Food Bridge Application

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Abstract— Food wastage is a significant global issue, especially in urban areas where hotels, restaurants, and events generate substantial surplus food that often ends up in waste. At the same time, millions of underprivileged individuals face hunger and malnutrition. To address this gap, we propose a technology-driven platform that connects food providers with NGOs to ensure efficient redistribution of surplus food to the needy. The platform facilitates real-time communication between food donors and food-receiving organizations through an intuitive web and mobile interface. Key features include donor registration, instant notifications to nearby NGOs, logistics coordination using route optimization, and a transparent tracking system. AI integration ensures efficient matching of food donors with NGOs based on location and availability. This solution minimizes food wastage, promotes social responsibility, and supports humanitarian efforts by utilizing existing technologies such as GPS, AI-based matching, and data analytics. The platform is scalable, user-friendly, and adaptable across cities and regions. By bridging the gap between food surplus and hunger, this project contributes to sustainable development goals, particularly zero hunger and reduced food wastage. It has significant social, economic, and environmental impacts, making it a practical and innovative approach to addressing a critical global challenge.

***Index Terms*—food waste, agile, NGO, GPS, hunger, surplus food**

I. Introduction

Food insecurity remains one of the pressing issues globally, and India is no exception. According to the Food and Agriculture Organization (FAO), approximately 40% of the food produced in India is wasted every year. Simultaneously, India ranks 107th out of 121 countries in the Global Hunger Index 2022, indicating a serious hunger problem. The contradiction is stark , food is wasted in abundance, while millions suffer from hunger and malnutrition.

A major contributor to this food wastage is surplus food from parties, restaurants, weddings, and institutional canteens. Often, this food is still safe for consumption, but due to lack of planning or timely logistics, it ends up being discarded. NGOs working to distribute food to the underprivileged usually operate in silos, without a streamlined mechanism to receive real-time alerts about available food donations. FoodBridge is designed to act as a digital connector between food donors and non-profit organizations. It provides a centralized platform where food donors can post surplus food availability, and nearby NGOs or volunteers can claim it for timely pickup and distribution. The platform fosters a culture of responsible consumption, builds community trust, and promotes sustainability.

II. Literature Review

Food wastage remains a critical global issue, particularly in urban areas where large-scale food providers generate significant surplus (FAO, 2013). Despite this, millions continue to suffer from hunger and malnutrition, pointing to a systemic inefficiency in food distribution (Alexander et al., 2017). Research shows that technological interventions, such as AI-based platforms, can play a pivotal role in bridging this gap by enabling efficient matching between food donors and NGOs, optimizing logistics, and ensuring transparency in redistribution (Bhattacharya & Saha, 2021). Human-centered computing studies further suggest that platforms designed with intuitive interfaces and real-time communication features can significantly improve engagement and reduce wastage (Ganglbauer et al., 2013). Additionally, organizations like WRAP emphasize that overcoming logistical and coordination challenges through digital solutions can substantially enhance redistribution efforts (WRAP, 2020). Together, these findings validate the potential of a technology-driven food redistribution platform in achieving sustainability and social equity. Recent research highlights the significant role of artificial intelligence (AI), optimization algorithms, and real-time data systems in enhancing the efficiency and sustainability of food distribution and logistics. Laguna et al. (2009) present a tabu search methodology effective for scheduling, which can be adapted to logistics systems for improved task sequencing. Gupta and Sethi (2021) provide a comprehensive review of AI applications in food distribution, emphasizing demand forecasting and route optimization. Zhang and Li (2020) explore logistics and supply chain models aimed at reducing costs and ensuring timely food deliveries. The integration of real-time data has also shown measurable benefits; Lee and Kim (2018) demonstrate its impact on enhancing efficiency in food donation programs, while Fernandes (2022) emphasizes how real-time location services improve urban food delivery operations. Addressing the food waste crisis, Chandrasekar and Jones (2020) advocate for AI-driven solutions that manage surplus and expiration data effectively. Similarly, Mathews and Rao (2019) propose smart algorithmic strategies to reduce waste in urban logistics. Bhattacharya and Arnold (2020) focus on optimizing pickup and delivery systems in food donation logistics, aiming to maximize food recovery and minimize costs. Collectively, these studies underscore the critical intersection of AI, real-time systems, and optimization in building smarter, more sustainable food logistics networks.

Research gap

Despite growing research on AI-driven food redistribution and logistics optimization, several key gaps remain unaddressed. First, most existing studies focus on theoretical models or small-scale implementations, lacking real-world validation in complex urban settings. This highlights the need for large-scale, empirical evaluations of such systems to assess scalability and effectiveness. Additionally, while human-centered design is acknowledged as crucial for platform success, there is limited exploration of user experience, interface usability, and adoption barriers among diverse stakeholders such as NGOs, small food donors, and volunteers. Another significant gap lies in the integration of these technological platforms with existing legal and regulatory frameworks governing food safety and donation practices, which is essential for long-term viability. Furthermore, the challenge of data fragmentation across food donors, logistics providers, and recipient organizations calls for research into interoperable standards and

APIs that enable seamless real-time communication. Ethical concerns, including potential algorithmic bias and inequitable access to technology, are also underexplored in the literature, indicating the need for fair and inclusive AI design. Moreover, comprehensive assessments of social, environmental, and economic impacts are scarce, limiting understanding of the broader sustainability outcomes. Finally, most platforms adopt top-down approaches, with minimal involvement of local communities or grassroots innovations, underscoring the importance of participatory models that empower local actors in food redistribution ecosystems. Addressing these gaps is vital for developing effective, inclusive, and sustainable technology-driven solutions to combat food waste and hunger.

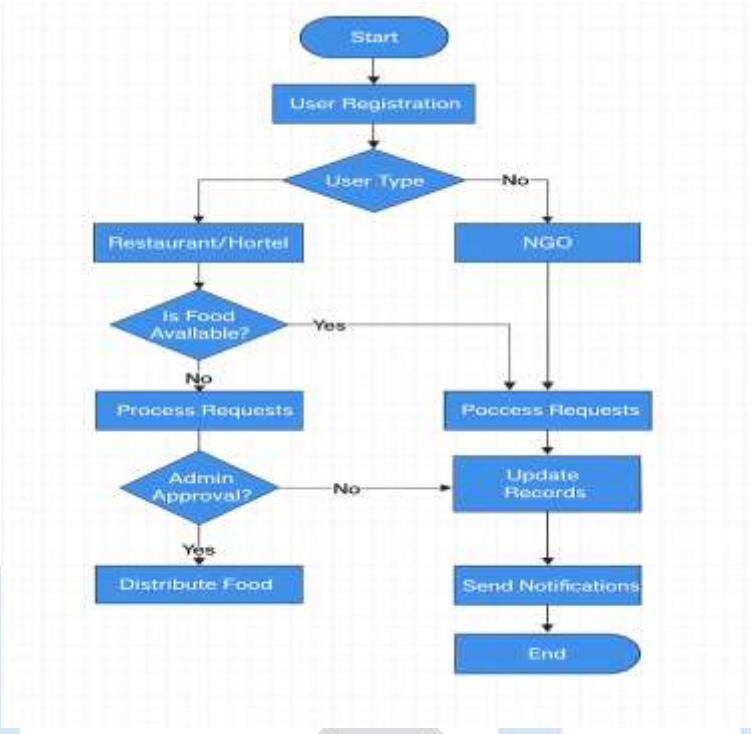
III. PROPOSED SYSTEMS

The FoodBridge platform effectively addresses several critical research gaps identified in the domain of food redistribution and logistics optimization. By adopting an Agile Scrum-based development methodology and involving end-users such as NGOs and donors throughout the process, the system moves beyond theoretical models to deliver a real-world, validated solution. Its user-centered design, featuring intuitive interfaces, real-time notifications, and streamlined workflows, ensures accessibility and engagement across a diverse user base, thereby overcoming gaps in usability and adoption found in earlier studies. The inclusion of an admin approval mechanism introduces a governance layer that aligns with legal and regulatory frameworks, addressing the often-overlooked need for compliance in food donation systems. FoodBridge also enhances coordination and data interoperability among stakeholders through real-time communication features and structured status tracking, mitigating the fragmentation commonly seen in traditional systems. The platform is built to support fairness and inclusivity by catering to both small and large donors and ensuring equitable food distribution based on availability and need. Its iterative development, driven by continuous user feedback, enables ongoing refinement and provides a foundation for long-term impact assessment. Furthermore, by involving community actors in the development process, FoodBridge embraces a participatory model that empowers local stakeholders and supports grassroots innovation. Collectively, these features demonstrate how FoodBridge responds holistically to existing gaps, offering a scalable, ethical, and user-focused solution to combat food waste and hunger. The Algorithm of FoodBridge is shown in fig. 1. Fig.2. gives the Flow chart of FoodBridge.

Fig. 1. FoodBridge Algorithm

1. Start
2. User Registration
    - → Classify User Type
        - → Restaurant/Hotel
            - → Food Listing
                - → Is Food Available?
                    - Yes → Notify NGOs
                    - No → Wait for Food Listing
        - → NGO
            - → Request Food
3. Process Requests
4. Admin Approval?
    - Yes → Distribute Food
    - No → Send Rejection Notification
5. Update Records
6. Send Notifications to Relevant Parties
7. End

Fig. 2. FoodBridge Flowchart



IV. METHODOLOGY

To ensure systematic development and effective delivery of the FoodBridge platform, we adopted an Incremental Development Methodology, which is a variant of Agile. This approach enabled us to divide the entire system into smaller, manageable components and develop them in stages. Each stage allowed for iterative refinement, integration of feedback, and simultaneous testing, resulting in a more flexible and adaptive development process. The primary reasons for choosing this methodology included the flexibility it provided, which allowed us to first develop a Minimum Viable Product (MVP) and then progressively enhance it. It also helped in mitigating risks, as issues could be identified and resolved early within each small iteration. Continuous improvement was made possible through the integration of feedback from peers and NGOs, who were provided early versions of the platform. Additionally, the methodology supported parallel development workflows, which enabled backend and frontend modules to be developed simultaneously, thereby improving team productivity. The methodology was executed through multiple phases that included requirement gathering and analysis, system design focusing on both architecture and user interface, implementation of modules in stages, rigorous testing and debugging, integration and deployment of the system, incorporation of user feedback for refinement, and finally, preparation of complete documentation. This approach ensured that the development remained aligned with real-world use cases and allowed the system to remain flexible and responsive to changing needs.

For the development of the FoodBridge project, we chose the Agile Process Model with a focus on Scrum principles. Agile was particularly well-suited for this project due to the dynamic nature of the requirements and the need for user-centered development. Scrum enabled us to break the work into iterative sprints, each delivering functional outputs that could be tested and refined based on user and mentor feedback.

Scrum's framework supported the project by enabling frequent iterations, encouraging daily stand-up meetings, and conducting regular sprint reviews to assess ongoing progress. This iterative structure helped us continuously integrate feedback from mentors, users, and NGO representatives, which ensured that the application evolved to meet user expectations. A key benefit of this model was that it ensured the availability of a working product at the end of each sprint, providing ongoing validation of our development.

Agile workflow for FoodBridge included four primary sprints. The first sprint, which spanned weeks one to three, focused on requirement analysis, the creation of initial UI wireframes, and the development of the donor module. In the second sprint, from week four to six, NGO module was build, implementing the notification system, and setting up the database. The third sprint, covering weeks seven and eight, was dedicated to the integration of map services. The fourth sprint, which began in week nine and continued onward, involved the development of the admin panel, integration of analytics, and comprehensive user testing. To manage and track our progress, key Scrum artifacts was used, such as the product backlog, which listed all required features and tasks in order of priority, and sprint backlogs, which defined the short-term goals for each sprint. Daily logs were also maintained to keep track of internal progress and ensure accountability. Overall, the Agile Scrum model supported transparent communication, ensured a predictable workflow, and maintained a strong focus on the user throughout the project lifecycle.

Planning for the FoodBridge project was carried out with precision to align deliverables with both time constraints and technical feasibility. Gantt charts and task boards were used to map out our timeline, distribute responsibilities, and monitor ongoing progress. This structured planning helped coordinate team efforts and kept the development process on track.

The project began with a requirement gathering phase during the first two weeks, where we engaged with NGOs and donors to understand their specific needs and documented them comprehensively. This was followed by a design phase in the third week, which involved creating user interface mockups and designing the database schema. The development was split into two key phases: the first, during weeks four to six, focused on implementing donor login and the post-donation module; the second, in weeks seven and eight, involved building the NGO dashboard and the claim food module. Weeks nine and ten were dedicated to integration and testing, during which we conducted user acceptance tests and resolved bugs based on user feedback. The final deployment and documentation phase, which is ongoing, involves hosting the platform, preparing the final presentation, and compiling the project report. To manage planning and task tracking, Trello was used, where tasks were organized into boards marked as backlog, in-progress, and completed. In parallel, Google Sheets was employed to outline weekly goals and assign specific tasks to team members. This combination of

visual tools and detailed scheduling helped streamline the development process, minimized delays, and ensured effective collaboration, especially during the integration of different system modules.

V. USING THE TEMPLATE

The platform is built to support fairness and inclusivity by catering to both small and large donors and ensuring equitable food distribution based on availability and need. Its iterative development, driven by continuous user feedback, enables ongoing refinement and provides a foundation for long-term impact assessment. Furthermore, by involving community actors in the development process, FoodBridge embraces a participatory model that empowers local stakeholders and supports grassroots innovation. Collectively, these features demonstrate how FoodBridge responds holistically to existing gaps, offering a scalable, ethical, and user-focused solution to combat food waste and hunger.

Fig. 3. shows the User Interface and User Experience (UI/UX) for FoodBridge.

As per the study and analysis, in section 3. The gaps have been tried to overcome in the proposed system. Analyzing other similar platforms it has been evaluated that the proposed system performance is better than existing system, its depicted in Fig.4., which compares the performance for food waste reduction, Delivert Timliness, Request fulfilment rate and system update.

Fig. 3. UI/UX of FoodBridge

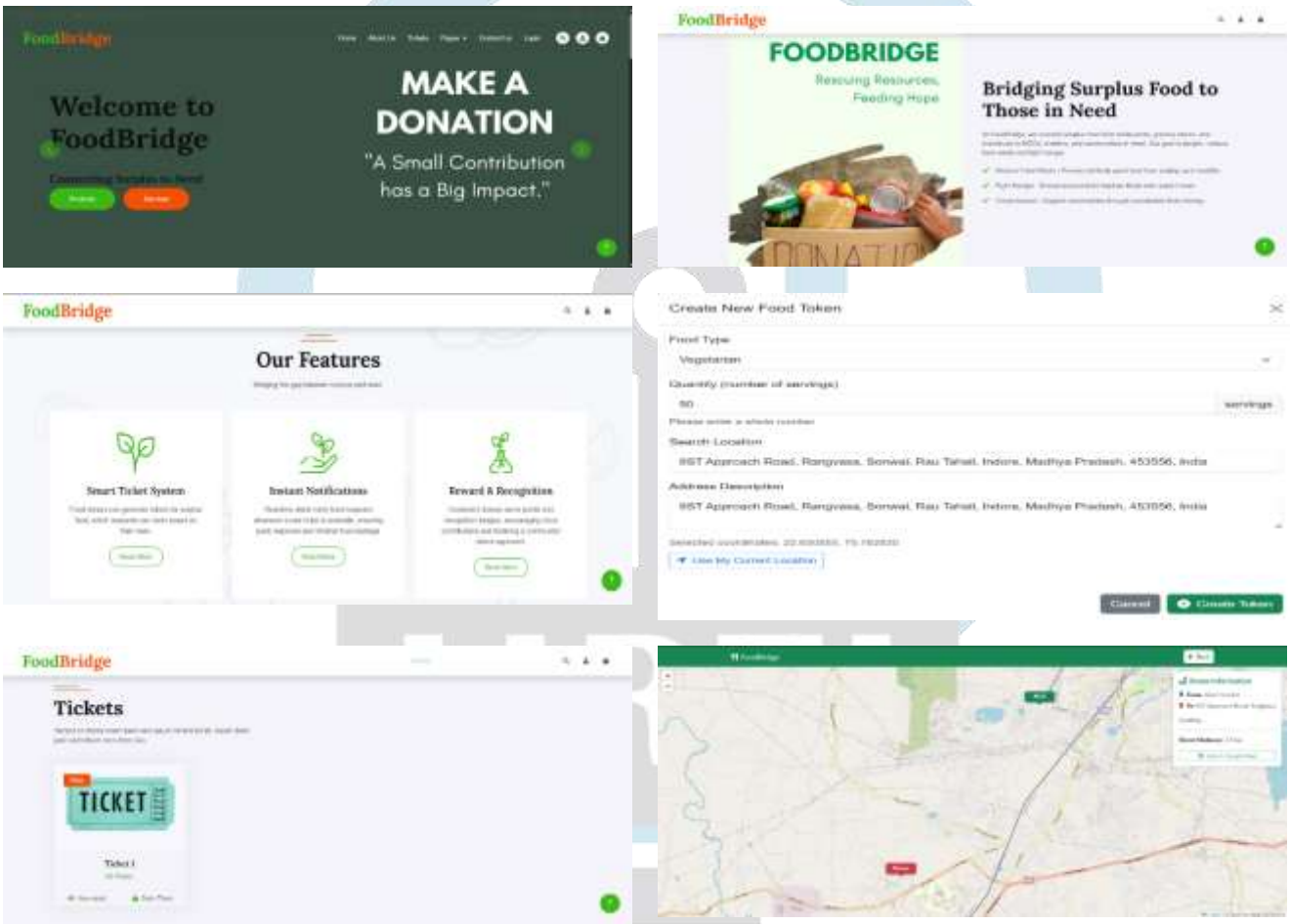
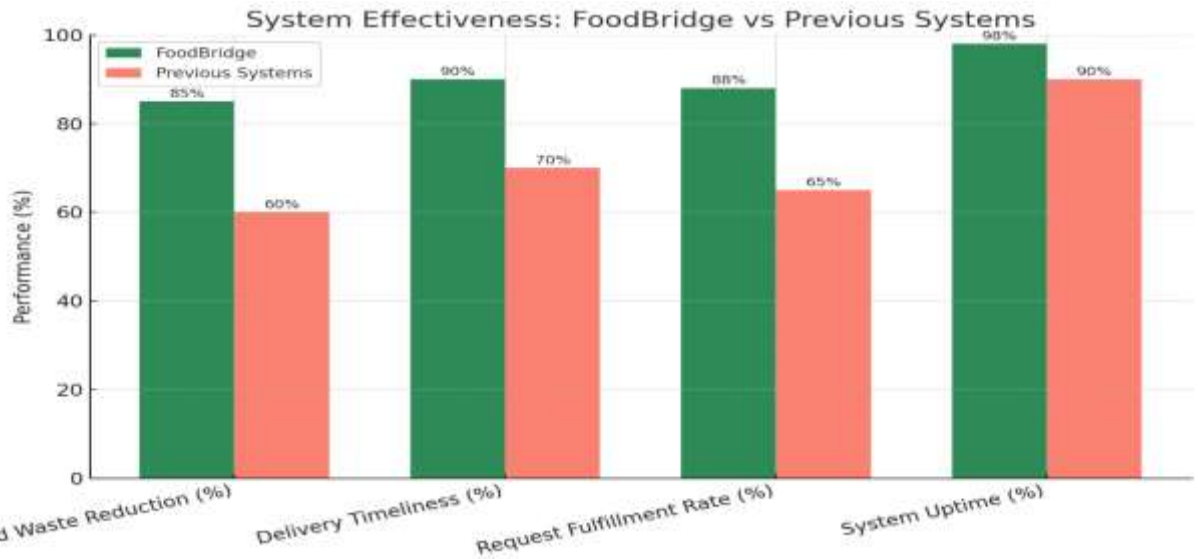


Fig.4. Effectiveness of FoodBridge



VI. Conclusion

The FoodBridge App effectively addresses the pressing issues of food wastage and hunger by seamlessly connecting food donors, recipients, and logistic partners through a streamlined digital platform. By facilitating the generation of food availability tickets, managing claims, and coordinating deliveries, the app ensures responsible redistribution of surplus food with enhanced efficiency and transparency. Key features such as real-time notifications, eligibility verification, and efficient delivery management contribute to timely and equitable food distribution. The current work highlights the transformative role of technology in fostering community collaboration and promoting sustainable practices, ultimately supporting social welfare and resource optimization.

VII. Future Scope

Looking ahead, several enhancements can further amplify the impact of the FoodBridge App. These include integrating advanced AI for demand prediction and route optimization to improve delivery efficiency, and adding multilingual support to cater to diverse user groups. Expanding partnerships with NGOs, government bodies, and food banks will help increase the platform's reach. The development of real-time analytics dashboards can aid in monitoring food distribution trends and user engagement for data-driven decision-making. Additionally, introducing a user feedback system will help improve service quality, while creating dedicated mobile applications can enhance accessibility and user experience. Extending the platform to more cities and rural areas will ensure a broader impact, supported by increased outreach to donors and NGOs. Furthermore an additional feature can also be added of using the food if the ticket expires and also collecting the green waste from parties, restaurants, weddings, and institutional canteens for utilizing these for compost preparation. Thus the advantage will be multifold as this will fulfill the requirement of needy if ticket is not expired, but if ticket expires it can be delivered or processed for compost preparation.

VIII. Acknowledgment

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