Assignment 2: Data Representation

Project Title: City full of Events

Team: Mohammad Shakirul Islam, Donovan Aikman, Nazanin Shamshiri

1. INTRODUCTION

Managing the resources of a city and building a plan for it is one of the tasks carried out by the municipality. Planning for a city involves how events are scheduled efficiently with respect to the existing venues. Event planners are responsible for best accommodating events which respond to the needs of residents for entertainment, recreation, shows, etc.

People, who wish to plan and hold events in designated venues owned by the city, are in need of consultation with event planners to see their options and plan accordingly. Event planners must go through pages of information about every venue to present those that are suitable for the type of the event intended to be held. A great amount of time is spent on communicating this information with the client. Depending on the potential date of the event, the information about venues keeps changing and many options can be explored by the event planner and the client. As the venues have inherent spatial information, it is often challenging to learn about their locality and accessibility based on verbal communication.

2. DESIGN RATIONALE

Our proposed design is an interactive 3D map of City of Victoria, BC that encodes geographical, time series and other types of data about the top 6 venues of the city.

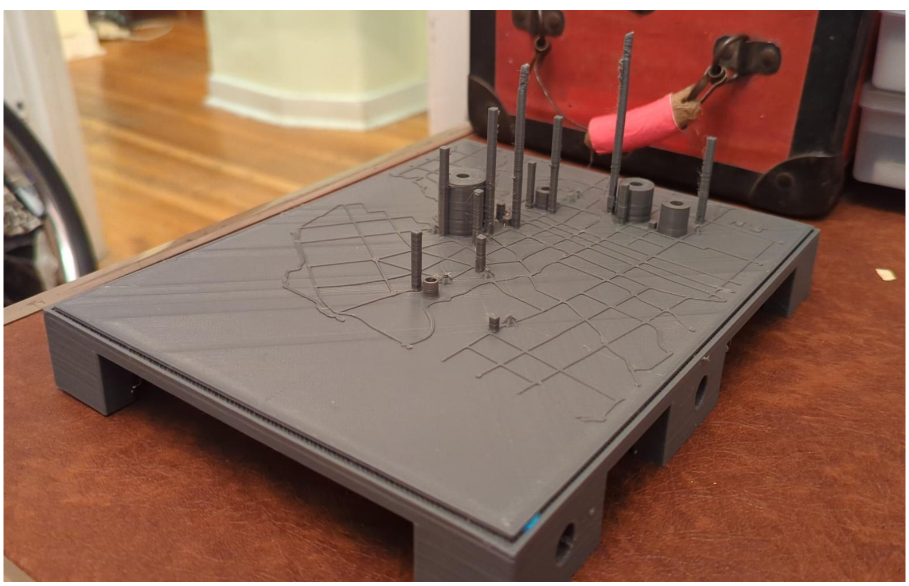

Fig 1: The map encodes the main street lines and the main purpose of it is to show the information about the top 6 venues of Victoria.

The data attributes about the venues and events are as follows:

Table 1.1: Data attributes, data types and their encodings

Data attribute	Data type	Encoding
Venue location	Positional	Relative location (with or without an underlying map)
Venue capacity	Numerical	Cylinder volume by the venue & Number shown on the screen
Venue cost	Numerical	Number shown on the screen
Traffic volume near the venue	Numerical	Bar height
Bus paths near the venue	Positional	Lines for routes
Bus routes types near the venue	Categorical	shapes for the type of routes determined by frequency or destination
Date of the events	Date	Date: MM/DD shown on the screen
Event Type	Categorical	LED colour
Event Location	Positional (to venue)	Relative location (with or without an underlying map)
Event name	Categorical	Name shown on the screen

Table 1.2: Data attributes and the interactions afforded by the model. Those interactions shown as (Fixed) correspond to the attributes encoded in the physicality of the 3D model. Therefore no interaction is needed to discover these attributes.

Data attribute	Interaction	Source
Venue location	(Fixed)	City Vibe magazine
Venue capacity	(Fixed) & Shown after the selection of the venue with the venue button on a specific date	Estimated & experience
Venue cost	Shown after the selection of the venue with the venue button on a specific date	Estimated & experience
Traffic volume near the venue	(Fixed)	City of Victoria Open Data
Bus paths near the venue	(Fixed)	BC Transit
Bus routes types near the venue	(Fixed)	BC Transit
Date of the events	Turning the time knob	City Vibe magazine
Event Type	Shown on the map after the selection of the date with the time knob	City Vibe magazine
Event Location	(Fixed)	City Vibe magazine
Event name	Shown after the selection of the venue with the venue button on a specific date	City Vibe magazine

There are some data attributes that are constant for every venue; meaning that they do not change over time. Therefore, we decided to encode some of these attributes in the physicality of our model. On the other hand, there are some data attributes that are dynamic; meaning that they change over time. These data are considered as time series data and are supported by the interactions afforded by our model.

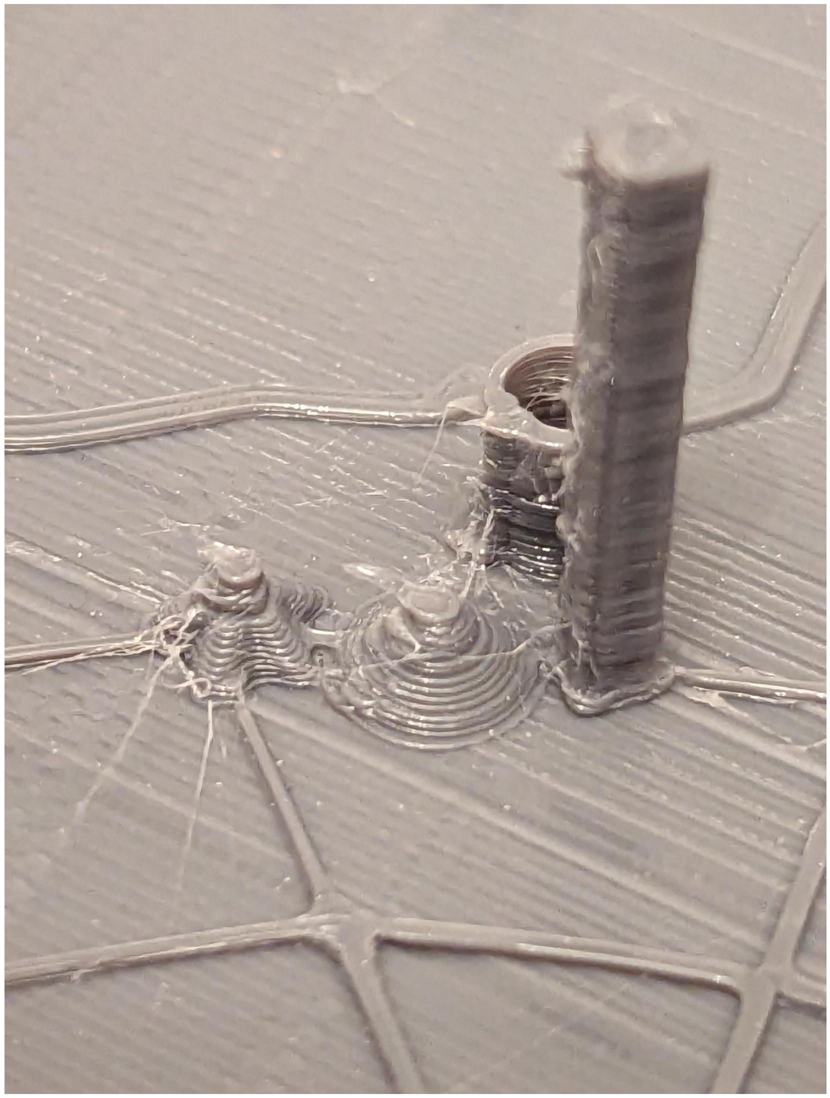

Fig 2: Physicalization of constant data attributes

Constant data are:
Venue location, Venue capacity, Venue cost, Average traffic volume, Bus routes/paths and the types of routes near the venue.

All the attributes above are encoded in the physicality of the model except for the Venue cost that is encoded on a digital screen, as it was added later to the design. The capacity of venues are shown on the screen as well as encoded by physical cylinders to provide more precision.

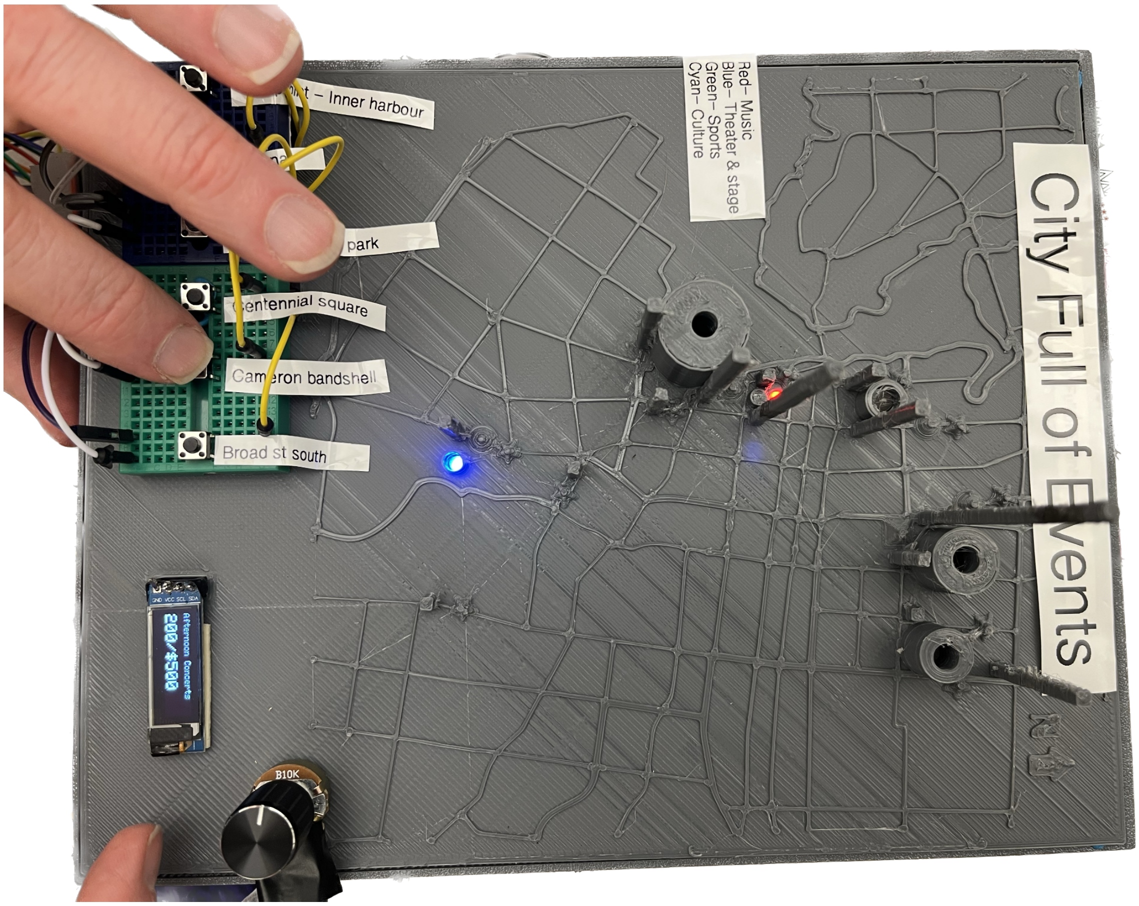

Fig 3: Dynamic data attributes supported by interactions

Dynamic data are:
Data of the event, Name of the event, Type of the event at a venue

Interaction 1:
One of the time series data, data that changes over time, is the date of events manipulated by a rotating knob. The user turns the knob and sees the date shown on a digital screen. If the knob is turned clockwise (between -45 to 45 degrees) , the date will go forward in time and if it is turned counter clockwise(between 135 to 225 degrees), the date will go backward in time. The more the knob is rotated in the respective direction, the faster time changes. When the knob is between 45 to 135 degrees, the time stops and fixates. Then the user will get to do interaction 2.

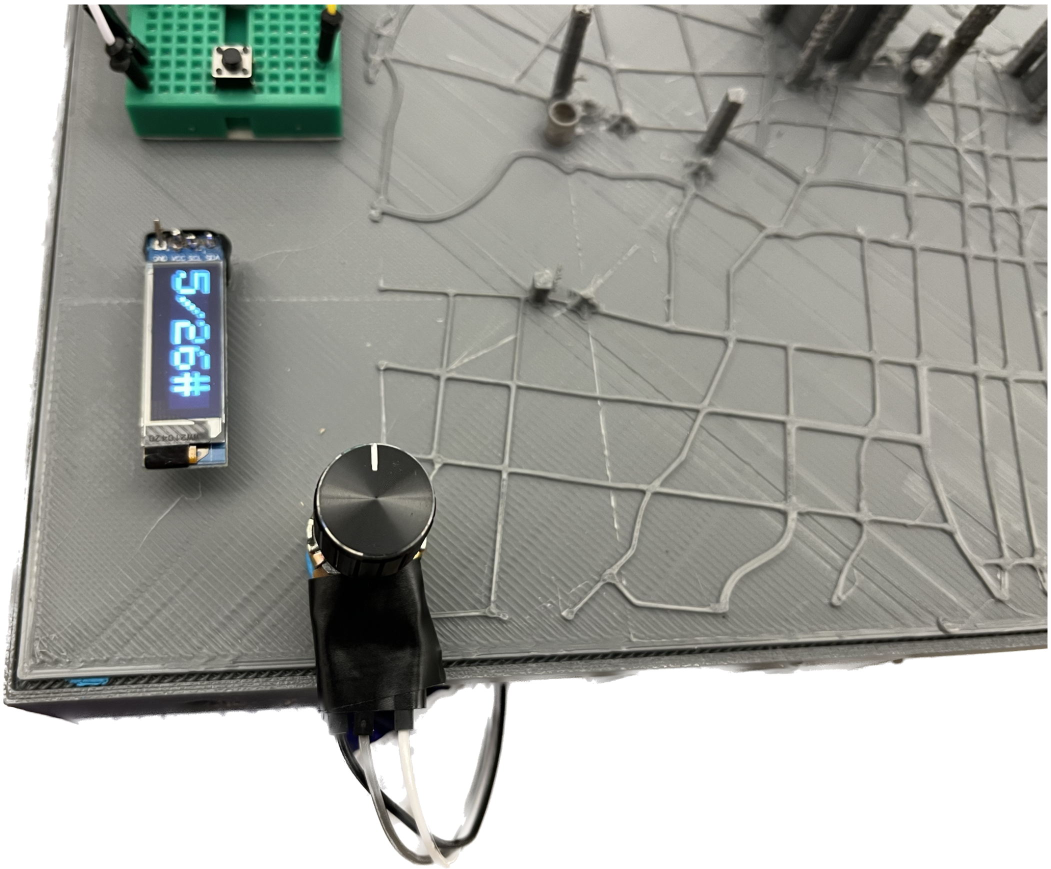

Fig 4: The date, MM/DD, is shown on a digital screen with a pound sign, meaning the date is fixed

Concurrently, going through different dates, the type of event held by each venue is shown on that venue by color. We used LED lamps to visualize colors.

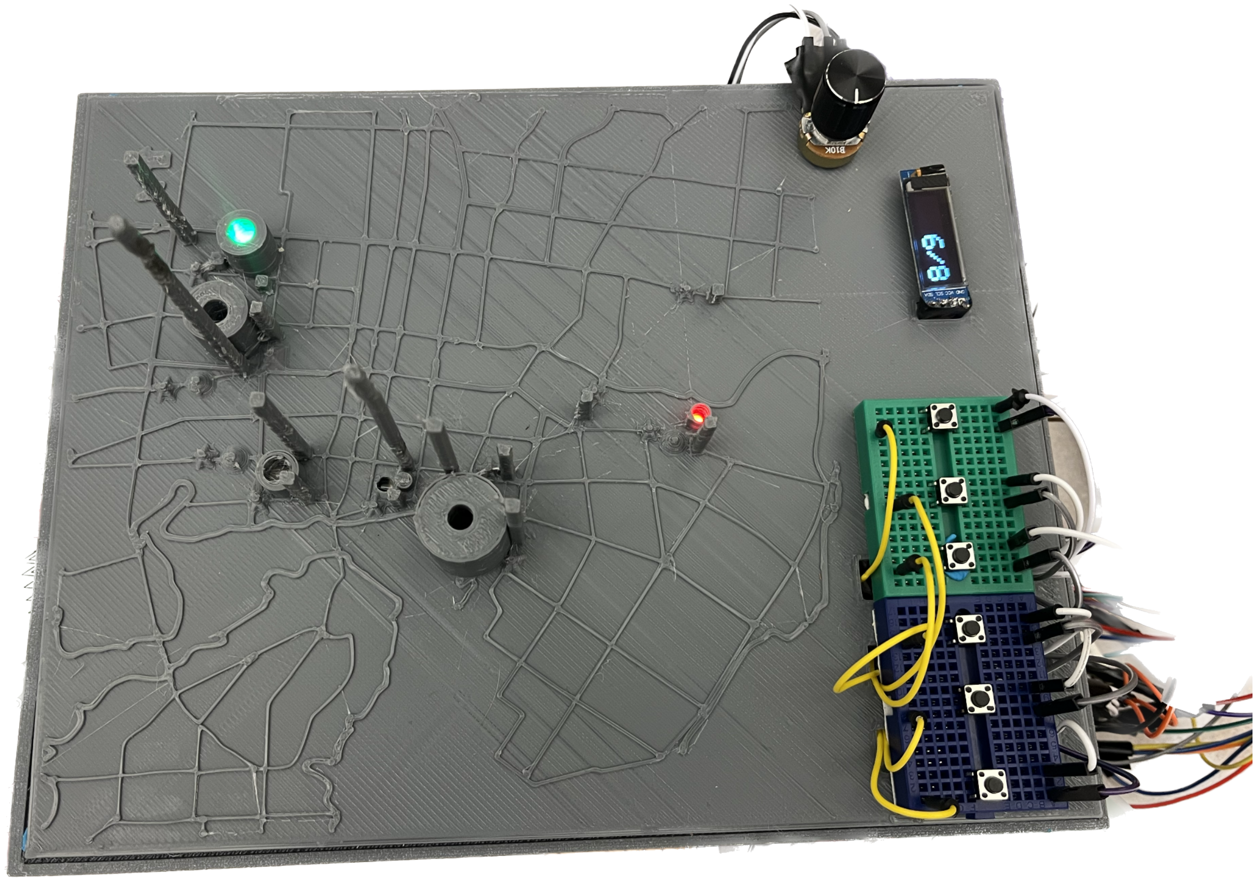

Fig 5: For every date shown on the screen, we can see the LED lights light up according to the color encodings. For example here only 2 venues hold events on 8/9 that are sports (green) and music (red)

Interaction 2:

If the user fixes the date by the instructions above, they can explore additional information on each venue. When the time is fixed, the user can push a button that corresponds to a venue to see the name of the event held by that venue on the selected date, the capacity of the venue and the cost of that venue. All the information is shown on the same digital screen. If there is no event on that specific date, it shows ‘no events today’ followed by the cost and the capacity of the venue.

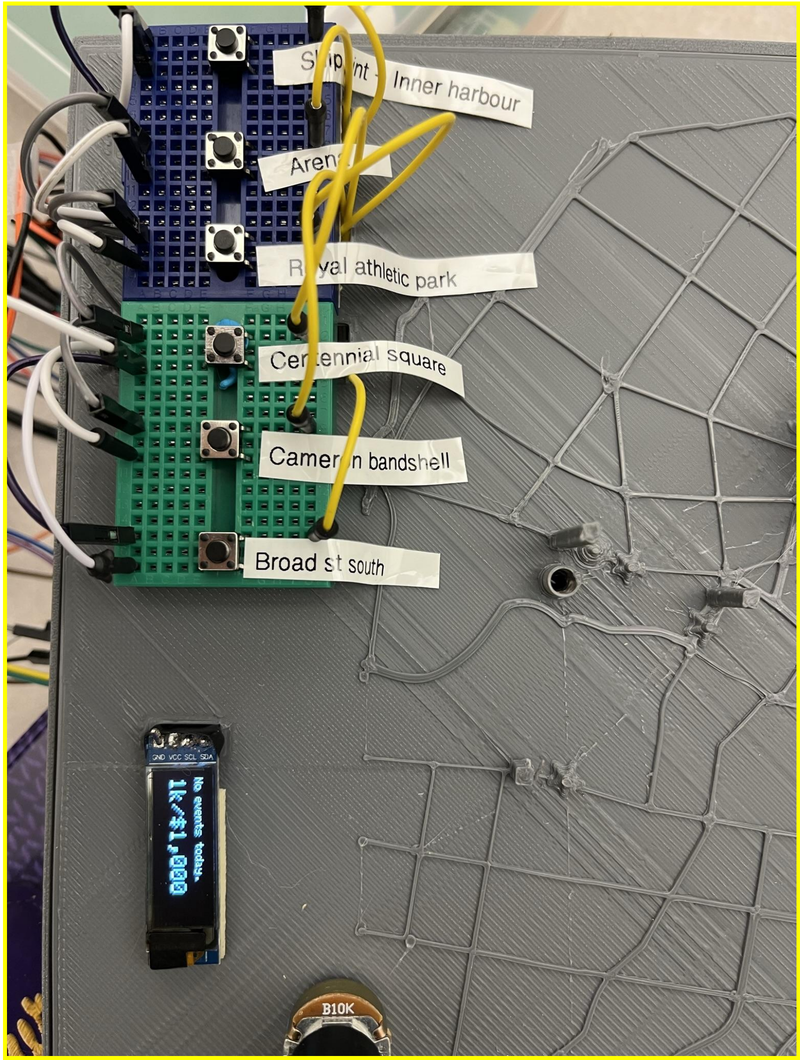

Fig 6: A button has been pushed here which results in the information on the screen about that venue.

3. THE USER

The user of this system is the event planner working for the city.

Creative Tasks:

1. The event planner can see the pattern of events across a season with this visualization to identify how some events are held in certain times of the year, or how some venues hold certain types of events. They will have a clear vision of the city information to analyze based on evidence. Seeing the patterns through sheets of paper with many numbers requires a lot more time and attention than seeing them through visualizations. This can lead to consideration while planning events. For

example, the event planner might conclude that a certain event is better to be held on some date because it is convenient for people attending another event to visit, or how it is better to plan two events separately because the traffic gets heavy around those events.

2. The event planner can share the information about available venues on certain dates while being consulted by a person interested in renting a venue. Traditional tools used by urban planners are meant for experts and they put a limit on diverse participation. A tool that creates opportunities for more collaboration across groups of individuals will welcome creativity[9]. For example, the data can be from the future, showing the booked venues and available ones in the next couple of months. Therefore, they can see all the options and details on the map while picking a venue. This will result in more fit choices.
3. The event planner can demonstrate how a festival season looks like, while presenting to other stakeholders. Stakeholders from different professional backgrounds come together to build a solid plan for cities. Urban planning requires professionals working together and sharing their knowledge in a collaborative setting. Communicating information and making communal decisions for cities based on multiple factors is a challenging task. This may result in new insights about the venues and the area around it. For example, they might see that a venue is worth investing in as it will benefit from more music gear, or how the events affect traffic congestion and what measures should be taken by the city or the police to address this problem.

In the four C models of creativity, this user lies under the Little-C model as they discover new patterns in data and are able to share that information with other professionals, making room for new feedback and discussions. The discussions may bring new insights for the event planner or other stakeholders of the city, resulting in new approaches while planning for the city.

4. SYSTEM IN DETAIL

4.1. DATA

Data for this project came primarily from a variety of sources. Physical markers of BC Transit for bus routes[1] and City of Victoria Open Data were used for car traffic nearest the venues[2]. Details such as venue capacity and cost came from Donovan's own familiarity with working with the city on those venues. Event data was pulled from venue listings [3][4][5] and the official City Vibe guide [6].

We also have a spreadsheet[15] of our final dataset as well as the notes around our encodings and a listing of events that we needed to remove due to project scope limitations.

4.2. 3D MODEL

The idea of representing different data in one model was overwhelming at the beginning. Therefore we started with brainstorming and this is a draft planning on encoding the data in different venues and their associated streets and daily traffic data.

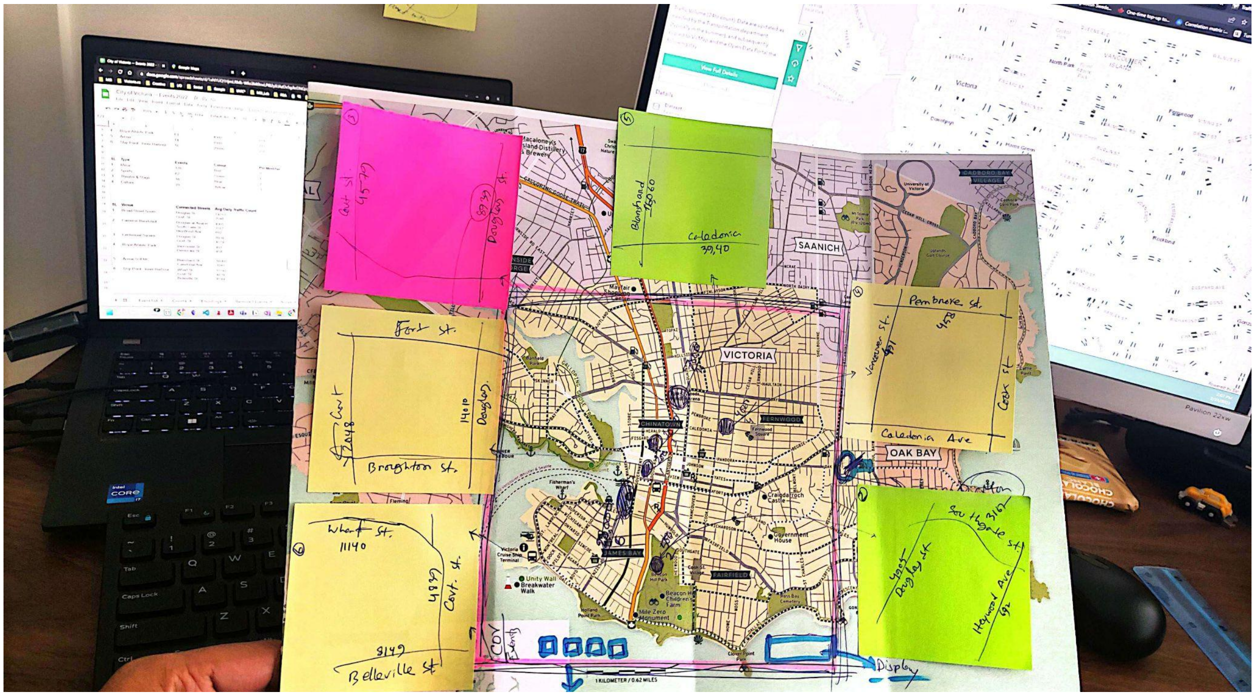

Fig 7 : Initial ideation of the CoV map

This 3D model was created using TinkerCAD and was initially based on the City of Victoria's "City Boundaries map." However, the final version was created based on the "Neighborhood Boundaries" map from the City of Victoria's website, which was created in June 2009 [7]. The model includes six different venues where different types of events are organized throughout the year. These venues are represented by cylinder shapes.

In addition to the venues, the model includes daily average traffic data around the venues [2]. This data is encoded in box shapes in the Z axis, and was collected from the "City of Victoria Open Data Portal." It is important to note that only traffic locations associated with the venues were considered for this part of the model.

The model also includes encoded traffic routes [1], which are represented in different shapes based on their average traffic frequency. Regional routes are encoded as cone shapes, frequent routes are pyramid shapes, and local routes are represented as star shapes. The data for these routes was collected from the "BC Transit website Schedules and Maps."

In the front view we can clearly see a different view of the actual model. All the red bars represent the daily average traffic data around the routes of the venues. The orange colour cylinders are the different venues and size are different because of their actual capacity.

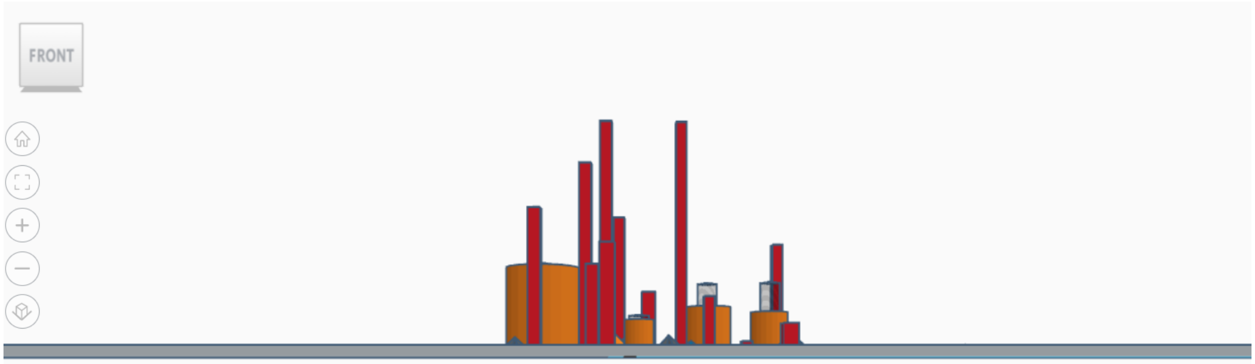

Fig 8 :Front view of the model

In top view we can clearly see different traffic routes in star, cone and cylinder shape.

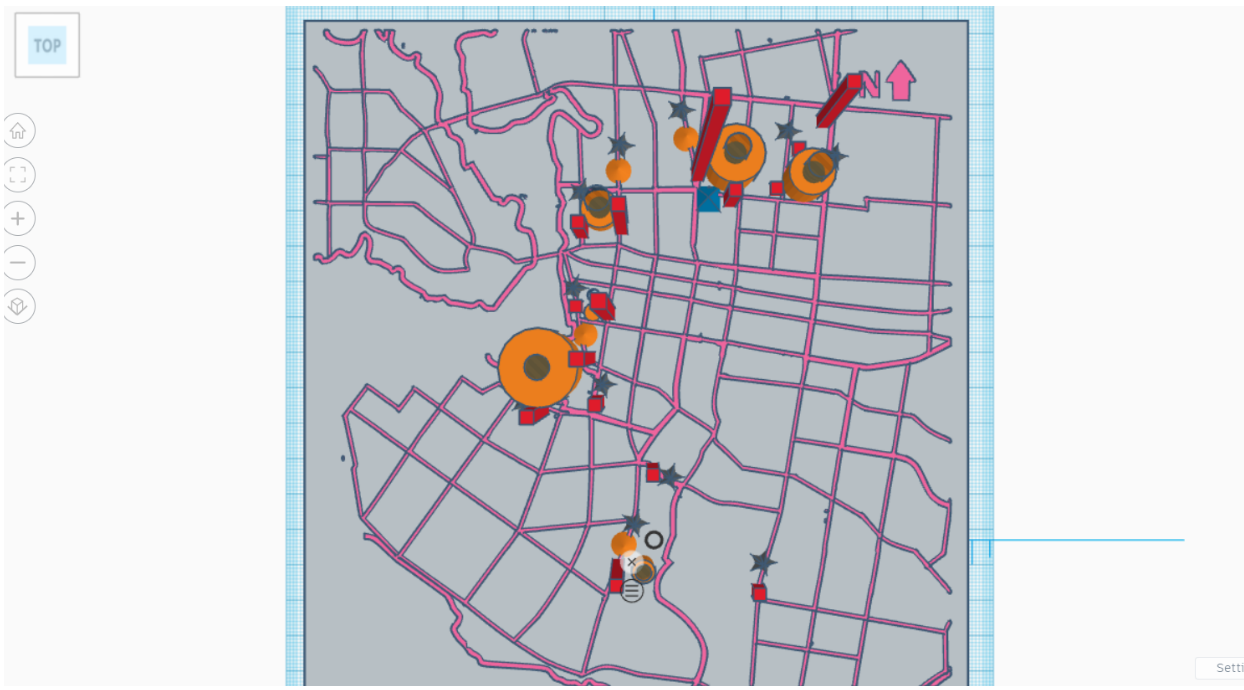

Fig 9 :Top view of the model

In home view all the physical data are visible.

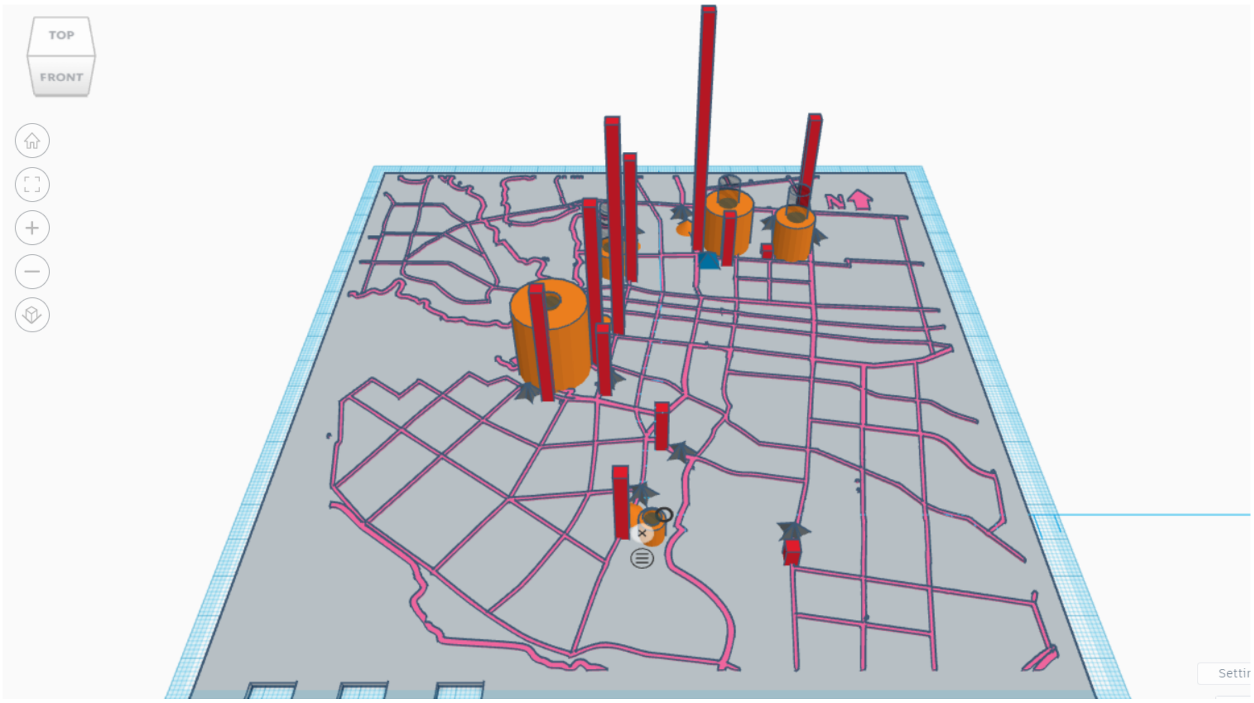

Fig 10 :Home view of the model

The 3D model was printed using a Creality Ender 5+ 3D printer, bringing the digital model to life in physical form. Overall, this 3D model provides a unique and interactive way to visualize and explore the city of Victoria, including its venues and transportation infrastructure [17].

4.3. ELECTRONICS

Assembly is fairly straightforward but time consuming for the number of things that need to be wired in. You will need the following components:

Quantity	Component
1	Arduino Mega2560
1	I2C SSD1306 128x32 display
6	Pushbutton
1	10 kΩ Potentiometer
6	10 kΩ Resistor
7	LED RGB
Lots	Connecting wires
	Tape and glue to attach to city map

Wire each portion to the Arduino main board as follows in the figures below. Breadboard is pictured for schematic purposes only though.

These will need to be attached to the 3d printed city as pictured in Figure 5. We are going to assume that the assembler is familiar with the location of venues in the City of Victoria. The RGB bulbs will go under the city board and shine up through the holes for each venue. All buttons and venue lights are from left to right in descending order of venue size as follows:

Left	Ship Point - Inner Harbour
	SOMC Arena
	Royal Athletic Park
	Centennial Square
	Cameron Bandshell in Beacon Hill Park
Right	Broad Street South.

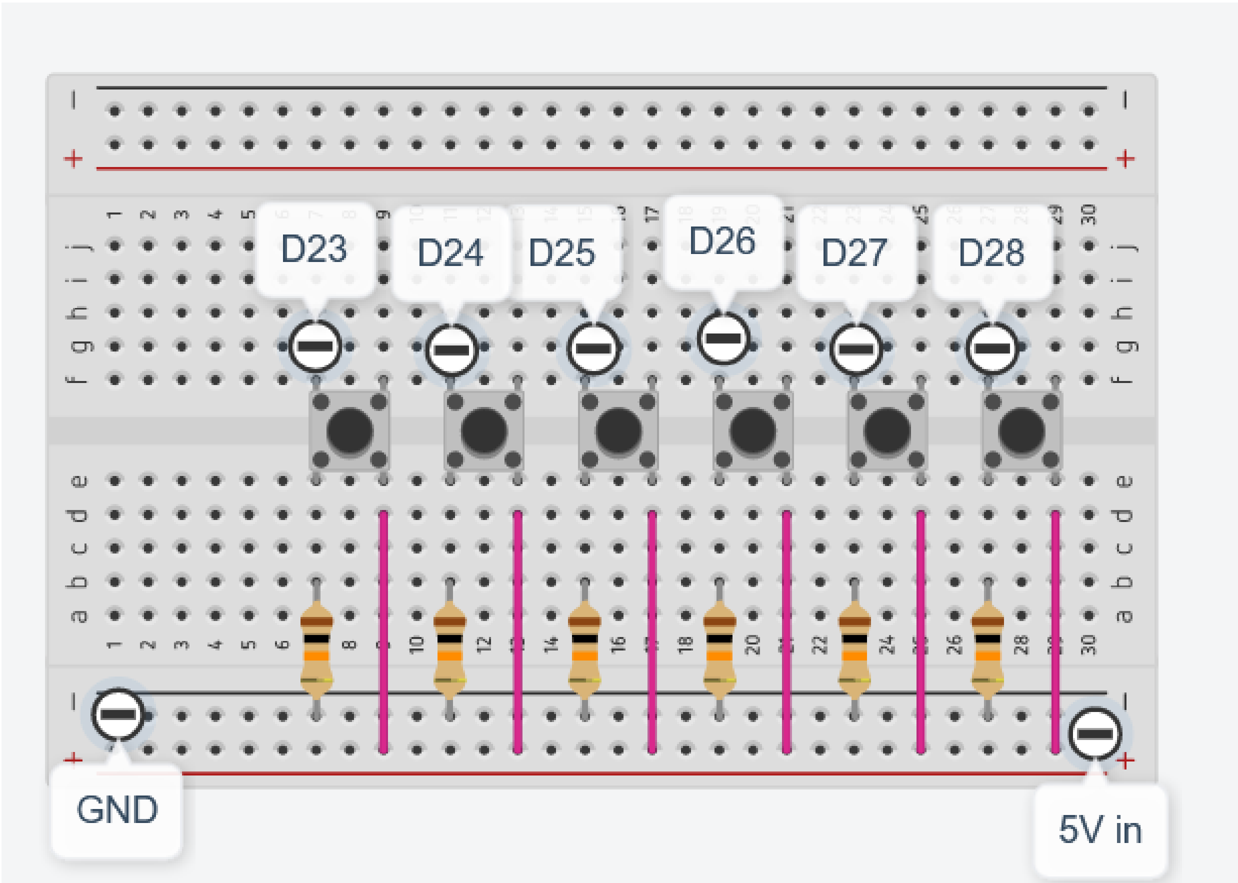

Fig 11: Pushbuttons wiring

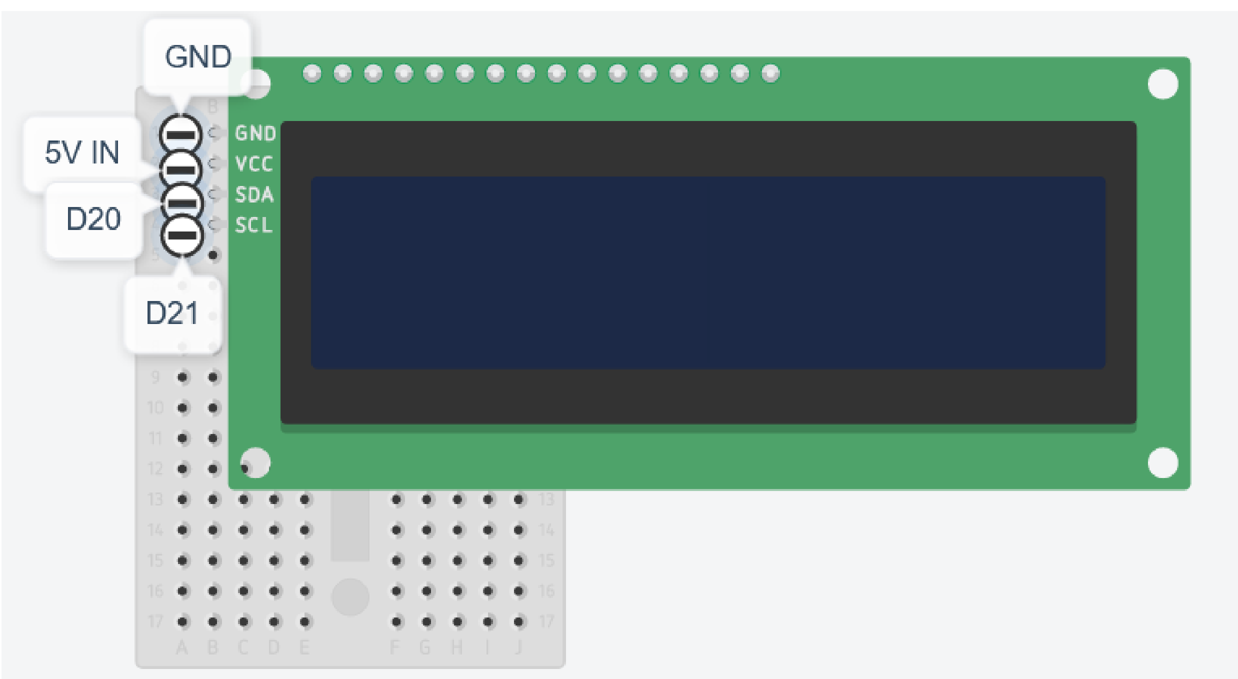

Fig 12 : I2C Display wiring

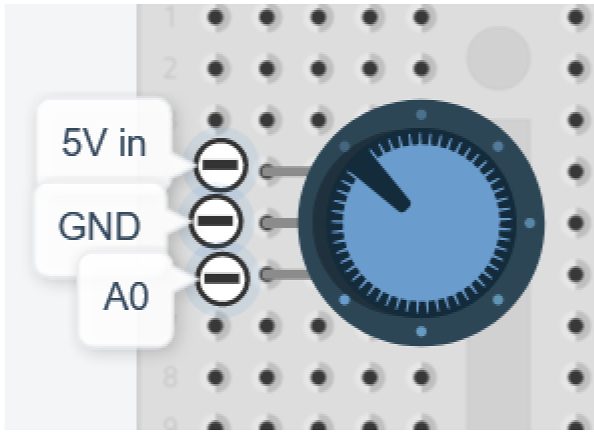

Fig 13: Potentiometer wiring

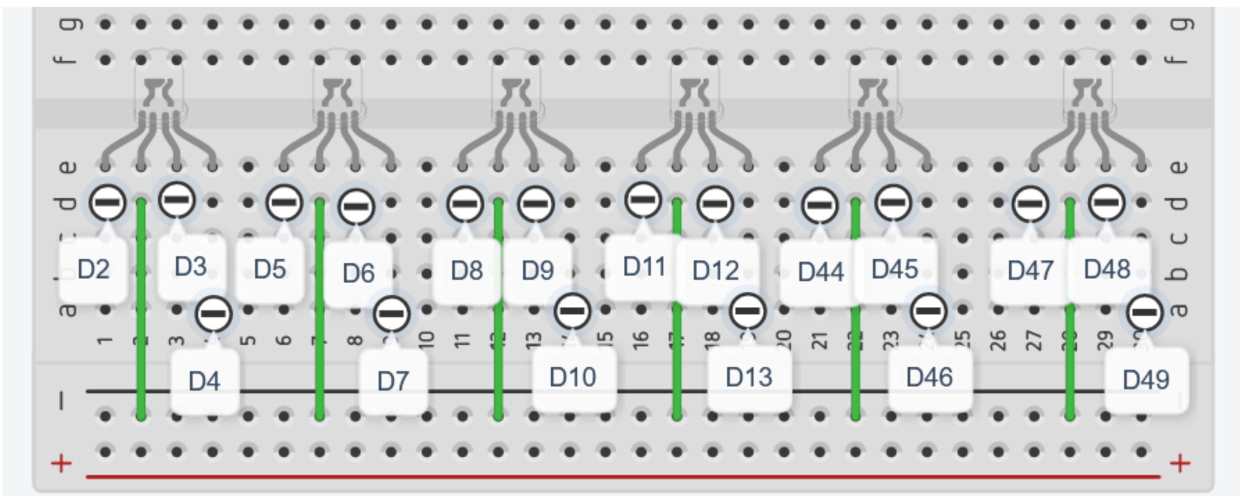

Fig 14: RGB lights wiring

Once you have assembled all the wires and attached them to the city layout, the code can be uploaded from the github source[8]: **https://github.com/mdaikman/ACityFullofEvents/**

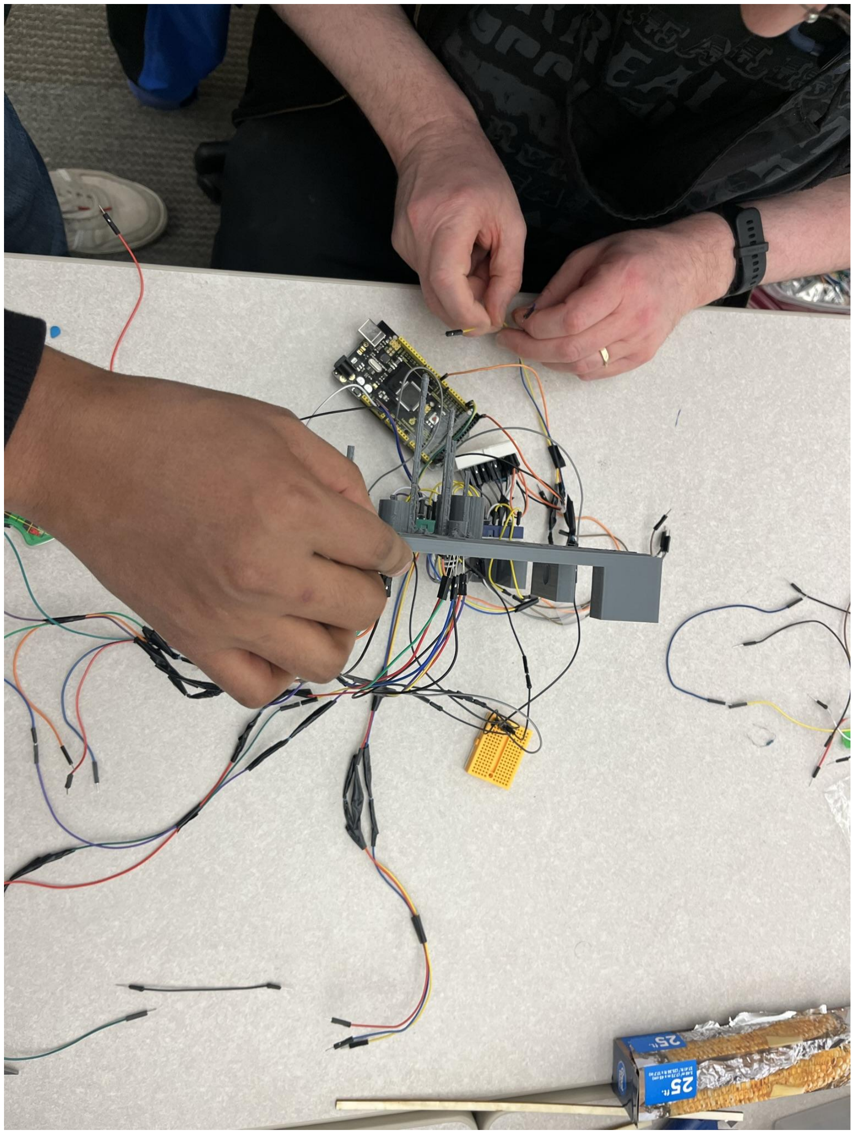

Fig 14: Connecting the wires

5. STRENGTHS

There is some reasoning behind choices we made for our proposed design:

- A map that offers interactivity enables people to grasp all the information about venues with much less effort and confusion. Using maps as learning, exploration, and analysis tools is a common approach in city planning [9].
- The design offers a tangible user interface that allows users to manually manipulate time and see time series data on the map with the help of physical controls and electronics. TUIs support pragmatic and epistemic action [11]. enabling users to understand more precisely and therefore make decisions more wisely.
- We used 3D printing, a simple arduino kit and stationary materials to build the design. Encoding locations within everyday objects lying around brings new insights and, therefore, aids the process of solving problems [12].
- The physicality of this design provides a simple and familiar access to the map which brings the feeling of intuitive directness and it welcomes collaboration[13][14]. Physicalizations may help individuals in engaging with and communicating information to each other more effectively than with digital representations.[10]. In our design, the physical form is exploited; for example the tangible street lines add to the understandability of it. It also uses the third dimension in order to encode more data in a compact space. Offline interactions such as pointing, change of views, turning and pushing are supported as a result of physicalization.

6. LIMITATIONS

There have been some technical limitations while implementing the project:

- The number of available pins on the board limited us to 6 venues, therefore we removed a subset of our data. This can be seen in the spreadsheet.[15]
- In case there were more than one event in a day, we mainly focused on one event when showing them with LED lights. The alternate event may be discoverable by a brief flash of light at the beginning.
- Print size is limited to about 186mm x186mm, but we extended it a bit more. The size of the print is a bit small and buttons are cramped as the size of the 3D printer and the time of printing were limited.
- There is no adjustable input data. For this model, we use a single hardcoded data set since it is only a prototype.
- The loading of the data is done by a function in the Arduino code that could be replaced to read from another source in the future (physical medium, web page, photo, what-have-you, etc)
- While mapping the capacity to the volume of the cylinders, because the size of our map prevented us from having large cylinders, we could not agree on a constant ratio.

- While mapping the traffic volume to the height of bar charts, we divided the data points by 100 to scale them. Because 3D bars are weak when it comes to bigger sizes, we had to divide some data points that were relatively big by 2 again.

7. REFERENCES

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[2] Daily average traffic, Victoria Opendata portal, https://opendata.victoria.ca/datasets/traffic-volume/explore?location=48.422272%2C-123.365068%2C14.59

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[4] HarbourCats, https://harbourcats.com/harbourcats-announce-2022-west-coast-league-schedule/

[5] Royal Athletic Park, https://www.victoria.ca/EN/main/residents/facilities/royal-athletic-park.html

[6] City vibe guide 2022: https://www.victoria.ca/EN/main/residents/culture/investment-grants/cityvibe.html

[7] City of Victoria Map (Neighborhood Boundaries) v2 CAD Model, https://www.victoria.ca/assets/Departments/Planning~Development/Maps/Neighborhood%20Boundaries.pdf

[8] Github code: **https://github.com/mdaikman/ACityFullofEvents/**

[9] Maquil, V., Leopold, U., De Sousa, L.M. et al. Towards a framework for geospatial tangible user interfaces in collaborative urban planning. J Geogr Syst 20, 185–206 (2018).

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[16] Project website, https://onlineacademiccommunity.uvic.ca/shakirulcsc586b/cst-ass-2/

[17] URL of the mode, https://www.tinkercad.com/things/1LzlhrVPN8S-copy-of-cityofv-v2/edit?sharecode=w3EjELszPU-xhghpf3WfbmmoCh4ppXIP41NP6VUhIZo