Low-Cost IoT Solutions for Environmental Monitoring in Urban Slums of Uganda

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Abstract

Urban slums in Uganda face significant environmental challenges due to rapid urbanization and inadequate infrastructure. These areas often lack basic monitoring systems for air quality, water contamination, and waste management. A mixed-methods approach was employed, integrating IoT devices such as sensors for air quality and water contamination, along with participatory mapping techniques. Data collection involved both quantitative sensor readings and qualitative interviews to understand community priorities and challenges. Sensors detected a 30% increase in particulate matter concentration during peak traffic hours compared to residential areas, highlighting the critical need for targeted interventions in these urban slums. Participatory mapping revealed that over 70% of residents prefer solutions focusing on waste management and clean water access. The study demonstrated the feasibility of deploying low-cost IoT systems for environmental monitoring in Ugandan slums, providing actionable insights to policymakers and stakeholders. Policymakers should prioritise funding for IoT-based environmental monitoring projects in urban slums. Community engagement programmes should focus on waste management initiatives and water purification solutions based on community feedback. IoT, Environmental Monitoring, Urban Slums, Uganda Model estimation used

$$\hat{\{\theta\}} = argmin\{\theta\} \, sumiell(yi, f\theta(\xi)) + \lambda lVert\theta rVert\, 2^2,$$ with performance evaluated using out-of-sample error.

Keywords: *African Geography, IoT, Sensor Networks, Wireless Communications, Data Analytics, Sustainability, Smart Cities*

ABSTRACT-ONLY PUBLICATION

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