

PROFESSIONAL READINESS FOR INNOVATION
, EMPLOYABILITY AND ENTREPRENEURSHIP

PROJECT REPORT

TITLE : CAR RESALE VALUE PREDICTION

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Project Report Format

1. **INTRODUCTION**
 - 1.1 Project Overview
 - 1.2 Purpose
2. **LITERATURE SURVEY**
 - 2.1 Existing problem
 - 2.2 References
 - 2.3 Problem Statement Definition
3. **IDEATION & PROPOSED SOLUTION**
 - 3.1 Empathy Map Canvas
 - 3.2 Ideation & Brainstorming
 - 3.3 Proposed Solution
 - 3.4 Problem Solution fit
4. **REQUIREMENT ANALYSIS**
 - 4.1 Functional requirement
 - 4.2 Non-Functional requirements
5. **PROJECT DESIGN**
 - 5.1 Data Flow Diagrams
 - 5.2 Solution & Technical Architecture
 - 5.3 User Stories
6. **PROJECT PLANNING & SCHEDULING**
 - 6.1 Sprint Planning & Estimation
 - 6.2 Sprint Delivery Schedule
 - 6.3 Reports from JIRA
7. **CODING & SOLUTIONING (Explain the features added in the project along with code)**
 - 7.1 Home Page
 - 7.2 Data Entry Page
 - 7.3 Output Display Page
 - 7.4 Model Selection & Hyperparameter Tuning
 - 7.5 Flask Integration
8. **TESTING**
 - 8.1 Test Cases
 - 8.2 User Acceptance Testing
9. **RESULTS**
 - 9.1 Performance Metrics
10. **ADVANTAGES & DISADVANTAGES**
11. **CONCLUSION**
12. **FUTURE SCOPE**

13. APPENDIX

Source Code

GitHub & Project Demo Link

1.INTRODUCTION

1.1 Project Overview

This system “Car Resale Value Prediction” aims to build a regression model to predict used cars' resale value based on multiple aspects, including vehicle mileage, year of manufacturing, fuel consumption, transmission, road tax, fuel type, and engine size. This model can benefit sellers, buyers, and car manufacturers in the used cars market. Upon completion, it can output a relatively accurate price prediction based on the information that user’s input. Various regression methods, including linear regression, polynomial regression, support vector regression, decision tree regression, and random forest regression, were applied in the research to achieve the highest accuracy.

This system was implemented as a web application where the user enters the details of the car to get an estimation of the car’s resale value.

1.2 Purpose

Car resale value prediction helps the user to predict the resale value of the car depending upon various features like kilometers driven, fuel type, etc. The purpose of this system is of commercial interest to sellers/financer to be able to predict the resale value of cars with better accuracy. The most essential elements for forecast are brand and model, period use of vehicle, mileage of vehicle, gear type and fuel type utilized in the vehicle just as fuel utilization per mile profoundly influences cost of a vehicle because of continuous changes in the cost of a fuel. In view of the differing highlights and factors, and furthermore with the assistance of master information the vehicle resale value forecast has been done precisely.

2.LITERATURE SURVEY

2.1 Existing problem

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/financers to be able to predict the salvage value (residual value) of cars with accuracy.

2.2 References

- Monburinon, N., Chertchom, P., Kaewkiriya, T., Rungpheung, S., Buva, S., & Boonpou, P. (2018). Prediction of Prices for Used Cars by Using Regression Models. 5th International Conference on Business and Industrial Research (ICBIR), (pp. 115-119). Bangkok.
- Noor, K., & Jan, S. (2017). Vehicle Price Prediction System using Machine Learning Techniques. International Journal of Computer Applications, 27-31.
- Pudaruth, S. (2014). Predicting the Price of Used Cars using Machine Learning. International Journal of Information & Computation Technology, 754-764.
- Research, F. -M. (2020, February 25). Automotive Industry in Dubai. Retrieved 10 24, 2021, from <https://www.feedbackme.com/automotive-industry-in-uae>
- Rizvi, R. (2019, April). Car Production is on the Rise in Dubai. Retrieved September 10, 2019, from <https://propakistani.pk/2019/04/08/car-production-is-on-the-rise-in-dubai/>
- Used Vehicle Value Index. (2021, April). Retrieved from manheim: <https://publish.manheim.com/en/services/consulting/used-vehicle-value-index.html>

2.3 Problem Statement Definition

It is easy for any company to price their new cars based on the manufacturing and marketing cost it involves. But when it comes to a used car it is quite difficult to define a price because it involves it is influenced by various parameters like car brand, manufactured year etc. The goal of our system is to predict the best price

for a used car in the based on the previous data related to sold cars using machine learning.

3.IDEATION AND PROPOSED SOLUTION

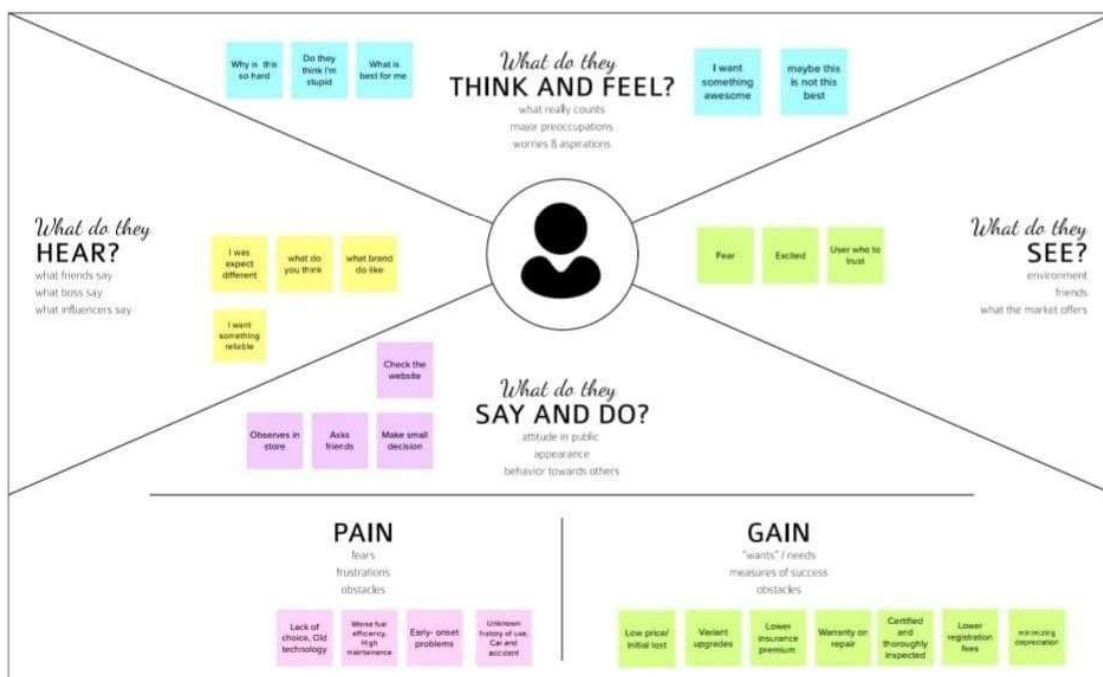
3.1 Empathy Map Canvas

Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1

Build empathy and keep your focus on the user by putting yourself in their shoes.



Share your feedback

3.2 Ideation & Brainstorming

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

Template

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- 10 minutes to prepare
- 1 hour to collaborate
- 2-8 people recommended

Share template feedback

Need some inspiration?
See a finished version of this template to kickstart your work.

[Open example](#)

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.

B

Set the goal
Think about the problem you'll be focusing on solving in the brainstorming session.

C

Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#)

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

PROBLEM

How Can We Provide An Accurate Prediction Of Car Resale Value?

Key rules of brainstorming

To run a smooth and productive session

- Stay in topic.
- Defer judgment.
- Go for volume.
- Encourage wild ideas.
- Listen to others.
- If possible, be visual.

Step-2: Brainstorm, Idea Listing and Grouping

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.

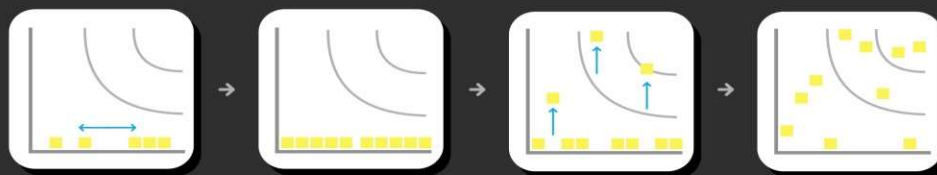
20 minutes



Importance
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

TIP
Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the **H** key on the keyboard.

Feasibility
Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)



3.3 . Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The main aim of the project is to predict the price of the used cars using the various Machine Learning (ML) models. The project should take parameters related to used cars as input and enable the customers to make decisions by their own.
2.	Idea / Solution description	The model is to built that would give the nearest resale value of the vehicle. By using these best accuracy value will be taken as a solution and it will be integrated to the web-based application where the user is notified with the status of his product.
3.	Novelty / Uniqueness	Used cars price prediction is effectively used to determine the worthiness of the car by their own within few minutes by using various features such as year, model, mileage(km), etc.
4.	Social Impact / Customer Satisfaction	If the user wants to buy or sell a own car it helps user to predict the correct valuation by their own. A loss function is to be optimized and mainly a weak learner can make predictions for used cars easily.
5.	Business Model (Revenue Model)	It helps users to predict the correct valuation of the cars remotely with perfect valuation and without human intervention like car dealer in the process to eliminate biased valuation predicted by the dealer.
6.	Scalability of the Solution	Using stored data and machine learning approaches, this project proposed a scalable framework for predicting values for different types of used cars present all over India.

3.4 Problem Solution Fit

<p>1. CUSTOMER SEGMENT(S)</p> <p>Used car sellers</p> <p>CS</p>	<p>6. CUSTOMER CONSTRAINTS</p> <ul style="list-style-type: none"> To determine the worthiness of the car by their own within few minutes. <p>CC</p>	<p>5. AVAILABLE SOLUTIONS</p> <ul style="list-style-type: none"> In the past User cannot find the value of used car buy their own without prior knowledge about cars. <p>AS</p>
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<p>2. JOBS-TO-BE-DONE / PROBLEMS</p> <ul style="list-style-type: none"> • Condition of Engine • Year of Registration • Kilometers Travelled • Age of Car • Variety of Car 	<p>9. PROBLEM ROOT CAUSE</p> <ul style="list-style-type: none"> • Unaware of Price Prediction • The price predicted by the dealers or brokers for used car is not trustful 	<p>7. BEHAVIOUR</p> <ul style="list-style-type: none"> • Condition of Car • History Of Car • Model Of Car • Scams
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Identify strong TR & EM	3. TRIGGERS TR When it comes to Vehicle people are posting pictures of using it.	10. YOUR SOLUTION SL Predicting the price of used cars using the Machine Learning (ML) algorithms and collection data's about different cars. The project will take parameters related to used car as inputs and enable the customers to make decisions by their own.	8.CHANNELS of BEHAVIOUR CH 1. ONLINE They compare price , model of the car in different sites 2. OFFLINE They would visit Dealers and enquire about the price
	4. EMOTIONS : EM BEFORE : Fear , Anxiety , Elation AFTER : Satisfaction , Joy , Confident , Balance Of Mind		

4.REQUIREMENT ANALYSIS

4.1 Functional Requirements

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration to the related websites	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Users Profile	Personal details, Bank account ,Is He/She interested in buying a car
FR-4	Gather information about the vehicle	Through the registered websites they collect information
FR-5	Display the functionality of the vehicle	Details: Fuel type , Manufactured year , Miles Driven , Record

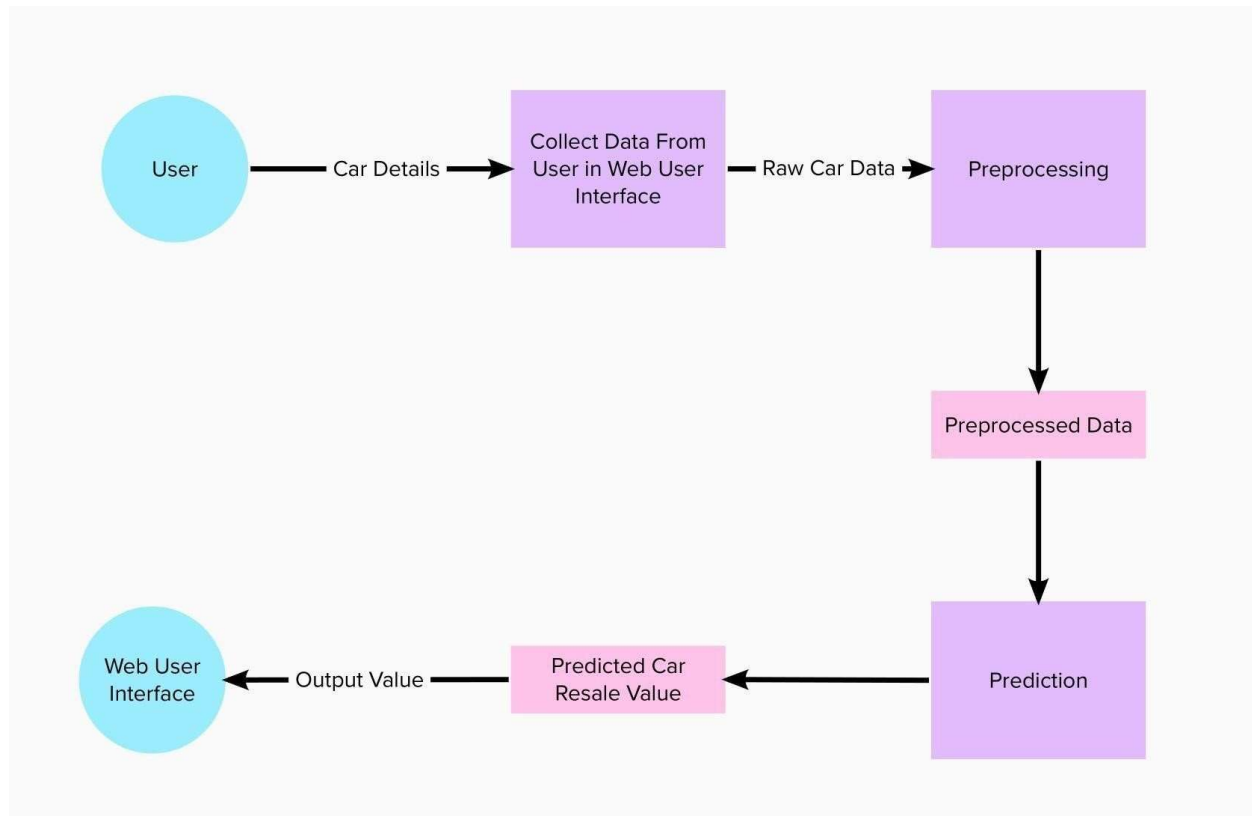
4.2 Non-Functional requirements

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

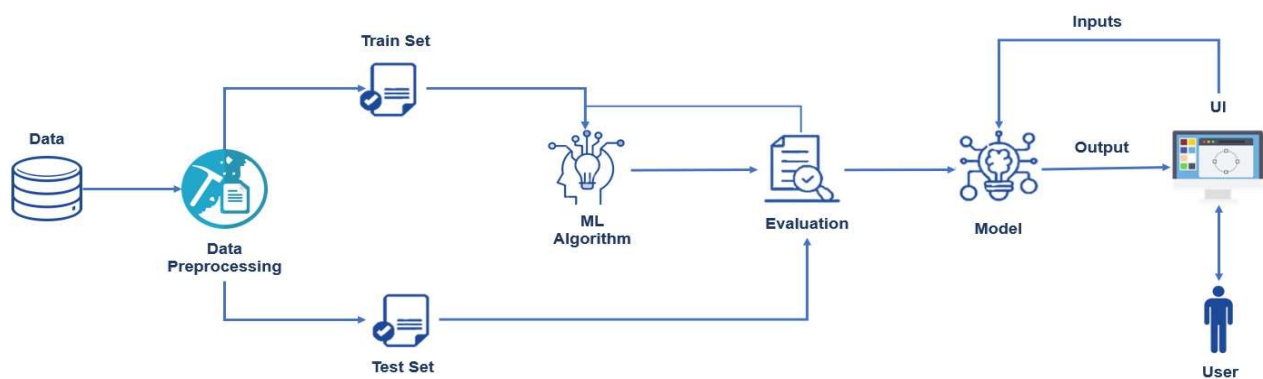
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	User friendly UI Simple and easy to Understand
NFR-2	Security	Aware of scams
NFR-3	Reliability	The system must perform without failure
NFR-4	Performance	The landing page must support several users must provide 5 second or less response time
NFR-5	Availability	Uninterrupted services must be available all time except the time of server updation.

5.PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture



5.3 User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria
Customer (Mobile User)	Data Entry	USN-1	As a user, I can enter the car details in the application.	I can enter the car details
	Obtain output	USN-2	As a user, I will receive car resale value in the application.	I can receive my car resale value
Customer (Web User)	Data Entry	USN-1	As a user, I can enter the car details in the application.	I can enter the car details
	Obtain output	USN-2	As a user, I will receive car resale value in the application.	I can receive my car resale value
Administrator	Landing page	USN-3	As an admin , I will update the dataset and retrain the model if needed for accurate results .	I can check if the update is reflected or not

6.PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning & Estimation

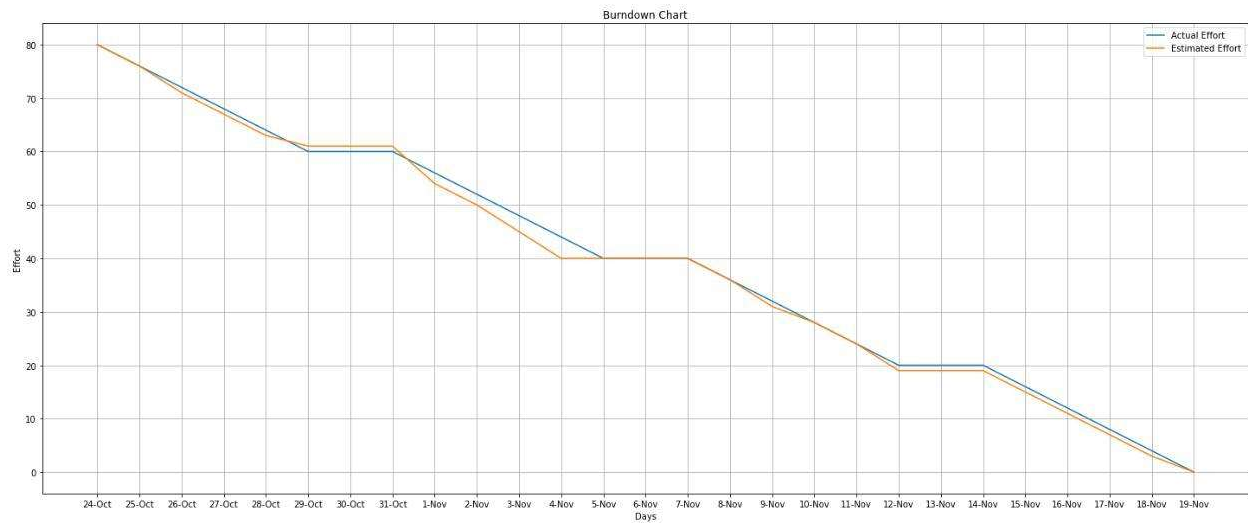
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points
Sprint-1	Designing Homepage	USN-1	As a user I can view the homepage of the web application	1
Sprint-2	Designing Data Entry Page	USN-2	As a user I can enter the details of my car to be sold in the web application	1
Sprint-3	Result Page	USN-3	As a user I can view the predicted resale value of my car based on the details	1
Sprint-4	Resale Value Prediction	USN-4	As a user I can expect the resale value of my car predicted by the application	1

6.2 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as Planned End Date)
Sprint-1	18	6 Days	24 Oct 2022	29 Oct 2022	18
Sprint-2	18	6 Days	31 Oct 2022	05 Nov 2022	18
Sprint-3	18	6 Days	07 Nov 2022	12 Nov 2022	18
Sprint-4	18	6 Days	14 Nov 2022	19 Nov 2022	18

6.3 Reports From Jira

Burndown Chart



RoadMap

	NOV
Sprints	CRVP Sprint 1, CRVP Sprint 2, CRVP Sprint 3,...
> CRVP-10 Designing Homepage	
> CRVP-11 Designing Data Entry Page	
> CRVP-12 Result Page	
> CRVP-13 Resale Value Prediction	

7.CODING AND SOLUTIONING

7.1 Home Page

Displays the home page of the application.

Code:

1) car.html

```
<!DOCTYPE html>
<nav lang="en" dir="ltr">
  <head>
    <meta charset="utf-8">
    <title>Car resale value </title>
    <link rel="stylesheet" href="../static/css/style.css">
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/4.7.0/css/font-awesome.min.css">
  </head>
  <body>
    <section class="header">
      <div class="text-box">
        <h1>Car resale value Predictor</h1><br>
        <p>An application where you can predict the amount of resale value of your car</p>
        <br>
        <a href="/predict_page" class="visit-btn ">Check price</a>
      </div>
    </section>
  </nav>
</body>
</body>
</body>
</html>
```

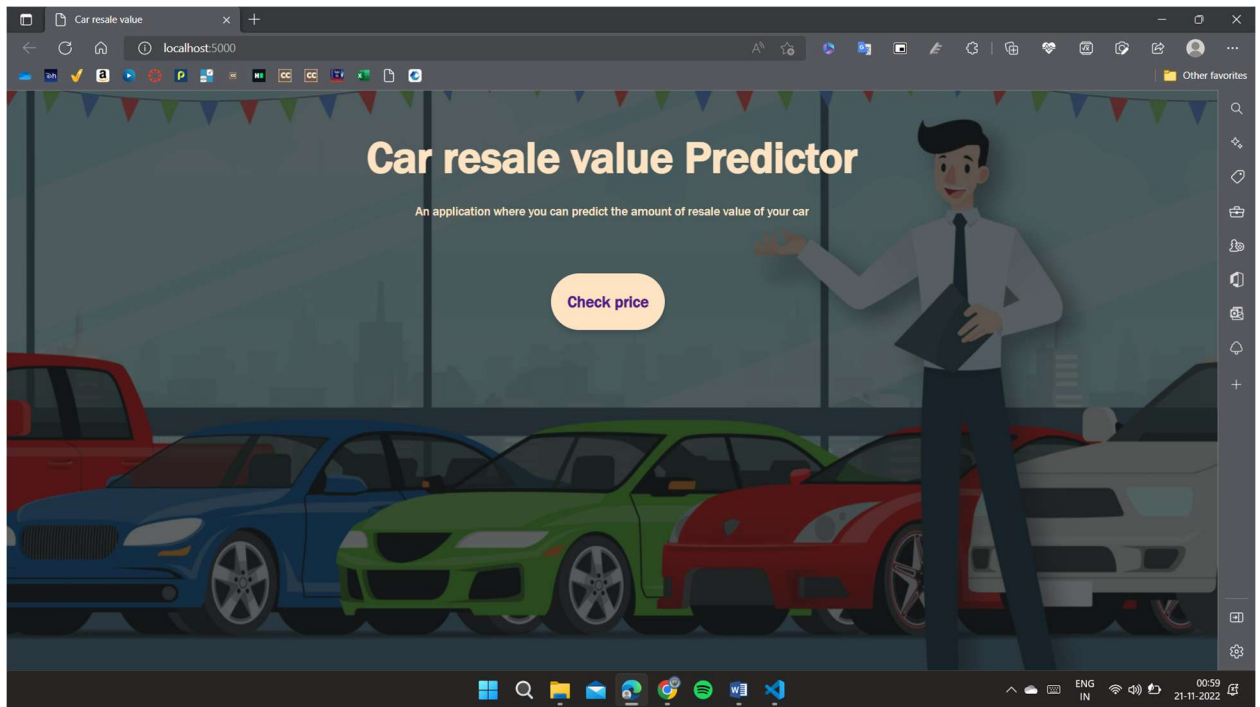
2) style.css

```
*{
  margin: 0;
  padding: 0;
}

body{
  font-family :'Franklin Gothic Medium';
  margin: 0;
}

.header{
  min-height: 100vh;
  width: 100%;
  background-image: linear-
gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(..Images/car1.jpg);
  background-position: center;
  background-size: cover;
  position :absolute;
}
```

```
.text-box {
  text-align: center;
  position: relative;
  color: #FFE4C4;
  top: 50%;
}
.text-box h1 {
  margin-top: 50px;
  font-size: 55px;
}
.text-box p {
  margin: 10px 0 40px;
  font-size: 15px;
}
.text-box a.visit-btn {
  text-align: center;
  padding: 10px 20px;
  font-weight: 700;
  white-space: inherit;
  vertical-align: middle;
  border: 2px solid transparent;
  display: inline-block;
  margin: 10px 10px 0 0;
  border-radius: 50px;
  overflow: hidden;
  background-color: #FFE4C4;
  border: 0;
  line-height: 50px;
  box-shadow: 0 3px 6px 0 rgba(0,0,0,0.16);
  font-size: 20px;
  text-decoration: none;
  position: relative;
}
.text-box a.visit-btn:hover {
  background-image: linear-gradient(to left, #FFE4C4, #a147e4);
  background-position: left center;
}
```



7.2 Data Entry Page

Allows user to enter the details about the car for which the resale value is to be predicted.

Code:

1. value.html

```
<!DOCTYPE html>
<html lang="en" dir="ltr">
<head>
<link rel="stylesheet" href="../static/css/value.css">
<title>Car resale value</title>

</head>
<body>
  <section class="form">
    <form action="/predict" method="GET">
      <table border="0" align="center">
        <tbody>
          <tr>
            <td><h1>Get the Accurate Resale Value of Your Car</h1>
          </td>
        </tbody>
      </table>
      <tr>
        <td><label for="year" padding:10px>Registration year : </label></td>
        <td><input id="year" maxlength="50" name="regyear" type="text" />
        <br>
        <br>
      </td>
    </tr>
  </section>
</body>
</html>
```

</tr>

<tr>

<td><label for="month">Registration Month : </label></td>

<td><input id="month" maxlength="50" name="regmonth" type="text" />

</td>

</tr>

<tr>

<td><label for="power">Power of car in PS: </label></td>

<td><input id="power" maxlength="50" name="powerps" type="text" />

</td>

</tr>

<tr>

<td><label for="kilometer">Kilometers that car have driven : </label></td>

<td><input id="kilometer" maxlength="50" name="kms" type="text" />

</td>

</tr>

<tr>

<td><label for="geartype">Gear type : </label></td>

<td><input type="radio" name="geartype" value="manual"/> Manual

<input type="radio" name="geartype" value="automatic"/> Automatic

<input type="radio" name="geartype" value="not-declared"/> Not declared

</td>

</tr>

<tr>

<td><label for="damage">Your car is repaired or damaged : </label></td>

<td><input type="radio" name="damage" value="yes"/> Yes

<input type="radio" name="damage" value="no"/> No

<input type="radio" name="damage" value="not-declared"/> Not declared

</td>

</tr>

```

<tr>
<td><label for="model">Model Type : </label></td>
<td>
<select name="model" id="model">
<option value="" disabled selected hidden>Choose Model Name...</option>
<option value="golf">Golf </option>
<option value="grand">Grand </option>
<option value="fabia">Fabia </option>
<option value="3er">3er </option>
<option value="2_reihe">2 Reihe </option>
<option value="andere">Andere </option>
<option value="c_max">C Max </option>
<option value="3_reihe">3 Reihe </option>
<option value="passat">Passat </option>
<option value="navara">Navara </option>
<option value="ka">Ka </option>
<option value="polo">Polo </option>
<option value="twingo">Twingo </option>
<option value="a_klasse">A klasse </option>
<option value="scirocco">Scirocco </option>
<option value="5er">5er </option>
<option value="meriva">Meriva </option>
<option value="arosa">Arosa </option>
<option value="c4">C4 </option>
<option value="civic">Civic </option>
<option value="transporter">Transporter </option>
<option value="punto">Punto </option>
<option value="e_klasse">E Klasse </option>
<option value="clio">Clio </option>
<option value="kadett">Kadett </option>
<option value="kangoo">Kangoo </option>
<option value="corsa">Corsa </option>
<option value="one">One </option>
<option value="fortwo">Fortwo </option>
<option value="1er">1er </option>
<option value="b_klasse">B Klasse </option>
<option value="signum">Signum </option>
<option value="astra">Astra </option>
<option value="a8">A8 </option>
<option value="jetta">Jetta </option>
<option value="fiesta">Fiesta </option>
<option value="c_klasse">C Klasse </option>
<option value="micra">Micra </option>
<option value="vito">Vito </option>
<option value="sprinter">Sprinter </option>
<option value="156">156 </option>

```

<option value="escort">Escort </option>
<option value="forester">Forester </option>
<option value="xc_reihe">Xc Reihe </option>
<option value="scenic">Scenic </option>
<option value="a4">A4 </option>
<option value="a1">A1 </option>
<option value="insignia">Insignia </option>
<option value="combo">Combo </option>
<option value="focus">Focus </option>
<option value="tt">Tt </option>
<option value="a6">A6 </option>
<option value="jazz">Jazz </option>
<option value="omega">Omega </option>
<option value="slk">Slk </option>
<option value="7er">7er </option>
<option value="80">80 </option>
<option value="147">147 </option>
<option value="glk">Glk </option>
<option value="100">100 </option>
<option value="z_reihe">Z Reihe </option>
<option value="sportage">Sportage </option>
<option value="sorento">Sorento </option>
<option value="v40">V40 </option>
<option value="5er">5er </option>
<option value="ibiza">Ibiza </option>
<option value="3er">3er </option>
<option value="mustang">Mustang </option>
<option value="eos">Eos </option>
<option value="touran">Touran </option>
<option value="getz">Getz </option>
<option value="a3">A3 </option>
<option value="almera">Almera </option>
<option value="megane">Megane </option>
<option value="7er">7er </option>
<option value="1er">1er </option>
<option value="lupo">Lupo </option>
<option value="r19">R19 </option>
<option value="zafira">Zafira </option>
<option value="caddy">Caddy </option>
<option value="2_reihe">2 Reihe </option>
<option value="mondeo">Mondeo </option>
<option value="cordoba">Cordoba </option>
<option value="colt">Colt </option>
<option value="impreza">Impreza </option>
<option value="vectra">Vectra </option>
<option value="berlingo">Berlingo </option>

<option value="80">80 </option>
<option value="m_klasse">M Klasse </option>
<option value="tiguan">Tiguan </option>
<option value="i_reihe">I Reihe </option>
<option value="espace">Espace </option>
<option value="sharan">Sharan </option>
<option value="6_reihe">6 Reihe </option>
<option value="panda">Panda </option>
<option value="up">Up </option>
<option value="seicento">Seicento </option>
<option value="ceed">Ceed </option>
<option value="5_reihe">5 Reihe </option>
<option value="yeti">Yeti </option>
<option value="octavia">Octavia </option>
<option value="mii">Mii </option>
<option value="rx_reihe">Rx Reihe </option>
<option value="6er">6er </option>
<option value="modus">Modus </option>
<option value="fox">Fox </option>
<option value="matiz">Matiz </option>
<option value="beetle">Beetle </option>
<option value="c1">C1 </option>
<option value="rio">Rio </option>
<option value="touareg">Touareg </option>
<option value="logan">Logan </option>
<option value="spider">Spider </option>
<option value="cuore">Cuore </option>
<option value="s_max">S Max </option>
<option value="a2">A2 </option>
<option value="x_reihe">X Reihe </option>
<option value="a5">A5 </option>
<option value="galaxy">Galaxy </option>
<option value="c3">C3 </option>
<option value="viano">Viano </option>
<option value="s_klasse">S Klasse </option>
<option value="1_reihe">1 Reihe </option>
<option value="avensis">Avensis </option>
<option value="sl">Sl </option>
<option value="roomster">Roomster </option>
<option value="q5">Q5 </option>
<option value="kaefer">Kaefer </option>
<option value="santa">Santa </option>
<option value="cooper">Cooper </option>
<option value="leon">Leon </option>
<option value="4_reihe">4 Reihe </option>
<option value="500">500 </option>

<option value="laguna">Laguna </option>
<option value="ptcruiser">Ptcruiser </option>
<option value="clk">Clk </option>
<option value="primera">Primera </option>
<option value="exeo">Exeo </option>
<option value="159">159 </option>
<option value="transit">Transit </option>
<option value="juke">Juke </option>
<option value="qashqai">Qashqai </option>
<option value="carisma">Carisma </option>
<option value="accord">Accord </option>
<option value="corolla">Corolla </option>
<option value="lanos">Lanos </option>
<option value="phaeton">Phaeton </option>
<option value="boxster">Boxster </option>
<option value="verso">Verso </option>
<option value="swift">Swift </option>
<option value="rav">Rav </option>
<option value="kuga">Kuga </option>
<option value="picanto">Picanto </option>
<option value="kalos">Kalos </option>
<option value="superb">Superb </option>
<option value="stilo">Stilo </option>
<option value="alhambra">Alhambra </option>
<option value="911">911 </option>
<option value="mx_reihe">Mx Reihe </option>
<option value="m_reihe">M Reihe </option>
<option value="roadster">Roadster </option>
<option value="ypsilon">Ypsilon </option>
<option value="cayenne">Cayenne </option>
<option value="galant">Galant </option>
<option value="justy">Justy </option>
<option value="90">90 </option>
<option value="sirion">Sirion </option>
<option value="crossfire">Crossfire </option>
<option value="6_reihe">6 Reihe </option>
<option value="agila">Agila </option>
<option value="duster">Duster </option>
<option value="cr_reihe">Cr Reihe </option>
<option value="v50">V50 </option>
<option value="discovery">Discovery </option>
<option value="c_reihe">C Reihe </option>
<option value="v_klasse">V Klasse </option>
<option value="yaris">Yaris </option>
<option value="c5">C5 </option>
<option value="aygo">Aygo </option>

<option value="cc">Cc </option>
<option value="carnival">Carnival </option>
<option value="fusion">Fusion </option>
<option value="bora">Bora </option>
<option value="forfour">Forfour </option>
<option value="100">100 </option>
<option value="cl">Cl </option>
<option value="tigra">Tigra </option>
<option value="156">156 </option>
<option value="300c">300c </option>
<option value="100">100 </option>
<option value="147">147 </option>
<option value="q3">Q3 </option>
<option value="spark">Spark </option>
<option value="v70">V70 </option>
<option value="x_type">X Type </option>
<option value="5_reihe">5 Reihe </option>
<option value="ducato">Ducato </option>
<option value="s_type">S Type </option>
<option value="x_trail">X Trail </option>
<option value="toledo">Toledo </option>
<option value="altea">Altea </option>
<option value="7er">7er </option>
<option value="voyager">Voyager </option>
<option value="calibra">Calibra </option>
<option value="bravo">Bravo </option>
<option value="range_rover">Range Rover </option>
<option value="antara">Antara </option>
<option value="tucson">Tucson </option>
<option value="q7">Q7 </option>
<option value="citigo">Citigo </option>
<option value="jimny">Jimny </option>
<option value="cx_reihe">Cx Reihe </option>
<option value="wrangler">Wrangler </option>
<option value="lybra">Lybra </option>
<option value="range_rover_sport">Range Rover Sport </option>
<option value="lancer">Lancer </option>
<option value="159">159 </option>
<option value="freelander">Freelander </option>
<option value="captiva">Captiva </option>
<option value="c2">C2 </option>
<option value="500">500 </option>
<option value="range_rover_evoque">Range Rover Evoque </option>
<option value="sandero">Sandero </option>
<option value="note">Note </option>
<option value="900">900 </option>

<option value="147">147 </option>
<option value="defender">Defender </option>
<option value="cherokee">Cherokee </option>
<option value="clubman">Clubman </option>
<option value="samara">Samara </option>
<option value="2_reihe">2 Reihe </option>
<option value="1er">1er </option>
<option value="3er">3er </option>
<option value="601">601 </option>
<option value="3_reihe">3 Reihe </option>
<option value="4_reihe">4 Reihe </option>
<option value="5er">5er </option>
<option value="6_reihe">6 Reihe </option>
<option value="legacy">Legacy </option>
<option value="pajero">Pajero </option>
<option value="auris">Auris </option>
<option value="niva">Niva </option>
<option value="5_reihe">5 Reihe </option>
<option value="s60">S60 </option>
<option value="nubira">Nubira </option>
<option value="vivaro">Vivaro </option>
<option value="g_klasse">G Klasse </option>
<option value="lodgy">Lodgy </option>
<option value="850">850 </option>
<option value="serie_2">Serie 2 </option>
<option value="6er">6er </option>
<option value="charade">Charade </option>
<option value="croma">Croma </option>
<option value="outlander">Outlander </option>
<option value="gl">Gl </option>
<option value="doblo">Doblo </option>
<option value="musa">Musa </option>
<option value="amarok">Amarok </option>
<option value="156">156 </option>
<option value="move">Move </option>
<option value="9000">9000 </option>
<option value="v60">V60 </option>
<option value="145">145 </option>
<option value="aveo">Aveo </option>
<option value="200">200 </option>
<option value="300c">300c </option>
<option value="b_max">B Max </option>
<option value="delta">Delta </option>
<option value="terios">Terios </option>
<option value="rangerover">RangeRover </option>
<option value="90">90 </option>

```
<option value="materia">Materia </option>
<option value="kalina">Kalina </option>
<option value="elefantino">Elefantino </option>
<option value="i3">I3 </option>
<option value="kappa">Kappa </option>
<option value="serie_3">Serie 3 </option>
<option value="48429">48429 </option>
<option value="serie_1">Serie 1 </option>
<option value="discovery_sport">Discovery Sport </option>
```

```
</select>
```

```
<br>
```

```
<br>
```

```
</td>
```

```
</tr>
```

```
<tr>
```

```
<td><label for="brand">Brand :</label></td>
```

```
<td>
```

```
<select name="brand" id="brand">
```

```
<option value="" disabled selected hidden>Choose Brand Name...</option>
```

```
<option value="volkswagen">Volkswagen </option>
```

```
<option value="audi">Audi </option>
```

```
<option value="jeep">Jeep </option>
```

```
<option value="skoda">Skoda </option>
```

```
<option value="bmw">Bmw </option>
```

```
<option value="peugeot">Peugeot </option>
```

```
<option value="ford">Ford </option>
```

```
<option value="mazda">Mazda </option>
```

```
<option value="nissan">Nissan </option>
```

```
<option value="renault">Renault </option>
```

```
<option value="mercedes_benz">Mercedes Benz </option>
```

```
<option value="opel">Opel </option>
```

```
<option value="seat">Seat </option>
```

```
<option value="citroen">Citroen </option>
```

```
<option value="honda">Honda </option>
```

```
<option value="fiat">Fiat </option>
```

```
<option value="mini">Mini </option>
```

```
<option value="smart">Smart </option>
```

```
<option value="hyundai">Hyundai </option>
```

```
<option value="sonstige_autos">Sonstige Autos </option>
```

```
<option value="alfa_romeo">Alfa Romeo </option>
```

```
<option value="subaru">Subaru </option>
```

```
<option value="volvo">Volvo </option>
```

```
<option value="mitsubishi">Mitsubishi </option>
```

```
<option value="kia">Kia </option>
```

```
<option value="suzuki">Suzuki </option>
<option value="lancia">Lancia </option>
<option value="porsche">Porsche </option>
<option value="toyota">Toyota </option>
<option value="chevrolet">Chevrolet </option>
<option value="dacia">Dacia </option>
<option value="daihatsu">Daihatsu </option>
<option value="trabant">Trabant </option>
<option value="saab">Saab </option>
<option value="chrysler">Chrysler </option>
<option value="jaguar">Jaguar </option>
<option value="daewoo">Daewoo </option>
<option value="rover">Rover </option>
<option value="land_rover">Land Rover </option>
<option value="lada">Lada </option>
</select>
<br>
<br>
</td>
</tr>
```

```
<tr>
<td><label for="fuelType">Fuel Type :</label></td>
<td>
<select name="fuelType" id="brand">
<option value="" disabled selected hidden>Choose Fuel Type...</option>
<option value="petrol"> Petrol </option>
<option value="diesel"> Diesel </option>
<option value="not-declared"> Not Declared </option>
<option value="lpg">LPG </option>
<option value="cng">CNG </option>
<option value="hybrid">Hybrid </option>
<option value="others">Others </option>
<option value="electric">Electric </option>
</select>
<br>
<br>
</td>
</tr>
```

```
<tr>
<td><label for="vehicletype">Vehicle type:</label></td>
<td>
<select name="vehicletype" id="vehicle" >
<option value="" disabled selected hidden>Choose Vehicle Type...</option>
<option value="coupe">Coupe </option>
```

```

<option value="suv">SUV </option>
<option value="kleinwagen">Kleinwagen </option>
<option value="limousine">Limousine </option>
  <option value="cabrio">Cabrio </option>
  <option value="bus">Bus </option>
  <option value="kombi">Kombi </option>
  <option value="andere">Andere </option>
  <option value="volkswagen">Volkswagen </option>
</select>
<br>
<br>
</td>
</tr>
</tbody>
</table>
  <input name="Submit" type="Submit" value="Submit" id="button"/>
</form>
</section>
</body>
</html>

```

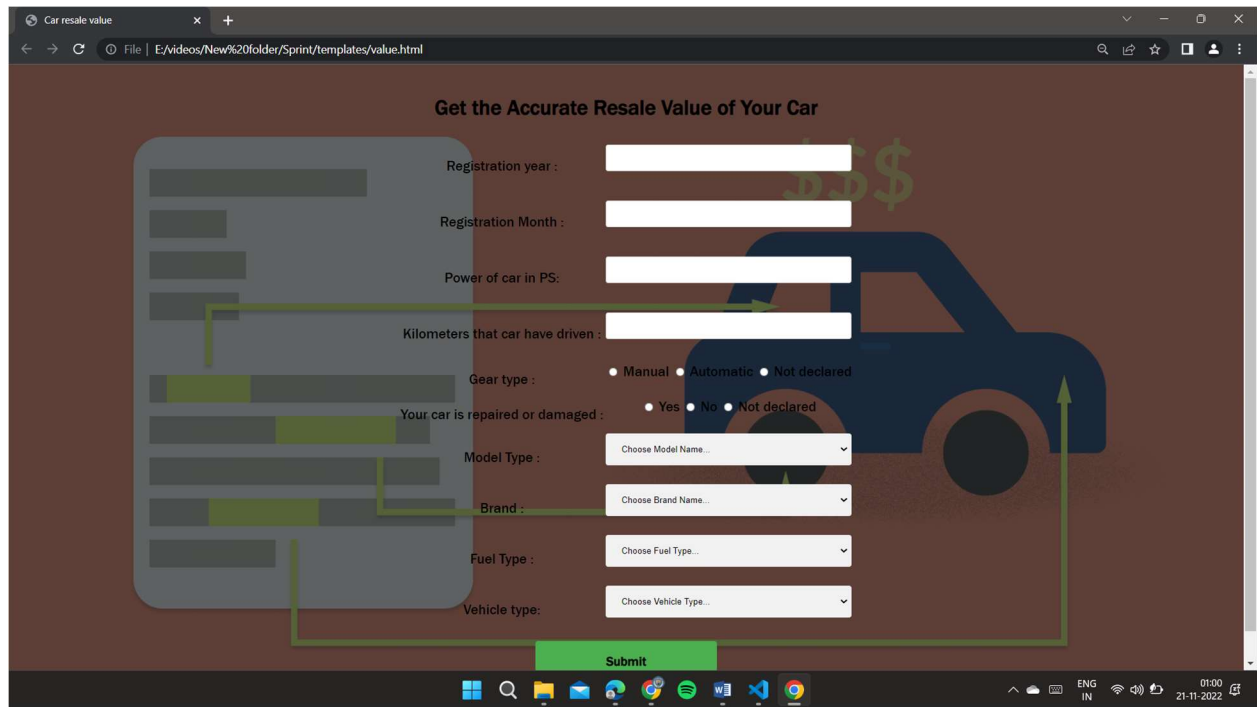
2. value.css

```

.header{
  width: 100%;
  text-align: center;
  padding-top: 20px;
  font-size:20px;
  font-family :'Franklin Gothic Medium';
  background-color:#43FFB6;
  border:0%;
  top:0px;
  bottom:0px;
  right:0px;
  left:0px;
  overflow-y:auto;
}
body{
  margin: 0;
  font-family :'Franklin Gothic Medium';
}
.form{
  background-image: linear-
gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(../Images/car2.jpg);
  background-position: center;
  background-size: cover;
  position: relative;

```

```
text-align: center;
padding:20px;
display: flex;
flex-direction: column;
align-items: center;
font-size:22px;
}
input[type=text] {
width: 100%;
padding: 12px 20px;
margin: 8px 0;
display: inline-block;
border: 1px solid #ccc;
border-radius: 4px;
box-sizing: border-box;
}
select {
width: 100%;
padding: 16px 20px;
border: none;
border-radius: 4px;
background-color: #f1f1f1;
}
input[type=submit] {
font-family :'Franklin Gothic Medium';
font-weight: 700;
width: 40%;
background-color: #4CAF50;
color: black;
font-size: 20px;
padding: 20px 20px;
margin: 8px 0;
border: none;
border-radius: 4px;
cursor: pointer;
}
input[type=submit]:hover {
background-color: #37853b;
}
*{
color:black;
}
```



7.3 Output Display Page

The predicted resale car value is displayed in this page.

Code

1. predict.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">
  <link rel="stylesheet" href="../static/css/predict.css">
  <title>Car Resale Predicted Value</title>
</head>
<body>
  <section class="header">
    <nav></nav>
    <div class="text-box">
      <h1>The Predicted Car Resale Value is </h1>
      <h1>{{predict}}</h1>
    </div>
  </section>
</body>
</html>
```

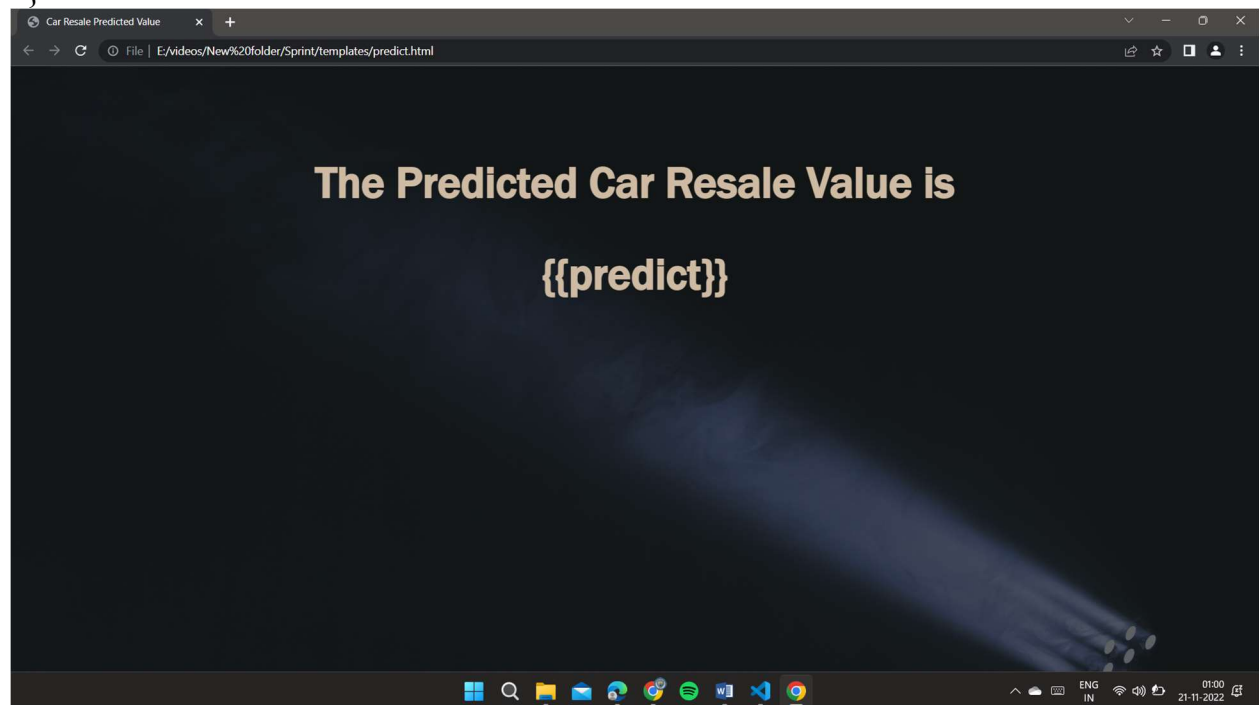
2. predict.css

```
.header{
  min-height: 100vh;
```

```

width: 100%;
background-image: linear-
gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(../Images/car3.jpg);
background-position: center;
background-size: cover;
position: relative;
}
nav{
display:flex;
padding: 2% 6%;
justify-content: space-between;
align-items: center;
}
.text-box{
text-align: center;
position: relative;
color: #cfbba3;
top:50%;
}
.text-box h1{
margin-top: 50px;
font-size: 55px;
}
body{
margin: 0;
font-family :'Franklin Gothic Medium';
}

```



7.4 Preprocessing data and Model Selection

```
## Importing Libraries
import pandas as pd
import numpy as np
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import cross_val_score, train_test_split
import pickle
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score
from sklearn.linear_model import LinearRegression
from sklearn.ensemble import RandomForestRegressor

## Collecting Dataset
df = pd.read_csv("autos.csv")
df

## Read and clean data sets
df.seller.value_counts()
### Removing the seller type having only least cars
df=df[df.seller != 'gewerblich']
### Now all the sellers are same so we can get rid of this column
df=df.drop('seller',1)
df.offerType.value_counts()
### Removing the Offer Type that is having only 12 listings
df=df[df.offerType != 'Gesuch']
df
### Now all the offers are same so we can get rid of this column
df=df.drop('offerType',1)
df.shape
### Updating data to the present trend
df = df[(df.powerPS > 50) & (df.powerPS <900)]
df.shape
df = df[(df.yearOfRegistration >= 1950) & (df.yearOfRegistration < 2017)]
df.shape
df.head()
df.columns
### Dropping unnecessary columns
df.drop(['name', 'abtest', 'dateCrawled', 'nrOfPictures', 'lastSeen', 'postalCode', 'dateCreated'],
axis='columns', inplace=True)
df
new_df = df.copy()
new_df.columns
new_df.head()
### Dropping Dupilcates
new_df = new_df.drop_duplicates(['price', 'vehicleType', 'yearOfRegistration', 'gearbox',
'powerPS', 'model', 'kilometer', 'monthOfRegistration', 'fuelType', 'notRepairedDamage'])
new_df.shape
### Translating Data in understandable format
new_df.gearbox.replace(('manuell', 'automatik'), ('manual', 'automatic'), inplace=True)
```

```

new_df.fuelType.replace(('benzin', 'andere', 'elektro'), ('petrol', 'others',
'electric'), inplace=True)
new_df.vehicleType.replace(('kleinwagen', 'cabrio', 'kombi', 'andere'), ('small
car', 'convertible', 'combination', 'others'), inplace=True)
new_df.notRepairedDamage.replace(('ja', 'nein'), ('Yes', 'No'), inplace=True)
new_df.head()
new_df = new_df[(new_df.price >= 100) & (new_df.price <= 150000)]
new_df['notRepairedDamage'].fillna(value='not-declared', inplace=True)
new_df['fuelType'].fillna(value='not-declared', inplace=True)
new_df['gearbox'].fillna(value='not-declared', inplace=True)
new_df['vehicleType'].fillna(value='not-declared', inplace=True)
new_df['model'].fillna(value='not-declared', inplace=True)
new_df.head()
### Creating new preprocessed Data
new_df.to_csv("pp_data.csv")
labels = ['gearbox', 'notRepairedDamage', 'model', 'brand', 'fuelType', 'vehicleType']

mapper = {}
for i in labels:
    mapper[i] = LabelEncoder()
    mapper[i].fit(new_df[i])
    tr = mapper[i].transform(new_df[i])
    np.save(str('classes'+i+'.npy'), mapper[i].classes_)
    new_df.loc[:, i+'_labels'] = pd.Series(tr, index=new_df.index)

labeled = new_df[['price', 'yearOfRegistration', 'powerPS', 'kilometer', 'monthOfRegistration']
                +[x+"_labels" for x in labels]]

print(labeled.columns)
### Split the data into dependent and independent variables.
Y = labeled.iloc[:,0].values
X = labeled.iloc[:,1:].values
X
Y
Y = Y.reshape(-1,1)
print(X.shape, Y.shape)
### Train test split
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size = 0.3, random_state = 3)
X_train
### Choosing appropriate model
### Multilinear Regression
multiple_lin_reg = LinearRegression()
multiple_lin_reg.fit(X_train, Y_train)
y_pred_mlr = multiple_lin_reg.predict(X_test)
### Metrics Evaluation
mae = mean_absolute_error(Y_test, y_pred_mlr)

```

```

mse = mean_squared_error(Y_test, y_pred_mlr)
rmse = np.sqrt(mse)
rmsle = np.log(rmse)
n,k = X_train.shape
r2=r2_score(Y_test,y_pred_mlr)
adj_r2= 1 - ((1-r2)*(n-1)/(n-k-1))
print(mae,mse,rmse,rmsle,r2,adj_r2)
regressor = RandomForestRegressor(n_estimators=300,max_depth=10,random_state=34)
regressor.fit(X_train,np.ravel(Y_train,order='C'))
y_pred = regressor.predict(X_test)
### Metrics Evaluation
mae = mean_absolute_error(Y_test, y_pred)
mse = mean_squared_error(Y_test, y_pred)
rmse = np.sqrt(mse)
rmsle = np.log(rmse)
n,k = X_train.shape
r2=r2_score(Y_test,y_pred)
adj_r2= 1 - ((1-r2)*(n-1)/(n-k-1))
print(mae,mse,rmse,rmsle,r2,adj_r2)
#### R^2 score is an indicator of accuracy of Regression Models, and the accuracy is
measured as close to 1 of this value. Therefore, as seen, Random Forest Regression is better than
Multiple Linear Regression Model on this dataset when comparing their R^2 scores.
### Save the model
filename = 'crvp.sav'
pickle.dump(regressor,open(filename,'wb'))

```

7.5 Flask Integration

```

# Import Libraries
import pandas as pd
import numpy as np
from flask import Flask, render_template, Response, request
import pickle
from sklearn.preprocessing import LabelEncoder
import requests

API_KEY = "hKEAjbDOQF9fNf7tINrykXASVwLWFdkulNDdbJaLgtNe"
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}

app = Flask(__name__)#initiate flask app

def load_model(file='crvp.sav'):#load the saved model
    return pickle.load(open(file, 'rb'))

```

```

@app.route('/')
def index():#main page
    return render_template('car.html')

@app.route('/predict_page')
def predict_page():#predicting page
    return render_template('value.html')

@app.route('/predict', methods=['GET','POST'])
def predict():
    reg_year = int(request.args.get('regyear'))
    powerps = float(request.args.get('powerps'))
    kms= float(request.args.get('kms'))
    reg_month = int(request.args.get('regmonth'))

    gearbox = request.args.get('geartype')
    damage = request.args.get('damage')
    model = request.args.get('model')
    brand = request.args.get('brand')
    fuel_type = request.args.get('fuelType')
    veh_type = request.args.get('vehicletype')

    new_row = {'yearOfRegistration':reg_year, 'powerPS':powerps, 'kilometer':kms,
               'monthOfRegistration':reg_month, 'gearbox':gearbox,
               'notRepairedDamage':damage,
               'model':model, 'brand':brand, 'fuelType':fuel_type,
               'vehicleType':veh_type}

    print(new_row)

    new_df = pd.DataFrame(columns=['vehicleType','yearOfRegistration','gearbox',
                                   'powerPS','model','kilometer','monthOfRegistration','fuelType',
                                   'brand','notRepairedDamage'])
    new_df = new_df.append(new_row, ignore_index=True)
    labels = ['gearbox','notRepairedDamage','model','brand','fuelType','vehicleType']
    mapper = {}

    for i in labels:
        mapper[i] = LabelEncoder()
        mapper[i].classes = np.load(str('classes'+i+'.npy'), allow_pickle=True)
        transform = mapper[i].fit_transform(new_df[i])
        new_df.loc[:,i+'_labels'] = pd.Series(transform, index=new_df.index)
    labeled = new_df[['yearOfRegistration','powerPS','kilometer','monthOfRegistration'] +
[x+'_labels' for x in labels]]

```

```

X = labeled.values.tolist()
print('\n\n', X)
#predict = reg_model.predict(X)

#NOTE: manually define and pass the array(s) of values to be scored in the next line
payload_scoring = {'input_data': [{'fields': ["yearOfRegistration", "powerPS",
"kilometer", "monthOfRegistration", "gearbox_labels", "notRepairedDamage_labels",
"model_labels", "brand_labels", "fuelType_labels", "vehicleType_labels"], 'values': X}]}
print(payload_scoring)
response_scoring = requests.post('https://us-
south.ml.cloud.ibm.com/ml/v4/deployments/4bbb629f-8821-451b-89a9-
4902644d9f86/predictions?version=2022-11-18',
json=payload_scoring, headers={'Authorization': 'Bearer ' + mltoken})
predictions= response_scoring.json()
print(response_scoring.json())
predict = predictions['predictions'][0]['values'][0][0]
print("Final prediction :",predict)

return render_template('predict.html',predict=predict)

if __name__ == '__main__':
    reg_model = load_model()#load the saved model
    app.run(host='localhost', debug=True, threaded=False)

```

8. TESTING

8.1 Test Cases Scenarios

1	Verify user is able to see home page?
2	Verify user is able to navigate to data entry page?
3	Verify user is able to see data entry page?
4	Verify user is able to enter values in the fields?
5	Verify user is able to navigate to output display page?
6	Verify user is able to view the output display page?
7	Verify user is able to view the car resale value output in the output display page?

8.2 User Acceptance Testing

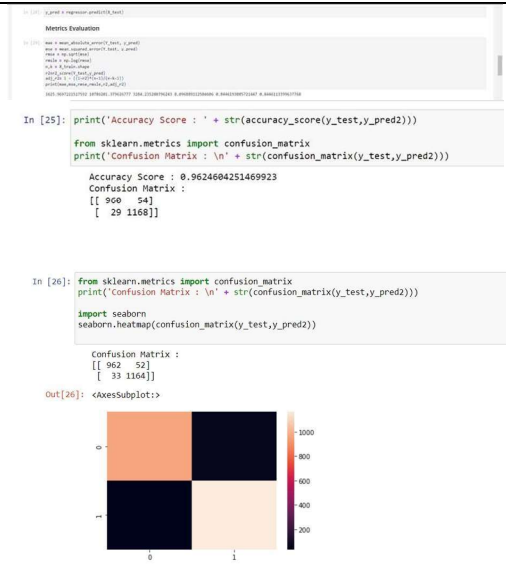
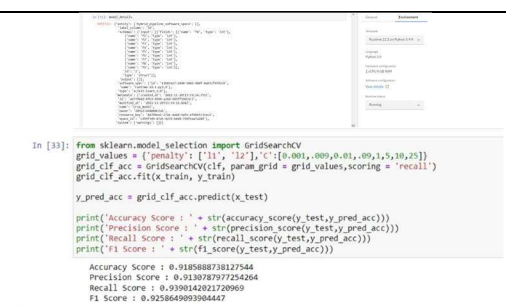
This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Home Page	5	0	0	5
Data Entry Page	15	0	0	15
Output Page	4	0	0	4
Hyper Parameter Tuning	3	0	0	3
Final Model Building	2	0	0	2
Flask Application	10	0	0	10
Train Model on IBM	3	0	0	3
Final Report Output	4	0	0	4

9.RESULTS

9.1 Performance Metrics

S.No.	Parameter	Values	Screenshot

1.	Metrics	<p>Regression Model: MAE -1625.969 , MSE – 10786201.379, RMSE -3284.235 , R2 score – 0.8446</p> <p>Classification Model: Confusion Matrix - , Accuray Score- & Classification Report -</p>	 <pre> In [25]: print('Accuracy Score : ' + str(accuracy_score(y_test,y_pred2))) from sklearn.metrics import confusion_matrix print('Confusion Matrix : \n' + str(confusion_matrix(y_test,y_pred2))) Accuracy Score : 0.9624604251469923 Confusion Matrix : [[962 54] [54 1168]] In [26]: from sklearn.metrics import confusion_matrix print('Confusion Matrix : \n' + str(confusion_matrix(y_test,y_pred2))) import seaborn seaborn.heatmap(confusion_matrix(y_test,y_pred2)) Confusion Matrix : [[962 52] [33 1164]] Out[26]: <AxesSubplot> </pre>
2.	Tune the Model	Hyperparameter Tuning Validation Method -	 <pre> In [33]: from sklearn.model_selection import GridSearchCV grid_values = {'penalty': ['l1', 'l2'], 'C': [0.001, 0.009, 0.01, 0.09, 1, 5, 10, 25]} grid_clf_acc = GridSearchCV(clf, param_grid = grid_values, scoring = 'recall') grid_clf_acc.fit(x_train, y_train) y_pred_acc = grid_clf_acc.predict(x_test) print('Accuracy Score : ' + str(accuracy_score(y_test,y_pred_acc))) print('Precision Score : ' + str(precision_score(y_test,y_pred_acc))) print('Recall Score : ' + str(recall_score(y_test,y_pred_acc))) print('F1 Score : ' + str(f1_score(y_test,y_pred_acc))) Accuracy Score : 0.9185888738127544 Precision Score : 0.9130787977254264 Recall Score : 0.9398142521720969 F1 Score : 0.9258649939304447 </pre>

10. ADVANTAGES AND DISADVANTAGES

Advantages :

- Application is easy to use
- User Friendly
- No Cost
- No need to commission any agent to get car resale value estimate

Disadvantages :

- User needs to fill every asked detail of the car
- Doesn't work for cars from different distributions
- Not always accurate

11. CONCLUSION

The increased prices of new cars and the financial incapability of the customers to buy them, used Car sales are on a global increase. Therefore, there is an urgent

need for a Car Resale Value Prediction system which effectively determines the worthiness of the car in terms of cost. The proposed system is a web application that will help users to determine the accurate price of used cars.

12. FUTURE SCOPE

In future, large historical data of car price can be used to train the model, and which can help improve the estimation of the machine learning model. Moreover, we can build an application for mobile phone platforms like android, iOS for interacting with users. For better performance, we plan to judiciously design deep learning neural networks.

13. APPENDIX

Source Code

User Interface

Car.html

```
<!DOCTYPE html>  
<nav lang="en" dir="ltr">
```

```

<head>
  <meta charset="utf-8">
  <title>Car resale value </title>
  <link rel="stylesheet" href="../static/css/style.css">
  <link rel="stylesheet" href="https://cdn.jsdelivr.net/npm/bootstrap@4.7.0/dist/css/bootstrap.min.css">
</head>
<body>
  <section class="header">
    <div class="text-box">
      <h1>Car resale value Predictor</h1><br>
      <p>An application where you can predict the amount of resale value of your car</p>
      <br>
      <a href="/predict_page" class="visit-btn ">Check price</a>
    </div>
  </section>
</nav>
</body>
</body>
</body>
</html>

```

style.css

```

*{
  margin: 0;
  padding: 0;
}

body{
  font-family : 'Franklin Gothic Medium';
  margin: 0;
}

.header{
  min-height: 100vh;
  width: 100%;
  background-image: linear-
gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(../Images/car1.jpg);
  background-position: center;
  background-size: cover;
  position :absolute;
}

.text-box{
  text-align: center;
  position: relative;
  color: #FFE4C4;
  top:50%;

```

```

}
.text-box h1 {
    margin-top: 50px;
    font-size: 55px;
}
.text-box p {
    margin: 10px 0 40px;
    font-size: 15px;
}
.text-box a.visit-btn {
    text-align: center;
    padding: 10px 20px;
    font-weight: 700;
    white-space: inherit;
    vertical-align: middle;
    border: 2px solid transparent;
    display: inline-block;
    margin: 10px 10px 0 0;
    border-radius: 50px;
    overflow: hidden;
    background-color: #FFE4C4;
    border: 0;
    line-height: 50px;
    box-shadow: 0 3px 6px 0 rgba(0,0,0,0.16);
    font-size: 20px;
    text-decoration: none;
    position: relative;
}
.text-box a.visit-btn:hover {
    background-image: linear-gradient(to left, #FFE4C4, #a147e4);
    background-position: left center;
}

```

Value.html

```

<!DOCTYPE html>
<html lang="en" dir="ltr">
<head>
<link rel="stylesheet" href="../static/css/value.css">
<title>Car resale value</title>

</head>
<body>
    <section class="form">
        <form action="/predict" method="GET">
            <table border="0" align="center">
                <tbody>
                    <tr>
                        <td>
                            <h1>Get the Accurate Resale Value of Your Car</h1>

```

```

<tr>
  <td><label for="year" padding:10px>Registration year : </label></td>
  <td><input id="year" maxlength="50" name="regyear" type="text" />
  <br>
  <br>
</td>
</tr>

<tr>
  <td><label for="month">Registration Month : </label></td>
  <td><input id="month" maxlength="50" name="regmonth" type="text" />
  <br>
  <br>
</td>
</tr>

<tr>
  <td><label for="power">Power of car in PS: </label></td>
  <td><input id="power" maxlength="50" name="powerps" type="text" />
  <br>
  <br>
</td>
</tr>

<tr>
  <td><label for="kilometer">Kilometers that car have driven : </label></td>
  <td><input id="kilometer" maxlength="50" name="kms" type="text" />
  <br>
  <br>
</td>
</tr>

<tr>
  <td><label for="geartype">Gear type : </label></td>
  <td><input type="radio" name="geartype" value="manual"/> Manual
    <input type="radio" name="geartype" value="automatic"/> Automatic
    <input type="radio" name="geartype" value="not-declared"/> Not declared
    <br>
    <br>
  </td>
</tr>

<tr>
  <td><label for="damage">Your car is repaired or damaged : </label></td>
  <td><input type="radio" name="damage" value="yes"/> Yes
    <input type="radio" name="damage" value="no"/> No
  </td>
</tr>

```

```
<input type="radio" name="damage" value="not-declared"/> Not declared
<br>
<br>
</td>
</tr>
```

```
<tr>
<td><label for="model">Model Type : </label></td>
<td>
<select name="model" id="model">
<option value="" disabled selected hidden>Choose Model Name...</option>
<option value="golf">Golf </option>
<option value="grand">Grand </option>
<option value="fabia">Fabia </option>
<option value="3er">3er </option>
<option value="2_reihe">2 Reihe </option>
<option value="andere">Andere </option>
<option value="c_max">C Max </option>
<option value="3_reihe">3 Reihe </option>
<option value="passat">Passat </option>
<option value="navara">Navara </option>
<option value="ka">Ka </option>
<option value="polo">Polo </option>
<option value="twingo">Twingo </option>
<option value="a_klasse">A klasse </option>
<option value="scirocco">Scirocco </option>
<option value="5er">5er </option>
<option value="meriva">Meriva </option>
<option value="arosa">Arosa </option>
<option value="c4">C4 </option>
<option value="civic">Civic </option>
<option value="transporter">Transporter </option>
<option value="punto">Punto </option>
<option value="e_klasse">E Klasse </option>
<option value="clio">Clio </option>
<option value="kadett">Kadett </option>
<option value="kangoo">Kangoo </option>
<option value="corsa">Corsa </option>
<option value="one">One </option>
<option value="fortwo">Fortwo </option>
<option value="1er">1er </option>
<option value="b_klasse">B Klasse </option>
<option value="signum">Signum </option>
<option value="astra">Astra </option>
<option value="a8">A8 </option>
<option value="jetta">Jetta </option>
```

<option value="fiesta">Fiesta </option>
<option value="c_klasse">C Klasse </option>
<option value="micra">Micra </option>
<option value="vito">Vito </option>
<option value="sprinter">Sprinter </option>
<option value="156">156 </option>
<option value="escort">Escort </option>
<option value="forester">Forester </option>
<option value="xc_reihe">Xc Reihe </option>
<option value="scenic">Scenic </option>
<option value="a4">A4 </option>
<option value="a1">A1 </option>
<option value="insignia">Insignia </option>
<option value="combo">Combo </option>
<option value="focus">Focus </option>
<option value="tt">Tt </option>
<option value="a6">A6 </option>
<option value="jazz">Jazz </option>
<option value="omega">Omega </option>
<option value="slk">Slk </option>
<option value="7er">7er </option>
<option value="80">80 </option>
<option value="147">147 </option>
<option value="glk">Glk </option>
<option value="100">100 </option>
<option value="z_reihe">Z Reihe </option>
<option value="sportage">Sportage </option>
<option value="sorento">Sorento </option>
<option value="v40">V40 </option>
<option value="5er">5er </option>
<option value="ibiza">Ibiza </option>
<option value="3er">3er </option>
<option value="mustang">Mustang </option>
<option value="eos">Eos </option>
<option value="touran">Touran </option>
<option value="getz">Getz </option>
<option value="a3">A3 </option>
<option value="almera">Almera </option>
<option value="megane">Megane </option>
<option value="7er">7er </option>
<option value="1er">1er </option>
<option value="lupo">Lupo </option>
<option value="r19">R19 </option>
<option value="zafira">Zafira </option>
<option value="caddy">Caddy </option>
<option value="2_reihe">2 Reihe </option>

<option value="mondeo">Mondeo </option>
<option value="cordoba">Cordoba </option>
<option value="colt">Colt </option>
<option value="impreza">Impreza </option>
<option value="vectra">Vectra </option>
<option value="berlingo">Berlingo </option>
<option value="80">80 </option>
<option value="m_klasse">M Klasse </option>
<option value="tiguan">Tiguan </option>
<option value="i_reihe">I Reihe </option>
<option value="espace">Espace </option>
<option value="sharan">Sharan </option>
<option value="6_reihe">6 Reihe </option>
<option value="panda">Panda </option>
<option value="up">Up </option>
<option value="seicento">Seicento </option>
<option value="ceed">Ceed </option>
<option value="5_reihe">5 Reihe </option>
<option value="yeti">Yeti </option>
<option value="octavia">Octavia </option>
<option value="mii">Mii </option>
<option value="rx_reihe">Rx Reihe </option>
<option value="6er">6er </option>
<option value="modus">Modus </option>
<option value="fox">Fox </option>
<option value="matiz">Matiz </option>
<option value="beetle">Beetle </option>
<option value="c1">C1 </option>
<option value="rio">Rio </option>
<option value="touareg">Touareg </option>
<option value="logan">Logan </option>
<option value="spider">Spider </option>
<option value="cuore">Cuore </option>
<option value="s_max">S Max </option>
<option value="a2">A2 </option>
<option value="x_reihe">X Reihe </option>
<option value="a5">A5 </option>
<option value="galaxy">Galaxy </option>
<option value="c3">C3 </option>
<option value="viano">Viano </option>
<option value="s_klasse">S Klasse </option>
<option value="1_reihe">1 Reihe </option>
<option value="avensis">Avensis </option>
<option value="sl">Sl </option>
<option value="roomster">Roomster </option>
<option value="q5">Q5 </option>

<option value="kaefer">Kaefer </option>
<option value="santa">Santa </option>
<option value="cooper">Cooper </option>
<option value="leon">Leon </option>
<option value="4_reihe">4 Reihe </option>
<option value="500">500 </option>
<option value="laguna">Laguna </option>
<option value="ptcruiser">Ptcruiser </option>
<option value="clk">Clk </option>
<option value="primera">Primera </option>
<option value="exeo">Exeo </option>
<option value="159">159 </option>
<option value="transit">Transit </option>
<option value="juke">Juke </option>
<option value="qashqai">Qashqai </option>
<option value="carisma">Carisma </option>
<option value="accord">Accord </option>
<option value="corolla">Corolla </option>
<option value="lanos">Lanos </option>
<option value="phaeton">Phaeton </option>
<option value="boxster">Boxster </option>
<option value="verso">Verso </option>
<option value="swift">Swift </option>
<option value="rav">Rav </option>
<option value="kuga">Kuga </option>
<option value="picanto">Picanto </option>
<option value="kalos">Kalos </option>
<option value="superb">Superb </option>
<option value="stilo">Stilo </option>
<option value="alhambra">Alhambra </option>
<option value="911">911 </option>
<option value="mx_reihe">Mx Reihe </option>
<option value="m_reihe">M Reihe </option>
<option value="roadster">Roadster </option>
<option value="ypsilon">Ypsilon </option>
<option value="cayenne">Cayenne </option>
<option value="galant">Galant </option>
<option value="justy">Justy </option>
<option value="90">90 </option>
<option value="sirion">Sirion </option>
<option value="crossfire">Crossfire </option>
<option value="6_reihe">6 Reihe </option>
<option value="agila">Agila </option>
<option value="duster">Duster </option>
<option value="cr_reihe">Cr Reihe </option>
<option value="v50">V50 </option>

<option value="discovery">Discovery </option>
<option value="c_reihe">C Reihe </option>
<option value="v_klasse">V Klasse </option>
<option value="yaris">Yaris </option>
<option value="c5">C5 </option>
<option value="aygo">Aygo </option>
<option value="cc">Cc </option>
<option value="carnival">Carnival </option>
<option value="fusion">Fusion </option>
<option value="bora">Bora </option>
<option value="forfour">Forfour </option>
<option value="100">100 </option>
<option value="cl">Cl </option>
<option value="tigra">Tigra </option>
<option value="156">156 </option>
<option value="300c">300c </option>
<option value="100">100 </option>
<option value="147">147 </option>
<option value="q3">Q3 </option>
<option value="spark">Spark </option>
<option value="v70">V70 </option>
<option value="x_type">X Type </option>
<option value="5_reihe">5 Reihe </option>
<option value="ducato">Ducato </option>
<option value="s_type">S Type </option>
<option value="x_trail">X Trail </option>
<option value="toledo">Toledo </option>
<option value="altea">Altea </option>
<option value="7er">7er </option>
<option value="voyager">Voyager </option>
<option value="calibra">Calibra </option>
<option value="bravo">Bravo </option>
<option value="range_rover">Range Rover </option>
<option value="antara">Antara </option>
<option value="tucson">Tucson </option>
<option value="q7">Q7 </option>
<option value="citigo">Citigo </option>
<option value="jimny">Jimny </option>
<option value="cx_reihe">Cx Reihe </option>
<option value="wrangler">Wrangler </option>
<option value="lybra">Lybra </option>
<option value="range_rover_sport">Range Rover Sport </option>
<option value="lancer">Lancer </option>
<option value="159">159 </option>
<option value="freelander">Freelander </option>
<option value="captiva">Captiva </option>

<option value="c2">C2 </option>
<option value="500">500 </option>
<option value="range_rover_evoque">Range Rover Evoque </option>
<option value="sandero">Sandero </option>
<option value="note">Note </option>
<option value="900">900 </option>
<option value="147">147 </option>
<option value="defender">Defender </option>
<option value="cherokee">Cherokee </option>
<option value="clubman">Clubman </option>
<option value="samara">Samara </option>
<option value="2_reihe">2 Reihe </option>
<option value="1er">1er </option>
<option value="3er">3er </option>
<option value="601">601 </option>
<option value="3_reihe">3 Reihe </option>
<option value="4_reihe">4 Reihe </option>
<option value="5er">5er </option>
<option value="6_reihe">6 Reihe </option>
<option value="legacy">Legacy </option>
<option value="pajero">Pajero </option>
<option value="auris">Auris </option>
<option value="niva">Niva </option>
<option value="5_reihe">5 Reihe </option>
<option value="s60">S60 </option>
<option value="nubira">Nubira </option>
<option value="vivaro">Vivaro </option>
<option value="g_klasse">G Klasse </option>
<option value="lodgy">Lodgy </option>
<option value="850">850 </option>
<option value="serie_2">Serie 2 </option>
<option value="6er">6er </option>
<option value="charade">Charade </option>
<option value="croma">Croma </option>
<option value="outlander">Outlander </option>
<option value="gl">Gl </option>
<option value="doblo">Doblo </option>
<option value="musa">Musa </option>
<option value="amarok">Amarok </option>
<option value="156">156 </option>
<option value="move">Move </option>
<option value="9000">9000 </option>
<option value="v60">V60 </option>
<option value="145">145 </option>
<option value="aveo">Aveo </option>
<option value="200">200 </option>

```
<option value="300c">300c </option>
<option value="b_max">B Max </option>
<option value="delta">Delta </option>
<option value="terios">Terios </option>
<option value="rangerover">RangeRover </option>
<option value="90">90 </option>
<option value="materia">Materia </option>
<option value="kalina">Kalina </option>
<option value="elefantino">Elefantino </option>
<option value="i3">I3 </option>
<option value="kappa">Kappa </option>
<option value="serie_3">Serie 3 </option>
<option value="48429">48429 </option>
<option value="serie_1">Serie 1 </option>
<option value="discovery_sport">Discovery Sport </option>
```

```
</select>
<br>
<br>
</td>
</tr>
```

```
<tr>
<td><label for="brand">Brand :</label></td>
<td>
<select name="brand" id="brand">
<option value="" disabled selected hidden>Choose Brand Name...</option>
<option value="volkswagen">Volkswagen </option>
<option value="audi">Audi </option>
<option value="jeep">Jeep </option>
<option value="skoda">Skoda </option>
<option value="bmw">Bmw </option>
<option value="peugeot">Peugeot </option>
<option value="ford">Ford </option>
<option value="mazda">Mazda </option>
<option value="nissan">Nissan </option>
<option value="renault">Renault </option>
<option value="mercedes_benz">Mercedes Benz </option>
<option value="opel">Opel </option>
<option value="seat">Seat </option>
<option value="citroen">Citroen </option>
<option value="honda">Honda </option>
<option value="fiat">Fiat </option>
<option value="mini">Mini </option>
<option value="smart">Smart </option>
<option value="hyundai">Hyundai </option>
```

```

<option value="sonstige_autos">Sonstige Autos </option>
<option value="alfa_romeo">Alfa Romeo </option>
<option value="subaru">Subaru </option>
<option value="volvo">Volvo </option>
<option value="mitsubishi">Mitsubishi </option>
<option value="kia">Kia </option>
<option value="suzuki">Suzuki </option>
<option value="lancia">Lancia </option>
<option value="porsche">Porsche </option>
<option value="toyota">Toyota </option>
<option value="chevrolet">Chevrolet </option>
<option value="dacia">Dacia </option>
<option value="daihatsu">Daihatsu </option>
<option value="trabant">Trabant </option>
<option value="saab">Saab </option>
<option value="chrysler">Chrysler </option>
<option value="jaguar">Jaguar </option>
<option value="daewoo">Daewoo </option>
<option value="rover">Rover </option>
<option value="land_rover">Land Rover </option>
<option value="lada">Lada </option>
</select>
<br>
<br>
</td>
</tr>

<tr>
<td><label for="fuelType">Fuel Type :</label></td>
<td>
<select name="fuelType" id="brand">
<option value="" disabled selected hidden>Choose Fuel Type...</option>
<option value="petrol"> Petrol </option>
<option value="diesel"> Diesel </option>
<option value="not-declared"> Not Declared </option>
<option value="lpg">LPG </option>
<option value="cng">CNG </option>
<option value="hybrid">Hybrid </option>
<option value="others">Others </option>
<option value="electric">Electric </option>
</select>
<br>
<br>
</td>
</tr>

```

```

        <tr>
        <td><label for="vehicletype">Vehicle type:</label></td>
        <td>
            <select name="vehicletype" id="vehicle" >
            <option value="" disabled selected hidden>Choose Vehicle Type...</option>
            <option value="coupe">Coupe </option>
            <option value="suv">SUV </option>
            <option value="kleinwagen">Kleinwagen </option>
            <option value="limousine">Limousine </option>
            <option value="cabrio">Cabrio </option>
            <option value="bus">Bus </option>
            <option value="kombi">Kombi </option>
            <option value="andere">Andere </option>
            <option value="volkswagen">Volkswagen </option>
            </select>
            <br>
            <br>
        </td>
        </tr>
    </tbody>
</table>
    <input name="Submit" type="Submit" value="Submit" id="button"/>
</form>
</section>
</body>
</html>
Value.css

```

```

.header{
    width: 100%;
    text-align: center;
    padding-top: 20px;
    font-size:20px;
    font-family :'Franklin Gothic Medium';
    background-color:#43FFB6;
    border:0%;
    top:0px;
    bottom:0px;
    right:0px;
    left:0px;
    overflow-y:auto;
}
body{
    margin: 0;
    font-family :'Franklin Gothic Medium';
}
.form{

```

```

background-image: linear-
gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(../Images/car2.jpg);
background-position: center;
background-size: cover;
position: relative;
text-align: center;
padding:20px;
display: flex;
flex-direction: column;
align-items: center;
font-size:22px;
}
input[type=text] {
width: 100%;
padding: 12px 20px;
margin: 8px 0;
display: inline-block;
border: 1px solid #ccc;
border-radius: 4px;
box-sizing: border-box;
}
select {
width: 100%;
padding: 16px 20px;
border: none;
border-radius: 4px;
background-color: #f1f1f1;
}
input[type=submit] {
font-family :'Franklin Gothic Medium';
font-weight: 700;
width: 40%;
background-color: #4CAF50;
color: black;
font-size: 20px;
padding: 20px 20px;
margin: 8px 0;
border: none;
border-radius: 4px;
cursor: pointer;
}
input[type=submit]:hover {
background-color: #37853b;
}
*{
color:black;

```



```
}
```

Predict.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">
  <link rel="stylesheet" href="../static/css/predict.css">
  <title>Car Resale Predicted Value</title>
</head>
<body>
  <section class="header">
    <nav></nav>
    <div class="text-box">
      <h1>The Predicted Car Resale Value is </h1>
      <h1>{{predict}}</h1>
    </div>
  </section>
</body>
</html>
```

Predict.css

```
.header{
  min-height: 100vh;
  width: 100%;
  background-image: linear-
gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(..Images/car3.jpg);
  background-position: center;
  background-size: cover;
  position: relative;
}
nav{
  display: flex;
  padding: 2% 6%;
  justify-content: space-between;
  align-items: center;
}
.text-box{
  text-align: center;
  position: relative;
  color: #cfbba3;
  top: 50%;
}
.text-box h1{
```

```

        margin-top: 50px;
        font-size: 55px;
    }
    body{
        margin: 0;
        font-family : 'Franklin Gothic Medium';
    }

```

app.py

```

# Import Libraries
import pandas as pd
import numpy as np
from flask import Flask, render_template, Response, request
import pickle
from sklearn.preprocessing import LabelEncoder
import requests

API_KEY = "hKEAjbvDOQF9fNf7tINrykXASVwLWFdkulNDdbJaLgtNe"
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}

app = Flask(__name__)#initiate flask app

def load_model(file='crvp.sav'):#load the saved model
    return pickle.load(open(file, 'rb'))

@app.route('/')
def index():#main page
    return render_template('car.html')

@app.route('/predict_page')
def predict_page():#predicting page
    return render_template('value.html')

@app.route('/predict', methods=['GET','POST'])
def predict():
    reg_year = int(request.args.get('regyear'))
    powerps = float(request.args.get('powerps'))
    kms= float(request.args.get('kms'))
    reg_month = int(request.args.get('regmonth'))

    gearbox = request.args.get('geartype')
    damage = request.args.get('damage')

```

```

model = request.args.get('model')
brand = request.args.get('brand')
fuel_type = request.args.get('fuelType')
veh_type = request.args.get('vehicleType')

new_row = {'yearOfRegistration':reg_year, 'powerPS':powerps, 'kilometer':kms,
           'monthOfRegistration':reg_month, 'gearbox':gearbox,
           'notRepairedDamage':damage,
           'model':model, 'brand':brand, 'fuelType':fuel_type,
           'vehicleType':veh_type}

print(new_row)

new_df = pd.DataFrame(columns=['vehicleType','yearOfRegistration','gearbox',
                              'powerPS','model','kilometer','monthOfRegistration','fuelType',
                              'brand','notRepairedDamage'])
new_df = new_df.append(new_row, ignore_index=True)
labels = ['gearbox','notRepairedDamage','model','brand','fuelType','vehicleType']
mapper = {}

for i in labels:
    mapper[i] = LabelEncoder()
    mapper[i].classes = np.load(str('classes'+i+'.npy'), allow_pickle=True)
    transform = mapper[i].fit_transform(new_df[i])
    new_df.loc[:,i+'_labels'] = pd.Series(transform, index=new_df.index)
labeled = new_df[['yearOfRegistration','powerPS','kilometer','monthOfRegistration'] +
[x+'_labels' for x in labels]]

X = labeled.values.tolist()
print('\n\n', X)
#predict = reg_model.predict(X)

#NOTE: manually define and pass the array(s) of values to be scored in the next line
payload_scoring = {'input_data': [{'fields': ["yearOfRegistration", "powerPS",
"kilometer", "monthOfRegistration", "gearbox_labels", "notRepairedDamage_labels",
"model_labels", "brand_labels", "fuelType_labels", "vehicleType_labels"], 'values': X}]}
print(payload_scoring)
response_scoring = requests.post('https://us-
south.ml.cloud.ibm.com/ml/v4/deployments/4bbb629f-8821-451b-89a9-
4902644d9f86/predictions?version=2022-11-18',
json=payload_scoring,headers={'Authorization': 'Bearer ' + mltoken})
predictions= response_scoring.json()
print(response_scoring.json())
predict = predictions['predictions'][0]['values'][0][0]
print("Final prediction :",predict)

```

```
return render_template('predict.html',predict=predict)

if __name__=='__main__':
    reg_model = load_model()#load the saved model
    app.run(host='localhost', debug=True, threaded=False)
```

GitHub & Project Demo Link:

<https://github.com/IBM-EPBL/IBM-Project-23595-1659888283>

https://drive.google.com/file/d/1SePUxhy6Isx4TXHVP7iL_4kTKvdYZg5o/view?usp=share_link