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Dissertation

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Design and Implementation of a Digital Platform for Food Surplus Redistribution

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Dedication

Toumache Hibeterrahmane:

I dedicate this work with deep love and gratitude to my beloved father Allah yrahmo, whose memory continues to inspire me every day. His values, sacrifices, and prayers will always remain a guiding light in my life. To my dear mother, thank you for your endless love, patience, and unconditional support. You have always been my source of strength and motivation throughout this journey.

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Abstract

In response to the growing issue of food waste and ongoing food insecurity, this final year project proposes a digital solution aimed at facilitating the redistribution of food surplus. The developed platform connects donors and beneficiaries through a simple interface including request management, real-time notifications, and geolocation. Existing solutions were analyzed to identify their limitations and to propose a more efficient approach. This project contributes to improving resource distribution and strengthening social solidarity.

Résumé

Face à l'augmentation du gaspillage alimentaire et à la persistance de l'insécurité alimentaire, ce projet de fin d'études propose une solution numérique visant à faciliter la redistribution des surplus alimentaires. La plateforme développée permet de mettre en relation les donateurs et les bénéficiaires à travers une interface simple intégrant la gestion des demandes, les notifications en temps réel et la géolocalisation. L'analyse des solutions existantes a permis d'identifier leurs limites et de proposer une approche plus efficace. Ce projet contribue ainsi à optimiser la distribution des ressources et à renforcer la solidarité sociale.

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General Introduction

Food waste has become a major global issue with serious environmental, economic, and social consequences. Every year, large quantities of food are discarded across the supply chain, from production to consumption. At the same time, a significant portion of the population suffers from food insecurity and lacks access to sufficient nutrition. This paradox highlights a fundamental imbalance in the management and distribution of food resources.

In urban environments, food surplus is commonly generated by restaurants, supermarkets, bakeries, and catering services. These establishments often produce more food than they can sell or use, leading to waste despite the food being still safe for consumption. On the other hand, charitable organizations and vulnerable populations face difficulties in accessing consistent food supplies. This situation reveals the need for efficient systems capable of connecting food providers with those in need.

Traditional food redistribution methods are often manual, fragmented, and inefficient. Communication between stakeholders relies on informal processes, which leads to delays, lack of coordination, and loss of valuable resources. In addition, the absence of real-time information and geographic optimization limits the effectiveness of redistribution efforts.

With the rapid development of digital technologies, new solutions can be designed to address these challenges. Digital platforms provide a powerful means of connecting users, managing data, and enabling real-time interactions. By integrating geolocation technologies and automated processes, it becomes possible to create efficient systems for managing food surplus and reducing waste.

The main objective of this project is to design and implement a food surplus redistribution platform that facilitates the interaction between donors and beneficiaries. The platform aims to allow businesses to declare surplus food, enable associations to identify and claim available resources, and ensure efficient coordination of redistribution activities. By doing so, the system contributes to reducing food waste and improving social impact.

This report is organized into four main chapters. Chapter 1 presents the fundamental concepts related to food waste, digital platforms, and geolocation systems. Chapter 2 analyzes existing solutions. Chapter 3 describes the design of the proposed system, and Chapter 4 presents the implementation and results. Finally, a general conclusion summarizes the work and outlines future perspectives.

Chapter 1

General Concepts

1.1 Introduction

The problem of food waste has become increasingly critical in modern societies. At the same time, technological advancements have enabled new approaches to resource management and coordination. This chapter presents the fundamental concepts necessary for understanding the development of a food surplus redistribution platform.

1.2 Food Waste and Its Impact

1.2.1 Definition

Food waste refers to the disposal of food that is still suitable for human consumption [**6**]. It occurs at various stages of the supply chain, including production, distribution, and consumption.

1.2.2 Environmental Impact

Food waste contributes significantly to environmental degradation. The production of food requires natural resources such as water, land, and energy. When food is wasted, these resources are also wasted. Additionally, decomposing food produces greenhouse gases that contribute to climate change [**21**].

1.2.3 Economic Impact

Food waste represents a financial loss for businesses and society. Producers, distributors, and retailers lose revenue on unsold products, while municipalities incur additional costs for waste management [**12**].

1.2.4 Social Impact

Food waste exists alongside food insecurity. Many individuals lack access to sufficient food, while large quantities are discarded. Improving redistribution systems can help reduce this imbalance [**6**].

1.2.5 Food Waste in Algeria

Food waste in Algeria is a serious problem. According to AND, the country throws away about 900 million baguettes annually [**1**], costing USD 320 million [**2**]. This worsens during Ramadan, with an extra 100 million baguettes wasted [**3**].

The main causes are overconsumption, lack of awareness [**4**], and poor inventory management. Bread and bakery products cause the biggest loss (USD 94 million, 31%) [**13**].

The Algerian Ministry of Commerce launched a campaign to fight waste, but no proper digital platform exists. This gap motivated our FoodShare platform [**14**].

1.3 Circular Economy

1.3.1 Definition

The circular economy is a model that aims to minimize waste and maximize resource efficiency. It promotes reuse, recycling, and sustainable consumption [**7**].

1.3.2 Application to Food Systems

In food systems, the circular economy encourages the redistribution of surplus food instead of disposal. This approach extends the lifecycle of products and reduces waste.

1.4 Digital Platforms

1.4.1 Definition

A digital platform is a system that connects different users and facilitates interaction between them. Platforms enable efficient exchange of information and resources [**16**].

1.4.2 Role in Redistribution

Digital platforms allow real-time communication between donors and beneficiaries. They centralize data and improve coordination, making redistribution more efficient.

1.5 Geolocation Systems

1.5.1 Definition

Geolocation technologies determine the physical location of users or objects. These technologies include GPS and web-based mapping systems [**22**].

1.5.2 Applications

In a redistribution platform, geolocation helps identify nearby donors and beneficiaries, optimize matching, and reduce transportation time.

1.6 Logistics and Coordination

1.6.1 Importance

Logistics is essential for transporting and distributing food efficiently. Proper coordination ensures that food reaches beneficiaries quickly [**5**].

1.6.2 Challenges

Food redistribution faces challenges such as limited shelf life, transportation constraints, and coordination between multiple actors.

1.6.3 Digital Solutions

Digital platforms can improve logistics by automating processes, providing real-time updates, and optimizing routes.

1.7 Conclusion

This chapter introduced the fundamental concepts related to food waste, circular economy, digital platforms, geolocation, and logistics. These concepts provide the theoretical foundation for analyzing existing solutions in the next chapter.

Chapter 2

Analysis of Existing Systems

2.1 Introduction

Food waste has emerged as a major global issue with significant social, economic, and environmental consequences. To address this challenge, several digital platforms have been developed to facilitate the redistribution of surplus food between donors and beneficiaries. This chapter presents and critically analyzes existing food redistribution platforms in order to better understand their functionalities and to identify the limitations and challenges associated with their use. This analysis provides a basis for defining the key objectives and requirements of the proposed FoodShare platform.

2.2 Study of Existing Systems

We have analyzed three of the most representative platforms in the field of food waste reduction.

2.2.1 Too Good To Go

Is a mobile application launched in 2016 to fight food waste by connecting users with restaurants, bakeries, supermarkets, and stores that have surplus unsold food. The platform allows customers to purchase food at reduced prices instead of letting it go to waste, helping both businesses and consumers while reducing environmental impact.



Figure 2.1: Too Good To Go

Table 2.1: Strengths and Limitations

Strengths	**Limitations**
Large user base (over 50 million users).	Does not target charitable organizations.
Simple and intuitive interface.	Based on selling, not donating food.
Effective in reducing waste at the consumer level.	No request management system (acceptance/rejection).
	No real-time notifications for donors.
	No impact tracking dashboard.

2.2.2 Olio

Is a free mobile application designed to reduce food waste by connecting neighbors and local businesses to share surplus food and household items with people nearby instead of throwing them away. The platform allows users to give away or request items easily while promoting sustainability and community support.



Figure 2.2: Olio

Table 2.2: Strengths and Limitations

Strengths	**Limitations**
Promotes community solidarity and mutual help.	No professional donor and beneficiary structure.
Simple and user-friendly interface.	No request validation or verification process.
Helps reduce food waste.	Lack of an admin dashboard for supervision.
Allows direct communication between users.	Limited control over the quality and safety of shared items.
Free and accessible to all users.	Limited monitoring and tracking features.

2.2.3 Food Rescue US

Is a nonprofit platform dedicated to reducing food waste and fighting hunger by connecting food donors with local volunteers and social service agencies. The platform organizes the collection and redistribution of surplus food from restaurants, grocery stores, and other businesses to people in need through a simple and efficient rescue system.



Figure 2.3: Food Rescue us

Table 2.3: Strengths and Limitations

Strengths	**Limitations**
Targets associations and charitable organizations.	Requires volunteers for logistics.
Includes impact measurement.	No real-time notifications via WebSocket.
	No integrated request management.
	Complex onboarding process.

2.3 Comparative Analysis

The following table presents a comparative analysis between existing food redistribution platforms and our platform based on several important criteria.

Table 2.4: Comparative Analysis of Existing Platforms and FoodShare

Criteria	**Too Good To Go**	**Olio**	**Food Rescue US**	**Our Platform FoodShare**
Target Audience	Individuals	Individuals & Communities	Associations & Volunteers	Donors & Associations
Business Model	Selling surplus food	Free sharing	Food donation redistribution	Food surplus redistribution
Geolocation	Yes	Yes	Yes	Yes (PostGIS)
Real-time Notifications	Push notifications only	Limited	No	Bidirectional notifications (Socket.IO)
Request Management	No	Limited	No	Accept/Reject requests
Impact Tracking	No	Limited	Limited	Meals saved
Admin Dashboard	No	No	Limited	Full admin dashboard
Donor/Beneficiary Roles	No	No	Partial	Clearly separated roles

2.4 Critique of Existing Systems

Based on our analysis, we identify the following limitations common to existing platforms[**18**].

Critiques:

1. **Lack of Request Management :** Most platforms do not allow donors to accept or reject beneficiary requests[**8**]. Once a donation is posted, the first person to claim it gets it, without any validation process.

2. **No Real-time Notifications :** Only Too Good To Go offers push notifications, but they are not bidirectional[**17**]. Donors are not notified when a request is made, and beneficiaries are not notified when a request status changes.

3. **Absence of Admin Dashboard :** None of the analyzed platforms provide an administrative interface to manage users, monitor activities, or generate reports[**10**].

4. **Limited Impact Tracking :** Most platforms do not track environmental impact (meals saved, CO avoided) or provide statistics to donors and beneficiaries[**19**].

5. **No Role Differentiation :** The distinction between donors (businesses) and beneficiaries (associations) is not clearly defined, leading to confusion and misuse[**19**].

2.5 The Proposed Solutions

We propose FoodShare, a digital platform for food surplus redistribution that addresses the gaps in existing solutions[**15**].

Objectives:

1. **Connect Donors and Beneficiaries :** Businesses (donors) can post surplus food, and associations (beneficiaries) can search and reserve available donations.

2. **Implement Real-time Notifications :** The system integrates real-time notifications using technologies such as Socket.IO to ensure fast and efficient communication between users.

3. **Request Management :** Donors have full control to accept or reject beneficiary requests, allowing them to choose the most suitable recipient[**8**].

4. **Geolocation and Map visualisation :** Donations are located using PostGIS [**9**], while OpenStreetMap is integrated to provide a clear visualization of donation locations and facilitate user navigation within the platform.

5. **Secure Authentication :** JWT-based authentication with role-based access control (Donor, Beneficiary, Admin).

2.6 Conclusion

This chapter presented an analysis of three existing food surplus redistribution platforms, Too Good To Go, Olio, and Food Rescue US, with the aim of identifying the limitations that may affect the efficiency of such systems. Based on this study, the FoodShare platform was proposed as a more comprehensive and practical solution addressing the identified shortcomings. The next chapter will focus on the design and modeling of the platform in preparation for its implementation.

Chapter 3

System Design

3.1 Introduction

This chapter presents the system design of *FoodShare*, a food redistribution platform. It details the global architecture, the conceptual structure of the database, and the interactions between users and the platform. The system is modeled through a set of UML diagrams, namely the use case diagram, activity diagram, and sequence diagram, each capturing a distinct aspect of the platform's behavior and structure. The chapter also describes the core functionalities implemented to ensure efficient management of food donations and distribution.

3.2 System Architecture Overview

Before detailing the models and diagrams used to specify the platform, this section provides a high-level overview of the system architecture. Figure 3.1 illustrates the main components of the application and the communication flow between the frontend, backend, and database.

As shown in Figure 3.1, the platform follows a client–server architecture. Three categories of users (donors, beneficiaries, and administrators) interact with the platform through a frontend interface developed using React.js.

The frontend communicates with the backend through HTTP requests, while the backend processes business logic and manages data persistence through a PostgreSQL database.

This architecture separates the frontend, backend, and database components of the system.This separation improves system organization and simplifies maintenance and development.

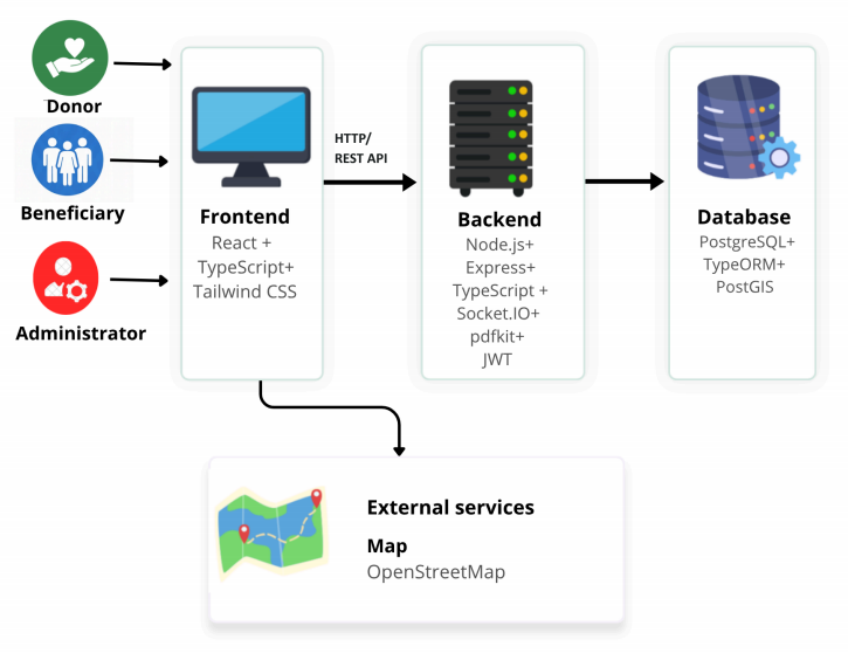


Figure 3.1: System Architecture

3.3 Functionalities

This section presents the main functionalities governing the operation and behavior of the FoodShare platform. These rules define the constraints and interactions between users, donations, and requests.

R1: A user may hold only one role: Donor, Beneficiary, or Administrator.

R2: Users may reset their password in case of password loss.

R3: A donor may publish one or multiple donations.

R4: A donation may be requested by multiple beneficiaries.

R5: Each donation must contain a food type, quantity, expiration date, and pickup address.

R6: The requested quantity must not exceed the available quantity of a donation.

R7: A donation status may be one of the following: *available*, *completed*, *expired*, or *cancelled*.

R8: A beneficiary may submit one or multiple donation requests.

R9: Only the donor is authorized to approve or reject requests.

R10: Approving a request decreases the available quantity of the corresponding donation.

R11: Users receive notifications related to donations and requests.

R12: Each donation must include a pickup address or GPS coordinates.

R13: Administrators may manage users and donations.

R14: Administrators may access platform statistics and reports.

3.4 Conceptual Data Model

The Conceptual Data Model (CDM) describes the main entities of the FoodShare platform, their attributes, and the relationships between them. It provides a representation of the system data structure before the physical database implementation.

The CDM contributes to organizing system data, ensuring consistency, and reducing redundancy within the database design.

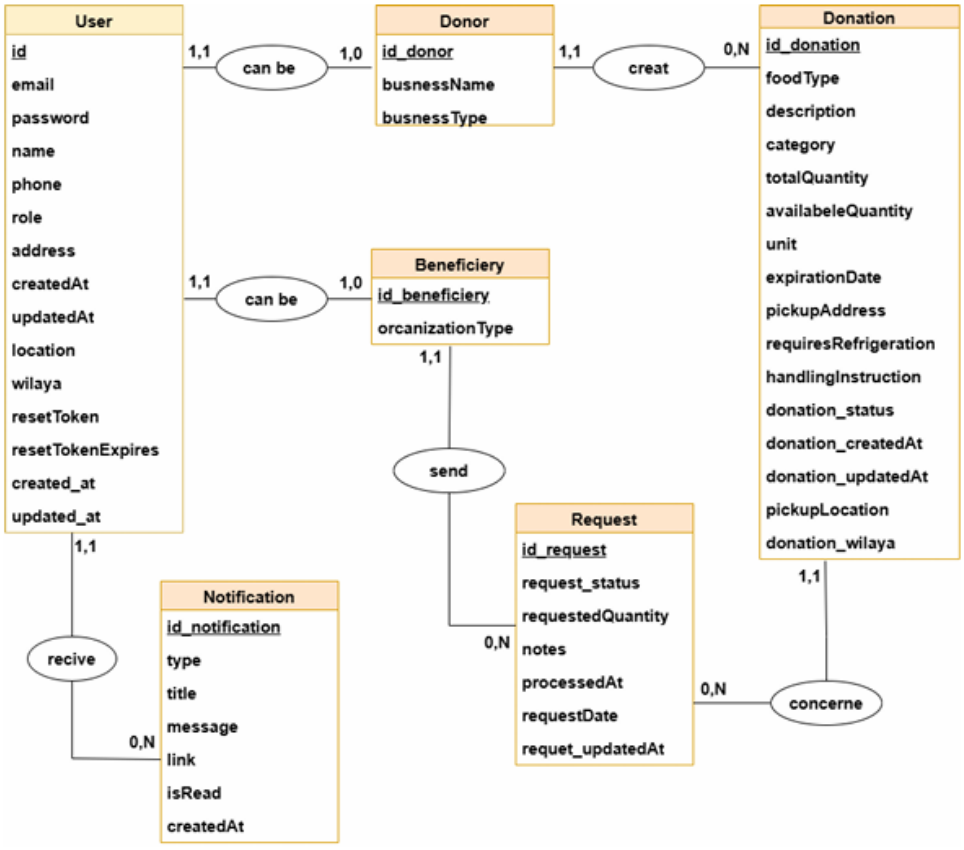


Figure 3.2: Conceptual Data Model of FoodShare

3.4.1 Entities

The following entities constitute the core data structure of the platform:

- **User**: Stores authentication and profile information for all platform users.
- **Donor**: Represents the donor profile associated with users who create food donation posts.
- **Beneficiary**: Represents the beneficiary profile associated with users who request donations.
- **Donation**: Represents food donations published by donors.
- **Request**: Represents requests submitted by beneficiaries for a specific donation.
- **Notification**: Stores notifications generated by the system for users.

3.4.2 Relationships and Cardinalities

The entities are interconnected through the following relationships:

Table 3.1: Relationships and Cardinalities

Relationship	**Cardinality**	**Description**
User → Donor	(1,1) – (0,1)	A user may optionally be a donor.
User → Beneficiary	(1,1) – (0,1)	A user may optionally be a beneficiary
User → Notification	(1,1) – (0,N)	A user may receive multiple notifications
Donor → Donation	(1,1) – (0,N)	A donor may create multiple donations
Beneficiary → Request	(1,1) – (0,N)	A beneficiary may submit multiple requests.
Donation → Request	(1,1) – (0,N)	A donation may receive multiple requests.

3.5 Use Case Diagram

The following use case diagram provides a complete overview of the functionalities available on the FoodShare platform. It clearly defines the external actors interacting with the system, their specific goals, and the relationships between the various use cases, such as <<include>> and <<extend>>.

System Actors

Use Case Diagram – FoodShare Platform

The figure below shows what users can do on the FoodShare platform. It focuses on the three main actors: the Donor, the Beneficiary, and the Administrator. Each one has different tasks, and the diagram helps us see the big picture before building the system.

Table 3.2: System Actors of FoodShare Platform

Actor	Description
Donor	Business, retailer, or individual who has a food surplus and wishes to donate it.
Beneficiary	Association, charity organization, or individual seeking to receive food.
Administrator	Person responsible for supervising and moderating the platform.

Common Features (All Users)

Once a user signs up, they can do the following things no matter their role:

- **Register or log in:** create an account and log in safely.
- **Manage profile:** update their name, phone, address, or email.
- **Reset password:** change their password if they forget it.
- **Receive notifications:** get real-time alerts about donations, requests, or account updates.

Donor

A donor can be a restaurant, bakery, supermarket, or anyone who has extra food and wants to give it away. In FoodShare, donors can:

- Post a new food surplus.
- Edit or delete their surplus listings.
- See who requested their donations.
- Accept or reject a request.
- Confirm when the food has been picked up.

Beneficiary

A beneficiary is usually an association, charity, or someone who needs food. They can use the platform to:

- Search for available donations by keyword, wilaya, or nearby location.
- Reserve a donation.
- View or cancel their reservations.
- Check the status of each request (pending, accepted, rejected, or collected).

Administrator

The administrator manages the platform by:

- Creating or deleting user accounts.
- Viewing statistics (donations, meals saved, active users).
- Exporting PDF reports.

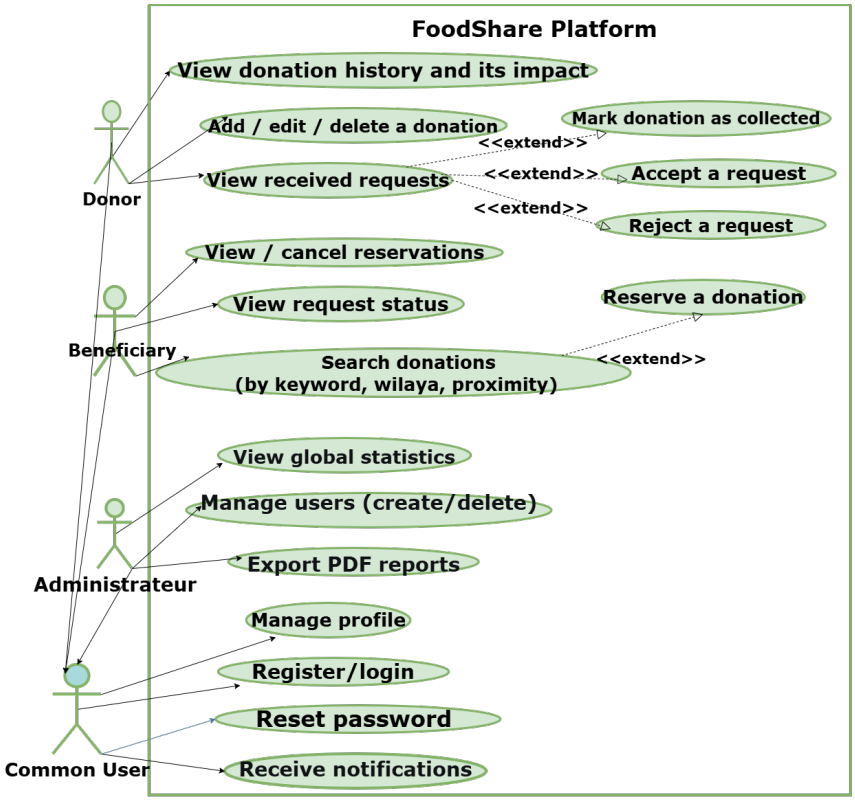


Figure 3.3: Use Case Diagram of the FoodShare Platform

Activity Diagram Explanation

1. The donor adds a donation. The system saves it and notifies nearby beneficiaries.
2. The beneficiary finds a donation and reserves it. The system creates a pending request and alerts the donor.
3. The donor accepts or rejects the request.
    - If accepted: status becomes APPROVED, the beneficiary is notified, and the available quantity is updated.
    - If rejected: status becomes REJECTED, the beneficiary is notified, and the process ends.
4. The beneficiary collects the donation using the pickup address provided.

5. The donor confirms the collection. The status changes to COLLECTED or COMPLETED, and the impact (meals saved, CO2 avoided) is updated.

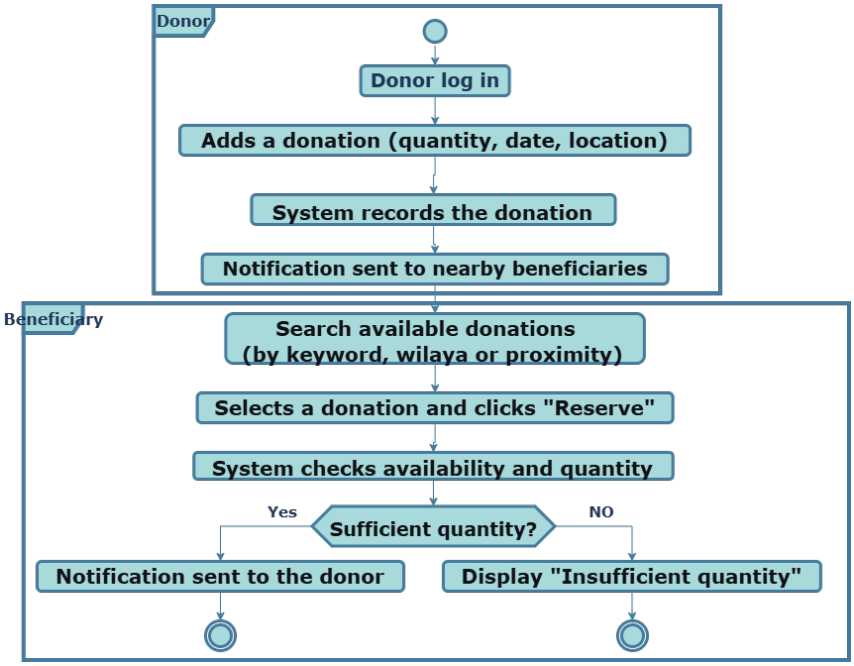


Figure 3.4: Activity Diagram – Donor adds donation and Beneficiary reserves

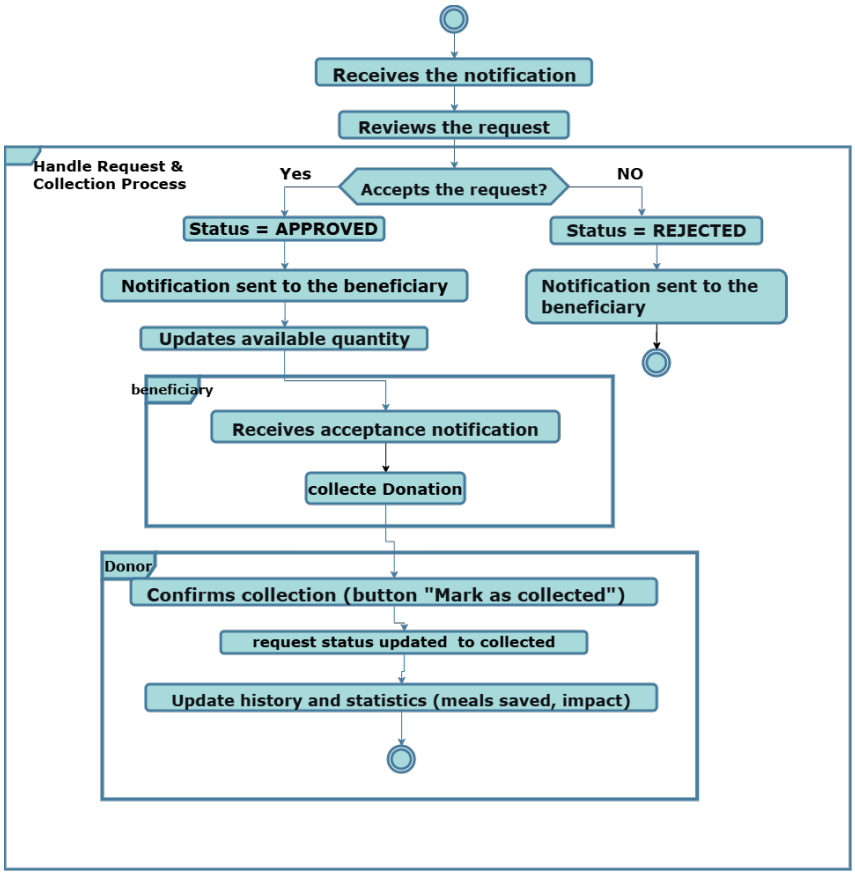


Figure 3.5: Activity Diagram – Donor accepts/rejects request and confirms collection

1. Sequence Diagram – Donor adds a donation

The donor fills out the donation form. The system saves it and notifies beneficiaries within 10km. A confirmation is sent to the donor.

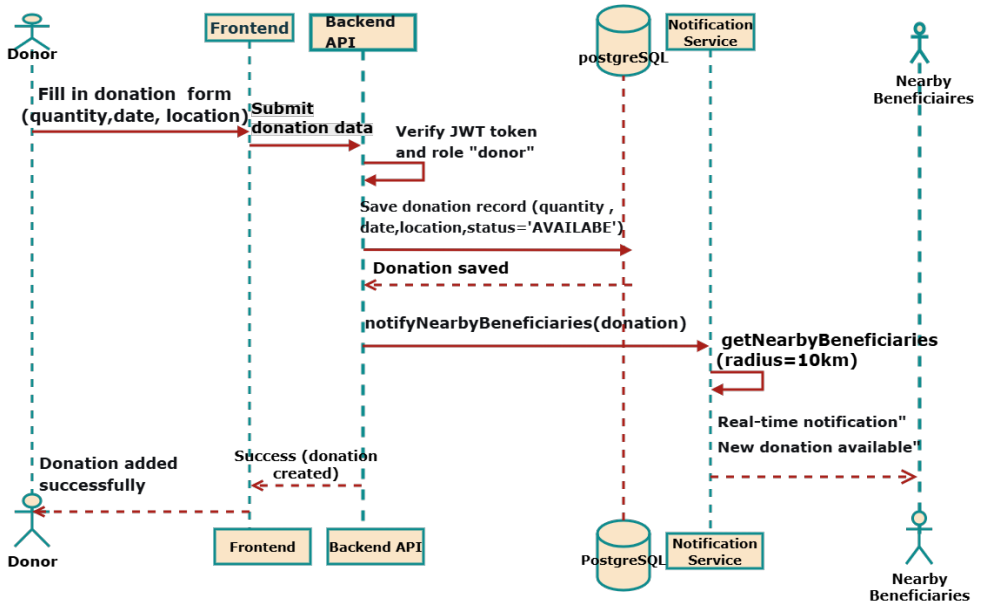


Figure 3.6: Donor creates a donation

2. Sequence Diagram – Donor accepts or rejects a request

The donor views pending requests and accepts or rejects. If accepted, the status becomes APPROVED, the quantity is updated, and the beneficiary is notified. If rejected, the status becomes REJECTED and the beneficiary is informed.

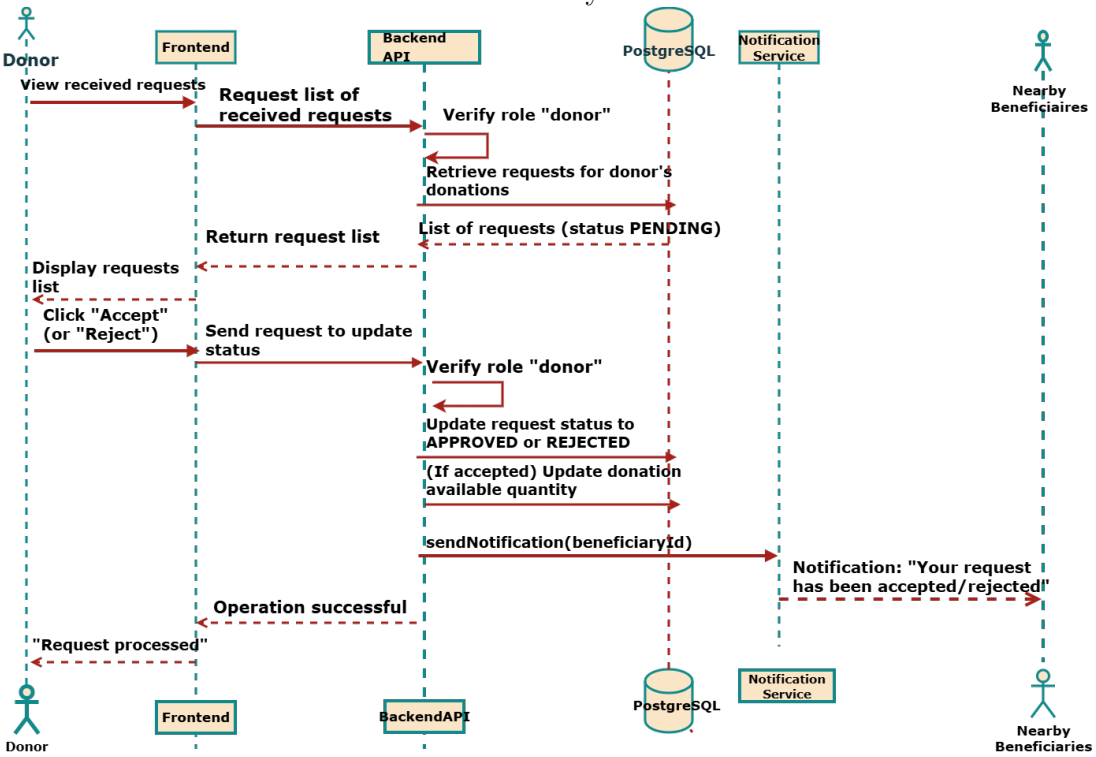


Figure 3.7: Donor handles a request

3. Sequence Diagram – Beneficiary reserves a donation

The beneficiary searches for available donations, selects one, and submits a request. The system checks the quantity. If available, a pending request is created, the quantity is updated, and the donor is notified. If not, an error message is returned.

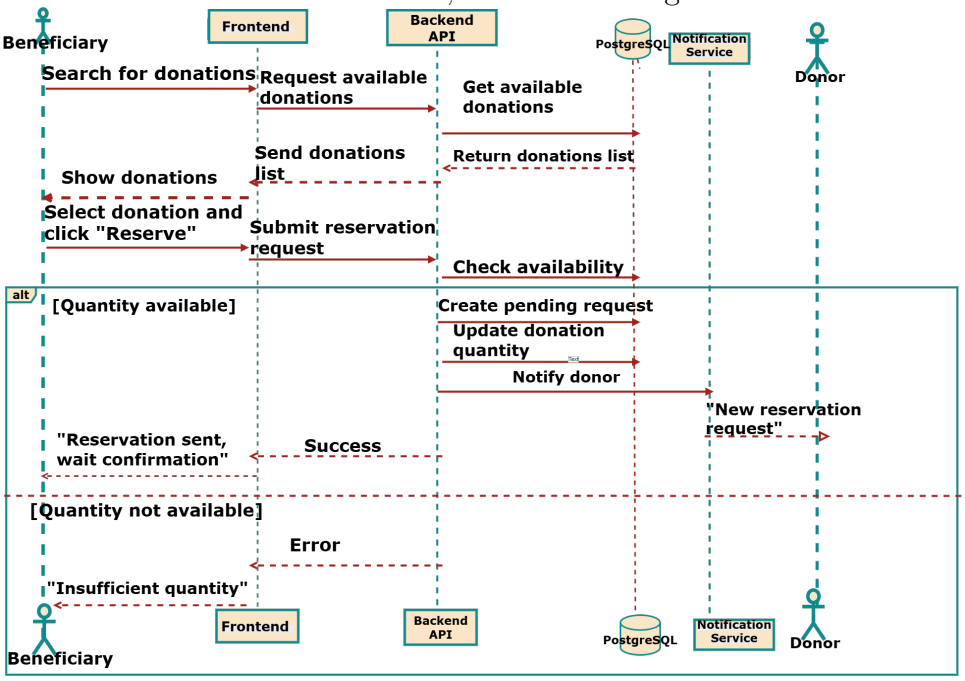


Figure 3.8: Beneficiary reserves a donation

4. Sequence Diagram – Beneficiary checks request status

The beneficiary goes to "My reservations". The system displays all requests with their status (PENDING, APPROVED, REJECTED, or COLLECTED).

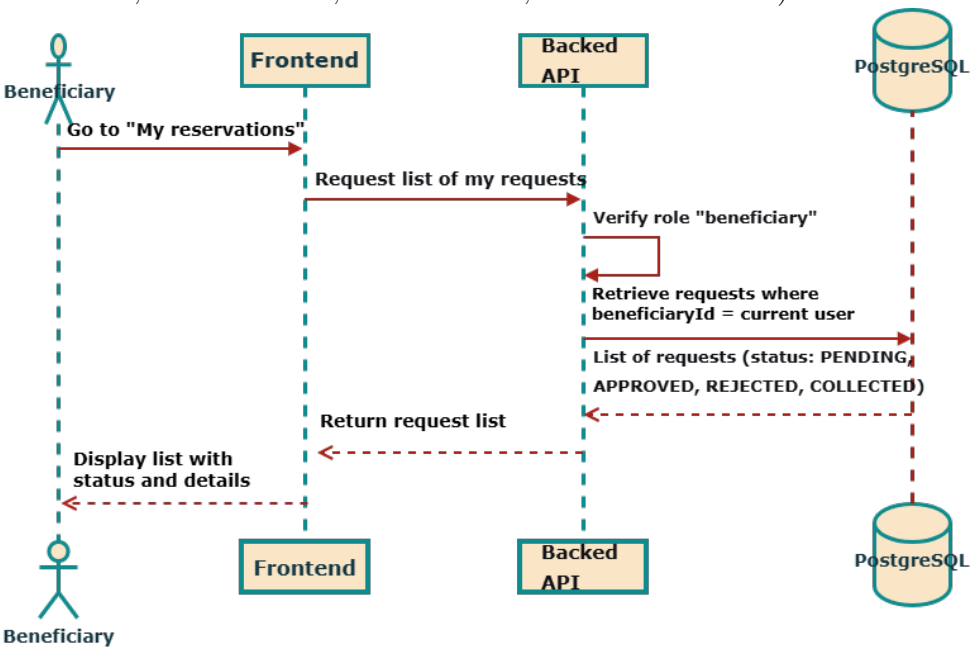


Figure 3.9: Beneficiary checks request status

5. Sequence Diagram – Administrator manages users

The admin creates or deletes a user. The system updates the database and confirms the operation.

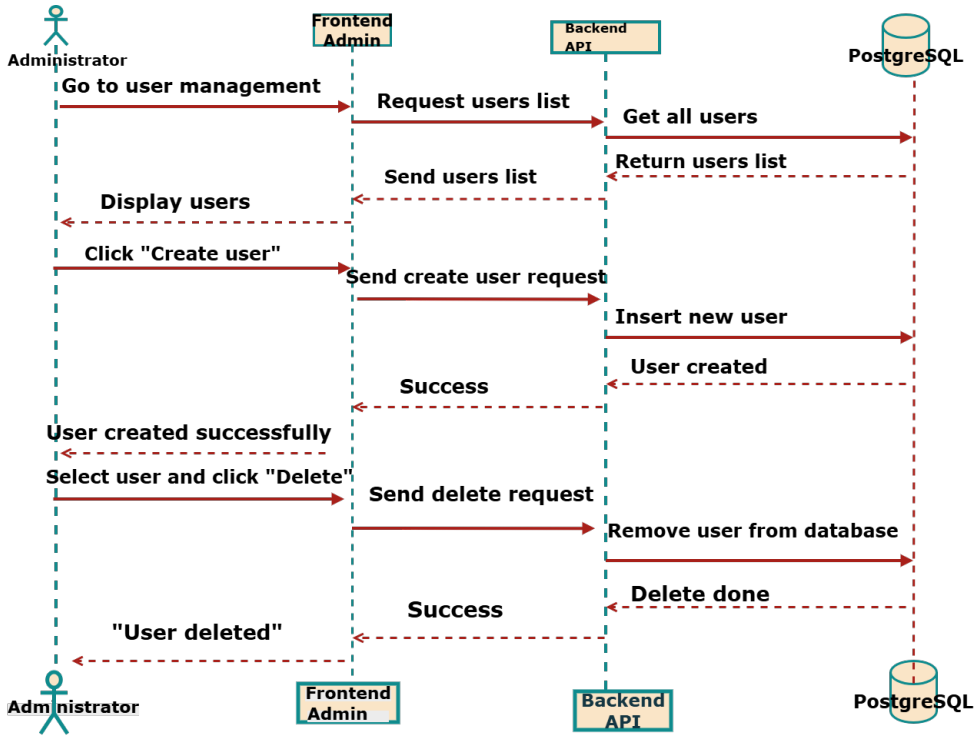


Figure 3.10: Administrator manages users

3.6 Conclusion

In this chapter, we presented the system architecture, data model, and UML diagrams (use case, activity, and sequence). This design phase prepares the implementation in the next chapter.

Chapter 4

System Implementation

4.1 Introduction

After completing the conceptual and analytical study presented in the previous chapters, the next phase of this project focuses on the implementation process, which represents a fundamental stage in the development of the proposed solution. This chapter presents the development environment adopted throughout the project, including the programming languages, frameworks, and technological tools utilized during the implementation phase. Furthermore, it concludes with a detailed presentation of the different interfaces composing the FoodShare platform.

4.2 Development Environment

Visual Studio Code: VS Code is a powerful integrated development environment (IDE) that allows developers to create, build, debug, test, and deploy applications in one place. This environment helped us improve productivity and ensure an efficient development process.



Figure 4.1: VScode

React: React is an open-source JavaScript library used for building interactive and dynamic user interfaces. In our platform, React was chosen for frontend development because of its component-based architecture, which improves code reusability, maintainability. It also provides high performance and responsiveness, making it suitable for developing a scalable interface that meets the project requirements.



Figure 4.2: React

Typescript: TypeScript is a strongly typed programming language built on JavaScript that improves code quality, readability, and maintainability. we used TypeScript in both frontend and backend development to reduce programming errors through static typing and better code organization.



Figure 4.3: Typescript

Tailwind CSS: Tailwind CSS was used in the frontend development to design responsive and modern user interfaces. Its utility-based approach simplified interface customization, improved design consistency, and contributed to a more maintainable and efficient development process.



Figure 4.4: Tailwind

Axios: Axios was used in the frontend development to manage communication with backend APIs. It facilitated efficient data exchange and simplified asynchronous request handling, contributing to improved application performance and reliability.



Figure 4.5: Axios

Socket.io: Socket.io is a JavaScript library that enables real-time and bidirectional communication between the client and the server.in our platform, Socket.IO was used in both frontend and backend development to support instant data exchange and real-time

notifications. It improves user interaction and ensures efficient communication within the application.



Figure 4.6: Socket.IO

Node.js: Node.js is a server-side JavaScript runtime environment used for developing scalable and efficient applications. Node.js was used in the backend development because of its high performance and ability to handle multiple requests asynchronously. It also facilitates fast data processing and ensures efficient communication between different system components.



Figure 4.7: Node.js

Express: Express.js is a lightweight and flexible web framework for Node.js used to develop server-side applications and APIs. Express.js was used in the backend development to simplify route management and handle client requests efficiently. It also improves application organization and facilitates the development of scalable and maintainable backend services.



Figure 4.8: Express

Thunder Client: Thunder Client is a lightweight extension integrated into Visual Studio Code used for testing HTTP requests and APIs. In the FoodShare platform, it was employed during both frontend and backend development to verify API endpoints and ensure proper data exchange between system components. It also simplified debugging processes and improved the efficiency and reliability of application testing and validation.



Figure 4.9: Thunder Client

JWT:JSON Web Token (JWT) is a secure method used for transmitting authentication and authorization information between systems in the form of encoded tokens. JWT was used to manage user authentication and secure access to protected resources. It ensures reliable session management and enhances application security during client-server communication.



Figure 4.10: Json web token

TypeORM: TypeORM is an Object-Relational Mapping (ORM) library for TypeScript and JavaScript used to interact with relational databases efficiently. we used TypeORM in the backend development to simplify database operations through object-oriented programming concepts. It also improves code maintainability, reduces query complexity, and facilitates database management within the application.



Figure 4.11: Typeorm

PostgreSQL: PostgreSQL was selected as the main database due to its reliability, ACID compliance, and extensibility through PostGIS. It offers advantages such as data integrity, concurrent access (MVCC), and support for spatial indexing. These features directly address the platform's requirements: managing complex relationships between users, donations, and requests, and enabling efficient geolocation-based searches for nearby food donations within a 10 km radius.



Figure 4.12: PostgresSQL

PostGIS: PostGIS is a spatial database extension for PostgreSQL that enables geographic object storage and location-based queries to manage and process geographic data such as user locations and nearby food distribution points. It improves the accuracy of location-based services and supports efficient spatial queries within the system[**11**].



Figure 4.13: PostGIS

GitHub: GitHub is the complete AI-powered developer platform to build, scale, and deliver secure software. It provides Git repository hosting with additional collaboration, automation, and security features.



Figure 4.14: GitHub

Draw.io: draw.io was used to design and visualize the system architecture and UML diagrams of the FoodShare platform during the design phase. It helped simplify the representation of system components and workflows, contributing to a clearer and more organized system design.



Figure 4.15: Draw.io

4.3 Presentation of the Interfaces

4.3.1 Home Page

The Home Page represents the main entry point of the platform. It is designed with a simple, clear, and intuitive interface. This interface highlights the essential information of the platform and provides quick access to the main features.

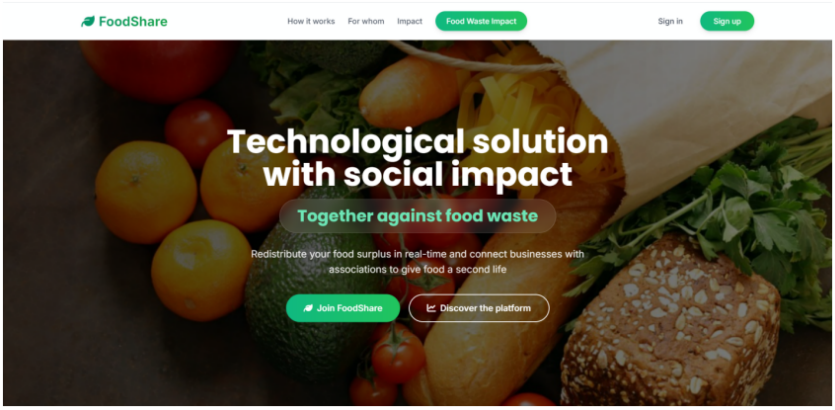


Figure 4.16: Home Page

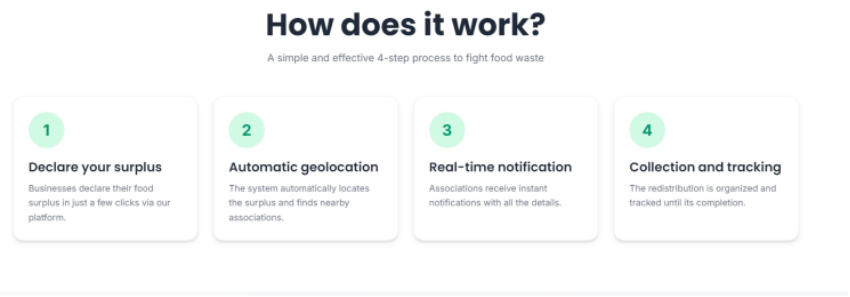


Figure 4.17: Home Page

4.3.2 Authentication Page:

The authentication interface ensures secure access to the FoodShare platform by requiring users to enter a valid email address and password before accessing their accounts. The backend verifies user credentials using JWT based authentication and encrypted password validation mechanisms. Once authenticated, users are granted access according to their role(Donor,Beneficiary). This mechanism enhances platform security and protects user data from unauthorized access.

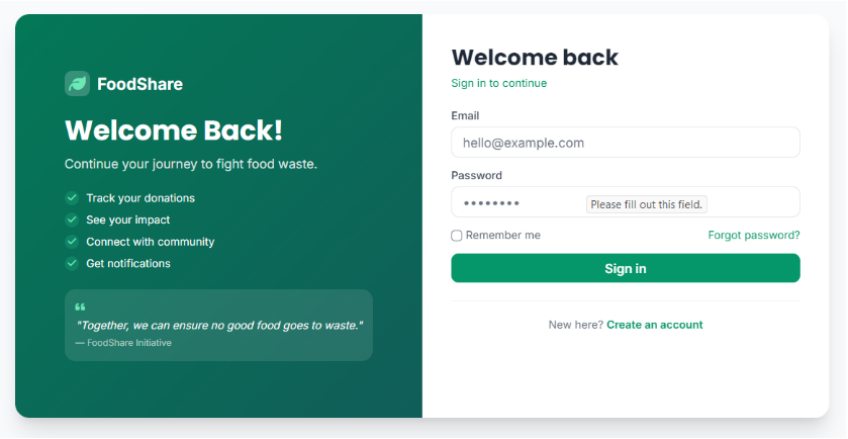


Figure 4.18: Authentication Interface

4.3.3 Registration

The registration interface is designed to allow new users to easily create an account by entering their personal information. It typically includes input fields. Once the user fills in all required fields, he can click the "Sign Up" button to submit his information and create an account.

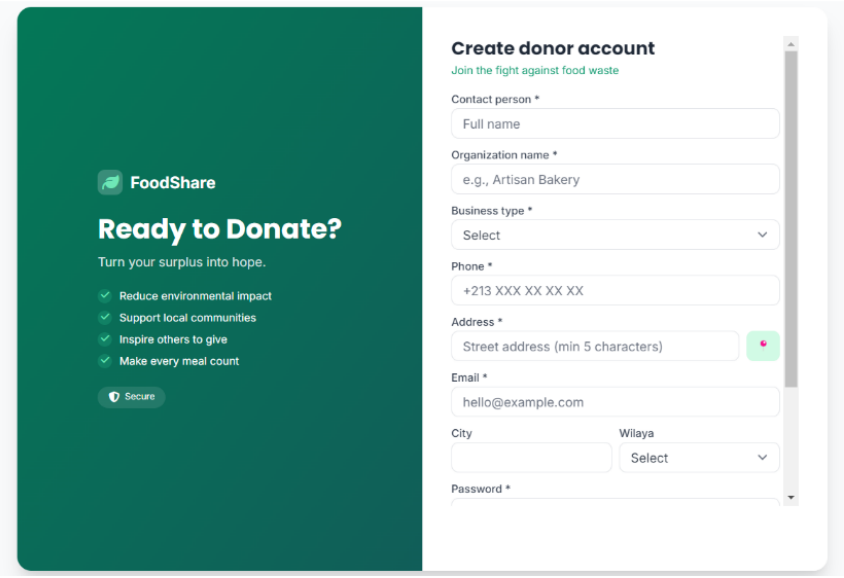


Figure 4.19: Registration - Donor

4.3.4 Donor

Donor Dashboard: after the donor successfuly creates an account or logs into the platform, this interface displayed, where the donor can manage his activities efficiently, including adding new donations, monitoring reservation requests, and access donation history. It also integrates a real-time notification system that facilitates communication between donors and beneficiaries, ensuring better coordination during the donation pro-

cess. The interface is designed with a simple and user-friendly structure to provide a smooth, efficient, and organized user experience.

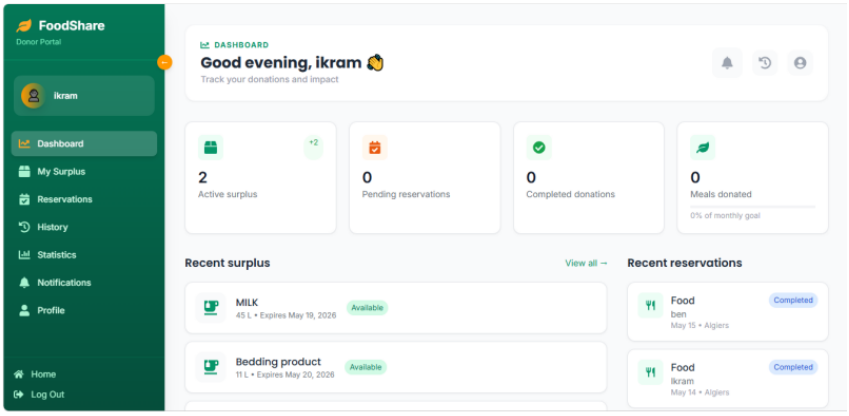


Figure 4.20: Donor - Dashboard

Add Surplus: This interface enables donors to publish food surplus by entering information such as food type, quantity, expiration date, and pickup address. The platform integrates a geolocation mechanism that automatically detects the donor's location and associates it with the appropriate wilaya. On the backend side, Node.js, Express.js, and TypeORM handle data validation, storage, and secure communication with the PostgreSQL/PostGIS database. Once the surplus is submitted, beneficiaries can view and reserve it in real time, while donors receive instant notifications through Socket.IO.

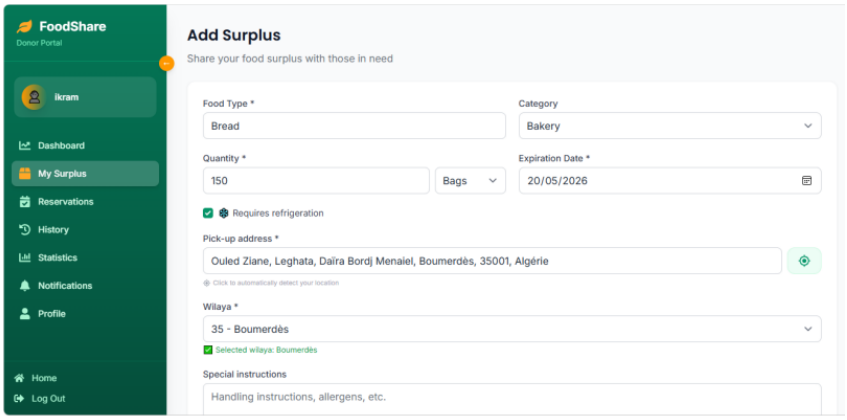


Figure 4.21: Donor - Add Surplus

4.3.5 Benefeciary

Benefeciary Dashboard: This interface represents the beneficiary dashboard of our platform. It provides beneficiaries with an overview of available food surplus, active reservations, completed orders, and social impact statistics. The dashboard also recommends nearby donations based on the user's location, facilitating faster access to available

resources. In addition, the integrated notification system enhances communication and improves the overall efficiency of the food redistribution process.

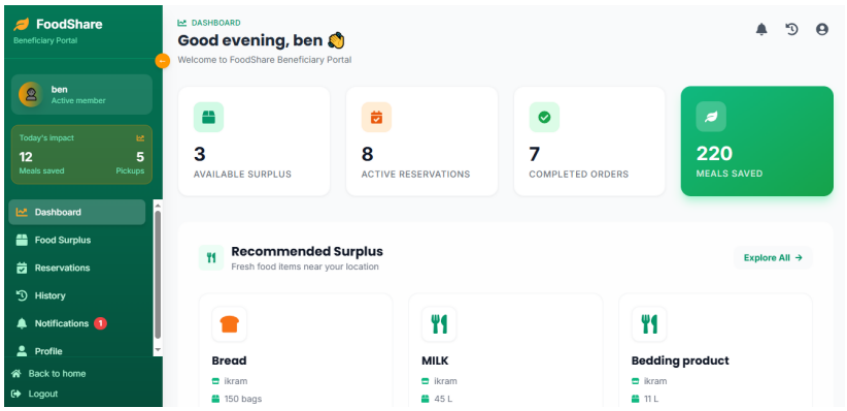


Figure 4.22: Beneficiary - Dashboard

Notification interface: This interface represents the notification system of the FoodShare platform. It relies on a real-time communication mechanism implemented using Socket.IO, allowing beneficiaries to instantly receive notifications whenever a donor adds a new food surplus. The backend processes and broadcasts these updates dynamically, ensuring fast synchronization between donors and beneficiaries. In addition, the interface displays reservation and request status updates, improving communication efficiency and enhancing the responsiveness of the redistribution process.

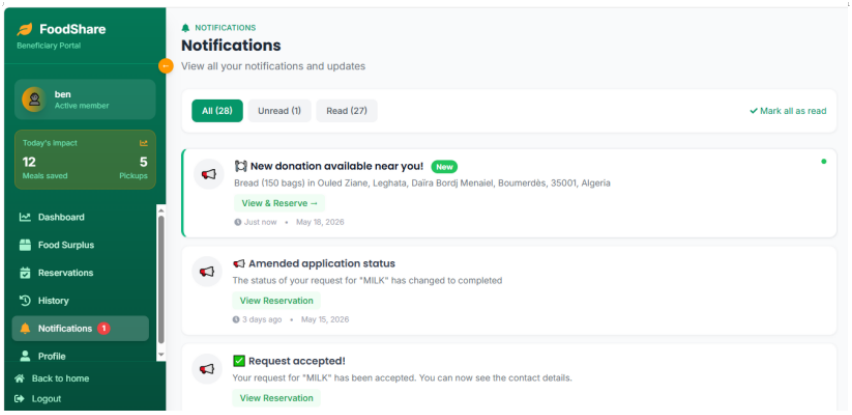


Figure 4.23: Beneficiary - Notification

Reservation Interface: Once the beneficiary clicks Confirm Reservation, the system sends a notification to the donor. When the donor accepts the request, the system automatically notifies the beneficiary of the acceptance, and the donor becomes able to collect the food from the designated pickup address. The backend validates the request against existing stock, updates the available amount in real time, and generates a reservation record linked to the beneficiary's profile. This workflow ensures transparent, real-time

visibility of donated surplus, mutual notification between donor and beneficiary, and efficient, traceable redistribution from donation to final pickup.

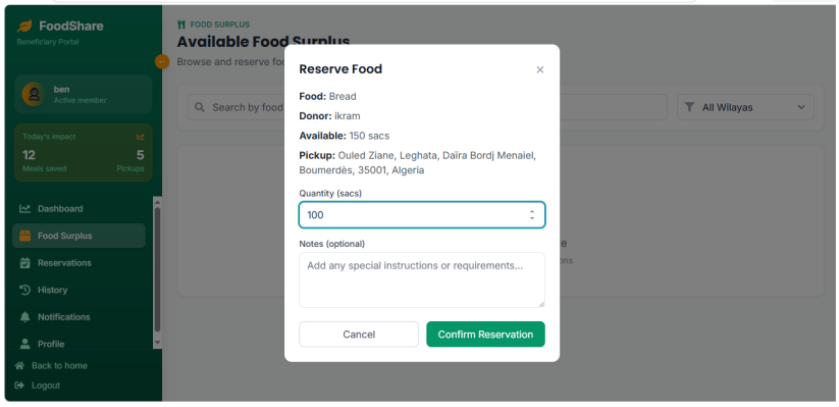


Figure 4.24: Beneficiary - Reservations

4.3.6 Admin

Admin Dashboard: The administrator dashboard provides a centralized interface for real-time platform monitoring. It displays key metrics (active users, donations, requests, and environmental impact). When a new user registers or a donation nears expiration (within 48 hours), the backend triggers automated notifications pushed to the frontend via WebSocket. The interface also supports on-demand PDF report generation using PDFKit, which streams the document directly to the client without page reload.

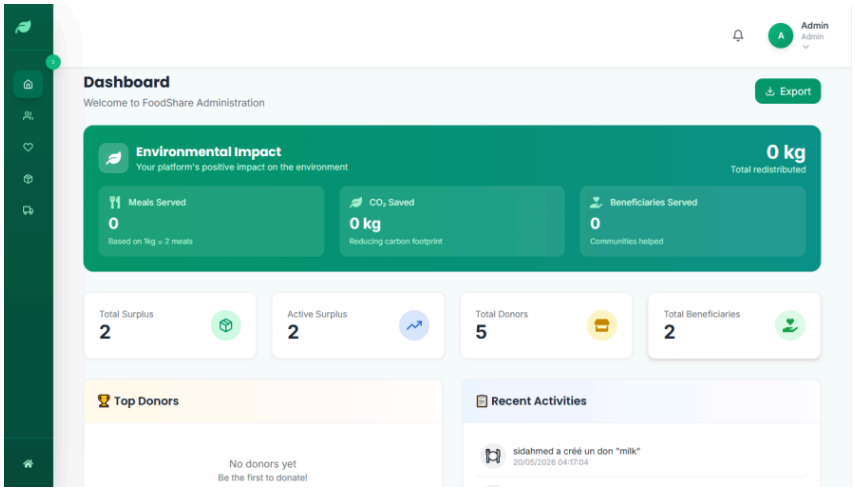


Figure 4.25: Admin - Dashboard

Add new user: Through this interface, the administrator can add new donors or beneficiaries, manage user accounts, and monitor donation activities within the system. The backend logic validates and stores user information securely using JWT authentication and PostgreSQL database management. This interface therefore ensures efficient user administration and maintains the reliability and organization of the FoodShare platform.

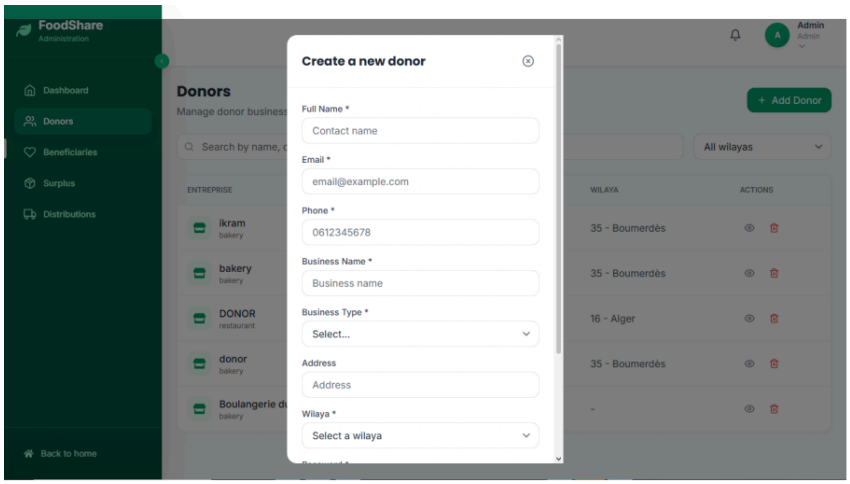


Figure 4.26: Admin - add new Donor

4.4 Conclusion

At the end of this chapter, the implementation process of the proposed solution was presented, along with the various technologies and development tools employed to achieve a functional version of the food surplus redistribution platform.

General Conclusion

Food waste represents one of the most pressing challenges faced by contemporary societies, given its significant environmental, economic, and social repercussions. Concurrently, a considerable number of individuals and charitable organizations continue to suffer from food insecurity and limited access to adequate nutrition. This contrast highlights the critical need for effective solutions capable of bridging the gap between food surplus sources and populations in need.

The objective of this project was to design and implement a digital platform, named FoodShare, dedicated to food surplus redistribution. The proposed system aims to enhance interaction between donors and beneficiaries through a user-friendly and efficient platform. By incorporating functionalities such as request management, real-time notifications, geolocation services, impact tracking, and an administrative dashboard, the platform addresses several limitations identified in existing solutions.

Throughout this work, the fundamental concepts related to food waste management, digital platform architectures, and geolocation technologies were studied. In addition, existing systems were analyzed in order to identify their strengths and limitations. Based on this analysis, a tailored solution was designed and implemented to meet the requirements of both donors and beneficiaries.

The developed platform contributes to the reduction of food waste, the optimization of resource distribution, and the reinforcement of social solidarity. Furthermore, the integration of modern web technologies such as Socket.IO and PostGIS enhances communication efficiency and enables advanced location-based services.

As future work, several enhancements may be considered, including the development of mobile applications, the integration of artificial intelligence-based recommendation systems, the implementation of advanced donation tracking mechanisms, and the extension of the platform to broader geographic areas. These improvements could further increase the system's efficiency, scalability, and overall social impact.

Bibliography

[1] Algerie360. *900 millions de baguettes de pain jetées par an : les influenceurs appelés à sensibiliser*. Mar. 6, 2024. URL: https://www.algerie360.com/.

[2] B. M. Beamon. "Measuring supply chain performance". In: *International Journal of Operations & Production Management* (1999).

[3] Ministère du Commerce et de la Promotion des Exportations. *Campagne nationale "Mobilisons-nous tous pour lutter contre le gaspillage"*. 2024.

[4] Agence Nationale des Déchets (AND). *Rapport sur le gaspillage alimentaire en Algérie*. 2023.

[5] Echorouk. *900 millions de baguettes sont jetées annuellement en Algérie*. Mar. 5, 2024. URL: https://www.echoroukonline.com/.

[6] FAO. *The State of Food and Agriculture 2019*. Food and Agriculture Organization, 2019.

[7] Ellen MacArthur Foundation. *Towards the Circular Economy*. 2015.

[8] FUSIONS. *Food Waste and Social Protection: The Role of Food Banks*. EU FUSIONS Project, 2015.

[9] H. C. J. Godfray et al. "Food Security: The Challenge of Feeding 9 Billion People". In: *Science* 327.5967 (2010), pp. 812–818.

[10] Build for Good. *Potluck - Digital Platform for Surplus Food Redistribution*. 2024. URL: https://www.build.gov.sg/.

[11] PostgreSQL Global Development Group. *PostgreSQL 15 Documentation*. 2023. URL: https://www.postgresql.org/docs/.

[12] J. Gustavsson et al. *Global Food Losses and Food Waste*. FAO, 2011.

[13] JGraph. *Draw.io: Free Online Diagram Software*. 2024. URL: https://www.draw.io.

[14] B. Lipinski et al. *Reducing Food Loss and Waste*. Tech. rep. World Resources Institute, 2013.

[15] J. Parfitt, M. Barthel, and S. Macnaughton. “Food waste within food supply chains: quantification and potential for change to 2050”. In: *Philosophical Transactions of the Royal Society B* 365.1554 (2010), pp. 3065–3081.

[16] G. Parker, M. Van Alstyne, and S. Choudary. *Platform Revolution*. W. W. Norton, 2016.

[17] S. A. B. R. Rahman et al. “After Stars: A Real-Time Food Donation and Redistribution Platform”. In: *Scilit* (2025).

[18] Centre de Recherche en Économie Appliquée (CREAD). *Étude sur les habitudes de consommation des ménages algériens*. 2024.

[19] D. Steele. “The Role of Food Donation in Reducing Food Waste”. In: *Journal of Food Law & Policy* 10.2 (2014), pp. 215–240.

[20] T. Tiemann and A. Fringe. “Digital Platforms for Food Donation: A Systematic Review”. In: *Journal of Humanitarian Logistics and Supply Chain Management* 8.3 (2018), pp. 342–367.

[21] UNEP. *Food Waste Index Report 2021*. United Nations Environment Programme, 2021.

[22] Y. Zheng and X. Zhou. “Computing with Spatial Trajectories”. In: *Springer*. 2011.