

Tea Waste Recovery System

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Abstract

The Tea Waste Recovery Management System aims to solve the problem of waste from tea shops, which can harm the environment and waste valuable resources. Every day, tea shops throw away large amounts of used tea powder, causing pollution and missing the chance to recycle these organic materials. If tea waste is not managed properly, it can pile up in landfills, releasing harmful gases into the air. This not only damages the environment but also wastes a resource that could help local farmers. To tackle this issue, the project creates a digital platform that connects tea shop owners with local farmers. The platform makes it easy for tea shop owners to schedule pickups for their used tea powder. This ensures that the waste is collected and used efficiently. Farmers benefit by getting these nutrient-rich tea leaves to use as organic fertilizer for their crops. This natural fertilizer is a great alternative to chemical fertilizers, helping to improve soil quality and promote sustainable farming practices. One of the main goals of the system is to reduce the amount of tea waste sent to landfills. By recycling tea waste into compost, the project helps lower greenhouse gas emissions. This process supports a circular economy, where waste is minimized, and resources are reused effectively. The system also strengthens the connection between tea shop owners and farmers. Tea shop owners can dispose of their waste in an ecofriendly way, while farmers gain access to a natural fertilizer source that enhances crop production. This partnership helps small-scale farmers who may not afford expensive synthetic fertilizers. Overall, the Tea Waste Recovery Management System offers a practical solution for managing tea waste. It promotes sustainability and supports local economies, helping farmers thrive while reducing waste from tea shops. Through this collaboration, both tea shops and farmers can contribute to a healthier environment.

Keyword: Management, solve, harm, resources, pollution, recycle, organic, materials, properly, landfills, harmful, gases, environment, nutrient-rich, fertilizer, alternative, chemical, quality, emissions, sustainability, collaboration

INTRODUCTION

As environmental concerns continue to rise, managing waste responsibly has never been more crucial. One often-overlooked area is the tea industry, where tea shops generate large amounts of used tea powder daily. Unfortunately, much of this waste is discarded without a second thought, ending up in landfills, where it decomposes and releases harmful gases like methane and carbon dioxide, contributing to air pollution and climate change. However, what if this waste could be turned into something beneficial [1].

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The Tea Waste Recovery Management System is designed to address this issue by creating a digital platform that connects tea shop owners with local farmers. Instead of simply throwing away used tea

powder, tea shop owners can schedule pickups effortlessly, ensuring the waste is collected and repurposed as organic fertilizer. This reduces landfill waste and promotes sustainable farming by providing farmers with a cost-effective, eco-friendly alternative to chemical fertilizers [2].

For farmers, access to nutrient-rich compost means improved soil health and better crop yields. Unlike chemical fertilizers that can degrade soil over time, organic tea compost enhances microbial activity, retains moisture, and enriches the soil with essential nutrients. Additionally, by adopting natural compost, farmers lower their dependency on expensive chemical fertilizers, reducing costs while improving their environmental footprint [3].

For tea shop owners, this system provides a convenient and responsible way to dispose of their waste. Instead of contributing to pollution, they become active participants in a circular economy, ensuring their waste serves a purpose. This also strengthens their relationship with local farmers, fostering community-driven sustainability initiatives. The platform is designed to be user-friendly, allowing tea shop owners to track pickups, manage waste contributions, and monitor their impact [4]. Farmers, in turn, can browse compost availability, check nutrient details, and place orders with delivery or pickup options.

The system ensures that every step of the process—from collection to composting and distribution—is seamless and efficient. By bridging the gap between urban businesses and rural farmers, the Tea Waste Recovery Management System transforms waste into a valuable resource, reducing environmental damage while supporting sustainable agriculture and local economies. This project is more than just waste management—it's a step toward a cleaner, greener, and more connected future [5].

METHODOLOGY

Requirement Analysis and Role Definition

A solid requirement analysis is the backbone of a smooth, well-functioning system (Figure 1). Each user tea shop owners, farmers, and admins have a specific role, and their needs are carefully mapped out to ensure effortless interaction. Tea shop owners can easily submit waste collection requests, track their status, and manage past submissions [6]. Farmers can browse compost availability, check its nutrient content, and place orders with delivery or pickup options. Admins oversee everything, from approving waste requests to managing compost inventory and workshops for sustainable farming. With well-defined user flows and permissions, the system ensures a seamless, intuitive, and efficient experience for everyone.

System Design and Architecture

The Tea Waste Recovery System is designed to create a seamless connection between tea shop owners, farmers, and administrators, making waste recycling both effortless and impactful. Instead of letting used tea leaves go to waste, this system ensures they are transformed into valuable organic compost for farmers, promoting sustainable agriculture.

For farmers, the platform offers a hassle-free way to access organic compost. After logging in, they can browse available compost, check its nutrient composition, and place an order. They can choose to pay on delivery or via UPI, making transactions convenient. Once the order is placed, they can track its progress in real time, ensuring a smooth purchasing experience [7].

On the other hand, admins act as the backbone of the system, managing both compost delivery and waste collection. They review farmers' orders, approve or reject them based on stock availability, and schedule deliveries accordingly. Similarly, they handle waste collection requests from tea shop owners. Once approved, the waste is picked up, processed into compost, and added back to the system. Admins also monitor overall system activity to keep everything running efficiently.

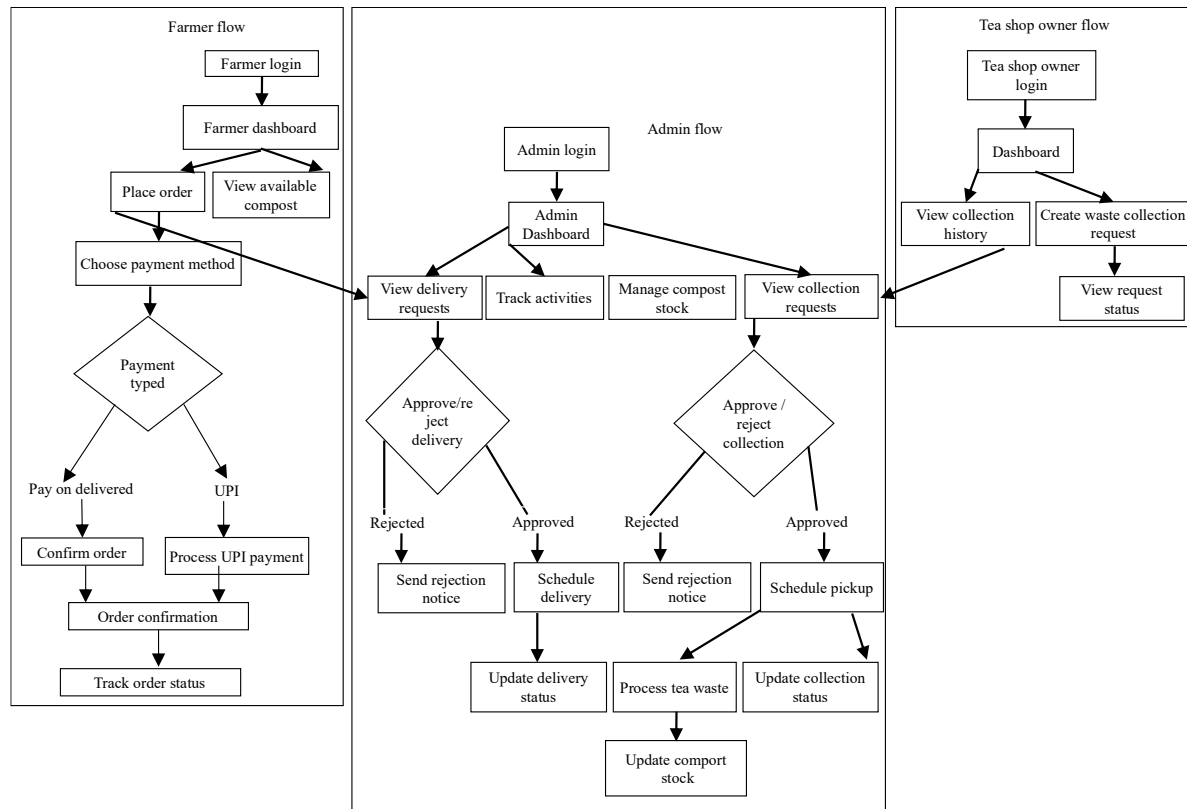


Figure 1. System design and architecture.

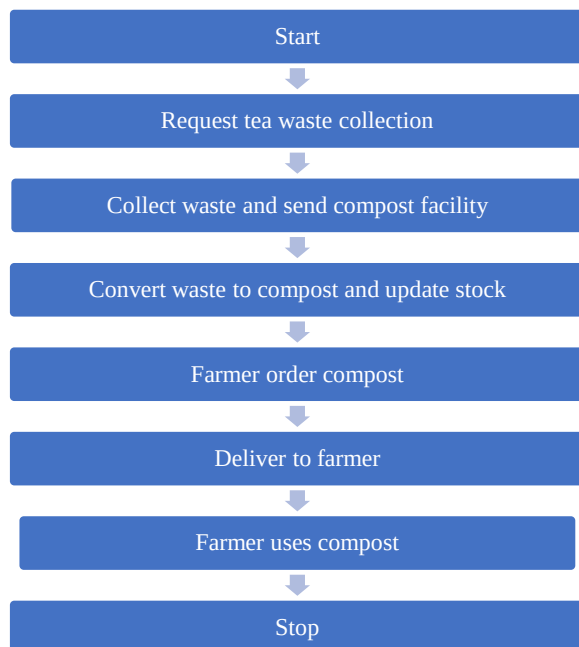


Figure 2. Workflow and implementation.

For tea shop owners, the platform provides a responsible way to dispose of used tea leaves. Instead of throwing them away, they can submit a collection request, track its status, and contribute to a greener environment. By bringing all these stakeholders together, the system promotes a circular economy, reducing waste, providing affordable compost to farmers, and making sustainability an easy and rewarding choice for everyone involved [8].

The system starts with tea shop owners, who collect used tea leaves and register on the mobile application. Through the platform, they submit waste collection requests, specifying the quantity available. The system efficiently processes these requests and schedules pickups, ensuring timely collection. A dedicated collection team then retrieves the tea waste and transports it to a composting facility. Moreover, Figure 2 Illustrates the workflow of the system.

At the composting facility, the tea leaves are mixed with organic materials and subjected to controlled decomposition. Critical factors such as temperature, moisture levels, and aeration are monitored in real time to optimize the composting process. Over time, this waste is transformed into high-quality organic compost, rich in essential nutrients beneficial for agriculture. Before being listed on the application, the compost undergoes a quality assessment to ensure it meets the required standards [9].

Database Scheme and Storage Strategy

A well-structured database schema ensures smooth operations in the Tea Waste Recycling System by managing waste requests, compost inventory, orders, and payments. The Users table stores details of farmers, tea shop owners, and admins. Waste requests track tea waste collection, with status fields for pending, approved, or rejected requests. The Compost Inventory table maintains stock levels, nutrient composition, and batch details. Orders link farmers to compost, tracking status from placement to delivery. Payments store transactions with methods (UPI, cash) and statuses.

User Interface Development (Flutter)

The Flutter UI is designed to feel natural and easy to use, making sure that farmers, tea shop owners, and admins can navigate the app without any hassle. For farmers, the app provides a smooth experience—they can browse compost, check its nutrients, place orders, and track deliveries in real time. Payment is flexible, with options like UPI and cash on delivery, so they can choose what works best for them. Tea shop owners can quickly submit waste collection requests, track their pickup status, and manage past requests, making waste disposal effortless. Admins get a clear, well-organized dashboard to approve waste pickups, manage compost stock, and track orders, ensuring everything runs efficiently [10]. The UI is designed to be clean, responsive, and user-friendly, working seamlessly across devices. By making everything simple and accessible, the app bridges the gap between tea shops and farmers, turning waste into something truly valuable.

Notification and Status Updates

The notification system keeps users informed every step of the way. Tea shop owners get instant updates when their waste collection requests are approved, scheduled, or rejected. Farmers receive alerts about compost availability, order confirmations, and delivery status. Real-time updates ensure smooth tracking, from waste collection to compost stock changes. This keeps everyone connected, making the process efficient, transparent, and hassle-free.

Testing and Validation

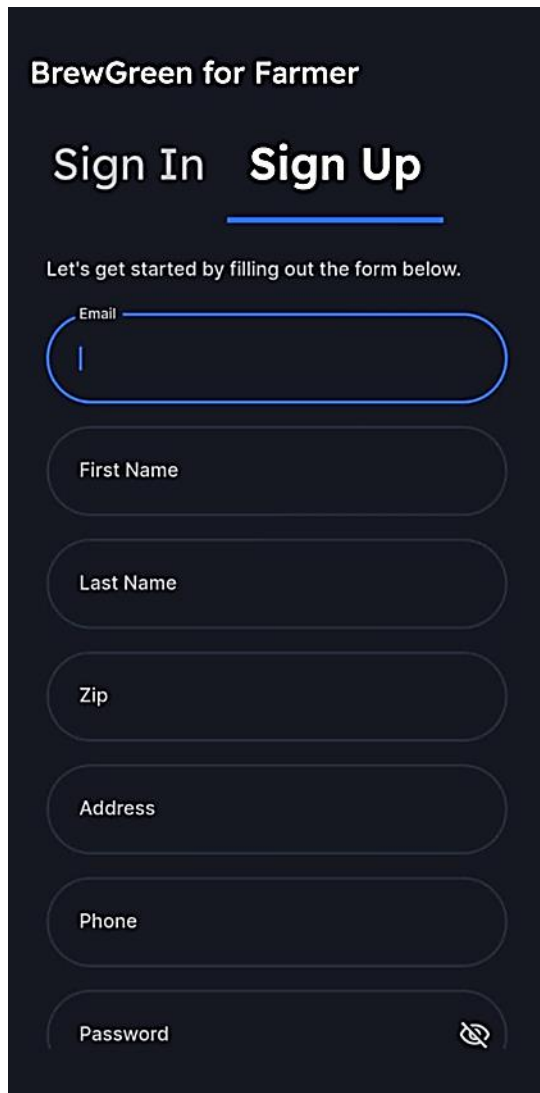
Thorough testing and validation ensure the system runs smoothly. Unit and integration tests are conducted on key modules like waste collection, composting, and payments, ensuring reliability at every step. To make the platform truly user-friendly, tea shop owners and farmers participate in user acceptance testing (UAT), helping validate the workflow. Their feedback ensures the system is efficient, seamless, and ready for real-world use.

Deployment and Maintenance

Deploy the Android application to the Play Store. Monitor system performance, address bugs, and update features based on user feedback. The system begins with tea shop owners collecting used tea leaves and registering on the mobile application. They submit waste collection requests by specifying the quantity of tea leaves available. The system processes these requests and schedules a pickup, ensuring an efficient collection process. Once scheduled, a collection team retrieves the tea waste from various locations and transports it to a composting facility.

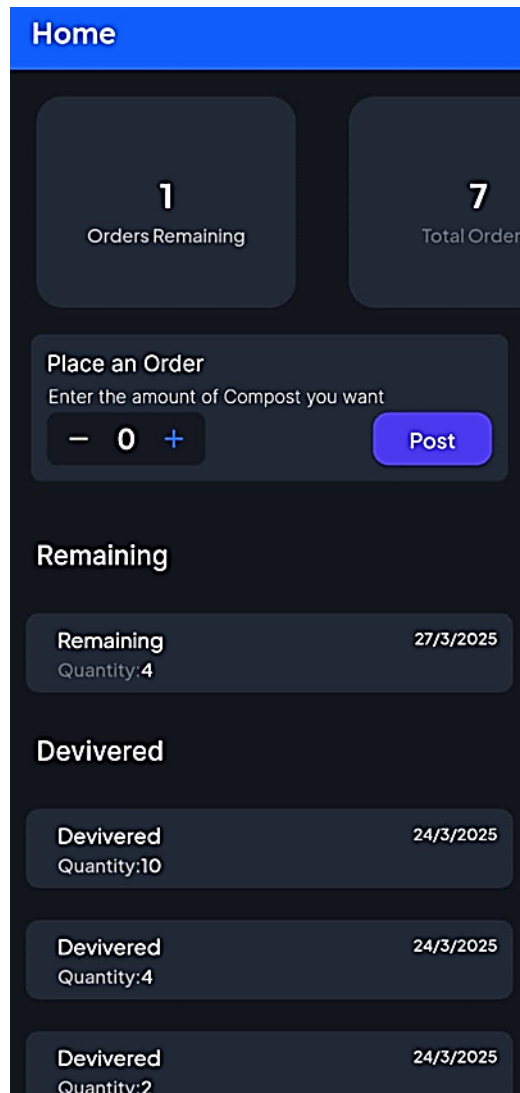
At the composting facility, the tea leaves undergo processing where they are mixed with organic materials and subjected to controlled decomposition. The system monitors critical factors such as temperature, moisture levels, and aeration to ensure optimal composting. Over time, the waste is converted into nutrient-rich compost, ready for agricultural use. The quality of the compost is assessed before being listed on the application for farmers. Farmers access the mobile platform to browse available compost, review its nutrient composition, and place orders. The system provides options for delivery or pickup, along with integrated payment methods for convenience. The application also educates farmers on the benefits of organic compost and sustainable farming practices.

Additionally, the platform includes tracking and analytics features, allowing users to monitor their waste contributions or compost purchases. By promoting a circular economy, the system reduces organic waste, lowers environmental impact, and provides farmers with affordable and eco-friendly compost. Overall, this project facilitates waste-to-resource conversion, connecting urban tea shop owners with rural farmers and fostering sustainable agricultural practices, while also contributing to a cleaner and greener environment. Figures 3–6 will represent the application interface while using by user.



The image shows a mobile application interface for 'BrewGreen for Farmer'. It features a dark blue background with white text. At the top, the title 'BrewGreen for Farmer' is displayed. Below it, there are two large buttons: 'Sign In' and 'Sign Up', with 'Sign Up' being highlighted by a blue underline. A message 'Let's get started by filling out the form below.' is followed by several input fields: 'Email' (with a blue outline), 'First Name', 'Last Name', 'Zip', 'Address', 'Phone', and 'Password' (with a toggle icon). The fields are arranged vertically and have rounded corners.

Figure 3. Application login output of farmers.



The image shows the 'Home' dashboard of the 'BrewGreen for Farmer' app. It has a blue header with the word 'Home'. Below the header, there are two cards: '1 Orders Remaining' and '7 Total Orders'. A 'Place an Order' section allows users to enter the amount of compost they want, with a numeric input field showing '0' and a 'Post' button. Below this, there are two sections: 'Remaining' and 'Devivered' (sic). The 'Remaining' section shows a quantity of 4 and a date of 27/3/2025. The 'Devivered' section shows three entries: a quantity of 10 on 24/3/2025, a quantity of 4 on 24/3/2025, and a quantity of 2 on 24/3/2025.

Figure 4. Application dashboard output of farmers.

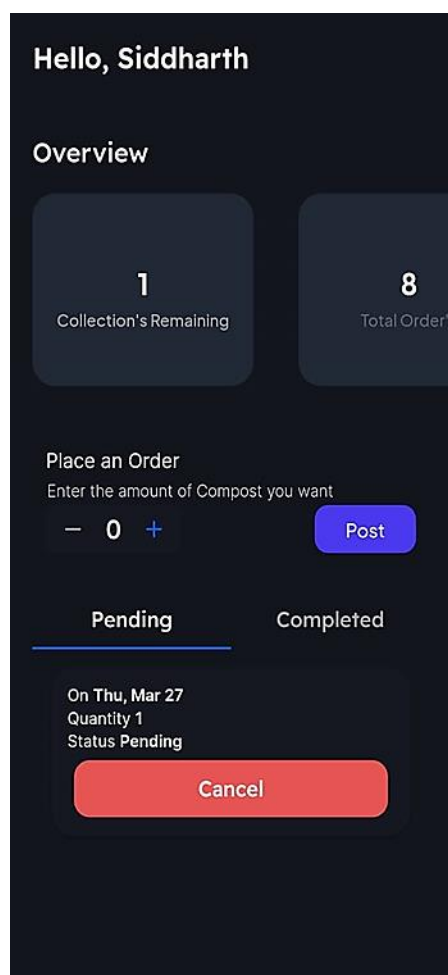


Figure 5. Application output of admin.

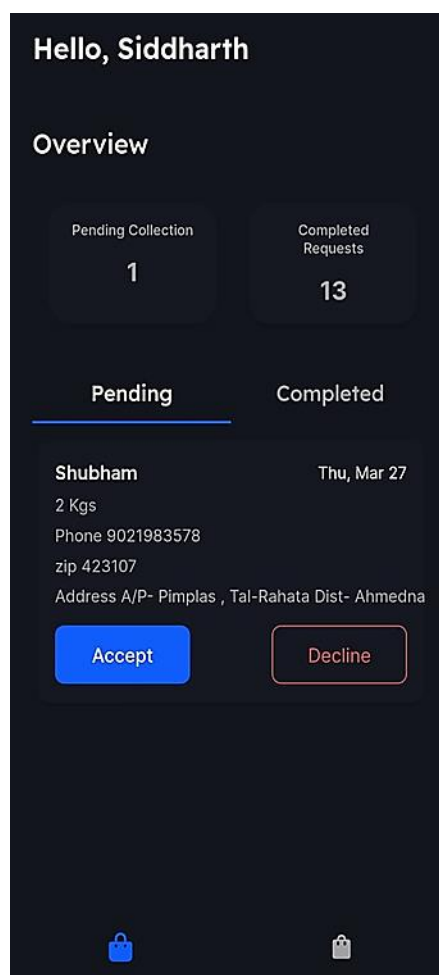


Figure 6. Application output of tea shop owner.

RESULT AND DISCUSSION

The images provided showcase different interfaces of a waste management system that facilitates the collection and distribution of compost derived from used tea leaves. The discussion focuses on the usability, design, and functionality of these interfaces for different user roles: the admin, farmers, and tea shop owners.

Admin Dashboard

The admin dashboard provides an overview of the system's activities, including pending and completed requests. The interface is designed to help admins manage waste collection requests efficiently, ensuring a smooth operational flow. The ability to accept or decline requests allows the admin to regulate the process and optimize resource allocation.

Farmer Dashboard

The farmer dashboard is designed for compost buyers. It displays compost availability, remaining orders, and past deliveries. The ability to place an order through a simple input system makes it user-friendly. The interface ensures farmers can track their compost orders and manage their supply effectively.

Login Page

The login page is minimalistic and focuses on easy access for users. With separate sign-in and sign-up options, it ensures a smooth onboarding process for new users. The structured input fields help in capturing essential user details.

Tea Shop Owner Dashboard

This dashboard facilitates tea shop owners in submitting waste collection requests. It includes an overview of pending and completed requests, allowing shop owners to track the status of their waste contributions. The structured interface enhances usability and efficiency.

CONCLUSION

The waste management system presented through these interfaces is well-structured, catering to different user roles—admins, farmers, and tea shop owners. Each dashboard is designed to streamline operations, ensuring efficiency in waste collection and compost distribution. The Admin Dashboard provides an overview of pending and completed requests, allowing for seamless request management. The Farmer Dashboard enables users to track remaining orders, view delivered quantities, and place new orders, ensuring a smooth supply chain of compost for agricultural use. The Tea Shop Owner Dashboard simplifies the process of waste disposal by allowing shop owners to request collections and monitor the status of their contributions. The Login Page offers a clean, user-friendly interface to facilitate easy access for all users. Overall, the system effectively promotes sustainability by bridging the gap between waste producers and compost users. Its intuitive design, structured workflows, and user-focused features make it an efficient tool for eco-friendly waste management.

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