Tamzid Choudhury

Final Project Report
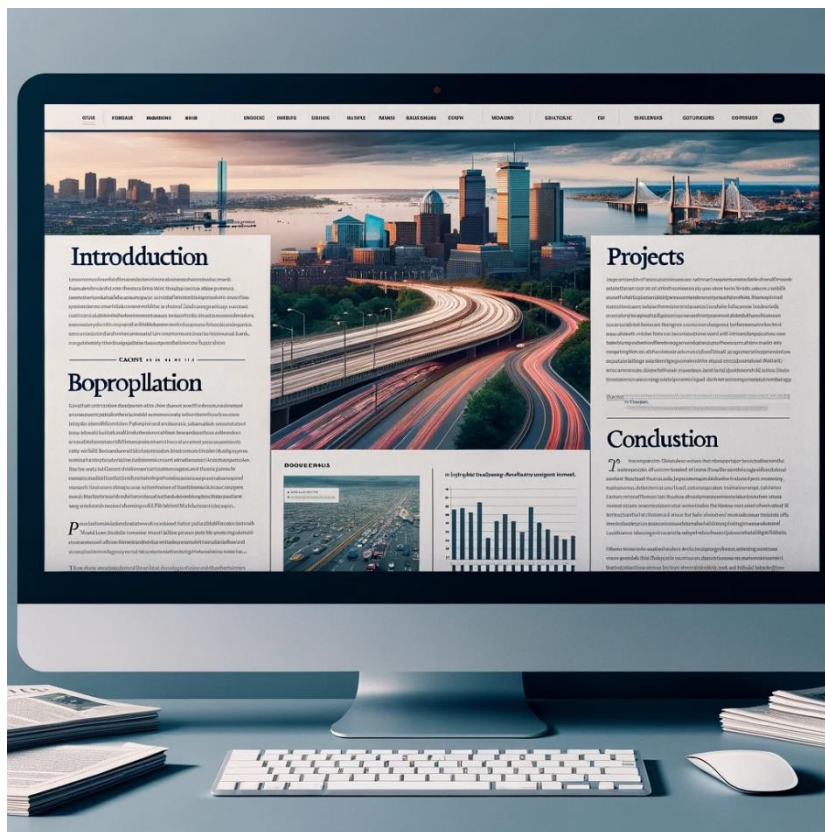
Boston Traffic Insights

Image generated using ChatGPT/DALL-E

Updated May 18, 2024

Description

This project explores the factors influencing traffic in Boston, focusing on how population trends and public projects affect traffic. By analyzing data from various sources, the project aims to provide insights about how these factors impact traffic patterns and infrastructure development of the city.

Technically not residing in Boston myself, however I see myself going into and out Boston very frequently. Almost 95% of the time I am on the road, I would be stuck in traffic, which would eventually lead to me arriving late at my destination. By visualizing trends and patterns that are in publicly available data, better traffic conditions could be achieved for everyone by taking educated and important steps.

I looked at this project as to feed someone who is curious to learn more about traffic patterns and the magnitude of it in Boston city. If I were the 'curious', I would go and look for information about it online, so I made a newspaper company styled online article out of my findings from the available data. I may have mistaken other sources of data to be relevant for this visualization story, and I willingly dropped most of them for the sake of simplicity.

The article goes on to show how the population and Boston city's public projects are affecting traffic in general. Noticeable patterns appear from the visualized data and the reader can follow along with the narrative texts related to it. Personally, the final say is that it will be difficult to match the rate of improvement with the rate at which traffic is worsening, but it is possible if resources are allocated properly. The viewer may feel the same, or not, but in either case they go away learning something interesting about traffic-related data.

Datasets

<u>For Population</u>
Data obtained for population was skimmed down and cleaned using python scripts, to include population data from 1950 up-to 2023. The website offered a projection of how the population may change up to 2050, however the predicted data seemed to follow a smooth and linear positive progression, so I did not include any data after 2024.

<u>For Boston City Projects</u>
The website was used to filter and resize the map so that only the city of Boston was showing. [https://www.massbuilds.com/map?municipal[ ]=Boston](https://www.massbuilds.com/map?municipal[ ]=Boston). Then the data was downloaded in an Excel Spreadsheet format, which was processed and filtered furthermore to search for entries that indicated "public transportation", "roads", "public space", alongside the status of the projects.

<u>Walkability</u>
The National Walkability Index is an index assigned to block groups, indicating how likely it is for the people in the defined block group would choose to walk instead of using a vehicle as their primary mode of transportation. Although an interesting data set, it was far too complicated to provide a relationship between traffic and the walkability index. Hence the data and it's prototype visualizations were dropped due to the existence of multiple continuously varying factors and my inability to properly visualize the effects of Walkability Vs Traffic.

Paper Sketches and Prototypes
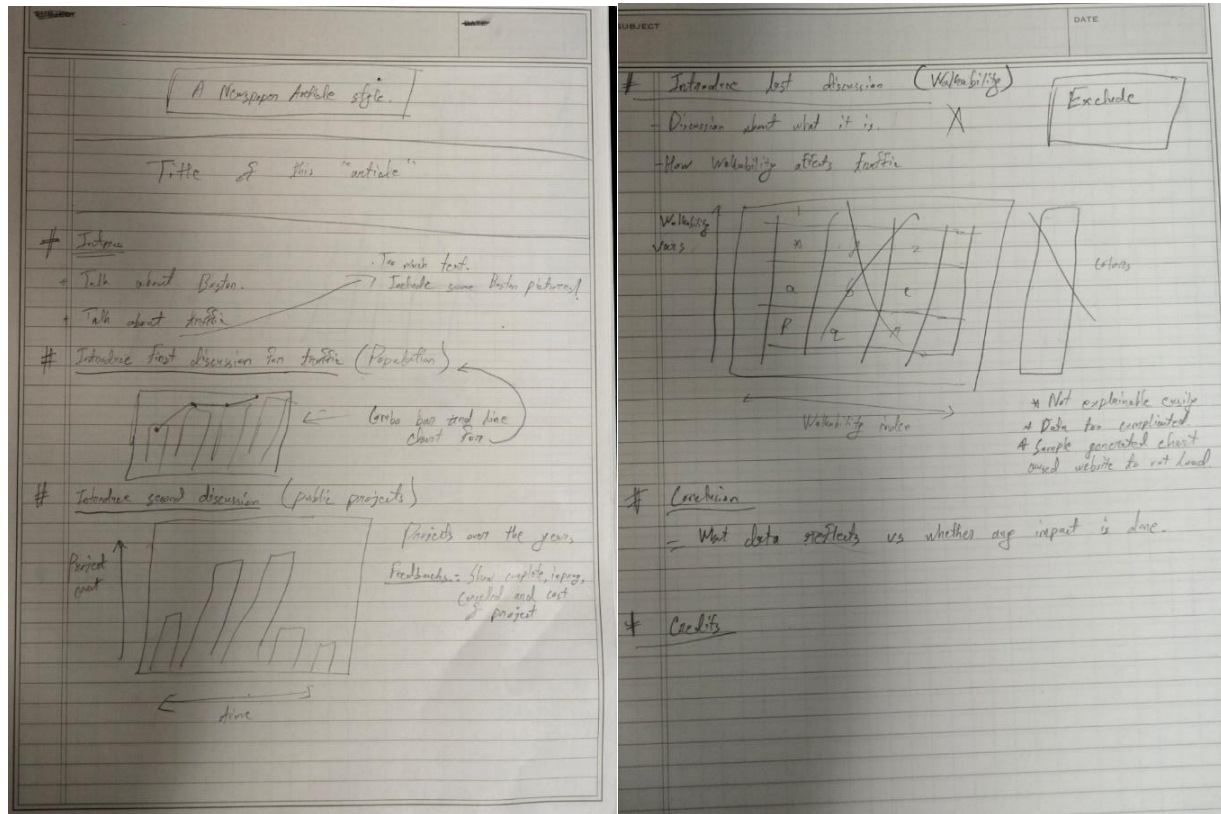
Technologies, Development and Deployment

Python
Plotly
HTML, CSS, and JavaScript
D3.js
GitHub

Final Product

The experience, at least how I initially imagined it, would be to make something that would feel as though you are going through one of those rolled up ancient scripts. This fit the notion about how Boston is one of the oldest cities in the United States.

https://www.google.com/url?sa=i&url=https%3A%2F%2Fin.pinterest.com%2Fpin%2F362750944991050535%2F&psig=AOvVaw2y4anli4c41acfL3EvhGto&ust=1716175502455000&source=images&cd=vfe&opi=89978449&ved=0CBEQjRxqFwoTCMD4no3imlYDFQAAAAAdAAAAABAE

After setting up the website interface, it felt cool. I originally hardcoded placeholders (containers and empty <div></div> sections) on this skeleton website where I had planned to place my visualizations once they were done.

I started working on the data processing part of the assignment. Since I was telling the story of what other factors affect traffic, the first thing that came to mind was population. Easily, the more people there are in the same amount of space, the more congested and tightly packed it would feel. Now, I cannot just rely on having my viewers/readers guess and assume the same way I did, so I ended up visualizing the population chart.

Direct link to the data file before and after using my script. https://github.com/zzztamzzz/CS617-Visualizing-Boston/tree/main/final_proj/attempts/data_processing/population/boston

The python script for the population data file was simple. One script removes irrelevant 'text' embedded in the data file and properly categorizes the 'date' field in the original file properly. The

other script was used to split the original file into two parts, one which contained data for the population count and the other containing the annual change. I wanted to try and visualize each data separately and then combined both of the data to form the population chart for the assignment. Plotly was a great choice as there were numerous examples on their documentation website on how to use Plotly with Python to construct beautiful visualizations.

Direct link to the chart script: https://github.com/zzztamzzz/CS617-Visualizing-Boston/tree/main/final_proj/attempts/chart_generations/population/boston

Direct link to the chart used in the website: https://github.com/zzztamzzz/CS617-Visualizing-Boston/blob/main/final_proj/attempts/chart_generations/population/boston/charts/boston_population_combination_chart.html

Now that I was done with one of my visualizations, I wanted to go ahead and add features to my website (which at the moment was the ancient scroll style). I wrote some narrative texts which were simply just mentioning an introduction section and a section for the population chart. Then, I attempted to reference the population visualization in this website file, and nice ancient scroll was no more. After numerous attempts at modifying scripts, styling, and scripting of the website, I finally decided to go for a different style. I realized that I did not like the appearance of the website, being an ancient scroll with a data visualization in it. You can't interact with paper like that. Then it hit me to make something of an article people find online. I figured that people find articles and read them all the time, so why not mine.
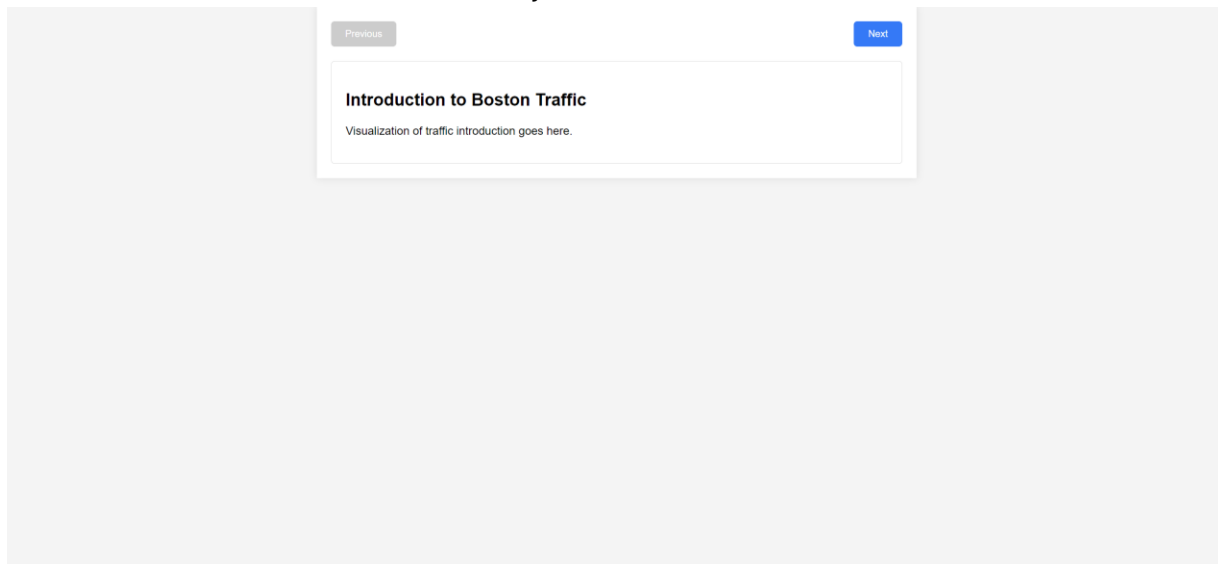
Before I even started my data processing and analysis on the city projects file, my website had a new face.

Now that I have the website stable, I switched over to studying the contents of the data obtained from MassBuilds. This data is very rich and offers information and details related to real estate projects. Upon studying the contents of the data file, there ware categorical data that had information related to "traffic". Here I wrote a script that would scan the contents of the original data file and filter the original file to create a new one which would contain information about projects related to traffic and affecting traffic, alongside the status of the projects for that year with how much money was spent in that year.

Direct link to the directory with the script used to filter store new data file:

https://github.com/zzztamzzz/CS617-Visualizing-Boston/blob/main/final_proj/attempts/data_processing/massbuilds/csv/boston_filtered/BosfilterAndStore.py

Now it was time to visualize it. I used some help from ChatGPT to suggest a good visualization for this type of data. It suggested a stacked bar chart, which I asked to write the code for me and it gave me a very basic version of the chart. I referred to the Plotly documentation and found some useful code examples on how to add features and interactivity to stacked bar chart. Going back and forth between ChatGPT and Plotly documentation, I finally tuned my chart the way I wanted it to be.

Direct link to the script used to generate the projects visualization:

https://github.com/zzztamzzz/CS617-Visualizing-Boston/blob/main/final_proj/attempts/chart_generations/massbuilds/boston/BostonBarChartGen.py
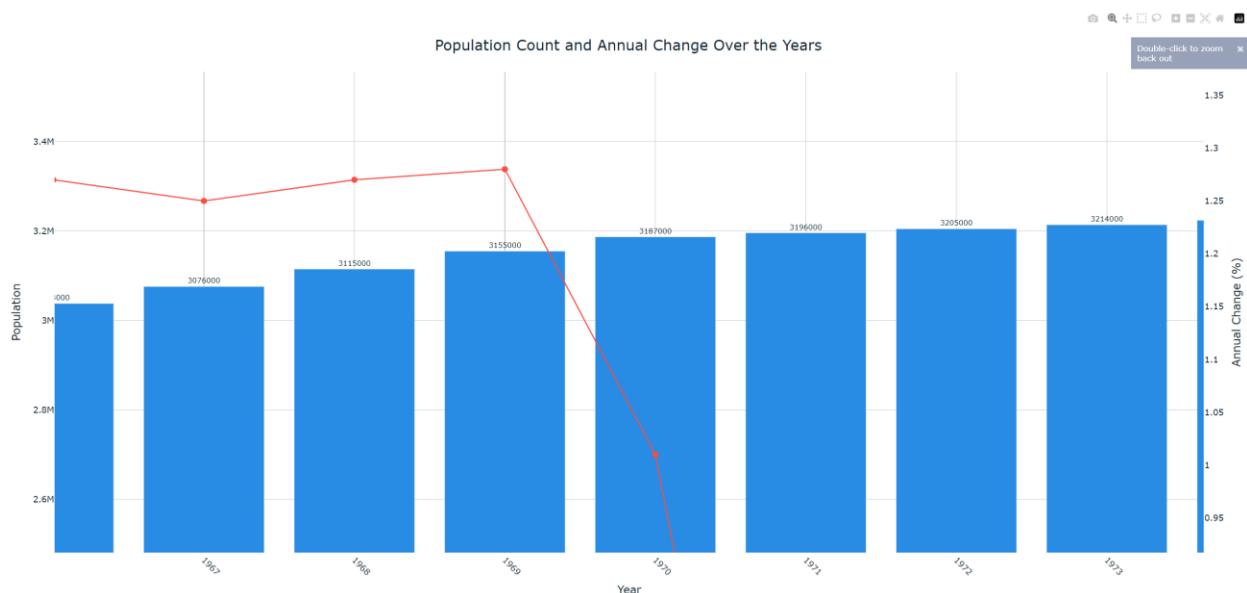
The default population chart:
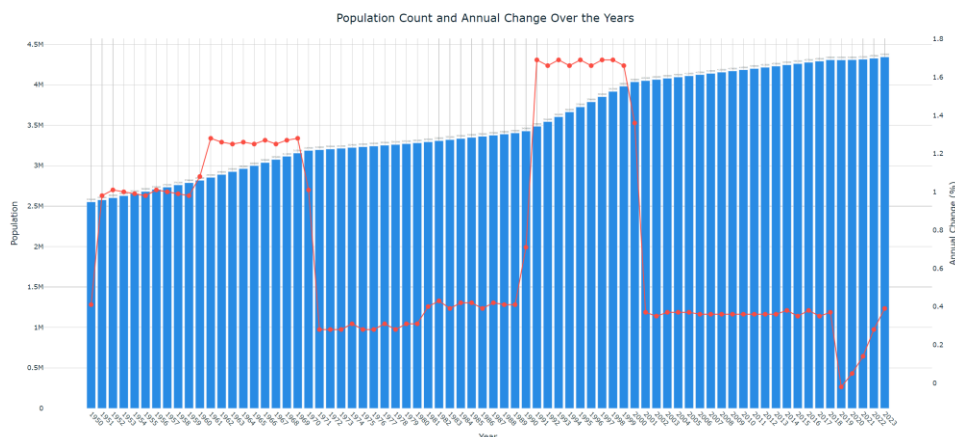
This chart also allows the user to zoom in onto certain parts of the chart. The user needs to select and highlight a certain section of the chart and the chart zooms in to clearly show the figures that is constructing the chart. For example:

Selecting.
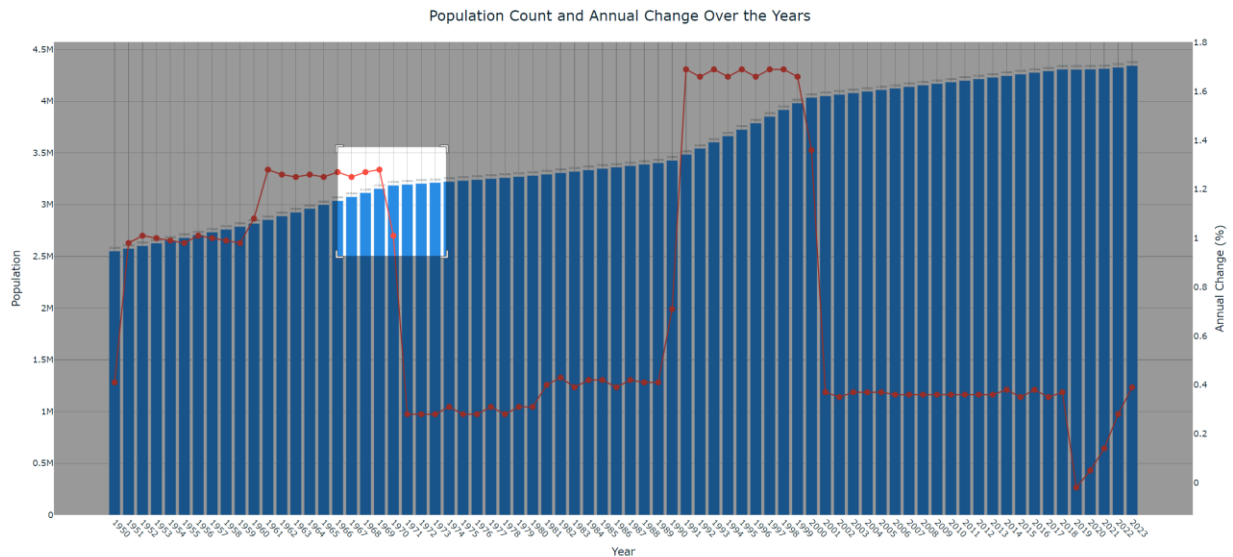
Now we have zoomed in

The user is also able to view the specific values in the chart, which automatically shows up for each bar and annual change point upon hovering the mouse.

Double clicking anywhere within the chart axis will reset the chart to it's original scale, showing the trend over the 7 decades.

Direct link to the Population Chart: https://html-preview.github.io/?url=https://github.com/zzztamzzz/zzztamzzz.github.io/blob/main/final_visualize_boston/charts/boston_population_combination_chart.html

Next comes the Boston City Projects chart. In comparison, the data file for this was far richer and more complex. I really had to sit down and study the data file in order to obtain the necessary data for the chart. My "search venture" was to find relevant data for projects that could have an indication of traffic impact, or the project was done/proposed for the sake of improving traffic. Once I found a few entries in the data file just by examining it manually, I wrote a python script to do the job for me. I also made the script discard any irrelevant data and only fetch certain classification of the data that existed in the file.

Direct link to python script that was used to filter and collect the data:

https://github.com/zzztamzzz/CS617-Visualizing-Boston/blob/main/final_proj/attempts/data_processing/massbuilds/csv/boston_filtered/BosfilterAndStore.py

The data files, both before and after using the script, can be found in the same directory as the script.

Now I had my data. I looked at example stacked bar charts and I adopted and mixed up a few design elements that were available on the Plotly Python website.

Direct link to the python script that was used to create the visualization:

https://github.com/zzztamzzz/CS617-Visualizing-Boston/blob/main/final_proj/attempts/chart_generations/massbuilds/boston/BostonBarChartGen.py

Number of Traffic-Related Projects and Total Spending by Status Each Year
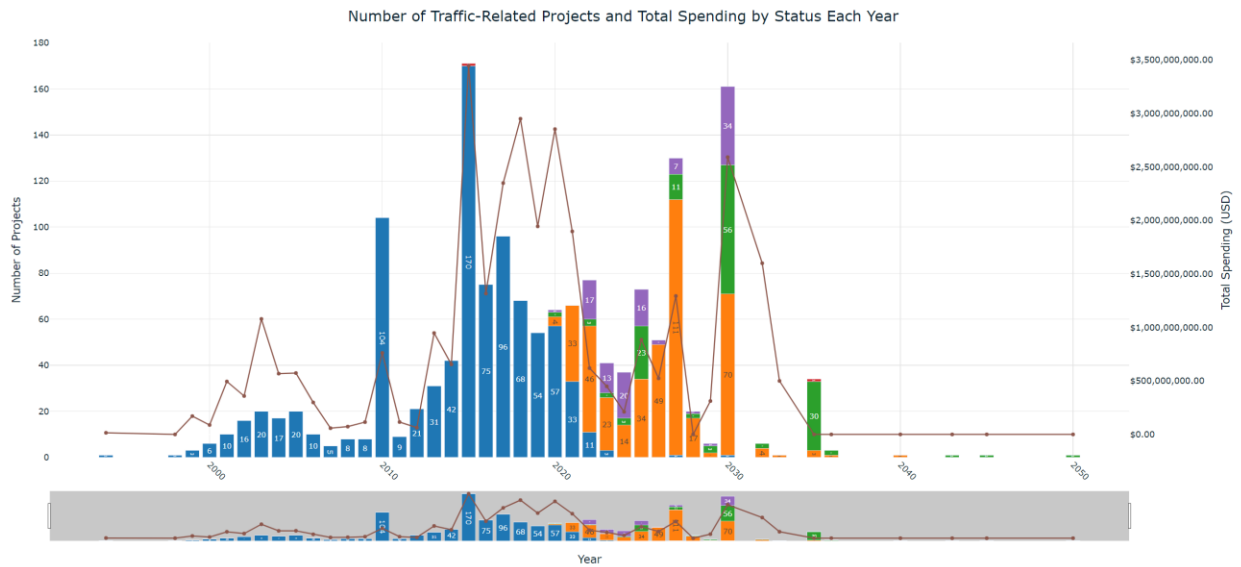
Direct link to the chart: https://html-preview.github.io/?url=https://github.com/zzztamzzz/zzztamzzz.github.io/blob/main/final_visualize_boston/charts/boston_projects_bar_chart.html

The chart is also generated with the same functionality as the population chart shown earlier. The users can select a particular portion of the chart to have a 'closer look' and the chart is resized. However, this chart only allows the users to select a time frame to look at. This limitation allows the chart to maintain the 'Total Spending' scale, which could cause misinterpreting the scale.

Number of Traffic-Related Projects and Total Spending by Status Each Year
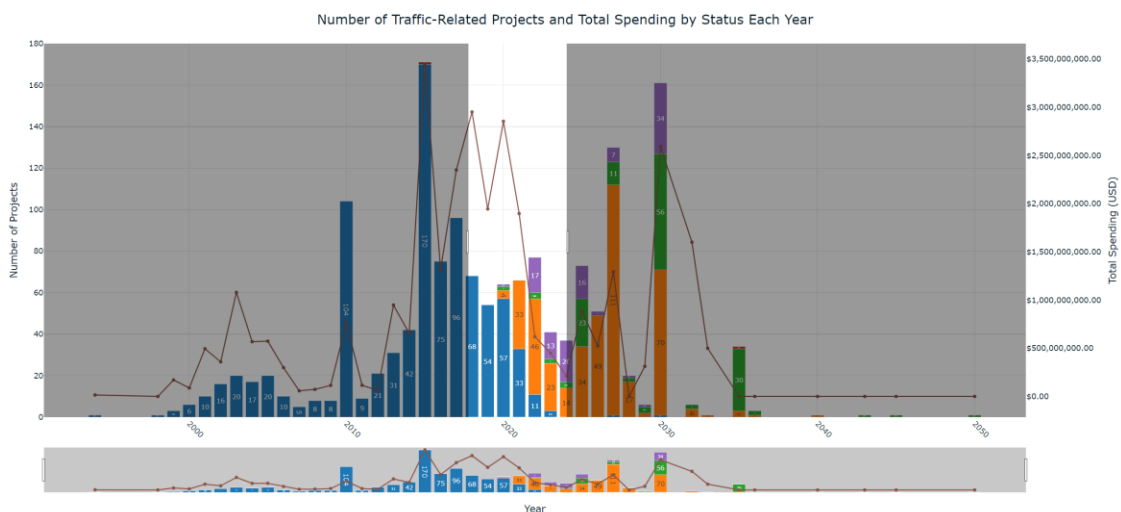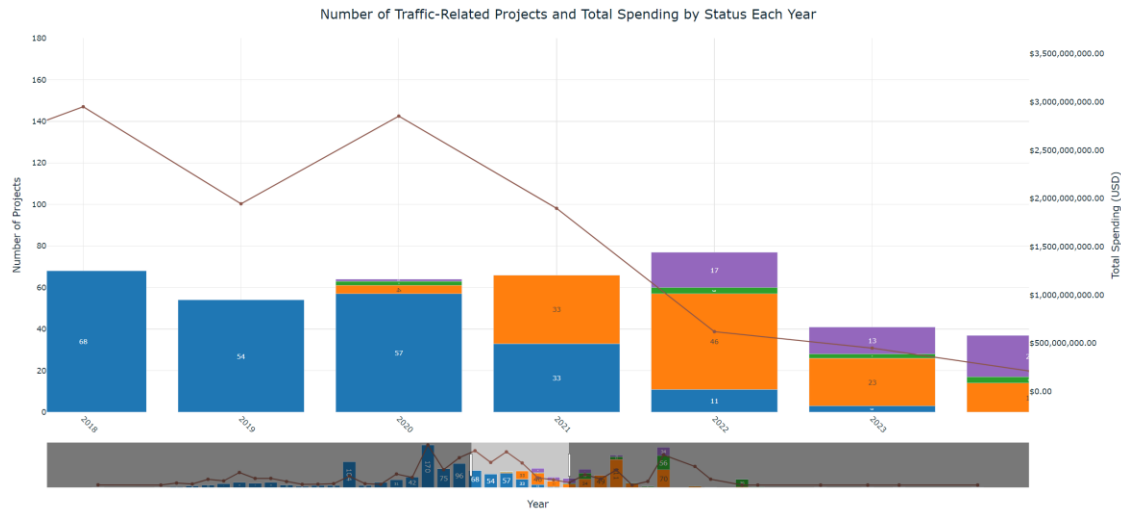
Direct link to the Boston City Projects chart: https://html-preview.github.io/?url=https://github.com/zzztamzzz/zzztamzzz.github.io/blob/main/final_visualize_boston/charts/boston_projects_bar_chart.html

The other visual animations in the respective sections are built purely in HTML with the help of D3.js. The idea to use the bubbles for the population line chart came to my mind because of one of the bonus homework assignments we did during the course. The bubbles are supposed to represent the population, and as more bubbles form in the confined space, the less free space we have for newer bubbles, causing congestion.

The animation with the lines going on a grid plane is supposed to showcase how roadways work. The distinction is meant to hint at the fact that a simpler and structured roadway system is actually beneficial than just making complicated and random directional ones.

Direct link to the directory containing all the files used for the website:

https://github.com/zzztamzzz/CS617-Visualizing-Boston/tree/main/final_proj/attempts/website_codes/fancyfy/paper

This is the same code that was pushed to GitHub Pages and is currently live.

Some screenshots of the website:

BOSTON TRAFFIC INSIGHTS

Introduction   Boston Population   Projects   Conclusion   Credits

Introduction

Welcome to our exploration of Boston, a city known for its rich history, vibrant culture, and dynamic urban landscape. As one of the oldest cities in the United States, Boston has played a significant role in the nation's history and continues to be a hub of innovation, education, and development.

In this article, we will delve into the factors that influence traffic in Boston, focusing on population trends and public projects. These factors play a crucial role in shaping the city's infrastructure and daily life, affecting how residents and visitors navigate the urban environment.

Visual Journey:

Let's take a moment to appreciate the beauty and complexity of Boston through two captivating images.

- **Boston from Longfellow Bridge:** This picture, taken during the daytime, offers a stunning view of Boston's skyline from the Longfellow Bridge. The bridge, a key piece of infrastructure, connects Cambridge to Boston and provides a picturesque vantage point of the city.
- **Boston Traffic on I-90 W:** Captured around 6:00 PM, this image shows a typical scene on I-90 W, one of Boston's major highways. The photograph, taken from within a car, highlights the daily traffic that many commuters experience as they travel through the city.

Population Increase in Boston

Let's look at this analogy. We have a fixed space and we keep adding bubbles. Over time, the environment becomes more congested. You can apply this analogy to anything that involves space.

In the case of Boston, the more people you have in a given space, the higher the likelihood of congestion and reduced free space. This concept is crucial in understanding urban planning and traffic management.
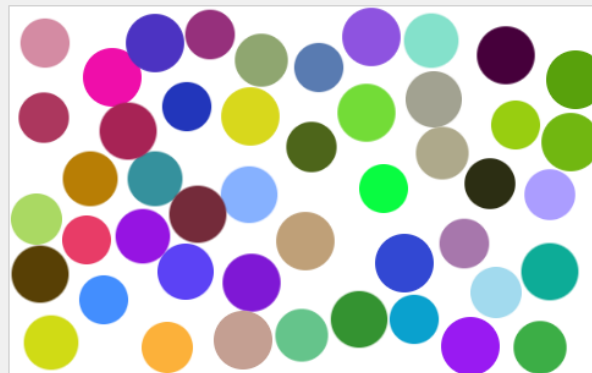
Understanding the population trends in Boston over the years gives us a fascinating glimpse into the city's growth and development. Our visualization combines a bar chart representing the population count and a line chart showing the annual percentage change from 1950 to 2023. This comprehensive view allows us to see not only the overall increase in population but also the year-by-year fluctuations.

Feel free to have a closer look at this interactive chart. Use your mouse to highlight a particular part

Feel free to have a closer look at this interactive chart. Use your mouse to highlight a particular part of the chart for viewing. Double click on the chart to reset to original.
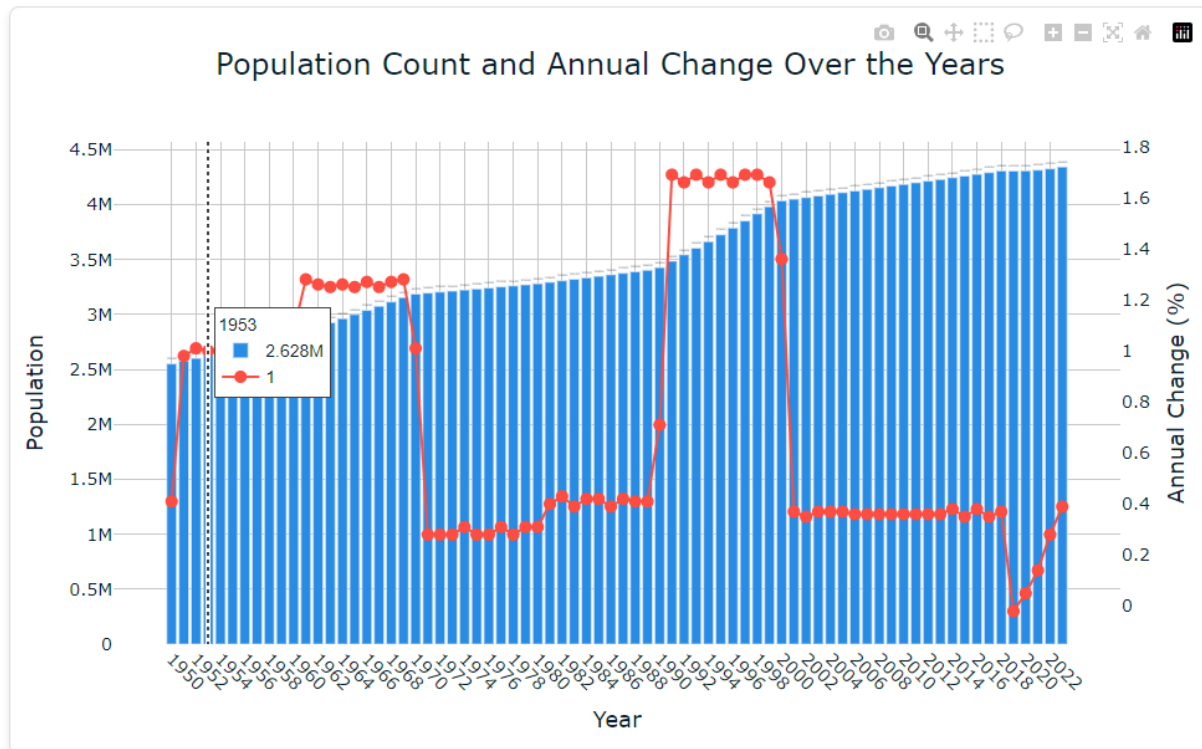

Chart Legend:

- Charles Blue: Boston population data
- Freedom Trail Red: Other relevant data

Key Observations:

- **The First Increase (1959-1961):** From 1959 to 1960, the annual percentage change in population growth increased from 0.98% to 1.08%. This upward trend continued from 1960 to 1961, with the percentage change rising from 1.08% to 1.28%. These increases suggest a period of positive growth for Boston.
  - **Historical Fact:** Boston experienced a post-war economic boom that led to job creation and industrial growth, attracting people to the city. The late 1950s and early 1960s were marked by significant economic expansion, which likely contributed to the increase in population during this period.

City Projects in Boston

Imagine the grid represents your city space. Instead of making complicated pathways on the grid, just follow along. It's easier to not get lost and confused when you follow a pattern. Most times, simple is better than complex.
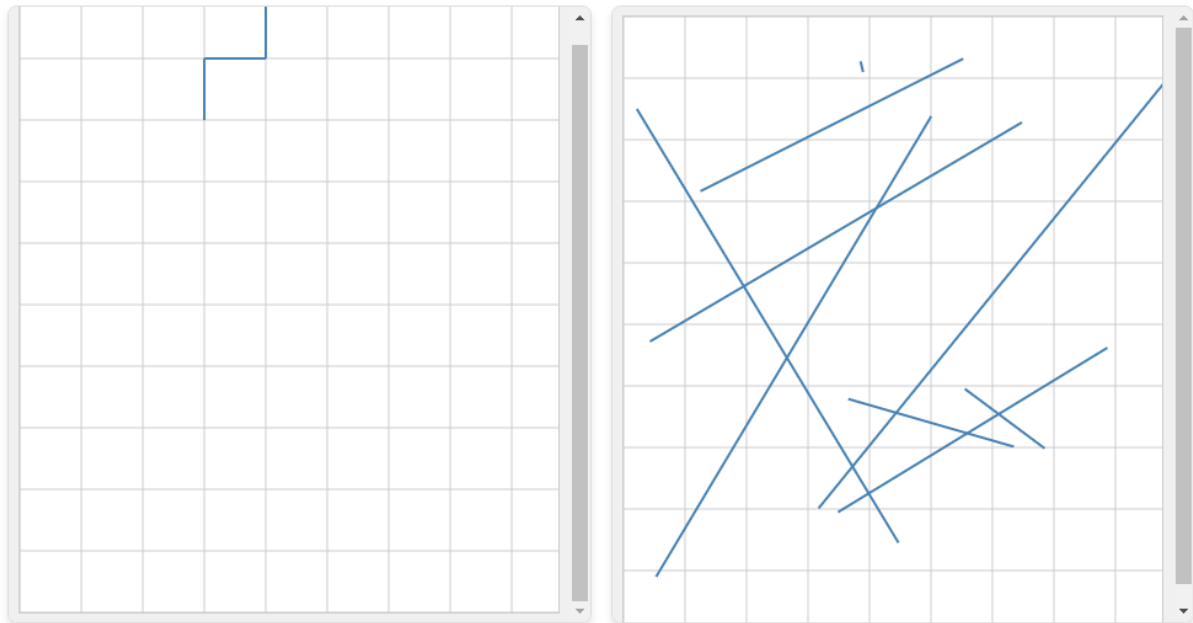

Boston's development over the years is marked by various public projects aimed at improving infrastructure, public spaces, and overall quality of life. Our visualization combines a stacked bar chart representing different stages of project completion and a line chart showing total spending on these projects from 1950 to 2023. This comprehensive view allows us to see not only the types and statuses of public projects but also the financial investment in them.

Key Observations:

- **Completed Projects:** This segment shows the number of projects that have been successfully completed each year. Over the decades, there have been impressive efforts to improve various aspects of the city, resulting in a steady number of completed projects.

- **Planning Projects:** Projects in the planning stage indicate the city's forward-looking approach to development. Planning projects have seen fluctuations, reflecting changes in administration priorities and funding availability.

○ **Fun Fact:** Many recent projects have focused on integrating green infrastructure and sustainable practices, aligning with global trends towards environmentally friendly urban development. Initiatives like the Silver Line Way rapid transit project and the expansion of the MBTA Key Bus Routes reflect Boston's commitment to sustainable transit solutions.

Use the horizontal scaling bar to adjust the range of years. Hover over each stacked bar to view project counts. Double click on the chart to reset the scale.

Number of Traffic-Related Projects and Total Spending by Status Each Year
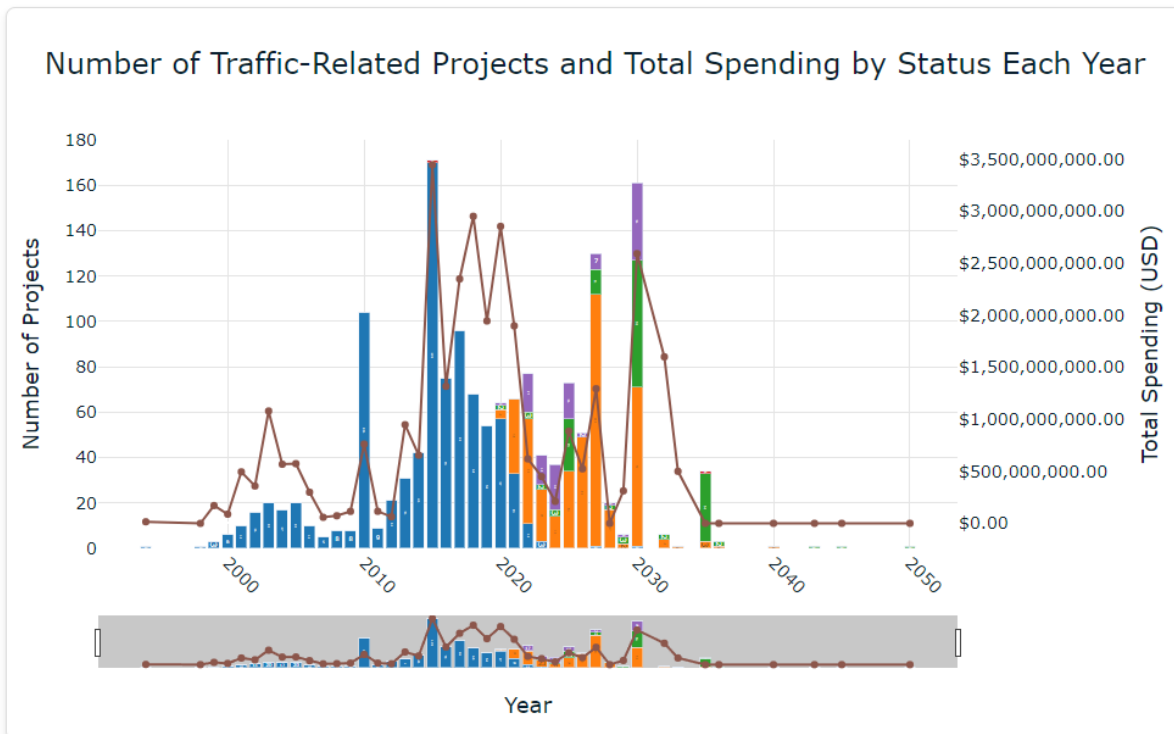
The colors used in the projects bar chart are:

- Blue: Completed Projects
- Orange: Planning Projects
- Green: Projected Projects
- Purple: In Construction Projects
- Red: Cancelled Projects
- Brown: Total Spending

3 of 5

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Conclusion

The data visualizations presented in this article highlight two critical factors impacting traffic in Boston: the steady increase in population and the numerous public projects aimed at improving the city's infrastructure. As we analyze these trends, several key insights emerge that underscore the need for strategic planning and effective execution.

Key Insights:

- **Continued Population Growth:** The population of Boston has been steadily increasing over the decades, and this trend is likely to continue. This growth brings with it increased demands on the city's infrastructure, necessitating proactive measures to accommodate the rising number of residents and visitors.

- **Need for Improved Infrastructure:** To manage the growing population, Boston must focus on building and enhancing its infrastructure. This includes expanding public transportation, improving road networks, and developing pedestrian-friendly areas. These efforts are crucial to prevent further congestion and ensure smooth mobility for all.

- **Quality Over Quantity in Public Projects:** While numerous public projects have been undertaken, it is essential to prioritize quality over quantity. Each project should be carefully evaluated to determine its potential impact on traffic control. Projects that do not contribute to better traffic management should be reconsidered or redesigned to ensure they effectively address the city's needs.

Making the Right Decisions:

- **Strategic Planning:** The city needs a comprehensive, long-term plan that anticipates future growth and allocates resources efficiently. Strategic planning will help prioritize projects that offer pronounced benefits in terms of traffic management and overall urban development.

- **Stakeholder Involvement:** Involving community stakeholders in the planning process can provide valuable insights and ensure that projects align with the needs of the residents. Public consultations and feedback can help identify the most pressing issues and develop solutions that are widely supported.

Conclusion:

In conclusion, the data underscores the urgent need for Boston to continuously improve its infrastructure to keep pace with population growth. By focusing on high-quality projects that genuinely enhance traffic management, the city can create a more efficient, sustainable, and livable environment for all. The future of Boston's traffic depends on the strategic decisions made today, and it is crucial to approach these challenges with foresight and a commitment to excellence.

The website turned out to be a simple and informative place for people to learn about how there can be patterns over time, most of which have historical importance while others happen due to certain events happening nationwide or worldwide. The website used to receive feedback from Martin and Dorothy was scratched off to become this current one. Thank you for the feedback! Here's the link to my 'newspaper article' website for this project:

https://zzztamzzz.github.io/final_visualize_boston/

References

https://plotly.com/python/

https://html-preview.github.io/

https://www.boston.gov/news/colors-typefaces-and-look-bostongov

https://www.massbuilds.com/map

https://www.macrotrends.net/global-metrics/cities/22939/boston/population

https://catalog.data.gov/dataset/walkability-index1

ChatGPT