

Smart Bin 2.0: AI-Driven Waste Sorting

for a Greener Future!

ECO-SORT

TEAM : JUST 4 FUN

PROBLEM STATEMENT

Globally, over 91% of plastic waste is not recycled, primarily due to misclassification and contamination in waste streams (UNEP, 2022). Inefficient sorting contributes to millions of tons of waste ending up in landfills or oceans, worsening environmental pollution and increasing processing costs. Traditional recycling methods rely heavily on manual sorting, which is labor-intensive, error-prone, and costly.

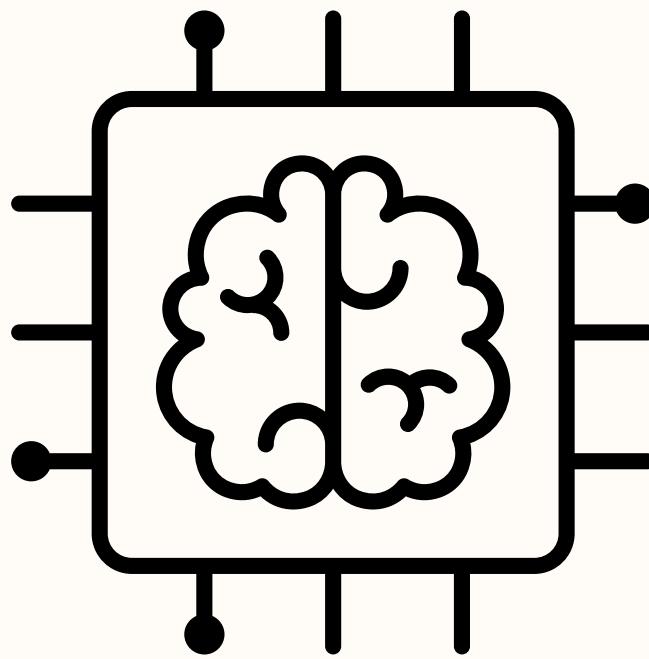
Our AI-powered waste sorting system combines deep learning and computer vision to automate classification, while our app motivates citizens to sort waste correctly, enhancing recycling efficiency and sustainability.

OUR SOLUTION:



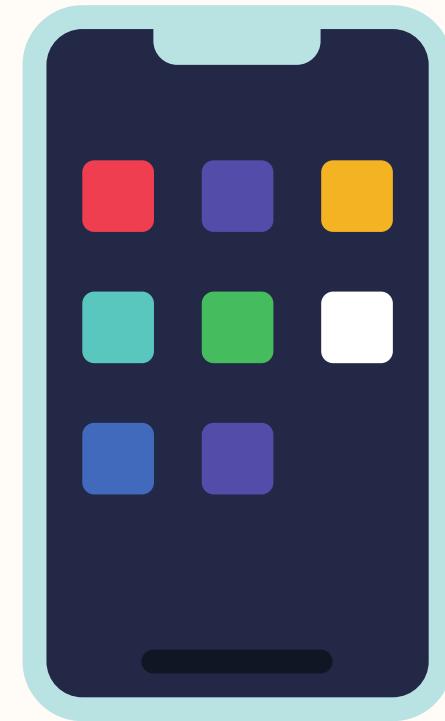
Smart Bin

- Camera to scan items



Deep Learning Model

- Identify the items and categorize



App

- Reward users based on their waste sorting

THE MODEL

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- MobileNetV2 is a pre-trained model for image classification.
- We fine-tuned MobileNetV2 to classify garbage types.
- Convolutional Neural Networks (CNNs) for feature extraction.

WHY MOBILENETV2?

- **Pre-trained Model:** Pre-trained on ImageNet, enabling the model to understand low-level features like textures, edges, and shapes.
- **Efficiency:** Lightweight and optimized for mobile devices.
- **Transfer Learning:** We used MobileNetV2 for feature extraction and trained only the last layers, reducing time and computational costs.

DEEP LEARNING TOPICS INCLUDED:

CONVOLUTIONAL NEURAL NETWORKS

Using **CNNs** to extract **spatial features** from images is a fundamental **deep learning technique** for image classification.

TRANSFER LEARNING:

Leveraging **pre-trained models** like **MobileNetV2** allows us to use advanced deep learning without needing massive amounts of labeled data.

OPTIMIZERS AND LOSS FUNCTIONS

Used the **Adam optimizer** to adjust our model's learning in the most efficient way possible, and to guide the model in correctly identifying **multiple categories** like plastic, metal, or paper.

DATA AUGMENTATION

Ensures that the **model generalizes** better by **learning** from a diverse set of **image variations**.

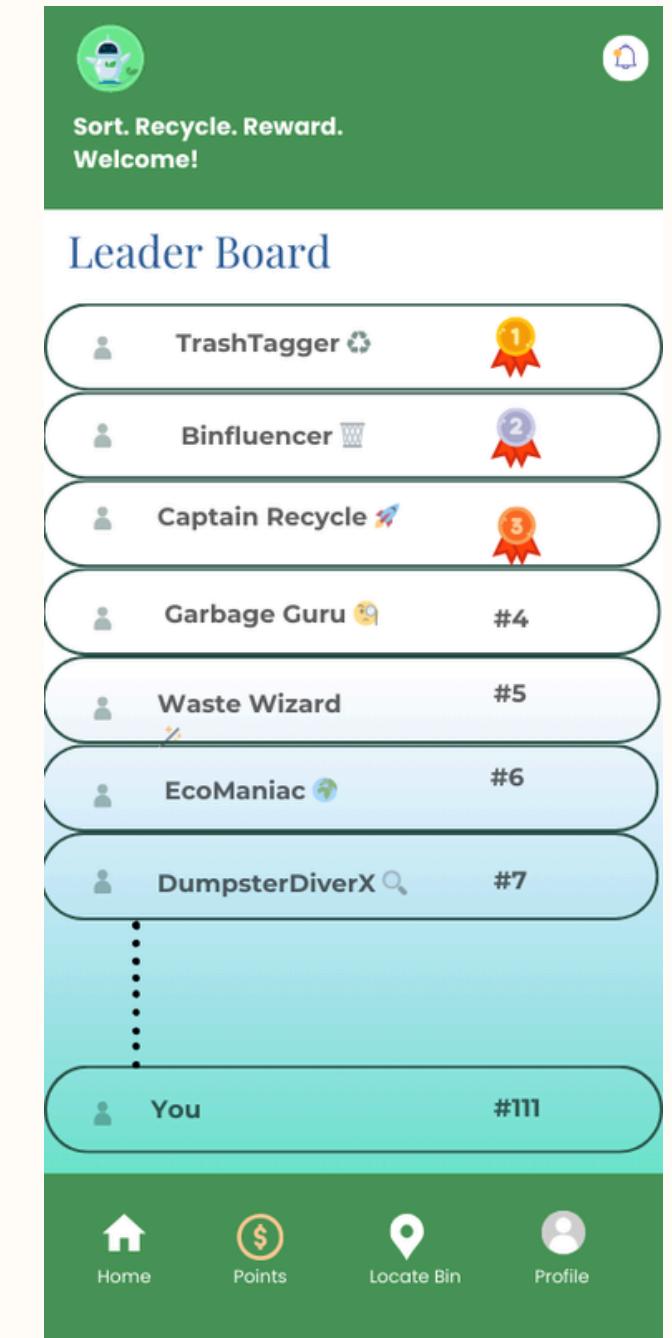
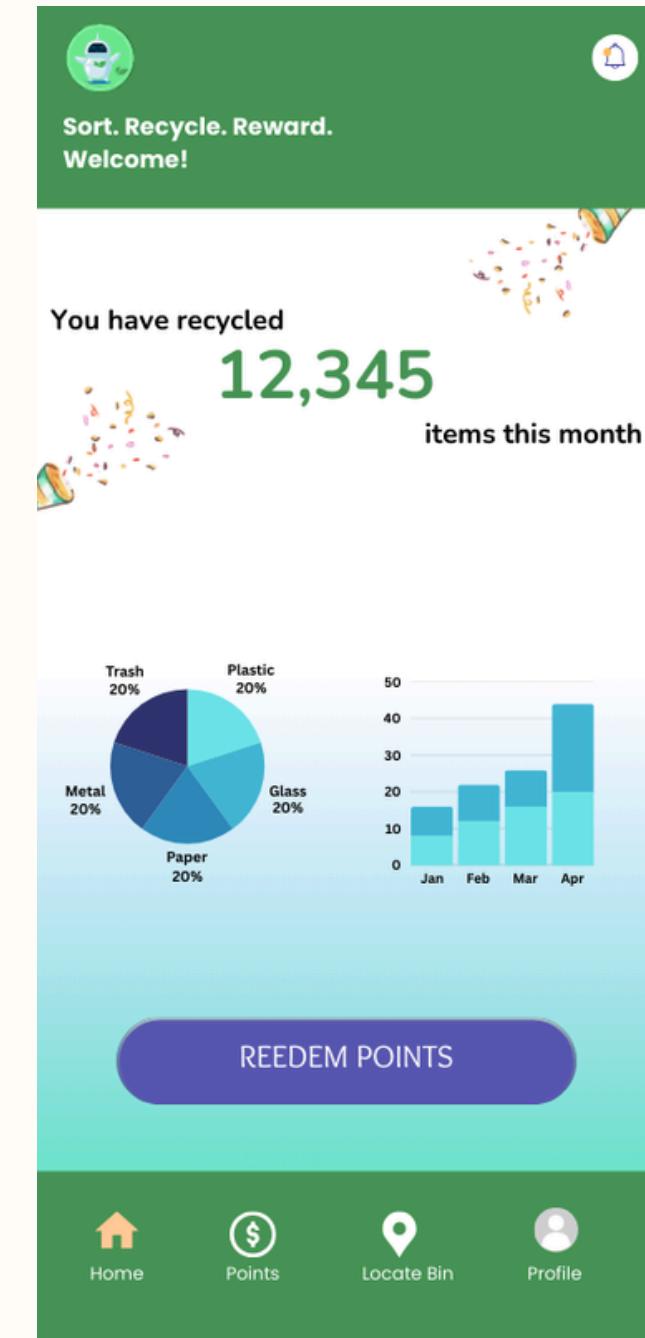
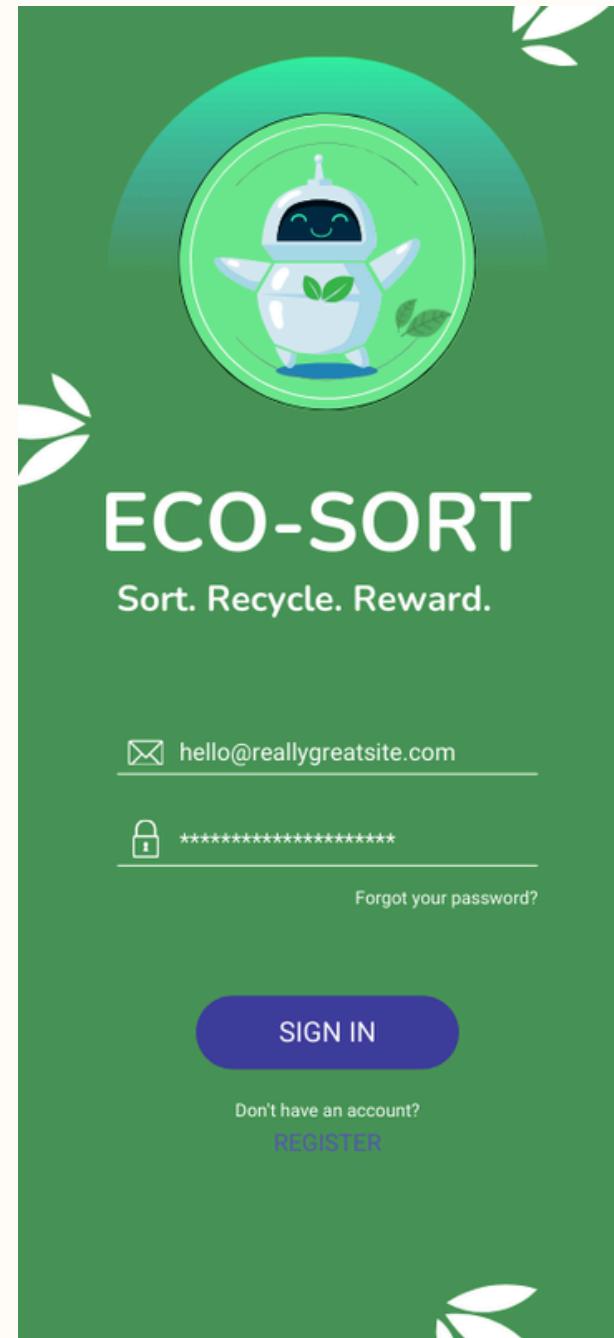
MODEL EVALUATION

Continuous evaluation through early stopping and validation helps in improving the **model's robustness**.

THE APP: ECO-SORT

MAIN FEATURES

- Receive **reward points** if sorted correctly.
 - 10 points for each
- **Deduct** points if not sorted correctly
 - -5 points for each wrong item sorted.



EXISTING SOLUTIONS

01

ZENROBOTICS

AI-Powered **Large-Scale** Waste Sorting with Robotic Arms

02

ENEVO

Enevo uses IoT sensors to track waste levels for efficient garbage collection.

03

WASTENETS

A **computer vision model** for trash classification, mainly used in research and AI testing.

WHY WE ARE BETTER?

- Sorts waste **at the source**, minimizing contamination before recycling.
 - Affordable, **compact AI-powered** Smart Bin for homes and public spaces.
 - Encourages proper waste disposal by **rewarding users**.
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- **AI vision-powered** sorting ensures accurate waste disposal.
 - **Rewards system** promotes better waste habits.
 - Can be combined with IoT for smarter waste management beyond just tracking bin levels.
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- AI-powered bin with real-time waste classification.
 - **Gamifies recycling** with points and rewards.
 - Deployable in real environments, not just labs.

RELEVENCE: WHY OUR SOLUTION MATTERS NOW

Over 2 billion tons of waste are generated annually, with only **9%** of plastics being recycled. Our **AI-driven sorting** increases recycling efficiency and reduces landfill overflow.

GLOBAL WASTE CRISIS

Governments and businesses prioritize sustainability. Our tech fits into **urban planning**, **corporate ESG initiatives**, and **zero-waste goals**..

GROWING SMART CITIES MOVEMENT

People often lack motivation to recycle correctly. Our **reward-based** system incentivizes responsible waste disposal and **long-term habit** formation.

BEHAVIORAL CHANGE THROUGH GAMIFICATION

Traditional recycling depends on human sorting, leading to contamination and wasted resources. Our solution automates and **optimizes** the process.

INEFFICIENT WASTE MANAGEMENT

Mismanaged waste leads to pollution, climate change, and ecosystem damage. Our system ensures **proper disposal** at the source, preventing harm.

ENVIRONMENTAL URGENCY

SCALABILITY

How Our Solution Grows:



From Small to Large-Scale Deployment

- Start with universities, malls, and offices.
- Expand to city-wide public bins and transport hubs.
- Partner with waste authorities & corporations for large-scale adoption.



Tech-Driven Growth

- **Scalable AI:** Can be retrained for different waste categories per country or region.
- **Cloud-Based & IoT-Enabled:** Easy updates, no massive infrastructure changes.
- **Modular Design:** New bins can be added seamlessly to the network.

FEASIBILITY



Technological

- Models like MobileNetV2 can be quickly deployed and fine-tuned.



Financial

- Potential cost savings in waste management and processing due to automated sorting.



Environmental

- Reduces waste contamination, increasing recycling efficiency and material recovery



IMPACT OF OUR SOLUTION:

Real Impact, Real Rewards

With AI ensuring perfect sorting, recyclables actually get recycled, **reducing landfill overflow** and building a **circular economy**.

Smarter Cities, Greener Future

By integrating real-time waste tracking, we help communities reduce unnecessary pickups, cutting **carbon emissions** and **traffic congestions**.

Less Waste, More Sustainability

With AI ensuring perfect sorting, recyclables actually get recycled, **reducing landfill overflow** and building a **circular economy**.

The Future of Waste is Here

No other solution combines **AI vision**, **real-time sorting**, and **user engagement** like we do. We're not just fixing waste management, we're redefining it.

REFERENCE

- Mostafa Mohamed. (2021). Garbage Classification (keras + Transfer Learning) Kaggle. <https://www.kaggle.com/code/mostafaabla/garbage-classification-keras-transfer-learning/notebook#End-Note>