NavigateSLC - Process Book

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Link to repository: https://github.com/dataviscourse2023/final-project-navigateslc

Overview and Motivation:

As international students, we face difficulties moving into a new home and a new environment in another country. While numerous sites try to be helpful, there is a glaring gap: there isn't a single, all-inclusive website that can easily provide a comprehensive summary of crucial information.

Our goal is to create a web application that, in addition to filling the information gap, improves the educational experience for students by featuring an interactive map as its main feature. This interactive map will be a thorough resource, arming students with the information they need to choose a residence best suited to their unique needs and preferences.

By creating this website, we aim to:

1. **Simplify Decision-Making**: We have first-hand experience that selecting the ideal residence is a crucial task for us international students. Our website will provide a visual representation of the city, highlighting different areas and housing possibilities and essential information like the area's closeness to facilities like transportation hubs, the university, and other necessities.

2. **Increase Convenience**: We want to make getting important information easier. Our website will provide a one-stop solution for students during their settlement process in place of them having to navigate different sources, saving them time and effort.

In conclusion, we aim to develop a simple website that will ease the transition for international students and give them the power to choose their new home with knowledge and confidence, thereby raising their quality of life in the city.

Project objectives:

We will be focusing on:

1. **Population Map:** Providing a population map with concentrations of students and student-friendly neighborhoods helps newcomers connect with their peers, fostering a sense of community and making social integration easier.
2. **Local Stores:** For students, access to nearby grocery stores, bookshops, and other essential retail outlets is vital. Including information on the locations of these stores helps students settle into their new surroundings more comfortably.
3. **Public Transport:** Students rely heavily on public transportation. A comprehensive map featuring bus stops, TRAX stations, and their schedules enables them to navigate the city efficiently, especially when commuting to campus or exploring its attractions.
4. **Tourism Highlights:** While students primarily focus on their studies, they also seek opportunities for leisure and exploration. Highlighting local attractions, parks, museums, and entertainment venues allows newcomers to balance their academic pursuits and leisure activities.
5. **Safety and Emergency Services:** It's crucial to provide information on the locations of police stations, medical facilities, and other emergency services. This helps students feel secure and prepared in case of any unforeseen circumstances.
6. **Student Services:** New students require access to university offices, counseling services, and academic support centers. Including these on the map ensures students can easily find the resources they need to excel academically and adjust to campus life.

In essence, tailoring the city map to the needs of new students fosters a smoother transition into city life and university culture. It equips us with the information we require for everyday living, studying, and exploring the city, thereby enhancing our overall experience as students.

Related work:

- Visualizations discussed in class and used in assignments such as scatter plots, heatmaps, bar, line, and radar charts.
- Interactions present in the COVID dataset assignment also coincided with the underlying idea of our project.
- Transit app: https://transitapp.com/
- UofU Class Map: https://myclassmap.utah.edu/
- All trails app: https://www.alltrails.com/
- Google maps: https://www.google.com/maps

Questions:

We started the project with our motivation to help other students settle into a new city. We asked ourselves, What are the necessary features required to be developed and integrated on our website to help onboard students to the University of Utah and into Salt Lake City?
We delved into the topic and came up with the project's objectives.

We had to understand and think from the student's perspective to identify the essential features that would assist a student in going about their routines.
What are the necessities that students require to settle down into a new city?

With our objectives and features listed, our next big question was.
How do we acquire such relevant datasets?
We had already utilized all of the apps mentioned in the related work and wanted to bring all of those apps onto a single platform as a one-point solution for students.

We approached the GIS department at the UofU to understand the map layout that was being utilized by them and acquire datasets that were available with them. This proved extremely helpful since the representative pointed us to the datasets that were publicly available and how to utilize the website to acquire the layers for the features that we were working on.

Now that we had collected the data and the necessary resources, we had to decide on the coding structure.

How do we manage the datasets, and what are the designs that are going to be utilized?

How do we develop informative, intuitive, and dynamic data visualization techniques on the acquired datasets, and how should they be presented?

What are the necessary features, and what are the optional features?

Data:

Datasets that were available online with public access:

- Parks: https://opendata.utah.gov/Recreation/Map-of-Salt-Lake-City-s-Parks/
- Public Transport: https://gis.utah.gov/data/transportation/transit/
- Topographical map: https://gis.utah.gov/data/elevation-and-terrain/
- Trails and Trailheads: https://gis.utah.gov/data/recreation/trails/

We have requested facilities@utah.edu to provide us with department-specific data. We have also requested the geography department to provide access to high-quality topographical maps of SLC, weather data, average block-wise rent data, and population density data.

We will update the list as we acquire them.

Data Processing:

Some of our data sources have overlapping information, such as transport routes of TRAX. We aim to pre-process the data and ensure data abstraction.

The multiple datasets that are being integrated have various differing columns and data types, which need to be unified by identifying the common data fields to be utilized optimally.

Then, develop a data integration strategy, which may involve merging, deduplicating, or aggregating overlapping data points. Data quality will be prioritized by cleansing and standardizing entries to ensure consistency, with an emphasis laid on helping students.

Since the visualization is essentially a map, the additional coordinates from the features must be superimposed, and they must be consistent with the underlying map coordinates, making the precise data pre-processing of coordinates a crucial component.

Exploratory Data Analysis:

From the data collected, we realized the following things:

The average block-wise data gave insights into how the students can utilize this information to find their community and figure out their living expenses and commutes.
The average block-wise rent data revealed the following tradeoff:

1. The locations that have a higher average rent have better accessibility to general amenities such as parks, grocery stores, and better connectivity with public transport, which is essential to help a student with setting up their routine.
2. The locations that have relatively lower average rent did not have the amenities that were easily accessible within walking distance in comparison to the higher average rent. The commute times to the university and the accessibility to public transport are much higher.

The weather dataset revealed following trends:

- The winters in Salt Lake City last long, from the months of November to March. The average temperatures in these months are in the range of 55℉ to 27℉ (13℃ to -3℃).
- The dataset also revealed that the summers are the hottest in the months of June, July, and August, ranging from 90℉ to 61℉ (32℃ to 14℃).

This data helps the students plan for their temperature-based clothing if they move into the city during the Fall or the Spring semesters to the University of Utah.

Visualization Design:

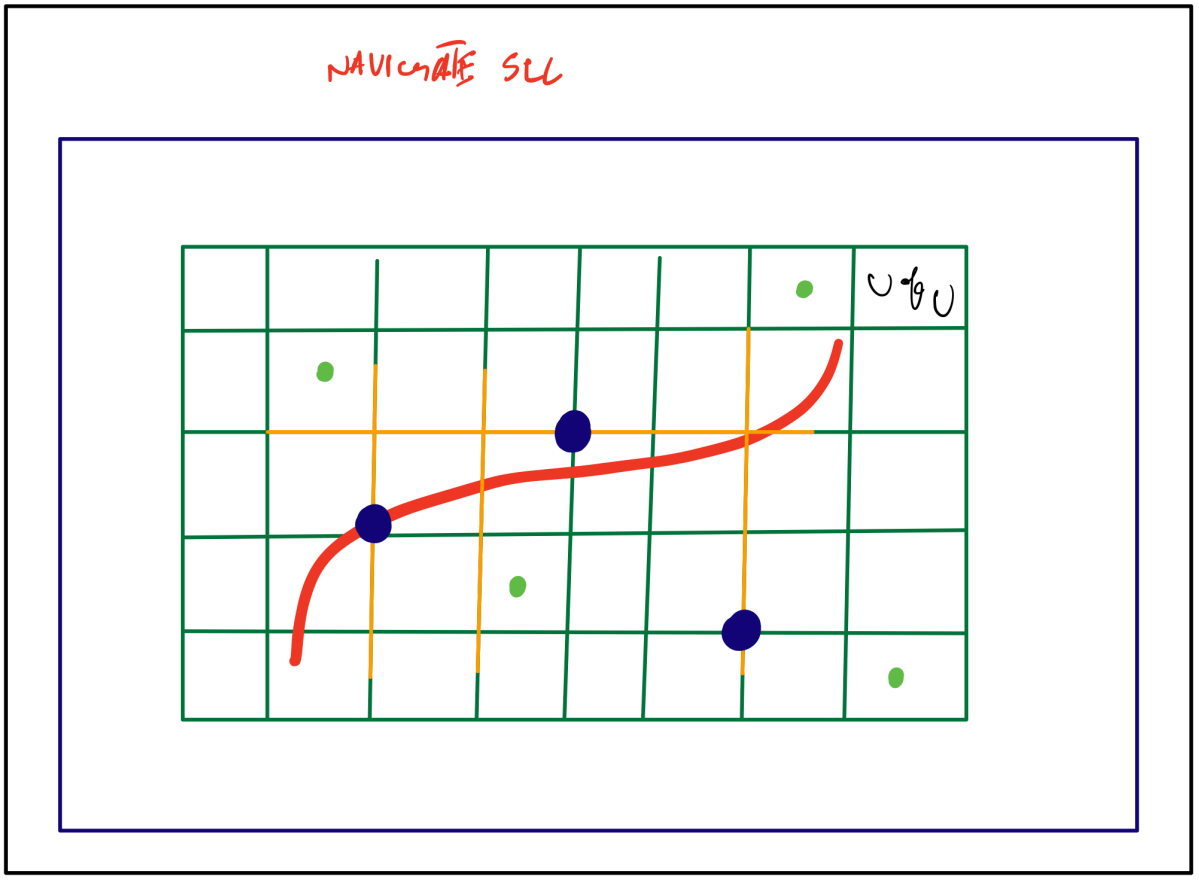
We start with a topological map. Over this, we intend to implement these filters:

1. **Block-wise visualization:** A menu option to select a particular block in SLC, which pops up the population density, average rent, convenience stores, and general recreational activities when the cursor hovers over it.
2. **Public transport route visualization:** This will explicitly highlight the bus routes. An option will be provided to select a particular bus route, which will be highlighted on the street map.
3. **Trail map:** Similar to the public transport route visualization, an option will be provided to select a particular trail/trailhead, which will be highlighted on the street map.
4. **University of Utah Visualization** - An option to particularly zoom into the campus will be incorporated. This will highlight all the buildings (along with historical information) and other places of significance on the campus.
5. **A macroscopic view:** of the entire city will be provided, and users will have the freedom to add and remove filters of their choice manually.

We came up with a few possible layouts for our website.

Initial Sketch:

- Overlay all the data and map layers onto one street view map with topographical information.
- The data consists of street view of roads, public transport routes, topography overlay, block-wise population density data, average rent prices, and a detailed map of departments in the University of Utah.
- In the sketch:
    - The red line corresponds to the TRAX routes.
    - The green grid corresponds to the city blocks, which contain block-wise data.
    - The orange lines are roads with street names.
    - The blue dots are bus stops.
    - The green dots are local landmarks.
    - The University of Utah has been included near the map's northeast as a detailed map overlay with links to departmental-specific data.

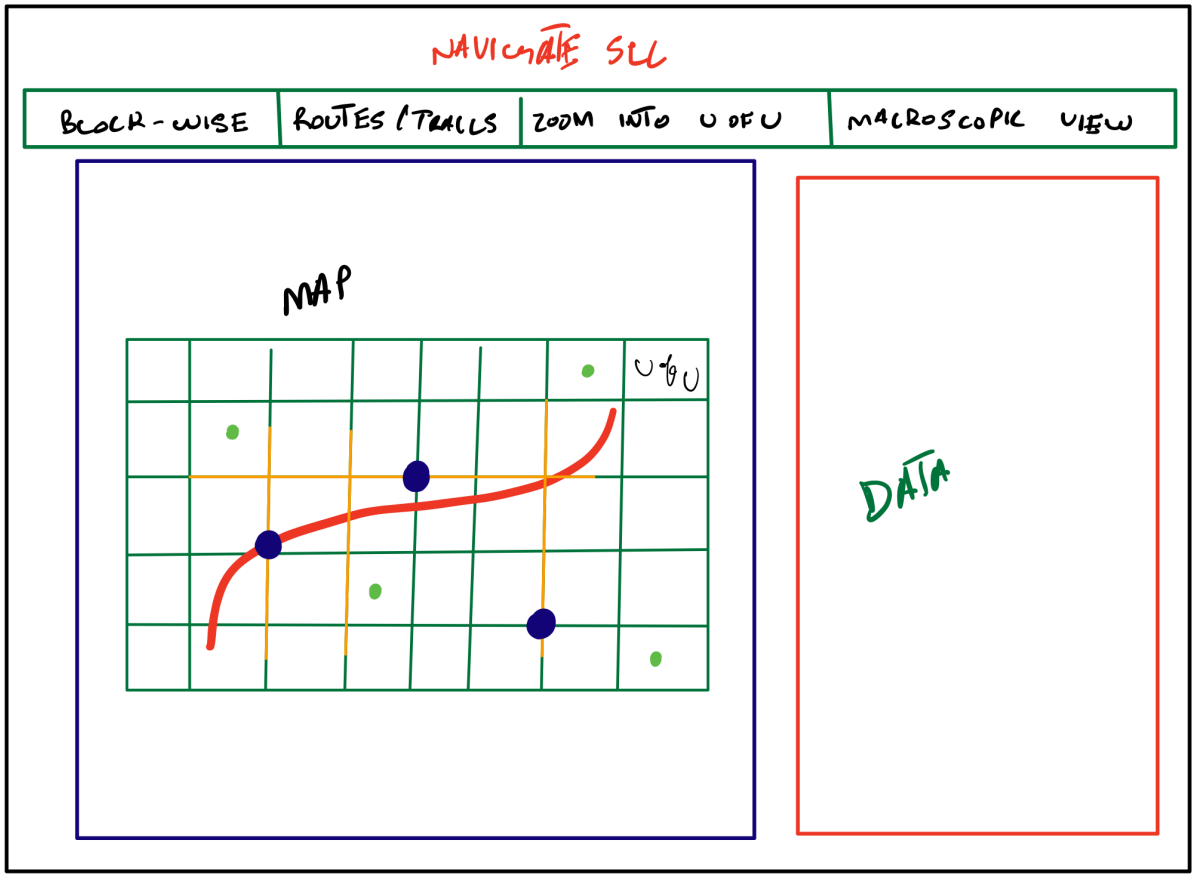


The above design has several issues:

1. There is a heap of information available, and understanding details becomes very difficult.
2. The entire visualization is cluttered due to multiple overlays of map layers and data layers.

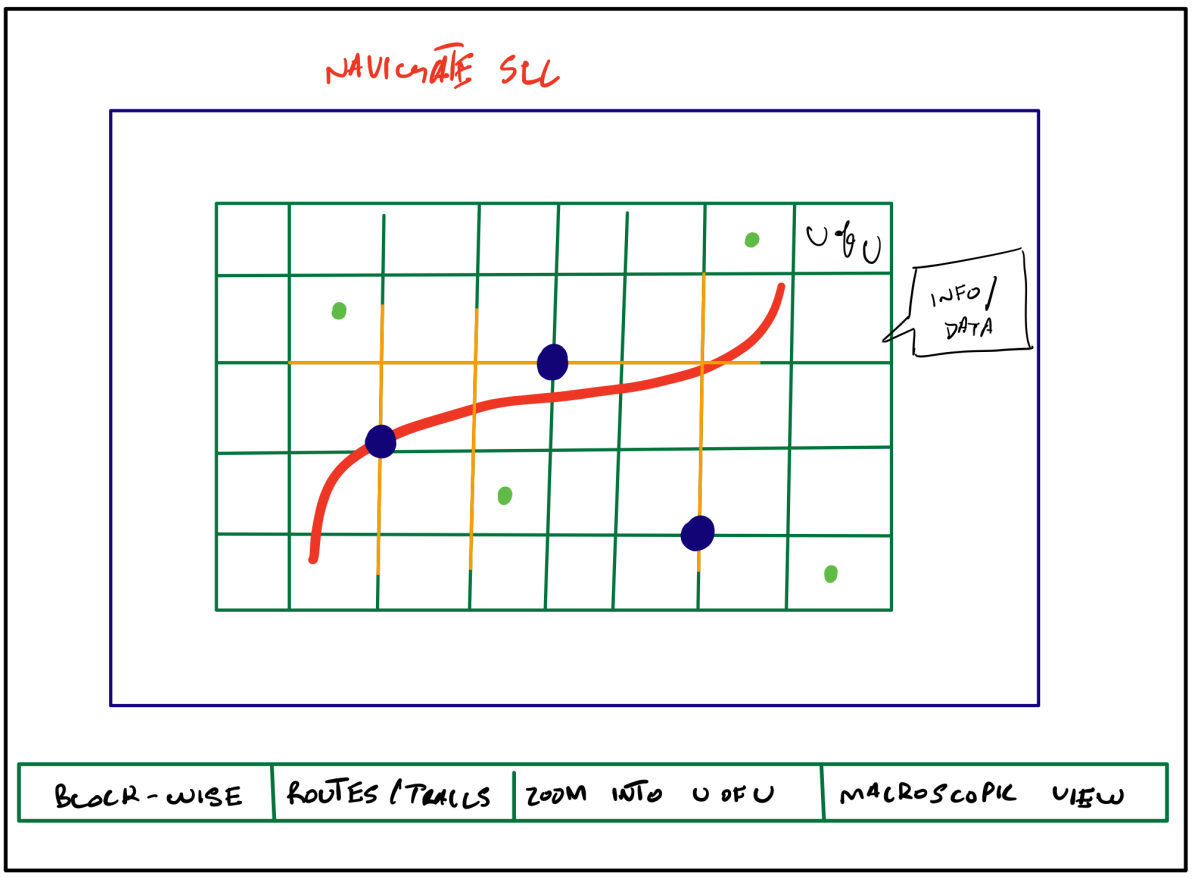
Improved Sketch:

- By utilizing filters for separating the overlays of different map layers.
- The data layer has been separated into a window that shows specific information about the selected filter.
- Filters: A block of buttons is present on the top of the page, and selecting the filter makes only data from that topic appear on the map section.
- Data Window: Selecting a particular element on the map will provide more information about that selection on the data window.



Final sketch:

- Since the data section is empty when there is no selection on the map, the size of the map on the screen can be maximized.
- The filters have been moved to the bottom of the page to provide more importance to the map.
- The design we have come up with is as follows:
    - A selection of the filter will overlay the map layer, which is filter specific to the street view map.
    - Each filter will have a drop-up, which provides a selection of features.
    - Upon selecting a feature, the map will be overlaid with a heat map (as applicable).
    - By hovering over a particular section with the cursor, a pop-up gets populated with the information related to the feature selected.



Must-Have Features:

- Topographical and street map
- UoU department and student services buildings with general and historical information.
- Population density with emphasis on student-friendly neighborhoods.
- The average rent across areas.
- Public transportation with stops, routes, and timings.
- Convenience Stores - with emphasis on cuisines
- Recreational Activities - including parks, theaters, tourism highlights, etc

Optional Features:

- Trails map overlay
- Live events notice board with information about local and state-level events.
- Past weather map overlay

Project Schedule:

Sep 15 - Submit the proposal

Sep 22 - Complete data collection and processing

Sep 29 - Have a primitive working visualization model - trying to incorporate all the collected data on the must-have features

Oct 6 - Collect feedback based on the primitive model - and incorporate suggestions in the visualization

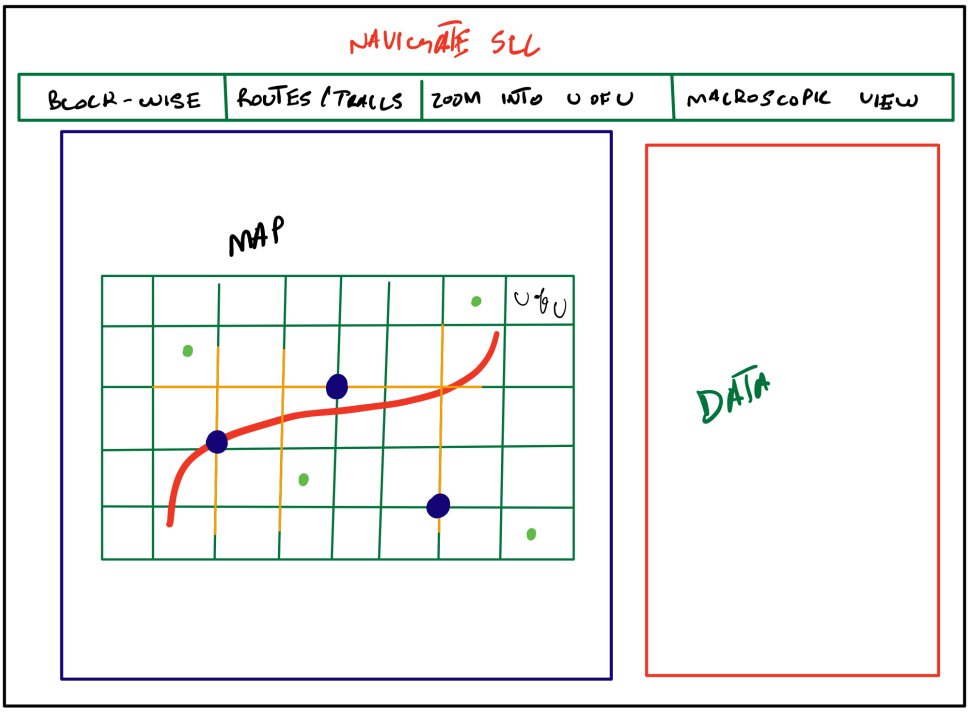
Oct 13 - Improve on the primitive model and make a version dealing with the addressed issues

Oct 20 - Collect feedback based on the improved model - and incorporate suggestions in the visualization

Oct 27 - Improve on the final model and make a version dealing with the addressed issues

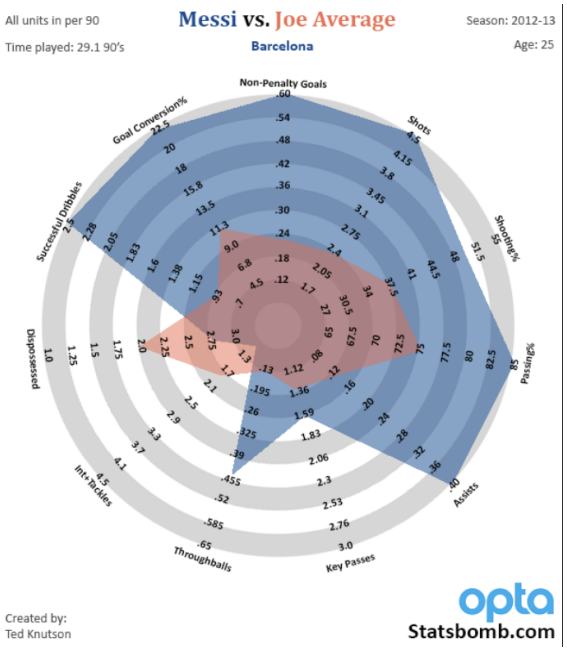
Nov 3 - If everything goes according to schedule, we can include our optional features in the remaining time.

Updated information:
We have decided to go ahead with this layout based on the TA's recommendation to display more visualizations:



We also have a few additional visualizations planned:

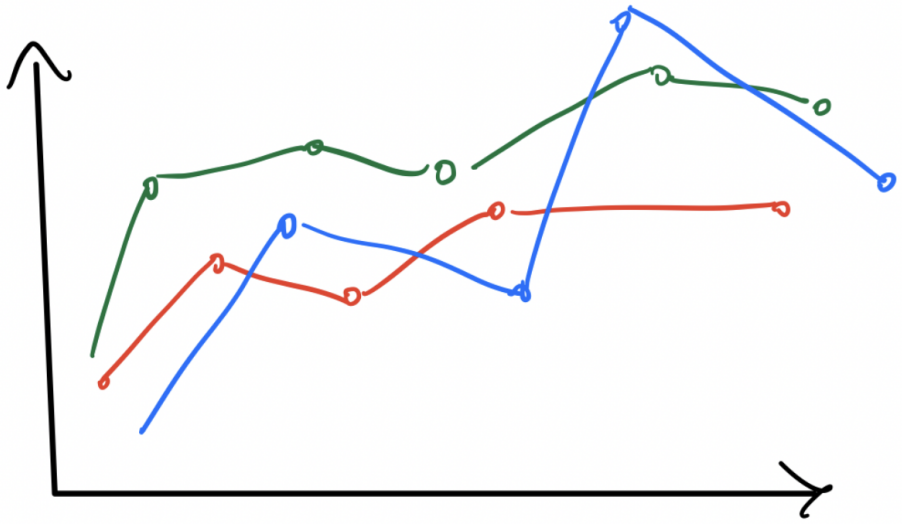
A radar chart to represent the block-wise data which contains multiple attributes:



The above graph is inspired by the game Fifa. Instead of the player stats on the edges of the circle, our visualization will have per-block attributes such as rent, population density, utilities, crime, altitude, and tourist attractions.

There will also be a list of all the bus routes in a block of the map. We also plan on adding a visualization overlay on the map that shows the route of the bus of the selected bus route (From the list).

In the macroscopic view, we have planned to add a line chart with information about the entire city as shown:

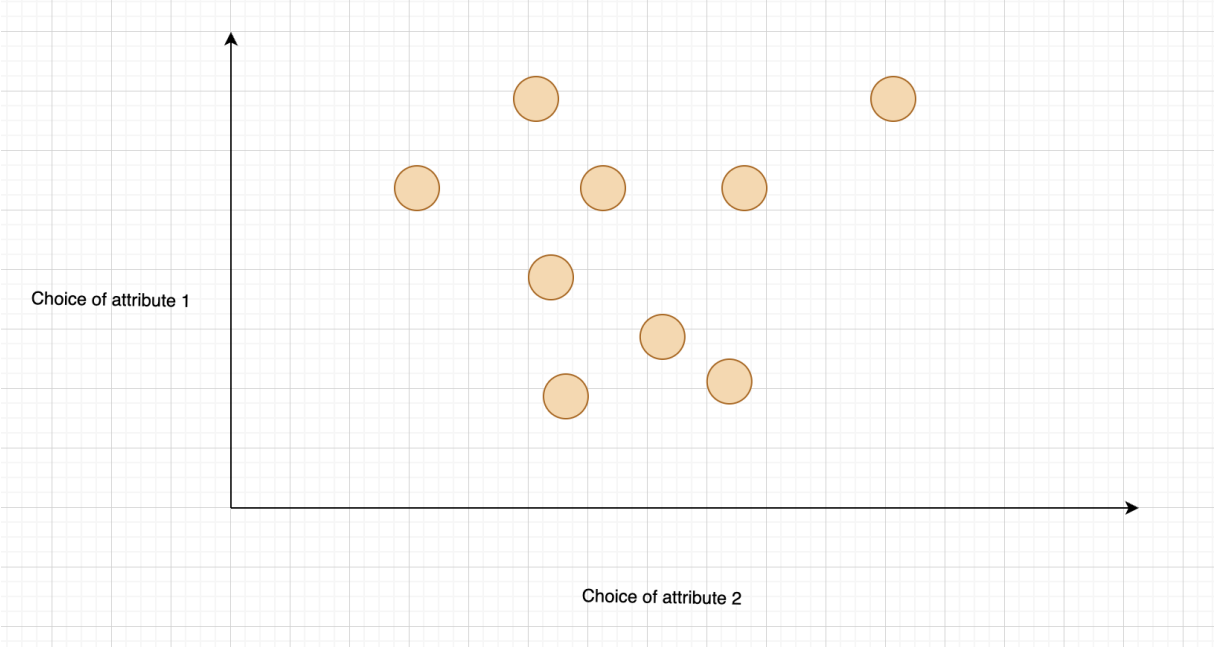


Here, the x-axis is the time in years, and the y-axis is the percentage increase/decrease of the particular feature.

The lines in the line chart represent the temperature, rent, population density, and other information that can be measured over a period of time.

Additionally, we will add a scatterplot of any two attributes out of rent, tourist attractions, population density, altitude, etc.

The points on the scatterplot will be the block numbers/names so that the students will be able to prioritize their preferences while looking for a place to live.



In this visualization, the users will be given a choice to change the attributes they want to plot and compare. The axes can be changed based on user preference, and the orange (color subject to change) dots are the block names/numbers.

UofU data:
Department specific data - number of students, number of programs offered, funding, number of faculties.

For this information, we plan to make a bar chart for each department. The different department attributes (mentioned above) will be color-coded on the scales so we can incorporate more data in one graph as shown below: