

ABSTRACT

Urban waste management demands efficient systems to optimize collection and reduce environmental impact. This project introduces TrashTrack, an IoT-based smart waste monitoring application that enables real-time tracking and route optimization. The system integrates ultrasonic, infrared, and GPS sensors on trash bins, with data transmitted via an ESP32 microcontroller and stored in Firebase. Developed using Kotlin and Jetpack Compose, the application employs a modified greedy algorithm that considers not only bin distances but also vehicle capacity and bin fill levels. Full bins are prioritized for collection. The implementation enhances operational efficiency by providing real-time bin status and supporting data-driven route planning. Usability testing involving 69 respondents yielded high performance metrics: 92.37% effectiveness, 92.29% usefulness, and 89.92% satisfaction.

Keywords: IoT, Waste Management, Greedy Algorithm, Route Optimization, Real-time Monitoring