CAR RESALE VALUE PREDICTION

NALAIYA THIRAN PROJECT BASED LEARNING

On

PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY ANDENTREPRENEURSHIP

Submitted By

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ABSTRACT

The Car Resale value prediction which implements, that the price of a new car in the industry is fixed by the manufacturer with some additional costs 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 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.

Existing System includes a process where a seller decides a price randomly and buyer has no idea about the car and it's value in the present day scenario. In fact, seller also has no idea about the car's existing value or the price he should be selling the car at.

To overcome this problem we have developed a model which will be highly effective. Regression Algorithms are used because they provide us with continuous value as an output and not a categorized value. 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.

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1. 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 project is developing machine learning models that can accurately predict the price of a used car based on its features, in order to make informed purchases. We implement and evaluate various learning methods on a dataset consisting of the sale prices of different makes and models . We will compare the performance of various machine learning algorithms like Linear Regression, Ridge Regression, Lasso Regression, Elastic Net, Decision Tree Regressor and choose the best out of it. Depending on various parameters we will determine the price of the car. Regression Algorithms are used because they provide us with continuous value as an output and not a categorized value 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.

1.1 PROJECT OVERVIEW

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

In order to predict the resale value of the car, we proposed an intelligent, flexible, and effective system that is based on using regression algorithms. Considering the main factors which would affect the resale value of a vehicle a regression model is to be built that would give the nearest resale value of the vehicle. We will be using various regression algorithms and algorithm with the best accuracy will be taken as a solution, then it will be integrated to the web-based application where the user is notified with the status of his product.

1.2 PURPOSE

Due to the huge requirement of used cars and lack of experts who can determine the correct valuation, there is an utmost need of bridging this gap between sellers and buyers. This project focuses on building a system that can accurately predict a resale value of the car based on minimal features like kms driven, year of purchase etc.

2. LITERATURE SURVEY

CAR RESALE VALUE PREDICTION SURVEYS

1. Car Price Prediction using Machine Learning Techniques Authors: Enis gegic.

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 in Bosnia and Herzegovina, we applied three machine learning techniques (Artificial Neural Network, Support Vector Machine and Random Forest). However, the mentioned techniques were applied to work as an ensemble. The data used for the prediction was collected from the web portal autopijaca.ba using web scraper that was written in PHP programming language. Respective performances of different algorithms were then compared to find one that best suits the available data set. The final prediction model 2 was integrated into Java application. Furthermore, the model was evaluated using test data and the accuracy of 87.38% was obtained.

2. Price Evaluation Model In Second Hand Car System Based On BP Neural Network Theory Authors: Ning sun.

With the rapid growth of the number of private cars and the development of the second-hand car market, second-hand cars have become the main choice when people buy cars. The online second-hand car platform provides both buyers and sellers the chance of online P2P trade. In such systems, the accuracy of second-hand car price evaluation largely determines whether the seller and the buyer can get more efficient trading experience.

3. Prediction of Car Price using Linear Regression Authors: A. Rengarajan .

In this paper, we look at how supervised machine learning techniques can be used to forecast car prices in India. Data from the online marketplace quikr was used to make the predictions. The predictions were made using a variety of methods, including multiple linear regression analysis, Random forest regressor and Randomized search CV. The predictions are then analyzed and compared to determine which ones provide the best results.

4. Vehicle Price Prediction System using Machine Learning Techniques Authors: Kanwal Noor.

In this paper, they proposed a model to predict the price of the cars through multiple linear regression method. Here system were able to achieve high level of accuracy using Multiple linear regression models to predict the price of cars collected from used cars website in Pakistan called Pak Wheels that totalled to 1699 records after pre-processing, and where 3 able to achieve accuracy of 98%, this was done after reducing the total amount of attributes using variable selection technique to include significant attributes only and to reduce the complexity of the model.

5. Predicting the Price of Second-hand Cars using Artificial Neural Networks Authors: Saamiyah Peerun.

The aim of this study is to assess whether it is possible to predict the price of second hand cars using artificial neural networks. Thus, data for 200 cars from different sources was gathered and fed to four different machine learning algorithms. We found that support vector machine regression produced slightly better results than using a neural network or linear regression. However, some of the predicted values are quite far away from the actual prices, especially for higher priced cars.

6. Used Car Price Prediction using K-Nearest Neighbor Based Model Authors: K.Samruddhi.

In this paper, a machine learning model is proposed to estimate the cost of the used cars using the K-Nearest Neighbor algorithm. The model is trained with used cars 7 data for different trained and test ratios. Then the proposed model is cross-validated using K fold method to examine the performance to avoid the over fit.

7. Prediction of Prices for Used Car by Using Regression Models Authors: Nitis Monburinon.

In this paper, the authors selected the data from the German ecommerce site. The main goal of this work is to find a suitable predictive model to predict the used cars price. They used different machine learning techniques for comparison and used the mean absolute error(MAE) as the metric. They proposed that their model with gradient boosted regression has a lower error with MAE value 0.28 and this gives the higher performance where linear regression has the MAE value 0.55, random forest with MAE value 0.35.

8. Used car price prediction using SVM Authors: Gegic..

In this paper, using data scrapped from a local Bosnian website for used cars totalled at 797 car samples after pre-processing, and proposed using these methods: Support Vector Machine, Random Forest and Artificial Neural network. Results have shown using only one machine learning algorithm achieved results less than 50%, whereas after combing the algorithms with pre calcification of prices using Random Forest, results with accuracies up to 87.38% was recorded

2.1 EXISTING PROBLEM

Unknown history,You may not know the accident and/or mechanical history of a used vehicle. Higher financing rates: Used cars tend to come with higher financing rates than their new counterparts, leading to increased costs down the line.

2.2 REFERENCES

[1] Sameerchand Pudaruth, "Predicting the Price of Used Cars using Machine Learning Techniques";(IJICT 2014)

[2] Enis gegic, Becir Isakovic, Dino Keco, Zerina Masetic, Jasmin Kevric, "Car Price Prediction Using Machine Learning"; (TEM Journal 2019)

2.3 PROBLEM STATEMENT DEFINITION

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
Customer need to resale a car	Customer	Buy resale car	Could not trust any seller	The condition of the battery seems, so poor in seller car	Sad
To get complete details of the car	Car enthusiastic	Get more number of cars in different brands	Can't get a trustworthy retailer	No warranty of buying pre-owned cars	Reluctant to buy
To complete review of the car	Car buyer	Search car based on expected amount to be affordable	Can't able to filter the car based on the particular amount	There is no such options to search based on amount	To search another platform that are better that it
To check the refinement of the car	Speed freak	To get high mileage of cars	An used car is not reliable	Because of low maintenance	Inconvenient

3. IDEATION & PROPOSED SOLUTION

Empathy Map Canvas: An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to helps teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

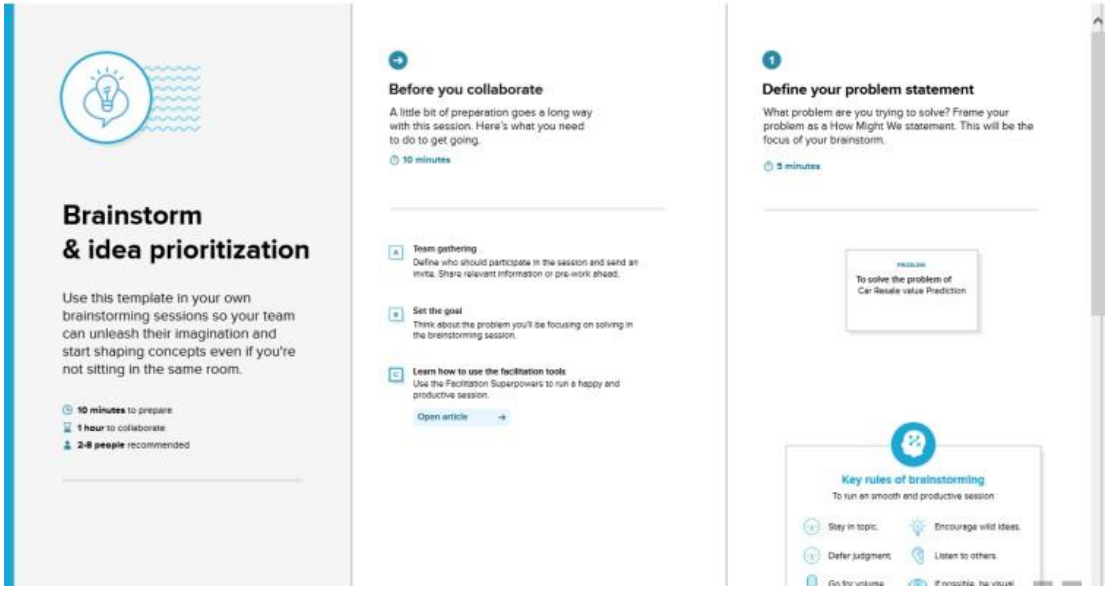
3.1 EMPATHY MAP CANVAS

3.2 IDEATION & BRAINSTORMING

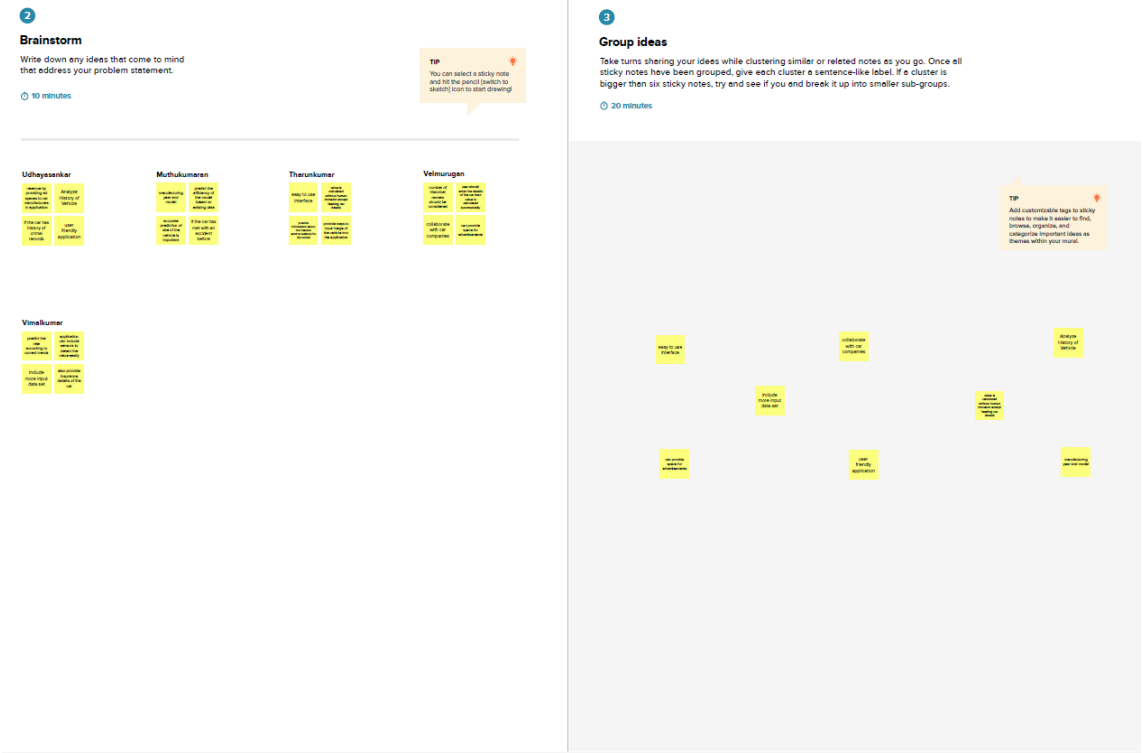
Brainstorm &Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions. 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.

Reference: https://www.mural.co/templates/empathy-map-canvas

Step-1: Team Gathering, Collaboration and Select the Problem Statement



Step-2: Brainstorm and group ideas



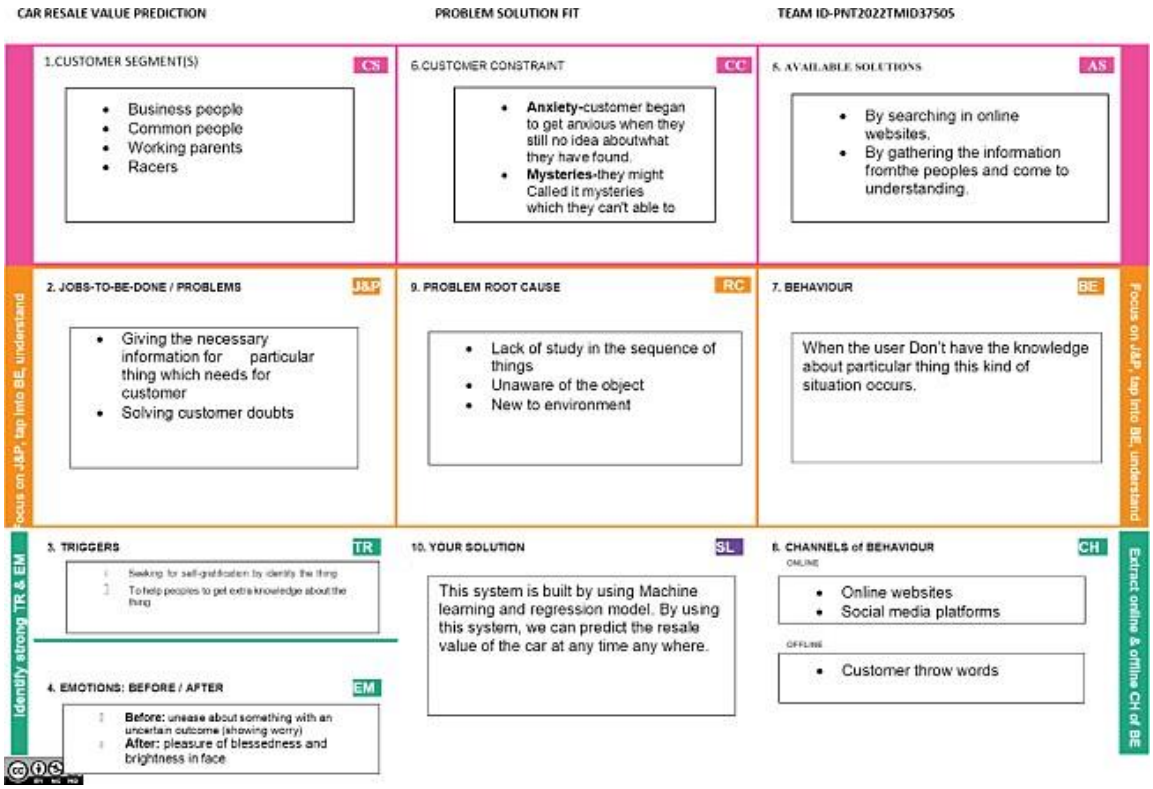
3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The main objective of the project is to predict the price of second hand 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, Hyundai Year of manufacturing like 2001...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 bayes and decision trees have been used to make the predictions. The predictions are then evaluated and compared in order to find those which provide the best performances.
2.	Idea / Solution description	New cars of a particular make, model, and year all have the same retail price, excluding optional features. This price is set by the manufacturer. Used car, however, are subject to supply-and-demand pricing. Further, used cars have additional attributes that factor into the price. These include the condition, mileage, and repair history, which sets cars that may have shared a retail price apart.
3.	Novelty / Uniqueness	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 deepen the knowledge of machine learning applied to car valuations and other similar price prediction problems.

4.	Social Impact / Customer Satisfaction	This work will focus on answering the research questions. They all entail a comparison of different 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 compared fairly. The algorithms selected must therefore be similar enough for the same dataset to be used for 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.
5.	Business Model (Revenue Model)	A revenue model is a blueprint that shows how a start up business will earn revenue or gross income from its standard business operations, and how it will pay for operating costs and expenses.
6.	Scalability of the Solution	Which of the models and parameters gives the best overall accuracy in making price predictions for used cars. The optimal parameters were determined in the process of implementing the models, and thus each model was implemented with the parameters that yielded the best performance by trial and error. All of the models approximated geometric appreciation, meaning that a constant 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 Stockman in his analysis of international depreciation rates

3.4 PROBLEM SOLUTION FIT

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns and recognize what would work and why.



4. REQUIREMENT ANALYSIS

Requirements analysis, also called requirements engineering, is the process of determining user expectations for a new or modified product. These features, called requirements, must be quantifiable, relevant and detailed. In software engineering, such requirements are often called functional specifications. Requirements analysis is critical to the success or failure of a systems or software project. The requirements should be documented, actionable, measurable, testable, traceable, related to identified business needs or opportunities, and defined to a level of detail sufficient for system design.

4.1 FUNCTIONAL REQUIREMNTS

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Car Details	Mandatory field for analyzing the price
FR-2	Result	The Price will be shown based on the given details

4.2 NON-FUNCTIONAL REQUIREMENTS

Non-functional Requirements:

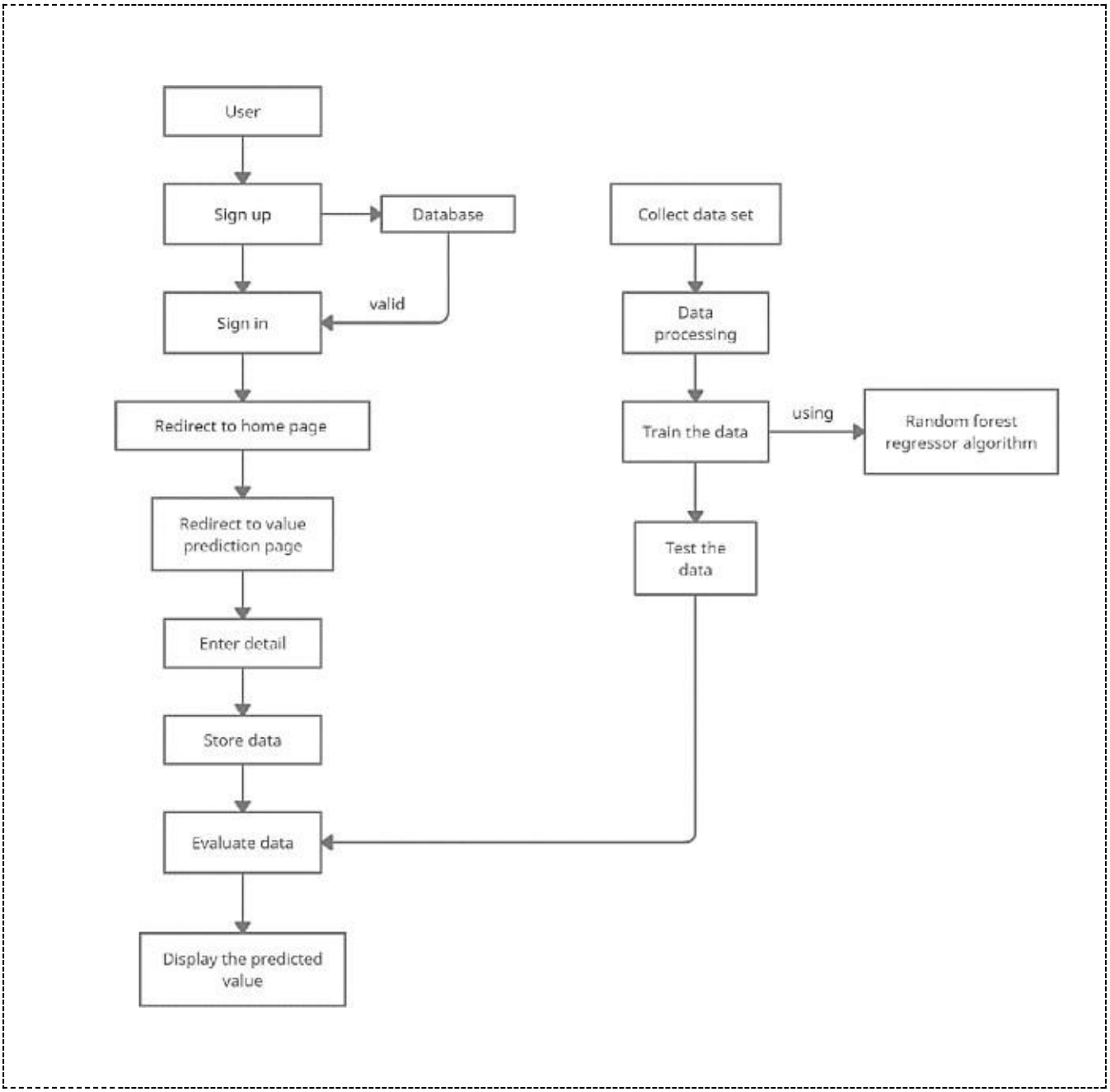
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	To create an UI makes as a user friendly, it makes a simple way to Understand
NFR-2	**Security**	Aware about fraudulent sites, it gives a fake information about the vehicle.
NFR-3	**Reliability**	Application must perform good and without failure
NFR-4	**Performance**	Website performance measures how quickly the pages of a website load and display in the web browser.
NFR-5	**Availability**	Website availability (also called website uptime) refers to the ability of the users to access and use a website or web service. A website's availability is typically communicated as a percentage for a given span of time.
NFR-6	**Scalability**	Application scalability is the ability of an application to handle a growing number of users and load, without compromising on performance and causing disruptions to user experience. To put it another way, scalability reflects the ability of the software to grow or change with the user's demands..

5. PROJECT DESIGN

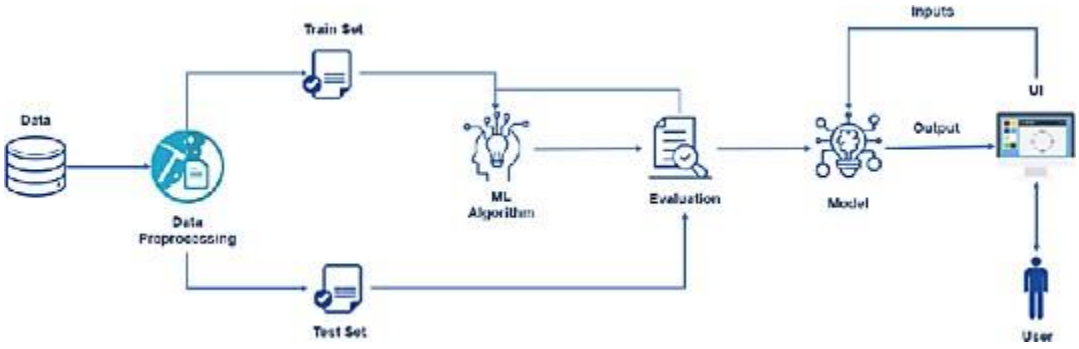
5.1 DATA FLOW DIAGRAMS

Data Flow Diagrams: A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2 SOLUTION & TECHNICAL ARCHITECTURE

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to: Find the best tech solution to solve existing business problems. Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders. Define features, development phases, and solution requirements. Provide specifications according to which the solution is defined, managed, and delivered.



5.3 USER STORIES

A user story is an informal, natural language description of features of a software system. They are written from the perspective of an end user or user of a system, and may be recorded on index cards, post-it notes, or digitally in project management software. Depending on the project, user stories may be written by different stakeholders like client, user, manager, or development team.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Desktop user)	Home Page	USN-1	As a user, I can view the home page of the web application.	I can view the homepage	Low	Sprint-1
Customer (Desktop user)	Data Entry	USN-2	As a user, I can enter my car details in the application.	I can enter the car details	Medium	Sprint-2
Customer (Desktop user)	View car Resale value	USN-3	As a user, I can view the resale value of my car.	I can view my car's resale value	Medium	Sprint-3
Customer (Desktop user)	Resale Value Prediction	USN-4	As a user, I expect the application to predict the resale value of my car.	I expect the application to predict my car resale price	High	Sprint-4

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	Pre-process the data	USN-1	Collect dataset	1	Low	Udhaya sankar R, Velmurugan S, Tharun kumar K K, Muthukumaran S, Vimalkumar S
		USN-2	Import requires and implement to use libraries	1	Low	Velmurugan S, Tharun kumar K K
		USN-3	Read and clean dataset	2	Low	Udhaya sankar R, Vimalkumar S, Muthukumaran S
		USN-4	Split data into two 1.independent 2.dependent variables	3	Medium	Tharun kumar K K, Vimalkumar S
Sprint-2	Model building	USN-1	Check the metrics of the model & Apply using regression model	3	Medium	Udhaya sankar R, Velmurugan S, Tharun kumar K K, Muthukumaran S, Vimalkumar S
Sprint-3	Application Building	USN-1	Build an HTML web page by using python flask	5	High	Udhaya sankar R, Tharun kumar K K, Muthukumaran S, Vimalkumar S
		USN-2	Execute and Evaluate the Test	5	High	Velmurugan S, Tharun kumar K K, Muthukumaran S, Vimalkumar S

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	To Train the model	USN-1	Train and use the machine learning model	5	High	Udhaya sankar,R, Velmurugan S
		USN-2	Integrate the flask	5	High	Tharun kumar K K, Muthukumaran S, Vimalkumar S

6.2 SPRINT DELIVERY SCHEDULE

Project Tracker, Velocity & Burndown Chart: (4 Marks)

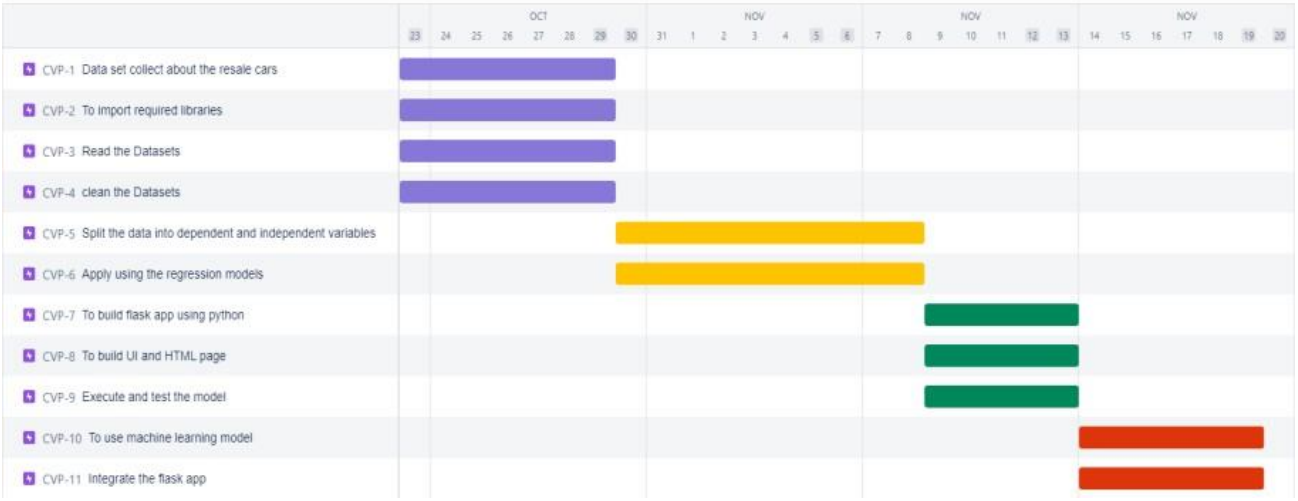
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	15 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	15 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	15 Oct 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	15 Oct 2022

6.3 REPORT FROM JIRA

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.

https://www.atlassian.com/agile/tutorials/burndown-charts



7. CODING & SOLUTION

7.1 FEATURE 1 Flask App

```
      import pandas as pd
import numpy as np
from flask import Flask, render_template, request
import requests

# NOTE: you must manually set API_KEY below using information retrieved from
your IBM Cloud account.
API_KEY = "SvFZ1utanucs0TZzlpy_2eM6I8WWpT7BXpM2tOhBiCA2"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token',
                               data={"apikey": API_KEY, "grant_type":
'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]
header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' +
mltoken}

app = Flask(__name__)
car = pd.read_csv('Cleaned_datasets.csv')
```

```
@app.route('/')
def index():
    companies = sorted(car['Brands'].unique())
    car_models = sorted(car['Car_names'].unique())
    year = sorted(car['year'].unique(), reverse=True)
    fuel_type = car['fuel_type'].unique()

    companies.insert(0, 'Select Company')
    return render_template('index.html', companies=companies,
car_models=car_models, years=year, fuel_types=fuel_type)


@app.route('/predict', methods=['POST'])
def predict():
    company = request.form.get('company')

    car_model = request.form.get('car_models')
    year = request.form.get('year')
    fuel_type = request.form.get('fuel_type')
    kms_driven = request.form.get('kilo_driven')

    # NOTE: manually define and pass the array(s) of values to be scored in the
next line

    payload_scoring = {"input_data": [{"fields": ['Car_names', 'Brands', 'year',
'kms_driven', 'fuel_type'],
                                       "values": [[car_model, company, year,
kms_driven, fuel_type]]}]}

    response_scoring = requests.post(
        'https://us-south.ml.cloud.ibm.com/ml/v4/deployments/3d15cfbe-4005-
4b16-a0e4-2b356ba00b60/predictions?version=2022-11-17',
        json=payload_scoring, headers={'Authorization': 'Bearer ' +
mltoken}).json()
    prediction = response_scoring['predictions'][0]['values']

    return str(np.round(prediction[00], 2))


if __name__== '__main__':
    app.run()
```

7.2 FEATURE 2-User Interface

```
            <!DOCTYPE html>
<html lang="en">
<head  xmlns="http://www.w3.org/1999/xhtml">
    <meta  charset="UTF-8">
    <meta  http-equiv="X-UA-Compatible"  content="IE=edge">
    <meta  name="viewport"  content="width=device-width,  initial-scale=1.0">
    <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/bootstrap.min.css"
rel="stylesheet"
            integrity="sha384-
EVSTQN3/azprG1Anm3QDgpJLIm9Nao0Yz1ztcQTwFspd3yD65VohhpuuCOmLASjC"
crossorigin="anonymous">
    <title>Car Resale Values Prediction </title>
    <link  rel="stylesheet"  href="/static/css/style.css">
    <link rel="stylesheet" type="text/css"
          href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/5.11.2/css/all.css">
    <script
src="https://ajax.googleapis.com/ajax/libs/jquery/3.4.1/jquery.min.js"></scrip
t>
    <script
src="https://cdn.jsdelivr.net/npm/popper.js@1.16.0/dist/umd/popper.min.js"
            integrity="sha384-
Q6E9RHvbIyZFJoft+2mJbHaEWldlvI9IOYy5n3zV9zzTtmI3UksdQRVvoxMfooAo"
            crossorigin="anonymous"></script>

    <!-- Bootstrap CSS -->
    <link rel="stylesheet"
href="https://stackpath.bootstrapcdn.com/bootstrap/4.5.0/css/bootstrap.min.css"
          integrity="sha384-
9aIt2nRpC12Uk9gS9baDl411NQApFmC26EwAOH8WgZl5MYYxFfc+NcPb1dKGj7Sk"
crossorigin="anonymous">
    <script
src="https://cdn.jsdelivr.net/npm/@tensorflow/tfjs@2.0.0/dist/tf.min.js"></scrip
t>

</head>
<body >
  <div class="card bg-dark text-black">
    <img src="https://4kwallpapers.com/images/walls/thumbs_2t/1147.jpg"
class="card-img" alt="..."  >
```

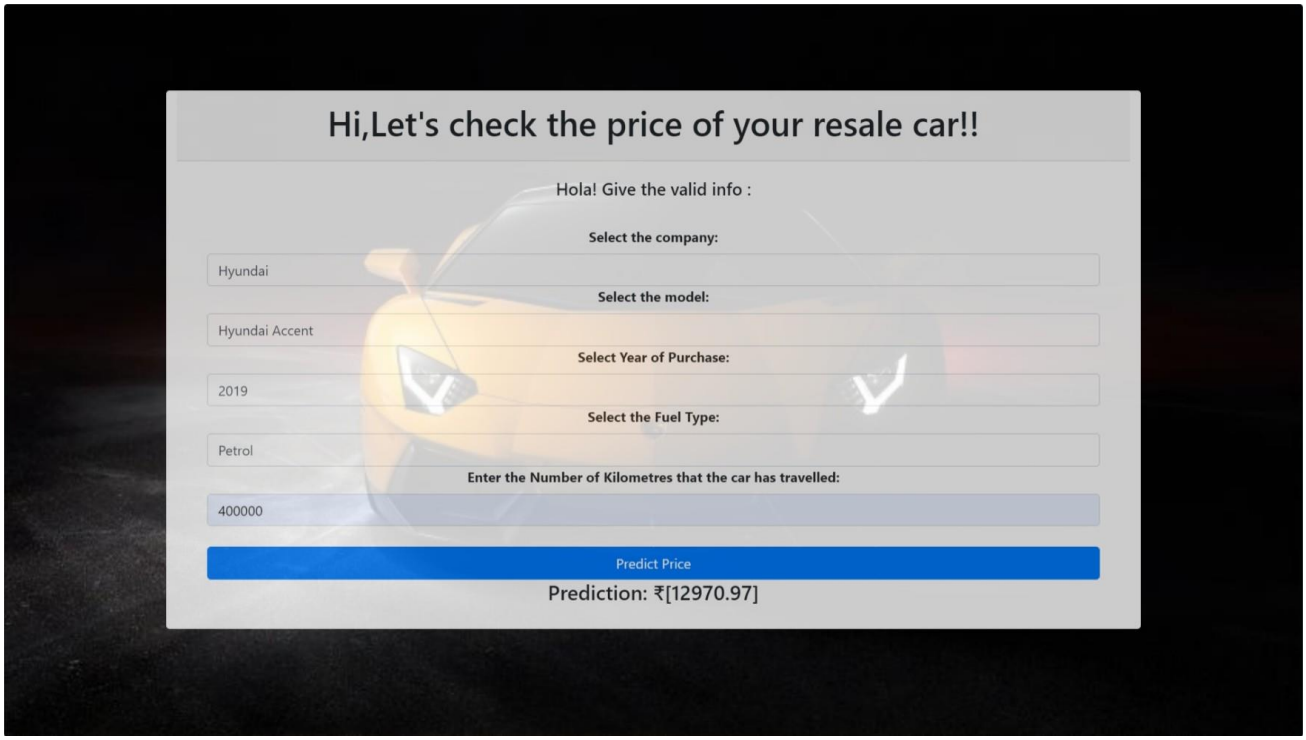
```
        <div  class="card-img-overlay">

            <div  class="container"  style="opacity:80%">
            <div class="row">
            <div class="card mt-50" style="width: 100%; height: 100%">
                <div  class="card-header"  style="text-align:  center">
                    <h1>Hi,Let's check the price of your resale car!!</h1>
                </div>
                <div  class="card-body"  style="justify-content:center;">
                    <div class="col-12" style="text-align: center">
                        <h5>Hola! Give the valid info : </h5>
                    </div>
                    <br>
                    <form  method="post"  accept-charset="utf-8"  name="Modelform"
>
                        <div class="col-12" 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 Brands in companies %}
                                <option value="{{ Brands }}">{{ Brands
}}</option>
                                {% endfor %}
                            </select>
                        </div>
                        <div class="col-12" 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-12" 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-12" 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-12" style="text-align: center">
                                <label><b>Enter the Number of Kilometres that the
car has travelled:</b> </label><br>
                                <input  type="text"  class="form-control"
id="kilo_driven" name="kilo_driven"
                                    placeholder="Enter the kilometres driven ">
                            </div>
                            <div class="col-12" style="text-align: center">
                                <button class="btn btn-primary form-control mt-4"
onclick="send_data()">Predict Price</button>
                            </div>
                        </form>

                        <div class="row">
                            <div class="col-12" style="text-align: center">
                                <h4><span  id="prediction"></span></h4>
                            </div>
                        </div>
                    </div>
                </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(company.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 submit the 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').innerHTML="Wait!  Predicting
Price.....";
        xhr.onreadystatechange = function(){
            if(xhr.readyState  ==  XMLHttpRequest.DONE){
                document.getElementById('prediction').innerHTML="Prediction:
₹"+xhr.responseText;

            }
        };

        xhr.onload=  function(){};

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


    <!-- jQuery first, 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"
        integrity="sha384-
Q6E9RHvbIyZFJoft+2mJbHaEWldlvI9IOYy5n3zV9zzTtmI3UksdQRVvoxMfooAo"
        crossorigin="anonymous"></script>
    <script
src="https://stackpath.bootstrapcdn.com/bootstrap/4.5.0/js/bootstrap.min.js"
        integrity="sha384-
OgVRvuATP1z7JjHLkuOU7Xw704+h835Lr+6QL9UvYjZE3Ipu6Tp75j7Bh/kR0JKI"
        crossorigin="anonymous"></script>
</body>
</html>
```

7.3 DATABASE SCHEMA



8. TESTING

8.1 TEST CASES

		Car_names	Brands	year	Price	kms_driven	fuel_type
1	0	Mahindra Jeep CL550	Mahindra	2006	425000	40	Diesel
2	2	Hyundai Grand i10	Hyundai	2014	325000	28000	Petrol
3	3	Ford EcoSport Titanium	Ford	2014	575000	36000	Diesel
4	5	Ford Figo	Ford	2012	175000	41000	Diesel
5	6	Hyundai Eon	Hyundai	2013	190000	25000	Petrol
6	7	Ford EcoSport Ambiente	Ford	2016	830000	24530	Diesel
7	8	Maruti Suzuki Alto	Maruti	2015	250000	60000	Petrol
8	9	Skoda Fabia Classic	Skoda	2010	182000	60000	Petrol
9	10	Maruti Suzuki Stingray	Maruti	2015	315000	30000	Petrol
10	11	Hyundai Elite i20	Hyundai	2014	415000	32000	Petrol
11	12	Mahindra Scorpio SLE	Mahindra	2015	320000	48660	Diesel
12	13	Hyundai Santro Xing	Hyundai	2007	80000	45000	Petrol
13	14	Mahindra Jeep CL550	Mahindra	2006	425000	40	Diesel
14	15	Audi A8	Audi	2017	1000000	4000	Petrol
15	16	Audi Q7	Audi	2014	500000	16934	Diesel
16	17	Mahindra Scorpio S10	Mahindra	2016	350000	43000	Diesel
17	18	Maruti Suzuki Alto	Maruti	2014	160000	35550	Petrol
18	19	Mahindra Scorpio S10	Mahindra	2016	350000	43000	Diesel
19	20	Mahindra Scorpio S10	Mahindra	2016	310000	39522	Diesel
20	21	Maruti Suzuki Alto	Maruti	2015	75000	39000	Petrol
21	22	Hyundai i20 Sportz	Hyundai	2012	100000	55000	Petrol

8.2 USER ACCEPTANCE TESTING

User Acceptance Testing (UAT) is a type of testing performed by the end user or the client to verify/accept the software system before moving the software application to the production environment. UAT is done in the final phase of testing after functional, integration and system testing are done. The User Acceptance of this product is not surveyed enough to give a solid conclusion. The theoretical and hypothetical acceptance is calculated to be high enough to conclude that this product is usable and valuable.

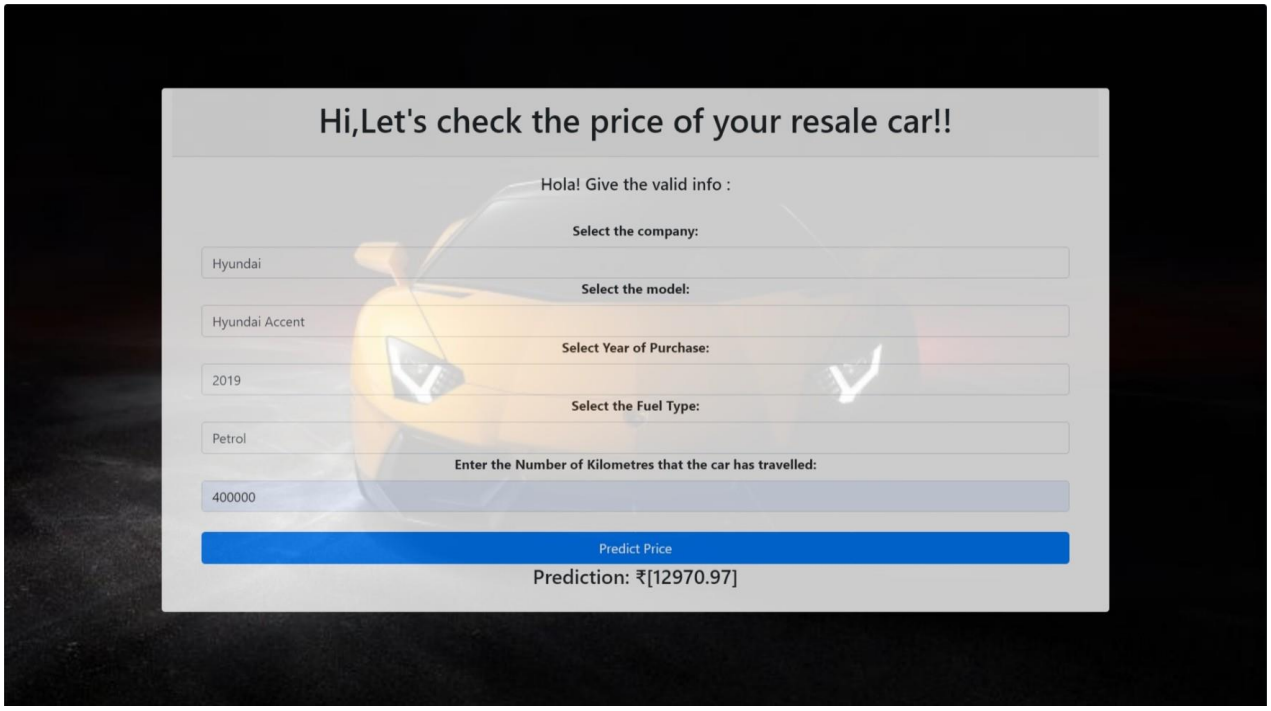
9. RESULTS

9.1 PERFORMANCE METRICS

The Performance is the Accuracy of the model trained.

The training accuracy of the model is 92%.

The testing accuracy of the model is 89%.



10. ADVANTAGES & DISADVANTAGES

Pros:

- Good at learning complex and non-linear relationships
- Highly explainable and easy to interpret

- Robust to outliers
- No feature scaling is required

Cons:

- Consumes more time
- Requires high computational power

11.CONCLUSION

We have successfully developed an application using python flask, HTML, CSS. By using the application, we can predict weather we can get admission in the desired University or not.

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. This paper compares 3 different algorithms for machine learning : Linear Regression, Lasso Regression and Ridge Regression.

12.FUTURE SCOPE

In future this machine learning model may bind with various website 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 user interface for interacting with user. For better performance, we plan to judiciously design deep learning network structures, use adaptive learning rates and train on clusters of data rather than the whole dataset

13.APPENDIX

SOURCE CODE

(https://github.com/IBM-EPBL/IBM-Project-24099-1659937600)

GITHUB & PROJECT DEMO LINK

(https://github.com/IBM-EPBL/IBM-Project-24099-1659937600)