DEVELOPMENT SMART TRASH CAN FOR RESIDENT USING IOT

(Development Smart Trash Can for Resident Using IoT)

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Abstract

The rapid urbanization and population growth have intensified the challenges of waste management, resulting in overflowing trash bins, inefficient collection schedules, and increased environmental pollution. Traditional waste management methods lack real-time monitoring and responsiveness, leading to suboptimal resource utilization and negative impacts on urban cleanliness and sustainability. This project proposes the development of a Smart Trash Can system for residential use, leveraging Internet of Things (IoT) technology to enable real-time monitoring and management of waste levels.

The system utilizes four HC-SR04 ultrasonic sensors strategically placed around the trash bin to provide accurate, multi-directional fill-level detection. An ESP32 microcontroller collects and processes sensor data, transmitting it via Wi-Fi to a backend server implemented with PHP and MySQL. The web-based dashboard offers real-time visualization, historical data analysis, and alert notifications, allowing users and waste management operators to monitor bin statuses effectively.

A quantitative research methodology was employed, including system design, implementation, and testing in a simulated residential environment. Results demonstrate an average sensor accuracy of 93.8%, system latency of approximately 1.6 seconds, and overall uptime of 98.5%. The system successfully triggers alerts when fill levels reach critical thresholds, contributing to efficient waste collection scheduling and reduction of overflow incidents.

The project highlights the feasibility of an affordable, scalable smart waste monitoring solution that improves environmental sustainability and urban hygiene. Recommendations for future work include expanding to multi-bin networks, incorporating alternative communication technologies, and developing mobile app integrations to enhance user accessibility and system robustness.

Keywords: *Smart Trash Can, Internet of Things (IoT), Waste Management, Ultrasonic Sensor, ESP32, Real-Time Monitoring.*