

Process Book

Project Metadata

Project Title: F1Delta

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Project Repository: <https://github.com/Srinanda-Yallapragada/F1Delta>

Background and Motivation:

My main motivation to chose Formula 1 as a topic is simple. I am a fan! In recent years, F1 has witnessed a huge surge in popularity, particularly in the United States. The 2024-2025 season has already delivered some of the most shocking and historic moves in F1 history. The biggest among them is Lewis Hamilton's unexpected switch to Ferrari. This move seemed almost unimaginable given his world championships and legacy with Mercedes. Beyond Hamilton's transfer, the driver market has been extremely dynamic, with Esteban Ocon moving to Haas, Carlos Sainz heading to Williams, and Nico Hülkenberg moving to Sauber. While several new drivers are entering the grid, I aim to focus specifically on these driver shifts and the changes in their driving styles across the different cars.

Another reason for choosing this project is the immense amount of data available in F1. Being a highly technical sport, every aspect of performance (lap times, tire degradation, car telemetry data, throttle and break metrics, engine RPM and more) can be analyzed in depth. A lot of this data requires knowledge from different aspects of the sport, which may overwhelm new fans. I want to explore ways to visualize these technical aspects in a way that makes them more accessible to newer fans and helps them understand the technical aspects of the sport better.

Project Objectives:

Here are a few questions I want to explore

How do their results compare to their previous team's results? Are they finishing higher or lower than their old team's drivers? Is the move helping their career, or would they have been better off staying? Fans are always curious to know if a team switch was the right move or not, and this would answer that question.

How consistent are their race lap times? Answering this question could indicate how comfortable the drivers are in their new machinery.

How does switching teams impact a driver's racing style? Do drivers like Hamilton, Ocon, Sainz, and Hülkenberg change their braking points, racing lines, or cornering speeds when adapting to a new car? The answer to this question could indicate to us how much the driver has to adapt due to their team switch.

How have their qualifying push lap performances changed? Are their best qualifying lap times improving or worsening? Have their driving lines or braking points in qualifying changed with a new car? The answer to this question would indicate any strategy changes of the driver during qualification for the race.

An important thing to note about this comparison is that when the project is due, only 6 races of the new season will have taken place. This is necessary context to consider the visualized data. We also know that the drivers are likely to improve over time as they become more familiar with their new team and race engineers. However, that shouldn't stop us from asking interesting questions. These

drivers are paid millions of dollars to earn every point possible, and points scored early in the season are just as valuable as those scored later on, making this exploration worthwhile!

Another caveat to consider is Carlos Sainz's move from Ferrari, where he was racing near the front of the grid, to Williams, a team that typically finishes towards the back. His performance differences will likely be heavily influenced by the car's capabilities (or so I believe), which will make it particularly interesting to investigate.

Data:

I plan to use <https://openf1.org/>. OpenF1 is a free and open-source API that provides real-time and historical Formula 1 data. The entire website would fully be reliant on this data source and so I would have no local collection of any data. This source does update its dataset with about a 3 second delay from when an event happens on track, which may allow me to have a realtime visualization component, however this would be a reach goal of the project.

I will also occasionally reference <https://www.statsf1.com/en/statistiques/pilote.aspx> for static data.

Formula 1 cars get faster every single year. This means that there is a chance that the data I am analyzing simply favors the most recent car in all cases. In this case I will have to pivot my strategy of analysis. I would instead compare the current driver with the driver who filled their seat as a form of comparison.

Data Processing:

I do not expect significant data clean up as the OpenF1 documentation is quite clear on what type of data is being returned and in what format it is available. I will also be able to filter what data I pull from the API based on time which will make it easier to pull relevant data based on lap times.

I will need to do some calculations to derive new quantities of data such as minimum speed in a corner but these should not take too long and will be calculated realtime using the latest API data available.

Visualization Design:

Since the audience of this project is the general audience, my homepage includes overall statistics of the driver. These are generally very easy to understand with no background and consist of simple ideas like podium finishes and total number of fastest laps etc. The home page also has a list of all the races that have taken place. These are represented as "thumbnails" so that the user can pick each race that they want to investigate themselves. Since each race is unique, it is not possible to aggregate improvements across multiple races due to the differences in location and track layout.

On the left of the thumbnails, I will have the race results from 2024. On the right, I will have the results of 2025. If the race has not taken place yet, I will grey the results out.

On page two, I elected to pick an overall track view which labels all the existing corners. It also shades the part of the track where the previous and current teams are faster on the track. This gives a clear visual indication on which year's car was faster in what parts of the track. the page itself will have a separation down the middle indicating the left of the page is 2024 and the right is 2025. I will present some statistics in the form of bars which will quickly convey which statistic was better. The better statistic will be highlighted in the years particular shading, likely in the color of the team.

On a click of any particular turn, the website will take you to page three where we can see more detailed statistics. This allows users to see deeper statistics per turn. Here the user can see a lap by lap breakdown of each turns breaking points and other telemetry data like minimum speed and the line taken through the corner. A line on top of a section of the turn is the most intuitive way to

convey the path taken by a driver across the turn. The line data is not shown on page 2 because I believe it would clutter the visualization too much.

Must-Have Features:

List the features without which you would consider your project to have failed.

- Must have the quick stats page on page 1.
- Must have the track overview with completion statistics on page 1.
- Must have the faster sector visualization on page 2.
- Must have the bar graph visualization of race stats on page 2.

Optional Features:

- The turn statistics while nice to investigate are not needed to gain insight into how the driver is fitting into his new team.
- The line the driver takes is important to see a change in the driving style, but may prove to be a technical challenge to finish before the semester ends. I may have to visualize the entire line taken across a lap instead of breaking it into a corner by corner basis. This would lose the breakpoint data and the throttle gradient information.

Project Schedule:

remaining weeks 8

- week 1: Page 1 quick stats
- week 2: Track thumbnails + stats
- week 3: Track overview + faster sector highlighting.
- week 4: Race statistics + manual introduction of context like safety cars
- week 5: Turn statistics graphs
- week 6: Turn statistics lines
- week 7: Turn statistics lines
- week 8: Overall polish.

①

F1 DELTA

Data points

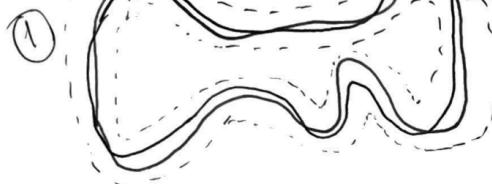
- Break pressed
- DRS pedaled on
- Car gear
- Speed
- Throttle
- Track data
- Car location on track
- Svg of track
- Weather

- Driver details
- Images
- Team name
- Team color

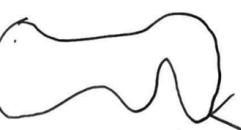
- Time to leader
- Fastest lap
- Quali lap time
- Lap times rate
- Sector times

Timing
data

Fastest Lap line comparison

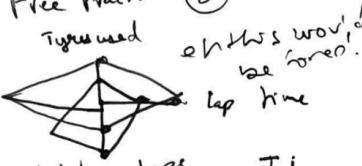


↳ Approx shape of track.
corner by corner



turnb zoom in & show
narrow line difference.
comparison hand but g like it.

Free Practice (5)



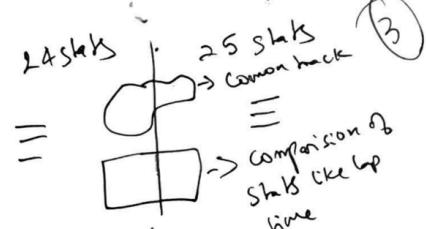
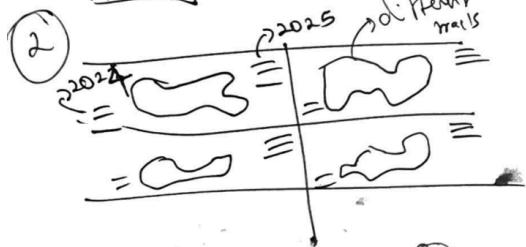
total num laps



Home Page



Quick stats
Podiums:
Wins:
Race Starts:
etc etc.



1 page per track.
+ Notable Events.

Filter:

g like ideals ② ③ ⑥ ④.

g would not do ⑤ as it is too
confusing. The scales would not make
sense.

Categorize:

- ① can be the overview of the track while
- ⑥ happens when you click on a corner.
- Each page would need contextualizing information.

Combine & Refine:

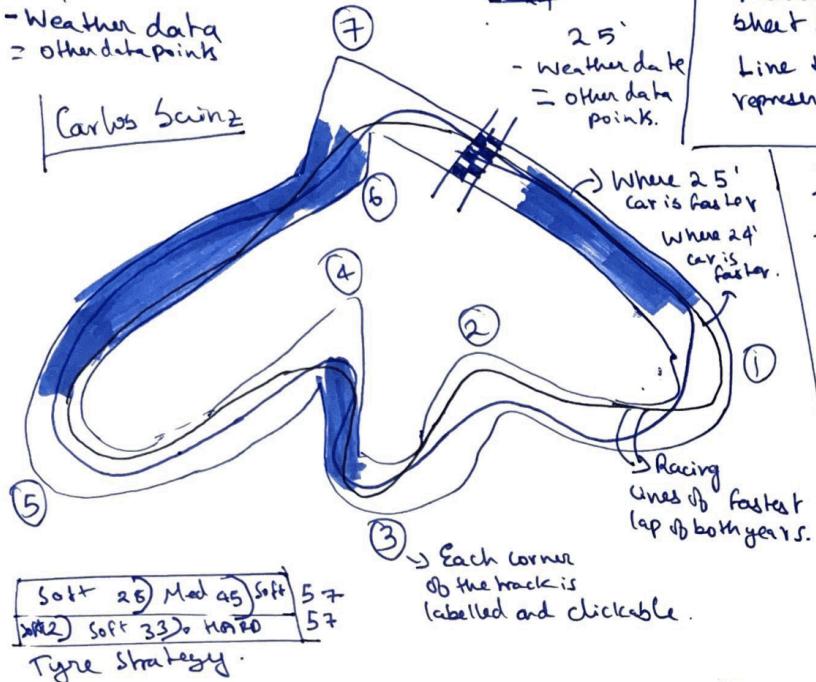
- ② can be the overview with multiple displays & interactive. When you click on a map, it brings up ① with
- ③ below it contextualizing the info.

② MELBOURNE 24 vs 25

D qual 1 D lap 3

- Weather data
= other data points

Carlos Sainz



Srinanda Kishore Yallapragada

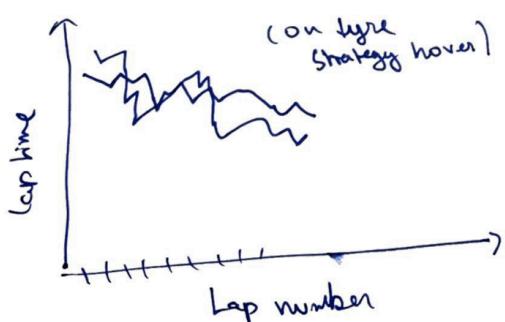
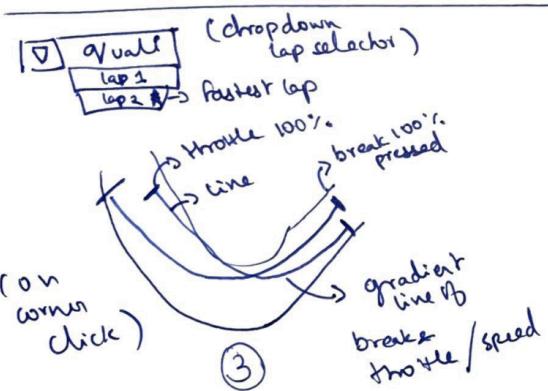
March 12, 2025

Sheet 2, F1 Delta

Line that driver takes
representation on the track

Operations

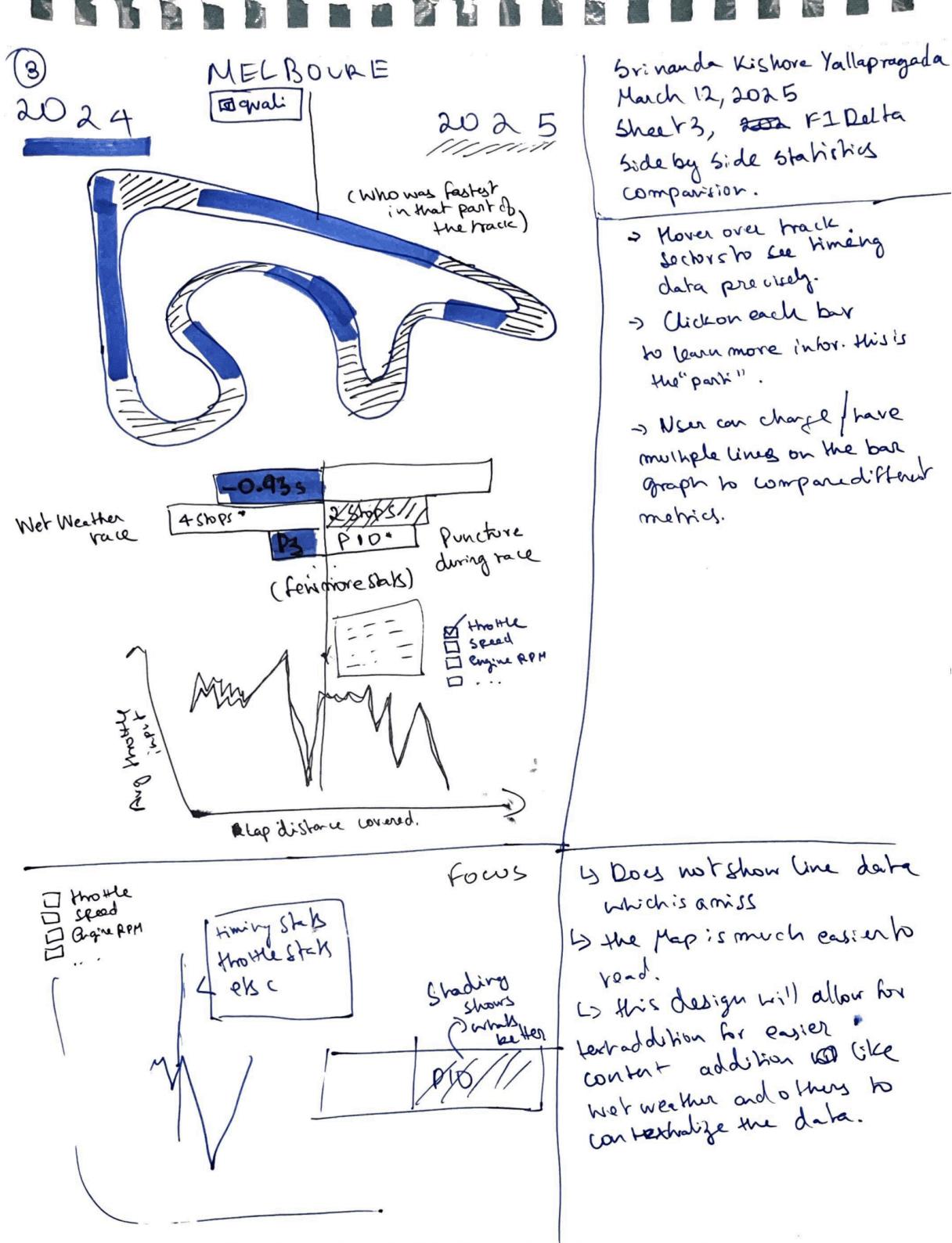
- Change the driver
- Select a corner to bring up breaking data & increase the size of the corner to focus on it.
- Can click on tyre strategy to see data on tyre stint as a graph.
- Select qual or lap number of race



Rows

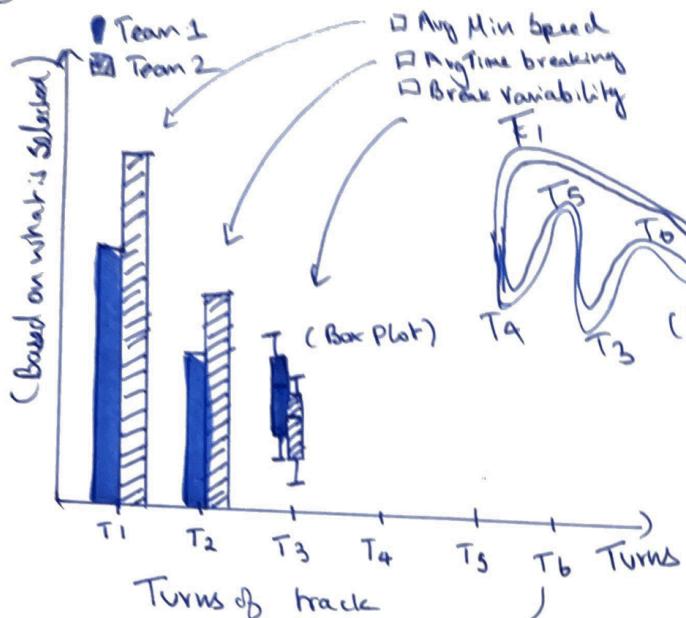
Discussion

- Tyre strategy may just be better as a graph
- What are the relevant stats
 - ↳ Safety cars, red flags
 - ↳ Weather, wind
- Is gradient enough to show throttle inputs?
- When in a corner?
 - ↳ I don't think so because from 0% to 100% throttle is a wide margin.
- Would an aggregate lap line make sense?
 - ↳ Yes Avg the line because of overtaking skewing the data.

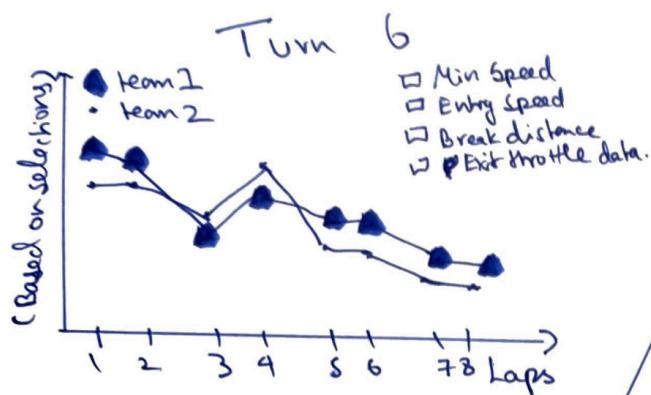


④

MELBOURNE RACE



(Select a particular turn)



Srinanda Kishore Yallapragada
March 13, 2025
Sheet 4, P1 Delta
Track turn based visualization
of driving style.

- Can interact with the multiple boxes to select what data to show on the Y axis. This would be aggregated across the full race
- Select a particular turn to bring up a lap by lap description of the available data. Similar to the other graphs, we can pick what's on the y axis.

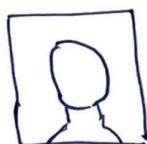
Operations ↗

Discussion

- Very mathematical as a visualization of data.
 - ↳ Can be a live highlight across the track?
- User load is high due to selecting many interface elements
- GT is effective as a quantitative analysis. But the goal is for new comers to the sport.
 - ↳ might use some elements in the final design.



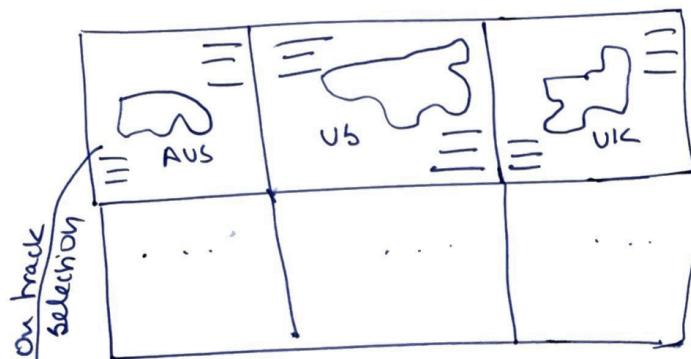
⑤ Page 1 (Home Page)



Quick Stats

- Podiums - Race stats
- Wins - Current team
- Poles - Previous team

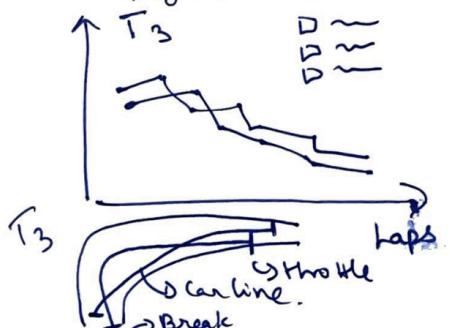
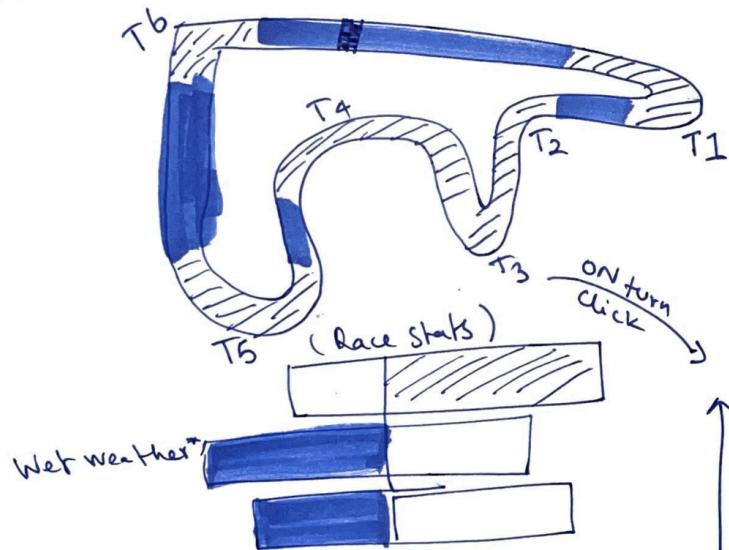
List of tracks Overview



Page 2 (Race Overview Comparison)

2024

2025
|||||



Page 3 (Turn Statistics)

- Details
- Requires data manipulation to calculate certain statistics
 - Data needs manual inspection for red flags
 - Manually add context for race on Page 2
 - Sector calculations need to learn
 - Quick stats should update with API.
 - Races line calc is hard
 - determining if a turn is hard -

Srinanda Kishore Yallapragada
Sheet 5, March 13 2025

F1 Delta

Task: Selection of Visualizations and computing ideas

Operations

- Select track to view
- Select driver to view
- Select turn of track
- Select turn data
- Hover on track, bar & line graphs for numerical data
- Interaction with check boxes

Project Milestone additional information

The structure of the website has been established with this milestone. Since a lot of the data is static, I have decided not to use any backend services and have the front-end directly communicate with the api's themselves. This makes it easier for development, and running the server simply is a python command with the public folder so deploying this will also not be difficult. I will likely be using github pages itself to deploy this website.

I underestimated the amount of data processing I would need to do for this project. Unfortunately, I am finding it difficult to find an api that directly gives f1 statistics of race results. Aggregated statistics are not available and thus need to be calculated on my own. I have already sourced some of these statistics like number of wins, poles and podiums, but this will need additional manual code to gain all the statistics I would want to display in this project. I downloaded some of the results data directly as a json rather than trying to use the api so that I could directly pull out the race results data that I need. This data has come from <https://github.com/jolpica/jolpica-f1> which is another service that provides f1 data. However, no free service has a direct statistics for each driver, they all mainly have the results.

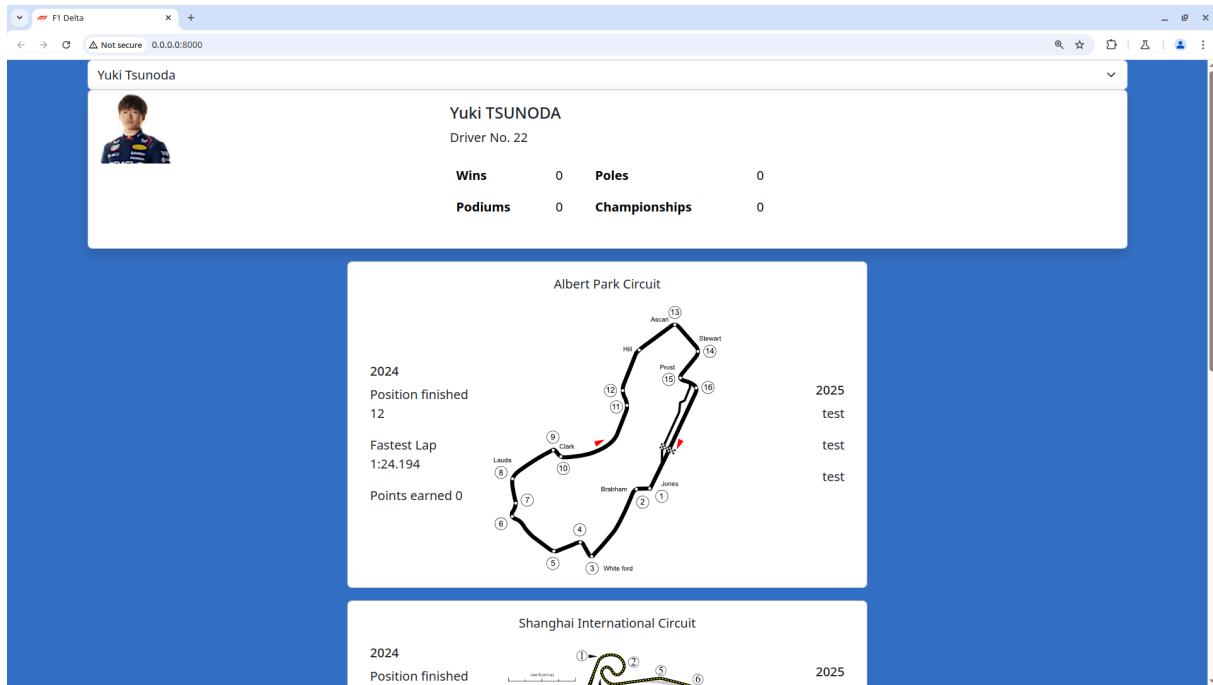
As of now the landing page provides a comparative overview of who the driver is in terms of their overall statistics like wins and poles, and then shows how much improvement is present across each race of the season that has occurred so far. The race data is pulled from an api, so as new races occur, the website automatically adds in additional race track cards. All geojson files have been acquired and loaded into the website. I will download the additional svg files as needed.

The project now includes drivers who have remained with the same teams, providing a broader comparative analysis. Rookies have been excluded due to the lack of previous years racing data.

Unfortunately , during the initial design of the website, I did not account for the fact that formula 1 cars across the seasons improve drastically in their performance. I will need to change some of the visualization goals to focus on metrics that are not as dependant on absolute car performance as all the cars will generally be going faster than the previous years. this means that data like sector times will not provide additional value as the 2025 cars will simply be faster across the entire track. the visualization may provide some anomalies, but it does not answer general questions about the drivers improvements.

I added the team color of the racing driver in the background that changes as you change the driver which is a visual cue as to which team they are looking at. This would be an indicator for those who are familiar with the teams colors that we see on track.

Below are some screenshots from the work in progress website



below is the loaded geojson of the particular track

