



The Smart and Trustworthy AIR quality network (STAIR): practical considerations in network design and community outreach

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Even Breathing Is A Risk In One Of Orlando's Poorest Neighborhoods

People inhale soot and noxious fumes from the car-laden highways encircling their historically black community.

By Julia Craven | 01/23/2018 05:46 am ET | Updated Jan 23, 2018



Parramore residents demand action on neighborhood pollution complaints

By: Angela Jacobs
Updated: Feb 27, 2018 - 10:19 AM



Griffin Park, Orlando

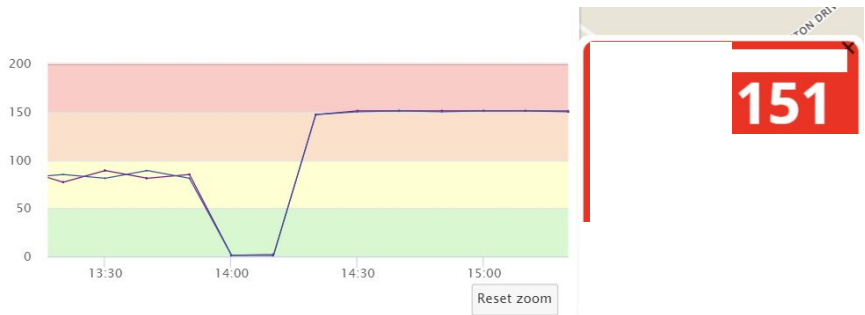
Open Access Article

On the Security and Data Integrity of Low-Cost Sensor Networks for Air Quality Monitoring

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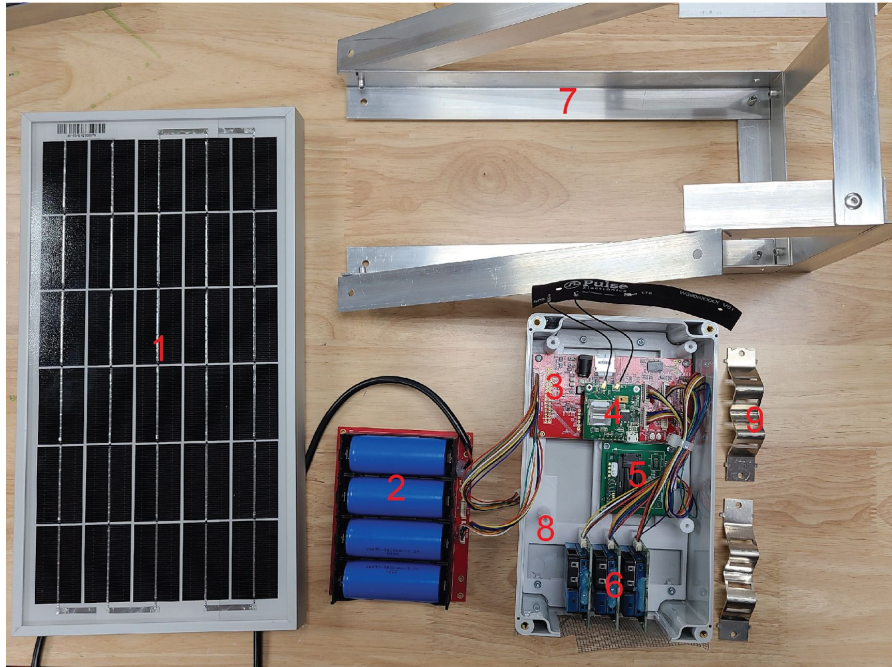
Sensors 2018, 18(12), 4451; <https://doi.org/10.3390/s18124451>



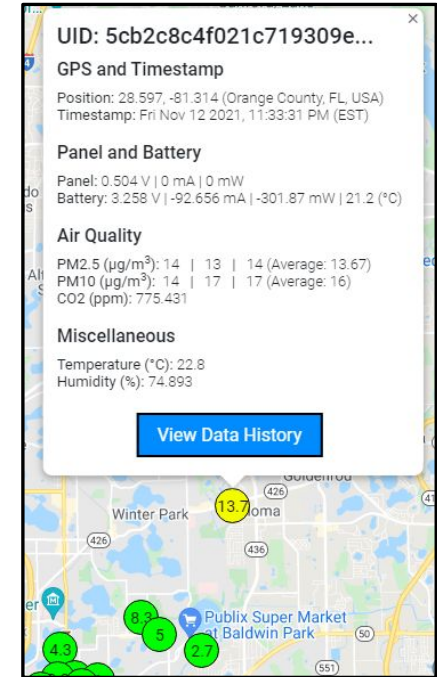
Goals of STAIR

- ❑ Establish a secure, trustworthy and reliable air quality monitoring network for Orlando, FL region
 - ❑ Design & build network for PM & CO₂, up to 100 nodes
 - ❑ Ensure high data quality through remote calibration, drift and malfunction detection
 - ❑ Create an accurate deep learning based simulation system
- ❑ Promote sustainable empowerment of residents
 - ❑ Promote wellness through social behavior study
 - ❑ Citizen trust in governance

STAIR Hardware



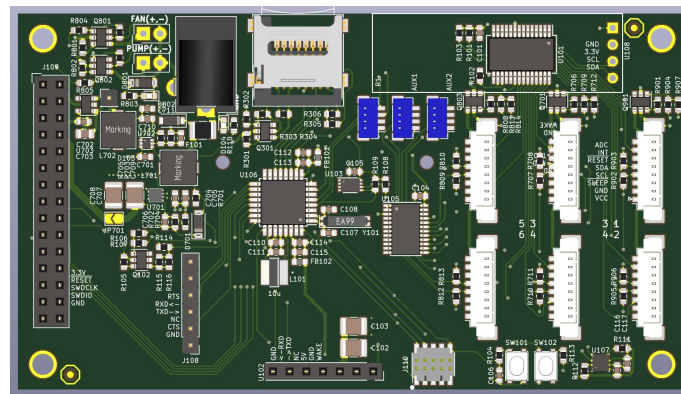
1. Solar panel
2. Battery module
(50Wh battery + solar charge + BMS)
3. Main board
4. NBloT module
5. CO₂ sensor module
6. PM sensor module x 3
7. Solar panel support
8. Internal support
9. Enclosure mount



Web interface

Design Considerations

- ❑ STAIR is an interdisciplinary research network
- ❑ Hardware control is a priority
- ❑ Custom mainboard (SAML11 microcontroller)
- ❑ “Three-in-one” compact battery module
 - ❑ Now with commercial charger & battery
- ❑ Flexible adapter boards
 - ❑ Mix & match sensors
 - ❑ Enable future upgrade



Mainboard design

Design Considerations

- ❑ Data quality is another priority
- ❑ Three Plantower PMSA003 sensors
- ❑ Install at best location feasible

- ❑ Open, sunlit, easy to access
 - ❑ Utility power not always available
 - ❑ Solar power preferred
 - ❑ Install pole if needed

- ❑ Solar condition vary drastically
 - ❑ Bigger panel if needed



On fence



On pole



30W panel

Community Engagement Considerations

- ❑ Keep stakeholders involved and informed
 - ❑ County Commissioners' offices
 - ❑ City of Orlando
 - ❑ Local Environmental Protection Division
- ❑ Active community outreach
 - ❑ Homeowner associations
 - ❑ Religious & non-profit organizations
 - ❑ Media outlets & social media
 - ❑ Newsletter, mailing list, yard sign etc
- ❑ Community grant available



At Alianza events



WFTV interview



Yard sign

Next Step

- ❑ 46 installed for homeowners
 - ❑ 18 schedule for community center
- ❑ New commercial battery module
 - ❑ 2.5x capacity
- ❑ Field calibration ongoing
- ❑ Collaboration welcome!



Mobile lab