Eco Earn: E-Waste Facility Locator

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ABSTRACT:

The rapid growth of E-waste (electronic waste) contributes to critical environmental and health challenges. According to government assessments, E-waste has risen more than fivefold over the past seven years and is estimated to exceed 800,000 tonnes. To address this issue, our platform uses artificial intelligence (AI) and machine learning (ML) to enhance E-waste management, offering real-time analysis and alerts about the hazardous and valuable components of outdated devices. Users can effectively locate nearby E-waste disposal services through a path-optimization feature, promoting responsible recycling and disposal. In addition, a chatbot improves user involvement. By combining sustainability beliefs and circular approaches, this action boosts awareness and supports e-waste management, providing a more sustainable hereafter.

Keywords: Recycling, Circularity, E-cycler, Eco-incentives, E-snap.

I. INTRODUCTION

To manage these issues, this study begins the E-Waste Facility Locator, and creative digital platform designed to refine E-waste management output. This user-centric request combines different functionalities, along with a geo-location-based facility locator, an appointment scheduling system, AI-powered image recognition, chatbot assistance, and sustainability tracking. The platform makes users to find neighboring approved recycling centers, arrange disposal schedules, and use real-time knowledge of durable resources. In addition, an engaging blog and a full repository of E-waste rules raise public awareness and education on suitable disposal practices.

One of the standout features of the system is an image recognition one that is driven by AI which enables individuals to upload photos of their E-waste and immediately get a rapid recyclable piece scan. Moreover, the system has a built-in credit feature where users will be rewarded credits, which could be used towards encouraging responsible recycling.

One of the major problems of effective E-waste management is the lack of advanced recycling units as almost 95% of E-waste is value-added in black markets with no technical expertise. The project emphasizes the significance of initiating systematic reverse logistics chains for effective collection, movement, and recycling of E-waste and concurrently filling availability, cost, and public awareness gaps.

II. LITERATURE SURVEY

Vishwakarma et al. (2022) discuss the growing issue of electronic waste (E-waste) within the Information and Communication Technology (ICT) sector, its prevailing management practices, challenges, and future directions. The study identifies the rapid increase in the production of E-waste arising from the fast pace of technological evolution and rising user electronics needs. Through the assessment of current ICT E-waste

management practices, the research outlines significant gaps which hamper successful recycling and disposal activities. In addition, the authors propose an internet-based recycling system using a use case diagram, illustrating the way online options enhance E-waste management. The study also summarizes industry policy and regulation that ICT companies establish, promoting sustainable behavior such as recycling, the values of the circular economy, and collaborative stakeholder action for managing the health and environmental risks arising from the accumulation of E-waste.

patlolla Madhu Sree Reddy et al. 2024 an app and mobile-web platform for efficient E-waste management. Key findings of the research usage of AI-enabled functionalities and support for multiple languages for assisting users in efficiently finding E-waste recycling centers in the vicinity with enhanced navigation An incentive mechanism has also been included in the app, motivating users to recycle their E-waste in terms of rewards—such as cryptocurrency or cashback. Apart from promoting environmental consciousness, the application also features educational pop-ups that make users aware of the environmental impact of incorrect disposal Through device assessment via machine learning and resale facilitation of recyclable material, the platform aims to enhance sustainability efforts, promote responsible behavior towards disposal, and enable circular economy activities, at least to enhance Through device assessment via machine learning and resale facilitation of recyclable material, the platform aims to enhance sustainability efforts, promote responsible behavior towards disposal, and enable circular economy activities, at least to enhance Through device assessment via machine learning and resale facilitation of recyclable material, the platform aims to enhance sustainability efforts, promote responsible behavior towards disposal, and enable circular economy activities, at least to enhance long-term environmental conservation and enhanced user experience.

Vijay Kumar M. N. and Swetha C. S. 2024 propose a web-based system to minimize and optimize the recycling of E-waste. The system compels users to look for authorized facilities by material and location, promoting good disposal practices and significant functionalities include secure user registration, search for facilities, waste pickup scheduling, and real-time alerts. In addition, the platform includes training materials and customers' feedback for improving interaction as well as sustainable E-waste management awareness. For the purposes of providing efficient operation, testing is conducted relentlessly on reliability as well as security for the system. By facilitating readability to recycling plants and advocating for environmentally safe practices, the E-Waste Facility Locator will reduce ecological damages, enhance the efficiency of recycling, and adopt a culture of sustainability.

Nitin Koshta, Sabyasachi Patra, and Surya Prakash Singh (2024) a location-allocation model targeted to enhance the collection of electronic waste (E-waste) from households. Their work emphasizes enhancing the location of E-waste collection centers to ensure effective and cost-efficient procurement. By analyzing household distribution patterns and transport logistics, the model assists to determine the most optimal locations of collection centers. his approach not only minimizes cost of operation but also increases user convenience, making it easier to have more usage participation in ethical E-waste disposal. The research sets the place of systematic infrastructure in the management of E-waste and helps in the development of ethical systems for waste collection.

Aute et al. (2023–2024) web application that is easy to use whose purpose is to simplify the disposal of electronic waste (E-waste) through promoting product recycling like phones, computers, and household appliances. The E-Waste Management System contains location-based services that enable people to locate recycling facilities within their vicinity, arrange pickups, and monitor their waste disposal in real time In addition to launching environmental sustainability, the platform enhances user lighting via learning centers and ensures compliance with E-waste regulations by an engaged team of policies. Through provision of guidelines on resource management, ethical recycling practices, and collaboration with government agencies, the system targets a more effective and sustainable approach to handling E-waste.

III. PROPOSED WORK

The E-Waste Facility Locator is a complete web portal to facilitate E-waste management through technology-enabling efficient recycling and disposal. The portal provides a basic web or mobile-based interface that allows users to locate certified E-waste recycling facilities, book pickups, and receive targeted advice for disposal. With the fast rate of generation of e-waste, there is an urgent need for efficient waste collection, recycling incentives, and citizen awareness, which the portal is capable of fulfilling. It also has facility-based location tracking by GPS where consumers are able to locate recycling units in their local area by facility type, type of services available, and geolocation. It also has the functionality that uses AI technology-enabled image recognition where consumers upload images of electronic waste and classify them as recyclable or not recyclable immediately and route them to the appropriate mode of disposal.

For the sake of encouraging responsible recycling behavior, the system operates an incentive-based reward scheme where the users are rewarded points for the recycling process. It also includes educational material, like interactive blogs and pop-ups, for encouraging awareness about sustainable E-waste disposal.

IV. SYSTEM ARCHITECTURE

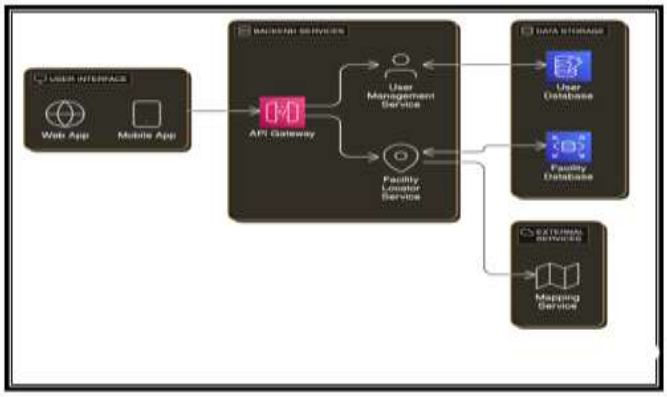

Fig 1: E-Waste Facility Locator Architecture

Fig1: E-Waste Facility Locator architecture is made to support efficient, scalable, and secure E-waste management with transparency in the design. The architecture includes the following main components:

User Interface (Web or Mobile Application):

It provides an interactive user interface by which E-waste recycling facilities can be found, pickups can be scheduled, and assistance can be received and provides seamless experience on devices for ease.

Backend Services:

An API Gateway is the middle layer to handle user requests and forward them to appropriate services.

User Management Service performs user authentication and management of user data.

Facility Locator Service supports facility search in real-time, geo-location, and access to information.

Data Storage:

User Database securely stores user details like profiles and activity history.

Facility List is the current list of all authorized facilities to recycle E-waste, location, services offered, and availability.

External Services:

Map Service uses external geo-location APIs to display the location of the facilities, directions, and live driving directions too.

V. METHODOLOGY

Modules:

User Interface Module

Web and mobile interface for accessing system features.

Includes forms for device scanning, facility search, and profile management.

Location Service Module

Uses GPS for real-time location tracking.

Integrates with Google Maps API for navigation and facility search.

Database Module

Stores user profiles, facility details, e-waste types, and transaction histories.

Uses MySQL for data management.

Notification Module

Sends alerts and reminders about recycling events and facility updates.

Information Module

Provides educational content on e-waste recycling and sustainability.

Includes articles, tips, and guides to promote user awareness.

Backend Module

Handles core business logic, user authentication, and data processing.

Supports API integrations for data retrieval and facility management.

ALGORITHM:

Authentication and Authorization Algorithm:

Authentication (Login):

Step 1:

- User submits email and password.

Step 2:

- Check if email exists in the database.
- not, return "Email not registered."

Step 3:

- Verify the password using the authenticate function.
- If incorrect, return "Incorrect credentials."

Step 4:

- Check if the user is active (is_active=True).
- If not, return "User not active."

Step 5:

- Log in the user using the login function.

Step 6:

- Redirect the user to the home page or dashboard.

Authorization (Access Control):

Step 1:

- After login, check the user's role or permissions.
- Regular users can access the home page.
- Admin users can access admin pages.

Step 2:

- Use the @login_required decorator to restrict access to certain views.
- If the user is not logged in, redirect them to the login page.

Step 3:

- Handle unauthorized access.
- If the user tries to access a restricted page, return "Unauthorized access."

Logout:

Step 1:

- User requests to log out.

Step 2:

- Log out the user using the logout function.

Step 3:

- Redirect the user to the login page or home page.

VI. RESULTS

Fig 2: Home Page

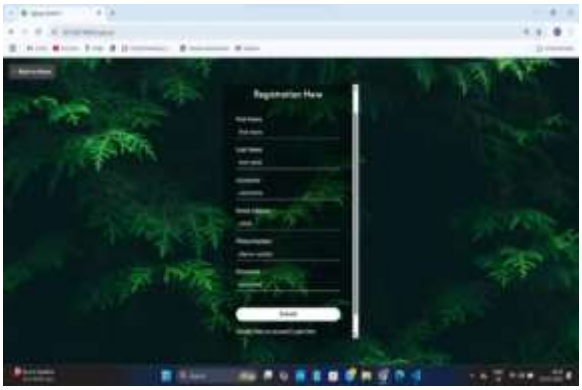

Fig 3: Registration Page

Fig 2: The E-Waste Facility Locator homepage provides a clean, eco-friendly entry point with quick access to key features like "Evaluator" and "Delivery", emphasizing quality, expertise, and fast service. Fig 3: The registration page supports straightforward account creation with essential fields, maintaining a consistent nature-inspired design that aligns with the platform's sustainability mission.

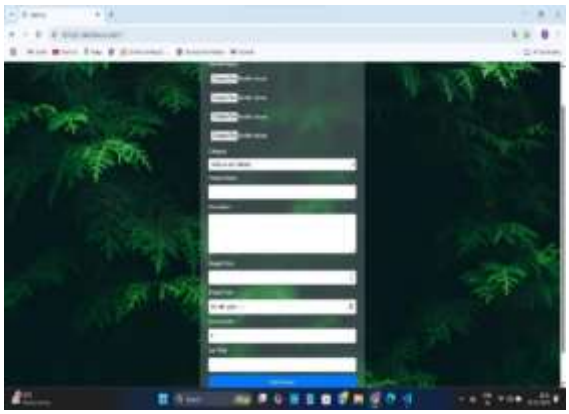

Fig 4: Device Details

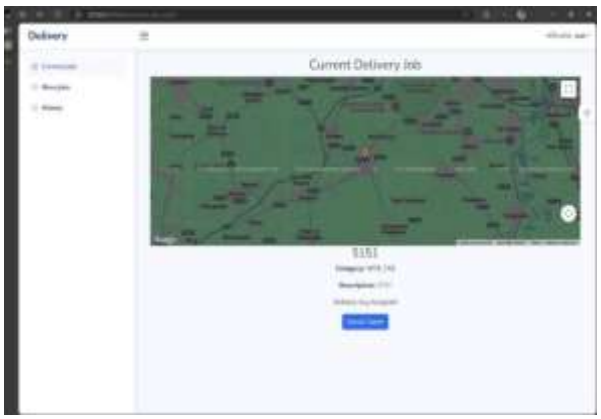

Fig 5: Delivery job location page

Fig 4: The device details page depicts a product entry interface with fields for images, category, and pricing details, Fig 5: The current delivery location shows a delivery tracking page with map integration and job status, highlighting a seamless workflow from product listing to delivery management.

VII. CONCLUSION

The E-waste facility locator system provides a creative solution to the growing issue of E-waste management using technology, accessibility, and environmental-friendliness. Through its GPS-based platform, customers can easily locate certified E-waste recycling facilities, allowing for convenient and responsible disposal. The system ensures enhanced user experience through distance and service-based filtering of facilities, cost estimate features, and step-by-step directions for successful E-waste drop-offs. One of the best features of this website is its chatbot, which is AI-based and always on hand to help users recycle and answer questions. There are also educational triggers and an information center integrated into the system to inform people about E-waste hazards and green recycling methods. Through rewards, the platform actually motivates users to engage in green disposal behavior, and also it raises awareness for the environment.

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