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## WASTE SEGREGATION USING ARDUINO AND MACHINE LEARNING

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### Abstract

This project presents an automated waste segregation system that integrates Arduino technology with machine learning for classifying waste into three categories: metal, plastic, and glass. The system uses inductive sensors, ultrasonic sensors, and a camera module for detection and classification. Metallic objects are identified using the inductive sensor, while non-metallic items are analyzed through image processing and classified using a trained machine learning model. The Arduino microcontroller controls servo motors to sort the items into the appropriate bins. This combination of automation and artificial intelligence improves waste segregation accuracy, reduces manual labor, and promotes sustainable recycling practices.

### Introduction

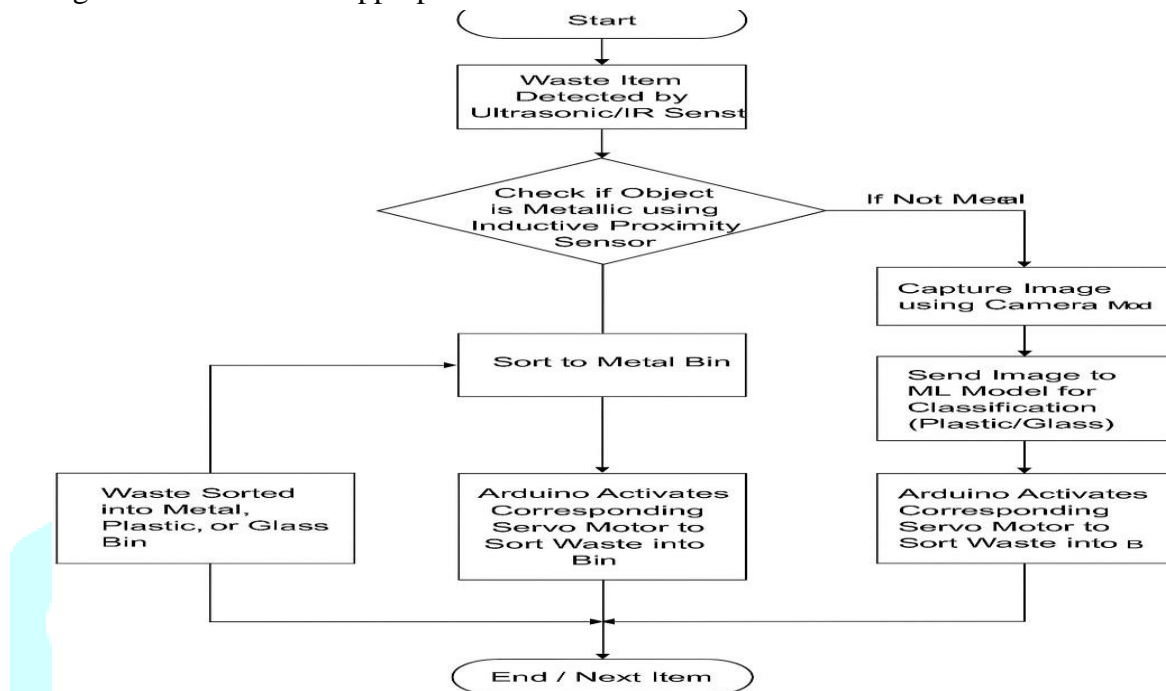
Waste management has become a pressing issue due to rapid industrialization and urban growth. Improper disposal and lack of segregation lead to environmental degradation and health hazards. Conventional waste sorting methods are labor-intensive and prone to error. This project proposes an intelligent, cost-effective system that automates segregation using Arduino for sensor control and machine learning for visual classification. The system focuses on efficiently sorting commonly recyclable materials such as metal, plastic, and glass.

### Literature Review

Several researchers have proposed automation in waste segregation using sensors and IoT. Suryawanshi and Patil (2016) developed a sensor-based segregator for metallic and non-metallic waste. Kodali and Archana (2017) emphasized IoT integration for smart waste monitoring. Sneha S. and Nair (2018) explored image processing for waste classification, while Rad et al. (2021) applied deep learning for intelligent sorting. These studies demonstrate progress but often rely on costly hardware. This project bridges that gap by combining affordable components with AI capability.

## Methodology

The system follows a sequential detection and sorting process. Initially, an ultrasonic sensor detects the presence of an object. An inductive proximity sensor checks for metal; if detected, the Arduino directs it to the metal bin. If not metal, a camera captures the image of the waste and sends it to a trained machine learning model for classification as plastic or glass. The result is sent back to Arduino, which activates servo motors to guide the item to the appropriate bin.



## Model



## Working

The waste item is first sensed by the ultrasonic sensor, triggering the Arduino to begin processing. The inductive sensor determines if it is metallic. Metallic objects are immediately sorted into their designated

bin. Non-metallic items are processed through the camera and classified by the machine learning model. The servo motor mechanism then directs the object to the respective bin. This automated process ensures efficient, reliable, and hygienic segregation.

## Conclusion

The proposed Arduino and machine learning-based waste segregation system offers a practical and scalable solution to the challenges of manual sorting. It improves classification accuracy and operational efficiency while reducing human exposure to waste. Future enhancements may include IoT connectivity and expansion to additional waste categories such as paper or organic materials.

## References

- [1] N. K. Suryawanshi and P. M. Patil, IJIREEICE, 2016.
- [2] R. K. Kodali and T. S. Archana, IEEE TENSYP, 2017.
- [3] Sneha S. and V. Nair, ICEECCOT, 2018.
- [4] A. Rad et al., Journal of Environmental Informatics Letters, 2021.
- [5] S. Mittal and A. Sharma, IJCA, 2019.

