African Film Studies (Media/Arts)

Low-Cost IoT Solutions for Environmental Monitoring in Urban Slums: A Comparative Study in Libya

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Published: 27 February 2010 | **Received:** 13 December 2009 | **Accepted:** 31 January 2010

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DOI: 10.5281/zenodo.18910757

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Abstract

Low-cost Internet of Things (IoT) solutions are essential for monitoring environmental conditions in resource-constrained urban slums, such as those found in Libya. A comparative analysis was conducted using data from four different IoT systems deployed across two urban slums in Libya over a year. Each system used varying combinations of low-cost sensors (e.g., particulate matter sensors, pH meters) and wireless communication methods (e.g., LoRaWAN, cellular networks). The deployment of LoRaWAN technology proved particularly effective for monitoring air quality in one slum area with a mean sensor error rate under 5%. Low-cost IoT solutions can significantly enhance environmental monitoring capabilities in urban slums without requiring high initial investments, offering substantial benefits to communities and policymakers. Policymakers should prioritise funding for the deployment of LoRaWAN networks as a foundational infrastructure for future environmental monitoring efforts in similar settings. 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, urbanization, sensor networks, wireless communications, data analytics, resource allocation, smart grids*

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