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Food Waste Management and Donation

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Abstract: ***Food waste is a pressing global issue. Every day, enormous quantities of edible food are discarded by restaurants, canteens, weddings, and other events, while millions of people go without a single meal due to poverty or lack of access. Bridging this gap requires a smarter, more connected approach. The Food Waste Management and Donation System (FWMDS) is a web and mobile platform designed to do exactly that — it links people who have surplus food with those who need it. The platform features two separate login portals: one for donors and one for recipients. Donors can post details about available food, including the type, quantity, and pickup location, while recipients can browse nearby listings and submit requests directly through the system. An interactive map enhances the experience by using color-coded markers: red indicates areas of frequent food need, green marks active food requests, and blue shows the user's current position. When a request is made, the system automatically notifies the donor so that both parties can coordinate a handover. By facilitating real-time communication and ensuring surplus food reaches people before it spoils, the FWMDS serves as a practical, technology-driven solution to hunger and food waste. [1].***

Keywords: Food Waste Management, Food Donation System, GPS Tracking, Map-Based Food Distribution, Location-Based Services.

I. INTRODUCTION

Food waste is a critical challenge with wide-reaching consequences for both the environment and human well-being. Each year, vast amounts of food are discarded at every stage of the supply chain — during preparation, storage, transport, and consumption. Restaurants, hotels, and supermarkets routinely discard perfectly edible surplus food simply because they lack an efficient way to redistribute it. Meanwhile, millions of people around the world struggle with hunger, unable to access adequate nutrition due to poverty or limited infrastructure. The contradiction is stark: abundance exists alongside deprivation, largely because of a missing connection between those who have food and those who need it. Traditional food donation methods — relying on phone calls, word of mouth, and charity partnerships — have helped to some degree, but they are often slow, inconsistent, and geographically limited. Donors frequently cannot locate a willing charity in time, and recipients may be unaware of available food nearby, causing edible donations to go to waste. Technology offers a compelling path forward. The Food Waste Management and Donation System (FWMDS) is a digital platform purpose-built to close this gap. It connects donors — including restaurants, event organizers, and households — with people in need, allowing them to list available food with details such as type, quantity, and location, while recipients can browse listings and place requests through the same interface.

One of the standout features of the system is its map-based interface, which uses color-coded markers to give users an at-a-glance view of food availability and demand. Red markers highlight areas where food shortages are frequently reported, green markers indicate active food requests, and blue marks the user's own location. This visual layer makes it straightforward for recipients to find nearby donations and for donors to understand where their contributions are most needed. The system also supports real-time messaging, so that once a request is made, the donor receives an instant notification and can coordinate the handover directly. By combining interactive maps, mobile accessibility, and automated alerts, the FWMDS offers a far more responsive and efficient alternative to traditional food sharing methods — one that holds genuine promise for reducing food waste and addressing hunger at the community level. [2].

II. LITERATURE SURVEY

Researchers and developers worldwide have been actively exploring technology-driven solutions to the food waste problem. A growing body of work suggests that digital tools — including mobile applications, cloud-based platforms, and location services — can meaningfully improve the way surplus food is identified, shared, and distributed. [3]

One study developed a mobile application that enables individuals and restaurants to share surplus food. Donors could list available food along with its location, allowing nearby recipients to find and claim it with ease. While the application improved accessibility compared to manual methods, it remained relatively basic in scope — lacking map integration or visual markers to indicate areas of high food demand. [4]

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Another study examined a cloud-based platform designed to coordinate food donations from restaurants and food companies to charitable organizations. The system centralized donation records and helped streamline the relationship between food businesses and charities, contributing to a measurable reduction in waste. However, the platform required continuous internet connectivity and did not support direct communication between individual donors and recipients, limiting its flexibility. [5]

Further research explored the use of GPS technology to match donors and recipients based on proximity, significantly speeding up the food distribution process. While effective, integrating real-time GPS tracking added technical complexity and depended heavily on accurate location data. A separate study focused on push notification systems that alert donors when someone nearby is in need, helping food reach recipients before it spoils. However, this approach was narrow in scope, offering no map visualization or broader resource management features. Taken together, these studies each address one piece of the puzzle but fall short of an integrated solution. The proposed system builds on their strengths by combining GPS-enabled location tracking, color-coded map visualization, and direct messaging between donors and recipients — creating a comprehensive platform that is both practical and easy to use. [6]

In summary, food donation systems play a vital role in addressing food insecurity by connecting those with surplus to those in need. When designed well, these platforms can track where food is available, where demand is highest, and ensure timely distribution — making them an essential tool in the broader effort to reduce waste and support vulnerable communities.

CITATION	MERIT	DEMERIT
[3]	Mobile applications allow easy communication between food donors and receivers.	Some systems only support basic communication without advanced features.
[3]	Digital food sharing platforms help reduce food waste by redistributing surplus food.	Limited functionality for identifying high-demand areas for food assistance.
[4]	Cloud-based systems allow centralized storage of food donation information.	Requires continuous internet connectivity to function properly.
[4]	Cloud platforms improve coordination between restaurants and charitable organizations.	Direct interaction between donors and individual receivers may be limited.
[5]	GPS-based systems help locate nearby donors and receivers efficiently.	Accurate location tracking is required for effective performance.
[5]	Location services reduce transportation time during food distribution.	Implementation of GPS systems may increase system complexity.
[6]	Notification systems allow donors to receive real-time food requests.	Systems mainly focus on notifications rather than full resource visualization.
[6]	Request management features improve response time between donors and receivers.	Lack of integrated map visualization for food availability.
[3]	Digital platforms encourage community participation in food donation.	Some applications do not support real-time monitoring of food demand.
[6]	Technology-based systems improve efficiency in food redistribution.	Many systems do not combine GPS, maps, and communication features together.

III. PROPOSED SYSTEM

The Food Waste Management and Donation System is a web-based platform built to bridge the gap between surplus food and the people who need it. At its core, the system connects donors with recipients using GPS tracking, an interactive map, and real-time messaging. It is structured around two distinct user roles. On the donor side, restaurant owners, event organizers, and individuals can log in and post details about their available food — specifying the type, quantity, pickup time, and location.

This information is saved and immediately displayed on the map, making it visible to anyone nearby who might need it. Recipients can log in separately, view food listings in their area, and reach out to a donor directly through the built-in messaging feature.

The platform's interactive map is one of its most intuitive features, using color-coded markers to give users an instant picture of the food landscape around them. Red markers highlight areas with consistently high food demand, green markers appear when a recipient has submitted a request in response to a posted donation, and blue marks the user's own location. This visual system helps both donors and recipients understand at a glance where food is available and where it is most urgently needed. GPS integration ensures that location data stays accurate, helping food reach recipients while it is still fresh. When a request is submitted, the donor receives a notification with the recipient's details and location, allowing them to decide on the best way to proceed.

By bringing together internet connectivity, GPS, and map-based visualization, the system offers an end-to-end solution for managing food donations. It removes the friction from the process, making it straightforward for anyone with surplus food to share it and for anyone in need to find it. [7]

IV. THEORY

The theoretical foundation of the system lies in using technology as a bridge between surplus and need. By combining GPS-based location services, interactive map interfaces, and real-time messaging, the platform enables users to identify available food, coordinate with one another, and ensure timely distribution. This approach optimizes resource allocation at the community level, reducing waste while simultaneously addressing food insecurity.

A. Algorithm

The system relies on a set of core algorithms to manage its key functions, including user authentication, location tracking, map visualization, request matching, and notification delivery. Together, these algorithms ensure that information flows efficiently between donors and recipients, keeping the platform responsive and reliable.

1) Authentication Algorithm: The authentication algorithm is responsible for verifying user identity at login. The system supports two user types — donors and recipients — and validates each user's credentials before granting access to their respective dashboard. If the username and password match the stored records, the user is logged in successfully. If not, access is denied and the user is prompted to try again. This mechanism ensures the platform remains secure and accessible only to registered users.

2) GPS Location Detection Algorithm: The GPS location detection algorithm determines the real-time position of each user using data from their device. This location is displayed on the map and used to surface nearby food donation points for recipients. Donors can also use this feature to pin the exact pickup location for their listed food. By continuously calculating and updating geographic coordinates, the algorithm enables accurate and efficient food discovery across the platform.

3) Map Marker Visualization Algorithm: The map marker visualization algorithm translates location data into a set of intuitive, color-coded markers on the map. Red markers flag areas with a recurring need for food assistance. Green markers appear when a recipient sends a request in response to a donor's food listing. Blue markers indicate the current user's position. Together, these markers give users a clear, real-time picture of food availability and demand across the map. By processing and categorizing location data into these distinct visual signals, the algorithm helps users make informed decisions quickly — whether they're looking to donate or find food nearby.

4) Food Request Matching Algorithm: The food request matching algorithm pairs recipients with suitable food listings based on proximity. When a donor uploads food details, the system stores and indexes that information. When a recipient searches for available food, the algorithm filters the existing listings based on the recipient's current location and presents the nearest options first. This location-aware filtering helps recipients quickly identify food sources that are practical to access.

5) Notification Algorithm: The notification algorithm handles real-time alerts between users. When a recipient submits a food request, the system immediately triggers a notification to the relevant donor.

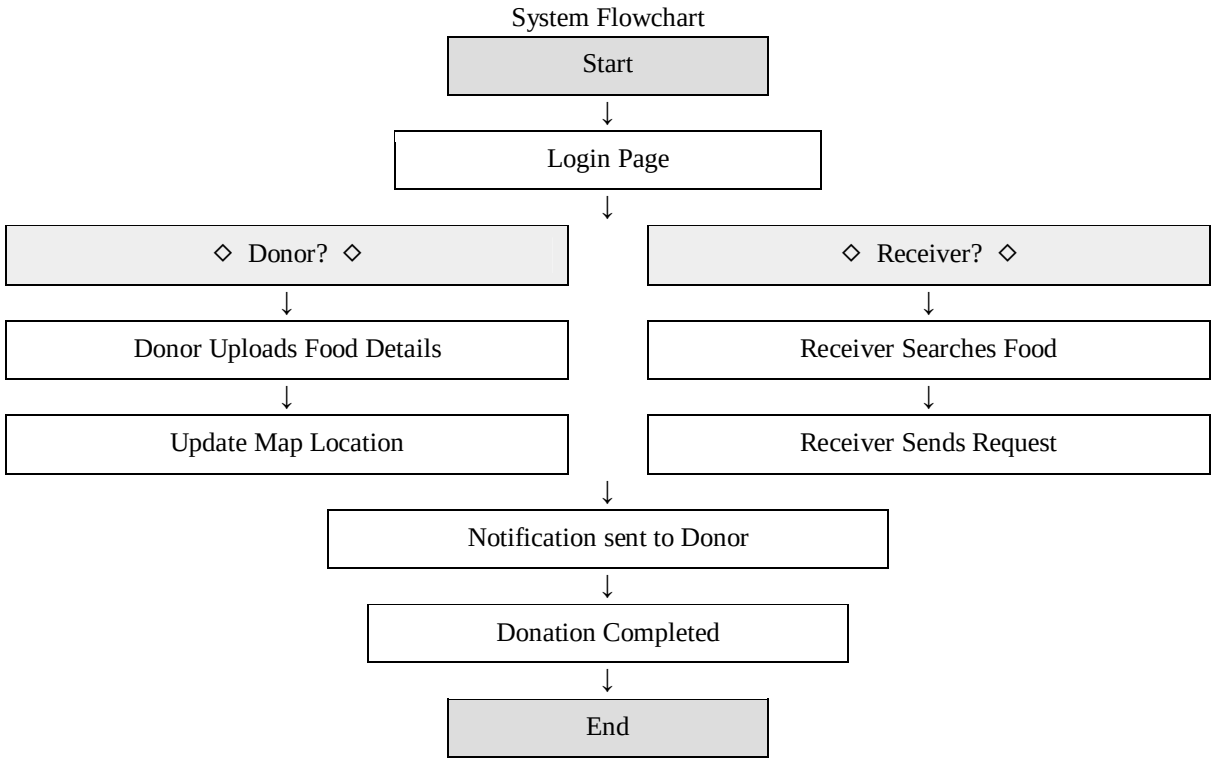
The notification includes key information about the recipient — such as their identity and location — so the donor can make an informed decision. The donor then reviews the request through their dashboard and can choose to approve or decline it.

By automating this alert process, the algorithm significantly improves response times and keeps communication between donors and recipients smooth and efficient.

Together, these algorithms form the operational backbone of the system. By integrating secure authentication, precise location detection, intelligent request matching, and real-time notifications, the platform provides a reliable and efficient method for reducing food waste and ensuring surplus food reaches those who need it most. [8].

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B. Workflow Diagram



The system workflow traces the complete journey of a food donation — from the moment a user opens the application to the point where food is successfully handed over. It illustrates how donors and recipients interact with the platform and how the system processes each request to ensure food reaches those who need it.

The workflow begins when a user opens the app or visits the website and is presented with a login screen offering two options: donor or recipient. After entering their credentials, the system authenticates the user and directs them to their personalized dashboard. For donors, the dashboard provides a form to upload food details — including type, quantity, availability window, and pickup location. Once submitted, this information is stored in the database and the food is marked on the map with a location pin, making it visible to nearby recipients. For recipients, the dashboard displays an interactive map showing food donations in their vicinity, along with their own location and areas where food assistance is frequently needed. When a recipient spots a suitable listing, they can submit a request directly through the platform. This triggers a notification to the donor, including the recipient's details, prompting the donor to decide whether to proceed with the donation.

Once the donor approves the request, the two parties coordinate the pickup or delivery of the food. After the donation is completed, the system removes the listing from the map to prevent duplicate requests and updates its records accordingly. This structured workflow ensures that food donations are handled in a clear, organized manner, with transparent tracking at every step to maintain accountability.

It keeps records of requests, notifications and donations which makes the system reliable.This helps find areas that need food help and makes the system work better.If the user logs in as a receiver, the system provides access to the receiver dashboard. The receiver can view available food donations displayed on the map using GPS-based location services. The map also shows the receiver's current location, nearby food donation points, and locations where people frequently require food assistance. By using this visual representation, the receiver can quickly identify accessible food sources.

When a recipient identifies a suitable food listing, they submit a request through the platform, triggering the system's request processing mechanism. The system automatically notifies the donor, sharing key details about the recipient — including their identity and location — to help the donor make an informed decision.

The donor reviews the request and either approves or declines it. If approved, the donor and recipient work out the logistics of collection or delivery. Once the food exchange is complete, the system updates its records and removes the listing from the map to prevent any further requests for the same donation.

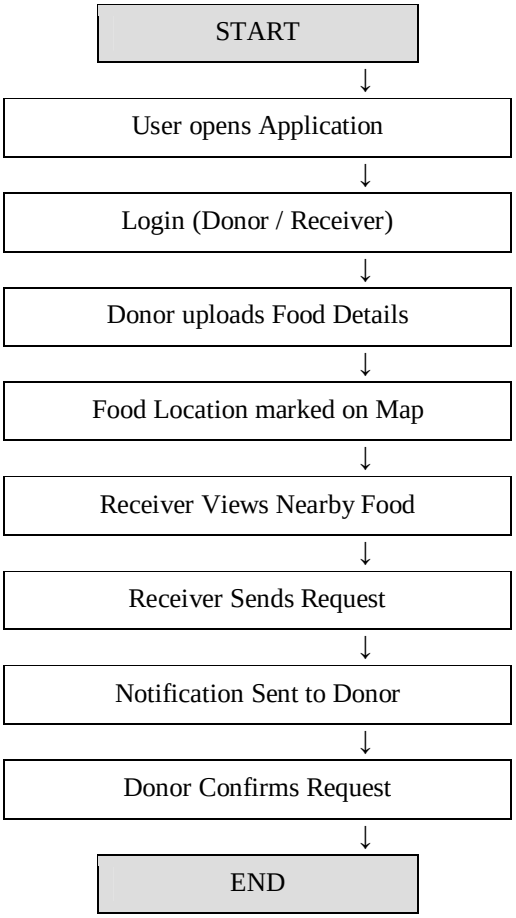
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This workflow ensures a clear and organized process for managing food donations. By combining user authentication, map visualization, request processing, and notification systems, the workflow enables efficient communication between donors and receivers.

As a result, the system helps minimize food wastage and supports individuals who are in need of food assistance. The workflow also allows the system to track real-time interactions between donors and receivers, ensuring transparency and accountability in the donation process.

By maintaining up-to-date records of all requests, notifications, and completed donations, the system builds a transparent and reliable log of redistribution activity. This ongoing data collection helps identify high-demand areas and continuously improves the platform's operational efficiency. [8].

WORKFLOW DIAGRAM



C. Flow Diagram

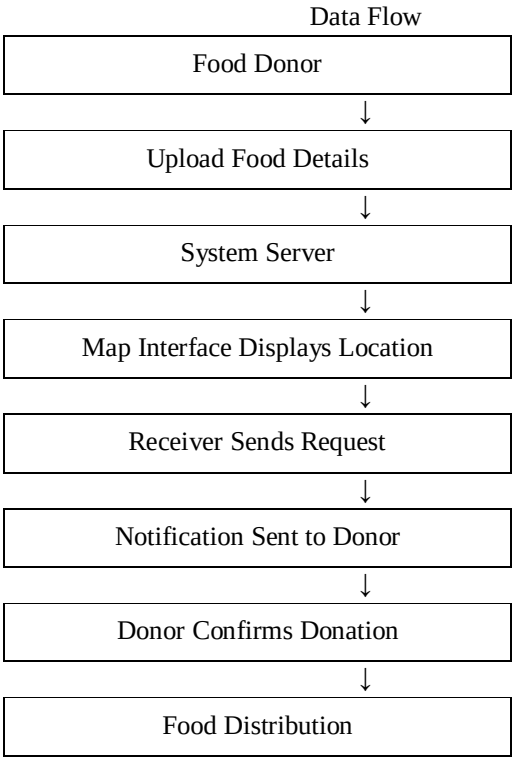
The flow diagram provides a step-by-step view of how the system operates internally, illustrating the movement of information and actions between each stage of the process. It offers a clear picture of how the platform functions from end to end.

Think of it as a blueprint that shows how donors, recipients, and the system itself interact and rely on each other to make food donations happen.

The goal of the Food Waste Management and Donation System is to make sure food donations are recorded tracked and delivered to people who need it. We want to reduce waste. The Food Waste Management and Donation System helps us achieve this.The process starts when a user opens the app or goes to the website of the Food Waste Management and Donation System. They begin by using the Food Waste Management and Donation System. Upon opening the application, users are greeted by a login page with two clear options: donor or recipient. Each user enters their credentials, and the system verifies them before granting access.

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If the credentials are incorrect, the user is asked to re-enter their details. Once verified, the user is directed to their role-specific dashboard. For a donor, the next step is submitting food details — providing information about what food is available and where.
The donor fills in details such as food type, quantity, availability window, and pickup location. The system saves this information to the database.
This information is then displayed on the map, making it visible to recipients in the area. For a recipient, the process involves browsing the map to find available food. The map uses markers to indicate where donations are listed, and the recipient can tap on a marker to view the full details of a specific listing.
When the recipient selects a listing, they submit a request through the platform. The system immediately sends a notification to the corresponding donor, alerting them that someone has expressed interest in their food.
The donor reviews the request and chooses to approve or decline it. If approved, the donor and recipient use the platform to coordinate the collection or delivery of the food, working together to complete the donation.
Once the food has been handed over, the system updates its records to mark the donation as complete. It maintains a comprehensive log of all interactions — including requests, notifications, and fulfilled donations — giving administrators a clear view of platform activity and the insights they need to make continuous improvements.
In short, the flow diagram captures the entire food donation cycle — from login to delivery — within a single, coherent view. It demonstrates how the system ensures that food distribution is both reliable and efficient, ultimately reducing waste and making a tangible difference in the lives of people in need. [8].

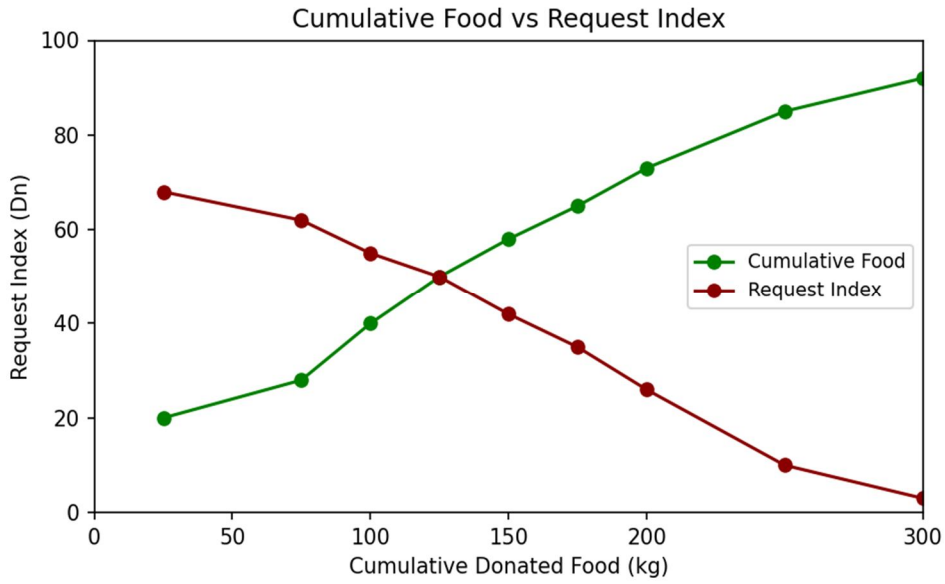


V. EXPERIMENTAL RESULT

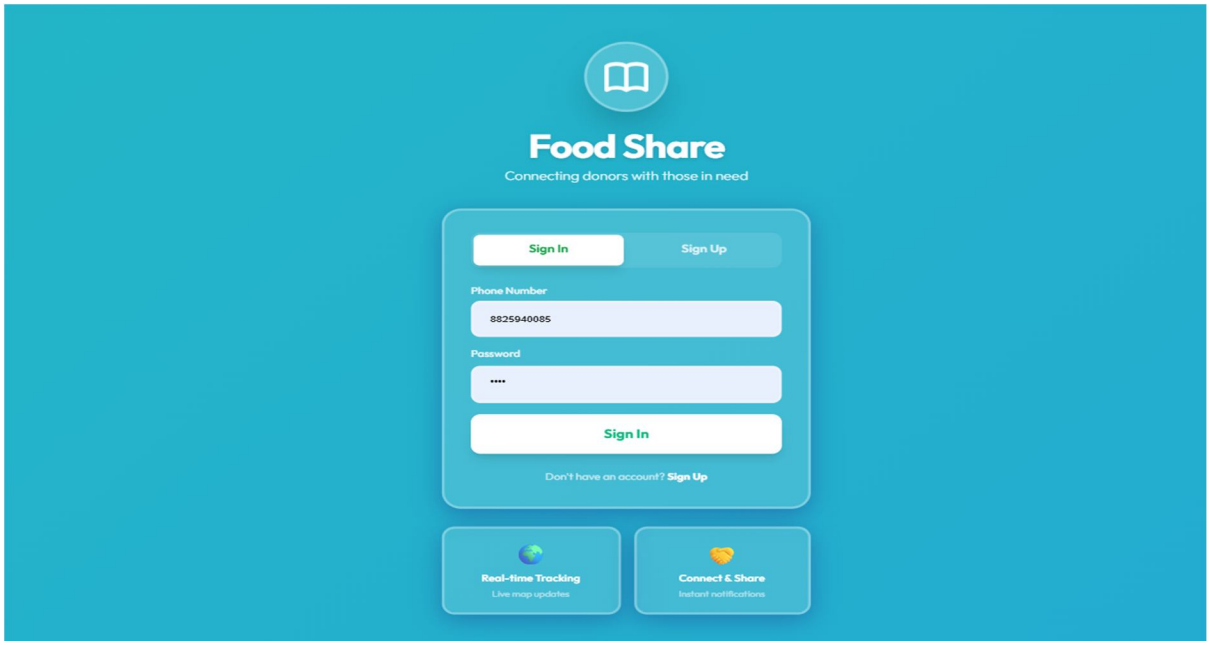
The system was evaluated through a series of real-world tests designed to assess its functionality, usability, and overall efficiency across a range of scenarios.
Testing involved accounts for both donors and recipients, covering the full range of platform functionality \u2014 from posting food listings and locating them via GPS, to processing requests and sending notifications. During testing, donors submitted food details through their dashboards, entering information such as food type, quantity, availability time, and GPS coordinates. The system stored this data and displayed the listings on the map with markers, giving recipients a clear visual guide to nearby food. Blue markers indicated recipient locations, while red markers highlighted areas of high food demand, making it straightforward to identify where help was needed most.

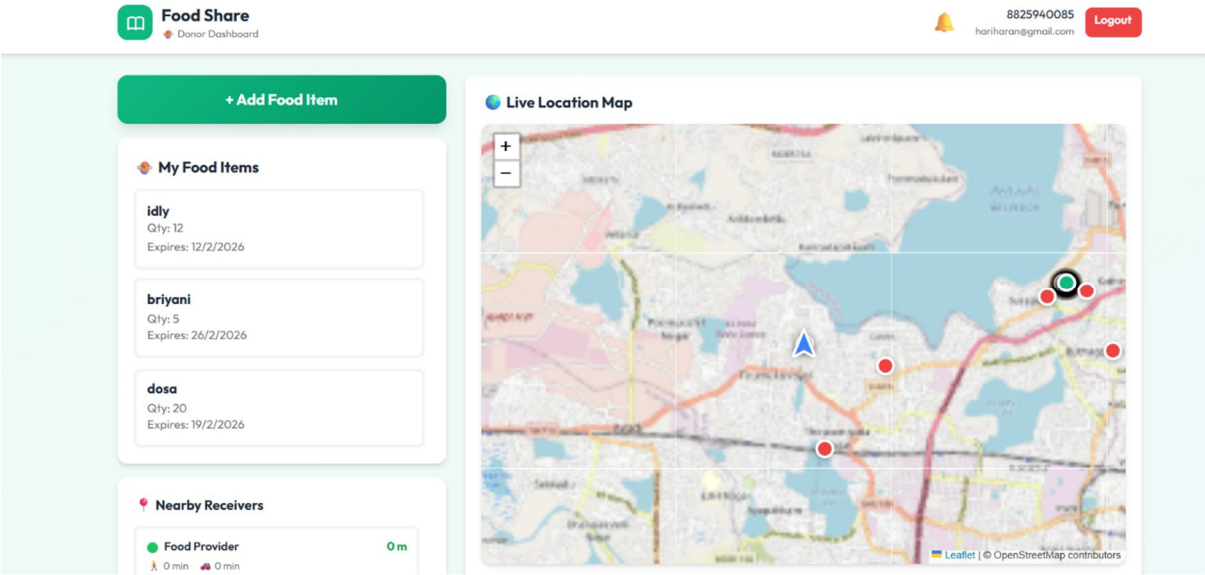
Recipients browsed the map using GPS, and the system calculated distances between their location and donor listings to help them find the most accessible option. When recipients submitted requests, the system delivered notifications to donors promptly, allowing them to approve or decline through their dashboards. A concurrent-user test was also conducted, with multiple donors and recipients using the platform simultaneously testing the database, request matching, and notification delivery. The system performed reliably throughout, maintaining accurate location markers, processing requests without delay, and keeping the map updated in real time.

The system also logged each completed donation and automatically removed fulfilled listings from the map, keeping the interface clean and accurate. These records fed into reports covering donation frequency, high-demand locations, and operational efficiency. User feedback was encouraging: donors found it easy to post food details and respond to requests, while recipients appreciated the GPS-enabled map for quickly identifying nearby donations. The experimental results confirmed that the platform meaningfully improves food redistribution, reduces waste, and supports communities facing food insecurity. These findings validate the system's effectiveness and practical value in real-world settings. [9].



VI. OUTPUT





VII. CONCLUSION

The Food Waste Management and Donation System represents a meaningful step forward in tackling one of the world's most pervasive problems — food waste — while simultaneously supporting those who face food insecurity. By making it simple for restaurants, canteens, event organizers, and households to donate surplus food, the system turns what would otherwise be waste into a lifeline for people in need. Built on GPS tracking, color-coded map visualization, and real-time messaging, the platform is designed to be intuitive and accessible for users of all backgrounds.

The platform's dual-role structure caters to both donors and recipients. Donors can post food details — including the type, quantity, availability window, and location — which are stored in the database and shown on the map using color-coded markers. Recipients can browse these listings in real time, identify donations near them, and submit requests directly through the system. When a request is made, the donor receives an instant notification with the recipient's details and needs, enabling swift and direct communication between both parties.

Testing demonstrated that the system works effectively under real-world conditions. The GPS and map components help users locate food quickly, the messaging system facilitates prompt communication, and the platform handles concurrent users without performance degradation. Completed donations are automatically removed from the map and recorded in the database, preventing duplicate requests and giving administrators a reliable view of where food assistance is most needed.

Beyond logistics, the system carries real social impact. By ensuring that food reaches people before it spoils, it actively reduces environmental harm while supporting vulnerable individuals and communities. Donors gain an easy, reliable channel to share what they have, and recipients benefit from faster access to food. It is a compelling demonstration of how thoughtfully designed technology can address complex social challenges.

Looking ahead, there is considerable scope to enhance the platform further. Deeper integration with charities and non-governmental organizations could extend its reach, while the addition of automated logistics, predictive analytics, and artificial intelligence could make food distribution smarter and more proactive — anticipating demand before shortages occur and minimizing spoilage. The data generated by the system could also provide valuable insights to governments and policy makers working on food security and sustainability.

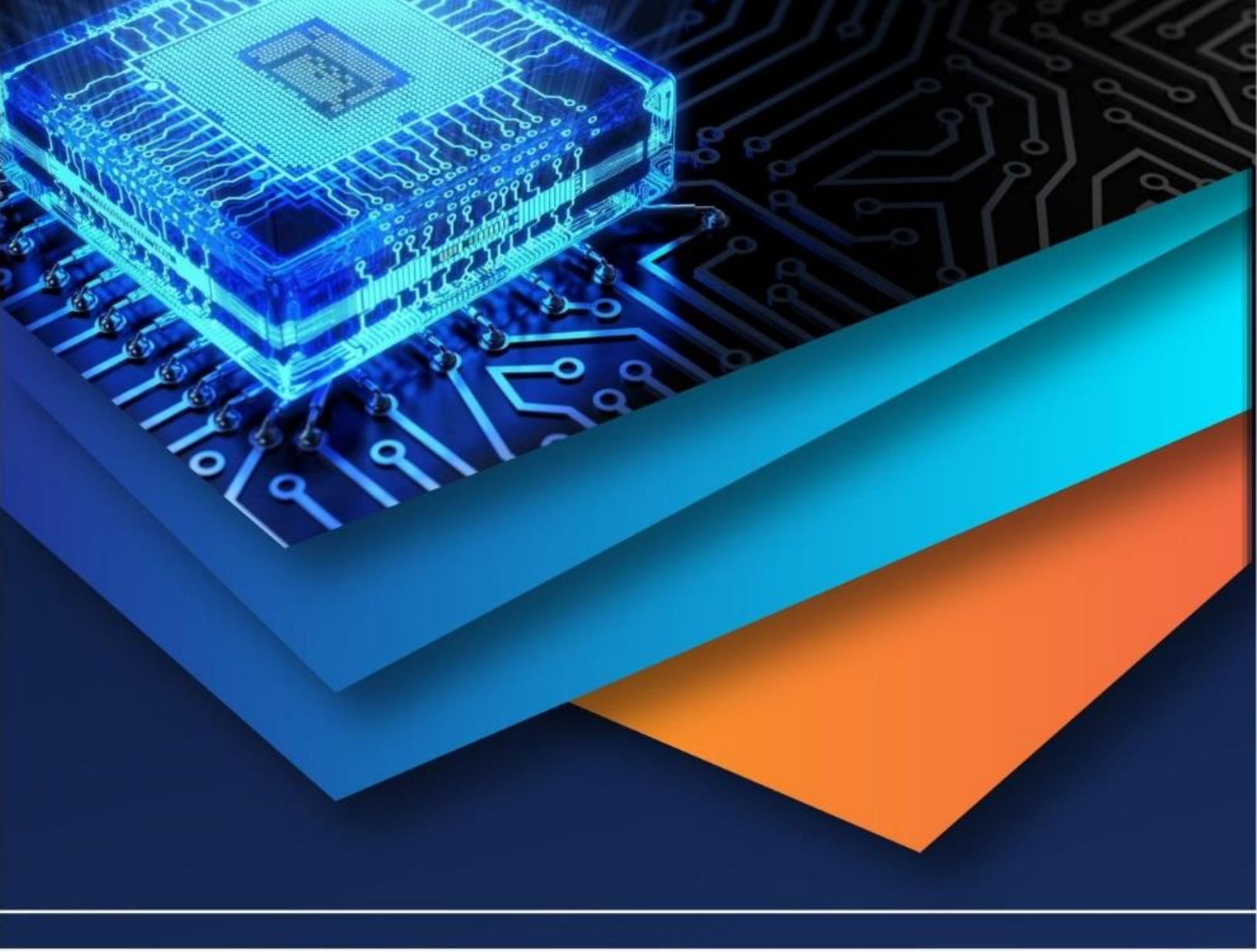
In conclusion the Food Waste Management and Donation System is a scalable and socially impactful solution for managing extra food and helping people in need. By combining location-based services, interactive maps, real-time messages and efficient management the system ensures food donations are delivered on time, minimizes waste, and contributes to a healthier environment. This project demonstrates the power of technology to drive meaningful social change and lays a strong foundation for future innovations in food waste management and community support. [10].

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