sixthsense

URBAN INFORMATICS II
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Our goal for the project is to use pervasive sensors as an **empowerment tool** for people to take back control of their lives and be able to comfortably walk around in public spaces. By designing a **wearable ultrasonic distance sensor**, we hope that individuals are able to weave themselves into the fabric of our “**new normal**” and become a part of our COVID-19 altered environment.

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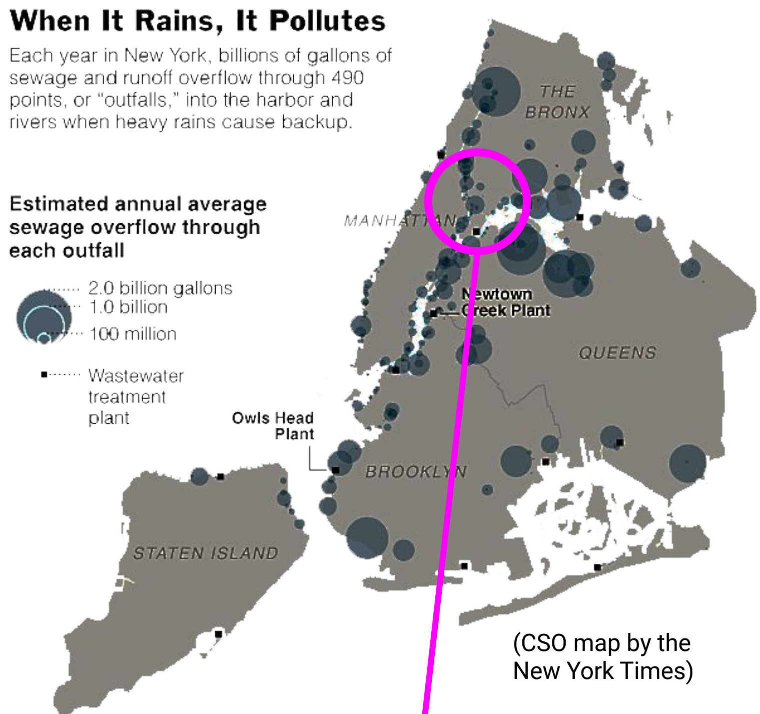
INTRODUCTION
initial proposal @ bronx starlight park

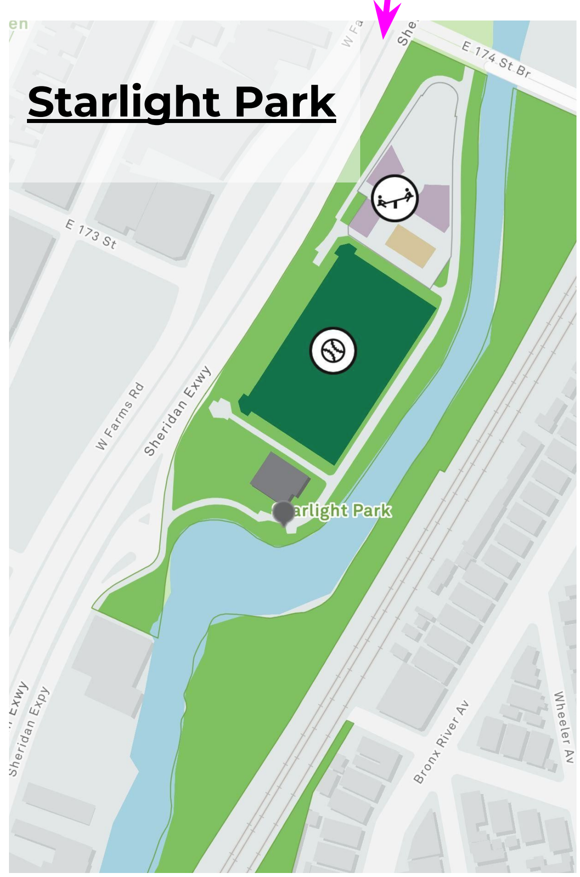
For our initial proposal for Starlight Park in the Bronx neighborhood, we were interested in expanding upon the precedent works by the Bronx River Alliance and address public health concerns of individuals coming into contact with contaminated water.

The issues of water quality were brought into forefronts for discussions after their “Project Water DROP (Detecting River Outfalls and Pollutants)” found that there was an outpouring of Enterococcus into the Bronx River and if individuals come into contact with the contaminated water, potential illness and threat to public health would arise.

Using sensors as a low-cost monitoring system, our initial project was to design a sensors that could alert pedestrians or park visitors when Combined Sewer Overflow (CSOs) might be happening in the waterway closest to them.



(CSO map by the New York Times)



(Illustration by Susan Green)

When the recent COVID 19 pandemic broke out, we pivoted to address some of the urban environment issues that arose, but we still sought to use sensors as a service for public health concerns.

Our project came about as a response to the current states of things in the world right now due to Coronavirus. Being able to safely utilize public spaces and parks where we can spend time outside and find support through engagement in an urban space could not be more important.

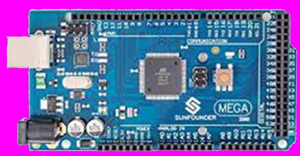
The social infrastructure these places provide is unparalleled in value in a time like this, where otherwise there would be nowhere else for people to escape to in search of a momentary change of scenery and temporary respite provided by a fleeting feeling of normalcy. This project aims to consider the mission of this course in conjunction with this idea and to provide a product that could promote feelings of safety and security in public spaces today.

How do we **build resilience** and plan for community engagement when we are obliged to practice social distancing?

How might we maintain a six feet apart social distance **without feeling self conscious and restricted** from our daily activities?

We imagine that through smart design, the wearable sensor can serve as an informative platform for public interactions (not to mention the fashion statement you would make!)

PROCESS
materials



Arduino Mega 2560

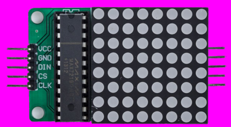
9v Battery

Stackable SD Card Shield

9v Battery Connector

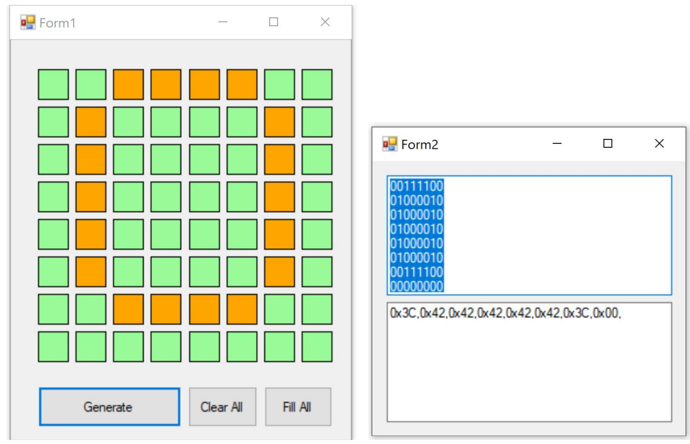
Ultrasonic Distance Sensor
HC -SR04

Jumper Wires



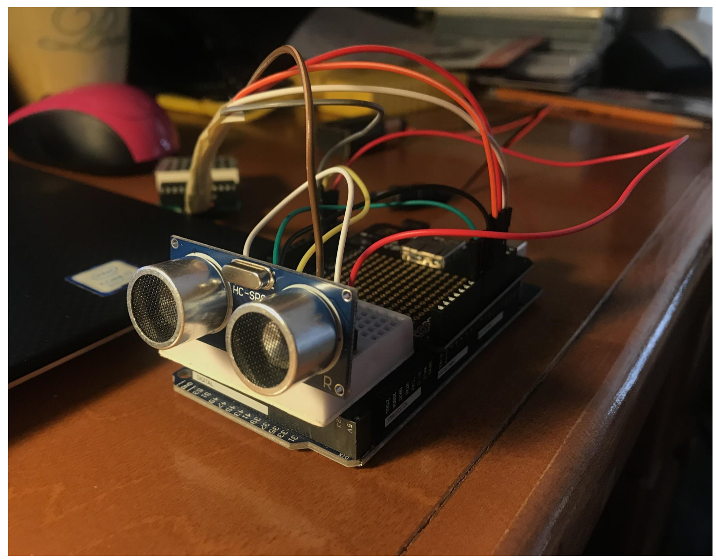
8x8 LED Matrix

Male to Female Jumper Wires

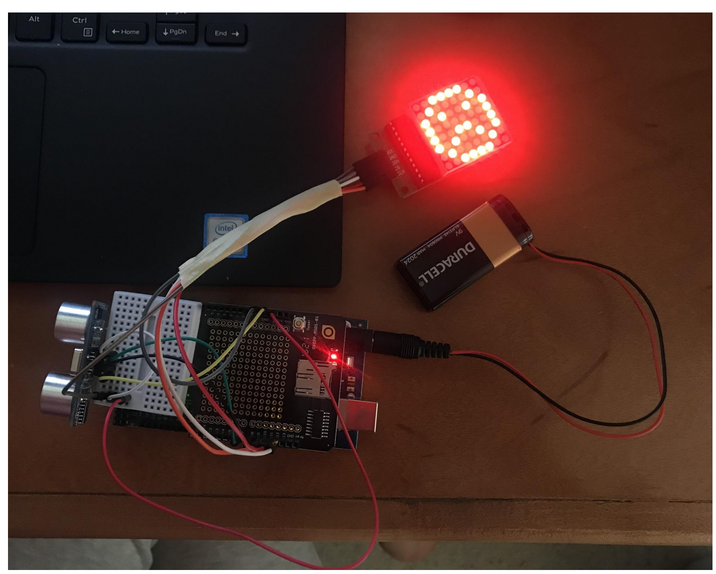


PROCESS
system design

The response system starts with the ultrasonic distance sensor which can detect distance using high frequency sound waves. The transducer of the sensor emits a pulse to receive an echo. The sensor then uses the measurement of time lapse between the emission and receivement of the ultrasonic pulse to determine the distance.



The arduino mega board serves as a platform for communication between the ultrasonic distance sensor and the 8x8 LED Matrix; therefore, it is programmed to fire a sad face symbology that was designed through a byte generator extension whenever the ultrasonic distance sensor detects a distance of less than 6 feet.



METHODOLOGY
user interface design

Similar to the semiotics of emojis, the usage of a visual language to communicate with others serves as advantageous design when we are limited to express facial emotions due to the COVID-19 implemented health code which requires everyone to wear a face mask in public for protection of virus transmission.

The sad faced programmed onto the display of the LED matrix was an intentional design choice because we believe that the simplicity of a pictogram is easily understood by everyone as a sign of discomfort and can serve as a social gestures to remind others of the 6 feet distance for public health safety.

The overall product design of the wearable sensor resonates with our project goals to ease the comforts of moving about in public space for users when they are limited by physical sight to understand mobility and behaviors of other people in public spaces. Additionally, the wearable ultrasonic distance sensor coincidentally shares the same symbology as an extra pair of eyes for users to have a better idea of the environment surrounding them.

METHODOLOGY
prototype deployment

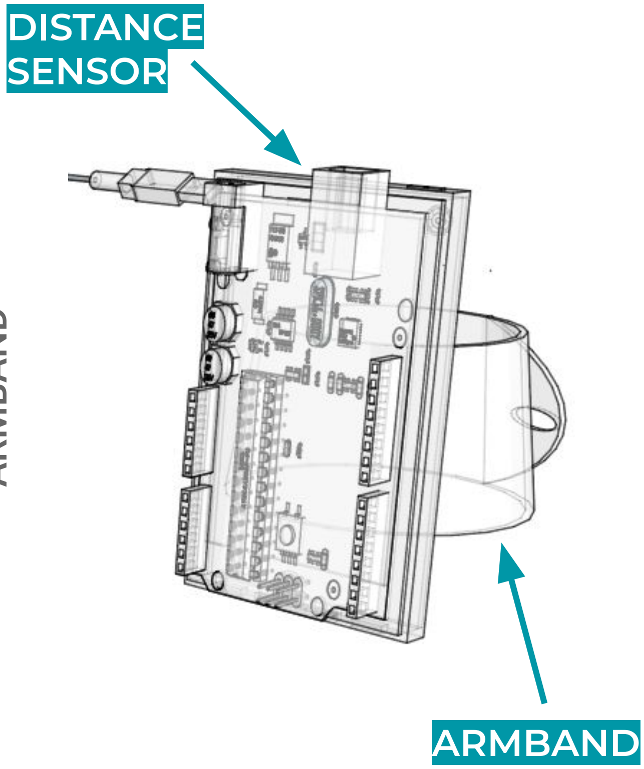
We were interested in testing the position worn by the sensor to assess which method is best for collecting least "noisy" data.

1. Backpack Style

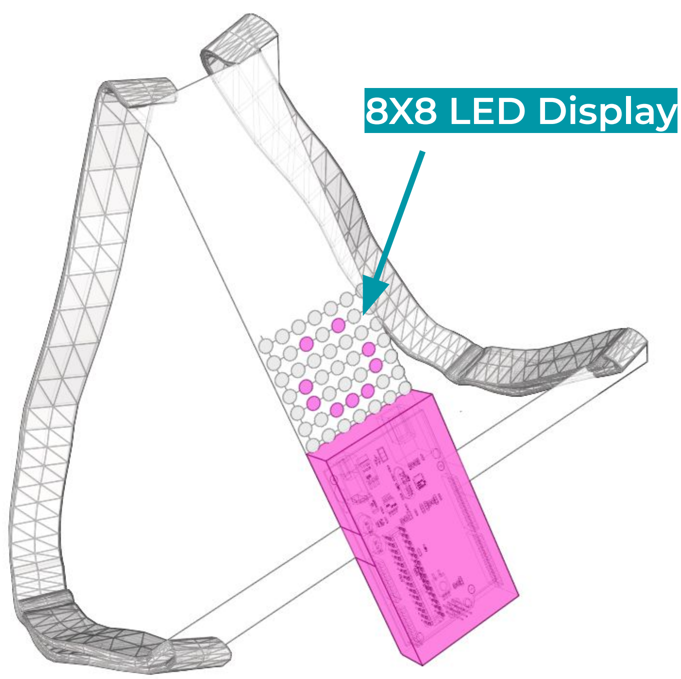
2. ArmBand Style

METHODOLOGY
high-fi prototype design

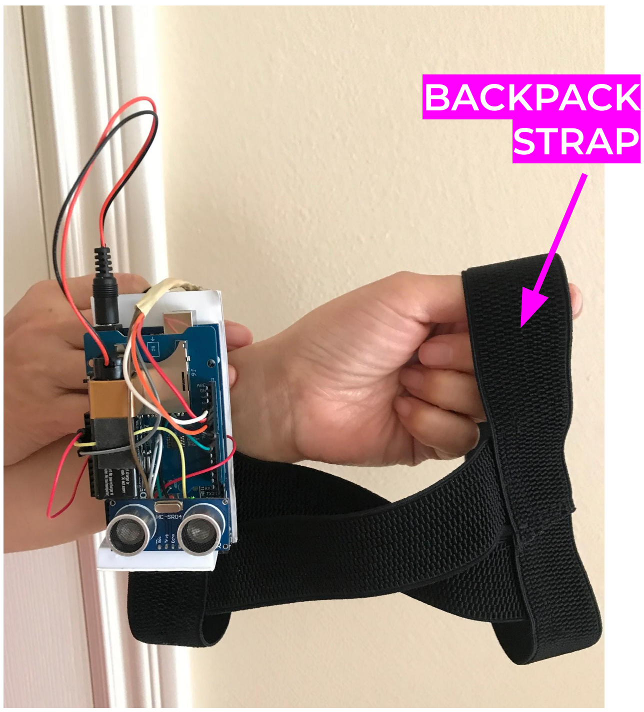
ARMBAND

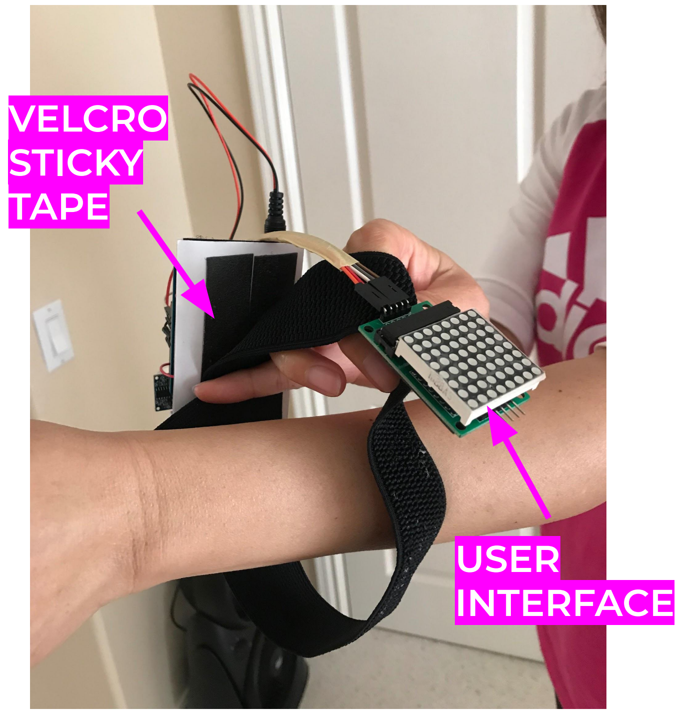


BACKPACK STYLE



METHODOLOGY
low-fi prototype design





Back View **Front View**

Using low-fi prototype materials, we fastened the sensor onto a shoulder support strap using velcro tape and patches so that it can be worn the “backpack style”. From the back, the ultrasonic sensor detecting movement behind a user and the front view is where the LED matrix is hung over the user’s shoulder and can alert the user.

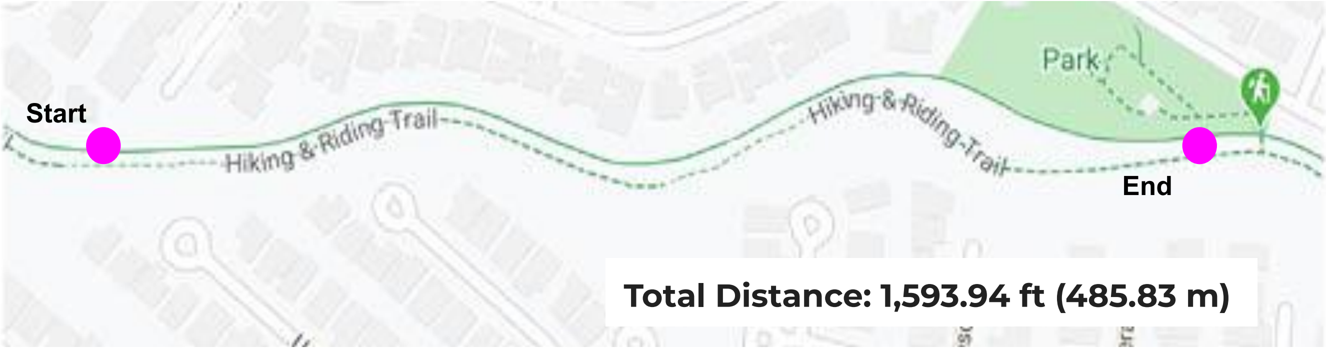
Due to time constraints, we were unable to build out a low-fi wearable armband product to test, so the sensor was held in the upper left arm area during the data collection process as means to test to the potential position of an arm band worn.

METHODOLOGY
local interactions



The sensor was tested in a neighborhood trail which has a relatively linear path on a Tuesday morning around 9am. Throughout certain areas of the trail, there are lane dividers to ease traffic such as nearby the entrance or when the trail path is more narrow.

SITE



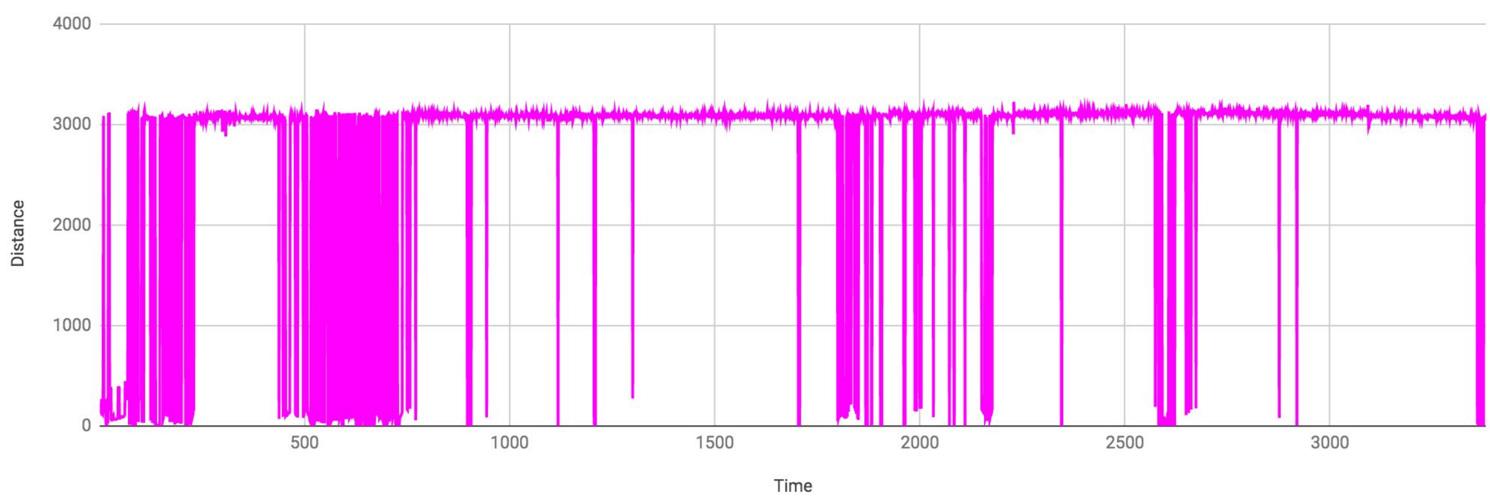
FINDINGS

Based on those explorations, we began to consider what our findings were. We asked:

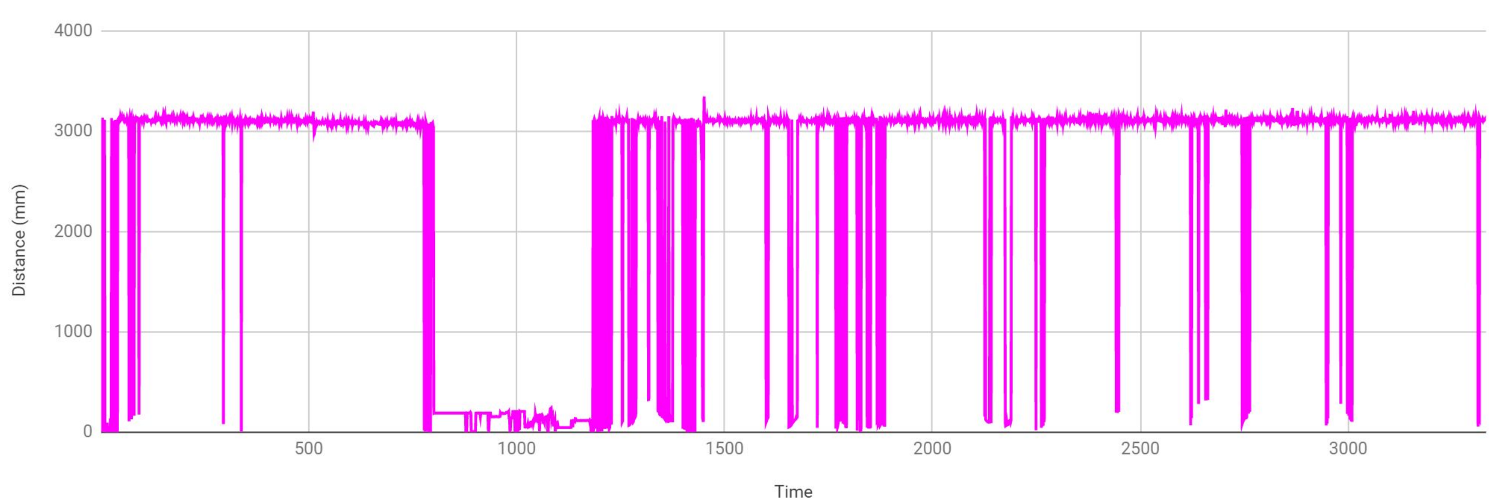
- Which style (backpack or arm band) seemed most appropriate for social distance sensing?
- Did one style produce more “noisy” data than the other?

DISTANCE VS. TIME

BACKPACK STYLE SENSOR

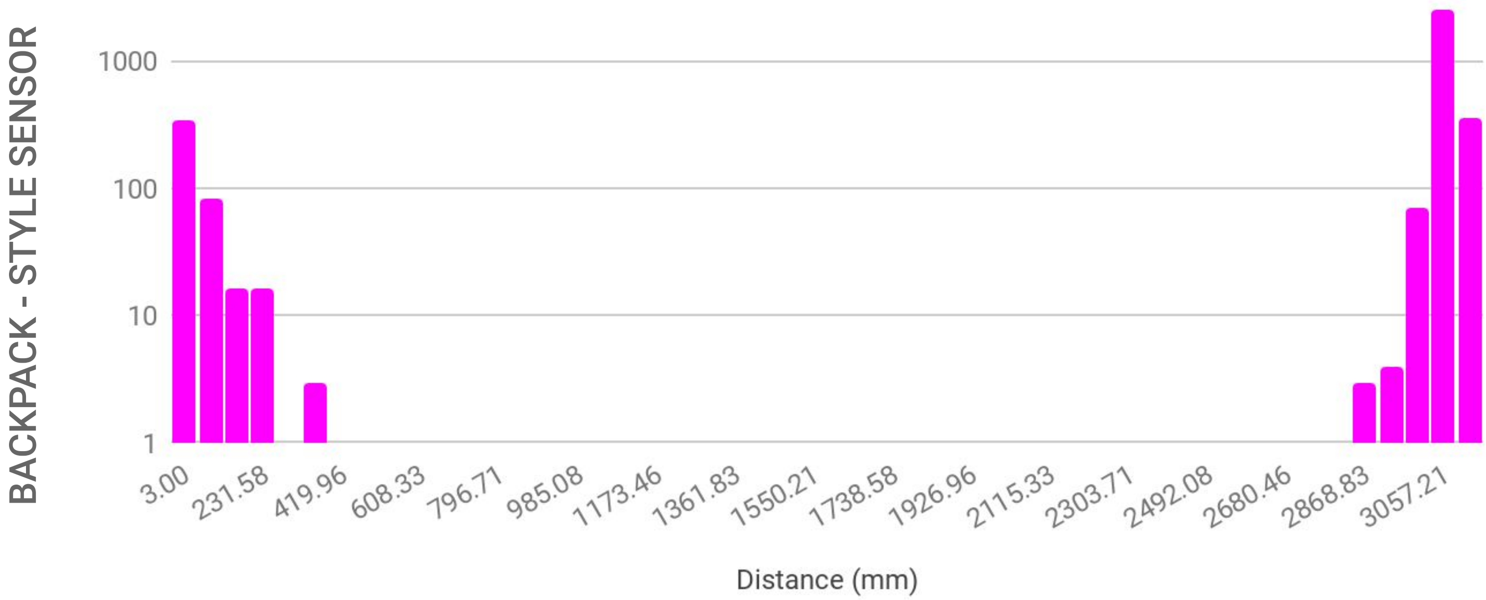


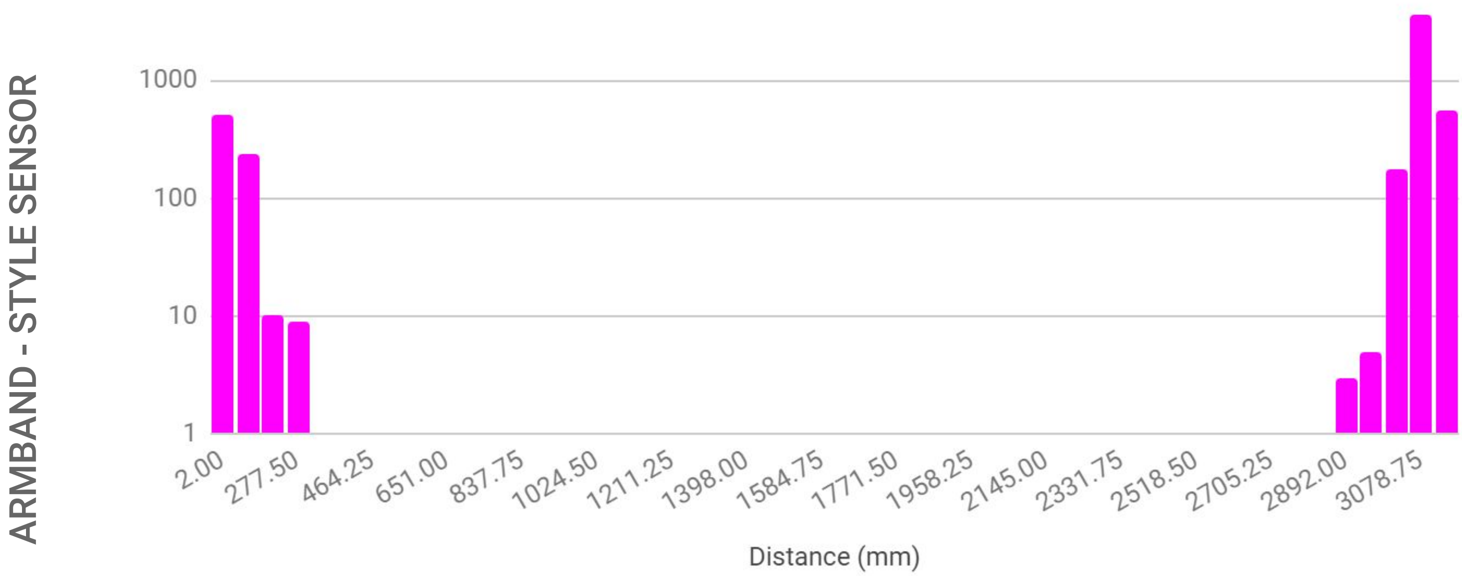
ARMBAND STYLE SENSOR



Visualizing the data, it seems both sensor deployments have data with the same levels of noise.

DISTANCE HISTOGRAMS





In both visualizations, we found that findings were quite consistent across both deployments. Based on these findings, we feel comfortable suggest either deployment type would be suitable for social distance sensing, pending the type of space being occupied.

REFLECTIONS
limitations + opportunities

1) test locations
2) difficult to interpret nature of distance "invaders"
3) technical capability of device

Looking forward, it's important to understand the limits of our study. In developing this list, each limitation also seems to point to a series of future developments or applications for the technology we've been exploring. We wonder what findings might come about in different spatial configurations or different types of spaces (such as in the subway or in a grocery store) and at different times of day or night- this could inform the design of the sensor's wearable component

Future use of this technology could also provide insight on the nature of social distancing between locales with different political stances on the necessity of social distancing. An interesting study might compare rates of intrusion in public spaces in New York and Georgia for example to explore if adherence to guidelines reflects the political positions of the state's local governments.

Given the simplicity of our data structure and collection, it's hard to tell what type of interaction happened when someone crossed the 6' threshold.

For instance, it's difficult to validate after deployment if the invader was another person or perhaps an inanimate object we'd passed by.

Additionally, the way the sensor was created does not take into account different distance thresholds for different types of invaders. For example, if the safe social distance for bikers is recommended to be less than 6 feet since they pose a set of different risks, the device we've tested fails to consider interactions between these users.

In future applications, a more detailed examination into how the sensor might make sense of different types of interactions given the nature of how the data is displayed could inform more interpretive collection that might take into account different distance thresholds for different types of interactions.

Finally, there are some technical capabilities we didn't employ in this prototype that we think would benefit the functionality and applicability of the product. Addressing this limitation, we think it could be really exciting to explore different methods for communicating a distance intrusion in addition to the LED emoji we've protyped thus far. We'd love to test different methods of communication - maybe through sound or different means to understand how people respond to different types of signals. Furthermore, building geolocation into the device would be really interesting and potentially meaningful for future studies and applications concerned with social distance enforcement and contact tracing.

IMPLICATIONS FOR URBAN INTERACTION

New York

SUB

Intelligencer

CORONAVIRUS | APR. 25, 2020

Social-Distancing Policy Is No Walk in the Public Park

By James D. Walsh

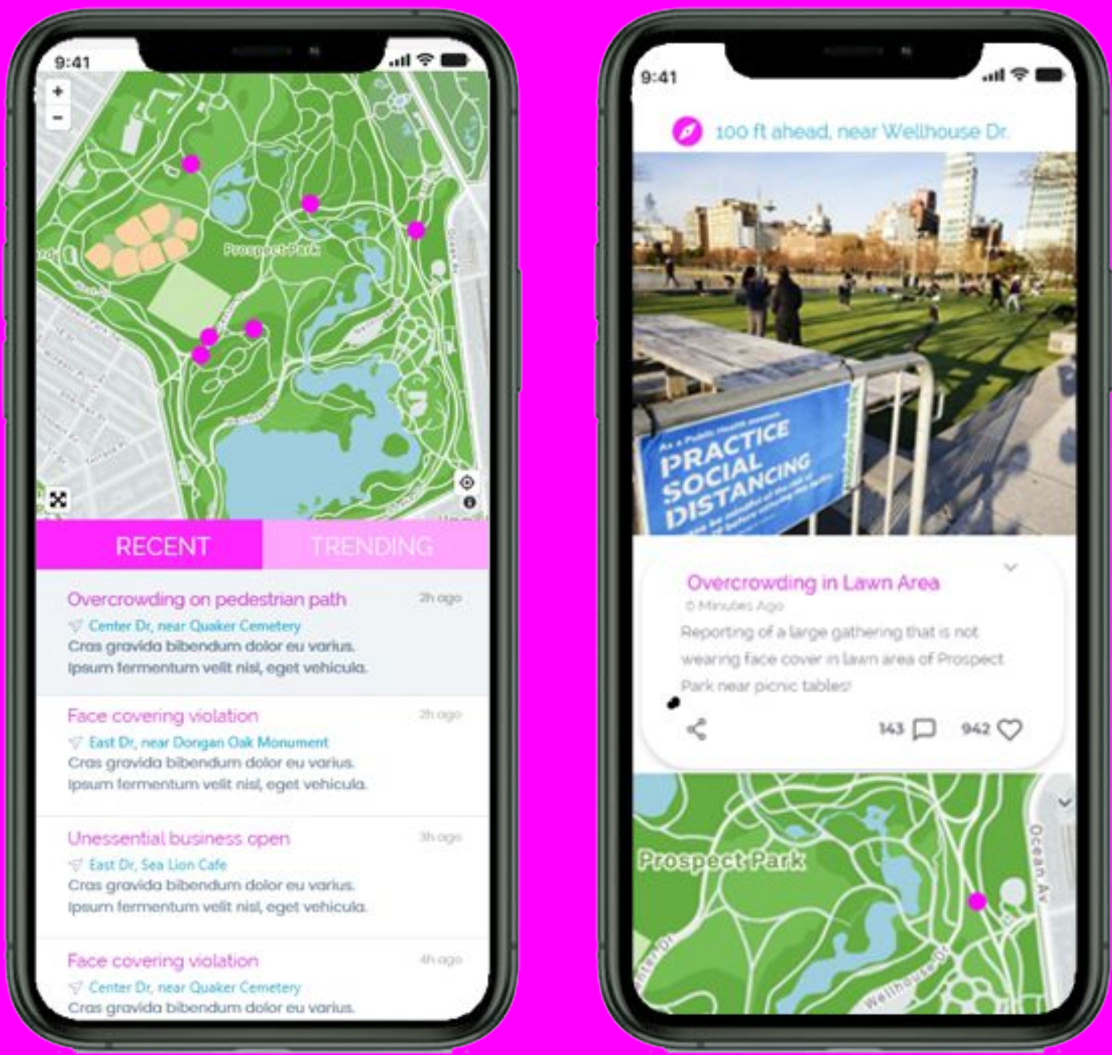
Building on that last point, we believe the future uses for this type of technology could be very impactful. In thinking about geolocating these types of wearable sensors, a ton of opportunities exist to better target enforcement of social distance infringements. Perhaps more significantly, this technology could also help with contact tracing as it would inform researchers where and when interferences happened and between who.

IMPLICATIONS FOR URBAN INTERACTION

Projects are already delving into these questions - like this one by Urban Planner Meli Harvey to provide a map of New York that shows the width of sidewalks in the city, aiming to highlight public areas where social distancing can be maintained.

But what about in our public spaces, plazas and parks, where movement is more spontaneous? From a planning perspective, information gleaned from deployment of our proposed sensors could be extremely useful not only in Coronavirus monitoring, but also in informing the future development of pedestrian and bike path design and planning as well as guidelines for future development knowing now what we do about the need for public spaces to account for future cases of mandatory social distance

IMPLICATIONS FOR URBAN INTERACTION



Looking towards the future of this technology, we imagined what an integrated app might look like to put the collection of data back into the hands of the public while providing a community wide platform. Something like this could help guide decisions on where is safest to socially distance in public space. It could also assist the city in monitoring and visualizing where social distancing restrictions are being ignored in a more seamless way - as currently they're using a new 311 "social distancing complaint" protocol where they've asked citizens to report observed health or safety violations

But what about life after corona? When this pandemic is over, you can imagine platform like this could still be useful by providing an easy way for people to scope out how busy certain public spaces are to help decide where might be best to host a quiet picnic or join a game of soccer

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