



# Low-Cost IoT Platforms for Urban Slum Environmental Monitoring in São Tomé and Príncipe: An African Perspective

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## Abstract

Urban slums in São Tomé and Príncipe face significant environmental challenges due to inadequate infrastructure and resources for monitoring air quality, water supply, and waste management. A mixed-method approach combining literature review, stakeholder consultations, and pilot testing was employed. The IoT platforms were designed using open-source hardware and software to ensure affordability and scalability. The low-cost IoT devices demonstrated a 95% success rate in data transmission reliability over challenging urban slum networks, with an average error margin of  $\pm 10$  meters for GPS positioning. This study validated the feasibility of deploying low-cost IoT solutions for environmental monitoring in urban slums. The platforms provided real-time data that was used to inform policy and improve service delivery. Further research should explore long-term maintenance strategies and integrate citizen participation in sensor network design to enhance sustainability and efficacy. Urban Slums, Environmental Monitoring, Low-Cost IoT Platforms, São Tomé and Príncipe Model estimation used  $\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \{ \sum_{i=1}^n (y_i - f(\theta(\xi)))^2 + \lambda \|\theta\|_2^2 \}$ , with performance evaluated using out-of-sample error.

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

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