



# Low-Cost IoT Solutions for Environmental Monitoring in Urban Slums of Senegal: A Comparative Study

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## Abstract

Urban slums in Senegal face significant environmental challenges such as air pollution and water contamination. Traditional monitoring solutions are often expensive and inaccessible to these communities. The study employed a mixed-methods approach combining IoT device deployment with qualitative interviews to assess the feasibility and impact of proposed solutions among target communities. A proportion (30%) of deployed IoT devices showed consistent performance in monitoring air quality, leading to immediate awareness among residents about pollution sources and health risks. Community feedback indicated a strong preference for low-cost, user-friendly solutions over expensive alternatives. The findings suggest that low-cost IoT solutions can effectively bridge the gap between environmental monitoring needs and community resources, particularly in resource-constrained urban settings like Senegal’s slums. Future research should focus on scaling up tested solutions with additional funding, while prioritising device durability and user training to maximise public health benefits. Model estimation used  $\hat{\theta} = \operatorname{argmin} \{ \theta \} \operatorname{sumiell} ( y_i, f\theta ( \xi ) ) + \lambda \operatorname{Vert} \theta \operatorname{Vert}^2$ , with performance evaluated using out-of-sample error.

**Keywords:** African Geography, IoT, Sensor Networks, Wireless Sensor Networks, Sustainability, Development Studies, Geographic Information Systems

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