CRISSCROSSING the park

A project on sensing air quality in the city by Elaine Hsieh.

Prof. Anthony Vanky Columbia GSAPP, Urban Planning Urban Informatics, Spring 2020

executive summary

The development of the “CrissCrossing the Park” project explores urban sensing specifically focused on air quality and environmental sensing at a micro-scale in New York. This project stemmed from our prompted research site, Starlight Park in the Bronx, and our client, the New York City Department of Parks and Recreation. The premise of this project approaches a topical discussion on how we, as urbanists, approach the inevitable integration of sensors in a public realm. We were encouraged to “play” in our sandbox (the course), and were provided with foundational tools to explore sensing at a “Do It Yourself” (DIY) level.

“CrissCrossing the Park” is a response to the environmental injustices currently taking place in the Bronx borough. It is a proposal for an educational engagement and activist tool that allows community members to become more aware of the conversation of air quality in individuals’ parks, which tend to seem out of reach.

“CrissCrossing the Park” explained

The name “CrissCrossing the Park” was inspired as a play on word to other, more playful, uses of the term. “CrissCross jumping rope” reminded me of “play” as a child. “CrissCross apple sauce” was a phrase commonly used by teachers during elementary school to refocus and pay attention.

“CrissCrossing the Park” is a reference to play, as well as to the dynamic that this project is meant to be deployed many times across a park and to be utilized by those passing by.

Left image shows jumping rope criss cross style
Right image shows student sitting “criss cross apple sauce” style
Bottom image shows nodes where the project would be deployed .

introduction

The question of deciding which park to go play at is typically a distance question. Is it close? or is it far? Or perhaps, asking what structures it may hold. Does it have a swing? an open space for Frisbee? a basketball court? Rarely, do we ask ourselves,
“Is the park I’m heading to healthy?”

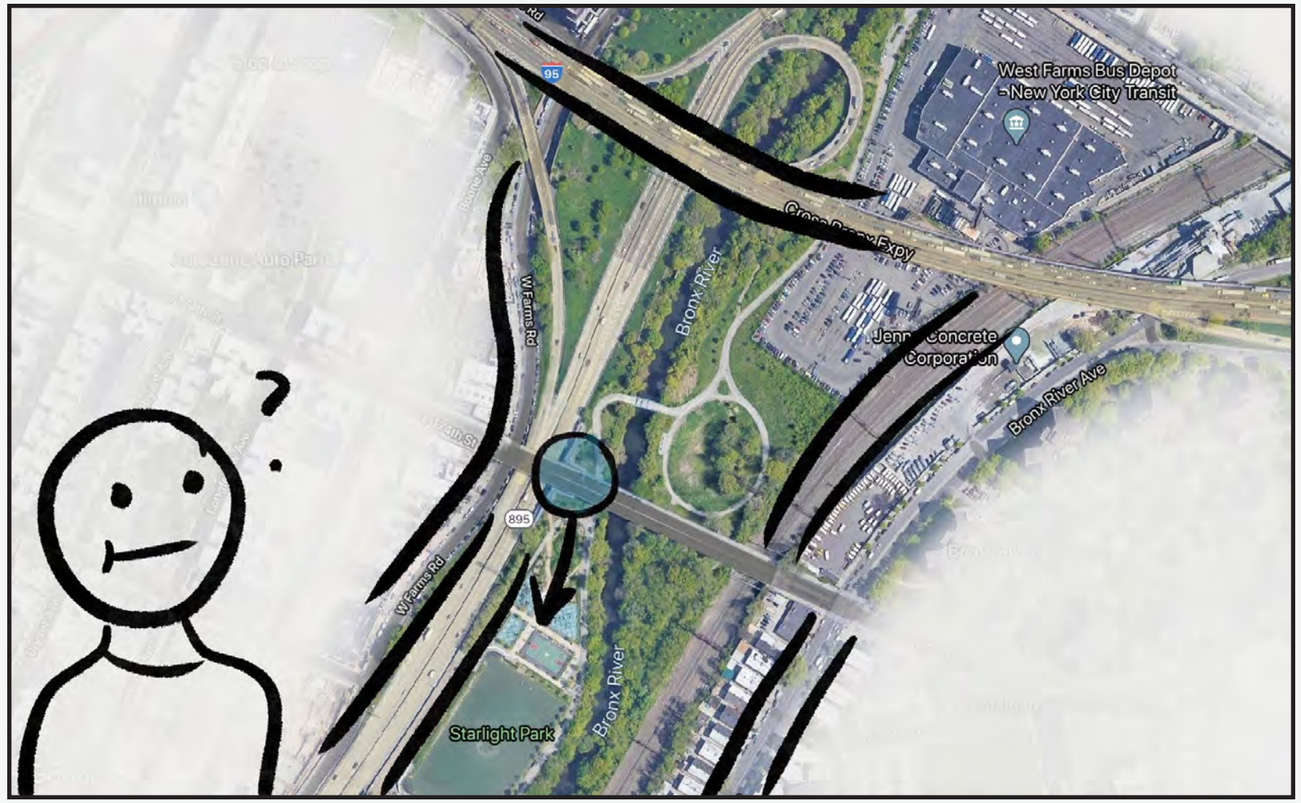
The premise of this study approaches “play” in a different aspect. While visiting our research site of Starlight Park in the Bronx, I noticed some unique aspects that differentiated this park from other parks in New York City.

A few observations:

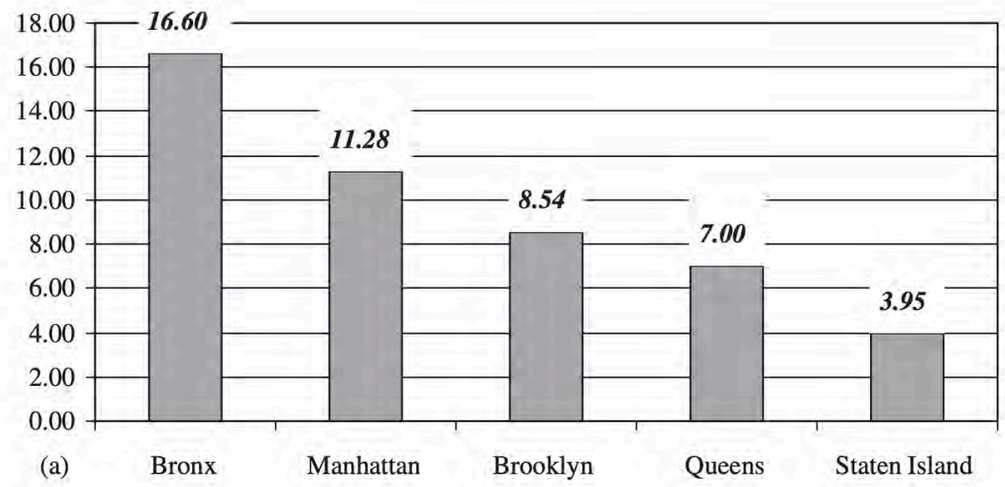
Starlight Park is adjacent to the Bronx River. Tangent to the recently cleaned riverbed, I thought of all the benefits that the city could invest money into, not including its already established water activities, such as canoeing, that were in place.

Starlight Park was inclusive to a variety of “play”. Fun! Basketball courts, soccer field, swings, play structures, an abundance of seating for parents and grandparents, and BBQ grills to utilize. If not the ultimate place for “play”, I’m not sure what other parks could compare.

Starlight Park neighbors an overhead highway, six-lane arterial, and many exhausting automobiles passing by were particularly noticeable in our visit.



As the borough of the Bronx has been studied over the years for maintaining both the highest rate of asthma and the highest percentage of people below the federal poverty line, it is imperative to note that the communities in the Bronx are affected by both poor environmental quality and a lack of fiscal resources to resolve those (Maantay 2007). With this noted, the lack of aggression towards providing environmental justice for communities in the Bronx by the government of NYC should be considered pernicious.



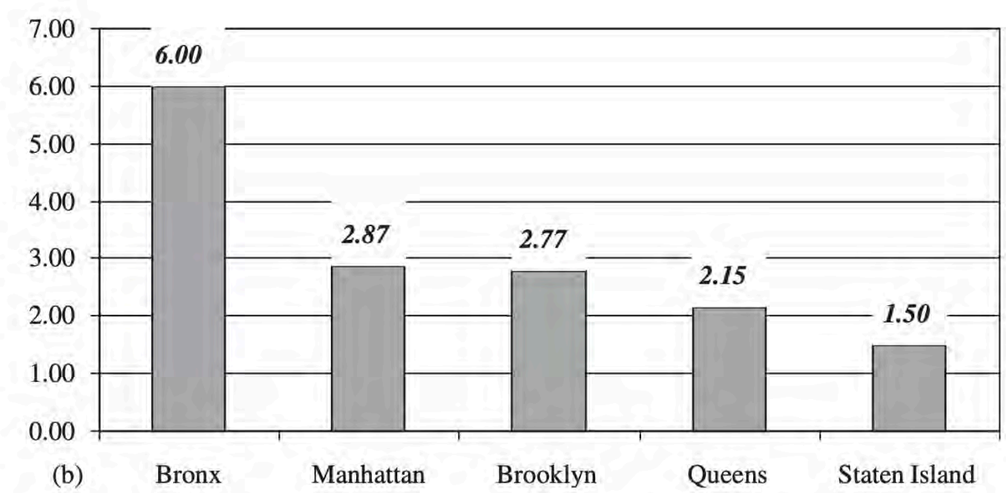
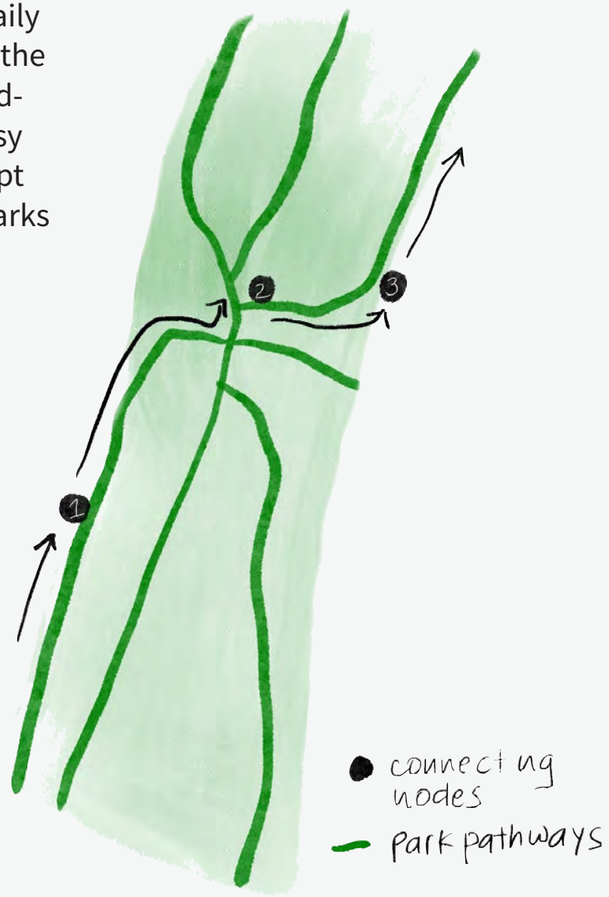


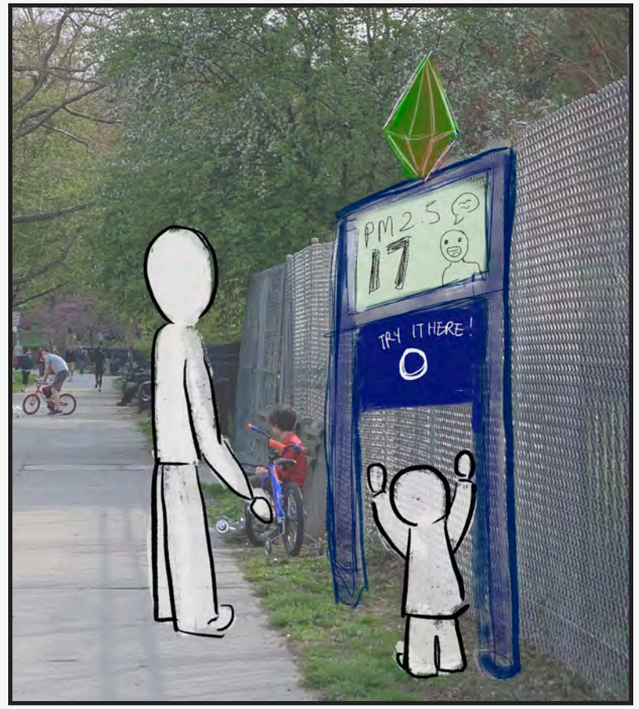
Fig. 1. (a) Asthma hospitalization rates for children aged 0–14, per 1000, by Borough (1997); (b) Asthma death rates for all ages, per 100,000, by Borough (1997). Data Source: NYC DOH (1999).

Source: Maantay 2007

the concept

In short, “CrissCrossing the Park” is a pilot project to bring awareness to air quality injustices in New York City and beyond. Simply, it is the deployment of multiple digital billboards that are integrated with an air quality sensor, as well as a digital screen that simplifies and summaries the complex issues of environmental quality in parks. The audience for this project targets frequent park users that may notice these digital boards during their daily strolls or runs. Hopefully to bridge the disconnection between understanding air quality and providing an easy platform to engage with the concept of sensors and why air quality in parks matter.



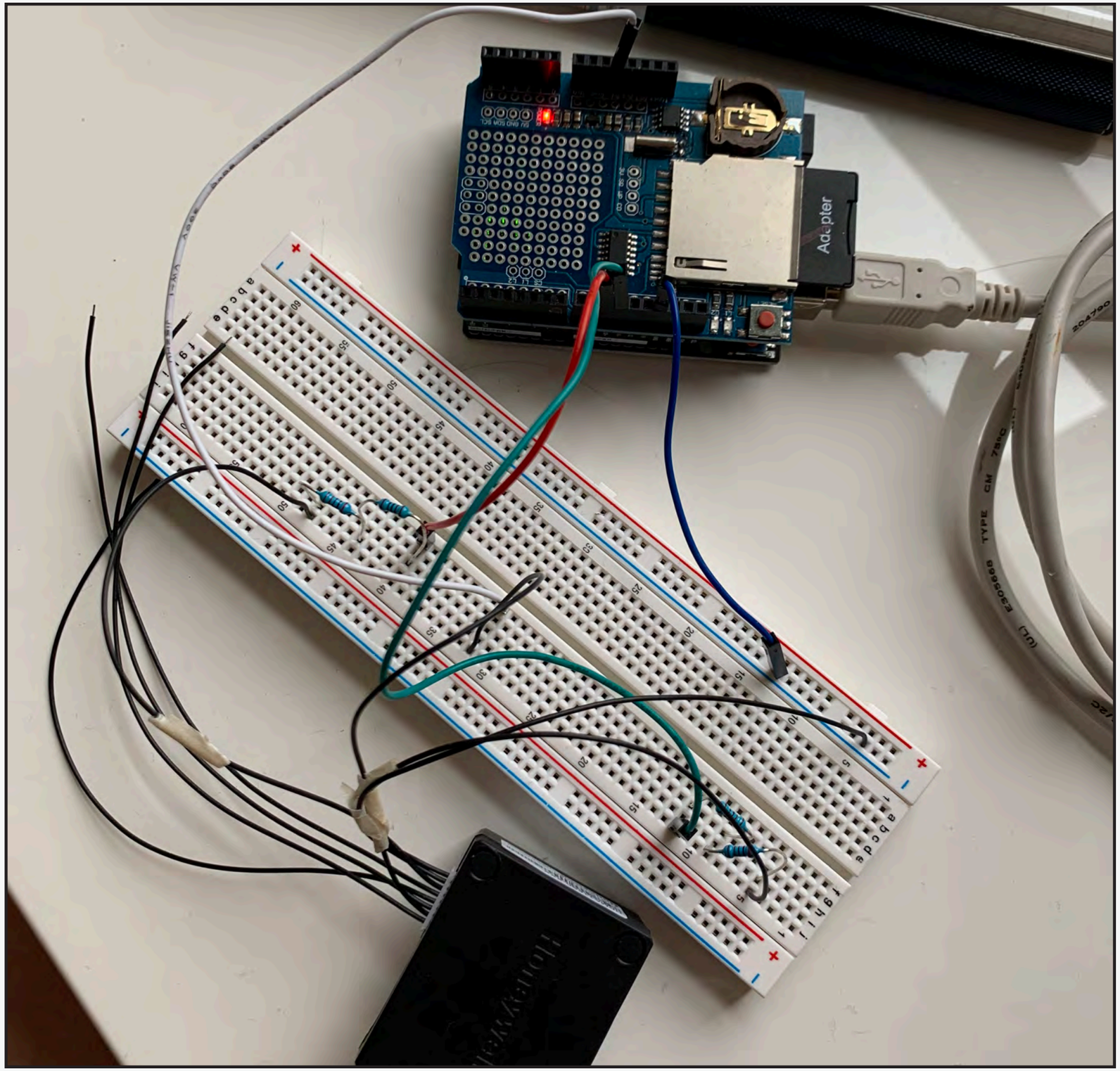


getting into the hardware

As a first-timer at building Arduino hardware and navigating through the Arduino coding language space, I felt a steep learning curve in understanding the use of these technologies.

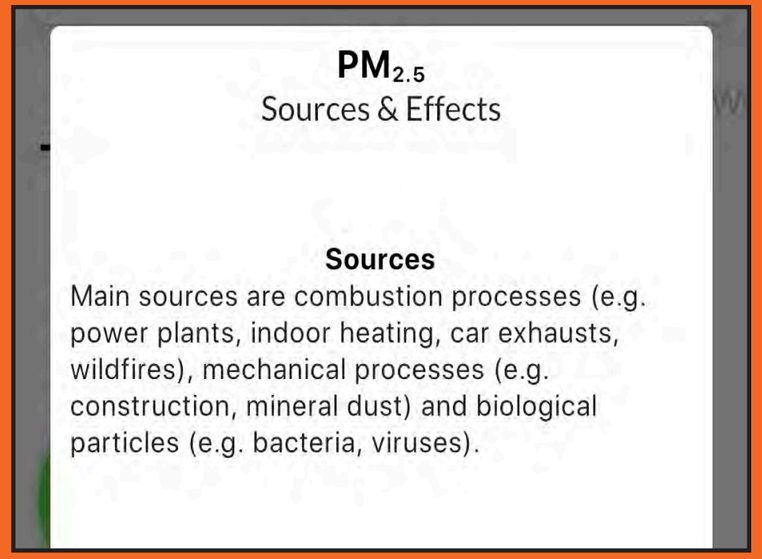
However, through much trial and error, reading tutorials, and collaborative learning effort with classmates, I was able to develop the skills to push forward with my ideas.

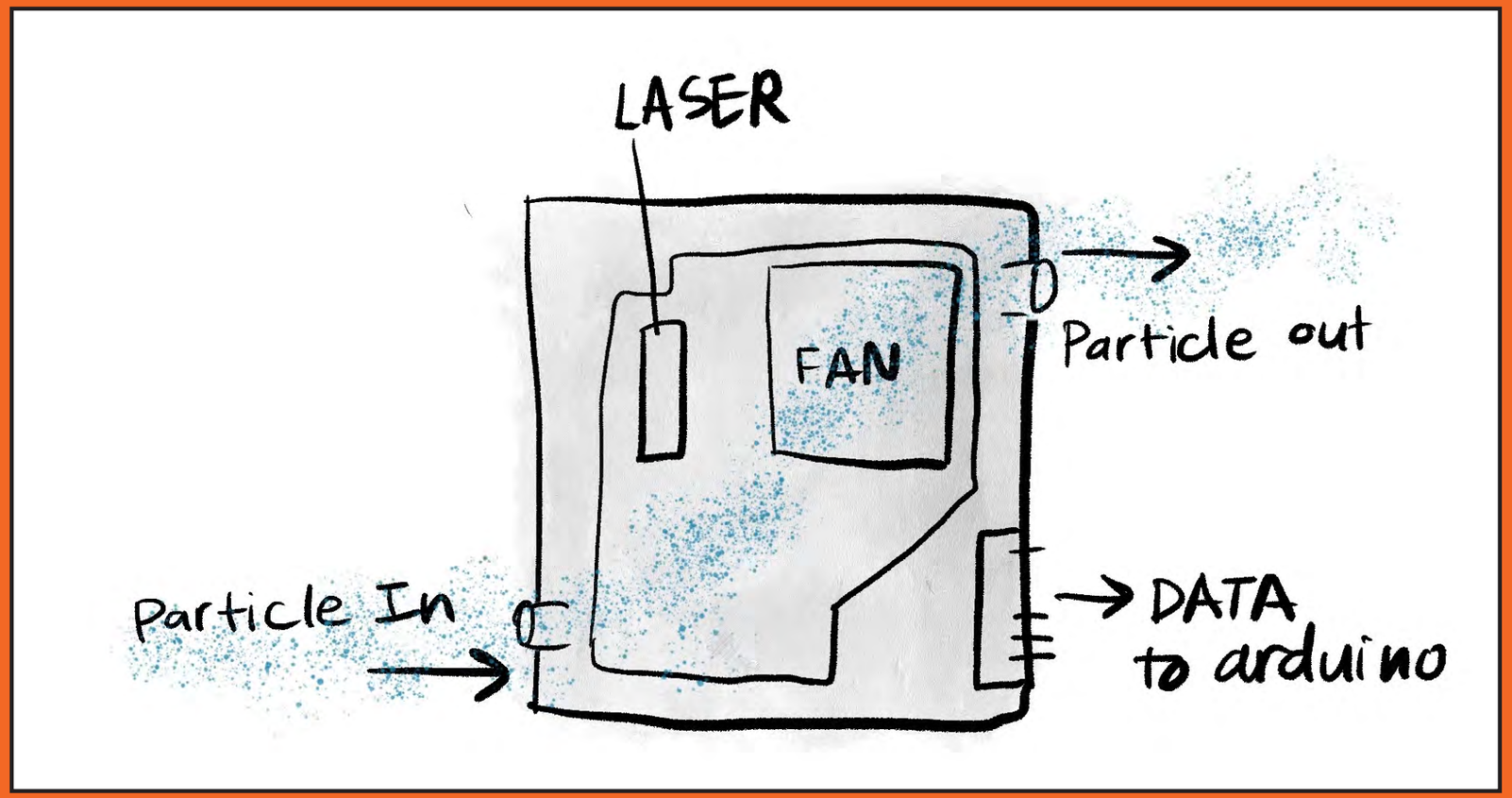
This section will be guided in a tutorial-like manner for others who want to replicate using this particular sensor.



understanding the hardware

Using the Honeywell HPM Particle Sensor, I collected data on PM2.5 and PM10. PM2.5 refers to atmospheric particulate matter (PM) that has a diameter of less than 2.5 micrometers, which is around 3% the diameter of a human hair. From studies, these fine particles are known to trigger chronic diseases such as asthma, heart attacks, and other respiratory issues. To understand this better, this diagram describes how particles enter the sensor, pass by the laser that counts the incoming particles, and within the sensor there is a fan that helps streamline this flow.





Sources: Top left, Sparkfun Official Handbook
Top right, Breezometer

connecting the hardware

equipment needed

+ Arduino
+ Breadboard
+ HPM Particle Sensor
+ 4 dupont wires
+ Two 1K, 2 2K resistors
+ USB Cable type A/B (to connect arduino to computer)

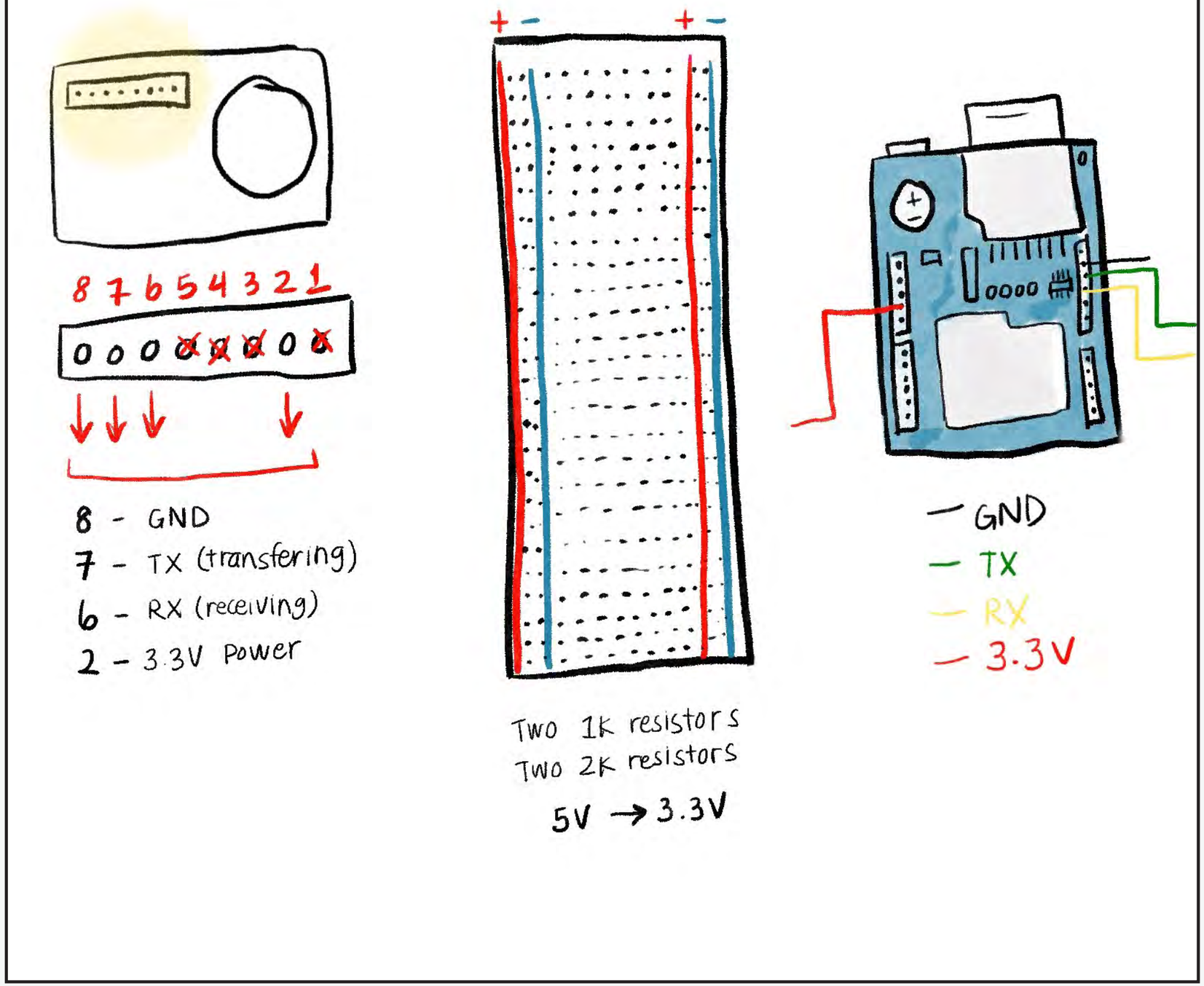
Connecting the Hardware

- Of the HPM sensor, you only use 4 cables, as shown.

- Use breadboard to assist in reducing voltage from 5V to converted 3.3V power.

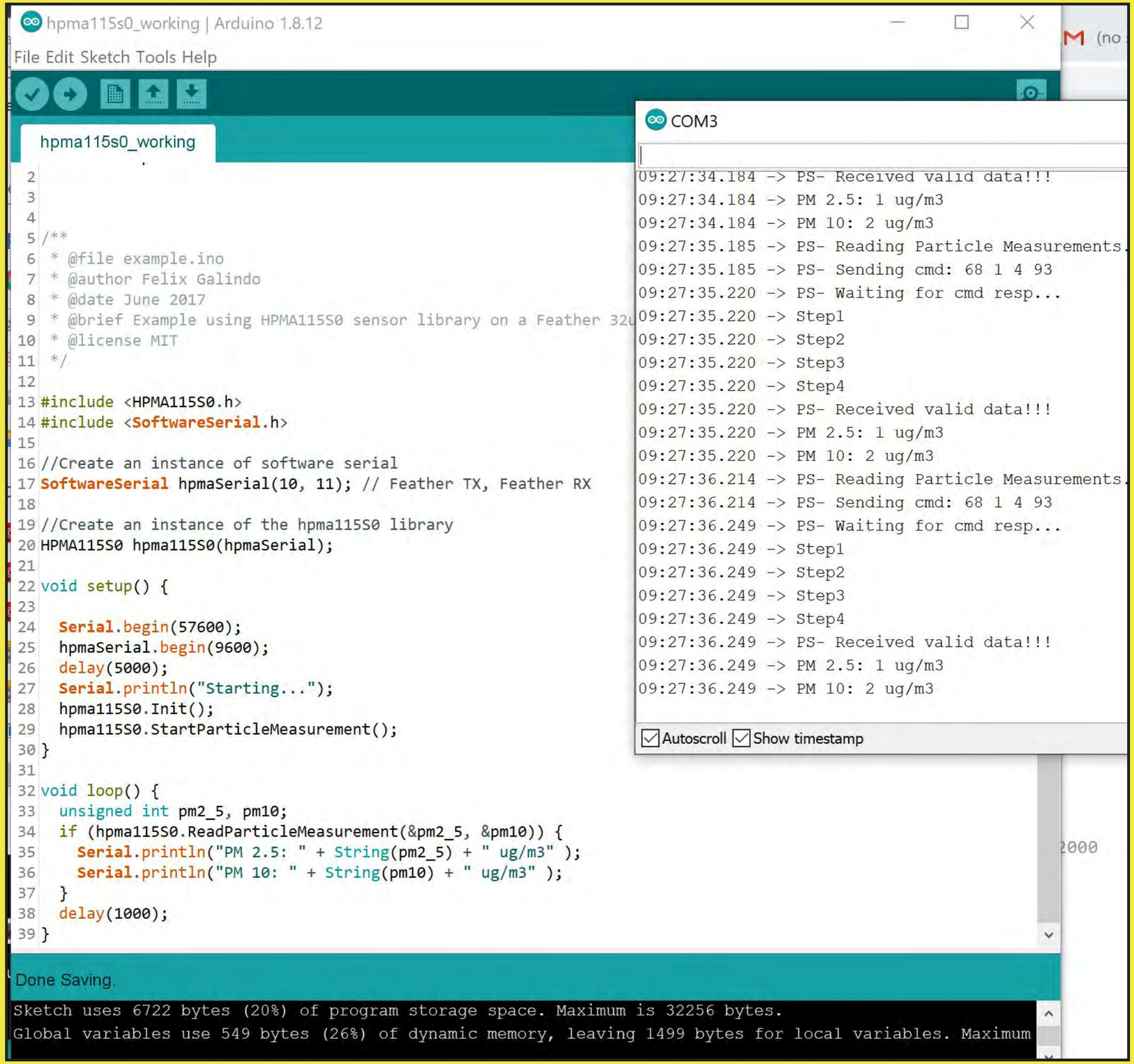
- Ensure the cables on the HPM Particle Sensor match those connected to your Arduino.

- Finally, connect your arduino to your computer using the USB Cable type A/B to power and code!



coding arduino

There are various ways to code this specific sensor, but one of the ways was shown. The source to this code is also shown. There were two libraries that were needed to download, SoftwareSerial and HPMA55S0. Most important to note that the delay represents time in milliseconds. I set my time delay to 1000 milliseconds, for capturing data every second as I was looking for a more continuous flow of information rather than periodical data.

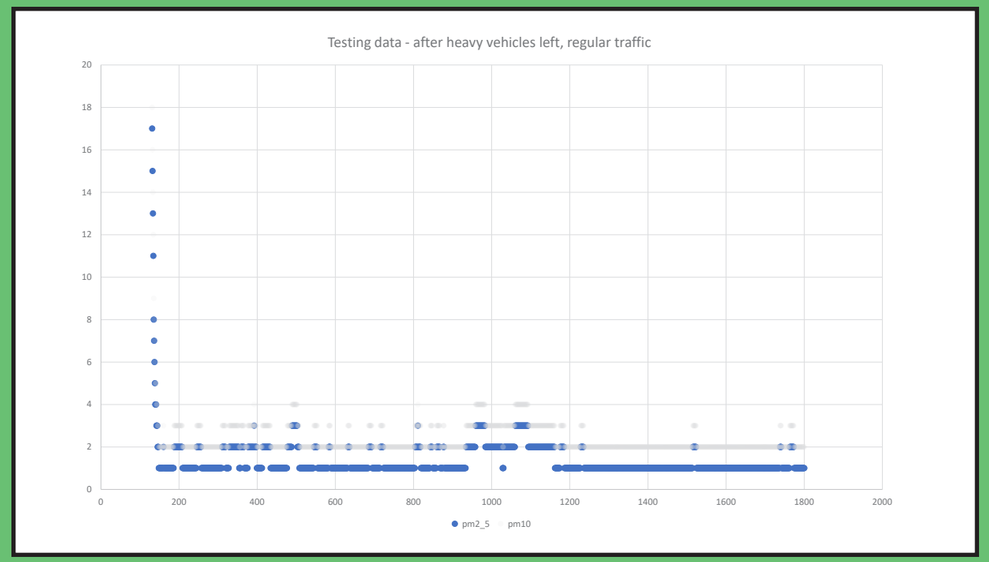


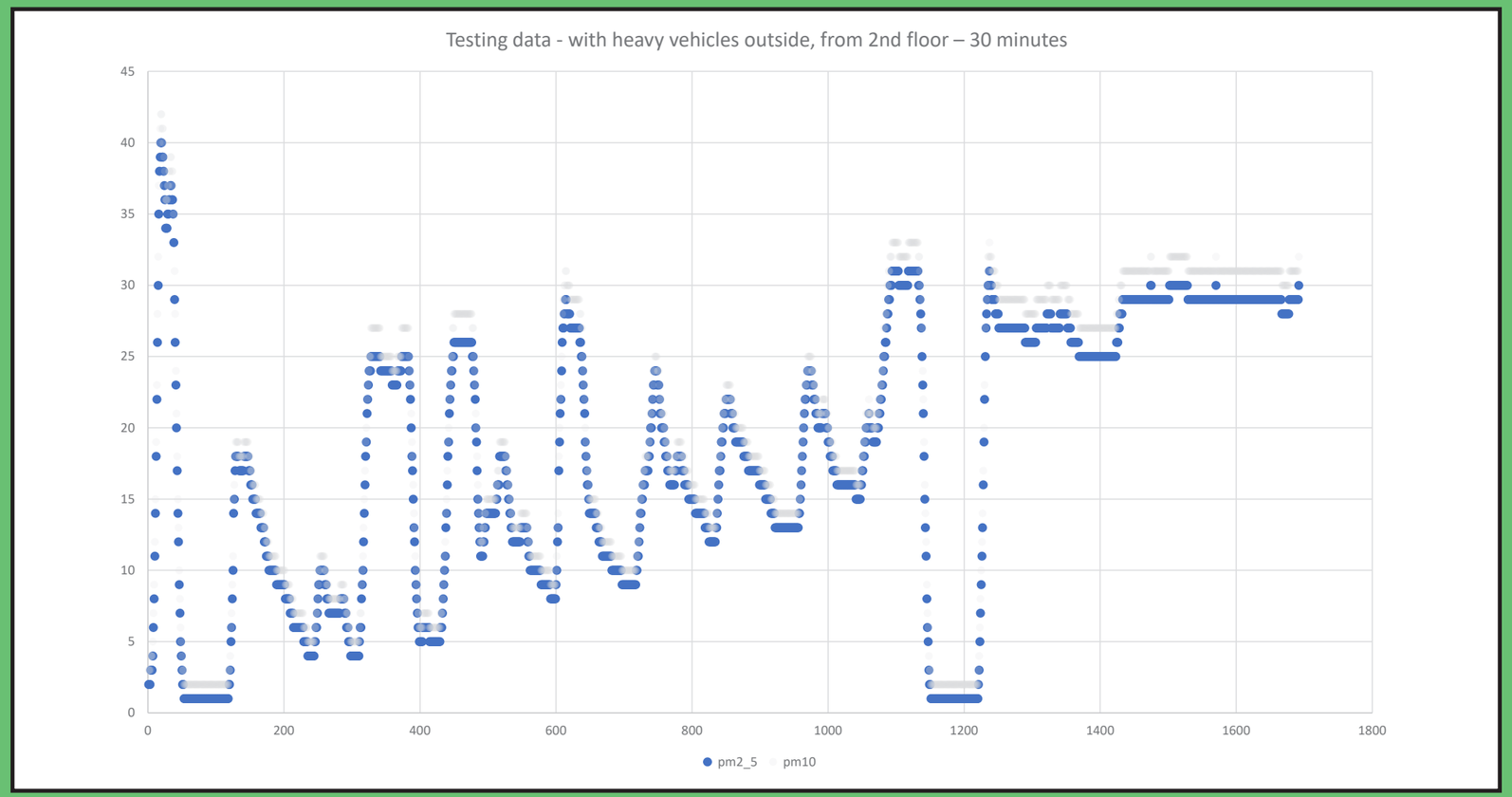
resulting data

While testing for data, a perfect scenario was planted right in front of my window sill. There was lingering heavy vehicles and construction going on right outside, which seemed like the perfect opportunity to test the sensor.

While this didn't resemble being on the floor level of the street, I wanted to see if even from the second floor, I would be able to pick up differential PM counts, and in fact it did. As you can see from one of my testing samples, I found that there were constant spikes in the data. This was within a 30-min period where I left it there untouched. The figure shows consistent spikes from 5 to 30 when heavy motor vehicles were lingering outside during a 30-min period of time. To ensure these spikes weren't natural to the area, after the heavy vehicles were gone, I took another half-hour reading that seemed much more stable, although the reading was much lower compared to the test before. You can see the data range more naturally at PM 2 to 5.

From this data, even while being a short test sample, I drew that heavy motorized vehicles have a significant effect on air quality in an area, even from the second floor of a building.





Sources: Top left, Sparkfun Official Handbook
Top right, Breezometer

moving forward

Looking toward the future, scaling the “CrissCrossing the Park” project is a natural step forward. In the initial scenario stated, the project only works in multiples, and if it acts as if it were a “guided tour” of sorts. While the city of New York is in progress of recording more micro-scaled data in South Bronx, engaging the community on these issues and providing a open conversation for where parks are placed and ideas on where communities could set up atypical parks site is imperative in improving the quality of life for many park users.

As people have their annual “check-ups” and buildings have “LEED” certification, it’s time to implement a “health” check up for the atmosphere of our parks, and we’ll call this the “CrissCrossing the Park” test.