

The Citizen Science Toolbox: Air Sensor Technology Resources

A cache of resources are being developed by the EPA to help interested parties become familiar with, and appropriately use, low-cost air quality sensors. The development of the Citizen Science Toolbox is filling a vital niche in helping to advance environmental air quality monitoring for a wide variety of purposes.

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The Growth of Interest in Low Cost Sensor Applications

The air sensor technology market is exploding with new sensors in all kinds of forms. Developers are putting sensors in wristbands, headphones, and cell phone add-ons. Small, portable and lower-cost measurement devices using sensors are coming on the market with a wide variety of potential uses to measure air quality in a neighborhood, school or near sources of air pollution such as highways and industrial facilities where air quality is a concern⁽¹⁾. The benefits of advanced sensor technologies are many and offer the potential opportunity to transform how we monitor air quality. Such technology has the potential to enable citizen scientists to gather local air quality data to help them better understand the air in their community.

Demand for air sensor technology is growing from states, communities, citizens, Tribes and industry interested in using real-time monitoring in local settings. This includes the need for market survey information on availability of air sensor products and costs.⁽²⁾ Possibly more important is the need for citizens and others to have practical information on sensor performance, data quality considerations for sensor users, and how individuals should interpret the data they collect. It is apparent that these latter factors have combined to either thwart citizens from collecting environmental data or have raised questions about the quality of the data obtained by citizens.

EPA is fostering development and implementation of air sensor technology on many fronts in an attempt to help overcome some of the aforementioned issues. Sharing information about such technology has been an important feature of EPA's effort. A series of air sensor technology workshops held by EPA has brought together developers, scientists, users, community groups and other interested parties to discuss a wide variety of topics related to sensor development and use⁽³⁾. The last workshop, EPA Air Sensors 2014, A New Frontier, was recently held in June 2014. Summary information on the recent and earlier sensor workshops are available at the conference website (<https://sites.google.com/site/airsensors2014/>).

In addition, EPA scientists have conducted laboratory evaluations on select ozone and nitrogen dioxide sensor technologies to provide sensor developers with information to improve performance of sensor products⁽⁴⁾.

The Citizen Science Toolbox: Products Useful for Potential Sensor Users

EPA is actively supporting citizen science projects and responding to community requests for information and guidance on sensor use. The Citizen Science Toolbox is being developed specifically with resources and other tools in mind that can be used by citizens to learn more about air sensor technology at a practical level. The Toolbox will provide guidance and instructions to citizens to allow them to effectively collect, analyze, interpret and communicate air quality data.

Currently, the toolbox includes documents that describe the current market survey (availability of technologies to meet specific air quality monitoring needs); select sensor evaluation reports; and a sensor user guide. Future tools will include standard operating procedures on actual use of low cost sensors; basic ideas for data analysis, interpretation, and communication; and other helpful information. EPA's Office of Research and Development (ORD) is currently collaborating on a pilot effort involving one EPA regional office and a local community action group (CAG) to develop a sensor package for use in the community. The goal of this pilot project is to determine the feasibility of such an effort for other regional offices to consider in their own collaborations with their local CAGs. The Citizen Science Toolbox has the potential to be a valuable resource for such collaborations.

Recent additions to the Toolbox include the following research publications, which are available on EPA's Next Generation Air Measuring website:

(<http://www.epa.gov/research/airscience/next-generation-air-measuring.htm>).

Specific Toolbox Reports

Mobile Sensors and Applications for Air Pollutants

This report identifies recent trends in mobile sensors and focuses on providing information for sensor developers and interested citizens on:

- Small, portable sensors, and some larger sensors that present opportunities for developing future mobile devices;
- Sensors in early stages of research and development, and some nearing deployment; and
- Commercial sensors incorporated into novel sensor systems.

Air Sensor Guidebook

This guide explores low-cost air sensor technologies; provides general guidelines on what to look for in obtaining a sensor; and examines important data quality features.

Sensor Evaluation Report

EPA scientists recently conducted performance trials of low-cost ozone and nitrogen dioxide air quality sensors to understand the current state of the science for such technologies. The sensors were evaluated in EPA laboratories using many of the performance criteria associated with Federal Reference Methods or Federal Equivalent Method evaluations. The report summarizes the results of these trials.

References

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