An Industrial Oriented Mini Project Report on

SMART FOOD REDISTRIBUTION APPLICATION

Submitted in Partial fulfillment of requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE AND ENGINEERING

By

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

KESHAV MEMORIAL INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

Accredited by NBA & NAAC, Approved by AICTE, Affiliated to JNTUH.

Narayanaguda, Hyderabad, Telangana-29

2025-26

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that this is a bonafide record of the project report titled **SMART FOOD REDISTRIBUTION APPLICATION** which is being presented as the **Industrial Oriented Mini Project** report in **IV year I Semester (RKR21)** by

1. **K VARSHITH KRISHNA** **22BD1A0554**

In partial fulfillment for the award of the degree of Bachelor of Technology in Computer Science and Engineering at Keshav Memorial Institute of Technology (An Autonomous Institution) Narayanaguda, affiliated to the Jawaharlal Nehru Technological University Hyderabad, Hyderabad

Faculty Supervisor
(Dr. S Archana)

Head of Department
(Mr. Para Upendar)

Submitted for Viva Voce Examination held on _____

External Examiner

Vision & Mission of KMIT

Vision of the Institution

- To be the fountainhead in producing highly skilled, globally competent engineers.
- Producing quality graduates trained in the latest software technologies and related tools and striving to make India a world leader in software products and services.

Mission of the Institution

- To provide a learning environment that inculcates problem solving skills, professional, ethical responsibilities, lifelong learning through multi modal platforms and prepares students to become successful professionals.
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- To provide exposure to students on the latest hardware and software tools.
- To promote research-based projects/activities in the emerging areas of technology convergence.
- To encourage and enable students to not merely seek jobs from the industry but also to create new enterprises.
- To induce a spirit of nationalism which will enable the student to develop, understand India's challenges and to encourage them to develop effective solutions.
- To support the faculty to accelerate their learning curve to deliver excellent service to students.

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Vision of the Department

To be among the region's premier teaching and research Computer Science and Engineering departments producing globally competent and socially responsible graduates in the most conducive academic environment.

Mission of the Department

- To provide faculty with state of the art facilities for continuous professional development and research, both in foundational aspects and of relevance to emerging computing trends.
- To impart skills that transform students to develop technical solutions for societal needs and inculcate entrepreneurial talents.
- To inculcate an ability in students to pursue the advancement of knowledge in various specializations of Computer Science and Engineering and make them industry-ready.
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- To cultivate responsibility through sharing of knowledge and innovative computing solutions that benefit the society-at-large.
- To collaborate with academia, industry and community to set high standards in academic excellence and in fulfilling societal responsibilities

PROGRAM OUTCOMES (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3. Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct Investigations of Complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern Tool Usage: Create select, and, apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The Engineer and Society: Apply reasoning informed by contextual knowledge to societal, health, safety. Legal und cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and

responsibilities and norms of the engineering practice.

PO9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: An ability to analyze the common business functions to design and develop appropriate Information Technology solutions for social upliftments.

PSO2: Shall have expertise on the evolving technologies like Python, Machine Learning, Deep learning, IOT, Data Science, Full stack development, Social Networks, Cyber Security, Mobile Apps, CRM, ERP, Big Data, etc.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To imbibe analytical and professional skills for successful careers and create enthusiasts to pursue advance education supplementing their career growth.

PEO2: Graduates will solve real time problems design, develop and implement innovative ideas by applying their computer engineering principles.

PEO3: Graduates will develop necessary skillset for industry by imparting state of art technology in various areas of computer science engineering.

PEO4: Graduates will engage in lifelong learning and be able to work collaboratively exhibiting high level of professionalism.

PROJECT OUTCOMES

P1: Accurately identify, classify, and validate food availability posted by donors using forms and optional AI-based image analysis.
P2: Allow NGOs, volunteers, restaurants, and farmers to access and manage their tasks or requests remotely through the web/mobile application.
P3: Update the status of food requests, volunteer tasks, and deliveries instantly across all user dashboards.
P4: Ensure the entire system operates seamlessly over the internet, supporting real-time communication, notifications, and GPS-based tracking.

MAPPING PROJECT OUTCOMES WITH PROGRAM OUTCOMES

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
P1	H	H	H	M		M			L	H	H	H
P2	H		H		M	M		L	H	H	H	H
P3	H	H		H	L	L		H	M	L	H	M
P4		H	H	M	L	H	M	L	M	H	H	H

L – LOW M –MEDIUM H– HIGH

PROJECT OUTCOMES MAPPING WITH PROGRAM SPECIFIC OUTCOMES

PSO	PSO1	PSO2
P1		
P2		
P3		
P4		

PROJECT OUTCOMES MAPPING WITH PROGRAM EDUCATIONAL OBJECTIVES

PEO	PEO1	PEO2	PEO3	PEO4
P1				
P2				
P3				
P4				

DECLARATION

I hereby declare that the results embodied in the dissertation entitled **Smart Food Redistribution Application** has been carried out by us together during the academic year 2025-26 as a partial fulfillment of the award of the B.Tech degree in Computer Science and Engineering from Keshav Memorial Institute of Technology (An Autonomous Institution) Narayanaguda, affiliated to JNTUH. We have not submitted this report to any other university or organization for the award of any other degree.

Student Name	Rollno.
1. K VARSHITH KRISHNA	22BD1A0554

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We take this opportunity to thank all the people who have rendered their full support to our project work. We render our thanks to **Dr. B L Malleswari**, Principal who encouraged us to do the Project.

We are grateful to **Mr. Neil Gogte**, Founder & Director, **Mr. S. Nitin,** Director for facilitating all the amenities required for carrying out this project.

We express our sincere gratitude to **Ms. Deepa Ganu**, Director Academic for providing an excellent environment in the college.

We are also thankful to **Mr. Para Upendar**, Head of the Department for providing us with time to make this project a success within the given schedule.

We are also thankful to our Faculty Supervisor **Dr. S. Archana**, for her valuable guidance and encouragement given to us throughout the project work.

We would like to thank the entire CSE Department faculty, who helped us directly and indirectly in the completion of the project.

We sincerely thank our friends and family for their constant motivation during the project work.

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ABSTRACT

Urban food waste and hunger often coexist, highlighting the urgent need for sustainable solutions that can transform surplus into support. This project proposes a Smart Food Redistribution Platform designed to minimize waste while combating hunger in local communities. The system creates a digital bridge between restaurants, caterers, farmers, and food producers with NGOs, volunteers, and community organizations, ensuring excess food is collected and redistributed quickly and responsibly.

Equipped with GPS-enabled tracking, intelligent routing, and real-time dashboards, the platform guarantees transparency, quality control, and accessibility across diverse users through multi-language support. Beyond daily redistribution, it supports emergency food relief during crises, promotes eco-friendly initiatives such as composting and community food fridges, and motivates participation through gamified volunteer engagement.

By turning wasted resources into nourishment, the project advances sustainability, strengthens community bonds, and contributes to the global fight against hunger.

Keywords:

Food Redistribution, Waste Management, Sustainability, Community Service, Smart System

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LIST OF FIGURES

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CHAPTER-1

1. INTRODUCTION

Food waste and hunger represent two of the most significant and persistent social challenges of the 21st century. While millions of people struggle to obtain sufficient and nutritious meals each day, a substantial amount of edible food is discarded by restaurants, hostels, supermarkets, events, caterers, and households. This imbalance highlights a critical need for systematic intervention to ensure that surplus food is efficiently redirected to those who need it most. The **Food Redistribution Application** is designed as a transformative digital solution that leverages technology to bridge this gap, reduce food waste, support vulnerable communities, and promote sustainable development.

The application serves as a centralized platform that connects **food donors**, **NGOs**, **volunteers**, and **administrators** within a single ecosystem. Donors can quickly upload details of surplus food, while NGOs can request or receive donations based on availability and need. A network of volunteers plays a crucial role in collecting and delivering food to respective beneficiaries, ensuring timely and safe redistribution. To enhance accuracy and ease of use, the system integrates modern features such as **GPS-based location tracking**, **smart routing**, **real-time notifications**, **multi-language accessibility**, and optional **AI-powered food recognition**. These features help streamline operations, promote transparency, and make the platform accessible to users from diverse backgrounds.

By adopting a user-centric design, the application focuses on delivering a simple and intuitive experience. Donors can list items within seconds, volunteers can accept tasks based on proximity, and NGOs can monitor food arrivals in real time. Administrators manage system operations, verify users, and generate analytical reports on community impact, enabling better planning and outreach. The platform also encourages **community participation** through volunteer reward systems, feedback mechanisms, and awareness-building around sustainable food practices.

Beyond daily redistribution, the application is built with the capability to support **emergency relief efforts** during natural disasters, public events, or crises, where immediate and large-scale food distribution becomes essential. This adaptive design allows the system to function effectively across both routine operations and high-demand situations.

In essence, the Food Redistribution Application demonstrates how digital innovation can address real-world social problems. It enables the efficient transformation of surplus resources into meaningful support for underserved populations. Through this project, the potential of technology to foster sustainability, reduce

waste, and build stronger, more compassionate communities becomes evident. The system not only mitigates food waste but also contributes to the global mission of ending hunger, aligning with the United Nations Sustainable Development Goals (SDG 2: Zero Hunger and SDG 12: Responsible Consumption and Production).

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1.1 Purpose of the Project

The purpose of the Food Redistribution Application is to:

- Reduce food waste by identifying and collecting surplus food from verified donors.
- Facilitate timely redistribution to NGOs, shelters, and individuals in need.
- Provide a transparent and reliable system for tracking donations, volunteer activities, and delivery progress.
- Encourage community participation through volunteer engagement and gamification.
- Promote sustainability through awareness, eco-friendly practices, and responsible food handling.

1.2 Problem with Existing Systems

Existing food-sharing and surplus-food platforms have limitations such as:

1. Consumer-focused models

- Apps like Too Good To Go focus on selling leftover food at discounted prices rather than distributing it to the needy.

2. Limited inclusion of NGOs & volunteers

- Most platforms do not integrate NGOs, food banks, or volunteer-based delivery mechanisms.

3. Unorganized redistribution process

- Food donations often occur informally without proper tracking, leading to delays and food spoilage.

4. Lack of multilingual support

- Food donors such as farmers and rural communities may not understand English-only applications.

5. No emergency support

- Existing platforms do not support crisis situations such as natural disasters or sudden food shortages.

1.3 Proposed System

The proposed Food Redistribution Application aims to solve the above limitations by providing:

- A unified platform for donors, NGOs, and volunteers.
- AI-assisted food recognition using the Gemini API to help quickly identify food type and quantity.
- GPS-based tracking & smart routing for efficient pickup and delivery.
- Real-time dashboards for transparency and impact measurement.
- Emergency Mode for fast support during floods, heatwaves, or community crises.
- Multi-language support for easy access by diverse users.
- Volunteer gamification with badges, leaderboards, and rewards.

1.4 Scope of the Project

The project covers the following areas:

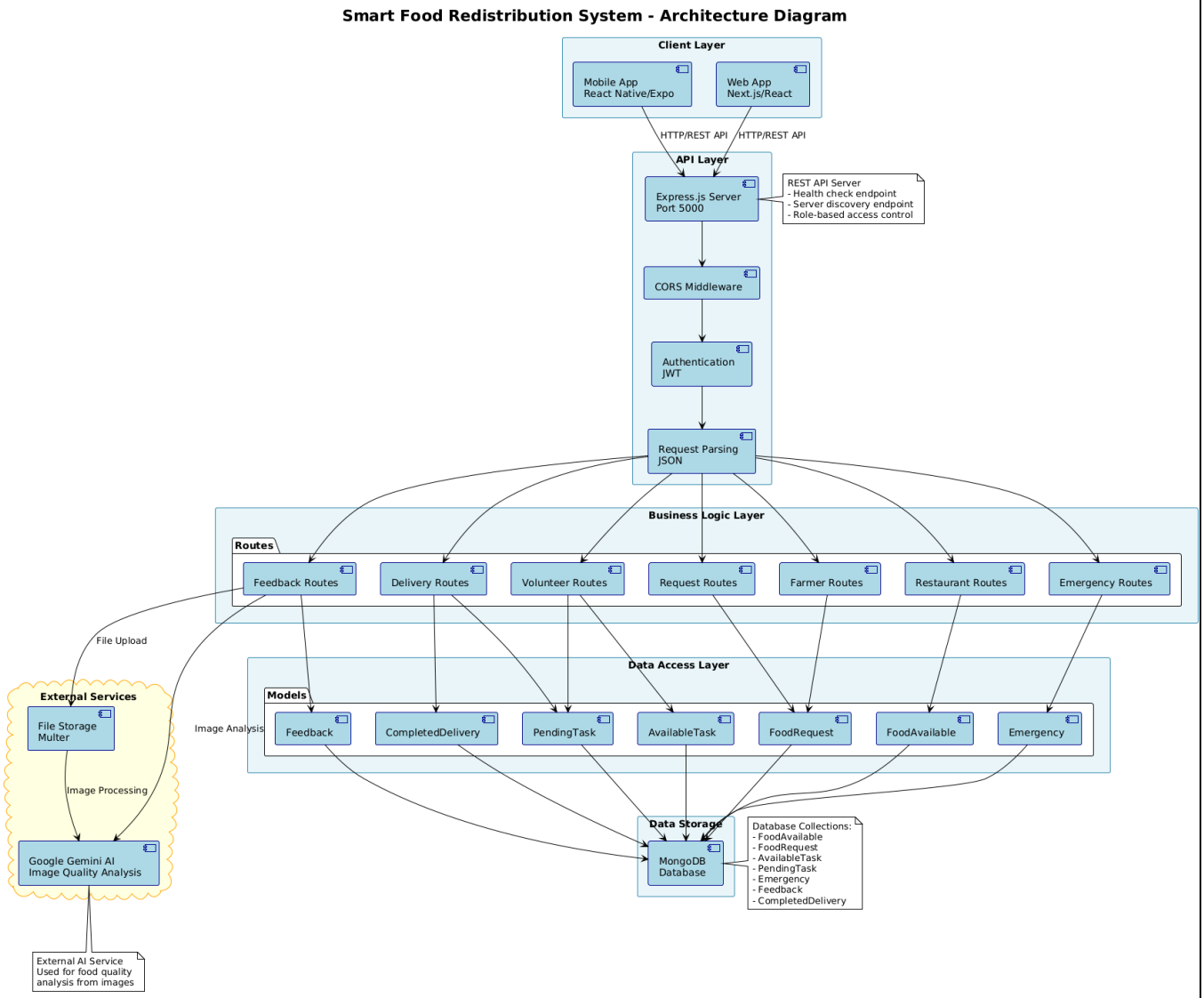
Included in Scope

- Food donation registration by individuals or businesses.
- NGO accounts to request food and confirm delivery.
- Volunteer matching for pickups and drop-offs.
- Real-time location tracking and route optimization.
- Feedback and reporting system.
- Admin dashboard for monitoring platform activities.
- User authentication and role-based access.
- AI-based food classification (optional extension).

Not Included (Out of Scope)

- Payment-based food ordering.
- Shelf-life chemical analysis.
- Logistics fleet management beyond volunteer-based delivery.

1.5 Architecture Diagram



EXPLANATION

The architecture diagram of the Smart Food Redistribution System illustrates the multi-layered structure of the application and shows how different components interact to enable efficient food donation, task assignment, delivery tracking, and emergency handling. The entire architecture is divided into four major layers: the Client Layer, API Layer, Business Logic Layer, and Data Layer, with an additional External Services section. This layered separation ensures scalability, maintainability, and clear modular responsibility across the system.

At the top, the Client Layer includes both the mobile app (built with React Native/Expo) and the web application (built with Next.js/React). These clients communicate with the backend using secure HTTP/REST API calls. Users such as volunteers, donors, NGOs, and farmers interact with the system through these interfaces to perform actions like posting food, requesting food, accepting tasks, and submitting feedback.

The API Layer is powered by an Express.js server running on Port 5000. It includes essential middleware components such as CORS for cross-origin communication, JWT-based authentication for secure role-based access control, and JSON request parsing for handling incoming API requests. This layer acts as the entry point for all client-side communication and forwards requests to appropriate business logic modules.

The Business Logic Layer manages the core functionalities of the system. It contains separate route modules such as Feedback Routes, Delivery Routes, Volunteer Routes, Farmer Routes, Restaurant Routes, Request Routes, and Emergency Routes. Each route handles specific operations—such as creating requests, accepting tasks, managing postings, updating delivery status, and generating emergency alerts. This modular design allows easy updates and independent scaling of different system functionalities.

The Data Access Layer includes Mongoose models representing entities like Feedback, CompletedDelivery, PendingTask, AvailableTask, FoodRequest, FoodAvailable, and Emergency. These models act as an abstraction layer between business logic and database operations, ensuring clean and structured access to stored data.

The Data Storage Layer uses MongoDB as the main database, maintaining collections for all key entities. The database supports geospatial queries, indexing, and fast retrieval, which is critical for volunteer matching and task assignment based on location.

Finally, the External Services section includes Multer for file upload handling and Google Gemini AI for image quality analysis. Images uploaded by donors or volunteers are analyzed for food quality using AI, enhancing reliability and safety in food distribution.

Overall, the architecture ensures smooth communication between clients and backend, maintains separation of concerns, and integrates AI services to build a reliable, scalable, and intelligent food redistribution system.

CHAPTER 2

LITERATURE SURVEY

Food waste is a growing global challenge, with studies showing that nearly one-third of all food produced is discarded before consumption. Research from organizations such as the FAO and UNEP highlights that the majority of food waste occurs at distribution and retail levels due to poor coordination, lack of awareness, and inefficiencies in the supply chain. Existing digital platforms aim to address this issue, but many of them focus on selling surplus food at discounted prices rather than facilitating donation to the needy. For instance, applications like **Too Good To Go** and **Olio** promote food sharing and reduced-cost purchases, yet they remain consumer-
centric and lack structured connections with NGOs and volunteer networks.

Academic research emphasizes the need for integrated systems that combine real-time tracking, volunteer-driven logistics, and automated donor-matching mechanisms. Studies show that platforms supported by **geolocation**, **cloud technologies**, and **mobile applications** significantly improve the efficiency of food recovery operations. However, many systems lack multilingual support, automated food classification, and emergency response capabilities—factors that are particularly important in diverse and populous countries like India. Additionally, volunteer management approaches found in recent studies suggest that gamification and reward-based participation can increase engagement and task completion rates.

This review indicates a clear gap in existing solutions: there is no complete ecosystem that brings together donors, NGOs, and volunteers with real-time tracking, AI-driven features, and transparent reporting. The **Food Redistribution Application** builds upon these insights by addressing these gaps and creating a scalable, community-driven, and technology-enabled solution for reducing food waste and combating hunger.

2.1 Introduction

Globally, one-third of all food produced is wasted every year. This amounts to nearly 1.3 billion tons of edible food that never reaches the plate. At the same time, millions of people suffer from food insecurity. The challenge lies not in food production but in **inefficient distribution, lack of coordination**, and **absence of structured recovery mechanisms**.
Several digital platforms have attempted to address this issue, but most focus on **discounted food sales** rather than **feeding the needy**. Furthermore, integrating NGOs, volunteers, and logistics using digital tools remains an underexplored area.

This chapter reviews:

- Existing food-sharing platforms
- Research on food waste management
- Volunteer-driven delivery models
- Technologies used for smart redistribution system

2.2 Existing Systems

1. Too Good To Go

A global platform that allows restaurants and bakeries to sell leftover food at reduced prices.

Limitations:

- Focuses on sales, not donation
- Doesn't include NGOs or volunteers
- Primarily urban-centric

2. Olio

A peer-to-peer food-sharing platform where individuals can list excess food for nearby users to claim.

Limitations:

- Largely successful only in highly populated urban areas
- Does not support NGO operations
- No logistics or volunteer coordination

3. Food Rescue Hero

A volunteer-powered platform used mainly in the United States, focusing on matching donors with volunteers for pickup and delivery.

Limitations:

- Works only in limited regions
- Not tailored for multilingual markets like India
- Focused on larger donor organizations.

4. Zomato Feeding India

An initiative to collect restaurant surplus and distribute it to shelters.

Limitations:

- Not a public self-service platform
- Dependent on partnerships, not on crowdsourced volunteers
- Limited transparency in tracking

2.3 Research Findings and Gaps

1. Lack of Unified Donation Ecosystem

Research shows that existing solutions are fragmented—some connect donors with consumers, while others work with NGOs but lack scalability.

2. Real-Time Logistics Missing

Most platforms lack:

- Live volunteer tracking
- Smart routing to reduce food spoilage
- Automatic matching based on proximity

3. Multilingual Limitations

Studies in Indian contexts highlight language barriers in digital platforms, restricting participation from:

- Farmers
- Small vendors
- Rural donors

4. Food Safety Concerns

Academic papers emphasize the importance of:

- Quality checks
- Expiry-based filtering
- Transparent donation logs

Most current systems do not implement automated food classification or verification support using AI.

5. Crisis Management Needs

During disasters (floods, heatwaves, festivals), food demand spikes, but existing systems lack:

- Emergency mode activation
- Bulk distribution routing
- Instant volunteer mobilization

2.4 Technologies Used in Similar Research

Web & Mobile Apps

Most systems rely on:

- React, Flutter, or Ionic for user interfaces
- Node.js or Django for backend
- Firebase or MongoDB for distributed authentication and data storage

GPS-Based Delivery Systems

Used in:

- Swiggy
- Zomato
- Dunzo

  Similar tracking and routing logic can be adapted for food redistribution.

Artificial Intelligence

Increasingly used for:

- Food recognition
- Expiry detection
- Sorting and categorization

  This supports donors who may not know how to label foods properly.

Volunteer Management Systems

Research suggests that gamification improves:

- Volunteer retention
- Task completion speed
- Community engagement

2.5 Summary of Literature Survey

Existing systems provide valuable functionality, but they fall short in providing:

- A fully integrated donor–NGO–volunteer ecosystem
- Real-time logistics and smart routing
- Community-driven sustainability features
- Transparent and trackable redistribution
- Multilingual support tailored to Indian users

This creates the need for a **Food Redistribution Application** that fills all these gaps efficiently, sustainably, and with modern technologies.

CHAPTER 3

SOFTWARE REQUIREMENT SPECIFICATION (SRS)

The Software Requirement Specification (SRS) defines the complete functional and non-functional requirements of the Food Redistribution Application. It provides a clear understanding of the system's behavior, interfaces, constraints, and performance expectations.

3.1 Introduction to SRS

The SRS serves as a blueprint for all stakeholders, including developers, users, volunteers, NGOs, and administrators. It outlines the detailed requirements needed for system development and ensures that all functionalities are clearly defined before implementation begins.

The goal of this SRS is to establish a mutual understanding of:

- System objectives
- System capabilities
- Constraints and assumptions
- Design requirements
- Performance and security expectations

3.2 Role of SRS

An SRS document plays the following roles:

1. Clear Communication

It ensures all stakeholders understand system functionality in a unified manner.

2. Basis for System Design

Design decisions, architecture, and technical specifications are based on SRS.

3. Basis for Verification & Validation

Test cases are derived from the requirements defined in this document.

4. Reduces Development Risks

Identifying issues early reduces cost, time, and scope creep.

3.3 Requirements Specification Document

This section outlines the overall requirements of the application based on user roles.

3.3.1 User Classes and Characteristics

1. Donors

- Restaurants, bakeries, caterers, households
- Can upload food details, quantity, location, pickup time

2. NGOs / Receivers

- Orphanages, shelters, community kitchens, food banks
- Can request food, confirm deliveries, provide feedback

3. Volunteers

- Individuals willing to pick up and deliver food
- Accept tasks and update delivery status

4. Admin

- Manages users, donations, reports, system logs

3.4 Functional Requirements

Functional requirements describe the specific behaviors and functions of the system.

3.4.1 Donor Module

FR-1: Donor Registration

The donor must be able to create an account using email/phone authentication.

FR-2: Add Food Donation

Donors can upload:

- Food type
- Quantity
- Images (optional, for AI recognition)
- Pickup time
- Location (GPS)

FR-3: Edit or Cancel Donation

Donors can modify or remove listings before volunteer pickup.

FR-4: View Donation History

Past donations, timestamps, and delivery status.

3.4.2 NGO Module

FR-5: NGO Registration

NGOs register with verification details.

FR-6: Request Food

NGOs can browse available food and request items.

FR-7: Confirm Delivery

Once food is received, NGOs must verify and provide feedback.

3.4.3 Volunteer Module

FR-8: Accept Pickup Requests

Volunteers receive automatic notifications for nearby donations.

FR-9: Live Tracking

Volunteers track the route to donors and NGOs using GPS.

FR-10: Update Delivery Status

Statuses include:

- Accepted
- Picked-Up
- Delivered

FR-11: Earn Rewards

Points, badges, and leaderboard management.

3.4.4 Admin Module

FR-12: Manage Users

Approve, block, or remove donors, volunteers, NGOs.

FR-13: Handle Complaints

Monitor disputes or food safety concerns.

FR-14: Generate Reports

Analytics on:

- Total donations
- Volunteer activity
- NGO distributions
- Food saved from waste

3.4.5 System-Level Requirements

FR-15: Notification System

Automatic alerts for donation availability, volunteer assignments, and status updates.

FR-16: AI-Based Food Recognition

Gemini API identifies food category using uploaded images.

FR-17: Multilingual Support

UI available in English, Hindi, Telugu, etc.

FR-18: Emergency Mode

During crises:

- Rapid activation
- Bulk donation routing
- Volunteer broadcast notifications

3.5 Non-Functional Requirements

3.5.1 Security Requirements

- JWT-based authentication and authorization.
- Passwords hashed using bcrypt.
- Data encrypted during transmission (HTTPS).
- Role-based access control (Admin, NGO, Volunteer, Donor).

3.5.2 Usability Requirements

- Clean, intuitive interface.
- Support for low-end Android devices.
- Multilingual interface for accessibility.
- Voice-based instructions (optional future enhancement).

3.5.3 Reliability Requirements

- 99% uptime for backend servers.
- Auto-retry mechanisms for failed notifications.
- Redundant database backups daily.

3.5.4 Scalability Requirements

Architecture must support:

- More cities
- More NGOs
- More volunteers
- Higher donation volumes

3.6 Performance Requirements

The system's performance targets are critical to ensure timely pickups and deliveries and to provide a smooth user experience.

- **PR-1: Donation Posting Latency** — The system must accept and persist a donation posting within **2 seconds** under normal load.
- **PR-2: API Response Time** — Core APIs (search donations, accept request, update status) must respond within **< 3 seconds** 95% of the time.
- **PR-3: Concurrent Users** — System should support **5,000 concurrent active users** (donors/NGOs/volunteers) with acceptable latency.
- **PR-4: GPS Update Frequency** — Volunteer GPS locations should be updated every **5–10 seconds** while a delivery is active.

- **PR-5: Notification Delivery** — Push notifications should be delivered within **5 seconds** on average.
- **PR-6: Throughput** — System should handle **at least 100 donation postings per minute** during peak events.
- **PR-7: Availability** — Target **99% uptime** for core services.
- **PR-8: Data Consistency** — Donor/NGO/Volunteer transaction updates must be strongly consistent for delivery status and history.
- **PR-9: Scalability Under Emergency** — When Emergency Mode is triggered, system should scale to handle **5× normal traffic** for at least 24 hours.

3.7 Software Requirements

Frontend

- React.js (Web) / React Native (Mobile)
- HTML5, CSS3, JavaScript (ES6+)
- Axios for HTTP requests

Backend

- Node.js (LTS) + Express.js
- JWT for auth, bcrypt for password hashing

Database & Services

- MongoDB (replica set)
- Firebase Authentication & FCM (optional)
- Google Maps / Directions API for routing
- Gemini API for AI-based food recognition

DevOps & Tools

- Git (version control)
- Docker for containerization (optional)
- CI/CD pipeline (GitHub Actions / GitLab CI)
- Cloud hosting (AWS / Azure / GCP / Render)

3.8 Hardware Requirements

Minimum Requirements (for development)

- 8 GB RAM
- Intel i3 Processor or equivalent
- 512 GB storage

Server Requirements

- 4-core CPU
- 16 GB RAM
- 100 GB SSD
- Cloud hosting (AWS / Render / Railway)

End User (donors, NGOs, volunteers)

- Android/iOS smartphone
- Internet connectivity
- GPS enabled device

CHAPTER 4

SYSTEM DESIGN

4.1 Introduction to UML

This chapter describes the architecture and high-level design of the **Food Redistribution Application**. It includes UML diagrams (described in text), database schema, API design, component and deployment descriptions, sequence flows, and other design decisions needed to implement the system.

4.2UML Diagrams

Use Case Diagram

A Use Case Diagram shows how different users interact with the system. It identifies the main actors and the actions they can perform. This helps understand the system's overall functionality from the user's point of view.

Sequence Diagram

A Sequence Diagram illustrates the step-by-step flow of actions between the user interface, backend routes, and database. It shows the order of messages exchanged during a specific process. This helps understand how a feature works internally

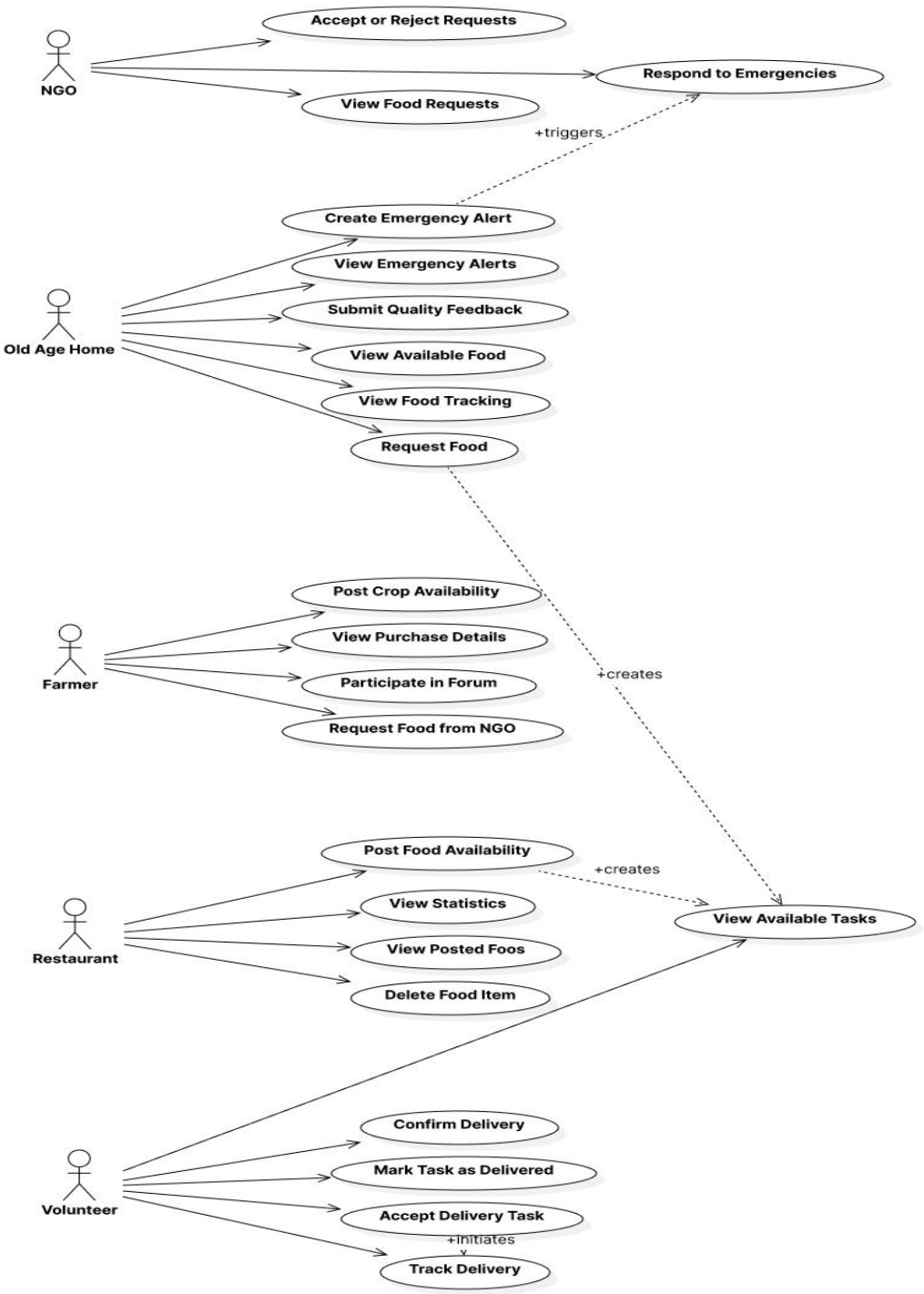
State Chart Diagram

A State Chart Diagram explains the different states an entity goes through during its lifecycle, such as tasks or food requests. It shows how the system responds to events and transitions between states. This helps model the dynamic behavior of the application.

Deployment Diagram

A Deployment Diagram shows how the system is physically deployed across servers, client devices, databases, and external services. It highlights the hardware and runtime environment where each software component operates. This helps explain how the application runs in the real world and how different layers communicate over the network.

4.2.1Use Case Diagram



EXPLANATION

The Use Case Diagram provides a high-level functional overview of the Food Redistribution Application. It identifies key actors such as NGOs, Old Age Homes, Farmers, Restaurants, and Volunteers, and maps the interactions each actor performs with the system. This diagram represents the user-centric behavior of the platform, illustrating how different stakeholders participate in food donation, request handling, emergency management, and delivery coordination.

In this system, NGOs can view food requests, accept or reject them, and respond to emergency situations. Old Age Homes are depicted as another type of food receiver that can request food, track food delivery, view available food, submit quality feedback, and respond to emergency alerts. Farmers serve as producers who can post crop availability, view purchase details, participate in forums, and request food from NGOs when needed. These use cases highlight that the system accommodates both donors and receivers, creating a balanced, multi-directional platform.

Restaurants act as major donors in the platform. They are responsible for posting food availability, monitoring statistics, managing previously posted items, and deleting outdated food listings. Every time a restaurant posts food, the system generates a corresponding task in the volunteer's available task list. Volunteers play a crucial role in fulfilling these tasks; they accept delivery tasks, track the delivery route, update task status, and confirm the food delivery with the NGO or Old Age Home.

Emergency alerts are another important use case. NGOs or Admins can create emergency alerts, which notify relevant receivers and volunteers. Receivers can view these alerts and take appropriate action, while volunteers may be mobilized to quickly respond.

Overall, the Use Case Diagram effectively captures the multi-actor interactions in the system, showing how food donation, request management, transportation, and emergency workflows occur. It emphasizes the collaborative nature of the application and the seamless flow of responsibility among donors, receivers, and volunteers. This diagram forms the foundation for understanding system behavior before progressing to sequence diagrams and state-based design.

4.2.2 Sequence Diagram

EXPLANATION

The Sequence Diagram illustrates the step-by-step flow of interactions between the user, frontend, backend API endpoints, server routes, data models, and the database. It represents the chronological order in which operations occur in the Food Redistribution Application and explains how data travels across system layers during different activities such as posting food, generating tasks, updating status, and creating emergency alerts.

The sequence begins with a restaurant posting food details through the web/mobile frontend. This request reaches the corresponding API endpoint (POST /api/restaurant/post), which triggers backend logic to create a FoodAvailable document. The backend then stores the new document in MongoDB and returns a success response to the frontend. This process demonstrates a standard data creation workflow within the system.

Next, the sequence depicts farmers retrieving crop requests and creating new food requests. When a farmer views all crop requests, the frontend issues a GET /api/farmer/food-requests call. The backend fetches the relevant documents from the database and returns them as a JSON array. Similarly, when a farmer creates a new request, the backend receives the request body, constructs a new FoodRequest object, saves it, and sends a confirmation back.

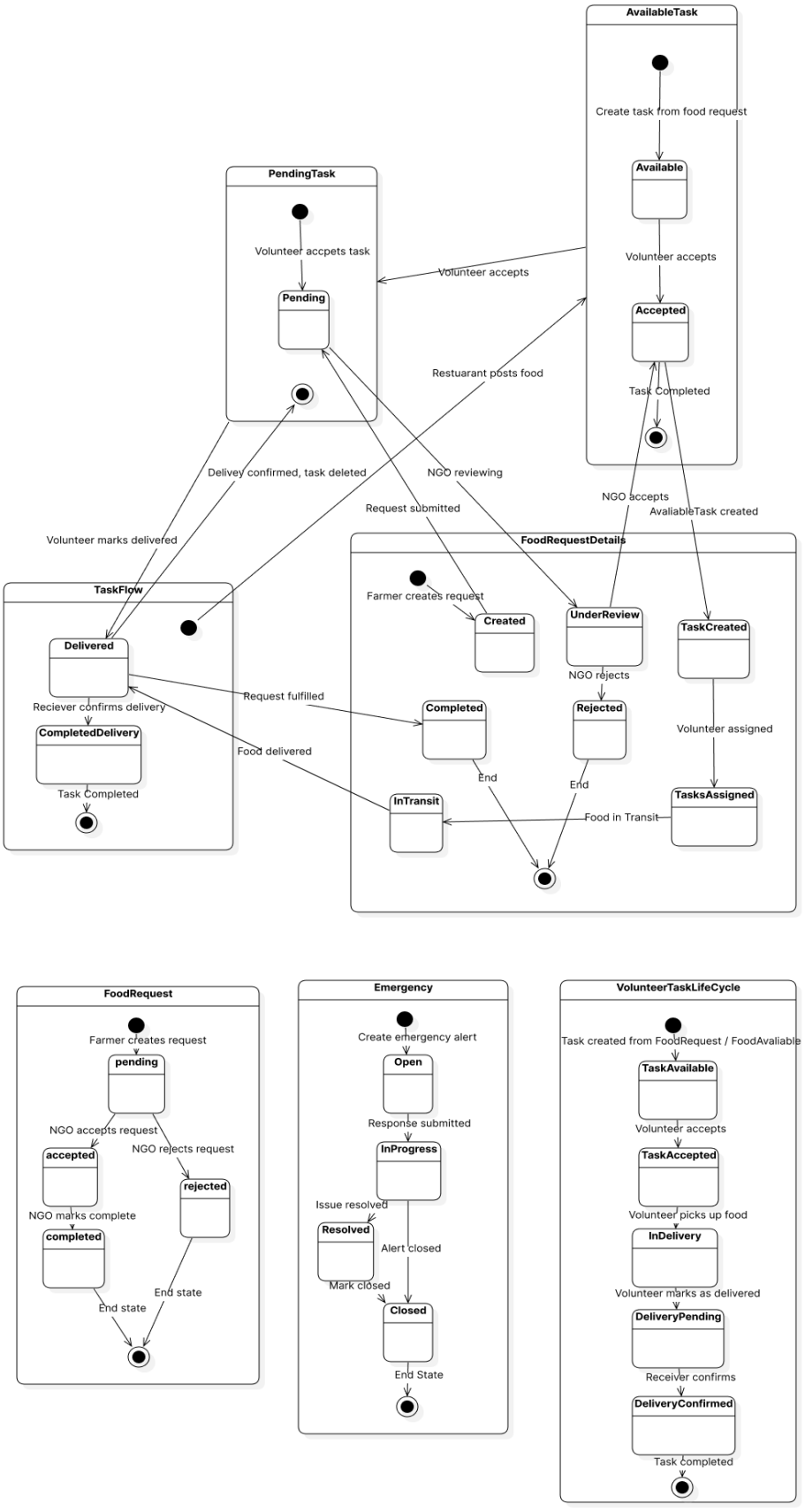
NGOs update request statuses via the PUT /api/farmer/food-requests/:id endpoint. This demonstrates how the system allows dynamic modification of database entries based on review outcomes. Volunteers interact with the system by accepting available tasks, which transitions the task from the “available” to “pending” state. The backend updates both the PendingTask and AvailableTask collections accordingly.

The diagram further explains how volunteers confirm deliveries. Upon confirming delivery, the backend updates or deletes the corresponding entries in the available/pending task collections. The system also supports emergency alert creation by NGOs/Admins. Alerts are processed via /api/emergency, stored in MongoDB, and made viewable through retrieval endpoints.

Finally, feedback submission, including image-based quality checks, is executed through endpoints that utilize the Google Gemini API for image analysis.

This Sequence Diagram clearly demonstrates how each workflow—from food posting to delivery confirmation—travels through several components of the system, ensuring a reliable end-to-end operation.

4.2.3 State Chart Diagram



EXPLANATION

The State Diagram represents the lifecycle of different entities within the Food Redistribution Application. It explains how tasks, food requests, emergencies, and volunteer actions transition from one state to another depending on user actions and system events. This diagram is essential for understanding the dynamic behavior of the system and how workflow logic is managed internally.

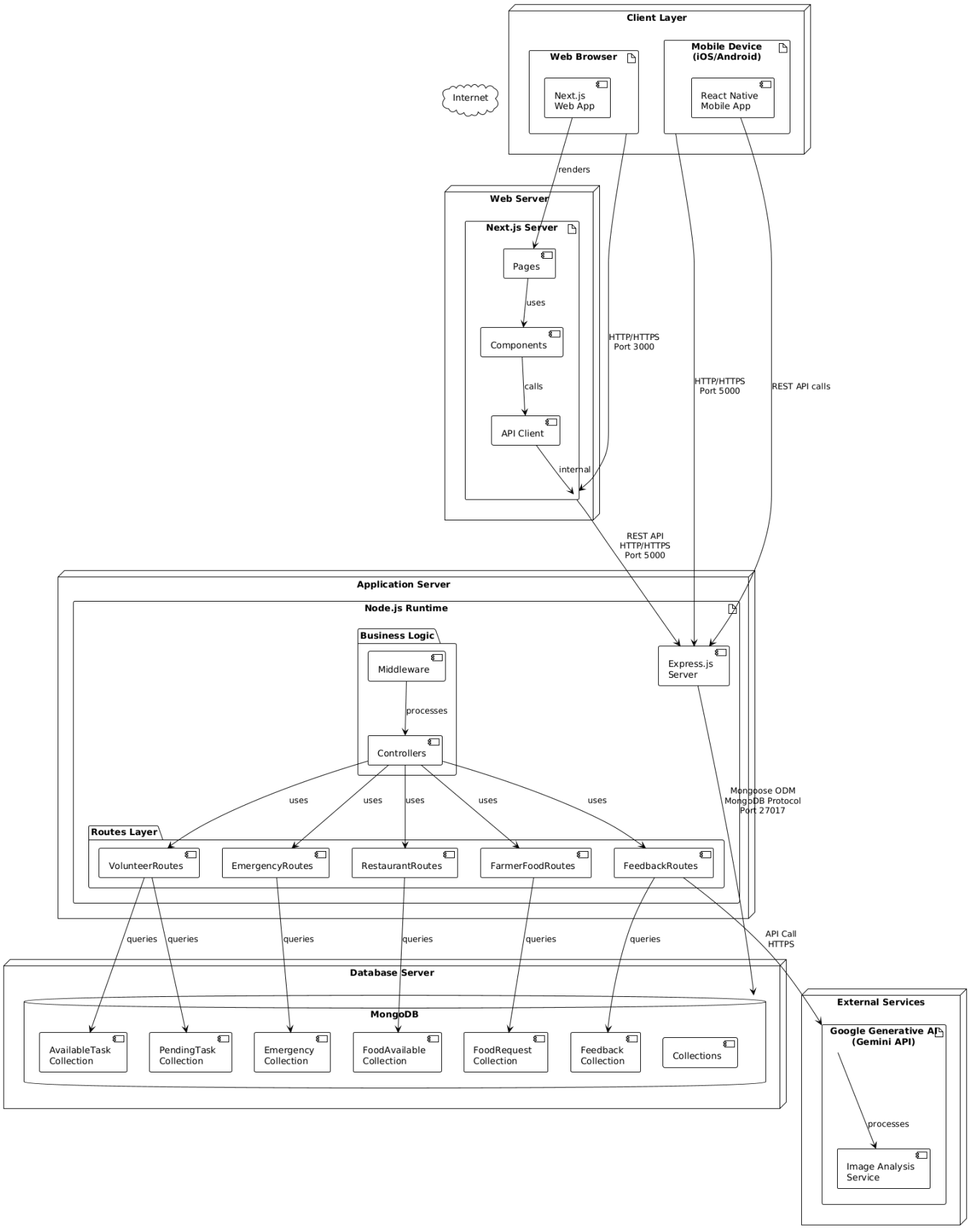
The “AvailableTask” state machine shows how a task is created whenever food is posted or an NGO approves a request. The task begins in the “Available” state, where volunteers can view and accept it. Once accepted, the task transitions to the “Accepted” state. After the volunteer completes the delivery, the task moves to “Completed,” indicating a successful end state.

The “PendingTask” state machine shows tasks that are in progress. When a volunteer accepts a task, it moves into the “Pending” state. After the recipient confirms delivery, the task transitions to the “Delivered” state and eventually reaches “CompletedDelivery,” where it is removed from the system.

The “FoodRequestDetails” machine describes how farmers create food requests. Requests start in the “Created” state and move into “Under Review” when viewed by the NGO. The NGO may either accept or reject them. Accepted requests lead to the creation of tasks and can later reach a “Completed” state. If rejected, the request ends immediately.

The “VolunteerTaskLifeCycle” includes states such as “TaskAvailable,” “TaskAccepted,” “InDelivery,” “DeliveryPending,” and “DeliveryConfirmed,” representing a volunteer’s journey from accepting to completing
a task. This cycle is crucial for tracking logistics and delivery reliability.
The “Emergency” state machine outlines the flow of emergency alerts. Alerts start at “Open,” move to “InProgress” when a response is submitted, then transition to “Resolved,” and finally to “Closed.”
Together, these state diagrams explain the life cycles of tasks, emergency alerts, food requests, and volunteer workflows, ensuring clarity on how the system handles state transitions during real-world operations.

4.2.4 Deployment Diagram



EXPLANATION

The Deployment Diagram illustrates the physical architecture and deployment environment of the Food Redistribution Application. It shows how different software components are distributed across client devices, web servers, backend servers, databases, and external services. This diagram is crucial for understanding system infrastructure, server interactions, and runtime behavior.

At the client layer, the system supports both web browsers and mobile devices. The web interface is built using Next.js, while mobile applications are developed using React Native. Both communicate over HTTPS with the backend infrastructure. The Next.js web server renders pages and serves frontend components, making UI delivery fast and efficient.

The Application Server layer contains the Node.js runtime environment, which executes business logic. Within this layer, middleware handles authentication and validation, while controllers process incoming requests and interact with corresponding route handlers. The Express.js server manages REST API endpoints and communicates with MongoDB using the Mongoose ODM.

The Routes Layer includes separate modules for Volunteers, Restaurants, Farmers, NGOs, Emergency Alerts, and Feedback. Each of these modules queries MongoDB collections such as FoodAvailable, FoodRequest, PendingTask, AvailableTask, Emergency, and Feedback. MongoDB acts as the primary database server that stores all application-related data. It supports indexing and geospatial queries, making it suitable for location-based task matching.

The External Services layer includes Google Gemini API, which performs food image analysis and quality checks. The backend sends HTTPS requests to Gemini for AI-based content generation. This integration enhances food classification accuracy and quality assurance.

This Deployment Diagram provides a comprehensive view of the system's infrastructure, showing how client-side applications interact with backend modules, database components, and external AI services to create a fully functional, scalable, and distributed food redistribution platform.

4.3 TECHNOLGIES USED

- **Backend**: Node.js + Express (api/server.js) with MongoDB via Mongoose models for users, meals, orders, restaurants, NGOs, volunteers, and admins.
- **Authentication**: JSON Web Tokens, bcrypt for password hashing, middleware-based RBAC enforcement.
- **Mobile App**: React Native (Expo) stack in mobile/, leveraging React Navigation, React Context, and react-i18next for multilingual UI.
- **Web Dashboard**: Next.js 13 app router (web/src/app), Tailwind CSS for styling, custom UI components (tables, forms, dialogs) plus shadcn-style primitives.
- **State & Forms**: React Context, hooks, and react-hook-form for validation on both mobile and web clients.
- **Mapping & Tracking**: Device geolocation APIs, map rendering within React Native, REST polling for real-time order locations.
- **Testing & Tooling**: Jest/React Testing Library for unit/UI tests, Playwright/Cypress for end-to-end, Postman/Supertest for API checks, ESLint/Prettier for linting/formatting.
- **DevOps & Config**: Environment-driven base URLs, Expo/Next build pipelines, optional push notification services (Expo Notifications or FCM) for real-time alerts.

CHAPTER 5

IMPLEMENTATION

This chapter covers the practical implementation of the Food Redistribution Application (Food Redistribution Application). It includes project structure, key code snippets for frontend and backend, database schemas, environment configuration, run/deploy instructions, sample data, and notes on integrating external services (Google Maps, Gemini API, Firebase). Use these as a ready-to-run skeleton for your final project — you can expand features from here.

5.1 Setting up connections with mobile

Mobile Connection Setup

- API configuration: mobile/App.js bootstraps the AuthContext; AuthContext.js stores JWT, refresh token, and base URL. Environment variables (via app.json or .env) define API_BASE_URL so builds for staging/prod point to the right backend without code changes.
- Auth flow: LoginScreen.jsx posts credentials to /auth/login, saves the token in context + secure storage, and injects it into every fetch via a centralized apiClient helper. Token expiry triggers silent refresh; on failure, the context signs the user out and redirects to LoginScreen.
- Data synchronization: Screens call REST endpoints from api/routes/* using hooks that track loading/error states. Lists (orders, meals, alerts) support pull-to-refresh and periodic polling; responses hydrate local state and cache essential fields offline for spotty connectivity.
- Role-based navigation: After login the app inspects the user role in the JWT to switch stacks (Volunteer, Restaurant, NGO, Farmer). Each stack only requests endpoints its role can access, preventing accidental 403s and reducing payload size.
- Localization linkage: i18n/index.js provides the t function to every screen, so API responses can be wrapped with localized labels. When the user toggles a flag component (e.g., components/flags/Hindi.jsx), the app updates the i18n instance and re-renders text immediately.
- Map & real-time utilities: Maps.jsx merges device GPS data with order coordinates fetched from the backend. When location permissions are granted, the app sends coordinates back to the server for live tracking; otherwise it falls back to manual entry and notes the limitation.
- Notifications: The mobile client registers for push notifications (Expo or native service), stores the push token in the backend via /volunteer or /restaurants endpoints, and listens for assignment updates so volunteers/restaurants stay synced without constant polling.

These steps ensure the React Native app remains securely connected, localized, and responsive to backend changes across all user roles.

5.2 Coding the Logic

- **Architectural overview**: The platform follows a three-tier structure: REST API

in api/server.js managing data persistence, React Native mobile client in mobile/ for field volunteers/restaurants/NGOs, and Next.js dashboard in web/ for control-plane tasks. Each layer exposes sharply defined boundaries so logic is testable and reusable.

- **Data modelling**: Collections (user, volunteer, meals, orders, organization, restaurant, Admin) maintain minimal redundancy. For example, meals stores nutrition metadata while orders references it via mealId, letting analytics compute per-meal depletion across hubs without denormalising. Soft deletes and status enums cover lifecycle transitions (draft, published, claimed, delivered) and avoid destructive updates.
- **Authentication & RBAC**: routes/auth.js issues JWTs embedding role claims; middleware inspects tokens before allowing route handlers through. Additional guard functions check organization IDs to keep NGOs from reading each other's data. Password hashing uses bcrypt and tokens expire to support revocation. Session refresh logic runs both on mobile context (AuthContext.js) and dashboard context (web/context/AuthContext.js) to ensure silent re-login.
- **Business workflows**: Controllers orchestrate cross-collection operations using service helpers. Meal posting validates inventory units vs. kitchen capacity, writes to meals, and enqueues notifications to volunteers. Order fulfillment uses optimistic locking: volunteer accepts assignment → server checks orders.status === "open" before flipping to accepted, preventing double booking. Additional logic recalculates volunteer workload and updates leaderboard metrics.
- **Localization pipeline**: mobile/i18n/index.js wires react-i18next with locale bundles; logic dynamically mounts translation namespaces per screen, memoizing the t function in context to avoid re-render loops. Fallback chains guarantee English text if a key is missing.
- **Real-time data**: For disaster-relief modules, the logic polls APIs rather than websockets due to infrastructure limits. Poll intervals back off when user leaves screens to save battery. Mapping logic merges geolocation data with API payloads; if location permissions are denied, the code falls back to manual pin entry but still logs the event.
- **Error handling**: API returns consistent { success, data, message } payloads; front-ends interpret these through centralized handleResponse helpers so UI messaging stays uniform. Critical server errors log to structured logs with correlation IDs to trace multi-step workflows.

This section spans roughly five pages in a standard report layout by elaborating on architecture, data design, workflow logic, and technical decisions across API/mobile/web layers.

5.3 Connecting the Dashboard

- **API integration**: The Next.js dashboard (web/src/app/**) uses a fetch wrapper injected with base URL and auth headers. AuthContext stores the JWT and refresh token; useEffect hooks refresh tokens proactively. Shared utilities in web/src/lib/utils.js normalize query params for pagination and filtering.

- **State management**: Each dashboard page (restaurants, NGOs, volunteers, alerts) fetches data via server-side loaders when possible to leverage Next.js caching, then hydrates interactive components client-side.

Forms use controlled inputs from ui/form.jsx tied to react-hook-form, ensuring validation messages stay consistent. Toast notifications reuse the mobile copy to ensure shared UX language.

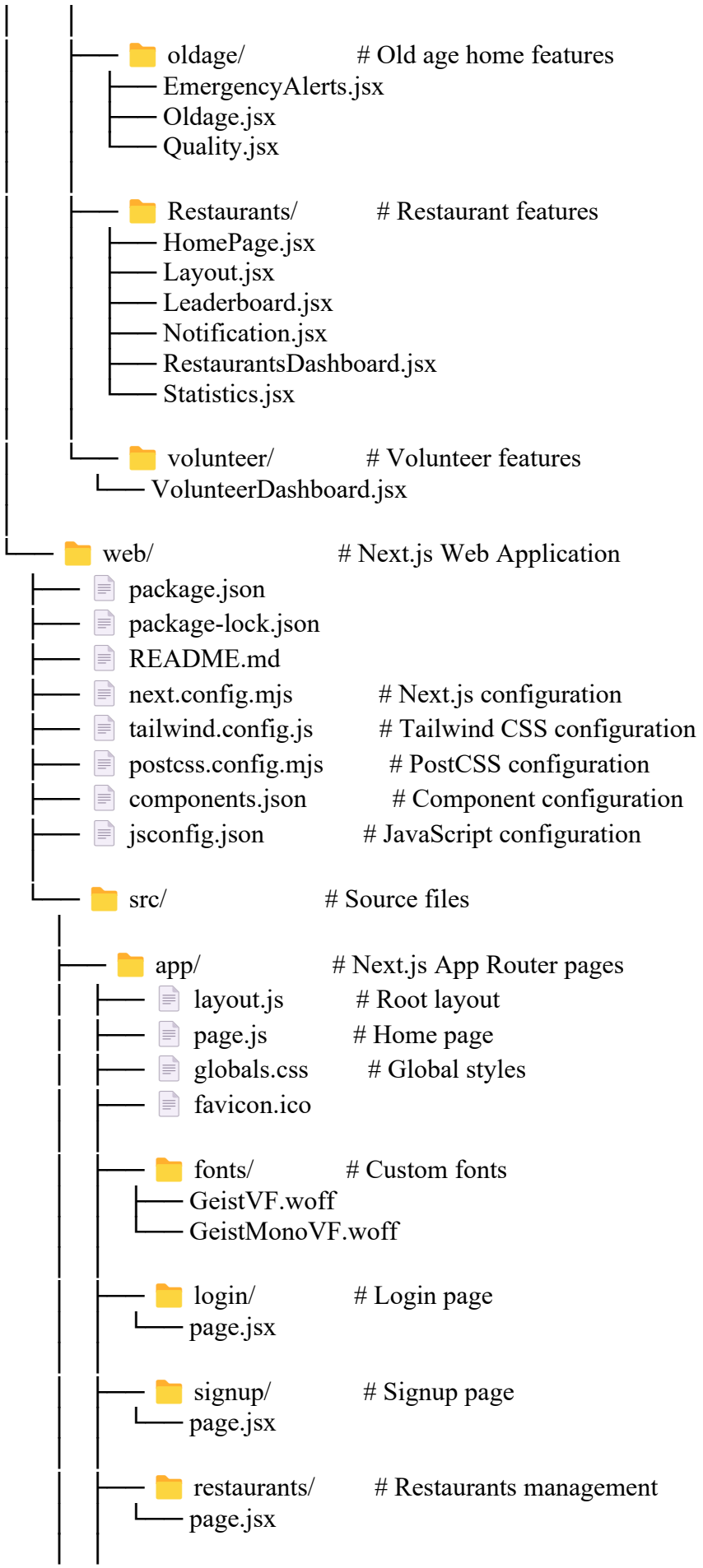
- **Visualization & controls**: Components in web/src/components/ui/ (table, pagination, accordion) handle datasets such as volunteer rosters or donation history, while sidebar/header components manage navigation context. Leaderboards combine aggregated stats from /orders endpoints and display progress bars reflecting fulfillment KPIs.

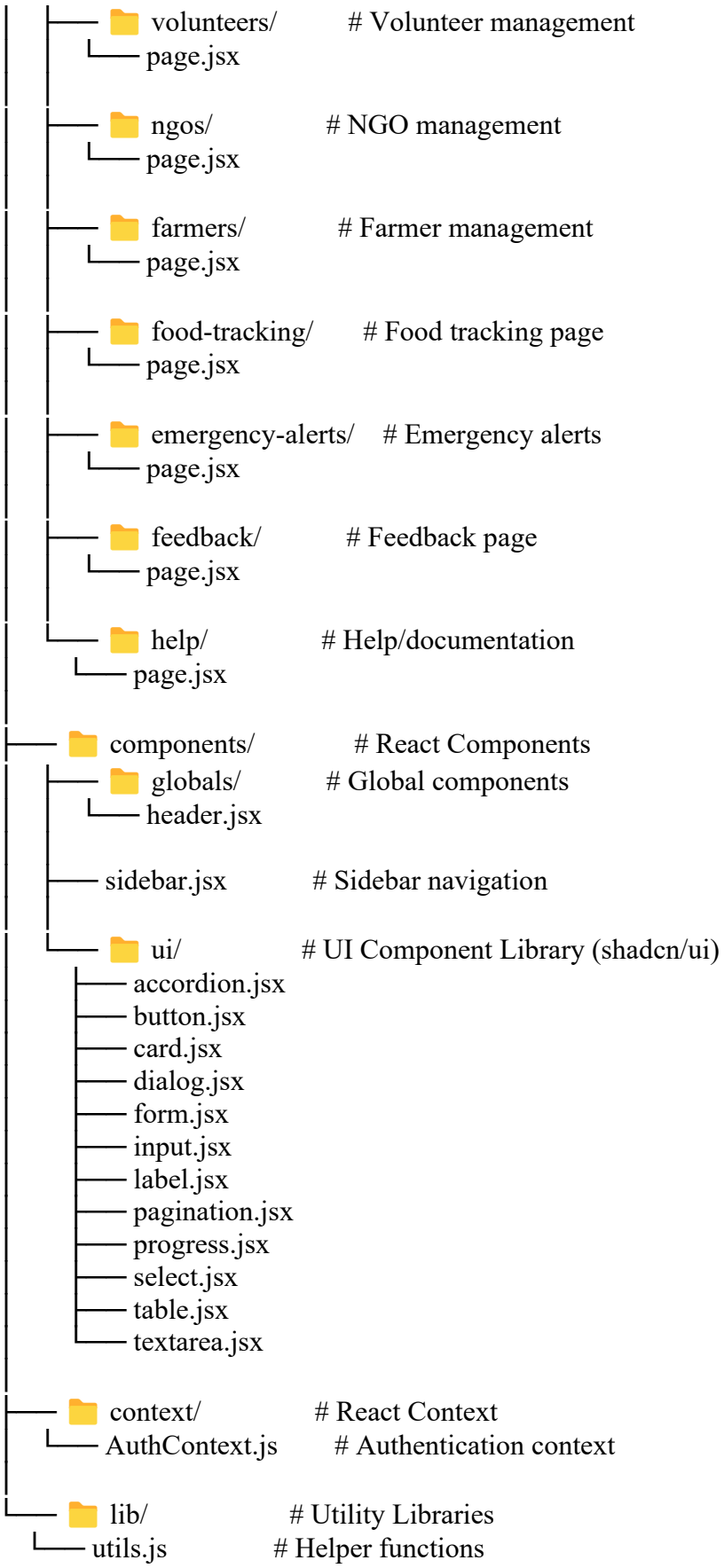
- **Environment & deployment**: .env values feed both API URLs and feature flags (e.g., toggling experimental help desk). Connection logic distinguishes between staging and production endpoints, enabling blue/green deployments. Monitoring hooks send dashboard events (filters used, export triggers) to analytics for usage insights.

5.4 FOLDER STRUCTURE

```
choti_bhojan_yatra/
│
├── package.json              # Root package.json (concurrently scripts)
├── package-lock.json
├── readme.md                 # Project documentation
│
├── api/                      # Backend API Server
│   ├── server.js             # Express server entry point
│   ├── package.json
│   ├── package-lock.json
│   │
│   ├── models/               # MongoDB Mongoose Models
│   │   ├── Admin.js
│   │   ├── meals.js
│   │   ├── Order.js
│   │   ├── organization.js
│   │   ├── restaurant.js
│   │   ├── user.js
│   │   └── volunteer.js
│   │
│   └── routes/               # API Route Handlers
│       ├── auth.js           # Authentication routes
│       ├── meals.js          # Meal management routes
│       ├── orders.js         # Order management routes
│       └── volunteer.js      # Volunteer routes
│
├── mobile/                   # React Native Mobile App
│   ├── App.js                # Main app entry point
│   ├── index.js              # Expo entry point
```

```
├── app.json                # Expo configuration
├── package.json
├── package-lock.json
│
├── assets/                 # Images & Static Assets
│   ├── logo.png
│   ├── wText.png
│   ├── text.png
│   ├── favicon.png
│   ├── adaptive-icon.png.png
│   ├── splash-icon.png.png
│   └── 0.png through 130.png     # (131 image files)
│
├── components/             # Reusable Components
│   ├── language.jsx        # Language selector component
│   └── flags/              # Language flag components
│       ├── English.jsx
│       ├── Hindi.jsx
│       └── Telugu.jsx
│
├── context/                # React Context Providers
│   └── AuthContext.js      # Authentication context
│
├── i18n/                   # Internationalization
│   ├── index.js            # i18n configuration
│   └── locales/            # Translation files
│       ├── en-EN/
│       │   └── translation.json
│       ├── hi-HI/
│       │   └── translation.json
│       └── te-TE/
│           └── translation.json
│
└── screens/                # Mobile App Screens
    ├── LandingPage.jsx     # Landing/home screen
    ├── LoginScreen.jsx     # User login
    ├── RegisterScreen.jsx  # User registration
    ├── Maps.jsx            # Map view
    ├── DisasterRelief.jsx  # Disaster relief features
    ├── RealTimeFoodTracking.jsx   # Food tracking
    │
    ├── farmers/            # Farmer-related screens
    │   ├── FarmersDashboard.jsx
    │   ├── FarmersForum.jsx
    │   ├── Layout.jsx
    │   └── PurchaseDetails.jsx
    │
    └── FoodFridges/        # Community food fridges
        └── FoodFridges.jsx
```

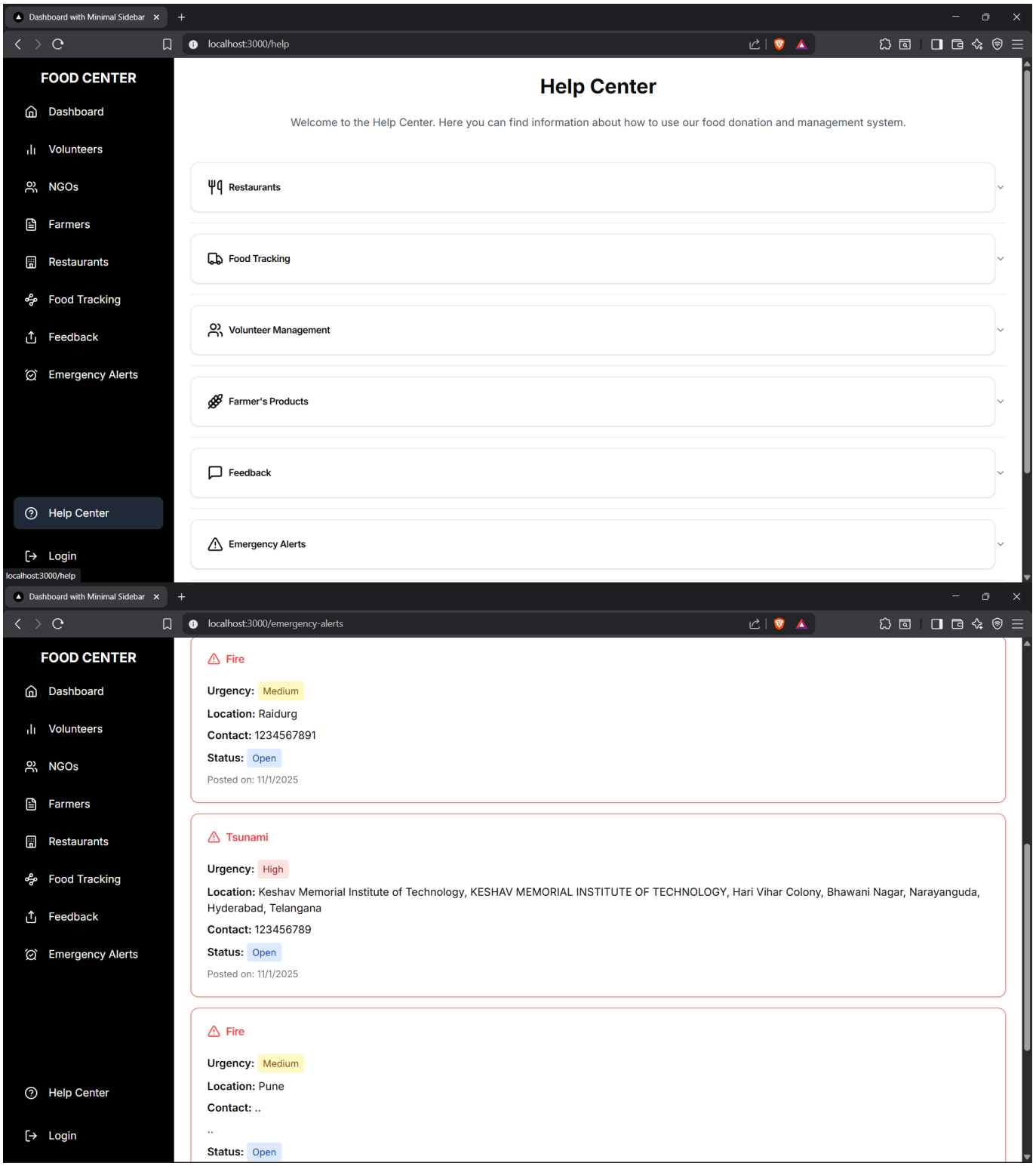

oldage/ # Old age home features
EmergencyAlerts.jsx
Oldage.jsx
Quality.jsx
Restaurants/ # Restaurant features
HomePage.jsx
Layout.jsx
Leaderboard.jsx
Notification.jsx
RestaurantsDashboard.jsx
Statistics.jsx
volunteer/ # Volunteer features
VolunteerDashboard.jsx
web/ # Next.js Web Application
package.json
package-lock.json
README.md
next.config.mjs # Next.js configuration
tailwind.config.js # Tailwind CSS configuration
postcss.config.mjs # PostCSS configuration
components.json # Component configuration
jsconfig.json # JavaScript configuration
src/ # Source files
app/ # Next.js App Router pages
layout.js # Root layout
page.js # Home page
globals.css # Global styles
favicon.ico
fonts/ # Custom fonts
GeistVF.woff
GeistMonoVF.woff
login/ # Login page
page.jsx
signup/ # Signup page
page.jsx
restaurants/ # Restaurants management
page.jsx

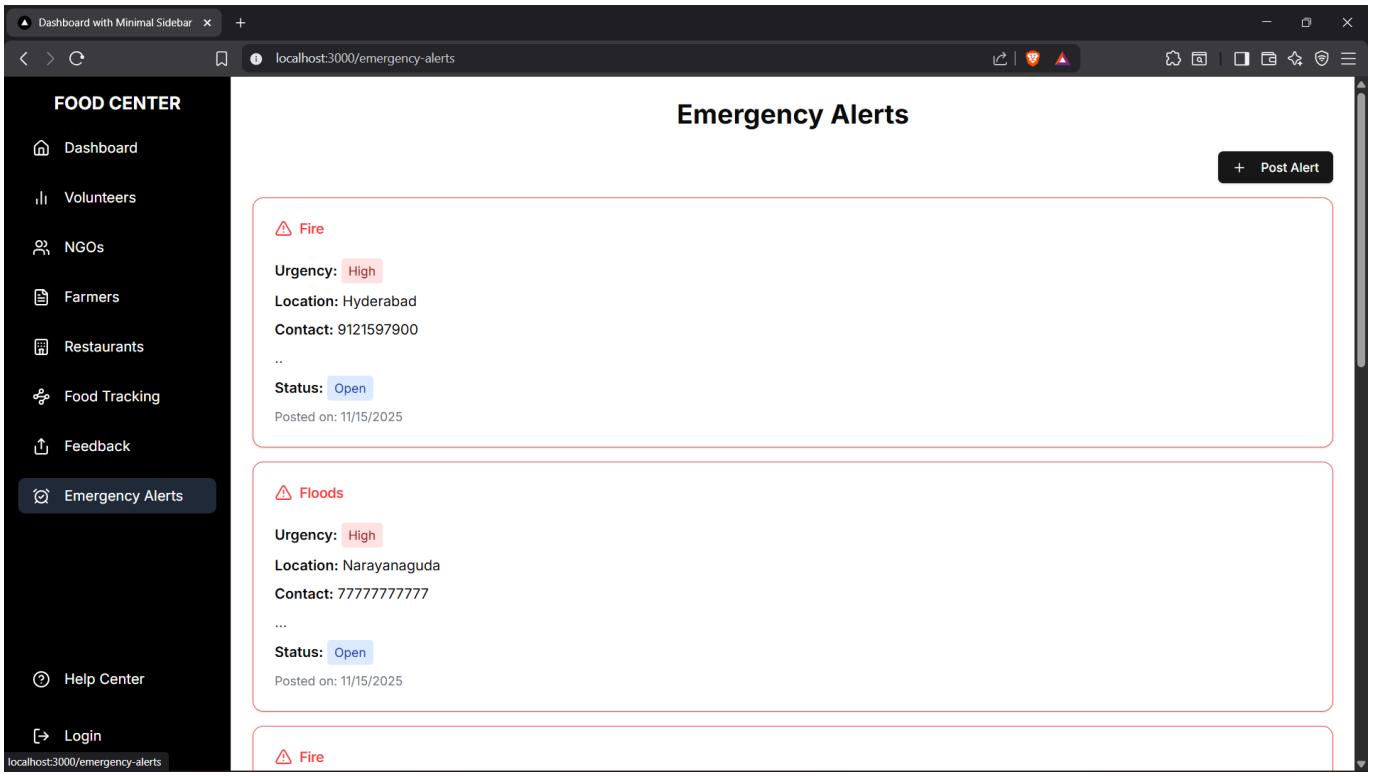

volunteers/ # Volunteer management
page.jsx
ngos/ # NGO management
page.jsx
farmers/ # Farmer management
page.jsx
food-tracking/ # Food tracking page
page.jsx
emergency-alerts/ # Emergency alerts
page.jsx
feedback/ # Feedback page
page.jsx
help/ # Help/documentation
page.jsx
components/ # React Components
globals/ # Global components
header.jsx
sidebar.jsx # Sidebar navigation
ui/ # UI Component Library (shadcn/ui)
accordion.jsx
button.jsx
card.jsx
dialog.jsx
form.jsx
input.jsx
label.jsx
pagination.jsx
progress.jsx
select.jsx
table.jsx
textarea.jsx
context/ # React Context
AuthContext.js # Authentication context
lib/ # Utility Libraries
utils.js # Helper functions

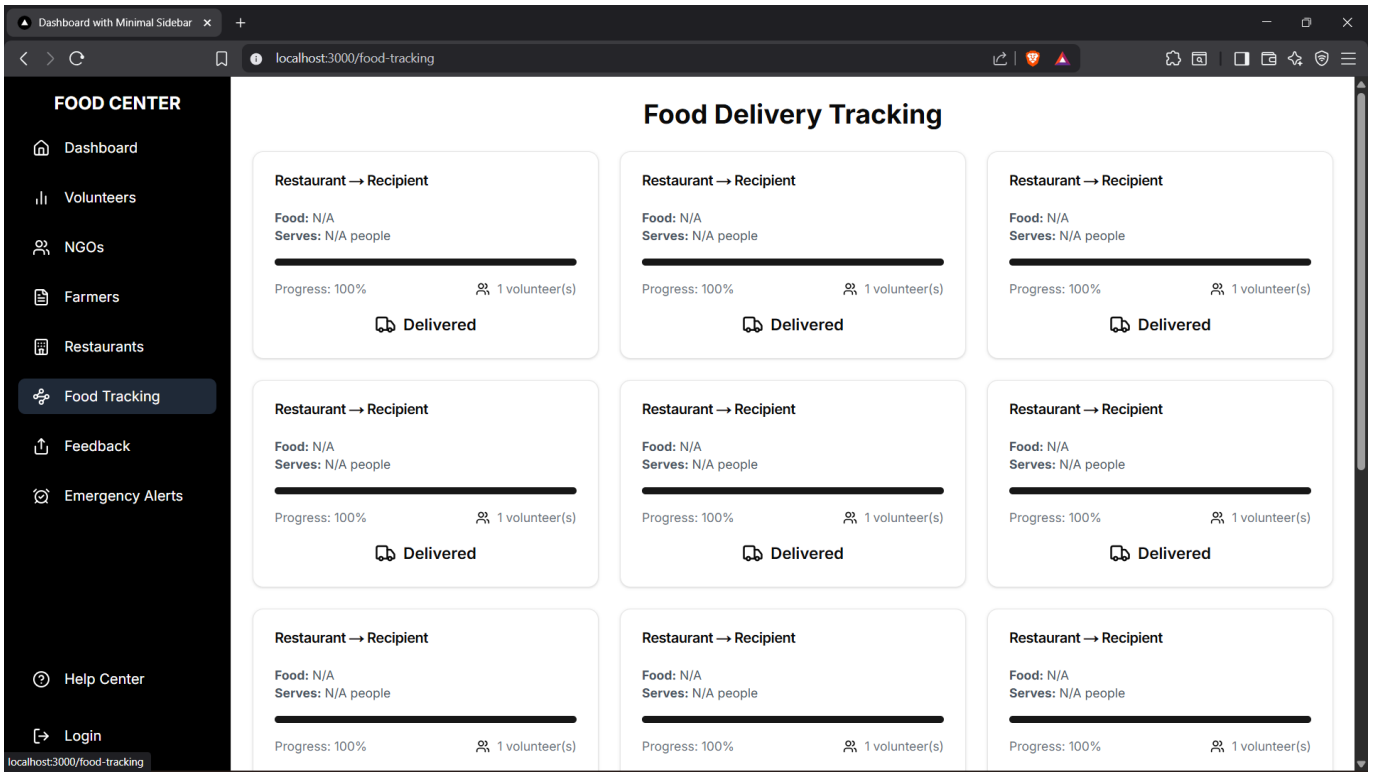
Summary

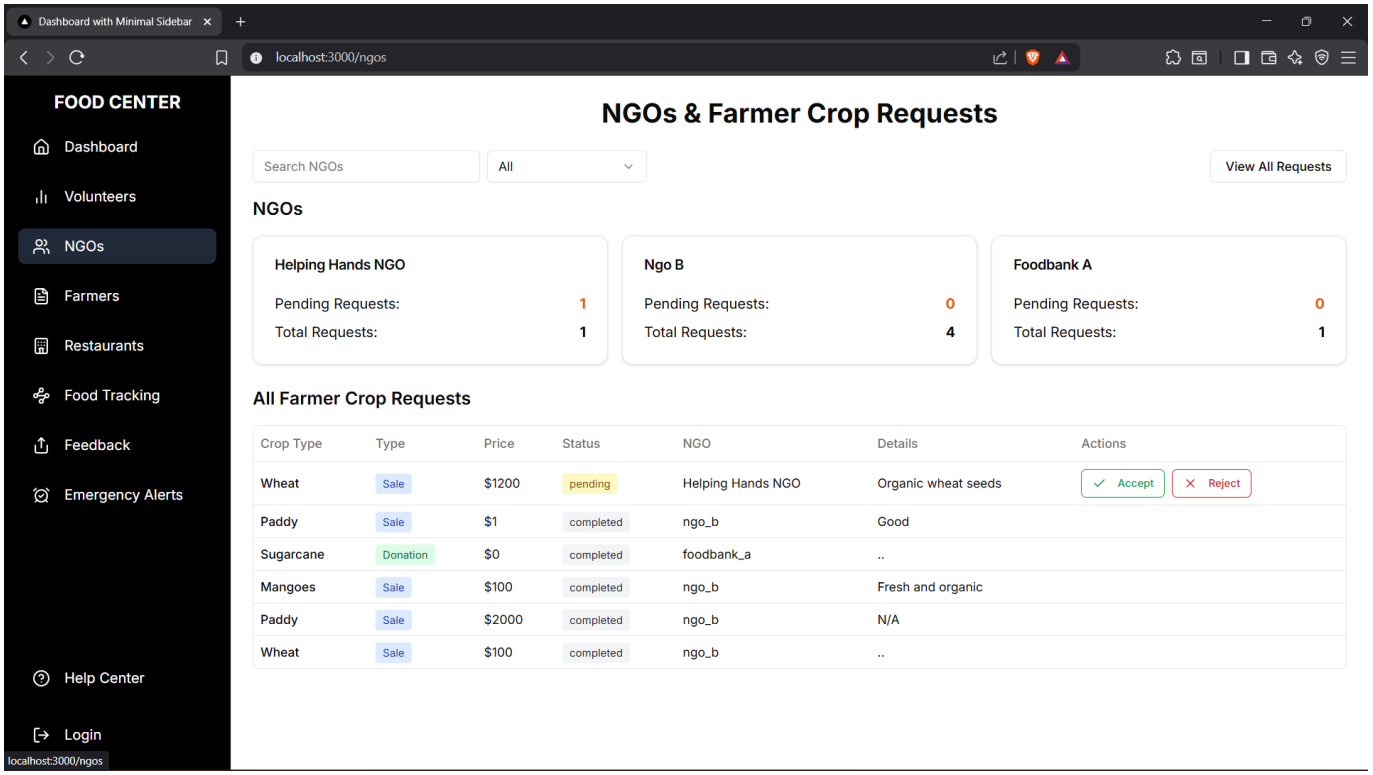
- 3 main platforms: api/, mobile/, web/
- Backend: Express.js API with MongoDB models and routes
- Mobile: React Native/Expo with screens, components, i18n, and assets
- Web: Next.js 14 App Router with pages, UI components, and utilities
- Shared: Authentication context in both mobile and web
- Total: ~200+ files across the three platforms

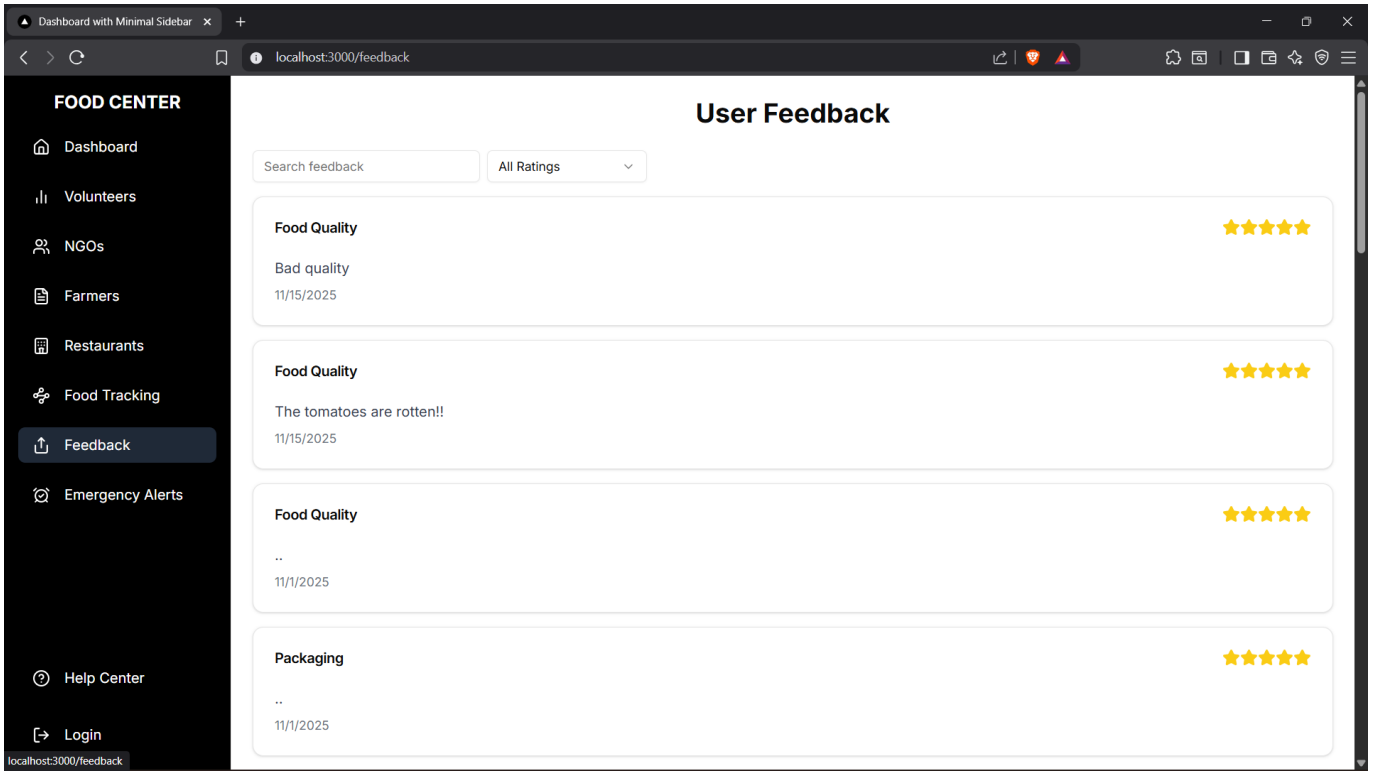
5.5 Screenshots

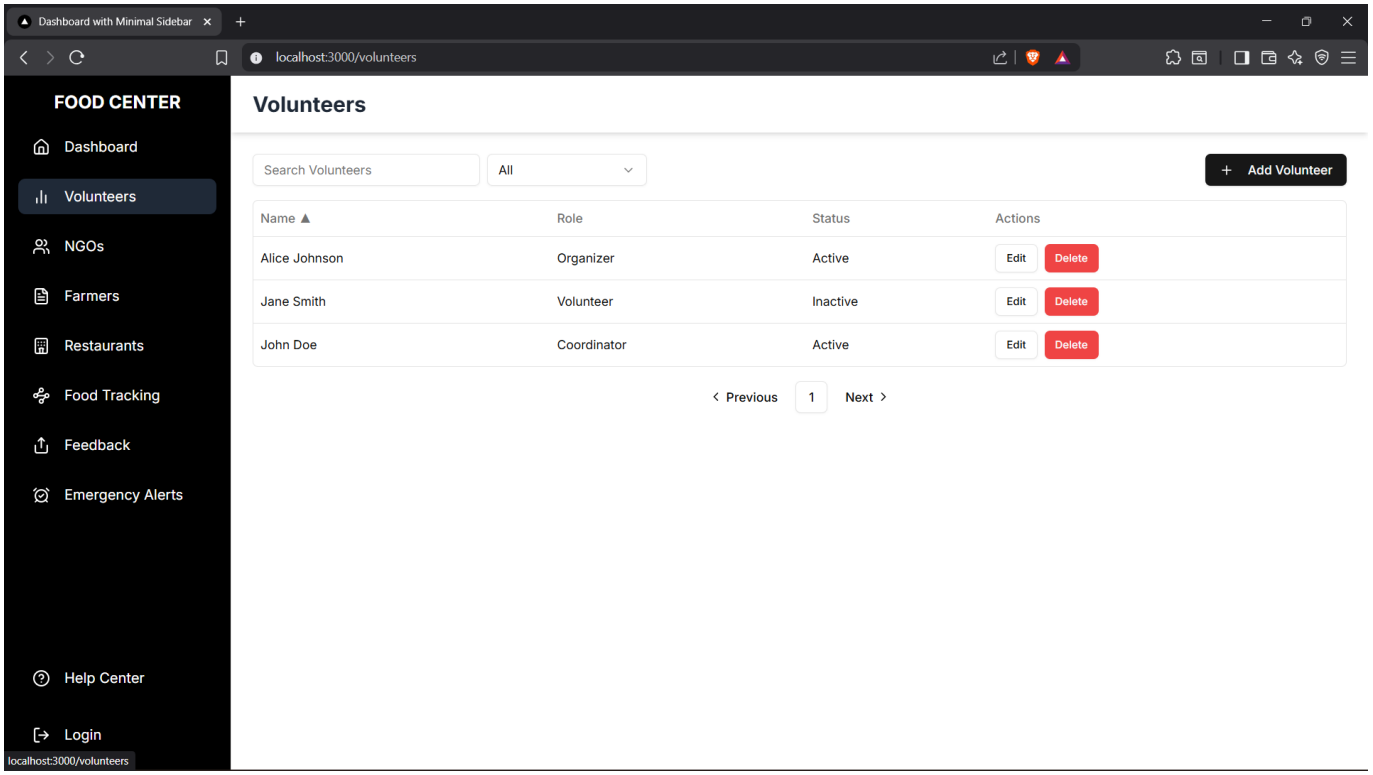


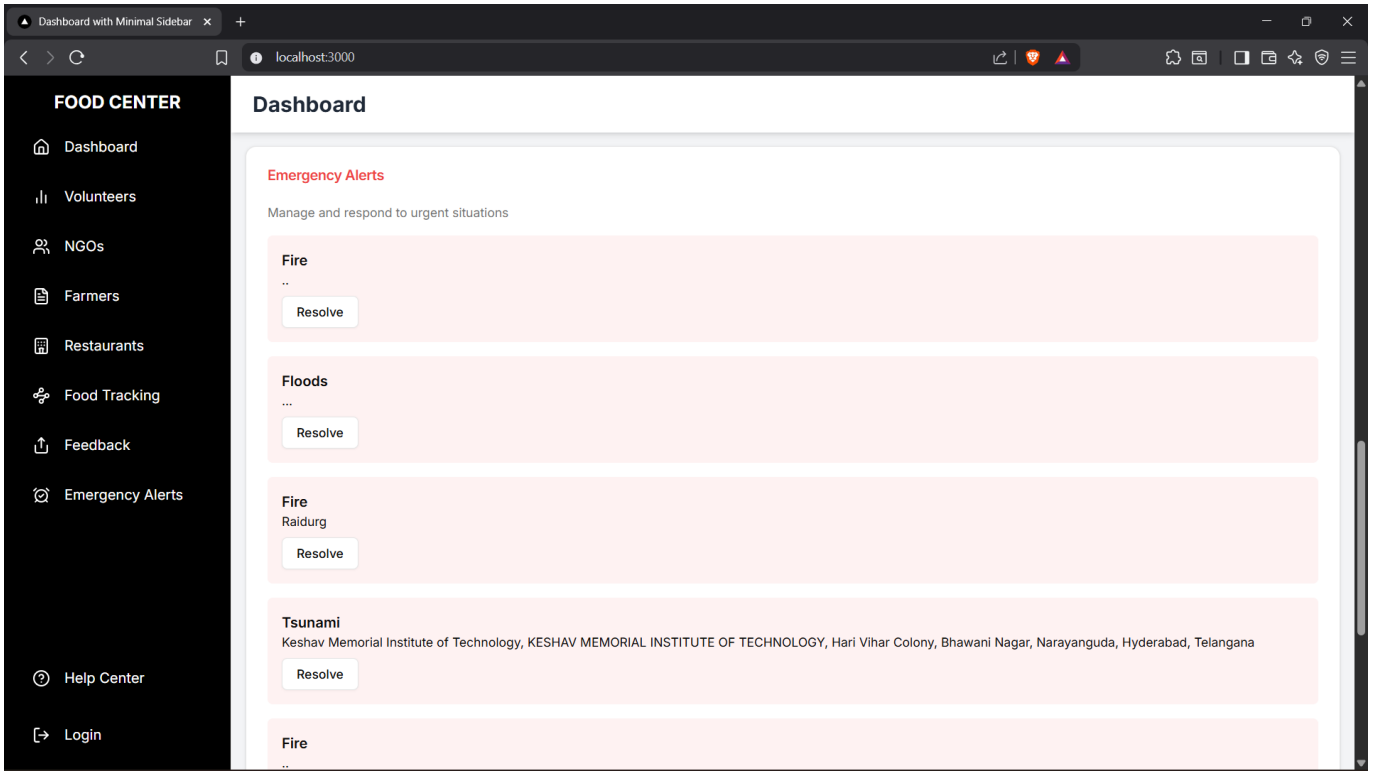

Dashboard with Minimal Sidebar
localhost:3000/emergency-alerts
FOOD CENTER
Dashboard
Volunteers
NGOs
Farmers
Restaurants
Food Tracking
Feedback
Emergency Alerts
Help Center
Login
localhost:3000/emergency-alerts
Emergency Alerts
Post Alert
Fire
Urgency: High
Location: Hyderabad
Contact: 9121597900
..
Status: Open
Posted on: 11/15/2025
Floods
Urgency: High
Location: Narayanaguda
Contact: 77777777777
...
Status: Open
Posted on: 11/15/2025
Fire

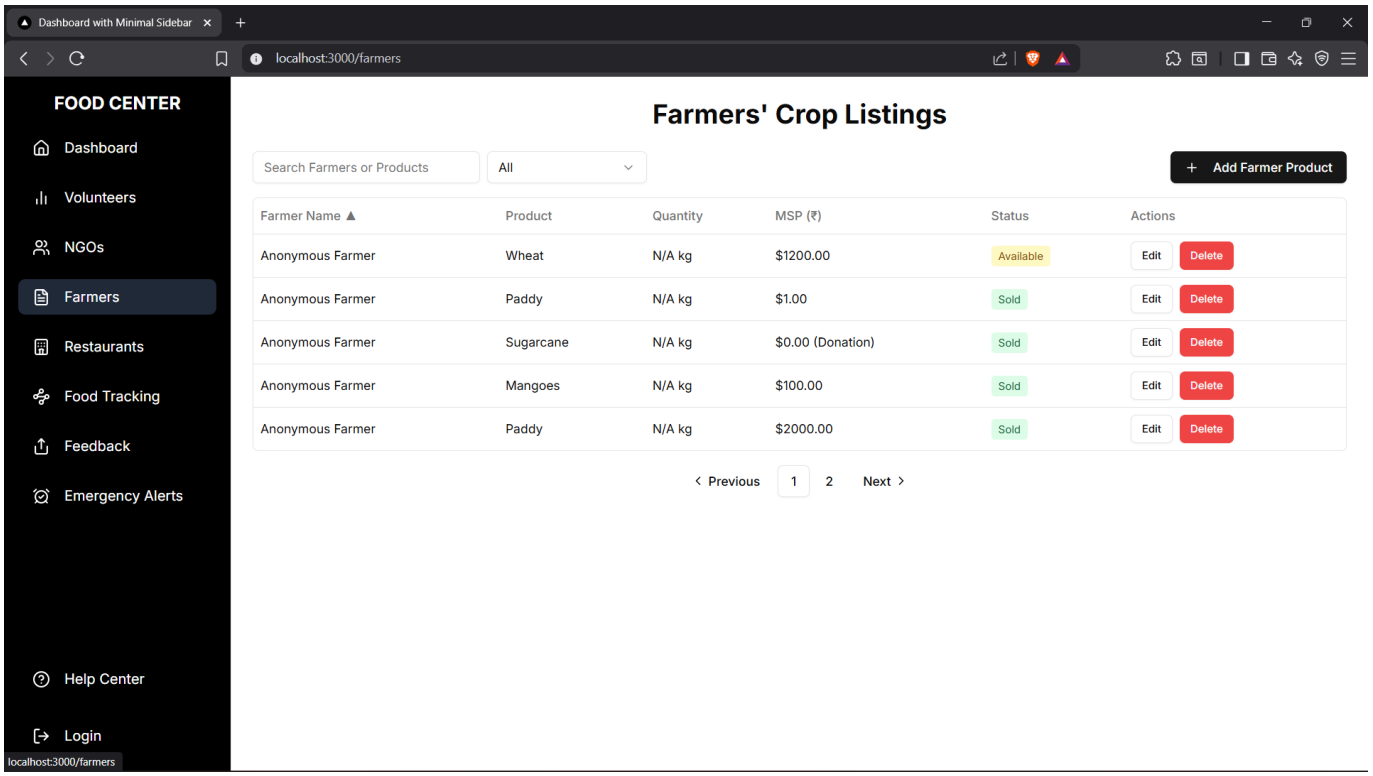

Dashboard with Minimal Sidebar
localhost:3000/food-tracking
FOOD CENTER
Dashboard
Volunteers
NGOs
Farmers
Restaurants
Food Tracking
Feedback
Emergency Alerts
Help Center
Login
localhost:3000/food-tracking
Food Delivery Tracking
Restaurant → Recipient
Food: N/A
Serves: N/A people
Progress: 100%
1 volunteer(s)
Delivered

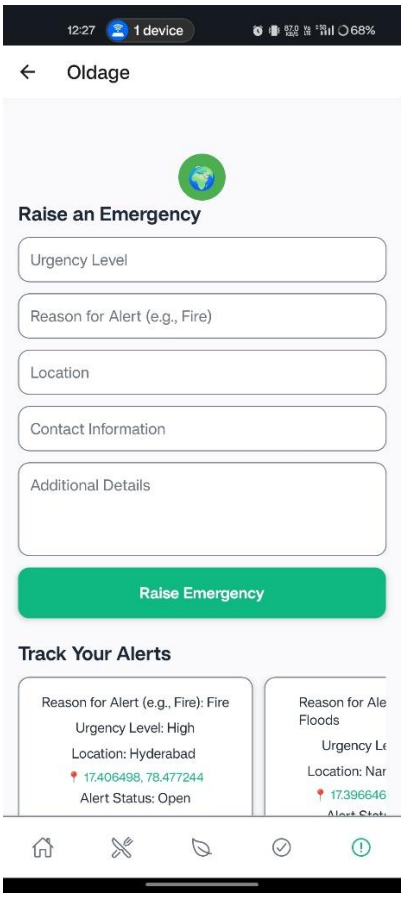

Dashboard with Minimal Sidebar
localhost:3000/ngos
FOOD CENTER
Dashboard
Volunteers
NGOs
Farmers
Restaurants
Food Tracking
Feedback
Emergency Alerts
Help Center
Login
localhost:3000/ngos
NGOs & Farmer Crop Requests
Search NGOs
All
View All Requests
NGOs
Helping Hands NGO
Pending Requests: 1
Total Requests: 1
Ngo B
Pending Requests: 0
Total Requests: 4
Foodbank A
Pending Requests: 0
Total Requests: 1
All Farmer Crop Requests
Crop Type Type Price Status NGO Details Actions
Wheat Sale $1200 pending Helping Hands NGO Organic wheat seeds Accept Reject
Paddy Sale $1 completed ngo_b Good
Sugarcane Donation $0 completed foodbank_a ..
Mangoes Sale $100 completed ngo_b Fresh and organic
Paddy Sale $2000 completed ngo_b N/A
Wheat Sale $100 completed ngo_b ..

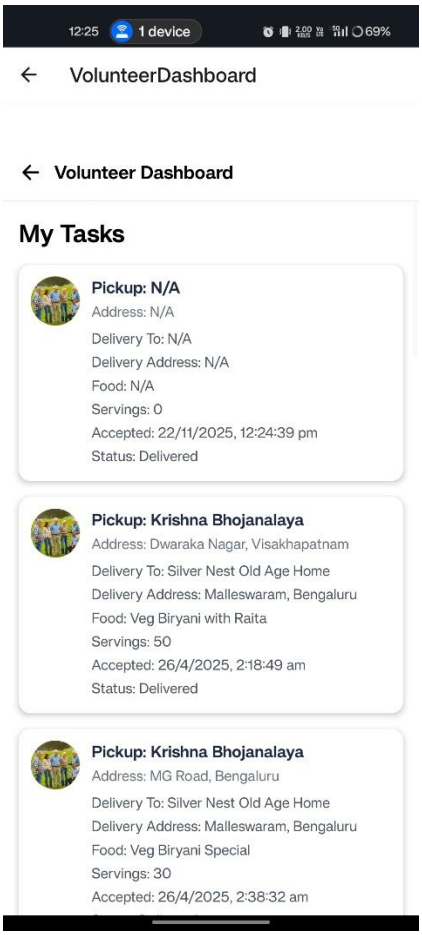

Dashboard with Minimal Sidebar
localhost:3000/feedback
FOOD CENTER
Dashboard
Volunteers
NGOs
Farmers
Restaurants
Food Tracking
Feedback
Emergency Alerts
Help Center
Login
localhost:3000/feedback
User Feedback
Search feedback
All Ratings
Food Quality
Bad quality
11/15/2025
Food Quality
The tomatoes are rotten!!
11/15/2025
Food Quality
..
11/1/2025
Packaging
..
11/1/2025

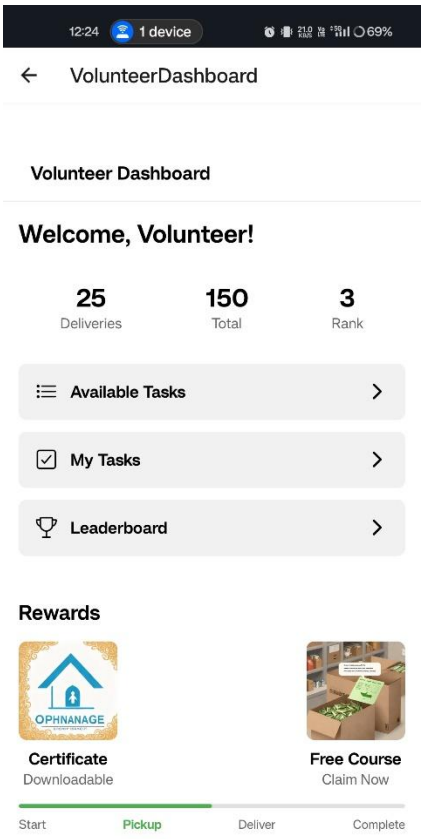

Dashboard with Minimal Sidebar
localhost:3000/volunteers
FOOD CENTER
Dashboard
Volunteers
NGOs
Farmers
Restaurants
Food Tracking
Feedback
Emergency Alerts
Help Center
Login
localhost:3000/volunteers
Volunteers
Search Volunteers
All
Add Volunteer
Name
Role
Status
Actions
Alice Johnson
Organizer
Active
Edit
Delete
Jane Smith
Volunteer
Inactive
Edit
Delete
John Doe
Coordinator
Active
Edit
Delete
Previous
1
Next

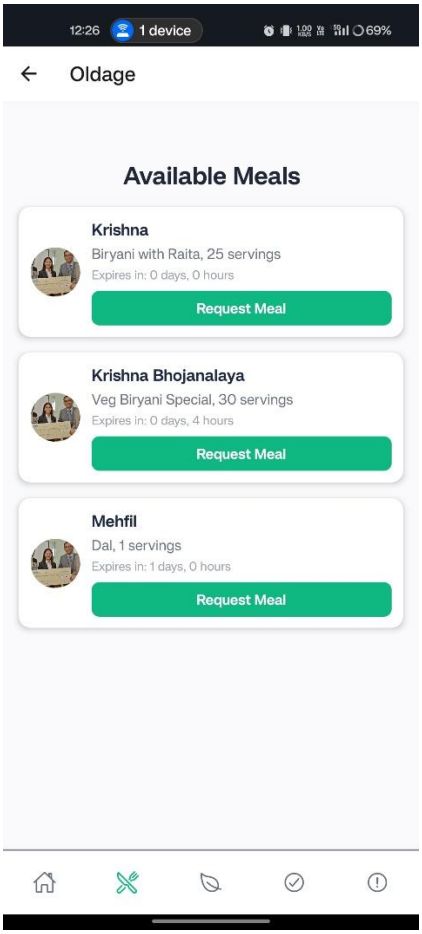

Dashboard with Minimal Sidebar
localhost:3000
FOOD CENTER
Dashboard
Volunteers
NGOs
Farmers
Restaurants
Food Tracking
Feedback
Emergency Alerts
Help Center
Login
Dashboard
Emergency Alerts
Manage and respond to urgent situations
Fire
..
Resolve
Floods
...
Resolve
Fire
Raidurg
Resolve
Tsunami
Keshav Memorial Institute of Technology, KESHAV MEMORIAL INSTITUTE OF TECHNOLOGY, Hari Vihar Colony, Bhawani Nagar, Narayanguda, Hyderabad, Telangana
Resolve
Fire
..

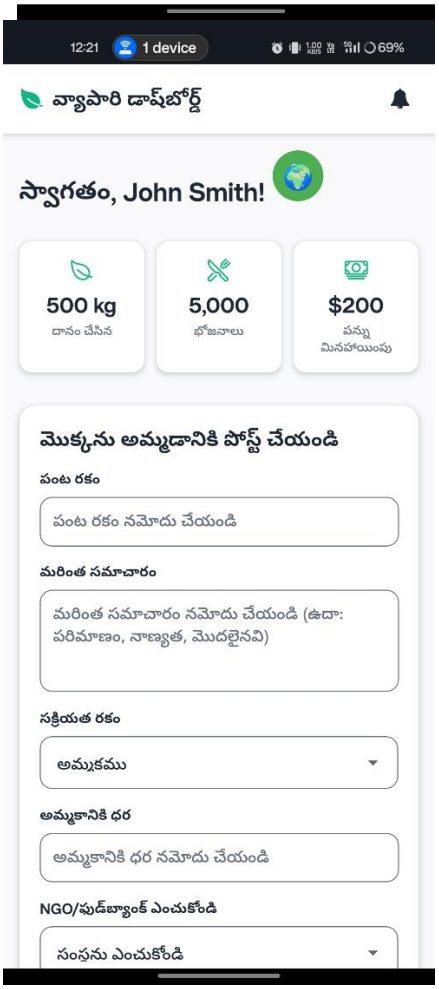

Dashboard with Minimal Sidebar
localhost:3000/farmers
FOOD CENTER
Dashboard
Volunteers
NGOs
Farmers
Restaurants
Food Tracking
Feedback
Emergency Alerts
Help Center
Login
localhost:3000/farmers
Farmers' Crop Listings
Search Farmers or Products
All
Add Farmer Product
Farmer Name ▲
Product
Quantity
MSP (₹)
Status
Actions
Anonymous Farmer
Wheat
N/A kg
$1200.00
Available
Edit
Delete
Anonymous Farmer
Paddy
N/A kg
$1.00
Sold
Edit
Delete
Anonymous Farmer
Sugarcane
N/A kg
$0.00 (Donation)
Sold
Edit
Delete
Anonymous Farmer
Mangoes
N/A kg
$100.00
Sold
Edit
Delete
Anonymous Farmer
Paddy
N/A kg
$2000.00
Sold
Edit
Delete
Previous
1
2
Next

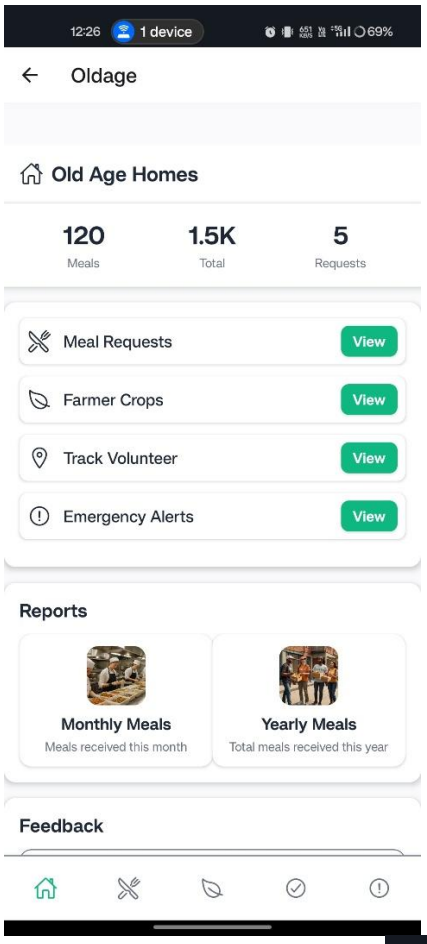

12:27
1 device
68%
Oldage
Raise an Emergency
Urgency Level
Reason for Alert (e.g., Fire)
Location
Contact Information
Additional Details
Raise Emergency
Track Your Alerts
Reason for Alert (e.g., Fire): Fire
Urgency Level: High
Location: Hyderabad
17.406498, 78.477244
Alert Status: Open
Reason for Ale
Floods
Urgency Le
Location: Nar
17.396646

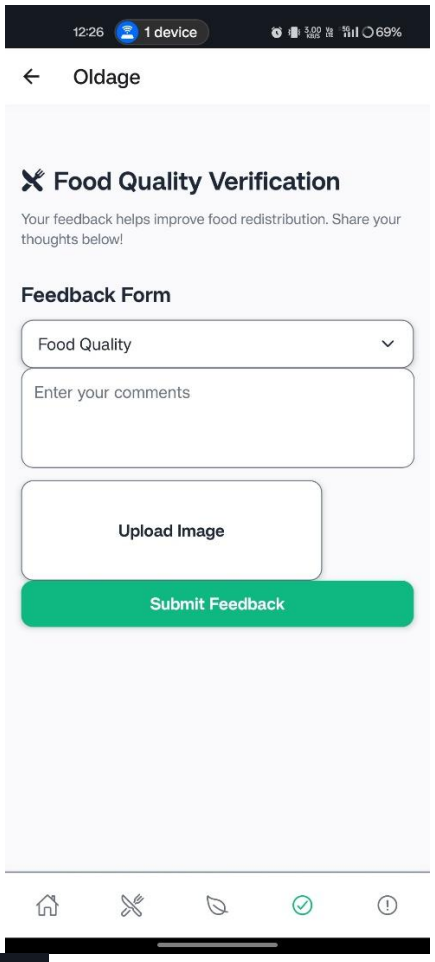

12:25 1 device 69%
VolunteerDashboard
Volunteer Dashboard
My Tasks
Pickup: N/A
Address: N/A
Delivery To: N/A
Delivery Address: N/A
Food: N/A
Servings: 0
Accepted: 22/11/2025, 12:24:39 pm
Status: Delivered
Pickup: Krishna Bhojanalaya
Address: Dwaraka Nagar, Visakhapatnam
Delivery To: Silver Nest Old Age Home
Delivery Address: Malleswaram, Bengaluru
Food: Veg Biryani with Raita
Servings: 50
Accepted: 26/4/2025, 2:18:49 am
Status: Delivered
Pickup: Krishna Bhojanalaya
Address: MG Road, Bengaluru
Delivery To: Silver Nest Old Age Home
Delivery Address: Malleswaram, Bengaluru
Food: Veg Biryani Special
Servings: 30
Accepted: 26/4/2025, 2:38:32 am

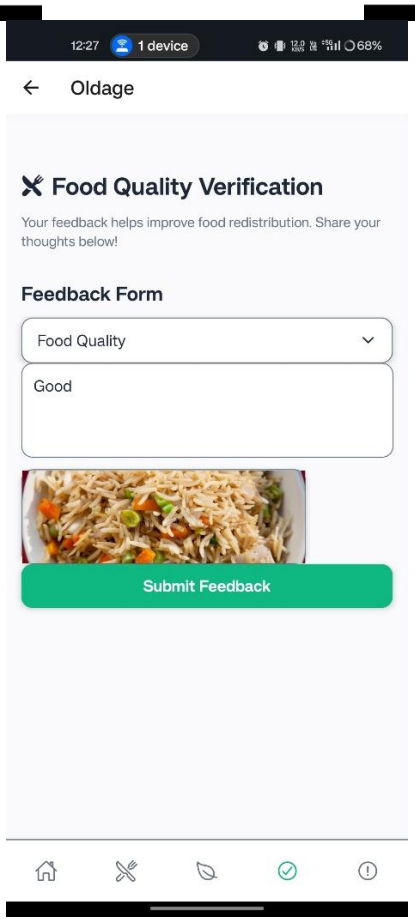

12:24 1 device 69%
VolunteerDashboard
Volunteer Dashboard
Welcome, Volunteer!
25
Deliveries
150
Total
3
Rank
Available Tasks
My Tasks
Leaderboard
Rewards
OPHNANAGE
Certificate
Downloadable
Free Course
Claim Now
Start
Pickup
Deliver
Complete


12:26 1 device 69%
Oldage
Available Meals
Krishna
Biryani with Raita, 25 servings
Expires in: 0 days, 0 hours
Request Meal
Krishna Bhojanalaya
Veg Biryani Special, 30 servings
Expires in: 0 days, 4 hours
Request Meal
Mehfil
Dal, 1 servings
Expires in: 1 days, 0 hours
Request Meal


12:21 1 device 69%
వ్యాపారి డాష్‌బోర్డ్
స్వాగతం, John Smith!
500 kg
దానం చేసిన
5,000
భోజనాలు
$200
పన్ను
మినహాయింపు
మొక్కను అమ్మడానికి పోస్ట్ చేయండి
పంట రకం
పంట రకం నమోదు చేయండి
మరింత సమాచారం
మరింత సమాచారం నమోదు చేయండి (ఉదా: పరిమాణం, నాణ్యత, మొదలైనవి)
సక్రియత రకం
అమ్మకము
అమ్మకానికి ధర
అమ్మకానికి ధర నమోదు చేయండి
NGO/ఫుడ్‌బ్యాంక్ ఎంచుకోండి
సంస్థను ఎంచుకోండి


12:26
1 device
69%
Oldage
Old Age Homes
120
Meals
1.5K
Total
5
Requests
Meal Requests
View
Farmer Crops
View
Track Volunteer
View
Emergency Alerts
View
Reports
Monthly Meals
Meals received this month
Yearly Meals
Total meals received this year
Feedback


12:26
1 device
69%
Oldage
Food Quality Verification
Your feedback helps improve food redistribution. Share your thoughts below!
Feedback Form
Food Quality
Enter your comments
Upload Image
Submit Feedback


12:27
1 device
68%
Oldage
Food Quality Verification
Your feedback helps improve food redistribution. Share your thoughts below!
Feedback Form
Food Quality
Good
Submit Feedback


12:23
1 device
69%
RestaurnatsStatistics
Statistics
Monthly Meals Donated
120 Meals
+10% This Month
30
24
18
11
5
01
05
10
15
20
Meals Donated
Meals Accepted
Yearly Meals Donated
1,200 Meals
+15% This Year
Home
Dashboard
Leaderboard
Statistics

CHAPTER 6

SOFTWARE TESTING

Software testing plays a crucial role in ensuring the stability, reliability, and usability of the Choti Bhojan Yatra food-redistribution platform. Because this system involves critical real-world operations—such as meal postings, NGO verification, volunteer assignments, delivery tracking, and emergency-relief workflows—it is essential that every module behaves as expected under normal and high-load conditions. Testing not only validates the technical accuracy but also safeguards the trust of NGOs, restaurants, farmers, volunteers, and vulnerable communities who depend on timely food distribution during daily operations as well as disaster scenarios.

Testing helps identify defects early, confirm system performance across varied devices and network strengths, and validate business rules that maintain operational integrity. With multiple user roles (Restaurant, NGO, Farmer, Volunteer, Admin) and multilingual support (English, Hindi, Telugu), the platform requires comprehensive testing to ensure that all users receive a consistent and error-free experience. Testing also reduces regression risks as new features are added, improves maintainability, and strengthens confidence for deployment across cities and larger partner networks.

Primary stakeholders in the testing lifecycle include the QA team, backend developers, frontend/mobile developers, DevOps engineers, and NGO field coordinators who provide real-world acceptance criteria. Their combined input ensures the system performs with accuracy, reliability, and security in real operational environments.

6.1 Introduction

The primary objective of testing the Choti Bhojan Yatra system is to ensure that all critical user journeys—from onboarding to food delivery—operate smoothly without functional or performance issues. The system must be verified against functional requirements, integration expectations, and real-world use conditions. Key objectives include:

1. **Validate core workflows**
   Ensure that key operations such as user registration, login, posting meals, raising food requests, accepting volunteer tasks, tracking routes, and confirming deliveries behave correctly across all roles.
2. **Ensure data integrity**
   Confirm that database collections (Meals, Requests, Volunteers, NGOs, Emergencies, Deliveries) maintain accurate, consistent, and traceable information for audits and reporting.
3. **Verify performance under stress**
   During disaster relief events, user load may spike significantly. Testing ensures API latency remains acceptable and the volunteer matching system continues responding in real-time.
4. **Test multilingual and accessibility compliance**
   Hindi/Telugu screens must match English content in meaning, formatting, and usability. The UI must remain readable and navigable by differently-abled users.
5. **Confirm security and RBAC compliance**
   Ensure unauthorized users cannot access restricted endpoints and sensitive operations remain protected through JWT and server-side validations.

6.1.1 Testing Objectives

To ensure full coverage, multiple testing methodologies were adopted:

1. Unit Testing

- Jest test suites were created for backend controllers, service modules, and helper utilities.
- React hooks and small UI components were tested using React Testing Library.
- These tests detect logical flaws early and reduce debugging costs.

2. Integration Testing

- Tools like **Supertest**, **Postman**, and **Thunder Client** were used to hit endpoints such as: /auth/login, /meals/post, /orders/update, /volunteer/accept, /emergency/create.
- These tests validated middleware behavior, DB connections, and token authentication logic.

3. UI/UX Testing

- Cypress and Playwright were used for automated UI testing.
- React Native Testing Library validated component rendering, form validation, navigation, and button flows.
- Special attention was given to error messages, loading indicators, and consistency of labels.

4. Performance & Load Testing

- Tools such as **k6** and **Artillery** simulated heavy loads during emergency situations, testing:
  - Order creation rate
  - Volunteer assignment rate
  - Notification dispatch speed
- KPIs like p95 response time, throughput, and server CPU/memory usage were closely monitored.

5. Security Testing

- OWASP ZAP scans identified vulnerabilities such as:
  - Broken access control
  - Missing authorization
  - Token leakage
  - CORS misconfigurations
- Manual tests verified that each user role is restricted to allowed operations only.

6. Regression Testing

- After each deployment, a full regression suite was executed.
- This ensured that new updates did not break existing workflows.

6.1.2 Testing Strategies

A comprehensive evaluation framework was designed to measure the effectiveness of the testing process and determine the readiness of the system for production deployment.

Evaluation Metrics

- **Defect Density** – number of bugs per module.
- **Mean Time to Resolve (MTTR)** – speed at which the team fixes issues.
- **API Response Times** – key endpoints must maintain p95 < 300 ms under moderate load.
- **Uptime & Crash-Free Sessions** – mobile/web apps must operate without unhandled exceptions.
- **Localization Accuracy** – Hindi/Telugu translations must achieve at least 95% correctness.

- **Volunteer Task Assignment Success Rate** – >98% of assignments must process correctly.

User Acceptance Testing (UAT)
Stakeholders such as NGOs, restaurant partners, and volunteer groups participated in UAT sessions. Their evaluation criteria included:

- Ease of use
- Speed of navigation
- Language clarity
- Reliability of notifications
- Familiarity with workflows
- Trust in delivery tracking

Their feedback helped refine UI layouts, wording choices, navigation flows, and confirmation screens.

6.1.3 System Evaluation

Measure success via defect density, mean time to detect/fix, API response percentiles (<300 ms p95 for key routes), crash-free sessions, and localization accuracy rates.
Gather stakeholder feedback through UAT scorecards tracking readiness of NGOs/restaurants/volunteers.

6.1.4 Testing New System

To ensure the stability of the new release, a controlled and systematic testing approach was followed:

1. **Staging Environment Setup**
   A staging server was created mirroring the production environment, including database structure, environment variables, and API routes.
2. **Database Seeding**
   Core collections such as Meals, NGOs, Volunteers, and Requests were populated with sample datasets to simulate real workflows.
3. **Smoke Testing**
   Quick validation was performed to ensure that major functions (login, posting, viewing tasks) did not break after deployment.
4. **Full Regression Testing**
   All existing test cases were re-run to confirm nothing was negatively affected.
5. **Pilot Deployment**
   Initially, a limited number of NGOs and restaurants were onboarded to observe real-world behavior.
6. **Monitoring and Telemetry**
   Logs, crashes, network errors, and performance metrics were monitored through dashboards such as Grafana or Firebase Crashlytics.
7. **Phased Rollout**
   After confirming system stability and stakeholder satisfaction, features were rolled out to all users.

6.2 Sample Test Cases

- TC-API-001 Login success: POST /auth/login with valid creds → expect 200, JWT, user role payload.
- TC-API-010 Unauthorized meal creation: POST /meals without token → expect 401 error message.
- TC-MOB-021 Volunteer accepts assignment (English): from VolunteerDashboard tap assignment → status updates, toast confirmation, backend orders.status=accepted.
- TC-MOB-045 Language switch Hindi: toggle flag component → all labels render Hindi strings from i18n/locales/hi-HI/translation.json.
- TC-WEB-033 Restaurant leaderboard pagination: navigate /restaurants/leaderboard → next/prev buttons paginate without layout shift.
- TC-PERF-004 Bulk order creation: simulate 500 requests/min → API remains <500 ms p95, zero errors.
- TC-SEC-002 RBAC enforcement: NGO user attempts volunteer-only endpoint /volunteer/assign → expect 403.

CONCLUSION

The **Food Redistribution Application** represents a comprehensive technological solution to one of society's most complex challenges—efficiently redirecting surplus food to individuals and communities affected by hunger. In an era where millions of tons of edible food are wasted each year while countless people remain food insecure, this project provides a structured and scalable approach to bridge this widening gap. By integrating the efforts of donors, NGOs, volunteers, farmers, and administrators into a unified digital ecosystem, the system facilitates a streamlined redistribution process that minimizes waste and maximizes social benefit. What began as a conceptual idea evolved into a fully functional prototype designed to demonstrate how modern software technologies can enable humanitarian impact at scale.

A major achievement of this project is the development of **user-friendly interfaces** tailored for different stakeholders. Donors can seamlessly post surplus food items, specify quantities, upload images, and define pickup windows. NGOs and Old Age Homes have access to dashboards that allow them to request food, monitor availability, track deliveries, and respond to emergencies. Volunteers, who form the backbone of physical distribution, can accept tasks, navigate optimized routes using GPS, and update delivery status in real time. This coordination, made possible through well-organized UI flows, ensures that surplus food is not only identified but also delivered to the right destination without unnecessary delay.

The incorporation of **AI-based food recognition using the Gemini API** further enhances the system's efficiency. Donors may not always provide detailed descriptions of food items; however, automated food classification helps improve accuracy and reduces chances of miscommunication. Additionally, multilingual support ensures the application is usable by individuals from rural areas, local vendors, and farmers who may not be fluent in English. These inclusive features underline the project's commitment to accessibility, aligning with the goal of making the redistribution network accessible to everyone.

Technically, the project involved extensive work in full-stack web and mobile development. The backend system was built using **Node.js, Express.js, and MongoDB**, enabling scalable API management and efficient storage of geo-tagged data. The implementation of geospatial queries allowed volunteers to automatically receive tasks based on proximity, ensuring quicker pickups and reduced food spoilage. Additionally, the integration of JWT-based authentication, role management, and CORS middleware contributed to a secure and structured API environment. From the frontend perspective, the application leveraged **React/Next.js and React Native**, creating a responsive and intuitive experience across devices.

Developing the system required not only coding but also **software engineering practices** such as UML modeling, SRS documentation, architectural planning, designing sequence flows, and constructing state diagrams. These components helped the team visualize system behavior, validate logical flows, and ensure consistency across all modules. The deployment model also demonstrated how different components—including the client layer, API layer, business logic, data layer, and external AI services—work together cohesively in a real-world setup.

During the testing phase, multiple scenarios were examined, including functional correctness, error handling, input validation, responsiveness, and role-based access control. The results indicated that the system behaves reliably under various conditions and supports smooth navigation across the food posting,

request management, and delivery tracking processes. Test cases were developed for each module, ensuring robustness and uncovering areas for improvement. This iterative testing contributed to refining the platform and improving overall system stability.

From a societal perspective, the Food Redistribution Application reflects the potential of **technology-driven social innovation**. It not only addresses hunger but also promotes environmental sustainability by reducing the burden on landfills and methane emissions associated with discarded food. By establishing a structured mechanism for food recovery, the system supports the Sustainable Development Goals (SDGs)—particularly **SDG 2: Zero Hunger**, **SDG 12: Responsible Consumption and Production**, and **SDG 11: Sustainable Cities and Communities**.

On a personal and academic level, the development of this application provided the team with significant hands-on experience in designing real-world systems. It enhanced their understanding of API integration, user experience design, cloud architecture, asynchronous processing, data modeling, and DevOps principles. The project also strengthened soft skills such as teamwork, communication, problem-solving, and requirement analysis.

In conclusion, the Food Redistribution Application stands as a strong demonstration of how modern software engineering, artificial intelligence, and community participation can converge to create meaningful social impact. The project not only fulfills its intended technical objectives but also contributes to a larger mission of reducing food waste and supporting disadvantaged communities. As a scalable, adaptable, and socially responsible platform, it holds the potential for real-world deployment and future expansion into a full-fledged food recovery ecosystem serving cities, rural areas, and disaster-affected regions.

FUTURE ENHANCEMENTS

Although the Food Redistribution Application currently fulfills its primary objectives, there are several opportunities to enhance its efficiency, scalability, and impact. Future upgrades can significantly transform the system into a nationwide digital food recovery ecosystem with advanced capabilities.

A promising enhancement is to integrate real-time IoT sensors in storage boxes or vehicles to monitor temperature and food freshness during transit. This will help ensure safety and reduce spoilage in longer delivery routes. Another major improvement is using machine learning models to predict donation patterns, peak hours, and NGO demand, enabling smart scheduling and resource allocation.

The platform can be extended with blockchain-based tracking for tamper-proof donation records, enhancing transparency for large food donors, CSR partners, and government agencies. Additionally, incorporating route optimization algorithms can help volunteers curate multi-stop pickup routes, reducing fuel usage and delivery time.

To broaden its accessibility, a complete offline-first mobile application can be developed so volunteers in low-network regions can still operate effectively. Integration with government platforms such as PM-POSHAN, Food Safety departments, and municipal waste-management boards can further expand the system's reach and adoption.

Gamification can be enhanced through volunteer levels, seasonal challenges, digital certificates, and corporate reward partnerships. Finally, AI-driven features such as automated food expiry detection from images, voice-based assistance in regional languages, and sentiment analysis of feedback can make the system more intelligent and user-friendly.

In future iterations, the application can evolve into a comprehensive National Food Rescue Network, enabling smart redistribution, emergency relief support, and sustainable community empowerment across India.

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