PROJECT REPORT

IBM SkillsBuild From Learner to Builder: Become an AI Agent Architect

Presented By: MAVERICS

Group Members:

1. NOUFAN N
2. GAUTAM PRADEEP
3. MUHAMMED KAIF B
4. NAKUL S N
5. CHRISTY SUNIL SAM
6. VASUDEV G

College: COLLEGE OF ENGINEERING , TRIVANDRUM

Title

WasteWise : A Smart Waste Management System Using AI-Driven Sorting and Reward System

Introduction

Effective waste management is a growing challenge in modern urban environments. One of the most critical issues is poor source segregation, where users incorrectly dispose of waste due to confusion or lack of motivation. This results in contaminated recycling streams, making large volumes of otherwise recyclable material unusable. Despite the presence of color-coded bins and awareness campaigns, the absence of real-time feedback or personal incentives has led to low user compliance.

Another major concern is the improper disposal of electronic waste (e-waste), such as batteries and circuit boards. These materials often end up in general waste, releasing toxic substances into landfills and posing serious environmental and health risks.

Our project addresses these challenges by introducing an AI-driven smart waste management system that automates waste classification and engages users through gamified rewards. By integrating image recognition with a reward-based feedback loop, the system

not only improves sorting accuracy but also encourages responsible disposal habits. This approach aims to make recycling intuitive, rewarding, and impactful—benefiting both the environment and society at large.

Problem Statement

Improper waste segregation and lack of user motivation lead to contaminated recycling streams and inefficient processing. Without incentives or feedback, users often discard waste incorrectly. Additionally, unsafe e-waste disposal introduces toxic hazards. A smart, automated, and engaging solution is needed to improve sorting accuracy and promote responsible waste management behavior.

Objective

The objective of this project is to develop a smart AI-powered recycling bin that automates waste classification and encourages responsible disposal through a gamified rewards system. By combining real-time image recognition with redeemable Honor Points, the system aims to make recycling easy, engaging, and impactful—empowering users to make a positive environmental difference with every disposal.

Why This Problem?

Improper waste segregation leads to contaminated recycling, environmental damage, and costly processing. Users lack motivation due to the absence of feedback or incentives, while e-waste mishandling introduces toxic risks. With rising urban waste and sustainability goals, solving this problem is critical. A smart, engaging system can drive behavioral change and transform waste management into an efficient, impactful process.

Solution

Overview

WasteWise introduces a transformative approach to tackling urban waste challenges through automation, artificial intelligence, and behavioral incentives. At its core is an AI-powered smart bin equipped with a camera and image recognition model that automatically classifies waste as biodegradable, recyclable, or e-waste. Once identified, the

system routes the waste to the appropriate processing path, ensuring better segregation and minimal contamination.

To enhance user participation, the system includes a gamification layer where individuals earn "Honor Points" for proper disposal, track their progress through a mobile app, and redeem rewards. This not only boosts engagement but also promotes consistent responsible behavior. The entire process is backed by a secure cloud infrastructure that stores user data, model analytics, and disposal metrics in real time.

By combining real-time waste identification, behavioral motivation, and data-driven insights, the system ensures a more sustainable, scalable, and citizen-friendly waste management process. The design supports integration into urban environments such as smart cities, campuses, and corporate facilities. Overall, the project reimagines recycling not as a chore, but as an intelligent, rewarding, and environmentally impactful action.

Features

- **AI-Based Waste Classification:** Uses image recognition to instantly identify and sort waste into biodegradable, recyclable, or e-waste categories with high accuracy.

- **Gamified User Engagement:** Introduces "Honor Points" as a reward for correct disposal, motivating users through gamification and positive reinforcement.

- **Mobile App Integration:** Companion app allows users to track their impact, redeem points, view disposal history, and receive real-time feedback and tips.

- **Smart Routing of Waste:** Automatically directs each type of waste to the appropriate treatment method (composting, recycling, or secure e-waste handling).

- **Data Analytics Dashboard:** Centralized monitoring for administrators showing waste metrics, classification accuracy, and user participation rates.

- **Scalable and Modular Design:** Supports deployment across smart cities, campuses, and corporate spaces, with flexible configuration and expansion capabilities.

Technical Implementation

- **Multi-Agent Architecture:** The system is powered by specialized agents—Classifier, Separator, and Component Identification—each performing a distinct role in analyzing waste images using Google's Gemini model.

- **AI-Powered Classification:** The Classifier Agent uses a pre-trained generative vision model to categorize waste as biodegradable, non-biodegradable, mixed, or e-waste, along with a reason for the classification.

- **Mixed Waste Handling via Separator Agent:** If mixed waste is detected, the Separator Agent breaks down the image into item-level insights, counts each type, and determines the dominant waste stream for routing.

- **Automated Treatment Protocols:** Based on waste type, the system presents AI-driven treatment processes—from anaerobic digestion for biodegradable waste to secure shredding and metal recovery for e-waste.

- **Gamified Honor Score System:** Each correctly identified and processed item earns the user points based on its environmental impact, fostering engagement and responsible behavior through a scoring mechanism.

- **Relay App Integration for Confirmation:** After processing, the system sends users a personalized confirmation email, including the type of waste treated and the Honor Score awarded, using a connected automation webhook.

Conclusion

WasteWise offers a unified, intelligent solution to the challenge of improper waste segregation. By combining AI-powered classification, smart routing, and gamified user engagement, it transforms waste disposal into a rewarding experience. This approach not only increases recycling efficiency but also builds lasting eco-conscious behavior. Leveraging IBM's secure and scalable infrastructure ensures reliable deployment across various urban environments. The system provides real-time insights to users and administrators, supporting both environmental and operational goals. Ultimately, the project fosters a behavioral shift—making sustainability accessible, measurable, and engaging for all stakeholders in a smart city ecosystem.