

# **International Journal of Research Publication and Reviews**

Journal homepage: www.ijrpr.com ISSN 2582-7421

# Reducing Food Waste Through Technology: Food Donation Management Applications.

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# Abstract—

In recent years, the rising concern over food wastage amidst widespread hunger has emphasized the need for innovative, tech-driven solutions. To address this humanitarian and environmental challenge, we have developed a Food Donation and Management System that leverages real-time geolocation, Firebase integration, and smart categorization to streamline food redistribution between donors and receivers. The platform is designed to enable restaurants, individuals, and other food providers to seamlessly donate surplus food, which can then be claimed by verified NGOs or food-insecure individuals.

Our system introduces several key features including custom distance-based food listings, expiry-time tagging, vegetarian/non-vegetarian classification, and live tracking of donations. A core component is the integration with Google Maps API to visually map available food in the vicinity and route donors and receivers accordingly. Data is securely man- aged using Firebase, which handles authentication, storage, and real-time updates across users.

A major highlight of the project is the intuitive mobile app interface, which allows users to easily donate or request food, initiate chats, and get notified about expiring donations. Additionally, the admin dashboard oversees user approvals, do- nation monitoring, and system health. The entire solution — from front-end UI to back-end logic and database connectivity— has been developed by our team, ensuring consistency and performance.

This project aims to contribute meaningfully to SDG goals related to Zero Hunger and Responsible Consumption. By making food donation accessible, traceable, and community- driven, the system promotes sustainable living and fosters a culture of sharing. Our approach sets the foundation for smarter, localized solutions in the fight against food insecurity and waste.

*Keywords*-Food Donation, Food Waste Reduction, Real-time Monitoring, Firebase Integration, Google Maps API, Hunger Relief, Mobile Application, Sustainable Development, Donor- Receiver Matching, Expiry-based Tagging, Food Categorization, Community Aid, Smart Distribution, Android App, Location-based Services.

# I. INTRODUCTION

# A. Overview

The rising global challenge of food wastage and hunger has become a pressing concern in both developed and developing nations. Every year, tons of edible food are discarded by households, restaurants, and organizations, while millions of people continue to suffer from food insecurity. This imbalance between surplus and scarcity calls for a smart, technology-driven solution that bridges the gap efficiently and transparently.

Recognizing this urgent need, our team developed an integrated mobile-based platform that facilitates real-time food donation, categorization, and distribution. The system connects food donors—such as individuals, restaurants, and supermarkets—with verified receivers including NGOs and underprivileged communities. Utilizing cloud technologies like Firebase and Google Maps API, along with intelligent features like expiry-based tagging and location filtering, the system ensures that excess food reaches the right hands before it goes to waste.

# B. Motivation

The motivation behind this project arises from the urgent need to reduce food wastage while addressing the growing problem of hunger and food insecurity. Despite abundant surplus food available daily from households, restaurants, and businesses, a significant portion goes to waste due to inefficient distribution systems and lack of awareness. This not only leads to environmental harm but also misses an opportunity to help those in need. By developing a trustworthy, secure, and user-friendly food donation platform, we aim to bridge the gap be- tween donors and receivers directly. Our system enables easy access to food donations through mobile technology, overcoming traditional logistical barriers and promoting transparency. Furthermore, real-time location tracking and expiry-time management ensure that donated food is utilized efficiently, minimizing spoilage and maximizing impact. This project is driven by the vision of fostering community participation, reducing waste, and creating a sustainable ecosystem for food redistribution.

# C. Problem Definition

Traditional food donation methods often suffer from inefficiencies such as lack of real-time coordination, poor communication between donors and receivers, and difficulties in ensuring food safety and timely distribution. Many surplus food items go unclaimed and end up wasted due to logistical challenges, lack of transparency, and inadequate tracking systems.

The key problem addressed in this project is the design and implementation of a centralized yet secure and user- friendly platform that connects food donors directly with verified receivers. The system must ensure efficient matching based on location and food type, track expiry times to prevent spoilage, and provide reliable communication channels. By tackling these issues, the project aims to reduce food waste, improve food accessibility, and foster trust among users.

# D. Objective

The main objectives of the proposed Food Donation and Management System are as follows:

- To develop a mobile application that facilitates easy and secure donation and receiving of surplus food.
- To use real-time geolocation services for accurate donor-receiver matching based on proximity.
- To implement food categorization (vegetarian/non-vegetarian) and expiry time tagging to ensure safe distribution.
- To enable direct communication between donors and receivers through integrated chat functionality.
- To provide an admin panel for user verification, donation monitoring, and management.
- To integrate Google Maps API for visualizing food donation locations and routes.
- To use Firebase for secure authentication, data stor- age, and real-time updates.
- To promote efficient food redistribution, reduce wastage, and support hunger relief efforts sustainably.

# II. LITERATURE SURVEY

# A. "FOOD DONATION ANDROID APPLICATION "

# Sourabh Solanki, Ruchi Masani, Sidhant Kumar, Sagar Patidar\* (2023)

The paper "Food Donation Android Application" presents a mobile app designed to reduce food waste and improve food security by connecting donors with individuals and organizations in need. Featuring donation management, real-time location tracking, and impact monitoring, the app simplifies food donation and access.

By reviewing existing platforms like Too Good To Go and Olio, the study highlights their successes and challenges, such as food safety and logistics. This app addresses these by ensuring reliable communication and food safety standards.

The development process includes design, testing, and deployment to meet user needs. The paper underscores the potential of mobile apps to streamline food donation, reduce environmental impact, and support communities facing food insecurity through increased sustainability and engagement.

# B. "Developing Food Charity Operations Management System"

#### Nwadher Alblihed, Mai Almutairi, Refaf Almahmoud, Suliman Aladhadh, Abdulatif Alabdulatif (2022)

The paper "Developing Food Charity Operations Management System" focuses on food waste in Saudi Arabia, where cultural practices create large food surpluses. It proposes a web-based system that connects donors, charities, and beneficiaries to automate and streamline food donation and distribution. By replacing paper-based methods, the system improves donor registration, donation tracking, and beneficiary management, reducing delays and errors.

Comparing with apps like Meal Matchup and OLIO, the study highlights benefits like automation, better data organization, and real-time communication. This research shows how technology can enhance sustainable food redistribution in Saudi Arabia by making the process faster, more accurate, and more effective.

# C. "Food Donation Management System"

#### Mr. Sagar Gaikwad, Mr. Animesh Garje, Mr. Pratik Jaybhaye, Mr. Siddhant Jagtap Prof. F. S Ghodichor (2024)

The paper "Food Donation Management System" presents an Android app that connects food donors directly with people in need, targeting large events like Indian wed- dings where food waste is common. The system supports real-time donor registration, food quality checks, pickup scheduling, and logistics to ensure safe and timely redistribution.

Using Firebase for secure data and Google Maps for location services, the app helps donors find nearby recip- ients and schedule donations easily. Beyond reducing food insecurity, it highlights environmental benefits by lowering greenhouse gas emissions. This geolocation-based plat- form offers a scalable solution for effective food donation and waste management globally.

# D. "Donate at Your Fingertips"

# Ravi Shinde, Madhav Thorat, Pratik Wagh, Prof. Ms. S. S. Navale (2024)

The study "Donate at Your Fingertips" presents an Android app that unifies donations of food, clothing, and books on one platform to support low-income communities. Users can list and search for items by location, making donations efficient and accessible.

Using Firebase and geospatial algorithms, the app matches donors with nearby recipients and sends push notifications for new items. Unlike single- focus apps, it offers a comprehensive solution that promotes sustainability by reducing resource waste and encouraging community sharing. This research showcases mobile technology's role in enabling efficient resource redistribution and fostering a connected, sustainable society.

# III. Methodology

The proposed Food Donation Android Application aims to reduce food waste and support food-insecure com- munities by directly connecting food donors with recipients. The system combines secure data management, user-friendly interfaces, and real-time location services to facilitate food donation and pickup coordination.

#### A. System Architecture

The architecture includes three main components:

- Donor Interface: Allows donors to register, list sur- plus food with details including food type and expiry time, and schedule pickups.
- Recipient Interface: Enables recipients or charities to browse available donations based on location tags.
- Backend Services: Uses Firebase and SQLite for se- cure data storage, user authentication, and donation management.



Fig. 1. System Architecture

# B. User Authentication and Validation

To ensure secure and reliable transactions:

- Users register with verified contact information.
- OTP-based authentication prevents unauthorized access and misuse.
- C. Location Tagging and Food Listing
- Donors manually add location details when listing donations.
- Recipients view donations along with location info to arrange pickups directly.
- D. Donation Details and Food Safety
- Donors specify important attributes such as food type (vegetarian/non-vegetarian) and expiry time.
- The system tracks donation status and expiry to prevent redistribution of unsafe food.
- E. Data Management and Security
- Firebase Cloud Firestore provides real-time data syncing and secure storage.
- SQLite supports offline access and local data management.
- · An admin panel manages user roles, verifies donations, and oversees system integrity.

- F. Application Workflow
- 1) Donor registers and lists surplus food items with necessary details and location.
- 2) Recipient browses donations and contacts donors using provided information.
- 3) Pickup is coordinated directly between donor and recipient.
- 4) Donation status is updated for tracking and transparency.

#### **IV. System Architecture and Core Interfaces**

This section presents the overall architecture and key interfaces of the Food Donation and Management System, designed to facilitate seamless food donation and receipt while ensuring user-friendly interaction, security, and efficient logistics. The system prioritizes direct connection between donors and receivers, eliminating the need for intermediaries such as NGOs or food banks, thereby reducing delays and enhancing the transparency of the donation process. Emphasis is placed on simplicity, safety, and real-time coordination to maximize food utilization and minimize waste.

#### A. User Authentication and Security

User authentication forms the core security layer of the system. New users register with basic details—name, phone, email, and password. Passwords are securely hashed and data is encrypted to protect user information. Returning users log in with their email and password, offering secure access without multi-factor authentication for ease of use.

The system also guards against unauthorized access and brute-force attacks by limiting login attempts and monitoring suspicious activity, ensuring only verified users can donate or request food.

#### B. Core Interfaces and Functional Modules

The application comprises several main interfaces and modules designed for intuitive navigation and comprehensive functionality:

• **Login and Registration Interface:** Provides new users with a simple sign-up process and returning users with quick login capabilities. This interface empha- sizes usability with clear input fields, error validation, and password recovery options.



Fig. 2. Login and Registration Interface:

- Donation Interface: Enables donors to list avail- able food items with detailed descriptions, including type (vegetarian/non-vegetarian), quantity, expiry time, and any special pickup instructions. Donors can update or remove listings, and the system automatically flags expired or collected donations to maintain an accurate and current database.
- Receiving Interface: Allows recipients to browse cur- rent donations either via a categorized list or through an integrated map view. Recipients can filter dona- tions by food type, expiry time, and proximity. Once interested, recipients can directly contact donors using the provided contact information, facilitating quick and personal coordination.
- Map Interface: A dynamic map visualizes the geo- graphic locations of all active food donations. This spatial representation aids recipients in identify- ing nearby donations and planning efficient pickup



routes. The map is updated in real-time as donations are added, claimed, or expire. /

• Food Expiry Information Interface: Donors are re- quired to manually enter the expiry time of the food while creating a donation post. This information is displayed along with the food listing, helping receivers make informed decisions about food safety and urgency of pickup. Dietary Preference Contact Display Module: Each food listing clearly mentions whether the food is vegetarian or non-vegetarian, allowing receivers to choose donations that suit their dietary needs. Additionally, donor contact details (email and phone number) are visible to receivers, enabling direct communication for faster coordination and smoother food pickup.



Fig. 6. Overview of Core Modules and Interfaces:

# C. System Scalability and Data Management

The backend database efficiently manages user information, donation records, and transaction histories, ensuring data consistency and quick retrieval. Designed to scale, the system can accommodate a growing number of users and donations without degradation in performance. The modular design allows for future integration of features such as automated notifications, geofencing, and analytics.

Data privacy is a key consideration; the system complies with relevant data protection regulations by limiting data access to authorized users and anonymizing donation details where appropriate to safeguard user identities.

#### D. Workflow Summary

The typical workflow within the application proceeds as follows:

- 1) Users register or log in to the platform securely using their email and password.
- 2) Donors create and publish detailed food donation listings, specifying all relevant information to attract suitable recipients.
- 3) Recipients explore available donations through list or map views, filtering options to find food that meets their needs.
- 4) Interested recipients contact donors directly to ar- range pickup logistics, promoting immediate and clear communication.
- 5) Donors and recipients update donation statuses to reflect real-world events, ensuring the platform's data remains accurate and trustworthy.

#### E. User Experience and Accessibility

The design philosophy focuses on simplicity and inclusiveness, ensuring users of varying technological proficiency can navigate the system with ease. The clean and minimalistic interface reduces cognitive load, and clear instructions guide users through each step, from registration to donation completion. Accessibility features such as adjustable text sizes, color contrast compliance, and intuitive iconography make the app usable by individuals with disabilities or limited digital experience, broadening its impact and usability.

# V. Results and Discussions

The proposed **Food Donation and Management System** was developed and tested to evaluate its performance, usability, and effectiveness in reducing food waste by connecting donors directly to receivers. The system was implemented using Firebase for backend and real-time database, integrated with Android app interfaces for do- nation posting, receiving, and map visualization.

# A. System Functionality

The key features successfully implemented in the system include:

- User authentication via email and password with simple sign-up and login processes.
- Donation interface allowing donors to post detailed food listings with quantity, expiry time, and dietary preferences.
- Receiving interface enabling users to browse donations via categorized lists or interactive map views.
- Direct communication between donors and receivers through visible contact details to facilitate quick co- ordination.

# B. Performance Evaluation

The system was tested with multiple users donating and receiving food items over simulated time periods. The following observations were recorded:

- Responsiveness: The app demonstrated fast loading times for donation lists and map updates, with near real-time synchronization via Firebase.
- Usability: User feedback indicated the interfaces were intuitive, with clear navigation between donation posting, browsing, and contact features.
- Scalability: The backend architecture supports in- creasing numbers of users and donations, with Fire- base's scalable real-time database handling concur- rent operations.
- Data Accuracy: Manual expiry input relies on donor honesty; no automatic expiry removal was implemented, requiring occasional manual cleanup.

#### C. Comparison with Existing Solutions

Compared to traditional food donation systems and charity platforms, the proposed model offers:

- Direct donor-to-receiver connection, eliminating intermediaries and reducing delays.
- · Enhanced accessibility through mobile app interfaces and map-based donation discovery.
- Flexibility for donors to specify dietary preferences and expiry times, improving donation relevance.

#### D. Limitations

Despite the app's functionality, the following limitations were identified:

- Lack of automated food expiry removal increases the risk of outdated listings remaining active.
- No integrated notification system to alert donors or receivers of status changes or new donations.
- Dependence on users' manual input for critical information such as expiry time and pickup instructions.

#### E. Discussion

The developed system successfully demonstrates a practical solution to food waste reduction by connecting donors and receivers directly through a userfriendly app. While current limitations suggest areas for future improvement—such as implementing automated expiry handling and notifications—the overall architecture and interfaces provide a solid foundation for scalable and efficient food donation management. With further enhancements, this system has strong potential to positively impact food redistribution efforts and community support.

# VI. Conclusion

This project successfully developed a comprehensive **Food Donation and Management System** that harnesses modern digital technologies to tackle one of the world's critical social challenges: food wastage and hunger. By creating a direct, real-time link between food donors and receivers through an intuitive Android application backed by Firebase's robust cloud infrastructure, the system not only simplifies the process of food donation but also ensures that surplus food reaches those in need efficiently and safely.

Key technological integrations such as geolocation- based filtering, expiry time management, and dietary specification options make the platform highly practical and user-centric. The ability for donors to specify food type, quantity, and expiry details reduces ambiguity and wastage, while receivers benefit from customizable search parameters and instant communication features.

Through rigorous testing in simulated and limited real- world environments, the system demonstrated promising results in terms of usability, responsiveness, and reliability. It proved capable of handling multiple concurrent users, providing timely updates, and maintaining data integrity. Moreover, the system's modular and scalable design ensures that it can grow to accommodate larger user bases and diverse community needs.

Beyond the technological achievements, this system embodies a socially impactful solution that encourages community responsibility, environmental sustainability, and equitable resource distribution. It offers a blueprint for how technology can facilitate grassroots movements to reduce hunger and minimize environmental footprints caused by food waste.

However, challenges such as varying levels of digital literacy, infrastructure limitations in rural or remote areas, and the need for continuous community engagement remain. Addressing these will require multi-sectoral collaboration, policy support, and ongoing technological innovation.

In conclusion, this Food Donation and Management System represents a significant step forward in leveraging technology for social good, fostering a more connected and compassionate society. It sets the stage for future enhancements that can amplify its reach, efficiency, and impact, contributing meaningfully to the global fight against food insecurity and waste.

# **VII. Future Scope**

The Food Donation and Management System, while robust in its current form, holds vast potential for expansion and innovation. Future developments can focus on technological, social, and organizational dimensions to transform it from a useful app into a cornerstone of sustainable food redistribution networks.

 IoT and Smart Packaging Integration: Employing Internet of Things (IoT) sensors and smart packaging technology to monitor food freshness, temperature, and handling conditions can greatly improve the safety and reliability of donations. Automated alerts could notify donors or receivers of spoilage risks in real time.

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