Abstrak

Background: Efficient and inclusive waste management is a fundamental component of modern smart city initiatives. Existing IoT-based mobile application systems for waste management frequently lack accessible interfaces, creating barriers particularly for elderly users and individuals with limited digital literacy. Objective: This research aims to design and implement a mobile application for waste collection integrated with a text-based AI Chatbot and a Voice Assistant powered by Large Language Model (LLM) technology, targeting elderly users and those with low digital literacy as primary beneficiaries. Methods: The system was developed using the Flutter framework following a Software Development Life Cycle (SDLC) approach. The AI Chatbot and Voice Assistant were integrated via a RESTful backend API. Functional verification used black-box testing across five core modules, and performance evaluation measured response latency across 30 automated trials per modality. Results: All core modules passed functional testing. The text-based Chatbot achieved an average response latency of 1.45 seconds, while the Voice Assistant recorded an average of 7.72 seconds due to sequential Speech-to-Text (STT) and Text-to-Speech (TTS) processing layers. Conclusion: This multimodal AI integration successfully bridges operational logistics with an inclusive interface for smart city waste management, demonstrating that AI can significantly reduce procedural barriers and improve accessibility for diverse demographic groups.

Keywords: AI Chatbot; Mobile Application; Smart City; Voice Assistant; Waste Management