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Development of Sensors and IoT Systems for Environmental Monitoring in Ugandan Mining Sites

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Abstract

Mining activities in Uganda have led to environmental degradation such as water pollution, soil contamination, and air quality issues. These problems necessitate real-time monitoring systems for sustainable management. A multi-step approach was employed, including the design and implementation of sensor modules for specific environmental parameters such as pH levels, temperature, humidity, and gas concentrations. IoT architecture integration allowed for real-time data transmission and analysis. The system demonstrated a precision error rate of less than 5% in monitoring air quality gases (e.g., sulfur dioxide) compared to reference instruments used during calibration. The developed sensor and IoT systems have shown potential for effective environmental monitoring in Ugandan mining sites, offering significant improvements over traditional manual monitoring methods. Further research should focus on integrating more advanced predictive analytics into the system to enhance early warning capabilities. Environmental Monitoring, Mining Sites, Sensors, Internet of Things (IoT), Precision Error Rate The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, Africa, SpatialDynamics, MicrobialMonitoring, WearableTechnology, GeospatialAnalysis, RemoteSensing*

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