Contribution ID: **31** Type: **not specified**

Cost-effective, High impact : the AI_r system for Air Quality Monitoring

Thursday 4 December 2025 10:40 (12 minutes)

Effective air quality monitoring is essential because it alerts communities when pollution levels are high, allowing people to take necessary precautions. Traditionally, reliable monitoring requires reference-grade stations, but these are expensive and limited—especially in low-resource settings. The South African Consortium for Air Quality Monitoring (SACAQM) developed the AI_R system, which integrates IoT technologies, cost-effective sensors, and artificial intelligence to provide real-time air quality data. The system is equipped with advanced technologies such as LTE and GPS connectivity and has been deployed across multiple indoor and outdoor locations in Gauteng Province, South Africa. Deployment takes place in government buildings, including clinics, hospitals, and community centres, and also extends to a growing citizen-science network where we collaborate directly with local communities. These cost-effective sensors generate rich spatial and temporal datasets and offer valuable insights, including the identification of highly polluted areas. They also show strong potential as practical alternatives to reference-grade monitoring stations. We applied forecasting models to data collected from the AI_R system to predict the next 24 hours of $PM_{2.5}$ concentrations. The combination of the AI_R system with predictive modelling provides an efficient early-warning tool for anticipating air quality conditions and supporting timely public health interventions.

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Session Classification: AI and air quality data analytics