food details

New Food Request

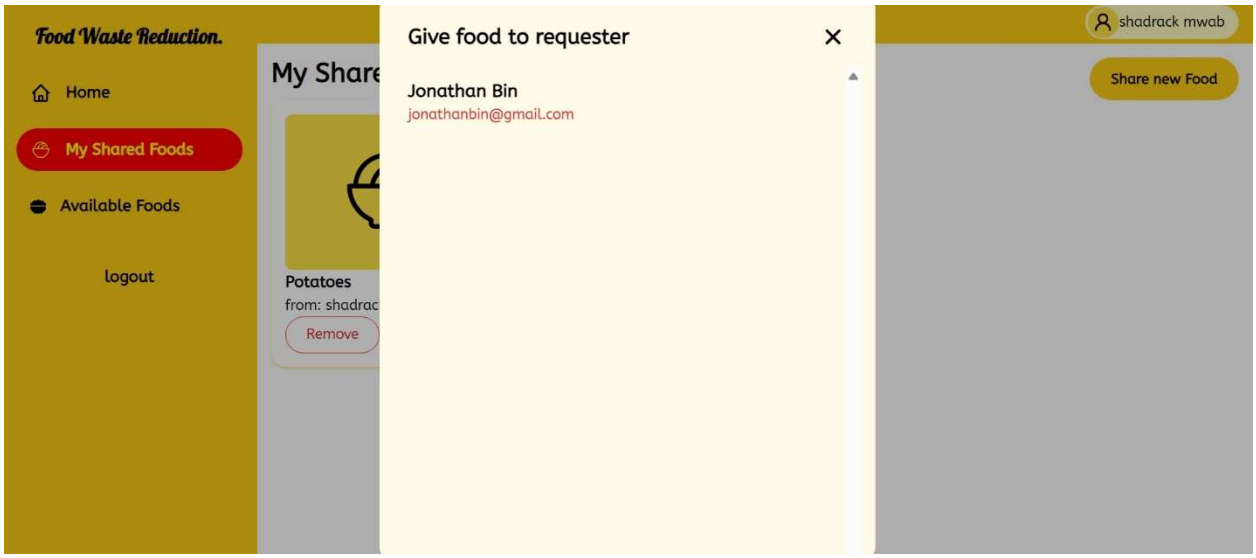


Figure 16 New Food Request

Received Foods on (User Interface)

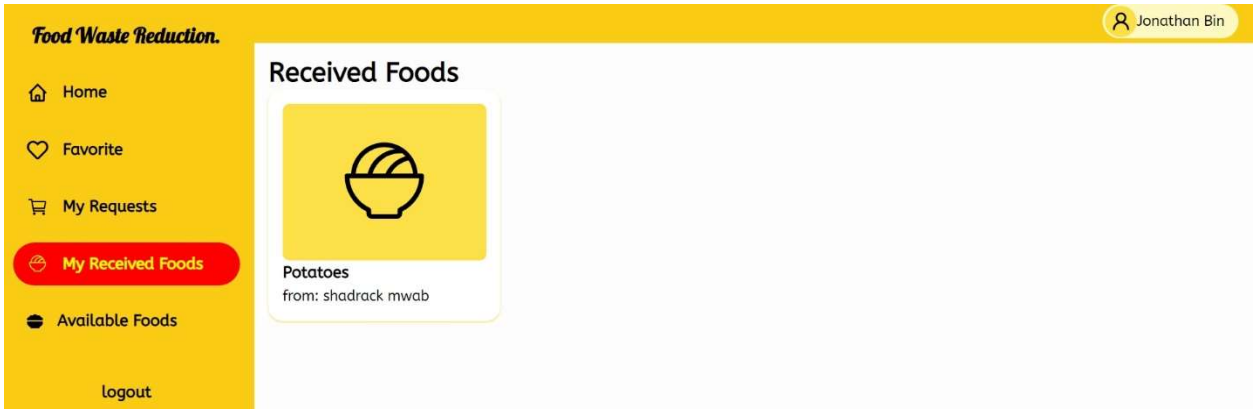


Figure 17 received foods

Request Foods

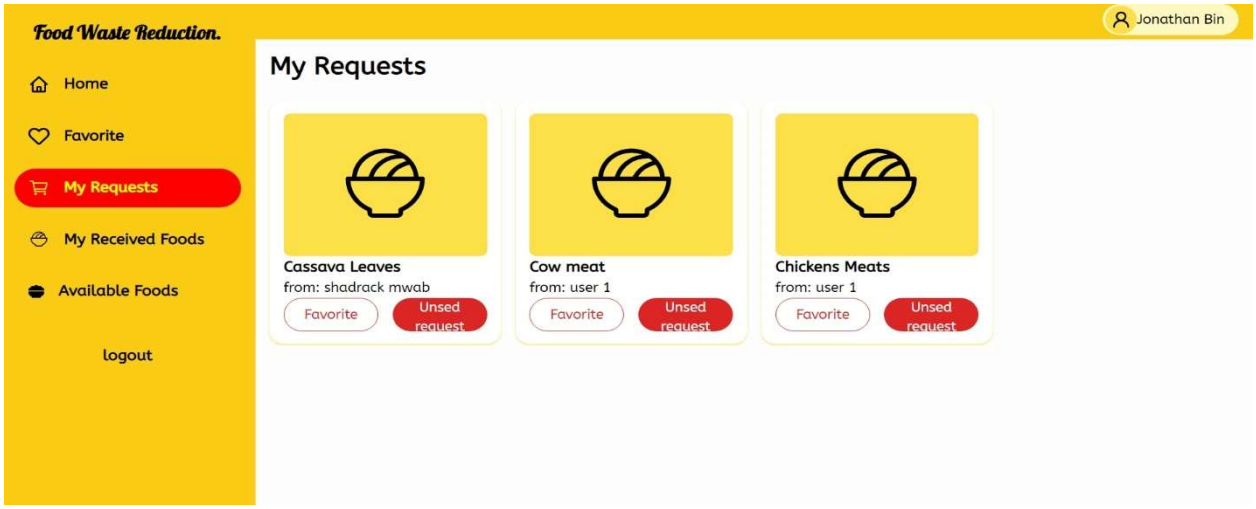


Figure 18 My Request Foods

4.2 Testing

4.2.1 Introduction

Testing is an essential phase in the development of the Online Food Excess Reduction System to ensure its functionality, performance, and user experience. This section outlines the different types of testing performed, including unit testing, validation testing, integration testing, functional and system testing, and acceptance testing. These testing phases ensure that the system operates as intended and meets the requirements of all stakeholders.

4.2.2 Unit Testing Outputs

Unit testing focuses on individual components of the system, ensuring that each function and module operates correctly in isolation. The tests target specific functionalities, such as form validation, database queries, and API responses.

Table 3 Unit testing

No	Description	Test result
1	Login	PASS
2	Dashboard	PASS
3	Available Foods	PASS
4	My request	PASS
5	My received foods	PASS

4.2.3 Validation Testing Outputs

Validation testing ensures that the system's input and output data meet the required standards and constraints. It checks that user inputs, such as food donation details or user credentials, are properly validated and handled by the system.

Table 4 Validation testing

No	Description	Test result
1	Give	PASS
2	Favorite	PASS
3	Logout	PASS
4	Share Foods	PASS
5	Send Foods	PASS

4.2.4 Integration Testing Outputs

Integration testing verifies that the different modules of the system (User, Admin, and Delivery Person modules) work seamlessly together. This ensures proper communication between the frontend and backend via RESTful APIs.

Output:

- Successful integration between user donation submission and admin dashboard for viewing donations.
- Verified smooth data flow between delivery assignment and tracking.

4.2.5 Functional and System Testing

Functional testing ensures that the system's features, as defined in the requirements, function as expected. System testing evaluates the overall system performance, covering both functional and non-functional aspects.

Output:

- Functional testing of user registration, donation tracking, and admin operations passed.
- System-wide testing of performance and data integrity across modules completed successfully.

4.2.6 Acceptance Testing Report

Acceptance testing focuses on verifying that the system meets the business requirements and user needs. This phase involves end users interacting with the system to determine if it performs according to their expectations.

Output:

- User acceptance tests confirmed that the system meets all functional requirements.
- Admins and delivery personnel successfully navigated the system and validated key features such as donation management and delivery tracking.

These outputs demonstrate that the system has undergone rigorous testing to ensure quality, performance, and reliability across all modules.

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The Online Food Excess Reduction Platform successfully addressed the issue of food Waste in Goma by connecting food donors with recipients, facilitating efficient food redistribution, and raising awareness about the importance of reducing food Excess. The platform's user-friendly interface and robust features contributed to its widespread adoption and positive impact on the community.

5.2 Recommendations

To further enhance the platform's impact, it is recommended to explore partnerships with local businesses and organizations to increase food donations and expand the reach of the platform. Additionally, integrating real-time tracking and delivery optimization features could improve the efficiency of food distribution.

5.3 Future Work

Future research could focus on assessing the long-term sustainability of the platform, exploring the potential for generating revenue through partnerships or advertising, and investigating the platform's impact on reducing greenhouse gas emissions and promoting sustainable agriculture.

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- Too Good To Go. (2021). Too Good To Go App. Too Good To Go.
- WHO. (2020). Malnutrition. World Health Organization.
- Investment Analysis and Portfolio Management (Sonargaon University)

Appendices:

```
import React, { useEffect, useState } from "react";
import SidebarAndTopBar from "../components/SidebarAndTopBar";
import YellowRoundedButton from "../components/YellowRoundedButton";
import NewFood from "../popups/NewFood";
import FoodItem from "../components/FoodItem";
import { useDispatch, useSelector } from "react-redux";
import { getAvailableFoods } from "../redux/slices/foodsSlice";

const AvailableFoods = () => {
  const dispatch = useDispatch();
  const [isSharingFood, setIsSharingFood] = useState(false);
  const { availableFoods } = useSelector((state) => state.foods);
  const { currentUser } = useSelector((state) => state.user);
  useEffect(() => {
    dispatch(getAvailableFoods());
  }, []);
  return (
    <SidebarAndTopBar>
      {isSharingFood && (
        <NewFood closeHandler={() => setIsSharingFood(false)} />
      )}
      <div className="w-full flex justify-between">
        <h1 className="font-semibold text-3xl">Available Foods</h1>
        {currentUser?.role === "donor" && (
          <YellowRoundedButton
            name={"Share new food"}
            onClick={() => setIsSharingFood(true)}
          />
        )}
      </div>
      <div className="w-full grid grid-cols-4 gap-4 my-6">
        {availableFoods.map((food) => (
          <FoodItem food={food} key={food.id} />
        ))}
      </div>
    </SidebarAndTopBar>
  );
};

export default AvailableFoods;
```

```
import React, { useEffect, useState } from "react";
import SidebarAndTopBar from "../components/SidebarAndTopBar";
import YellowRoundedButton from "../components/YellowRoundedButton";
import NewDonor from "../popups/NewDonor";
import { useDispatch, useSelector } from "react-redux";
import { getDonors } from "../redux/slices/donorsSlice";

const Donors = () => {
  const dispatch = useDispatch();

  const [isAddingDonor, setIsAddingDonor] = useState(false);

  const { donors } = useSelector((state) => state.donors);

  useEffect(() => {
    dispatch(getDonors());
  }, []);

  return (
    <SidebarAndTopBar>
      {isAddingDonor && (
        <NewDonor closeHandler={() => setIsAddingDonor(false)} />
      )}
      <div className="w-full flex justify-between">
        <h1 className="font-semibold text-3xl">Donors</h1>
        <YellowRoundedButton
          name={"Add donor"}
          onClick={() => setIsAddingDonor(true)}
        />
      </div>
      {donors[0] && (
        <table className="w-full mt-6">
          <thead className="bg-yellow-400 h-[2.4rem] rounded-t-lg">
            <tr>
              <th className="pl-4 text-start">id</th>
              <th className="pl-4 text-start">name</th>
              <th className="pl-4 text-start">email</th>
              <th className="pl-4 text-start">phone number</th>
              <th className="pl-4 text-start">address</th>
            </tr>
          </thead>
          <tbody>
            {donors.map((donor, index) => {
              return (
                <tr
                  className={`border border-t-0 border-yellow-400 h-[2.4rem] ${
                    index % 2 !== 0 ? "bg-yellow-200" : ""
                  } hover:bg-yellow-300 hover:cursor-pointer`}
                >
                  <td className="pl-4">{donor.id}</td>
                  <td className="pl-4">{donor.name}</td>
                  <td className="pl-4">{donor.email}</td>
```

```
                <td className="pl-4">{donor.phone_number}</td>
                <td className="pl-4">{donor.address}</td>
              </tr>
            );
          })}
        </tbody>
      </table>
    )}
  </SidebarAndTopBar>
 );
};

export default Donors;
```

```
import React, { useEffect } from "react";
import SidebarAndTopBar from "../components/SidebarAndTopBar";
import { useDispatch, useSelector } from "react-redux";
import Claim from "../components/Claim";
import { getMyFavorites } from "../redux/slices/favoritesSlice";

const Favourites = () => {
 const dispatch = useDispatch();
 const { currentUser } = useSelector((state) => state.user);
 const { myFavorites } = useSelector((state) => state.favorites);

 useEffect(() => {
  dispatch(getMyFavorites({ user_id: currentUser.id }));
 }, [myFavorites.length]);
 return (
  <SidebarAndTopBar>
   <h1 className="font-semibold text-3xl">Favorites</h1>
   <div className="w-full grid grid-cols-4 my-6 gap-4">
    {myFavorites.map((favorite) => (
     <Claim claim={favorite} key={favorite.id} />
    ))}
   </div>
  </SidebarAndTopBar>
 );
};

export default Favourites;
```

```
import React, { useEffect, useState } from "react";
import SidebarAndTopBar from "../components/SidebarAndTopBar";
import { getAvailableFoods } from "../redux/slices/foodsSlice";
import { useDispatch, useSelector } from "react-redux";
import FoodItem from "../components/FoodItem";

const Home = () => {
  const dispatch = useDispatch();
  const { availableFoods } = useSelector((state) => state.foods);
  useEffect(() => {
    dispatch(getAvailableFoods());
  }, []);
  return (
    <SidebarAndTopBar>
      <h1 className="font-semibold text-3xl">Available food</h1>
      <div className="w-full grid grid-cols-4 gap-4 my-6">
        {availableFoods.map((food) => (
          <FoodItem food={food} />
        ))}
      </div>
    </SidebarAndTopBar>
  );
};

export default Home;


import React, { useEffect, useState } from "react";
import foodBg from "../assets/food-bg.png";
import TextInputWithLabel from "../components/TextInputWithLabel";
import ButtonHighLight from "../components/ButtonHighLight";
import { Link, useNavigate } from "react-router-dom";
import { useDispatch, useSelector } from "react-redux";
import { login } from "../redux/slices/userSlice";

const Login = () => {
  const dispatch = useDispatch();

  const navigate = useNavigate();

  const { currentUser } = useSelector((state) => state.user);
  const [email, setEmail] = useState("");
  const [password, setPassword] = useState("");

  const submitHandler = () => {
    const user = { email, password };
    dispatch(login({ user }));
  };

  useEffect(() => {
    if (!currentUser) return;
    navigate("/");
```

```
  }, [currentUser]);
  return (
    <div className="w-full h-[100vh] grid grid-cols-2 bg-[#facc15]">

      <div className="flex flex-col items-center justify-center">
        <h1 className="text-4xl font-semibold text-black" >Login</h1>
        <TextInputWithLabel
          placeholder={"enter your email"}
          label={"email"}
          onChange={(e) => setEmail(e.target.value)}
        />
        <TextInputWithLabel
          placeholder={"enter your password"}
          type="password"
          label={"password"}
          onChange={(e) => setPassword(e.target.value)}
        />
        <ButtonHighLight name={"Login"} onClick={submitHandler} />
        <p>or</p>

        <Link to={"/signup"}>
          <p className="text-lg font-semibold hover:underline text-white">
            sign up
          </p>
        </Link>
      </div>
      <img src={foodBg} alt="" className="w-full h-full object-cover" />
    </div>
  );
};

export default Login;

import React, { useEffect } from "react";
import SidebarAndTopBar from "../components/SidebarAndTopBar";
import { useDispatch, useSelector } from "react-redux";
import { getMyClaims } from "../redux/slices/claimsSlice";
import Claim from "../components/Claim";

const MyClaims = () => {
  const dispatch = useDispatch();

  const { myClaims } = useSelector((state) => state.claims);
  const { currentUser } = useSelector((state) => state.user);

  useEffect(() => {
    dispatch(getMyClaims({ user_id: currentUser.id }));
  }, []);

  return (
    <SidebarAndTopBar>
      <h1 className="font-semibold text-3xl">My Requests</h1>
      <div className="w-full grid grid-cols-4 gap-4 my-6">
```

```
        {myClaims.map((claim) => (
          <Claim claim={claim} key={claim.id} />
        ))}
      </div>
    </SidebarAndTopBar>
  );
};

export default MyClaims;

import React, { useEffect, useState } from "react";
import SidebarAndTopBar from "../components/SidebarAndTopBar";
import YellowRoundedButton from "../components/YellowRoundedButton";
import NewFood from "../popups/NewFood";
import { useDispatch, useSelector } from "react-redux";
import { getSharedFoods } from "../redux/slices/foodsSlice";
import FoodItem from "../components/FoodItem";

const MyFoods = () => {
  const dispatch = useDispatch();

  const [isSharingFood, setIsSharingFood] = useState(false);
  const { sharedFoods } = useSelector((state) => state.foods);
  const { currentUser } = useSelector((state) => state.user);

  useEffect(() => {
    dispatch(getSharedFoods({ id: currentUser.id }));
  }, []);
  return (
    <SidebarAndTopBar>
      {isSharingFood && (
        <NewFood closeHandler={() => setIsSharingFood(false)} />
      )}
      <div className="w-full flex justify-between">
        <h1 className="font-semibold text-3xl">My Shared Foods</h1>
        <YellowRoundedButton
          name={"Share new Food"}
          onClick={() => setIsSharingFood(true)}
        />
      </div>
      <div className="w-full grid grid-cols-4 gap-4">
        {sharedFoods.map((food) => (
          <FoodItem key={food.id} food={food} />
        ))}
      </div>
    </SidebarAndTopBar>
  );
};

export default MyFoods;
import React, { useEffect } from "react";
import { useSelector } from "react-redux";
import { useNavigate } from "react-router-dom";
```

```
const NotFound = () => {
  const navigate = useNavigate();
  const { currentUser } = useSelector((state) => state.user);
  useEffect(() => {
    if (currentUser) return;
    navigate("/login");
  }, [currentUser]);
  return (
    <div className="h-full w-full flex items-center justify-center flex-col">
      <p className="font-bold text-4xl text-red-500">404</p>
      <p>Page not found</p>
    </div>
  );
};

export default NotFound;
import React, { useEffect } from "react";
import SidebarAndTopBar from "../components/SidebarAndTopBar";
import { useDispatch, useSelector } from "react-redux";
import { getReceivedFoods } from "../redux/slices/foodsSlice";
import FoodItem from "../components/FoodItem";

const ReceivedFoods = () => {
  const dispatch = useDispatch();

  const { currentUser } = useSelector((state) => state.user);
  const { receivedFoods } = useSelector((state) => state.foods);

  useEffect(() => {
    dispatch(getReceivedFoods({ receiver_id: currentUser.id }));
  }, []);

  useEffect(() => {
    console.log(receivedFoods);
  }, [receivedFoods]);

  return (
    <SidebarAndTopBar>
      <h1 className="font-semibold text-3xl">Received Foods</h1>
      <div className="w-full grid grid-cols-4 gap-4">
        {receivedFoods.map((food) => (
          <FoodItem food={food} key={food.id} />
        ))}
      </div>
    </SidebarAndTopBar>
  );
};

export default ReceivedFoods;

import React, { useEffect } from "react";
import SidebarAndTopBar from "../components/SidebarAndTopBar";
```

```
import { useDispatch, useSelector } from "react-redux";
import { getReceivers } from "../redux/slices/receiversSlice";

const Receivers = () => {
  const dispatch = useDispatch();

  const { receivers } = useSelector((state) => state.receivers);

  useEffect(() => {
    dispatch(getReceivers());
  }, []);

  return (
    <SidebarAndTopBar>
      <div className="w-full flex justify-between">
        <h1 className="font-semibold text-3xl">Receivers</h1>
      </div>
      {receivers[0] && (
        <table className="w-full mt-6">
          <thead className="bg-yellow-400 h-[2.4rem] rounded-t-lg">
            <tr>
              <th className="pl-4 text-start">id</th>
              <th className="pl-4 text-start">name</th>
              <th className="pl-4 text-start">email</th>
              <th className="pl-4 text-start">phone number</th>
              <th className="pl-4 text-start">address</th>
            </tr>
          </thead>
          <tbody>
            {receivers.map((receiver, index) => {
              return (
                <tr
                  className={`border border-t-0 border-yellow-400 h-[2.4rem] ${
                    index % 2 !== 0 ? "bg-yellow-200" : ""
                  } hover:bg-yellow-300 hover:cursor-pointer`}
                >
                  <td className="pl-4">{receiver.id}</td>
                  <td className="pl-4">{receiver.name}</td>
                  <td className="pl-4">{receiver.email}</td>
                  <td className="pl-4">{receiver.phone_number}</td>
                  <td className="pl-4">{receiver.address}</td>
                </tr>
              );
            })}
          </tbody>
        </table>
      )}
    </SidebarAndTopBar>
  );
};

export default Receivers;
```

```
import React, { useEffect, useState } from "react";
import foodBg from "../assets/food-bg.png";
import TextInputWithLabel from "../components/TextInputWithLabel";
import ButtonHighLight from "../components/ButtonHighLight";
import { Link, useNavigate } from "react-router-dom";
import { signUp } from "../redux/slices/userSlice";
import { useDispatch, useSelector } from "react-redux";

const SignUp = () => {
  const dispatch = useDispatch();
  const navigate = useNavigate();

  const { currentUser } = useSelector((state) => state.user);

  const [name, setName] = useState("");
  const [email, setEmail] = useState("");
  const [password, setPassword] = useState("");
  const [confirmPassword, setConfirmPassword] = useState("");
  const [address, setAddress] = useState("");
  const [phoneNumber, setPhoneNumber] = useState("");
  const [error, setError] = useState("");

  const submitHandler = () => {
    setError("");
    if (
      name === "" ||
      email === "" ||
      password === "" ||
      confirmPassword === "" ||
      address === "" ||
      phoneNumber === ""
    ) {
      setError("All fields are required");
      return;
    }

    if (password !== confirmPassword) {
      setError("Confirm password doesn't match with password");
      return;
    }
    dispatch(
      signUp({
        user: {
          email,
          name,
          password,
          role: "receiver",
          address,
          phone_number: phoneNumber,
        },
      })
    );
```

```
};

useEffect(() => {
  if (!currentUser) return;
  navigate("/");
}, [currentUser]);
return (
  <div className="w-full h-[100vh] grid grid-cols-2 bg-yellow-50">
    <div className="flex flex-col items-center justify-center">
      <h1 className="text-4xl font-semibold">Sign up</h1>
      <TextInputWithLabel
        placeholder={"enter your name"}
        label={"Name"}
        onChange={(e) => setName(e.target.value)}
      />
      <TextInputWithLabel
        placeholder={"enter your email"}
        label={"email"}
        type="email"
        onChange={(e) => setEmail(e.target.value)}
      />
      <TextInputWithLabel
        placeholder={"Enter your phone number"}
        label={"Phone number"}
        onChange={(e) => setPhoneNumber(e.target.value)}
      />
      <TextInputWithLabel
        placeholder={"Enter your address"}
        label={"Address"}
        onChange={(e) => setAddress(e.target.value)}
      />
      <TextInputWithLabel
        placeholder={"enter your password"}
        type="password"
        label={"password"}
        onChange={(e) => setPassword(e.target.value)}
      />
      <TextInputWithLabel
        placeholder={"confirm your password"}
        type="password"
        label={"confirm password"}
        onChange={(e) => setConfirmPassword(e.target.value)}
      />
      <p className="text-red-600">{error}</p>
      <ButtonHighLight name={"Sign up"} onClick={submitHandler} />
      <p>or</p>
      <Link to={"/login"}>
        <p className="text-lg font-semibold hover:underline text-yellow-500">
          Login
        </p>
      </Link>
    </div>
    <img src={foodBg} alt="" className="w-full h-full object-cover" />
```

```
    </div>
  );
};
```

export default SignUp;

Time Frame

The time frame for the Online Food Excess Reduction System project is divided into several phases to ensure systematic development, testing, and deployment. Each phase includes specific activities and milestones to track progress and ensure timely completion. The overall project duration is estimated to be 12 months.

Table 5 Time Frame

Phase	Duration	Tasks
Phase 1: Planning and Requirement Analysis	Month 1-2	Initial project kickoff and stakeholder meetings. Detailed requirement gathering and documentation. Finalizing project scope and objectives. Approval of project plan and requirements by all stakeholders.
Phase 2: Design and Development	Month 3-6	System architecture design and database schema development. Frontend design (HTML, CSS, JavaScript, React js, Tailwind CSS) and prototyping. Backend development (a RESTful Ruby on Rails API) and integration with PostgreSQL database. Development of User Module functionalities. Development of Administrator Module functionalities. Development of Donor Person Module functionalities.
Phase 3: Testing and Quality Assurance	Month 7-8	Unit testing of individual components. Integration testing of the entire system. System testing and debugging. User Acceptance Testing (UAT) with pilot users.
Phase 4: Pilot Deployment and Feedback	Month 9-10	Initial deployment in selected pilot regions. Monitoring system performance and collecting user feedback. Analyzing feedback and making necessary improvements.
Phase 5: Full Deployment	Month 11-12	Refinement of system based on pilot feedback. Full deployment in all targeted regions. Training sessions for users and stakeholders. Official launch and ongoing support setup.
Ongoing Maintenance and Support	Post-launch	Continuous monitoring, maintenance, and periodic updates based on user feedback and technological advancements.