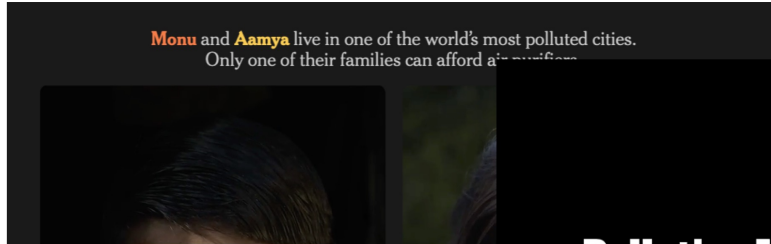# Using IoT To Measure Air Quality

Julia Gersey

Outline

- Inspiration For Study

- Introduction/Problem

- Methodology

- Sensor Prototype

- Testing

- Results

- Next Steps

- Questions

Inspiration For Study

Monu and Aamya live in one of the world's most polluted cities. Only one of their families can afford air purifiers.

In Landmark Ruling, Air Pollution Recorded as a Cause of Death for British Girl

Legal and environmental experts hailed a coroner's ruling that, for the first time in Britain, directly linked a specific person's death to air pollution.

Ella Adoo-Kissi-Debrah in a photo shown by her mother, Rosamund. Hollie Adams/Agence France-Presse — Getty Images

FEATURE

Pollution Is Killing Black Americans. This Community

E.P.A. Chief Vows to 'Do Better' Protect Poor Communities

The Environmental Protection Agency on Wednesday announce stepped-up enforcement and monitoring t disadvantaged communities struggling with polluted water.
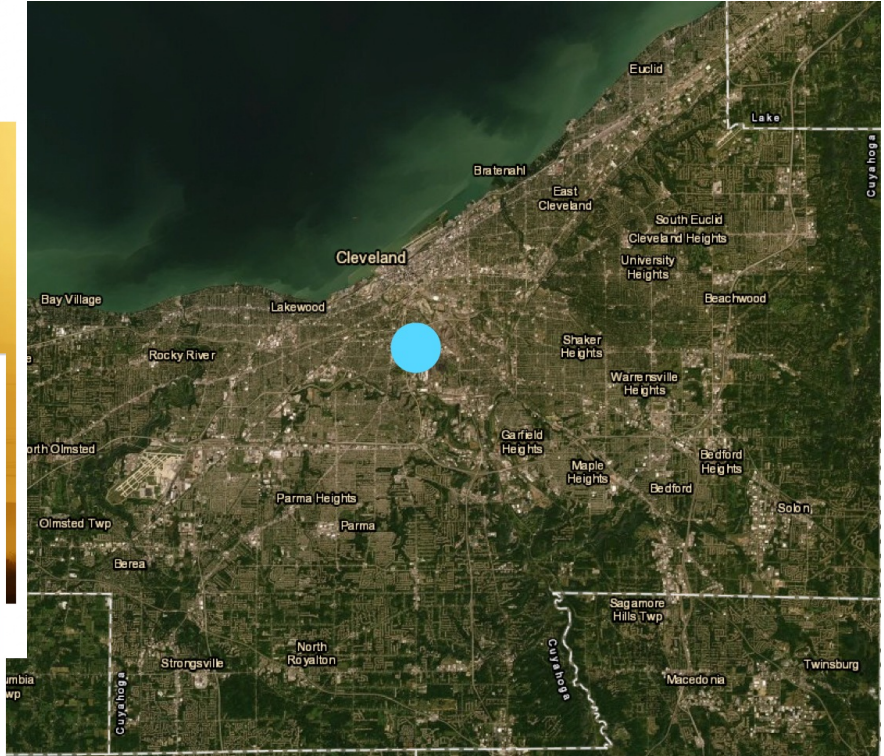
SCIENCE

Air Quality Disparities Persist Despite Overall Gains

When A Gas Plant Moves Next Door

Kevin and Marlene Young's land sits beside the future Guernsey Power Station. [Kevin Kopanski for The Allegheny Front]

News   By Julie Grant, The Allegheny Front   SUPPORT PROVIDED BY

BW BALDWIN WALLACE UNIVERSITY

Introduction/Problem

- Fine-Grained to increase urban reporting
  - Only one PM 2.5 sensor for Cleveland/Cuyahoga

- Aim for historically redline communities
  - Research shows these areas are affected the most
  - Corresponds with Steel Mill Pollution in Cleveland

- Enclosure to protect hardware from the elements
  - Clear housing to show what's inside
    - Mistaken for surveillance

BW
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WALLACE
UNIVERSITY
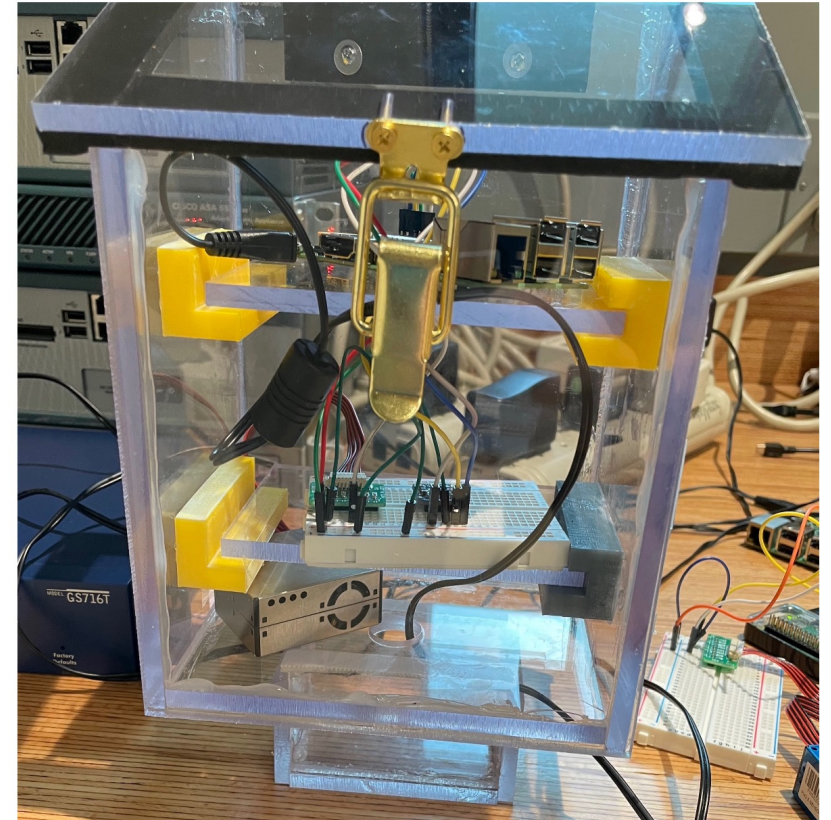
Methodology

- Low-cost
  - less cost to build = more sensors
  - Encourage $30-40 sensor instead of COTS $200+ sensor
  - Partnered with PCsForPeople

- Low-power
  - Power is expensive and limits placement of sensors
  - Encourage community partners (Slavic Village)

- Generally Available boards
  - Raspberry Pi/Arduino
  - Easy for younger computing students to learn

- Accuracy
  - Previous research papers show that although low-cost sensors may not be as precise as Purple Air, EPA or COTS sensors, it accurately shows general trends in air quality
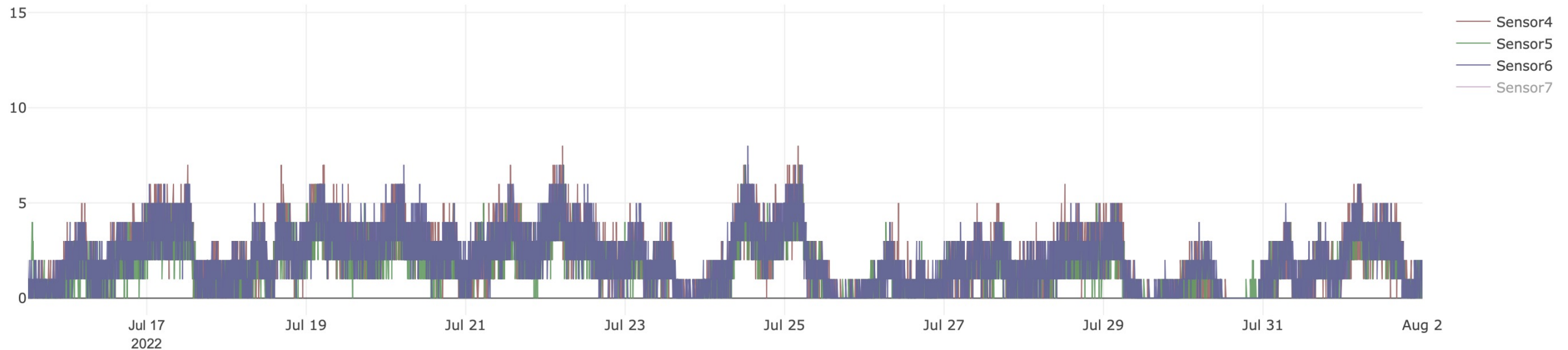
Sensor Prototype
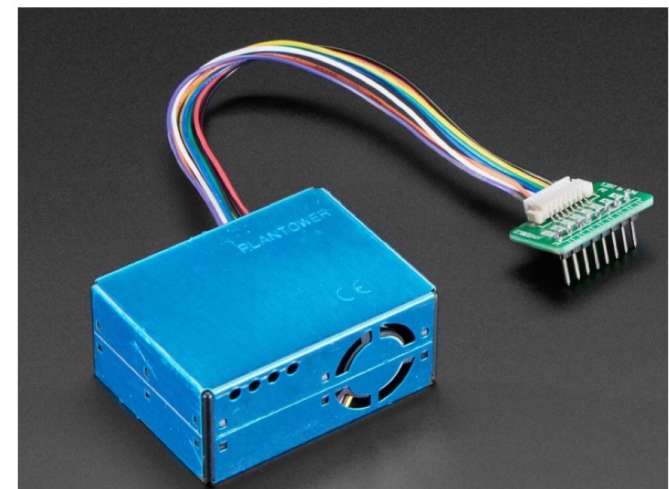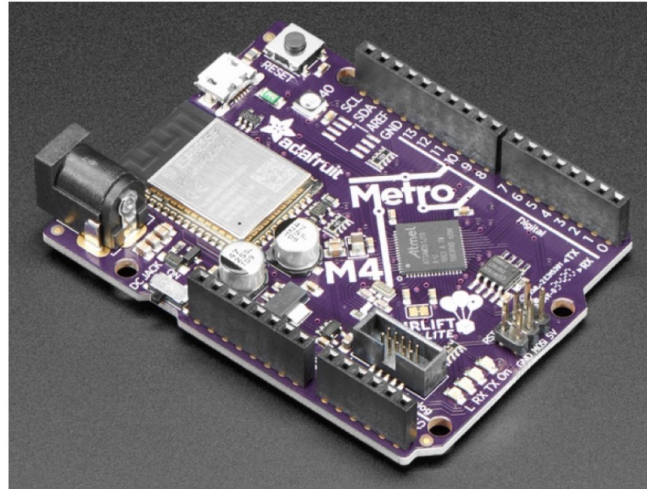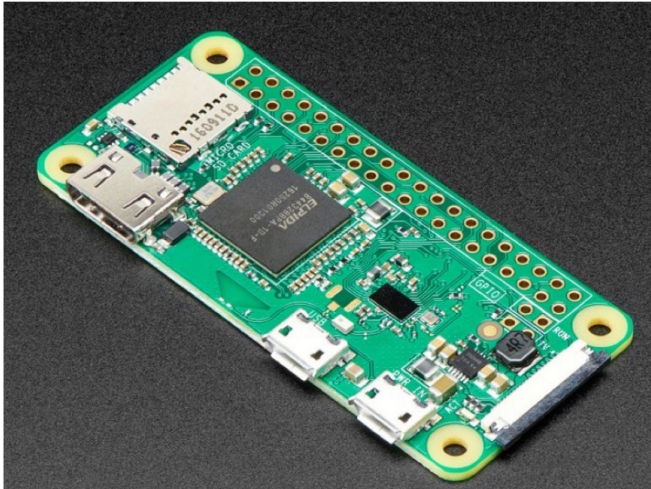
Version 1 & 2: Raspberry Pi Zero W, Adafruit Metro M4 Airlift, Plantower PMS5003 PM Sensor

(Current) Version 3: Raspberry Pi Pico W with Plantower PMS5003 PMSensor
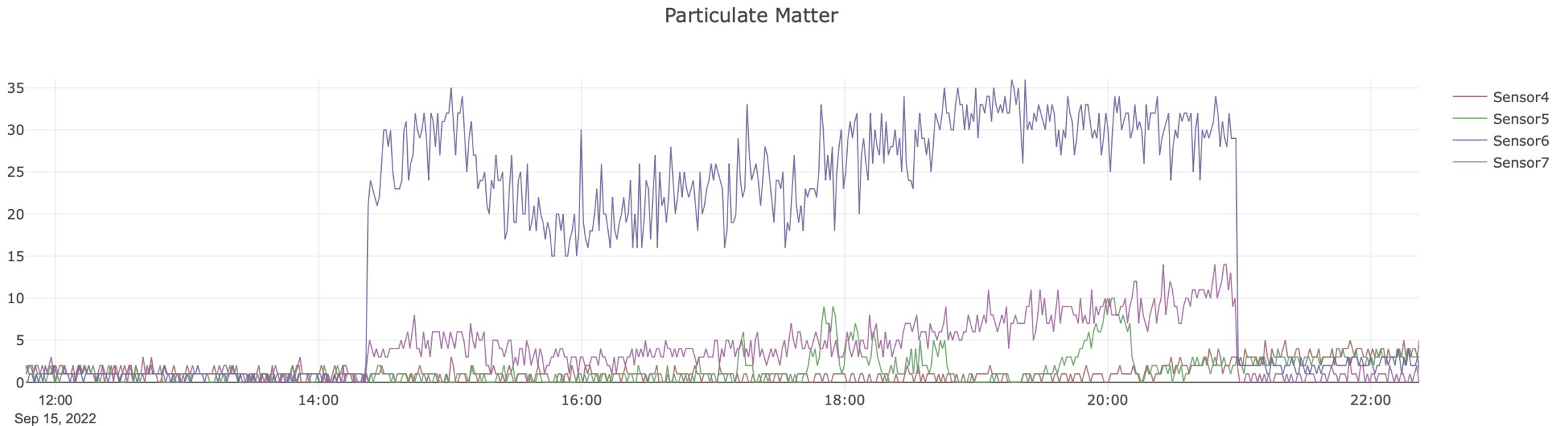
Testing

- Testing in Controlled Lab Environment showed similar readings
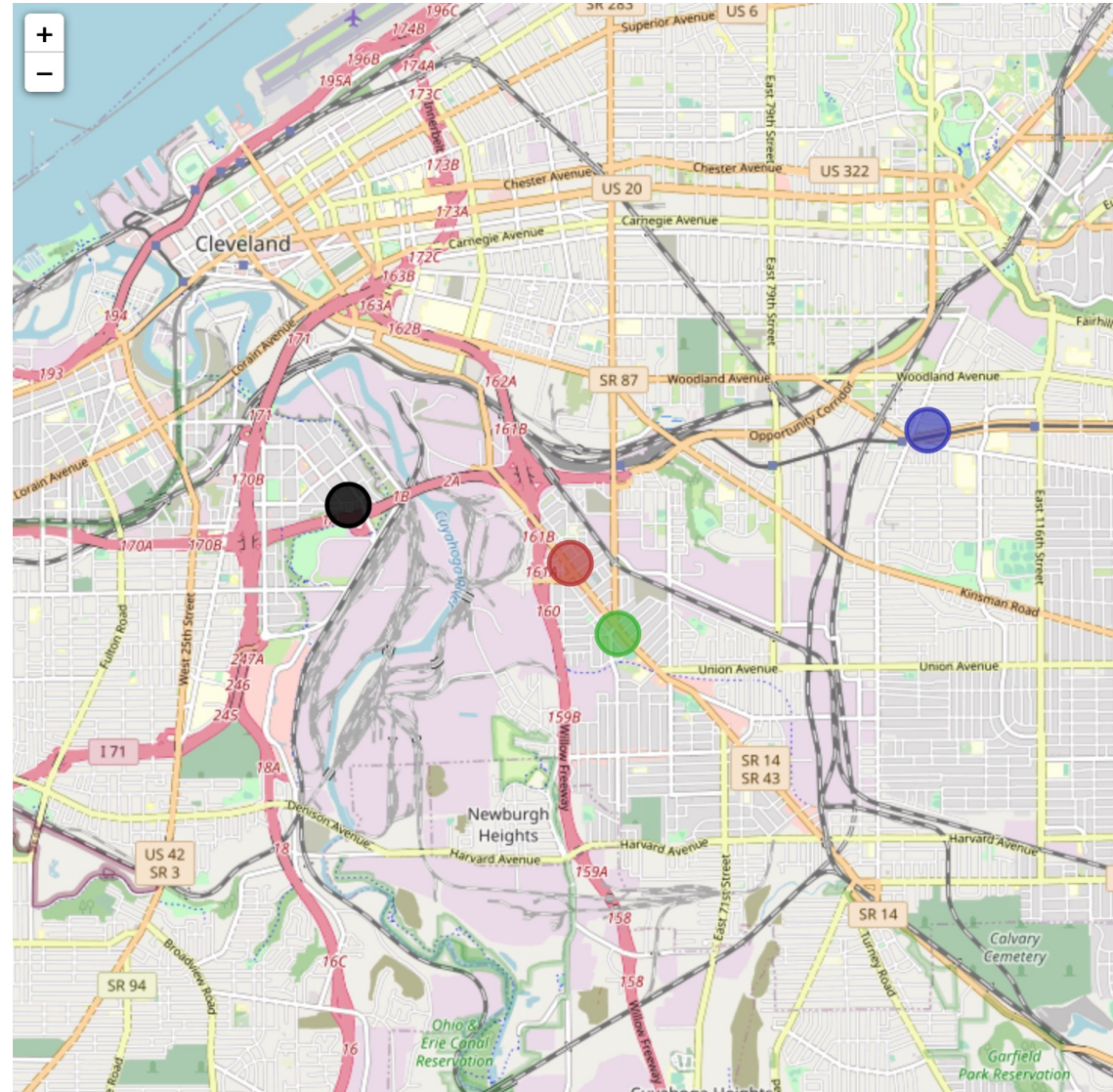
Particulate Matter

Testing

- Testing in the Engineering Students' enclosure gave linear offset


Particulate Matter

Testing

- Pilot study with PCsForPeople around Cleveland

Results

- Trends matched expectations
  - Cleveland firework show
  - Daily rush hour
- 2x difference <4 miles
  - Steel Mill pollution
- Different readings than EPA
  - More fine-grained
  - Focused on Urban Environment
  - Showed Steel Mill pollution
- Publicly available data
  - https://mopsdev.bw.edu/~bkrupp/aq/view.php

Poster Accepted into ACM SenSys 2022
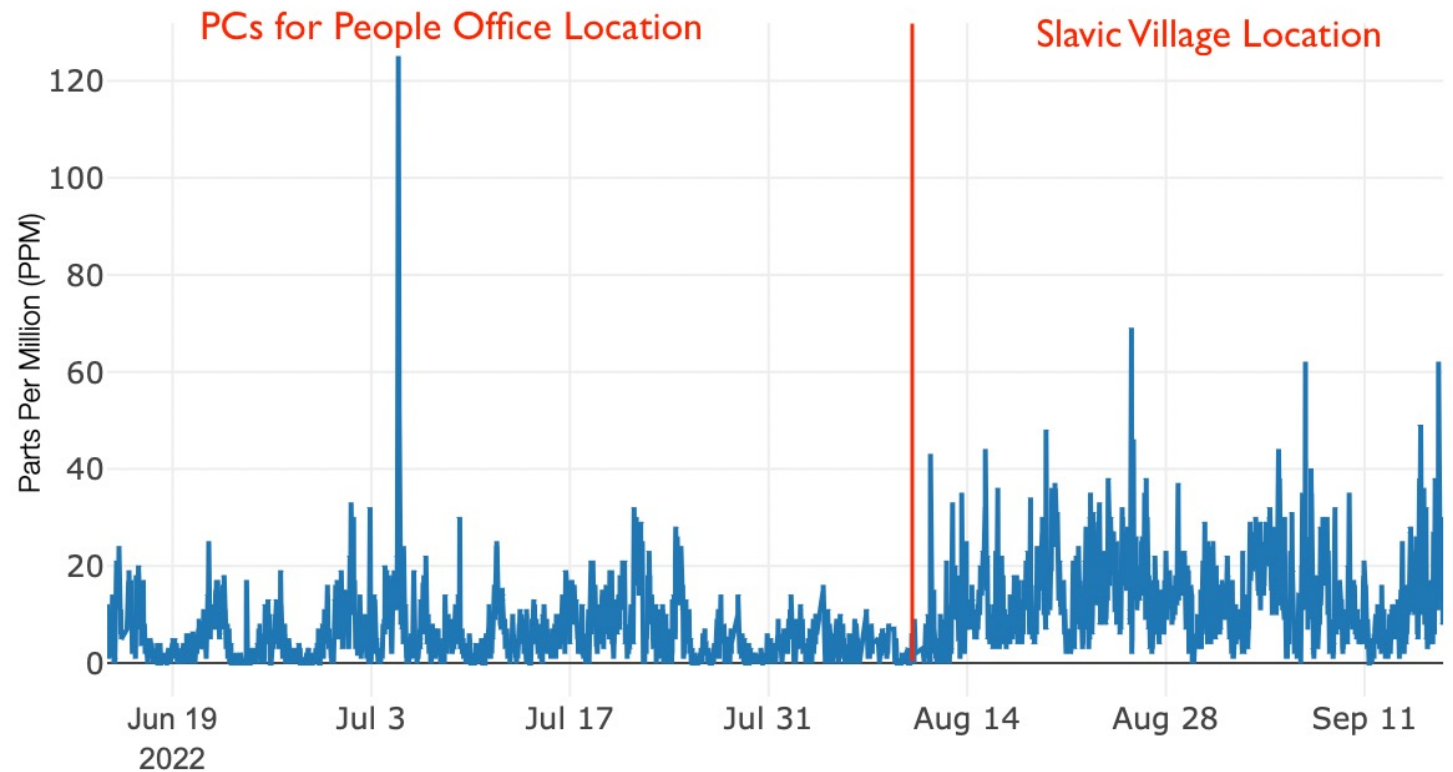
Next Steps

- Build K-12 CS AQ Curriculum

- Implement Opportunistic Sensing

- Pilot Study at BW

- Increase Sensors around Cleveland

Questions?

Thank You!

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