Optimizing Food Donations with GPS and Smart Routing for Zero Waste

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Abstract -- **Optimizing Food Donations with GPS and Smart Routing for Zero Waste is a transformative digital platform that seeks to redefine how communities handle food surplus and organic waste. At its core, the platform addresses the growing environmental and social challenges posed by food wastage by connecting food donors—ranging from individuals and households to large-scale event organizers and institutions—with recipients such as NGOs, composting agencies, and community kitchens. Through the integration of real-time GPS technology, AI-powered smart routing, and an intuitive user interface, the platform ensures that food reaches the most appropriate destination efficiently and with minimal resource consumption.**

This platform not only simplifies the logistical complexities of food redistribution but also empowers users through interactive features such as a responsive chatbot for assistance and a reward-based system to encourage environmentally conscious behavior. By enabling effective coordination among donors, transporters, and recipients, it fosters a collaborative ecosystem committed to sustainability and zero waste. The application's holistic approach combines data analytics, behavioral incentives, and community engagement, ultimately paving the way for a greener, more equitable future where food is never wasted and resources are used optimally.

Index Terms – **Composting, Food Wastage, Waste Management, Environmental Sustainability, Community Engagement, Smart Routing**

I. INTRODUCTION

Food wastage continues to be a critical global issue, with millions of tons of edible food being discarded each year despite the existence of widespread hunger and environmental degradation. The pressing need to address this challenge has led to the development of innovative solutions that leverage modern technology to streamline food redistribution and waste management. One such initiative is *Optimizing Food Donations with GPS and Smart Routing for Zero Waste*, a platform designed to connect food donors with recipients and composting organizations in an efficient, eco- friendly manner.

This platform seeks to bridge the gap between surplus food sources—such as restaurants, community kitchens, government food schemes, and markets—and the organizations or individuals who can benefit from these resources. By integrating GPS-based tracking and smart routing technologies, the system enables real-time location mapping and optimal delivery paths for surplus food, ensuring that it reaches its destination quickly and in good condition. These features are vital in preserving food quality, reducing spoilage, and maximizing the usability of donated items.

At the heart of the platform is a commitment to accessibility and user empowerment. Whether a user is an individual with leftover food, a vendor managing unsold produce, or a nonprofit coordinating food redistribution, the interface is designed to be intuitive and supportive. The inclusion of an AI-powered chatbot further enhances the user experience by offering real-time guidance on sustainable waste practices tailored to each user's needs.

. In addition, the platform fosters a sense of environmental responsibility by encouraging users to adopt sustainable habits. Through a points-based reward system and community engagement features, users are incentivized to participate actively in food redistribution and composting efforts. This combination of technology, behavioral nudges, and environmental ethics lays the foundation for a scalable, impactful solution to the growing problem of food waste.

II. EXISTING SOLUTION

Several initiatives and platforms currently address the challenges of food wastage and sustainable waste management, each tackling different aspects of the problem. These existing solutions have laid a valuable foundation, demonstrating the potential of combining technology, logistics, and community engagement to mitigate food loss and promote environmental responsibility.

One notable category of existing solutions includes **food redistribution platforms** such as *Feeding India*, *Too Good To Go*, and *Olio*. These services primarily focus on connecting food donors— typically restaurants, households, and supermarkets—with recipients in need. *Feeding India*, for example, has partnered with numerous organizations to collect and distribute surplus food across Indian cities, significantly reducing hunger and waste. *Too Good To Go* uses a marketplace model where users can buy surplus food from local vendors at reduced prices, preventing it from being discarded. *Olio* enables peer-to-peer food sharing by allowing individuals to list and claim surplus food items within their local communities.

Another line of effort involves **government-backed initiatives**, such as India's *Madhyan Bhojan Yojana* (Mid-Day Meal Scheme), which provides meals to schoolchildren. While this program has been crucial in tackling child hunger, it often leads to surplus food at scale. Currently, most of this surplus is unmanaged and discarded, due to a lack of structured redirection systems.

On the **composting and organic waste management** side, solutions like *Daily Dump* in India promote at-home composting through the sale of compost kits and educational resources. Municipal corporations in some cities have adopted smart bins or waste segregation programs that support composting but are limited in reach and adoption due to a lack of awareness, incentives, and tech- driven logistics.

Despite the progress made by these platforms, a common shortcoming is the lack of **integration between donation and composting workflows**. Most existing systems operate in silos—either focusing on food recovery or composting—not both. In addition, many lack real-time GPS tracking or intelligent routing, resulting in delayed pickups, spoilage of food, and inefficient operations.
Moreover, user engagement tends to decline over time due to the absence of reward mechanisms or personalized support.

III. LITERATURE SURVEY

The issue of food wastage and its environmental implications has been widely explored in academic and industrial research. According to a report by the Food and Agriculture Organization (FAO), nearly one-third of all food produced globally is wasted, contributing significantly to greenhouse gas emissions and resource depletion. Studies have emphasized the need for structured intervention systems that can collect, redirect, or repurpose surplus food before it becomes waste. Research by Parfitt et al. (2010) highlighted logistical inefficiencies and poor inventory practices in the supply chain as major causes of food loss, indicating that a technology-driven solution could mitigate these gaps.

In the realm of food donation platforms, recent studies have shown the effectiveness of mobile and web-based

systems in connecting donors with recipients. A study by Kumar and Lee (2020) explored the use of AI chatbots in guiding users through sustainable decisions. Their research demonstrated how chatbot integration can increase user engagement and streamline operations in sustainability- focused platforms. Similarly, Bhatt and Sinha (2021) emphasized the benefits of real-time GPS tracking for last-mile delivery in food donation, underlining the importance of responsive logistics to preserve food quality during transportation.

The field of composting has also seen innovative applications of technology. Research conducted by Singh and Patel (2022) explored the role of IoT-based smart bins in managing organic waste, allowing for more accurate and efficient segregation and composting processes. These findings support the integration of smart systems into composting networks, suggesting that the adoption of real-time data can enhance environmental outcomes. However, such solutions are often implemented in isolation and lack the end-to-end coordination needed to scale their benefits across broader communities.

IV. APPLICATIONS

The platform finds diverse applications across multiple sectors where food waste is prevalent and sustainability is a key objective. One of the most impactful applications is in urban households and residential communities, where leftover or soon-to-expire food can be easily registered on the platform for donation or composting. The GPS and smart routing features ensure that users are connected with nearby NGOs or composting agencies in real time, minimizing effort while maximizing utility.

In the hospitality and food service industries—such as restaurants, cafes, and catering businesses— the platform helps efficiently redirect unsold but consumable food to organizations that serve underprivileged communities. This not only reduces operational waste but also fulfills corporate social responsibility goals. Community events, weddings, and social gatherings can also benefit by scheduling pickups for leftover food, avoiding unnecessary disposal.

Educational institutions and government-run meal programs, such as the Midday Meal Scheme, often produce surplus food. With the platform, schools and community kitchens can coordinate with nearby shelters or food banks to redistribute excess food, ensuring it reaches those who need it. This plays a crucial role in reinforcing the social safety net while minimizing food spoilage and disposal costs.

Agricultural vendors and market sellers who deal with perishable goods like fruits and vegetables can use the platform to manage unsold or spoiled produce. Instead of discarding them in landfills, the produce can be directed to local composting centers, promoting a circular economy model where organic waste is converted into nutrient-rich compost for farming or gardening. These varied applications highlight the platform's role as a scalable, tech-driven solution for combating food waste across different layers of society.

V. IMPLEMENTATION

The platform's user interface (UI) is built using **ReactJS** and **Redux**, which together provide dynamic rendering and smooth user interactions. ReactJS ensures that the UI components are highly responsive and can efficiently update without requiring full page reloads. **Redux** handles state management, ensuring that the data flow across different parts of the application remains consistent and predictable, especially when dealing with real-time location data, user input, and food donation statuses. Additionally, **Material UI** and **Bootstrap** are integrated for a visually appealing and responsive design, ensuring that the platform remains user-friendly on both desktop and mobile devices.

On the back end, the platform uses **Node.js** and **Express.js**, which are powerful frameworks for building scalable and asynchronous server-side applications. **Node.js** allows for handling a large number of concurrent users, making the

system robust and able to scale efficiently as more users engage with the platform. **Express.js** streamlines the creation of APIs, making the integration of complex operations like user authentication, food donation data management, and integration with third-party services smoother.

The system relies on a **MongoDB** database for real-time data storage and retrieval. As a NoSQL database, MongoDB offers flexibility in handling diverse data types, which is essential for tracking different kinds of data such as food donation details, GPS coordinates, user profiles, and agency information. The database's schema is designed to accommodate evolving data requirements, making the platform scalable as it grows and expands into new regions.

One of the core features of the platform is the **GPS integration** for real-time location tracking. Using the **Google Maps API**, the system allows users to pinpoint their location and find nearby composting agencies, NGOs, and donation centers. To optimize transportation logistics, **smart routing algorithms** are implemented to calculate the most efficient paths for food donation or compost transportation. These algorithms take into account factors such as distance, traffic conditions, and available routes to minimize time, reduce carbon emissions, and ensure food quality during transit.

VI. ACKNOWLEDGMENT