CAR RESALE VALUE PREDICTION

TEAM ID:PNT2022TMID52881

- submitted by

Abitha.S (193002004)

Brindha.K (193002018)

Nandana.R (193002064)

Lokesh.T (193002054)

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 Feature 1
   7.2 Feature 2
   7.3 Database Schema (if Applicable)
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**

CHAPTER 1   **INTRODUCTION**

1.1 PROJECT OVERVIEW

Accurate car price prediction for used cars involves expert knowledge,because price usually depends on many unique features and factors.Generally,the most important ones are brand name ,model,kilometers driven,type of fuel,year of registration,damaged parts and mileage.The fuel consumption per mile highly affected the price of a car due to often changes in the price of the fuel.Distinct features like exterior color,door number,type of transmission,dimensions,safety,air conditioning,interior will result in determining the price of the car.Data Cleaning,Data Processing,Model Building using Machine learning algorithms,Application building are involved to predict the price of a used car.

1.2 PURPOSE

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. 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 is to be built that would give the nearest resale value of the vehicle. We will be using various regression algorithms and algorithms 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.

CHAPTER 2   **LITERATURE SURVEY**

2.1 Existing problem

Car Resale value prediction is one of the best to sell our in this market for an best and better price.Rather than giving our car to an less price , the customer those who uses the car will be benefited and the seller will also be benefitted.The goal of this research is to create a system that can impartially forecast a car's resale value based on little information such as the number of miles travelled and the year of purchase.You don't even need to register to have your automobile valued; all you need to do is provide some basic information about it, such as its make, model, amount of miles driven, city of residence, and contact information.

2.2 REFERENCES

[1]   Pudaruth Sameerchand , Pudaruth Sameerchand , Predicting the price of Used Car Using Machine Learning Techniques

[2]   Enis gegic, Becir ,Isakovic, Dino Keco, ,Zerina Masetic,Jasmin Kevric Car Price Prediction Using Machine Learning

[3]   Ning sun,Hongxi Bai,Yuxia Geng,Huizhu Shi Price Evaluation model in second hand car system

[4]   Doan Van Thai, Luong Ngoc Son, Pham Vu Tien, Nguyen Nhat Anh, Nguyen Thi Ngoc Anh Prediction car prices using qualify qualitative data and knowledge-based systems.
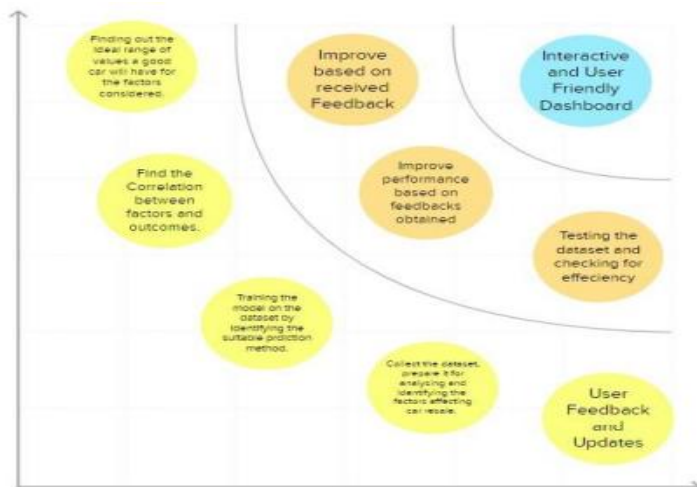
CHAPTER 3   IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS
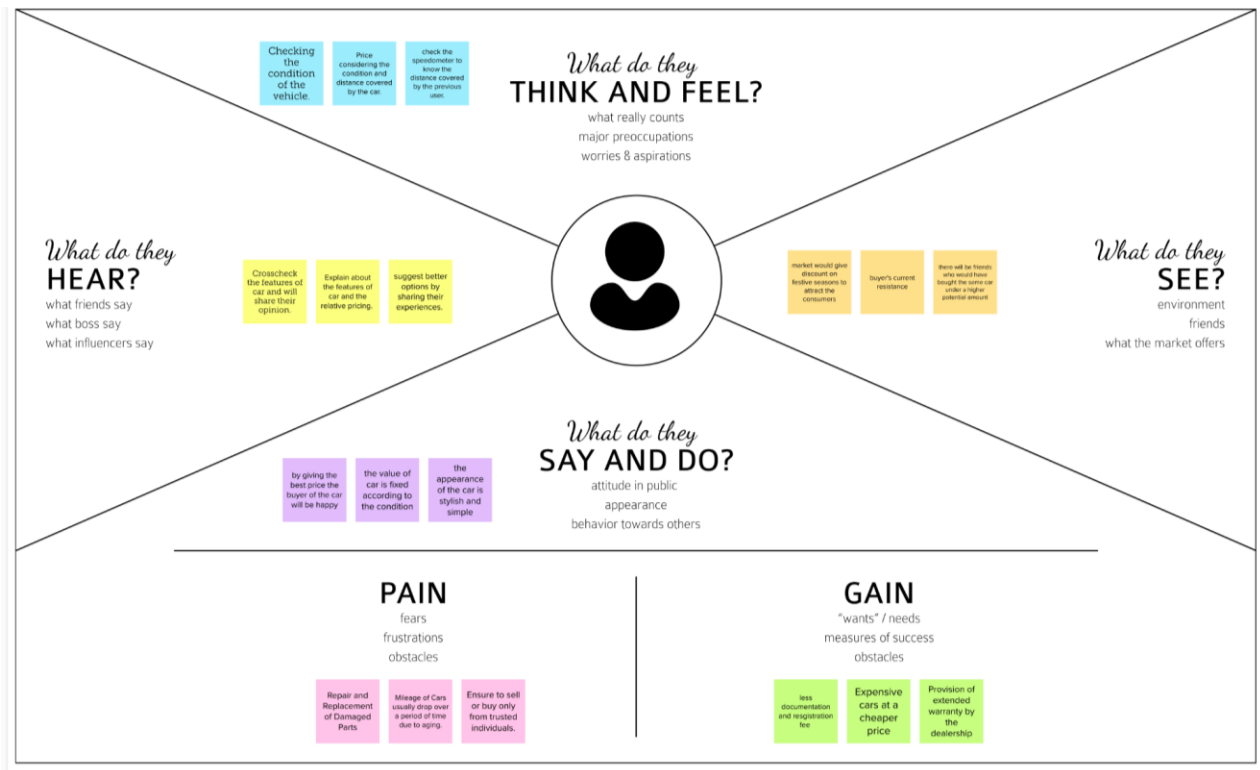
3.2 IDEATION AND BRAINSTORMING

ABITHA.S

Observe engine conditions of a car.	Refer the research paper.	Training the model with datasets.
Wear and Tear factors.	To prepare a database that contains complete information.	Train the model for worst cases to improve accuracy.
Possible risk factors are analysed.	Crosscheck the results with standard methods.	Crosschecking the documents given by the owner.

NANDANA.R

enquire about the car conditions with the previous owner	improve the model for all test cases	finding out ideal factors for working conditions of car
download a dataset and clean it by removing unnecessary details	find the correlations between outcome and factors by various graphs and plots	improving the accuracy by training with more datasets
minimization of the errors compared with previous datasets	analysis are done instantly in an improved manner	user friendly interface for better usage

BRINDHA.K

Performing a thorough check on car's past records like registration papers,insurance etc	check for odometer tampering.Tally the record with previous records	Seek expert advice or ask a trusted mechanic to look into the conditions of the car
Check for paint differences and rust in the body of the car	Inspect if there are any major dents found on the car	Check for the month and year the tyre has been manufactured
Test driving the car will give you insights about its performance	Analysis can be done instantly	Better efficiency and accuracy

LOKESH.T

Collect necessary information	Make sure the analysis is error free	Differentiate damaged and fully functional parts.
Collect feedback from Users	Find feasible tools	Replace Damaged parts
Perform background checks on the previous owner	Cross-check the provided information	Compare with Latest features available in the Market

Dataset Collection and Preparation	Training, Testing and Optimizing	Work and Deliverables
collect the dataset, prepare it for analyzing and identify the factors affecting the resale value of the car	Training the model on the dataset by identifying the best suitable prediction methodology	Interactive and User Friendly Dashboard
find the correlation between factors and outcomes.	Test the dataset for all possible test cases and check for efficiency	User Feedback and Updates
finding out the ideal range of values a healthy person will have for the factors considered	minimization of errors compared with previous prototypes	Delivery of Project at estimated time

3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Evaluating the best resale value based on the conditions of the car so that it saves money.
2.	Idea / Solution description	In this project,we plan to build an interactive dashboard for predicting the resale value of the car based on price, kilometers run, year of registration, brand, vehicle type, gear box, etc. Using Machine learning algorithms like Random Forest algorithm, in which we predict the resale value of the car.
3.	Novelty / Uniqueness	Provide users with money back under cases of dissatisfaction. Provide users opportunity to sell vintage valuable cars at a satisfactory price.
4.	Social Impact / Customer Satisfaction	Customers will learn more about the vehicle they wish to buy,by analyzing the wear and tear factors and determining the best price for the vehicle.
5.	Business Model (Revenue Model)	Profitable for both the automobile industry and the customers so that they can plan and improve their future models.
6.	Scalability of the Solution	Currently a small set of car details were used to train the model. More car details and a larger group of parameters will be included and used to train the model. Hence a better price estimate can be achieved in the future alongside a wider range of car brands and car models being included. Therefore, the model gets more generalized and ready for common use.

3.4 PROBLEM SOLUTION FIT

The Problem-Solution Fit simply means that we have found a problem with our customer and that the solution we have realized for it actually solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns and recognize what would work and why. The purpose is to solve complex problems in a way that fits the state of your customers and succeed faster and increase your solution adoption by tapping into existing mediums and channels of behavior .

1. CUSTOMER SEGMENT(S) `CS`

A person who wishes to buy or sell the car

6. CUSTOMER CONSTRAINTS `CC`

Customers may have a limited funds and would prefer not to spend on features that are luxurious or unnecessary.

Also, customers might not have any resale showrooms nearby, or might not be able to visit one.

5. AVAILABLE SOLUTIONS `AS`

Available solutions often have issues in predicting the right value and often end up over pricing it discouraging buyers.

2. JOBS-TO-BE-DONE / PROBLEM

By creating an interactive dashboard, it would be easier for the customers to either sell or buy the car by looking into the features they require.

9. PROBLEM ROOT CAUSE `RC`

Users at most instances would have an outline about the features that they would expect their car to have, however wouldn't necessarily have a particular car in mind.

Also many users would not be aware about the price resale cars are should be put out for.

7. BEHAVIOUR `BE`

When the necessary data is provided, users expect accurate cost prediction and results.

3. TRIGGERS

Affordable fuel-efficient vehicle that meets your everyday needs to save money as well as help the environment.

4. EMOTIONS: BEFORE / AFTER `EM`

Before: Difficulty to choose cars based of the budget. Decisions had to made in order to sacrifice some features due to less options.

After: Ease of access and wide range of options to pick from including all the new features.

10. YOUR SOLUTION `SL`

Offering cost worthy and reliable cars based of the needs and budget of the user.

8. CHANNELS of BEHAVIOUR `CH`

ONLINE:
Predicting the performance of a vehicle based of historical data.
Customer reviews.
Pictures of both interiors and exteriors.

OFFLINE:
Test drive options.
Live assessment.

CHAPTER 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	Registration through website/mobile
FR-2	User Confirmation	Confirmation via Email
FR-3	User Login	Captcha & credentials
FR-4	Help Desk	Service Email and other contact details.
FR-5	Security	Failed Logins & Bot access prevention.

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 interface.
NFR-2	Security	Data and model security to prevent outside access and modification.
NFR-3	Reliability	Trusted Data set used and model tested multiple times to ensure reliable results.
NFR-4	Performance	Performance metrics analysis.
NFR-5	Availability	Available for access across all platforms and for free of cost.
NFR-6	Scalability	Currently a small set of car details were used to train the model. More car details and a larger group of parameters will be included and used to train the model.

CHAPTER 5   **PROJECT DESIGN**

Data Flow Diagrams ,Solution & Technical Architecture

5.1 DATA FLOW DIAGRAMS:

A Data Flow Diagram (DFD) is a graphical representation of the flow of data in a business information system. It describes the processes that are involved in a system to transfer data from the input to the file storage and reports generation. It shows how data enters and leaves the system, what changes the information, and where data is stored.
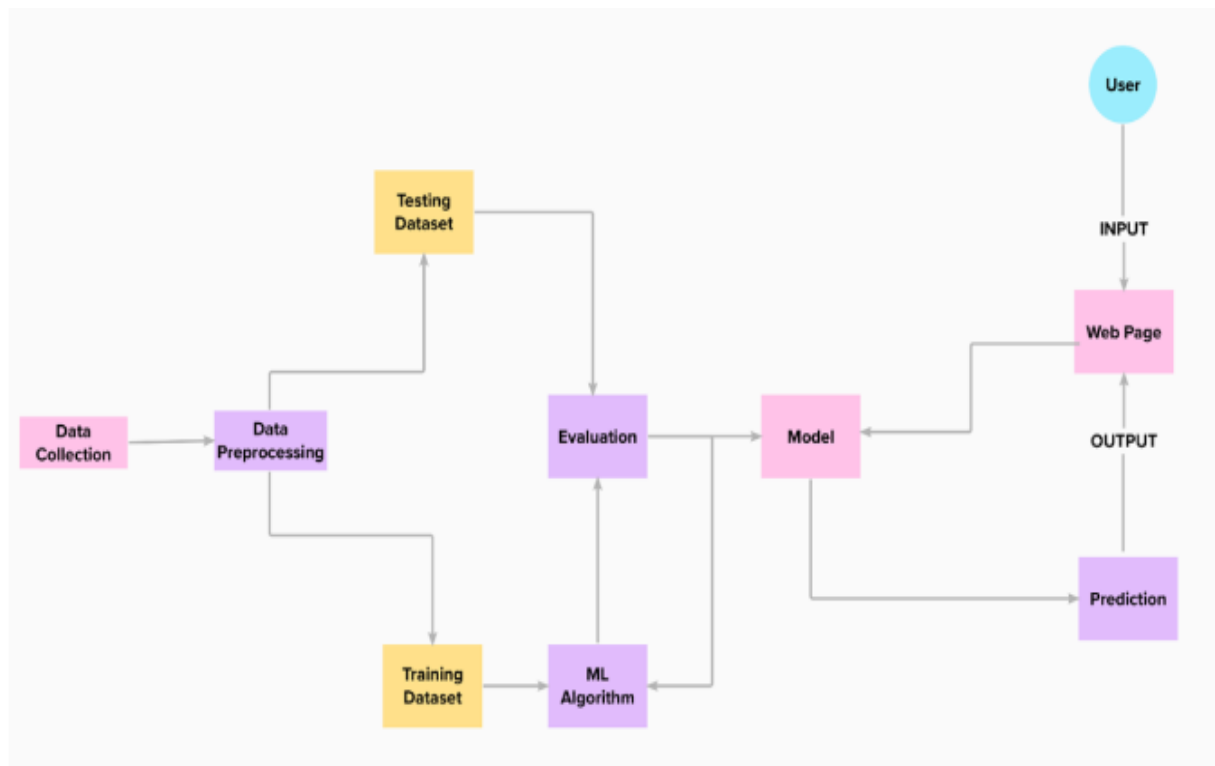
5.2 SOLUTION AND ARCHITECTURE DIAGRAM:

Solution Architecture: Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

• Find the best tech solution to solve existing business problems.

• Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.

• Define features, development phases, and solution requirements.

• Provide specifications according to which the solution is defined, managed, and delivered.

```
                        ┌──────────────────┐
                        │       DATA       │
                        └──────────────────┘
                                 │
                     ┌──────────────────────────┐
                     │  DATA PRE-PROCESSING      │
                     └──────────────────────────┘
           ┌──────────────┐              ┌──────────────┐
           │   TEST SET   │              │  TRAIN SET   │
           └──────────────┘              └──────────────┘
                        ┌──────────────────┐
                        │   ML ALGORITHM   │
                        └──────────────────┘
                        ┌──────────────────┐
                        │   EVALUATION     │
                        └──────────────────┘
                        ┌──────────────────┐
                        │      MODEL       │
                        └──────────────────┘
                    INPUT              OUTPUT
                        ┌──────────────────┐
                        │      USER        │
                        │   INTERFACE      │
                        └──────────────────┘
                        ┌──────────────────┐
                        │      USER        │
                        └──────────────────┘
```
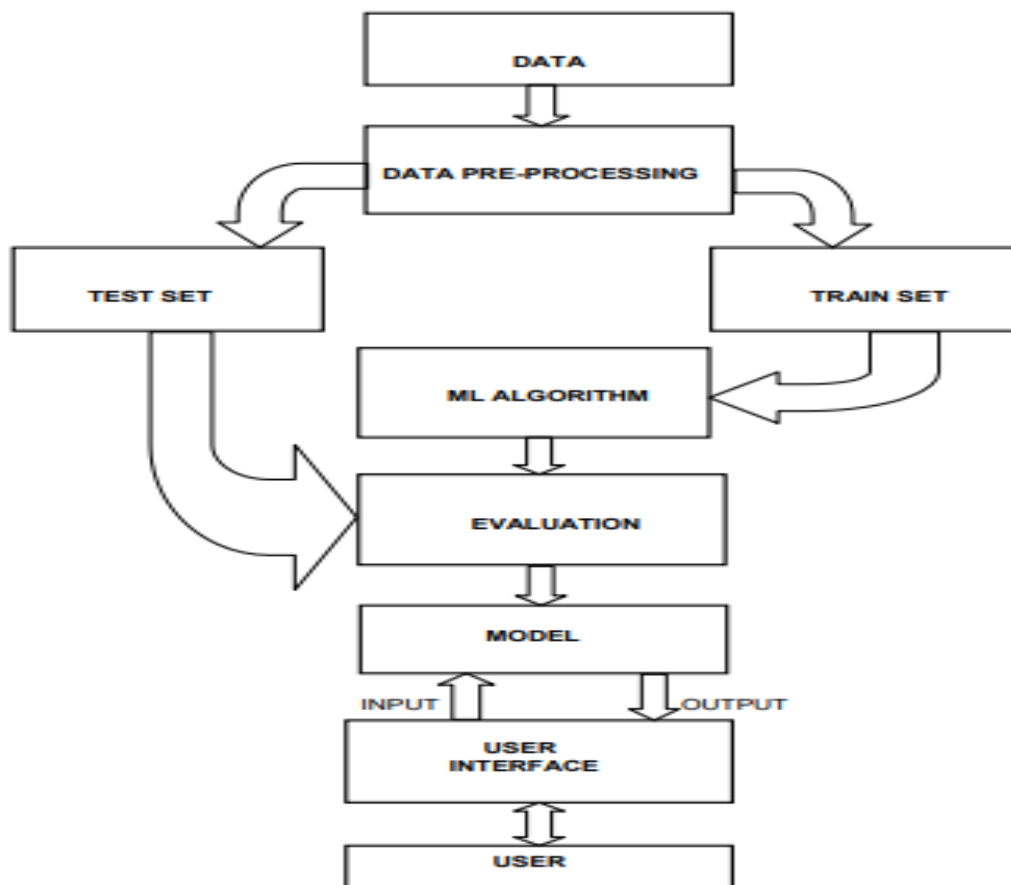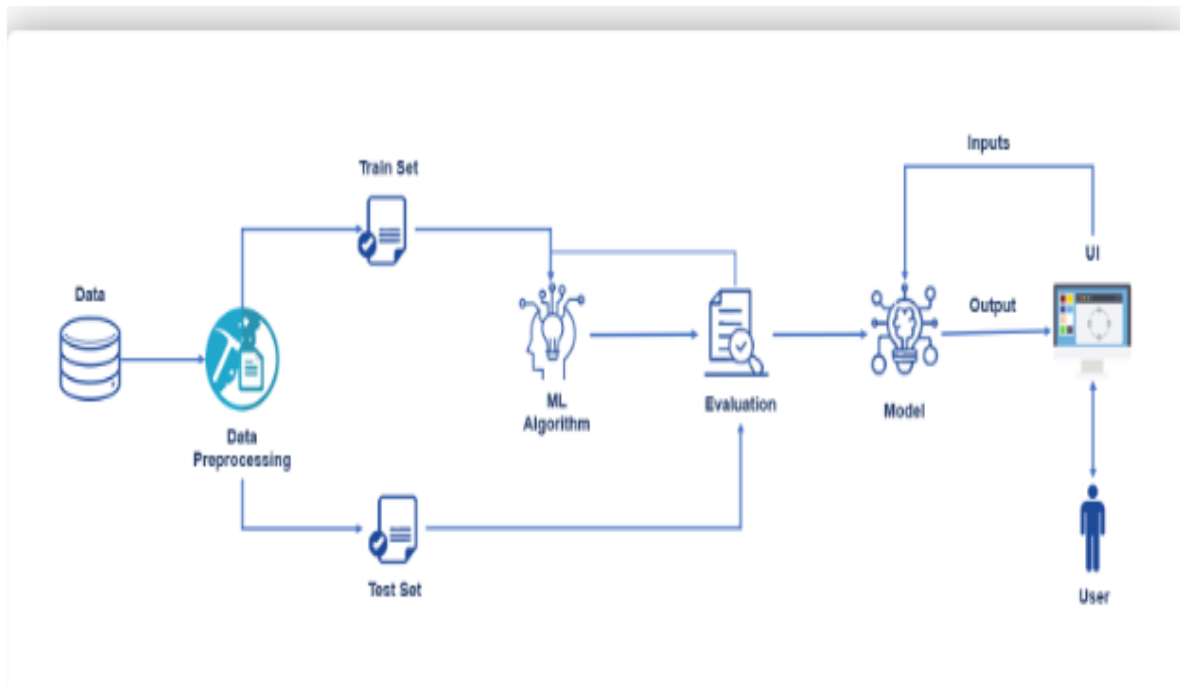
5.3 USER STORIES:

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	Priority	Release
Customer (Mobile user)	Data Entry	USN-1	As a user, I can enter the car details in the application and receive an unique ID to verify my credentials	I can access the account and enter the car details	Medium	Sprint-1
Customer (Mobile user)	Obtain output	USN-2	As a user, I will receive car resale value in the application	I can receive my car resale value	High	Sprint-1
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	Medium	Sprint-1

Customer (Mobile user)	Obtain output	USN-2	As a user, I will receive car resale value in the application.	I can receive my car's resale value	High	Sprint-1
Customer (Web user)	Login	USN-3	As a user,I will contact the dealer and negotiate the price.	I can receive if my offer is accepted or not	Medium	Sprint-2
Customer Care executive	Helpdesk	USN-4	As a user,I will contact the helpdesk in case of any query.	I will be given an appropriate solution for my query.	Medium	Sprint-2
Administrator	Security	USN-5	As the administrator,I would be notified regarding failed logins and login other than the registered devices.	I will notify the user to verify from their end.	High	Sprint-3

CHAPTER 6 **PROJECT PLANNING & SCHEDULING**

6.1 SPRINT PLANNING & ESTIMATION

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Pre- process the data	USN-1	Collect and download the Dataset	2	High	Abitha Brindha
Sprint-1		USN-2	Import required libraries	1	High	Nandana Lokesh
Sprint-1		USN-3	Read and clean the dataset	2	Low	Abitha
Sprint-2	Model Building	USN-1	Split the data into independent and dependent variables	2	Medium	Brindha

Sprint-2		USN-2	Build regression model	1	High	Nandana Lokesh
Sprint-3	Application Building	USN-1	Build python application	2	Medium	Abitha
Sprint-3		USN-2	Test the application model	3	High	Brindha Nandana Lokesh
Sprint-4	Train the model	USN-1	Train the model	3	High	Abitha Brindha Nandana Lokesh

6.2 SPRINT DELIVERY SCHEDULE:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	IN PROGRESS
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	IN PROGRESS
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	IN PROGRESS

REPORTS FROM JIRA:
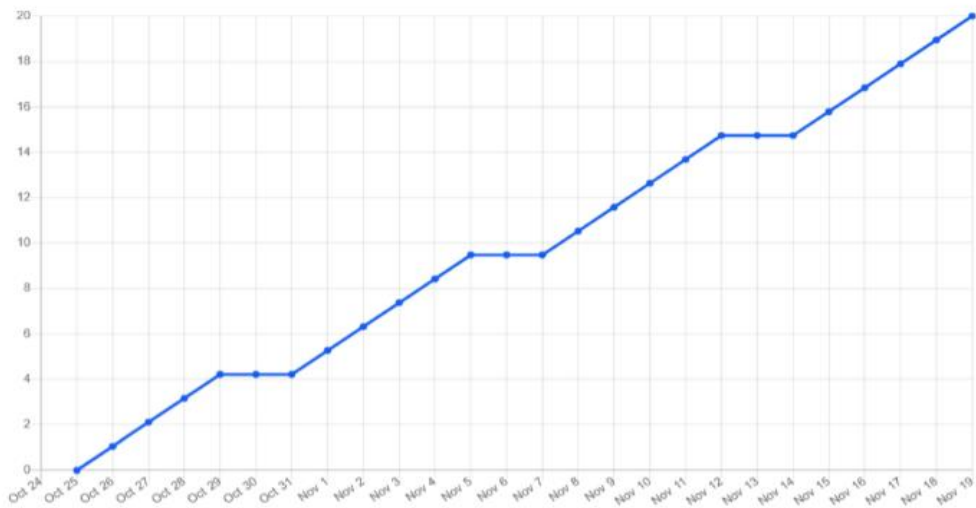
HOME PAGE

HTML FILE

```html
<!DOCTYPE html>

<html>

<head>

    <title>Car Resale Value Prediction</title>

    <link rel="stylesheet" href="../static/css/style.css">

</head>

<body>

    <div class="banner">

        <div class="navbar">

            <img src="../static/Images/logo11.png" class="logo">

            <ul>

                <li><a href="/predict_page">Check the Value</a></li>

                <li><a href="#">Contact Us</a></li>

            </ul>
```

```html
            </div>

            <div class="content">

                <h1>Best resale price</h1>

                <p>Our Algorithm can determine the best for your used car</p>

                <div>

                    <a href="/predict_page"><button
type="button"><span></span>Get the Best Price!</button></a>


                </div>

            </div>

        </div>

</body>

</html>
```

CSS FILE

```css
*{

    margin: 0;

    padding: 0;
```

```css
        font-family: sans-serif;

}

.banner{

        width: 100%;

        height: 100vh;

        background-image: linear-
gradient(rgba(0,0,0,0.75),rgba(0,0,0,0.75)),url(../Images/valuation.jpg);

        background-size: cover;

        background-position: center;

}

.navbar{

        width: 85%;

        margin: auto;

        padding: 35px 0;

        display:  flex;

        align-items: center;

        justify-content: space-between;
```

```css
    }

    .logo{

        width:  120px;

        cursor: pointer;

    }

    .navbar ul li{

        list-style: none;

        display: inline-block;

        margin: 0 20px;

        position: relative;

    }

    .navbar ul li a{

        text-decoration: none;

        color: #fff;

        text-transform: uppercase;

    }

    .navbar ul li::after{
```

```css
        content: '';

        height: 3px;

        width: 0;

        background: #A9D3FF;

        position: absolute;

        left: 0;

        bottom: -10px;

        transition: 0.5s;

}

.navbar ul li:hover::after{

        width: 100%;

}

.content{

        width: 100%;

        position: absolute;

        top: 50%;

        transform: translateY(-50%);
```

```css
        text-align: center;

        color: #fff;

}

.content h1{

        font-size: 70px;

        margin-top: 80px;

}

.content p{

        margin: 20px auto;

        font-weight: 100;

        line-height: 25px;

}

button{

        width: 200px;

        padding: 15px 0;

        text-align: center;

        margin: 20px 10px;
```

```css
        border-radius: 25px;

        font-weight: bold;

        border: 2px solid #A9D3FF;

        background: transparent;

        color: #fff;

        cursor: pointer;

        position: relative;

        overflow: hidden;

    }

span{

        background: #A9D3FF;

        height: 100%;

        width: 0;

        border-radius: 25px;

        position: absolute;

        left: 0;

        bottom: 0;
```

```css
        z-index: -1;

        transition: 0.5s;

}

button:hover span{

        width: 100%;

}

button:hover{

        border: none;

}
```

INPUT PAGE:

[23:47, 11/19/2022] lokesh: <!DOCTYPE html>

<html>

<head>

  <title> CAR RESALE VALUE PREDICTION</title>

  <style>

     @import url("https://fonts.googleapis.com/css?family=Open+Sans:400,700");

```css
:root {

  --white: #afafaf;

  --red: #e31b23;

  --bodyColor: #292a2b;

  --borderFormEls: hsl(0, 0%, 10%);

  --bgFormEls: hsl(0, 0%, 14%);

  --bgFormElsFocus: hsl(0, 7%, 20%);

}


* {

  padding: 0;

  margin: 0;

  box-sizing: border-box;

  outline: none;

}
```

```css
a {

  color: inherit;

}



input,

select,

textarea,

button {

  font-family: inherit;

  font-size: 100%;

}



button,

label {

  cursor: pointer;

}



a {
```

```css
select {

  appearance: none;

}


/* Remove native arrow on IE */

select::-ms-expand {

  display: none;

}


select:-moz-focusring {

  color: transparent !important;

  text-shadow: 0 0 0 var(--white);

}


textarea {

  resize: none;

}
```

```css
ul {

  list-style: none;

}


body {

  font: 18px/1.5 "Open Sans", sans-serif;

  background: var(--bodyColor);

  color: var(--white);

  margin: 1.5rem 0;

  text-align: center;

}


.container {

  max-width: 800px;
```

```css
    margin: 0 auto;

    padding: 0 1.5rem;

}


.my-form h1 {

  margin-bottom: 1.5rem;

}


.my-form li,

.my-form .grid>*:not(:last-child) {

  margin-bottom: 1.5rem;

}


.my-form select,

.my-form input,

.my-form textarea,

.my-form button {
```

```css
    width: 100%;

    line-height: 1.5;

    padding: 15px 10px;

    border: 1px solid var(--borderFormEls);

    color: var(--white);

    background: var(--bgFormEls);

    transition: background-color 0.3s cubic-bezier(0.57, 0.21, 0.69, 1.25),

        transform 0.3s cubic-bezier(0.57, 0.21, 0.69, 1.25);

}


.my-form ::placeholder {

    color: inherit;

    /Fix opacity issue on Firefox/

    opacity: 1;

}


.my-form select:focus,
```

```css
.my-form input:focus,

.my-form textarea:focus,

.my-form button:enabled:hover,

.my-form button:focus,

.my-form input[type="checkbox"]:focus+label {

  background: var(--bgFormElsFocus);

}


.my-form select:focus,

.my-form input:focus,

.my-form textarea:focus {

  transform: scale(1.02);

}


.my-form *:required,

.my-form select {

  background-repeat: no-repeat;
```

```css
    background-position: center right 12px;

    background-size: 15px 15px;

  }


  .my-form *:required {

    background-image: url(https://s3-us-west-
2.amazonaws.com/s.cdpn.io/162656/asterisk.svg);

  }


  .my-form select {

    background-image: url(https://s3-us-west-
2.amazonaws.com/s.cdpn.io/162656/down.svg);

  }


  .my-form *:disabled {

    cursor: default;

    filter: blur(2px);
```

```css
    }


    .my-form .required-msg {

        display: none;

        background: url(https://s3-us-west-2.amazonaws.com/s.cdpn.io/162656/asterisk.svg) no-
repeat center left / 15px 15px;

        padding-left: 20px;

    }



    .my-form .btn-grid {

        position: relative;

        overflow: hidden;

        transition: filter 0.2s;

    }



    .my-form button {

        font-weight: bold;
```

```css
}


.my-form button>* {

    display: inline-block;

    width: 100%;

    transition: transform 0.4s ease-in-out;

}


.my-form button .back {

    position: absolute;

    left: 50%;

    top: 50%;

    transform: translate(-110%, -50%);

}


.my-form button:enabled:hover .back,

.my-form button:focus .back {
```

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

      }



    .my-form button:enabled:hover .front,

    .my-form button:focus .front {

      transform: translateX(110%);

    }

  </style>

  <link rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/css/bootstrap.min.css">

</head>



<body>

  <form class="my-form" action="/y_predict" method="post">

    <div class="container">

      <h1>Enter Your Car Details to Predict Price</h1>

      <ul>
```

```html
<li>

  <div class="row">

    <div class="grid grid-2 col-sm-6">

      <input id="regyear" type="text" name="regyear" required

        placeholder="Year Of Registration" />

    </div>

    <div class="grid grid-2 col-sm-6">

      <input id="regmonth" type="text" name="regmonth" required

        placeholder="Month Of Registration" />

    </div>

  </div>

</li>

<li>

  <div class="row">

    <div class="grid grid-2 col-sm-6">

      <input id="powerps" type="text" name="powerps" required
placeholder="Power of Car in PS" />
```

```html
        </div>

        <div class="grid grid-2 col-sm-6">

          <input id="kms" type="text" name="kms" required

            placeholder="Kilometers the Car has Driven" />

        </div>

    </div>

</li>

<li>

  <div class="row">

    <div class="grid grid-2 col-sm-6">

      <select id="gearbox" name="gearbox" required>

        <option selected disabled> Select Gear Box Type</option>

        <option value="manual">Manual</option>

        <option value="automatic">Automatic</option>

        <option value="not-declared">Not-Declared</option>

      </select>

    </div>
```

```html
        <div class="grid grid-2 col-sm-6">

          <select id="dam" name="dam" required>

            <option selected disabled>Your Car is damaged or repaired</option>

            <option value="No">No</option>

            <option value="Yes">Yes</option>

            <option value="not-declared">Not-Declared</option>

          </select>

        </div>

      </div>

    </li>

    <li>

      <div class="row">

        <div class="grid grid-2 col-sm-6">

          <select id="modeltype" name="modeltype" required>

            <option selected disabled>Model Type</option>

            <option value="80">80</option>

            <option value="90">90</option>
```

```html
<option value="100">100</option>

<option value="145">145</option>

<option value="147">147</option>

<option value="156">156</option>

<option value="159">159</option>

<option value="200">200</option>

<option value="500">500</option>

<option value="850">850</option>

<option value="900">900</option>

<option value="911">911</option>

<option value="9000">9000</option>

<option value="1_reihe">1_Reihe</option>

<option value="1er">1Er</option>

<option value="2_reihe">2_Reihe</option>

<option value="3_reihe">3_Reihe</option>

<option value="300c">300C</option>

<option value="3er">3Er</option>
```

```
<option value="4_reihe">4_Reihe</option>

<option value="5_reihe">5_Reihe</option>

<option value="5er">5Er</option>

<option value="6_reihe">6_Reihe</option>

<option value="6er">6Er</option>

<option value="7er">7Er</option>

<option value="a_klasse">A_Klasse</option>

<option value="a1">A1</option>

<option value="a2">A2</option>

<option value="a3">A3</option>

<option value="a4">A4</option>

<option value="a5">A5</option>

<option value="a6">A6</option>

<option value="a8">A8</option>

<option value="accord">Accord</option>

<option value="agila">Agila</option>

<option value="alhambra">Alhambra</option>
```

```html
<option value="almera">Almera</option>

<option value="altea">Altea</option>

<option value="amarok">Amarok</option>

<option value="andere">Andere</option>

<option value="antara">Antara</option>

<option value="arosa">Arosa</option>

<option value="astra">Astra</option>

<option value="auris">Auris</option>

<option value="avensis">Avensis</option>

<option value="aveo">Aveo</option>

<option value="aygo">Aygo</option>

<option value="b_klasse">B_Klasse</option>

<option value="b_max">B_Max</option>

<option value="beetle">Beetle</option>

<option value="berlingo">Berlingo</option>

<option value="bora">Bora</option>

<option value="boxster">Boxster</option>
```

```html
<option value="bravo">Bravo</option>

<option value="c_klasse">C_Klasse</option>

<option value="c_max">C_Max</option>

<option value="c_reihe">C_Reihe</option>

<option value="c1">C1</option>

<option value="c2">C2</option>

<option value="c3">C3</option>

<option value="c4">C4</option>

<option value="c5">C5</option>

<option value="caddy">Caddy</option>

<option value="calibra">Calibra</option>

<option value="captiva">Captiva</option>

<option value="carisma">Carisma</option>

<option value="carnival">Carnival</option>

<option value="cayenne">Cayenne</option>

<option value="cc">Cc</option>

<option value="ceed">Ceed</option>
```

```
<option value="charade">Charade</option>

<option value="cherokee">Cherokee</option>

<option value="citigo">Citigo</option>

<option value="civic">Civic</option>

<option value="cl">Cl</option>

<option value="clio">Clio</option>

<option value="clk">Clk</option>

<option value="clubman">Clubman</option>

<option value="colt">Colt</option>

<option value="combo">Combo</option>

<option value="cooper">Cooper</option>

<option value="cordoba">Cordoba</option>

<option value="corolla">Corolla</option>

<option value="corsa">Corsa</option>

<option value="cr_reihe">Cr_Reihe</option>

<option value="croma">Croma</option>

<option value="crossfire">Crossfire</option>
```

```html
<option value="cuore">Cuore</option>

<option value="cx_reihe">Cx_Reihe</option>

<option value="defender">Defender</option>

<option value="delta">Delta</option>

<option value="discovery">Discovery</option>

<option value="discovery_sport">Discovery_Sport</option>

<option value="doblo">Doblo</option>

<option value="ducato">Ducato</option>

<option value="duster">Duster</option>

<option value="e_klasse">E_Klasse</option>

<option value="elefantino">Elefantino</option>

<option value="eos">Eos</option>

<option value="escort">Escort</option>

<option value="espace">Espace</option>

<option value="exeo">Exeo</option>

<option value="fabia">Fabia</option>

<option value="fiesta">Fiesta</option>
```

```html
<option value="focus">Focus</option>

<option value="forester">Forester</option>

<option value="forfour">Forfour</option>

<option value="fortwo">Fortwo</option>

<option value="fox">Fox</option>

<option value="freelander">Freelander</option>

<option value="fusion">Fusion</option>

<option value="g_klasse">G_Klasse</option>

<option value="galant">Galant</option>

<option value="galaxy">Galaxy</option>

<option value="getz">Getz</option>

<option value="gl">Gl</option>

<option value="glk">Glk</option>

<option value="golf">Golf</option>

<option value="grand">Grand</option>

<option value="i_reihe">I_Reihe</option>

<option value="i3">I3</option>
```

```html
<option value="ibiza">Ibiza</option>

<option value="impreza">Impreza</option>

<option value="insignia">Insignia</option>

<option value="jazz">Jazz</option>

<option value="jetta">Jetta</option>

<option value="jimny">Jimny</option>

<option value="juke">Juke</option>

<option value="justy">Justy</option>

<option value="ka">Ka</option>

<option value="kadett">Kadett</option>

<option value="kaefer">Kaefer</option>

<option value="kalina">Kalina</option>

<option value="kalos">Kalos</option>

<option value="kangoo">Kangoo</option>

<option value="kappa">Kappa</option>

<option value="kuga">Kuga</option>

<option value="laguna">Laguna</option>
```

```html
<option value="lancer">Lancer</option>

<option value="lanos">Lanos</option>

<option value="legacy">Legacy</option>

<option value="leon">Leon</option>

<option value="lodgy">Lodgy</option>

<option value="logan">Logan</option>

<option value="lupo">Lupo</option>

<option value="lybra">Lybra</option>

<option value="m_klasse">M_Klasse</option>

<option value="m_reihe">M_Reihe</option>

<option value="materia">Materia</option>

<option value="matiz">Matiz</option>

<option value="megane">Megane</option>

<option value="meriva">Meriva</option>

<option value="micra">Micra</option>

<option value="mii">Mii</option>

<option value="modus">Modus</option>
```

```html
<option value="mondeo">Mondeo</option>

<option value="move">Move</option>

<option value="musa">Musa</option>

<option value="mustang">Mustang</option>

<option value="mx_reihe">Mx_Reihe</option>

<option value="navara">Navara</option>

<option value="niva">Niva</option>

<option value="not-declared">Not-Declared</option>

<option value="note">Note</option>

<option value="nubira">Nubira</option>

<option value="octavia">Octavia</option>

<option value="omega">Omega</option>

<option value="one">One</option>

<option value="outlander">Outlander</option>

<option value="pajero">Pajero</option>

<option value="panda">Panda</option>

<option value="passat">Passat</option>
```

```html
<option value="phaeton">Phaeton</option>

<option value="picanto">Picanto</option>

<option value="polo">Polo</option>

<option value="primera">Primera</option>

<option value="ptcruiser">Ptcruiser</option>

<option value="punto">Punto</option>

<option value="q3">Q3</option>

<option value="q5">Q5</option>

<option value="q7">Q7</option>

<option value="qashqai">Qashqai</option>

<option value="r19">R19</option>

<option value="range_rover">Range_Rover</option>

<option value="range_rover_evoque">Range_Rover_Evoque</option>

<option value="range_rover_sport">Range_Rover_Sport</option>

<option value="rangerover">Rangerover</option>

<option value="rav">Rav</option>

<option value="rio">Rio</option>
```

```html
<option value="roadster">Roadster</option>

<option value="roomster">Roomster</option>

<option value="rx_reihe">Rx_Reihe</option>

<option value="s_klasse">S_Klasse</option>

<option value="s_max">S_Max</option>

<option value="s_type">S_Type</option>

<option value="s60">S60</option>

<option value="samara">Samara</option>

<option value="sandero">Sandero</option>

<option value="santa">Santa</option>

<option value="scenic">Scenic</option>

<option value="scirocco">Scirocco</option>

<option value="seicento">Seicento</option>

<option value="serie_2">Serie_2</option>

<option value="serie_3">Serie_3</option>

<option value="sharan">Sharan</option>

<option value="signum">Signum</option>
```

```html
<option value="sirion">Sirion</option>

<option value="sl">Sl</option>

<option value="slk">Slk</option>

<option value="sorento">Sorento</option>

<option value="spark">Spark</option>

<option value="spider">Spider</option>

<option value="sportage">Sportage</option>

<option value="sprinter">Sprinter</option>

<option value="stilo">Stilo</option>

<option value="superb">Superb</option>

<option value="swift">Swift</option>

<option value="terios">Terios</option>

<option value="tigra">Tigra</option>

<option value="tiguan">Tiguan</option>

<option value="toledo">Toledo</option>

<option value="touareg">Touareg</option>

<option value="touran">Touran</option>
```

```html
<option value="transit">Transit</option>

<option value="transporter">Transporter</option>

<option value="tt">Tt</option>

<option value="tucson">Tucson</option>

<option value="twingo">Twingo</option>

<option value="up">Up</option>

<option value="v_klasse">V_Klasse</option>

<option value="v40">V40</option>

<option value="v50">V50</option>

<option value="v60">V60</option>

<option value="v70">V70</option>

<option value="vectra">Vectra</option>

<option value="verso">Verso</option>

<option value="viano">Viano</option>

<option value="vito">Vito</option>

<option value="vivaro">Vivaro</option>

<option value="voyager">Voyager</option>
```

```html
            <option value="wrangler">Wrangler</option>

            <option value="x_reihe">X_Reihe</option>

            <option value="x_trail">X_Trail</option>

            <option value="x_type">X_Type</option>

            <option value="xc_reihe">Xc_Reihe</option>

            <option value="yaris">Yaris</option>

            <option value="yeti">Yeti</option>

            <option value="ypsilon">Ypsilon</option>

            <option value="z_reihe">Z_Reihe</option>

            <option value="zafira">Zafira</option>


        </select>

    </div>

    <div class="grid grid-2 col-sm-6">

        <select id="brand" class="input" name="brand" required>

            <option selected disabled>Brand of the Car</option>

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

```html
<option value="alfa_romeo">Alfa_Romeo</option>

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

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

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

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

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

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

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

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

<option value="mercedes_benz">Mercedes_Benz</option>

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

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

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

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

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

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

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

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

<option value="toyota">Toyota</option>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

<option value="daihatsu">Daihatsu</option>
```

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

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

            <option value="land_rover">Land_Rover</option>

            <option value="trabant">Trabant</option>

            <option value="sonstige_autos">Sonstige_Autos</option>

          </select>

        </div>

      </div>

    </li>

    <li>

      <div class="row">

        <div class="grid grid-2 col-sm-6">

          <select id="fuel" class="input" name="fuel" required>

            <option selected disabled>Fuel type of the car</option>

            <option value="petrol">Petrol</option>

            <option value="diesel">Diesel</option>

            <option value="lpg">Lpg</option>
```

```html
                <option value="hybrid">Hybrid</option>

                <option value="cng">Cng</option>

                <option value="electric">Electric</option>

                <option value="not-declared">Not-Declared</option>

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

            </select>

        </div>

        <div class="grid grid-2 col-sm-6">

            <select id="vehicletype" class="input" name="vehicletype" required>

                <option selected disabled>Vehicle Type</option>

                <option value="convertible">Convertible</option>

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

                <option value="combination">Combination</option>

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

                <option value="samll car">Samll Car</option>

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

                <option value="not-declared">Not-Declared</option>
```

```html
                    <option value="others">Others</option>

                </select>

            </div>

        </div>

    </li>

    <li>

        <button class="btn-grid" type="submit">Predict The Price</button>

    </li>

    </ul>

    </div>

    </form>

</body>


</html>
```

[23:48, 11/19/2022] lokesh: <!DOCTYPE html>

<html>

```
<head>

  <title> CAR RESALE VALUE PREDICTION</title>

  <style>

    div {

      padding: 8px;

    }


    h1,

    h2 {

      text-align: center;

      text-transform: uppercase;

      color: #273342;

    }


    p {

      text-indent: 50px;

      text-align: justify;
```

```
      letter-spacing: 3px;

    }



    a {

      text-decoration: underline;

      color: #543fd7;

    }

  </style>

  <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/4.7.0/css/font-awesome.min.css">

</head>



<body>

  <div>

    <h1>The resale value predicted is </h1>

    <h2><i class="fa fa-inr"></i>{{ypred}}</h2>

  </div>
```

</body>

</html>

PREDICTION PAGE:

```html
<!DOCTYPE html>

<html>

<head>

  <title> CAR RESALE VALUE PREDICTION</title>

  <style>

    div {

      padding: 8px;

    }


    h1,

    h2 {

      text-align: center;

      text-transform: uppercase;
```

```css
        color: #273342;

    }


    p {

        text-indent: 50px;

        text-align: justify;

        letter-spacing: 3px;

    }


    a {

        text-decoration: underline;

        color: #543fd7;

    }

</style>

<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">

</head>
```

```html
<body>

  <div>

    <h1>The resale value predicted is </h1>

    <h2><i class="fa fa-inr"></i>{{ypred}}</h2>

  </div>

</body>


</html>
```

CHAPTER 8   TESTING

8.1 User Acceptance Testing and Test-Cases

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
HomePage_TC_001	UI	Home Page	Verify all the UI elements in Home page rendered properly		1. Enter URL and click go 2. Verify all the UI elements displayed or not	.	All the UI elements rendered properly	Working as expected	Pass		N		Abitha
HomePage_TC_002	Functional	Home Page	Verify the Data Entry page can be reachable.		1. Enter URL and click go 2. Verify all the UI elements displayed or not. 3. Press the Check Price button.	.	User should navigate to Data Entry Page	Working as expected	Pass		N		Brindha
DataEntryPage_TC_001	UI	Data Entry Page	Verify all the UI elements in Data Entry page rendered properly		1. Enter URL and click go 2. Verify all the UI elements displayed or not. 3. Press the Check Price button in the home page 4. Verify all the UI elements displayed or not	.	All the UI elements rendered properly	Working as expected	Pass		N		Lokesh
DataEntryPage_TC_002	Functional	Data Entry Page	Verify user is able to enter all values		1. Enter URL and click go 2. Verify all the UI elements displayed or not. 3. Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered	2012 12 12 12 Manual Yes Golf Volkswagen Petrol Coupe	User should be able to enter all values in data entry page	Working as expected	Pass		N		Nandana
DataEntryPage_TC_003	Functional	Data Entry Page	Verify the Output Display page can be reachable.		1. Enter URL and click go 2. Verify all the UI elements displayed or not. 3. Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered 6. Press the submit Button	.	User should navigate to Output Display Page	Working as expected	Pass		N		Abitha

OutputDisplayPage_TC_001	UI	Output Display Page	Verify all the UI elements in Output Display page rendered properly	1. Enter URL and click go 2. Verify all the UI elements displayed or not. 3. Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered 6. Press the submit Button 7. Verify all the UI elements displayed or not	-	All the UI elements rendered properly		Working as expected	Pass	N	Brindha
OutputDisplayPage_TC_002	Functional	Output Display Page	Verify user is able to get predicted result	1. Enter URL and click go 2. Verify all the UI elements displayed or not. 3. Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered 6. Press the submit Button 7. Verify all the UI elements displayed or not 8. Verify if the predicted value is displayed or not	-	Predited Car Resale Value is displayed on the page		Working as expected	Pass	N	Nandana Lokesh

Test Scenarios :

Verify user is able to see home page?
Verify user is able to navigate to data entry page?
Verify user is able to see data entry page?
Verify user is able to enter values in the fields?
Verify user is able to navigate to output display page?
Verify user is able to view the output display page?

TEST CASE 1
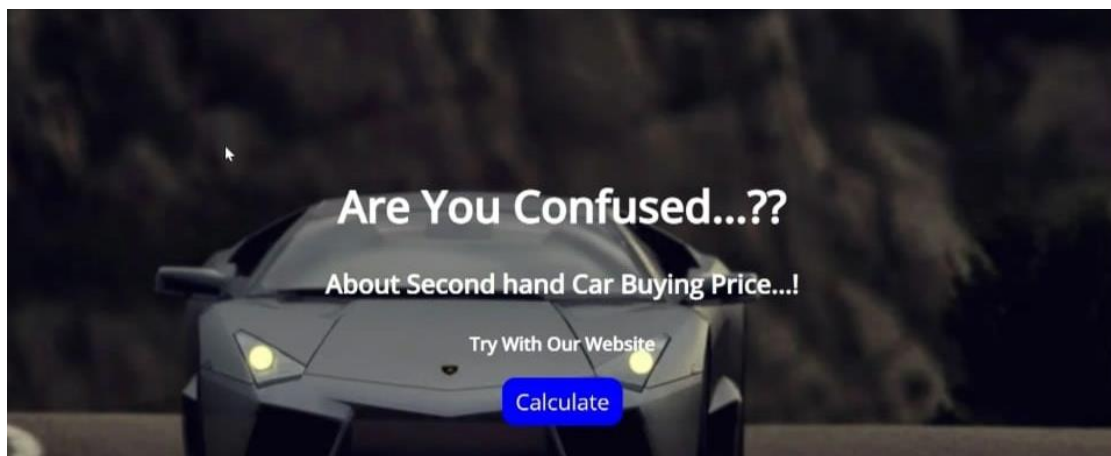
TEST CASE 2

Enter Your Car Details to Predict Price

2001	7
200	2000
Manual	No
500	Seat
Diesel	Convertible

Predict The Price

TEST CASE 3

THE RESALE VALUE PREDICTED IS

₹8906.02

CHAPTER 9   **RESULTS**

9.1 PERFORMANCE METRICS

'mae': 1327.549477341283,

'mse': 9492244.283543464,

'rmse': 3080.948601249859,

'rmsle': 8.032992815968017,

'r2': 0.8668348937732229,

'adj_r2_score': 0.8668269262555739

CHAPTER 10   ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- Our chosen model – Light Gradient Boosting Machine is robust to rarely occurring outliers.

- Has a Low risk of over-fitting.

- Works very well on large datasets.

- It reduces the installation cost.

- It will monitor 24/7.

- Very useful to sell the car for a reasonable price.

- It has an accuracy of 86.68.

DISADVANTAGES

- Very hard to use for targeted ranges of problems.

- For more accurate and real time results, we would need a dataset which contains millions of data points.

CHAPTER 11   **CONCLUSION**

Price prediction analyzes a good or service based on its attributes,demand and current market trends using an algorithm.The pricing is then adjusted by the programme at a level that it believes would both draw people and optimize sales.The method is known as price forecasting or predictive pricing in some queries.

CHAPTER 12   **FUTURE SCOPE**

When compared to February 2020,average prices were up 42.5% in September 2022.While it's possible that used vehicle prices have peaked, new car prices are expected to be high through the end of 2022. Prices are anticipated to drop for both new and used automobiles in 2023, by 2.5% to 5% for new cars and 10% to 20% for used cars.

CHAPTER 13   APPENDIX

Model Selection and Execution

```python
import pandas as pd

import numpy as np

from sklearn.preprocessing import LabelEncoder

from sklearn.model_selection import train_test_split

from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score

import pickle

from lightgbm import LGBMRegressor

from google.colab import drive

drive.mount('/content/drive')

data=pd.read_csv("/content/drive/MyDrive/ibm/autos_preprocessed.csv",header=0,sep=',',encoding='Latin1')

data.head()

labels = ['gearbox', 'notRepairedDamage', 'model', 'brand', 'fuelType', 'vehicleType']

mapper = {}

for i in labels:

    mapper[i] = LabelEncoder()

    mapper[i].fit(data[i])

    tr = mapper[i].transform(data[i])

    np.save(str('classes'+i+'.npy'), mapper[i].classes_)
```

```python
        data.loc[:, i+'_labels'] = pd.Series(tr, index=data.index)

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

print(labeled.columns)

def find_scores(Y_actual, Y_pred, X_train):

    scores = dict()

    mae = mean_absolute_error(Y_actual, Y_pred)

    mse = mean_squared_error(Y_actual, Y_pred)

    rmse = np.sqrt(mse)

    rmsle = np.log(rmse)

    r2 = r2_score(Y_actual, Y_pred)

    n, k = X_train.shape

    adj_r2_score = 1 - ((1-r2)*(n-1)/(n-k-1))

    scores['mae']=mae

    scores['mse']=mse

    scores['rmse']=rmse

    scores['rmsle']=rmsle

    scores['r2']=r2

    scores['adj_r2_score']=adj_r2_score

    return scores

X = labeled.iloc[:,1:].values
```

```python
Y = labeled.iloc[:,0].values.reshape(-1,1)

X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.4, random_state=42)

model=LGBMRegressor(boosting_type="gbdt",learning_rate=0.07,metric="rmse",n_estimators
=300,objective="root_mean_squared_error",random_state=42,reg_sqrt=True)

model.fit(X_train, Y_train)

Y_pred = model.predict(X_test)

find_scores(Y_test,Y_pred, X_train)

pickle.dump(model, open('resale_model.sav', 'wb'))

from sklearn.ensemble import RandomForestRegressor

from sklearn.metrics import r2_score

regressor=RandomForestRegressor(n_estimators=1000,max_depth=10,random_state=34)

regressor.fit(X_train,np.ravel(Y_train,order='C'))

Y_pred=regressor.predict(X_test)

print(r2_score(Y_test,Y_pred))
```

Github link: [IBM-EPBL/IBM-Project-20166-1659714045: Car Resale value Prediction (github.com)](github.com)

Video demo link:
https://drive.google.com/file/d/1bTnZWFQSu0QnBGuwrVCtOQGFB7zY0gS5/view?u=sharing