Team ID	PNT2022TMID33247
Team Members	SABAREES V SANTHOSH T SANTHOSH KUMAR G SANTHOSH KUMAR S

Machine Learning Based Vehicle Performance Analyzer

Documentation

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1. INTRODUCTION

1.1 Project Overview

The automotive industry is extremely competitive. With increasing fuel prices and picky consumers. Automobile makers are constantly optimizing their processes to increase fuel efficiency. So, we can help the predicting processor done easier by developing the application.

1.2 Purpose

The purpose of this project is to give the customer a portal to predict the performance of the vehicle (miles per gallon). Now a days fuel prices are increasing and automobile industries try to optimize the vehicle for running them using less fuel. This application helps them to predict the performance of the vehicle.

2. LITERATURE SURVEY

2.1 Existing Problem

It is hard to predict the performance of the vehicle. It takes us a lot of time and hard work to predict the performance. if the vehicle designing engineer able to predict the performance of vehicle with less amount of the time, It make the Engineer design and testing process easier for them.

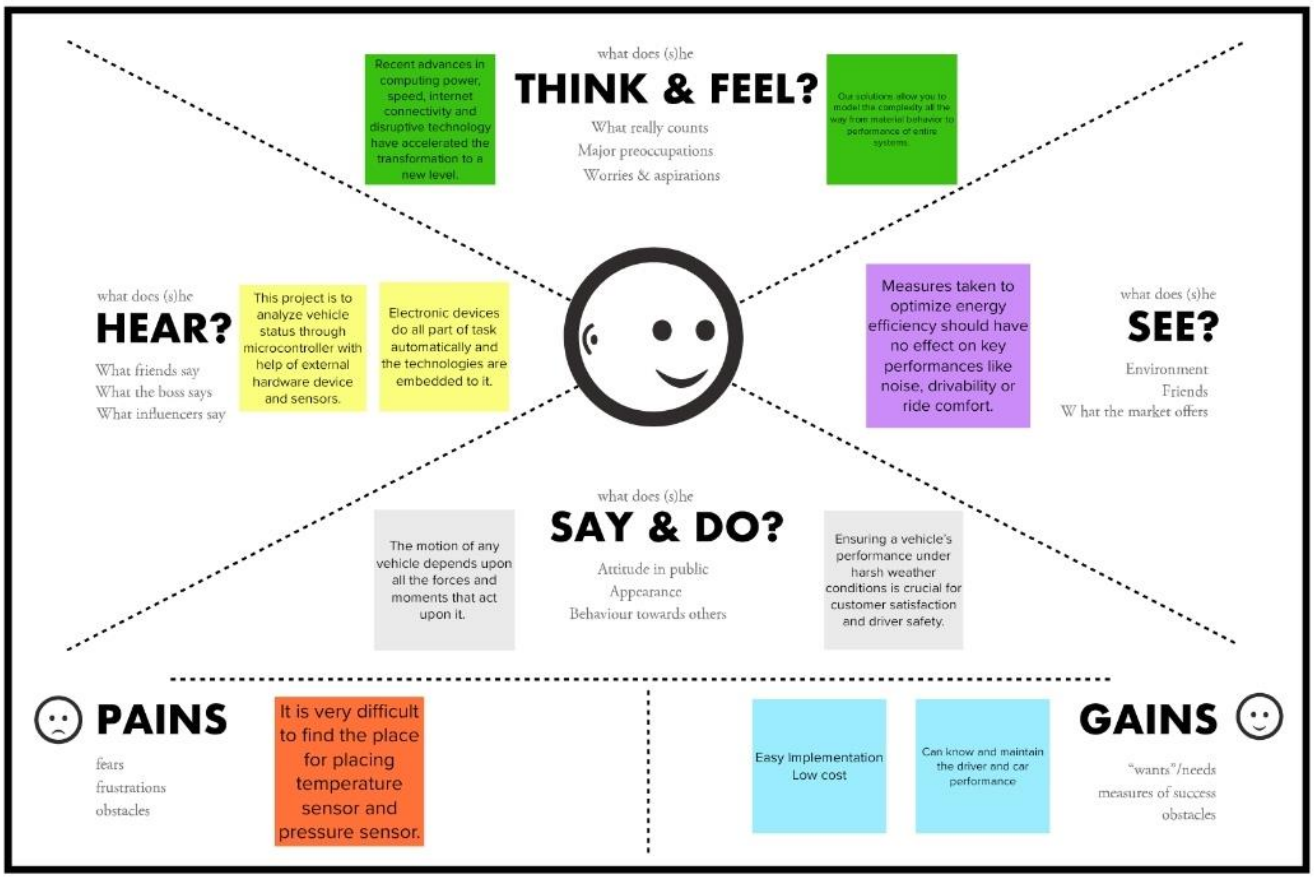
2.2 References

https://www.researchgate.net/publication/273951090_Simulation_for_prediction_of_vehicle_efficiency_performance_range_and_lifetime_A_review_of_current_techniques_and_their_applicabilit y_to_current_and_future_testing_standards

https://www.etssolution-asia.com/blog/vehicle-performance-engineering

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2) Ideation & Brainstorming

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

SABAREES V

- The main goal of current study is to predict the performance
- The data helps to improve certain behavior of vehicle
- The analysis based on engine type and horsepower etc.,
- The performance objectives like mileage, flexibity and cost.

SANTHOSH T

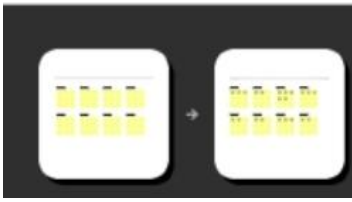
- Analysis depends on the driving distance
- Performance varies with power of vehicle
- The braking performace want to be check frequently
- Keep checking on tyre allignment for safety

SANTHOSH KUMAR G

- Design of the body must incorporate standards of safety
- Requirements for pollution-controls to be included
- Vehicleto be flexible to perform in every situation
- To increase the performance structure and weight to be good

SANTHOSH KUMAR S

- The fuel consumption plays the major role in performance
- Including and checking the conditons of the Air bag
- Attributes includes mainly with integrated safety
- The steering working plays major role in performance



3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

General Checkings

- The conditions of tyre and engine conditions
- The general conditions like fuel and air checkings

Safety Precautions

- Checking conditions of Airbags and other safety gears
- The braking and steering conditions checking frequently

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

Share the mural
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

Export the mural
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint
Define the components of a new idea or strategy.
Open the template →

Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience.
Open the template →

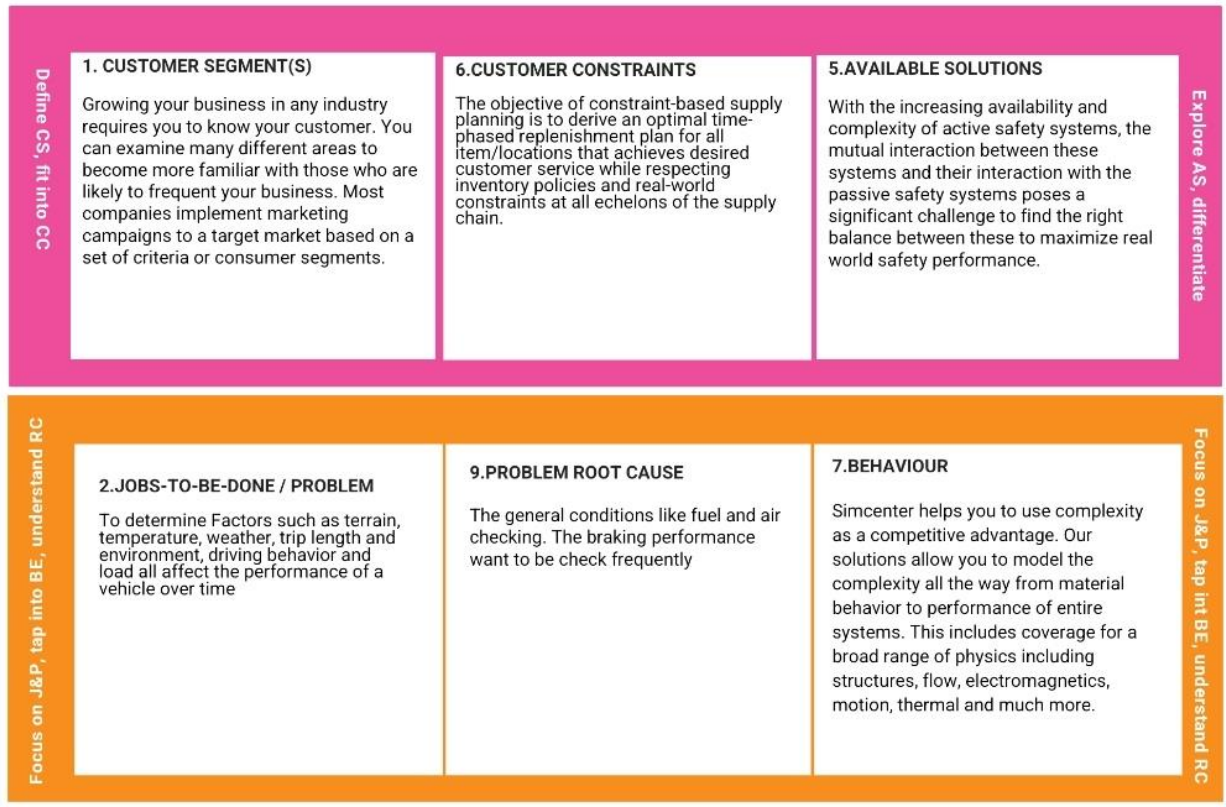
Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template →

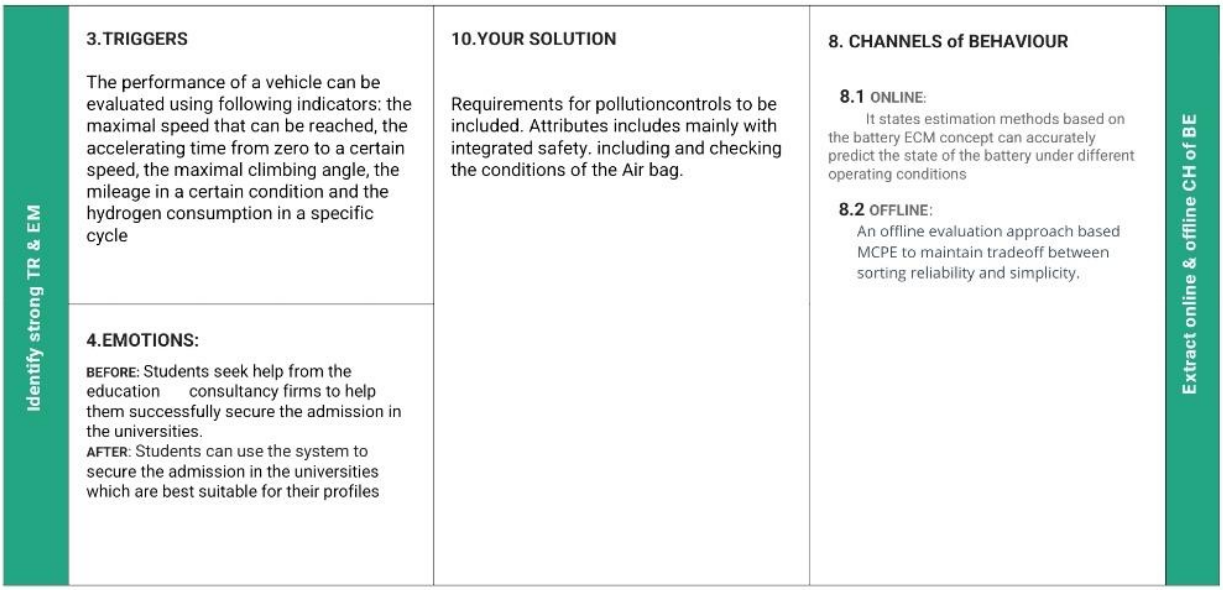
Share template feedback

3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To determine Factors such as terrain, temperature, weather, trip length and environment, driving behaviour and load all affect the performance of a vehicle over time.
2.	Idea / Solution description	The main goal of current study is to predict the performance and the data helps to improve certain behaviour of vehicle.
3.	Novelty / Uniqueness	Factors such as terrain, temperature, weather, trip length and environment, driving behaviour and load all affect the performance of a vehicle over time
4.	Social Impact / Customer Satisfaction	To identify how the reasons which are influencing customer satisfaction. (Reasons: Features, Performance, Maintenance Cost, Mileage, Aesthetics).
5.	Business Model (Revenue Model)	Performance Analyzer integrates, cleanses, harmonizes, and models revenue management data to highlight insights and unlock profitable growth.
6.	Scalability of the Solution	solutions to optimize safety and performance linked to ADAS by validating resulting behaviour when integrating active and passive safety systems.

3.4 Proposed Solution fit





4.REQUIREMENT ANALYSIS

4.1Functional requirement

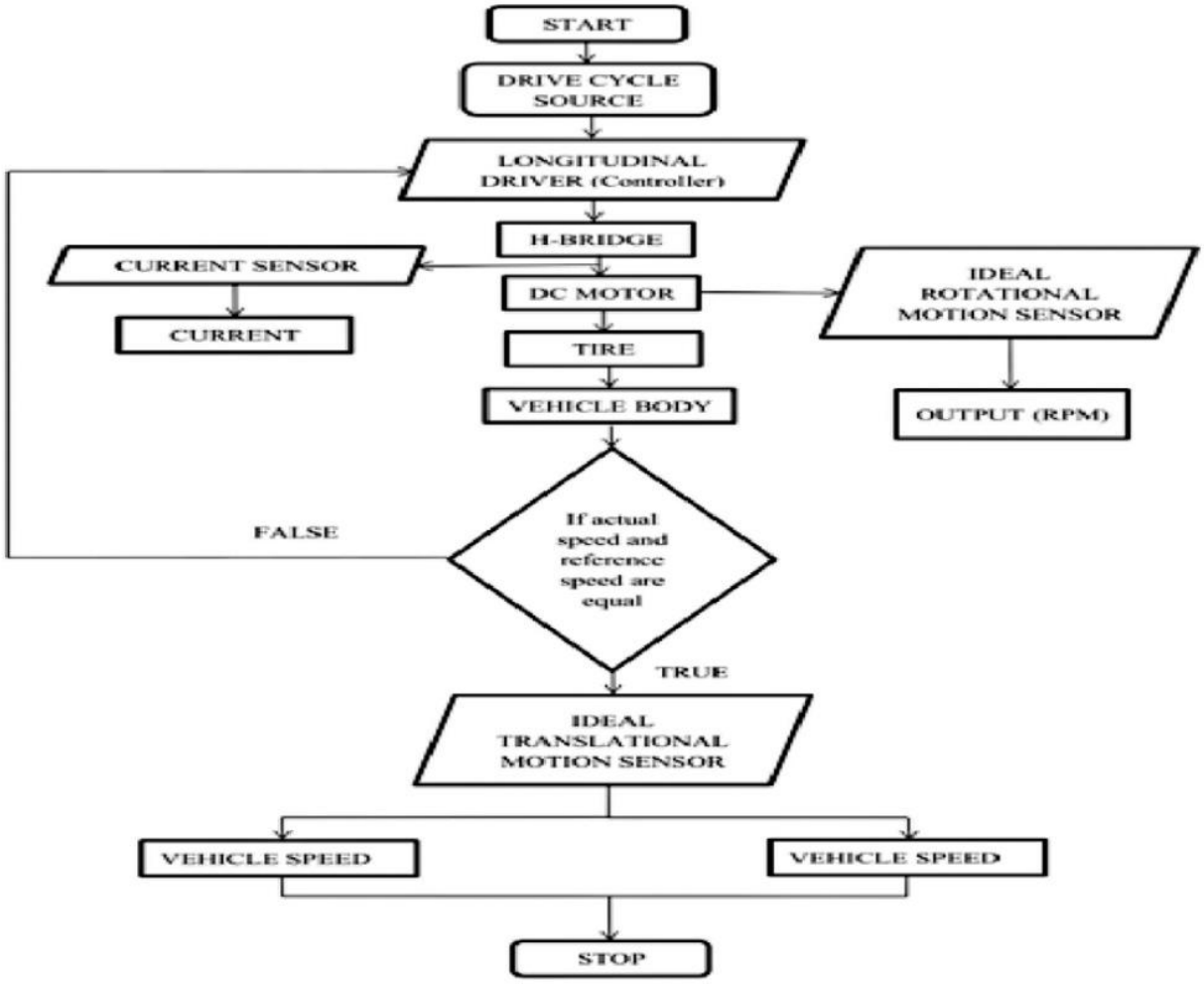
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Google O-Auth
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Vehicle Data Collection	User input through a Form Sending the data to the server
FR-4	Query Processing	Predict the expected mileage using the ML modelLook for newer cars that are like the current model.
FR-5	Report Generation	Show the expected mileage, graph the expected mileage throughout time. Suggest similar car models from the database.

4.2 Non-Functional Requirements

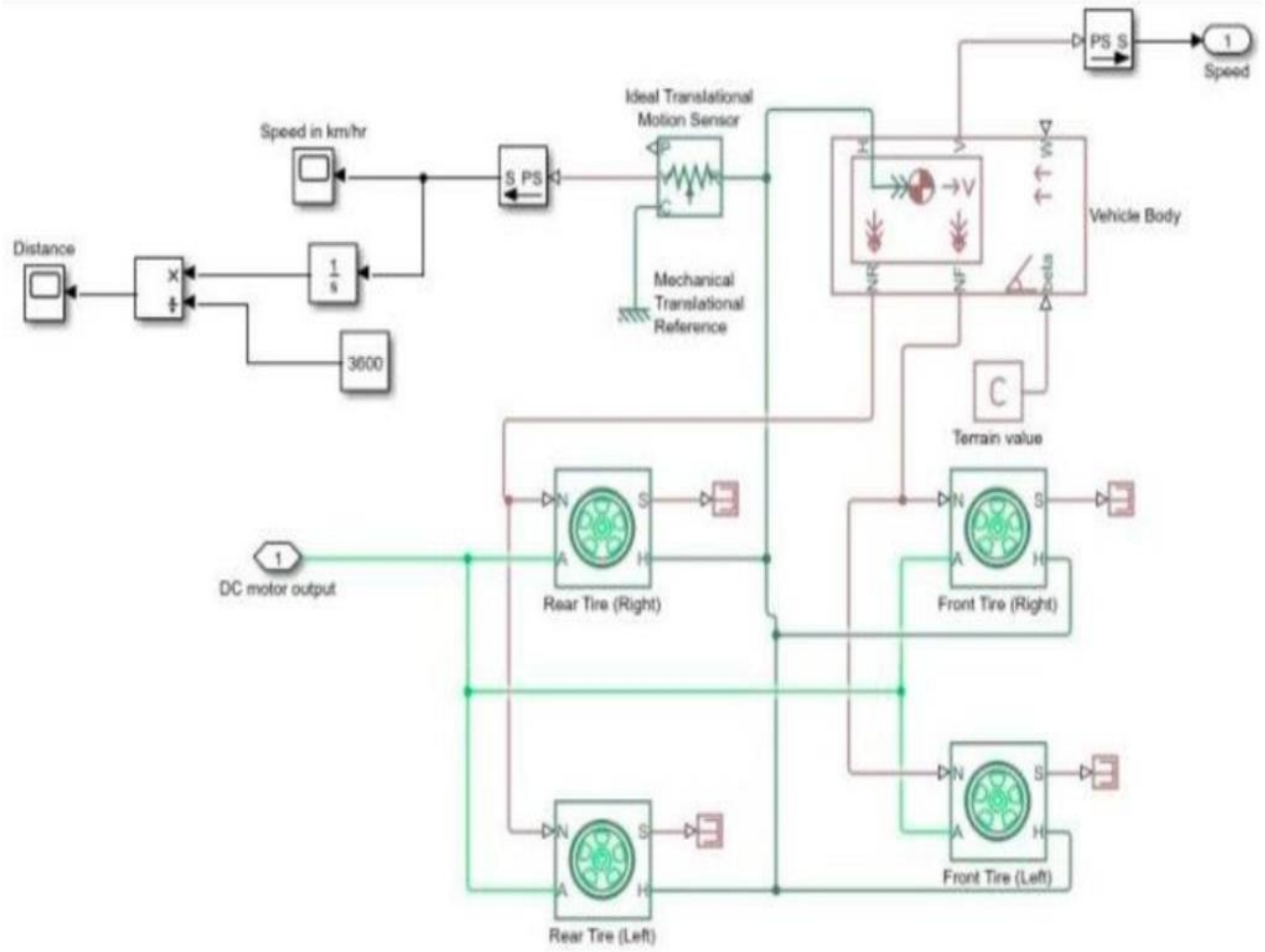
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	This application does not require any new specialized hardware to collect data. It tries to estimate mileage through data that the user can collect manually.
NFR-2	**Security**	Protected against all forms of web-based threats including but not limited to the OWASP Top 10 vulnerabilities, ensuring Confidentiality, Integrity, and Availability (CIA Triad).
NFR-3	**Reliability**	The application will give near perfect predictions regarding the efficiency and the remaining life span of the car and it will be devised such that the false positives will not affect the users badly in any way.
NFR-4	**Performance**	This application can support a reasonably large number of users accessing the services
NFR-5	**Availability**	Ensuring that the application would be available to all the users at all the time, minimizing the downtime of the services.
NFR-6	**Scalability**	This application can be extended for all the vehicles, not only for cars.

5.PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture



5.3 User Stories (yet to change)

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Visiting Webpage	USN-1	As a user, I can able to view the website using the good domain name	I can access the website	High	Sprint-4
	Design	USN-2	As a user, I can able to Enter the data	I can submit the data to the server to preict	High	Sprint-1
	Result	USN-3	As a user I can get the predicted performance	I get the MPG value	High	Sprint 3
	Design	USN-4	Good experience and less time consuming	I get user friendly UI	Low	Sprint 4
	Result	USN-5	Website is fast	I get result faster	Low	Sprint 4
	Result	USN-6	As a user I expect the prediction is highly accurate	High value	Medium	Sprint 3

6.PROJECT PLANNING &SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Download the dataset.	20	High	SABAREES, SANTHOSH T
Sprint-2	Data Pre-processing	USN-2	Import libraries and read the dataset	4	Medium	SANTHOSH T, SANTHOSH S
Sprint-2		USN-3	Handle the missing value and label the encoding	4	Medium	SANTHOSH G, SANTHOSH S
Sprint-2		USN-4	Split the dataset into train and test data	6	Medium	SANTHOSH T, SANTHOSH G
Sprint-3	Model Building	USN-5	Train the datasets to run smoothly and see an incremental improvement in the prediction rate for the available Machine Learning algorithms.	5	Low	SANTHOSH S,SABAREES
Sprint-3		USN-6	Build The Model with The Decision Tree Algorithm	6	Low	SANTHOSH G,SABAREES
Sprint-4	Application Building	USN-7	Build Python Code	5	Low	SANTHOSH S, SANTHOSH T
Sprint-4		USN-8	Output	5	Low	SANTHOSH G,SABAREES

6.2 Sprint Delivery Schedule

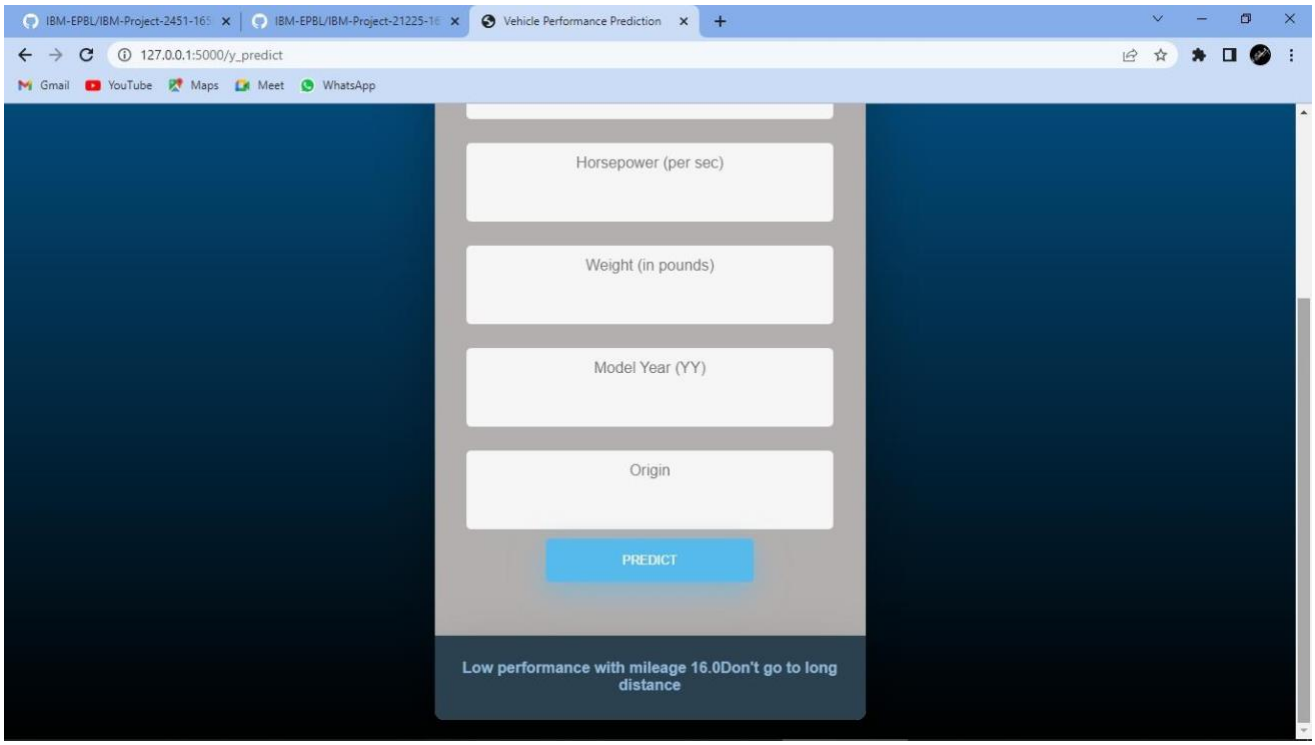
Sprint	Total Story points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on planned End Date	Sprint Release Date (Actual)
Sprint-l	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

7.CODING & SOLUTION

7.1 GUI.

Created A GUI based interface for the easy utilization for the customer using HTML,CSS and Python

Output:



7.2 MODEL

Implantation of the model integrated with HTML and CSS in Appendex .

8 TESTING.

Input dataset:

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Predicted Output:

```
In [129]: y_pred = rf.predict(x_test)

In [130]: y_pred

Out[130]: array([15.95333333, 38.6       , 31.13333333, 27.21333333, 15.84666667,
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                 15.        , 33.05      , 37.68333333, 18.44666667, 23.15333333,
                 17.1       , 18.73      , 29.83666667, 28.93333333, 26.99666667,
                 26.12666667, 34.61      , 26.51333333, 35.71666667, 23.57666667,
                 15.58666667, 34.23333333, 14.46333333, 13.65      , 23.53333333,
                 13.15      , 34.19666667, 11.7       , 33.33666667, 20.40333333,
                 28.61333333, 29.48333333, 37.87      , 11.16666667, 20.58666667,
                 21.13      , 31.33666667, 19.14      , 18.07333333, 17.82666667,
                 18.26666667, 17.97666667, 25.73      , 27.51333333, 25.50666667,
                 14.08333333, 26.15666667, 25.84666667, 19.56666667, 20.40333333,
                 21.79333333, 25.53      , 13.96666667, 13.4       , 27.88      ,
                 23.11666667, 28.21666667, 15.81333333, 30.93333333, 36.49333333,
                 24.40333333, 21.46666667, 19.47      , 31.60666667, 14.93333333,
                 14.61666667, 28.9       , 22.06      , 13.5       , 17.49      ])
```
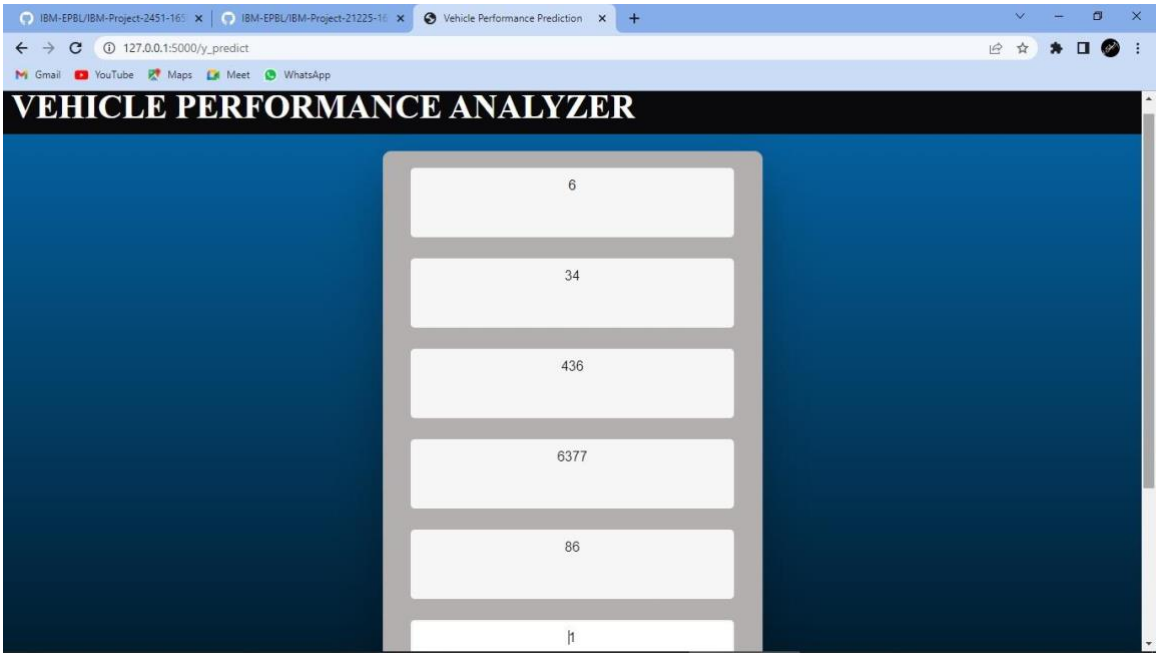
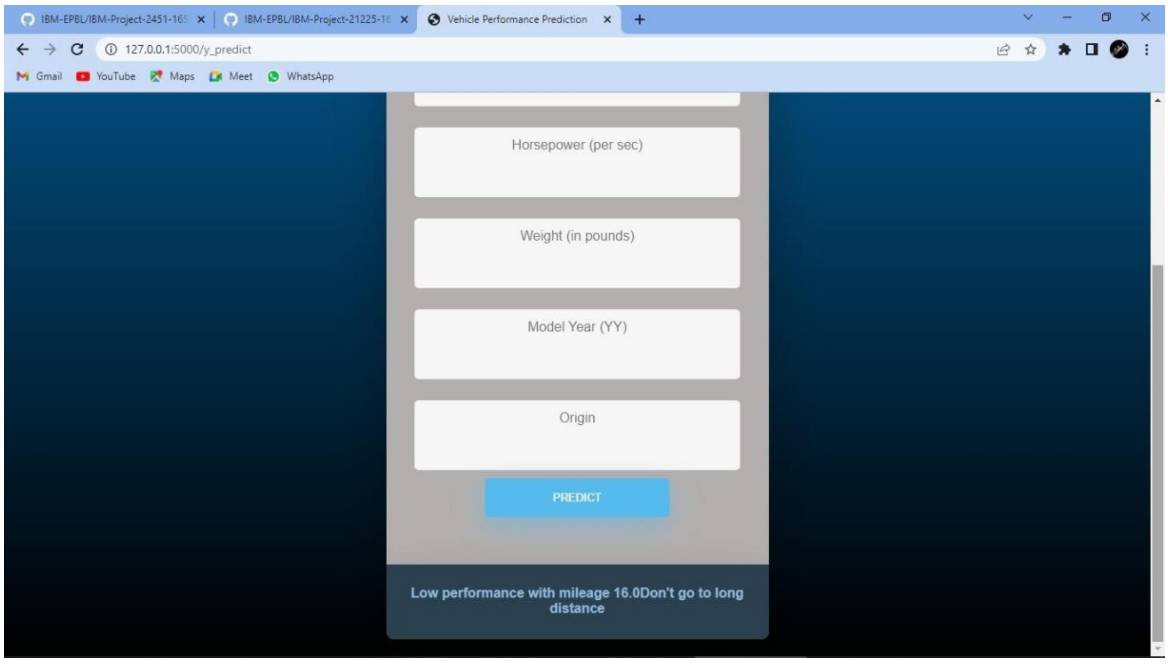

8.2 User Accepting Testing.

INPUT:



Output:



9.RESULTS

Model Evaluation

```
from sklearn.metrics import r2_score,mean_squared_error
```

```
acc = r2_score(y_test, y_pred)
```

```
acc
```

```
0.8570363544939325
```

```
err=np.sqrt(mean_squared_error(y_test,y_pred))
```

```
err
```

```
2.7436940578959117
```

10.ADVANTAGES AND DISADVANTAGES.

Advantages:

- Prediction of vehicle performance is faster and easier.
- Easy and wide range of access from everyday user to machinist in workshops.

Disadvantages:

- Accuracy need to be increased
- The dataset should be wide to for every region
- Values such as standard climate conditions need to be considered on the long run of vehicles

11.CONCLUSION.

The automotive industry is extremely competitive. With increasing fuel prices and picky consumers. Automobile makers are constantly optimizing their processes to increase fuel efficiency. The performance analysis of the car is based on the various parameters. These are the factors on which the health of the car is analyzed, improved to gain the competitive advantage. This application will solve the problems in evaluation of the vehicle

12.FUTURE SCOPE

- Developing the CSS and Animation of the Website
- Developing the High Accuracy Model
- Developing the Code to make API key highly secure

GITHUB LINK: https://github.com/IBM-EPBL/IBM-Project-2451-1658471828
(Consist of source code , demo video and related data files)