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Project Proposal

Yakadabadu.lk

(Scrap Collection and Recycling Management System)

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1. Background

1.1 Company Background

Yakadabadu.lk is a revolutionary web-based platform that seeks to make scrap collection, recycling, and resale processes in Sri Lanka easier. It operates on the 3R principle—Reduce, Reuse, and Recycle—to promote efficient and sustainable waste management.

Sri Lanka is faced with huge waste disposal issues due to the rapid rate of urbanization, ineffective segregation of waste, and minimal recycling activities. Yakadabadu.lk aims at filling this gap by providing a structured and technology-driven method of dealing with recyclable waste.

The website operates on three primary roles:

- **Users:** Parties or people that generate recyclable waste and schedule pickups.
- **Drivers:** Pickup personnel who receive pickup requests and transport material to respective plants.
- **Administrators:** Managers responsible for monitoring activities, generating reports, and offering efficient workflow.

With the implementation of technology in waste management, Yakadabadu.lk minimizes pollution, encourages proper recycling, and enables a circular economy.

1.2 What is Waste Management?

Waste management is the systematic collection, transportation, treatment, recycling, and disposal of waste products in an environmentally friendly manner.

Effective waste management is essential to:

- **Reduce pollution** – Prevents harmful substances from contaminating air, water, and soil.
- **Conserve natural resources** – Promotes recycling and reduces the demand for raw materials.
- **Enhance sustainability** – Encourages responsible consumption and waste reduction.

- **Improve public health** – Minimizes risks associated with improper waste disposal, such as disease outbreaks.

Globally, unsustainable waste management has led to environmental degradation and caused issues such as climate change, deforestation, and ocean pollution. Effective waste management solutions such as scrap collection and recycling systems are central to waste volume reduction and an encouragement of resource recovery.

1.3 What is a Scrap Collection & Recycling System?

A Scrap Collection & Recycling System is a web-based platform that simplifies waste collection, logistics, and recycling. It connects individuals and organizations with waste collection services to facilitate proper segregation, processing, and reuse of recyclable material.

Key Advantages of a Scrap Collection & Recycling System:

- **Convenience** – Users can schedule pickups without the hassle of manual coordination.
- **Resource Optimization** – Prevents landfill waste by promoting reuse and resale of valuable resources.
- **Eco-Friendly Impact** – Minimizes carbon footprints by diverting recyclable waste from conventional disposal methods.
- **Data-Driven Management** – Enables tracking of waste generation patterns and optimizing recycling programs.

By integrating cutting-edge web technologies, Yakadabadu.lk enhances user engagement, operational efficiency, and environmental consciousness.

1.4 Our Web Application – Yakadabadu.lk

Yakadabadu.lk is developed using the MERN stack (MongoDB, Express.js, React, Node.js) and provides an easy-to-use, interactive solution to manage recyclable waste. The website possesses the following main features:

- **User Pickup Scheduling**

The users can easily book scrap collections through an intuitive web interface. The system manages the collection requests efficiently and on time, providing real-time updates to the users.

- **Driver Pickup Management**

Drivers receive automatic alerts for pickup requests and can schedule and route optimizations. Coordination between drivers and users is optimized by the system to reduce delays and ensure maximum productivity.

- **Resell Reusable Items**

Instead of discarding reusable materials, the system makes it possible to resell them. Items in good condition can be put up for sale, promoting reuse over disposal. This feature reduces waste and aligns with circular economy principles.

- **Admin Dashboard & System Management**

Administrators are able to utilize a comprehensive dashboard that provides:

  - **Real-time analytics** – Tracks waste collection data and recycling trends.
  - **Report generation** – Enables tracking of operations for making informed decisions.
  - **User & driver management** – Ensures smooth functionality across the platform.

- **Finance Management**

The system has a finance module that helps manage revenue, spending, and salary generation efficiently:

- **Revenue Monitoring** – Monitoring revenues from scrap collection, reusable sales, and partnerships with recycling firms.
- **Cost Control** – Monitoring operation expenses, like vehicle maintenance, fuel, and administrative fees.
- **Auto Salary Calculation** – Automated calculation and payment of monthly salary for administrators, drivers, and other staff for timely and transparent salary release.

In incorporating the finance management into the platform, Yakadabadu.lk ensures financial transparency, operational excellence, and viability assured.

2. Problems and Motivations

2.1 Problems

- **Inefficient scrap collection**

  Currently, there is no structured system to collect scrap efficiently. Collectors work manually without proper scheduling or optimized routes. They travel from door to door randomly and check for pickups and sellers too wait for collectors to pass by, which is unreliable. This results in wasted time, energy and fuel.

- **Limited accessibility for Scrap Sellers**

  Users face difficulties finding reliable collectors or recycling centers nearby. Therefore, people discard recyclable or reusable items as waste.

- **Low returns for Scrap Sellers**

  Many scrap sellers are unaware of the actual market value of their scrap. When scrap collectors are found by word of mouth, it involves multiple intermediaries who take a significant share of the profit.

- **Manual financial management**

  Salaries, expenses and transactions are recorded manually leading to human errors and it is difficult to make reports or track profit/loss accurately.

- **Waste of reusable items**

  Many reusable items are discarded as waste because there is no proper platform to list and sell reusable items.

- **Negative impact on the environment**

  Improper disposal of scrap leads to environmental pollution and people must face various health issues due to exposure of hazardous materials.

2.2 Motivations

- **Improved waste management System**

  Users can dispose of scrap easily by scheduling pickups and listing recyclable items.

- **Establishment of an optimized scrap collection system**

  Structured system will allow drivers to receive pickup requests with optimized routes. This will save time and reduce fuel costs and improve the effectiveness of scrap collection.

- **Automated and Transparent financial management system**

  Automated salary calculations, ledger tracking and financial reports will reduce human errors helping with decision making.

- **Better user engagement with rating and review system**

  This will prevent scrap sellers from manipulation and ensure trust and service quality for drivers and listed items.

- **Maximizing reuse opportunities**

  Encouraging to sell reusable items will reduce discarding of waste and create a source of income to sellers.

3. Aim and Objectives

3.1 Aim

To develop a comprehensive, digitalized scrap collection and recycling management system that connects users, drivers, and recycling centres to facilitate efficient and sustainable waste management.

3.2 Objectives

- Develop a user-friendly platform for scheduling waste pickups.
- Implement an optimized driver management system for real-time waste collection tracking.
- Integrate a resale marketplace for users to sell reusable materials.
- Ensure data accuracy through digital tracking and automated reporting.
- Provide an administrative dashboard for monitoring and regulatory oversight.

4. System Overview

We have divided *Yakadabadu.lk* into **five main components (or subsystems):**

1. **User Management** – Handles user registration, authentication, and role-based access control for admins, customers, and drivers.
2. **Pickup Scheduling Management** – Allows users to schedule waste pickups, track requests, and receive real-time status updates.
3. **Resale Management** – Facilitates the resale of reusable items by allowing users to list and purchase second-hand materials.
4. **Driver and Route Management** – Manages driver assignments, pickup schedules, and tracking of waste collection activities.
5. **Finance Management** – Handles payment transactions, earnings for waste collectors, and financial reports for admin users.

All these components will be integrated into the **front-end interface**, ensuring seamless interactions for users.

The **Web API** will be implemented using **REST API** with **Express.js**, acting as the bridge between the **frontend** and **backend** of the system.

The **backend** will be developed using **Node.js**, processing data retrieved from **MongoDB**, which serves as the primary database for storing user data, transactions, and operational records. Data will be exchanged in **JSON format** to ensure efficient processing.

The **Driver and Collector Management** module will leverage **Google Maps API (or an alternative Map API)** to provide real-time **geolocation tracking**, **route optimization**, and **pickup status updates**, improving the efficiency of the collection process.

The entire system will be **hosted on an external cloud storage solution**, ensuring scalability, security, and reliability for all users.

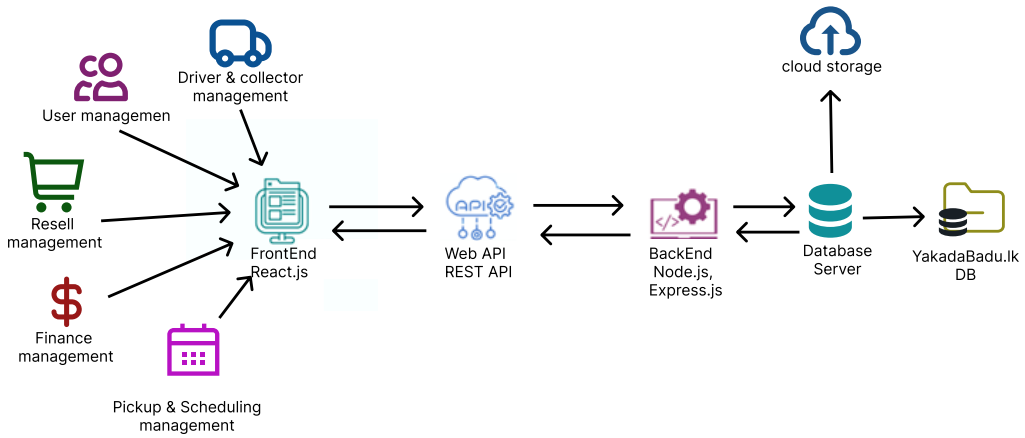


Figure 1 – System Diagram

4.1 Functional Requirements of Yakadabadu.lk

4.1.1 Scrap Collection Management

This module addresses all the scrap collection–related tasks in the Yakadabadu.lk system. Users can book pickups for their scrap items based on their availability. The system has provisions for editing and rescheduling as needed.

- Registered users can book a scrap collection by selecting their location, preferred date, and scrap material type.
- When a collection request is lodged, a pickup schedule is generated from available collection slots and assigned to a driver.
- Users can query the status of collection requests and modify or cancel requests as appropriate.
- Users can see their collection history, upcoming pickups, and missed collections. If a scheduled collection is missed and not cancelled beforehand, the system marks it as missed pickup and notifies the user.

4.1.2 User Management

This module provides user registration and management capabilities. There are three broad types of users: **unregistered users**, **registered users**, **Drivers** and **administrators**.

- Unregistered users can register by providing their details (name, email, phone number, address) and selecting a password and username.
- Registered users can keep their accounts, update personal information, and delete their accounts if needed.
- Administrators oversee all user accounts, such as user registration approval, permission setting, and removal of users who violate system policies.
- Employees working on collections can apply for leave, view their leave summary, and view attendance through the user management system.

4.1.3 Customer Support & Feedback Management

This module allows users to provide feedback regarding their scrap collection and the service of the driver who has been assigned to them.

- Users can provide feedback after their collection has been made. Users are allowed to edit or delete their feedback as appropriate.
- Drivers can view feedback posted but cannot edit or delete it.
- Users can rate their driver, and ratings are displayed next to driver profiles when assigning new collection requests.
- Feedback is required to be approved or denied by an admin prior to being posted to ensure quality control.
- The customer service manager can generate feedback trend reports and user satisfaction reports.
- Users can contact customer support for rescheduling, missed pickups, or any questions using the contact form in the app.

4.1.4 Route Optimization & Pickup Scheduling

This module generates optimum scrap collection routes for drivers, minimizing travel time and consolidating pickups. The software calculates the most efficient possible route based on real-time data and pre-set parameters.

- As users schedule a pickup, the software automatically optimizes routes by considering distance, traffic, and pickup priority.

- The software clusters nearby pickup points to conserve fuel and increase efficiency.
- A daily pickup route plan is formulated and assigned to drivers, so that they stick to an optimized route.
- Drivers are given turn-by-turn instructions via the interface of the system, ensuring effortless collection operations.
- Users are informed about their estimated pickup time and can also track the location of the driver in real time.
- When there's a shift in traffic conditions, the system re-routes dynamically to figure out a faster alternative.

4.1.5 Payment & Financial Management

This module handles payment for scrap collection, financial transactions, and reporting.

- When a scrap collection is done, the users receive a payment token indicating the amount of money earned based on the type and weight of the scrap.
- Users can choose their payment method (bank deposit, or cash pickup).
- If users opt for direct deposit, they have to save their bank details in the system, which can be edited or removed later.
- The finance manager tracks all transactions and generates payment reports.
- Admin-level managers can view financial overviews and transaction history.
- Financial reports, like cumulative earnings, user payments, and pending payouts, can be viewed.

4.1.6 Scrap Inventory & Recycling Management

This module tracks accumulated scrap materials and their stage in the recycling process.

- Drivers update the status of scrap collected in the system after collection, categorizing materials by type and weight.
- The inventory manager oversees the storage of scrap and maintains a watch on available stock.

- The system notifies the inventory manager to contact recycling plants when accumulated scrap has reached a specific stage.
- Reports on scrap collection trends, storage levels, and recycling progress are made available for administrators.

4.2 Non-Functional Requirements

4.2.1 Performance Requirements

- The system must be able to support at least 500 simultaneous users with no noticeable degradation of performance.
- The response time for any transaction (for example, booking a pickup or payment processing) must not exceed 3 seconds at normal loads.
- Data retrieval for reports must not exceed 5 seconds, even when large amounts of data are being processed.
- The system must be tuned for both desktop and mobile performance, with smooth user interaction.

4.2.2 Security Requirements

- User data, including payment details, personal info, and scrap collection record, must be encrypted using AES-256 encryption.
- Role-based access control (RBAC) must be enforced to prevent unauthorized access to employee and admin dashboards.
- Passwords must be hashed using hashed encryption (bcrypt or Argon2) for further security.
- The system must use two-factor authentication (2FA) for accounts to prevent unauthorized access.
- Automated penetration testing and security audits should be conducted regularly to detect vulnerabilities.

4.2.3 Availability Requirements

- The system should have at least 99.5% uptime for uninterrupted availability of services.

- In case of system failure, automatic failover mechanisms should switch operations over to a standby server.
- The platform should be available 24/7, with planned maintenance windows announced at least 48 hours in advance.

4.2.4 Usability Requirements

- The system must possess an intuitive UI that follows industry standards of readability and accessibility.
- All pages must be responsive, with easy navigation across devices and screen sizes.
- The system must possess help documentation and tooltips to guide users through the registration, pickup scheduling, and payment flows.
- The average learning curve for new users must not exceed 30 minutes based on usability testing.

4.2.5 Scalability Requirements

- The system architecture should support horizontal scaling by the addition of servers with an increase in the number of users.
- The database should be designed to handle up to 1 million records, offering long-term storage without any loss in performance.
- APIs and microservices should be designed to offer easy integration with third-party services such as recycling plants, payment gateways, and logistics services.

4.2.6 Compliance Requirements

- The system must comply with Sri Lanka's data protection laws, ensuring user privacy and data security.
- Payment processing must be carried out in line with PCI DSS requirements, enabling secure and safe transactions.
- The system must comply with ISO 27001 security requirements for risk management and data protection.

4.2.7 Backup and Disaster Recovery Requirements

- Automatic backup must be performed daily, and weekly full-system backups must be stored in a secure cloud environment.
- On failure criticality, the system should be able to restore operations from the last available backup within 30 minutes.
- There should also be a secondary disaster recovery plan for continuity of service during major disruptions

4.3 Technical requirements

- **Hardware:** The system should have hardware components that meet the required specifications, such as processing power, memory, and storage capacity.
- **Operating System:** The system should be designed to work with a specific operating system, such as Windows, MacOS, or Linux**.**
- **Database:** The system should have a database to store and manage data efficiently. User
- **Interface:** The system should have an easy-to-use interface that allows users to interact with the system and perform necessary tasks.
- **Data Security:** The system should have appropriate security measures in place to protect data from unauthorized access, such as encryption and user authentication.
- **Networking:** The system should be able to connect to a network to enable data transfer and communication with other devices**.**
- **Performance:** The system should be designed to perform efficiently and effectively to meet the needs of the users.
- **Compatibility:** The system should be compatible with other hardware and software components that are required for its operation.
- **Scalability:** The system should be scalable and able to handle increasing amounts of data and users as the system grows.
- **Maintenance:** The system should be easy to maintain, update, and troubleshoot to ensure its continued operation and optimal performance.

5. Literature Review

Increased concern about environmental sustainability and waste management has led to the development of numerous scrap collection and recycling systems. The systems are aimed at facilitating effective disposal, collection, and recycling of waste products with a low environmental impact and high efficiency in the utilization of resources. This literature review explores existing solutions in the industry, their flaws and merits, and the reasons why a better or alternative system like Yakadabadu.lk is required.

5.1 ScrapAd

ScrapAd is a global online marketplace that unites scrap material buyers and sellers. It provides a secure marketplace for the trading of various types of waste, including metals, plastics, and paper.

Advantages:

- Secure and verified marketplace for trading.
- Global reach and bulk trading opportunities.
- Integration of AI-based pricing for scrap materials.

Disadvantages:

- Mainly intended for bulk industrial buyers and sellers.
- Limited to global markets, which makes it less suitable for localized waste collection.
- No direct collection system for small businesses or households.

5.2 Karo Sambhav (India)

Karo Sambhav is an Indian organization that provides an e-waste management platform, enabling responsible recycling of electronic waste through authorized recyclers.

Advantages:

- Enables extended producer responsibility (EPR) fulfilment.

- Provides awareness and education for responsible recycling.
- Collaborations with several companies and recyclers.

Disadvantages:

- Only for electronic waste (e-waste) and thus limited in application.
- No direct incentive for single customers or small businesses.
- Requires coordination with producers, restricting access by non-organized recyclers.

5.3 Recycle Coach

Recycle Coach is a cell phone application providing waste management features, including garbage collection calendars and recycling information by users' geolocation.

Advantages:

- Informative content using an easily navigable interface.
- Personalized waste collection calendars to users.
- Provision of interfaces with municipal trash collection services.

Disadvantages:

- Does not provide direct scrap collection or recycling services.
- Made available in municipal governments that use the system.
- No scrap buyers and sellers platform.

5.4 Junkart (India)

Junkart is an Indian online scrap collection platform that connects scrap collectors with individuals and firms for doorstep pickup of recyclables.

Advantages:

- Door-to-door collection service provided.
- Instant payments and rewards to users selling scrap.

- Localized service, targeting particular city needs.

Disadvantages:

- Scalability only up to some cities limited.
- No advanced technology integration like AI-based pricing or tracking.
- More oriented towards domestic scrap than industrial waste.

While existing solutions offer multiple facets for the recycling and collection of scrap, they are notably short on expansive waste management along with regional expandability. There are many platforms that are specific to giant-scale industries only (ScrapAd), specialized to specific types of waste only (Karo Sambhav), or lose out on being connected with online platforms (Junkart). Moreover, not many platforms are as encouraging towards an individual user as or in the form of a collective system that facilitates collection, recycling, and trade under one portal together.

5.5 Why Yakadabadu.lk is Needed:

- A localized scrap collection service for Sri Lanka.
- A two-model that combines both industrial and household scrap collection.
- A simple-to-use marketplace to effectively match recyclers, scrap sellers, and buyers.
- Environmental impact tracking to promote sustainable practices.

While there are several scrap collection and recycling websites, they either cater to niche segments or are not sophisticated enough to ensure the recycling process is efficient. Yakadabadu.lk aims to address these gaps by offering an intelligent, localized, and user-friendly website that encourages responsible recycling and provides financial incentives to users. By breaking the constraints of current systems, Yakadabadu.lk can significantly enhance waste management efficiency in Sri Lanka.

6. Methodology

6.1 Agile Software Engineering Methodology

Agile methodology is an iterative and incremental approach to software development that emphasizes flexibility, collaboration, and rapid delivery of working software. The Agile Manifesto values:

- **Individuals and interactions over processes and tools** – Prioritizing communication and collaboration.
- **Working software over comprehensive documentation** – Focusing on delivering functional software.
- **Customer collaboration over contract negotiation** – Ensuring continuous engagement with users.
- **Responding to change over following a plan** – Adapting to evolving requirements.

Agile teams work in short iterations or sprints, typically lasting one to four weeks, ensuring rapid development and frequent user feedback. In this project, **Kanban** is used as the preferred Agile methodology.

6.1.1 Reasons for selecting Agile Methodology

- **Customer satisfaction** – Continuous delivery of value.
- **Flexibility** – Adapting to evolving project requirements.
- **Collaboration** – Encouraging teamwork and accountability.
- **Transparency** – Open communication and progress tracking.
- **Continuous improvement** – Refining processes and ensuring efficiency.

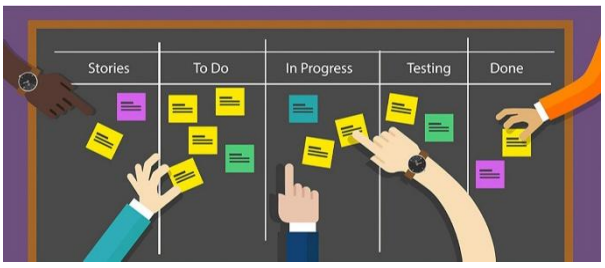


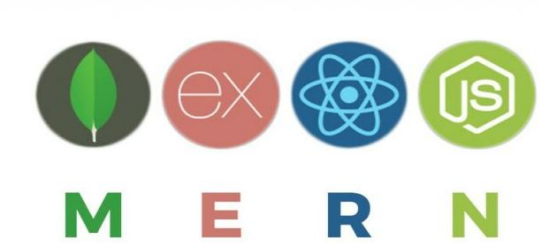
Figure 2 – Kanban Methodology

6.1.2 Why Kanban is Better for Yakadabadu.lk?

1. **Continuous Workflow:** Tasks such as scrap collection, recycling, and trading require continuous operation rather than fixed sprint cycles.
2. **Flexibility and Adaptability:** Kanban allows immediate changes based on real-time data, unlike Scrum's fixed sprints.
3. **No Fixed Sprint Cycles:** The project involves ongoing feature development rather than set sprint deadlines.
4. **Better for Small Teams:** Kanban is lightweight and suited for teams that need efficiency without the structured overhead of Scrum.

6.2 Tools and Technologies

We use **MERN stack** for developing our web application. MERN is a combination of 4 technologies**: MongoDB**, **Express JS**, **React JS**, and **Node JS**.



MongoDB – NoSQL database for flexible and scalable data storage.

Express.js – Web application framework for backend development.

React.js (Vite App) – Efficient and modular frontend framework optimized for fast development.

Node.js – Cross-platform runtime for scalable backend operations.

Additional tools include:

Visual Studio Code – Code editor for development.

GitHub – Version control and collaboration platform.

7. Evaluation Method

7.1 Project plan (Gantt chart)

Process	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12
Requirement Analysis & Documentation												
Planning												
Page UI Design												
Database Designing												
Coding the Structure												
Development												
Testing												
Launching the web application												

Figure 3 – Grantt Chart

7.2 - Project Timeline – Yakadabadu.lk

We started gathering information for Yakadabadu.lk from the of the semester. It took us approximately two weeks from the start of the semester to complete the requirement analysis and documentation phase. We were able to gather all the information required within this time, setting a solid base for our project without any major problems.

In the second week, we focused on planning the project, defining milestones, and structuring our development process. In the third week, we began designing the UI/UX with Figma, ensuring that our platform is user-friendly and aligns with the major functionalities of Yakadabadu.lk.

During the fourth week, we were working on the database design phase that took approximately three weeks. While doing this, we felt the need to implement additional features to make it more effective. We were able to create the basic database layers, but additional complexity in the second layer is required to achieve optimum data handling for user roles, transactions, and tracking waste.

Starting from the fifth week, we will begin building the platform, aiming for both backend and frontend development. This will consume approximately six weeks, and during this time, all the features required, such as user authentication, waste collection scheduling, and admin features, will be successfully developed.

Going into the ninth week, we will intensify our development process, refining the code and integrating the various tools and frameworks required for Yakadabadu.lk. We will focus on optimizing performance, security, and usability without compromising the smooth user experience.

From week twelve, we will enter the testing phase, during which we will conduct unit testing, integration testing, and user acceptance testing to verify the functionality and performance of the platform. With the end of the testing phase, Yakadabadu.lk will be live as a complete web application, and our project will be successfully concluded.

This structured timeline ensures that each component of the platform—requirement gathering, UI/UX designing, database structuring, development, and testing—will be executed in a proper way, resulting in a high-quality and user-friendly web solution for recycling and waste management.

8. Conclusion

In conclusion, the Yakadabadu.lk project represents a significant step forward in addressing the pressing waste management challenges faced in Sri Lanka. By leveraging modern web technologies and a user-centric approach, this platform aims to streamline the scrap collection and recycling processes, promoting a culture of sustainability and responsible waste management. The integration of features such as user pickup scheduling, driver management, and a resale marketplace not only enhances operational efficiency but also empowers individuals and businesses to actively participate in recycling efforts.

The proposal outlines a comprehensive plan that includes a robust technical framework, a clear understanding of user needs, and a commitment to environmental sustainability. By addressing the current gaps in waste management systems and providing a localized solution, Yakadabadu.lk is poised to make a meaningful impact on the community and contribute to a circular economy. As the project progresses, continuous user feedback and iterative improvements will ensure that the platform remains relevant and effective in meeting the evolving needs of its users. Ultimately, Yakadabadu.lk aspires to be a catalyst for change, fostering a cleaner, greener, and more sustainable future for Sri Lanka.

9. References

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3. Google Developers, "Google Maps API for Logistics," Developer Guide, 2024.
4. OpenAI, "AI-Assisted Research on Waste Management, Agile Methodologies, and System Development," OpenAI, 2024.

10. Appendix

1. **Figure 1 - System Diagram:** A graphical representation of the system, illustrating components such as inputs, processes, outputs, and interactions.
2. **Figure 2 - Kanban Methodology:** A workflow visualization method that organizes tasks into categories like To Do, In Progress, Testing, and Done, promoting efficiency and continuous delivery.
3. **Figure 3 - Gantt Chart:** A project management tool providing a timeline-based visual representation of tasks, dependencies, and project phases.

Student ID and Name with Initials	Tasks
IT23144408 Fernando W A A T	Function - Driver and Route Management Completed the System Overview, Methodology and Appendix sections in the proposal report.
IT23202122 P P D R Pathirage	Function - Resale Management Completed the Background and Conclusion sections in the proposal report.
IT23140752 Gunawardena A A	Function – Finance Management Completed the Problem & Motivation and Evaluation Method sections in the proposal report.
IT23216778 S A R U Amarasinghe	Function - Pickup Scheduling Management Completed the Aim and Objectives sections in the proposal report.
IT23320550 K T A Kularathne	Function – User Management Completed the Literature Review sections in the proposal report.