CAR RESALE VALUE PREDICTION

PROJECT REPORT

Submitted by

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CONTENTS

INTRODUCTION

Determining whether the listed price of a used car is a challenging task, due to the many factors that drive a used vehicle's price on the market. The focus of this projectis developing machine learningmodels that can accurately pre dictthe price of a used car based on its features, in order to make informed purchases. Implement and evaluate various learning methods on a dataset consisting of the sale prices of different makes and models. Depending on various parameters we will determine theprice of the car. Regression Algorithms are used because they provideuswith continuous value as an output and not a categorized v alue because of which it will be possible to predict the actual price a car rather than the price range of a car. User Interface has also been developed which acquires input from any user and displays the Price of a car according to user's inputs.

1.2 PROJECT OVERVIEW

- Able to understand the problem to classify if it is a regression or classificationkind of problem.
- Able to know how to pre-process/clean the data using different data pre-processing techniques.
- Applying different algorithms according to the dataset.
- Able to know how to evaluate the model.
- Able to build web applications using the Flask framework.

1.3 PURPOSE

This project aims to deliver price prediction models to the public, to help guide the individuals looking to buy or sell cars and to give them a better insight into the automotive sector. Buying a used car from a dealer can beafrustratingandan unsatisfying experience as some dealers are known to deploy dece it ful sale tactics to dose a deal. Therefore, to help consumers avoid falling victims to such tactics, this study hopes to consumers with right tools to guide them in their shopping experience.

The production of cars has been steadily increasing in the past decade, with over 70 million passenger cars being produced in the year 2016. This has given rise to the used car market, which on its own has become a booming industry. The recent advent of online portals has facilitated the need for both the customer and the seller to be better informed about the trends and patterns that determine the value of a used car in the market.

2.LITERATURE SURVEY

With the recentarrival of internetportals, buyers and sellers may obt ain an appropriatestatus of the factors that ascertain the market price of a used automobile. Lasso Regression, Multiple Regression, and Regression Trees are examples of machine learning algorithms. We will try to develop a statistical model that can forecast the value of a pre-owned automobile based on priorcustomer details and different parameters of the vehicle. This paper aims to compare the efficiency of different models' predictions to find the appropriate one.

On the subject of used automobile price prediction, several previous studies have been conducted. To anticipate the value of pre-owned automobiles in Mauritius, Pudaruth employed naive Bayes, k-nearest neighbours, multiple linear regression, and decision trees. However, because there were fewer cars observed, their results were not good for prediction. In his article,Pudaruth concluded t hat decision trees andnaïveBayes are ineffective for continuous-valued variables.

To anticipate the price of a vehicle, Noor and Jan employed Multiple linear regression.They used a variable selection methodology to determinevariablesthathadthe highest influence and then eliminated the rem ainder. Only a few variables are includedin the data, which were utilised to c reate the linear regression model. With an R-squareof 98 percent, the outcome was outstanding.

Peerunetal. conducted study to assess the neural network's perform ance in predicting used automobile prices. However, especially on higher-priced cars, the estimated value is not very close to the real price. In forecasting the price of a usedcar, they found that support vector machine regression outperformed neural networksand linear regression by a little margin.

To accurately anticipate the price of a car, many different approach es have been usedin the digital world, ranging from machine learning approaches like multiple linear regression, k-nearest neighbour, and naive bayes to random forest and decision treeto the SAS enterprise miner.

2.1 EXISTING PROBLEM

Using various machine learning algorithms, we will predict the price. The algorithms involve Ridge Regression and Lasso Regression. The best model which predicts the most accurate price is selected. After selection of the best model the predicted price is displayed to the user according to user’s inputs.User can gi ve input throughwebsitetofor used carprice prediction to machine l earning model.

Ridge Regression

A Ridge regressoris basically a regularized versionof Linear Regressor. The regularized term has the parameter ‘alpha’ which controls the regularization of the model i.e helps in reducing the variance of the estimates.

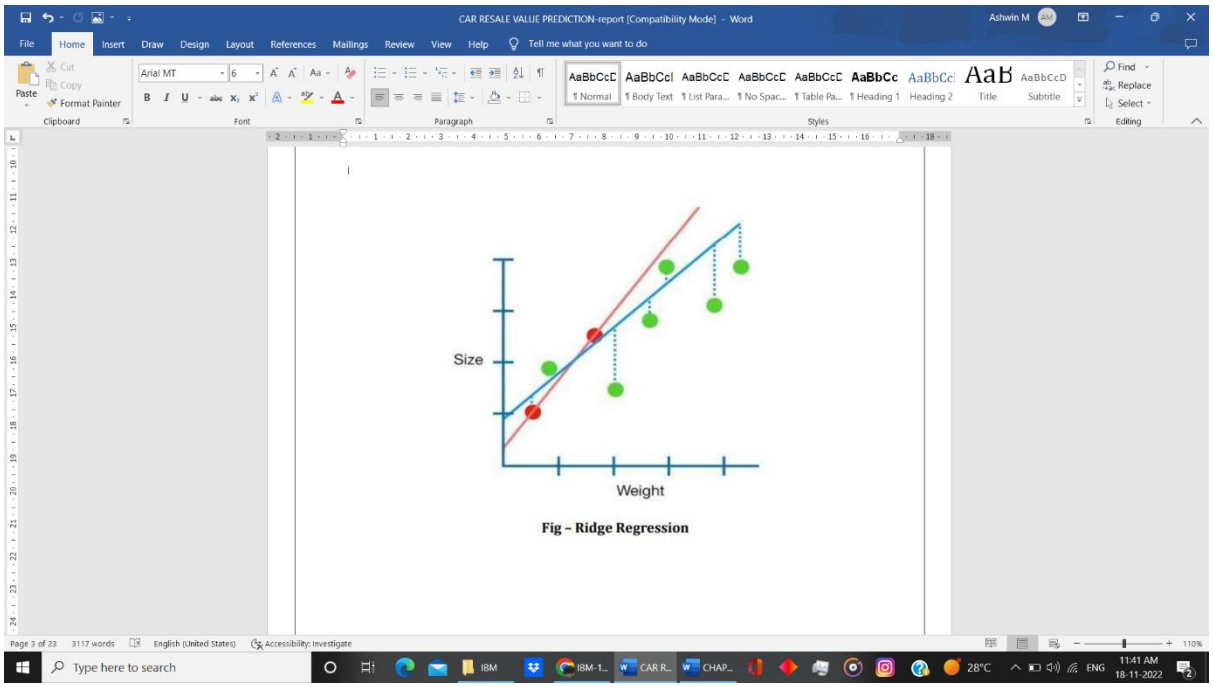

Fig – Ridge Regression

Lasso Regression

The “LASSO” stands for Least Absolute Shrinkage and Selection Operator. Lasso regression is a regularization technique. It is used over regression meth odsfor a moreaccurate prediction. This model uses shrinkage. Shrinkage iswheredatavaluesare shrunktowards a centralpoint as the mean. The lasso pr ocedure encourages simple,sparse models (i.e. models with fewer parameters). This particular type of regressionis well-suited for models showing high levels of multicollinearity or when you want

to automate certainparts of model selection, like variable selection/parameter elimination.

2.2 REFERENCES

- Doan Van Thai, “Prediction car prices using quantify qualitat ive data andknowledge-based system.”
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- Nitis Monburinon, “Prediction of Pricesfor Used Car by Using Regression Models”[4]https://towardsdatascience.com/used-car-priceprediction-using-machine- learninge3be02d977b2
- 4.https://www.semanticscholar.org/paper/vehiclePrice-Prediction-System-using-
- Machine-Noor Jan/fc87ead6754b188b1b8629db77badf361fd24a22
- https://www.docsity.com/en/research-projectproposal-online-car-rental-system/5232831/
- Comparative Analysis of Used Car Price Evaluation Models, Tongji University, Shanghai 200000, China.
- Nitis Monburinon, “Prediction of Prices for Used Car by Using Regression Models”,5th International Conference on Business and Industrial Research, (ICBIR), Bangkok,Thailand, 2018 [9] Jaideep A Muley, “Prediction of Used Cars’ Prices by Using SASEM”, Oklahoma State University
- Nabarun Pal, “A methodology for predicting used cars prices using
  Random Forest”, Futureof Information and Communications Conference, 2018
- Kuiper, Shonda, "Introduction to Multiple Regression: How Much Is Your Car Worth?" - Journal Of Statistics Education, 2008

2.3 PROBLEM STATEMENT AND DEFINITION

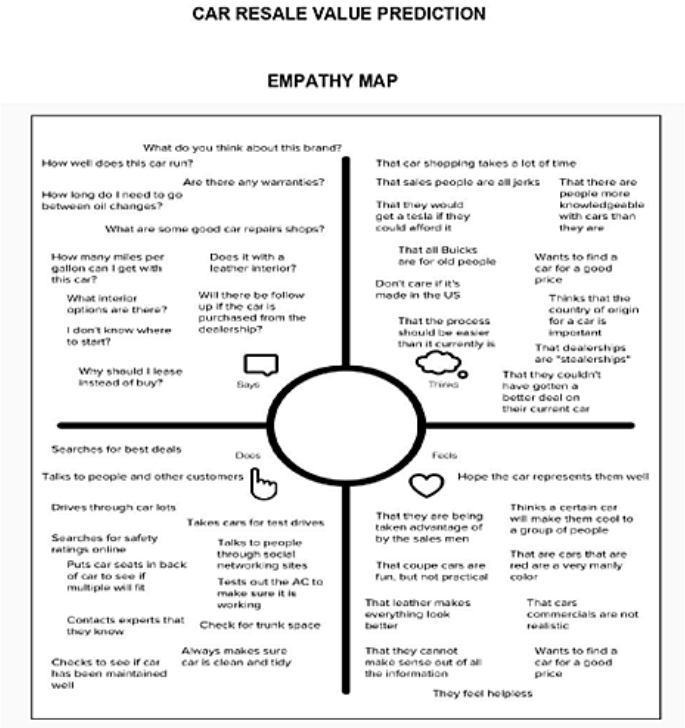
The prices of new cars in the industry are fixed by the manufac turer with some additionalcosts incurred by the Government in the form of taxes. So, customers buying a new car can be assured of the money they invest to be worthy. But due to the increased price of new cars and the incapability of customers to buy new cars due to the lack of funds, used cars sales are on a global increase. Predicting the prices of used cars is an interesting and much-needed problem to be addressed. Customers can be widelyexploited by fixing unrealistic prices for the used cars and many falls into this trap. Therefore, rises an absolute necessity of a used car price prediction system to effectively determine the worthiness of the car using a variety of features. Due to the adverse pricing of cars and the nomadic nature of people in developed countries, the cars are mostly bought on a lease basis, where there is an agreement between the buyer and seller. These cars upon completion of the agreement are resold. So, reselling has become an essential part of today's world.

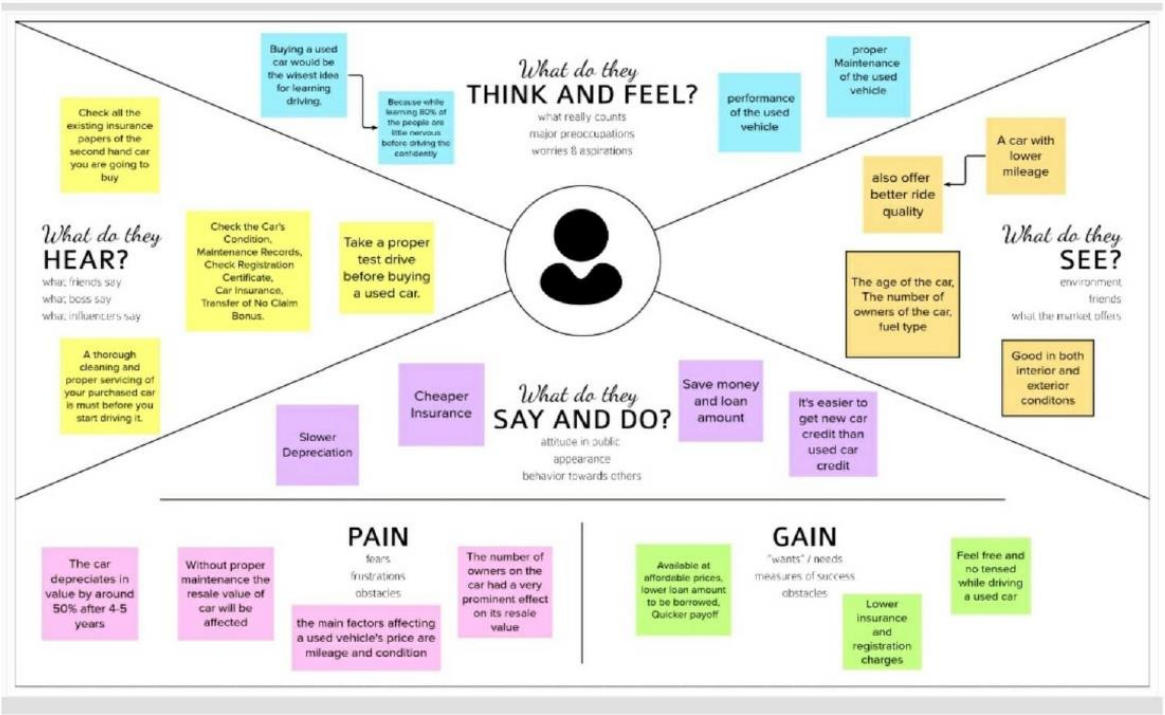
The main aim of this project is to predict the price of used cars using the various Machine Learning (ML) models. This can enable the customers to make decisions based on different inputs or factors namely Brand or Type of the car one prefers like Ford, Hyundai, Model of the car namely Ford Figo, Hyundai C reta, Year of manufacturing like 2020, 2021, Type of fuel namely Petrol, Diesel, Price range or Budget, Type of transmission which the customer prefers like Automatic or Manual, Mileage to name a few characteristic features required by the customer. This project Car Price Prediction deals with providing the solution to these problems. Different techniques like multiple linear regression analysis, k-nearest neighbours, naïve baye sand decision trees have been used to make the predictions. The predictions are then evaluated andcomparedin order to find those which provide th e best performances.

3.IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

With difficult economic condition, it is likely that sales of second-hand imported cars and used cars will increase. In many development countries, it is common to lease a car rather than buying it outright. After the lease period is over, the buyer has the possibility to buy the car as its residual value, i.e., its expected resale value. Thus, it is of commercial interest to be able to predict the salvage value of cars with accuracy.





PAINS	GAINS
Buying a used car means that it can fall apart at any time.	The main attraction of buying a used car is because you do not have to pay for its first depreciation.
Even if the used car is in good working order, you have to deal with repairs sooner than later.	Get a cheaper sales tax and more affordable insurance.
Buying a used car is that it has no warranty.	Can save about a thousand dollars by avoiding the new car registration fees.
You may not know that reason why it was traded in. You need to obtain the vehicle history report first.	You don't have to settle for expensive dealership add-ons when buying a used car.

3.2 IDEATION AND BRAINSTORMING

3.3 PROPOSED SOLUTION

There are two primary phases in the system:

1. Training phase: The system is trained byusing the data in the data set and fits a model (line/curve) based o n the algorithm chosen accordingly.

2. Testing phase: the system is provided with the inputs and is tested for its working. The accuracy is checked. And therefore, the data that is used to train the model ơr test it, has to be appropriate. The system is designed to detect and pre

dict price of usedcar and hence appropriate algorithms must be used to do the two different tasks. Before the algorithms are selected for further use, different algorithms were compared for its accuracy. The well-suited one for the task was chosen.

The main aim of this project is to predictthe price of used cars using the various Machine Learning (ML) models. This can enable the customers to make decisions based on different inputs or factors namely brand or Type of the car one prefers like Ford, Hyundai,Model of the car namelyFord Figo, HyundaiCreta, Year of manufacturing like 2020, 2021,Type of fuel namely Petrol,Diesel, Price range or Budget,Type of transmission which thecustomer pref erslike Automatic or Manual, Mileageto name a few characteristic f eaturesrequired by the customer. This project Car Price Prediction deals with providing the solution to these problems. Techniques like multiple linear regression analysis have beenused to make the predictions. The predictions are then evaluated and compared in orderto find those which provide the best performances.

New cars of a particular make, model, and year all have the same retailprice,excluding optional features. This price is set by the manu facturer. Used car, howeverare subject tosupply-and-demand pricing. Further, used cars have additional attributes that factor into the price. These include the condition, milage,

and repair history, which sets cars that mayhave share da retail price apart.

The purpose of this thesis is to evaluate several different machine learning models for used car price prediction and draw conclusions about how they behave. This will deepenthe knowledge of machine learning applied to car valuations and other similar price prediction problems.

This work will focus on answering the research questions. They all entail a comparison ofdifferent ML algorithms for price prediction. This will be accomplished by sourcing and preparing a dataset on which all the algorithms can be trained on and comparedfairly. The algorithms selectedmust therefore be similar en ough for the same datasetto be usedfor all of them. This also means that no large optimization efforts on the dataset will be made to boost the performance, if these changes do not benefit the other models. Maximizing price prediction performance of any one algorithm in ways that do not offer better comparisons is outside the scope of this work.

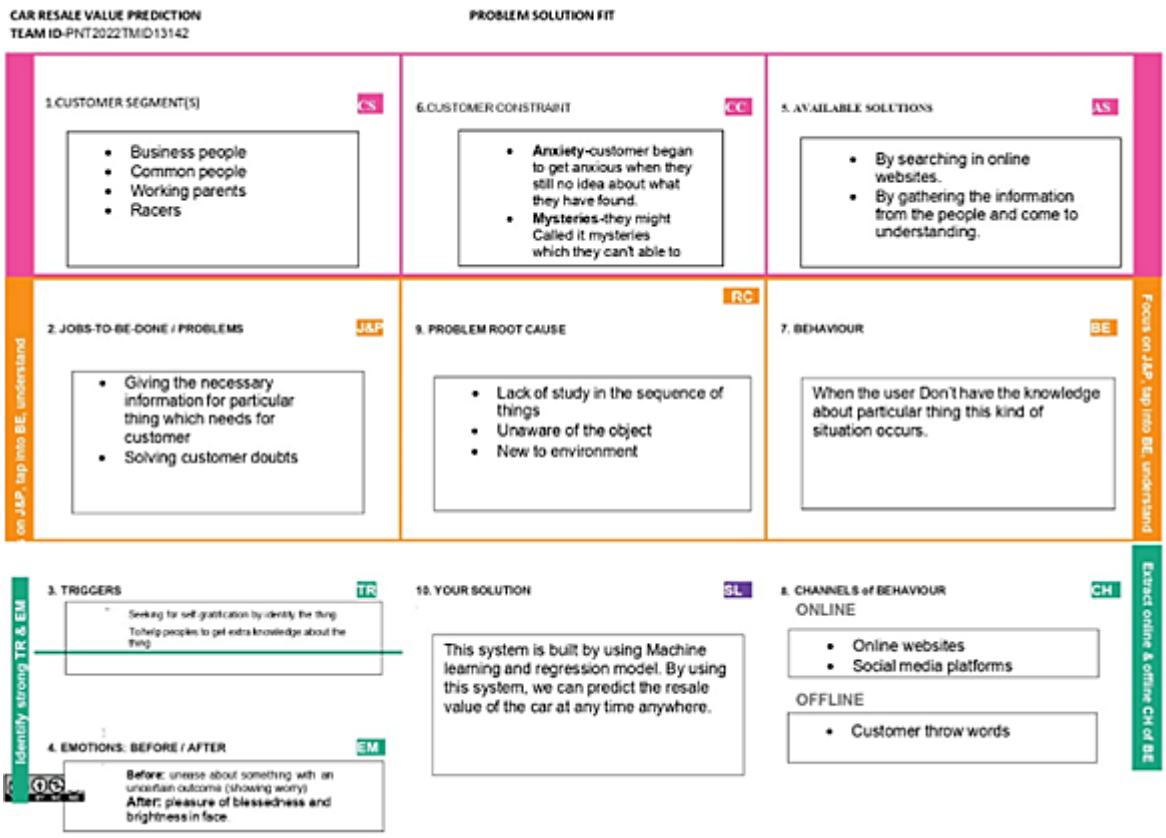
A revenue model is a blueprint that shows how a start-up business willearnrevenueor gross incomefrom its standardbusiness operation s, and how it will pay for operating costsand expenses.

The optimal parameters were determined in the processof implementing the models, andthus each model was implemented with the parameters

that yielded the best performanceby trial and error. All of the models approximated geometric appreciation, meaning that aconstant percentage of value is lost every year independent of the age of the vehicle. Random Forest Regression had a significantly higher assessed average depreciation at approximately 13.8%, compared to the others with 9.7%. This is closer to the range of 15%-31% assessed by Karl Storch Mann in his analysis of international depreciation rates.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To predict resale value for any second hand imported cars and used cars considering its usage
2.	Idea / Solution description	To develop an Machine Learning Algorithm which predicts the resale value for any used cars which is displayed with UI
3.	Novelty / Uniqueness	Car Resale value can be predicted at a higher accuracy
4.	Social Impact / Customer Satisfaction	Our software is very cheap and It can be used in any device with minimum configuration
5.	Business Model (Revenue Model)	The Software can be accessed by anyone who owns from anywhere . Since it is being deployed in cloud it can be accessed by everyone
6.	Scalability of the Solution	As the software is being deployed in cloud it can be even accessed in mobile phones

3.4 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

FR No.	Functional Requirement (Epic)	Sub Requirement (Story/ Sub-Task)
FR-1	User Registration	Registration through Website
FR-2	User Confirmation	Confirmation via website
FR-3	Car Registration	Registering the car details
FR-4	Value Prediction	Predicting the car resale value

Anaconda Navigator:

Anaconda Navigator is a free and open-source distribution of the Python and R programming languages for data science and machine learning related applications. It can be installed on Windows, Linux, and macOS. Conda is an open-source, cross-platform, package management system. Anaconda comes with great tools like JupyterLab, Jupyter Notebook, Console, Spyder, Glue viz, Orange, RStudio, Visual Studio Code. For this project, we will be using Jupyter notebook and Spyder To install Anaconda navigator and to know how to use Jupyter Notebook & Spyder using Anaconda watch the video to build Machine learning models you must require the following packages Sklearn: Scikit-learn is a library in Python that provides many unsupervised and supervised learning algorithms. NumPy: NumPy is a Python package that stands for

'Numerical Python'. It is the core library for scientific computing, which contains a powerful n-dimensional array object Pandas: pandas are a fast, powerful, flexible, and easy to use open-source data analysis and manipulation tool, built on top of the Python programming language. Matplotlib: It provides an object-oriented API for embedding plots into applications using general-purpose GUI toolkits Flask: Web framework used for building Web applications.

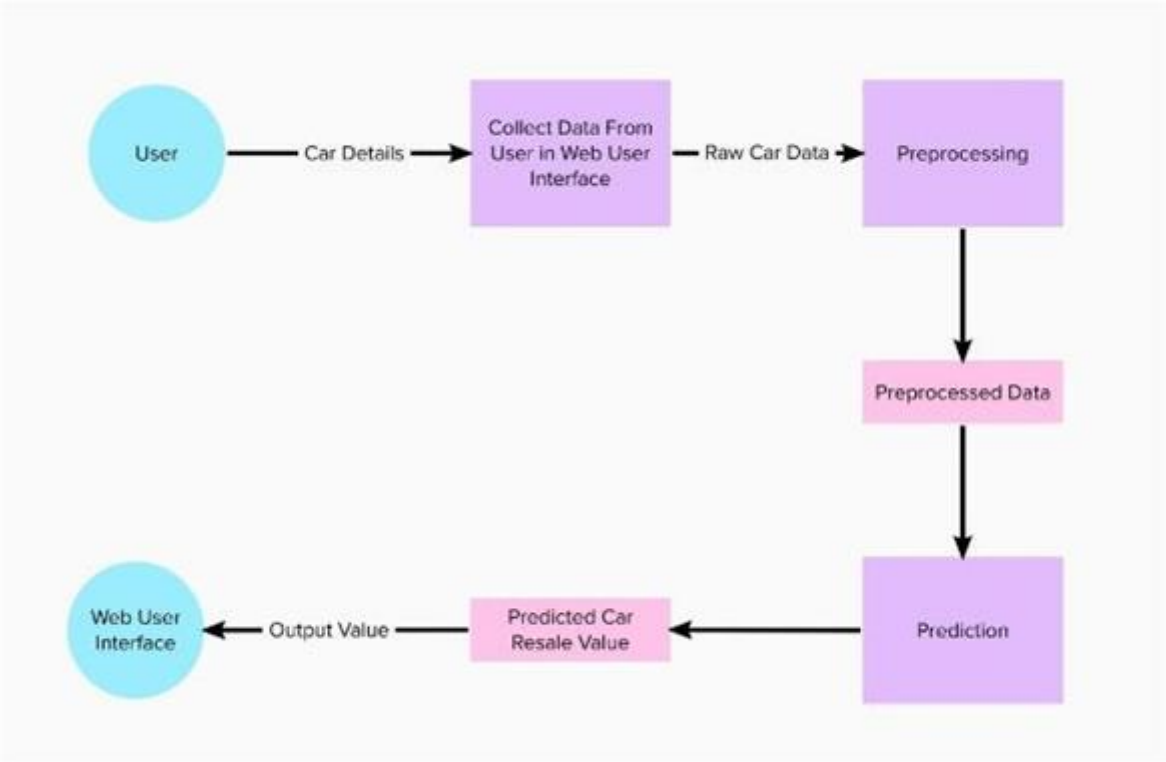
1. Open anaconda prompt.
2. Type “pip install NumPy” and click enter.
3. Type “pip install pandas” and click enter.
4. Type “pip install matplotlib” and click enter
5. Type “pip install scikit-learn” and click enter.
6. Type “pip install Flask” and click enter

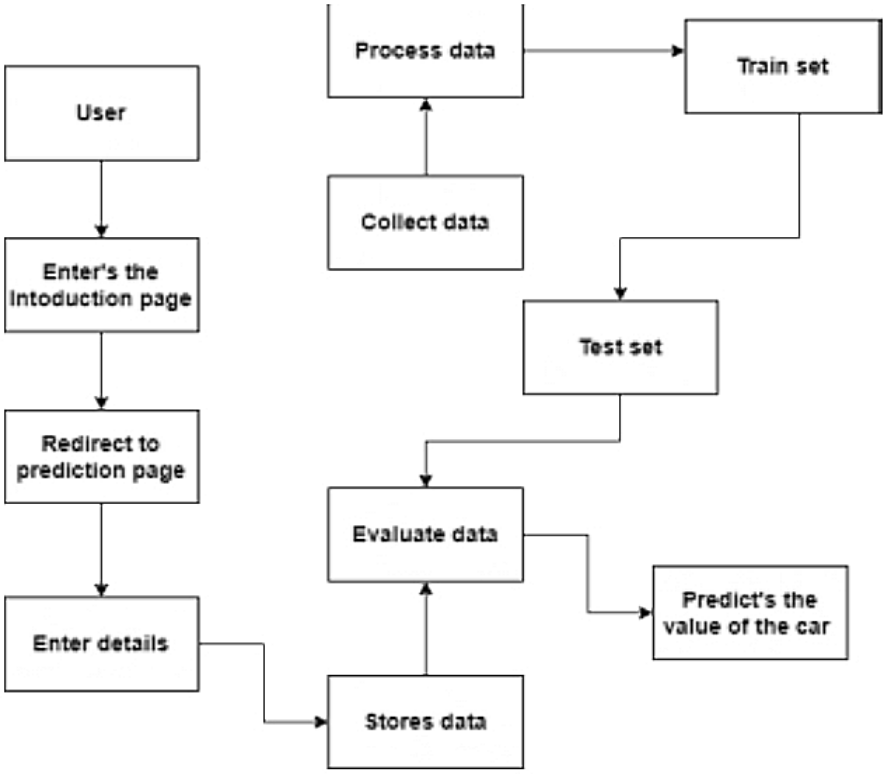
4.2 NON-FUNCTIONAL REQUIREMENTS

FR No.	**Non-Functional Requirement**	**Description**
NF R-1	**Usability**	Predicting the resale value
NF R-2	**Security**	Providing security to the website
NF R-3	**Reliability**	Providing high reliability by predicting values for different types of cars
NF R-4	**Performance**	Providing high performance by using some machine learning techniques
NF R-5	**Availability**	It is used for all types of cars
NF R-6	**Scalability**	Predicting values for different types of cars

5.PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

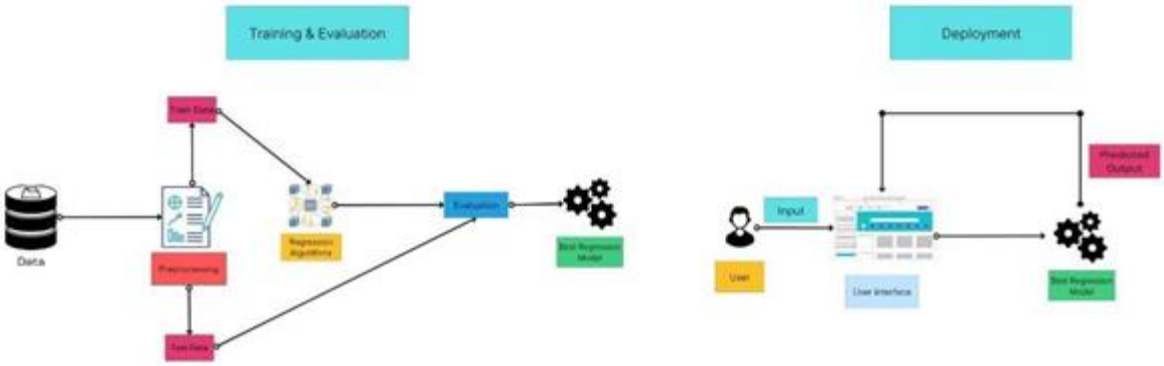




User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (web user)	Enters the browser	USN-1	As a user, I can access to website using a web browser	I can enter by selecting the appropriate web link	High	Sprint-1
		USN-2	As a user, I can proceed to the prediction page by selecting the check value button in the home page	I can enter into it without any acceptance	High	Sprint-1
Customer (mobile user)	Enters into a mobile browser	USN-3	As a user, I can use any of the appropriate mobile browser to enter into the website	I can enter by using an appropriate web link	Medium	Sprint-1
Customer Care Executive						
Administrator						

5.2 SOLUTION AND TECHNICALARCHITECTURE



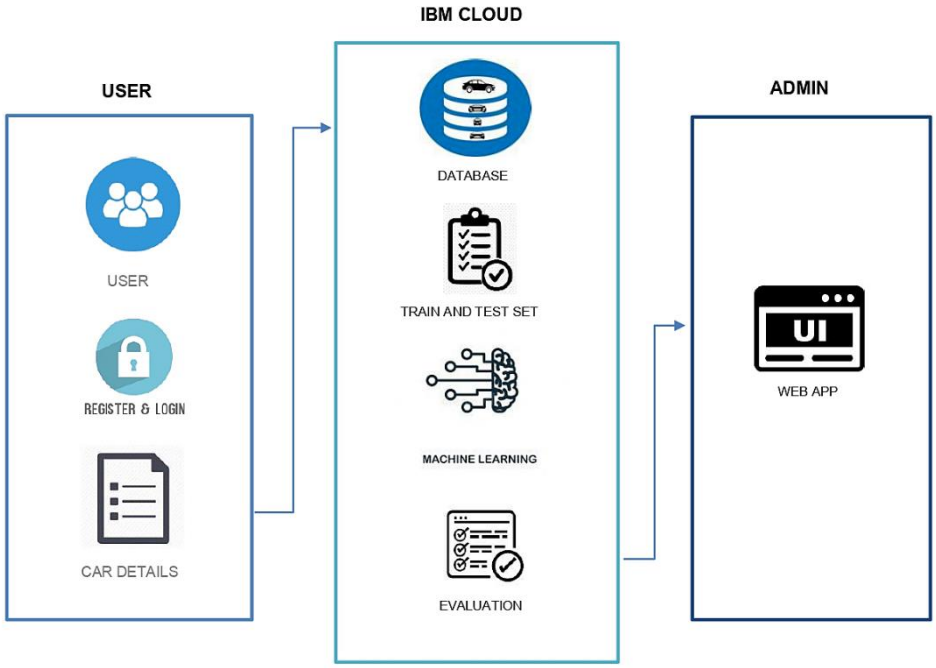


Table-1: Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	A website where the user interacts	HTML, Python ,Flask
2.	Data Pre-process	Pre-processing of the dataset	Pandas, Numpy
3.	Prediction	Resale value Prediction	Python models
4.	Cloud Database	Database Service on Cloud	IBM Cloud
5.	Machine Learning Model	ML model for predicting prices	Regression Model

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	open-source frameworks used for development	Python, Flask, Python Libraries
2.	Security Implementations	User Authentication	SHA-256 Encryption
3.	Scalable Architecture	The 3-tier architecture (Web, Application, Database) is scalable.	IBM Cloud
4.	Availability	Application made available even under heavy load	IBM Cloud - cloud hosting
5.	Performance	Able to handle multiple requests	IBM Cloud - load balancers

5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Data Entry	USN-1	As a user, I can enter the car details in the application.	I can enter the car details	Medium	Sprint-1
Customer (Mobile user)	Obtain output	USN-2	As a user, I will receive car resale value in the application.	I can receive my car resale value	High	Sprint-1
Customer (Mobile user)	Data Entry	USN-1	As a user, I can enter the car details in the application.	I can enter the car details	Medium	Sprint-1
Customer (Mobile user)	Obtain output	USN-2	As a user, I will receive car resale value in the application.	I can receive my car resale value	High	Sprint-1

6. PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Dataset reading and Pre processing	USN-1	Cleaning the dataset and splitting to dependent and independent variables	2	High	Shravan Shankar R
Sprint-2	Building the model	USN-2	Choosing the appropriate model for building and saving the model as pickle file	1	High	Nafisha Nifasath S
Sprint-3	Application building	USN-3	Using flask deploying the ML model	2	Medium	Lalitha Kumar M M
Sprint-4	Train the model in IBM	USN-4	Finally train the model on IBM cloud and deploy the application	2	Medium	Hrithik Kumar S

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	15	5 Days	24 Oct 2022	29 Oct 2022	15	29 Oct 2022
Sprint-2	15	5 Days	31 Oct 2022	05 Nov 2022	15	05 Nov 2022
Sprint-3	15	5 Days	07 Nov 2022	12 Nov 2022	15	12 Nov 2022
Sprint-4	15	5 Days	14 Nov 2022	19 Nov 2022	15	19 Nov 2022

7. CODING AND SOLUTIONING

7.1 FEATURE 1

index.html

```
<!DOCTYPE h


tml>


 <html lang="en">
 <head xmlns="http://www.w3.org/1999/xhtml">
    <meta charset="UTF-8">
    <title>Car PricePredictor</title>
    <link rel="stylesheet" href="static/css/style.css">
    <link rel="stylesheet" type="text/css" href="https://cdnjs.cloudflare.com/ajax/libs/fon
        t-awesome/5.11.2/css/all.css">
    <script src="https://ajax.googleapis.com/ajax/libs/jquery/3.4.1/jquery.min.js"></script
>
    <script
          src="https://cdn.jsdelivr.net/npm/popper.js@1.16.0/dist/umd/popper.min.js"integ
          rity="sha384-
Q6E9RHvbIyZFJoft+2mJbHaEWldlvI9IOYy5n3zV9zzTtmI3UksdQRVvoxMfooAo"
          crossorigin="anonymous"></script>


    <!-- BootstrapCSS -->
    <link                                                    rel="stylesheet"
href="https://stackpath.bootstrapcdn.com/bootstrap/4.5.0/css/bootstrap.min.css"
          integrity="sha384-
9aIt2nRpC12Uk9gS9baDl411NQApFmC26EwAOH8WgZl5MYYxFfc+NcPb1dKGj7S
k" crossorigin="anonymous">
    <script src="https://cdn.jsdelivr.net/npm/@tensorflow/tfjs@2.0.0/dist/tf.min.js"></scr
ipt>


 </head>
 <body class="bg-dark">


 <div class="container">
```

```
    <div class="row">
        <div class="card mt-50" style="width: 100%; height: 100%">
            <div class="card-header" style="text-align: center">
                <h1>Welcome to Car Price Predictor</h1>
            </div>
            <div class="card-body">
                <div class="col-12" style="text-align: center">
                    <h5>This app predicts the price of a car you want to sell. Try filling thedetails
below: </h5>
                </div>
                <br>
                <form method="post" accept-charset="utf-8" name="Modelform">
                    <div class="col-md-10 form-group" style="text-align: center">
                        <label><b>Select the company:</b> </label><br>
                        <select class="selectpicker form-
control" id="company"name="company" required="1"
                            onchange="load_car_models(this.id,'car_models')">
                            {% for company in companies %}
                            <option value="{{ company }}">{{ company}}</option>
                            {% endfor %}
                        </select>
                    </div>
                    <div class="col-md-10 form-group" style="text-align: center">
                        <label><b>Select the model:</b> </label><br>
                        <select class="selectpicker form-
control" id="car_models"name="car_models" required="1">
                        </select>
                    </div>
                    <div class="col-md-10 form-group" style="text-align: center">
                        <label><b>Select Year of Purchase:</b> </label><br>
                        <select class="selectpicker form-control" id="year" name="year"

required="1">

{% for year in years %}
<option value="{{ year }}">{{ year }}</option>
```

```
                    {% endfor %}
                </select>
            </div>
            <div class="col-md-10 form-group" style="text-align: center">
                <label><b>Select the Fuel Type:</b> </label><br>
                <select class="selectpicker form-control" id="fuel_type"name="fuel_type" required="1">
                    {% for fuel in fuel_types %}
                    <option value="{{ fuel }}">{{ fuel }}</option>
                    {% endfor %}
                </select>
            </div>
            <div class="col-md-10 form-group" style="text-align: center">
                <label><b>Enter the Number of Kilometres that the car hastravelled:</b> </label><br>
                <input type="text" class="form-control" id="kilo_driven"name="kilo_driven" placeholder="Enter the kilometres driven">
            </div>
            <div class="col-md-10 form-group" style="text-align: center">
                <button class="btn btn-primary form-control"onclick="send_data()">Predict Price</button>
</div>
</form>
            <br>
            <div class="row">
                <div class="col-12" style="text-align: center">
                    <h4><span id="prediction"></span></h4>
                </div>
            </div>
        </div>
    </div>
</div>
```

```
<script>

    function load_car_models(company_id,car_model_id)
    {
        var  company=document.getElementById(company_id); var
        car_model=
        document.getElementById(car_model_id);console.log(comp
        any.value);
        car_model.value=""; car
        _model.innerHTML="";
        {% for company in companies %}
            if( company.value == "{{ company}}")
            {
                {% for model in car_models %}
                    {% if company in model %}


                        var newOption=
                        document.createElement("option");newOption.value
                        ="{{ model }}"; newOption.innerHTML="{{ model
                        }}"; car_model.options.add(newOption);
                    {% endif%}
                {% endfor %}
            }
        {% endfor %}
    }


    function form_handler(event) {
        event.preventDefault(); // Don't submitthe form normally
    }
    function send_data()
    {
        document.querySelector('form').addEventListener("submit",form_handler);


        var fd=new FormData(document.querySelector('form'));




        var xhr= new XMLHttpRequest({mozSystem: true});
```

```
        xhr.open('POST','/predict',true);document.getElementById('prediction').innerHTM
        L="Wait! Predicting Price.....
        ... ";
        xhr.onreadystatechange =
            function(){ if(xhr.readyState == XMLHttpReq
            uest.DONE){
                document.getElementById('prediction').innerHTML="Prediction:
₹"+xhr.responseText;


            }
        };


        xhr.onload= function(){};


        xhr.send(fd);
    }
</script>



<!-- jQueryfirst, then Popper.js, then Bootstrap JS -->
<script src="https://code.jquery.com/jquery-
        3.5.1.slim.min.js"integrity="sha384-
DfXdz2htPH0lsSSs5nCTpuj/zy4C+OGpamoFVy38MVBnE+IbbVYUew+OrCXaRkfj"
        crossorigin="anonymous"></script>
<script
        src="https://cdn.jsdelivr.net/npm/popper.js@1.16.0/dist/umd/popper.min.js"integ
        rity="sha384-
Q6E9RHvbIyZFJoft+2mJbHaEWldlvI9IOYy5n3zV9zzTtmI3UksdQRVvoxMfooAo"
        crossorigin="anonymous"></script>
<scriptsrc="https://stackpath.bootstrapcdn.com/bootstrap/4.5.0/js/bootstrap.min.js"integr
        ity="sha384-
OgVRvuATP1z7JjHLkuOU7Xw704+h835Lr+6QL9UvYjZE3Ipu6Tp75j7Bh/kR0JKI"
        crossorigin="anonymous"></script>
</body>

</html>
```

style.css

```
.{
    margin: 0;
    padding: 0;
    box-sizing: border-box;
}
.bg-dark{
        background-color: #75767B;
}



.mt-50{
        margin-top: 50px;
}
#canvas{
    border: 2px solid black;
```

FEATURE 2

application.py

```
from flask import
Flask,render_template,request,redirectfrom flask_cors
import CORS,cross_origin
import pickle
import pandas as
pdimport numpy a
s np


app=Flask(_name_)cors=CORS
(app)
model=pickle.load(open('LinearRegressionModel.pkl','rb'))

car=pd.read_csv('Cleaned_Car_data.csv')


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

```
    companies=sorted(car['company'].unique()) car_models=sorted(car['name'].uniqu
    e()) year=sorted(car['year'].unique(),reverse=True)fuel_type=car['fuel_type'].uniq
    ue()


    companies.insert(0,'Select Company')

    return                    render_template('index.html',companies=companies,car_model
s=car_models, years=year,fuel_types=fuel_type)



@app.route('/predict',methods=['POST'])@cross_origin(
)
def
    predict(): company=request.form.get('company')
    car_model=request.form.get('car_models')year=re
    quest.form.get('year') fuel_type=request.form.get(
    'fuel_type') driven=request.form.get('kilo_driven')
    prediction=model.predict(pd.DataFrame(columns=['name',
                                'company',
          'year','kms_driven', 'fuel_type'],
                        data=np.array([car_model,company,year,driven,fuel_type]).resha

pe(1, 5)))

    print(prediction)

    return
str(np.round(prediction[0],2))if__na
me__=='__main__':
    app.run()
```

8.TESTING

8.1 TEST CASES

A test case has components that describe input, action and an expected response, in order to determine if a feature of an application is working correctly. A test case is a set of instructionson "HOW" to validate a particular test objective/target, which when followed will tell us if theexpected behavior of the system is satisfied or not.

Characteristics of a good test case:

- Accurate: Exacts the purpose.
- Economical: No unnecessary steps or words.
- Traceable: Capable of being traced to requirements.
- Repeatable: Can be used to perform the test over and over.
- Reusable: Can be reused if necessary

S.NO	FUNCTION	DESCRIPTION	EXPECTED OUTPUT	ACTUAL OUTPUT	STATUS
1	Framework construction	Generate the GUI for admin and user	Individual page for admin and user	Individual page for admin and user	Success

2	Read the comments	Comments analysis	Comments in text format	Comments in text format	Success
3	Classification	Classify the datasets	Negative comments	Negative comments	Success
4	Rules implementation	Block the comments and friends	Block the users	Block the users	Success

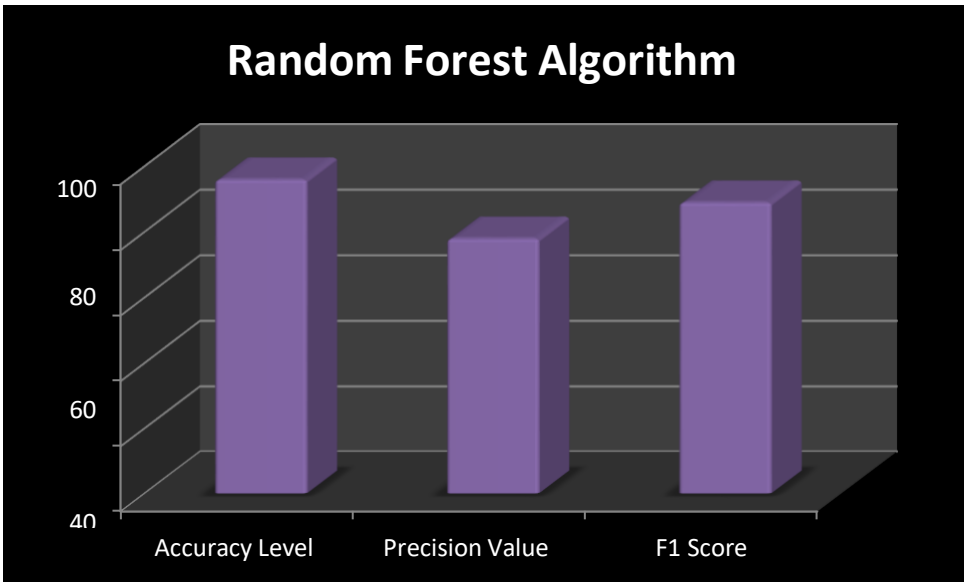
8.2 USER ACCEPTANCE TESTING

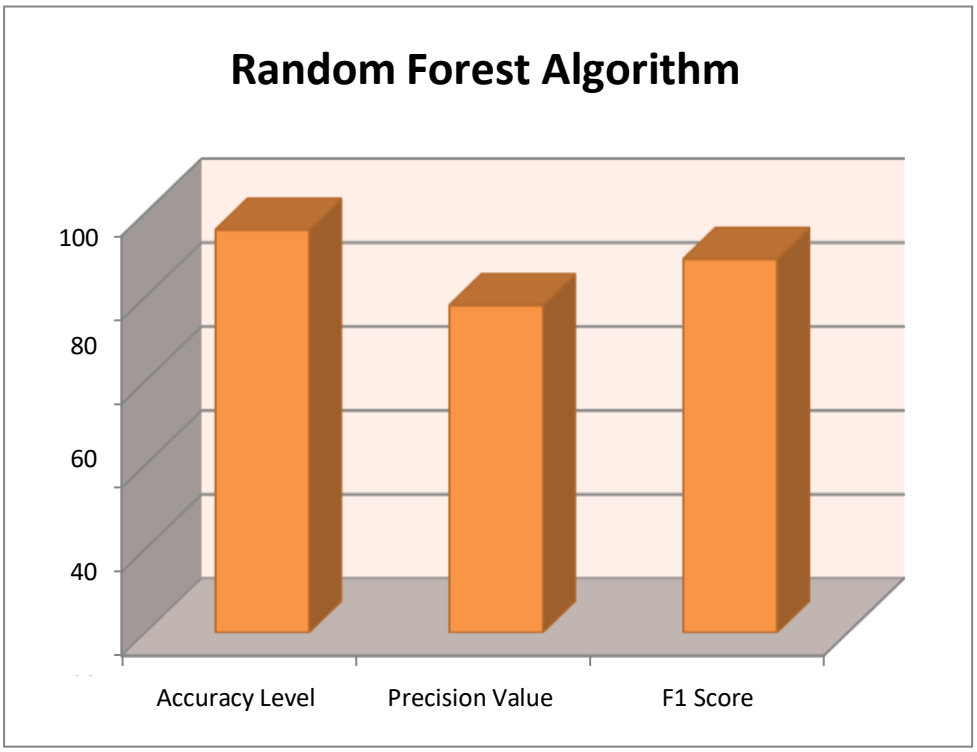
Acceptance testing can be defined in many ways, but a simple definition is the succeeds when the software functions in a manner that can be reasonable expected by the customer. After the acceptance test has been conducted, one of the two possible conditions exists. This is to fine whether the inputs are accepted by the database or other validations. For example accept only numbers in the numeric field, date format data in the date field. Also the null check for the not null fields. If any error occurs then show the error messages. The function of performance characteristics to specification and is accepted. A deviation from specification is uncovered and a deficiency list is created. User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

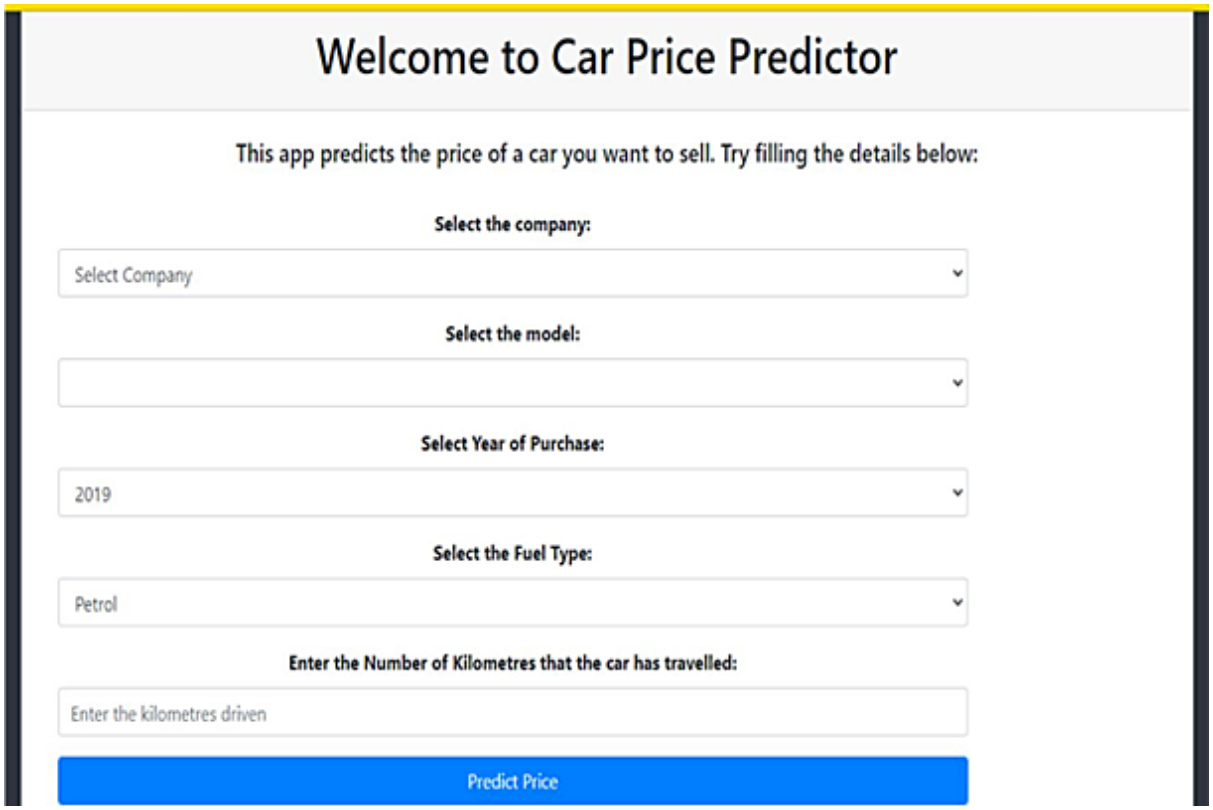
9.RESULTS

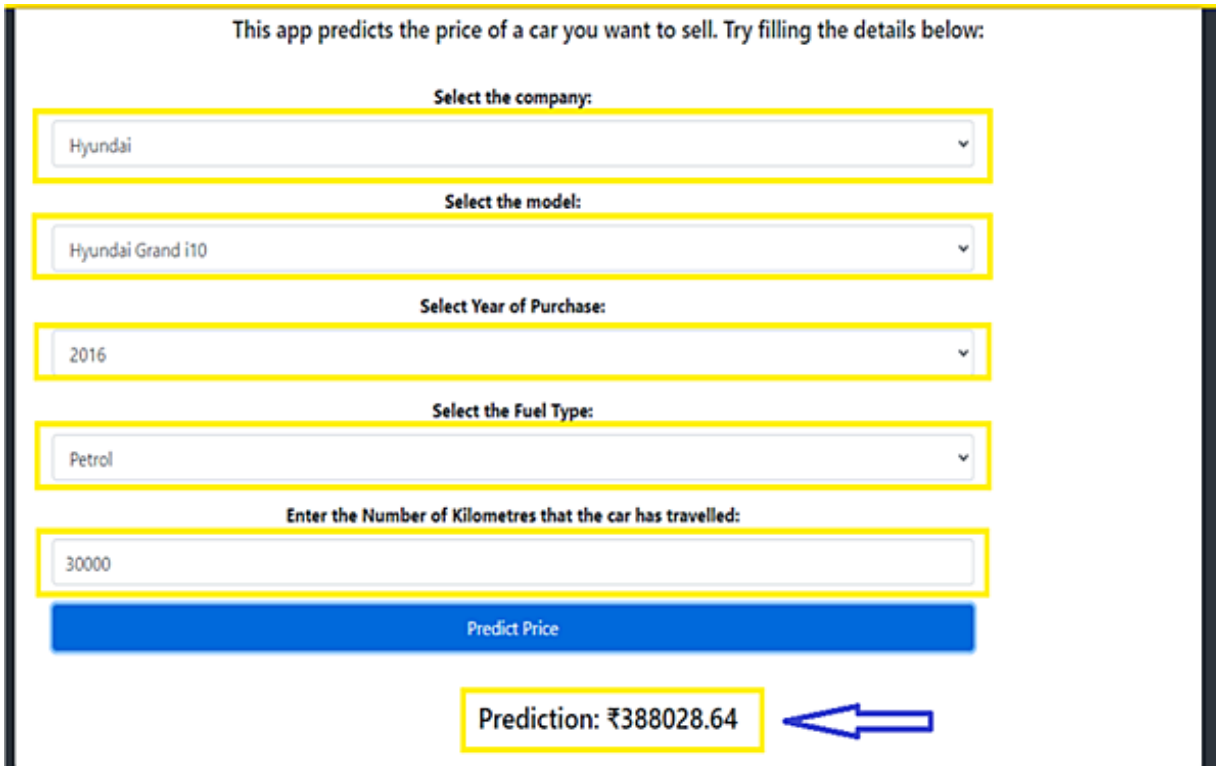
9.1 PERFORMANCE METRICS

EXISTING SYSTEM




Random Forest Algorithm
100
80
60
40
Accuracy Level
Precision Value
F1 Score


Welcome to Car Price Predictor
This app predicts the price of a car you want to sell. Try filling the details below:
Select the company:
Select Company
Select the model:
Select Year of Purchase:
2019
Select the Fuel Type:
Petrol
Enter the Number of Kilometres that the car has travelled:
Enter the kilometres driven
Predict Price



10. ADVANTAGES AND DISADVANTAGES

10.1 ADVANTAGES

1.Cost is less

Used cars are exponentially more affordable than buying a new vehicle.

2.Lower Insurance Rates

Another less known fact is that car insurance costs less per month for a used car, than a new car, So the savings of buying a used car is evident on a monthly basis in the form of the monthly premium in addition to the sticker price.

3.Many Used Cars Include a Warranty

One of the most commonquestions about buying a used car is about warranty. Many used cars are still under factory warranty. Most people who lease a car, turn it back in after three years, and still have 2 years left on its 5-year warranty. Certified Pre-Owned Vehicles and most used cars have gone throughа rigorous inspection and willcome with an extended warranty by the time you see them on the lot.

4.Selection

While you can't pick and choose color, options and trim on a used car,likeyouwouldon a new vehicle.You are able to shop the different years of a model you prefer, andyou have the opportunity to get a model or style that is no longer in production.

10.2 DISADVANTAGES

1.cost is less

When you buy a new car, it's made to order. You have the option of picking the colour, the features, whether or not you want a sunroof, and more. When you buy a used car, you get what you pay for. If the car has a crappy radio, you'll have to deal with it or pay to have it replaced.

2.Little to No Warranty

When you buy used cars, they are usually sold "as-is." This means that any issues itmay have been completely your responsibility. If

you buy the car, take it to get gas, and the battery dies, you have to purchase a new battery. Some dealerships will provide warranties, but they are usually very limited.

3.Worse Fuel Efficiency

One of the biggest selling points when choosing a car is how many miles per gallon itcan get for both freeway and city driving. Every year, the number increases with newmodels and now some cars get an impressive 30 or 40 miles per gallon (mpg). Whenyou purchase a used car, you're not guaranteed to get a vehicle that gets over 20 or 25 mpg—although this will depend on the make and model.

11.CONCLUSION

The increased pricesof new cars and the financial incapability of the cust omersto buythem, Used Car sales are on a global increase. Therefore, there is an urgentneed fora Used Car Price Prediction system which effectively deter mines the worthiness of thecar using a variety of features. The proposed system will help to determine the accurate price of used car price prediction. Car price prediction can be a challenging task due to the high number of attributes that should be considered for the accurate prediction. The major step in the prediction process is collection and pre-processing of the data. In this research, PHP scripts were built to normalize, standardize and clean data to avoid unnecessary noise for machine learning algorithms. Data cleaning is one

of the processes that increases prediction performance, yet insufficient for the cases of complex data sets as the one in this research. Applying single machine algorithm on the data set accuracy was less than 50%. Therefore, the ensemble of multiple machine learning algorithms has been proposed and this combination of ML methods gains accuracy of 92.38%. This is significant improvement compared to single machine learning method approach. However, the drawback of the proposed system is that it consumes much more computational resources than single machine learning algorithm. Although, this system has achieved astonishing performance in car price prediction problem our aim for the future research is to test this system to work successfully with various data sets. We will extend our test data with ebay and OLX used cars data sets and validate the proposed approach.

12.FUTURE WORKS

In future this machine learningmodel may bind with variouswebsite which can providereal 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 user interfacefor interacting with user. For better p erformance, we planto judiciously design deep learningnetwork stru ctures, use adaptive learning rates and train on clusters of data rather than the whole dataset.

13.APPENDIX

Git up Account Link:

https://github.com/IBM-EPBL/IBM-Project-10486-1659182129.git

Website Link:

https://car-price-price.herokuapp.com/

You Tube Link:

https://youtu.be/0XQOkDj1c4k