**Idea proposal Submission**

Real-Time Recycling Sorting Using Deep Learning

Group no: Group 8

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**1. Project Idea**

The goal of this project is to develop an automated system that uses deep learning-based computer vision to classify and sort recyclable materials (e.g., plastic, paper, metal, glass) in real time. Manual sorting methods are slow, labor-intensive, and prone to errors, leading to inefficient recycling. This AI-powered system will improve sorting accuracy, reduce contamination, and enhance recycling efficiency.

**2. Relevance to Sustainable Development Goals (SDGs)**

This project aligns with:

Primary Alignment:

* SDG 12 (Responsible Consumption and Production): Promotes sustainable waste management by increasing recycling rates.

Secondary Alignment:

* SDG 13 (Climate Action): Reduces landfill waste and associated greenhouse gas emissions.
* SDG 11 (Sustainable Cities and Communities): Reduce the environmental impact of cities; Promotes cleaner cities by reducing improper waste disposal.

**3. Literature Examples**

1. "[Real-Time Household Waste Detection and Classification Using Deep Learning](https://www.mdpi.com/2071-1050/17/5/1902)" (2023) – Uses the YOLOv8 model to sort household waste into 17 categories. Designed for smart bins and robotic waste sorting

2. **"**[Real-Time Recycling Material Detection with CNN**s**](https://www.mdpi.com/2313-4321/7/1/9)" (2022) **–** A CNN-based system that sorts paper, plastic, metal, and carton on a conveyor belt

**4. Data Description**

* Dataset: Publicly available datasets (e.g., [TrashNet](https://www.kaggle.com/datasets/feyzazkefe/trashnet), [Kaggle Waste Images](https://www.kaggle.com/datasets/techsash/waste-classification-data)) containing labeled images of recyclable materials.
* Data Format: JPEG/PNG images (224x224 pixels for model input).
* Data Size: ~10,000 images across multiple waste categories.
* Preprocessing: Image resizing, normalization, and augmentation (rotation, flipping) to enhance model robustness.

**5. Approach (Deep Learning)**

* Model: A Convolutional Neural Network (CNN) will be trained for image classification, with potential fine-tuning using transfer learning (e.g., ResNet, EfficientNet).
* Justification: CNNs are highly effective for image recognition tasks, and deep learning allows for high accuracy in complex sorting scenarios.
* Deployment: The system will be optimized for real-time performance, enabling integration with conveyor belts or smart bins in recycling facilities.

Expected Outcomes:

* Improved Sorting Accuracy: Target ≥90% classification precision.
* Cost Efficiency: Reduces reliance on manual labor, lowering operational costs.
* Scalability: Can be adapted for use in municipal recycling programs worldwide.