

# Building an Aerosol Sensor Network and Inspiring Citizen Scientists

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# Air Quality: A Salt Lake Concern

Hundreds of Utahns rally for clean air  
Salt Lake Tribune, January 23, 2017



Booming Utah's Weak Link: Surging Air  
Pollution *New York Times*, September 10,  
2021

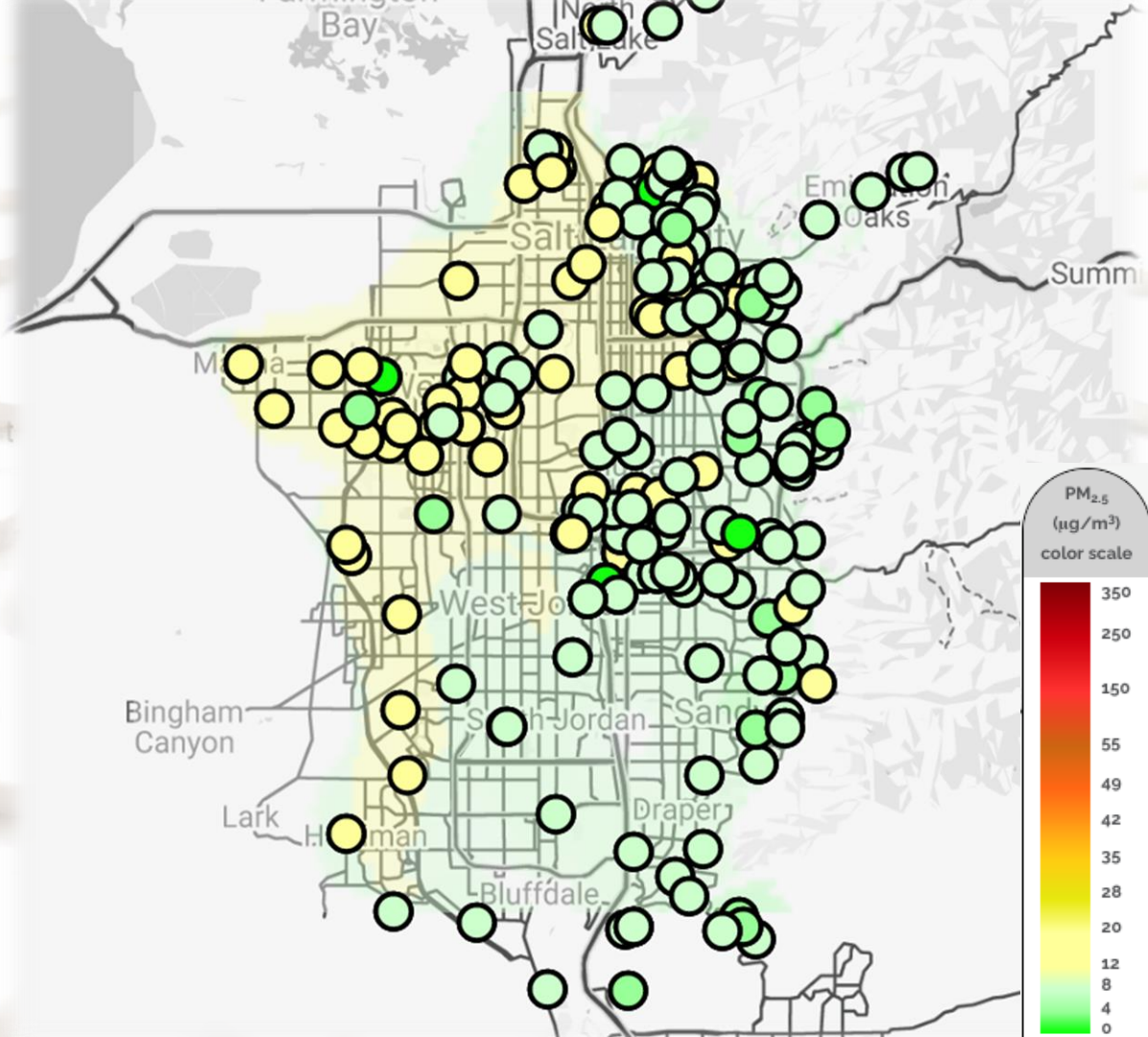


# Excellent Ingredients for Citizen Science

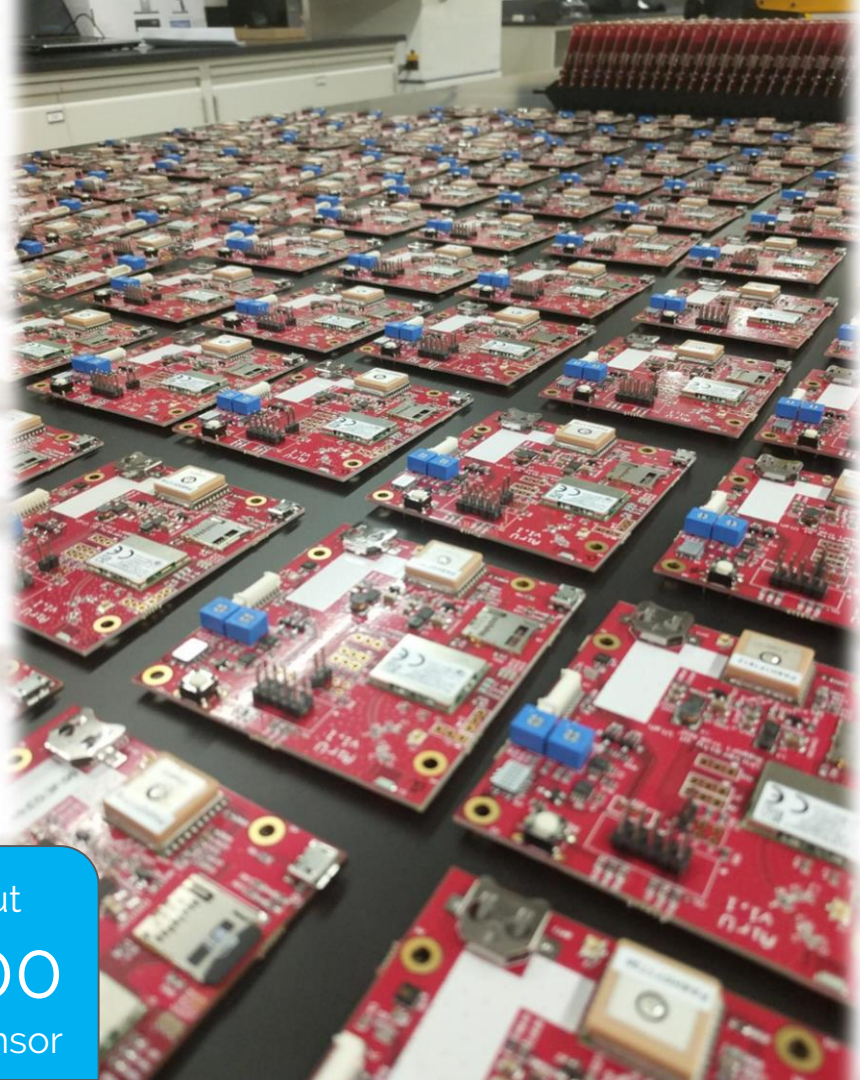
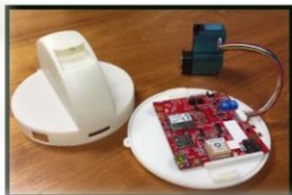
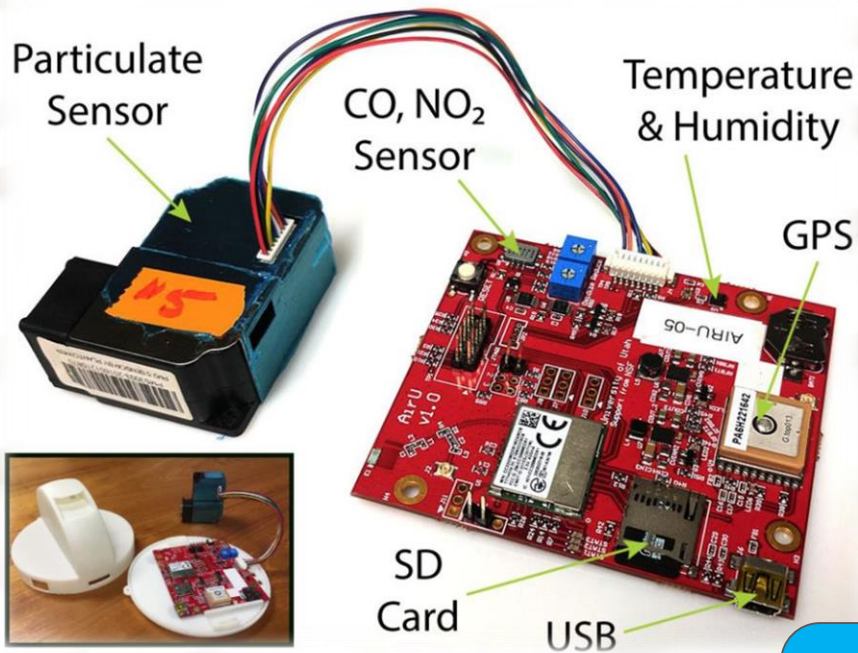


- Important global & local problem
  - Strong citizen motivation
- Need for distributed, networked measurements
  - Hardware available at a reasonable cost
- Involves a wide collection of STEM concepts
  - Engineering, biology, medicine, physics, chemistry, mathematics, environmental science, meteorology, electronics..
  - Many points of entry into student interests, and teacher curricular demands.

# Community-hosted sensor network



# Our AirU Sensors

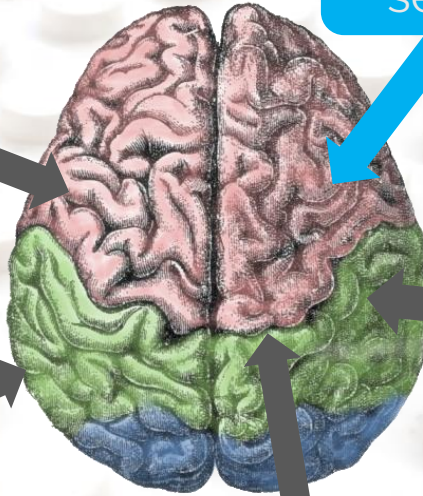
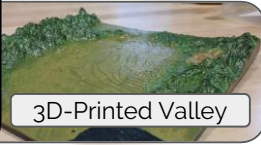


About  
**\$200**  
Per Sensor

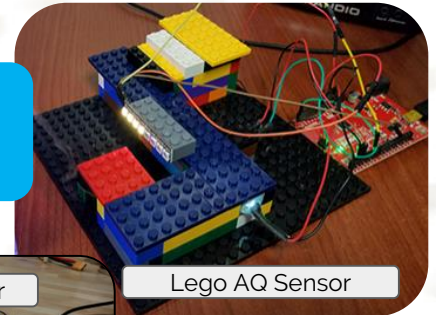
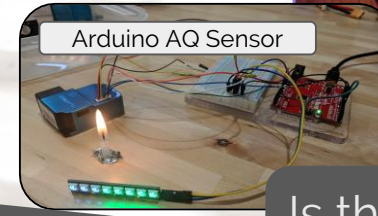
# Inspiring citizen scientists

<https://airu.coe.utah.edu/teaching-modules/>

Understanding our air quality problem



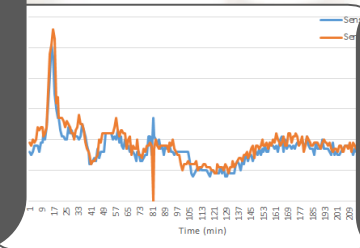
How do our AQ sensors work?



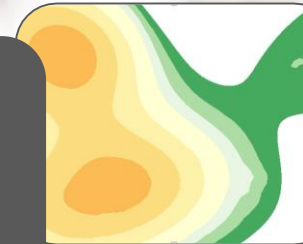
Is there really a spider in there?



Distinguish between a working and a malfunctioning sensor



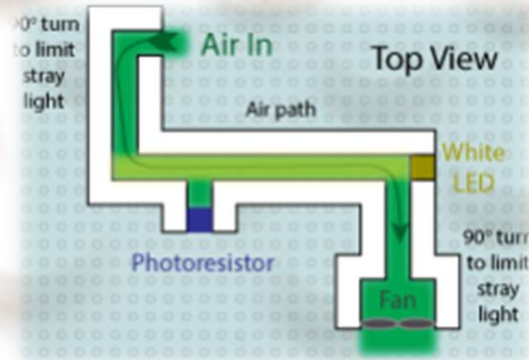
Visualization to identify and explain trends



# Lego AQ Sensor: Understanding the Sensor

<https://airu.coe.utah.edu/teaching-modules/>

- Aim:
- Open up the “Black Box”
- Engage students with higher regions of Bloom’s Taxonomy.



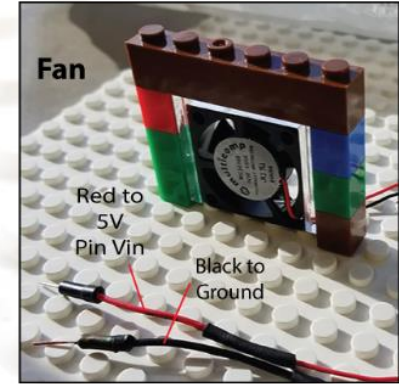
## Curricular Connections:

- Basic Circuits
- Basic Programming
- Properties of Light
- Measurement Errors

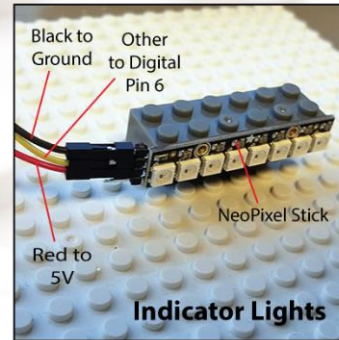
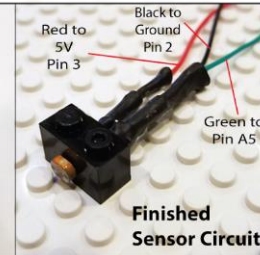
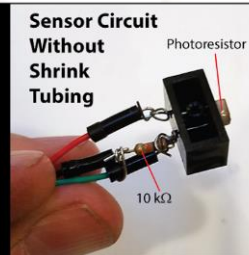
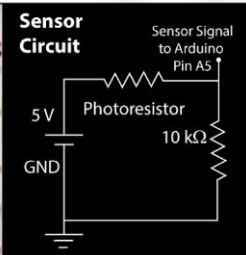
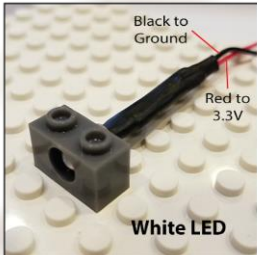


# Lego AQ Sensor, Materials

<https://airu.coe.utah.edu/teaching-modules/>



About \$40 Per Kit





# Module Execution

- Give background presentation:  
<https://goo.gl/dGzUbG>
- Groups of 2 or 3
- Build for 15-30 min
- Test with fog or mist
  - Redesign if needs be
- **1.5 hr periods** work best, but 50 min works.







# Thanks

National Science Foundation

- CPS: Synergy: A Layered Framework of Sensors, Models, Land-Use Information and Citizens for Understanding Air Quality in Urban Environments (1646408)
- EAGER: AirU: Community Network to Understand Air Quality and Sensor Reliability (1646408)

Chemical Engineering Outreach Students

Local support: UCAIR, Rocky Mountain Power Foundation, Lawrence T. and Janet T. Dee Foundation, Students at AMES High School, University of Utah students in the College of Engineering, University of Utah UROP funding

Everyone who is hosting a sensor

Community partners; Breathe Utah, PurpleAir, Salt Lake City, Jordan, and Granite school districts, Salt Lake City

Dr. Kerry Kelly, Dr. Whitaker and Dr. Gaillardon have financial interest in the company Tetrad: Sensor Network Solutions, LCC, which commercializes solutions for environmental monitoring.





`www.AQandU.org`

`airu.coe.utah.edu` (teaching modules)

`https://www.tellussensors.com/`

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# Chemical Engineering Outreach Program

- NSF origins
  - Department sustained since 2014
- Paid & volunteer undergraduate outreach “mentors”
- Visits requested through online form
- Over 30 teaching modules
- Now visits over 2,000 student each year



How to attract underrepresented students?

How to justify investment?

