

Project Report

Team ID : PNT2022TMID31242

1. INTRODUCTION

Project Overview

Purpose

2. LITERATURE SURVEY

Existing problem

References

Problem Statement Definition

3. IDEATION & PROPOSED SOLUTION

Empathy Map Canvas

Ideation & Brainstorming

Proposed Solution

Problem Solution fit

4. REQUIREMENT ANALYSIS

Functional requirement

Non-Functional requirements

5. PROJECT DESIGN

Data Flow Diagrams

Solution & Technical Architecture

User Stories

6. PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation

Sprint Delivery Schedule

Reports from JIRA

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

Feature 1

Feature 2

Database Schema (if Applicable)

8. TESTING

Test Cases

User Acceptance Testing

9. RESULTS

Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE

13. APPENDIX

Source Code

GitHub & Project Demo Link

INTRODUCTION

1.1 Overview

This project is used to analyze vehicles based on several fields of data which are collected by various methods, these data are well analyzed by the model created in python and the result derived from it. By utilizing the results generated one can improve their performance.

1.2 Purpose

The main purpose of the project is to depict the current performance of the vehicle accurately so that the user may upgrade accordingly to achieve better performance.

1. LITERATURE SURVEY

2.1 Existing problem

Some of the existing solutions for solving this problem are:

1. Modelling and performance analysis of a vehicle with kinetic dynamic suspension system:

The proposed KDS system consists of two hydraulic circuits acting on two pairs of torsional rods and levers, which can be treated as novel anti-roll bars. Hence, these anti-roll bars do not work independently, but are coupled to merely respond to particular motion modes. The results show that the KDS system considerably improves the vehicle's anti-roll ability.

2. Improved vehicle performance using combined suspension and braking forces:

The specific focus of this research is the integration of active suspension components with anti-lock braking (ABS) mechanisms. Simulations of the integrated controller and an ABS system demonstrate a significant increase in performance.

2.2 References

1. **Environment Setup:**
<https://conda.io/projects/conda/en/latest/user-guide/tasks/manage-environments.html>
2. **Handling missing values:** <https://youtu.be/xkRz6R0FIQ4>
3. **Splitting dataset into trainset:** <https://youtu.be/-KYiefj2wuw>
4. **Integrating Flask:**
<https://www.analyticsvidhya.com/blog/2020/04/how-to-deploy-machine-learning-model-flask/>


2.3 Problem Statement Definition

Predicting the performance level of cars is an important and interesting problem. The main goal is to predict the performance of the car to improve certain behaviours of the vehicle. This can significantly help to improve the system's fuel consumption and increase efficiency.

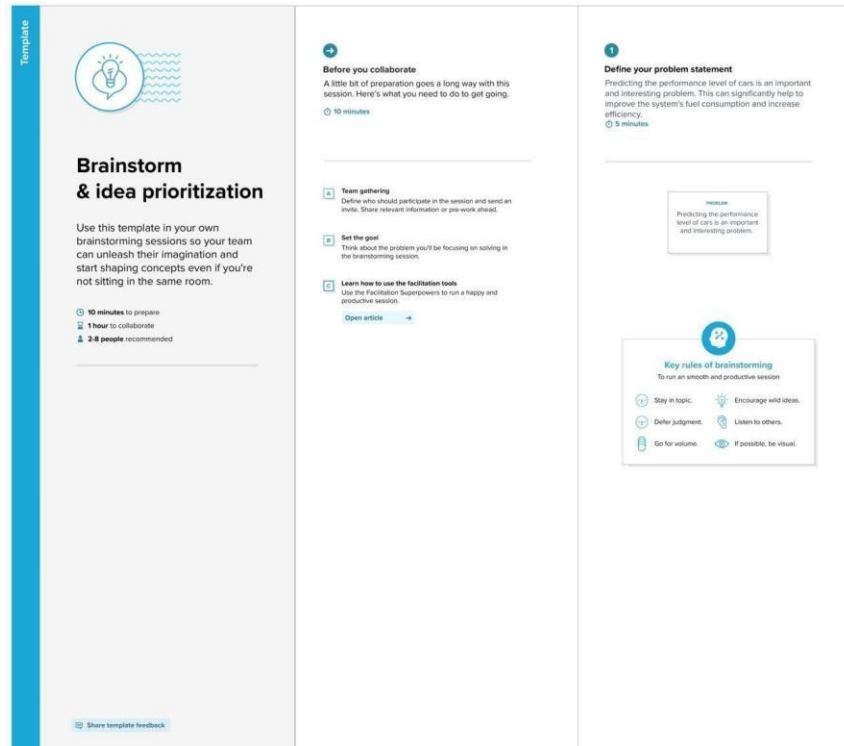
The performance analysis of the car is based on the engine type, no of engine cylinders, fuel type, horsepower, etc. These are the factors on which the health of the car can be predicted. It is an ongoing process of obtaining, researching, analysing, and recording health based on the above three factors. The performance objectives like mileage, dependability, flexibility and cost can be grouped together to play a vital role in the prediction engine and engine management system. This approach is a very important step towards understanding the vehicle's performance.

3.IDEATION & PROPOSED SOLUTION

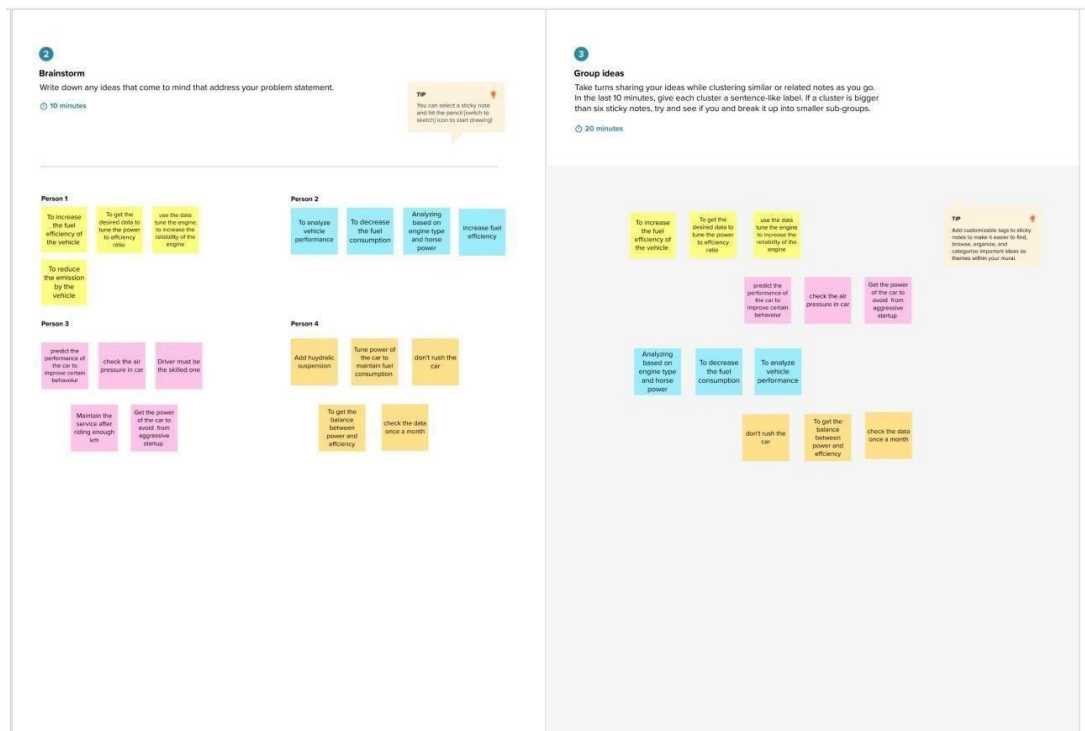
3.1 Empathy Map Canvas

<div>Template</div> <div></div> <div>IDEATION</div> <div>TEAM IDEA</div> <div><p><i>Predicting performance levels cars is an important and interesting issue. The main goal is to predict the performance of the car in order to improve certain behavior of the vehicle. This can go a long way in improving the system's fuel economy and increasing efficiency.</i></p></div> <div></div> <div>Share template feedback</div>	<div>TOPIC Machine Learning based Vehicle Performance Analyzer</div> <div>VISWANATHAN R<div><p>Maintaining Your Engine</p><p>When it comes to vehicle performance, your engine is the first thing you should maintain. Poor engine performance guarantees you from travelling very far. When your engine isn't operating properly, you also spend a lot more money on fuel. Being stranded on the side of the road because your engine broke down is one of the worst things that could happen.</p><p>We may have experienced frequent failure of warning lights, erratic operation of indicators, etc. when you use the vehicle for a long time without maintenance. This can be problematic while driving, especially on long drives. Imagine getting a low engine oil warning that can only be reset by an electrician! Such warnings will make you panic and affect your enjoyment of the trip. Regular car service will save you from this.</p></div><div><p>Gearing</p><p>In simpler words, the gearing of a bike is how the engine's motor revolutions connect to wheel speed. On a motorbike, changing the gearing can have a significant impact on performance and speed. On a motorbike, the gearing will show you the power and speed as well as how the acceleration feels.</p><p>Regular service inspections enable the mechanic to identify any potential problems that need to be fixed before they become serious and endanger driving safety. To prevent potential vehicle faults, it is recommended to have your car tested and serviced on a regular basis by qualified mechanics.</p></div></div> <div>ARAVINDH P<div><p>Brake Performance</p><p>For maximum safety and performance, your braking system needs to be checked on a regular basis. Every now and then, the fluid that makes your brake function needs to be replaced. Without it, your brakes may seize up, which would have a serious impact on how your automobile operates. You might end up stranded on a roadside, unattended.</p><p>The effect of proper maintenance will be evident in the vehicle's appearance and performance. The buyer will check the vehicle with the help of an experienced technician before joining the shop. A properly maintained vehicle will have a better resale value than an unmaintained one. Because the components, accessories and overall performance of the vehicle will be great.</p></div><div><p>Engine and Power</p><p>It might seem obvious, but the performance of your bike improves with engine power. It might not be as crucial to pay attention to in Andie's stop-and-go city traffic, but for those lengthy highway journeys, strong bikes will fly like a charm.</p><p>It can be expensive to replace the spark plugs and cylinder head. If you frequently get maintenance, you can simply avoid these costs. Engine failure will occur if these parts are not repaired.</p></div></div> <div>KAVIYARASU S<div><p>Taking Care of Your Electronics</p><p>Monitoring on your car's electronics system is another thing you should do. The electronic system in your car could malfunction, causing it to act strangely. Due to the electronic system's poor performance, numerous issues have arisen. As a result, mechanical components frequently malfunction and you are unable to pinpoint the underlying cause of the problem.</p><p>During the vehicle's routine maintenance, a qualified technician inspects it and makes any necessary repairs or replacements. Otherwise, it could have a domino effect and render the related components defective. As a result, the car's general condition improves greatly.</p></div><div><p>Efficiency of Fuel</p><p>Another thing that might seem obvious, but is nonetheless very important to this list. One of the first things you consider when purchasing a bike is the vehicle's mileage. You can customize your bike by changing the gears and the engine's power, but you can't alter the gasoline tank's size. Keep this in mind while you fill up for those road trips!</p><p>Making sure your car is safe to drive is one of the main reasons to have it serviced. Regular oil changes are essential, and the mechanic should also conduct a routine inspection to make sure there aren't any hidden problems that might surprise themselves while you're driving. This includes inspecting your brakes, coils and air filters, and tyre pressure. You will be happy you had your automobile serviced rather than continuing to drive a potentially hazardous vehicle if they find a problem that requires quick treatment.</p></div></div> <div>SOUNDHARRAJAN S<div><p>Constant Tire Maintenance</p><p>You wouldn't believe it, but your tyre actually has a significant impact on how well your car performs. Poor fuel economy might be significantly slowed by reducing the incorrect set of tyres. Altering the tyre pressure has the same effect. Your tyre has a significant impact on safety as well. One of the most crucial things you should do to ensure that your automobile runs as efficiently as possible is to have your tyres serviced in time.</p><p>Any seasoned driver can recognize the importance of car maintenance. They are aware that problems can be quickly identified and fixed, which can help you avoid spending a lot of money, time, and most importantly, stress! By having regular maintenance performed on your car, you may avoid using it up prematurely like so many other drivers. Running short on fuel, driving on tyres with little to no tread, and driving without control are all things that can and will gradually increase the cost of maintaining your car.</p></div><div><p>Both the appearance and performance of the car will show the impact of proper maintenance.</p><p>Before closing the purchase, the buyer will inspect the car with the aid of a qualified technician. A vehicle with good maintenance will sell for more money than one without. Because the vehicle's parts, accessories, and general performance will be excellent. If you intend to sell the car, you must subject it to routine maintenance to get the greatest price.</p><p>The fact that having your automobile checked and maintained on a regular basis by maintenance experts will save you money overall is something that many individuals choose not to do because they believe doing so is a costly alternative. Your automobile will utilize fuel more efficiently after a service, providing you a higher return on your fuel investment.</p></div></div>
---	---

Step-1: Team Gathering, Collaboration and Select the Problem Statement



Step-2: Brainstorm, Idea Listing and Grouping



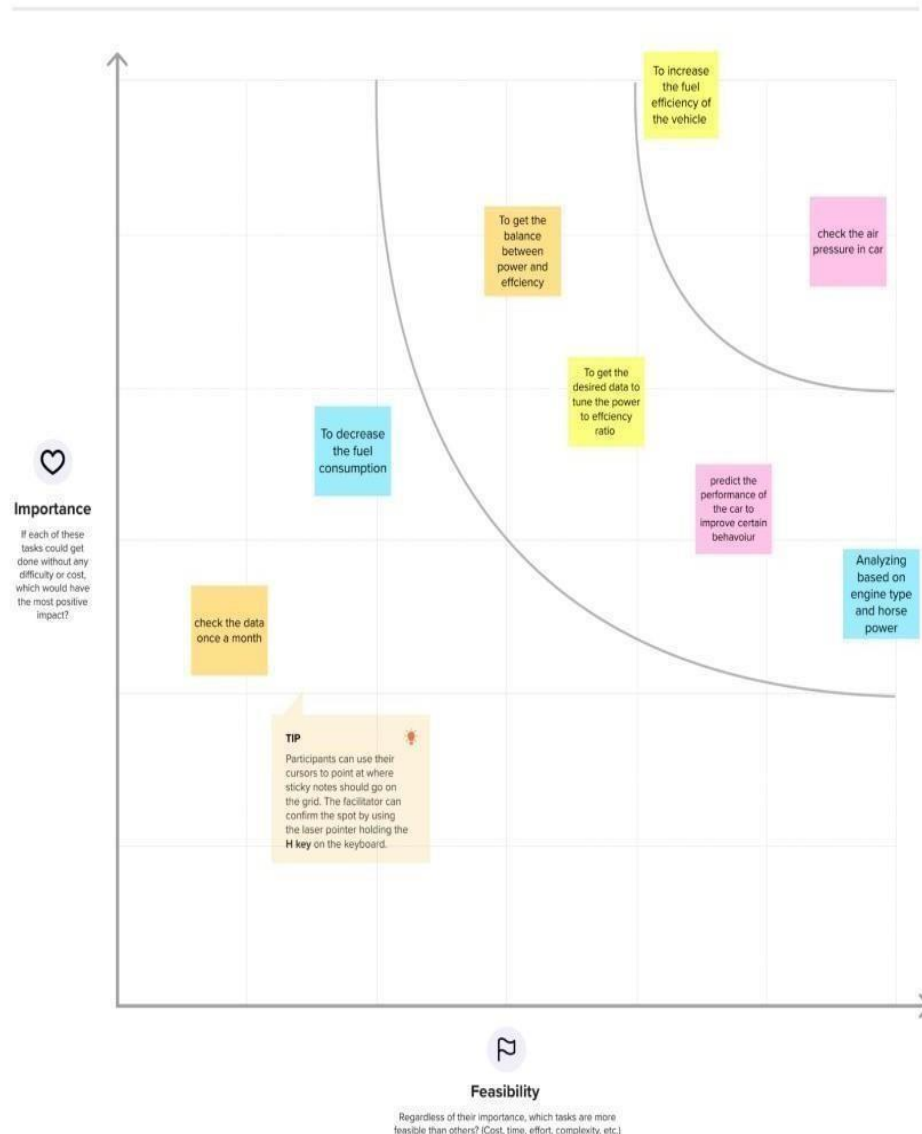
Step-3: Idea Prioritization

4

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

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

B 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

Proposed Solution Template

Date	18 October 2022
Team ID	PNT2022TMID31242
Project Name	Machine Learning based Vehicle Performance Analyzer
Maximum Marks	2 Marks

Proposed Solution Template:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	In our day-to-day life vehicles play an integral part in all our lives. We are lagging in servicing it because we are preoccupied with our daily tasks which have a direct impact on the environment. To improve the performance and efficiency of our vehicle, it must be properly serviced and maintained. So, to remind the owner about vehicle maintenance, we have created Vehicle Performance Analyzer using machine learning.
2.	Idea / Solution description	To improve the vehicle's performance efficiency, it is critical to analyse the factors using a variety of well-known machine learning algorithms such as linear regression, decision tree, and random forest. Automotive traction batteries' range, durability, and longevity are "hot topics" in automotive engineering. And now we'll look at mileage performance. We will create models using various algorithms and neural networks to solve this problem. We'll then see which algorithm accurately predicts car performance and its efficiency. This can significantly reduce system fuel consumption and increase efficiency.
3.	Novelty / Uniqueness	There are a few works that analyse vehicle performance using very few vehicle parameters, whereas, in our idea, we use the number of cylinders, displacement, horsepower, weight, model's year and country of origin to determine vehicle performance. We anticipate that as more data is added to fit the model, the sensitivity of our measure will increase. Because our model will be exposed to more possible scenarios, it will be able to find more data that is similar to the previously unseen ones.

4.	Social Impact / Customer Satisfaction	The main objective of this Vehicle performance analyser is that it helps in major reduction of emissions from the vehicles. The reduced amount of poisonous gas emission will definitely improve the quality of air in our environment. By using this Vehicle Performance Analyser customers can know the technical status of their own vehicle. It provides the customer to maintain good quality of the vehicle by enhancing the engine performance, taking care of the interior, regular tire maintenance and also improves the driver safety whereas vehicle gives service alerts which provides better driving experience.
5.	Business Model (Revenue Model)	This System will provide detailed information about the vehicle performance and very user-friendly interface to use. By being informative and unique, it attracts more customers leading to higher revenue. As it plays a vital role in maintaining the efficiency of the vehicle and also in saving the environment from global warming it has a greater impact on the competitive business world.
6.	Scalability of the Solution	Irrespective of the vehicle type or the count of vehicles, this system will analyse the performance of the vehicle and also gives periodic service alerts, when performance of the vehicle degrades. Multiple users can also access the system at same time, it processes the results without any delay.

3.4. Problem Solution fit

Project Title: Machine Learning based Vehicle Performance Analyzer

Project Design Phase-I - Solution Fit

Team ID: PNT2022TMID31242

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Who is your customer? <ul style="list-style-type: none">❖ People who uses their vehicle on daily basis.	6. CUSTOMER CONSTRAINTS CC What constraints prevent your customers from taking action or limit their choices of solutions? <ul style="list-style-type: none">❖ Complex Design of the vehicle which restricts the users themselves to take immediate actions on any repair or damage of the vehicle.❖ Only trained technicians will be able to identify and rectify the problems and issues arising on vehicles.	5. AVAILABLE SOLUTIONS AS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What price & costs do these solutions have? <ul style="list-style-type: none">❖ Nowadays quick vehicle service schemes has been established in many authorised service centres.❖ Vehicle service centres are more in number also in all geographic locations when compared to earlier.❖ Availability of spare parts is also very easy for every kind of vehicle in these days as internet helps to get these spare parts online.	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS J&P Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides. <ul style="list-style-type: none">❖ Vehicles must have both powerful and fuel efficient engines.❖ It is equally important to monitor the vehicle usage pattern and also to record the performance of the vehicle, so that if any deviations occur in the performance it will immediately notify the user, to get it done by the service centre.	9. PROBLEM ROOT CAUSE RC What is the real reason that this problem exists? What is the back story behind the need to do this job? <ul style="list-style-type: none">❖ People doesn't know about the importance of maintaining a vehicle.❖ It is an important duty for each and every one of us to ensure that our vehicle doesn't cause any kind of pollution to the environment.❖ Proper servicing and maintenance of vehicle also ensures the safety of the user.	7. BEHAVIOUR BE What does your customer do to address the problem and get the job done? <ul style="list-style-type: none">❖ First of all, if any problems or repairs occur in a vehicle it will be notified to the user via vehicle performance analyser through email or sms.❖ After the notification from the vehicle, the user must take the vehicle to the nearest service centre to get the repairs and problems to be rectified.❖ If the user takes immediate action after notification means the minor problems can be rectified easily or else the user's ignorance may lead to some major problems which may reduce the safety of the user and also may cost a lot of money to rectify such major problems.	
Identify strong TR & EM	3. TRIGGERS TR What triggers customers to act? <ul style="list-style-type: none">❖ Keeping customers waiting too long for services to be completed.	10. YOUR SOLUTION SL If you are working on an existing business, write down your current solution first, fill in the context, and check how much it fits reality. If you are working on a new business proposition, think hard & think out of the box before coming up with a solution that fits within customer limitations, solves a problem and matches customer behavior. <ul style="list-style-type: none">❖ The vehicle performance analyser helps in monitoring the performance of the vehicle using Machine learning. It takes engine performance, braking performance and safety as the main constraints and if any anomalous activities are found on the performance of the vehicle then it is immediately notified to the user and it ensures the safety of both the user and the vehicle. The main contribution is that it helps in protecting the environment, as proper servicing of the vehicle will reduce the carbon emissions.	8. CHANNELS OF BEHAVIOR CH K1 ONLINE What kind of actions do customers take online? <ul style="list-style-type: none">❖ Customers will book their service slots based on their availability and time schedule.❖ Customers will also get live updates from the service center regarding the service completion status of their vehicle so that they need not stay in the service center for a longer period of time, it is easier for them to collect the vehicle from the service center once the service is done. K2 OFFLINE What kind of actions do customers take offline? <ul style="list-style-type: none">❖ Customers will test drive the serviced vehicle to ensure that the problem/repair is rectified and will check whether the repair notification has disappeared after the service.	Identify strong TR & EM
	4. EMOTIONS: BEFORE / AFTER EM How do customers feel when they face a problem or a job and afterwards? <ul style="list-style-type: none">❖ Unsatisfied and Frustrated > Feeling comfortable and Happy.			

4.REQUIREMENT ANALYSIS

4.1.Functional requirement

Date	18.October.2022
Team ID	PNT2022TMID31242
Project Name	Machine Learning-Based VehiclePerformance Analyzer
Maximum Marks	2 Marks

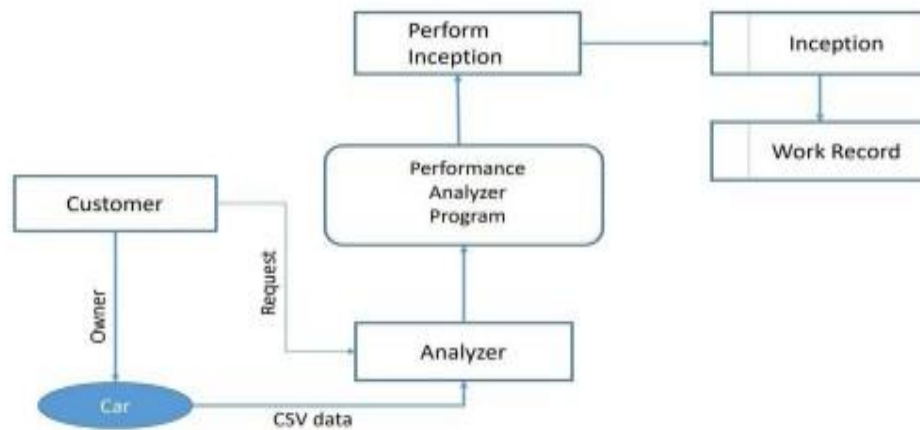
FR.No	FUNCTIONAL REQUIREMENTS (Epic)	NON- FUNCTIONAL REQUIREMENTS
FR-1	Enter the Inputs	Get Inputs through a form
FR-2	User Essential	Predict the performance of the vehicle
FR-3	Data Prepossessing	Sample Dataset for training purpose
FR-4	User input Evaluation	Evaluating the given user values
FR-5	Prediction	Fuel consumption and efficiency of the vehicle

5.PROJECT DESIGN

5.1.Data Flow Diagrams

Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2 Solution & Technical Architecture:

TECHNOLOGY ARCHITECTURE

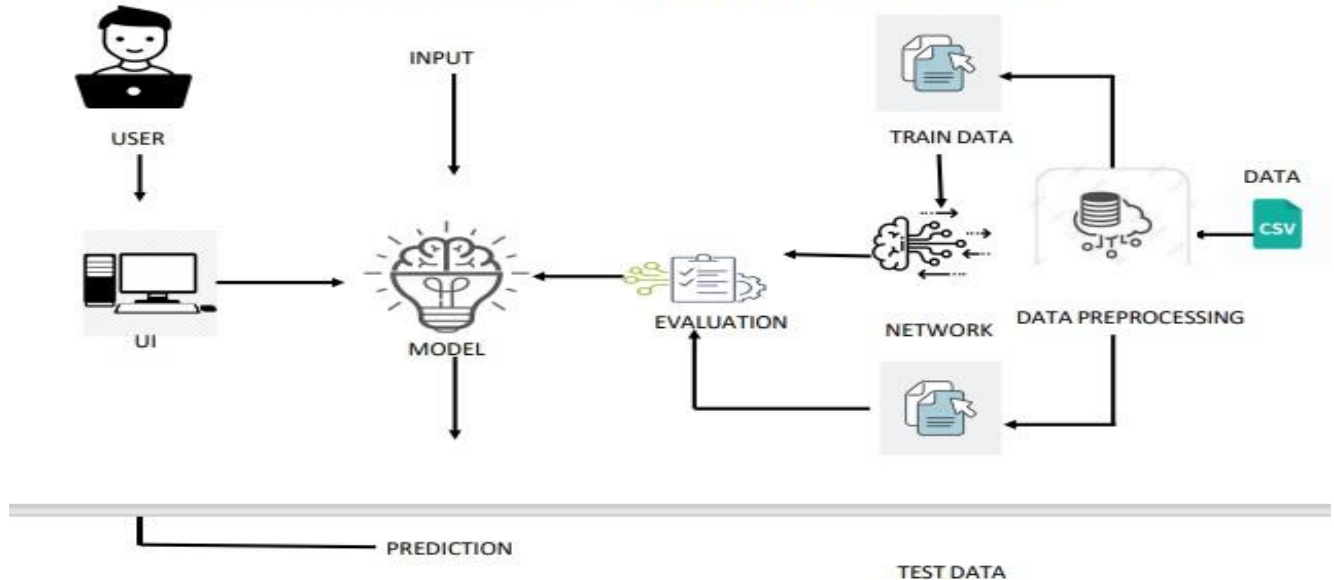


Table-5.2.1: Components & Technologies:

S. No	Component	Description	Technology
1.	User Interface	With the help of web UI, user has better experience And can access the website user-friendly.	HTML, CSS, JavaScript, React JS.
2.	Application Logic-1	Customer can login with username and password.	Java / Python
3.	Application Logic-2	Customer can give their vehicle faults.	IBM Watson STT service
4.	Application Logic-3	Customer can check their vehicle performance and can check the vehicle after the service.	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
11	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration:	Local, Cloud Foundry, Kubernetes, etc.

Table-5.2.2: Application Characteristics:

S. No	Characteristics	Description	Technology
1	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used
5	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Technology used

5.3.User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Access the webpage	USN-1	As a user, anyone can access the webpage to check the specifications of the vehicle.	I can access my webpage online at any time.	High	Sprint-1
Customer	Performance of the vehicle	USN-2	As per the usage of the user, the performance of the vehicle should be predicted easily.	Prediction can be done in an easy way.	High	Sprint-2
Customer	Accuracy to check the performance and health of the car	USN-3	By using our prediction, it helps to check the health of the car.	The efficiency of the car can be predicted	High	Sprint-1

6. Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Preprocessing	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	30	High	Viswanathan.R Aravindh.P Soundharrajan.S Kaviyarasu.S
Sprint-3	Web Page Design	USN-3	As a user, I can register for the application through Facebook	30	High	Viswanathan.R Aravindh.P Soundharrajan.S Kaviyarasu.S
Sprint-4	Result	USN-4	As a user, I can register for the application through Gmail	20	High	Viswanathan.R Aravindh.P Soundharrajan.S Kaviyarasu.S

6.1.Project Tracker, Velocity & Burndown Chart:

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 -1	30	1 Days	01 Nov 2022	03 Nov 2022	30	12 Nov 2022
Sprint -2	20	2 Days	03 Nov 2022	05 Nov 2022	20	12 Nov 2022
Sprint -3	20	5 Days	06 Nov 2022	11 Nov 2022	20	12 Nov 2022
Sprint-4	20	4 Days	12 Nov 2022	16 Nov 2022	20	16 Nov 2022

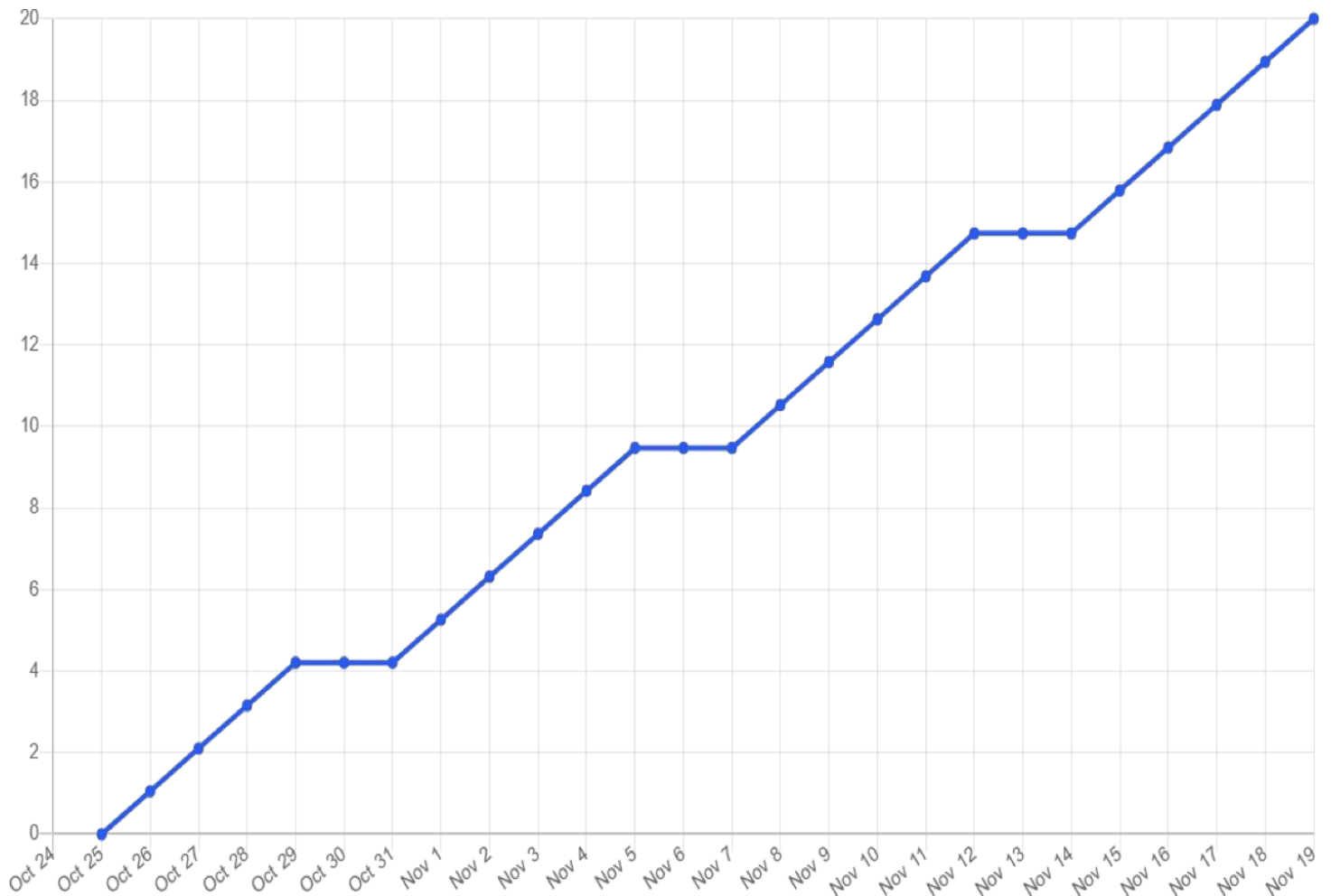
Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{\text{sprint duration}}{\text{velocity}} = \frac{20}{10} = 2$$

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



7. CODING & SOLUTIONING:

7.1. Features:

FR No.	Feature	Description
FR-1	Enter the input	Get input through the form
FR-2	User Essential	Predict the performance of the vehicle
FR-3	Data preprocessing	Sample dataset for training purpose
FR-4	User input Evaluation	Evaluating the given user values
FR-5	Prediction	Fuel consumption and efficiency of the vehicle

8. Testing:

TEST CASES:

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
HomePage_TC_001	Functional	Home Page	Verify if the user is able to enter the data into the text field in the webpage and click the button		1. Enter the URL 2. Enter the values	[9,307,130,1504,70,1]	Page refresh	Working as expected	Pass				Sandesh
HomePage_TC_002	Functional	Home page	Verify if the user is able to view the output after the submit button has been clicked		1. Click the submit button		Low performance with mileage [7,1]	Working as expected	Pass				Sandesh

User Acceptance Testing:

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	1	1	0	0	2
Duplicate	1	0	0	0	1
External	1	0	0	0	1
Fixed	1	1	1	1	4
Not Reproduced	0	0	0	0	0
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	4	2	1	1	13

Outsource Shipping	0	0	0	0
Exception Reporting	1	0	0	1
Final Report Output	4	0	0	4
Version Control	1	0	0	1

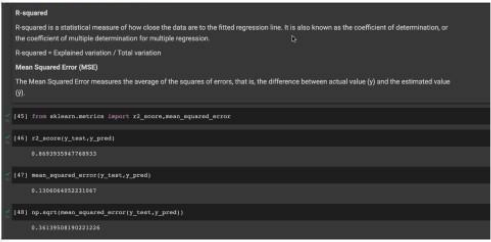
3. Test Case Analysis


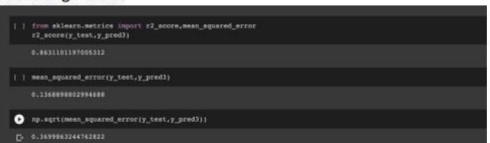
This report shows the number of test cases that have passed, failed, and untested

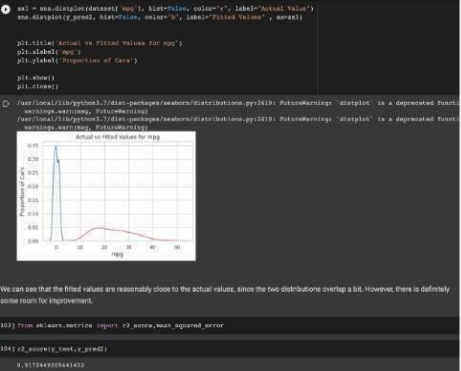
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	4	0	0	4
Client Application	4	0	0	4
Security	1	0	0	1

9.RESULTS:

PERFORMANCE METRICS:

S.No.	Parameter	Values	Screenshot
1.	Metrics	Regression Model: MAE - , MSE - , RMSE - , R2 score - Classification Model: Confusion Matrix - , Accuracy Score- & Classification Report -	Decision tree regressor 

			Random forest regressor  Linear regression  Conclusion: When comparing models, the model with the higher R-squared value is a better fit for the data. When comparing models, the model with the smallest MSE value is a better fit for the data. Comparing these three models, we conclude that the DecisionTree model is the best model to be able to predict mpg from our dataset.
--	--	--	--

Accuracy	Training Accuracy - 0.91724492094	
----------	-----------------------------------	--

10.PROS AND CONS:

PROS:

- Using the Random Forest Algorithm in the model helps to perform both classification as well as regression tasks.
- A random forest produces good predictions that can be easily understood
- It can handle large datasets easily Random Forest Algorithm provides a higher-level accuracy in predicting outcomes.

CONS:

- The main limitation of using random forest algorithm in the model is that a large number of trees can make the algorithm too slow and ineffective for real-time predictions.
- The random forest algorithm is quite slow to create predictions once it is trained.

11. CONCLUSION:

The ability to estimate a car's performance level presents a big and fascinating challenge. Forecasting vehicle performance in order to improve particular vehicle behavior was our main goal. performance evaluation of the car considering its horsepower, cylinder count, fuel type, and engine type, among other things. Based on the factors, like horsepower, cylinder count, fuel type, and engine type, the health of the car is forecasted. We analyzed the components using a number of well-known machine learning approaches, like linear regression, decision trees, and random forests, in order to optimize the performance efficiency of the vehicle. The power, longevity, and range of automobile traction batteries are now the "hot topics" in automotive engineering. In this case, we additionally consider mileage performance. To answer this problem, we have built the models using a variety of methods and neural networks. We've then

compared which algorithm is most accurate in forecasting car performance (Mileage). A front- end webpage was designed to help give the user an attractive front while they input the values required by the developed machine learning model. The IBM cloud platform was used to develop the model.

12. FUTURE WORKS:

The dataset used for this model is an old vehicle dataset, thus the model's accuracy would drop when the details of vehicles released in recent times are given as input. Thus, in the future we propose to use the latest dataset set containing vehicle information to help train the model. We also plan to use other classification algorithms such as SVM and Decision Trees instead of Random Forest and measure if any accuracy gain occurs. Finally, we propose to scale the machine learning model to also analyze the performance of a larger range of vehicles.

13. APPENDIX:

Car Performance Prediction.ipbyn:

```
import numpy as np
import pandas as pd
import os, types
import pandas as pd
    from botocore.client import Config
import ibm_boto3

def __iter__(self): return 0

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It
# includes your credentials.
# You might want to remove those credentials before you share the
# notebook.
cos_client = ibm_boto3.client(service_name='s3',

    ibm_api_key_id='wdPOG7CvYRZxYt4sjm8d_Qv7Fzslp7NDy9yWfHWE
    xaSG',
    ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3.private.us.cloud-object-
    storage.appdomain.cloud')

bucket = 'machinelearningbasedvehicleperfor-donotdelete-pr-
eqbab3sfwyugyu'
object_key = 'car performance (1).csv'

body = cos_client.get_object(Bucket=bucket,Key=object_key)['Body']
# add missing __iter__ method, so pandas accepts body as file-like object
if not hasattr(body, "__iter__"): body.__iter__ = types.MethodType( __iter__, body )

datas = pd.read_csv(body)
    datas.head()
```

```

x=datas.iloc[:,1:8]
x
y=datas.iloc[:,0]
y
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test =
train_test_split(x,y,test_size=0.2,random_state=0
from sklearn.preprocessing import StandardScaler
sd=StandardScaler()
x_train=sd.fit_transform(x_train)
x_test=sd.fit_transform(x_test)
from sklearn.ensemble import RandomForestRegressor
d=RandomForestRegressor(n_estimators=30,random_state=0)
d.fit(x_train,y_train)
!pip install ibm_watson_machine_learning

from ibm_watson_machine_learning import APIClient
wml_credentials={
    "url":"https://us-south.ml.cloud.ibm.com",

    "apikey":"zDg62IPh9bpRQ06F0TDmtiqqDoQfoiv4z4tcu2RUY9fF"
}
client=APIClient(wml_credentials)
def guid_from_space_name(client,space_name):
    space=client.spaces.get_details()
    #print(space)
    return(next(item for item in space['resources'] if
item['entity']['name']==space_name)['metadata']['id'])
space_uid=guid_from_space_name(client,'models')
print("Space UID = "+ space_uid)
client.set.default_space(space_uid)
client.software_specifications.list()
software_spec_uid =
client.software_specifications.get_uid_by_name("runtime-22.1-py3.9")
software_spec_uid

model_details = client.repository.store_model(model=d,meta_props={
    client.repository.ModelMetaNames.NAME : "Model Building",

```

```
client.repository.ModelMetaNames.TYPE : "scikit-learn_1.0",
```

```
client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software  
_spec_uid }  
)
```

```
model_id = client.repository.get_model_uid(model_details)
```

```
model_id
```

```
#Prediction
```

```
y_pred=d.predict(x_test)
```

```
y_pred
```

```
from sklearn.metrics import r2_score
```

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

```
accuracy
```

```
import pickle
```

```
pickle.dump(d,open('regression.pkl','wb'))
```

```
x2=[[4,7,58,89,1000,568,70]]
```

```
y=d.predict(x2)
```

```
y
```

Sourcing end point.py:

```
import requests
```

```
# NOTE: you must manually set API_KEY below using information  
retrieved from your IBM Cloud account.
```

```
API_KEY = " 6Um4mZdaiEEL5HIQcUtfZPUwMjauxm0vA_sigkM1ZMrF"
```

```
token_response = requests.post('https://iam.cloud.ibm.com/identity/token',
```

```
data={"apikey":
```

```
API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
```

```
mltoken = token_response.json()["access_token"]
```

```
header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' +  
mltoken}
```

```
# NOTE: manually define and pass the array(s) of values to be scored in  
the next line
```

```
payload_scoring = {"input_data": [{"fields":
```

```
["Cylinders","Displacement","Horsepower","Weight","Acceleration","Mo
```

```
delYear","Origin"]], "values": [4,7,58,89,1000,568,70]]}]}
```

```
response_scoring = requests.post(https://us-  
south.ml.cloud.ibm.com/ml/v4/deployments/17588351-5478-4848-  
9747-cee50f78b2e1/predictions?version=2022-11-19,  
json=payload_scoring,  
headers={'Authorization': 'Bearer ' + mltoken})  
print("Scoring response")  
print(response_scoring.json())
```

Index.html:

```
<html>  
<head>  
<meta charset="ISO-8859-1">  
  
<style>  
  body{  
    background-size: cover;  
  }  
</style>  
</head>  
<body background="cars.jpg">  
  
<div align="center">  
  <h1>VEHICLE PERFORMANCE PREDICTION</h1>  
  
  <br><br><br>  
  <form action="output.html" method="get">  
    <table>  
      <tr>  
        <td><b>No of Cylinders:</b></td>  
        <td><input type="text" name="Cylinders" /></td>  
      </tr>  
      <tr>  
        <td><b>Enter Displacement:</b></td>  
        <td><input type="text" name="Displacement" /></td>  
      </tr>  
      <tr>  
        <td><b>Enter Horsepower:</b></td>  
        <td><input type="text" name="HorsePower" /></td>  
      </tr>  
      <tr>  
        <td><b>Weight:</b></td>  
        <td><input type="text" name="Weight" /></td>  
      </tr>  
      <tr>
```



```

        <td><b>Model Year:</b></td>
        <td><input type="text" name="Model" /></td>
    </tr>
    <tr>
        <td><b>Enter Origin:</b></td>
        <td><input type="text" name="Origin" /></td>
    </tr>

</table><br>

<input type="submit" value="PREDICT"/>

</form>
</div>

```

app.py:

```

from flask import Flask, request, Response, send_from_directory
import requests
import json
from flask_cors import CORS
import ibm_db

# NOTE: you must manually set API_KEY below using information
#       retrieved from your IBM Cloud account.
API_KEY = " 6Um4mZdaiEEL5HIQcUtfZPUwMjiauxm0vA_sigkM1ZMrF"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token',
    data={"apikey":
        API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' +
    mltoken}

# NOTE: manually define and pass the array(s) of values to be scored in
#       the next line
#payload_scoring = {"input_data": [{"fields":
    [ ["Cylinders", "Displacement", "Horsepower", "Weight", "Acceleration", "Mo
    delYear", "Origin"], "values": [4,7,58,89,1000,568,70]]}]

```

```
#API_KEY_NEW = 'https://us-  
south.ml.cloud.ibm.com/ml/v4/deployments/6ed70a51-2d98-4119-  
a5bf-eda733928a88/predictions?version=2022-11-17'
```

```
app=Flask(__name__)
```

```
@app.route('/health-check', methods=['GET'])  
def health_check_for_user():  
    return Response("Running")
```

```
@app.route('/get-key', methods=['GET'])  
def get_key():  
    API_KEY = "6Um4mZdaiEEL5HIQcUtfZPUwMjauxm0vA_sigkM1ZMrF"  
    token_response =  
    requests.post('https://iam.cloud.ibm.com/identity/token',  
data={"apikey":  
    API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})  
    mltoken = token_response.json()["access_token"]  
    return Response(mltoken)
```

```
@app.route('/get-users', methods=['GET'])  
def get_users():  
    return get_user()
```

```
@app.route('/get-performance', methods=['POST'])  
def get_performance_for_user():  
    print(request.args)  
    query = request.get_json()  
    print(query)  
    inp = query.get('inp')  
    payload_scoring = {"input_data": [{"field": ["cylinders", "displacement",  
"horsepower", "weight", "acceleration", "model year", "origin"]},  
"values": [  
    inp]]}]}
```

```

API_KEY = "6Um4mZdaiEEL5HIQcUtfZPUwMjauxm0vA_sigkM1ZMrF"
token_response =
requests.post('https://iam.cloud.ibm.com/identity/token',
data={"apikey":
API_KEY,
"grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json',
          'Authorization': 'Bearer ' + mltoken}
url = API_KEY_NEW
api_response = requests.post(url=url, json=payload_scoring,
headers=header)
return Response(api_response)

if __name__ == '__main__':
    app.run(debug=True)

```

GitHub & Project Demo Link:

[https://github.com/IBM-EPBL/IBM-Project-4655-1658737118/blob/main/DEMO%20VIDEO/Demo%20Video%20\(IBM\).webm](https://github.com/IBM-EPBL/IBM-Project-4655-1658737118/blob/main/DEMO%20VIDEO/Demo%20Video%20(IBM).webm)

