Basic Information:

- Project Title: Pedestrian Density in Melbourne
- Names and CUID:
    - Richard Garcia (C11787424)
    - Ashton Sobeck (C94738489)
- Github Repository
    - https://github.com/ashsobeck/melbourne-pedestrian-visualization
- Github Pages Link
    - https://ashsobeck.github.io/melbourne-pedestrian-visualization/

Background and Motivation:

We focused on relating our project and problem to state-of-the-art research. We were interested in new and fresh visualization problems concerning city density and how these visualizations could help solve infrastructure issues. We found an article on the IEEE Transactions on Visualization and Computer Graphics. The article is titled "UrbanMotion: Visual Analysis of Metropolitan-Scale Sparse Trajectories" (https://ieeexplore-ieee-org.libproxy.clemson.edu/document/9086086).

The main summary of the research article uses smart device data in three major cities in China (Beijing, Tianjin, and Tangshan) to create a dashboard called UrbanMotion that visualizes multi-directional population flows of each city. This visualization was found helpful in "visually analyzing population movement in modern cities and having the potential to help in real-world applications such as "traffic optimization, urban planning, and business site configuration."

We took inspiration from this article to formulate the problems we want to solve using a dataset we found of pedestrian movement in Melbourne, Australia.

Project Objectives:

There are two primary questions we would like to answer with our visualization:

1. **How can the knowledge of massive human movement in Melbourne contribute to optimizing infrastructures such as energy, traffic, and urban planning?**
2. **Is pedestrian movement influenced by a deviation in weather (e.g. rain, extreme heat) or a natural disaster (e.g. earthquake, flood)?**

Multiple benefits arise from answering these two questions that are interrelated to each other. By visualizing our pedestrian dataset we would like to visualize mass movement of pedestrians. This will allow us to focus city infrastructure efforts toward the most heavily populated routes of pedestrians, avoiding unnecessary costs as well as improving infrastructure that is the most important to pedestrians. By seeing how deviations in weather or a natural disaster influence pedestrian movement, we will be able to see what areas of Melbourne need infrastructure improvements to prevent mass pedestrian movement to a specific area of Melbourne (e.g., adding more shade in areas where pedestrians move away from because of extreme heat).

Data:

We are using a dataset collected by the city of Melbourne, Australia that shows the number of pedestrians identified by sensors in different areas of Melbourne. Currently, there are 3.86 million rows of data for this dataset. The data starts in 2009, and is updated every month.

Link:
https://data.melbourne.vic.gov.au/Transport/Pedestrian-Counting-System-Monthly-counts-per-hour/b2ak-trbp

Data Processing:

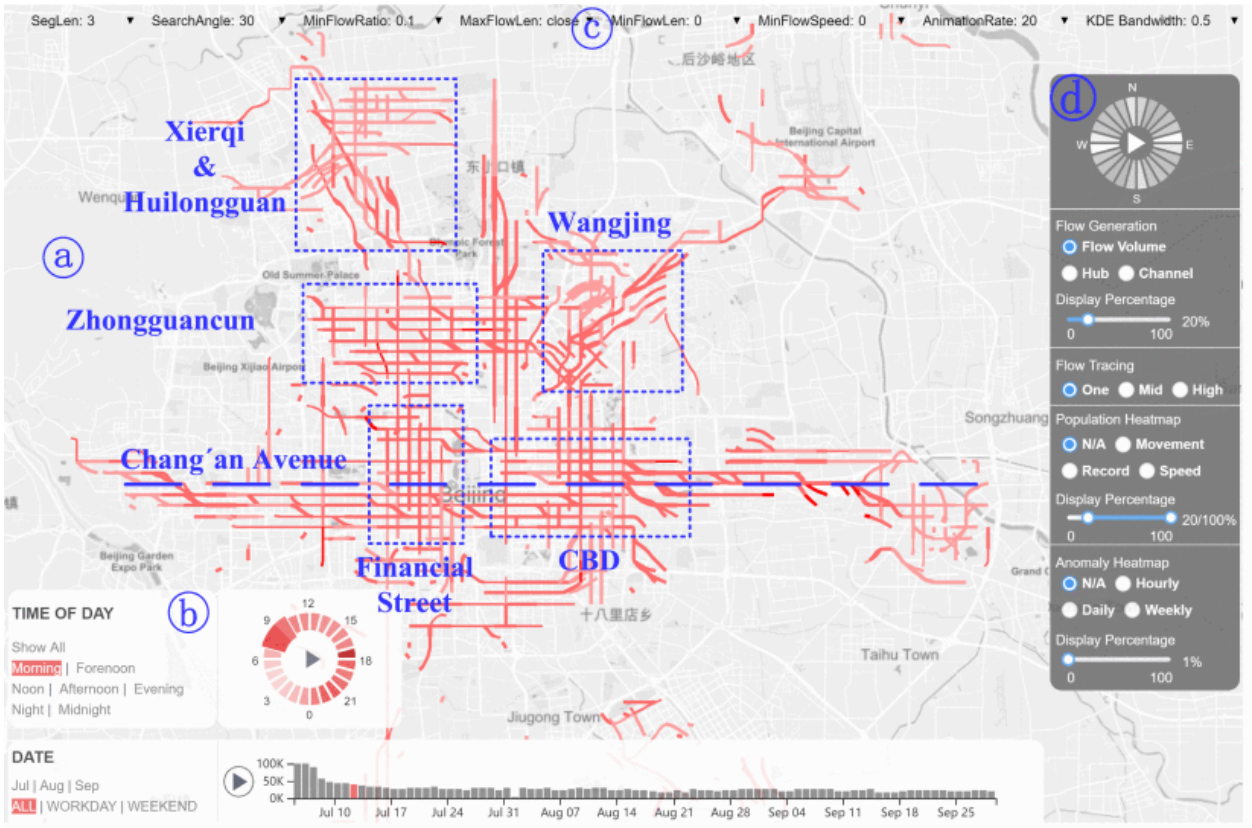
The dataset has been cleaned and refined by the city of Melbourne. It has 10 columns that are well named with a description and data type summary for each column. Each row represents the total hourly sensor count of pedestrians for a specific location at a specific date and time. Because the data is separated by monthly, day, and time we can show snapshots of month to month, day to day, and hourly changes. Due to this level of detail we can decide how much of the dataset we want to visualize in our visualizations. We will utilize the attributes Date_Time, Year, Month, Mdate, Day, Time, Sensor_Name (which is the street name) and Hourly_Counts (total hourly sensor readings (count of pedestrians).

To get specific data, the city of Melbourne has provided an API endpoint that allows us to query specific parameters of the entire dataset without having to clean the entire dataset ourselves. With this API, we can also reduce the footprint of the data used, and if we do not want to use the 10 years of data that Melbourne provides, we do not have to.

The rest of our data processing will be done by d3. Since we do not have to use an external tool to clean the dataset (ie: R or python), we will be able to save time and jump right into developing the visualization. The only external script that we will need is one to query the API and put the response into a csv file that will be used by our JavaScript.

Visualization Design:

For our visualization design, we want to draw reference and reflect on the paper that we have based our project on. Staying close to state-of-the-art research is one of our primary goals. To achieve this goal, we reviewed the main visualizations that the paper showed throughout. In the image below, UrbanMotion is the visualization that the authors of the paper made.



We drew heavily on this design, and want to implement a way for the user to have a similar functionality, but based in Melbourne, Australia. While we do not have a cardinal direction for our dataset, we aim to show snapshots at a certain date and time just like UrbanMotion. We also want to have a comparison to showcase a regular day of pedestrian density versus a day when a natural disaster or bad weather occurred. We believe that this is essential in understanding the ways that pedestrians operate throughout the city of Melbourne, and having this functionality helps the user better understand how to plan for the future.

Must-Have Features:

The must-have features that we will need for a final version of our visualization are implementing a visualization similar to UrbanMotion and having a natural disaster or inclement weather comparison. These two features are essential to keeping true to the initial research on pedestrian movement, and we believe that without these features, our visualization will be incomplete. Specifically, to have a visualization comparable to

UrbanMotion, we will need to have a map of Melbourne, Australia that we can overlay the pedestrian density with. Taking cues from the image above that showcases UrbanMotion, we would ideally have a hour, day, week, month, and year picker on the bottom or side of the visualization. Without having a main visualization similar to UrbanMotion, the parallel to answering the same question that the paper did is simply not present. Having a visualization that shows pedestrian density through the day and different times throughout that day encapsulates what we want to achieve in this project. We also want to compare pedestrian density on days that have inclement weather or a natural disaster to regular days that no bad weather or event happened.

Optional Features:

We first will need to get the main functionality of our UrbanMotion-like visualization done before we can implement “nice to have” features. Having a bottom bar chart like UrbanMotion has that shows the spread of pedestrian density would be very nice to include with our visualization. This bar chart gives a
It would also be interesting to compare holidays to regular days on top of the visualizations that we will be providing in the must-haves. This is not imperative to the questions that we would like to answer, but does give insight to users on how future holidays could look like in terms of pedestrian density in Melbourne.
Another optional feature would be to add a stop motion like slideshow to our UrbanMotion counterpart for days in a week or month, which would be set by the user. The point of this feature would be to show the user the progression throughout a day or week of pedestrian density within Melbourne. This could be useful in determining the busiest times in a day or week without manually changing the filters on the original visualization.

Project Schedule:

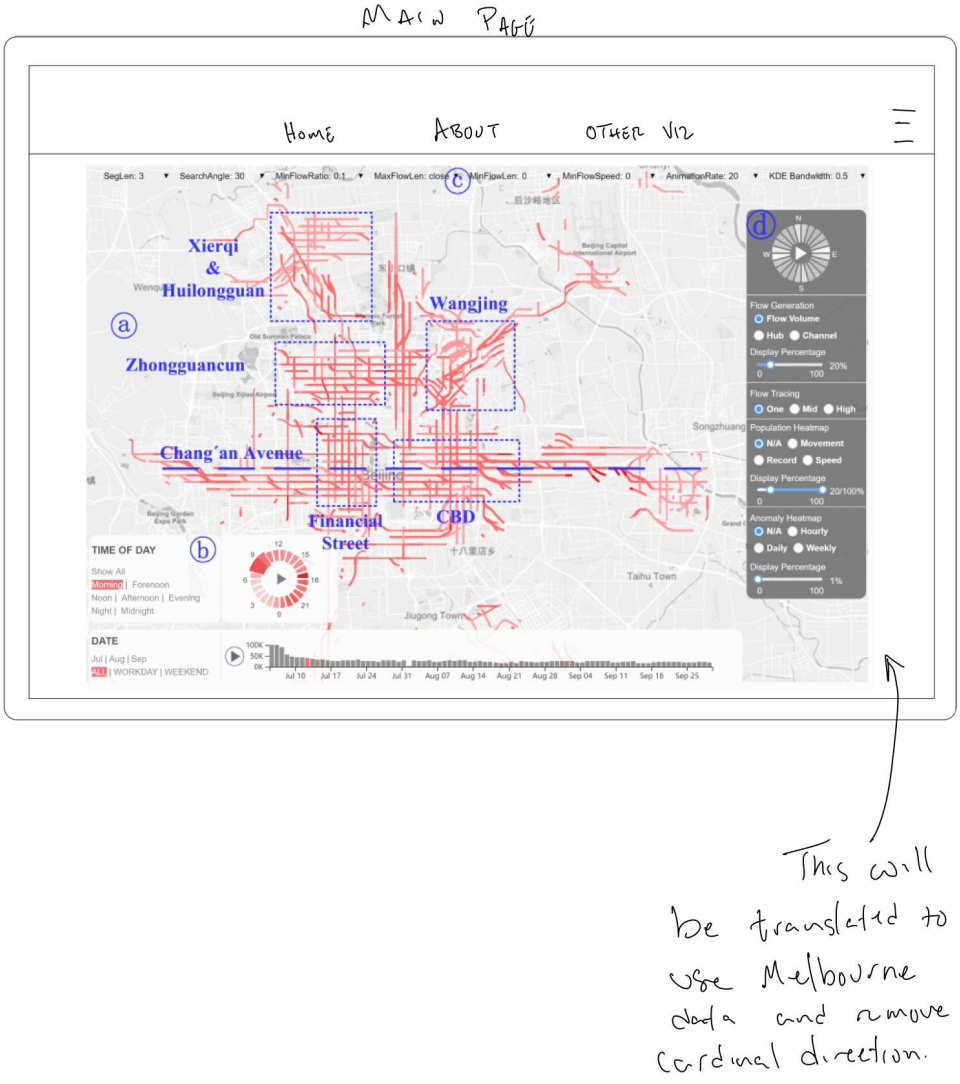
- Week of 10/18
    - Start work on Project Prototype.

    - From the initial structure of our proposal, figure out which parts of the visualization need to be implemented first.
    - After figuring out the first features needed, do necessary research on how to implement it in d3.
    - **Goal**: Have initial parts of visualization implemented. This will set us up not to have much crunch time the week before the prototype is due.
- Week of 10/25
    - Continue work on prototype. With some initial features implemented,
    - **Goal:** Implement most of the visualization, so that there is a week for fit and finish work. If not finished, we have a buffer to get some more features done.
- Week of 11/1
    - Prepare to turn in the prototype.
    - Finish up last visualizations in d3.
    - “Fit and finish” for the prototype
    - **Goal:** Turn in prototype on 11/7.
- Week of 11/8
    - Brainstorm what should be put into oral presentation for the class.
    - Based on when peer assessment feedback comes through, work on issues highlighted this week and next.
    - **Goal:** Initial thoughts of what the oral presentation should be.
- Week of 11/15
    - Focus on implementing peer assessment fixes into the website and visualization.
    - **Goal:** Peer assessments to be broken down and added to website and visual.
- Week of 11/22
    - Each team member to complete an equal amount of work on the final delivery
    - **Goal:** Work on final delivery
- Week of 11/29

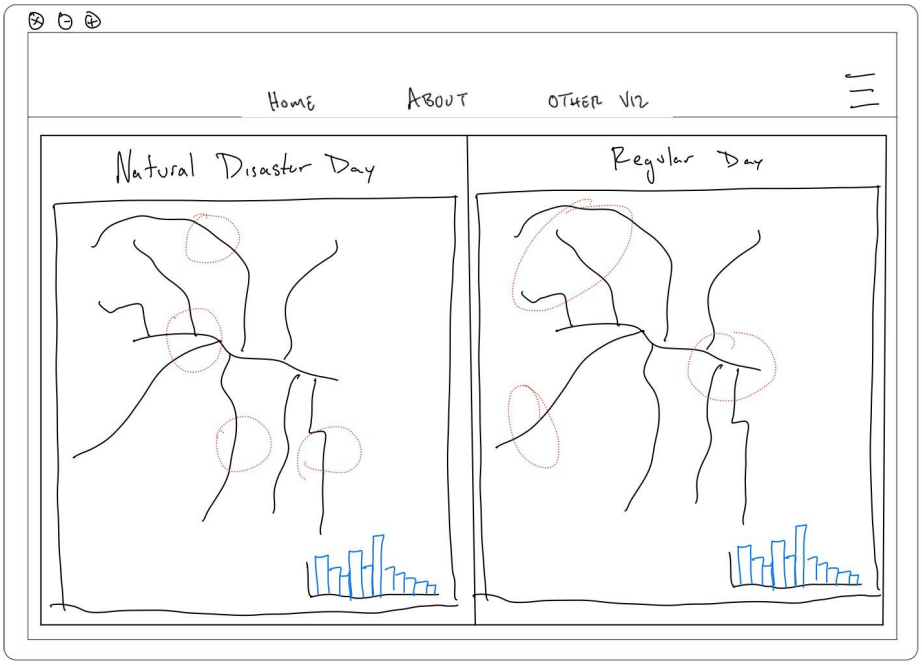
- Practice the oral presentation before class
- Present oral presentation to class
- Each team member to continue to complete an equal amount of work on the final delivery
- **Goal:** Present oral presentation, work on final delivery

- Week of 12/6
  - Each team member to complete the peer assessment
  - **Goal:** Complete peer assessment.

Sketches:



The image above is our main page. It will have our interpretation of UrbanMotion with Melbourne, Australia's data. Below is our comparison page that will be accessed via a burger menu or the "Other Visualizations" tab of the navigation bar.



This sketch was the first iteration of our website layout with the main visualization front and center. A description of the problem was added to the side of the main visual and the bottom of the website page described the comparison of pedestrian movement during harsh weather or natural disasters. We decided to go with the iteration of the website above as it conveys the information in a manner more easily understood.

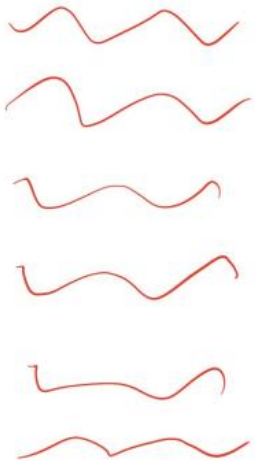
Title of Website

Main Viz

Map of Melbourne

Day, Month, Hour snapshot options

Description of Problem



Weather/Natural Disaster comparisons