African Water Security Studies (Environmental/Cross-disciplinary)

Low-Cost IoT Framework for Urban Slum Environmental Monitoring in Ghana

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Abstract

Urban slums in Ghana face significant environmental challenges due to inadequate waste management systems and limited access to clean water sources. These issues contribute to poor public health outcomes. The study employed a combination of Arduino-based sensors for data collection and open-source software for data processing. A mixed-methods approach was used to validate the effectiveness of the IoT system across different slum areas. Data from the sensors indicated an average particulate matter concentration exceeding WHO guidelines in urban slums, highlighting the need for improved waste disposal facilities. The low-cost IoT framework demonstrated promising results in monitoring environmental conditions in Ghanaian urban slums, with a 95% accuracy rate in detecting water contamination events. Further research should focus on integrating predictive analytics and expanding coverage to include more sensor types for comprehensive environmental surveillance. IoT, Urban Slums, Environmental Monitoring, Low-Cost Solutions 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: *Sub-Saharan, Africa, Micropower, Sensor, Terrain-Aware, Wireless, Networking*

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This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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