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Project On

Car Resale Value Prediction

Powered by IBM India

Submitted by

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PROJECT ID: PNT2022TMID27396

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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 user's 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 visualized the data to understand the dataset better. The dataset was divided and modified to fit the regression, thus ensuring the performance of the regression.

1.1 Project 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, KN-N 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:

Vehicle_name; Year; Selling_Price; Present_Price; Kms_Driven; Fuel_type.

Seller_type; Transmission; Owner and so on.

1.2 Purpose

Car resale value prediction helps the user to predict the re sale value of the car depending upon various features like kilometers 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

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 are 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.

2.1 References

At present, under the guidance of the new generation of information technology, the rapid accumulation of data, the continuous improvement of computing power, the continuous optimization of algorithm models, and the rapid rise of multi-scene applications have made profound changes in the development environment of Machine Learning.

[1] Kanwal Noor, 2017, Vehicle Price Prediction System using Machine Learning Techniques International Journal of Computer Applications. Volume 167 - Number 9

[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.

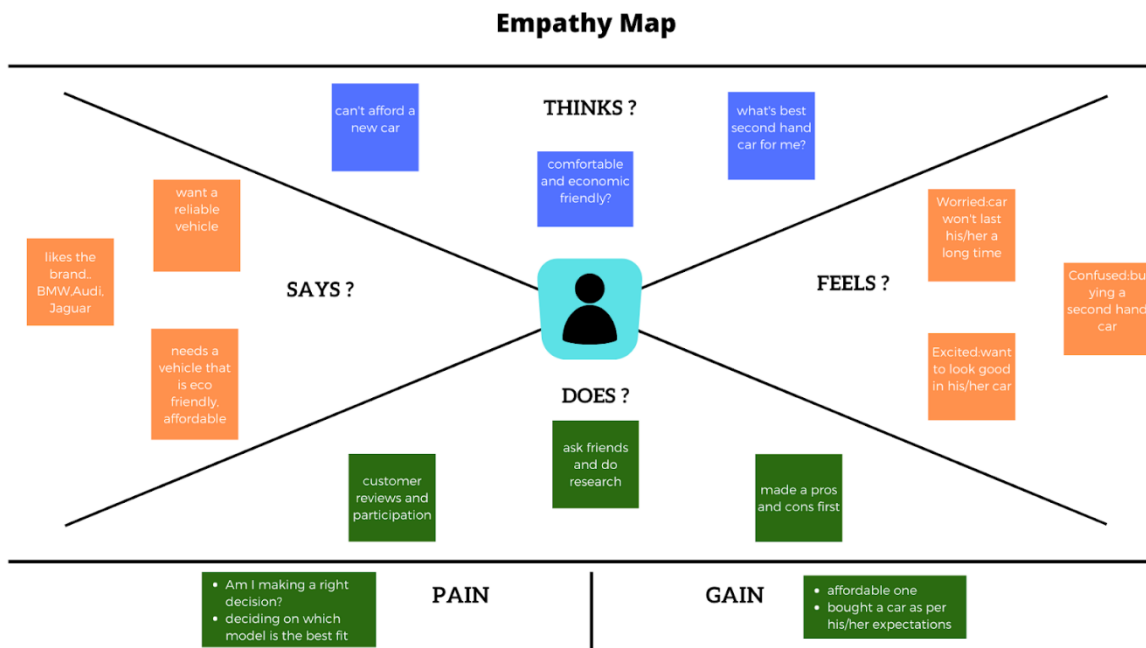
[6] O. Celik and U. O. Osmanoglu, "Prediction of The Prices of Second-Hand Cars", *Avrupa Bilim ve Teknoloji Dergisi*, no. 16, pp. 77-83, Aug. 2019.

2.2 Problem statement definition

I am	I'm trying to	But	Because	Which makes me feel
customer	Buy resale car	Could not trust any seller	the conditon of the battery seems so poor in reselling car	sad
car enthusiast	get more number of cars in different brands	can't get a trustworthy retailer	No warrenty of buying pre-owned cars	Reluctant to buy
Car buyer	Search car based on expected amount	can't able to filter the car based on amount	there is no such option to search based on amount	to search another platforms that are better that it
Speed freak	to get high mileage cars	a used car is not reliable	because of low maintainence	inconvinient

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming

STEP 1:

3. Prediction using Car image.
4. By using the exterior and interior image of the car.
5. The value will be predicted based on the appearance of the car. If there any damage or n numbers scratches the car resale value will be quite affected.
6. By using neural network value of the car can be predicted.
7. Neural network algorithm is developed by considering the human brain that takes a set of units as input and transfers results to a predefined output.

STEP 2:

8. The main objective of this project is to predict the Prices of used cars, compare the prices and estimate the lifespan of a particular car.
9. Insurance, Company claims, etc.
- o regression Algorithm is used to predict the value.

10. Regression model based on k-nearest neighbor machine learning algorithm was used to predict the price of a car.

STEP 3:

11. Prediction using engine car condition.

o User should upload engine sound in the format of audio file.

12. By using Convolutional Neural Networks methodology price can be predicted.

13. CNNs for Machine Learning on sound data by spectrogram approach that was just converts each song (or song segment) into a spectrogram: a two-dimensional matrix

STEP 4:

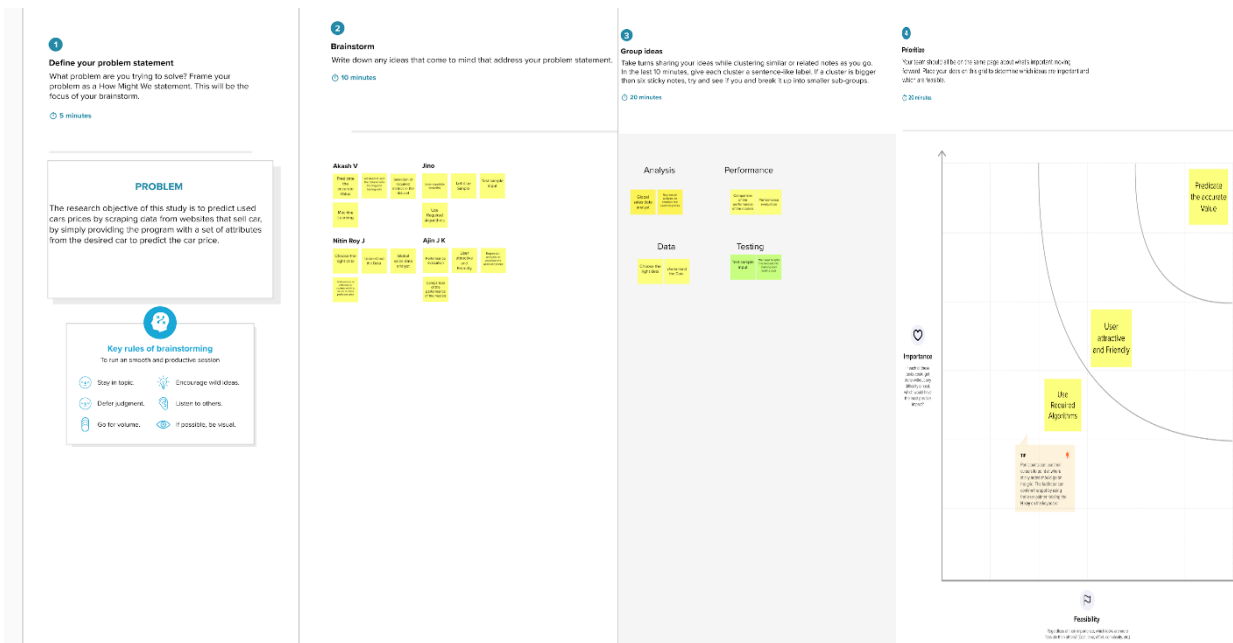
Economic Conditions.

o Kilometers Covered.

o Its mileage (the number of kilometers it has run) and its horsepower

o Car prediction using XG Boost algorithm accurate results will be monitored.

o XG Boost as a regression model gave the best MSLE and RMSE values.



3.3 Proposed Solution

S. No	Parameter	Description
1.	Problem Statement (Problem to be solved)	To develop a webpage to predict the resale value of a car
2.	Idea / Solution description	To train the system with the dataset using a regression model
3.	Novelty / Uniqueness	By using the optimal regression model to predict the value in a less amount of time and predict its value
4.	Social Impact / Customer Satisfaction	The customer can get an idea about the resale value of their car .to have an idea whether to sell their vehicle or not based on their financial condition
5.	Business Model (Revenue Model)	The web-based application has a friendly UI for the customer to enter their vehicles detail and the system predicts the value within few seconds
6.	Scalability of the Solution	The solution given by the trained system is efficient and is nearly accurate value of the vehicle.

3.4 Proposed Solution fit

Car Resale Value Prediction

Project Design Phase-I: Problem Solution Fit

Team ID: PNT2022TMD27396

Focus on J&P, tap into BE, understand	1. CUSTOMER SEGMENT(S) CS <ul style="list-style-type: none"> Business people Common people Working parents Racers 	6. CUSTOMER CONSTRAINT CC <ul style="list-style-type: none"> Anxiety-customer began to get anxious when they still no idea about what they have found. Mysteries-they might Called it mysteries which they can't able to 	5. AVAILABLE SOLUTIONS AS <ul style="list-style-type: none"> By searching in online websites. By gathering the information from the peoples and come to understanding.
	2. JOBS-TO-BE-DONE / PROBLEMS J&P <ul style="list-style-type: none"> Giving the necessary information for particular thing which needs for customer Solving customer doubts 	9. PROBLEM ROOT CAUSE RC <ul style="list-style-type: none"> Lack of study in the sequence of things Unaware of the object New to environment 	7. BEHAVIOUR BE <p>When the user Don't have the knowledge about particular thing this kind of situation occurs.</p>
Identify strong TR & EM	3. TRIGGERS TR <ul style="list-style-type: none"> Seeking for self-gratification by identify the thing To help peoples to get extra knowledge about the thing 	10. YOUR SOLUTION SL <p>This system is built by using Machine learning and regression model. By using this system, we can predict the resale value of the car at any time any where.</p>	8. CHANNELS of BEHAVIOUR CH <p>ONLINE</p> <ul style="list-style-type: none"> Online websites Social media platforms <p>OFFLINE</p> <ul style="list-style-type: none"> Customer throw words
	4. EMOTIONS: BEFORE / AFTER EM <p>Before: unease about something with an uncertain outcome (showing worry)</p> <p>After: pleasure of blessedness and brightness in face.</p>		Extract online & offline CH of BE



4. REQUIREMENT ANALYSIS

4.1 Functional Requirement

The functional Requirements of this projects involves the better understanding of Pre-processing, Application designing using HTML & CSS and

IBM Watson Cloud. IBM Watson provides the services such as Database, deployment etc.

Hardware requirements Operating system- Windows 7,8,10

Software Requirements

- Python
- Visual Studio Code
- PIP 2.7
- Jupyter Notebook
- Chrome

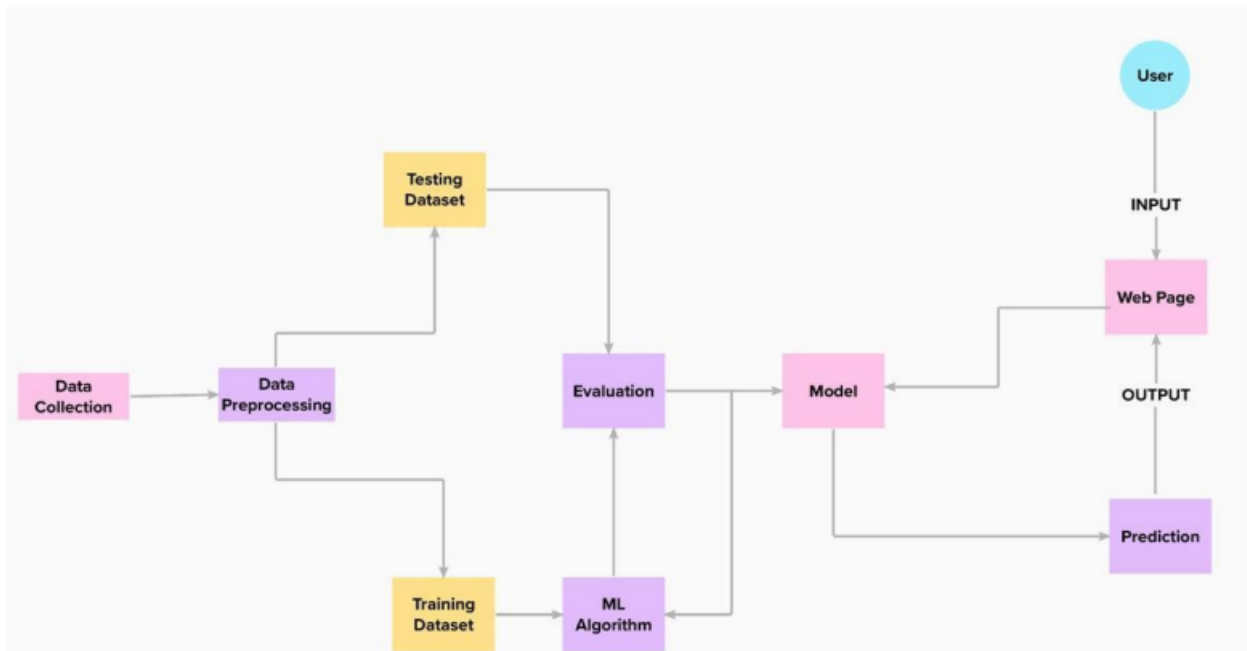
4.2 Non-Functional Requirement

The Non - Functional Requirements of this project are,










- Highly accurate Image Predictive model
- better user responsive web application
- Cloud database for storing the information's

5.PROJECT DESIGN

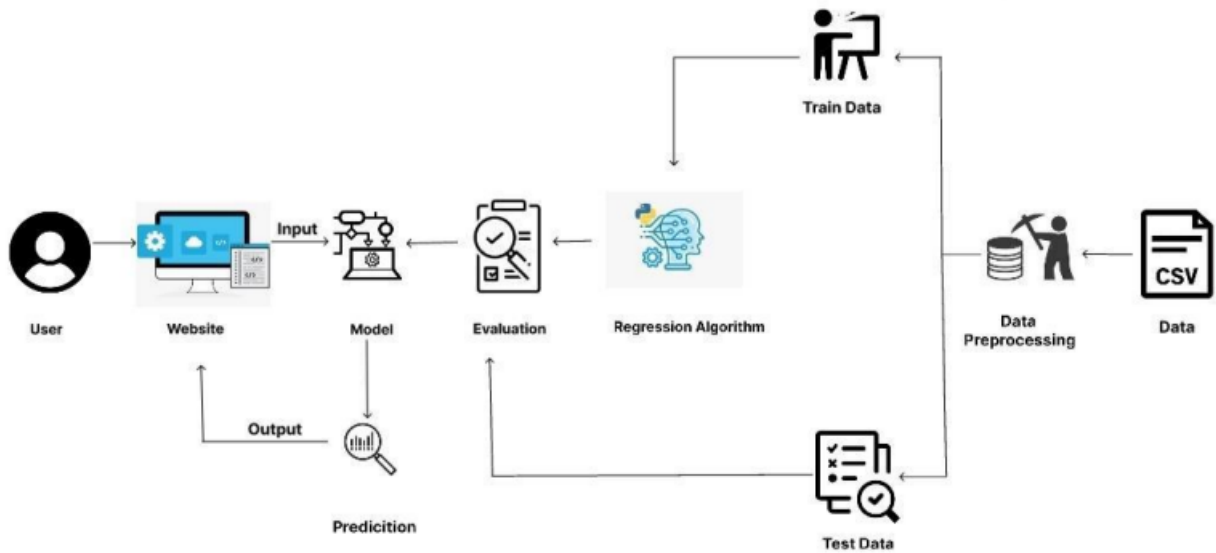
5.1 Data Flow Diagrams



5.2 Customer Journey Map

SCENARIO	Entice	Enter	Engage	Exit	Extend
BROWSING, GETTING TO KNOW ABOUT THE RESALE VALUE OF THE CAR	 Entice How does someone initially become aware of this process?	 Enter What do people experience as they begin the process?	 Engage In the core moments in the process, what happens?	 Exit What do people typically experience as the process finishes?	 Extend What happens after the experience is over?
 Steps What does the person (or group) typically experience?	<div>VISIT THE WEBSITE</div> <div>USER WILL BE ABLE TO VISIT THE WEBSITE ON ALL DEVICES</div> <div>PREVIEW THE WEBSITE</div> <div>USER WILL BE ABLE TO PREVIEW THE WEBSITE ON ALL DEVICES</div> <div>TRAVERSE HOME PAGE</div> <div>THE USER WILL BE ABLE TO TRAVERSE THE HOME PAGE OF THE WEBSITE</div> <div>TRAVERSE THE PREDICTION PAGE</div> <div>THE USER WILL BE ABLE TO TRAVERSE THE PREDICTION PAGE OF THE WEBSITE</div> <div>ENTER THE PREDICTION PAGE</div> <div>THE USER WILL BE ABLE TO ENTER THE PREDICTION PAGE OF THE WEBSITE</div> <div>PREDICTION</div> <div>THE USER WILL BE ABLE TO GET THE PREDICTION OF THE CAR</div> <div>OUTPUT</div> <div>THE USER WILL BE ABLE TO GET THE OUTPUT OF THE PREDICTION</div> <div>RESULT INTERFACE</div> <div>THE USER WILL BE ABLE TO SEE THE RESULT OF THE PREDICTION</div> <div>CONTACT PAGE</div> <div>THE USER WILL BE ABLE TO GET THE CONTACT PAGE OF THE WEBSITE</div> <div>CUSTOMER REVIEW</div> <div>THE USER WILL BE ABLE TO GET THE CUSTOMER REVIEW OF THE WEBSITE</div>				
 Interactions What interactions do they have at each step along the way? <ul style="list-style-type: none">■ People: Who do they see or talk to?■ Places: Where are they?■ Things: What digital touchpoints or physical objects would they use?	<div>THE USER WILL FIND THE WEBSITE WORKING AT ANY BROWSER</div> <div>THE USER WILL FIND THE WEBSITE WORKING AT IOS, ANDROID MOBILE</div> <div>THE USER WILL FIND THE HOME PAGE OF THE SITE AT ANY BROWSER</div> <div>THE USER WILL BE ABLE TO NAVIGATE THROUGH ALL THE PAGES OF THE SITE AT ANY BROWSER</div> <div>THE USER WILL BE ABLE TO FIND THE PREDICTION PAGE</div> <div>THE USER WILL BE ABLE TO FIND THE RESULT PAGE</div> <div>THE USER WILL BE ABLE TO FIND THE CUSTOMER SUPPORT PAGE AT THE END OF PREDICTION</div> <div>THE USER WILL BE ABLE TO FIND THE REVIEW AT THE END OF THE WEBSITE</div>				
 Goals & motivations At each step, what is a person's primary goal or motivation? ("Help me..." or "Help me avoid...")	<div>HELPS TO FIND THE WEBSITE</div> <div>HELPS TO FIND THE WEBSITE</div> <div>HELPS TO FIND THE WEBSITE</div> <div>HELPS TO FIND THE HOME PAGE</div> <div>HELPS TO FIND THE PREDICTION PAGE</div> <div>HELPS TO KNOW ABOUT THE PRICE OF THE RESALE VALUE OF THE CAR</div> <div>HELPS TO GET MORE DETAILS ABOUT THE SCENARIO</div> <div>USER WILL KNOW MORE ABOUT THE WEBSITE AND THE WAY TO BUY THE CAR</div> <div>THE USER WILL BE ABLE TO GET REVIEWS REGARDING THE WEBSITE, DETAILS</div> <div>REVIEWS OF THE USER WILL BE HELPFUL IN IMPROVING THE WEBSITE</div>				
 Positive moments What steps does a typical person find enjoyable, productive, fun, motivating, delightful, or exciting?	<div>WEBSITE LOOKS ATTRACTIVE AND VERY INFORMATIVE</div> <div>THE USER FINDS VERY INFORMATIVE CONTENT ABOUT THE WEBSITE</div> <div>THE USER WILL BE EXCITED TO TRAVERSE THROUGH THE WEBSITE</div> <div>THE USER WILL FIND AN INTERESTING PAGE ABOUT THE WEBSITE</div> <div>THE USER FINDS THE PREDICTION PAGE</div> <div>THE USER KNOWS THE PREDICTION PAGE</div> <div>THE USER COULD GET SUPPORT FROM THE CONTACT PAGE</div> <div>THE USER FINDS THE PREDICTION PAGE</div> <div>THE REVIEWS FROM THE USER WILL BE HELPFUL IN IMPROVING THE WEBSITE</div> <div>THE USER COULD GET SUPPORT FROM THE CONTACT PAGE</div>				
	<div>[Description of a negative moment]</div>				
	<div>[Idea]</div> <div>[Idea]</div>				

5.3 Solution & Technical Architecture



5.4 User Stories

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint- 1	Home Page	USN- 1	As a user, I can view the home page of the web application.	20	Low	Akash V
Sprint-2	Car resale value	USN-2	As a user, I can be redirected to the data entry page	20	Medium	Akash V
Sprint-3	display Data Entry	USN-3	As a user, I can enter my car details in the required fields.	20	Medium	Akash V
Sprint-4	Resale Value Prediction	USN-4	As a user, I expect the application to predict the resale value of my car.	20	Medium	Akash V

6.PROJECT PLANNING

6.1 Sprint Planning and Estimation

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	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

6.2 Sprint Delivery Schedule

- Pre-requisites
- Import Required libraries
- Collect Data Set
- Pre the process the data
- Choose the Appropriate Model
- Train the model on IBM
- Integrate with Flask endpoint
- Index.html
- Registration form.html
- Flask application
- App.py

7.CODING & SOLUTION

7.1 Feature 1

Import Libraries

```
In [1]: import pandas as pd
import numpy as np
import matplotlib 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 lightgbm import LGBMRegressor
```

Import Dataset

```
In [2]: df=pd.read_csv("Dataset.csv", header=0, sep=',', encoding='Latin1',)
```

Read Dataset

```
In [3]: df.head()
```

```
Out[3]:
```

	dateCrawled	name	seller	offerType	price	abtest	vehicleType	yearOfRegistration	gearbox	powerPS	model	kilometer	month
0	2016-03-24 11:52:17	Golf_3_1.6	privat	Angebot	480	test	NaN	1993	manuell	0	golf	150000	
1	2016-03-24 10:58:45	A5_Sportback_2.7_Tdi	privat	Angebot	18300	test	coupe	2011	manuell	190	NaN	125000	
2	2016-03-14 12:52:21	Jeep_Grand_Cherokee_"Overland"	privat	Angebot	9800	test	suv	2004	automatik	163	grand	125000	

7.2 Feature 2

```
from flask import Flask, render_template, Response, request
import pandas as pd
import numpy as np
import pickle
from sklearn.preprocessing import LabelEncoder
```

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

```
def load_model(file='resale_model.sav'):
    return pickle.load(open(file, 'rb'))
```

```
@app.route("/")
def index():
    return render_template('homeview.html')
```

```
@app.route('/predict')
def predict_page():
    return render_template('predictionview.html')
```

```
@app.route('/y_predict', methods=['GET', 'POST'])
def predict():
```

```
    regyear = int(request.args.get('regyear'))
    powerps = float(request.args.get('powerps'))
    kms = float(request.args.get('kms'))
    regmonth = 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')
    fueltype = request.args.get('fuelType')
```

```

vehicletype = request.args.get('vehicletype')

new_row = {'yearOfReg':regyear, 'powerPS':powerps, 'kilometer':kms,
           'monthOfRegistration':regmonth, 'gearbox':gearbox,
           'notRepairedDamage':damage,
           'model':model, 'brand':brand, 'fuelType':fueltype,
           'vehicletype':vehicletype}

print(new_row)

new_df = pd.DataFrame(columns=['vehicletype','yearOfReg','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[['yearOfReg','powerPS','kilometer','monthOfRegistration'] + [x+'_'+labels for x in labels]]

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

print("Final prediction :",predict)

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

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

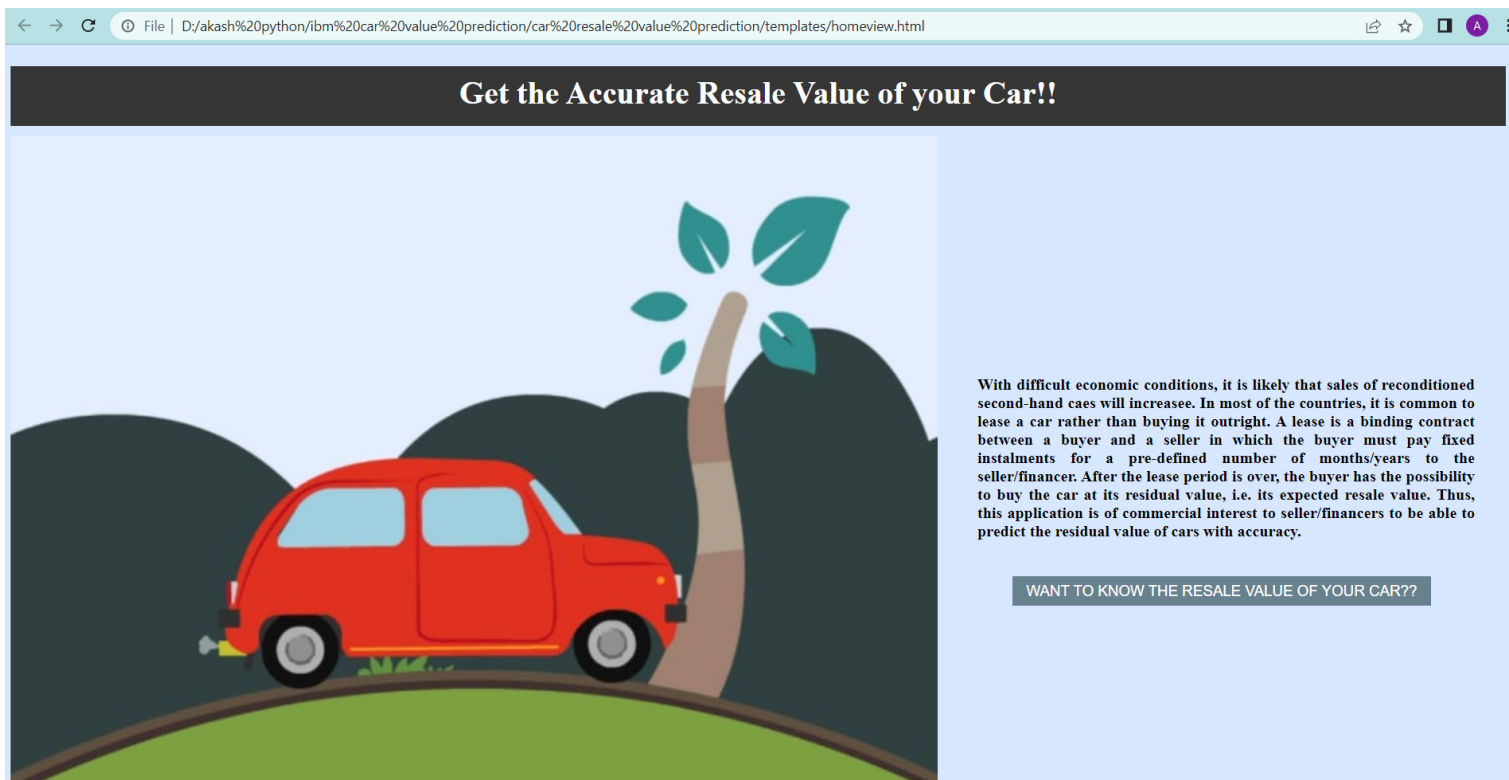
```


8.TESTING

8.1. Test Cases

1. User Login and Registration test
2. Database Update test
3. Prediction test

8.2. User Acceptance Testing



← → ↻ File | D:/akash%20python/ibm%20car%20value%20prediction/car%20resale%20value%20prediction/templates/predictionview.html

Get the Accurate Resale Value of your Car!!

Please fill the following details of your car:

Registration Year	<input type="text" value="2011"/>
Registration Month	<input type="text" value="May"/>
Power of car in PS	<input type="text" value="190"/>
Kilometers the car has driven	<input type="text" value="125000"/>
Gear Box Type	<input checked="" type="radio"/> Manual <input type="radio"/> Automatic <input type="radio"/> Not declared
Your car is damaged or repaired	<input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not declared
Model Type	<input type="text" value="Grand"/>
Brand of the car	<input type="text" value="Jeep"/>
Fuel type of the car	<input type="text" value="Diesel"/>
Vehicle type	<input type="text" value="SUV"/>

The login web page is tested with the invalid user information to check the invalid login testing into the webpage

← → ↻ File | D:/akash%20python/assignments/project%20development%20phase/Sprint%203/templates/predictedview.html

Get the Accurate Resale Value of your Car!!

The resale value predicted is : 15357.074356322181

9. PERFORMANCE

9.1 Performance metrics

```
{'mae': 1325.112086905962,  
'mse': 9577053.62710202,  
'rmse': 3094.6815065692977,  
'rmsle': 8.03744027403009,  
'r2': 0.8661221626879432,  
'adj_r2 score': 0.8661152969113608}
```

The model is tested with the various damaged car

images which are 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 AND 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.

GitHub Repo: <https://github.com/IBM-EPBL/IBM-Project-18020-1659678238>

13.APPENDIX

App.py

```

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

app = Flask(__name__)

def load_model(file='resale_model.sav'):
    return pickle.load(open(file, 'rb'))

@app.route('/')
def index():
    return render_template('homeview.html')

@app.route('/predict')
def predict_page():
    return render_template('predictionview.html')

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

    new_row = {'yearOfReg':regyear, 'powerPS':powerps, 'kilometer':kms,
               'monthOfRegistration':regmonth, 'gearbox':gearbox,
               'notRepairedDamage':damage,
               'model':model, 'brand':brand, 'fuelType':fueltype,
               'vehicletype':vehicletype}

    print(new_row)

    new_df = pd.DataFrame(columns=['vehicletype','yearOfReg','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[['yearOfReg','powerPS','kilometer','monthOfRegistration'] + [x+'_labels' for x in labels]]

    X = labeled.values.tolist()

```

```
print("\n\n", X)
predict = reg_model.predict(X)

print("Final prediction :",predict)

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

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