Air Alliance Houston Case Study

Sampling the City - December 5, 2020

Sampling the City
Air Quality Awareness Fundraiser and Social Ride

The purpose of this experiment was to raise awareness about the growing problem of air pollution in the city of Houston by collecting localized air quality data.

This exercise will also be used to bring the Air Alliance Houston cycling community together to discuss air pollution and how to reduce their exposure based on the information collected.

Finally, this event will help raise the profile of Air Alliance Houston's fundraising efforts and set the stage for future work.

Question to answer

Air pollution is responsible for respiratory illnesses and can amplify various underlying health conditions and potentially lead to death. In Houston, there is a lack of awareness and a lack of information to help raise this awareness in a scientific way. This project is an experiment to test the use of low-cost sensors in addressing both issues—raising awareness and collecting hyper-local data.

Project description

Air Alliance Houston partnered with McMacCx and Plume Labs to organize a sensor-enhanced series of bike rides throughout the Houston area. Riders were equipped with Flow 2 personal pollution monitors for the duration of their rides starting at 10am and ending at 2pm. Each rider's pollution exposure was continuously measured during the ride and plotted on an interactive map.

Participants in Action

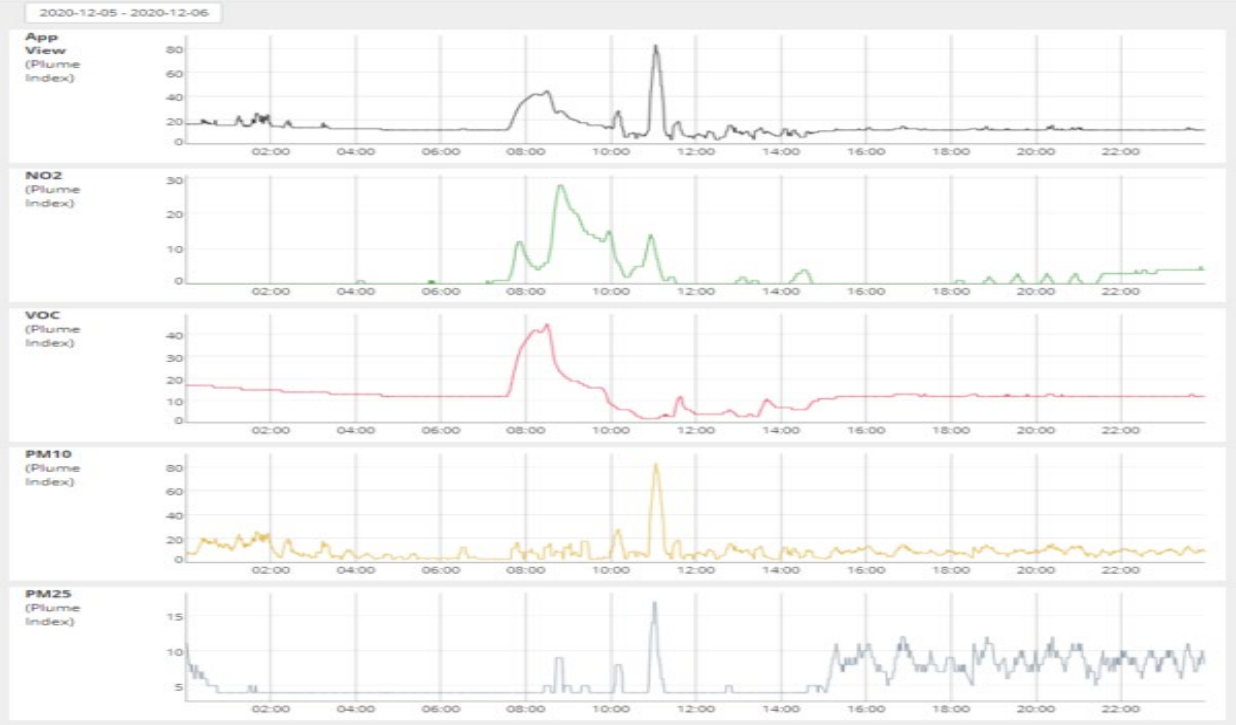
The data was also collected and analyzed using the Plume Labs Fleet Basecamp dashboard. Participants were also invited to discuss their experiences following the ride, and all of this information was incorporated into a final report published by Air Alliance Houston.

Project implementation

Seven groups of bikers equipped with Flow personal pollution monitors rode along designated routes in the Houston area, collecting data for each route. This data was displayed in a number of street maps and line graphs - showing each rider's exposure, what pollutants they were breathing, to what degree, and where.

Simms Bayou Group Street Map

For the street maps in particular, users were able to filter the results by pollutant. This allows for a deeper analysis of exposure levels. The user can also freely select automatically generated 'moves' and 'spots' on the map. 'Moves' correspond to each user's GPS measurements and pollution exposure levels, and spots indicating when the participant remained static for an extended period of time.



Simms Bayou Group Graph

Participant pollution data was also populating line graphs that display data on each of the pollutants as well as a total Air Quality Index adding an additional option for analysis and storytelling.

Project results

Simms Bayou Group

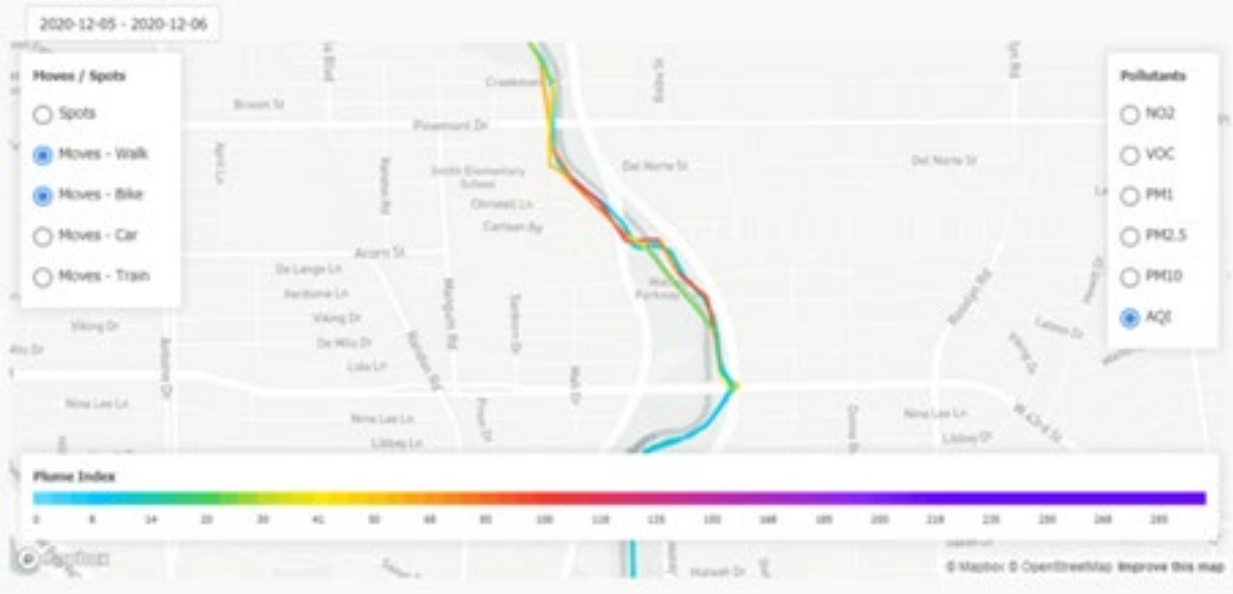
The streaks of red shown on the Simms Bayou group's map indicates the highest amount of pollution that's between Old Spanish Trail and South Loop. According to their line graphs, there is a noticeable spike of NO2, PM10, and PM2.5 at around 11am due to diesel exhaust from heavy-duty machinery and vehicles.

East End Group

The lines on the East End group's map appear strange at first but were still able to indicate high pollution levels more in the orange zone. At 11am, there was a spike in NO2 and then PM10 levels shortly afterwards, perhaps due to car exhaust and/or industrial facility emissions.

Heights Group

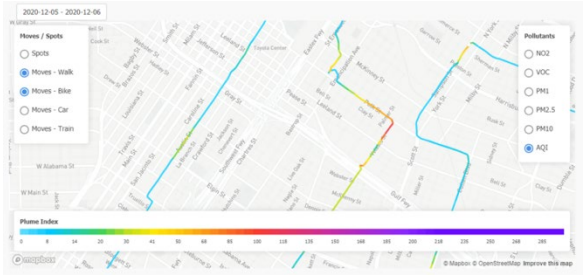
The Heights group actually had two sets of data as one member had their own personal air monitor with them. This allowed us to not only witness high pollution levels in the purple zone, but corresponding spikes of PM10 and PM2.5 when they transfer from one device to another after a few minutes.



Brays Bayou Group

As for Brays Bayou group, they're lacking a map due to Bluetooth connectivity issues. Therefore, the route that was taken along with the location of any high air pollution contributors will be unknown. However, the line graphs will still be able to portray a story, with PM10 fluctuating throughout and with NO2 gaining slight elevation of about 50ug/m3 around 10:30am.

Downtown Group



The Downtown group's map seems to be the only one so far to display a single high air pollution reading in the red zone for a period of time. There are high levels of PM10 and PM2.5 around 11am, which seems to have been captured as the group rode along the designated bike greenway. The cause was linked to construction dust and industrial emission that was present in the area.

Sheldon Group

The Sheldon group was perhaps the only group to encounter and record the highest amount of pollutant concentration, reaching up to 300ug/m3. This became most notable as NO2 levels shot up immediately after the monitor was powered on and quickly leveling off after the group left their origin point and into more rural portions of the ride. Elevated PM10 levels exceed 30ug/m3 around noon.

Spring Creek Group

Just like the Brays Bayou group, the Spring Creek Greenway group is lacking a map (caused by Bluetooth connection issues). Spikes in NO2 and VOC levels are the most visible due to instrument calibration as the monitor tries to return to its normal recording state and a tailpipe exhaust that is measured in the parking lot before the ride respectively.

Project impact

This project helped Air Alliance Houston get a basic understanding of the air quality in the local area. In the aftermath of the ride, environmental attorney and friend of Air Alliance Houston, Jen Powis, got to talk about her experience during the ride on a podcast.

Jen Powis detailing the ride: https://sprocketpodcast.blubrry.com/e551-jen-powis-air-quality-monitoring-by-bike/

Next Steps

Collect more data and improve the data collection process. Because air quality is highly variable - hour to hour, day to day, the decision was made to collect more data. A lot was learned from this first proof of concept in terms of deployment and logistics. For example: some monitors weren't fully online and synced with the app during the rides. It may also be helpful to have multiple monitors along for future rides. It is also important to make sure all monitors are online and synced to GPS ahead of the ride to prevent loss of valuable data and to preserve accuracy.

A sign-up process and greeted communication in advance (detailing the routes and expectations) could ensure a more inclusive and family friendly ride.

Conclusion

In conclusion, this experiment serves as a useful steppingstone for what lies ahead when it comes to air quality and pollution. It would be safe to say that more rides need to be conducted before there's more to be said on the data and technology function. If we could do that with the funds and community that has developed, the better chances there are of bettering the decisions of people about their health and environment in making our case heard. We can't make a change with just technology alone, so providing that reassurance and encouragement through the data, it's the foundation that's needed to compel people to make the change.