PROJECT REPORT - 2022

CAR RESALE VALUE PREDICTION

IBM Team ID: PNT2022TMID20203

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

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous institution affiliated to Anna University)

COIMBATORE-641 013

Project Report Format

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.

1.1 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 ,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.

1.2 Purpose:

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 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 SecondHand Cars", Avrupa Bilim ve Teknoloji Dergisi, no. 16, pp. 77-83, Aug. 2019

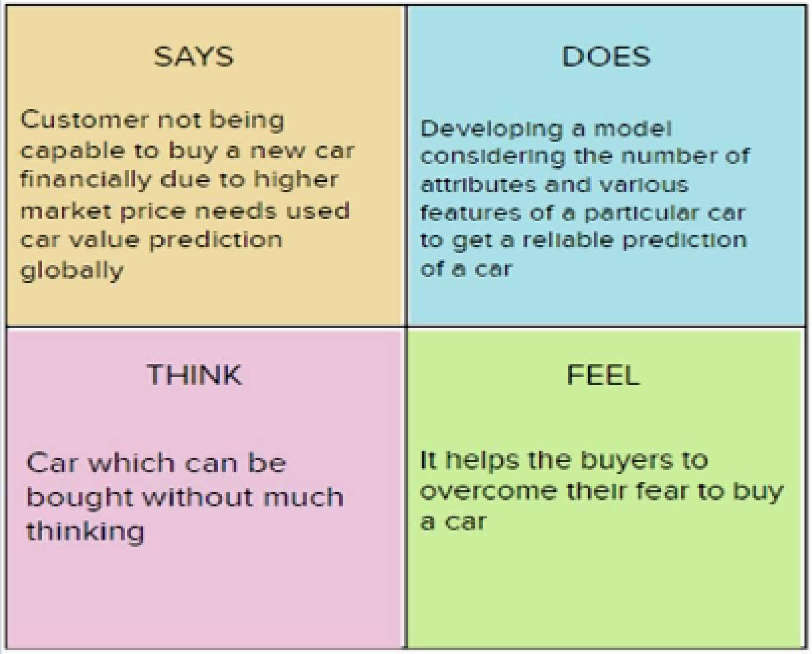
2.3 Problem Statement Definition

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

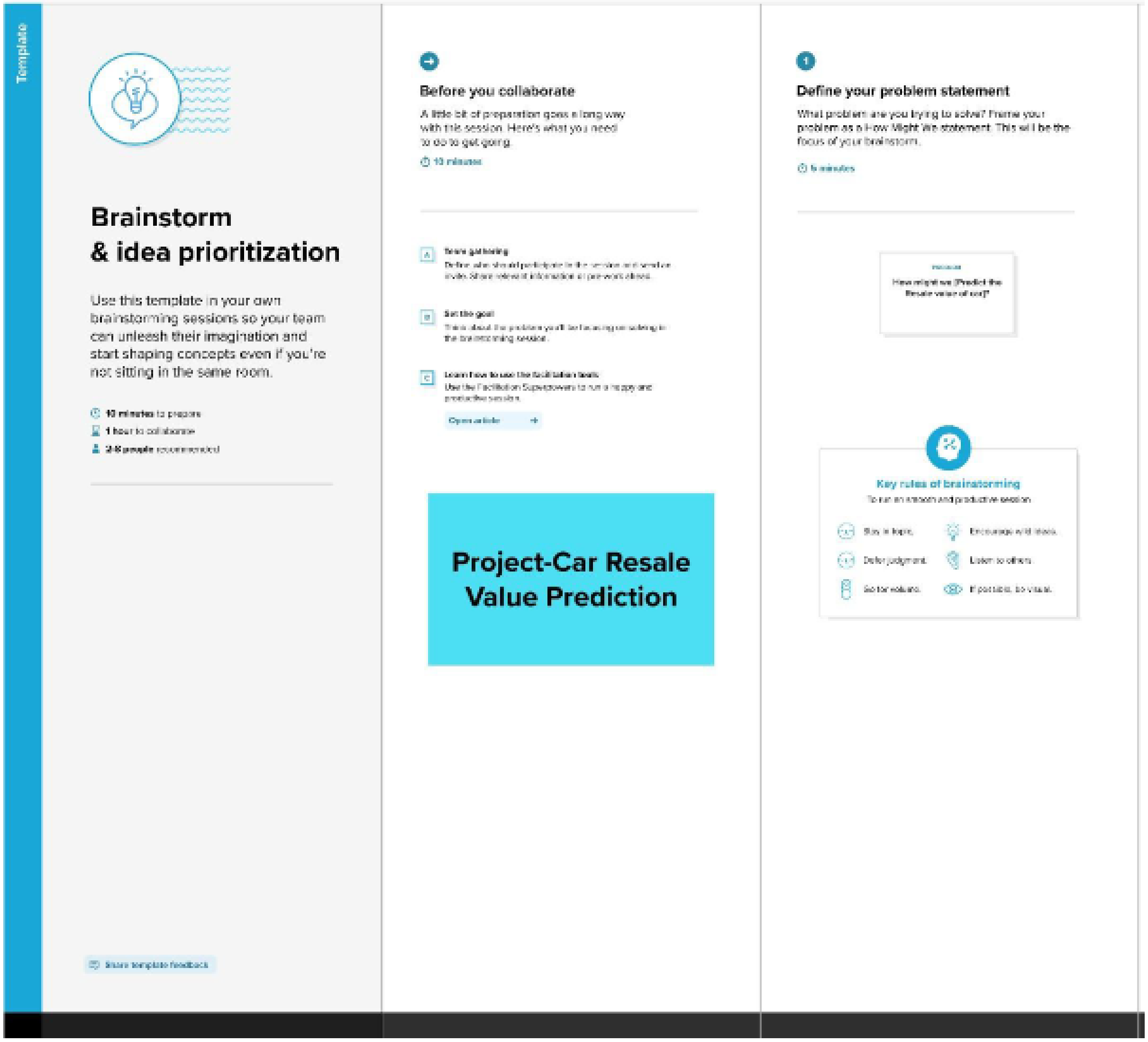
3.1 Empathy Map Canvas



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

.

3.2 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
2-8 people recommended

Share template feedback

Before you collaborate

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

10 minutes

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

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

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

Open article →

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.

5 minutes

PROBLEM
How might we [Predict the Resale value of car]?

Key rules of brainstorming
To run an smooth and productive session

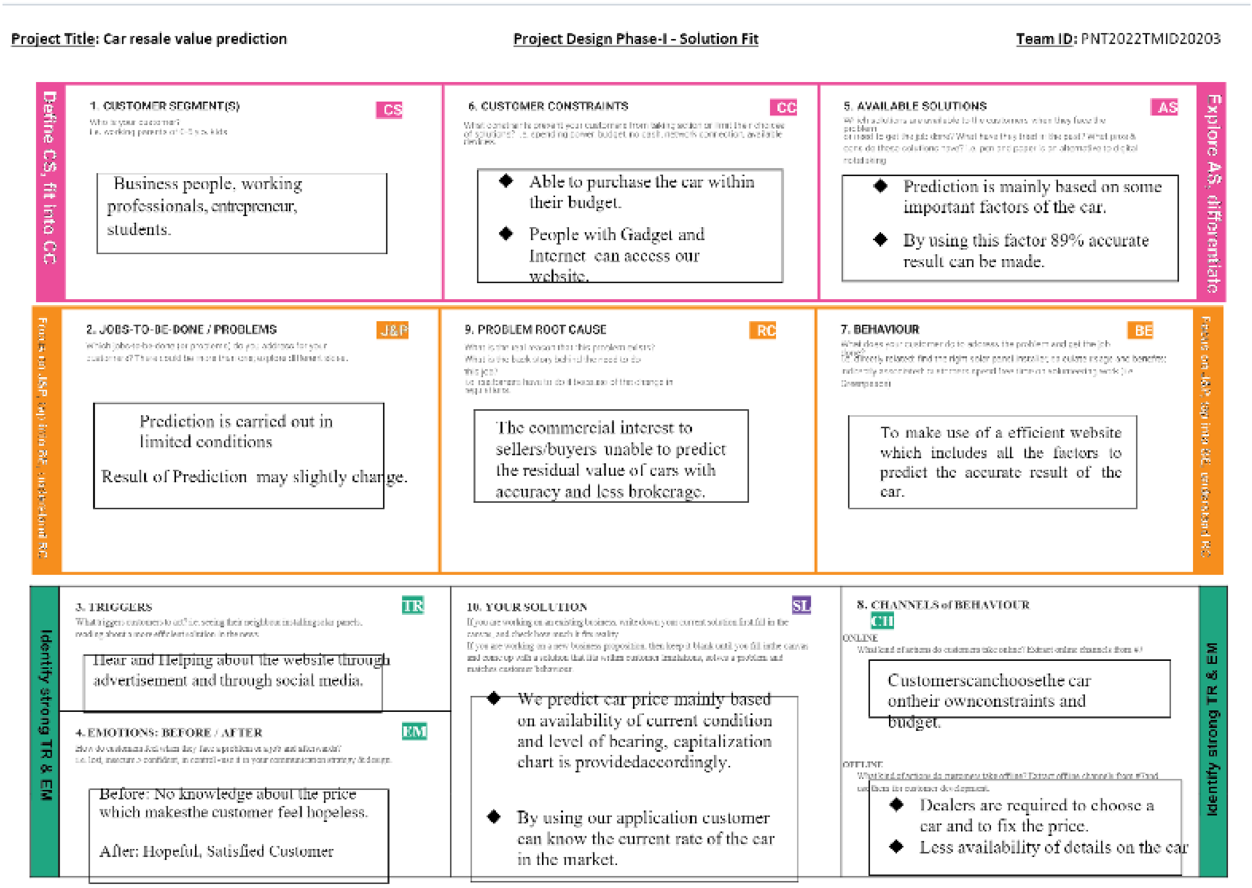
Stay in topic.
Encourage wild ideas.
Defer judgment.
Listen to others.
Go for volume.
If possible, be visual.

3.3 Proposed Solution

S. No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To Predict the value of the used car using Data Science
2.	Idea / Solution 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.
3.	Novelty / Uniqueness	We predict Used Car price mainly based on the car condition and mitigation level of quality, capitalization chart is provided accordingly.
4.	Social Impact / 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.
5.	Business Model (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.
6.	Scalability of the Solution	Whatever may be the vehicle type or count of vehicle, this 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: PNT2022TMID20203

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Who is your customer? i.e. working parents of 0-5 y.o. kids

Business people, working professionals, entrepreneur, students.

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.

- Able to purchase the car within their budget.
- People with Gadget and Internet can access our website.

5. AVAILABLE SOLUTIONS AS

Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

- Prediction is mainly based on some important factors of the car.
- By using this factor 89% accurate result can be made.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.

Prediction is carried out in limited conditions

Result of Prediction may slightly change.

9. PROBLEM ROOT CAUSE RC

What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations.

The commercial interest to sellers/buyers unable to predict the residual value of cars with accuracy and less brokerage.

7. BEHAVIOUR BE

What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

To make use of a efficient website which includes all the factors to predict the accurate result of the car.

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TR

What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.

Hear and Helping about the website through advertisement and through social media.

4. EMOTIONS: BEFORE / AFTER EM

How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design.

Before: No knowledge about the price which makesthe customer feel hopeless.

After: Hopeful, Satisfied Customer

10. YOUR SOLUTION SL

If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.

- We predict car price mainly based on availability of current condition and level of bearing, capitalization chart is providedaccordingly.
- By using our application customer can know the current rate of the car in the market.

8. CHANNELS of BEHAVIOUR CH

ONLINE

What kind of actions do customers take online? Extract online channels from #7

Customerscanchoosethe car ontheir ownconstraints and budget.

OFFLINE

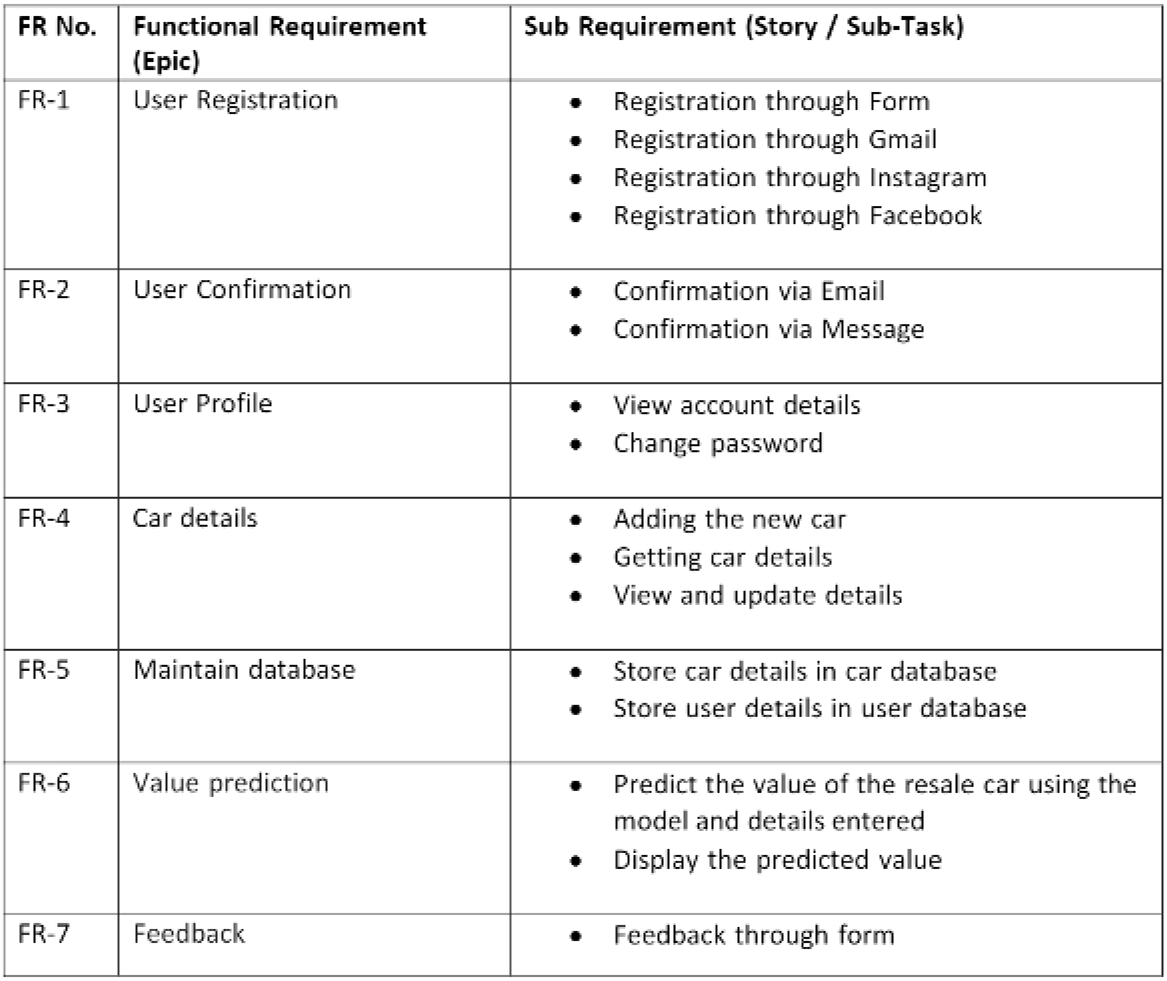
What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.

- Dealers are required to choose a car and to fix the price.
- Less availability of details on the car

Identify strong TR & EM

4. REQUIREMENT ANALYSIS

4.1 Functional requirement



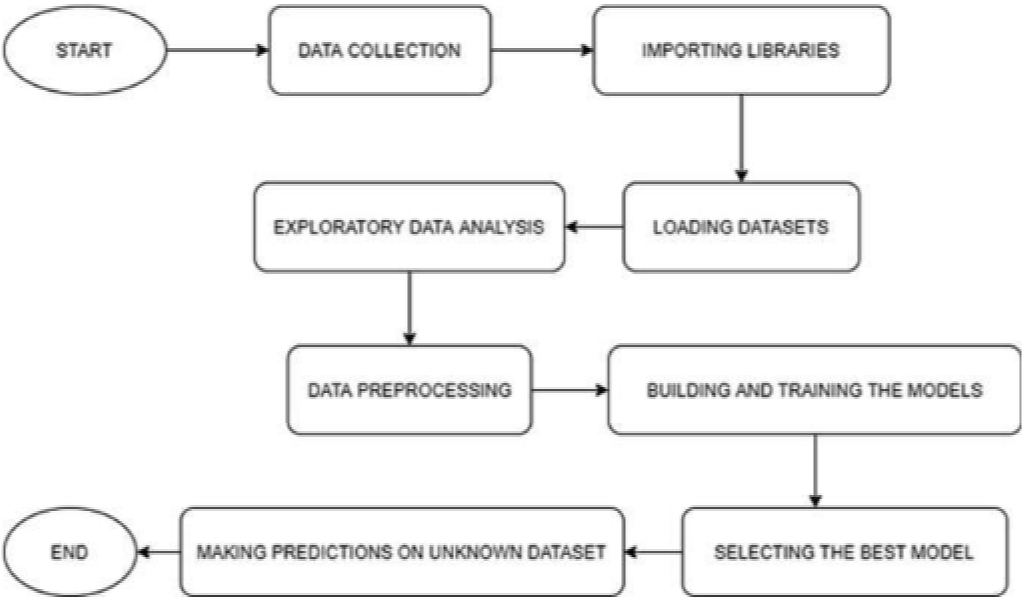
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	• Registration through Form • Registration through Gmail • Registration through Instagram • Registration through Facebook
FR-2	User Confirmation	• Confirmation via Email • Confirmation via Message
FR-3	User Profile	• View account details • Change password
FR-4	Car details	• Adding the new car • Getting car details • View and update details
FR-5	Maintain database	• Store car details in car database • Store user details in user database
FR-6	Value prediction	• Predict the value of the resale car using the model and details entered • Display the predicted value
FR-7	Feedback	• Feedback through form

Non-functional Requirements:

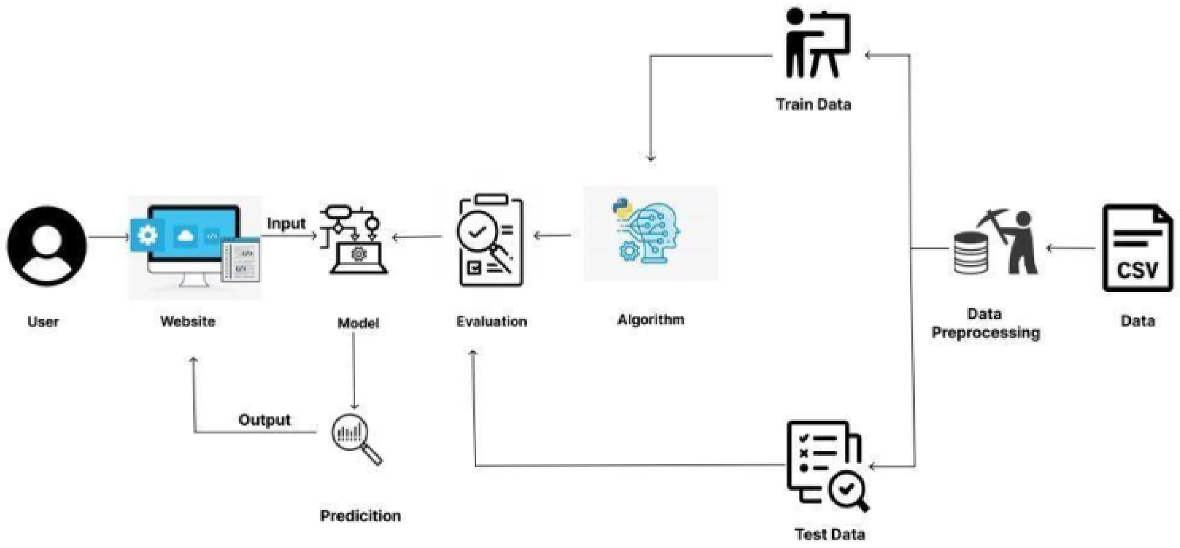
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	• User friendly UI • Clear instructions and sample examples will be provided • Easy process flow to predict value
NFR-2	**Security**	• User authentication while entering website • No information is shared with third party • User can see only his details
NFR-3	**Reliability**	• Data will be stored and replicated so that data loss can be avoided • Rate of occurrence of failure is very less
NFR-4	**Performance**	• Quick prediction results • Fast website loading • Efficient ML algorithm to provide accurate result with less time complexity
NFR-5	**Availability**	• Application can be accessed from both mobile and desktop • Single page failure does not affect the whole website • Uninterrupted user services
NFR-6	**Scalability**	• Able to handle large amount of data and traffic globally without failure • Database can be scaled according to the usage in a cost effective manner

5.PROJECT DESIGN

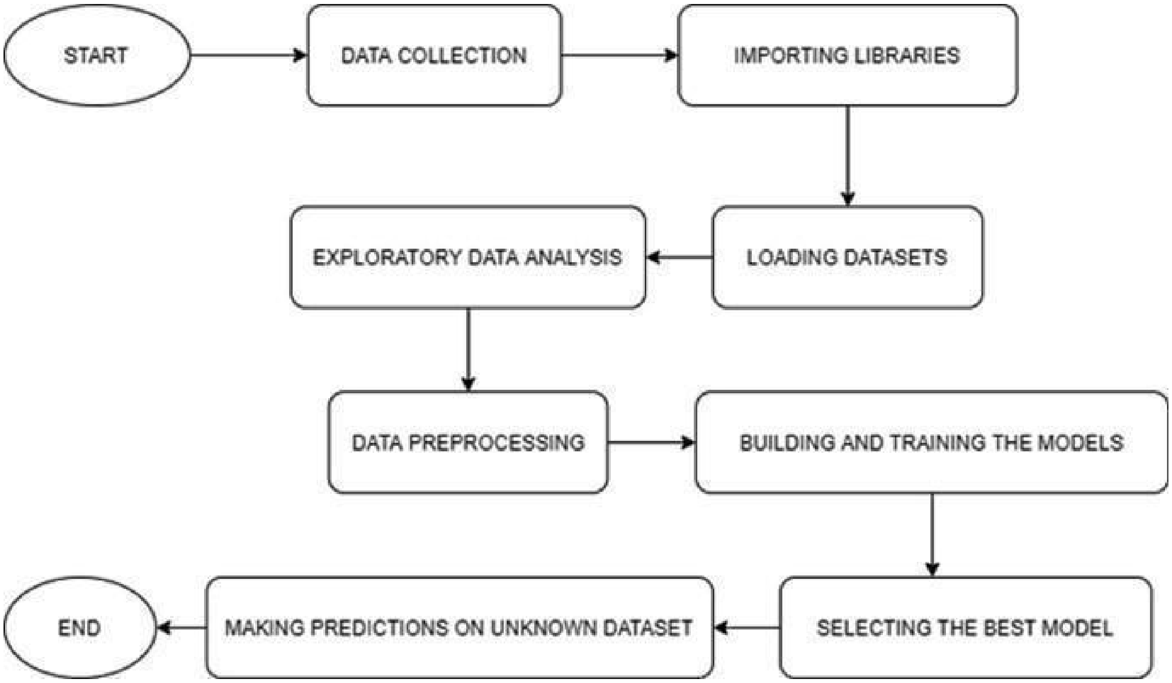
5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture



5.3 User Stories


START
DATA COLLECTION
IMPORTING LIBRARIES
LOADING DATASETS
EXPLORATORY DATA ANALYSIS
DATA PREPROCESSING
BUILDING AND TRAINING THE MODELS
SELECTING THE BEST MODEL
MAKING PREDICTIONS ON UNKNOWN DATASET
END

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

6 .PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

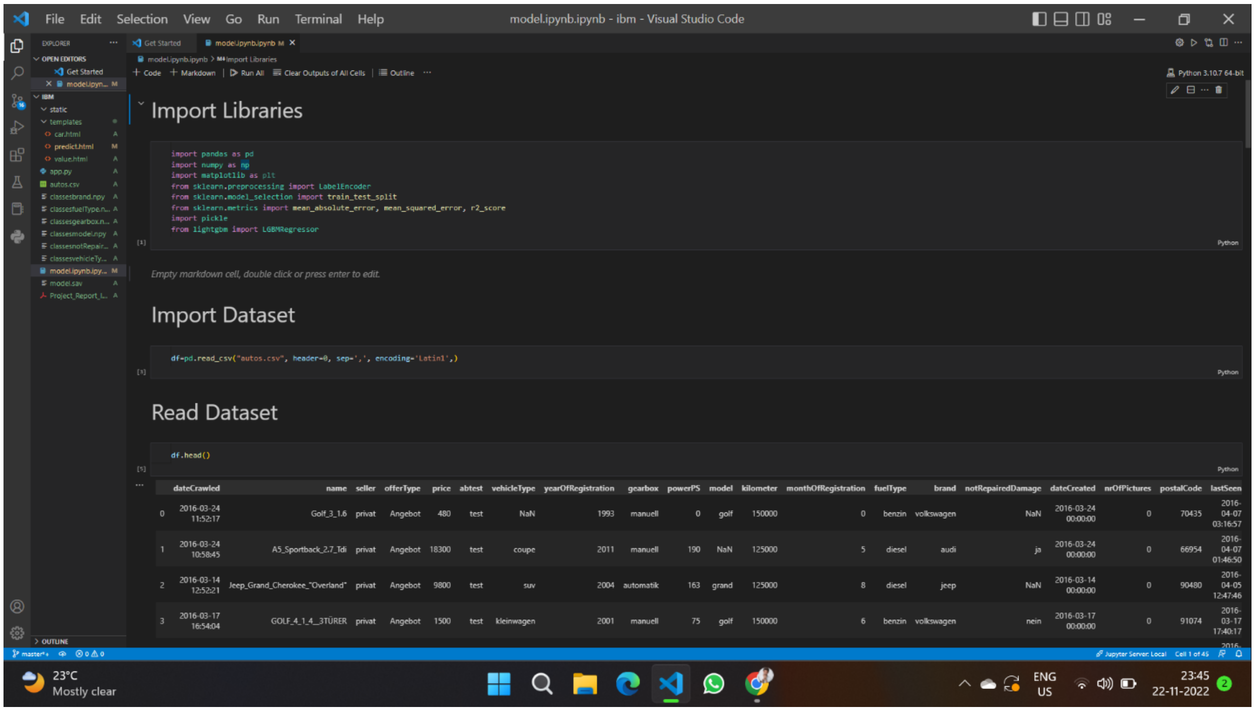
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Entry	USN-1	As a user, I can enter the car resale details in the application.	2	Medium	Kalaiselvi P
Sprint-1	Obtain output	USN-2	As a user, I will receive car resale cost in the application	1	High	Mary Shipani J
Sprint-1	Data Entry	USN-3	As a user, I can enter the car resale details in the application.	2	Medium	Shenbagalakshmi S

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

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	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)



Import Libraries

```
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
```

[1]

Empty markdown cell, double click or press enter to edit.

Import Dataset

```
df=pd.read_csv("autos.csv", header=0, sep=',', encoding='Latin1',)
```

[3]

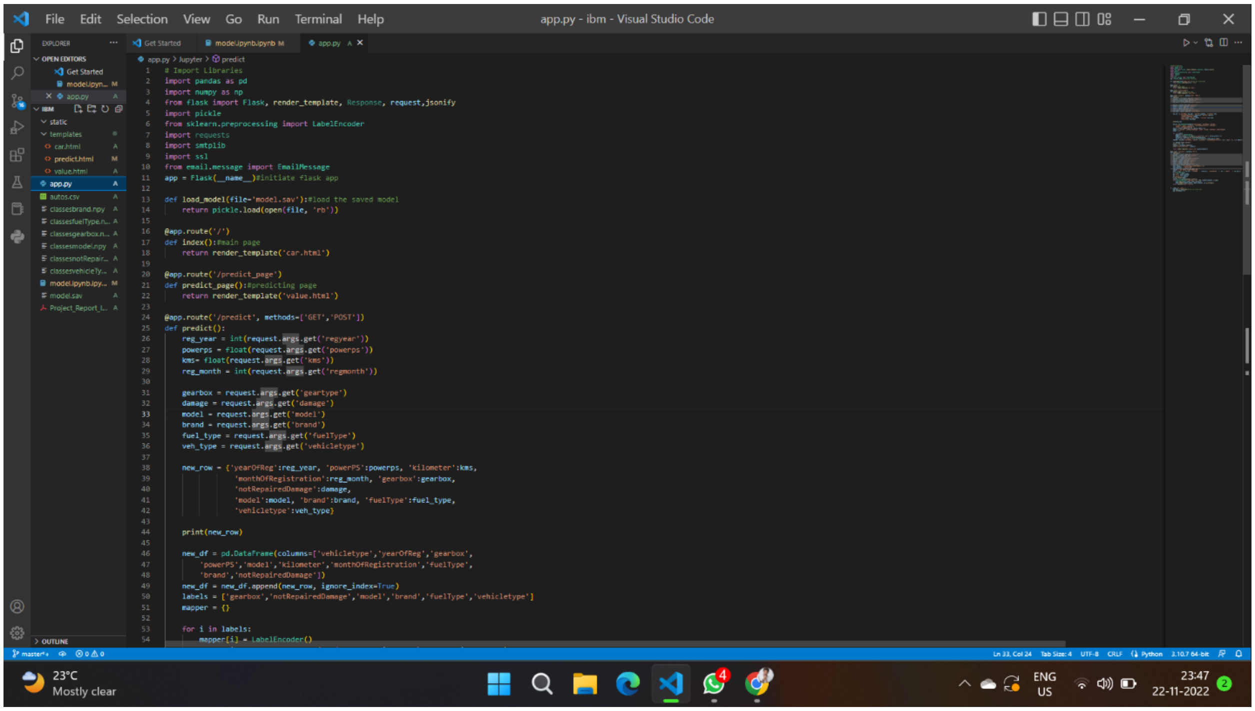
Read Dataset

```
df.head()
```

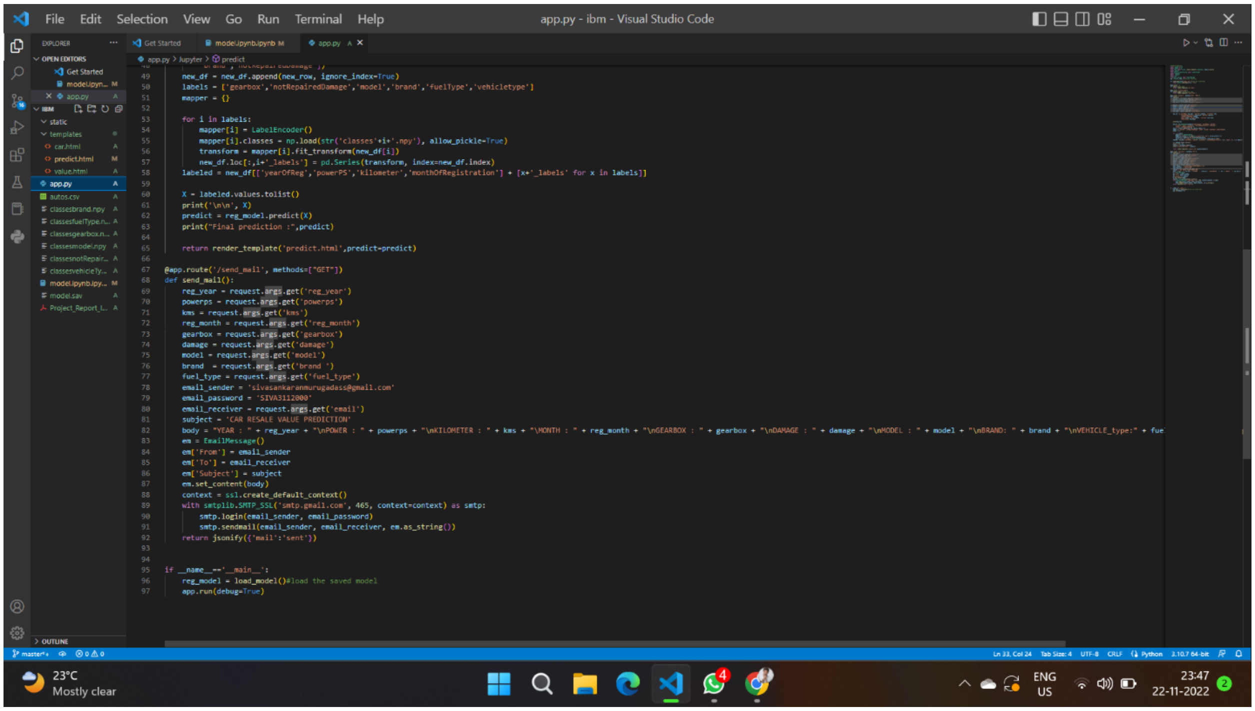
[5]

	dateCrawled	name	seller	offerType	price	abtest	vehicleType	yearOfRegistration	gearbox	powerPS	model	kilometer	monthOfRegistration	fuelType	brand	notRepairedDamage	dateCreated	nrOfPictures	postalCode	lastSeen
0	2016-03-24 11:52:17	Golf_3_1.6	privat	Angebot	480	test	NaN	1993	manuell	0	golf	150000	0	benzin	volkswagen	NaN	2016-03-24 00:00:00	0	70435	2016-04-07 03:16:57
1	2016-03-24 10:58:45	A5_Sportback_2.7_Tdi	privat	Angebot	18300	test	coupe	2011	manuell	190	NaN	125000	5	diesel	audi	ja	2016-03-24 00:00:00	0	66954	2016-04-07 01:46:50
2	2016-03-14 12:52:21	Jeep_Grand_Cherokee_"Overland"	privat	Angebot	9800	test	suv	2004	automatik	163	grand	125000	8	diesel	jeep	NaN	2016-03-14 00:00:00	0	90480	2016-04-05 12:47:46
3	2016-03-17 16:54:04	GOLF_4_1_4__3TÜRER	privat	Angebot	1500	test	kleinwagen	2001	manuell	75	golf	150000	6	benzin	volkswagen	nein	2016-03-17 00:00:00	0	91074	2016-03-17 17:40:17

7.1 Feature 2


File Edit Selection View Go Run Terminal Help
app.py - ibm - Visual Studio Code
Get Started
model.ipynb.ipynb M
app.py A
app.py > Jupyter > predict
23°C
Mostly clear
ENG
US
23:47
22-11-2022

```python
# Import Libraries
import pandas as pd
import numpy as np
from flask import Flask, render_template, Response, request,jsonify
import pickle
from sklearn.preprocessing import LabelEncoder
import requests
import smtplib
import ssl
from email.message import EmailMessage
app = Flask(__name__)#initiate flask app

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

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

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

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

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

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

    print(new_row)

    new_df = pd.DataFrame(columns=['vehicletype','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()
```


File Edit Selection View Go Run Terminal Help
app.py - ibm - Visual Studio Code
Get Started
model.ipynb.ipynb M
app.py A
app.py > Jupyter > predict
23°C
Mostly clear
ENG
US
23:47
22-11-2022

```python
    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('predict.html',predict=predict)

@app.route('/send_mail', methods=["GET"])
def send_mail():
    reg_year = request.args.get('reg_year')
    powerps = request.args.get('powerps')
    kms = request.args.get('kms')
    reg_month = request.args.get('reg_month')
    gearbox = request.args.get('gearbox')
    damage = request.args.get('damage')
    model = request.args.get('model')
    brand  = request.args.get('brand ')
    fuel_type = request.args.get('fuel_type')
    email_sender = 'sivasankaranmurugadass@gmail.com'
    email_password = 'SIVA3112000'
    email_receiver = request.args.get('email')
    subject = 'CAR RESALE VALUE PREDICTION'
    body = "YEAR : " + reg_year + "\nPOWER : " + powerps + "\nKILOMETER : " + kms + "\MONTH : " + reg_month + "\nGEARBOX : " + gearbox + "\nDAMAGE : " + damage + "\nMODEL : " + model + "\nBRAND: " + brand + "\nVEHICLE_type:" + fue
    em = EmailMessage()
    em['From'] = email_sender
    em['To'] = email_receiver
    em['Subject'] = subject
    em.set_content(body)
    context = ssl.create_default_context()
    with smtplib.SMTP_SSL('smtp.gmail.com', 465, context=context) as smtp:
        smtp.login(email_sender, email_password)
        smtp.sendmail(email_sender, email_receiver, em.as_string())
    return jsonify({'mail':'sent'})


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

8.TESTING

8.1 Test Cases

Testcase ID	FeatureType			Component	TestScenario	Pre-Requisite	StepsTo Execute	T ata
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	
HomePage_TC_002	Functional			Home Page	Verifiy 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.	
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	
DataEntryPage_TC_002	Functional			Data Entry Page	Verifyuser 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. Verifyall the UI elements displayed or not 5. Verify if all values can be entered	2 1 1 1 0 A matic Y 2 Reihe S t C L usine
DataEntryPage_TC_003	Functional			Data Entry Page	Verifiy theOutput 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. Verifyall the UI elements displayed or not 5. Verify if all values can be entered 6. Press thesubmit Button	
OutputDisplayPage_TC_001	UI			Output DisplayPage	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. Verifyall the UI elements displayed or not 5. Verify if all values can be entered 6. Press thesubmit Button 7. Verifyall the UI elements displayed or not	

OutputDisplayPage_TC_002	Functional			Output DisplayPage	Verify user is ableto 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. Verifyall the UI elements displayed or not 5. Verify if all values can be entered 6. Press thesubmit Button 7. Verifyall the UI elements displayed or not 8. Verifyif the predicted valueis displayed or not	

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

14. APPENDIX

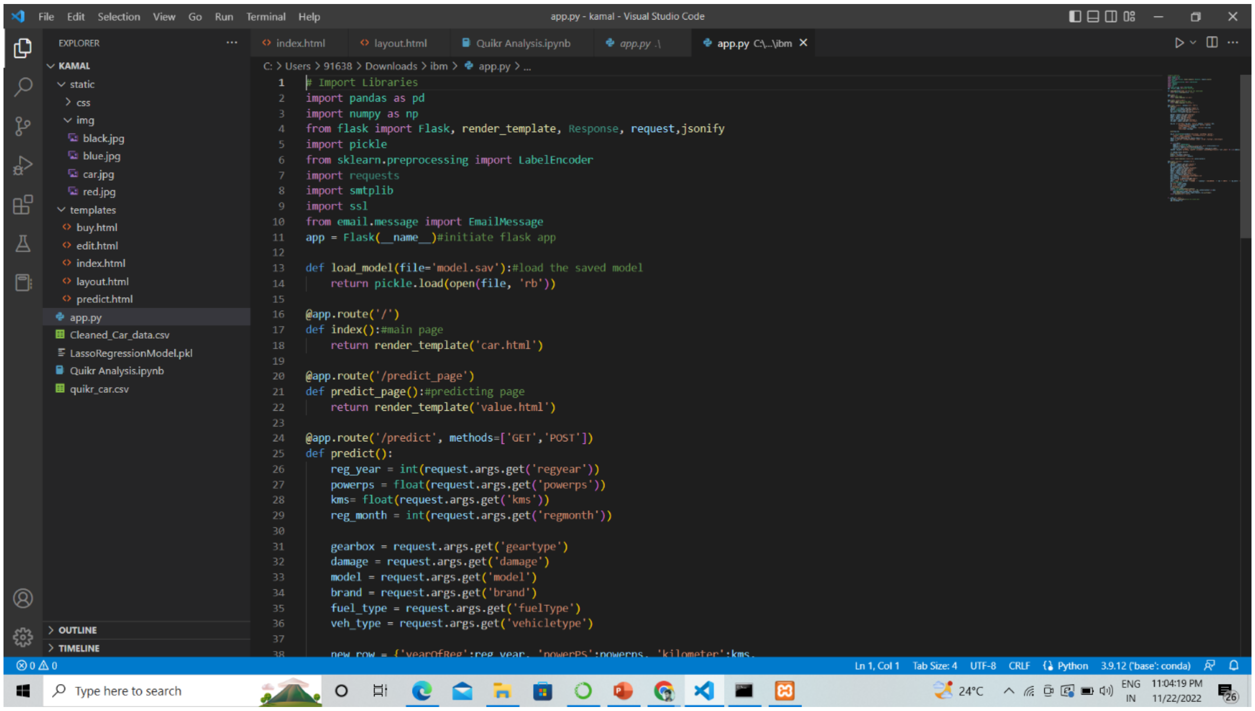
GitHub Repo:

https://github.com/IBM-EPBL/IBM-Project-3961-1658675334

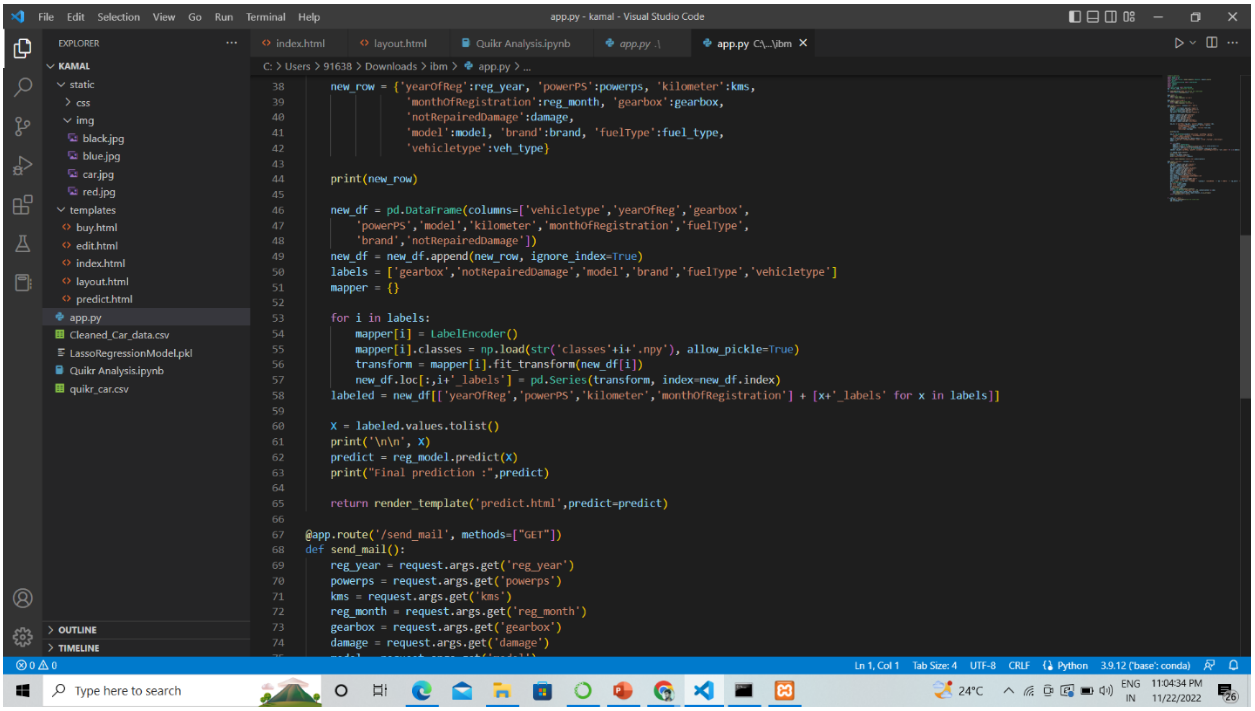
Video Link:

https://drive.google.com/file/d/1E9B_AJ0SjbXFNU88g0BI-cM2ySrOv4bj/view?usp=share_link

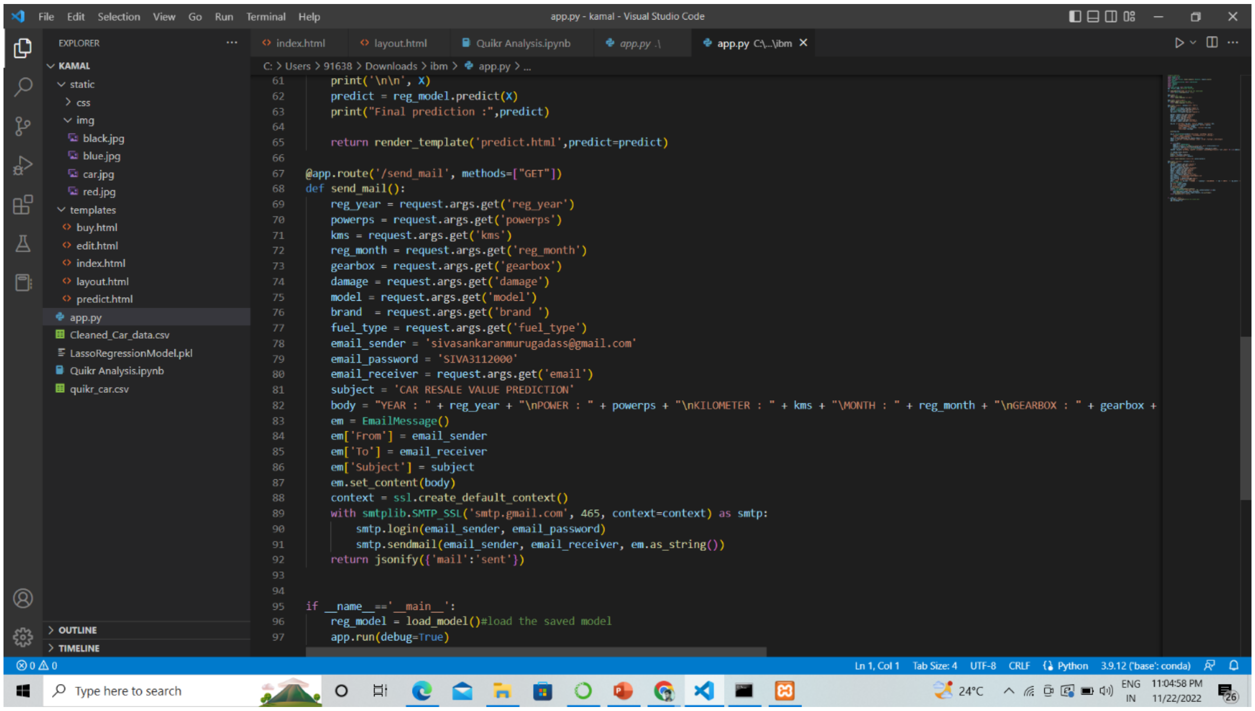
App.py



```python
# Import Libraries
import pandas as pd
import numpy as np
from flask import Flask, render_template, Response, request,jsonify
import pickle
from sklearn.preprocessing import LabelEncoder
import requests
import smtplib
import ssl
from email.message import EmailMessage
app = Flask(__name__)#initiate flask app

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

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

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

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

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

```



```python
    new_row = {'yearOfReg':reg_year, 'powerPS':powerps, 'kilometer':kms,
                'monthOfRegistration':reg_month, 'gearbox':gearbox,
                'notRepairedDamage':damage,
                'model':model, 'brand':brand, 'fuelType':fuel_type,
                'vehicletype':veh_type}

    print(new_row)

    new_df = pd.DataFrame(columns=['vehicletype','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('predict.html',predict=predict)

@app.route('/send_mail', methods=["GET"])
def send_mail():
    reg_year = request.args.get('reg_year')
    powerps = request.args.get('powerps')
    kms = request.args.get('kms')
    reg_month = request.args.get('reg_month')
    gearbox = request.args.get('gearbox')
    damage = request.args.get('damage')
```



```python
    print('\n\n', X)
    predict = reg_model.predict(X)
    print("Final prediction :",predict)

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

@app.route('/send_mail', methods=["GET"])
def send_mail():
    reg_year = request.args.get('reg_year')
    powerps = request.args.get('powerps')
    kms = request.args.get('kms')
    reg_month = request.args.get('reg_month')
    gearbox = request.args.get('gearbox')
    damage = request.args.get('damage')
    model = request.args.get('model')
    brand  = request.args.get('brand ')
    fuel_type = request.args.get('fuel_type')
    email_sender = 'sivasankaranmurugadass@gmail.com'
    email_password = 'SIVA3112000'
    email_receiver = request.args.get('email')
    subject = 'CAR RESALE VALUE PREDICTION'
    body = "YEAR : " + reg_year + "\nPOWER : " + powerps + "\nKILOMETER : " + kms + "\MONTH : " + reg_month + "\nGEARBOX : " + gearbox +
    em = EmailMessage()
    em['From'] = email_sender
    em['To'] = email_receiver
    em['Subject'] = subject
    em.set_content(body)
    context = ssl.create_default_context()
    with smtplib.SMTP_SSL('smtp.gmail.com', 465, context=context) as smtp:
        smtp.login(email_sender, email_password)
        smtp.sendmail(email_sender, email_receiver, em.as_string())
    return jsonify({'mail':'sent'})


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