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An IoT-Based Smart Garbage Monitoring System for Solid Waste Management in Urban Environments

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Abstract: *Rapid urbanization and high housing demands have led to significant challenges in municipal solid waste management, resulting in overflowing public dustbins, environmental pollution, and heightened health risks from vector-borne diseases. This paper presents an automated, Internet of Things (IoT)-based* ***Garbage Monitoring System*** *designed to replace traditional static waste collection bins with intelligent, real-time tracking nodes. Built upon the open-source* ***ESP8266 NodeMCU*** *microcontroller framework, the system incorporates an* ***HC-SR04 ultrasonic sensor*** *mounted beneath the bin lid to measure garbage volume percentages continuously. When the waste depth crosses a predefined threshold, telemetry data is localized on a 16x2 character Liquid Crystal Display (LCD) and transmitted via HTTP POST requests over Wi-Fi to a remote web server. Prototype testing validates the system's capacity to optimize collection routes, reduce human resource overhead, and prevent roadside accumulation, directly contributing to "Smart Cities" initiatives and public health frameworks.*

Keywords: *Rapid urbanization*

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