

## App 1: Optimize the route of city cleaning in Baltimore City

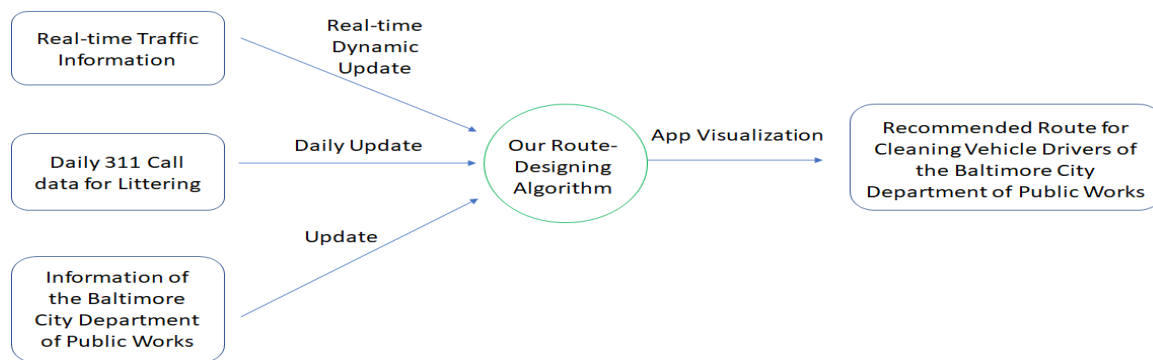
### Required Data as the Input of App 1:

1. Daily 311 call data of littering for Baltimore City with location and time
2. Information about daily traffic condition within the region of Baltimore City
3. Information on the working hour/vehicle types of the Baltimore City Department of Public Works

### Output data:

1. The location of 311 calls of littering in Baltimore City on a city map with daily updates
2. A recommended route optimized by our algorithm for every cleaning vehicle used by the City's Department of Public Works will be presented to the officers
3. The recommended route changes dynamically once we combine the real-time traffic information

### The flow of experience by using this app:



### Goals:

- Reduce 311 Calls of littering in Baltimore City by 5% in the next year
- Reduce 311 Calls of littering in Baltimore City by 15% to 20% in the following five years

### Target User:

- Cleaning vehicle drivers of the Baltimore City Department of Public Works

### How we collect / present data:

- Collect 311 call data from the local government database of Baltimore City every day
- Collect traffic information/advisories from the Baltimore City Department of Transportation
- Propose and dynamically update the optimized route every day for all cleaning vehicles that belong to the Baltimore City Department of Public Works

### How the app may fail:

- The insufficient amount of cleaning vehicles/cleaners for the Baltimore City Department of Public Works makes it unlikely to cover the cleaning demands of Baltimore City
- The app fails to keep the recommended routes up to date when the traffic pattern changes that the cleaners could not get to the places where they are in need
- The visualization is not well-organized that the drivers of cleaning vehicles may feel confused when using it

## App 2: Rearrange the location of trash cans in Baltimore City

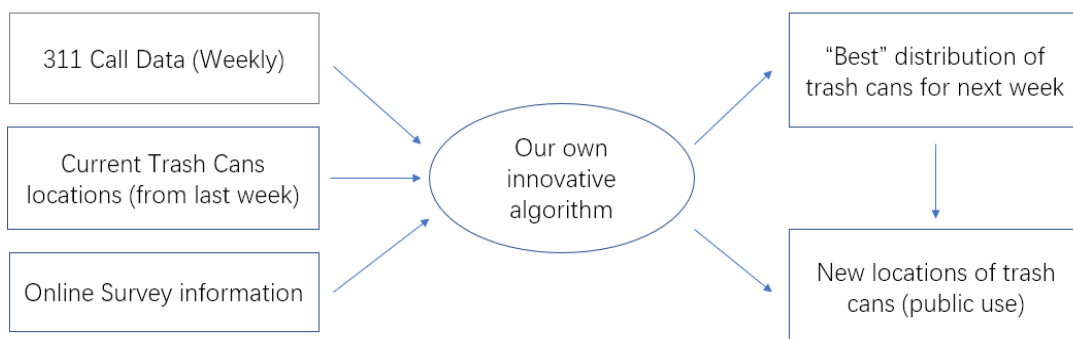
### Required Data as the Input of App 2:

1. 311 call data of Baltimore City on a weekly basis
2. The current number of trash cans and their locations on a weekly basis
3. Online survey information of Baltimore City residents

### Output data:

1. For the government, we provide the optimal distribution of trash cans in the city
2. For the general public, we dynamically update the new locations of trash cans in Baltimore City and let them find convenient places for trash disposal

### The flow of experience by using our product:



### Goals:

- Reduce litter in Baltimore City by 5% each year in the next 5 years
- In the future, the government can use this app to rearrange the trash cans in Baltimore City every week and share the new location information of these trash cans with the general public

### Target User:

- The government of Baltimore City, especially the Department of Public Works
- The general public, especially those finding trash cans being moved away from their neighborhood

### How we collect / present data:

- Collect 311 call data from the local government database every week
- Collect location of trash cans from last week's calculation results
- Propose a spatial plot containing the "Best" distribution of trash cans to the government
- Share the new location of trash cans with the general public by the help of Google Map

### How the app may fail:

- People may not download/use our app due to low awareness of keeping the city clean
- The information may not be updated efficiently every week
- Unclear visualization of the location of the trash cans
- Missing/broken trash cans due to vandalism not supplemented/repaired on time

### App 3: Greedy Algorithm for selecting locations for cleaners via a smartphone app

Required data that has implemented in App 3:

1. Daily 311 call data of Baltimore City for littering
2. Google Map API used to determine the location of reported litters

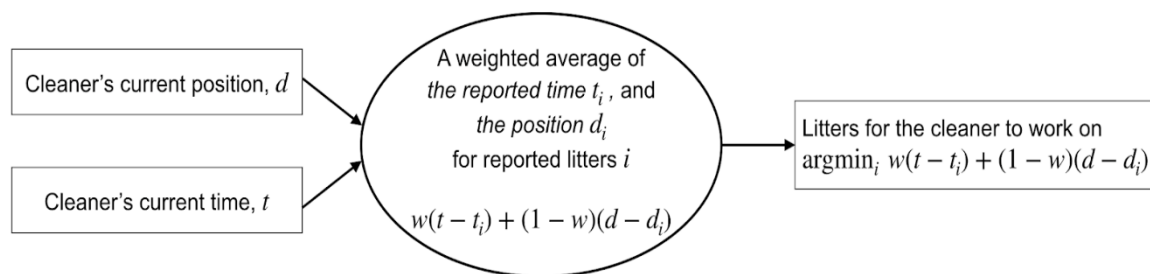
Input data for App3 when used every time:

1. The current location of the cleaner
2. The current time when the cleaner begins the search
3. The searching radius of the cleaner that he/she would be willing to cover

Output data:

1. The location with litter for the cleaner to work on
2. Location result consolidated with Google Navigation allowing the cleaner to find an approach to the littering site

The flow of experience by using our product:



Goals:

- Reduce 311 calls of littering in Baltimore City by 3% to 5% each year in the next 5 years

Target User:

- Cleaners working for the Baltimore City Department of Public Works or other street cleaning service providers
- Enthusiastic citizens who want to help cleaning litters in Baltimore City

How we collect / present data:

- Collect 311 call data from the local government database every day
- Set up Google Map API for obtaining location information or enabling navigation for cleaners
- Use Greedy Algorithm to search for a reported litter on file which is the most urgent (using the variable  $t$ ) and closest (using the variable  $d$ ) for this cleaner
- Navigate the cleaner to the reported litter location via Google Navigation

How the app may fail:

- In some locations the internet may fail, which makes it difficult for the cleaner to input his/her location and time
- Cleaners may not carry smartphones with them all the time at work so that they could not get additional information from our proposed smartphone app