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Purdue AirSense: An Open-source Air Quality Monitoring System

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ABSTRACT

Ambient air pollutants have received increasing attention in recent years since studies have demonstrated their adverse health effects. To address the sparsity of concentration data for major ambient air pollutants, researchers have introduced several new low-cost measurement methods. Despite these efforts, only a few gas concentration data and aerosol size distribution data are publicly accessible through online platforms. In this study, we used Alphasense sensors to build an innovative low-cost portable sensor system that measures the concentration of ozone, CO, NO_x, and coarse and fine particulate matter (PM). Alongside the portable sensor system, we assembled lab-grade analytical instruments in a central monitoring station to measure the background concentrations of ozone, CO, NO_x, and PM (coarse, fine, and ultrafine) in the West Lafayette region and to validate the sensor system measurements. Data from the low-cost sensor module were retrieved and published on a web platform that was built to present major ambient pollutant data in a user-friendly manner for classroom use. Particularly, the Alphasense OPC-N2 sensor captured temporal variations of coarse- and fine-particle concentrations. Thus, the low-cost module, if massively distributed, could be used to assess local exposures; the central monitoring station could capture regional concentration trends in the longer term. Furthermore, the web platform could educate the public on air quality monitoring and promote citizen science.

KEYWORDS

Ambient Air Quality Monitoring, Data Integration Platform, Big Data, Data Visualization, Low-cost Sensing