American International University-Bangladesh (AIUB)

Department of Computer Science

Faculty of Science & Technology (FST)

Leftover Food Distribution System

A Software Engineering Project Submitted
By

Semester: Summer 24-25		Section: K	Group Number: 06	
SL	**Student Name**	**Student ID**	**Contribution (CO3+CO4)**	**Individual Marks**
1	Mahin Sarker	22-48338-3		
2	Diapneeta Pramanik	22-48286-3		
3	Tojammel Jakaria Jenin	22-48309-3		
4	Md.Iftekharul Islam	22-48290-3		
5	Sirazum Munira Munni	22-48379-3		

The project will be evaluated for the following Course Outcomes

CO3 (PO-g-1) ***Select appropriate software engineering models, project management roles and their associated skills for the complex software engineering project and evaluate the sustainability of developed software, taking into consideration the societal and environmental aspects***	Total Marks	
Selection of Software Engineering Models: Process model selection and presents sufficient evidence to support argument for the model selection	[5 Marks]	
Role identification and Responsibility Allocation: Well-planned project with proper role identification and responsibility allocation in the project management activities	[5Marks]	
Formatting and Submission: Submission, Defense, Completeness, Spelling, grammar, and Organization of the Project report	[5Marks]	
CO4 (PO-k-1) ***Apply engineering management principles and economic decision making to develop software engineering project management plan.***	Total Marks	
Project WBS and Testcases: Relevant WBS (project task list) and testcases for the proposed project are stated properly.	[5Marks]	
Effort Estimation and Scheduling: Project estimation was described using proper effort estimation or schedules based on available project resources	[5Marks]	
Risk Management: Sufficient and appropriate risks are identified, analyzed, and properly categorized or prioritized.	[5Marks]	

Description of Student's Contribution in the Project work

Student Name: Mahin Sarker Student ID: 22-48338-3 Contribution in Percentage (%): 25% Contribution in the Project: _____ Signature of the Student
Student Name: Dipaneeta Pramanik Student ID: 22-48286-3 Contribution in Percentage (%):25% Contribution in the Project: _____ Signature of the Student
Student Name: Tojammel Jakaria Jenin Student ID: 22-48309-3 Contribution in Percentage (%):25% Contribution in the Project: _____ Signature of the Student
Student Name: Md.Iftekharul Islam Student ID: 22-48290-3 Contribution in Percentage (%):25% Contribution in the Project: _____ Signature of the Student
Student Name: Sirazum Munira Munni Student ID: 22-48379-3 Contribution in Percentage (%): 25% Contribution in the Project: _____ Signature of the Student

1.PROJECT PROPOSAL

1.1 Background to the Problem:

A huge quantity of safe, edible food is thrown out every day in major centers of Bangladesh given the fact that millions of people suffer from chronic hunger. The UN Environment Program's 2024 Food Waste Index Report states that the average Bangladeshi household wastes about 82 kg of food annually, which is significantly more than in many wealthy countries. The main reason behind this waste is a lack of proper coordination. There is no central system that connects people or businesses who want to donate food with the NGOs and volunteers who can deliver it to those in need. Because of this, we face a few serious issues:

- Poor communication: Donors and food rescuers usually talk through informal channels, which waste time.
- Delivery problems: Without a proper system in place, collecting and delivering food is unreliable, and a lot of it goes bad before it can be used.
- Lack of trust and awareness: Many businesses do not know who they can safely donate food to. Some worry about getting in trouble for giving away leftovers.

This problem points to three major national challenges: hunger, environmental damage, and economic loss. First, around 1.6 million children are expected to suffer from acute malnutrition in 2025, while 14.1 million tons of food go to waste every year, redirecting even a portion of that 2025-08-03 Page 4 of 9 could make a big difference. Second, wasted food makes up a large part of the 5,000+ tons of daily waste in cities like Dhaka, most of which ends up in landfills such as Matuail or Aminbazar, where it releases methane, a powerful greenhouse gas, and leaks toxic substances into the soil and water. Third, food waste also means wasted money; up to 17–32% of rice and vegetables are lost after harvest, hurting both businesses and the economy.

So, solving this problem is not just about feeding people is also about creating a fair, eco-friendly, and efficient society. A coordinated, technology-driven approach is needed to connect donors, NGOs, and volunteers to reduce food waste, fight hunger, and maximize societal benefits.

References:

1. The Business Standard. (2024, March 28). *A Bangladeshi wastes 82kg of food a year at home – more than an American, Dutch, Japanese*. The Business Standard. https://www.tbsnews.net/bangladesh/bangladeshi-wastes-82kg-food-year-home-more-american-dutch-japanese-817246

2. Integrated Food Security Phase Classification (IPC). (2025, July 4). *Bangladesh: Acute Malnutrition Situation for January - December 2025*. IPC Global Platform. https://www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1159654/

3. The Daily Star. (2022, August 6). *Where does all our waste end up?*. The Daily Star. https://www.thedailystar.net/star-weekend/environment/where-does-all-our-waste-end-1587943

4. Food Planning and Monitoring Unit (FPMU). (2024, April 25). *Estimation of overall food losses and waste at all levels of the food chain*. Ministry of Food, Government of Bangladesh. https://fpmu.mofood.gov.bd/sites/default/files/files/fpmu.mofood.gov.bd/miscellaneous_info/93100d80_c142_4cf2_9c93_a98fc3673b07/2024-02-11-05-30-d7134057c18a333eccd343324d55f940.pdf

5. Prothom Alo. (2025, March 3). *Internet users decrease by 13.2 million*. Prothom Alo English. https://en.prothomalo.com/bangladesh/7ifddqcbtf

1.2 Solution to the Problem and Process Model Selection:

Project Scope:

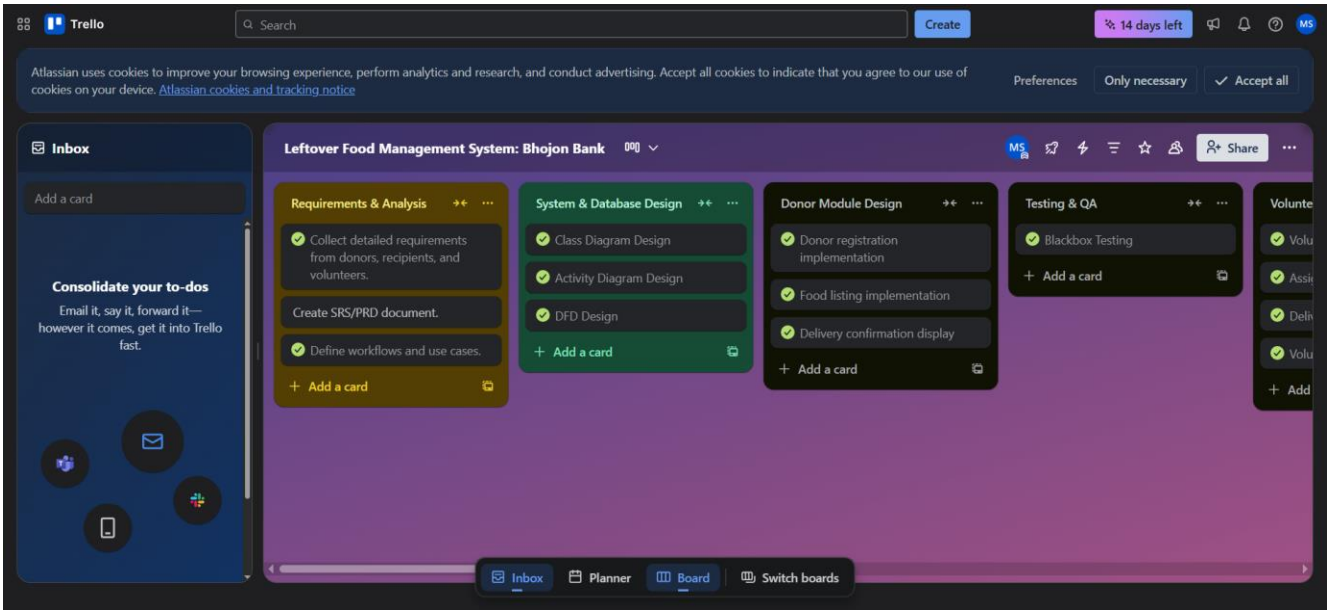
The main goal of this project **"Bhojon Bank"** is to create a mobile and web application that helps reduce food waste and fight hunger in Bangladesh. The application connects individuals or businesses with surplus food to NGOs and volunteers who can distribute it to those in need. The system works in real-time, ensuring food is collected and delivered efficiently.

Key features include:

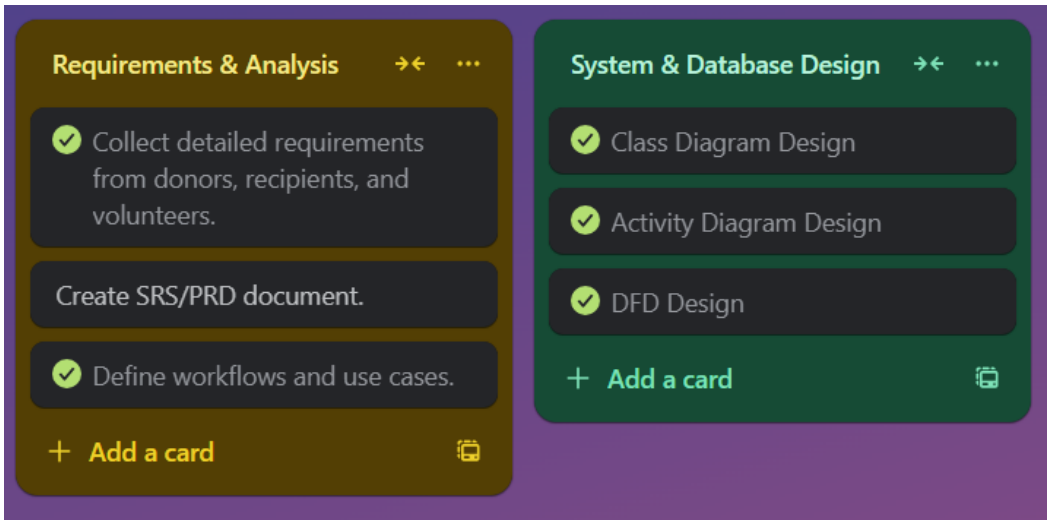
- Centralized data management.
- Real-time analytics and reporting.
- User authentication and role-based access.
- Automated notifications and reminders.
- Enables donors to list available food for donation quickly and easily.
- Automatically connects donated food with registered recipients or NGOs in need.
- Coordinates volunteers to collect and deliver food efficiently.

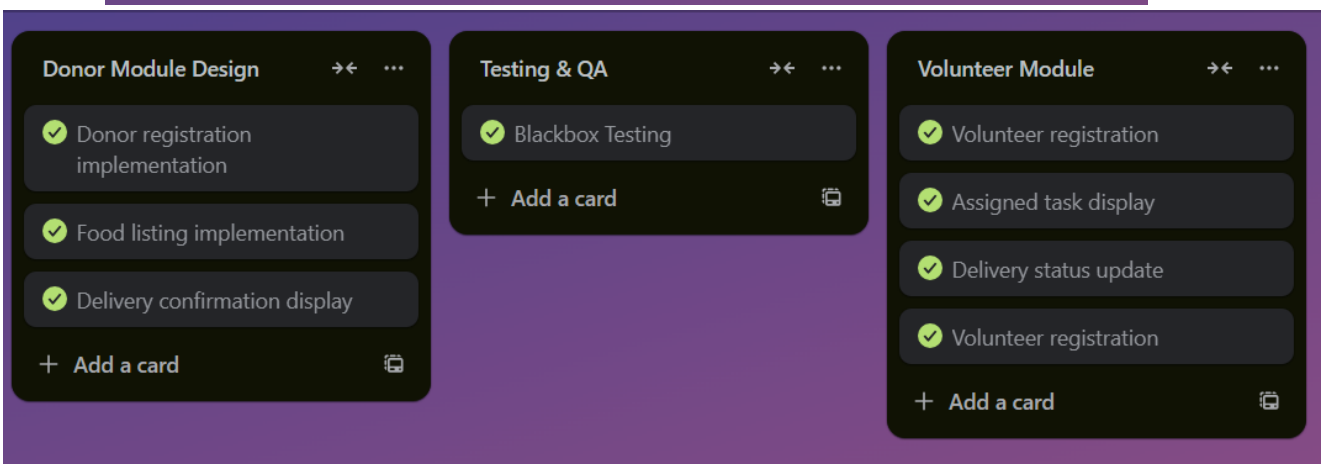
User Story Boards:

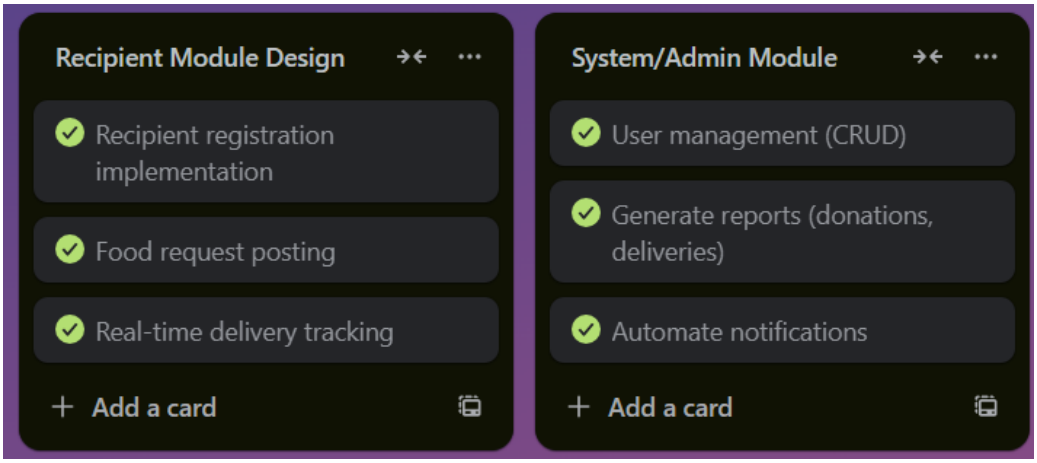
Trello Board Name: Leftover Food Management System: Bhojon Bank



User story list with cards made using TRELLO:







Existing Software Solutions:

Several apps and platforms have been developed globally to address food waste:

- Too Good to Go: Focuses on selling leftover food from restaurants and bakeries at a discounted price, reducing waste while generating revenue.
- Feeding India (by Zomato): Collects surplus food and distributes it to the needy but suffers from limited automation and weak coordination of volunteers, which reduces efficiency.

Many of these platforms require payment, making them inaccessible to individuals who cannot afford to purchase leftover food. Additionally, they often lack proper volunteer management systems and efficient delivery logistics, which are essential for timely and reliable distribution. Most existing solutions are not localized for Bangladesh, overlooking important cultural requirements such as Halal food, technological limitations, and infrastructure constraints like inconsistent internet coverage. Furthermore, they generally do not integrate real-time tracking, research data collection, or environmental impact monitoring features that are critical for a socially driven system.

Selected Software Development Process Model:

Bhojon Bank is designed to address real problems related to food waste and hunger, but its features and user needs are likely to evolve over time. For this reason, the Agile methodology with the Scrum framework was chosen as the most suitable approach. Agile is specifically built to handle uncertainty, allowing the team to adapt quickly as new ideas or requirements emerge. Scrum organizes development into short, focused cycles called Sprints, at the end of which a Sprint Review is held to demonstrate progress to stakeholders such as donors, NGOs, and volunteers, and to gather feedback. This feedback is then used to update the Product Backlog, a live list of features and tasks. For example, during one review, users suggested adding a halal certification tracking feature, which was incorporated into the backlog for future development.

The Scrum framework is particularly well-suited to Bhojon Bank's team size and structure. Daily stand-ups, sprint planning, and backlog reviews ensure continuous communication and coordination, keeping tasks organized and aligned with business objectives. This structure makes it feasible to meet project goals efficiently while maintaining high-quality deliverables.

Agile Scrum is also incredibly flexible, able to adjust to shifting user needs, new technology, and modifications in the project's scope. The team can respond to feedback, rearrange tasks, and add new features throughout each sprint without interfering with overall development. Because of its flexibility, Bhojon Bank can stay productive, relevant, and in line with the changing needs of both its users and the larger social environment. For a dynamic and socially significant project like Bhojon Bank, Agile with Scrum is the best option because traditional methods like Waterfall lack this degree of flexibility.

Project Environment Analysis:

The *Bhojon Bank* project involves a variety of stakeholders, including donors, volunteers, and recipients, each with unique expectations. Their requirements may evolve due to real-world challenges such as ensuring food safety, integrating geolocation features, or enabling effective reporting systems. While the project's core functions like donating food, volunteering for delivery, and posting recipient needs are relatively stable, other aspects are more dynamic. Features such as interface design, notification preferences, or coordination tools may change over time based on continuous user feedback. For this reason, the requirements are considered semi-stable but adaptive, making an iterative development approach suitable.

Team Size, Communication & Feasibility:

The development team consists of five members, which aligns well with Agile Scrum, as the framework is designed for small, cross-functional teams. Communication within the team is facilitated through daily stand-up meetings, sprint planning, and sprint review sessions, ensuring that everyone stays aligned with project goals. Task boards and digital project management tools such as Trello, Notion, or Jira are used to maintain transparency and coordinate responsibilities efficiently. The incremental approach of Scrum guarantees that a working version of the system is always available, making it feasible to meet deadlines and achieve the business objectives of reducing food waste while supporting community needs.

Flexibility of the Model:

One of the key strengths of Scrum is its flexibility in accommodating changes throughout the project lifecycle. If the scope expands for instance, by adding new features like a live chat option or partnerships with NGOs such changes can easily be incorporated into future sprints. The model also supports technology adaptation, allowing the system to adopt new tools or techniques, such as AI-driven demand prediction, without disrupting the overall development process. Furthermore, Scrum ensures that user requirements remain central by gathering direct feedback after each sprint,

which keeps the system closely aligned with the evolving needs of its stakeholders.

Creative Real-Life Solution:

Bhojon Bank reduces food wastage by connecting donors with volunteers and recipients in real-time:

- Donors can quickly list excess food.
- Volunteers ensure safe delivery.
- Recipients get notified instantly.

This creates a sustainable, socially impactful ecosystem to tackle hunger.

Target Users & Benefits

- **Donors:** Restaurants, hotels, households get to reduce food waste, contribute to social good.
- **Volunteers:** Students, NGOs, community workers who will Build social service credentials, gain experience.
- **Recipients:** Needy individuals, low-income families get access to fresh, surplus food.

All parties benefit from a transparent and reliable system.

Evidence Supporting Model Selection:

The choice of Agile Scrum for the Bhojon Bank project is strongly supported by its ability to deliver incremental results in a structured, yet flexible manner. Each sprint produces a working module of the system, allowing the team and stakeholders to validate features quickly and provide immediate feedback. This is particularly important in a community-based project like Bhojon Bank, were user needs such as notification preferences, volunteer coordination, or donation tracking may evolve rapidly. Unlike traditional models such as Waterfall, which follow a rigid linear sequence, Scrum accommodates changing requirements without derailing the project timeline, ensuring continuous improvement. The iterative process also allows the team to identify issues early, reduce rework, and maintain alignment with the overall goal of minimizing food waste while serving the community effectively.

Risk & Uncertainty Management:

Risk	Description	Impact	Mitigation Plan
Donor unwillingness or low participation	Donors may hesitate to donate food due to lack of trust or awareness.	High	Awareness campaigns, liability protection, and trust-building features
Server Failure	System becomes unavailable during critical periods, affecting delivery.	High	Deploy reliable hosting, regular backups, and redundancy.
	Unauthorized access		Encrypt data, enforce

Privacy Breaches	to personal or sensitive data of donors/recipients.	High	strict access controls, and follow privacy laws.
Fraudulent Activities	Fake donations or requests may misuse system resources.	Medium	Implement verification steps and regular monitoring.
Integration Issues	Difficulty linking payment gateways, logistics, or third-party partners.	Medium	Use standard APIs, thorough testing, and technical documentation
Application Bugs/Crashes	Software errors could disrupt operation or access.	High	Perform rigorous testing, bug tracking, and quick fixes.
Miscommunication with Stakeholders	Delayed or missed notifications to donors or recipients.	Medium	Use reliable channels (SMS, email), maintain backups.
Regulatory Compliance	Failure to meet food safety, health, or data regulations.	High	Conduct compliance reviews, keep records.
Overloading Dashboard with Real-Time Data	Too much data slows dashboard, affecting decisions.	Medium	Optimize software, limit displayed data, upgrade hardware.
Duplicate/Conflicting Requests	Multiple requests for the same item can cause confusion.	Medium	Use request validation and conflict resolution logic.
Negative Publicity	Mismanagement or incidents may harm reputation.	Medium	Have crisis management plans and transparent communication.
Environmental Risks	Floods, fires, or other disasters affect operations.	Medium	Develop disaster recovery plans and insure assets.
Legal Disputes	Issues over donations, volunteer agreements, or liability.	Medium	Consult with legal experts and maintain clear contracts.
Expanding Scope	New feature requests may expand project	High	Maintain a clear backlog, get approval for major

Beyond Plan	scope beyond schedule/resources.		changes, and limit features per sprint.
Food spoilage during collection/delivery	Delays may cause donated food to expire or become unsafe.	High	Add reporting/verification system, allow rating of donors, and enforce rules.
Recipient misuse of system	Fake recipients may request food unnecessarily.	Medium	Add verification steps, track request history, and set request limits.
Limited funding/resources	High cost of system development and hosting may be unsustainable.	High	Seek NGO/government/private partnerships, phased rollout to reduce costs.
Inaccurate location tracking	Wrong location data may delay delivery.	Medium	Use GPS verification, allow manual corrections, integrate with reliable map APIs.

Relation to Project Schedule:
Scrum supports timely delivery through time-boxed sprints, typically 1 weeks each, with each sprint producing a functional module (e.g., Donor module in Sprint 1, Volunteer module in Sprint 2). This incremental approach ensures continuous progress tracking, reduces the risk of delays, and allows the team to adjust priorities based on feedback, keeping the project on schedule and aligned with business objectives.

Justifications For Selection:
Why Not Others?
Waterfall: The Waterfall model is sequential and rigid. It requires all requirements to be fully defined upfront. In Bhojon Bank, features such as volunteer coordination, donor notifications, or

recipient posts may change based on real-world feedback, making Waterfall unsuitable.

V-Model: While the V-Model emphasizes validation at every stage, it lacks flexibility. Any change in requirements would require revisiting multiple stages, causing delays and inefficiency for our small, dynamic team.

Prototyping: Prototyping helps visualize interfaces, but it does not ensure continuous delivery of functional modules. For Bhojon Bank, delivering working components (Donor, Volunteer, Recipient) incrementally is crucial.

Why only Agile Model with Scrum Framework:
XP (Extreme Programming): XP focuses heavily on pair programming and frequent code updates. As a small student team, pair programming is not practical, and our features are well-defined, so constant story revisions are unnecessary.
DSDM: DSDM emphasizes heavy documentation and formal rules. Our system will be lightweight and team communication is sufficient through meetings and backlog management. Excess documentation would be costly and unnecessary.

Why Scrum?
We selected Scrum because it supports iterative development through time-boxed sprints, delivering working modules incrementally. Scrum combines sprint planning, daily standups, reviews, and retrospectives which enable our small team to track progress, coordinate tasks, and incorporate user feedback efficiently. Scrum is ideal for Bhojon Bank as the system involves interactions among Donors, Volunteers, and Recipients, forming a complex feedback loop. Review meetings allow us to assess feedback and adjust features after each sprint, ensuring alignment with real-world needs.
Compared to other Agile frameworks, Scrum provides structured roles (Product Owner, Scrum Master, Development Team) and sprint-based planning, which suits our team size and university schedule, keeping work organized while promoting collaboration.

1.3 Project Role Identification and Responsibilities:

For the Bhojon Bank project, roles and responsibilities are defined according to the Agile Scrum framework to ensure smooth collaboration, clear accountability, and efficient project delivery. The project involves both development and management aspects, with each role contributing to key stages such as requirements gathering, design, implementation, testing, and deployment.

Scrum Master (Mahin Sarker):

The Scrum Master acts as the team guide and facilitator. Their main responsibilities include:

- The Scrum Master acts as the team guide and facilitator. Their main responsibilities include:
- Ensuring the Scrum process is followed correctly and the team remains productive.
- Facilitating Daily Standups, Sprint Planning, Sprint Review, and Retrospective meetings.
- Removing obstacles that hinder team progress during implementation and testing phases.
- Coordinating with the Product Owner and management to align development priorities with business goals.
- The Scrum Master is not a decision-maker for product features but ensures process quality and team efficiency.

Product Owner (Dipaneeta Pramanik):

The Product Owner oversees the product vision and manages the Product Backlog. Responsibilities include:

- Gathering and prioritizing requirements during the requirements gathering and design phases.
- Making final decisions about which features go into the product.
- Collaborating with the Scrum Master, management, and the customer to ensure that the delivered system provides maximum value.
- Reviewing backlog items during sprint planning to guide the team.
- The Product Owner holds decision-making authority regarding scope and feature prioritization.

Scrum Team (Md. Iftekharul Islam):

The Scrum Team is responsible for designing, developing, and testing the Bhojon Bank system. Key responsibilities:

- Translating backlog items into working software during implementation.
- Estimating effort and creating the Sprint Backlog.
- Conducting unit testing, integration testing, and code reviews to maintain quality.
- Reporting impediments and suggesting improvements for continuous deployment.
- The team is self-organizing, with members assigned tasks based on their expertise (developers, designers, testers). They collectively ensure quality assurance.

Customer (Sirazum Munira Munni):

The **Customer** represents the end-users of the Bhojon Bank system. Responsibilities include:

- Providing requirements and feedback during the requirements gathering stage.
- Validating features during design review and sprint demos.

- Helping the team understand real-world problems and use cases to ensure that the system meets user expectations.
- The Customer plays a critical advisory role in shaping functionality but does not manage the development process.

Management (Tojammel Jakaria Jenin):

Management oversees resources and ensures alignment with business objectives. Responsibilities include:

- Providing support, tools, and resources required by the Scrum Team.
- Setting standards, goals, and policies for project execution.
- Participating in planning and deployment reviews to ensure compliance with company vision.
- Assisting in risk management and resource allocation to avoid project bottlenecks.
- Management is primarily responsible for resource management, decision-making support, and strategic guidance.

2. SOFTWARE REQUIREMENTS SPECIFICATIONS (SRS) / PRODUCT REQUIREMENTS DOCUMENT (PRD)

2.1 Functional Requirements

The system described is designed to reduce food waste, facilitate donation, and enhance the efficiency of food distribution to those in need. The major functionalities include:

1. **User Registration and Authentication:**
    - Users (individuals, restaurants, organizations) can create accounts and securely log in.
    - Ensures only authorized access to donation and management features.

2. **Food Donation Listing:**
    - Users can post available surplus food items, specifying quantity, type, expiry, and location.
    - Enables easy cataloging and visibility of food available for donation.

3. **Request and Matching Service:**
    - NGOs, charities, or individuals in need can browse available listings and request items.
    - The system matches donors to recipients based on location and urgency.
    - Automated notifications facilitate prompt collection and distribution.

4. **Pickup and Delivery Management:**
    - Schedules and tracks pickup or delivery of donated food.
    - Integrate with logistics partners or volunteers for efficient transportation.

5. **Waste Tracking and Reporting:**
    - Records details of donations, successful matches, and food waste reduction statistics.
    - Provides analytics dashboards for users and administrators.

As the system manages four primary roles:

1. **Donor:**
    - Can register and authenticate.
    - List surplus food for donation: Specify type, quantity, expiry, and location.
    - Track status of donations: See when items are claimed, picked up, or delivered.

2. **Recipient:**
    - Register and authenticate.
    - Browse available food donations.
    - Confirm receipt of donations.

3. **Volunteer:**
    - Register and authenticate.
    - View and claim delivery/pickup tasks: Assign themselves to pick up food from donors and deliver to recipients.
    - Update status of deliveries: Mark as in progress/completed.

4. **System (Automated):**
    - Match donations with recipient requests based on location, urgency, and suitability.
    - Schedule and coordinate pickup/delivery tasks, notify volunteers.
    - Manage user roles and permissions.

- Maintain analytics dashboard: Track food waste reduction, user activity, and system performance.

Core Services, Operations and Features:

- User Management: Registration, login, role assignment.
- Donation Listing & Request Service: Donor's post, recipients request, system matches and coordinates.
- Pickup/Delivery Assignment: Volunteers claim, system tracks, notifications sent.
- Reporting & Analytics: For system admins, showing key metrics and impact.

User Story Based Workflow:

User Story 1: Donor lists food for donation workflow (Donor → System → Volunteer → Recipient):

As a donor, I log in, list surplus food items, and wait for the system to match my donation. I receive a notification when a volunteer is assigned for pickup and can track the status.

Workflow:

1. Donor logs in to the system.
2. Donor lists leftover food details (type, quantity, expiry, location).
3. System validates and stores the donation entry.
4. System notifies available volunteers.
5. Volunteer accepts the task and collects the food.
6. Food is delivered to the recipient.
7. Donor receives confirmation that food has been successfully delivered.

User Story 2: Recipient requests food workflow (Recipient → System → Volunteer → Donor):

As a recipient, I browse available donations, request suitable items, and wait for confirmation and delivery. I confirm receipt and the donor gets notified of their donated food being delivered.

Workflow:

1. Recipient registers/logs in to the system.
2. Recipient posts a food request (location, number of people).
3. System checks for matching donations.
4. If matched, system assigns a volunteer.
5. Volunteer picks up food from donor.
6. Volunteer delivers food to the recipient.
7. Recipient confirms receipt in the system.

User Story 3: Volunteer delivers food workflow (Volunteer → System → Donor → Recipient):

As a volunteer, I log in, see available pickup tasks, claim one, and follow instructions to collect and deliver food. I update the status after delivery.

Workflow:

1. Volunteer logs in to the system.
2. Volunteer views available pickup/delivery tasks.
3. Volunteer accepts a suitable task.
4. System provides details of donor and recipient.
5. Volunteer collects food from donor.
6. Volunteer delivers food to the recipient.
7. Volunteer updates status as *delivered* in the system.

User Story 4: System matches and coordinates (System ↔ Donor / Recipient / Volunteer):

The system automatically matches donor listings with recipient requests and assigns volunteers based on availability and location.

Workflow:

1. System receives donation entries from donors.
2. System receives food requests from recipients.
3. System matches donations with requests based on location, urgency, and availability.
4. System assigns volunteers automatically or notifies nearby volunteers.
5. System tracks status of donations and deliveries in real time.
6. System sends notifications to donors, recipients, and volunteers.
7. System generates reports (meals served, food saved, environmental impact).

Acceptance Criteria:

1. Each role can access only their permitted features.
2. Donations are listed, matched, and tracked end-to-end.
3. Status updates and notifications are sent at each stage.
4. Feedback is collected after transactions.
5. Admin/system can generate reports on all activities.

2.2 Non-Functional Requirements:

Performance: < 2 seconds response time for major actions; support 1,000+ concurrent users.

Reliability: 99.9% uptime with 24/7 availability, in case of failure, automatic recovery should occur within 5 minutes.

Integrity/Security: Encrypted data, role-based access, privacy compliance. Only authorized users can access their respective dashboards.

Usability: The app should be easy to use with a simple interface, even for non-technical users. Accessible in both English and Bangla for inclusivity.

Maintainability: The system should allow easy updates for bug fixes and new features. Code should follow modular structure for easier debugging.

Scalability: Cloud infrastructure, horizontal scaling, easy role/feature addition. It should allow integration of advanced features such as AI-based freshness detection or carbon savings tracking in future.

3. PROJECT ESTIMATION AND SCHEDULING

3.1 Effort and Cost Estimation:

Bhojon Bank is a medium-sized mobile and web application designed to reduce food waste in Bangladesh by connecting donors, volunteers, and recipients. The system handles donor registrations, food listings, volunteer task management, recipient requests, notifications, delivery tracking, and reporting. The project also includes future features such as AI-based freshness detection, Halal certification verification, carbon savings tracking, and automated matching of donations to recipients.

Lines of Code (LOC) Estimation:

The size of the system can be estimated by predicting the number of lines of code required for each module. Let's assume that the the project is predicted to have 10,000 SLOC. Also if a productivity rate of 500 LOC per person-month, the total effort can be calculated as:

Effort = 10,000 LOC / 500 LOC per person-month = 20 person-months

COCOMO Model Estimation:

Using the COCOMO (Constructive Cost Model), we select the project mode (e.g., Organic, Semi-detached, Embedded) based on complexity and requirements. Assume this project fits the **Organic** category.

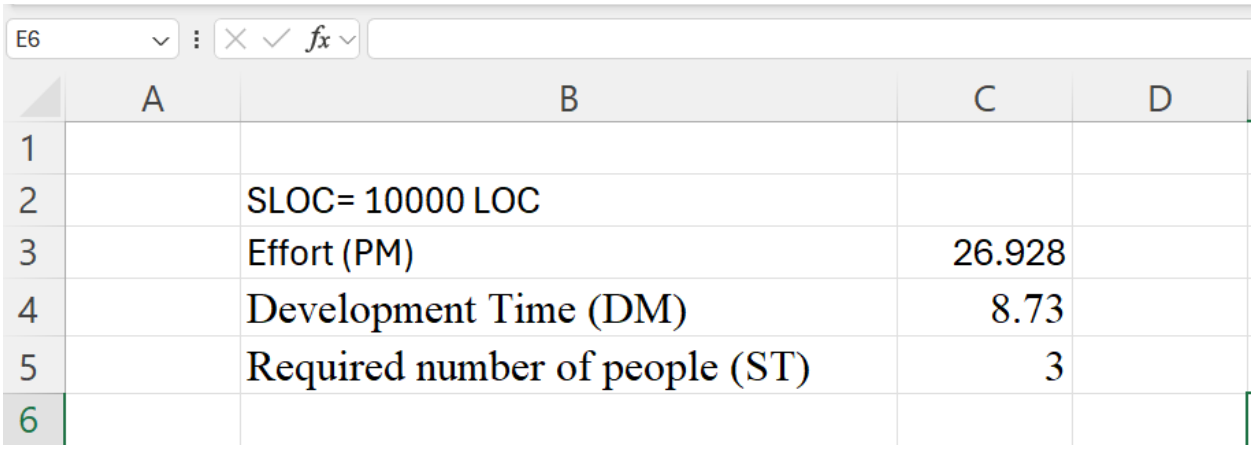
COCOMO Equations:

- **Effort (PM)** = $\text{Coefficient}_{\text{<Effort Factor>}} \times (\text{SLOC} / 1000)^{\wedge}P$
- **Development Time (DM)** = $2.50 \times (\text{PM})^{\wedge}T$
- **Staffing (ST)** = PM / DM

Organic Coefficients:

- Coefficient = 2.4
- P = 1.05
- T = 0.38

Calculation:



	A	B	C	D
1				
2		SLOC= 10000 LOC		
3		Effort (PM)	26.928	
4		Development Time (DM)	8.73	
5		Required number of people (ST)	3	
6				

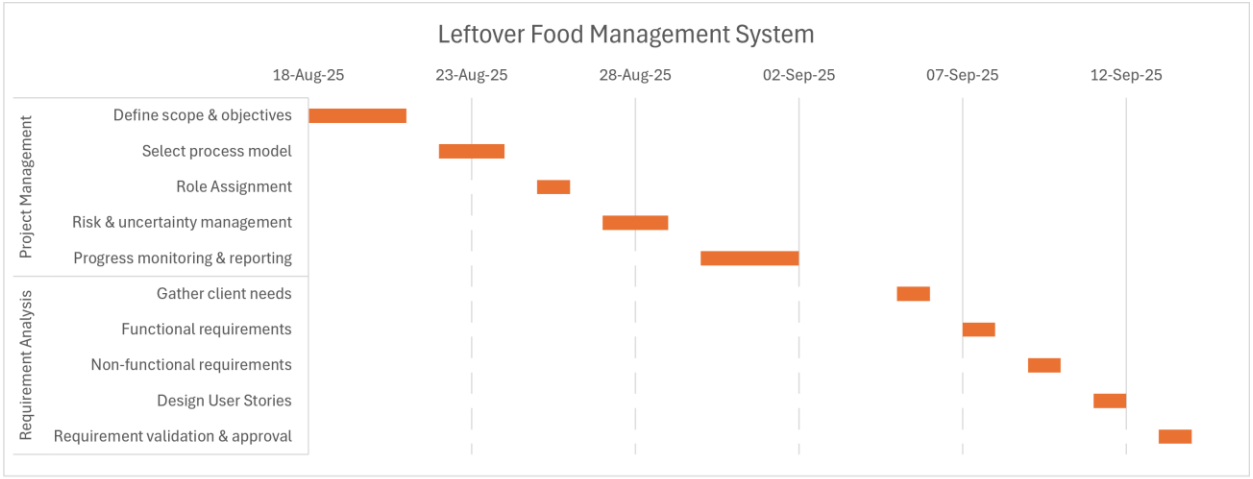
For SLOC = 20,000

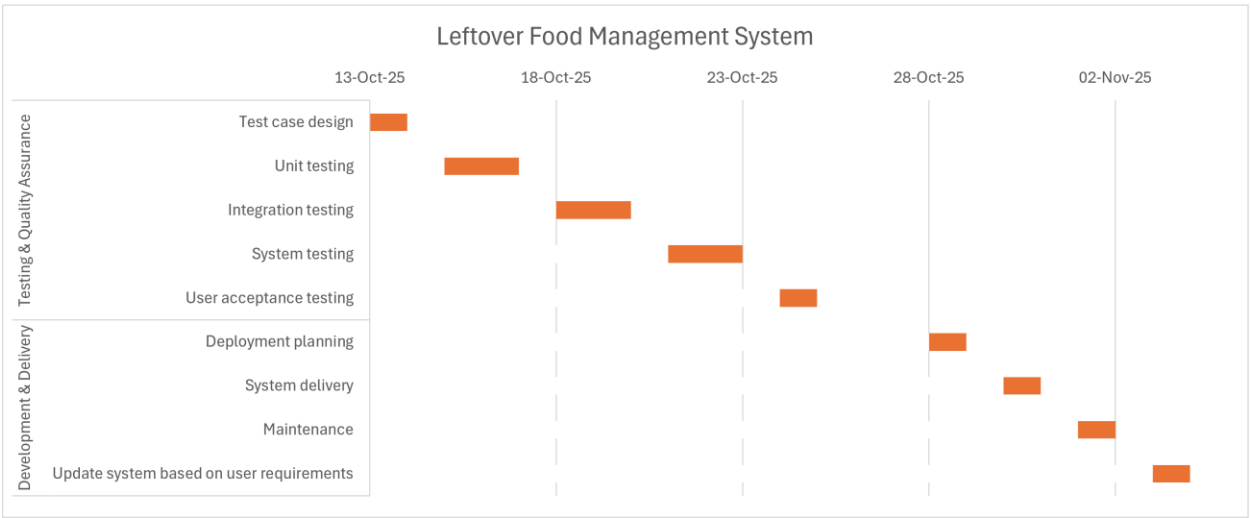
Effort = PM = 2.4× (10K/1000) ^ 1.05 = 26.928

Development Time = DM = 2.50 × (26.928) ^ 0.38 = 8.73 weeks

Required number of people = ST = PM/DM = (26.928/8.73) = 3 people

3.2 Project Scheduling:

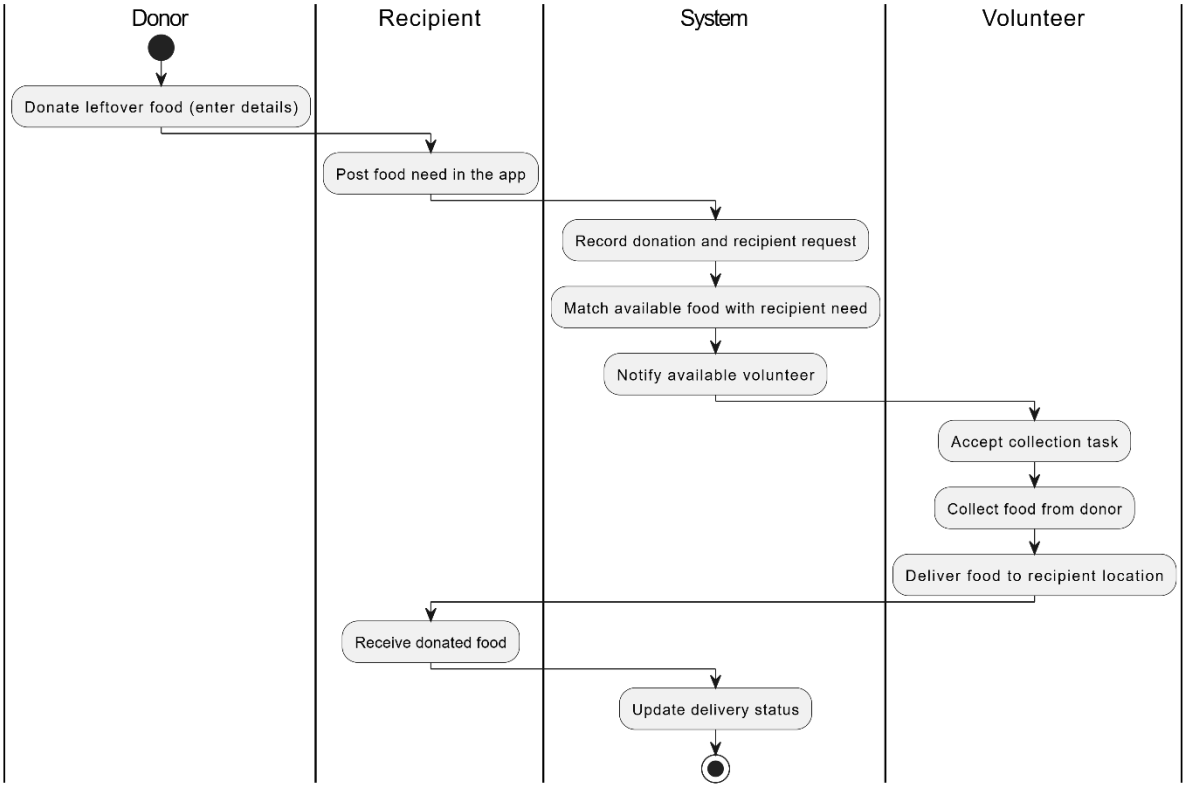




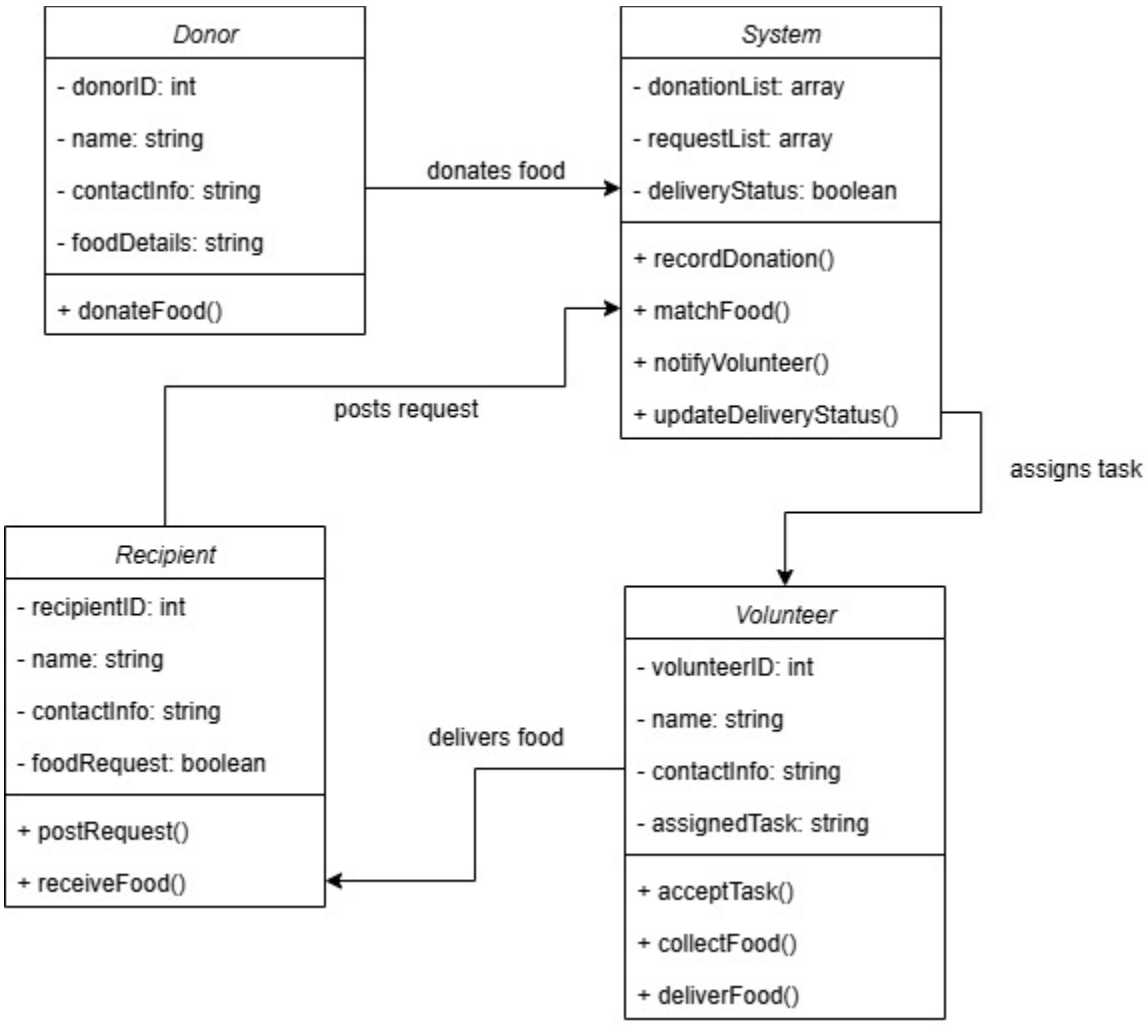
4. SOFTWARE DESIGN

4.1 System Design:

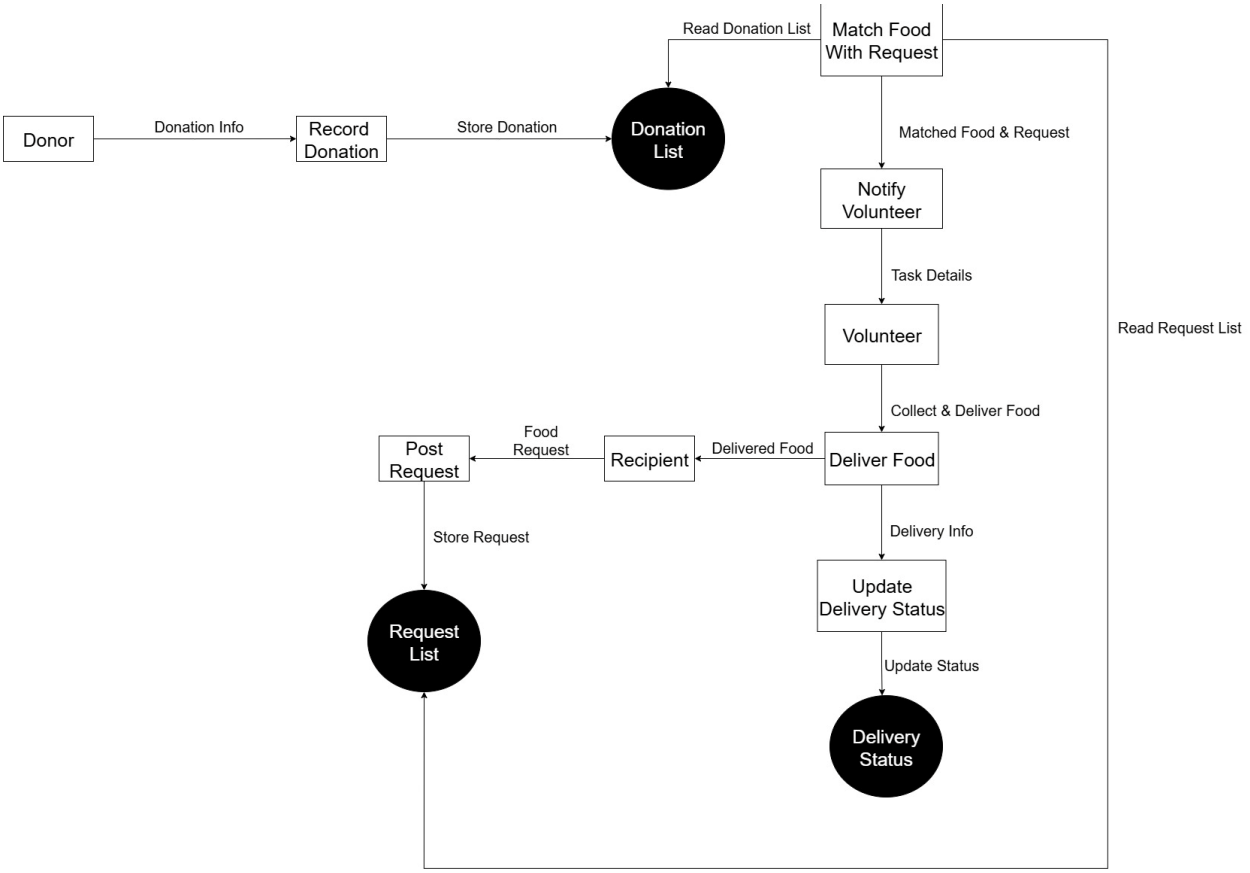
Activity Diagram:



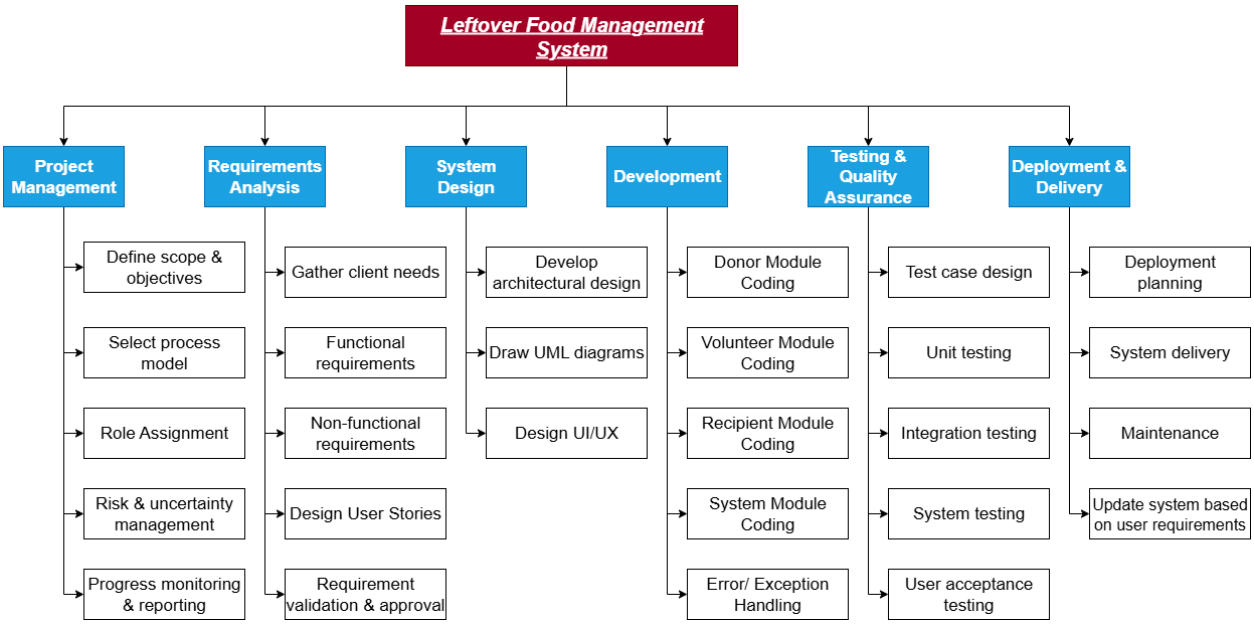
Class Diagram:



Data Flow Diagram:

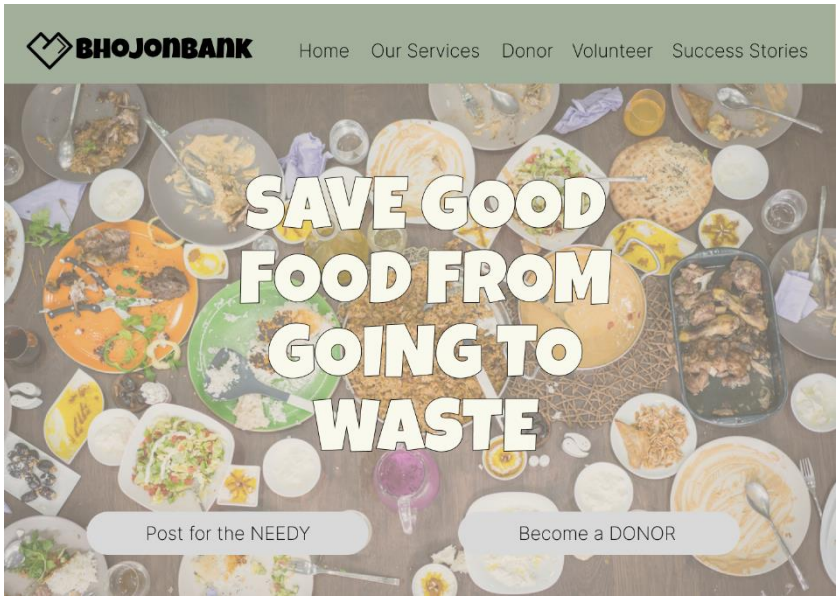


Work Break Down Structure:

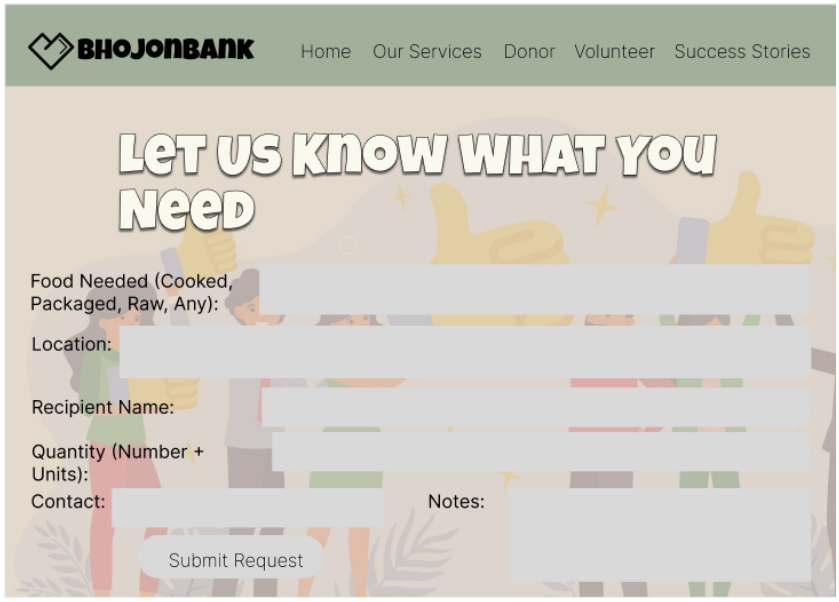


4.2 UI / Wireframe Design

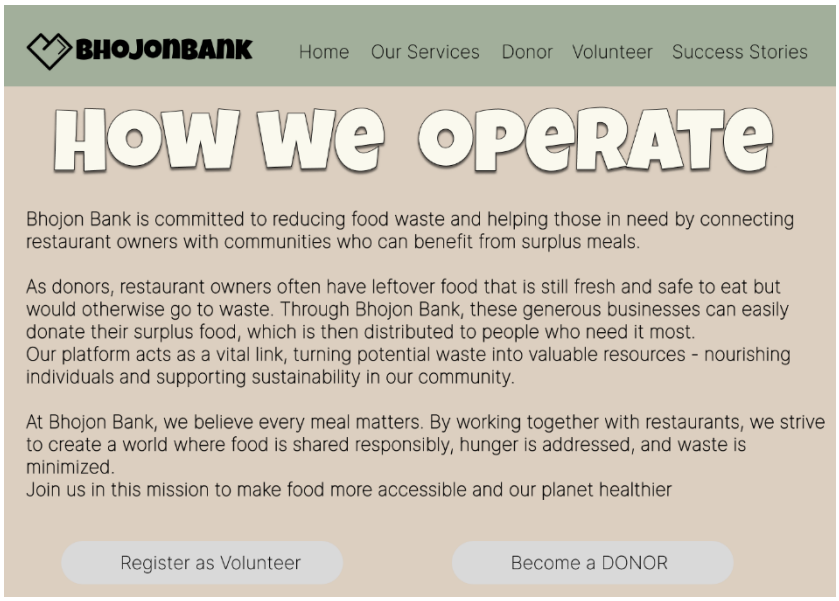
1. Home Page:



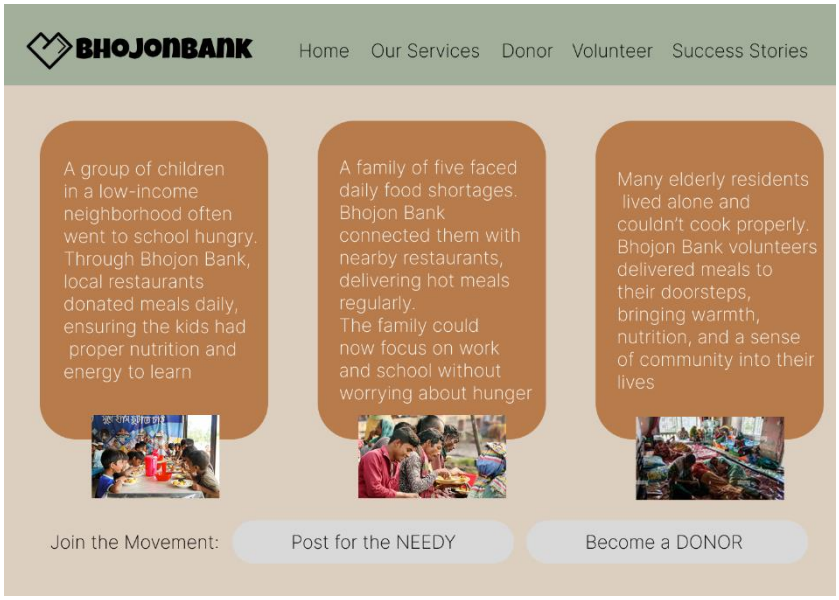
2. Recipient Request Page:



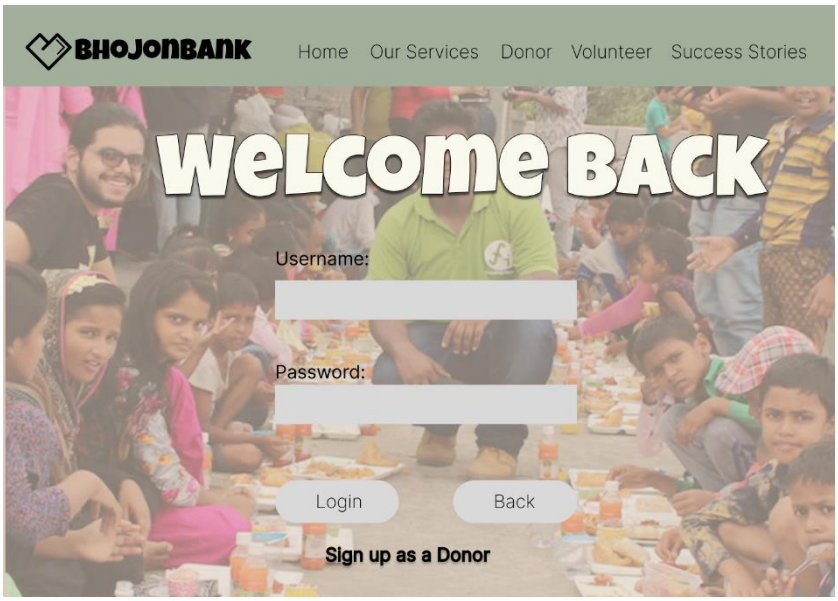
3. Our Services Page:



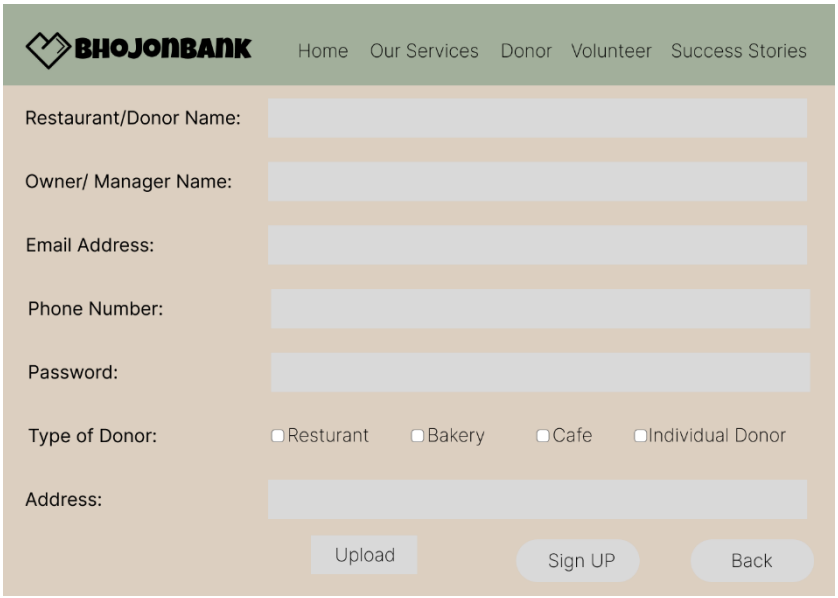
4. Success Story Page:



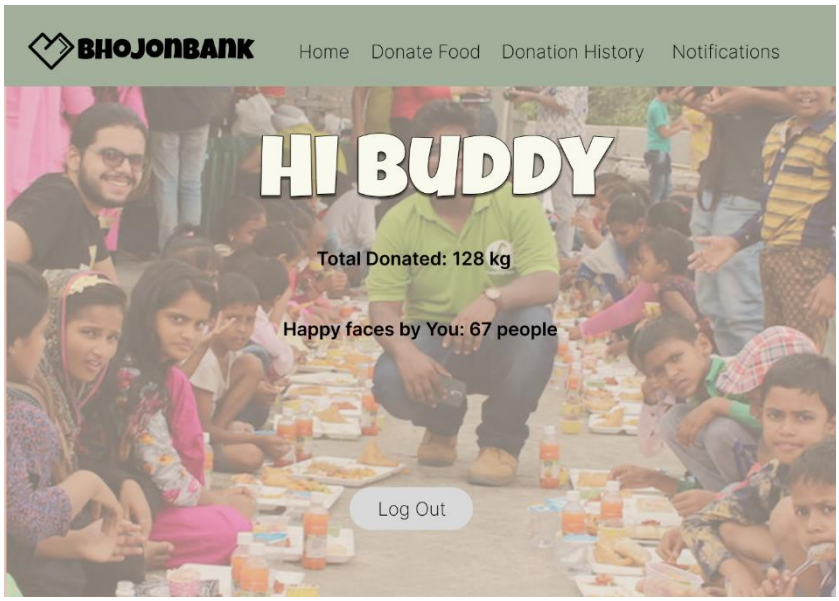
5. Donor Login Page:



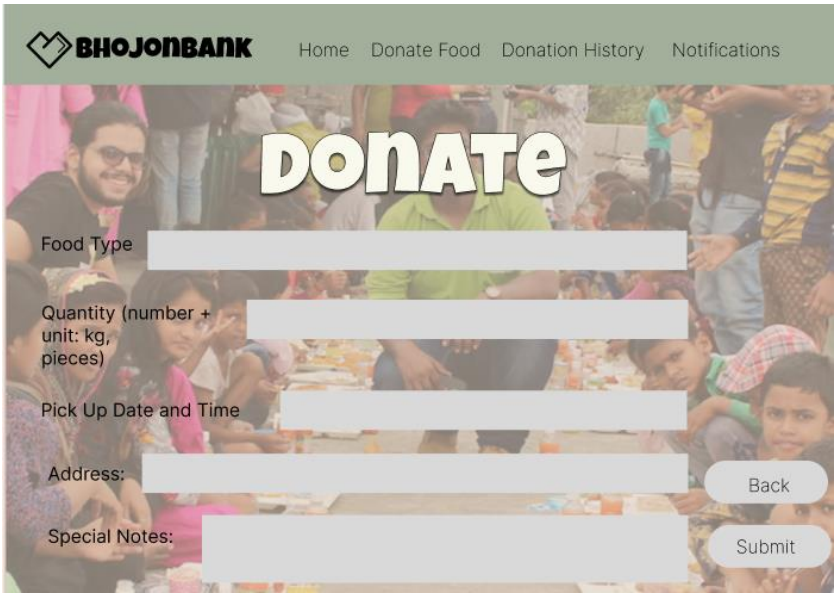
6. Donor Sign Up Page:



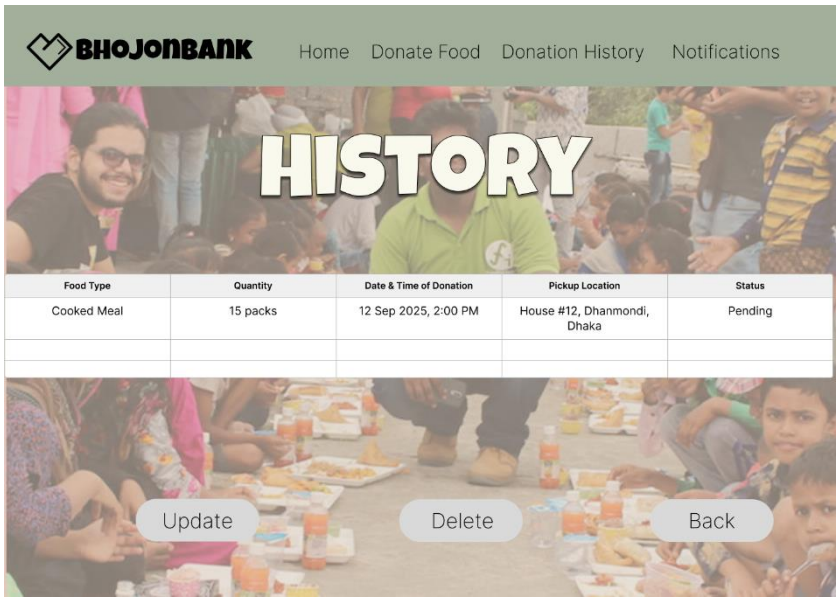
7. Donor Dashboard Page:



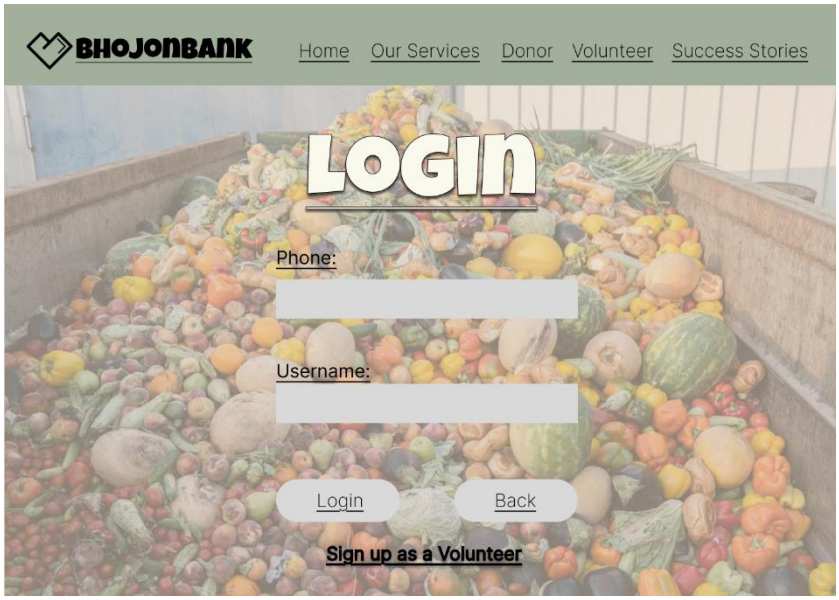
8. Donate Food Page:



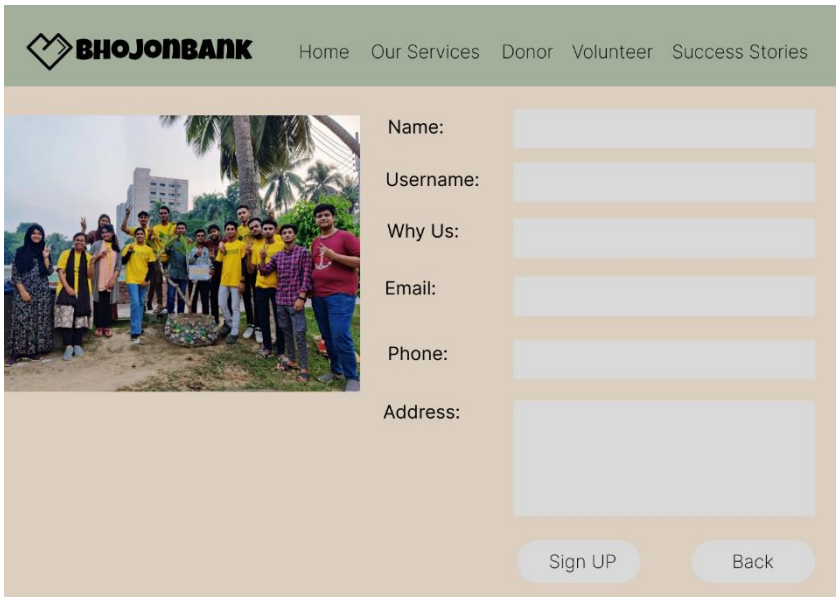
9. Donation History Page:



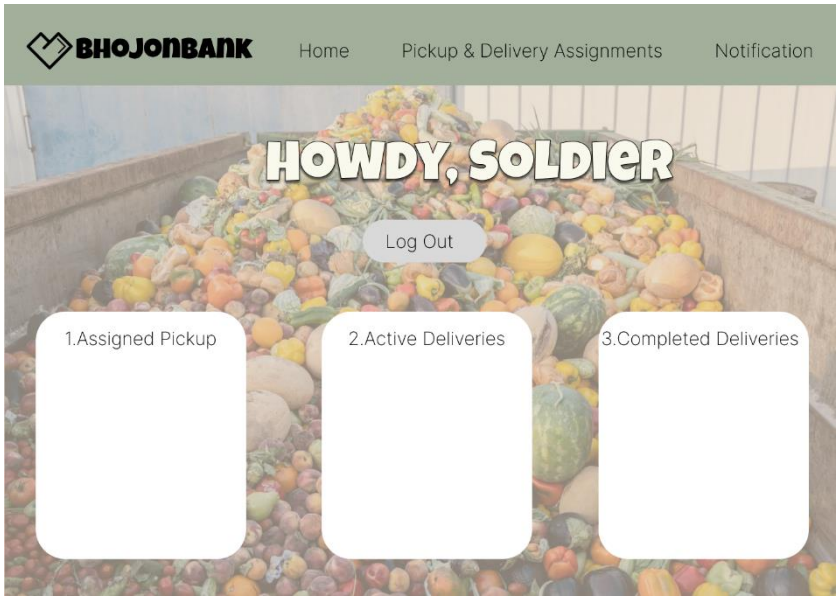
10. Volunteer Login Page:



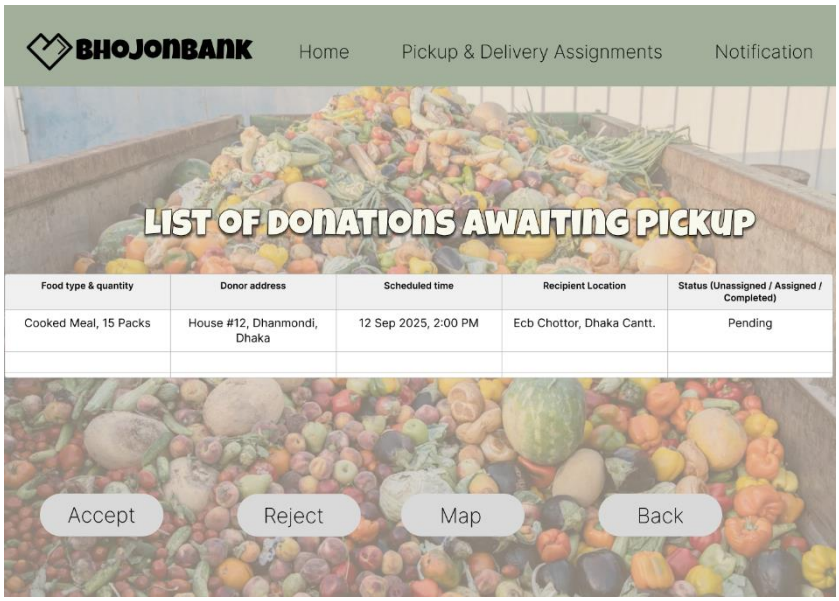
11. Volunteer Registration Page:



11. Volunteer Dashboard Page:

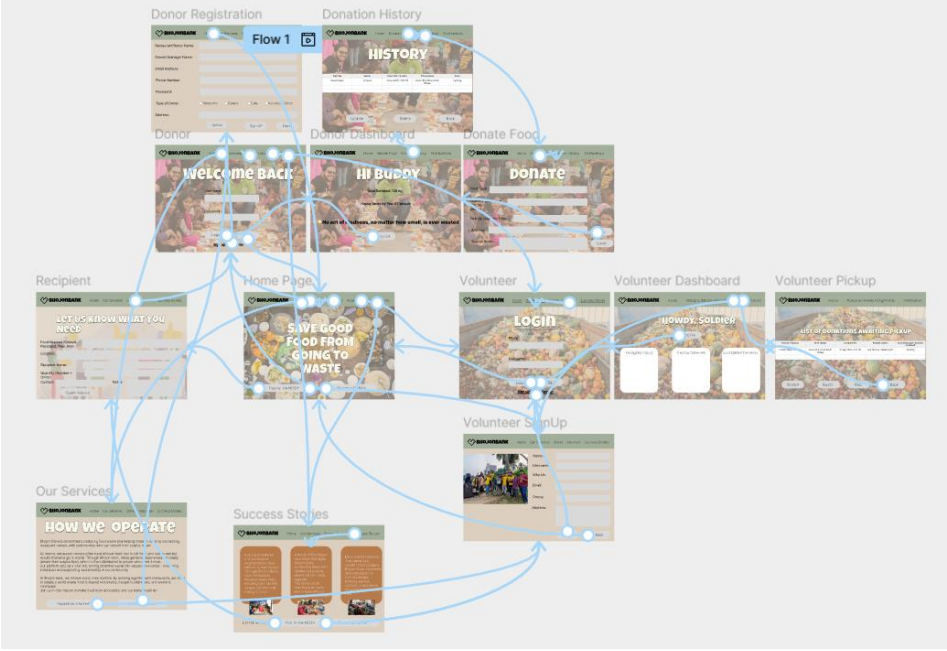


12. Volunteer Pickup & Delivery Page:



Wireframing:

Proper wireframing has been implemented using figma app:



Link: https://www.figma.com/proto/Mo2UzhQtfArOomIoHOBhXa/Untitled?node-id=1-3&t=DJBiYOBiwL6mQqtC-1&scaling=min-zoom&content-scaling=fixed&page-id=0%3A1&starting-point-node-id=102%3A247

5. TESTING

Project Name: Bhojon Bank			**Test Designed by: Mahin Sarker**	
Test Case ID: TC_1			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Login Session			Test Execution date: 18/09/2025	
Test Title: Verify login with valid username and password				
Description: Ensure valid users can log in.				
Precondition: The user has a valid username and password				
Dependencies: User registration completed				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
1. Go to login page **2. Enter username** **3. Enter password** **4. Click Submit**	Username: donor01 Password: 12345	User is logged in successfully	As expected	Pass

Project Name: Bhojon Bank			**Test Designed by: Mahin Sarker**	
Test Case ID: TC_2			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Login Session			Test Execution date: 18/09/2025	
Test Title: Verify login with invalid password				
Description: Ensure system denies access for wrong credentials.				
Precondition: The user Account exists.				
Dependencies: Password verification service working.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**

Enter username and wrong password	Username: donor01 Password: wrongpass	System shows “Invalid credentials” message	As expected	Pass

Project Name: Bhojon Bank			**Test Designed by: Mahin Sarker**	
Test Case ID: TC_3			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Login Session			Test Execution date: 18/09/2025	
Test Title: Verify login with empty fields				
Description: Ensure system validates mandatory fields				
Precondition: None				
Dependencies: Form validation module enabled.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Leave username and password empty → Submit	Username: Password	System prompts "Fields required"	As expected	Pass

Project Name: Bhojon Bank	**Test Designed by: Mahin Sarker**
Test Case ID: TC_4	Test Designed date:
Test Priority (Low, Medium, High): High	Test Executed by: Md.Iftekharul Islam
Module Name: Login Session	Test Execution date: 18/09/2025
Test Title: Verify password reset functionality	
Description: Ensure password reset link is sent to user email.	
Precondition: User registered with a valid email.	
Dependencies: Email service must be functional.	

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
Click "Forgot Password" → Enter email	donor01@gmail.com	Password reset link sent	As expected	Pass

Project Name: Bhojon Bank			**Test Designed by: Dipaneeta Pramanik**	
Test Case ID: TC_5			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Food Donation			Test Execution date: 18/09/2025	
Test Title: Verify donor can add food donation				
Description: Ensure donors can post a new donation successfully				
Precondition: Donor must be logged in.				
Dependencies: Database must allow insertion.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Enter food details → Submit	Food: Rice, Qty: 5kg	Donation appears in system	As expected	Pass

Project Name: Bhojon Bank	**Test Designed by: Dipaneeta Pramanik**
Test Case ID: TC_6	Test Designed date: 14/09/2025
Test Priority (Low, Medium, High): High	Test Executed by: Md.Iftekharul Islam
Module Name: Food Donation	Test Execution date: 18/09/2025
Test Title: Verify food donation with missing details	
Description: Ensure system validates required fields.	

Precondition: Donor logged in.				
Dependencies: Input validation enabled.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Submit form with missing quantity	Food: Rice, Qty: ""	System prompts "Quantity required"	As expected	Pass

Project Name: Bhojon Bank			**Test Designed by: Dipaneeta Pramanik**	
Test Case ID: TC_7			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Food Donation			Test Execution date: 18/09/2025	
Test Title: Verify donor can edit donation				
Description: Donor should be able to update donation details.				
Precondition: Donation already created.				
Dependencies: Database update service functional.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Edit existing donation → Save	Change Qty: 5kg → 10kg	Updated details appear	As expected	Pass

Project Name: Bhojon Bank	**Test Designed by: Dipaneeta Pramanik**
Test Case ID: TC_8	Test Designed date: 14/09/2025
Test Priority (Low, Medium, High): High	Test Executed by: Md.Iftekharul Islam
Module Name: Food Donation	Test Execution date: 18/09/2025

Test Title: Verify donor can delete donation				
Description: Ensure donors can remove unwanted donations.				
Precondition: Donation exists in system.				
Dependencies: Delete service enabled.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Select donation → Delete	Donation ID: 1001	Donation removed	As expected	Pass

Project Name: Bhojon Bank			**Test Designed by: Tojammel Jakaria Jenin**	
Test Case ID: TC_9			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Food Request			Test Execution date: 18/09/2025	
Test Title: Verify recipient can post request				
Description: Ensure recipients can request food successfully.				
Precondition: Recipient must be logged in.				
Dependencies: Database insertion enabled.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Enter request details → Submit	Food: Vegetables, Qty: 2kg	Request appears in system	As expected	Pass

Project Name: Bhojon Bank			**Test Designed by: Tojammel Jakaria Jenin**	
Test Case ID: TC_10			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Food Request			Test Execution date: 18/09/2025	
Test Title: Verify posting request with missing fields				
Description: Ensure system validates missing input.				
Precondition: Recipient logged in.				
Dependencies: Input validation active.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Leave food type blank → Submit	Food: "", Qty: 2kg	System prompts "Food type required"	As expected	Pass

Project Name: Bhojon Bank			**Test Designed by: Tojammel Jakaria Jenin**	
Test Case ID: TC_11			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Food Request			Test Execution date: 18/09/2025	
Test Title: Verify recipient request submission without login				
Description: Ensure recipient can update request				
Precondition: Request must exist				
Dependencies: Database update service active				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**

Edit request → Change qty	Old Qty: 2kg → New Qty: 3kg	Updated successfully	As expected	Pass

Project Name: Bhojon Bank	**Test Designed by: Tojammel Jakaria Jenin**
Test Case ID: TC_12	Test Designed date: 14/09/2025
Test Priority (Low, Medium, High): High	Test Executed by: Md.Iftekharul Islam
Module Name: Food Request	Test Execution date: 18/09/2025
Test Title: Verify recipient can cancel request	
Description: Ensure recipient can cancel posted requests	
Precondition: Request must exist	
Dependencies: Delete service enabled	

Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Cancel request → Confirm	Request ID: 2001	Request removed	As expected	Pass

Project Name: Bhojon Bank	**Test Designed by: Md.Iftekharul Islam**
Test Case ID: TC_13	Test Designed date: 14/09/2025
Test Priority (Low, Medium, High): High	Test Executed by: Md.Iftekharul Islam
Module Name: Volunteer	Test Execution date: 18/09/2025
Test Title: Verify volunteer sees available tasks	
Description: Ensure volunteers can view unassigned tasks.	
Precondition: At least one donation or request exists.	
Dependencies: Task allocation service working.	

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
Volunteer logs in → Open tasks	N/A	Tasks displayed	As expected	Pass

Project Name: Bhojon Bank			**Test Designed by: Md.Iftekharul Islam**	
Test Case ID: TC_14			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Volunteer			Test Execution date: 18/09/2025	
Test Title: Verify volunteer accepts a task				
Description: Ensure volunteer can claim a task				
Precondition: Unassigned task available.				
Dependencies: Update service active				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Select task → Accept	Task ID: 3001	Task assigned	As expected	Pass

Project Name: Bhojon Bank	**Test Designed by: Md.Iftekharul Islam**
Test Case ID: TC_15	Test Designed date: 14/09/2025
Test Priority (Low, Medium, High): High	Test Executed by: Md.Iftekharul Islam
Module Name: Volunteer	Test Execution date: 18/09/2025
Test Title: Verify volunteer rejects a task	
Description: Ensure volunteer can reject tasks.	
Precondition: Task available	

Dependencies: Status update working.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Select task → Reject	Task ID: 3002	Task remains unassigned	As expected	Pass

Project Name: Bhojon Bank				**Test Designed by: Md.Iftekharul Islam**
Test Case ID: TC_16				Test Designed date: 14/09/2025
Test Priority (Low, Medium, High): High				Test Executed by: Md.Iftekharul Islam
Module Name: Volunteer				Test Execution date: 18/09/2025
Test Title: Verify completed task update				
Description: Ensure completed deliveries are marked correctly.				
Precondition: Volunteer assigned a task.				
Dependencies: Task status update functional.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Mark task complete	Task ID: 3003	Status = "Delivered"	As expected	Pass

Project Name: Bhojon Bank	**Test Designed by: Sirazum Munira Munni**
Test Case ID: TC_17	Test Designed date: 14/09/2025
Test Priority (Low, Medium, High): High	Test Executed by: Md.Iftekharul Islam
Module Name: Notification	Test Execution date: 18/09/2025

Test Title: Verify donor receives confirmation notification				
Description: Ensure donor gets confirmation after donation submission				
Precondition: Donor submits donation				
Dependencies: Notification service active.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Donor posts donation	Food: Rice	"Your donation has been listed" message	As expected	Pass

Project Name: Bhojon Bank			**Test Designed by: Sirazum Munira Munni**	
Test Case ID: TC_18			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Tracking			Test Execution date: 18/09/2025	
Test Title: Verify login with valid username and password				
Description: Test the website login page				
Precondition: The user has a valid username and password				
Dependencies: if any				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Volunteer marks task complete	Task ID: 4001	Recipient gets "Your food has arrived"	As expected	Pass

Project Name: Bhojon Bank	**Test Designed by: Sirazum Munira Munni**

Test Case ID: TC_19			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Tracking			Test Execution date: 18/09/2025	
Test Title: Verify real-time tracking of delivery				
Description: Ensure recipient can track delivery live				
Precondition: Volunteer assigned to delivery				
Dependencies: GPS/location service enabled				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Volunteer starts delivery → Open tracking	Task ID: 4002	Location updates shown	As expected	Pass

Project Name: Bhojon Bank			**Test Designed by: Sirazum Munira Munni**	
Test Case ID: TC_20			Test Designed date: 14/09/2025	
Test Priority (Low, Medium, High): High			Test Executed by: Md.Iftekharul Islam	
Module Name: Tracking			Test Execution date: 18/09/2025	
Test Title: Verify system records completed deliveries				
Description: Ensure all completed deliveries are logged.				
Precondition: Delivery completed.				
Dependencies: History database enabled.				
Test Steps	**Test Data**	**Expected Results**	**Actual Results**	**Status (Pass/Fail)**
Volunteer marks complete → Check history	Task ID: 4003	Delivery shown in history	As expected	Pass

6. CONCLUSION:

Our project ‘Leftover Food Management System’ also known as **Bhojon Bank** effectively tackles the critical issues of food waste and hunger in Bangladesh by connecting donors, volunteers, and recipients through a mobile and web platform. The system allows real-time donation management, efficient volunteer coordination, and accurate delivery tracking. Using the Agile Scrum methodology ensures flexibility, continuous feedback, and iterative improvements, making the system adaptable to evolving user needs and technological changes. Metrics such as function points, object-oriented measures, and maintenance indices confirm that Bhojon Bank is well-structured, maintainable, and reliable, successfully meeting its core objectives of reducing food waste and helping those in need.

7. FUTURE WORK

Future enhancements aim to increase automation, intelligence, and social impact. Planned features include AI-based freshness detection to ensure food safety, automated Halal certification checks, and a carbon savings tracker to measure environmental benefits. The system will also implement improved automated matching between donations and recipients, expand connectivity with offline options (SMS/USSD), and provide analytics dashboards for research and policy support. These improvements will make Bhojon Bank more efficient, culturally aware, environmentally conscious, and socially responsible.