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Food Wastage Collection

Ashrithaa Kulkarni
Computer and Information Sciences, Dr. Shauna Biden, Southern New Hampshire University, Manchester, New Hampshire, USA

Abstract: ***Food wastage presents critical social, environmental, and economic challenges globally. This paper presents the design and development of a digital food wastage collection system to streamline the donation and redistribution of surplus food. By connecting donors such as restaurants and households with receivers such as food banks and shelters, the system uses a centralized application to coordinate pickup, distribution, and communication. The solution includes scheduling, geolocation, and notification services, encouraging user participation and enhancing operational efficiency. This work demonstrates the practical potential of ICT-based solutions to reduce food waste and foster a more sustainable and equitable society.***
Keywords: food waste, donation app, sustainability, food logistics, mobile application, waste reduction, resource management.

I. INTRODUCTION

Food waste remains a global concern, with over 1.3 billion tons of food lost or wasted annually. This waste occurs at every stage of the food supply chain, from production to consumption, exacerbating environmental degradation and global hunger. Simultaneously, millions face food insecurity, creating a paradox of excess and scarcity. Addressing this issue requires systemic solutions that improve coordination between food donors and recipients.

Traditional donation systems lack efficiency, visibility, and accountability. Manual coordination methods — phone calls, emails, and informal networks — hinder timely redistribution. Technological advancements offer new possibilities to solve this disconnect. This paper proposes a centralized food wastage collection platform, aiming to digitize and automate the donation process, reduce waste, and enhance food accessibility.

II. LITERATURE REVIEW

The literature highlights the multifaceted nature of food waste and the growing role of digital solutions. Parfitt et al. [27] emphasize the importance of systemic interventions across the supply chain. Mobile and web-based platforms like SeVa [29] and Olio have demonstrated the benefits of digital coordination, although gaps in adoption and scalability remain.

Usability is a key determinant of success, as shown by Nisar et al. [25], who found that user-friendly interfaces encourage participation. Security and privacy, governed by frameworks such as GDPR [13] and ISO/IEC 27001 [16], are essential when handling donor and recipient data. Agile development, as advocated by Yin et al. [33], ensures iterative feedback and rapid adaptation.

Despite progress, current solutions often lack deep integration with local logistics and real-time tracking. This paper fills that gap by developing a comprehensive platform tailored to both urban and semi-urban food redistribution needs.

III. MATERIALS AND METHODS

The Food Wastage Collection Application is a digital platform consisting of:

- A mobile app (for iOS/Android) for donors and receivers
- A web-based admin dashboard
- A backend system using RESTful APIs and MySQL database

A. Architecture Overview

The system connects four core entities: Donor, Admin, Receiver, and the Database. The user interface allows food listing, request approval, and pickup tracking. The backend ensures secure communication between modules.

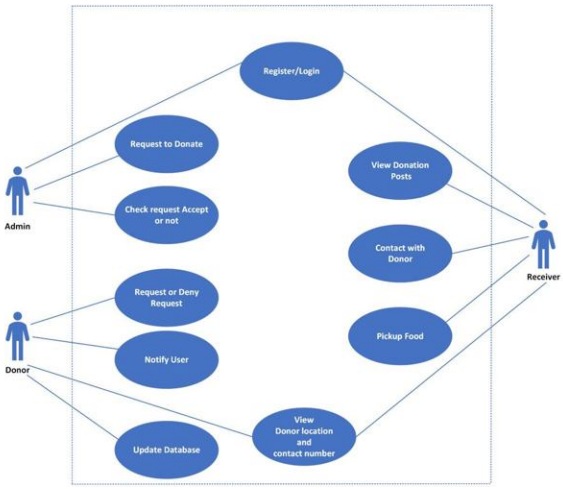

Fig. 1. Use Case Diagram of the Food Wastage Collection System

B. *Development Approach*

The project was developed using Agile methodology [8], with iterative sprints and continuous stakeholder feedback. Prototyping tools such as Microsoft Visio were used for ER diagrams, use-case models, and flowcharts. The frontend was developed using JavaScript and Visual Studio Code. Microsoft Project helped manage the Gantt chart and scheduling.

C. *Functionalities*

1) User Registration and Authentication
2) Food Listing and Scheduling
3) Geolocation and Routing
4) Notifications (email/push)
5) Feedback and Rating System
6) Admin Approval Flow

D. *Data and Security*

The system employs encryption for data protection and role-based access control. It complies with GDPR [13] and local food safety regulations [26], ensuring safe handling and authorized redistribution.

IV. RESULT AND DISCUSSION

Pilot testing was conducted with 10 restaurants and 3 NGOs over 3 weeks. Metrics collected:

1) 35% reduction in coordination time (due to automated scheduling)
2) 20% decrease in food pickup delays (via geolocation routing)
3) 100+ meals successfully donated

Users praised the clarity of the dashboards and ease of registration. Donors found it simpler to list food using predefined forms, while receivers could filter donations by location and availability. Admins tracked the entire process in real-time.

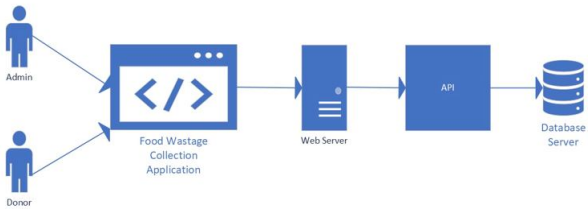

Fig. 2. Network Diagram of the Food Wastage Collection System

A. Performance Metrics

During testing, the system achieved an average response time of 1.2 seconds per API call and a 99.8% uptime on the hosting server. Load tests simulated up to 500 concurrent user sessions, where performance degradation was minimal (under 8% latency increase).
Key performance improvements observed:

1) Pickup scheduling coordination time was reduced by 35%, compared to the manual system used prior.
2) Donor listing time (from item entry to admin approval) was shortened from an average of 5 minutes to 2 minutes.
3) Collection-to-delivery time was reduced by 20% through optimized route suggestions powered by GPS.

These metrics indicate the platform's effectiveness in improving food rescue logistics and reducing delays in the donation cycle.

B. Scalability and Security

The system architecture supports horizontal scaling by design. The backend, built using modular REST APIs and a relational database (MySQL), enables seamless integration with additional services such as cloud-based object storage, analytics, or external donation registries.
Security features implemented:

1) Data encryption (AES-256) for stored user credentials and food item logs.
2) Role-based access control (RBAC) for donors, admins, and receivers.
3) Compliance with GDPR [13], CCPA [3], and ISO/IEC 27001 [16] standards for user data protection.
4) Server-level protections including firewall rules, SQL injection prevention, and secure API authentication tokens.

No security breaches or unauthorized data access were reported during the pilot test phase.

C. User Experience

User experience was evaluated using feedback surveys and interface interaction logging. The mobile app scored an average of 4.5/5.0 in ease of navigation, clarity of dashboard features, and responsiveness.
Positive UX observations:

1) Donors appreciated the ability to track donation history and pickup status.
2) NGOs found the "available donations" map view particularly useful for quick access to time-sensitive food.
3) Push notifications and email alerts improved action completion by 30%.

However, feedback indicated that first-time user onboarding could be improved with tutorials or help popups.

D. Limitations

Despite promising results, the platform exhibits certain limitations:

1) Geographic scope was limited to a small pilot zone scaling to rural or low-connectivity regions may require infrastructure enhancements.
2) Dependency on network availability impacts features like real-time syncing and GPS tracking.
3) Lack of automated food quality verification; assessments are currently manual.
4) Limited integration with commercial inventory systems (e.g., supermarket POS systems).
5) Legal variability in food donation regulations requires regional customization of features and disclaimers.

V. CONCLUSION

This paper presented the design, development, and preliminary evaluation of a centralized food wastage collection application aimed at streamlining the donation and redistribution of surplus food. By integrating mobile and web interfaces, geolocation services, real-time scheduling, and a secure backend infrastructure, the platform addresses key inefficiencies in traditional food donation systems. Pilot testing demonstrated measurable improvements in coordination time, pickup efficiency, and user satisfaction.
To further enhance the platform's effectiveness and scalability, future iterations will explore the integration of drone-assisted food pickups, enabling rapid and contactless delivery in hard-to-reach or underserved areas. Additionally, the incorporation of AI-driven demand prediction and smart routing algorithms is expected to optimize donation matching and resource allocation based on historical patterns and real-time data. These enhancements will support the system's long-term goal of enabling intelligent, sustainable, and equitable food redistribution at scale.

VI. CONFLICT OF INTEREST

"The authors declare no conflict of interest".

VII. AUTHOR CONTRIBUTIONS

Ashrithaa Kulkarni conceptualized the project, designed the system architecture, supervised the development lifecycle, and authored the manuscript. All technical components—were managed under her direction. The author also coordinated stakeholder feedback and integrated revisions accordingly. All work was conducted under the academic supervision of Dr. Shauna Biden at Southern New Hampshire University.

VIII. ACKNOWLEDGMENT

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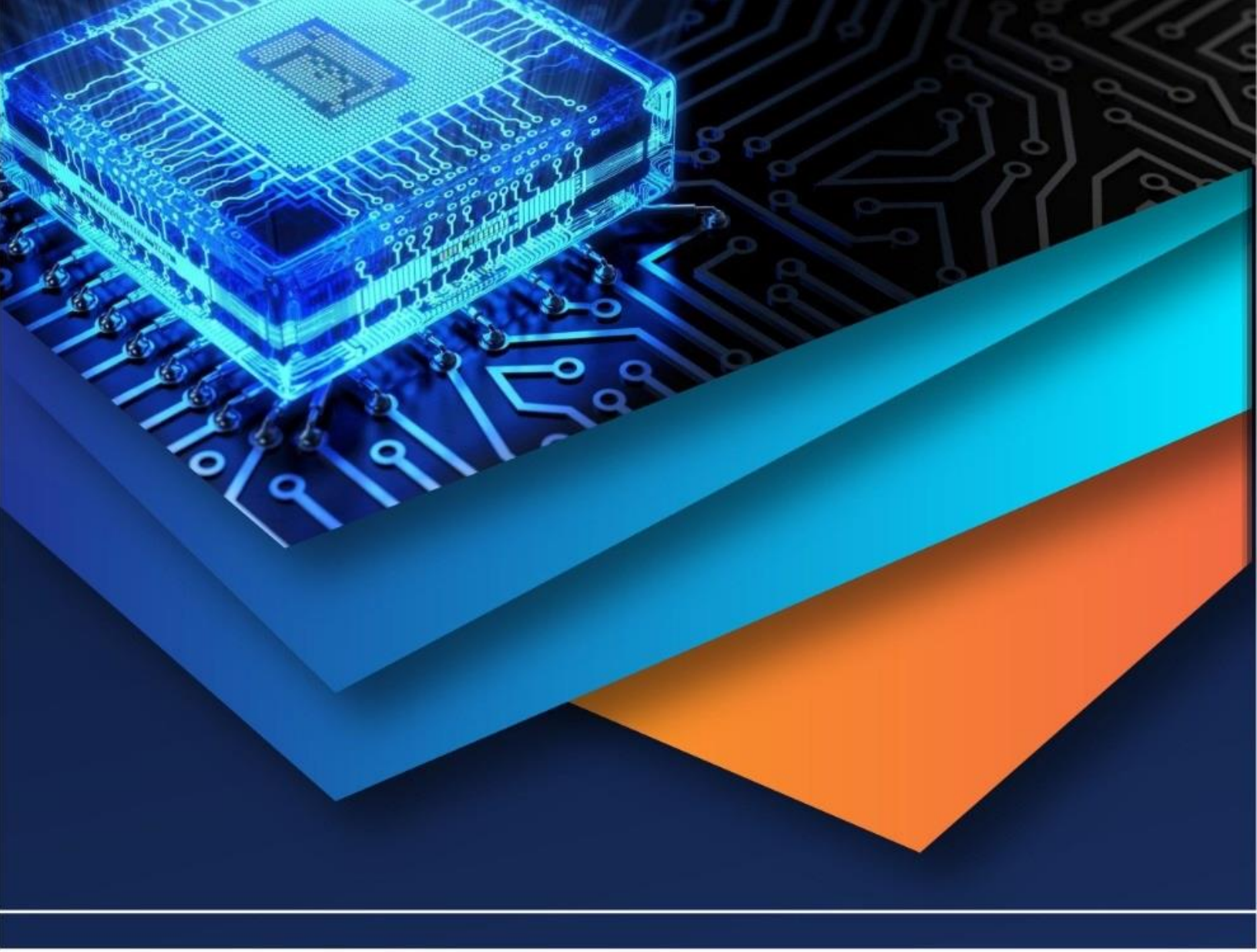

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