SLC Traffic Patterns

1. BASIC INFORMATION

Project Title: SLC Traffic Patterns

Team Members:

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Project Repository Link:
https://github.com/dataviscourse2023/final-project-slctrafficpatterns

2. BACKGROUND AND MOTIVATION

Salt Lake City, located in the heart of Utah, is the largest city in the state and serves as its economic, cultural, and transportation hub. With a population that has been steadily growing over the years, the city has experienced significant changes in its traffic patterns and transportation infrastructure. Understanding and analyzing these traffic patterns is crucial for city planners, policymakers, and residents.

3. PROJECT OBJECTIVES

The project's main aim is to build a time-series flow of the traffic analysis in Salt Lake City.

Here are some key objectives for our project on Salt Lake City traffic patterns:

Traffic Flow Analysis: Analyze the current traffic flow in Salt Lake City to spot bottlenecks, congestion sites, and regions with high traffic volumes.

Commuter Behavior: Investigate commuter behavior, including commute times, routes, and modes of transportation, to comprehend residents' and workers' daily travel patterns.

Traffic Safety Assessment: Traffic Safety Assessment: Examine traffic safety by looking at accident statistics, identifying high-risk regions, and suggesting ways to make the roads safer and have fewer accidents.

Data-Driven Policy Recommendations: Use data analysis and modeling to create policy recommendations for traffic management, urban planning, and infrastructure development.

Infrastructure Evaluation: Examine the condition and capacity of existing transportation infrastructure (roads, bridges, public transit), and recommend improvements or expansions where needed.

Long-Term Planning: To make sure that the suggested solutions are flexible and forward-looking, take into account projected population increase, technological improvements, and changing transportation trends.

Recreational activities and tourism: Examine traffic patterns about tourist attractions and suggest solutions to enhance visitor experiences and ease congestion during busy travel times.

Cost-Benefit Analysis: Conduct a cost-benefit analysis of proposed transportation policies and enhancements to inform decisions and allocate resources.

Policy Implementation: Outline a schedule, potential pilot projects, and the accountable parties for implementing the advised policies.

Monitoring and Evaluation: Establish a mechanism for tracking traffic trends and assessing the success of adopted policies.

4. DATA

The project's primary objective is to construct a Salt Lake City (SLC) heatmap that reflects its traffic patterns. To achieve this, we plan to use data from UDOT's Traffic Management System that tracks vehicle activity at various monitoring stations in SLC. From this dataset, we are considering the following key data points for our heatmap: latitude, longitude, route, station_id, and timestamp. Furthermore, we are exploring additional data attributes such as density, directionality, and demographic information if available and relevant to the project's goals.

The data we have is contained in two different csv files; one file (Utah Traffic MetaData.csv) contains the metadata on each station, and the other file (Utah Traffic.csv) contains the actual traffic data.
Utah MetaData Contains the latitude, longitude, route, station ID and the Utah Traffic, which contains the hourly observations of 50 stations for January 2022.

We are looking forward to building a prototype based on the available data and increasing the data size.

Sample Dataset Link:
https://www.kaggle.com/datasets/johnyoungsorensen/salt-lake-city-traffic

The data set was sourced from:
https://www.udot.utah.gov/connect/business/traffic-data/traffic-statistics/

5. DATA PROCESSING

Apart from accounting for times when certain stations did not have monitoring data, we are not looking for any data cleaning right now. If more is required, we will handle that as it comes up.

6. VISUALIZATION DESIGN

Initial Ideas for Interface:

IDEA 1: Initially, we considered having the heatmap and statistics displayed on a single page. This approach was intended to provide users with a comprehensive view of traffic patterns. However, we recognized that it could lead to challenges in maintaining a clean and uncluttered interface.

IDEA 2: This approach separates the website's essential features into distinct pages. One page will focus on presenting statistical data, while another will prominently display the heatmap. We will also create additional pages for data-related content and information about our team.

Idea 2 aligns better with our goals, enabling us to divide the workload and focus on individual pages. This approach enhances the user experience by offering a well-organized and user-friendly navigation system.

Website Structure and Features:

Homepage: The homepage is dedicated to the primary feature of the website – the interactive heatmap of Salt Lake City's traffic patterns.

Date and Time Filters: Users can select specific dates and times to visualize historical traffic data.

Interactive Map: The central focus of the homepage is the interactive map, which allows users to drag, zoom in, and zoom out for a detailed view of traffic conditions.

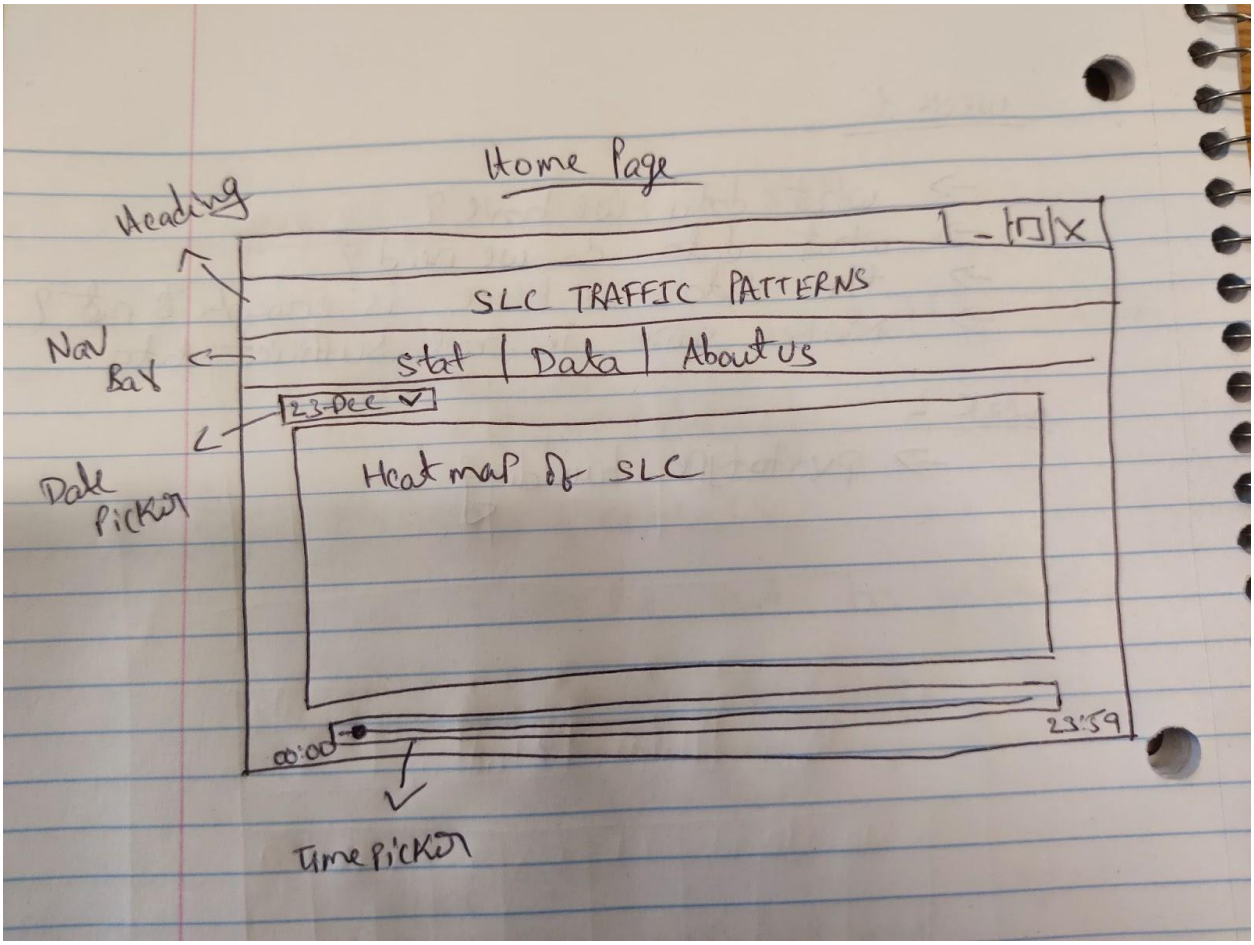
Comprehensive Statistics: The statistics page serves as a repository for various traffic-related statistics. Each statistic is accompanied by its description, providing users with valuable insights into traffic patterns.

Interactivity: Whenever possible, statistics will be presented in an interactive format, enhancing user engagement and understanding.
Data and About Us Pages:

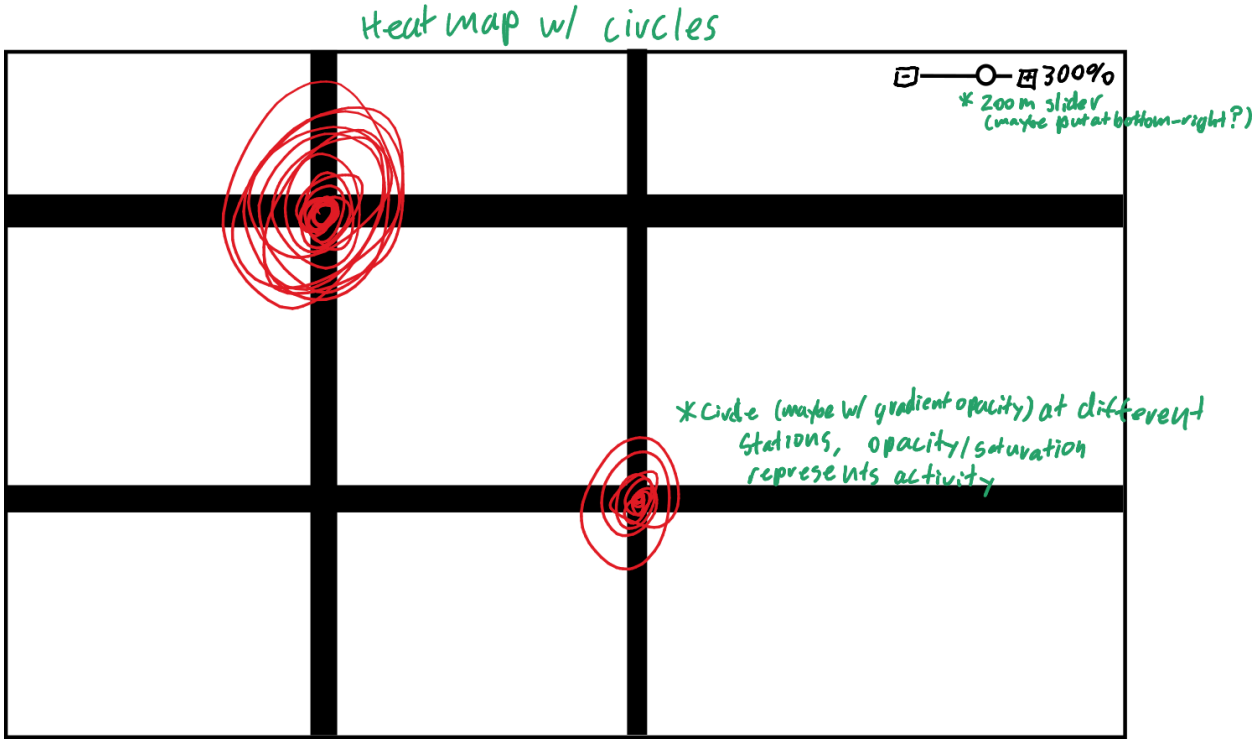
Data Page: This page is dedicated to users interested in the raw data used for analysis. It provides access to the dataset used for generating the heatmap and related information.

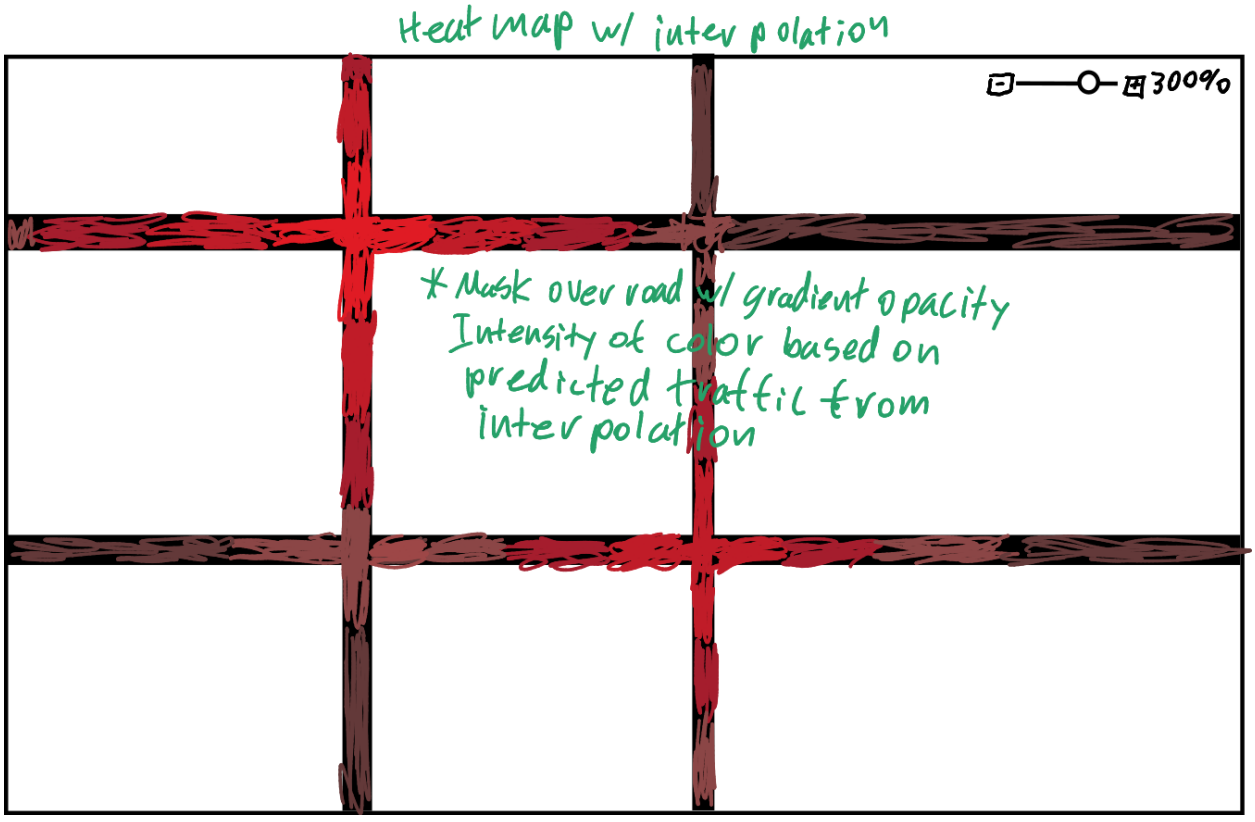
About Us Page: Here, users can find details about the contributors, developers, and the team behind the website. This section adds transparency and builds trust with users.
Navigation Bar: A user-friendly navigation bar at the top of each page provides hyperlinks to navigate between different sections of the website easily

Some of the initial drawings we had for the website

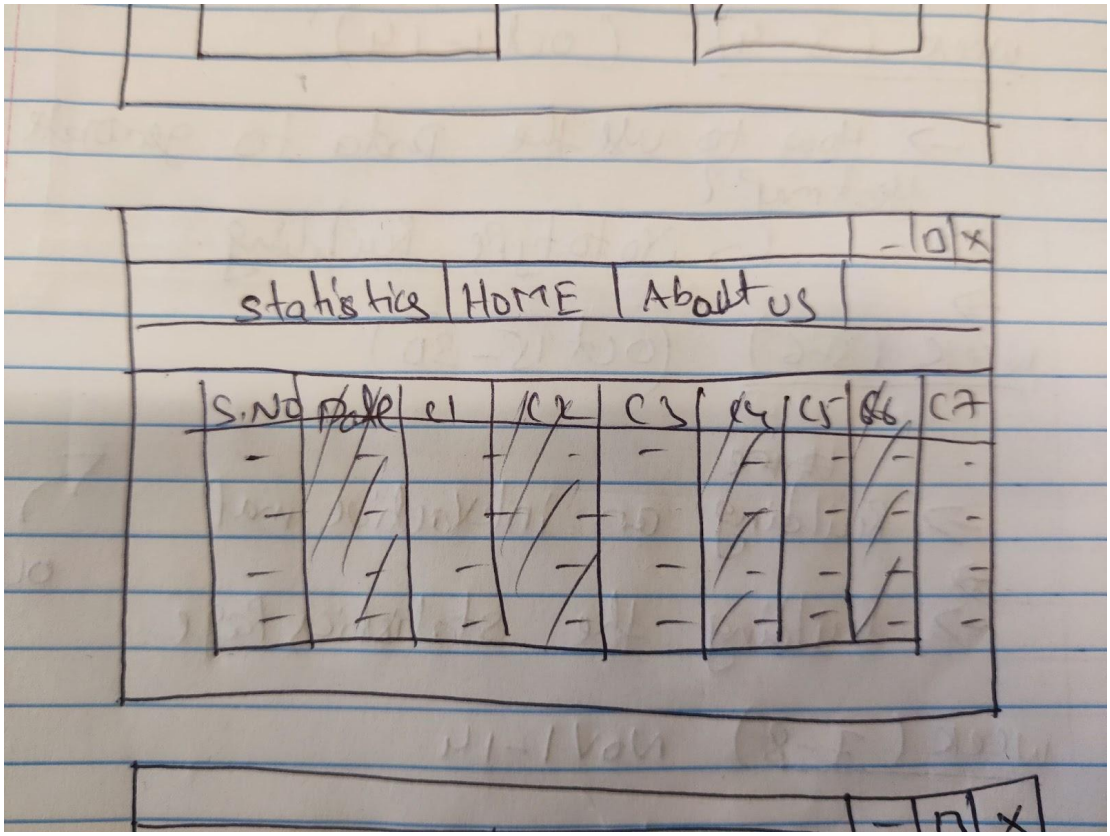


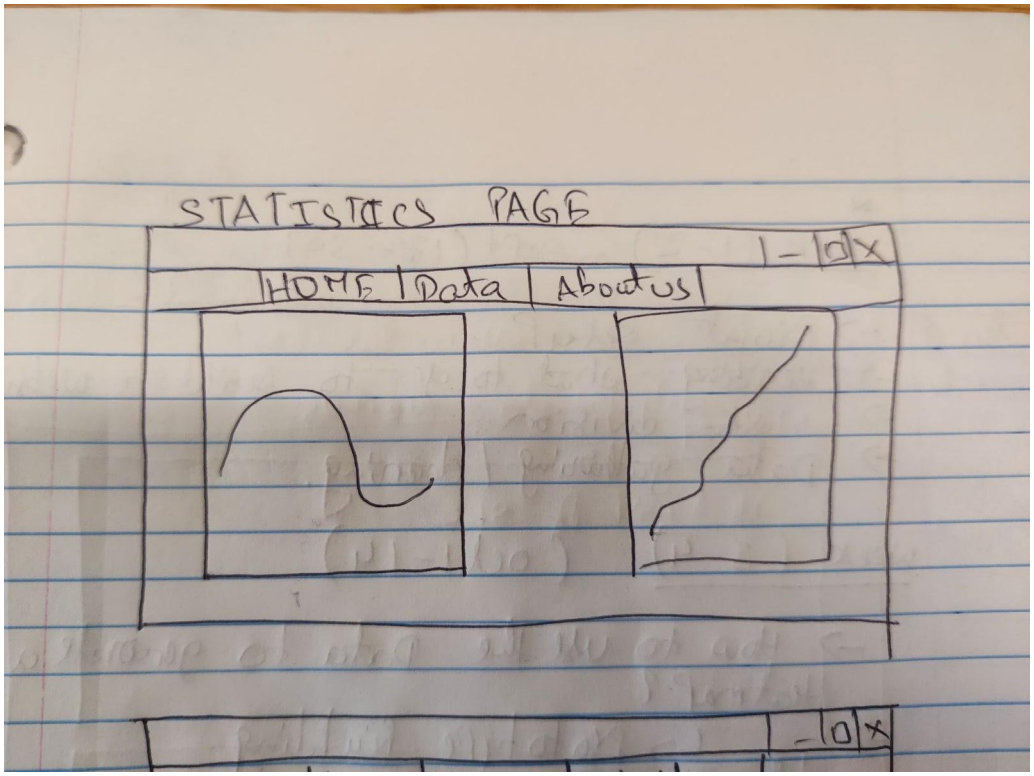
Initial drawings for the heatmap



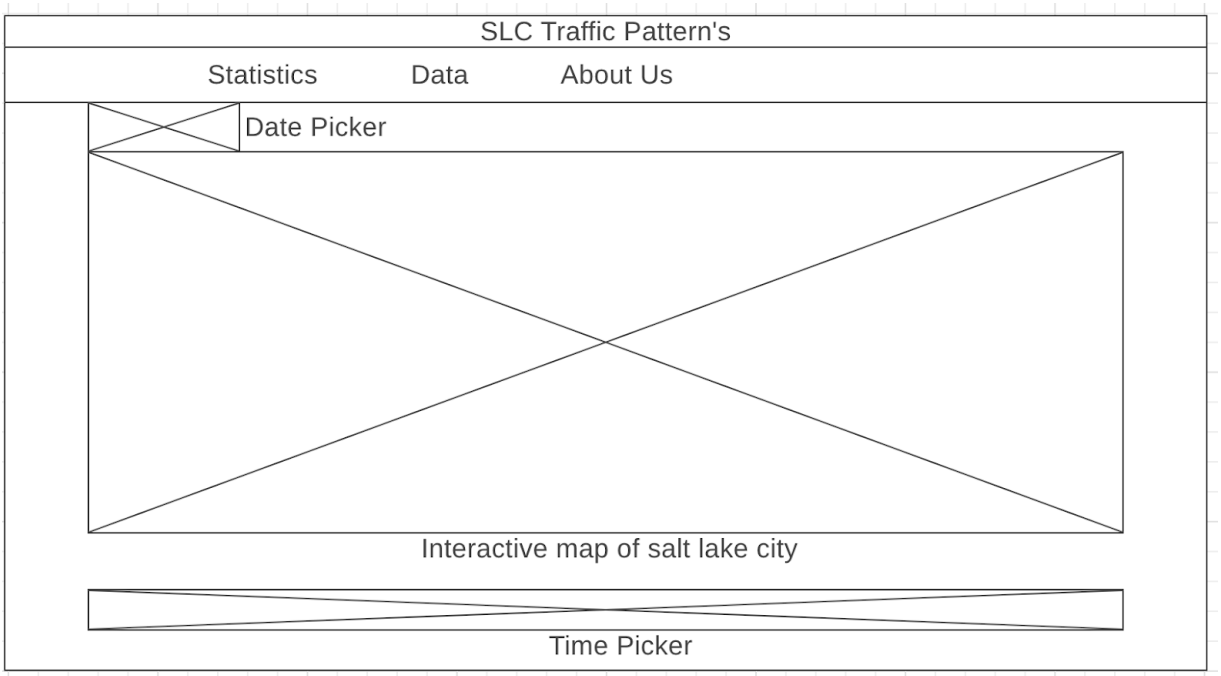


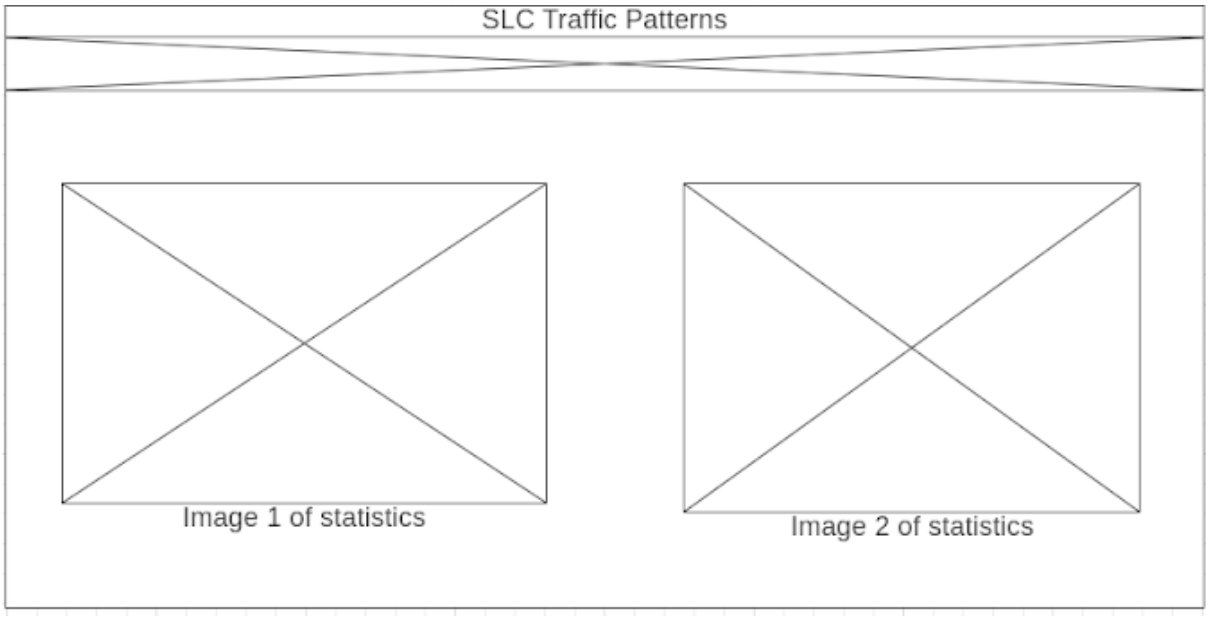
Initial drawings for the statistics page





Proper wireframes made using wireframe.cc





7. MUST-HAVE FEATURES

a. **Interactive Map:** The interactive map allows users to visualize traffic conditions for a specific date. We plan to implement a rainbow color gradient for the heatmap, with red indicating the most congested roads and green for free-flowing traffic. We will use orange to represent moderate traffic areas, creating a smooth transition between red and green. Users can zoom in and out for a more detailed view. We also aim to provide different map views, such as street and satellite views.

b. **Date/Time Selector:** The Date/Time selector enables users to choose a specific date from a calendar dropdown. Users can then visualize the heatmap and observe traffic changes using a draggable time slider.

c. **Statistics:** The statistics page offers valuable insights based on the collected data. It includes an overview of key statistics and historical traffic trends.

8. OPTIONAL FEATURES

a. **Time-lapse of heatmap between 2 dates:** This feature allows users to watch a short video displaying the changes in the heatmap between two selected dates. It provides a dynamic visual representation of how traffic conditions evolve over time.

b. **Additional Statistics:** If time permits, consider adding a page dedicated to the impact of special events on traffic patterns, displaying specific dates of events in the city. Similarly, you can create a page that analyzes the impact of weather conditions on traffic if resources allow.

9. PROJECT SCHEDULE

The project has a 10-week timeline, and we have structured a biweekly schedule for completing specific activities.

Week 1: Project Setup and Tool/Framework Selection

- Project initiation and goal setting.
- Selection of development tools and frameworks.
- Work division and team roles.
- Initial data gathering and cleaning.

Week 2: Data Preparation and Division

- Continued data gathering and cleaning.
- Further preparation of the dataset.
- Division of tasks and responsibilities among team members.

Week 3: Interactive Map Setup and Prototyping

- Setting up the framework for the interactive map.
- Prototyping the layout and design of the map.
- Preliminary testing of map functionality.

Week 4: Integration with Date/Time Picker

- Integrating the interactive map with the date/time picker.
- Ensuring seamless interaction between map and date selection.
- Testing phase 1 to identify and address any issues.

Week 5: Statistics and Data Viewer Page

- Commencement of building the statistics page.
- Design and development of the data viewer page.
- Continuation of testing to validate functionalities.

Week 6: Statistics Page and Testing Phase 2

- Completion of the statistics page.
- Enhanced interactivity for the data viewer page.
- In-depth testing during phase 2, focusing on user experience.

Week 7: Refinements and Bug Fixes

- Addressing any identified issues, corrections, and bug fixes.
- Reviewing and enhancing the user interface and overall design.
- Preparing for optional features if time permits.

Week 8: Final Testing and Quality Assurance

- Comprehensive testing of all features and pages.
- User acceptance testing and feedback collection.
- Fine-tuning and performance optimization.

Week 9: Project Improvements and Optional Features

- Implementing improvements based on user feedback.
- Additional corrections and enhancements.
- If time allows, begin work on optional features.

Week 10: Finalization and Documentation

- Finalizing all aspects of the website.
- Documentation of the project, including data sources and methodologies.

- Preparing for the website's launch and public release.

Evaluation:

Data Quality and Utility:

For our project, we utilize two primary datasets: "metadata.csv" and "data.csv." "Metadata.csv" provides essential information, including the monitor locations and their corresponding routes, while "data.csv" contains timestamped traffic density values that enable us to create our visualizations. Our dataset covers January 2022 and comprises nearly 750 records.

Up to this point, the data we've employed has proven highly beneficial. We haven't encountered any issues or challenges with the data, and it has effectively supported our project's objectives.

Accomplishments:

We successfully established the map and commenced work on refining the data's intensity representation. Our map is dynamically updated with our data, and we visualize this intensity through circles. We're currently focused on improving the accuracy of traffic representation by data interpolation along the routes.

Challenges:

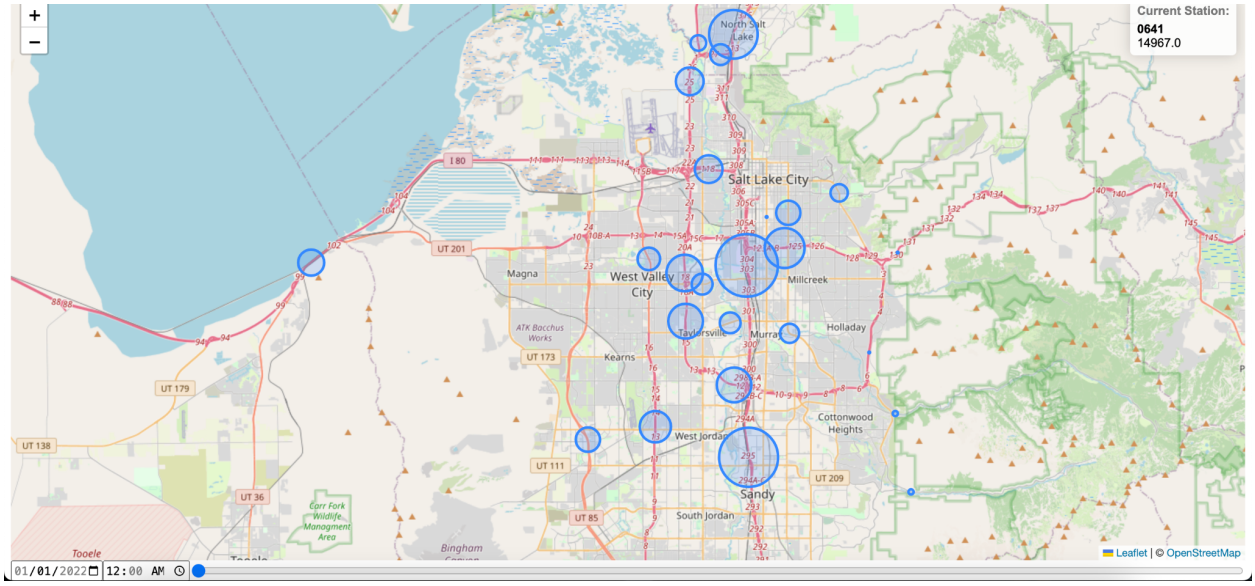
We're currently facing challenges when integrating our data with the map. We've explored various options like polylines, GeoJson, and third-party extensions like the MapQuest extension. Our plan involves manually drawing lines for each route and updating traffic density on those specific lines. To address this challenge, we seek guidance from our professors or TAs for valuable insights.

Alignment with Expectations:

So far, our progress aligns with our initial expectations. We've reached a point where we can visualize traffic intensity on the main screen, but we aim to enhance the visualization's appeal and accuracy soon.

Current screenshots of the map:

This is our current implementation of the website, where we can see a little interactivity by getting the current station details by hovering on each different circle. All the data will be dynamically updated by changing the pointer location on the dragbar.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West Valley City
Millcreek
Holladay
Murray
Taylorsville
Kearns
Magna
West Jordan
Cottonwood Heights
Sandy
South Jordan
North Salt Lake
Tooele
Bingham
I 80
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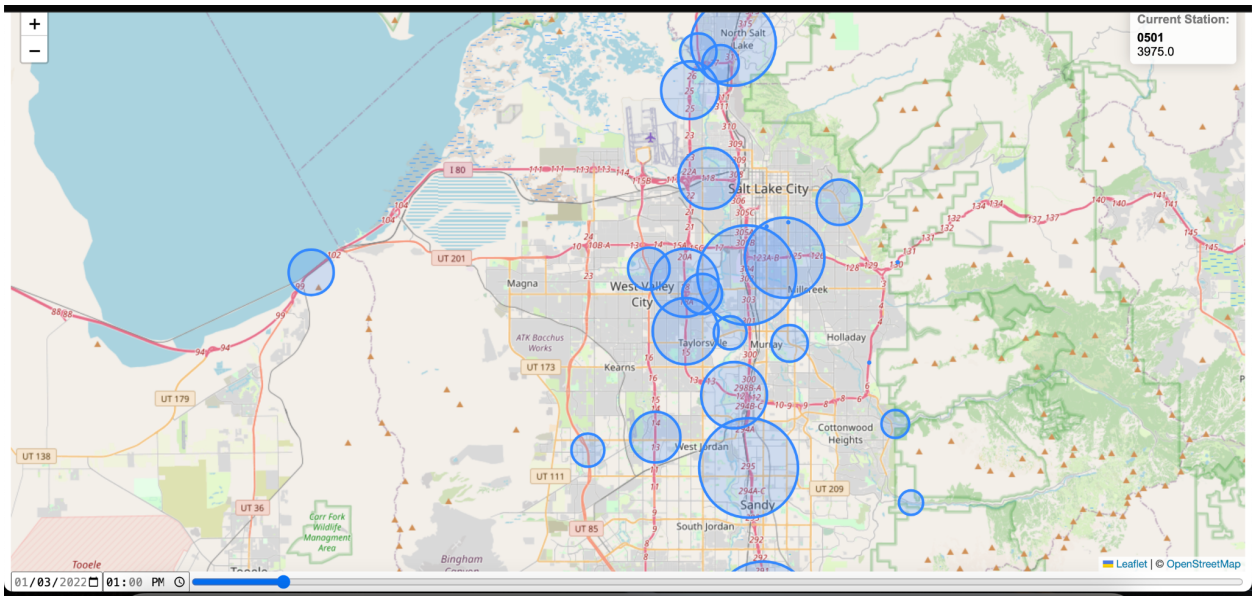
UT 173
UT 179
UT 138
UT 36
UT 111
UT 85
UT 209
01/01/2022
12:00 AM
Leaflet | © OpenStreetMap


Current Station:
0501
3975.0
Salt Lake City
West Valley City
Millcreek
Holladay
Murray
Taylorsville
Kearns
Magna
West Jordan
Cottonwood Heights
Sandy
South Jordan
North Salt Lake
Tooele
Bingham
I 80
UT 201
UT 173
UT 179
UT 138
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UT 85
UT 209
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Leaflet | © OpenStreetMap