



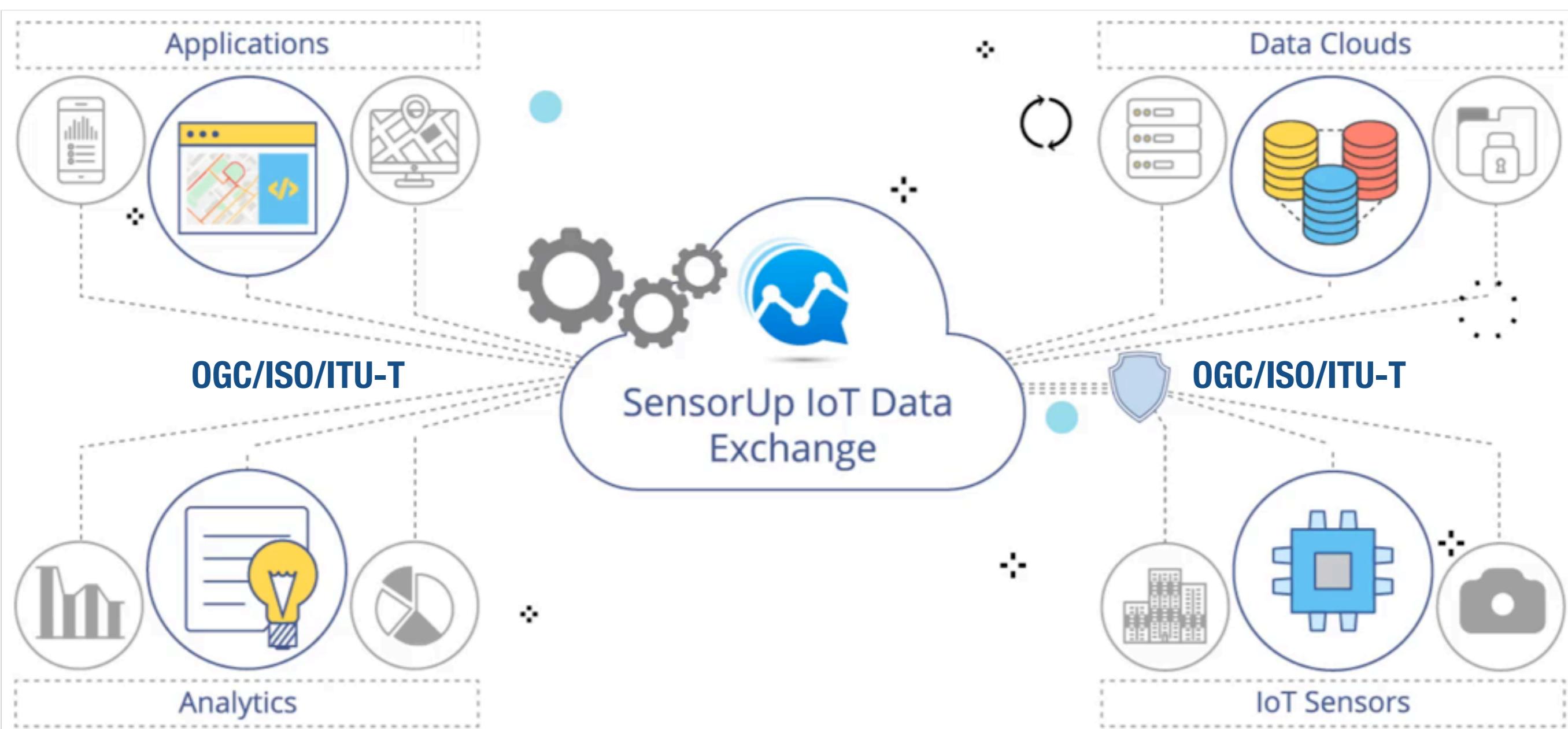
Smart Citizens for Smart Cities

Dr. Steve Liang, Ph.D., P.Eng.
Founder and CEO, SensorUp
Chair and Editor of OGC SensorThings API

<http://www.sensorup.com>
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SensorUp Introduction

- SensorUp is a cloud-based IoT platform helping companies to rapidly aggregate multiple IoT data sources and then transform them into actionable insights (based on open standards!!).
- SensorUp offers world's first, most complete, and most deployed OGC SensorThings API implementation.
- SensorUp is backed by VC and growing fast. We just finished a \$2m seed round in March '18.



Q: Number premature deaths per year could be attributed to ambient particulate matter pollution?

3.7 million

about the population of Singapore or LA

An average person breath **13,000** litres of air per day.

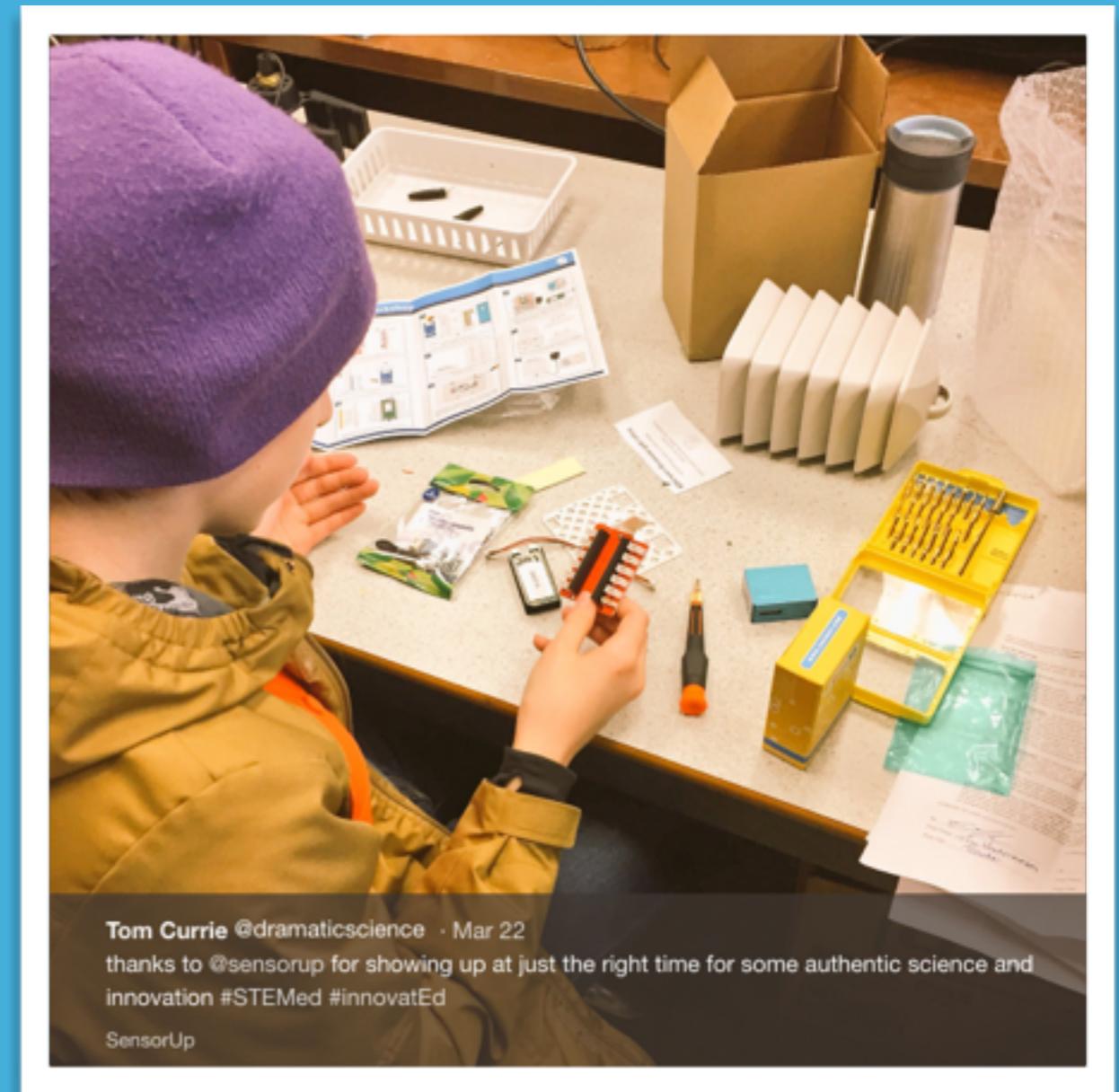
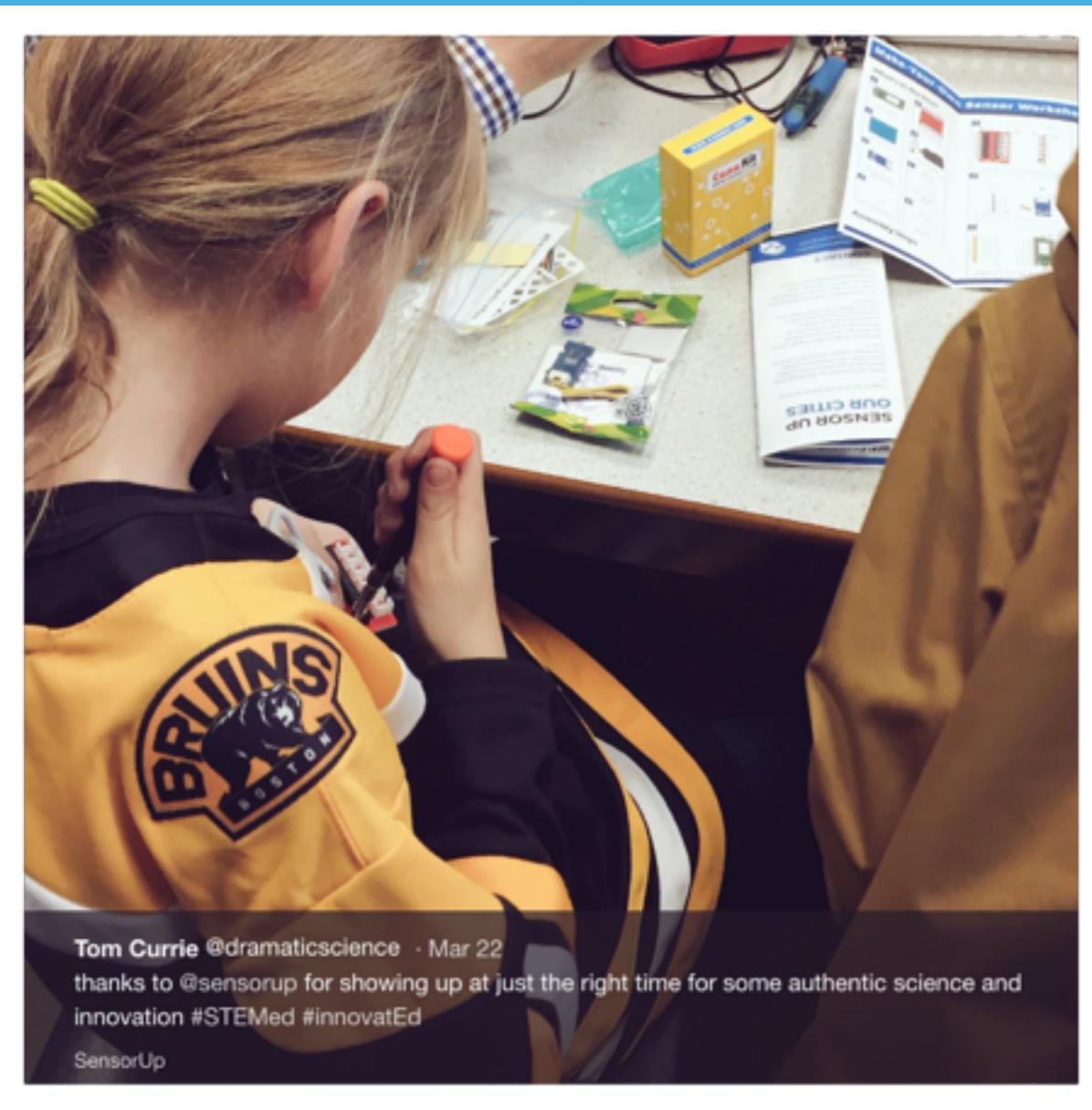
There is **no data** available to know the quality of that amount of air we breathed in and out every day.

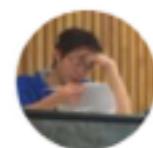
How much does a typical air quality monitoring cost?

\$0.5 million

There must be a better way!





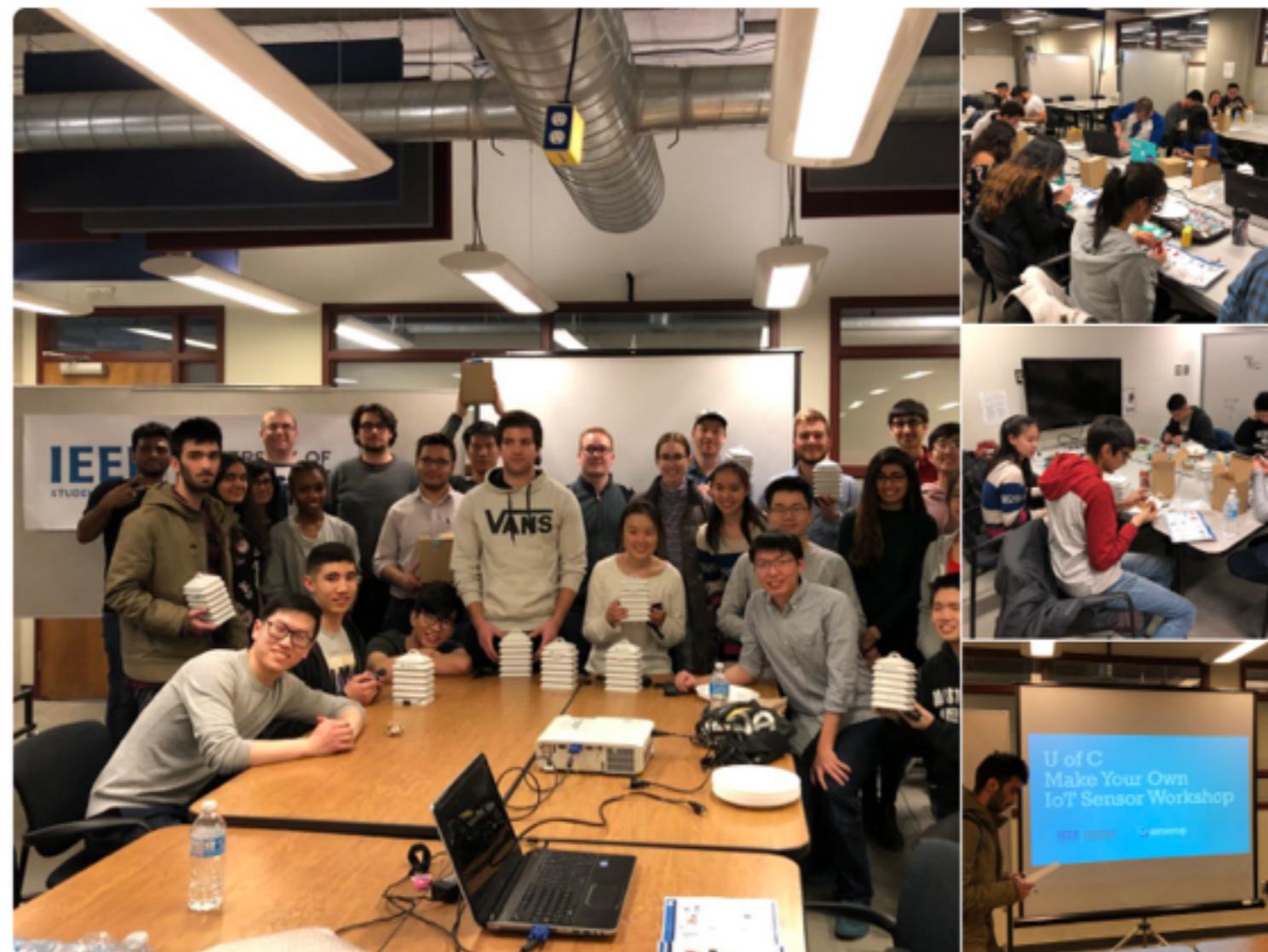


Nung-Shun Chou @NungShun · Apr 4

UofC Make your IoT workshop!!

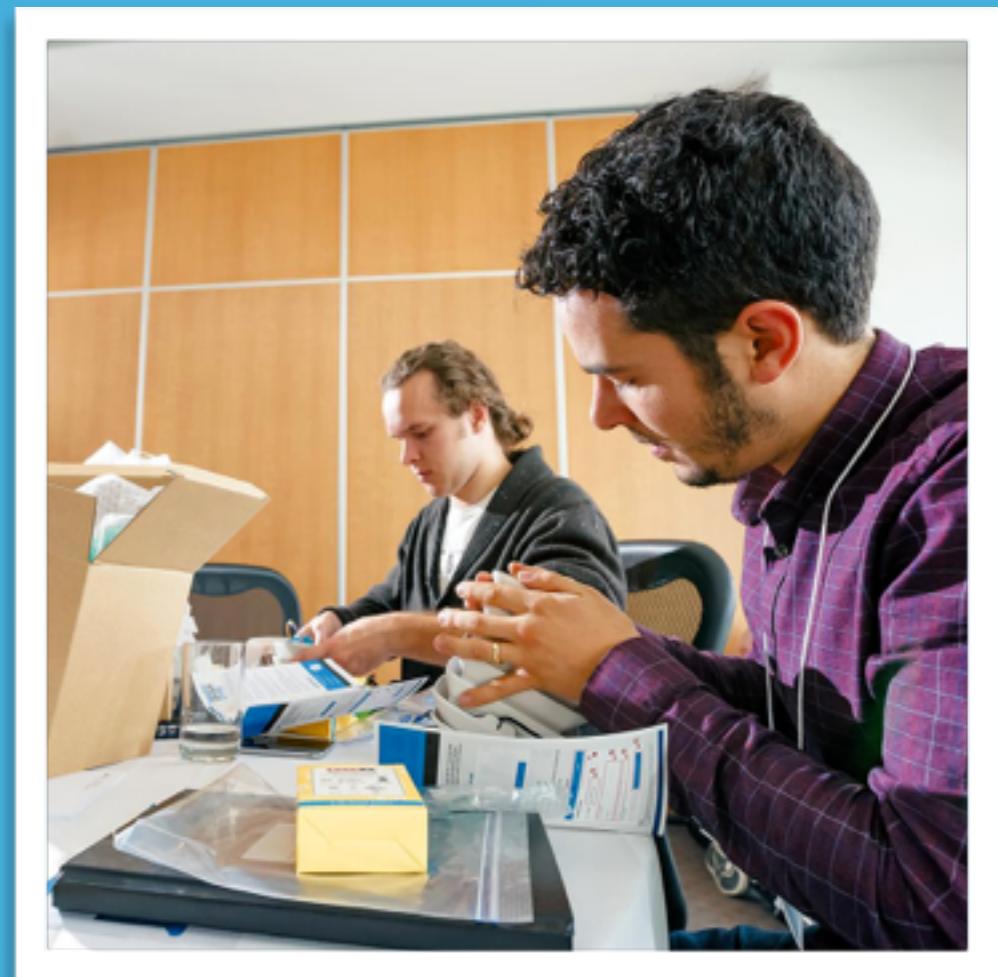
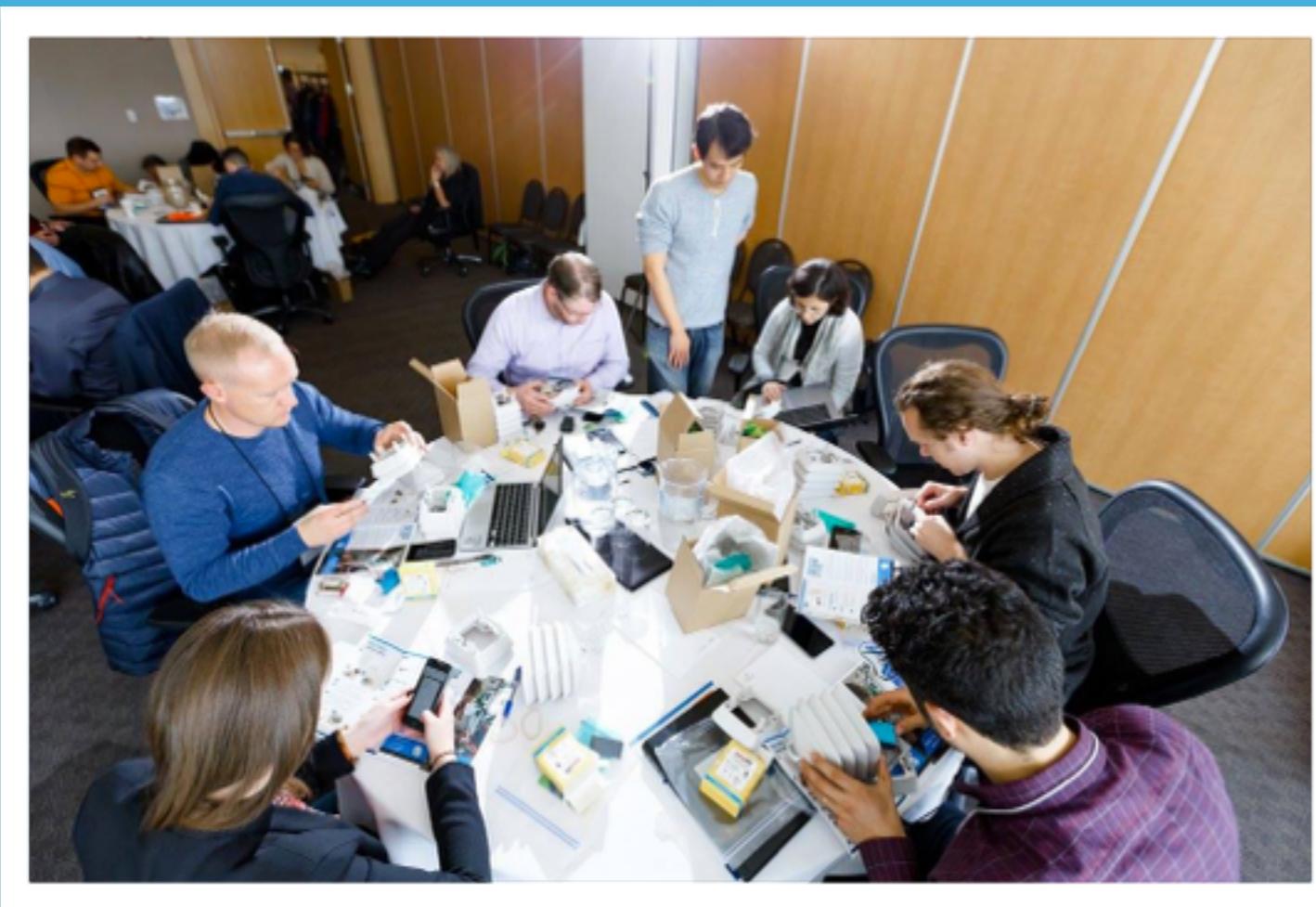
Thanks to SensorUp provide us this great device [@sensorup](#)

#IEEEStudentbranchucalgary

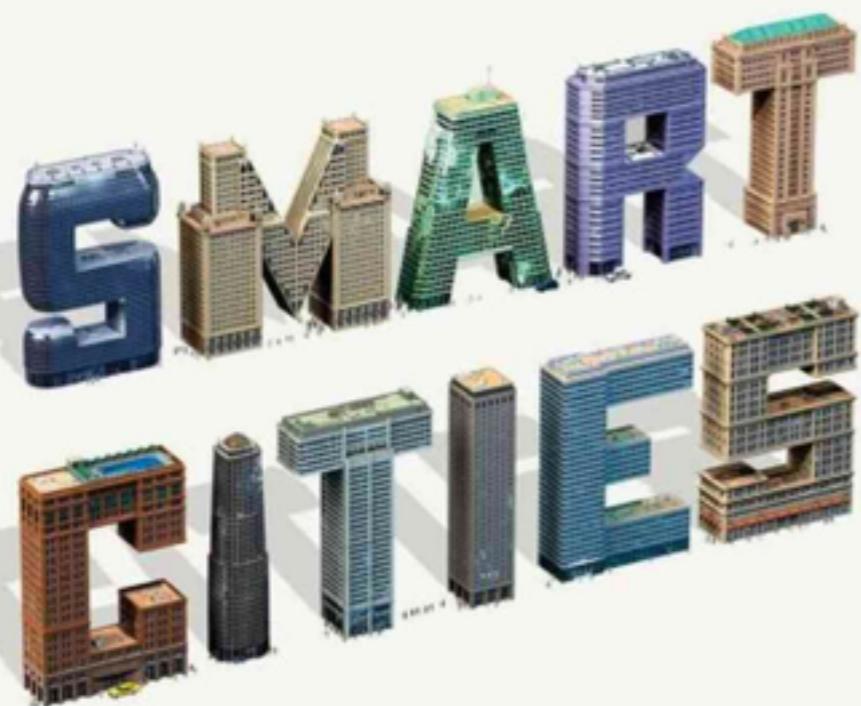


Make-Your-Sensors Workshop

- Starter Kit includes all necessary materials to run the Make-Your-Sensor Workshop.



BIG DATA, CIVIC HACKERS, AND THE
QUEST FOR A NEW UTOPIA



ANTHONY M. TOWNSEND

“

You are part of the mind of the smart city itself. And that gives you power to shape the future.

”

“

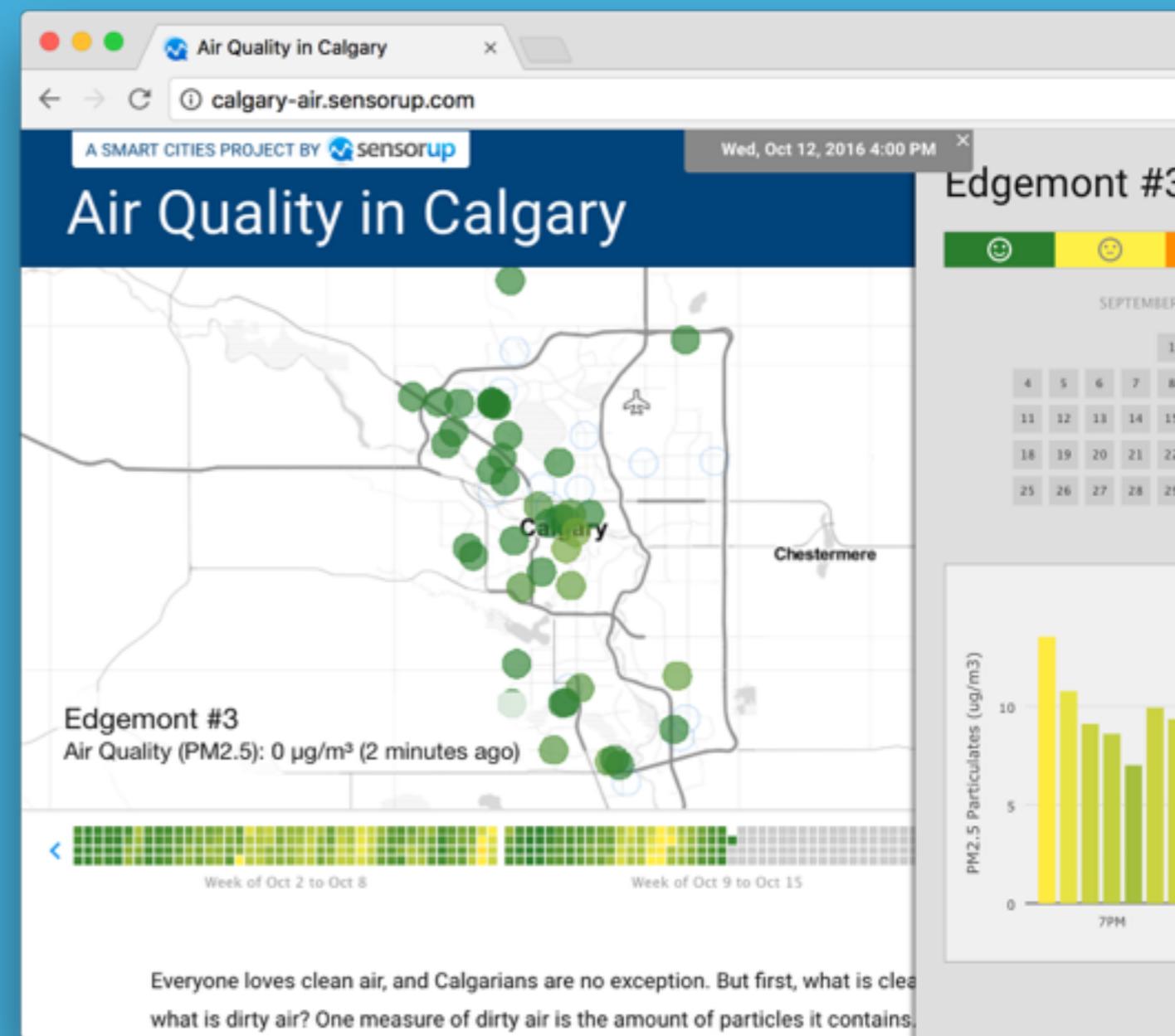
Civic Hacker: anyone willing to get his or her hands dirty solving problems.

Open Government Data

”



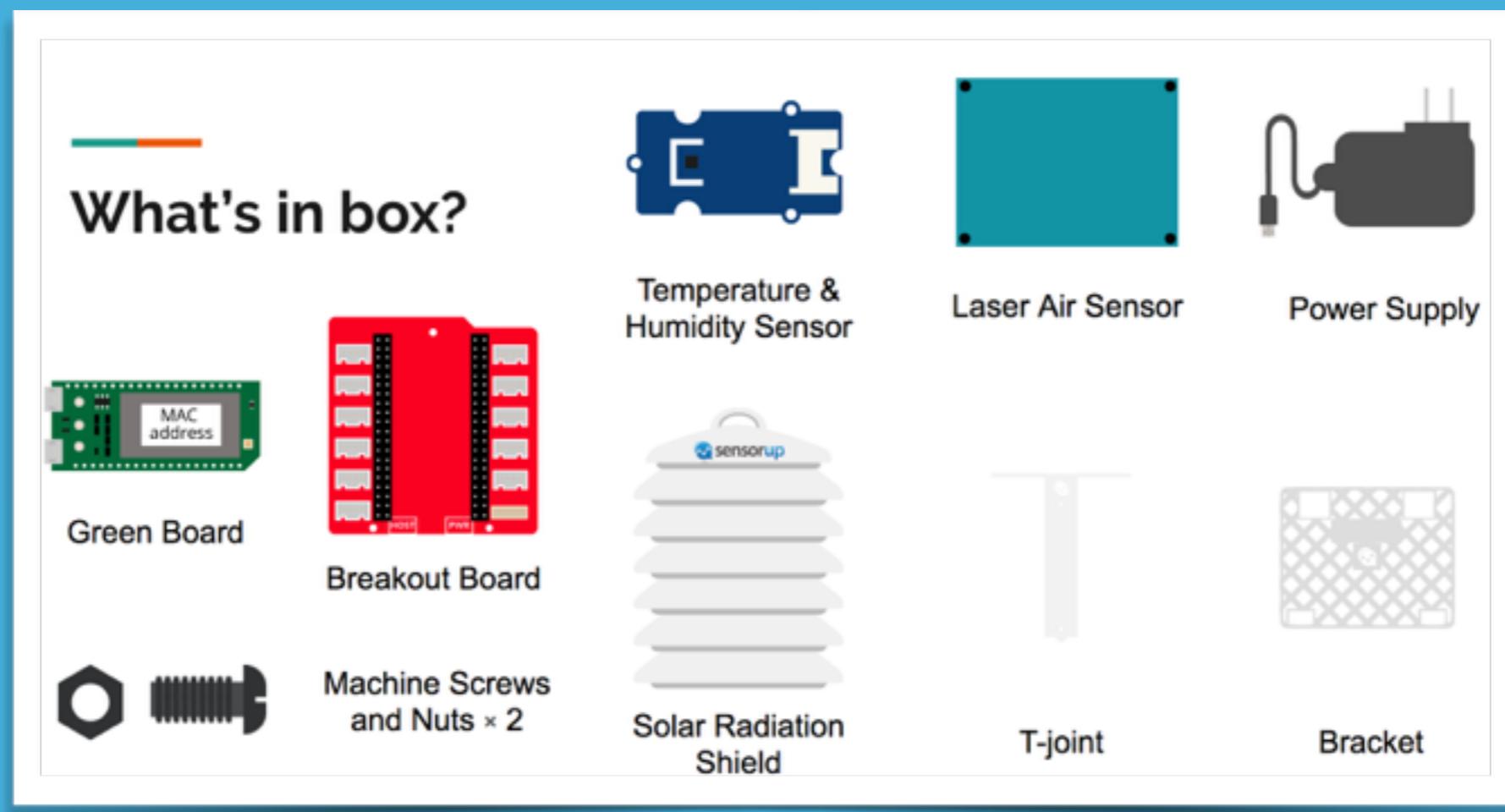
Smart Citizens for Smart Cities



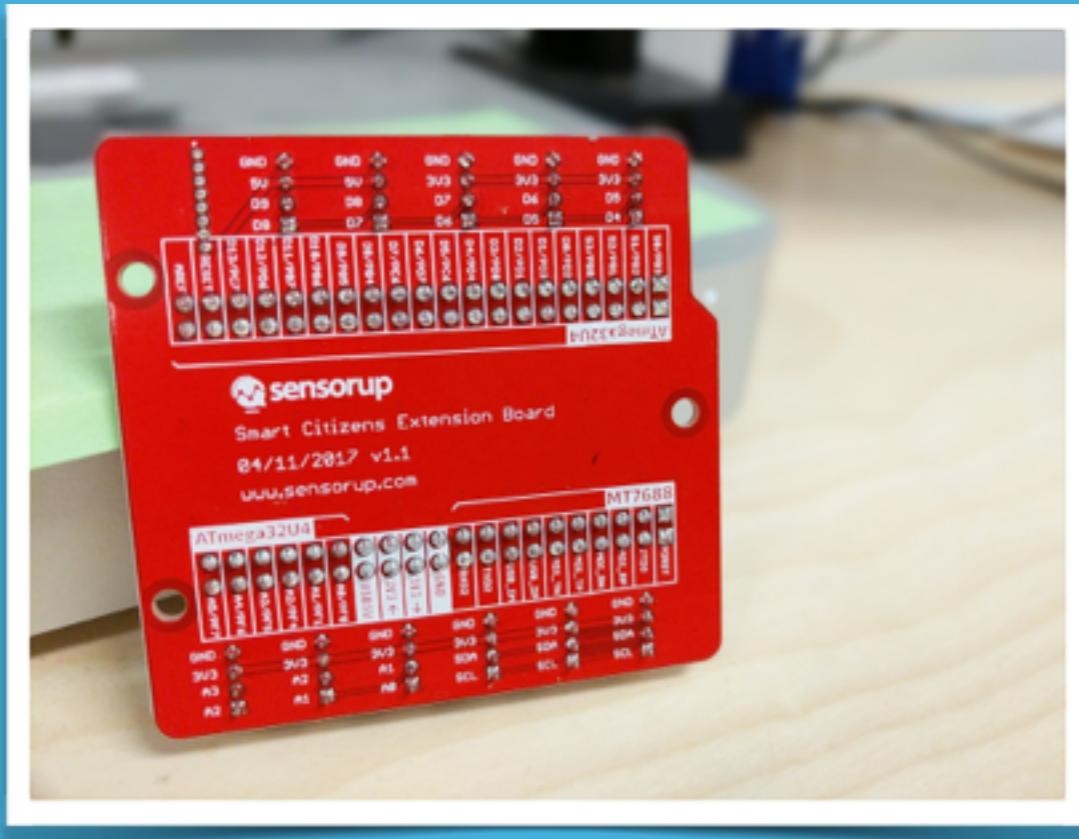
Air Quality Sensing Hardware Kit - I

Air Quality Sensing Kits

DIY sensing kits, that can be assembled by citizens within 5 minutes.



SensorUp Smart Citizens Board



OGC SensorThings API



Open Geospatial Consortium

Submission Date: 2015-10-26
Approval Date: 2016-02-19
Publication Date: 2016-08-04

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Internal reference number of this OGC® document: 15-078r6
Version: 1.0
Category: OGC® Implementation Standard

Editors: Steve Liang (University of Calgary/SensorUp)
Chih-Yuan Huang (National Central University)
Tania Khalafbeigi (University of Calgary/SensorUp)

OGC SensorThings API
Part 1: Sensing

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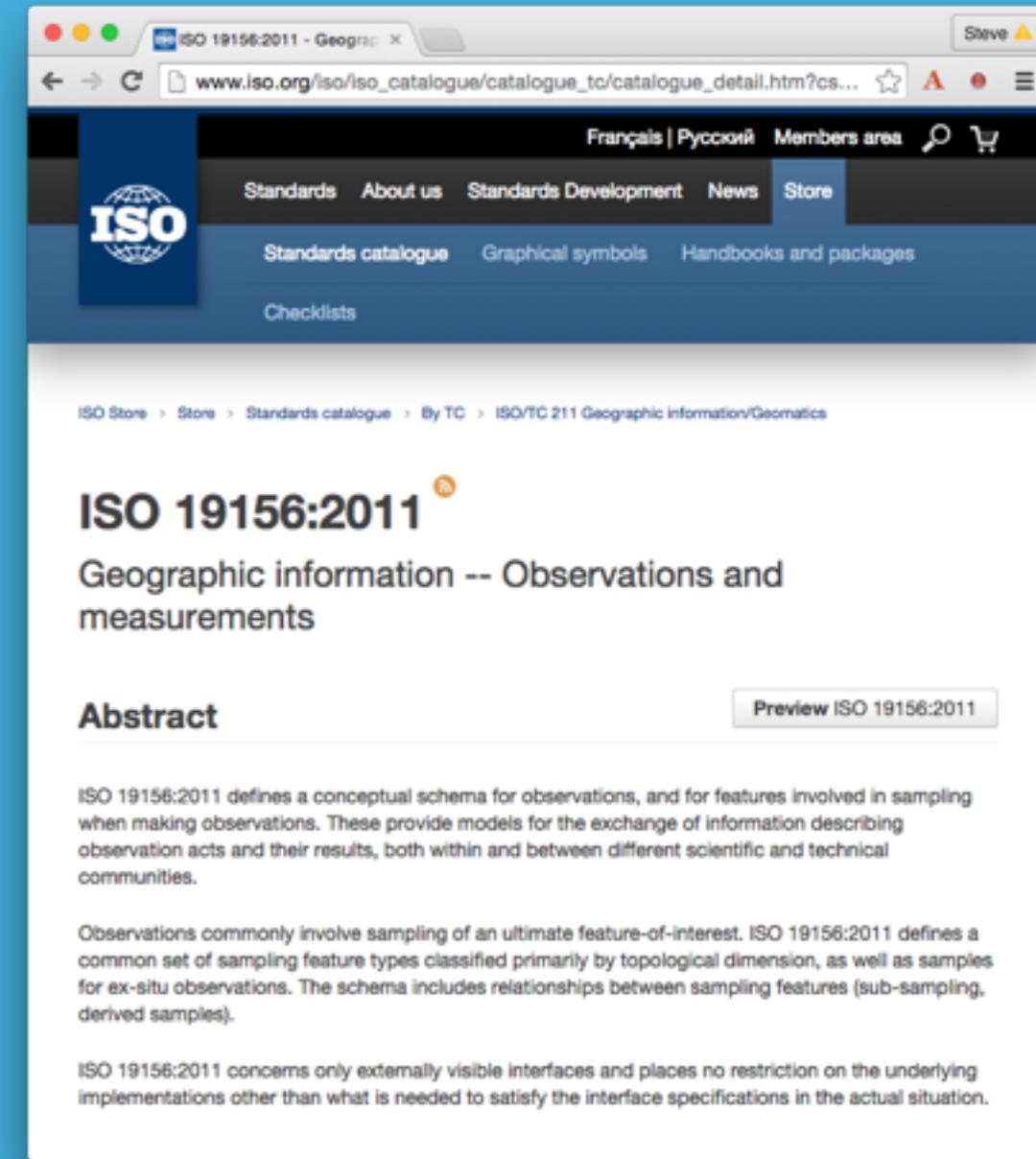
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The official normative version of this standard is available at:
<http://docs.opengeospatial.org/is/15-078r6/15-078r6.html>

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Document type: OGC® Standard
Document subtype: Implementation Standard
Document stage: Approved
Document language: English

1
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SensorThings is based on OGC/ISO 19156:2011



The screenshot shows the ISO 19156:2011 standard page on the ISO website. The page title is "ISO 19156:2011 - Geographic information -- Observations and measurements". The abstract states: "ISO 19156:2011 defines a conceptual schema for observations, and for features involved in sampling when making observations. These provide models for the exchange of information describing observation acts and their results, both within and between different scientific and technical communities. Observations commonly involve sampling of an ultimate feature-of-interest. ISO 19156:2011 defines a common set of sampling feature types classified primarily by topological dimension, as well as samples for ex-situ observations. The schema includes relationships between sampling features (sub-sampling, derived samples). ISO 19156:2011 concerns only externally visible interfaces and places no restriction on the underlying implementations other than what is needed to satisfy the interface specifications in the actual situation."

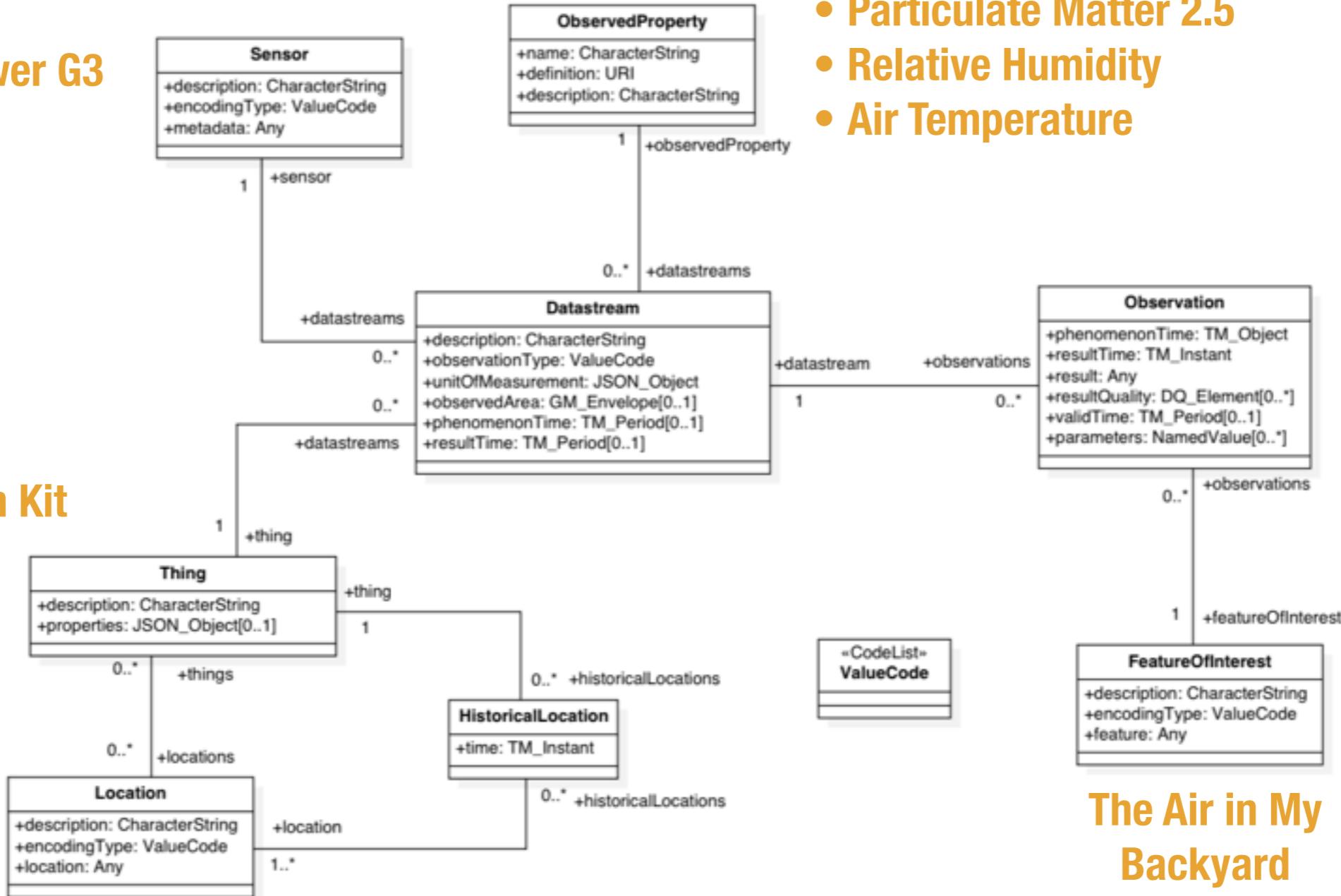


International
Organization for
Standardization

The data model

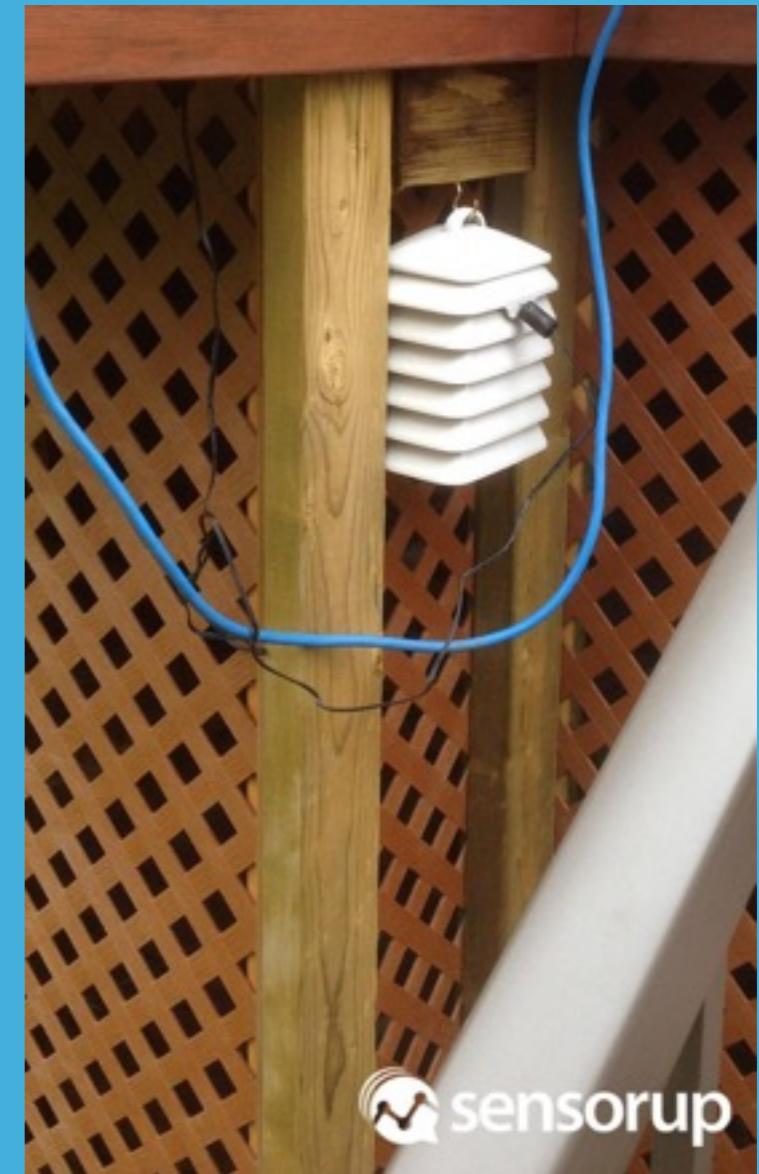
- Plant Tower G3
- DHT22

Smart Citizen Kit



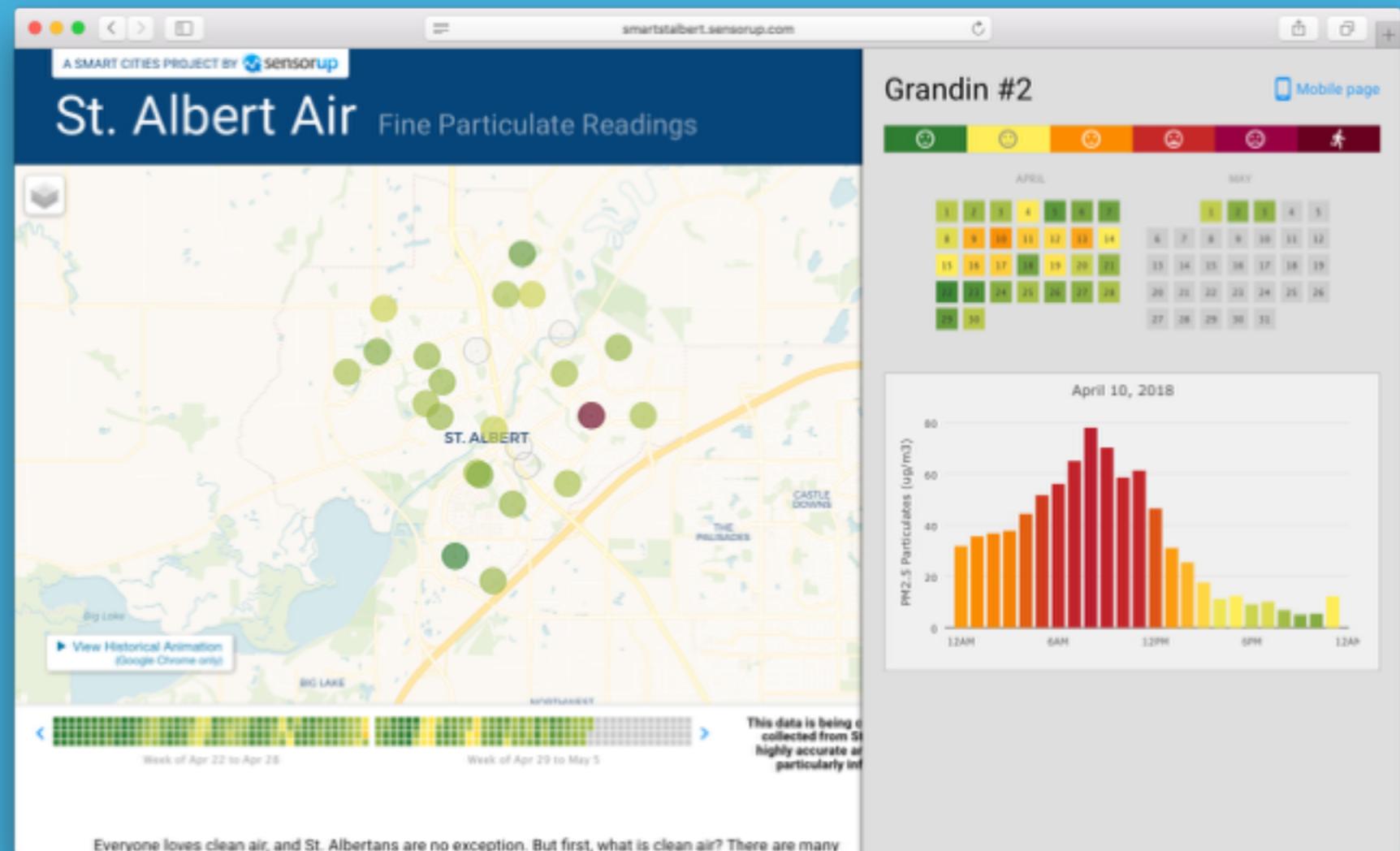
Air Quality Sensing Hardware Kit - 2

Sensing Kits Deployed by Citizens



Smart City Public Portal

Allow users to visualize and analyze historical and real-time air quality data over a user-friendly web portal.



Smart City Smartphone APP

Smart City Smartphone APP

Allow users to visualize and analyze historical and real-time air quality data with their smartphone.

Map

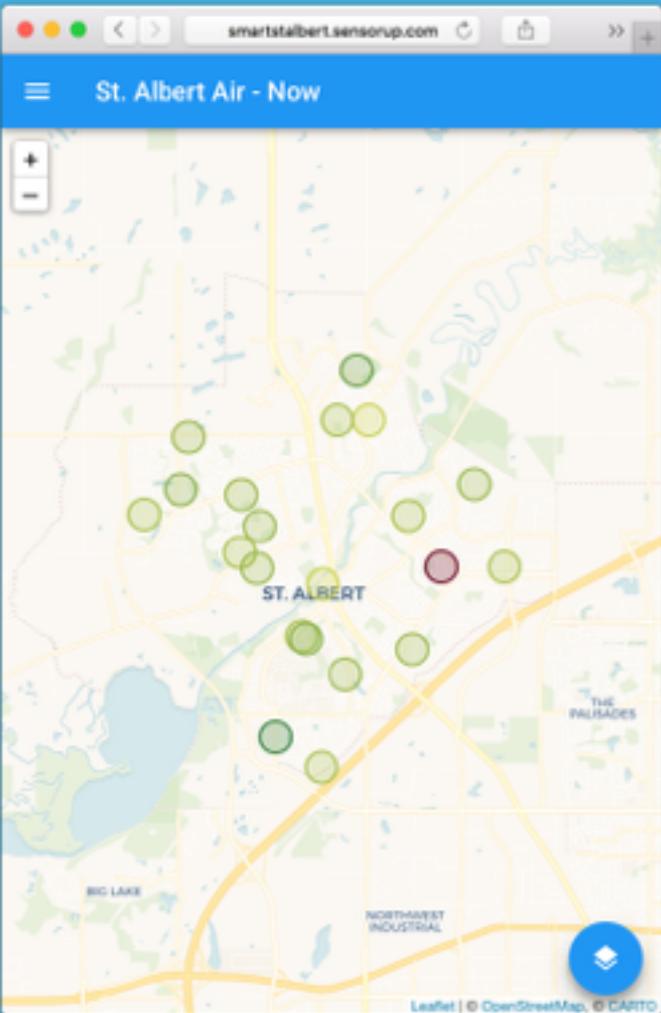
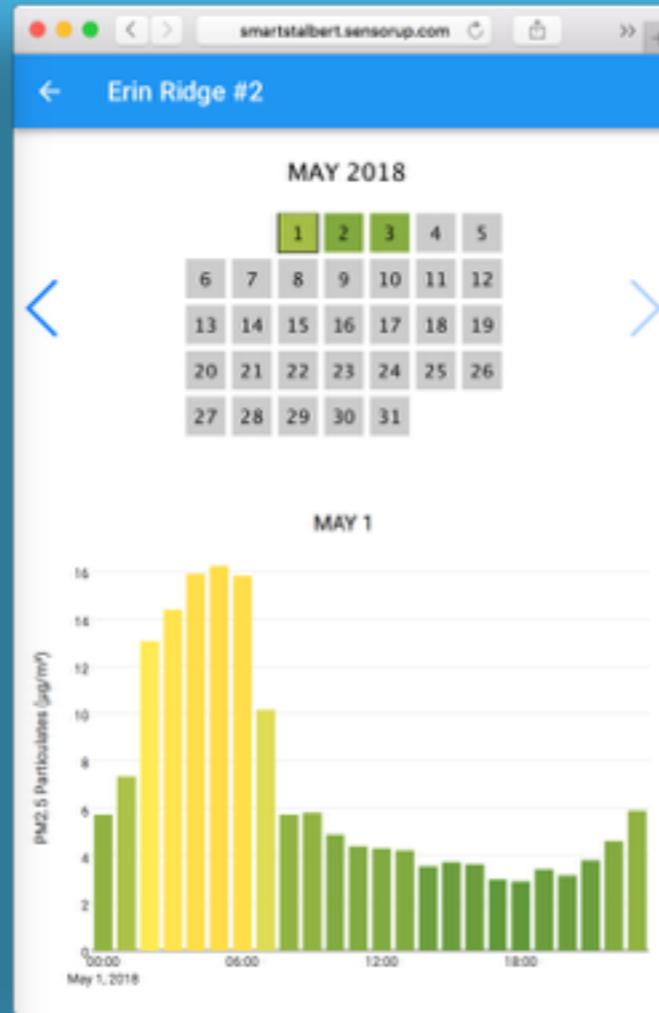
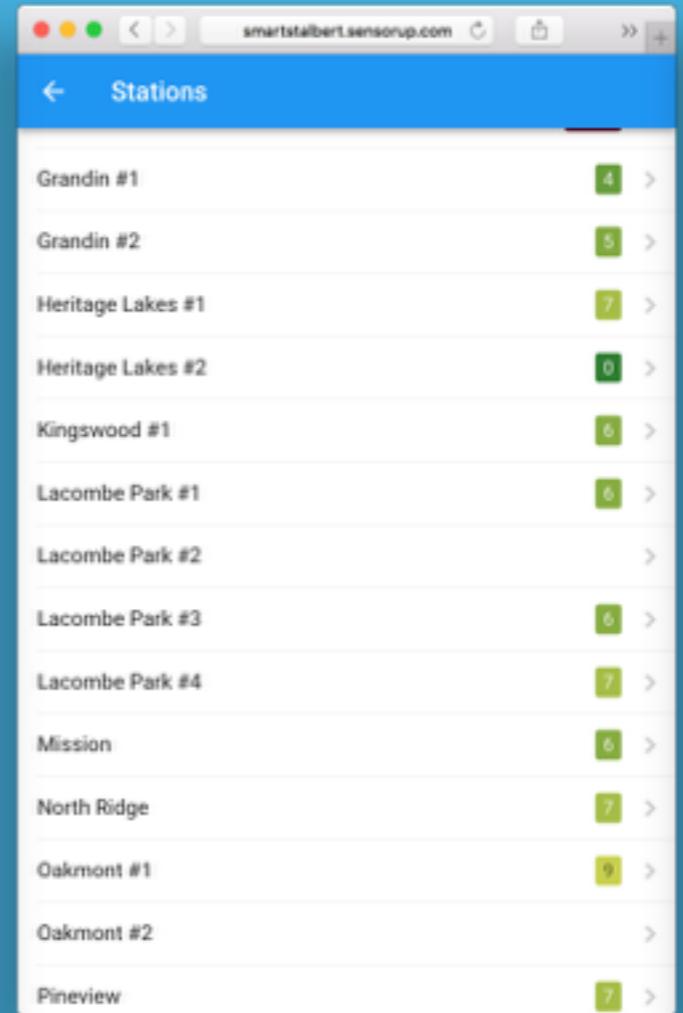


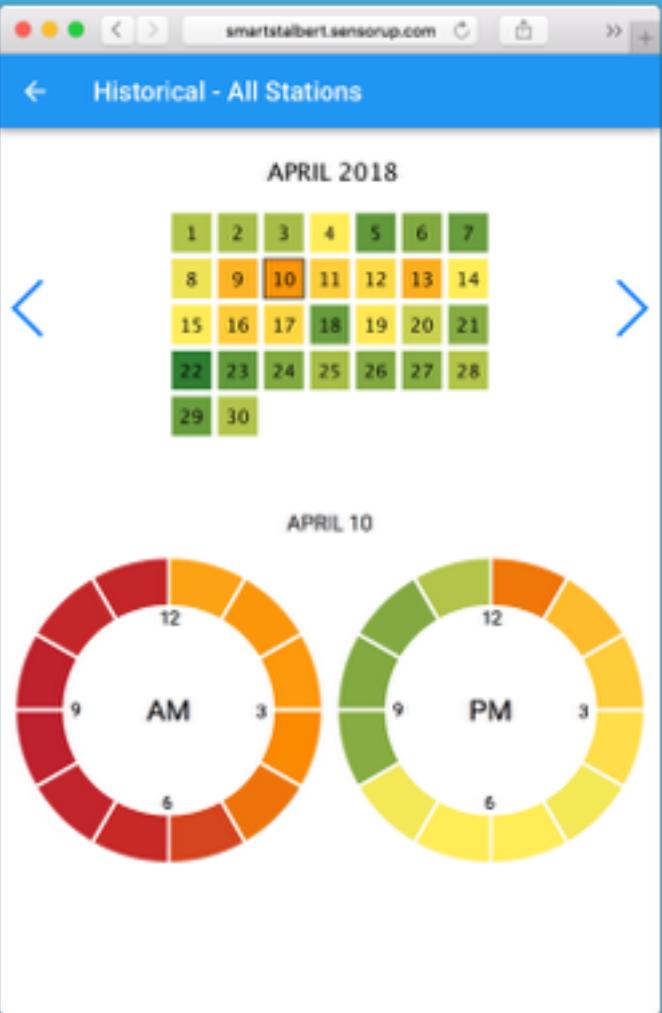
Chart and Trend



Sensor Stations

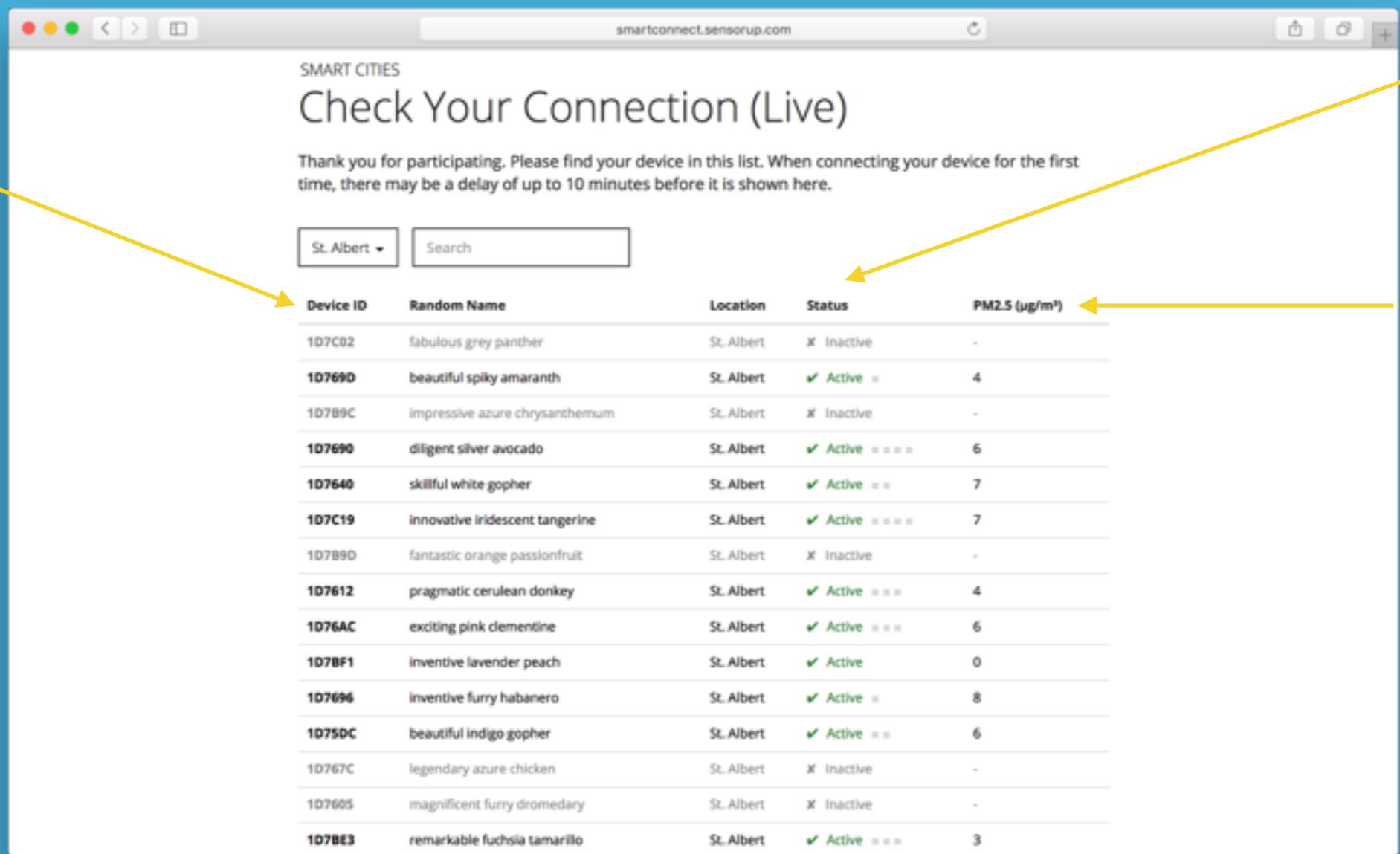


All Stations



Device Management Portal

Allow authorized users to manage the devices' connectivity statuses over a password-protected web portal.



Device ID

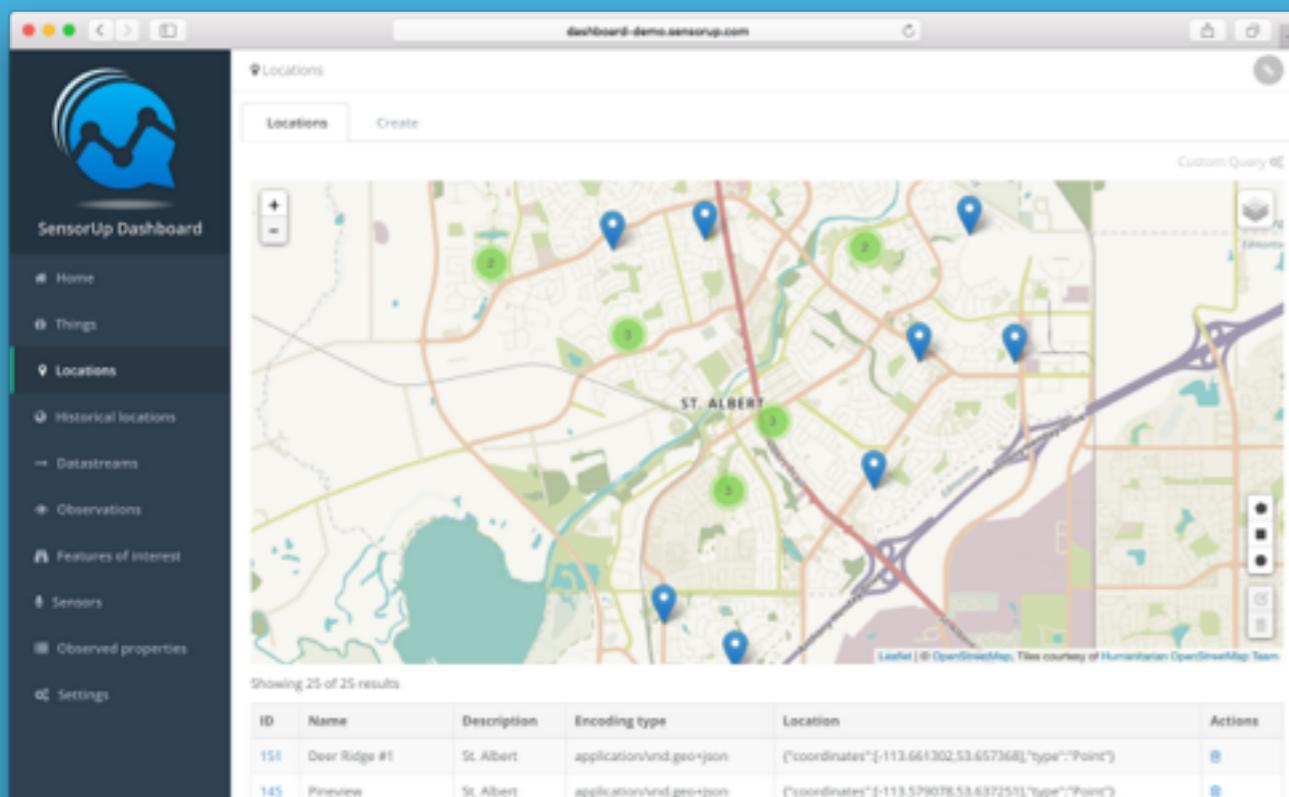
Status

Real-time readings

Device ID	Random Name	Location	Status	PM2.5 ($\mu\text{g}/\text{m}^3$)
1D7C02	fabulous grey panther	St. Albert	<input checked="" type="checkbox"/> Inactive	-
1D769D	beautiful spiky amaranth	St. Albert	<input checked="" type="checkbox"/> Active	4
1D7B9C	impressive azure chrysanthemum	St. Albert	<input checked="" type="checkbox"/> Inactive	-
1D7690	diligent silver avocado	St. Albert	<input checked="" type="checkbox"/> Active	6
1D7640	skillful white gopher	St. Albert	<input checked="" type="checkbox"/> Active	7
1D7C19	innovative iridescent tangerine	St. Albert	<input checked="" type="checkbox"/> Active	7
1D7B9D	fantastic orange passionfruit	St. Albert	<input checked="" type="checkbox"/> Inactive	-
1D7612	pragmatic cerulean donkey	St. Albert	<input checked="" type="checkbox"/> Active	4
1D76AC	exciting pink clementine	St. Albert	<input checked="" type="checkbox"/> Active	6
1D7BF1	inventive lavender peach	St. Albert	<input checked="" type="checkbox"/> Active	0
1D7696	inventive furry habanero	St. Albert	<input checked="" type="checkbox"/> Active	8
1D75DC	beautiful indigo gopher	St. Albert	<input checked="" type="checkbox"/> Active	6
1D767C	legendary azure chicken	St. Albert	<input checked="" type="checkbox"/> Inactive	-
1D7605	magnificent furry dromedary	St. Albert	<input checked="" type="checkbox"/> Inactive	-
1D7BE3	remarkable fuchsia tamarillo	St. Albert	<input checked="" type="checkbox"/> Active	3

Data Management Portal

Allow authorized users to manage the data collected by the sensors, *i.e.*, clean-up, quality control, update location, add contextual data, etc.



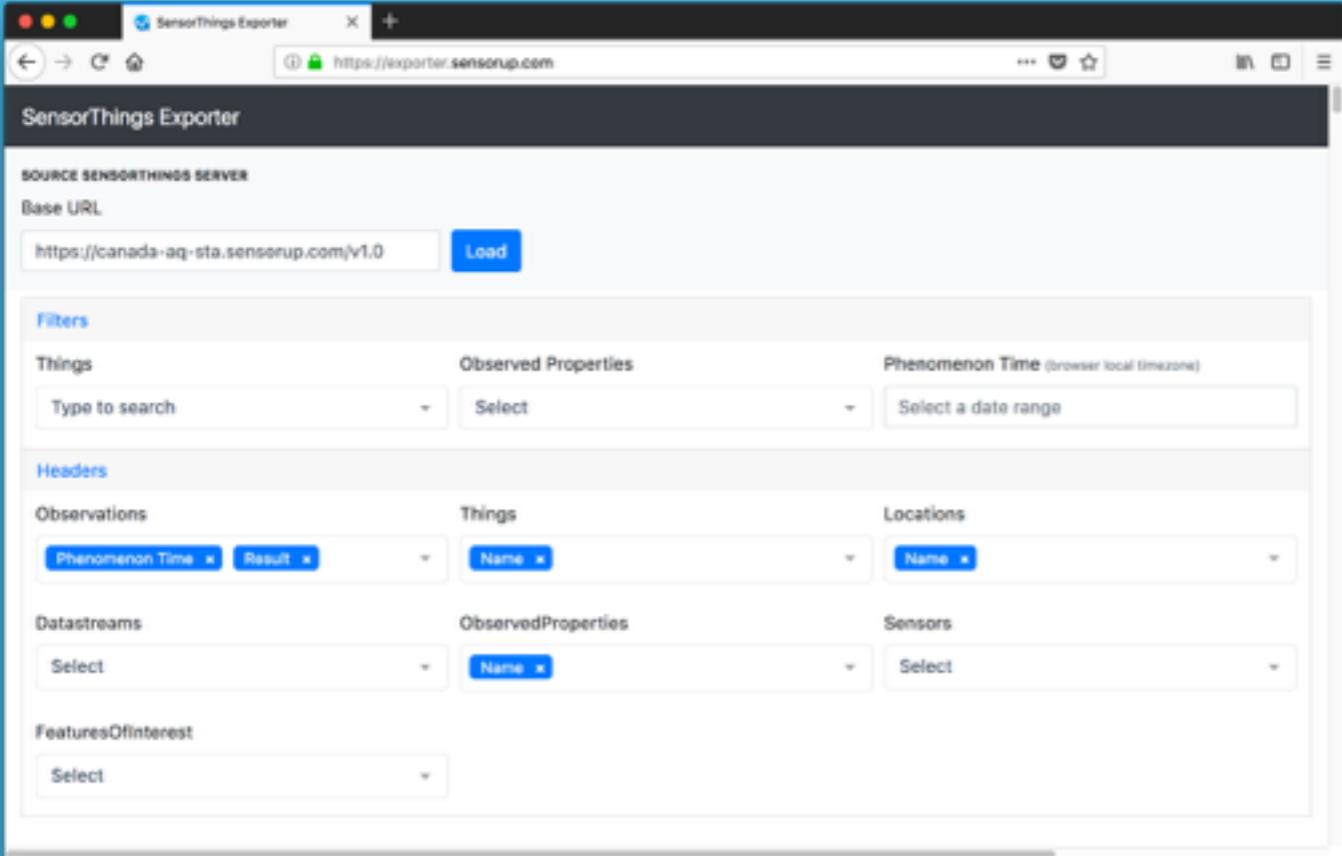
Manage / Update Locations



Manage / Update Sensor Observations

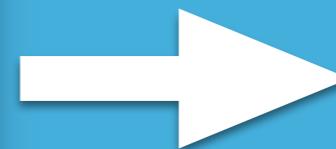
Data Exporter

Allow authorized users to filter and export data to popular data formats for machine learning and artificial intelligence



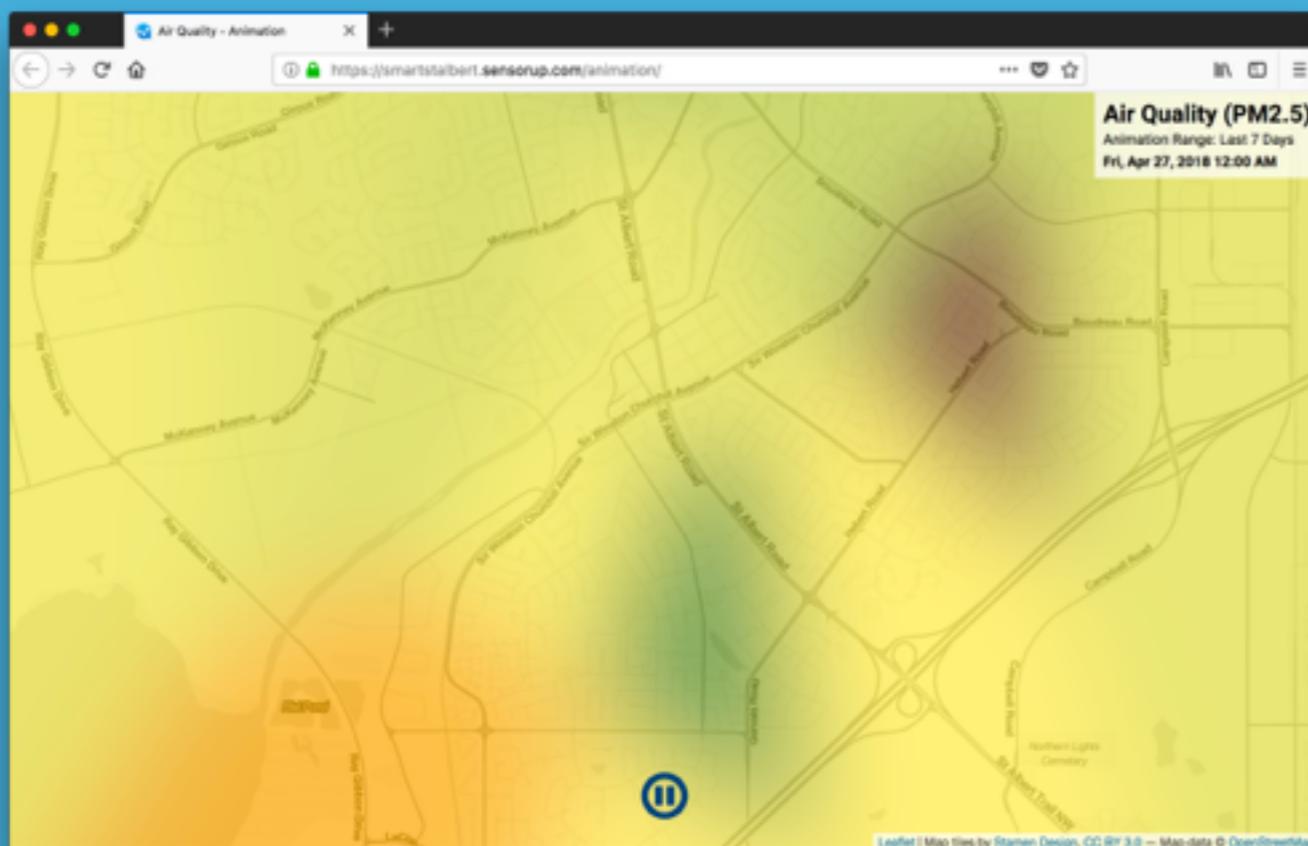
The screenshot shows the SensorThings Exporter interface. At the top, it says "SensorThings Exporter" and "SOURCE SENSORTHINGS SERVER". Below that is a "Base URL" input field containing "https://canada-aq-sta.sensorup.com/v1.0" with a "Load" button next to it. Under "Filters", there are sections for "Things", "Observations", "Datastreams", and "FeaturesOfInterest", each with dropdown menus for selecting filters. There are also sections for "Observed Properties", "Locations", "ObservedProperties", "Sensors", and "Name" with dropdown menus.

Data Exporter

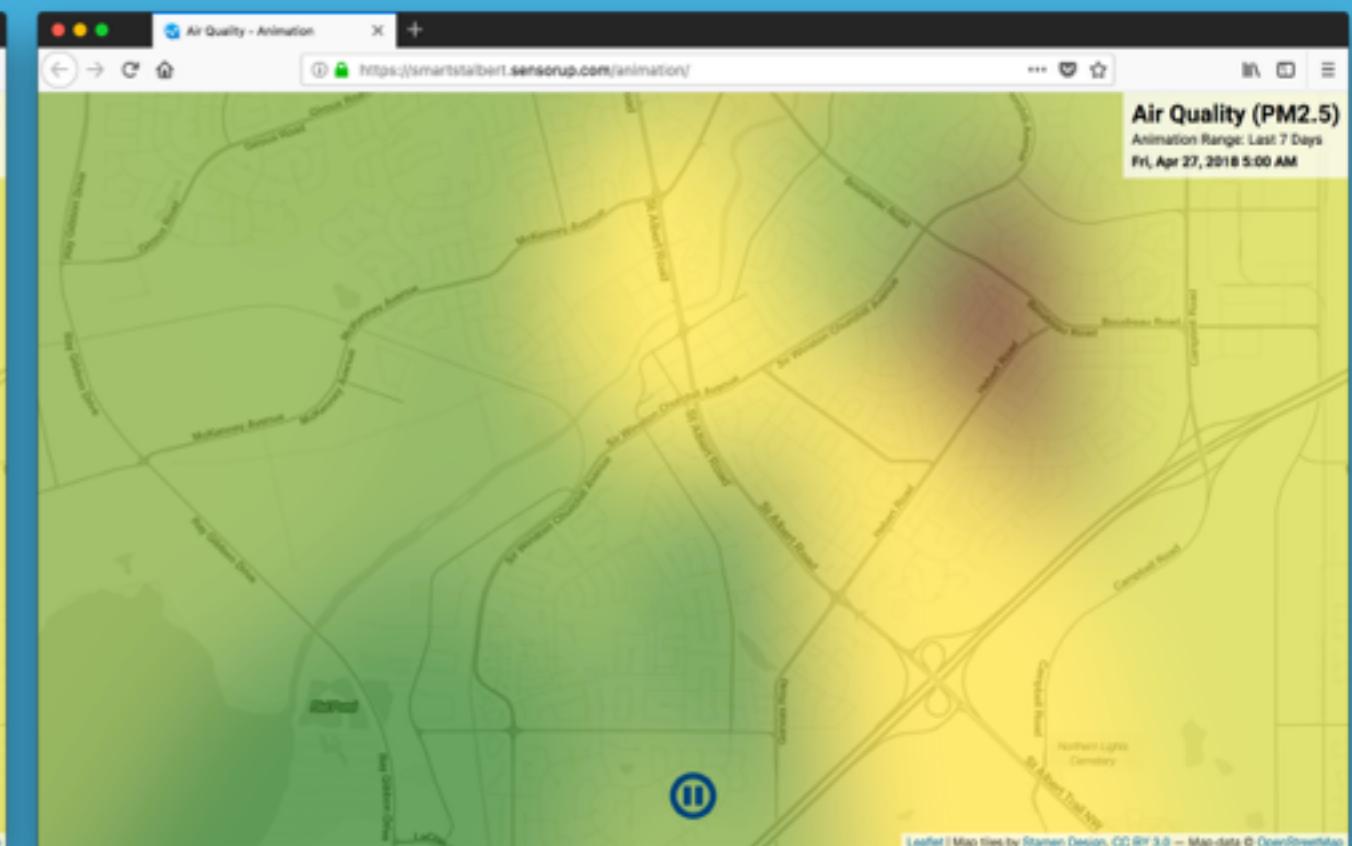


More...

Air Quality Trends



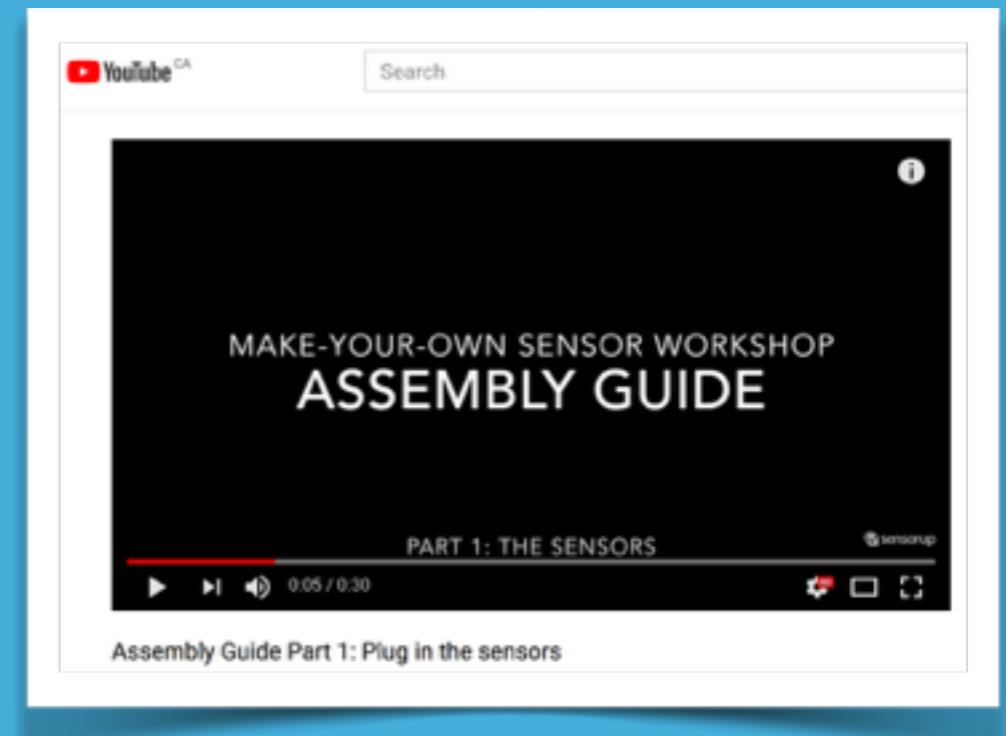
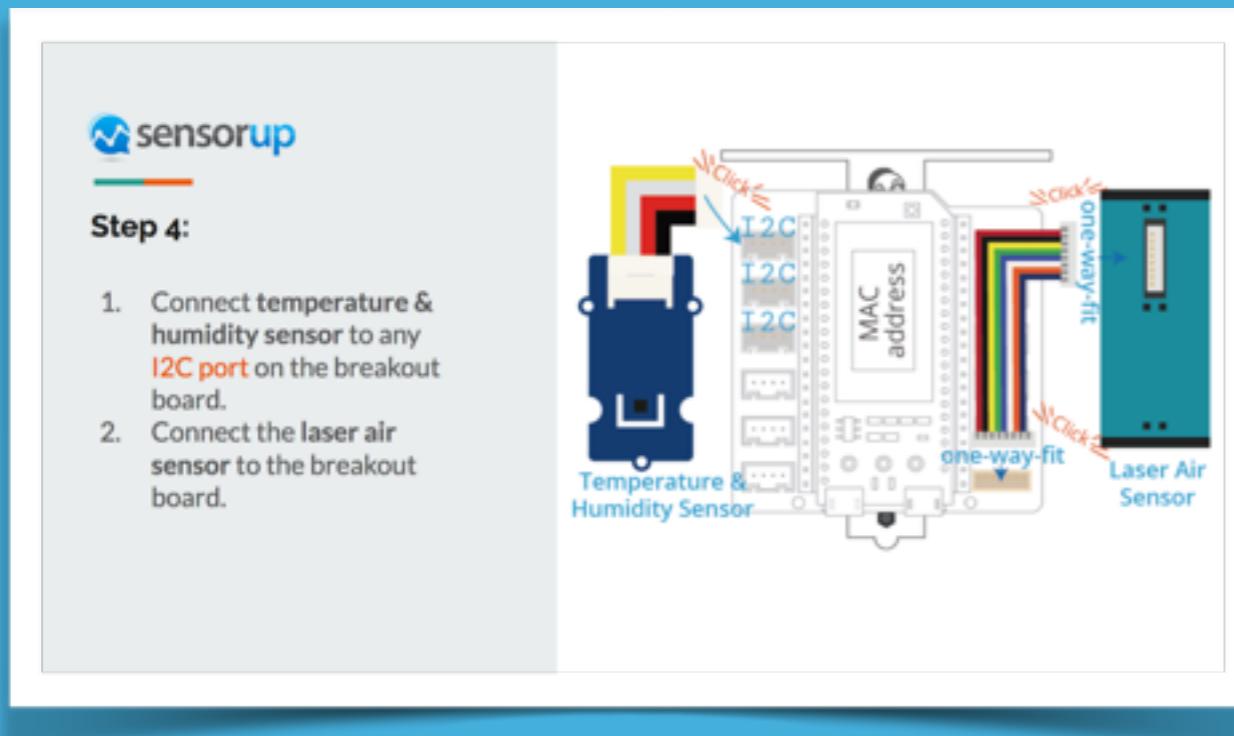
12:00 AM



8:00 AM

Citizen Engagement Kit

- The engagement kit includes all necessary materials to run the Make-Your-Sensor Workshop.



Step-by-Step Assembly Manual

Instructional Videos

The Smart City Starter Kit consists of...



IoT Sensors



Citizen Engagement
Kit



Managing, Visualizing,
and Reporting



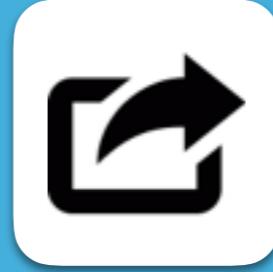
Mapping



Analyzing



Alarming



Data Export

■ Expanding to **500** sensors across **10** Canadian cities

- Calgary
- Edmonton
- Vancouver
- St Albert
- Montreal
- Ottawa
- Kamloops
- more...



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LIFE

Sponsored by TELUS

Big data will mean big benefits for smart cities

NP MATT FLEMING, SPECIAL TO NATIONAL POST | November 12, 2015 | Last Updated: 11:45 AM ET More from Special to National Post

metro

News / Calgary

Check the air quality by your house, live, through new Calgary start up

SensorUp uses air monitors through the city to give by-the-hour updates

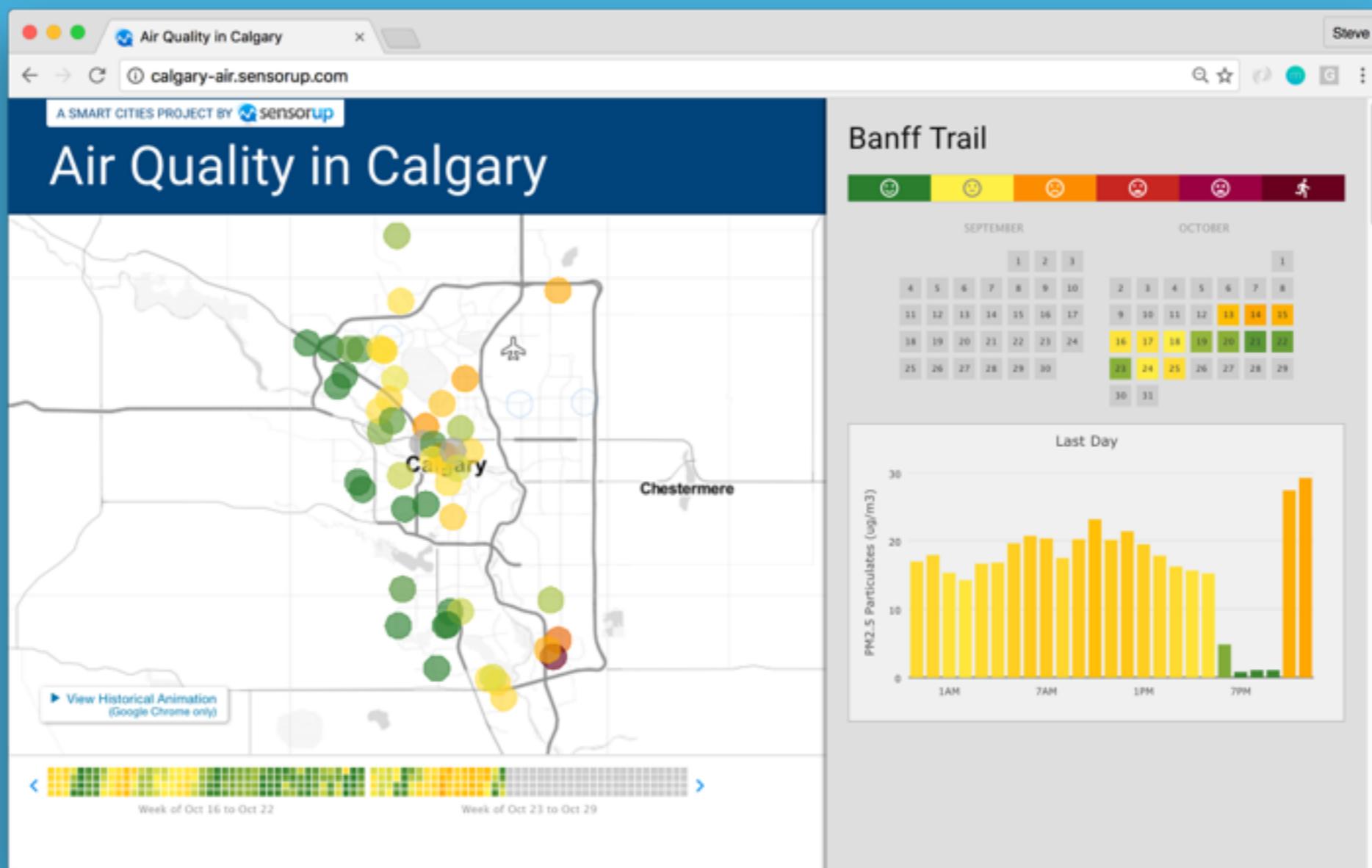
Steve Liang

Aaron Chaitin - Metro

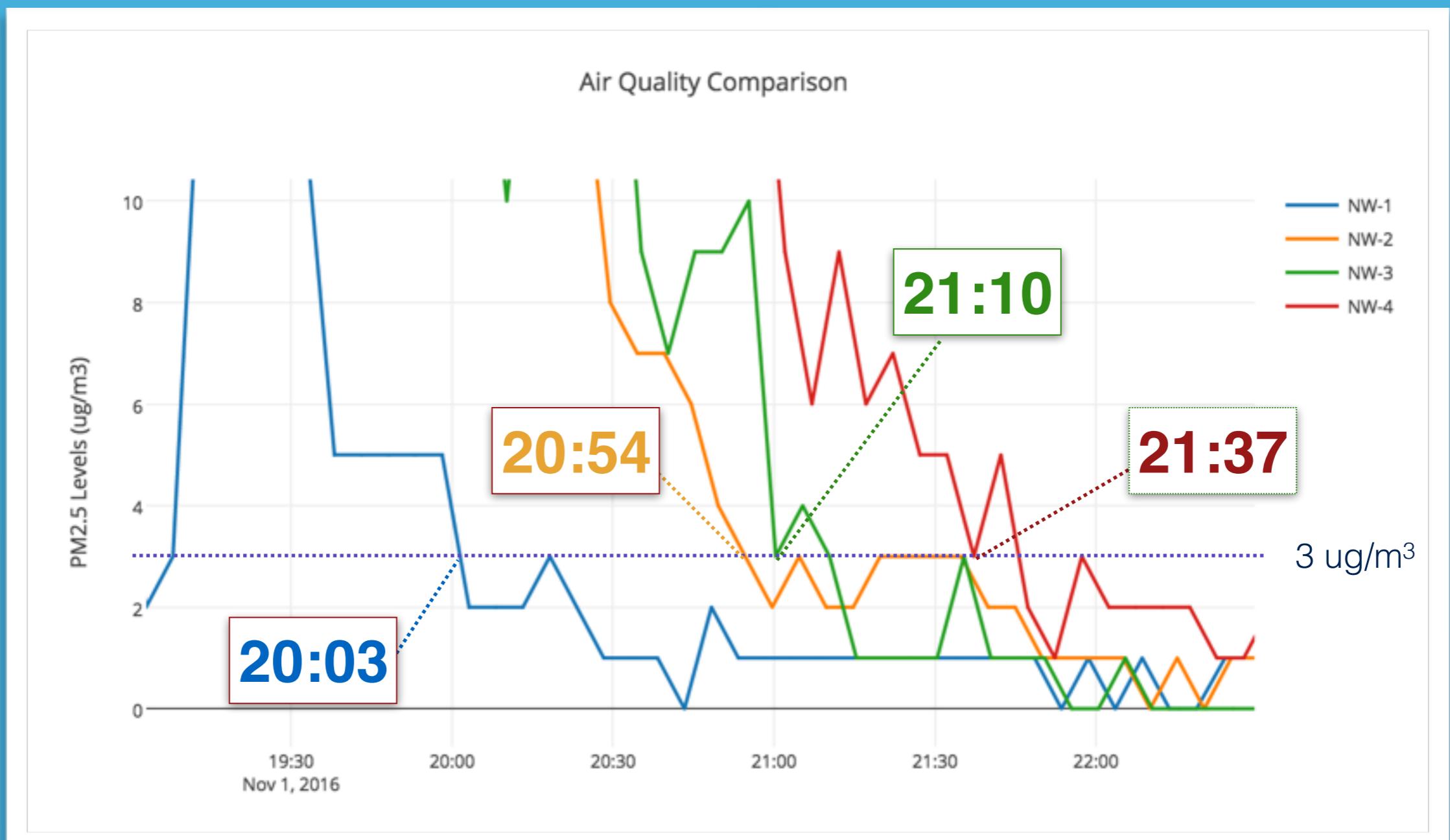
SensorUp's Steve Liang hopes sensors like these will be installed through Calgary -- with everyone contributing to the information web.

#YYC Air Quality

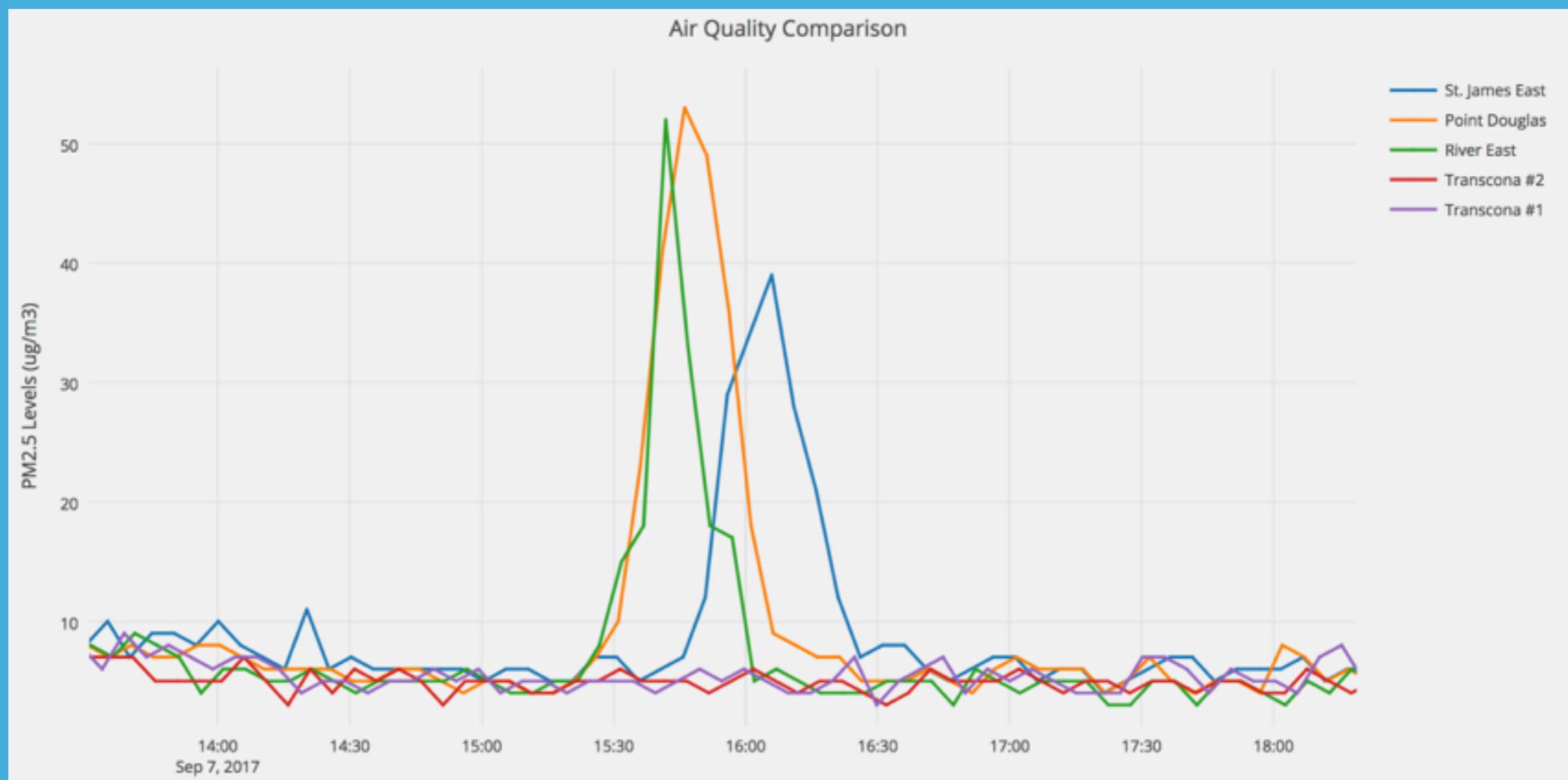
<http://smartcalgary.sensorup.com>



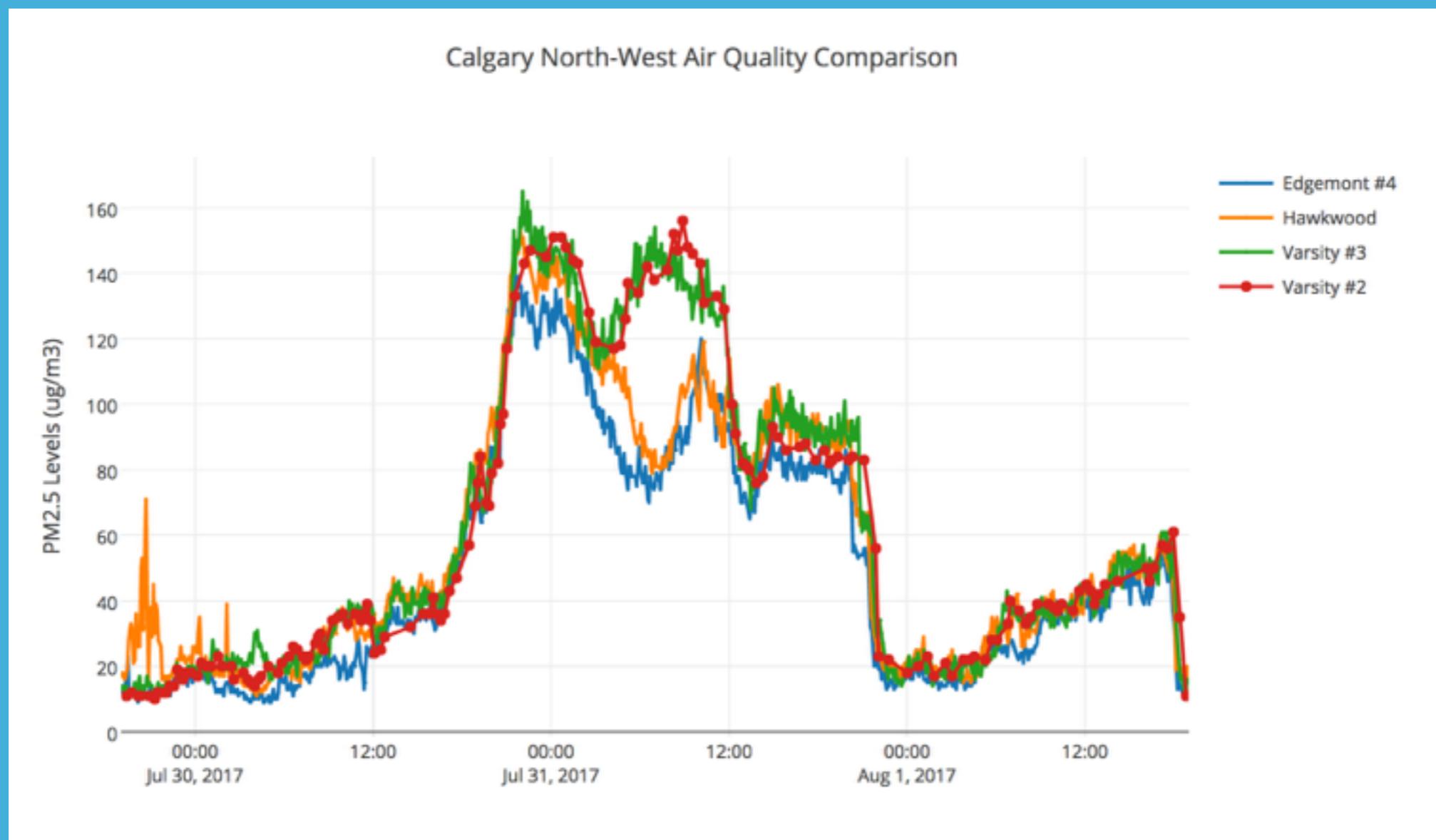
We can nowcast air quality trend at a hyper-local scale



Winnipeg - Hyper-local Air Quality Data



Calgary - Hyper-local Air Quality Data



share.sensorup.com/?t=ss-v1&id=188

DEMO

Thanks!!



Steve Liang, P.Eng., Ph.D.

Founder and CEO

<http://www.sensorup.com>

steve.liang@sensorup.com