



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

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## Abstract

Mining activities in Senegal are associated with significant environmental impacts such as air pollution, water contamination, and dust emissions, which pose health risks to workers and communities. The need for effective monitoring systems to mitigate these effects is paramount. The study employed a mixed-method approach combining laboratory testing with field trials to validate sensor performance and IoT system reliability. Data from these deployments were analysed using statistical models to assess environmental impact metrics over time. Sensor networks demonstrated consistent accuracy within  $\pm 5\%$  of reference standards for particulate matter (PM<sub>2.5</sub>) levels, indicating a reliable monitoring capability essential for compliance with local regulations. The developed IoT systems successfully integrated sensor data into a central platform that provided real-time alerts and historical trend analysis for environmental managers in mining sites. Recommendation to implement the proposed solutions in existing or new mining operations, along with ongoing system maintenance and regular calibration of sensors. Environmental Monitoring, Mining Sites, IoT Systems, Sensor Development, Senegal The maintenance outcome was modelled as  $Y = \beta_0 + \beta_1 X + u + \varepsilon$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** African, GIS, IoT, Sensor, Wireless, Network, Datafusion

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