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A USER-CENTERED SMART PLATFORM FOR FOOD WASTE REDUCTION AND RESOURCE SUSTAINABILITY: DESIGN OF FOODSAVER HUB

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ABSTRACT

Food waste remains a significant global challenge with severe environmental, social, and economic implications. According to the Food and Agriculture Organization (FAO, 2021), approximately one-third of food produced globally—about 1.3 billion tonnes—is wasted annually. In urban areas, large volumes of surplus yet edible food from restaurants, hotels, and grocery stores are discarded due to the absence of efficient redistribution systems. This study presents the design and implementation of FoodSaver Hub, an intelligent, web-based platform developed to connect food vendors with consumers in real time, thereby reducing food waste and enhancing access to affordable meals. A user-centered requirement-gathering approach was employed, involving interviews, meetings, and surveys with vendors, customers, and community organizations to ensure the system meets real-world needs. The resulting platform incorporates key functional components, including vendor registration, surplus food listing management, geolocation-based customer search, order tracking, and review features. Additionally, an administrative module supports system oversight, analytics, and reporting. Non-functional requirements such as performance, security, usability, and accessibility were also addressed to ensure reliability and user satisfaction. The Food Saver Hub model aligns with the United Nations Sustainable Development Goal 12.3, which aims to halve global food waste by 2030, and demonstrates how digital innovation can support sustainable consumption and production. This work contributes to the growing field of technology-enabled sustainability solutions by providing a replicable framework for surplus food redistribution in urban settings.

KEYWORDS: Food waste reduction, sustainable development, surplus food redistribution, FoodSaver Hub.

INTRODUCTION

Food waste is one of the most pressing global issues affecting environmental sustainability, food security, and economic efficiency. According to the Food and Agriculture Organization of the United Nations (FAO), approximately 1.3 billion tonnes of food are wasted annually, representing one-third of all food produced for human consumption (FAO, 2021). This waste occurs across the supply chain from production and distribution to retail and households.

One of the primary contributors to food waste, especially in urban areas, is the lack of efficient mechanisms for redistributing surplus or leftover food from vendors to consumers in a timely and cost-effective manner. Restaurants, hotels, bakeries, and grocery stores often have surplus food nearing its expiry date, which is still safe for consumption but ends up discarded due to the absence of effective connection channels with potential consumers (Papargyropoulou et al., 2014).

This research work creates a sustainable, socially-driven ecosystem that reduces food wastage, provides affordable or free meal options, and promotes environmental conservation. This approach supports the principles of the circular economy by redistributing edible surplus food to where it is needed most, instead of allowing it to go to waste, thereby aligning with the United Nations Sustainable Development Goal (SDG) 12.3, which aims to halve global food waste by 2030.

Problem Statement

In many urban centers, food vendors dispose of large quantities of unsold but edible food at the close of business. This is caused by a lack of infrastructure to connect these vendors with customers quickly and efficiently before the food spoils. And Surplus meals are discarded daily, contributing to environmental degradation and food insecurity whi;e this leads to Limited Access to Affordable Meals this poses many low-income individuals cannot afford restaurant meals at regular prices despite the availability of discounted surplus food. At the same time an Absence of a Centralized Matching Platform that is there is no widely adopted system in Nigeria for connecting leftover food vendors to potential customers in real-time. Furthermore, Poor Vendor Visibility, that is Many small-scale food vendors lack the digital presence needed to attract customers beyond their immediate physical location. Moreover,

Food waste in landfills contributes to greenhouse gas emissions, particularly methane, which accelerates climate change (EPA, 2023).

LITERATURE REVIEW

Overview of Food Wastage Issues Globally

Food wastage has emerged as a critical socio-economic and environmental issue worldwide. According to the Food and Agriculture Organization (FAO, 2021), approximately 1.3 billion tonnes of food are wasted annually, representing about one-third of all food produced for human consumption. This wastage occurs across the entire supply chain from production, handling, and processing to retail and consumption stages.

In developed countries, a significant portion of waste occurs at the consumer and retail levels, often due to aesthetic standards, over-purchasing, and inefficient supply chains. In contrast, developing nations experience waste mainly during post-harvest handling, transportation, and storage due to inadequate infrastructure (Parfitt et al., 2010).

The implications are multi-dimensional:

1. **Economic Impact**: The FAO estimates the global economic cost of food wastage at over **$940 billion annually**.
2. **Environmental Impact**: Wasted food contributes to greenhouse gas emissions equivalent to **8–10% of global emissions**, making it the third-largest emitter after the US and China (UNEP, 2021).
3. **Social Impact**: Despite food surplus, over **828 million people** suffer from hunger globally (WFP, 2022).

Addressing food wastage is therefore crucial, not just for environmental sustainability, but also for achieving global food security and poverty reduction goals, aligning with the United Nations' **Sustainable Development Goal 12.3**, which targets halving global per capita food waste by 2030.

System Analysis

a. Requirement Gathering Approach

The requirement gathering phase of the FoodSaver Hub project was a critical step to ensure that the system meets the real needs of its users and stakeholders. To achieve this, a combination of qualitative research methods was employed, including meetings, interviews,

and surveys. These methods were directed primarily toward vendors who generate leftover food, potential customers who would benefit from accessing these foods, and other relevant users such as community organizations.

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c. Meetings and Interviews

A few face-to-face meetings were conducted with local food vendors, including restaurants and small-scale food retailers. These meetings aimed to understand their current challenges with leftover food management and the practical considerations they face. In-depth interviews allowed for detailed exploration of vendor concerns, such as logistical constraints, desired platform features, and expectations.

d. Surveys

To supplement the meetings, structured surveys were administered to a wider group of prospective users, including regular customers and households interested in participating in food redistribution. The surveys gathered quantitative data on user preferences, willingness to engage with a digital platform, and feature prioritisation.

e. Stakeholder Engagement and Insights

Through these engagements, several important insights emerged:

A. Vendors expressed a strong interest in a user-friendly system that allows quick posting and management of leftover food listings.
B. Customers showed a preference for real-time notifications and clear geolocation features to find nearby food sources.
C. Concerns were raised regarding the reliability of pickup and delivery logistics, highlighting the need for an integrated volunteer network or partnerships.
D. Both groups emphasized the importance of transparency, security, and ease of communication through reviews and messaging.

These insights directly influenced the functional and non-functional requirements of the system, ensuring alignment with real-world needs and feasibility.

Vendor Functional Requirements

Vendors are the primary food donors on the platform. Their activities center around managing leftover food listings and interacting with customers.

A. **Vendor Registration and Login**: Vendors must be able to register for an account and securely log in to access the platform features.
B. **Profile Management**: Vendors can create and update their profiles, including contact information, business details, and profile avatars.
C. **Shop Location Management**: Vendors can set or update their shop location using interactive maps or geolocation services to facilitate nearby customer matching.
D. **Leftover Food Listings**: Vendors must be able to add new leftover food listings, specifying details such as food type, quantity, pickup times, and any special instructions.
E. **Manage Existing Listings**: Vendors can edit or delete their existing leftover food listings to keep the information current.
F. **Order Management**: Vendors can view orders placed by customers, update order statuses (e.g., confirmed, picked up), and communicate with customers regarding orders.
G. **Customer Reviews Management**: Vendors can view customer reviews and respond to feedback to build trust and improve service.
H. **Analytics Dashboard**: Vendors have access to sales, order, and performance analytics to help them understand usage patterns and optimize operations.
I. **Access to Help/Support Resources**: Vendors can access support materials or contact support through the platform for assistance.

Customer Functional Requirements

Customers are the primary beneficiaries, searching for and claiming leftover food.

A. **Customer Registration and Login**: Customers can create accounts and securely log in to access platform services.
B. **Location Detection and Vendor Search**: The platform detects the customer's current location or allows manual entry to search for nearby vendors offering leftover food.
C. **View Vendor Profiles and Listings**: Customers can browse vendor profiles and view detailed leftover food listings.

D. **Order Placement**: Customers can place orders to claim leftover food, specifying preferred pickup times or delivery options if available.
E. **Leave Reviews and Ratings**: After receiving food, customers can leave reviews and rate vendors to provide feedback and help future users.
F. **Order History and Status Tracking**: Customers can view their past orders and track the current status of active orders.
G. **Access Help/Support Resources**: Customers can reach out to support or view help materials to resolve issues or learn about platform use.

Admin Functional Requirements

The Admin users oversee platform operations, ensuring smooth functioning and quality control.

A. **Admin Authentication**: Secure login for admin users to access the administrative dashboard.
B. **User Account Management**: Ability to manage vendor and customer accounts, including approving new registrations, suspending, or deleting accounts when necessary.
C. **Listings and Orders Oversight**: Admins can view, edit, or remove listings and orders to maintain platform integrity.
D. **Reports and Analytics Access**: Access to comprehensive reports and analytics regarding platform activity, food redistribution metrics, user engagement, and system performance.

Non-Functional Requirements

Non-functional requirements define the system's quality attributes and constraints that impact user experience, system reliability, and maintainability. For FoodSaver Hub, the following key non-functional requirements have been identified:

Performance

A. **Responsiveness:** The platform must respond to user actions (e.g., searching listings, placing orders) within 2 seconds to ensure a smooth and engaging user experience.
B. **Concurrent Users:** The system should support simultaneous access by multiple vendors, customers, and admins without degradation of service.
C. **Real-Time Updates:** Critical updates such as new listings, order status changes, and notifications should be reflected in near real-time to maintain data accuracy and user trust.

D. **Load Handling:** The platform should be capable of handling peak loads during high activity periods without crashing or significant slowdown.

Security

A. **Authentication and Authorization:** Secure login mechanisms with encrypted password storage and session management must be implemented to prevent unauthorized access.
B. **Data Privacy:** User data, including personal details and location information, must be stored securely and comply with data protection regulations (e.g., GDPR, local laws).
C. **Secure Communication:** All data exchanges between clients and servers should use HTTPS/TLS protocols to safeguard against interception and tampering.
D. **Input Validation:** Robust validation of user inputs must be enforced to prevent injection attacks, cross-site scripting (XSS), and other common vulnerabilities.
E. **Audit Logging:** Important system events such as logins, orders, and changes to data should be logged for accountability and forensic purposes.

Usability

A. **User-Friendly Interface:** The system must offer an intuitive and easy-to-navigate interface for all user roles, minimizing the learning curve and encouraging frequent use.
B. **Accessibility:** The platform should comply with accessibility standards (e.g., WCAG 2.1) to accommodate users with disabilities.
C. **Multi-Device Support:** Responsive design must ensure usability across a range of devices including desktops, tablets, and smartphones.
D. **Help and Support:** Contextual help, FAQs, and easy access to support resources should be available to assist users in resolving issues promptly.

These non-functional requirements are critical to ensuring that FoodSaver Hub is reliable, secure, and provides a satisfying user experience under varying conditions.

Data Flow Diagram (DFD)

The Data Flow Diagram illustrates how data moves through the FoodSaver Hub system. It highlights the sources, processes, data stores, and destinations of information.

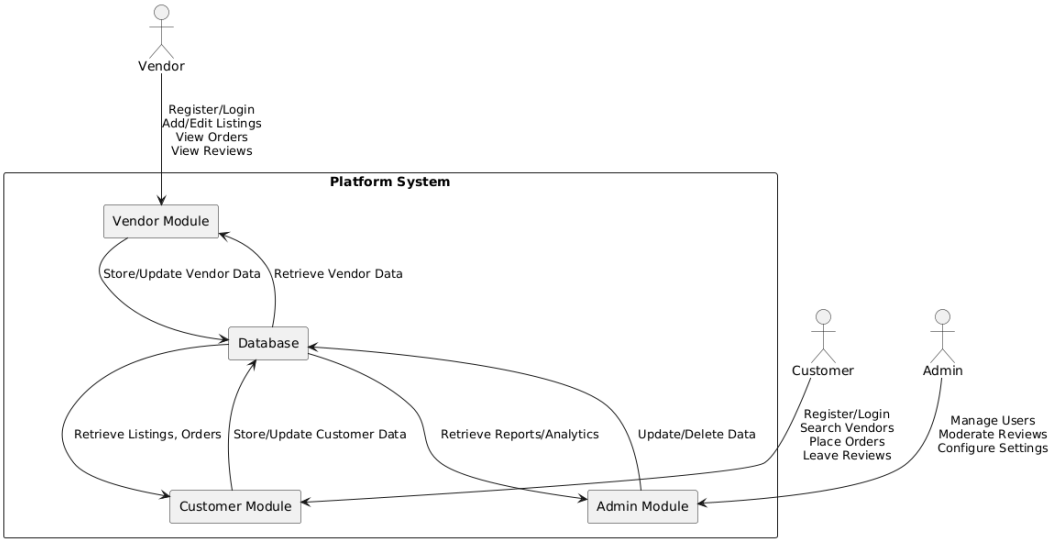

Fig. 1: Data Flow Diagram: This diagram clarifies the flow of user inputs (such as vendor listings or customer orders), system processes (like order processing or review management), and outputs (such as notifications or reports), ensuring an efficient and secure data handling process.

Sequence Diagram

Sequence Diagrams depict interaction sequences between users (vendors, customers, admin) and system components for critical processes such as vendor registration, order placement, review submission, and administrative approval.

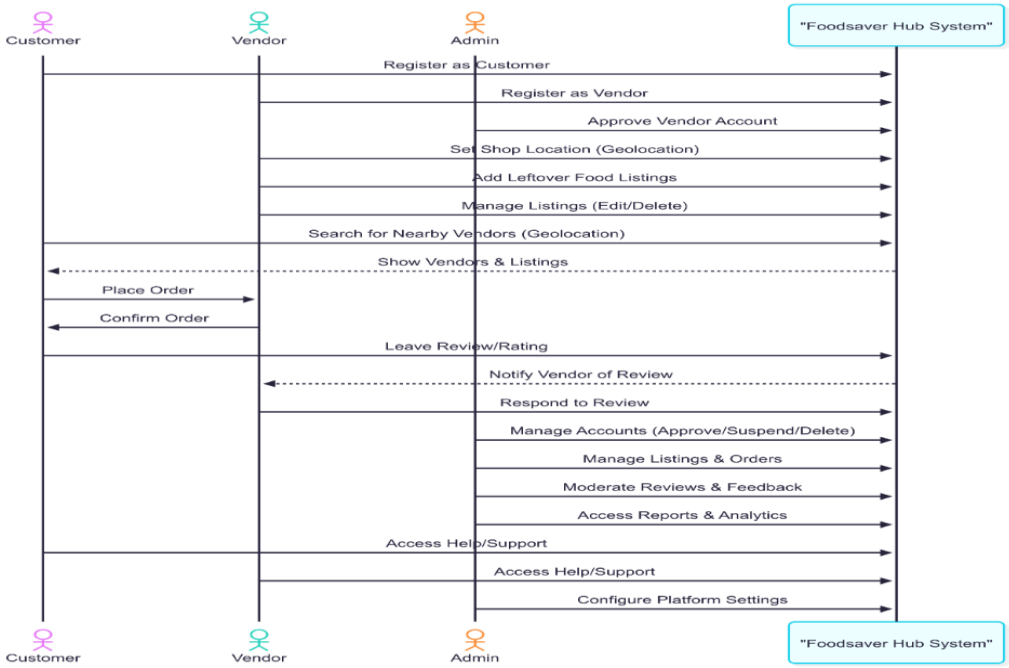

Fig. 2: Sequence Diagram: These diagrams clarify the order of operations and data exchanges, ensuring smooth user-system interactions.

1. System Design and Development

System Architecture

The architecture of **FoodSaver Hub** is designed to be modular, scalable, and accessible across multiple devices, with a primary focus on web and mobile compatibility. The system employs a **client-server** model, where the frontend interfaces communicate asynchronously with backend services using RESTful APIs, ensuring smooth and efficient data exchange.

Table Name	Key Fields	Description
User	UserID (PK), Email, UserRole	Stores all user account details
VendorProfile	VendorID (PK), UserID (FK), Location	Vendor-specific information
FoodListing	ListingID (PK), VendorID (FK), Status	Details of leftover food items
Order	OrderID (PK), CustomerID (FK), ListingID (FK), OrderStatus	Tracks customer orders
Review	ReviewID (PK), CustomerID (FK), VendorID (FK), Rating	Customer reviews and ratings
AdminSettings	SettingID (PK), SettingKey, SettingValue	Platform configurable settings

Database Security Considerations

A. Passwords are stored securely using strong hashing algorithms (default Php Hash).

B. Access to the database is restricted via role-based permissions to protect sensitive data.

C. Regular backups are planned to ensure data recovery in case of failure.

User Interface Design

This section presents the final implemented user interface of FoodSaver Hub, highlighting key screens for vendors, customers, and administrators. The UI reflects the practical realization of the wireframe prototypes described earlier, enhanced through user testing and iterative improvements during development.

Implemented Interface Screenshots

1. Homepage Design

Fig. 3: Homepage.

2. Vendor Dashboard: The vendor dashboard features a clean layout with sections for managing leftover food listings, viewing order summaries, responding to customer reviews, and updating profile details. Interactive elements such as modals and notifications provide real-time feedback on actions like listing additions or edits.

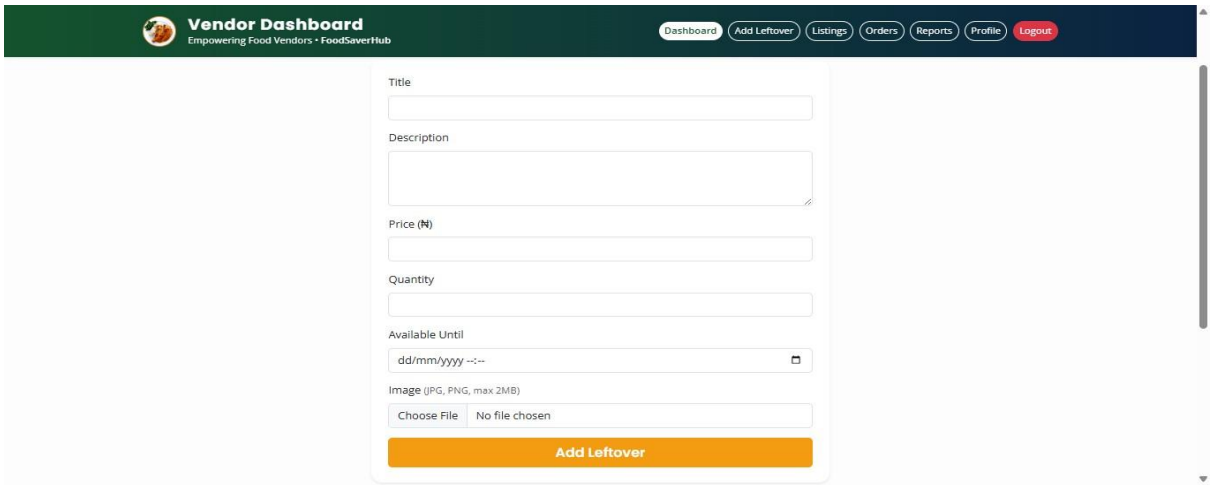

Fig. 4: Add Left over.

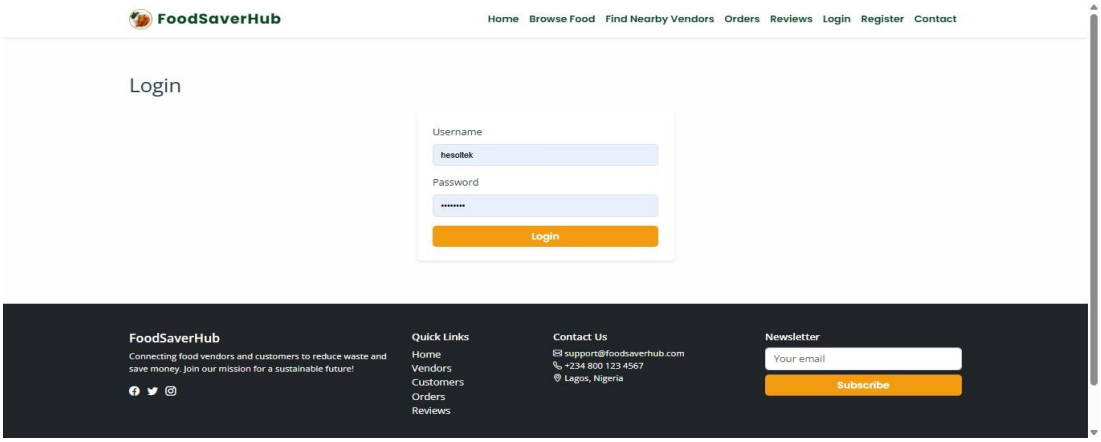

Fig. 5: Login.

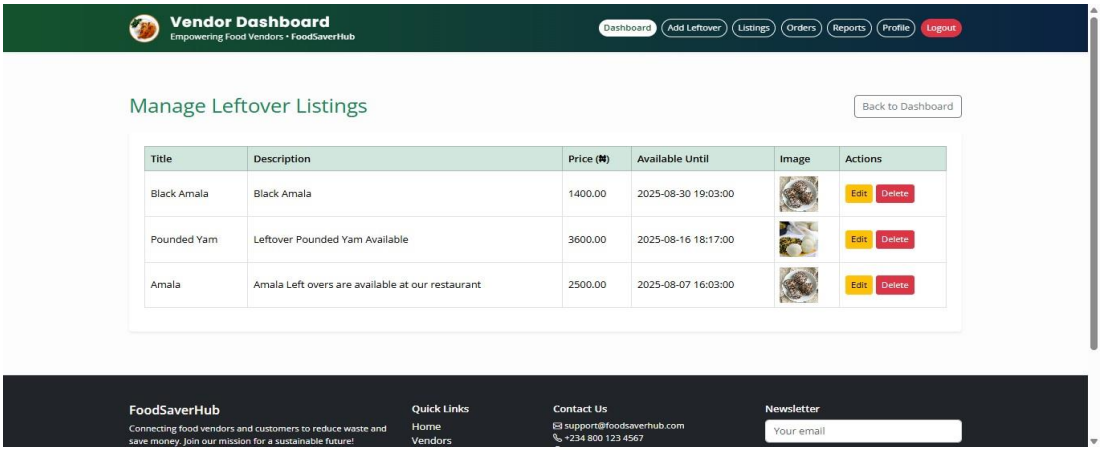

Fig. 6: Manage Listing.

3. Customer Home and Search: The homepage provides an interactive search interface powered by geolocation. Customers can filter listings by distance, food type, and availability. Listing cards display key information like vendor name, food description, and claim buttons. Maps integration visually plots vendor locations for ease of navigation.

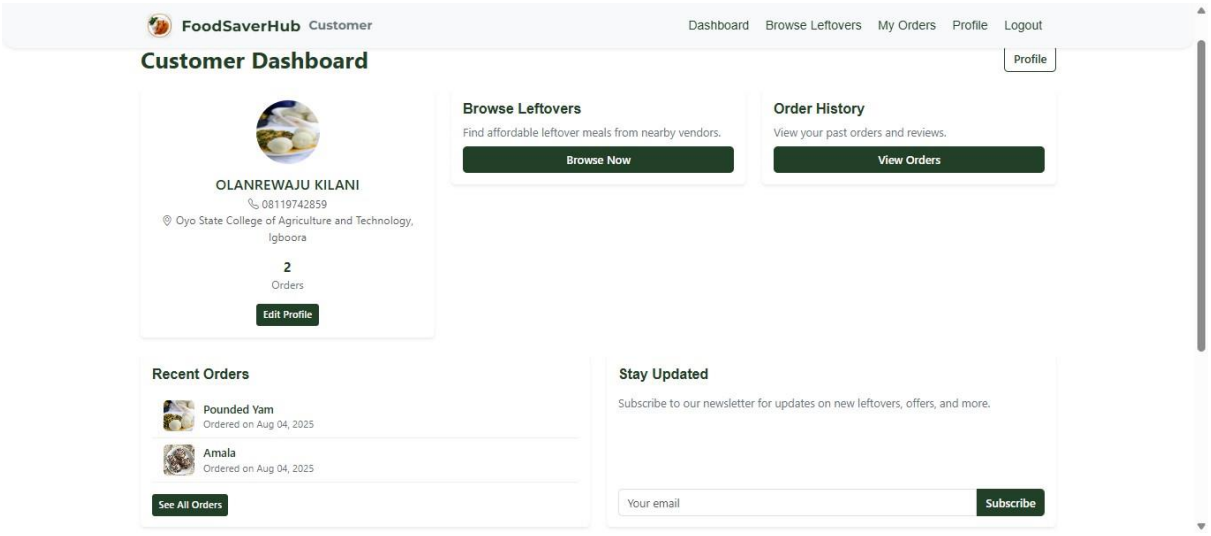

Fig. 7: Customer Dashboard.

4. Admin Dashboard: The admin dashboard consolidates user management, listing moderation, and platform analytics in a structured interface. Tables with sorting and search capabilities assist in efficiently handling large datasets. Dashboard charts visualize key performance indicators like total listings, active vendors, and user engagement metrics.

6. CONCLUSION AND RECOMMENDATIONS

Summary of Achievements

This project successfully designed and developed a fully functional web-based application using PHP, MySQL, HTML, and JavaScript to address the identified problem domain. The system was implemented with a modular architecture, ensuring maintainability and scalability.

However, the project met its objectives by providing a reliable, scalable, and secure system that can be adapted to similar application domains.

REFERENCES

1. Bootstrap Documentation. (2025). Bootstrap 5. https://getbootstrap.com/docs/5.0/getting-started/introduction/

2. EPA (2023). *Reducing the Impact of Wasted Food by Feeding the Soil and Composting.* United States Environmental Protection Agency. Retrieved from: https://www.epa.gov
3. Evans, D., Welch, D., & Swaffield, J. (2022). Constructing and mobilizing 'the surplus food network' in the UK: An analysis of food waste reduction platforms. *Sustainability*, 14(4), 2173.
4. FAO (2021). *Food Loss and Food Waste.* Food and Agriculture Organization of the United Nations. Retrieved from: https://www.fao.org
5. Food and Agriculture Organization of the United Nations (FAO). (2019). The State of Food and Agriculture 2019: Moving forward on food loss and waste reduction. FAO. https://www.fao.org/3/ca6030en/ca6030en.pdf
6. Mozilla Developer Network (MDN). (2025). HTML: HyperText Markup Language. Mozilla Foundation. https://developer.mozilla.org/en-US/docs/Web/HTML
7. Mozilla Developer Network (MDN). (2025). JavaScript Guide. Mozilla Foundation. https://developer.mozilla.org/en-US/docs/Web/JavaScript
8. MySQL Documentation. (2025). MySQL Reference Manual. Oracle Corporation. https://dev.mysql.com/doc/
9. Papargyropoulou, E., Lozano, R., Steinberger, J. K., Wright, N., & Ujang, Z. B. (2014). The food waste hierarchy as a framework for the management of food surplus and food waste. *Journal of Cleaner Production*, 76, 106–115.
10. PHP Documentation. (2025). PHP Manual. The PHP Group. https://www.php.net/manual/en/
11. REST API Tutorial. (2025). REST API Design Best Practices. https://restfulapi.net/
12. Wadhwa, A., & Saxena, A. (2018). Food waste reduction: An analysis of sustainable approaches. International Journal of Food Studies, 7(2), 180–193. https://doi.org/10.7455/ijfs/7.2.2018.a2