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Smart Waste Segregation System

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Abstract - An efficient waste management system relies on how good the waste segregation system is that can separate the waste into different types, biodegradable and non-biodegradable waste, for better treatment.
If the biodegradable and non-biodegradable waste is segregated at the source, then the biodegradable waste can be sent to the compost plants for converting the biodegradable waste into organic compost that can be used in agriculture and other applications.
But most of the time the waste is in mixed form at the source itself which leads to inefficient disposal. Although, not all the waste can be treated and will require a resting place in form of an engineered landfill, but at-least for the waste that can be treated, it should be segregated properly at the source.

***Key Words*:** biodegradable, non-biodegradable, waste ,segregation

1.INTRODUCTION

The rapid growth of urbanization and industrialization has led to a significant increase in the generation of solid waste. Improper waste management and lack of effective segregation techniques have become major environmental and social concerns in many developing countries. Traditional waste segregation methods rely heavily on manual labor, which is not only inefficient but also exposes workers to various health risks. To overcome these challenges, the adoption of smart and automated waste segregation systems has become a necessity.

This intelligent system not only reduces human intervention but also enhances recycling efficiency and supports the goals of sustainable waste management and smart city development. The implementation of such technology-driven solutions can significantly improve urban cleanliness, promote environmental protection, and create a foundation for efficient resource utilization.

2. Body of Paper

To solve the above problem, we have been working on one of the solutions in the form of a working project. The basic outline of the project is discussed in brief below:

There are 4 main parts in this project:
Image Acquisition: captures image, pre-processes it and make corrections if required.
Model Inference: takes pre-processed images as input, performs inference using the trained ML model and provides the inferred output results.
Communication Module: sends the inferred results to the embedded system module for appropriate bin lid controls based on the results inferred using the machine learning model.
Control Module: controls the directed bin lid motor for a preset amount of time and sends back the acknowledgement response to the communication module.

How we built it

We divided the project into 4 modules and worked on that and then combined them at the end.

Fig -1: Figure

3. CONCLUSIONS

This technology-driven solution minimizes human intervention, reduces health risks, and promotes recycling and environmental sustainability. The system contributes significantly toward achieving **smart city** objectives and supports the **Sustainable Development Goals (SDGs)** related to clean cities and responsible consumption. Future enhancements may include expanding the dataset for better model accuracy, integrating robotic arms for automatic sorting, and developing a mobile application for user interaction and monitoring.

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