EcoSort: A Mobile Application for Accurate Waste Segregation Using Image Recognition Technology

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1 Background of the Study

Waste management has been acknowledged since ancient times, as demonstrated by early cities like Rome and Athens. Nevertheless, this mainly focus in only removing the waste rather than recycling or segregation. With time, especially during industrialization and city growth processes, there was an increase in quantities of wastes leading to more systematic waste management approaches. It was only the end of the 20th century that waste categorization emphasizing on biodegradable, non-biodegradable, and recyclable materials became importance hence transitioning towards a recycling and usability in modern waste management systems.

In today's world, waste management has become a critical global issue due to rapid increase in urbanization, industrialization, and population growth. Especially in the Philippines, where it has been reported to increase more than 59.24 thousand tons per day. in 2022. Poor waste segregation, on one hand, contributes much to environmental degradation through soil and marine pollution. Various policies have been implemented to encourage proper waste disposal. However, public awareness and participation in proper segregation practices are still at a minimal rate.

Since mobile phone technology is increasingly becoming parts of people's live, it can provide a way to address such practical issues like waste management. This research proposes that a mobile application which will use an image recognition for sorting waste into biodegradable, non-biodegradable, and recyclable should be developed to help improve waste segregation practices. Through technology usage, this research aims to encourage people to properly segregate there waste and create an environmentally conscious behaviors.

Previous studies have explored various waste management approaches such as manual classification, recycling programs, and automated sorting systems. Most of the existing research on mobile applications used for real-time waste classification through image recognition is minimal. However, research by Papageorgiou et al. (2021) have carried out significant study which investigated the possibility to classify solid waste materials by use of mobile pictures through deep learning. In another study conducted by Li et al(2024), it has been indicated that effective user experience and interaction design in mobile application may help enhance user engagement and influence behavior change positively. For this reason, there is still no comprehensive waste classification system in combination with the capability of real-time image recognition focusing largely on mobile devices. This study aims to address this gap by developing an educational and practical mobile application for daily waste segregation purposes.

2   Statement of the Study

3 Objective of the Study

3.1 General Objective

The primary purpose of this Study is to develop a mobile application that will assist users in accurately classifies waste materials into biodegradable, non-biodegradable, and recyclable using an image recognition technology.

3.2 Specific Objective

- To develop an image recognition model, utilizing Google's AI training platform to accurately classifies waste items into biodegradable, non-biodegradable, or recyclable classes by training the model with uploaded images of various waste materials.

- To design a user-friendly mobile application interface using Android Studio, which will simplifies the process of identifying and categorizing of waste items.

- To evaluate the performance and accuracy of the trained model under various real-world conditions such as lightning and background interference.

- To assess the app's impact on users' environmental awareness and waste segregation behavior through feedback and usability testing.

- To provide a foundational study that can serve as a guide or inspiration for future developers working on related projects, such as automated waste sorting machines or other waste management innovations.

4 Significance

The programmed system holds significant potential as it seeks to address real-world environmental challenges through technological innovation. The development of a system capable to categorizing waste as biodegradable, non-biodegradable and recyclable will be instrumental in enhancing of sorting practices, thereby contributing to effective waste segregation. The following outlines the benefits of the system to various groups.

- **To students**: The system will enrich students' learning experiences in waste management, aiding their understanding of waste segregation and fostering greater environmental awareness.

- **To educators**: This tool will serve as a valuable resource for teachers, particularly those instructing in environmental science or related subjects. It can be integrated into teaching strategies to enhance engagement and effectively promote proper waste segregation practices.

- **To individuals**: The system will increase individual awareness regarding waste segregation, encouraging healthy environmental practices beginning at home, which can have a positive ripple effect on communities.

- **To environmentalists**: This system will support environmental advocates in promoting initiatives related to proper waste management, providing a practical tool for awareness campaigns.

- **To waste management professionals**: The system will aid in the sorting and collection of waste, improving recycling processes in facilities, and ensuring the proper handling of waste disposal.

- **To government authorities**: The system will be valuable for government efforts to promote waste sorting, enhancing waste management and recycling programs within communities.

- **To future researchers**: This system may inspire future researchers to build upon this work, developing new technological solutions that contribute to environmental sustainability.

5   Scope and Delimitation

The research aims to develop and evaluate a mobile application designed to assist users in waste segregation by recognizing and categorizing waste as recyclable, biodegradable, or non-biodegradable. The app will utilize image recognition technology alongside a comprehensive database of waste items to ensure accurate classification. Additionally, the study will assess the effectiveness of the user interface in guiding users, enhancing environmental awareness through educational content.

The scope of this study is limited to the Philippines or to other aspects of waste segregation. The research will not address other facets of environmental sustainability outside of waste management. Limitations of the study include the potential for misclassification due to the inherent challenges of image recognition technology. Furthermore, the app's effectiveness may be constrained by the initial comprehensiveness of its database, which may not cover all waste items users might encounter.