PHOENIX

CHENNAI INSTITUTE OF TECHNOLOGY
INOHAC26000237
RT33

SMART WASTE SEGREGATION AND RECYCLING SYSTEM

PROBLEM STATEMENT CODE : PS39
TRACK : AR/VR & INTERNET OF THINGS (IOT)

- Manual waste segregation is **inefficient, error-prone, and not scalable** for real-time usage.
- Incorrect segregation reduces **recycling efficiency** and increases **environmental impact**.
- Existing systems lack **real-time automated classification** of waste.
- There is no **built-in mechanism to validate segregation accuracy** during operation.
- Waste management systems do not provide **real-time monitoring or performance data**.
- A **user-independent solution** is required, where waste is segregated automatically **without requiring feedback from the person disposing it**.

PROPOSED SOLUTION & WORKING
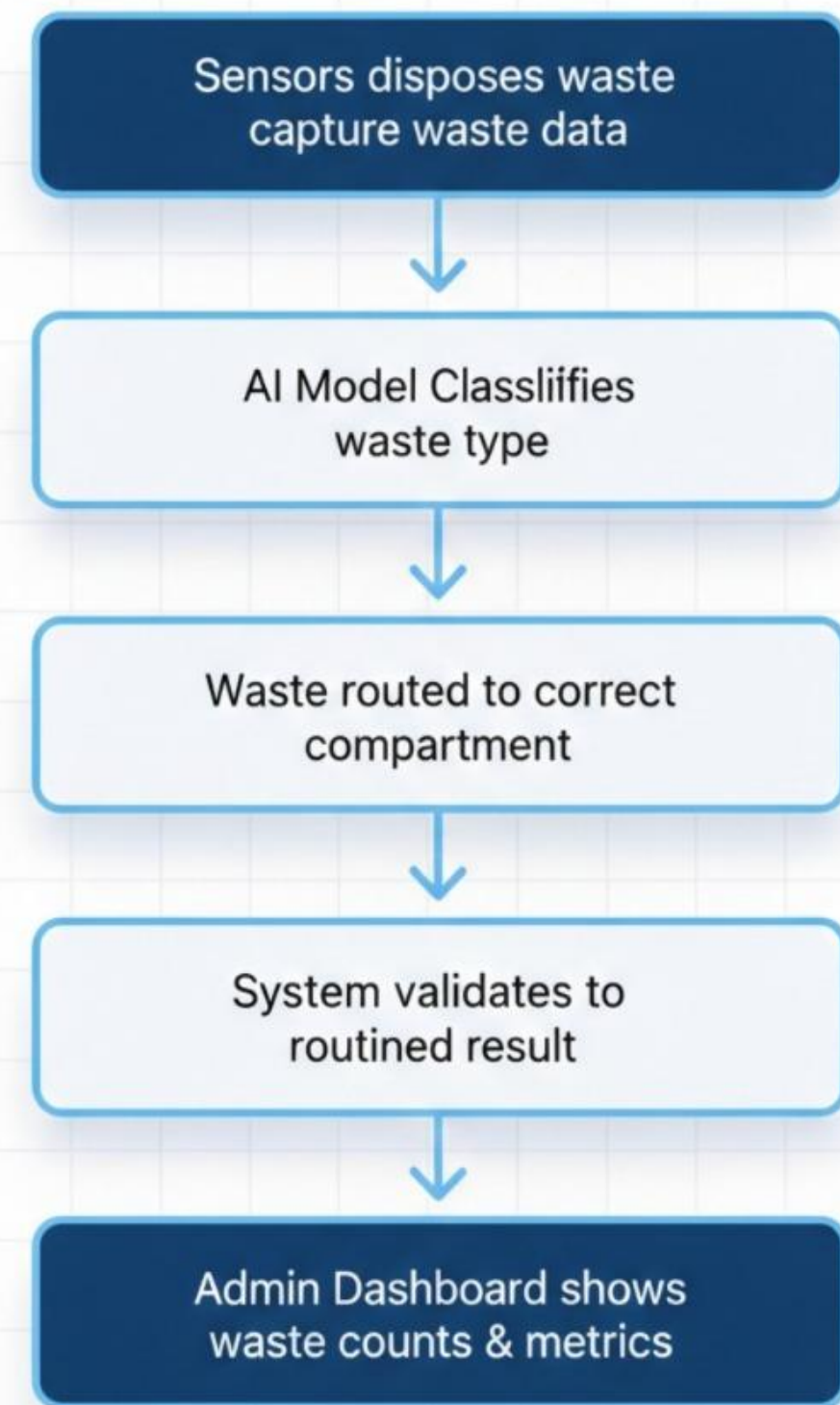
Solution Summary

- We propose an AI-enabled smart waste segregation system that uses camera and sensor inputs to automatically classify waste in real time. The system validates segregation accuracy through a fully automated feedback mechanism and provides live performance monitoring via a dashboard, without requiring any user interaction.

- This solution addresses inefficiencies in manual waste segregation by delivering a working, real-time prototype that improves classification accuracy, ensures reliability during operation, and supports scalable deployment through data-driven monitoring and documentation.

TECHNICAL WORKFLOW

The user disposes waste into a **compact smart dustbin** without any additional interaction.

- A **camera and basic sensors** inside the dustbin capture waste data at the time of disposal.
- An **AI-based image recognition model** processes the captured image and **classifies the waste in real time**.
- Based on the classification result, the system **routes the waste to the appropriate internal compartment** of the prototype.
- An **automated internal feedback mechanism** validates whether the waste has reached the correct compartment. This process is **fully system-driven** and does not involve the user.
- Classification and validation data are **logged and transmitted** to a centralized system.
- An **admin-accessible dashboard** displays **category-wise waste counts, system accuracy, and performance metrics**, enabling remote monitoring.
- Complete **documentation** is provided for evaluation and future scalability.

Sensors disposes waste capture waste data

↓

AI Model Classlifies waste type

↓

Waste routed to correct compartment

↓

System validates to routined result

↓

Admin Dashboard shows waste counts & metrics

FEATURES & TECH STACK

Features

- **Real-Time Waste Classification** using camera and AI
- **Automated Internal Segregation** into correct compartments
- **System-Driven Feedback Validation** (no user interaction)
- **Admin Dashboard Monitoring** for performance and waste data

Tech Stack

Front-End: HTML, CSS, JavaScript (Dashboard)
Back-End: Python, Flask
AI Layer: Python, OpenCV / TensorFlow
Database: SQLite / Firebase
Hardware: Camera, ESP32 , Sensors, MotorS
Hosting: Local server / Cloud (demo)

Novelty and USPs

Novelty

- A **compact, dustbin-sized smart waste segregation prototype** that performs **real-time classification and validation** at the point of disposal.
- Unlike existing solutions that rely on **manual sorting or user input**, the system uses a **fully automated internal feedback mechanism** to verify segregation accuracy.
- Combines **AI-based image recognition with system-driven validation and admin-level monitoring**, making it suitable as a **practical proof-of-concept** for real-world deployment.

USPs (Unique Selling Points)

- **No user interaction required** – users simply dispose waste normally.
- **Automated feedback validation** improves reliability without human involvement.
- **Real-time operation** within a compact, single-unit dustbin.
- **Admin dashboard monitoring** enables remote supervision and performance tracking.
- **Scalable design** – multiple units can be monitored through the same dashboard.

SDGs

SDG 3: Good Health and Well-Being

- Ensures the safety of sanitation workers by reducing exposure to hazardous waste
- Minimizes public health risks caused by improper waste handling
- Promotes a cleaner and healthier living environment

SDG 11: Sustainable Cities and Communities

- Supports the development of cleaner and more efficient waste management systems
- Improves waste handling infrastructure in both urban and rural areas
- Contributes to sustainable and livable communities

SDG 12: Responsible Consumption and Production

- Improves waste segregation accuracy
- Increases recycling rates
- Encourages a circular economy through responsible waste management

THANK YOU

By combining intelligent sensors with visual AI, we are not just sorting waste — **we are building a safer, cleaner, and more sustainable future for India.**