



EPA Research and Emerging Air Sensor Technology

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Region 4 State Commissioners' Visit to EPA RTP
August 30, 2017

Office of Research and Development

Problem (and Opportunity)

Innovation is needed in air monitoring:



Problem (and Opportunity)


Air sensor technology is here, and in quickly increasing use.

- Significant new players to the field
- Emerging diversity of approaches (mobile monitoring, sensor networks, crowd-sourcing)
- Exponential increase in data
- Data quality is uncertain

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MPCA to place new air quality sensors in every Mpls/St. Paul ZIP code - Open houses scheduled for residents to provide input on locations

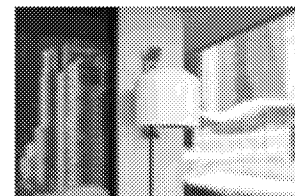
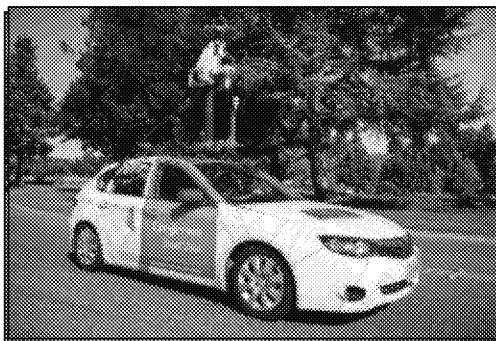


We Need Your Help to Fight Air Pollution

Weather Underground needs your help to gather air pollution data. When you install an air pollution monitor, you protect yourself and others in your community from dirty air.

[Buy the Best Air Pollution Monitor](#)

Learn More



Why We Recommend PurpleAir

Air pollution experts affiliated with Weather Underground have evaluated several air pollution monitoring devices and have determined that the PurpleAir PM-10 is the best device for most people to track the deadliest type of air pollution.

[Buy a PurpleAir Sensor](#)

Approach

- EPA ORD activities involve:
 - Air sensor market research and technology evaluation
 - Development and application of custom sensor systems for specific research studies
 - Development of sensor data analytics, visualization, and real-time quality assurance measures
 - Outreach and training

Approach

■ Air sensor market research and technology evaluation

Example: Community Air Sensor Network (CAIRSENSE) project: Atlanta, GA and Denver, CO

Collaboration with Region 4, State of GA

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Atmospheric
Measurement
Techniques
EGU

Community Air Sensor Network (CAIRSENSE) project: evaluation of low-cost sensor performance in a suburban environment in the southeastern United States

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Co-location of low-cost sensors at the South Dekalb NCore site; pilot four-node sensor network

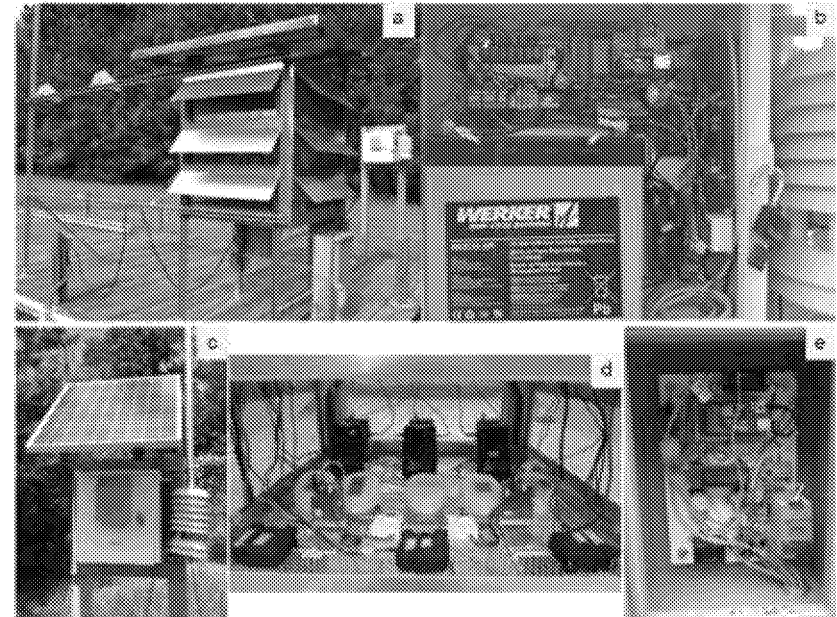


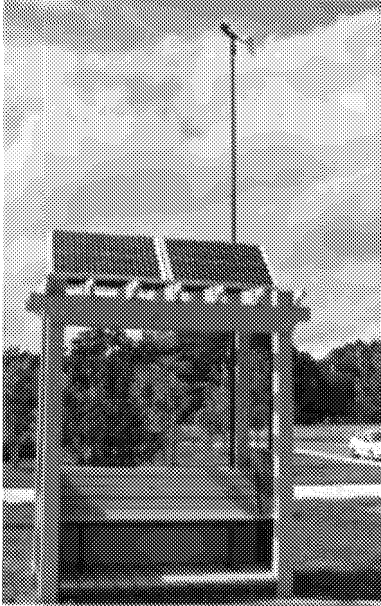
Figure 1. CAIRSENSE field equipment, including (a) SAFT instrument enclosure, (b and c) solar-powered WSN nodes, (d) interior of SAFT instrument shelter, and (e) WSN node utilizing 120 V (nominal) AC electricity.

Ongoing testing of sensors at EPA-RTP campus – laboratory and field tests

Approach

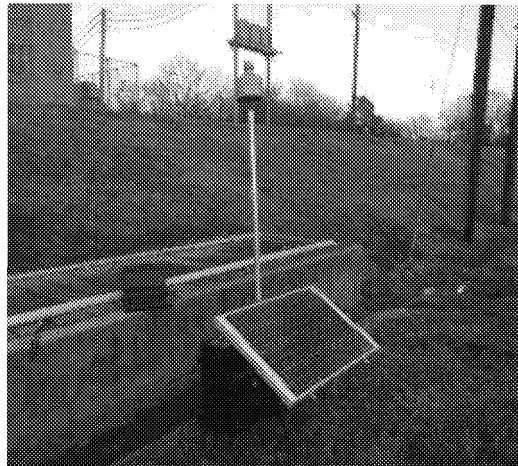
- Development and application of custom sensor systems

Village Green Project



Most common
measures:
PM_{2.5}
Ozone
NO₂
VOCs
Black carbon

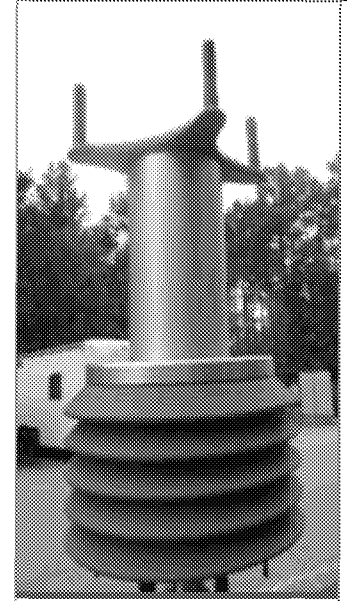
Drop-in-place sensor pods



Mobile sensors



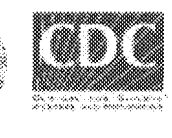
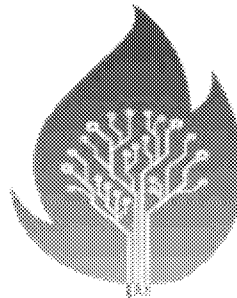
Fence-line monitoring



Aerial systems



Wildland Fire Sensors Challenge

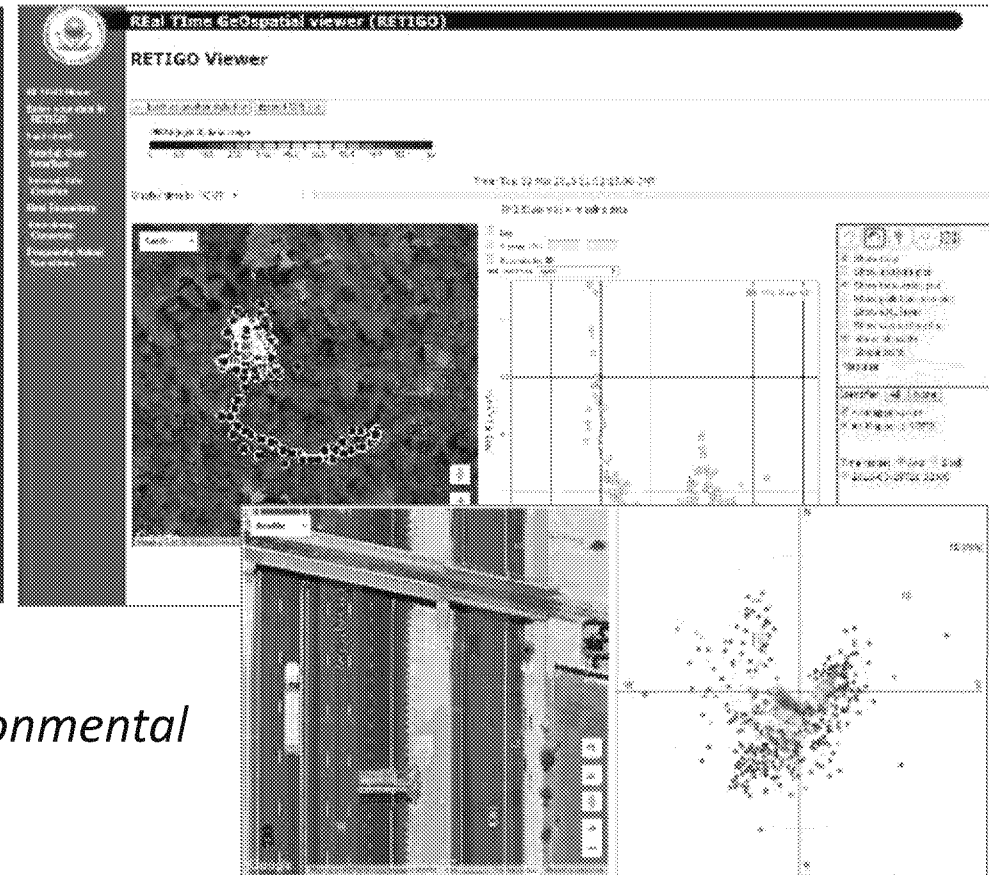
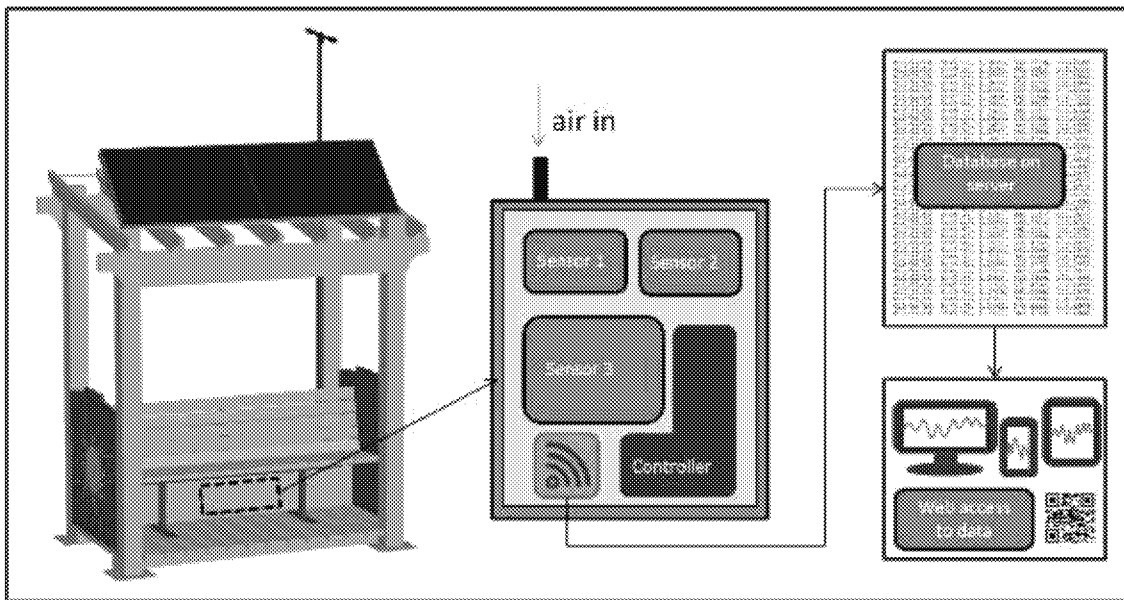


Approach

- Sensor data analytics, visualization, and real-time QA

Quality checks in real-time, posted at airnow.gov/villagegreen

RETIGO: Data visualization tool (epa.gov/retigo)

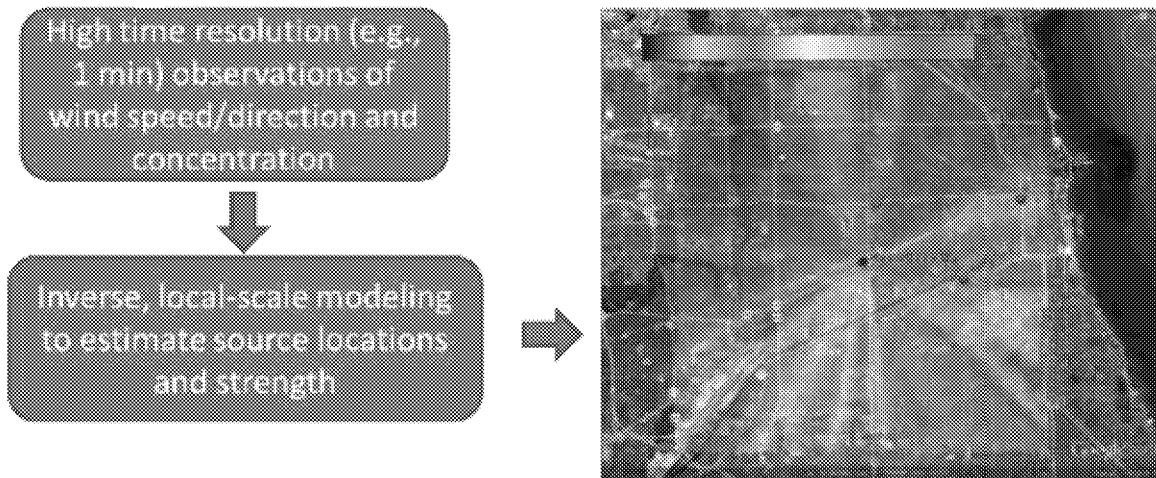


Multiple projects: Development of algorithms to flag/correct for measurement artifacts (drift, environmental conditions, interferences)

Approach

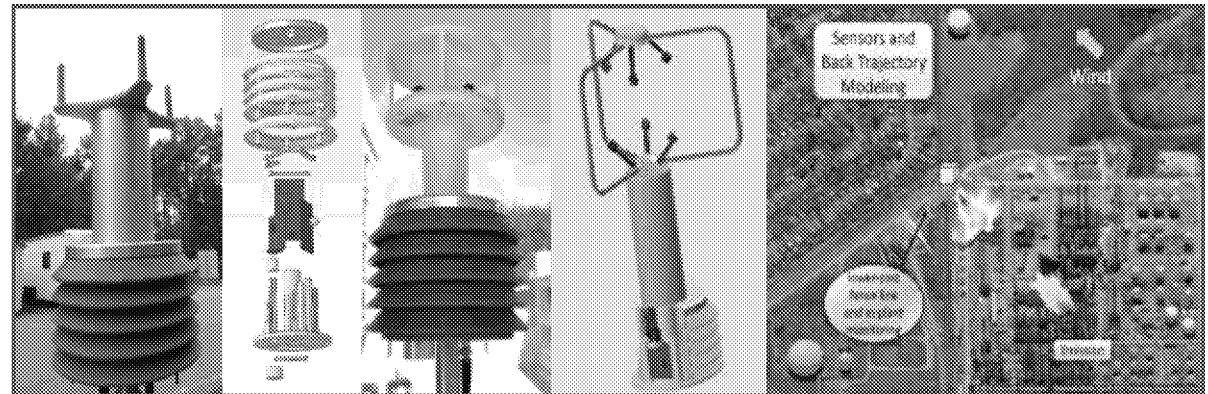
- Sensor data analytics, visualization, and real-time QA

Coupling wind data and sensors to understand source location and type:



Example: application to a regulatory-grade monitoring site in center of graphic, separating SO₂ contributions from rail yard, air port, and power plant. Reference: Cicero Rail Yard Study, EPA /600/R/12/621 February 2014

Example: Fence-line systems plus inverse modeling to estimate locations of leaks in a major industrial facility



Approach

■ Outreach and training

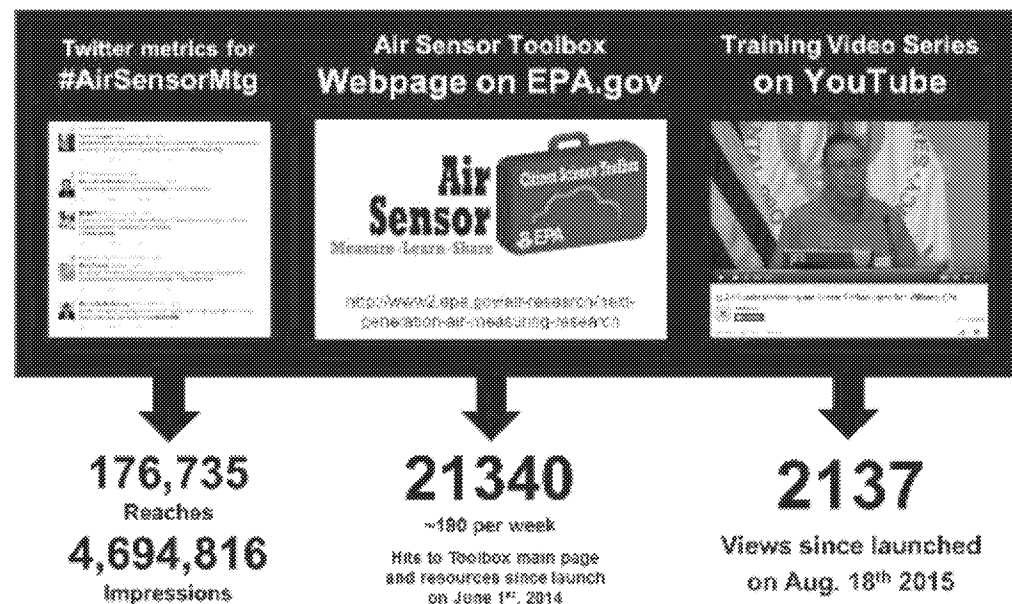
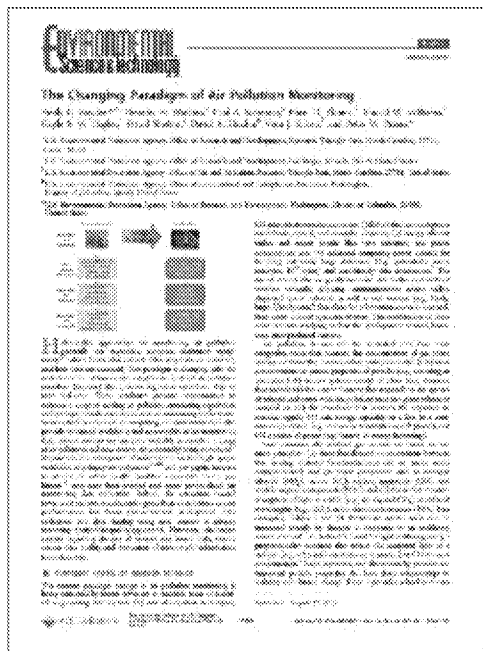
2015 Community Air Monitoring Training



- Air Sensor Toolbox:
<https://www.epa.gov/air-sensor-toolbox>
- Test reports on sensor performance (field and laboratory)
- Citizen science guidance
- Links to tools and research efforts
- Workshops to convene stakeholders

Results and Impact

- International leadership in emerging sensor technology – best practices, application methods, analytical approaches
- Advice and support to a multitude of stakeholders (state/local agencies, EPA regions and program offices, community groups)
- Cooperative research partnerships with private sector on sensor technology
- High impact publications and communications



Results and Impact

Ultimately, air sensor technology has promised to result in reduced pollution exposure and improved public health through:

- Identification and mitigation of unintended source emissions
- More extensive data supporting public health communication – e.g., sensors for Air Resource Advisors during wildland fires
- Improved knowledge on exposure to air pollution at a community and individual level

Star Tribune, June 25, 2016

Bicyclists strap on monitors to measure Twin Cities air quality





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