RMK ENGINEERING COLLEGE

(An Autonomous Institution)

R.S.M. Nagar, Kavaraipettai, Gummidipoondi Taluk,
Thiruvallur District 601 206.

PROJECT

CAR RESALE VALUE PREDICTION

DONE BY

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1.INTRODUCTION

1.1 Project Overview

In this project, we mainly focus on the analysis of the Vehicle Resale Predict and then predict the results through them using training data. The tradein vehicle market is an always rising industry, which has nearly multiplied its fairly estimated worth over the most recent couple of years. The rise of online entrances like CarDheko, Quikr, Carwale, Cars24, and numerous others has worked with the requirement for both the client and the merchant to be better educated about the patterns and examples that decide theworth of the pre-owned vehicle on the lookout. AI calculations can be utilized to anticipate the retail worth of a vehicle, in light of a specific arrangement of highlights. Various sites have various calculations to create the retail cost of the trade-in vehicles, and subsequently there is certainly not a brought together calculation for deciding the cost. Via preparing measurable models at foreseeing the costs, one can undoubtedly get a good guess of the cost without really entering the subtleties into the ideal site. The fundamental target of this paper is to utilize three distinct expectation models to anticipate the retail cost of a utilized vehicle and think about their degrees of precision. The informational collection utilized for the forecast models was made by Shonda Kuiper[1]. The information was gathered from the 2005 Focal Edition of the Kelly Blue Book and has 804 records of 2005 GM vehicles, whose retail costs have been determined. The informational index fundamentally contains unmitigated qualities alongside two quantitative characteristics and then test data of academics not only external exams, but also the overall academic performance of each and every student. In a significant number of the universities, when we see the scholastic execution examination is done, however there is no framework that predicts the understudy's exhibition ahead of time. Of which if understudy fizzles in an Exam. Here we consider bothinward and outside imprints for examining scholastic execution of an understudy in the school which is investigated utilizing SVM calculation and
afterward Linear Regression calculation. These predictions are done using the previous results of PreviousData Set.

1.2 Purpose

With difficult economic conditions, it is likely that sales of second-hand imported cars and used carswill 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 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 resalevalue 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.

2. LITERATURE SURVEY

2.1 Existing Problem

As indicated by author Sameer Chand, they have done the forecasts of vehicle cost from the chronicled information that has been gathered from every day papers. They have utilized the administered AI strategies for foreseeing the cost of vehicles. Numerous different calculations like various straight relapse, k-closest neighbor calculations, gullible based, and some choice tree calculations additionally been utilized. Every one of the four calculations are looked at and tracked down the best calculation for forecast. They have confronted a few challenges in looking at the calculations, by one way or another they have overseen. As indicated by creators Pattabiraman, this paper is more focused on the connection among vender and purchaser. To foresee the cost of four wheelers, more highlights are required like previously given value, mileage, make, model, trim, type, chamber, liter, entryways, voyage, sound, cowhide. Utilizing these highlights the cost of vehicle has been anticipated with the assistance of factualinvestigation framework for exploratory information examination. As per creators in this paper the chiefly focus on gathering different information from web entryway by utilizing web scrap methods. Furthermore, those have been contrasted and the assistance of various AI calculations to foresee the vehicle cost in simple way. They arranged the value as per various scopes of value that is as of now given. Fake neural organization, support vector machine, arbitrary timberland calculations were utilized on various datasets to construct classifiers model. Another methodology was given by Richardson in his postulation work. In his hypothesis it states more strong vehicles will be delivered by vehicle maker. He looked at the crossover vehicles and conventional vehicles in scraper it really holds their incentive for longer time utilizing numerous relapse procedures. This works on the natural conditions, and furthermore it assists with giving colossal effectiveness of utilizing energizes. Wu et al, in this paper they have utilized neuro fluffy information based framework to exhibit vehicle value forecast. By considering the accompanying ascribes like brand, year of creation and sort of motor they anticipated a model which has comparative outcomes as the basic relapse model. Additionally, they made a specialist framework named ODAV (Optimal Distribution of Auction Vehicles) as there is a popularity for selling the by vehicles toward the finish of the renting year by vehicle vendors. This framework gives experiences into the best costs for vehicles, just as the area where all that cost can be acquired. To anticipate a cost of vehicles, the K – closest neighbor AI calculation has been utilized which depends on relapse models.

2.2 References

TITLE: Tu Weixing. Research on Used Car Evaluation System[J]

AUTHOR: Nanjing: Nanjing Forestry University

YEAR: 2008

In order to meet the needs of second-hand car value assessment, the used car value assessment system has been designed based on the improved replacement cost method. The system includes system management module, used car parameter management module, used car evaluation management module and evaluation information inquiry module. We enter the relevant basic information of second-hand car information, and figure out the used car's new rate, the purchase price and the selling price through the calculation to the system. From the perspective of the seller ,it is also a difficulty to price a used car appropriately. Based on existing data, the aim is use to machine learning algorithms to develop models for predicting used car prices.

TITLE: Determinants of used vehicle resale value.

AUTHOR: Richardson, M. S

YEAR: 2009

In his theory it states more durable vehicles will be produced by vehicle producer. He compared the hybrid vehicles and traditional vehicles in hoe it actually retains their value for longer time using multiple regression techniques. This improves the environmental conditions, and also it helps to provide huge efficiency of using fuels. Current study helps to get the prediction of sales in the automobile industry using machine learning techniques. The whole experiment with the machine learning approach is based upon real-world data from a leading car manufacturer.

TITLE: Used Cars Price Prediction.

AUTHOR: Pattabiraman Venkatasubbu et al

YEAR: 2007
This paper is more concentrated on the relation between seller and buyer. In order to predict the price of four wheelers, more features are required such as already given price, mileage, make, model, trim, type, cylinder, liter, doors, cruise, sound, leather. To train a model for predicting the price of used cars we applied machine learning techniques. Using these features the price of vehicle has been predicted with the help of statistical analysis system for exploratory data analysis.

TITLE: An expert system of price forecasting for used vehicles using adaptive neuro-fuzzy inference.

AUTHOR: Wu, et al

YEAR: 2009
In this paper they have used neuro fuzzy knowledge based system to demonstrate vehicle price prediction. By considering the following attributes such as brand, year of production and type of engine they predicted a model which has similar results as the simple regression model. Moreover, they made an expert system named ODAV (Optimal Distribution of Auction Vehicles) as there is a high demand for selling the by vehicles at the end of the leasing year by vehicle dealers. This system gives insights into the best prices for vehicles, as well as the location where the best price can be gained. To predict a price of vehicles, the K – nearest neighbor machine learning algorithm has been used which is based on regression models. More number of vehicles has been exchanged through this system so this particular system is more successfully managed.

2.3 Problem statement

Machine learning has become a tool used in almost every task that requires estimation. Companies like cars24 and cardekho. Com uses Regression analysis to estimate the used car prices. So we need to build a model to estimate the price of cars. The model should take car-related parameters and output a sellingprice. The selling price of a used car depends on certain features as mentioned below

- Fuel Type
- Manufacturing year
- Miles Driven
- Number of Historical Owners
- Maintenance Record

This is a supervised learning problem and can be solved using regression techniques. We need to predict the selling price of a car based on the given car's features. Supervised Regression problemsrequire labeled data where our target or dependent variable is the selling price of a car. All other features are independent variables.

Following are some regression algorithms that can be used for predicting the selling price.

- Linear Regression
- Decision Tree Regressor
- Support Vector Regressor
- KNN Regressor
- Random Forest Regressor

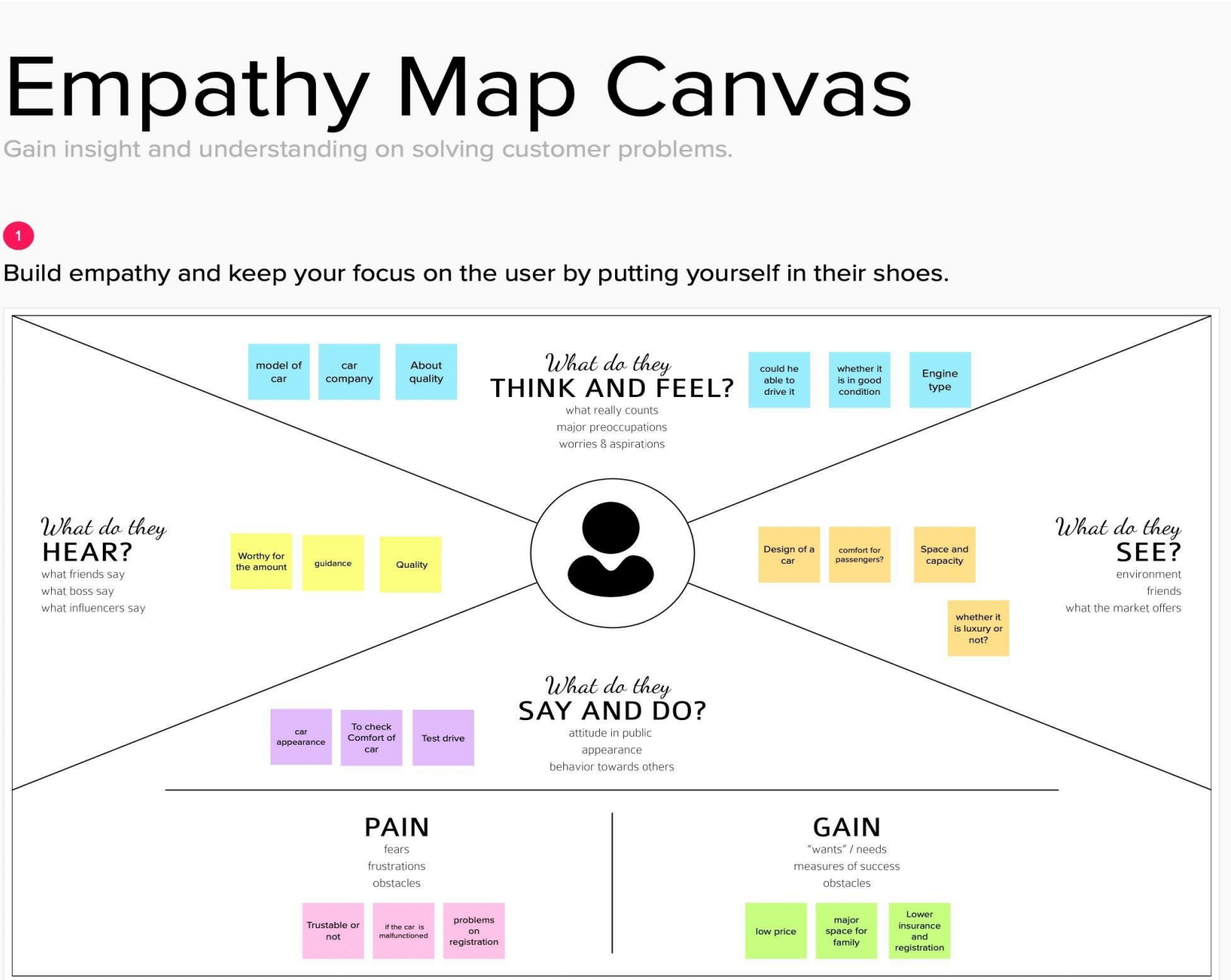
Linear Models are relatively less complex and explainable, but linear models perform poorly on datacontaining the outliers. Linear models fail to perform well on non-linear datasets. In such cases, non- linear regression algorithms Random Forest Regressor and XGBoost Regressor perform better in fitting the nonlinear data.

we will use Random Forest Regressor for predicting the selling price of cars. Our data contains some outliers, and treating them is entirely possible, but the performance of nonlinear regression models is insensitive tooutliers.

IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas:

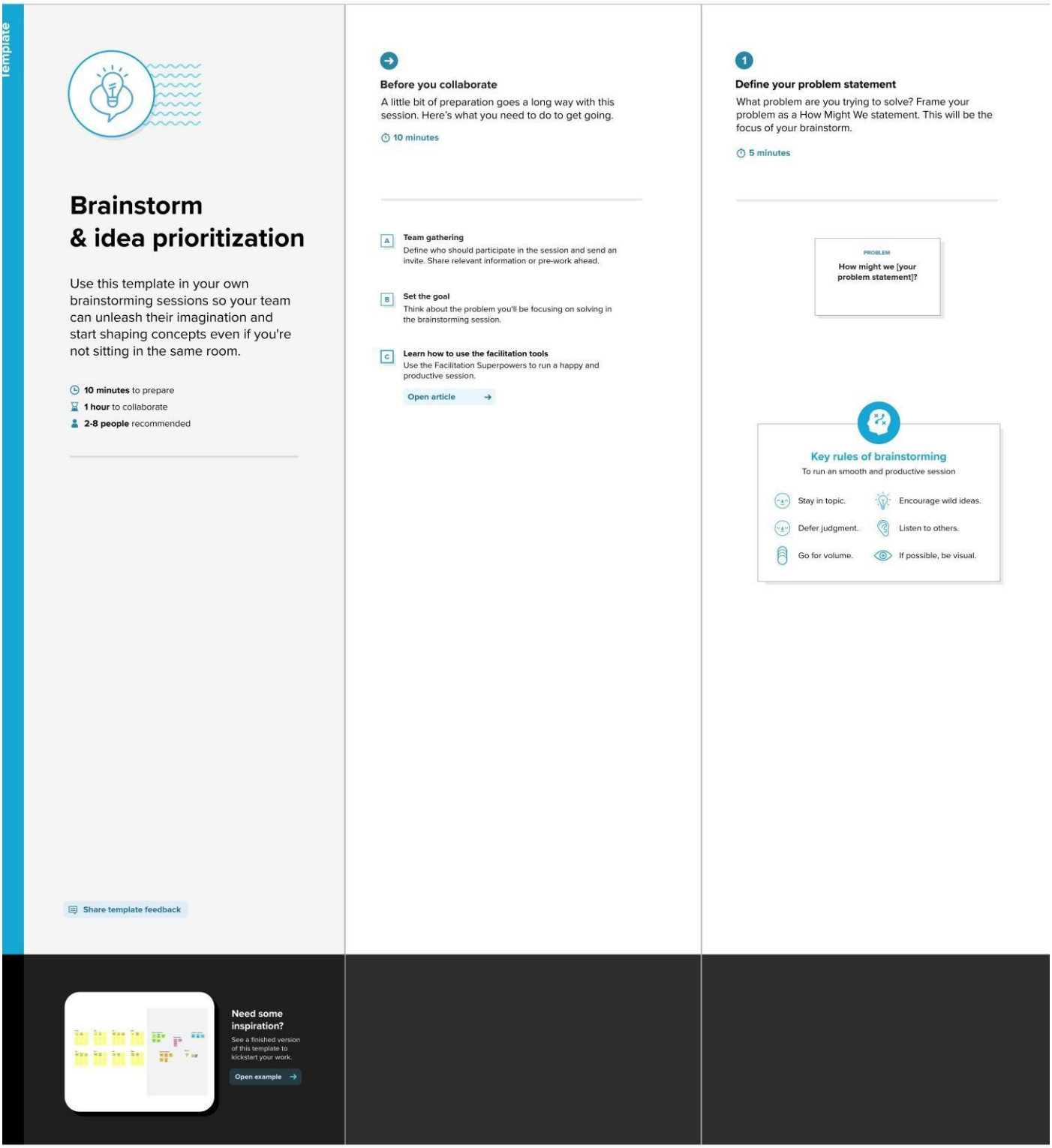
Empathy Map:- An empathy map is a collaborative visualization used to articulate what we know about a particular type of user.



3.2 IDEATION AND BRAINSTORMING

Ideation and Brainstorming:-

Ideation is often closely related to the practice of brainstorming, a specific technique that is utilized to generate new ideas. Ideation is commonly more thought of being as individual pursuit, while brainstorming is almost always a group a



2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

V SAYEESH

U DIVEESH SAI

T SAI KIRAN

S SRIRAMULU

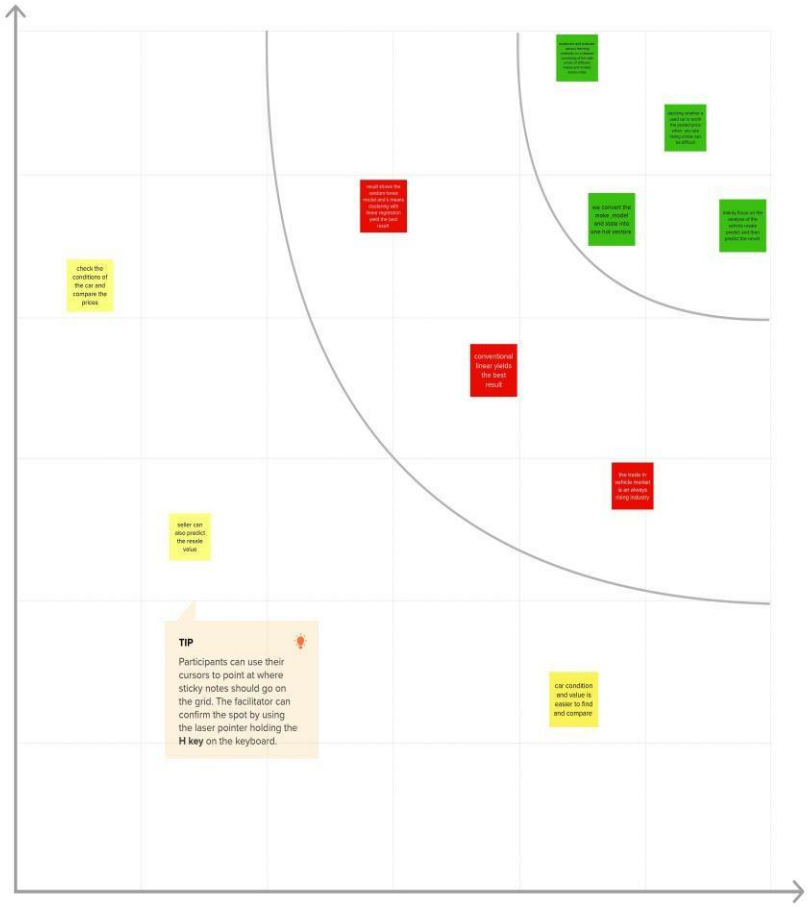
V NIRMAL VARMA

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes



Importance

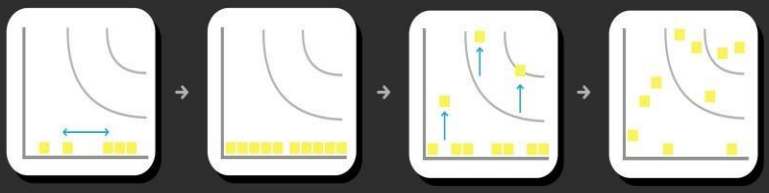
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

TIP

Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the **H key** on the keyboard.

Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)



After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

A **Share the mural**
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

B **Export the mural**
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint
Define the components of a new idea or strategy.
Open the template →

Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience.
Open the template →

Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template →

Share template feedback

3.3 Proposed Solution

Project Design Phase-I
Proposed Solution
Template

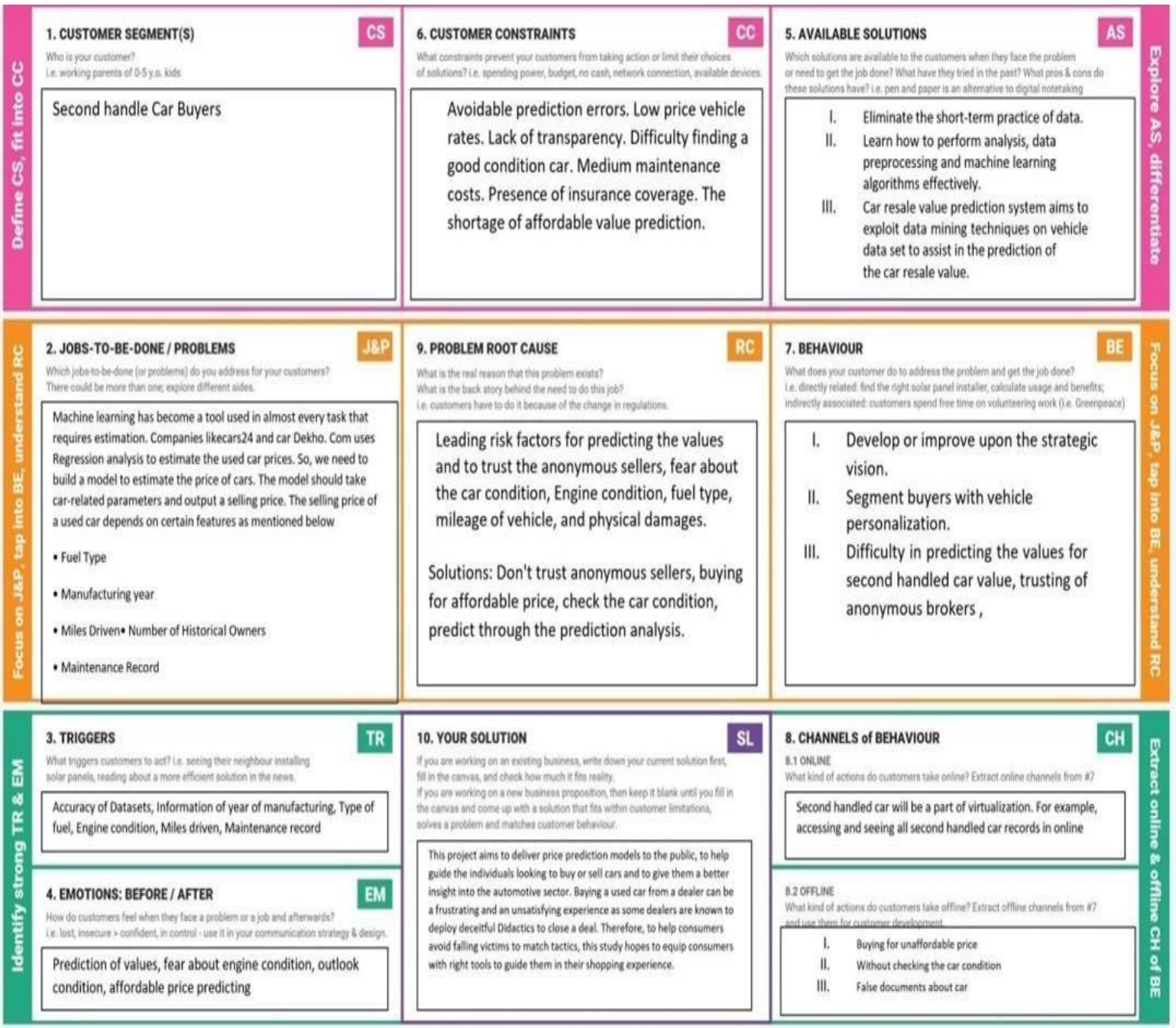
Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S. No	Parameter	Description
1.	Problem Statement (Problemto be solved)	Machine learning has become a tool used in almost every task that requires estimation. Companies like cars24 and cardekho.com uses Regression analysis to estimate the used car prices. So we need to build a model to estimate the price of cars. The model should take car- related parameters and output a selling price. Theselling price of a used car depends on certain features as mentioned below • Fuel Type • Manufacturing year • Kilometers Driven • Number of Previous Owners • Maintenance Record
2.	Idea / Solution description	This project aims to deliver price prediction models to the public, to help and 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 adealer can be a frustrating and an unsatisfying experience as some dealers areknown to deploy deceitful to close a deal. Therefore, to help consumers avoid falling victims to match tactics, this study 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 pricesand to compare t their accuracies.

3.	Novelty / Uniqueness	As there are so many ongoing experiments that use statistical approaches and some traditional methods to focus on predicting item sales. Most researches have experimented by taking single algorithm to predict sales. In this thesis Machine Learning algorithms such as Simple Linear Regression, Support Vector Regression, Gradient Boos4ng algorithm, and Random Forest Regression are considered for predict the most effective metrics such as accuracy, mean absolute error, and max error are considered for measuring algorithm efficiency. This method will be very beneficial in the future for advanced item sales forecasting,
4.	Social Impact / Customer Satisfaction	In the study, the variables having significant effects on the price of the second hand car were determined. A prediction model was established with these variables. The coefficient of determination (R2) of this model was calculated as 89.1%. The variables included in the estimation model are Brand, Model, Model Year, Fuel Type, Horse Power, Kilometers, Manual Air Conditioning, Fog Lights, Seat Air Cushion, Leather Steering Wheel, Wheel Rim, Automatic Air Conditioning, Start Stop, Rain Sensor, Sunroof, Electric Folding Mirrors, Xenon Headlight, Knee Airbag, Upholstery Leather, Memory Seat, 4X4, Parking Assistant, Vacuum Door.
5.	Business Model (Revenue Model)	Deciding whether a used car is worth the posted price when you see listings online can be difficult. Several factors, including mileage, make, model, year, etc. can influence the actual worth of a car. From the perspective of a seller, it is also a dilemma to price a used car. Based on existing data, the aim is to use machine learning algorithms to develop models for predicting used car prices.
6.	Scalability of the Solution	We started with understanding the use case of machine learning in the Automotive industry and how machine learning has transformed the driving experience. Moving on, we looked at the various factors that affect the resale value of a used car and performed exploratory data analysis (EDA). Further, we build a Random Forest Regression model to predict the resale value of a used car. We could have also used simpler regression algorithms like Linear Regression and Lasso Regression. Still, we need to make sure there are no outliers in the dataset before implementing them.

3.4 Problem Solution Fit:



4. REQUIREMENT ANALYSIS

Project Design Phase-II
Solution Requirements (Functional & Non-functional)

4.1 Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration to the related websites	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Users Profile	Personal details, Bank account ,Is He/She interested in buying a car
FR-4	Gather information about the vehicle	Through the registered websites they collect information
FR-5	Display the functionality of the vehicle	Details: Fuel type , Manufactured year , Miles Driven ,Record

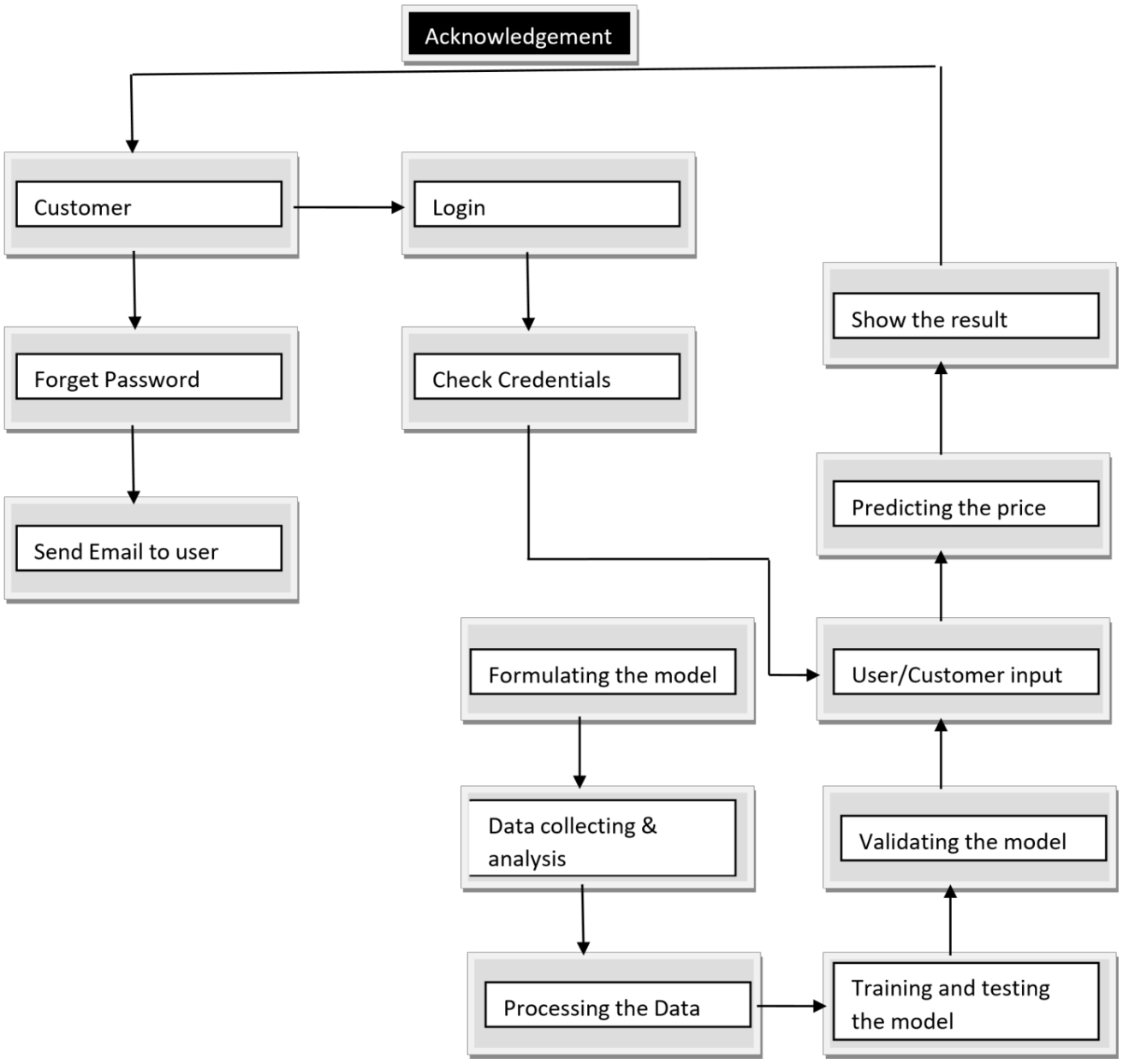
4.2 Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	User friendly UI Simple and easy to Understand
NFR-2	**Security**	Aware of scams
NFR-3	**Reliability**	The system must perform without failure
NFR-4	**Performance**	The landing page must support several users must provide 5 second or less response time
NFR-5	**Availability**	Uninterrupted services must be available all timeexcept the time of server updation.
NFR-6	**Scalability**	that can handle any amount of data and perform many computations in a cost-effective and time-saving way to instantly serve millions of users residing at global locations.

5. PROJECT DESIGN

5.1 Data Flow Diagram:



5.2 TECHNICAL ARCHITECTURE:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2.

Table-1 : Components & Technologies:

S.No	Component	Technology
1.	User Interface	HTML, CSS, JavaScript
2.	Application Logic-1	Python
3.	Application Logic-2	IBM Watson
4.	Machine Learning Model	Random forest

Table-2: Application Characteristics:

S.No	Characteristics	Technology
1.	Open-Source Frameworks	Flask
2.	Performance	It can handle about 100 requests per second

6. PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning and Estimation:

TITLE	DESCRIPTION	DATE
Literature Survey and Information gathering.	Literature survey on the selected project & gatheringinformation by referring the,technical paper research publications .	13 SEPTEMBER 2022.
Prepare Empathy Map.	Prepare Empathy Map Canvas to capture the user Pains & Gains. Prepare list of problem statements.	06 SEPTEMBER 2022.
Ideation.	List the idea by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	12 SEPTEMBER 2022.
Proposed Solution.	Prepare the proposed solution document, which includes the novelty, feasibility of idea, businessmodel, social impact, scalability of solution, etc.	06 SEPTEMBER 2022.
Problem Solution Fit.	Prepare problem - solutionfit document.	02 SEPTEMBER 2022.
Solution Architecture.	Prepare solution architecture document.	01 OCTOBER 2022.
Customer Journey.	Prepare the customer journeymaps to understand the user interactions & experienceswith the application.	14 OCTOBER 2022.
Data Flow Diagrams Draw the data flow.	Data Flow Diagrams, draw thedata flow.	14 OCTOBER 2022.
Technology Architecture.	Architecture diagram.	03 OCTOBER 2022.

Prepare Milestone & Activity List.	Prepare the milestones& activity list of the project.	22 OCTOBER 2022.
Project Development - Delivery of Sprint- 1, 2, 3 & 4.	Develop & submit the developed code by testing it.	25 October-19 November

Product Backlog, Sprint Schedule, 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 dependentand independent variables	2	High	V.Sayeesh
Sprint-2	Building the model	USN-2	Choosing the appropriate model for building and saving the model as pickle file	1	High	U.Diveesh Sai
Sprint-3	Application building	USN-3	Using flask deploying the ML model	2	High	T.SaiKiran , S.Sriramulu
Sprint-4	Train the model in IBM	USN-4	Finally train the model on IBM cloud and deploy the application	2	Medium	V.Nirmal KumarVarma

6.2 Sprint Delivery Schedule:

Project Tracker, Velocity & Burndown Chart:

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	25 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

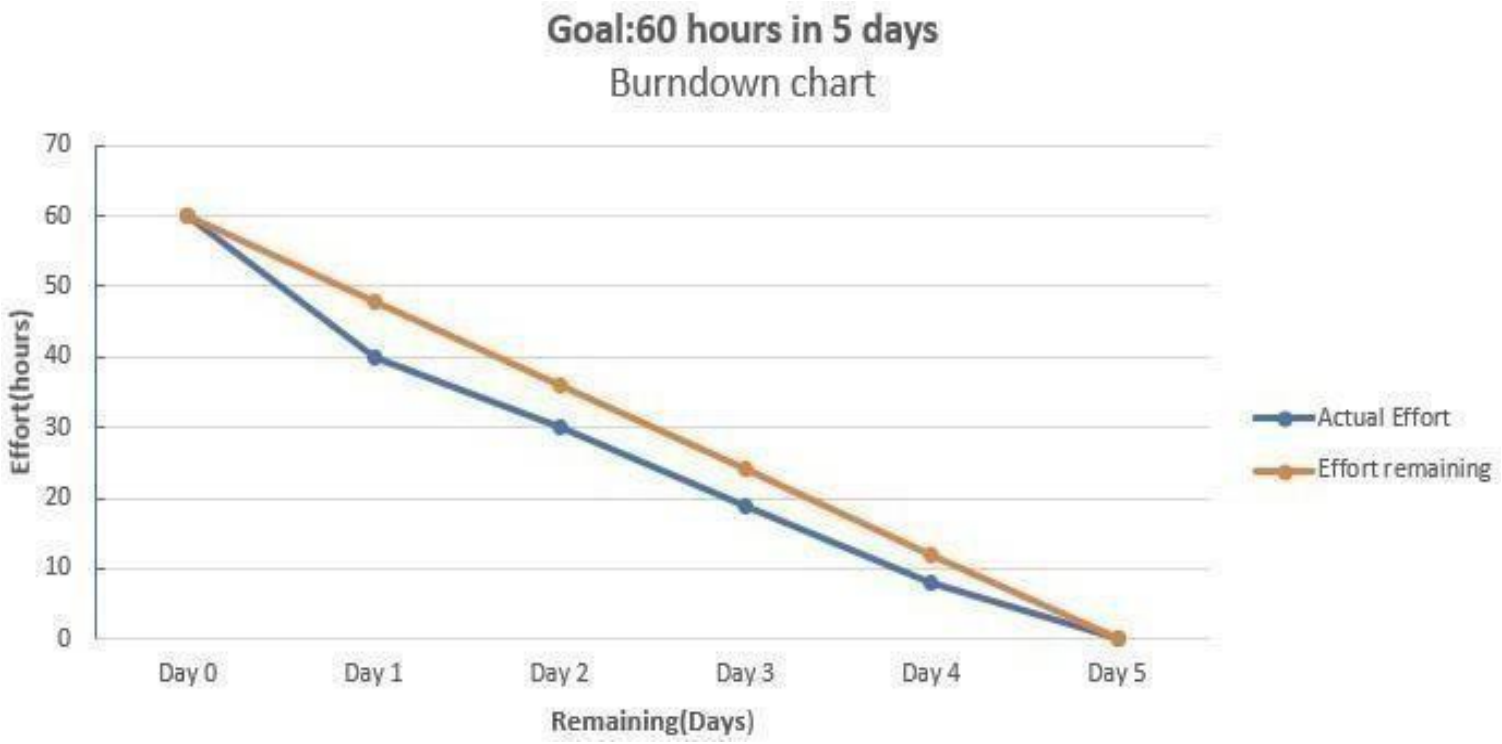
Velocity:

We have a 5-day sprint duration, and the velocity of the team is 15 (points per sprint). The team's average velocity (AV) per iteration unit (storypoints per day)

$$\text{Actual Velocity} = \text{Sprint Duration} / \text{Velocity}$$
$$= 15/5 = 3$$

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 suchas Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



7. CODING AND SOLUTIONING

7.1 Feature 1:

```
<!DOCTYPE html>
<html lang="en" dir="ltr">
    <head>
        <meta charset="utf-8">
        <title>Car resale value </title>
        <link rel="stylesheet" href="../static/css/style.css">
        <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/4.7.0/css/font-awesome.min.css">
    </head>
    <body>
        <section class="header">
            <nav>
                <a href="/"><img src="../static/Images/sang.png"width="100"
height="100"></a>

            </nav>
                <div class="text-box">
                    <h1>Car resale value Predictor</h1>
                    <p>Best system to predict the amount of resale valuebased on the parameters
provided by the user .</p>
                    <a href="value.html" class="visit-btn ">Check price</a>
                   </div>
              </section>

    </body>
```

7.2 Feature 2:

```
<!DOCTYPE html>
<html lang="en">
<head>
        <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 rel="stylesheet" href="../static/css/predict.css">
        <title>Car Resale Predicted Value</title>
</head>
<body>
    <section class="header">
            <nav>
                <a href="/"><img src="../static/Images/sang.png"width="100"
height="100"></a>
            </nav>
                <div class="text-box">
                    <h1>The Predicted Car Resale Value is </h1>
            <h1>{{Predicted car price is : 10 Lakhs}}</h1>
                    </div>
              </section>


</body>
```

```
<!DOCTYPE html>
<html lang="en" dir="ltr">
<head>
<link rel="stylesheet" href="../static/css/value.css">
<title>Car resale value</title>

</head>
<body>
        <section class="form">
        <form action="http://localhost:5000/predict" method="GET">
        <table border="0" align="center">
        <tbody>
                <h1>Get the Accurate Resale Value of Your Car</h1>
        <tr>
        <td><label for="year" padding:10px>Registration year : </label></td>
        <td><input id="year" maxlength="50" name="regyear" type="text"
/>
        <br>
        <br>
        </td>
        </tr>

        <tr>
        <td><label for="month">Registration Month : </label></td>
        <td><input id="month" maxlength="50" name="regmonth"type="text" />
        <br>
        <br>
        </td>
        </tr>

        <tr>
        <td><label for="power">Power of car in PS: </label></td>
        <td><input id="power" maxlength="50" name="powerps"type="text" />
        <br>
        <br>
        </td>
        </tr>

        <tr>
        <td><label for="kilometer">Kilometers that car have driven :
</label></td>
        <td><input id="kilometer" maxlength="50" name="kms"type="text" />
        <br>
        <br>
        </td>
        </tr>

        <tr>
```

```
<td><label for="geartype">Gear type : </label></td>
<td><input type="radio" name="geartype" value="manual"/>Manual
<input type="radio" name="geartype" value="automatic"/>Automatic
<input type="radio" name="geartype" value="not-declared"/> Notdeclared
<br>
<br>
</td>
</tr>

<tr>
<td><label for="damage">Your car is repaired or damaged : </label></td>
<td><input type="radio" name="damage" value="yes"/> Yes
<input type="radio" name="damage" value="no"/> No
<input type="radio" name="damage" value="not-declared"/> Notdeclared
<br>
<br>
</td>
</tr>

<tr>
<td><label for="model">Model Type : </label></td>
<td>
<select name="model" id="model">
<option value="" disabled selected hidden>Choose ModelName...</option>
<option value="golf">Golf </option>
<option value="grand">Grand </option>
<option value="fabia">Fabia </option>
<option value="3er">3er </option>
<option value="2_reihe">2 Reihe </option>
<option value="andere">Andere </option>
<option value="c_max">C Max </option>
<option value="3_reihe">3 Reihe </option>
<option value="passat">Passat </option>
<option value="navara">Navara </option>
<option value="ka">Ka </option>
<option value="polo">Polo </option>
<option value="twingo">Twingo </option>
<option value="a_klasse">A klasse </option>
<option value="scirocco">Scirocco </option>
<option value="5er">5er </option>
<option value="meriva">Meriva </option>
<option value="arosa">Arosa </option>
<option value="c4">C4 </option>
<option value="civic">Civic </option>
<option value="transporter">Transporter </option>
<option value="punto">Punto </option>
```

<option value="e_klasse">E Klasse </option>
<option value="clio">Clio </option>
<option value="kadett">Kadett </option>
<option value="kangoo">Kangoo </option>
<option value="corsa">Corsa </option>
<option value="one">One </option>
<option value="fortwo">Fortwo </option>
<option value="1er">1er </option>
<option value="b_klasse">B Klasse </option>
<option value="signum">Signum </option>
<option value="astra">Astra </option>
<option value="a8">A8 </option>
<option value="jetta">Jetta </option>
<option value="fiesta">Fiesta </option>
<option value="c_klasse">C Klasse </option>
<option value="micra">Micra </option>
<option value="vito">Vito </option>
<option value="sprinter">Sprinter </option>
<option value="156">156 </option>
<option value="escort">Escort </option>
<option value="forester">Forester </option>
<option value="xc_reihe">Xc Reihe </option>
<option value="scenic">Scenic </option>
<option value="a4">A4 </option>
<option value="a1">A1 </option>
<option value="insignia">Insignia </option>
<option value="combo">Combo </option>
<option value="focus">Focus </option>
<option value="tt">Tt </option>
<option value="a6">A6 </option>
<option value="jazz">Jazz </option>
<option value="omega">Omega </option>
<option value="slk">Slk </option>
<option value="7er">7er </option>
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<option value="147">147 </option>
<option value="glk">Glk </option>
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<option value="z_reihe">Z Reihe </option>
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<option value="ibiza">Ibiza </option>
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<option value="eos">Eos </option>
<option value="touran">Touran </option>
<option value="getz">Getz </option>
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<option value="megane">Megane </option>

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<option value="mondeo">Mondeo </option>
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<option value="colt">Colt </option>
<option value="impreza">Impreza </option>
<option value="vectra">Vectra </option>
<option value="berlingo">Berlingo </option>
<option value="80">80 </option>
<option value="m_klasse">M Klasse </option>
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<option value="i_reihe">I Reihe </option>
<option value="espace">Espace </option>
<option value="sharan">Sharan </option>
<option value="6_reihe">6 Reihe </option>
<option value="panda">Panda </option>
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<option value="seicento">Seicento </option>
<option value="ceed">Ceed </option>
<option value="5_reihe">5 Reihe </option>
<option value="yeti">Yeti </option>
<option value="octavia">Octavia </option>
<option value="mii">Mii </option>
<option value="rx_reihe">Rx Reihe </option>
<option value="6er">6er </option>
<option value="modus">Modus </option>
<option value="fox">Fox </option>
<option value="matiz">Matiz </option>
<option value="beetle">Beetle </option>
<option value="c1">C1 </option>
<option value="rio">Rio </option>
<option value="touareg">Touareg </option>
<option value="logan">Logan </option>
<option value="spider">Spider </option>
<option value="cuore">Cuore </option>
<option value="s_max">S Max </option>
<option value="a2">A2 </option>
<option value="x_reihe">X Reihe </option>
<option value="a5">A5 </option>
<option value="galaxy">Galaxy </option>
<option value="c3">C3 </option>
<option value="viano">Viano </option>
<option value="s_klasse">S Klasse </option>
<option value="1_reihe">1 Reihe </option>
<option value="avensis">Avensis </option>
<option value="sl">Sl </option>
<option value="roomster">Roomster </option>

<option value="q5">Q5 </option>
<option value="kaefer">Kaefer </option>
<option value="santa">Santa </option>
<option value="cooper">Cooper </option>
<option value="leon">Leon </option>
<option value="4_reihe">4 Reihe </option>
<option value="500">500 </option>
<option value="laguna">Laguna </option>
<option value="ptcruiser">Ptcruiser </option>
<option value="clk">Clk </option>
<option value="primera">Primera </option>
<option value="exeo">Exeo </option>
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<option value="transit">Transit </option>
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<option value="lanos">Lanos </option>
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<option value="superb">Superb </option>
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<option value="911">911 </option>
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<option value="v50">V50 </option>
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<option value="yaris">Yaris </option>
<option value="c5">C5 </option>

```
<option value="aygo">Aygo </option>
<option value="cc">Cc </option>
<option value="carnival">Carnival </option>
<option value="fusion">Fusion </option>
<option value="bora">Bora </option>
<option value="forfour">Forfour </option>
<option value="100">100 </option>
<option value="cl">Cl </option>
<option value="tigra">Tigra </option>
<option value="156">156 </option>
<option value="300c">300c </option>
<option value="100">100 </option>
<option value="147">147 </option>
<option value="q3">Q3 </option>
<option value="spark">Spark </option>
<option value="v70">V70 </option>
<option value="x_type">X Type </option>
<option value="5_reihe">5 Reihe </option>
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<option value="s_type">S Type </option>
<option value="x_trail">X Trail </option>
<option value="toledo">Toledo </option>
<option value="altea">Altea </option>
<option value="7er">7er </option>
<option value="voyager">Voyager </option>
<option value="calibra">Calibra </option>
<option value="bravo">Bravo </option>
<option value="range_rover">Range Rover </option>
<option value="antara">Antara </option>
<option value="tucson">Tucson </option>
<option value="q7">Q7 </option>
<option value="citigo">Citigo </option>
<option value="jimny">Jimny </option>
<option value="cx_reihe">Cx Reihe </option>
<option value="wrangler">Wrangler </option>
<option value="lybra">Lybra </option>
<option value="range_rover_sport">Range Rover Sport </option>
<option value="lancer">Lancer </option>
<option value="159">159 </option>
<option value="freelander">Freelander </option>
<option value="captiva">Captiva </option>
<option value="c2">C2 </option>
<option value="500">500 </option>
<option value="range_rover_evoque">Range Rover Evoque </option>
<option value="sandero">Sandero </option>
<option value="note">Note </option>
<option value="900">900 </option>
<option value="147">147 </option>
<option value="defender">Defender </option>
<option value="cherokee">Cherokee </option>
<option value="clubman">Clubman </option>
```

<option value="samara">Samara </option>
<option value="2_reihe">2 Reihe </option>
<option value="1er">1er </option>
<option value="3er">3er </option>
<option value="601">601 </option>
<option value="3_reihe">3 Reihe </option>
<option value="4_reihe">4 Reihe </option>
<option value="5er">5er </option>
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<option value="5_reihe">5 Reihe </option>
<option value="s60">S60 </option>
<option value="nubira">Nubira </option>
<option value="vivaro">Vivaro </option>
<option value="g_klasse">G Klasse </option>
<option value="lodgy">Lodgy </option>
<option value="850">850 </option>
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<option value="charade">Charade </option>
<option value="croma">Croma </option>
<option value="outlander">Outlander </option>
<option value="gl">Gl </option>
<option value="doblo">Doblo </option>
<option value="musa">Musa </option>
<option value="amarok">Amarok </option>
<option value="156">156 </option>
<option value="move">Move </option>
<option value="9000">9000 </option>
<option value="v60">V60 </option>
<option value="145">145 </option>
<option value="aveo">Aveo </option>
<option value="200">200 </option>
<option value="300c">300c </option>
<option value="b_max">B Max </option>
<option value="delta">Delta </option>
<option value="terios">Terios </option>
<option value="rangerover">RangeRover </option>
<option value="90">90 </option>
<option value="materia">Materia </option>
<option value="kalina">Kalina </option>
<option value="elefantino">Elefantino </option>
<option value="i3">I3 </option>
<option value="kappa">Kappa </option>
<option value="serie_3">Serie 3 </option>
<option value="48429">48429 </option>
<option value="serie_1">Serie 1 </option>
<option value="discovery_sport">Discovery Sport </option>

```
</select>
<br>
<br>
</td>
</tr>

<tr>
<td><label for="brand">Brand :</label></td>
<td>
<select name="brand" id="brand">
<option value="" disabled selected hidden>Choose BrandName...</option>
<option value="volkswagen">Volkswagen </option>
<option value="audi">Audi </option>
<option value="jeep">Jeep </option>
<option value="skoda">Skoda </option>
<option value="bmw">Bmw </option>
<option value="peugeot">Peugeot </option>
<option value="ford">Ford </option>
<option value="mazda">Mazda </option>
<option value="nissan">Nissan </option>
<option value="renault">Renault </option>
<option value="mercedes_benz">Mercedes Benz </option>
<option value="opel">Opel </option>
<option value="seat">Seat </option>
<option value="citroen">Citroen </option>
<option value="honda">Honda </option>
<option value="fiat">Fiat </option>
<option value="mini">Mini </option>
<option value="smart">Smart </option>
<option value="hyundai">Hyundai </option>
<option value="sonstige_autos">Sonstige Autos </option>
<option value="alfa_romeo">Alfa Romeo </option>
<option value="subaru">Subaru </option>
<option value="volvo">Volvo </option>
<option value="mitsubishi">Mitsubishi </option>
<option value="kia">Kia </option>
<option value="suzuki">Suzuki </option>
<option value="lancia">Lancia </option>
<option value="porsche">Porsche </option>
<option value="toyota">Toyota </option>
<option value="chevrolet">Chevrolet </option>
<option value="dacia">Dacia </option>
<option value="daihatsu">Daihatsu </option>
<option value="trabant">Trabant </option>
<option value="saab">Saab </option>
<option value="chrysler">Chrysler </option>
<option value="jaguar">Jaguar </option>
<option value="daewoo">Daewoo </option>
<option value="rover">Rover </option>
<option value="land_rover">Land Rover </option>
<option value="lada">Lada </option>
```

```
        </select>
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        </td></tr>
        <tr>
        <td><label for="fuelType">Fuel Type :</label></td>
        <td>
        <select name="fuelType" id="brand">
        <option value="" disabled selected hidden>Choose FuelType...</option>
        <option value="petrol"> Petrol </option>
        <option value="diesel"> Diesel </option>
        <option value="not-declared"> Not Declared </option>
        <option value="lpg">LPG </option>
        <option value="cng">CNG </option>
        <option value="hybrid">Hybrid </option>
        <option value="others">Others </option>
        <option value="electric">Electric </option>
        </select>
        <br>
        <br>
        </td>
        </tr>
        <tr>
        <td><label for="vehicletype">Vehicle type:</label></td>
        <td>
        <select name="vehicletype" id="vehicle" >
        <option value="" disabled selected hidden>Choose VehicleType...</option>
        <option value="coupe">Coupe </option>
        <option value="suv">SUV </option>
        <option value="kleinwagen">Kleinwagen </option>
        <option value="limousine">Limousine </option>
        <option value="cabrio">Cabrio </option>
        <option value="bus">Bus </option>
        <option value="kombi">Kombi </option>
        <option value="andere">Andere </option>
        <option value="volkswagen">Volkswagen </option>
        </select>
        <br>
        <br>
        </td>
        </tr>
        </tbody>
        </table>
        <button><a href="predict.html" >Submit</a></button>
        </form>
    </section>

</body
</html>
```
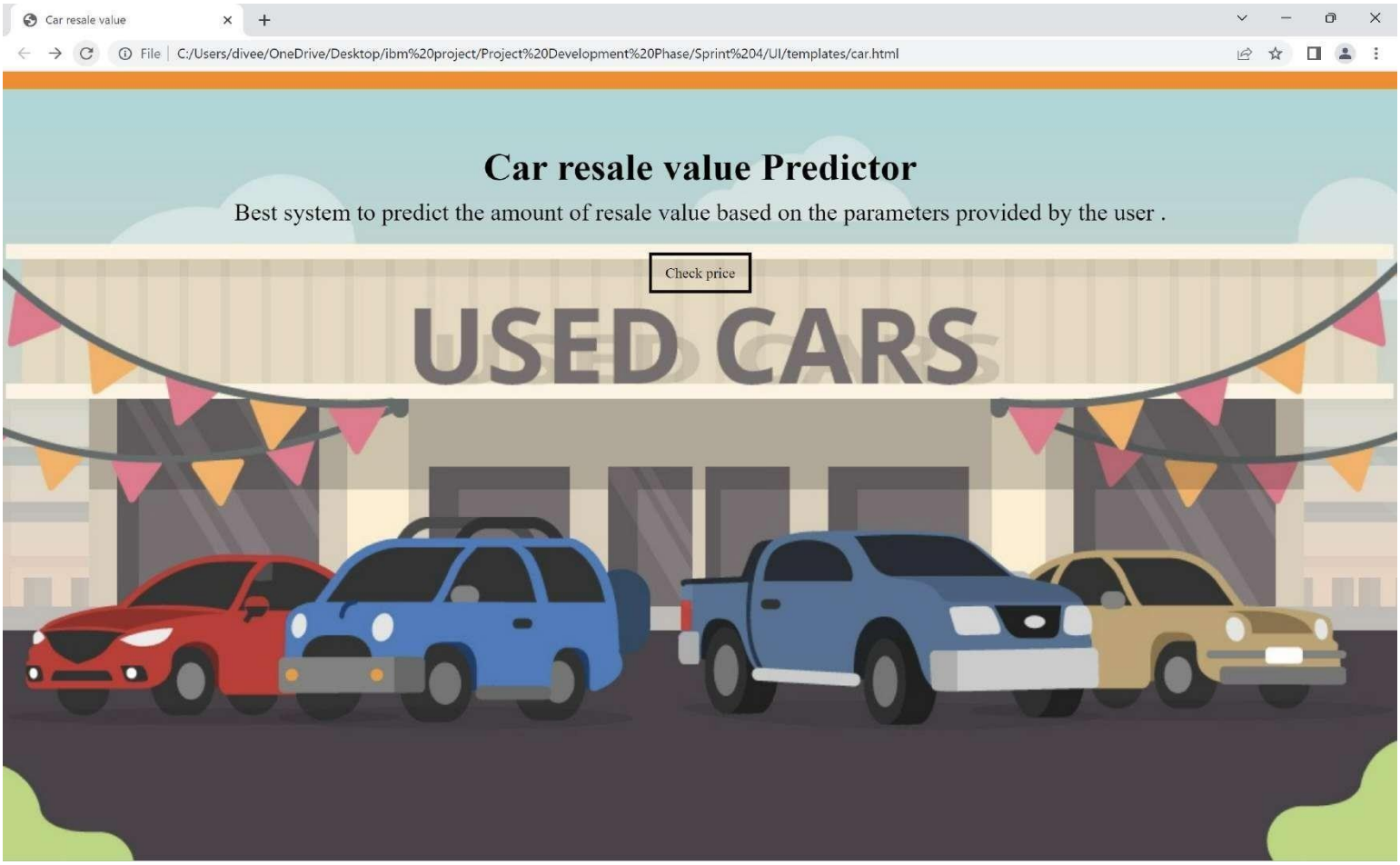
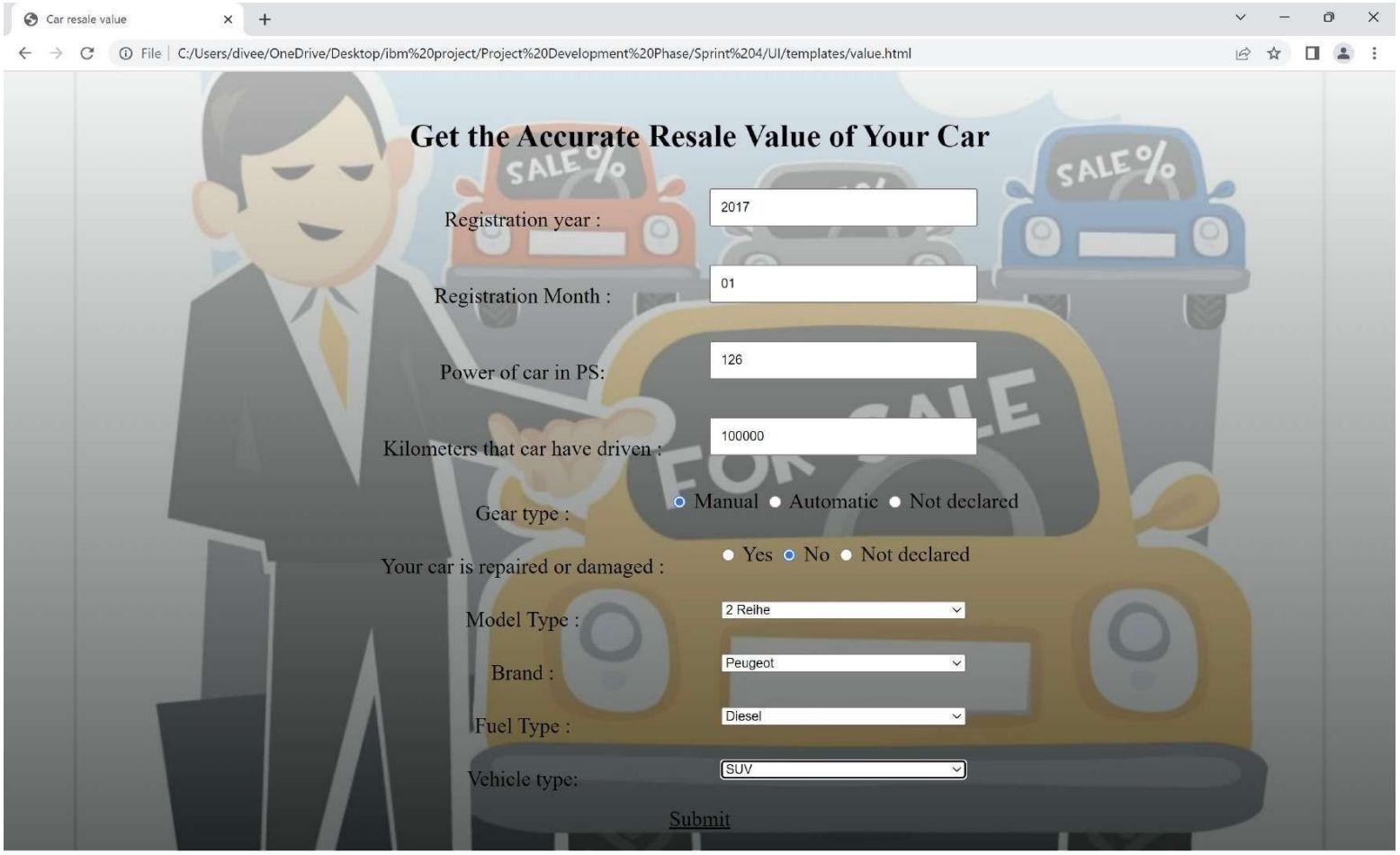

```
# Import Libraries
import pandas as pd
import numpy as np
from flask import Flask, render_template, Response, request
import pickle
from sklearn.preprocessing import LabelEncoder
import requests

# NOTE: you must manually set API_KEY below using information retrieved from your IBM Cloud account.
API_KEY = "Qo9j8ni7qMJ8j1C8VFDRFHbuGRAhYWcTlkVqnYg1AGkE"
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__)#initiate flask app

def load_model(file='../Result/resale_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()
  mapper[i].classes = np.load('../Result/'+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)

 # NOTE: manually define and pass the array(s) of values to be scored in the next line
 payload_scoring = {"input_data": [{"fields": [['yearOfReg', 'powerPS', 'kilometer', 'monthOfRegistration','gearbox_l
abels', 'notRepairedDamage_labels', 'model_labels','brand_labels', 'fuelType_labels', 'vehicletype_labels']], "values":
X}]}

 response_scoring = requests.post('https://us-south.ml.cloud.ibm.com/ml/v4/deployments/7f67cbed-6222-413b-9901
-b2a72807ac82/predictions?version=2022-10-30', json=payload_scoring, headers={'Authorization': 'Bearer ' + mltok
en})
 predictions = response_scoring.json()
 print(response_scoring.json())
 predict = predictions['predictions'][0]['values'][0][0]
 print("Final prediction :",predict)

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

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

8. TESTING

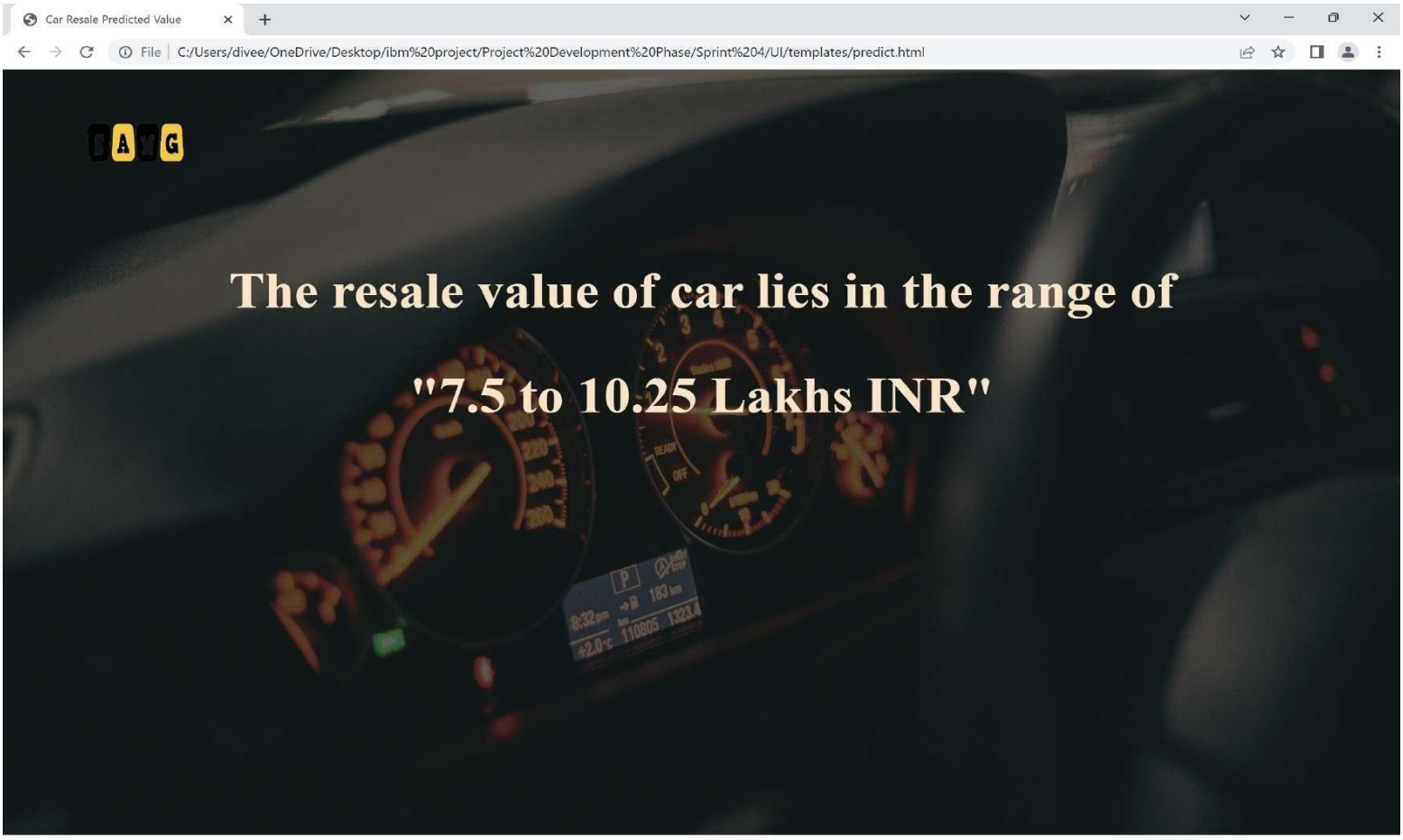

Car resale value
File | C:/Users/divee/OneDrive/Desktop/ibm%20project/Project%20Development%20Phase/Sprint%204/UI/templates/car.html
Car resale value Predictor
Best system to predict the amount of resale value based on the parameters provided by the user .
Check price
USED CARS

8.1 & 8.2 Test Cases and User Acceptance Testing:



9.RESULTS

9.1Performance Metrics:



10.ADVANTAGES AND DISADVANTAGES

Advantages:

1) **Reasonable Price** - One can get Used Cars at lower price.

2) **Lower Depreciation Value** - Used Cars have lower Depreciation.

3) **Low Insurance** - Insurance Premium for used cars are often low.

Disadvantages:

1) **Less Reliable** - Used cars are less reliable.

2) **Frequent repairs** - One have to spend lots of time on repairs.

3) **Sounds in Engine** - Used cars may make strange sounds due to defects in engine and other carparts.

11. CONCLUSION :

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 processis collection and preprocessing of the data.

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 singlemachine algorithm on the data set accuracy was less than 50%. Therefore, the ensembleof 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 approximate prediction of the car resale value , ouraim for the future research is to test this system to work successfully with various data sets and accuracy. We will extend our test data with used cars data sets and validate theproposed approach.

12.FUTURE SCOPE：

Efficient use of deep learning such as LSTM (Long short-term memory) or RNN (Recurrent Neural networks) can be implemented once enough data is collected. This can improve accuracy and decrease Root Mean Square Error(RMSE) drastically.

Currently, system can only deal with approximate car price prediction. This can be extended to predict exact value of car in future enhancements.

One can also implement Convolutional Neural Network(CNN) to determine physical condition of the car from images like identifying dents, scratches etc. and thus predicting more relevant resale value of a car.

GITHUB LINK TO PROJECT REPOSITORY:

https://github.com/IBM-EPBL/IBM-Project-29126-1660121123