ABSTRACT

Waste management in Indonesia faces significant challenges, marked by a waste volume of 68.7 million tons in 2022, according to data from the Ministry of Environment and Forestry. Organic waste, particularly food waste, is the largest component of this waste and is one of the main contributors to greenhouse gas emissions. The lack of waste sorting at the household level, coupled with limited supporting infrastructure, results in an inefficient waste management process, thereby impacting public health and environmental quality.

Based on observations and interviews with Bank Sampah Bersinar in Bandung, several operational challenges were identified, including the absence of a digital system for data recording, inconsistent pickup schedules across branches, and limited information on active branch locations. To address these issues, a mobile-based waste management application was designed with machine learning technology integration. The application is designed to detect waste types using the YOLOv8 model and identify products through object detection and barcode decoding.

The Resik application was tested using the black box method to ensure its functionality, as well as through the distribution of questionnaires. The questionnaire results showed that the application received positive responses from users, with a Perceived Usefulness score of 86.03%, Perceived Ease of Use of 85.04%, and Behavioral Intention to Use of 86.01%. Additionally, application performance testing using the GET, POST, and PATCH methods showed that the POST method had a relatively higher response time compared to the others, around 2000-2100 ms, while other endpoints had response times below 600 ms. Testing on the device model showed CPU usage of 21% and a frame rate per second (FPS) of 55.25 fps. In machine learning model testing on the dataset, the Random Forest model achieved an F1-score above 97% with precision and recall reaching 98% on thousands of data points. Meanwhile, the barcode decoder demonstrated excellent detection performance with a success rate of 93% out of a total of 60 tests under various lighting and tilt conditions, with optimal conditions yielding an average detection time of 63.98 ms. In machine learning object detection model testing, the model was able to detect with an average speed of 219.5 ms and an mAP@50 score of 0.995, recall of 0.999, and precision of 0.996.

Keywords: barcode, detection, mobile, waste, YOLOv8.