Car Resale Value Prediction

INDEX

1.INTRODUCTION

1.1 Project Overview:

- The user interacts with the UI (User Interface) to enter the input features.
- Entered input features are analyzed by the model which is integrated.
- Once the model analyzes the input, the prediction is showcased on the UI.

To accomplish this, we have to complete all the activities and tasks listed below

- Download the dataset.
- Pre process the data.
- Analyze the pre-processed data.
- Train the machine with preprocessed data using a machine learning algorithm.
- Save the model.
- Build a Web application using Flask and integrate with the model.

1.2 Purpose:

- The purpose of our project is to predict the depreciated value of the used car .This can enable the customers to make decisions on whether to buy the car or not .
- Due to the high pricing of new cars along with the incapability of customers to invest in them, second-hand car sales are on a global increase.
- A car resale value prediction system is required to effectively determi`ne the worthiness of the car using a variety of features.

- It is important to know their actual market value while both buying and selling.
- Having a fair estimate of the car’s worth is a sure shot way to get the best possible value for the old car.
- As a seller, he/she wants to get the maximum price but the aim is the opposite for the buyer or the car dealer. So, to become aware of such things should be given importance.
- Need to calculate resale value of the car with the help of the correct valuation tool to know the market price or what could be the market price of the vehicle.
- To negotiate with the dealer or seller with due diligence and end up in a profitable deal.
- Estimating the best price for the car.
- Getting insight into industry rates and trends.

2. LITERATURE SURVEY

2.1 Existing Problem:

Predicting the Price of Used Cars Using Machine Learning Techniques’ according to author Sameerchand Pudaruth they have done the predictions of car price from the historical data that has been collected from daily newspapers.Many other algorithms such as multiple linear regression, k- nearest neighbor algorithms , naïve based, and some decision tree algorithms also been used. All the four algorithms are compared and found the best algorithm for prediction. They have faced some difficulties in comparing the algorithms, somehow they have managed. According to author Pattabiraman, this paper is more concentrated on the relation between seller and buyer. In order to predict the price of four wheeler, more features are required such as already given price, mileage, make, model,trim, type, cylinder, liter, doors, cruise, sound, leather.Using these features the price of vehicle has been predicted with the help of statistical analysis system for exploratory data analysis. Accurately predicting the used car prices requires expert knowledge due to their nature of dependence on a variety of factors and features. Therefore, an efficient application or website built using an effective evaluation model to predict the resale value of the car is required.

2.2 References

- Sameerchand Pudaruth, “Predicting the Price of Used Cars using Machine Learning Techniques” ;(IJICT 2014).
- Enis Gegic, Becir Isakovic, Dino Keco, Zerina Masetic, Jasmin Kevric,” Car Price Prediction Using Machine Learning”; (TEM Journal 2019)
- Pattabiraman Venkatasubbu, Mukkesh Ganesh, ‘Used Cars Price Prediction using Supervised LearningTechniques’ (IJEAT) ISSN: 2249 – 8958, Volume-9 Issue-1S3, December 2019
- Noor, Kanwal, and Sadaqat Jan. "Vehicle price prediction system using machine learning

techniques." International Journal of Computer Applications 167, no. 9 (2017): 27-31.

2.3 Problem Statement Definition:

With difficult economic conditions, it is likely that sales of second-hand imported (reconditioned) cars and used cars will increase. In many developed countries, it is common to lease a car rather than buying it outright. Once the lease period is over, the buyer has the possibility to buy the car at its residual value, i.e., it's expected resale value. So, we need to predict a car's resale value based on minimal features like mileage, kilometers driven, condition of the car, etc. Thus, it is of commercial interest to sellers/financers to be able to predict the salvage value (residual value) of cars with accuracy.

Therefore we need an intelligent solution to predict the accurate resale value of the car and present it to the users in a web application.

3. IDEATION & PROPOSED SOLUTION

1. Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and Sunderstanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

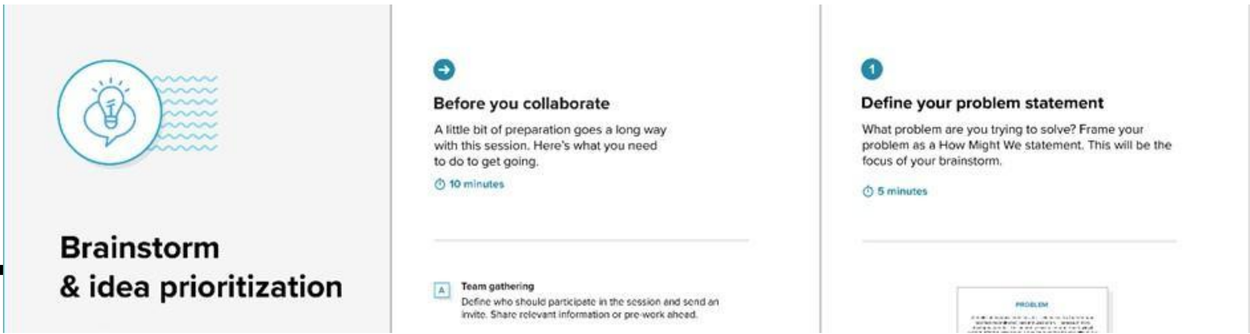
Think & Feel	Hear
● Varieties ● Condition ● Shows multiple options ● Fuel type ● User ● How long the car is used	● Best prediction ● Good initiative ● Demanding product

See ● Cost efficient ● Customer service ● Mileage	**Say & Do** ● More Secure ● Various Categories ● Feedback ● Easily predictable ● Commonly use ● Operate anywhere
Pain ● Physical Condition ● Location ● Time Consumption	**Gain** ● Reliable ● Budget-friendly ● Accuracy

2. Ideation & Brainstorming

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

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



Brainstorm & idea prioritization

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

A Team gathering

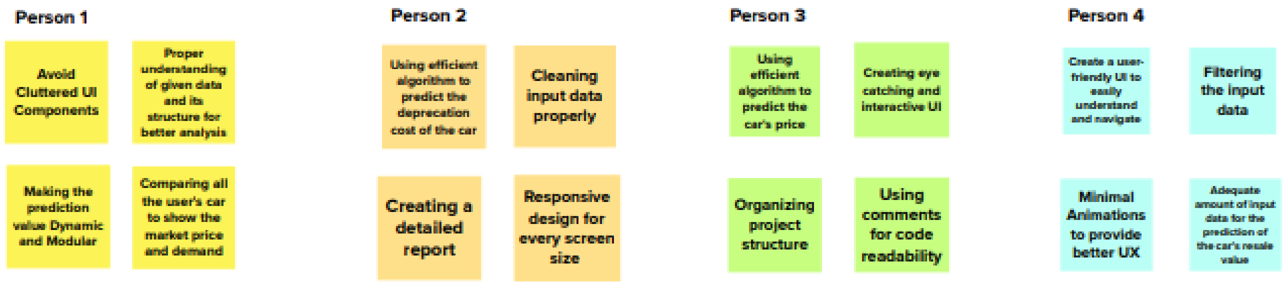
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

1 Define your problem statement

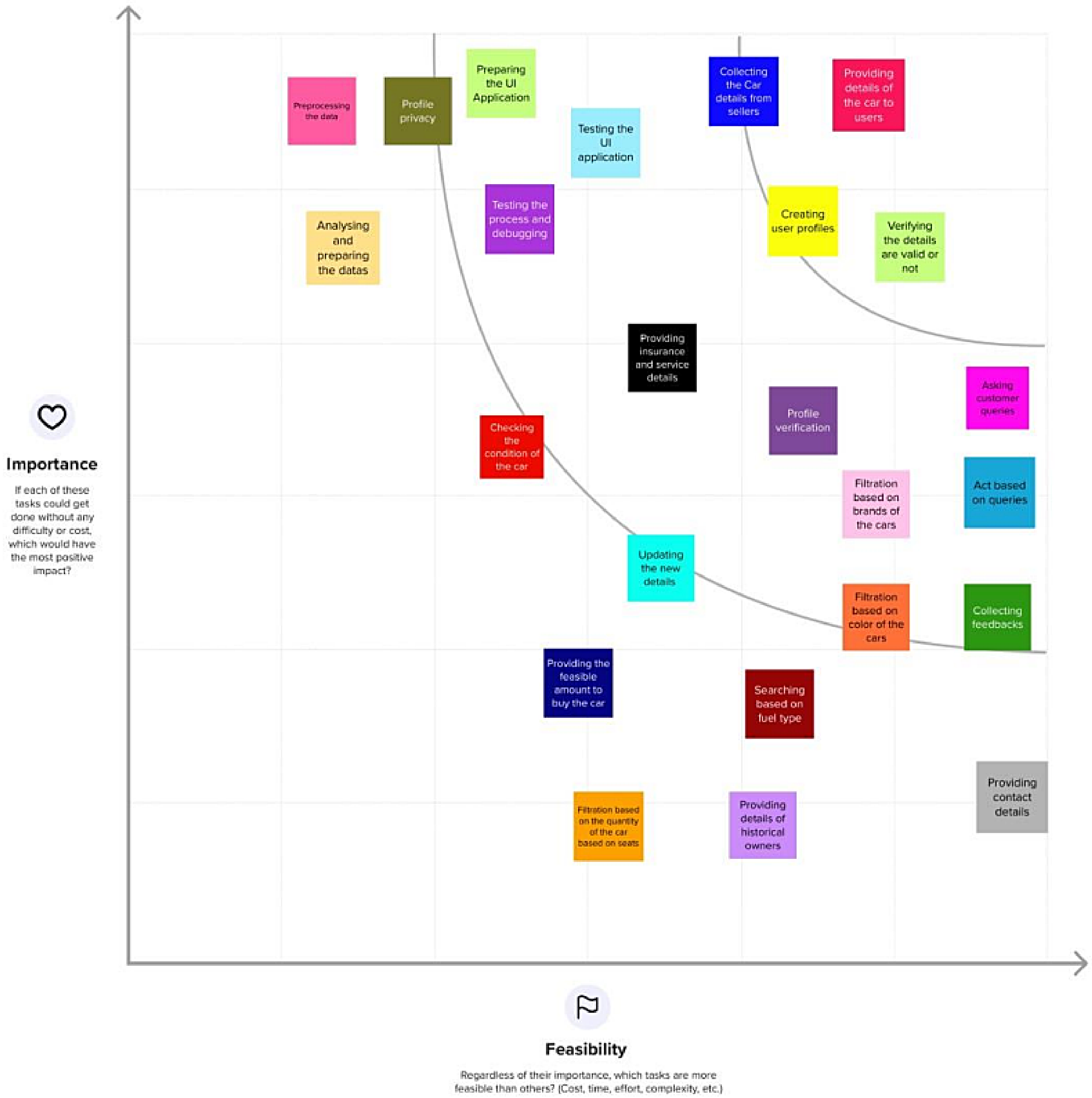
What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

Step-2: Brainstorm, Idea Listing and Grouping


Person 1
Avoid Cluttered UI Components
Proper understanding of given data and its structure for better analysis
Making the prediction value Dynamic and Modular
Comparing all the user's car to show the market price and demand
Person 2
Using efficient algorithm to predict the deprecation cost of the car
Cleaning input data properly
Creating a detailed report
Responsive design for every screen size
Person 3
Using efficient algorithm to predict the car's price
Creating eye catching and interactive UI
Organizing project structure
Using comments for code readability
Person 4
Create a user-friendly UI to easily understand and navigate
Filtering the input data
Minimal Animations to provide better UX
Adequate amount of input data for the prediction of the car's resale value

Step-3: Idea Prioritization



3. Proposed Solution

S.No	Parameter	Description

1.	Problem Statement (Problem to be solved)	**Car Resale Value Prediction** With difficult economic conditions, it is likely that sales of second-hand imported (reconditioned) cars and used cars will increase. In many developed countries, it is common to lease a car rather than buying it outright. Once the lease period is over, the buyer has the possibility to buy the car at its residual value, i.e., it's expected resale value. So, we need to predict a car's resale value based on minimal features like mileage, kilometers driven, condition of the car, etc. Thus, it is of commercial interest to sellers/financiers to be able to predict the salvage value (residual value) of cars with accuracy
2.	Idea / Solution description	Our main idea for predicting a car's resale value is to have a dynamic and most fitting algorithm that analyzes the vehicle type, model, fuel type, kilometers driven, etc., which generates an approximate market price of the car.Considering the main factors which would affect the resale value of a car, the machine learning model has been trained to give the nearest resale value of the car.The machine learning model that we have used is Random Forest Regression.
3.	Novelty / Uniqueness	We generate a detailed report that assists the buyer with the best practices to maintain a car and also produces an approximate schedule for the vehicle's maintenance.
4.	Social Impact / Customer Satisfaction	Usage of second-hand cars reduces the impact on the environment. It also speaks about the demand of the cars in the market and generates a report for the same..
5.	Business Model (Revenue Model)	We can monetize and run the advertisements on our platform which acts as a revenue stream. Based on the buyer's needs, we recommend a seller's car for a price.
6.	Scalability of the Solution	Our project focuses on handling multiple users and data simultaneously which can be attained with the help of IBM Cloud.

4. **Problem Solution fit**

The sales of second-hand imported cars and used cars is increasing nowadays. Predicting the price of used cars is an important and interesting problem. Predicting the resale value of a car is not an easy task. It is trite knowledge that the value of used cars depends on some factors. The value of a car drops right from the moment it is bought and the depreciation continues with each passing year. In fact, in the first year itself, the value of a car decreases by 20 percent of its initial value. The make and model of a car, total kilometers driven, overall condition of the car and various other factors further affect the car’s resale value. So, it is necessary to build a model and design an application or website to estimate the price of used cars. The model should take car related parameters and output a selling price of the car. The selling price of a used car depends on certain features as mentioned below:

- Fuel Type
- Manufacturing Year
- Miles Driven
- Number of Historical Owners
- Maintenance Record, etc.,

4. REQUIREMENTS

1. Functional Requirements:

Functional requirements are product features or functions that developers must implement to enable users to accomplish their tasks. So, it’s important to make them clear both for the development team and the stakeholders. Generally, functional requirements describe system behavior under specific conditions. A typical functional requirement will contain a unique name and number, a summary, and a rationale. This information is used to help the reader understand why the requirement is needed, and to track the requirement through the development of the system. The crux of the requirement is the description of the required behavior, which must be clear and readable. The described behavior may come from organizational or business rules, or it may be discovered through elicitation sessions with users, stakeholders, and other experts within the organization.Many requirements may be uncovered during the use case development. When this happens, the requirements analyst may create a placeholder requirement with a name and summary, and research the details later, to be filled in when they are better known.

Following are the functional requirements of the proposed solution

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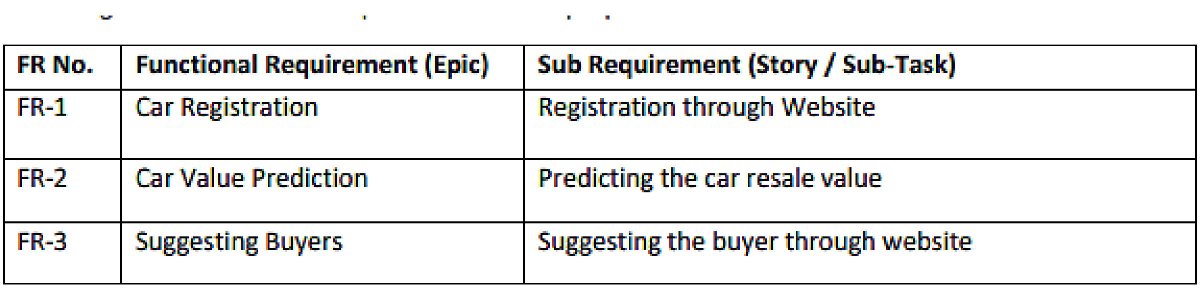


FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Car Registration	Registration through Website
FR-2	Car Value Prediction	Predicting the car resale value
FR-3	Suggesting Buyers	Suggesting the buyer through website

4.2 Non Functional Requirements:

Non-Functional Requirements are the constraints or the requirements imposed on the system. They specify the quality attribute of the software. Non-Functional Requirements deal with issues like scalability, maintainability, performance, portability, security, reliability, and many more. Non-Functional Requirements address vital issues of quality for software systems. If NFRs not addressed properly, the results can include:

- Users, clients, and developers are unsatisfied.
- Inconsistent software.
- Time and cost overrun to fix the software which was prepared without keeping NFRs in mind.

Following are the non-functional requirements of the proposed solution.

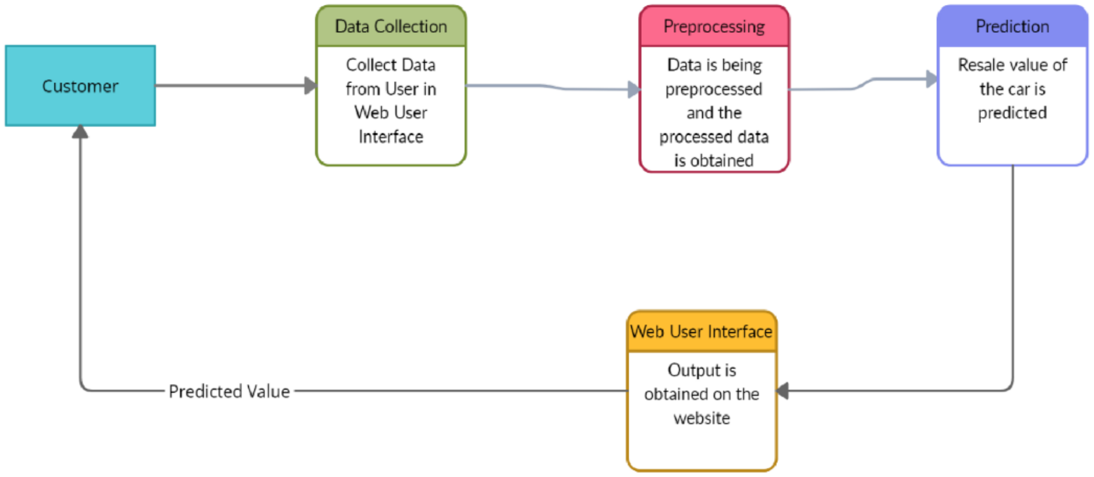
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Predicting the car's resale value
NFR-2	Security	Providing base level security for website
NFR-3	Reliability	Public can access the website 99% of the time without failure.
NFR-4	Performance	Enhancing performance by using efficient machine learning algorithm
NFR-5	Recoverability	If a major incident happens on the website, the business must take measures to go back to being fully operational within three days.
NFR-6	Security	No bots must access the website.

5. PROJECT DESIGN

5.1 Data Flow Diagrams

A data flow diagram (DFD) maps out the flow of information for any process or system. It uses defined symbols like rectangles, circles and arrows, plus short text labels, to show data inputs, outputs, storage points and the routes between each destination. Data flowcharts can range from simple, even hand-drawn process overviews, to in-depth, multi-level DFDs that dig progressively deeper into how the data is handled. They can be used to analyze an existing system or model a new one. Like all the best diagrams and charts, a DFD can often visually “say” things that would be hard to explain in words, and they work for both technical and nontechnical audiences, from developer to CEO. That’s why DFDs remain so popular after all these years. While they work well for data flow software and systems, they are less applicable nowadays to visualizing interactive, real-time or database-oriented software or systems.

Data flow diagram for the project:

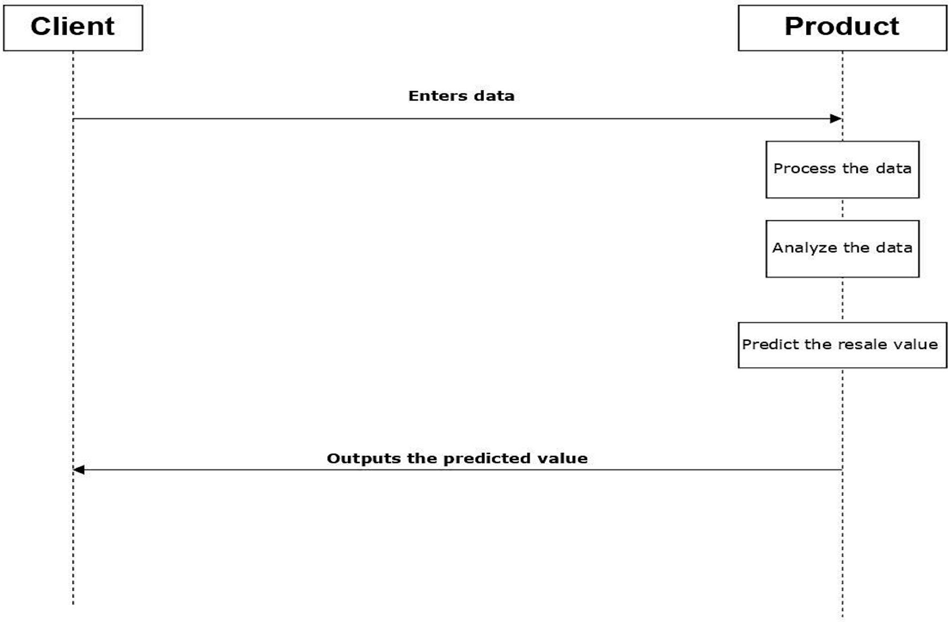

Customer
Data Collection
Collect Data from User in Web User Interface
Preprocessing
Data is being preprocessed and the processed data is obtained
Prediction
Resale value of the car is predicted
Web User Interface
Output is obtained on the website
Predicted Value

5.2 Solution and Technical Architecture:

Solution Architecture:

Solution Architecture is an architectural description of a specific solution. It is the practice of designing, describing, and managing solution engineering to match its specific business problems. It comprises subprocesses that draw guidance from various enterprise architecture viewpoints. Solution Architecture is the initial step taken when an organization aims to create a set of enterprise solutions, applications and processes that integrate with each other in order to address specific needs and requirements and that often lead to software architecture and technical architecture work.

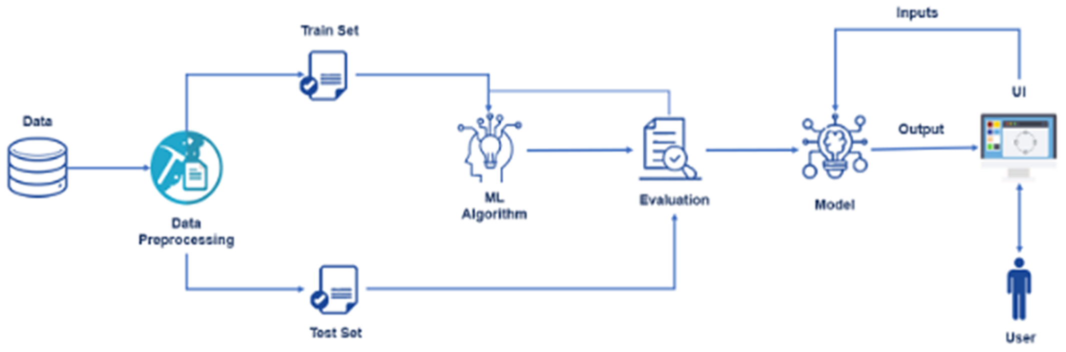
CAR RESALE VALUE PREDICTION



Technical Architecture:

Technical architecture—which is also often referred to as application architecture, IT architecture, business architecture, etc.—refers to creating a structured software solution that will meet the business needs and expectations while providing a strong technical plan for the growth of the software application through its lifetime. IT architecture is equally important to the business team and the information technology team.

Technical architecture includes the major components of the system, their relationships, and the contracts that define the interactions between the components. The goal of technical architects is to achieve all the business needs with an application that is optimized for both performance and security. The technical architecture of the proposed project is as follows:



5.3 User Stories

A user story is an informal, general explanation of a software feature written from the perspective of the end user. Its purpose is to articulate how a software feature will provide value to the customer. A user story is the smallest unit of work in an agile framework. It’s an end goal, not a feature, expressed from the software user’s perspective.

A user story is an informal, general explanation of a software feature written from the perspective of the end user or customer. The purpose of a user story is to articulate how a piece of work will deliver a particular value back to the customer. The user story for the project is as follows:

User Type	Functional Requirementst (Epic)	User Story Number	User Story / Task	Acceptance criteria
Customer (Web user)	Welcome Page	USN-1	Welcome page for the user	I can enter the value in a text box.
Customer (Web user)	Input page	USN-2	As a user, I Should be able to give input	I can enter the value in a text box
Customer (Web user)	Data pre-processing	USN-3	Processing the raw data for prediction	I can do by selecting the options in dropdown

Customer (Web user)	Model Building for prediction	USN-4	Building model for accurate price prediction	I can do it by clicking the submit button.
Customer (Web user)	Integrate the with Flask	USN-5	The model needs to be integrated with front end	I can save the details entered and the value in a pdf
Customer (Web user)	Train the model 18M Watson	USN-6	Model needs to be trained for accurate prediction	I can view all the required elements clearly

6. PROJECT PLANNING & SCHEDULING

1. Sprint Planning and Estimation

Sprint planning is an event in scrum that kicks off the sprint. The purpose of sprint planning is to define what can be delivered in the sprint and how that work will be achieved. Sprint planning is done in collaboration with the whole scrum team. In scrum, the sprint is a set period where all the work is done. However, before you can leap into action you have to set up the sprint. You need to decide on how long the time box is going to be, the sprint goal, and where you're going to start. The sprint planning session kicks off the sprint by setting the agenda and focus. If done correctly, it also creates an environment where the team is motivated, challenged, and can be successful. Bad sprint plans can derail the team by setting unrealistic expectations.

The following is the sprint planning and estimation for the project

Release	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Story Points**	**Priority**
Sprint-1	Welcome Page	USN-1	Welcome page for the us	20	Medium
Sprint-2	Input page	USN-2	As a user, I Should be able to give input	10	High

Sprint-2	Data pre-processing	USN-3	Processing the raw data for prediction	10	High
Sprint-3	Model Building for prediction	USN-4	Building model for accurate price prediction	10	High
Sprint-3	Integrate the model with Flask	USN-5	Model needs to be trained for accurate prediction	10	High
Sprint-4	Train the model IBM Watson	USN-6	Model needs to be trained for accurate prediction	20	High

2. **Sprint Delivery Schedule**

Since sprints take place over a fixed period of time, it’s critical to avoid wasting time during planning and development. And this is precisely where sprint scheduling enters the equation.In case you’re unfamiliar, a sprint schedule is a document that outlines sprint planning from end to end. It’s one of the first steps in the agile sprint planning process—and something that requires adequate research, planning, and communication.

Sprint Delivery Schedule for the proposed solution:

Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date (Planned)**
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022

7. CODING & SOLUTIONING

7.1 FEATURE 1

This is a supervised learning problem and can be solved using regression techniques. We need to predict the selling price of a car based on the given car's features. Supervised Regression problems require labeled data where our target or dependent variable is the selling price of a car.All other features are independent variables.

Linear Models are less complex and explainable, but linear models perform poorly on data containing the outliers. Linear models fail to perform well on non-linear datasets. In such cases, non-linear regression algorithms Random Forest Regressor perform better in fitting the nonlinear data.

This model was hence chosen to account for the many features in the dataset and compare a bagging technique with the following gradient boosting methods.

7.2 FEATURE 2

Given the evaluation parameters the Random Forest Regressor outperformed as it has the highest accuracy as well as the lowest error in all three valuation parameters. As a result of preprocessing and transformation, Random Forest Regressor came out with 90% accuracy.

8. TESTING

1. TEST CASES

- **Missing values**

The trained ML model requires few feature inputs for predicting the output. Failing which, the model throws invalid Input error. All the fields in the html form have been marked required using CSS and thus the user must input all fields.

- **Invalid Input**

The trained ML model requires only numerical input for all features. Thus, if the user uses symbols such as a comma while inputting, the model may throw an error. To overcome the same, preprocessing script is deployed in the backend which removes all unwanted characters like comma, whitespaces etc. so that model gets required input.

8.2 USER ACCEPTANCE TESTING

Acceptance testing focuses even more on the overall system features and functionality that are visible to the customer. Acceptance testing is often performed by customers to ensure customer usability and satisfaction. The purpose of this 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).

1. **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	10	4	2	3	19
Duplicate	1	0	1	0	2
External	2	1	0	2	5
Fixed	13	2	2	20	37
Not Reproduced	0	0	1	1	2
Skipped	0	0	0	0	0
Won’t fix	0	0	0	0	0
Totals	26	7	7	26	65

2. **Test Case Analysis**

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

Section	Test Case	Not Tested	Fail	Pass
Print Engine	5	0	0	5
Client Application	13	0	0	13
Security	2	0	0	2
Outsource Shipping	4	0	0	4
Exception Reporting	6	0	0	6
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. RESULTS

9.1 PERFORMANCE METRICS

Performance metrics are used to track progress. Metrics give some sort of concrete answer which easily can be followed up. There are different types of metrics used for testing.

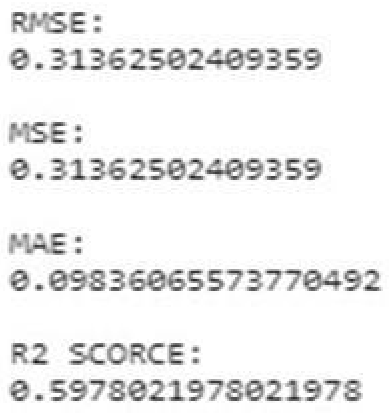
The regression model can be evaluated on following parameters:

Regression Model:

1. Mean Square Error (MSE): MSE is the single value that provides information about the goodness of regression line. Smaller the MSE value, better the fit because smaller value implies smaller magnitude of errors.

2. Root Mean Square Error (RMSE): RMSE is the quadratic scoring rule that also measures the average magnitude of the error. It is the square root of average squared difference between prediction and actual observation.

3. Mean Absolute Error (MAE): This measure represents the average absolute difference between the actual and predicted values in the dataset. It represents the average residual from the dataset.



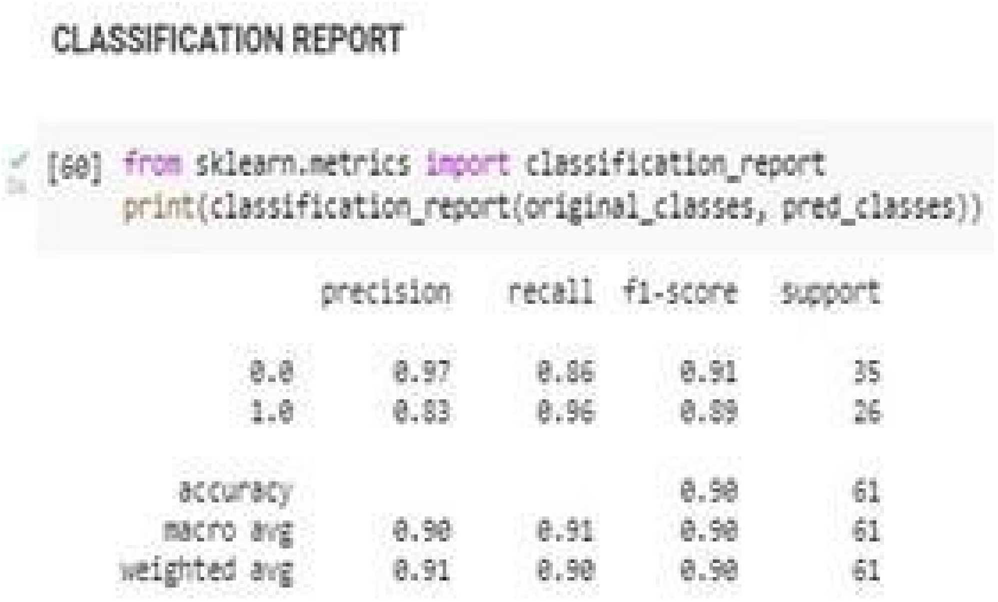
```
RMSE:
0.31362502409359

MSE:
0.31362502409359

MAE:
0.09836065573770492

R2 SCORCE:
0.5978021978021978
```

Regression Model: Report



CLASSIFICATION REPORT

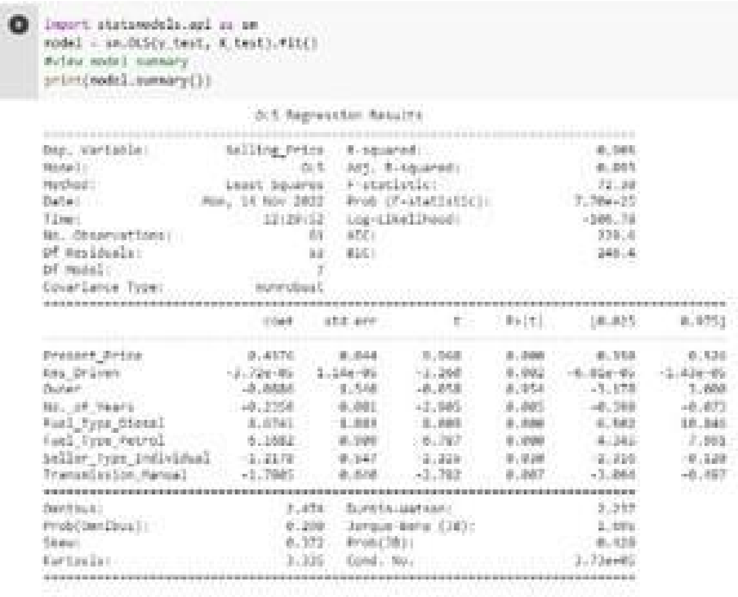
```
[60] from sklearn.metrics import classification_report
     print(classification_report(original_classes, pred_classes))
```

```
              precision    recall  f1-score   support

         0.0       0.97      0.86      0.91        35
         1.0       0.83      0.96      0.89        26

    accuracy                           0.90        61
   macro avg       0.90      0.91      0.90        61
weighted avg       0.91      0.90      0.90        61
```

Model Summary



```
import statsmodels.api as sm
model = sm.OLS(y_test, X_test).fit()
#view model summary
print(model.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:          Selling_Price   R-squared:                       0.905
Model:                            OLS   Adj. R-squared:                  0.895
Method:                 Least Squares   F-statistic:                     72.30
Date:                Mon, 14 Nov 2022   Prob (F-statistic):           7.70e-25
Time:                        12:29:12   Log-Likelihood:                -105.78
No. Observations:                  61   AIC:                             228.4
Df Residuals:                      53   BIC:                             245.4
Df Model:                           7
Covariance Type:            nonrobust
==========================================================================================
                             coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------
Present_Price              0.4576      0.044      9.568      0.000       0.358       0.526
Kms_Driven             -3.72e-05   1.14e-05     -1.260      0.002   -6.02e-05   -1.42e-05
Owner                     -0.0880      1.540     -0.058      0.954      -3.178       3.000
No._of_Years              -0.2350      0.081     -2.905      0.005      -0.398      -0.073
Fuel_Type_Diesel           8.6761      1.083      8.009      0.000       6.502      10.846
Fuel_Type_Petrol           5.1082      0.709      6.787      0.000       4.241       7.903
Seller_Type_Individual    -1.2170      0.547      2.224      0.030      -2.316      -0.120
Transmission_Manual       -1.7065      0.648     -2.702      0.007      -3.064      -0.497
==============================================================================
Omnibus:                        3.456   Durbin-Watson:                   2.257
Prob(Omnibus):                  0.200   Jarque-Bera (JB):                2.095
Skew:                           0.373   Prob(JB):                        0.428
Kurtosis:                       3.335   Cond. No.                     3.72e+05
==============================================================================
```

10. ADVANTAGES AND DISADVANTAGES

Advantages:

- Accuracy of our model is 90%.
- Prediction runs for different types of cars

Disadvantages:

- Accuracy can be improved.
- Prediction is done using only a few criteria.

11. CONCLUSION

We started with understanding the use case of machine learning in the Automotive industry and how machine learning has transformed the driving experience. We build a Random Forest Regression model to predict the resale value of a used car. Finally, we evaluated the performance of the model using the R squared score and Residual Plot.

We could have also used simpler regression algorithms like Linear Regression and Lasso Regression. Still, we need to make sure there are no outliers in the dataset before implementing them. Pair plots and scatter plots help visualize the outliers.

Then we have used a Flask application to display the predicted value to the users based on their corresponding input. This car resale value prediction can be used by the public to estimate the resale value of the car.

12. FUTURE SCOPE

Only few features are used to predict resale value of the car. This can be extended to more features. One can also implement CNN to determine physical condition of the car from images like identifying dents, scratches etc. and thus predicting more relevant resale value of a car.

For better performance, we plan to judiciously design deep learning network structures, use adaptive learning rates and train on clusters of data rather than the whole dataset. To correct for over fitting inRandom Forest, different selections of features and number of trees will be tested to check for change in performance.

13. APPENDIX

Source code:

- **app.py**

```
from flask import Flask,render_template,request,url_for,
   redirect

import os

import pandas as pd

import numpy as np

import flask

import pickle

app = Flask(__name__)


@app.route('/')

def home_page():

return render_template('index.html')


@app.route('/input', methods =["GET","POST"])

def input_page():

    return render_template('input.html')
```

```
@app.route('/dosubmit',methods=
["GET","POST"])
def dosubmit():
    if request.method == 'POST':


     abtest = int(request.form['abtest'])
     vehicletype = int(request.form.get('vehicle'))
     regyear = int(request.form['reg_year'])
     gearbox = int(request.form['gearBox'])
     powerps = float(request.form['power_ps'])
     kms = float(request.form['kilometer_driven'])
     regmonth = int(request.form.get('reg_month'))
     fuelType = int (request.form.get('fuel'))     brand =
    int (request.form.get('brand'))
     damage = int (request.form[ 'carDamage'])
     to_predict_list =
    [[abtest,vehicletype,regyear,gearbox,powerps,kms,re
    gmonth,fuelType,brand,damage]]
     loaded_model =
    pickle.load(open("finalmodel.pkl","rb"))
     result = loaded_model.predict(to_predict_list)
     ans = round(result[0],2)
     prediction = str(ans)
    return redirect(url_for('output_page',output_res =
    prediction))
@app.route('/output' ,methods = ["GET","POST"])
def output_page():
    output_res  = request.args.get('output_res')

    return render_template('output.html', prediction =
    output_res)

if __name__ == '__main__':

    app.run()
```

main.css

```
* {

  margin: 0;

  padding: 0;

  box-sizing: border-box;}

h1 {

  text-align: center;

}

body {

  background-image: linear-gradient(120deg, #a6c0fe
    0%, #f68084 100%);

  height: 100vh;

  display: flex;

  flex-direction: column;

  align-items: center;

}

.center {

  height: 75vh;

  width: 45vw;

}

    .fillDetails {
```

```
  padding: 25px;
}
    .outerFlex {
  display: flex;
  flex-direction: column;
  justify-content: space-around;
  align-items: center;
  width: 45vw;
  height: 75vh;
}
    .flexUnit {
  width: 100%;
  display: flex;
  flex-direction: row;
  margin-top: 10px;
  justify-content: space-between;
  align-items: center;
}
    .spaceAround {
  margin-left: 30px;
}
.submitButton {
  background: #FF8787;
  border-radius: 00.3rem;
  padding: 6px 10px;
```

```
   font-weight: 700;

   transition: all 0.3s;

  }

    .submitButton:hover {

   background: #E26868;

   cursor: pointer;

  }

    label {

   font-size: 24px;

  }

    input,

  select {

   font-size: 20px; }
```

- **index.html**

```
<!DOCTYPE html>

<html lang="en">

<head>

    <meta charset="UTF-8">

    <meta http-equiv="X-UA-Compatible" content="IE=edge">

    <meta name="viewport" content="width=device-width, initial-scale=1.0">

    <title>Document</title>

    <link rel="stylesheet" href="{{url_for('static',filename='css/main.css')}}">

</head>
```

```
<style>

    .center {

        margin: auto;

        width: 50%;

        text-align: center;

        padding: 10px;

    }

    .center {

        margin: 0;

        position: absolute;

        top: 30%;

        left: 50%;

        transform: translate(-50%, -50%);

    }

    .submit {

        background: #FF8787;

        border-radius: 00.3rem;

        font-weight: 700;

        transition: all 0.3s;
    }

    .p {

        margin: 10vh;

    }

</style>

<body>

    <h1>Car Resale Price Prediction </h1>

  <h2>Welcome</h2>

    <div class=center>

        <form >

            <div class="p">

                    <p>With difficult economic conditions, it is likely that sales of second-hand imported

                        (reconditioned) cars and used cars will increase.

                        In many developed countries, it is common to lease a car rather than buying it outright.


                        After the lease period is over, the buyer has the possibility to

                        buy the car at its residual value, i.e. its expected resale value. Thus, it is of commercial

                        interest to sellers/financier to be able to predict the salvage

                        value (residual value) of cars with accuracy.

                    </p>

                    <p>

                        In order to predict the resale value of the car, we proposed an intelligent, flexible, and

                        effective system that is based on using regression algorithms.
```

```
                Considering the main factors which would affect the resale value of a vehicle a regression
                model to be built that would give the nearest resale value of the vehicle.
                We will be using various regression algorithms and algorithm with the best accuracy will
                be
                taken as a solution,
                then it will be integrated to the web-based application
                where the user is notified with the status of his product.
              </p>
          </div>
          <button class="submitButton"><a href="{{url_for('input_page')}}">Proceed</a></button>

      </div>

      </div>

      </div>  </div></body></html>
```

- **intput.css**

```
* {

  margin: 0;

  padding: 0;

  box-sizing: border-box;

}

h1 {
  text-align: center;

}

body {

  background-image: linear-gradient(120deg, #a6c0fe 0%, #f68084 100%);

  height: 100vh;

  display: flex;

  flex-direction: column;

  align-items: center;

}


.center {

  height: 75vh;

  width: 45vw;

}

.fillDetails {

  padding: 25px;

}

.outerFlex {

  display: flex;

  flex-direction: column;
  justify-content: space-around;

  align-items: center;

  width: 45vw;

  height: 75vh;

}

.flexUnit {

  width: 100%;

  display: flex;

  flex-direction: row;

  margin-top: 10px;

  justify-content: space-between;

  align-items: center;

}

.spaceAround {

  margin-left: 30px;

}

.submitButton {

  background: #FF8787;

  border-radius: 00.3rem;
  padding: 6px 10px;

  font-weight: 700;

  transition: all 0.3s;

}

.submitButton:hover {

background: #E26868;

  cursor: pointer;

}

label {

  font-size: 24px;

}

input,

select {

  font-size: 20px;

}
```

- **input.html**

```
<!DOCTYPE html>

<html lang="en">

<head>
```

```
  <meta charset="UTF-8" />
  <meta http-equiv="X-UA-Compatible" content="IE=edge" />
  <meta name="viewport" content="width=device-width, initial-scale=1.0" />
  <title>input</title>
  <link rel="stylesheet" href="{{url_for('static',filename='css/input.css')}}" />
</head>
<body>
  <h1 class="fillDetails">
    <center>Please fill the details of your car:</center>
  </h1>
  <div class="center">
    <form action="/dosubmit" method='post'>
      <div class="outerFlex">
        <div class="flexUnit">
          <label for="abtest">AB Test :</label>
          <div>
            <input type="radio" name="abtest" id="test" value="0" />
            <label for="test" for="abtest">Test</label>
            <input type="radio" name="abtest" id="control" value="1" />
    <label for="control" for="abtest">Control</label>

  </div>

</div>

<div class="flexUnit">

  <label for="vehicle">Choose Vehicle Type :</label>

  <select name="vehicle">

    <option value="0">Coupe</option>

    <option value="1">SUV</option>

    <option value="2">Kleinwagen</option>

    <option value="3">Limousine</option>

    <option value="4">Cabrio</option>

    <option value="5">Bus</option>

    <option value="6">Kombi</option>

    <option value="7">Others</option>

  </select>

</div>


<div class="flexUnit">

  <label for="">Reg Year :</label><input type="number" min="1970" name="reg_year" />

</div>
```

```
        <div class="flexUnit">
          <label for="gearBox">Gear Box Type :</label>
          <div>
            <input type="radio" id="manual" name="gearBox" value="0" />
            <label for="manual">Manual</label>
            <input type="radio" id="automatic" name="gearBox" value="1" />
            <label for="automatic">Automatic</label>
          </div>
        </div>
        <div class="flexUnit">
          <label for="">Power of car in PS :</label><input type="number" min="0" name="power_ps"
/>
        </div>
        <div class="flexUnit">
          <label for="">Kilometer the car has driven:</label><input type="number" min="0"
name="kilometer_driven" />
        </div>

        <div class="flexUnit">
          <label for="">Reg Month :</label><input type="number" min="1" max="12"
name="reg_month" />
```

```
</div>
<div class="flexUnit">
  <label for="fuel">Choose Fuel Type :</label>
  <div>
    <select name="fuel">
      <option value="0">Diesel</option>
      <option value="1">Benzene</option>
      <option value="2">LPG</option>
      <option value="4">Hybrid</option>
      <option value="5">CNG</option>
      <option value="6">Elektro</option>
      <option value="3">Others</option>
    </select>
    <br />
  </div>
</div>

<div class="flexUnit">
  <label for="brand">Choose the brand of the Car :</label>
  <div>
```

```
<select name="brand">

  <option value="0">Alfa Romeo</option>

  <option value="1">Audi</option>

  <option value="2">BMW</option>

  <option value="3">Chevrolet</option>

  <option value="4">Chrysler</option>

  <option value="5">Citroen</option>

  <option value="6">Dacia</option>

  <option value="7">Daewoo</option>

  <option value="8">Daihatsu</option>

  <option value="9">Fiat</option>

  <option value="10">Ford</option>

  <option value="11">Honda</option>

  <option value="12">Hyundai</option>

  <option value="13">Jaguar</option>

  <option value="14">Jeep</option>

  <option value="15">Kia</option>

  <option value="16">Lada</option>

  <option value="17">Lancia</option>
```

```
<option value="18">Land Rover</option>

<option value="19">Mazda</option>

<option value="20">Mercedes Benz</option>

<option value="21">Mini</option>

<option value="22">Mitsubishi</option>

<option value="23">Nissan</option>

<option value="24">Opel</option>

<option value="25">Peugeot</option>

<option value="26">Porsche</option>

<option value="27">Renault</option>

<option value="28">Rover</option>

<option value="29">Saab</option>

<option value="30">Seat</option>

<option value="31">Skoda</option>

<option value="32">Smart</option>

<option value="33">Sonstige Autos</option>

<option value="34">Subaru</option>

<option value="35">Suzuki</option>

<option value="36">Toyota</option>
```

```
        <option value="37">Trabant</option>
        <option value="38">Volkswagen</option>
        <option value="39">Volvo</option>
      </select>
    </div>
  </div>
  <div class="flexUnit">
    <div>
      <label for="carDamage">Is your car damaged :</label>
    </div>
    <div>
      <input type="radio" id="yes" name="carDamage" value="1" />
      <label for="yes">Yes</label>
      <input type="radio" id="no" name="carDamage" value="0" />
      <label for="no">No</label>
    </div>
  </div>
  <button class="submitButton">Predict</button>
</div></form>
```

```
            </div>

          </body>

          </html>
```

output.css

```
* {

   margin: 0;

   padding: 0;

}

body {

   background-image: linear-gradient(120deg, #a6c0fe 0%, #f68084 100%);

   background-repeat: no-repeat

}

.container {

   height: 100vh;

   width: 100vw;

   display: flex;

   flex-direction: column;

   justify-content: space-around;

   align-items: center;
}

.flex {

    height: 40vh;

    width: 70vw;

    display: flex;

    flex-direction: column;

    justify-content: space-around;

    align-items: center;

}

.textB {

    font-size: 34px;

    font-weight: 700;

}

.textS {

    font-size: 26px;

    text-align: center;

}
```

- **output..html**

```
<!doctype html>
```

```
<html>
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Document</title>
    <link rel="stylesheet" href="{{url_for('static',filename='css/output.css')}}">
</head>
<body>
    <div class="container">
        <div class="flex">
            <div class="textB"> The estimated price of your car is {{ prediction }}</div>
            <div class="textS">The price of any car over the years depreciates and is dependent upon various factors that
                determine the
                resale
                value of the car. These factors range from year of purchase, make, model, kilometers driven and overall
                condition of the car. Used car valuation incorporates all these factors into the pricing model that
                takes
                into

                account data from millions of buyers & sellers of used cars to determine the most accurate price
range

                for

                your

                car.

            </div>

        </div>

    </div>

</body>

</html>
```

Github source link:

https://drive.google.com/file/d/1_tjWxvSvswe2tdEDxFh7-ppuuIsVE_cw/view

Github source link:

https://github.com/IBM-EPBL/IBM-Project-1739-1658411133

Video link:

https://drive.google.com/file/d/1qmbY81gmyconn7pDTzo9-xA-PIEzBsgk/view