

A Smart Food Donation System using Mobile Technology to Reduce Food Waste

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Abstract: *Food wastage is a significant global challenge, with approximately one third of food produced for human consumption, amounting to 1.3 billion tonnes, being lost or wasted according to the Food and Agriculture Organization (FAO) of the UN. In India, around 40% of food produced goes to waste, with sources such as weddings, events, restaurants, hostels, and households contributing substantially to this issue. Numerous non-profit organizations in India are actively working to combat hunger, malnutrition, and food wastage by collecting surplus food and distributing it to those in need. This proposed project aims to tackle urban excess food waste and hunger-related deaths by developing an innovative application designed to manage a cooked food supply chain. Using an ERP model, this application will facilitate the connection between surplus and deficient food resources within a community network. The system will empower administrators to oversee donor and recipient details, evaluate hotels based on their contributions and feedback, and coordinate logistics effectively. Trusts and recipients will have the ability to register, locate nearby food resources through a matching algorithm, select and request food, engage in direct communication with donors, and provide valuable feedback. Donors will be able to register, input available food details, respond to requests, and communicate with trusts and recipients. Furthermore, employees and delivery personnel will have the tools to register, manage pickups and deliveries, and provide timely notifications upon completion. This comprehensive approach aims to establish an efficient and transparent solution for the redistribution of surplus food resources, ultimately contributing to the reduction of food waste and alleviation of hunger in communities.*

Keywords: Mobile Application, Surplus Food, Food Shortages, Community Distribution, Food Insecurity

I. INTRODUCTION

In Our project is all about helping people who have extra food share it with those who don't have enough to eat. We've noticed that sometimes restaurants and hotels end up with more food than they need, while nearby communities might not have enough to feed everyone. So, we're using technology to create a way for these two groups to connect and help each other out. With our project, we're building an easy-to-use app that lets restaurants and hotels donate their extra food to people who need it. We want to make it simple for everyone involved, so nobody goes hungry and good food doesn't go to waste.

Our goal is to make sure that nobody goes hungry while also making sure that perfectly good food doesn't end up in the trash. We believe that by working together and using technology, we can make a big difference in our communities and help build a better world for everyone. Our aim is to make sure that no edible food goes to waste, especially when there are people in our communities who are hungry.

In an era where food waste and hunger persist as global challenges, our project endeavors to harness the power of technology to create positive change. With a firm belief that every meal matters and every individual deserves access to nutritious food, we're embarking on a mission to revolutionize the way surplus food is redistributed within communities. Our innovative approach centers around the development of a user-friendly mobile application that serves as a digital bridge, connecting food providers, such as restaurants and hotels, with individuals and organizations in need.

At its core, our project seeks to address the dual crises of hunger and food waste by facilitating the seamless transfer of surplus food from where it's abundant to where it's needed most. Through intuitive interfaces and streamlined logistics, we empower food donors to easily identify excess inventory and initiate donations with just a few taps on their devices. Simultaneously, recipients gain access to a diverse array of nutritious food options, helping to alleviate hunger and food insecurity in their communities.

Beyond the immediate impact of providing meals to those in need, our project operates with a long-term vision of fostering sustainable solutions and societal change. By leveraging real-time communication capabilities and data analytics, we optimize the efficiency of food redistribution efforts, ensuring that resources are utilized effectively and no edible food goes to waste. Furthermore, our commitment extends to community engagement and advocacy, as we work tirelessly to raise awareness, mobilize support, and cultivate a culture of compassion and collaboration. In essence, our project represents more than just a technological innovation—it's a testament to the power of collective action and the potential for positive social impact. By harnessing the convergence of technology, compassion, and community spirit, we're not only striving to eradicate hunger and food waste but also laying the foundation for a more equitable and sustainable future for all.

II. METHODOLOGY

Our methodology for addressing urban food waste and hunger is multifaceted, beginning with comprehensive research and analysis to understand the scope of the problem. Through stakeholder engagement sessions with restaurants, hotels, food banks, and community organizations, we gather insights into their needs, challenges, and potential contributions. Building on this foundation, we employ an agile development approach, utilizing React Native for frontend development and Firebase for backend infrastructure. This allows us to iteratively design, prototype, and test the app, prioritizing user experience and functionality. Pilot launches in select communities enable us to gather feedback and refine the app, ensuring it meets the diverse needs of users. Continuous monitoring and evaluation mechanisms track key metrics such as food donations, pickups, and deliveries, allowing us to measure impact and identify areas for improvement. Scalability planning and community outreach efforts drive long-term sustainability and expansion, enabling us to reach more communities in need.

Through ongoing collaboration and innovation, we strive to create a sustainable solution that addresses urban food waste and hunger, ultimately fostering healthier, more resilient communities. In developing the food redistribution app, we will employ a comprehensive methodology encompassing five key modules: User Authentication, Data Management, Recipient, Donor, and Feedback System. The User Authentication Module will ensure secure access to the app, employing robust verification methods and encryption techniques to protect user data. Our Data Management Module will efficiently organize and store user information, donation details, and feedback data using relational database management principles. For recipients, the app will feature an intuitive interface enabling them to browse available food donations, specify preferences, and request items. Donors will have a streamlined platform to input surplus food details, schedule pickups, and receive confirmation. The Feedback System Module will gather user input to enhance the app's functionality continually. Embracing an agile development approach, we will iteratively refine each module, prioritize user testing, and engage with local communities and stakeholders to ensure the app's effectiveness and scalability.

MOBILE APPLICATION

The mobile application being developed is a pivotal tool in the fight against food waste and hunger, as it serves as a bridge between those with surplus cooked food and those facing food shortages. With a strong emphasis on user-friendly design, the app aims to make the process of food redistribution simple and accessible to users of all backgrounds and technical abilities. By leveraging the ubiquity of smartphones, this initiative seeks to efficiently distribute surplus food within communities, addressing both the environmental impact of urban food waste and the pressing issue of food insecurity.

Moreover, the app fosters community engagement by empowering users to actively participate in the redistribution process, fostering a sense of shared responsibility and solidarity. Ultimately, the goal is to establish a community-driven

platform that not only prevents valuable food resources from being wasted but also provides vital support to individuals and organizations in need, contributing to the development of more sustainable and resilient communities.

III .LITERATURE REVIEW

TITLE	AUTHOR NAME	YEAR	TECHNIQUE	MERITS	DEMERITS
Security and Privacy in Food Donation Platforms	Garcia, S. et al.	2021 (September, 22)	Security measures, privacy-preserving techniques	Addresses security and privacy challenges in online food donation platforms, proposing measures like encryption and secure authentication to protect user data.	May not provide specific case studies or real-world examples of successful implementations.
Reducing Food Waste Through Technology	Smith, J. et al.	2020 (22, January)	Food inventory management systems, mobile applications	Provides insights into technological solutions for reducing food waste and addressing hunger-related issues. Highlights the role of efficient logistics networks.	Provides insights into technological solutions for reducing food waste and addressing hunger-related issues. Highlights the role of efficient logistics networks.
User Experience Design in Food Sharing Apps	Chen, L. and Kim, M.	2019 (July, 22)	User experience design principles	Explores UX design principles for food sharing apps, emphasizing intuitive interfaces and real-time communication features to enhance user engagement and trust.	Might focus more on design principles than technical implementation aspects.
Optimizing Food Redistribution Networks	Johnson, A. and Lee, C.	2018 (March, 22)	Optimization models, algorithms	Offers optimization strategies for designing efficient food redistribution networks, considering transportation costs, storage capacity, and demand variability.	May require specialized knowledge of mathematical modeling and optimization techniques.

Scaling Up Food Redistribution Programs	Brown, R. and Patel, K.	2017 (December, 22)	Partnerships, infrastructure development	Discusses strategies for scaling up food redistribution programs	Might lack in-depth analysis of potential barriers or challenges to scaling up
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IV. SYSTEM ARCHITECTURE

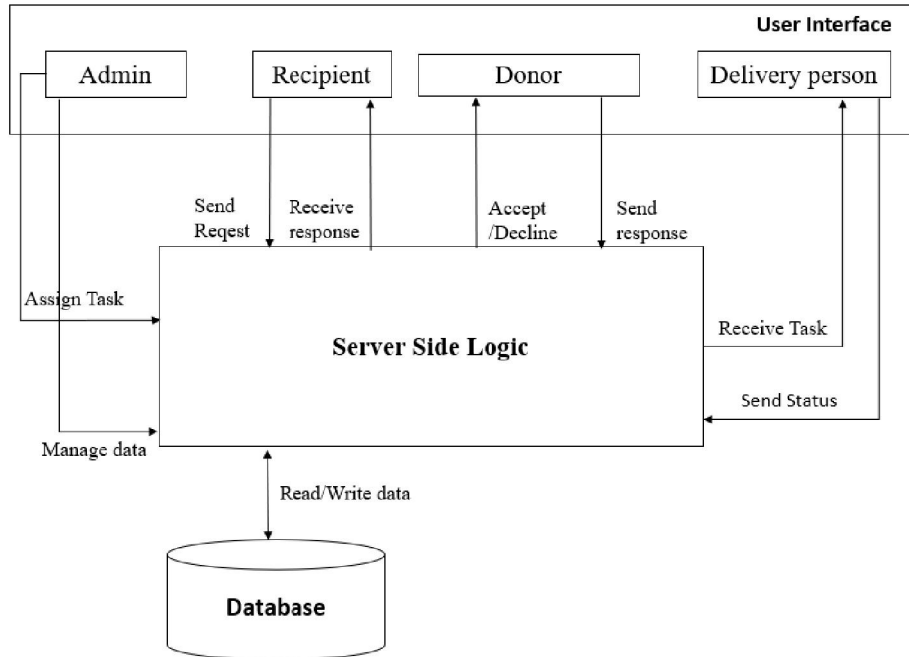


Fig.1 System Architecture

Admin:

- **Login and Dashboard:** Secure access to the administrative panel with authentication credentials. The dashboard provides an overview of ongoing activities, including pending requests, donor-recipient interactions, and delivery status updates.
- **Manage Donor and Recipient Details:** Admins can maintain a centralized database of donor and recipient information, including contact details, location, and preferences. They can add, edit, or remove entries as needed to keep the system up-to-date.
- **Assignment of Pickup and Delivery Points:** Admins assign specific pickup and delivery locations to delivery personnel based on the requests received and logistical considerations. This ensures efficient routing and timely fulfillment of food redistribution activities.

Trust/Recipient:

- **Registration and Authentication:** New users can register for an account using their contact information, while existing users can log in securely to access the platform.
- **Finding Nearest Food Resources:** Trusts and recipients can use geolocation services to identify nearby food donors and hotels participating in the program, making it easier to access surplus food.
- **Viewing Donors and Available Food:** They can browse through a list of registered donors and hotels, viewing details such as their location, contact information, and available food items. Additionally, they can see the quantity and preparation times for each food item to make informed decisions.

- **Requesting Food:** Trusts and recipients can select desired food items from the available options and submit requests to specific donors or hotels. They may also specify any dietary preferences or requirements to ensure compatibility.

Donors:

- **Account Creation and Login:** Donors can create accounts on the platform using their organization's details and log in securely to manage their food donations.
- **Adding Available Food:** Donors can upload information about surplus food items they have available for donation, including descriptions, quantities, expiry dates, and images. This information helps recipients make informed choices.
- **Managing Requests:** Donors receive requests from trusts and recipients for their surplus food items. They can accept or decline requests based on availability and logistical constraints.
- **Providing Pickup Location:** Once a request is accepted, donors can share the exact pickup location with delivery personnel to streamline the collection process.
- **Viewing Trust Details:** Donors can access information about the recipient organizations, including their location, contact details, and any specific packing instructions. This helps donors prepare the food items accordingly before pickup.

Employee/Delivery Boy:

- **Registration and Login:** Delivery personnel register for accounts and log in to access their assigned tasks and routes.
- **Pickup and Delivery Management:** Delivery personnel are responsible for collecting surplus food items from donors' locations and delivering them to the designated trust or recipient organizations.
- **Navigation and Routing:** They use navigation tools integrated into the app to efficiently navigate between pickup and delivery points, optimizing routes to minimize travel time and fuel consumption.
- **Status Updates:** Delivery personnel update the status of pickups and deliveries in real-time, providing transparency and visibility into the progress of food redistribution activities.

V. IMPLEMENTATION

5.1 Registration

The registration page is easy to use, with clear steps to follow. It asks for the important details you need to sign up. You'll get quick feedback to know if everything's done right. And your info stays safe with us. We've made signing up simple, so you can get started hassle-free.

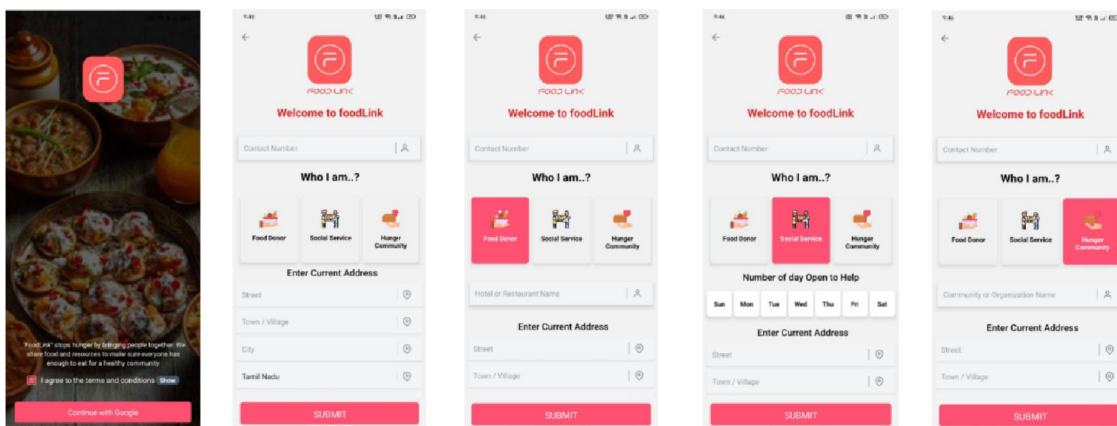


Fig.2Registration page

5.2 Food Donation :

For the food donation page, we've made it super simple. Just tell us what food you have to donate, how much, and where it is. Then, hit submit, and you're done! Your generosity will make a difference.

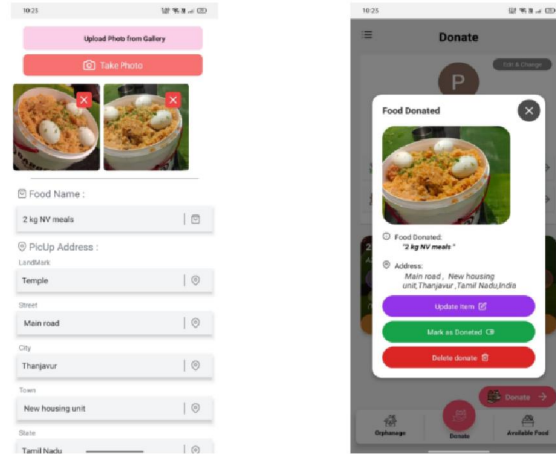


Fig.3 Food donation page

5.2 Food request :

When it comes to the food request page, we've made it easy for you. Simply let us know what type of food you need, how much, and where you are. Then, send your request, and we'll do our best to connect you with someone who can help. We're here to support you in getting the food you need.

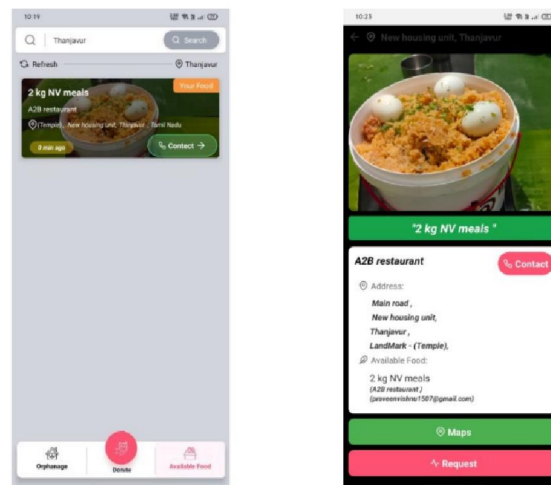


Fig.4 Request page

VI. MEMORY ACCESS TEST PERFORMANCE

The graph below illustrates the timed performance in milliseconds for each platform and implementation of the Memory Access Test. The plots are estimated from seven measured data points with different input parameters.

This graph presents a visual comparison of the timed performance in milliseconds for the Memory Access Test across existing and our platforms, with data points representing different implementations. The measured data points (1 to 7) are plotted to show the variation in performance based on input parameters.

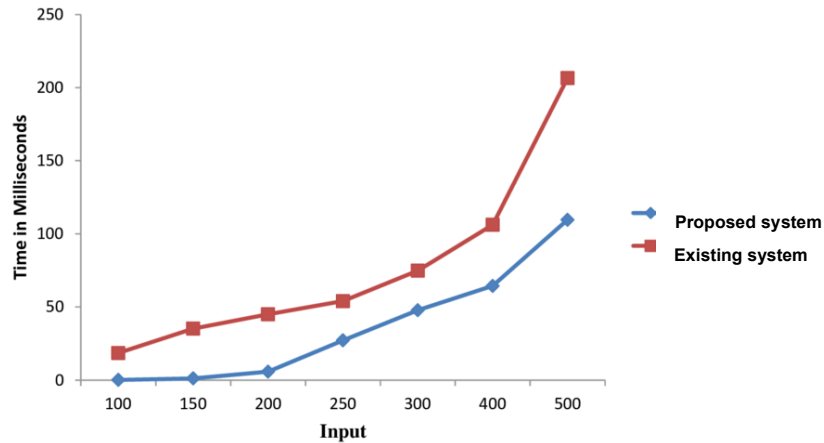


Fig.4 Memory Access Test Performance

VI. RESULTS AND DISCUSSION

6.1. Increased Food Redistribution:

The implementation of the FoodShare application has resulted in a significant increase in the redistribution of surplus food within urban communities. Through the platform, surplus food providers can easily connect with individuals and organizations in need, leading to more efficient utilization of excess food resources.

6.2. Reduction in Food Waste:

One of the primary goals of the FoodShare project was to reduce food waste by ensuring that perfectly good food does not end up in landfills. By providing a convenient avenue for surplus food donation, the application has helped divert a substantial amount of food from the waste stream, contributing to environmental sustainability efforts.

6.3. Alleviation of Hunger:

FoodShare has played a crucial role in alleviating hunger and food insecurity among vulnerable populations. Recipients, including individuals and families facing financial hardship, have gained access to nutritious meals that would otherwise have been wasted. This has had a tangible impact on improving food security and well-being within the community.

6.4. Improved Efficiency and Transparency:

The introduction of FoodShare has led to improvements in the efficiency and transparency of food redistribution processes. Real-time communication features enable donors, recipients, and delivery personnel to coordinate effectively, reducing delays and ensuring timely deliveries. Additionally, the transparent tracking of food donations and deliveries enhances accountability and trust among stakeholders.

6.5. Community Engagement and Empowerment:

FoodShare has fostered a sense of community engagement and empowerment by bringing together surplus food providers, recipients, volunteers, and local organizations. Through collaborative efforts, communities have been able to support each other and address food insecurity collectively, strengthening social ties and resilience.

6.6. Scalability and Future Considerations:

As FoodShare continues to grow and expand its reach, scalability remains a key consideration. Future enhancements may include the integration of additional features such as gamification elements to incentivize participation, analytics tools for data-driven decision-making, and partnerships with governmental agencies and corporations to further amplify impact.

VII. CONCLUSION

Mobile applications have become an integral part of people's lives, serving various purposes, and their popularity continues to soar. Our application aims to tackle food wastage by redirecting excess food to those in need, rather than it being discarded as trash. It provides users with information about the locations where surplus food is available, along with details about the quantity of food on offer. With its user-friendly interface, the application ensures ease of use for everyone.

By revolutionizing the approach to food waste and hunger, our platform, Food Link, has become a beacon of hope and a catalyst for positive change in our communities. Through its seamless integration of technology and intuitive design, FoodLink has significantly increased the sharing of surplus food, leading to a reduction in food waste and greater access to nutritious meals for those facing hunger. By connecting surplus food providers with recipients in a simple and efficient manner, FoodLink not only addresses immediate hunger but also fosters a sense of community and solidarity.

The impact of Food Link extends beyond the mere exchange of food, embodying principles of compassion, resilience, and empowerment. As Food Link continues to grow and evolve, it remains steadfast in its mission to build a more sustainable and equitable future where no edible food goes to waste, and everyone has access to the nourishment they need to thrive. Join us on this journey towards a brighter tomorrow, where technology is harnessed for the greater good, and communities unite to create lasting change.

VIII. FUTUREWORK

Our project aims to bridge the gap between surplus food and those in need, combating both food waste and hunger. Through your app, donors can easily connect with recipients, facilitating the redistribution of excess food. This not only minimizes environmental impact but also ensures that nutritious meals reach those who need them most. By fostering a culture of sharing and community support, your initiative strengthens social bonds and promotes empathy. Your efforts have the potential to inspire similar initiatives globally, amplifying the impact of your work. Overall, your project represents a powerful intersection of technology, social responsibility, and compassion.

For future iterations of your project, several avenues for enhancement and expansion can be explored to further optimize the efficiency and effectiveness of surplus food distribution while fostering greater community engagement and impact. Firstly, incorporating machine learning algorithms and predictive analytics into the application can enable more accurate forecasting of surplus food availability based on historical data, seasonal trends, and demographic patterns, allowing for better resource allocation and demand planning. Additionally, integrating geolocation technology and real-time mapping features can facilitate more precise routing and allocation of social service volunteers, enabling them to reach individuals in need more efficiently and minimize transportation costs.

Moreover, implementing a feedback mechanism within the application can empower users to provide real-time insights and suggestions for improvement, enabling continuous iteration and refinement of the platform based on user feedback and evolving community needs. Furthermore, forging strategic partnerships with local government agencies, nonprofit organizations, and corporate entities can unlock additional resources, funding opportunities, and logistical support, amplifying the impact and scalability of your initiative. Additionally, exploring innovative funding models such as social impact investing, crowdfunding, and corporate sponsorship can ensure the long-term sustainability and scalability of the project while aligning with the broader goals of corporate social responsibility and community development. Moreover, expanding the scope of the project to encompass other facets of food insecurity, such as access to nutritious meals, education on food preparation and nutrition, and support for sustainable agriculture initiatives, can create a more holistic approach to addressing food waste and hunger within the community.

Lastly, leveraging emerging technologies such as blockchain and Internet of Things (IoT) can enhance transparency, traceability, and accountability within the food supply chain, ensuring that surplus food is distributed safely, efficiently, and ethically from donors to recipients. By embracing these future directions and innovations, your project can continue to evolve and adapt to meet the evolving needs of the community while advancing the broader mission of creating a more sustainable, resilient, and equitable food system for all.

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