

**PROJECT REPORT - 2022**

**CAR RESALE VALUE PREDICTION**

**IBM Team ID: PNT2022TMID20203**

**TEAM MEMBERS:**

MARY SHIPANI J - 49621912078

PRIYADARSHINI G- 49621912090

SHENBAGALAKSHMI S - 49621912102

KALAISELVI P- 49621912122

**IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF  
THE DEGREE OF**

**BACHELOR OF ENGINEERING**

**IN**

**COMPUTER SCIENCE AND ENGINEERING**

**NATIONAL ENGINEERING COLLEGE**

(An Autonomous institution affiliated to Anna University)

**KOVILPATTI - 628501**

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## **1.INTRODUCTION:**

This project “Car Resale Value Prediction” aims to build a model to predict used cars' reasonable prices 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 users input. The model building process involves machine learning and data science. The dataset used was scraped from listings of used cars. 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. Before the actual start of model-building, this project visualised the data to understand the dataset better. The dataset was divided and modified to fit the regression, thus ensuring the performance of the regression.

### **1.1Project Overview:**

A car price prediction has been a high interest research area, as it requires noticeable effort and knowledge of the field expert. Considerable number of distinct attributes are examined for the reliable and accurate prediction. To build a model for predicting the price of used cars, the applied three machine learning techniques are random forest ,KNN and linear regression algorithm. Respective performances of different algorithms were then compared to find one that best suits the available data set. This ability to capture data, analyze it and use it to personalize a shopping experience or implement is the future of retail.

Parameters involved :

Car name;Year;Selling Price; Present Price; Kms Driven; Fuel type; Seller\_type;Transmission;Owner and so on.

### **1.2Purpose:**

Car resale value prediction helps the user to predict the resale value of the car depending upon various features like kilo-meters driven, fuel type, etc. This resale value prediction system is made for general purpose to just predict the amount that can be roughly acquired by the user. 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 value forecast has been done precisely.

## **2.LITERATURE SURVEY**

### **2.1Existing problem**

The problem is defined as the optimized way to estimate insurance cost based on the manufacturer with some additional costs incurred by the Government in the form of taxes. As the existing methods for estimating the cost takes a lot of time and energy and due to the increased price of new cars and the inability of customers to buy new cars due to the lack of funds, used cars sales are on a global increase.

The prices of new cars in the industry is fixed by the So, customers buying a new car can be assured of the money they invest to be worthy. There is a need for a used car price prediction system to effectively determine the worthiness of the car using a variety of features. Even though there are websites that offer this service, their prediction method may not be the best. Besides, different models and systems may contribute to

predicting power for a used car's actual market value. It is important to know their actual market value while both buying and selling.

## **2.2 References**

[1] Kanwal Noor, 2017, Vehicle Price Prediction System using Machine Learning Techniques International Journal of Computer Applications. Volume 167 - Number

[2] Mariana Lusitania et al, (2009). Support vector regression analysis for price prediction in a vehicle leasing application [3] Richardson, M. S. (2009). Determinants of used vehicle resale value.

[3] Listiani, M. (2009). Support vector regression analysis for price prediction in a car leasing application (Doctoral dissertation, Master thesis, TU Hamburg-Harburg).

[4]T. D. Phan, "Housing Price Prediction Using Machine Learning Algorithms: The Case of Melbourne City Australia", 2018 International Conference on Machine Learning and Data Engineering (iCMLDE), pp. 35-42, 2018.

[5]K. Samruddhi and R. Ashok Kumar, "Used Car Price Prediction using K-Nearest Neighbor Based Model", International Journal of Innovative Research in Applied Sciences and Engineering, vol. 4, no. 3, pp. 686-689, 2020. [6]O. Celik and U. O. Osmanoglu, "Prediction of The Prices of SecondHand Cars", Avrupa Bilim ve Teknoloji Dergisi, no. 16, pp. 77-83, Aug. 2019

## 2.3 Problem Statement Definition

Due to the huge requirement of used cars and lack of experts who can determine the correct valuation . A Effective solution to predict used cars prices by scraping data from websites that sell used cars, and analyzing the different aspects and factors that lead to the actual used car price valuation.

- ✓ to help guide the individuals looking to buy or sell cars and to give them a better insight into the automotive sector
- ✓ Therefore, to help consumers avoid falling victims to some dealer, this car resale value prediction hopes to equip consumers with right tools to guide them in their shopping experience
- ✓ Another goal of the project is to explore new methods to evaluate used cars prices and to compare their accuracy

## 3.IDEATION & PROPOSED SOLUTION

### 3.1 Empathy Map Canvas

| SAYS  | DOES   |
|---|--|
| Customer not being capable to buy a new car financially due to higher market price needs used car value prediction globally | Developing a model considering the number of attributes and various features of a particular car to get a reliable prediction of a car |
| THINK   | FEEL   |
| Car which can be bought without much thinking   | It helps the buyers to overcome their fear to buy a car  |

### 3.1 Ideation & Brainstorming

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
- 2-4 people recommended

→

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

1

Share guidelines

Define what you want participants to do in order to generate ideas. Share relevant information or previous ideas.

2

Set the goal

Think about the problem you'll be focusing on during the brainstorming session.

3

Learn how to use the facilitator's tools

Use the Facilitation Superpowers to run a happy and productive session.

Open activity →

Project-Car Resale Value Prediction

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.

10 minutes

How might we (Predict the Resale value of car)?

2

Key rules of brainstorming

To run an intense and productive session:

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

[Join template feedback](#)

### 3.3 Proposed Solution

| No. | Parameter | Description |
|-----|-----------|-------------|
|-----|-----------|-------------|

|   |   |  |
|---|---|--|
| . | Problem Statement<br>(Problem to be solved) | To Predict the value of the used car using Data Science  |
| . | Idea / Solution<br>Description              | Pre-owned car sale is more popular in developing country. People Who plan to purchase used car often struggle to find a within a budget as well as to predict the price of the second-hand car. So our project helps a potential buyer to estimate the price of a Second-hand car. Analysis Data using various Machine learning Algorithms |
| . | Noovelty / Uniqueness                       | We predict Used Car price mainly based on the car condition and mitigation level of quality, capitalization chart provided accordingly.  |
| . | Social Impact /<br>Customer Satisfaction    | By Using this application Customer can know the resale price of car in the market and chart provided user to know good maintenance and make quality of car.  |
| . | Business Model<br>(Revenue Model)           | Dealing with mitigation measure makes our idea futuristic and we provided detail information through chart. Being clear and unique, it attracts more customer leading higher revenue.  |



Scalability of the solution

Whatever may be the vehicle type or count of vehicle, the system predicts the appropriate resale value. If Multiple user access the system at same time, it process scalable.

### 3.4 Problem Solution fit

| Project Title: Car resale value prediction |  |     | Project Design Phase-I - Solution Fit   |    |   | Team ID: PNT2022TMD20203 |   |  |
|--|--|-----|---|----|---|--------------------------|---|--|
| Define CS, fit into CC                     | <b>1. CUSTOMER SEGMENT(S)</b><br><small>Who is your customer?<br/>i.e., working parents or C.O's, kids</small>   | CS  | <b>6. CUSTOMER CONSTRAINTS</b><br><small>What constraints prevent your customers from taking action on their own choice of solution? i.e., spending more budget, no cash, no more loan, no more credit etc.</small>   | CC | <b>5. AVAILABLE SOLUTIONS</b><br><small>We identify solutions available to the customers when they face the problem. i.e., what to get the job done? What have they tried in the past? what pros &amp; cons do these solutions have? Is your proposal is an alternative to a direct solution?</small> | AS                       | Explore AS, differentiate               |  |
|  | <div>Business people, working professionals, entrepreneur, students.</div>   |     | <div><ul style="list-style-type: none"><li>◆ Able to purchase the car within their budget.</li><li>◆ People with Gadget and Internet can access our website.</li></ul></div>  |    | <div><ul style="list-style-type: none"><li>◆ Prediction is mainly based on some important factors of the car.</li><li>◆ By using this factor 89% accurate result can be made.</li></ul></div>   |                          |   |  |
| Focus on CS, fit into CE, match with SP    | <b>2. JOBS-TO-BE-DONE / PROBLEMS</b><br><small>Which jobs-to-be-done (or problems) do you address for your customer? There could be more than one, replace all these jobs.</small>   | J&P | <b>9. PROBLEM ROOT CAUSE</b><br><small>What is the real reason that this problem exists?<br/>What is the basic story behind the need to do this job?<br/>i.e., customers have to do it because of this reason, why it exists</small>  | RC | <b>7. BEHAVIOUR</b><br><small>What does your customer do to address the problem and get the job done?<br/>i.e., directly related find the right order model, model, or custom image and benefits, indirectly associated to enhance overall customer satisfaction, i.e., Greenpeace</small>            | BE                       | Focus on CS, fit into CE, match with SP |  |
|  | <div>Prediction is carried out in limited conditions<br/>Result of Prediction may slightly change.</div>   |     | <div>The commercial interest to sellers/buyers unable to predict the residual value of cars with accuracy and less brokerage.</div>   |    | <div>To make use of a efficient website which includes all the factors to predict the accurate result of the car.</div>   |                          |   |  |
| Identify strong TR & EM                    | <b>3. TRIGGERS</b><br><small>What triggers customers to act? i.e., seeing their neighbor installing solar panels, reading about a new efficient car, etc. in the news.</small>   | TR  | <b>10. YOUR SOLUTION</b><br><small>If you are working on an existing business, subdivide your current solution that led to the current, and describe how much it has evolved.<br/>If you are working on a new business proposition, develop a blank until you fill in the canvas and wrap-up with a solution that solve customer frustrations, solve a problem and matches customer behaviour</small> | SL | <b>8. CHANNELS of BEHAVIOUR</b><br><small>ONLINE<br/>What kind of channels do customers like online? i.e., instant online channels, etc.<br/>OFFLINE<br/>What kind of channels do customers like offline? i.e., instant offline channels, etc.</small>  | CH                       | Identify strong TR & EM                 |  |
|  | <div>Clear and Helping about the website through advertisement and through social media.</div>   |     | <div><ul style="list-style-type: none"><li>◆ We predict car price mainly based on availability of current condition and level of hearing, capitalization chart is provided accordingly.</li><li>◆ By using our application customer can know the current rate of the car in the market.</li></ul></div>   |    | <div>Customers can choose the car on their own constraints and budget.<ul style="list-style-type: none"><li>◆ Dealers are required to choose a car and to fix the price.</li><li>◆ Less availability of details on the car</li></ul></div>  |                          |   |  |
|  | <b>4. EMOTIONS: BEFORE / AFTER</b><br><small>How do customers feel when they face a problem or a job and after solving it? i.e., feel, emotion, confidence, excitement, etc. in your customer's journey, in doing.</small> | EM  |   |    |   |                          |   |  |
|  | <div>Before: No knowledge about the price which makes the customer feel hopeless.<br/>After: Hopeful, Satisfied Customer</div>   |     |   |    |   |                          |   |  |

### 4 . REQUIREMENT ANALYSIS

## 4.1 Functional requirement

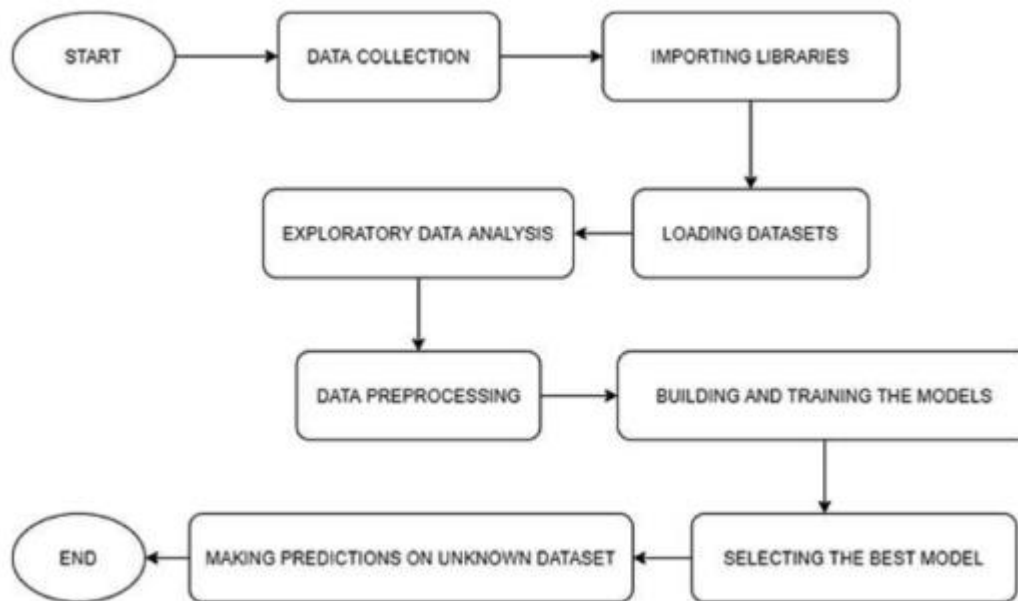
| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task)  |
|--------|-------------------------------|---|
| FR-1   | User Registration             | <ul style="list-style-type: none"><li>• Registration through Form</li><li>• Registration through Gmail</li><li>• Registration through Instagram</li><li>• Registration through Facebook</li></ul> |
| FR-2   | User Confirmation             | <ul style="list-style-type: none"><li>• Confirmation via Email</li><li>• Confirmation via Message</li></ul>   |
| FR-3   | User Profile                  | <ul style="list-style-type: none"><li>• View account details</li><li>• Change password</li></ul>  |
| FR-4   | Car details                   | <ul style="list-style-type: none"><li>• Adding the new car</li><li>• Getting car details</li><li>• View and update details</li></ul>  |
| FR-5   | Maintain database             | <ul style="list-style-type: none"><li>• Store car details in car database</li><li>• Store user details in user database</li></ul>   |
| FR-6   | Value prediction              | <ul style="list-style-type: none"><li>• Predict the value of the resale car using the model and details entered</li><li>• Display the predicted value</li></ul>                                   |
| FR-7   | Feedback                      | <ul style="list-style-type: none"><li>• Feedback through form</li></ul>   |

## **Non-functional Requirements:**

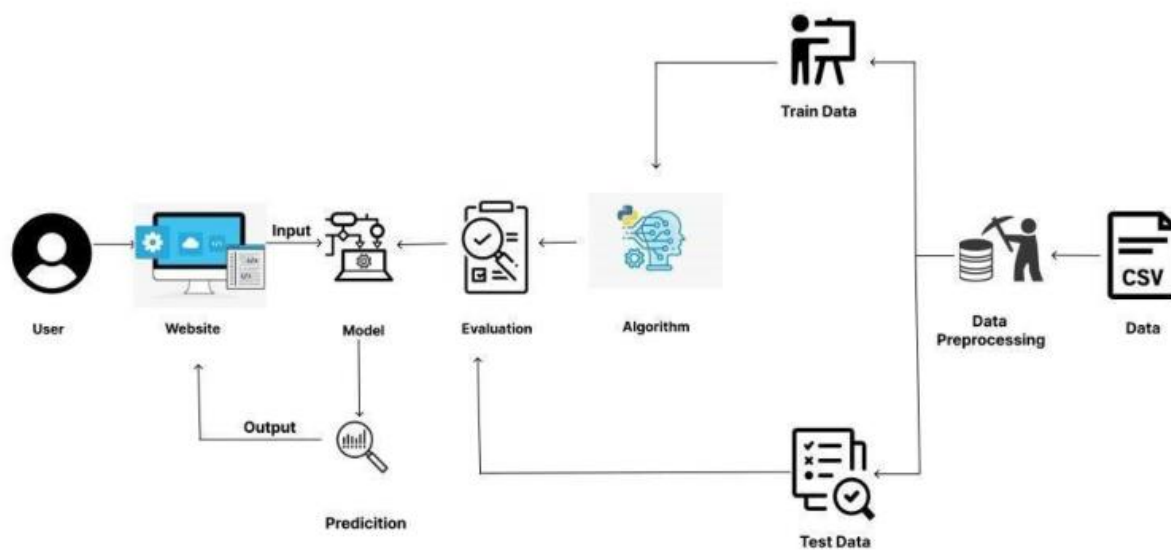
| FR No. | Non-Functional Requirement | Description  |
|--------|----------------------------|--|
| NFR-1  | <b>Usability</b>           | <ul style="list-style-type: none"><li>• User friendly UI</li><li>• Clear instructions and sample examples will be provided</li><li>• Easy process flow to predict value</li></ul>                                |
| NFR-2  | <b>Security</b>            | <ul style="list-style-type: none"><li>• User authentication while entering website</li><li>• No information is shared with third party</li><li>• User can see only his details</li></ul>                         |
| NFR-3  | <b>Reliability</b>         | <ul style="list-style-type: none"><li>• Data will be stored and replicated so that data loss can be avoided</li><li>• Rate of occurrence of failure is very less</li></ul>                                       |
| NFR-4  | <b>Performance</b>         | <ul style="list-style-type: none"><li>• Quick prediction results</li><li>• Fast website loading</li><li>• Efficient ML algorithm to provide accurate result with less time complexity</li></ul>                  |
| NFR-5  | <b>Availability</b>        | <ul style="list-style-type: none"><li>• Application can be accessed from both mobile and desktop</li><li>• Single page failure does not affect the whole website</li><li>• Uninterrupted user services</li></ul> |
| NFR-6  | <b>Scalability</b>         | <ul style="list-style-type: none"><li>• Able to handle large amount of data and traffic globally without failure</li><li>• Database can be scaled according to the usage in a cost effective manner</li></ul>    |

## 5.PROJECT DESIGN

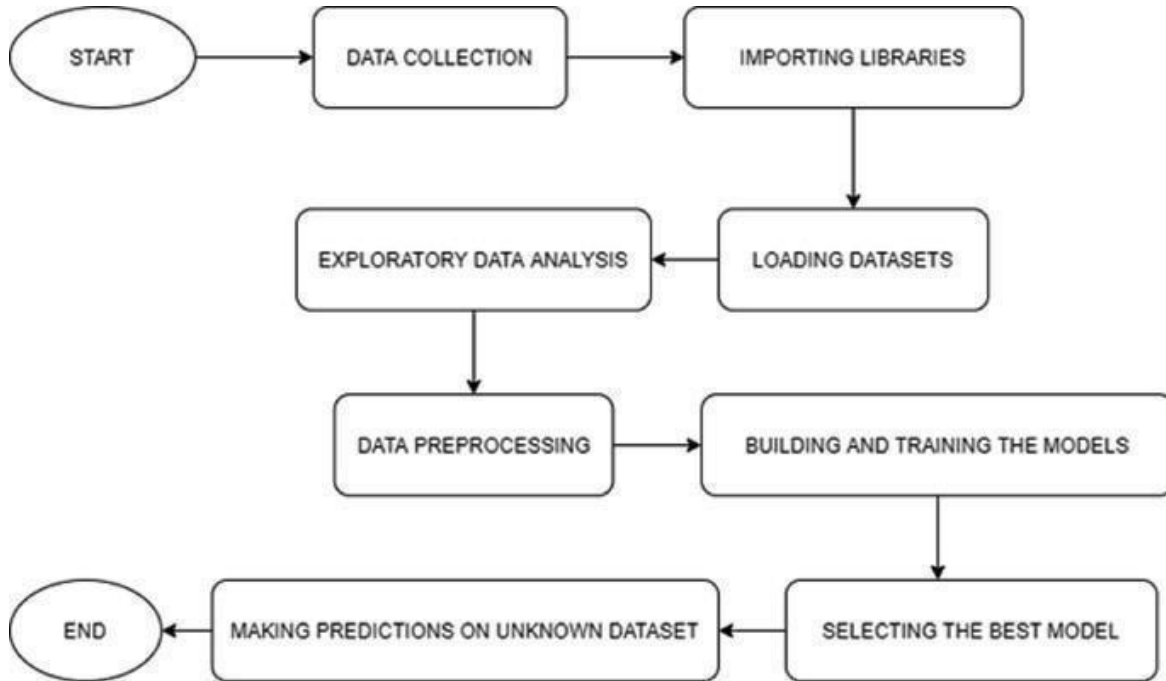
### 5.1 Data Flow Diagrams



### 5.2 Solution & Technical Architecture



### 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 (User)         | want to buy a used car        | SN-1              | As a user, I can register for the application by entering my email, password, and confirming my password. | can access my account dashboard   | High     | print-1 |
|                         |                               | SN-2              | As a user, I will receive confirmation email once I have registered for the application                   | can receive confirmation email & click confirm  | High     | print-1 |
|                         |                               | SN-3              | As a user, I can register for the resource I want   | can access the resource and know about the car varieties and their model and value of the car | Low      | print-2 |
|                         |                               | SN-4              | As a user, I can register for the application through Gmail   |   | Medium   | print-1 |
|                         | login                         | SN-5              | As a user, I can log into the application by entering email and password                                  |   | High     | print-1 |
|                         | dashboard                     |                   |   |   |          |         |
| Customer (Web user)     |                               |                   |   |   |          |         |
| Customer Care Executive |                               |                   |   |   |          |         |
| Administrator           |                               |                   |   |   |          |         |
|                         |                               |                   |   |   |          |         |
|                         |                               |                   |   |   |          |         |
|                         |                               |                   |   |   |          |         |

## 6 .PROJECT PLANNING & SCHEDULING

### 6.1 Sprint Planning & Estimation

| Sprint | Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|--------|--------------------|-------------------|-------------------|--------------|----------|--------------|
|--------|--------------------|-------------------|-------------------|--------------|----------|--------------|

|         |              |      |  |  |        |                  |
|---------|--------------|------|--|--|--------|------------------|
| print-1 | ata Entry    | SN-1 | as a user, I can enter the ca<br>esale details in the<br>pplication. |  | medium | alaiselvi P      |
| print-1 | btain output | SN-2 | as a user, I will receive car<br>esale cost in the applicatio        |  | high   | lary Shipani J   |
| print-1 | ata Entry    | SN-3 | as a user, I can enter the ca<br>esale details in the<br>pplication. |  | medium | henbagalakshmi S |

|         |                             |        |  |   |        |                 |
|---------|-----------------------------|--------|--|---|--------|-----------------|
| print-1 | Obtain output               | JSN-4  | As a user, I will receive car resale cost in the application                                   | 2 | High   | riyadharshini G |
| print-2 | Login                       | JSN-5  | As a user, I can log into the application by entering email & password                         | 1 | Low    | henbagalakshmi  |
| print-2 | Dashboard                   | JSN-6  | As a user, I can log into the dashboard by entering username & password                        | 2 | High   | Mary Shipani J  |
| print-3 | Car resale value prediction | JSN-7  | As a user, I can access the car resale value prediction section                                | 3 | High   | Calaiselvi P    |
| print-3 | Customer queries            | JSN-8  | As a customer care executive, I can check the customer queries that are posted in the website. | 2 | High   | henbagalakshmi  |
| print-4 | Maintaining website         | JSN-9  | As an administrator, I can maintain website and enhance the online presence.                   | 1 | Medium | riyadharshini G |
| print-4 |                             | JSN-10 | As an administrator, I can maintain issues in analysing values.                                | 1 | Medium | Mary Shipani J  |
| print-3 |                             | JSN-11 | As an administrator, I can update the website content  | 2 | High   | Calaiselvi P    |
| print-4 |                             | JSN-12 | As an administrator, I can improve the website   | 2 | High   | riyadharshini G |

## 6.2Sprint Delivery Schedule



| Sprint   | Total Story Point<br>\$ | 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  | 05 Nov 2022                  |
| Sprint-3 | 20                      | 6 Days   | 07 Nov 2022       | 12 Nov 2022               | 20  | 12 Nov 2022                  |
| Sprint-4 | 20                      | 6 Days   | 14 Nov 2022       | 19 Nov 2022               | 20  | 19 Nov 2022                  |

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

### 7.1 Feature 1

```

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
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 sklearn import LinearRegression

# Import Dataset

# Read Dataset

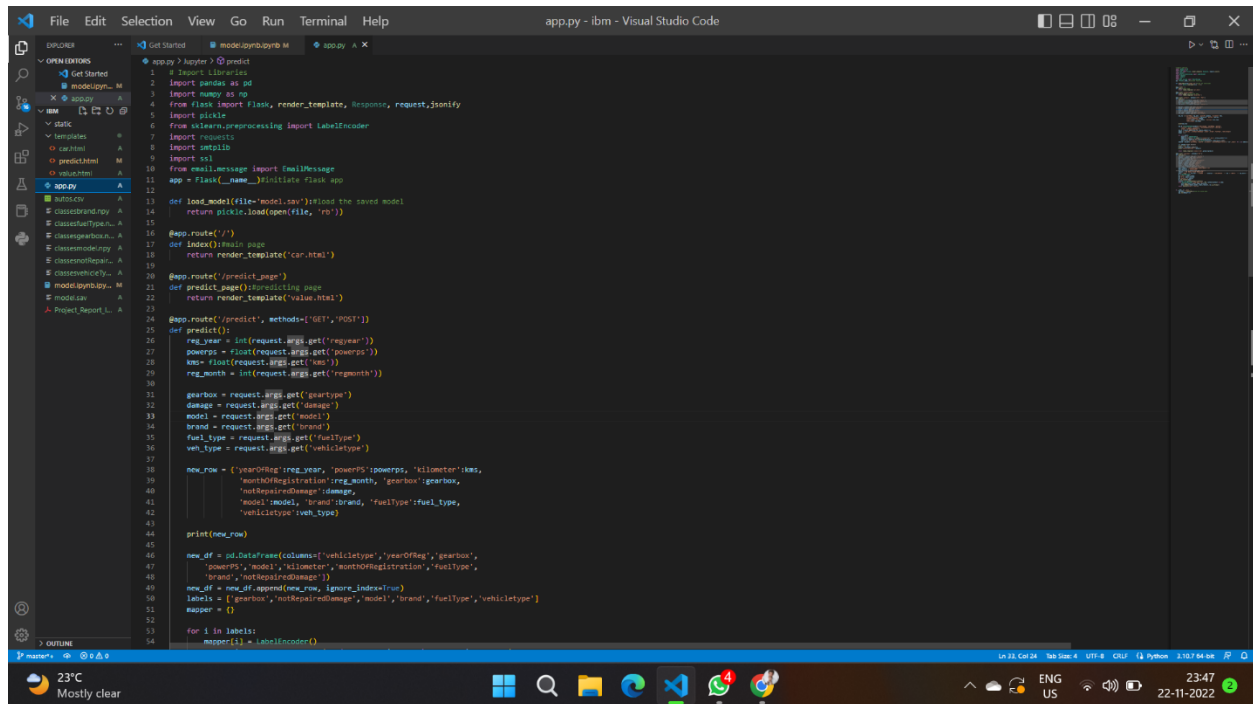
df = pd.read_csv('dataset.csv', header=0, sep=',', encoding='latin1')

df.head()

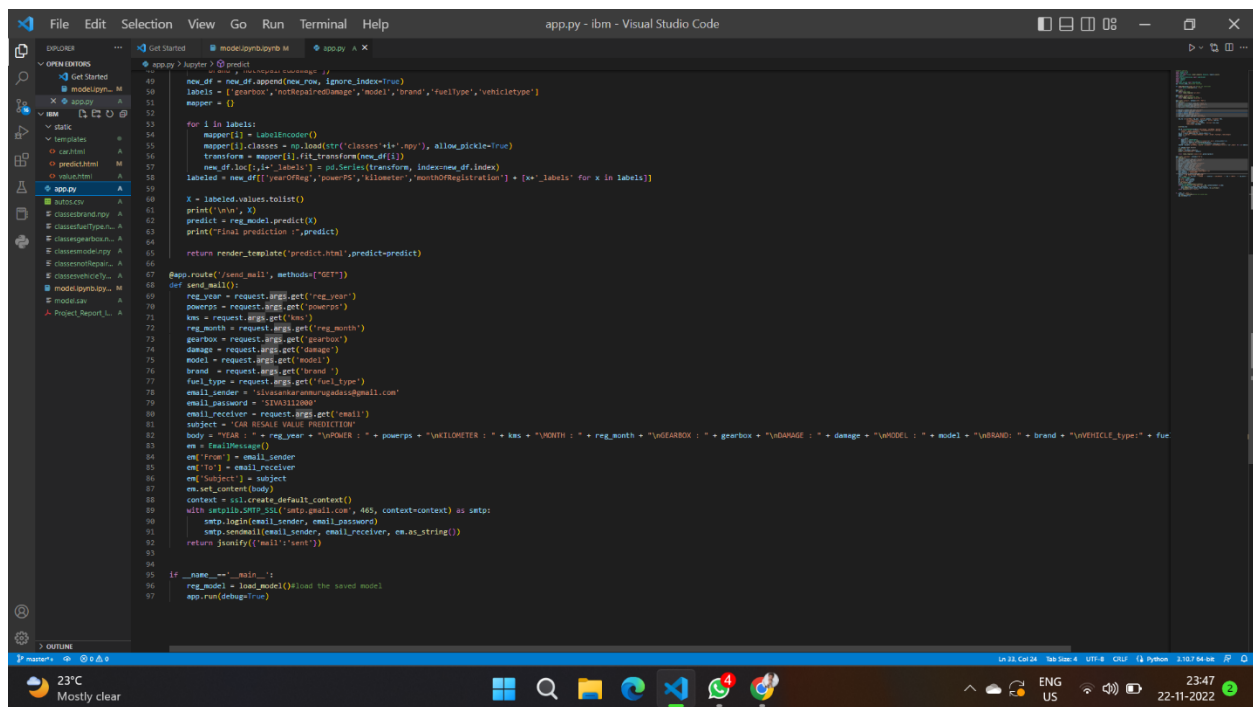
```

|   | dateCreated         | name                           | seller | offerType | price | status | vehicleType | yearOfRegistration | gearbox   | powerPS | model | kilometer | monthOfRegistration | fuelType | brand      | numberOfPreviousOwners | dateCreated         | numberOfHours | postalCode | location            |
|---|---------------------|--------------------------------|--------|-----------|-------|--------|-------------|--------------------|-----------|---------|-------|-----------|---------------------|----------|------------|------------------------|---------------------|---------------|------------|---------------------|
| 0 | 2018-03-24 15:52:17 | Golf 3 1.8                     | privat | Angelbot  | 480   | test   | hatch       | 1993               | manual    | 0       | golf  | 150000    | 0                   | benzin   | volkswagen | hatch                  | 2018-03-24 00:00:00 | 0             | 70435      | 2018-04-07 03:16:37 |
| 1 | 2018-03-24 10:56:45 | A3 Sportback 2.7 54i           | privat | Angelbot  | 18300 | test   | coupe       | 2011               | manual    | 190     | hatch | 125000    | 5                   | diesel   | audi       | je                     | 2018-03-24 00:00:00 | 0             | 68914      | 2018-04-07 01:46:39 |
| 2 | 2018-03-14 12:52:21 | Jeep Grand Cherokee "Overland" | privat | Angelbot  | 9800  | test   | suv         | 2004               | automatic | 163     | grand | 125000    | 8                   | diesel   | jeep       | hatch                  | 2018-03-14 00:00:00 | 0             | 90480      | 2018-04-09 12:47:48 |
| 3 | 2018-03-17 16:54:04 | GOLF A 1.4 16V TURBO           | privat | Angelbot  | 1500  | test   | kleinwagen  | 2001               | manual    | 75      | golf  | 150000    | 6                   | benzin   | volkswagen | jeep                   | 2018-03-17 00:00:00 | 0             | 91074      | 2018-03-17 17:46:17 |

### 7.2 Feature 2



```
1 # Import Libraries
2 import pandas as pd
3 import numpy as np
4 from flask import Flask, render_template, Response, request, jsonify
5 import pickle
6 from sklearn.preprocessing import LabelEncoder
7 import requests
8 import smtplib
9 import ssl
10 from email.message import EmailMessage
11 app = Flask(__name__)
12
13 def load_model(file='model.sav'):
14     return pickle.load(open(file, 'rb'))
15
16 @app.route('/')
17 def index():
18     return render_template("car.html")
19
20 @app.route('/predict_page')
21 def predict_page():
22     return render_template("value.html")
23
24 @app.route('/predict', methods=['GET', 'POST'])
25 def predict():
26     reg_year = int(request.args.get('regyear'))
27     powersp = float(request.args.get('powersp'))
28     kms = float(request.args.get('kms'))
29     reg_month = int(request.args.get('regmonth'))
30
31     gearbox = request.args.get('geartype')
32     damage = request.args.get('damage')
33     model = request.args.get('model')
34     brand = request.args.get('brand')
35     fuel_type = request.args.get('fueltype')
36     veh_type = request.args.get('veh_type')
37
38     new_row = {'yearOfReg': reg_year, 'powersp': powersp, 'kilometer': kms,
39               'monthOfRegistration': reg_month, 'gearbox': gearbox,
40               'notRepairedDamage': damage,
41               'model': model, 'brand': brand, 'fuelType': fuel_type,
42               'vehicleType': veh_type}
43
44     print(new_row)
45
46     new_df = pd.DataFrame(columns=['vehicleType', 'yearOfReg', 'gearbox',
47                                   'powersp', 'model', 'kilometer', 'monthOfRegistration', 'fuelType',
48                                   'brand', 'notRepairedDamage'])
49
50     new_df = new_df.append(new_row, ignore_index=True)
51     labels = ['gearbox', 'notRepairedDamage', 'model', 'brand', 'fuelType', 'vehicleType']
52     mapper = {}
53
54     for i in labels:
55         mapper[i] = LabelEncoder()
```



```
56         mapper[i].classes = np.loadstr('classes/' + i + '.npy'), allow_pickle=True
57         transform = mapper[i].fit_transform(new_df[i])
58         new_df.loc[:, i + '_labels'] = pd.Series(transform, index=new_df.index)
59     labeled = new_df[['yearOfReg', 'powersp', 'kilometer', 'monthOfRegistration']] + [x + '_labels' for x in labels]
60
61     x = labeled.values.tolist()
62     print('x\n', x)
63     predict = reg_model.predict(x)
64     print('final prediction :', predict)
65
66     return render_template("predict.html", _predict=predict)
67
68 @app.route('/send_mail', methods=['GET'])
69 def send_mail():
70     reg_year = request.args.get('reg_year')
71     powersp = request.args.get('powersp')
72     kms = request.args.get('kms')
73     reg_month = request.args.get('reg_month')
74     gearbox = request.args.get('gearbox')
75     damage = request.args.get('damage')
76     model = request.args.get('model')
77     brand = request.args.get('brand')
78     fuel_type = request.args.get('fuel_type')
79     email_sender = 'sivasankaranuragadisi@gmail.com'
80     email_receiver = request.args.get('email')
81     subject = 'CAR RESALE VALUE PREDICTION'
82     body = "YEAR : " + reg_year + " \nPOWER : " + powersp + " \nKILOMETER : " + kms + " \nMONTH : " + reg_month + " \nGEARBOX : " + gearbox + " \nDAMAGE : " + damage + " \nMODEL : " + model + " \nBRAND : " + brand + " \nVEHICLE_Type : " + fuel_type
83     em = EmailMessage()
84     em["from"] = email_sender
85     em["to"] = email_receiver
86     em["subject"] = subject
87     em.set_content(body)
88
89     content = ssl.create_default_context()
90     with smtplib.SMTP_SSL('smtp.gmail.com', 465, context=content) as smtp:
91         smtp.login(email_sender, email_password)
92         smtp.sendmail(email_sender, email_receiver, em.as_string())
93     return jsonify({'mail': 'sent'})
94
95 if __name__ == '__main__':
96     reg_model = load_model()
97     app.run(debug=True)
```

## 8.TESTING

### 8.1 Test Cases

|                          |  |  |            |  |  |                   |   |  |  |
|--------------------------|--|--|------------|--|--|-------------------|---|--|--|
|                          |  |  |            |  |  |                   |   |  |  |
|                          |  |  |            |  |  |                   |   |  |  |
|                          |  |  |            |  |  |                   |   |  |  |
|                          |  |  |            |  |  |                   |   |  |  |
| DataEntryPage<br>TC_002  |  |  | Functional |  |  | DataEntryPage     | User is able to enter values  |  | 1.Enter URL<br>2.Verify all the elements display<br>Press the Check button in the home<br>Verify all the UI displayed or not<br>Verify if all values entered                     |
| DataEntryPage<br>TC_003  |  |  | Functional |  |  | DataEntryPage     | The Output Display page can be reached                              |  | 1.Enter URL<br>2.Verify all the elements display<br>Press the Check button in the home<br>Verify all the UI displayed or not<br>Verify if all values entered<br>Press the submit |
| OutputDisplayPage_TC_001 |  |  | UI         |  |  | OutputDisplayPage | Verify all the UI elements in Output Display page rendered properly |  | 1.Enter URL<br>2.Verify all the elements display<br>Press the Check button in the home   |

|                            |  |  |             |  |  |   |  |  |  |
|----------------------------|--|--|-------------|--|--|---|--|--|--|
|                            |  |  |             |  |  |   |  |  | erifyall the UI<br>isplayed or not<br>erify if all valu<br>ntered<br>ress thesubmit<br>erifyall the UI<br>isplayed or not  |
| OutputDispla<br>age_TC_002 |  |  | Func<br>nal |  |  | Outputer is ableto get<br>isplayPredicted result<br>e |  |  | 1.Enter URL<br>o<br>2.Verify all<br>lements display<br>.Press the Chec<br>utton in the hor<br>erifyall the UI<br>isplayed or not<br>erify if all valu<br>ntered<br>ress thesubmit<br>erifyall the UI<br>isplayed or not<br>erifyif the prec<br>alueis displaye |

### 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?

## **8.2 User Acceptance Testing**

## Defect Analysis

| Resolution     | Severity 1 | Severity 2 | Severity 3 | Severity 4 | Subtotal |
|----------------|------------|------------|------------|------------|----------|
| by Design      | 10         | 4          | 2          | 3          | 20       |
| Duplicate      | 1          | 0          | 3          | 0          | 4        |
| External       | 2          | 3          | 0          | 1          | 6        |
| Fixed          | 11         | 2          | 4          | 20         | 37       |
| Not Reproduced | 0          | 0          | 1          | 0          | 1        |
| Skipped        | 0          | 0          | 1          | 1          | 2        |
| Won't Fix      | 0          | 5          | 2          | 1          | 8        |
| Totals         | 24         | 14         | 13         | 26         | 77       |

## Test Cast Analysis

| Section             | Total Cases | Not Tested | Fail | Pass |
|---------------------|-------------|------------|------|------|
| Print Engine        | 7           | 0          | 0    | 7    |
| Client Application  | 51          | 0          | 0    | 51   |
| Security            | 2           | 0          | 0    | 2    |
| Outsource Shipping  | 3           | 0          | 0    | 3    |
| Exception Reporting | 9           | 0          | 0    | 9    |
| Final Report Output | 4           | 0          | 0    | 4    |
| Version Control     | 2           | 0          | 0    | 2    |

## **9. RESULTS**

### **9.1 Performance Metrics**

```
{'mae': 1235.112086905962,  
  'mse': 9377053.62710202,  
  'rmse': 3084.6815065692977,  
  'rmsle': 8.43744027403009,  
  'r2': 0.8361221626879432,  
  'adj_r2_score': 0.8261152969113608}
```

The model is tested with the various damaged car images which is not used during the training and validation of the model which also shows that the model works with the accuracy of about 98% in the overall performance

## **10. ADVANTAGES & DISADVANTAGES**

- To develop an efficient and effective model which predicts the price of a used car according to the user's inputs and achieve good accuracy

### **CONS:**

- Less effective

## **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 Used Car Price Prediction system which effectively determines the worthiness of the car using a variety of features. The proposed system will help to determine the accurate price of used car price prediction.

## 12.FUTURE SCOPE

In future this machine learning model may bind with various websites which can provide real time data for price prediction. Also we may add large historical data of car price which can help to improve accuracy of the machine learning model. We can build an android app as a user interface for interacting with users. For better performance, we plan to judiciously design deep learning network structures, use adaptive learning rates and train on clusters of data rather than the whole dataset

## 13.APPENDIX

### 13.1 SOURCE CODE

```
import pandas as pd import numpy as np import matplotlib as plt
```

```
from sklearn.preprocessing import LabelEncoder  
import pickle import os, types import pandas as pd  
from botocore.client import Config  
import ibm_boto3
```

```
def ____iter_(self): return 0
```

```
# @hidden_cell
```

```
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials. # You might want to remove those credentials before you share the notebook.
```

```
cos_client = ibm_boto3.client(service_name='s3',
```

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

```
bucket      =      'carresalevaluepredictiondeploymen-donotdelete-pr-ryosh4pvhxemjh'      object_key      =
'autos_preprocessed.csv'
```

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

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

```
# print(df.seller.value_counts()) # df[df.seller!='gewerblich']
# # df=df.drop('seller',1
```



```
# print(df.offerType.value_counts()) # df[df.offerType!='Gesuch']
# df=df.drop('offerType',1)
```

17

```
print(df.shape)
df=df[(df.powerPS >50) & (df.powerPS <900)]
df=df[(df.yearOfRegistration >=1950) & (df.yearOfRegistration <2017)] print(df.shape)
(278578, 12)
(278578, 12)
```

```
#
df.drop(['name','abtest','dateCrawled','nrOfPictures','lastSeen','postalCode','dateCreated'],axis='columns,inplace=True)
```

```
new_df=df.copy()
new_df=new_df.drop_duplicates(['price','vehicleType','yearOfRegistration','gearbox','powerPS','model','kilometer','monthOfRegistration','fuelType','notRepairedDamage'])
```

```
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=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.to_csv("autos_preprocessed.csv")
```

```
from sklearn.preprocessing import LabelEncoder
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_) print(i,":",mapper[i])
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)
gearbox : LabelEncoder() notRepairedDamage : LabelEncoder() model : LabelEncoder()
brand : LabelEncoder() fuelType : LabelEncoder() vehicleType : LabelEncoder()
Index(['price', 'yearOfRegistration', 'powerPS', 'kilometer', 'monthOfRegistration', 'gearbox_labels',
'notRepairedDamage_labels', 'model_labels', 'brand_labels', 'fuelType_labels', 'vehicleType_labels'],
dtype='object')

Y=labeled.iloc[:,0].values X=labeled.iloc[:,1:].value

```

```

Y=Y.reshape(-1,1)
from sklearn.model_selection import cross_val_score,train_test_split
18
X_train,X_test,Y_train,Y_test= train_test_split(X,Y,test_size=0.3,random_state=3)

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'))
RandomForestRegressor(max_depth=10, n_estimators=1000, random_state=34) y_pred=regressor.predict(X_test)
print(r2_score(Y_test,y_pred)) 0.834527626497731

filename='resale_model.sav' pickle.dump(regressor,open(filename,'wb'))

```

## 13.2 GitHub Repo:

<https://github.com/IBM-EPBL/IBM-Project-24882-1659950473>

## 13. 2 Demo Link:

[https://drive.google.com/file/d/1lPCXGQdyOUUwyj9WIBEuNYzfzp9eiucx/view?  
usp=share link](https://drive.google.com/file/d/1lPCXGQdyOUUwyj9WIBEuNYzfzp9eiucx/view?usp=share_link)