Air-quality Maps from Networked Sensors in the Kent County Region

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Networked low-cost sensors have the potential for continuous mapping of air quality over a wide geographical area. These sensors are useful for in-situ measurements with a high temporal and spatial resolution that may not be feasible with satellite observations or targeted (and stationary) high-precision air-quality systems. Low-cost sensors offer modest accuracy and precision compared to their high-precision trace gas instruments. However, these networks can augment the loss of data profiles over spatial and temporal scales due to low-cost and extremely low-form factors. In this project, we show integrated, synchronous, and simulations development of automated air-quality and metrological sensors that include particulate matter (PM 2.5, PM 10), wind speed, temperature, and humidity sensors. The proposed sensor network in this project will profile air quality in real-time, useful for continuous monitoring and flux studies. An array of sensors and PM monitors are integrated with custom hardware and software interfaces with Raspberry-Pi and Arduino microcontrollers. We show PM 2.5 and PM 10 concentrations that can be measured accurately with a commercial (Alphasense Inc. OPC-N3) particle monitor. The affecting meteorological factors are also measured with sensors, including wind speed, temperature, and humidity, along with geospatial coordination from a GPS logging module. We conducted stationary and mobile field monitoring in different regions in Delaware, with a particular focus on Kent County. This research is essential for the health and environmental aspects of local communities in the area. Some factors regarding air quality and particle concentration can help identify correlated health issues that can have short-term and long-term effects on communities in the area. Real-time air-quality data integrated with data science can help identify viable solutions that can be put into place for societal challenges that relate to the data being gathered.

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