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MealMend: A Web-Based Platform for Surplus Food Redistribution and Sustainable Food Waste Management

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Abstract: ***Food waste and food insecurity coexist as significant environmental, social, and resource-management challenges. Edible surplus food generated by households, restaurants, food courts, institutions, markets, and social events may be discarded when timely coordination between donors and receiving organizations is unavailable. This paper presents MealMend, a web-based prototype designed to support structured surplus-food donation and sustainable food-waste management through a common digital interface. The system incorporates user registration and role selection, location entry, food categorization, structured donation details, pickup scheduling, donation-history tracking, and information related to sustainable recovery pathways. The proposed workflow prioritizes redistribution of suitable surplus food for human consumption while distinguishing organic material that may require alternative recovery through processes such as composting or anaerobic digestion. The prototype demonstrates the functional feasibility of organizing major donation and recovery activities through an integrated web-based workflow. The present study reports system design and prototype implementation rather than a field-deployment impact assessment; therefore, no quantitative claims regarding food-waste reduction, redistribution efficiency, or food-security improvement are made. Future work will focus on geolocation-based matching, verified receiver integration, automated notifications, food-safety controls, real-time status tracking, analytics, and pilot deployment.***

Keywords: ***Food Waste Management, Surplus Food, Food Donation, Food Redistribution, Sustainable Computing, Web Application.***

I. INTRODUCTION

Food waste represents a significant challenge at the intersection of environmental sustainability, resource efficiency, and food security. According to the United Nations Environment Programme, approximately 1.05 billion tonnes of food waste were generated across households, food-service establishments, and retail sectors in 2022 [1]. Food that is ultimately discarded also represents an inefficient use of the land, water, energy, labour, and other resources involved in its production, processing, transportation, and distribution. At the same time, a portion of surplus food may remain suitable for human consumption and could potentially be redirected to individuals or organizations capable of utilizing it.

Food recovery and redistribution provide an important mechanism for addressing this imbalance. The Food and Agriculture Organization of the United Nations (FAO) emphasizes the prevention of food loss and waste and recognizes the recovery and redistribution of safe and nutritious surplus food as an important approach for preventing suitable food from becoming waste [2], [3]. Food that cannot appropriately be redistributed may subsequently be considered for other recovery pathways, including composting and energy recovery. This distinction is important because surplus-food redistribution and organic-waste processing address different categories of material and should not be treated as interchangeable activities.

Despite the potential benefits of food redistribution, effective coordination between food donors and receiving organizations remains a practical challenge. Surplus food is often time-sensitive, and potential donors such as households, restaurants, grocery stores, institutions, food courts, and event organizers may not have an efficient mechanism for communicating the availability, quantity, location, and pickup requirements of food. Similarly, potential receivers may have limited visibility into available donations. Dependence on telephone calls, personal contacts, or other unstructured forms of communication may introduce delays and make donation activities difficult to coordinate and track.

Digital platforms provide an opportunity to improve this coordination by structuring the exchange of information between participants. Existing food-redistribution systems have investigated mechanisms such as donor and receiver registration, donation listings, location information, collection status, and centralized communication [4]–[6]. Such systems demonstrate how information and communication technologies can improve the visibility and organization of surplus-food redistribution.

To support this process, MealMend is proposed as a web-based platform for surplus-food redistribution and sustainable food-waste management. The system provides a structured interface through which participants can register, select their role, provide location information, enter surplus-food details, specify pickup requirements, and review donation history. In addition to facilitating donation-related information, the prototype presents a broader sustainability workflow that distinguishes redistribution of suitable surplus food from alternative recovery pathways for unavoidable organic waste.

The principal objective of MealMend is to establish a structured digital workflow for coordinating surplus-food donation while maintaining awareness of appropriate waste-recovery pathways. The present work focuses on the design and functional implementation of the MealMend prototype rather than demonstrating measurable reductions in food waste or food insecurity. Real-time donor-receiver matching, automated food-safety verification, GPS-based routing, production-level authentication, and quantitative assessment of real-world redistribution outcomes remain outside the scope of the current implementation.

II. RELATED WORK

Digital technologies have increasingly been investigated as mechanisms for improving surplus-food recovery and redistribution. Such systems primarily operate by improving the visibility of available food and facilitating information exchange among donors, receivers, volunteers, and other participants. The effectiveness of digital redistribution depends not only on making surplus food visible but also on providing sufficient information regarding quantity, location, availability, collection requirements, and transaction status.

Sanyal et al. [6] investigated surplus-food distribution from a computational perspective and proposed a game-theoretic framework for food redistribution in smart-city environments. Their work demonstrates how computational approaches can support coordination among participants while considering different requirements and preferences. Such approaches indicate the potential for digital systems to move beyond simple food listings toward structured or intelligent mechanisms for matching surplus-food sources with potential recipients.

More recent work has focused directly on web-based food-donation and redistribution platforms. Karanth et al. [4] presented a web-based platform designed to support efficient surplus-food management. The system allows surplus-food information to be registered and made accessible for redistribution, demonstrating the role of structured web interfaces in coordinating donors and receivers. Location and status-related information further illustrate how digital platforms can improve visibility throughout the donation process.

Similarly, Shivani and Usha [5] proposed a centralized web-based food-donation and redistribution system connecting food donors and NGOs. Their work addresses challenges associated with manual coordination, including communication delays and potential food spoilage. The use of a centralized platform demonstrates the value of bringing donation information, participant interaction, and record management into a common digital environment.

Collectively, these studies demonstrate that effective digital redistribution systems benefit from structured donation information, clearly defined participant roles, location awareness, timely communication, and traceable donation records. They also indicate opportunities for more advanced functionality such as automated matching, notification mechanisms, status tracking, and intelligent prioritization.

A related consideration is the treatment of surplus material that is not suitable for direct human consumption. Food redistribution and food-waste recovery represent different stages of a broader sustainability process. FAO guidance emphasizes the recovery and redistribution of safe and nutritious food under appropriate safety, quality, and regulatory conditions [3]. Organic material that cannot appropriately be redistributed may instead require alternative management pathways. Consequently, a sustainable food-management system should distinguish between material suitable for redistribution and material requiring recovery or processing.

The reviewed studies establish the relevance of digital platforms for coordinating surplus-food donation, while sustainability guidance establishes the importance of distinguishing redistribution from lower-value recovery pathways. Based on these observations, MealMend explores an integrated workflow that combines structured donation management with food-waste recovery awareness. The contribution of the proposed system is therefore not the claim that web-based food donation is itself a new concept. Rather, MealMend implements participant registration, role selection, location information, structured surplus-food entry, pickup scheduling, donation-history tracking, and sustainability-oriented recovery awareness within a unified web-based prototype.

Accordingly, the research gap addressed in this work lies in developing a unified prototype that connects structured surplus-food donation with pickup planning, donation traceability, and awareness of alternative recovery pathways within a single workflow.

III. PROPOSED SYSTEM AND METHODOLOGY

The proposed MealMend workflow is organized around five functional stages: participant onboarding, donation creation, collection planning, suitability assessment, and redistribution or recovery. The design aims to capture the minimum structured information required to support preliminary coordination while maintaining a clear distinction between surplus food intended for redistribution and organic material requiring alternative recovery.

A participant initially registers with the system by entering the required personal information and selecting an appropriate user role. As shown in Fig. 1, the MealMend registration interface captures user information and provides role selection to establish the participant's function within the proposed donation workflow. Role-based onboarding provides a foundation for differentiating the activities of donors and other participants as the system is extended.

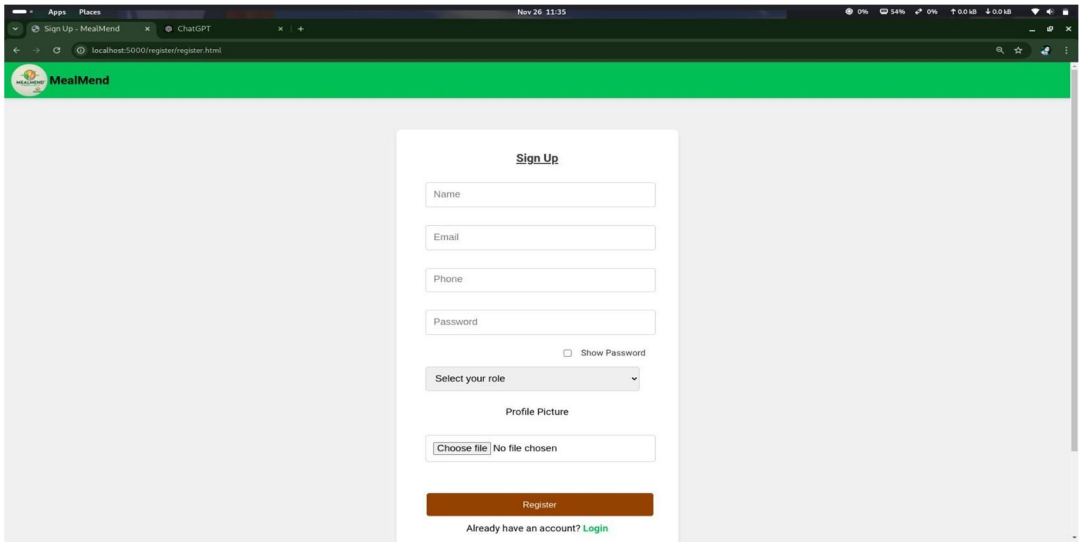

Fig. 1. MealMend registration interface with user-role selection.

Following registration, the participant enters the main application environment. As illustrated in Fig. 2, the home interface provides location entry together with access to the major services and informational components of MealMend. Location information can support preliminary collection coordination and provides a foundation for future implementation of geolocation-based donor-receiver matching.

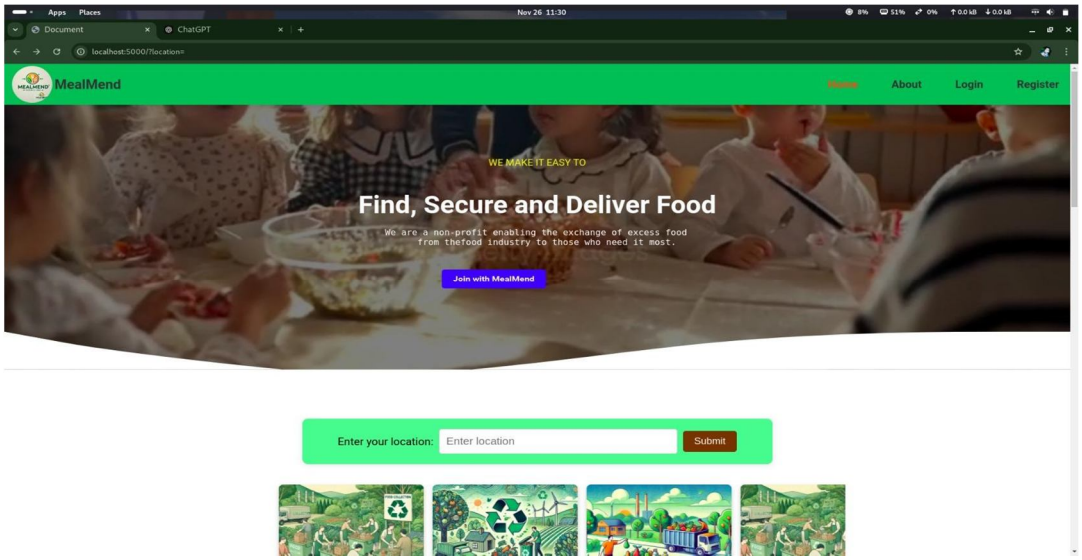

Fig. 2. MealMend home interface with location entry and service categories.

A donor can subsequently create a donation record containing information such as food category, food name, quantity, perceived quality, address, contact number, pickup date, and description. Capturing these attributes in a structured form reduces ambiguity compared with unstructured donation communication and provides essential information for preliminary collection planning.

Following collection, the conceptual workflow introduces a suitability decision. Food considered appropriate for human consumption is intended for redistribution through an appropriate receiving organization, subject to applicable food-safety, quality, and regulatory requirements. Organic material that is unsuitable for direct human consumption is treated separately and may be considered for recovery mechanisms such as composting or anaerobic digestion. This distinction is consistent with the principle that safe surplus food should be recovered and redistributed under appropriate safety and regulatory frameworks [3].

IV. SYSTEM IMPLEMENTATION

The MealMend prototype implements the proposed workflow through interconnected web interfaces for participant registration, location entry, donation management, service information, pickup scheduling, and donation-history viewing. The interface design is intended to keep the donation process structured while also providing information related to sustainable food-waste management.

The registration component, presented earlier in Fig. 1, captures basic participant details such as name, email address, phone number, password, user role, and an optional profile picture. Role selection establishes a basis for differentiating participant functions within the proposed system.The location and information component provides location entry and introduces the principal activities associated with the MealMend concept. As shown in Fig. 3, the service and information section presents food-waste collection, food donation, composting, community-oriented recovery, and educational or awareness-related activities. The interface therefore extends beyond donation entry and provides users with a broader view of possible approaches for managing surplus and organic food material.

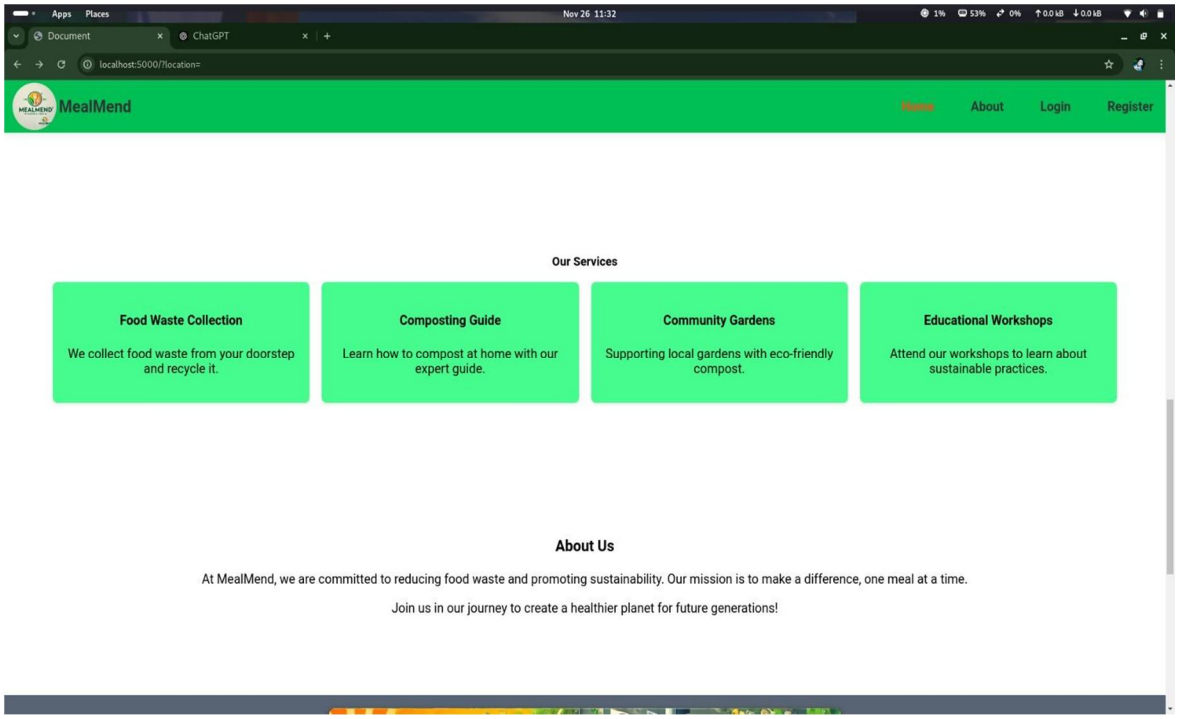

Fig. 3. MealMend service and information section.

The sustainability concept underlying MealMend is further represented in Fig. 4, which distinguishes food intended for redistribution from organic material requiring alternative recovery. Suitable surplus food follows a donation-oriented pathway involving collection and distribution, whereas unavoidable organic waste may be directed toward processing mechanisms such as composting or anaerobic digestion. Fig. 4 therefore represents the conceptual decision structure of MealMend rather than an automated food-safety classification mechanism.

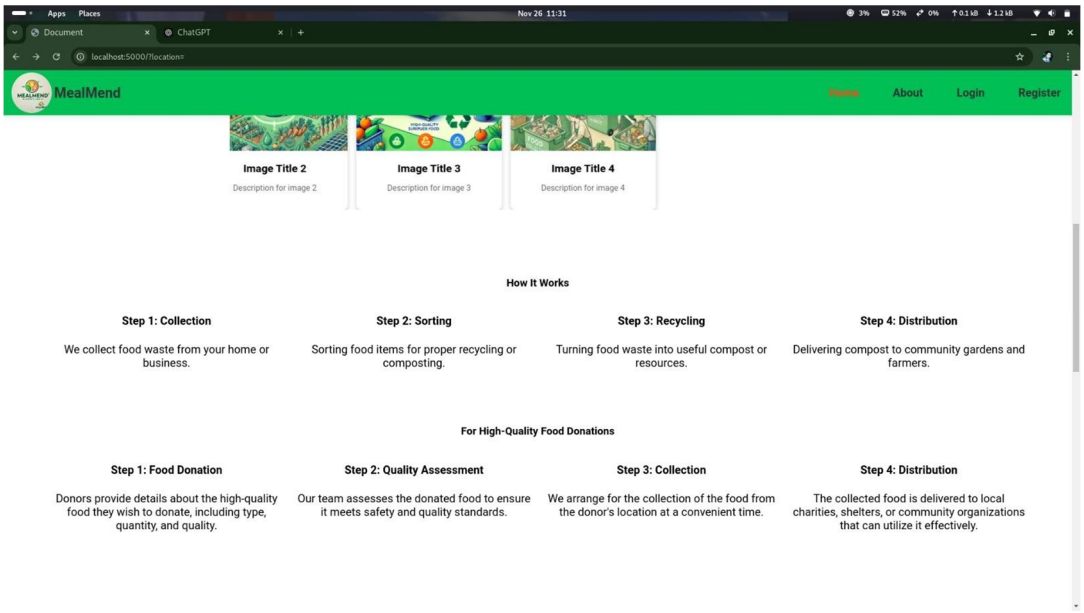

Fig. 4. Conceptual MealMend workflow for surplus-food redistribution and organic-waste recovery.

The principal transactional functionality is provided through the donation interface. As illustrated in Fig. 5, the donor interface allows the user to select a food category and enter structured information including food name, quantity, perceived quality, address, contact number, pickup date, and description. The inclusion of pickup information introduces an important temporal component into the donation record and provides a basis for coordinating the collection of perishable surplus food.

The prototype also provides access to donation history, allowing submitted donation records to be reviewed. This functionality establishes basic traceability within the prototype by maintaining information about previous donation activities. Although the present implementation does not demonstrate end-to-end real-time status tracking between donors and verified receivers, donation-history functionality provides a foundation for such capabilities in future versions.

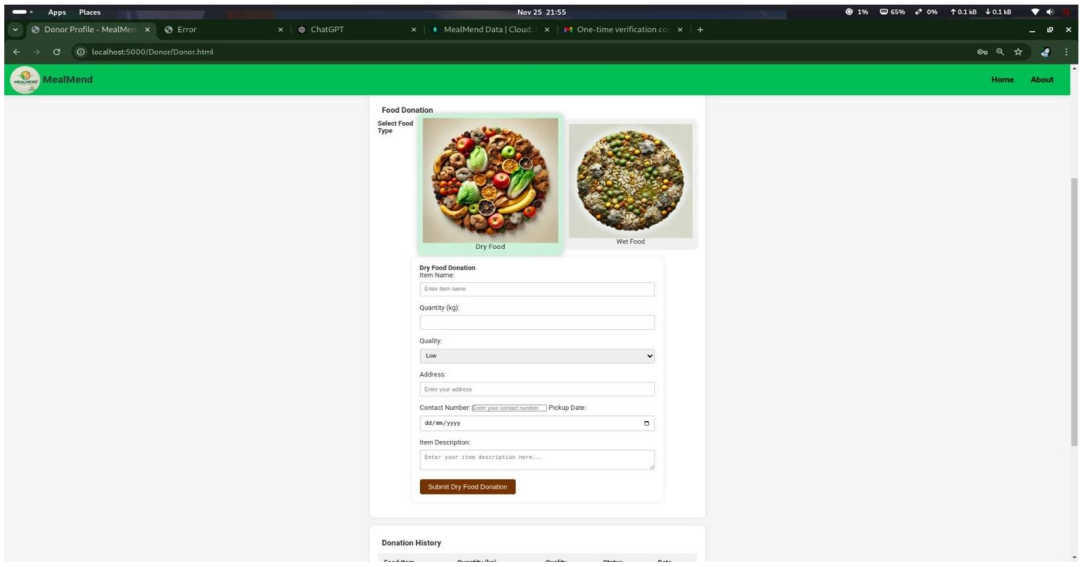

Fig. 5. Donor interface for food details, pickup scheduling and donation history.

Together, Figs. 1–5 illustrate the principal user-facing and conceptual components of the MealMend prototype. Registration establishes participant information and role selection, the home interface provides location entry and access to system services, the sustainability workflow distinguishes redistribution from organic-waste recovery, and the donation interface captures the information required for collection planning and donation-record maintenance.

V. FUNCTIONAL WORKFLOW

The overall functional workflow of MealMend is illustrated in Fig. 6. The workflow presents the sequence of activities involved in managing a surplus-food donation, beginning with user registration and continuing through collection, suitability assessment, and the final redistribution or recovery pathway.

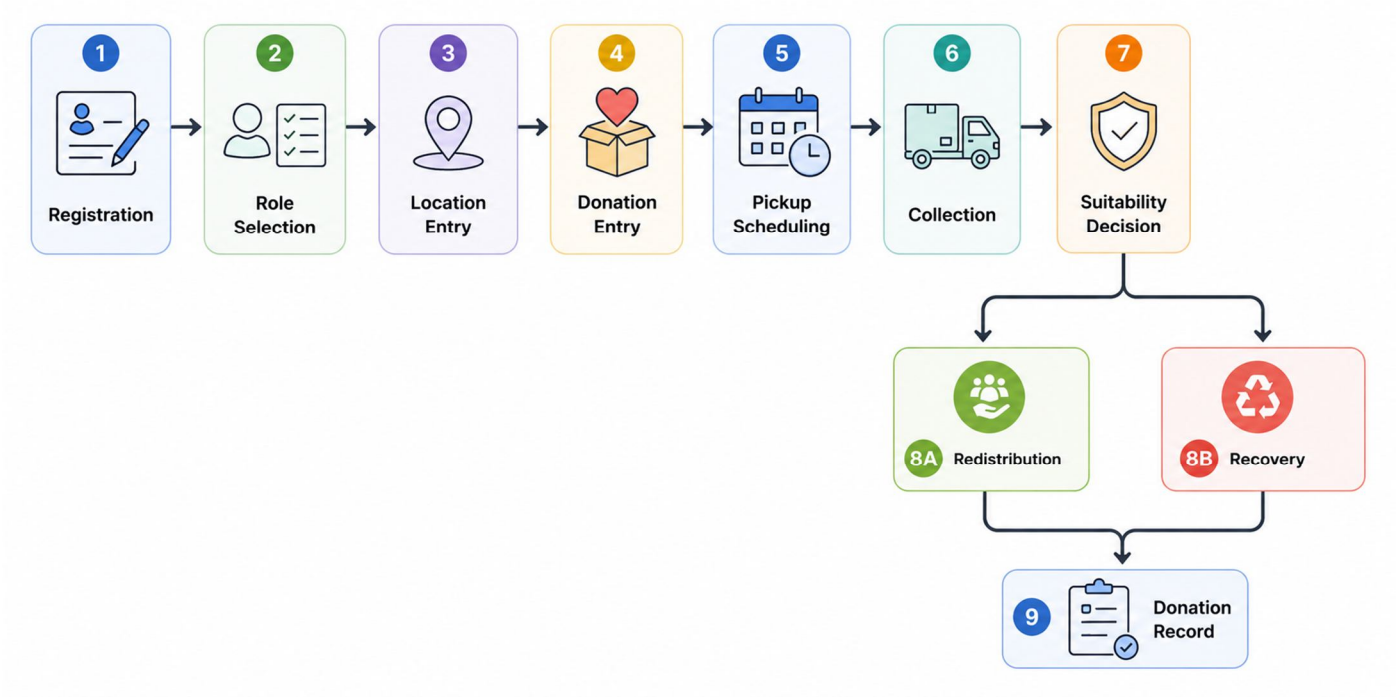

Fig. 6. Functional workflow of the MealMend system.

As shown in **Fig. 6**, the process begins with participant registration and role selection, followed by location entry and submission of structured donation details. The donor provides relevant information about the available food and specifies the pickup schedule to support collection planning. After collection, the food proceeds to a suitability decision stage. Food considered suitable for human consumption may proceed toward redistribution through an appropriate receiving organization, whereas material unsuitable for redistribution may be directed toward an alternative recovery pathway, such as composting or anaerobic digestion. The resulting activity is maintained as a donation record, providing basic traceability of the donation process.

The workflow provides a structured progression from donation initiation to its final handling while clearly separating surplus-food redistribution from organic-waste recovery. However, the suitability decision shown in Fig. 6 represents a conceptual stage in the current prototype and should not be interpreted as an automated food-safety assessment.

VI. RESULTS AND DISCUSSION

The implemented prototype demonstrates the principal interaction flow required for structured surplus-food donation management. The available implementation evidence includes participant registration and role selection, location entry, service information, food categorization, structured donation entry, pickup-date selection, and donation-history viewing. The interfaces presented in Figs. 1–5 demonstrate that these functions can be incorporated into a common browser-based workflow.

From a coordination perspective, the implementation addresses three fundamental information requirements. First, structured donation fields provide a consistent representation of the available food and its collection details, reducing ambiguity regarding the item, quantity, location, and contact information. Second, pickup scheduling introduces time information into the donation record, providing a basis for planning the collection of time-sensitive food. Third, donation-history functionality establishes basic traceability by retaining information about previously submitted donations.

The broader MealMend workflow also creates a conceptual connection between surplus-food redistribution and sustainable organic-waste recovery. This distinction is important because not all surplus material should automatically enter the same handling pathway. Food considered suitable for redistribution and organic material requiring recovery have different operational and safety requirements.

The present results should, however, be interpreted as functional prototype evidence rather than evidence of real-world impact. The available project material does not contain a field-deployment dataset, successful-pickup records, measured quantities of redistributed food, donor-to-receiver response-time benchmarks, landfill-diversion measurements, or a controlled usability study. Consequently, the present work does not claim experimentally verified reductions in food waste, food insecurity, or collection time. Establishing such outcomes requires pilot deployment with measurable operational and user-level indicators.

VII. LIMITATIONS AND FUTURE WORK

The present MealMend prototype establishes the functional structure of the proposed donation workflow; however, several capabilities required for real-world deployment remain outside the current implementation. The system does not yet demonstrate real-time donor-receiver matching, GPS-based navigation, automated notifications, verified receiver or NGO onboarding, production-grade authentication, automated food-safety validation, or quantitative operational analytics. Privacy controls and clearly defined data-management policies would also be required before deployment with real users.

Food safety represents a particularly important limitation. A donor-provided quality label cannot independently determine whether donated food is suitable for human consumption. Operational deployment would require appropriate mechanisms for considering preparation time, storage duration, temperature conditions, packaging integrity, allergen information, expiry or use-by information, and applicable food-safety regulations. Receiving organizations would also require appropriate procedures for accepting or rejecting donations.

Future development should therefore focus on strengthening the coordination, safety, traceability, scalability, and intelligence of the platform. Geolocation-based matching could identify suitable receiving organizations near a donor, while real-time acceptance and collection-status tracking could improve visibility throughout the donation lifecycle. Automated notifications could reduce communication delays, and expiry- or time-aware prioritization could help identify donations requiring urgent collection. Verified organization onboarding, secure authentication, privacy controls, and administrative monitoring would further strengthen the system for operational use.

A further direction is the incorporation of analytics and decision-support functionality. A deployed platform could record the number and quantity of donations, food categories, acceptance rates, successful-pickup rates, response times, redistribution outcomes, recovery routes, and geographical patterns. Such information could subsequently support improved matching, prioritization, capacity planning, and evaluation of the system's operational performance.

Most importantly, future research should evaluate MealMend through a real-world pilot study involving donors and receiving organizations. Suitable evaluation measures could include the number of donations posted, acceptance rate, successful-pickup rate, median donor-to-receiver response time, kilograms of food successfully redistributed, quantities directed toward alternative recovery, task-completion rate, usability, and participant satisfaction. Such an evaluation would allow the work to progress from functional prototype validation toward evidence-based assessment of operational effectiveness and sustainability impact.

VIII. CONCLUSION

This paper presented MealMend, a web-based prototype designed to support structured surplus-food redistribution and sustainable food-waste management. The system integrates participant registration, role selection, location information, structured donation entry, pickup scheduling, donation-history tracking, and sustainability-oriented recovery awareness within a common digital interface. The proposed workflow distinguishes surplus food intended for redistribution from organic material requiring alternative recovery, thereby connecting donation management with a broader food-waste-management perspective.

The present implementation demonstrates the functional feasibility of representing the proposed coordination workflow through a web-based platform. However, it does not establish measurable reductions in food waste or improvements in food-distribution outcomes. Real-world effectiveness will require deployment involving verified donors and receiving organizations together with appropriate food-safety controls, geolocation, notifications, secure authentication, privacy mechanisms, and operational monitoring.

Future pilot studies can provide quantitative evidence regarding successful redistribution, coordination efficiency, response time, waste diversion, usability, and participant acceptance. With these extensions and appropriate real-world evaluation, MealMend can evolve from a functional prototype into a more comprehensive digital platform for community-level surplus-food recovery and sustainable food-waste management.

IX. ACKNOWLEDGEMENT

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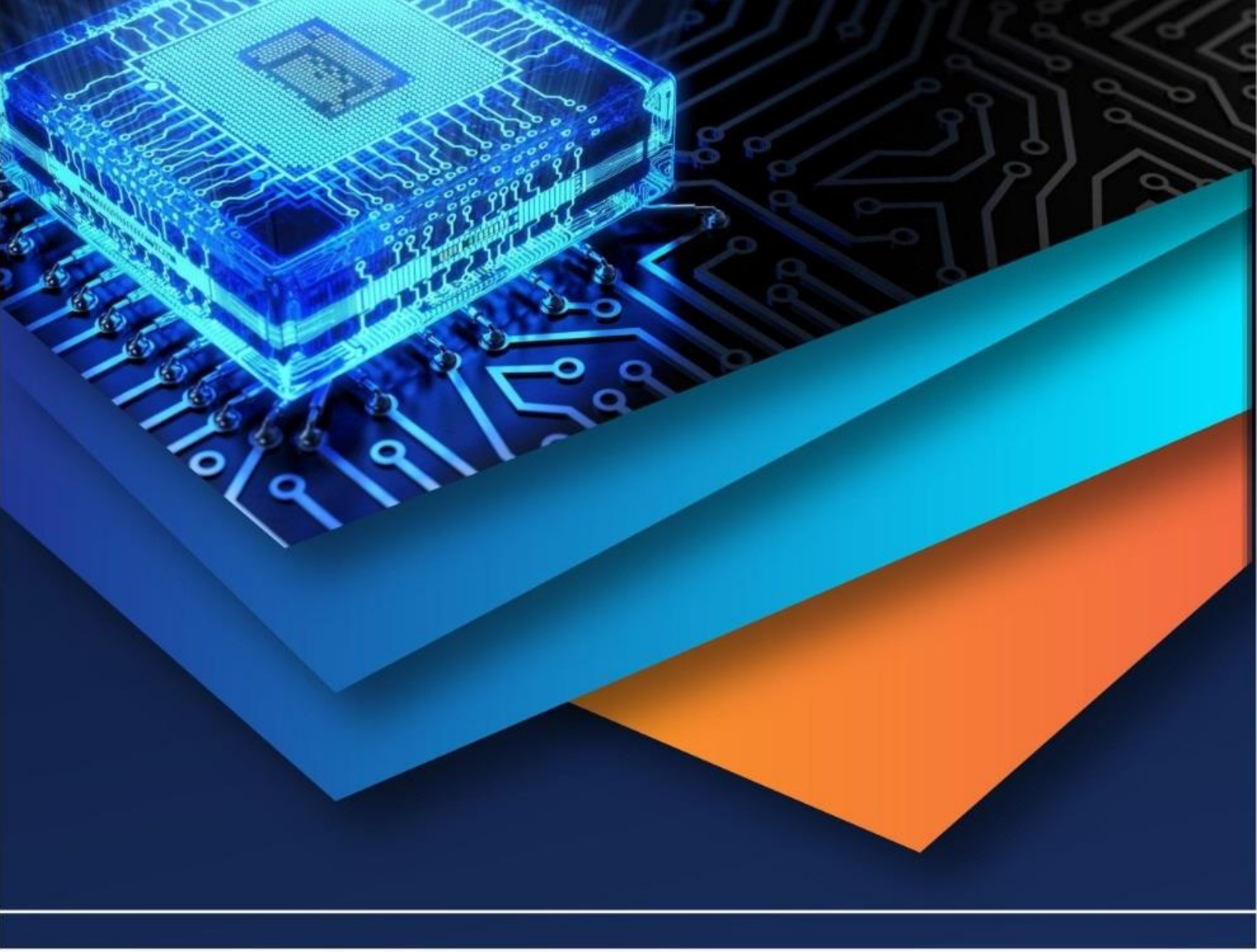

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