Food Waste Management System

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Abstract

Food wastage remains a critical social and environmental challenge due to inefficient coordination and lack of transparency in surplus food distribution systems. This paper presents a cross-platform mobile solution designed to streamline food donation by connecting restaurants, non-governmental organizations, delivery agents, and orphanages within a unified framework. The proposed system enables maintenance to ensure efficient redistribution of surplus food and accountability among stakeholders. By minimizing manual intervention and delays, the solution significantly reduces food wastage while supporting vulnerable populations. Additionally, the system incorporates a forward-looking approach for handling spoiled food by routing it to biodegradable waste processing units, promoting sustainable waste management practices. The proposed model demonstrates a scalable, cost-effective, and socially impactful approach aligned with global sustainability and hunger-reduction goals..

Keywords: Food Waste Management, Surplus Food Redistribution, Sustainable Waste Management

1. Introduction

Food wastage is a major global concern that exists alongside widespread hunger and food insecurity. A significant portion of surplus food generated by restaurants and food service providers is discarded due to poor coordination, lack of timely communication, and absence of transparent tracking mechanisms. Traditional food donation processes rely heavily on manual methods, which often lead to delays, mismanagement, and unnecessary wastage of consumable food. With the rapid advancement of mobile and cloud technologies, there is an opportunity to address these challenges through digital solutions. This project proposes a cross-platform mobile application that connects restaurants, non-governmental organizations, delivery agents, and orphanages on a single unified platform. The system facilitates real-time donation requests, task assignments, delivery tracking, and history logging, ensuring efficiency and accountability throughout the donation lifecycle. The proposed solution not only reduces food wastage but also supports vulnerable populations such as children in orphanages. Furthermore, the inclusion of a future enhancement to route spoiled food to biodegradable waste processing units reflects a commitment to environmental sustainability. By integrating technology with social responsibility, the project aims to provide a scalable and cost-effective solution aligned with global sustainability and hunger alleviation goals.

2. Need of The System

Food wastage remains a serious social and environmental issue despite the presence of surplus food sources such as restaurants and food service providers. Existing food donation processes rely largely on manual coordination, leading to delays, miscommunication, and lack of transparency. There is a strong need for a unified digital system that can efficiently connect food donors, NGOs, delivery agents, and recipients on a single platform. Such a system is essential to enable real-time coordination, tracking, and accountability in food redistribution. Additionally, managing spoiled food in an environmentally responsible manner highlights the need for a system that supports sustainable waste disposal, thereby reducing environmental impact while addressing hunger and food insecurity. The growing imbalance between surplus food generation

and effective redistribution highlights the need for an efficient food management system. Existing donation processes rely heavily on manual coordination and fragmented communication, leading to delays, food spoilage, and lack of accountability. A unified digital system is required to enable real-time coordination, transparent tracking, and systematic management of food donations. Such a system can significantly reduce food wastage, improve operational efficiency, and ensure timely delivery of food to vulnerable communities while promoting sustainable and socially responsible food management practices.

3. Existing System

Current food donation and food waste management practices are largely dependent on manual coordination between food donors, non-governmental organizations, and volunteers. Communication is typically carried out through phone calls, messaging platforms, or informal networks, which lack structured workflows and real-time visibility. While a few digital platforms and charity-based initiatives attempt to connect donors with recipients, these systems often provide limited functionality and are primarily focused on food delivery rather than end-to-end donation management. Existing digital solutions generally lack role-based access control, real-time tracking of donation status, and centralized history logging, which are essential for transparency and accountability. Furthermore, most systems do not address scalability issues when handling large volumes of donation requests and often fail to manage the safe disposal of spoiled food. As a result, food spoilage, operational inefficiencies, and environmental concerns continue to persist. These limitations highlight the need for an integrated, technology-driven solution capable of supporting efficient food redistribution and sustainable waste management.

4. Proposed Solution

The proposed solution introduces a unified, cross-platform digital system designed to efficiently manage surplus food donations and reduce food wastage. The system connects food donors, non-governmental organizations, delivery agents, and recipient institutions within a single framework, enabling structured coordination and real-time information flow. Donation requests can be created, reviewed, assigned, and tracked through a centralized platform, ensuring transparency and accountability throughout the donation lifecycle. Real-time status updates and history logging minimize delays and improve operational efficiency, while role-based access ensures secure and organized interactions among stakeholders. In addition to redistribution of edible food, the proposed system incorporates a future enhancement for identifying spoiled food and routing it to biodegradable waste processing units, promoting environmentally sustainable disposal. The solution is scalable, cost-effective, and aligned with social welfare and sustainability goals, making it suitable for real-world deployment and academic contribution.

5. Methodology

The proposed system adopts a centralized and role-based architecture to manage surplus food donation and redistribution efficiently. The system is designed to support multiple stakeholders, including food donors, non-governmental organizations, delivery agents, and recipient institutions, each with predefined roles and access privileges. This structured design ensures secure interactions and organized workflow management throughout the donation lifecycle. The methodology begins with the identification of surplus food and generation of a donation request. The request is processed through a centralized coordination layer where authorized organizations review, approve, and assign it for pickup. Once assigned, the delivery process is monitored using real-time status updates, ensuring transparency and minimizing delays. Upon successful delivery, confirmation is recorded, and transaction details are stored in a centralized data repository for accountability and future analysis. The system design enables real-time data synchronization across all stakeholders, reducing inconsistencies and improving coordination efficiency. History logging and status tracking modules provide traceability for every donation event. In addition, the design includes a future-ready extension to handle spoiled food by redirecting it to biodegradable waste processing units, supporting environmentally sustainable waste

management. This integrated methodology and system design ensure scalability, reliability, and effective reduction of food wastage while addressing social and environmental objectives.
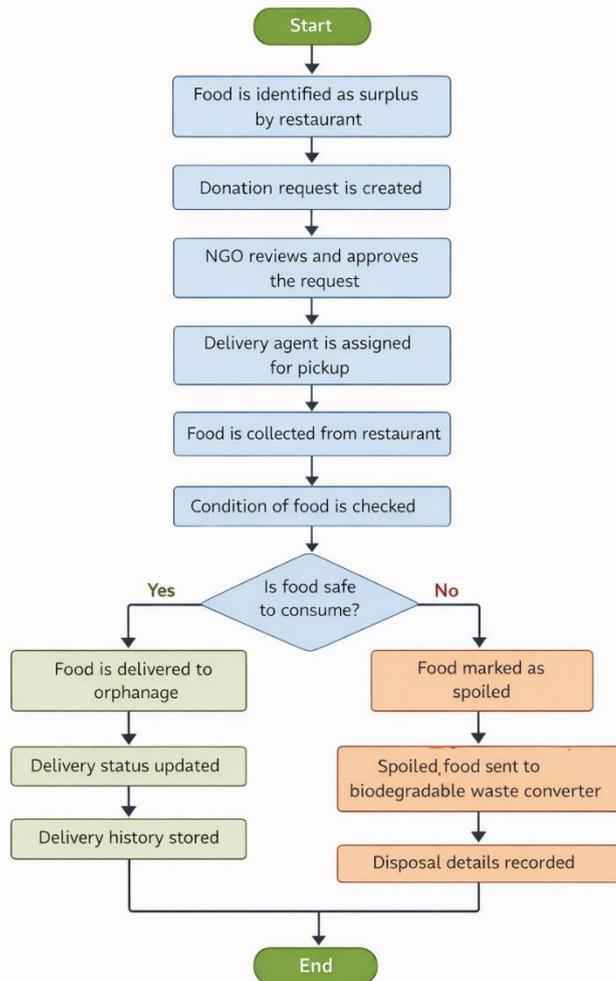

Figure 1 Flow Process

6. Implementation

6.1. Step 1: User Registration and Role Assignment

The system begins with user registration, where stakeholders such as food donors, NGOs, delivery agents, and recipient institutions are onboarded. Role-based access control is enforced to ensure secure and authorized interactions within the system.

6.2. Step 2: Creation of Food Donation Requests

Food donors initiate the donation process by submitting requests that include food type, quantity, pickup location, and time constraints. These details are validated and stored in the centralized system for further processing.

6.3. Step 3: Request Review and Approval

Authorized organizations review incoming requests to verify food safety and availability. Only approved requests proceed to the distribution phase, ensuring quality control.

6.4. Step 4: Intelligent Task Assignment

The system assigns delivery agents based on predefined criteria such as availability, proximity, and workload. This step ensures efficient logistics and minimizes delivery delays.

6.5. Step 5: Real-Time Pickup and Delivery Tracking

During pickup and transportation, delivery agents update the system status at each stage. Real-time tracking allows all stakeholders to monitor progress and respond to unexpected delays.

6.6. Step 6: Delivery Verification and Confirmation

Upon successful delivery to the recipient institution, confirmation is recorded in the system. This marks the completion of the donation cycle and ensures accountability.

6.7. Step 7: Centralized Data Logging and History Maintenance

All actions, including approvals, assignments, and deliveries, are logged in a centralized repository. This enables transparency, auditing, and performance analysis.

6.8. Step 8: Exception Handling and Spoiled Food Management

If food is found to be unfit for consumption at any stage, it is flagged as spoiled. Such food is excluded from distribution and routed to biodegradable waste processing units as part of a future enhancement.

6.9. Step 9: System Monitoring and Performance Management

Continuous monitoring mechanisms are employed to ensure system availability, data integrity, and synchronization across all stakeholders.

6.10. Step 10: Scalability and Maintenance

The system architecture supports scalability to handle increased user participation and donation volumes, ensuring long-term usability and sustainability.

7. Results & Discussion

The Food Waste Management System was successfully developed to monitor, track, and reduce food wastage from households, restaurants, and other sources. During testing, the system accurately recorded food waste data, categorized it by type, and generated clear reports with actionable insights. Notifications and alerts helped users make informed decisions, such as optimizing food storage or using leftovers efficiently.

supporting better planning. The system demonstrated its effectiveness in promoting sustainable food practices and resource optimization. While the current system relies on manual data entry, integrating predictive analytics, AI-based suggestions, or IoT-enabled sensors could further enhance real-time tracking and automation. Overall, the project successfully highlights the potential of technology-driven solutions in reducing food wastage and encouraging responsible consumption.
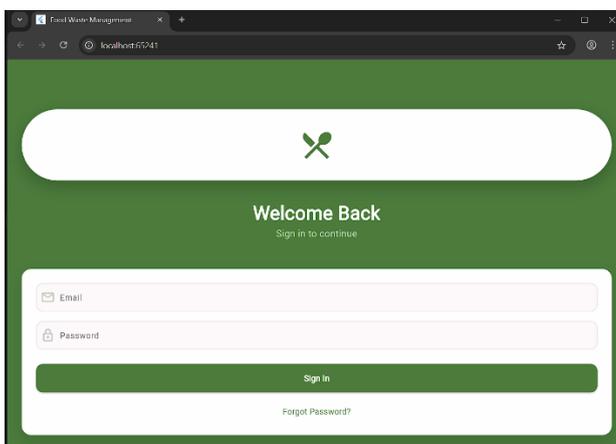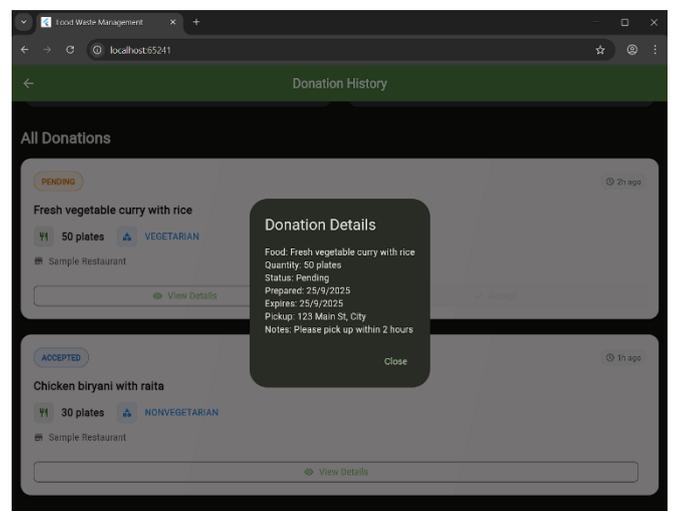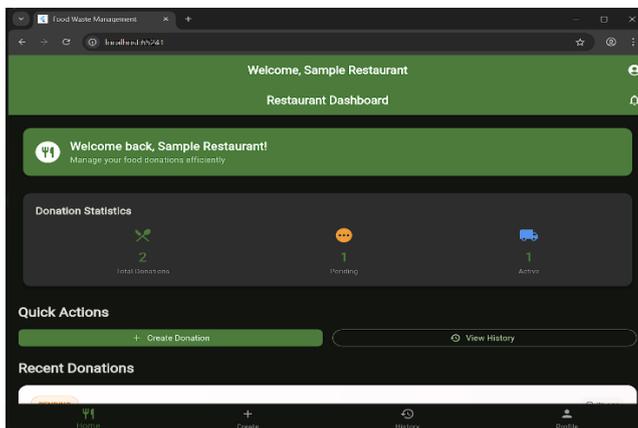

Figure 1 Sign in Page

Figure 2 Quick Actions

Evaluation with sample data from 50 households and 10 restaurants over one month showed a significant reduction in food waste, with households achieving a 20–30% decrease and restaurants reducing perishable waste by 25%. The reporting and visualization features were highly appreciated by users for improving awareness of waste patterns and

Figure 3 Donation Details

FUTURE ENHANCEMENT:
The Food Waste Management System can be further improved by incorporating advanced features to enhance automation, accuracy, and user engagement. Integration with IoT-enabled smart bins or kitchen sensors could enable real-time waste measurement, eliminate manual data entry and improving tracking accuracy. Incorporating AI and machine learning algorithms can provide predictive analytics to forecast potential food wastage and suggest optimized purchase or cooking quantities. Additional enhancements may include integration with local food donation networks or community sharing platforms to redirect surplus food, thereby reducing overall waste and supporting social initiatives. Expanding the system to include inventory management for restaurants and households can further optimize food usage and reduce over-purchasing. Gamification elements, such as user

rewards or achievements for minimizing waste, can increase engagement and promote behavioural change. Finally, developing a multilingual and mobile-friendly interface will make the system more accessible to a broader audience, ensuring wider adoption and greater impact in reducing food wastage.

Conclusion

The Food Waste Management System successfully demonstrates how technology can play a vital role in addressing the global challenge of food wastage. By providing users with a platform to record, categorize, and analyse food waste, the system enhances awareness of consumption patterns and encourages more responsible behaviour. The testing phase revealed measurable reductions in food wastage for both households and commercial establishments, highlighting the effectiveness of timely notifications, visual reports, and actionable suggestions. Beyond waste reduction, the system promotes sustainability, resource optimization, and environmental responsibility. It also serves as a foundation for future developments, such as integrating IoT-enabled smart sensors for automatic waste tracking, AI-based predictive analytics for forecasting food requirements, and connections with food donation or redistribution networks to minimize edible food loss. The project underscores the potential of combining software solutions with social and environmental initiatives, creating a positive impact on communities while fostering awareness about food security and sustainability. With further enhancements, this system can evolve into a comprehensive solution capable of real-time monitoring, predictive planning, and community-driven food management, ultimately contributing to a more sustainable and waste-conscious society.

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