RMK ENGINEERING COLLEGE

(An Autonomous Institution)

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

PROJECT

CAR RESALE VALUE PREDICTION

DONE BY

TEAM ID: PNT2022TMID15891

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CONTENTS

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 trade in the vehicle market is an always rising industry, which has nearly multiplied it's fairly estimated worth over the most recent couple of years. The rise of online entrances like CarDekho, 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 the worth 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 an utilized vehicle and think about their degrees of precision. The informational collection utilized for the forecast models was made by Shonda Kuiper. 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 both inward 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 the Previous Data 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 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 algorithms 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.

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 everyday 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 have 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 theyhave 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 the vehicle has been anticipated with the assistance of a factual investigation framework for exploratory information examination. As per creators in this paper they chiefly focus on gathering different information from web entryway by utilizing web scrap methods. Furthermore, those have been contrasted with the assistance of various AI calculations to foresee the vehicle cost in a 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 models. Another methodology was given by Richardson in his postulation work. In his hypothesis it states more strong vehicles will be delivered by vehicle makers. He looked at the crossover vehicles and conventional vehicles in scrapers. 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 utilizedneuro 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. More vehicles have been traded through this framework so this specific framework is all the more effectively oversaw.

2.2 REFERENCES

1. CAR RESALE VALUE PREDICTION USING MACHINE LEARNING BY

I. **Prashant Gajera**
II. **Akshay Gondaliya**
III. **Jenish Kavathiya**

The world is growing day by day and the expectations of every person are also growing up. Out of all the expectations one of them is to buy a car. But all are not able to buy a new car, so they will buy a used one. But new people don't know about the market price for his or her dream car for old car. That is where we need a platform which helps new people for car price prediction. In this paper we are coming up with that platform which is made using machine learning technology. Using supervised machine learning algorithms such as linear-regression, KNN, Random Forest, XG boost and Decision tree, let's try to build a statistical model which will be able to predict the price of a used car. For that, previous consumer data and a given set of features will help us. And we will also be comparing the prediction accuracy of these models to determine the optimal one.

Concluding whether a used car is worth the posted price when you see listings online can be difficult. Several factors, including mileage, make, model, year, km driven etc. can affect the actual worth of a car. From the perspective of a seller, it is also a difficulty to price a used car appropriately. Based on existing data, the aim is to use machine learning algorithms to develop models for predicting used car prices.

2. LINEAR REGRESSION FOR CAR SALES PREDICTION IN INDIAN AUTOMOBILE INDUSTRY BY

I. **Rohan Kulkarni**
II. **Anuja Bokhare**

The automobile industry is one of the leading industries in our economy. Sudden up rise in the demand for automobile vehicles and also the growth in profits are the leading factors for this industry to become one of the major and important ones. This industry is also coming up with various financial aids and schemes for the general population which is why people buying vehicles is causing a ripple effect and maximizing their profits and the growth of industry. This industry has been a great force and a contributor to our economy. That is why this is of important significance for us to accurately predict the sales of automobiles. That is why every industry or organization wants to predict the result by using their own past data and various learning algorithms of machine learning. This will help them visualize past data and help them to determine their future goals and plan accordingly and, thus, making sales predictions of the current trend in the market. Current study helps to get the prediction of sales in the automobile industry using machine learning techniques.

3. SUPPORT VECTOR REGRESSION ANALYSIS FOR PRICE PREDICTION BY

Mariana Listiani

To remain profitable under a tight competition, a leasing company has to offer a good leasing price. In order to determine the right price, it is necessary to predict the future price of a second hand car.

By knowing the car's value depreciation, the leasing price could be set to cover it. The approach commonly used for a price prediction task is multiple linear regression analysis. However, there are a large number of factors that drive the price, that make this crucial task di-cult. The standard regression approach might not be suitable for high dimensional data. A modern data mining technique which is independent of input dimension, namely Support Vector Regression, will be applied to overcome this potential problem. The forecasting accuracy will then be compared against the statistical regression model. In particular, a fully automatic approach for tuning and applying SVR is developed, borrowing ideas from the field of evolutionary search. The whole experiment with the machine learning approach is based upon real-world data from a leading German car manufacturer.

4. DETERMINANTS OF USED CAR RESALE VALUE

BY Michael S. Richardson

Hybrid vehicles have recently emerged as a growing market segment in the automobile industry. The value these vehicles hold over time has important implications for consumers. Vehicles that maintain their value better over time are likely to be in higher demand, and thus auto-makers are keen on producing more and more of these vehicles in the next few years. Using a multiple variable regression analysis, this thesis analyzes the major determinants of resale value in used cars. Current market values of used cars compared with their original prices are used as data. This study predicts that hybrid vehicles maintain their value better than traditional vehicles due to environmental perceptions as well as fuel efficiency ratings.

5. CAR VALUE PREDICTION USING MACHINE LEARNING

BY Yash, M. M. G. Y. D

A fair car value prediction has made it so easy for the buyers to get a car home, as it just requires a few efforts and brains of field experts. Day to day, there are many brands that bring new models to the market with lavish prices. Customers not being capable of buying a new car financially due to the higher market price, there is a need for used car value prediction globally which effectively determines the worthiness of a car that can be bought without much thinking. To train a model for predicting the price of used cars we applied machine learning techniques i.e., Regression Algorithms because it provides us continuous value as an output and not a categorized value such as Random Forest, linear regression and other algorithms for getting better accuracy. Then after processing the data from the dataset collected from Kaggle, we will be comparing the performance of different algorithms to get a chosen output. Further it would be available in GUI as a Web-application developed using Python-flask making it user friendly so that users could give input and get the price of a car according to it.

2.3 Problem Statement Definition

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. 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 problems require 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

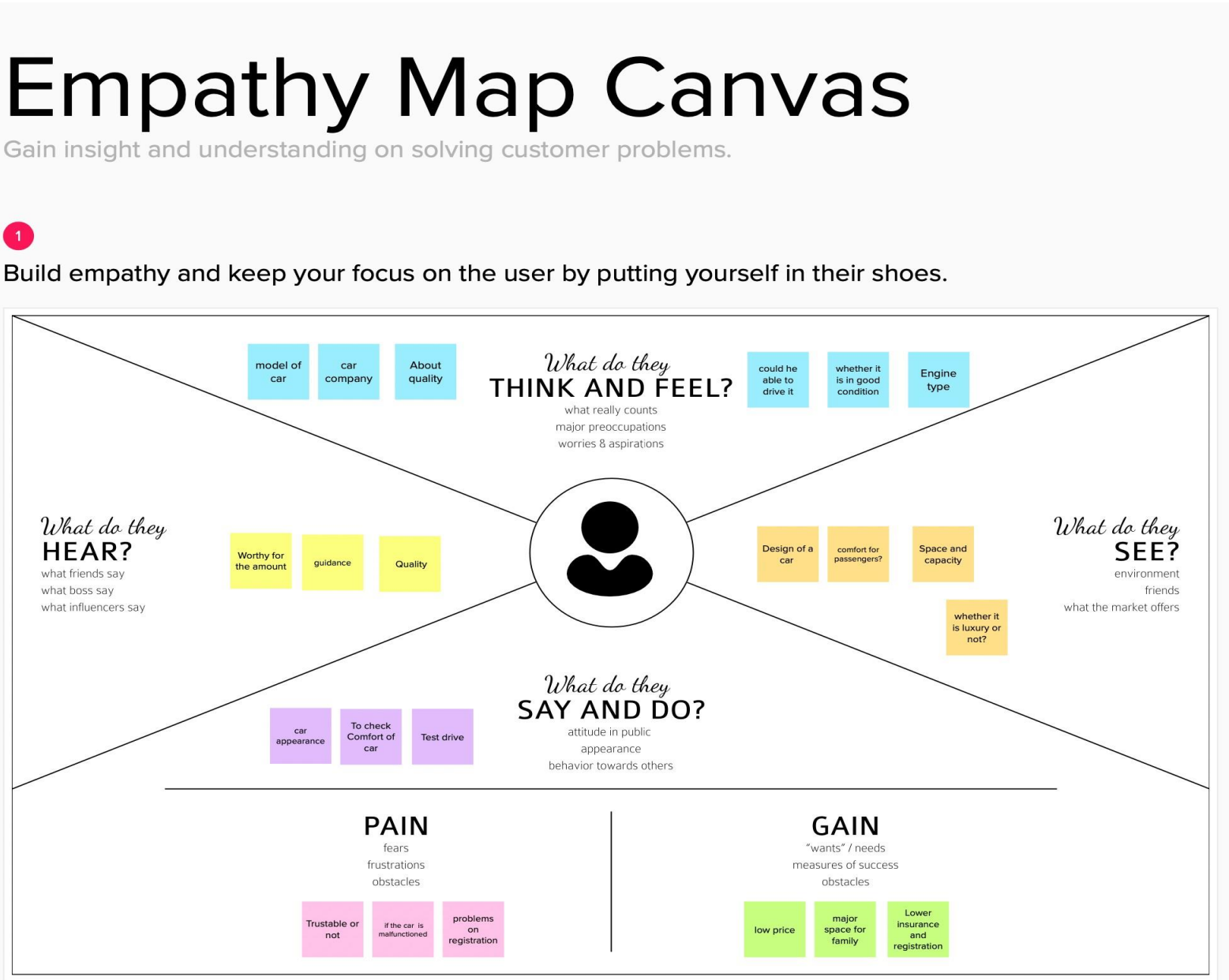
Linear Models are relatively less complex and explainable, but linear models perform poorly on data containing the outliers. Linear models fail to perform well on non-linear datasets. In such cases, non-linear regression algorithms Random Forest Regressor and XGBoost Regressor perform better in fitting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

3.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

Template

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

10 minutes to prepare
1 hour to collaborate
2-8 people recommended

Share template feedback

Before you collaborate

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

10 minutes

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

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

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

Open article →

1 Define your problem statement

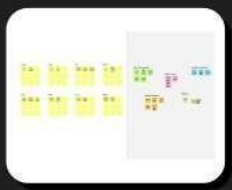
What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM
How might we [your problem statement]?

Key rules of brainstorming
To run an smooth and productive session

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



Need some inspiration?
See a finished version of this template to kickstart your work.

Open example →

2

Brainstorm

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

10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

NITHIN REDDY

SAHITH ANDEY

GOWTHAM REDDY

PAVAN VARMA

ROHIT VARMA

3

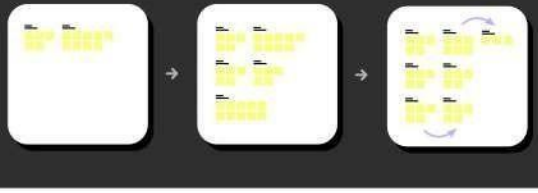
Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.



Project Design Phase-I Proposed Solution Template

3.4 Proposed Solution Template:

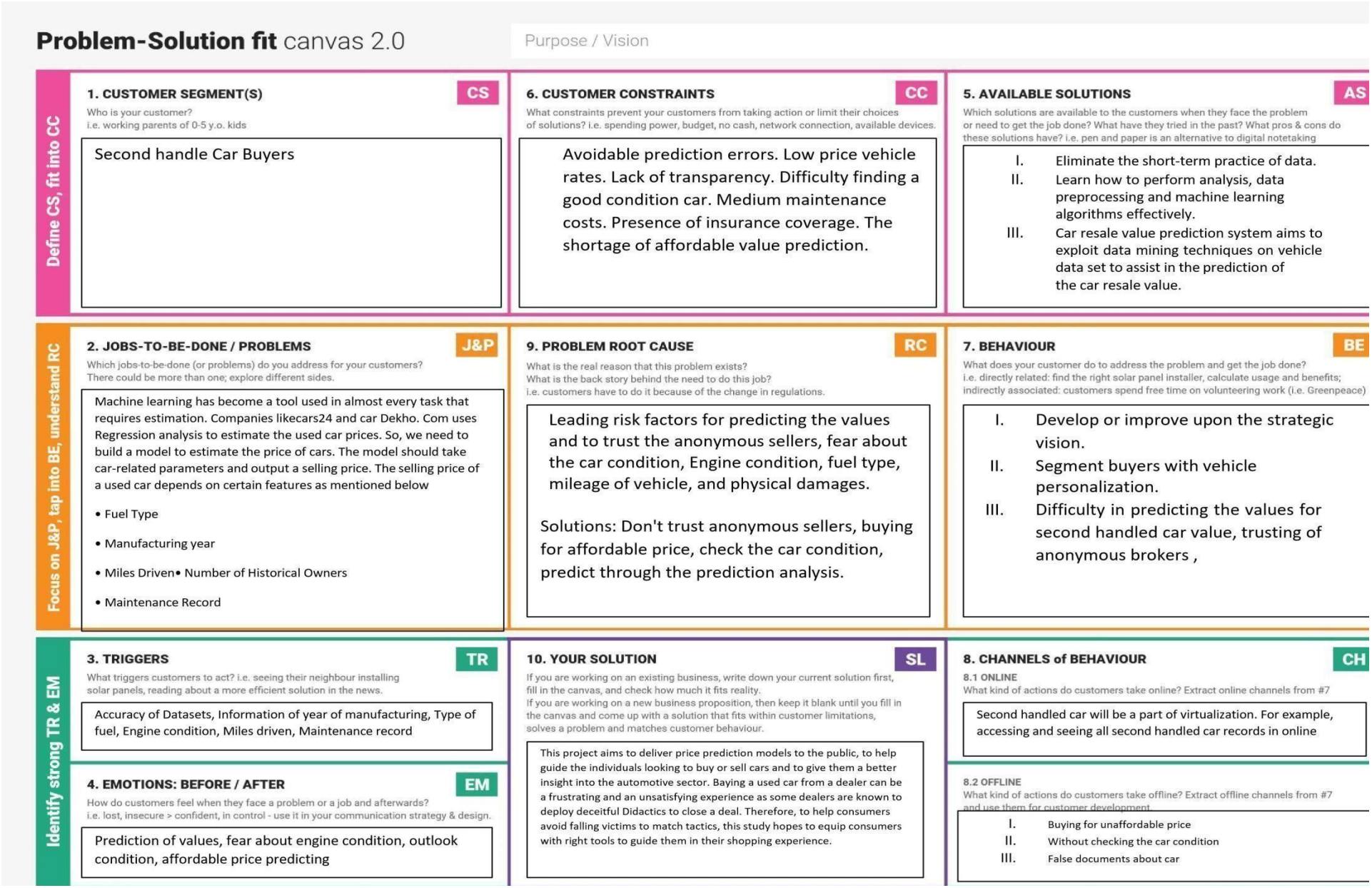
Project team shall fill the following information in the proposed solution template.

S. No	Parameter	Description
1.	Problem Statement (Problem to be solved)	Machine learning has become a tool used in almost every task that requires estimation. Companies like cars24 and cardekho.com use 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. The selling 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 a dealer can be a frustrating and an unsatisfying experience as some dealers are known to deploy deceitful to close a deal. Therefore, to help consumers avoid falling victims to match tactics, this study hopes to equip consumers with the right tools to guide them in their shopping experience. Another goal of the project is to explore new methods to evaluate used cars prices and to compare their 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 researchers have experimented by taking a single algorithm to predict sales. In this thesis Machine Learning algorithms such as Simple Linear Regression, Support Vector Regression, Gradient Boosting 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. Pair plots and scatter plots help visualize the outliers

3.3 Proposed Solution Fit



Problem-Solution fit canvas 2.0

Purpose / Vision

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) — CS

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

Second handle Car Buyers

6. CUSTOMER CONSTRAINTS — CC

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

Avoidable prediction errors. Low price vehicle rates. Lack of transparency. Difficulty finding a good condition car. Medium maintenance costs. Presence of insurance coverage. The shortage of affordable value prediction.

5. AVAILABLE SOLUTIONS — AS

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

I. Eliminate the short-term practice of data.
II. Learn how to perform analysis, data preprocessing and machine learning algorithms effectively.
III. Car resale value prediction system aims to exploit data mining techniques on vehicle data set to assist in the prediction of the car resale value.

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

2. JOBS-TO-BE-DONE / PROBLEMS — J&P

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

Machine learning has become a tool used in almost every task that requires estimation. Companies likecars24 and car Dekho. 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. 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

9. PROBLEM ROOT CAUSE — RC

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

Leading risk factors for predicting the values and to trust the anonymous sellers, fear about the car condition, Engine condition, fuel type, mileage of vehicle, and physical damages.

Solutions: Don't trust anonymous sellers, buying for affordable price, check the car condition, predict through the prediction analysis.

7. BEHAVIOUR — BE

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

I. Develop or improve upon the strategic vision.
II. Segment buyers with vehicle personalization.
III. Difficulty in predicting the values for second handled car value, trusting of anonymous brokers ,

Identify strong TR & EM

3. TRIGGERS — TR

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

Accuracy of Datasets, Information of year of manufacturing, Type of fuel, Engine condition, Miles driven, Maintenance record

4. EMOTIONS: BEFORE / AFTER — EM

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

Prediction of values, fear about engine condition, outlook condition, affordable price predicting

10. YOUR SOLUTION — SL

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

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. Baying a used car from a dealer can be a frustrating and an unsatisfying experience as some dealers are known to deploy deceitful Didactics 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.

8. CHANNELS of BEHAVIOUR — CH

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

Second handled car will be a part of virtualization. For example, accessing and seeing all second handled car records in online

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

I. Buying for unaffordable price
II. Without checking the car condition
III. False documents about car

4.REQUIREMENT ANALYSIS

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

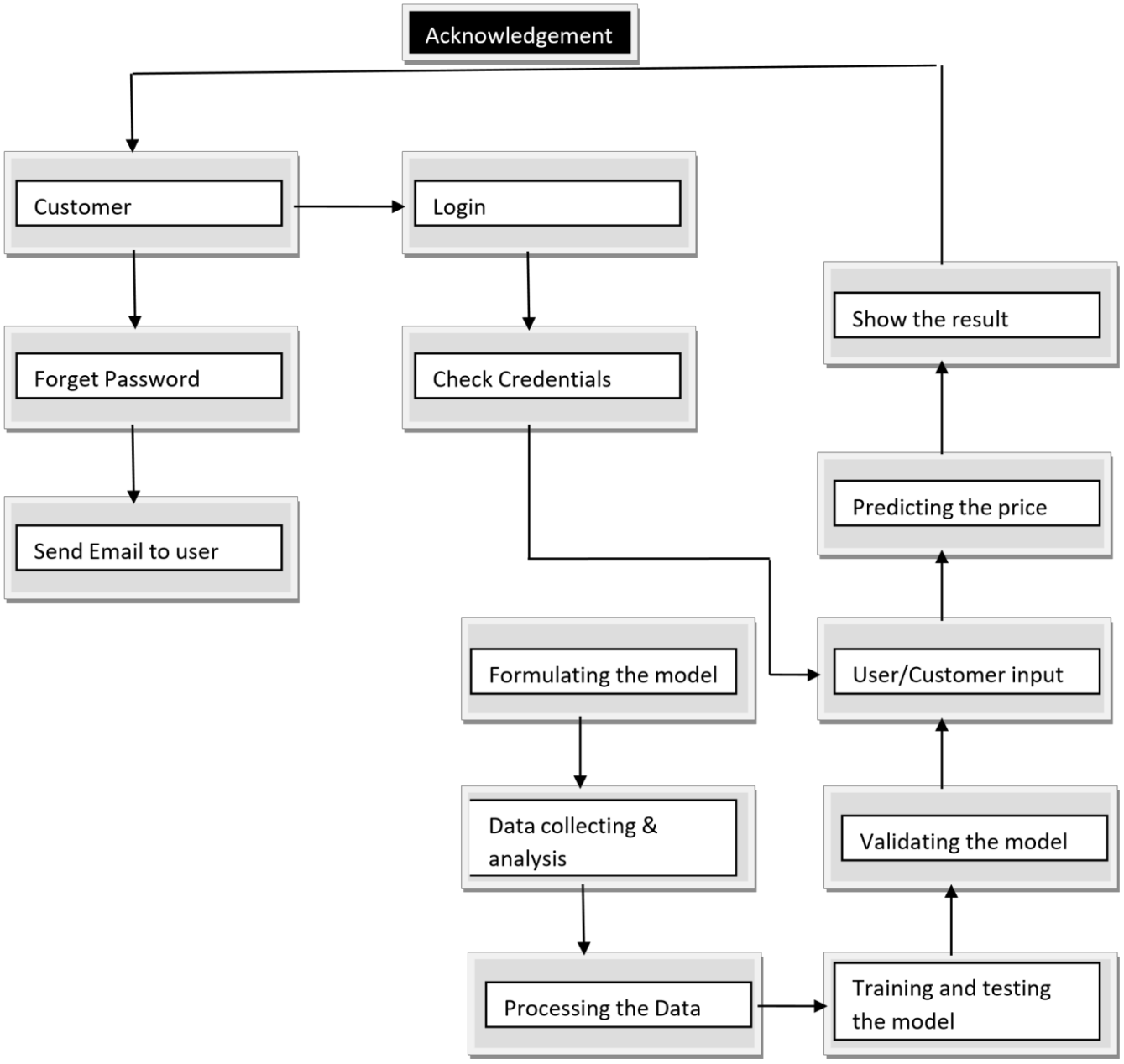
4.2 Non-functional Requirements:

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 time except 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

Project Planning Phase

Project Planning (Product Backlog, Sprint Planning, Stories, Story points)

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 dependent and independent variables	2	High	V.Nithin Bharath Reddy
Sprint-2	Building the model	USN-2	Choosing the appropriate model for building and saving the model as pickle file	1	High	V.Sahith Andey
Sprint-3	Application building	USN-3	Using flask deploying the ML model	2	High	R.Gowtham Reddy P.S.S.Rohit Varma
Sprint-4	Train the model in IBM	USN-4	Finally train the model on IBM cloud and deploy the application	2	Medium	V.Pavan Kumar Varma

Sprint Delivery Plan

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	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 (story points per day)

Actual Velocity = Sprint Duration/Velocity = 15/5 = 3

Burndown Chart:

A burndown 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.

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>
```

```
<!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">
    </body>
        <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>
```

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>
```

```
    <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"/> Not
declared
    <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"/> Not
declared
    <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 Model
Name...</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>
<option value="80">80 </option>
<option value="147">147 </option>
<option value="glk">Glk </option>
<option value="100">100 </option>
<option value="z_reihe">Z Reihe </option>
<option value="sportage">Sportage </option>
<option value="sorento">Sorento </option>
<option value="v40">V40 </option>
<option value="5er">5er </option>
<option value="ibiza">Ibiza </option>
<option value="3er">3er </option>
<option value="mustang">Mustang </option>
<option value="eos">Eos </option>
<option value="touran">Touran </option>
<option value="getz">Getz </option>
<option value="a3">A3 </option>
<option value="almera">Almera </option>
```

```
<option value="7er">7er </option>
<option value="1er">1er </option>
<option value="lupo">Lupo </option>
<option value="r19">R19 </option>
<option value="zafira">Zafira </option>
<option value="caddy">Caddy </option>
<option value="2_reihe">2 Reihe </option>
<option value="mondeo">Mondeo </option>
<option value="cordoba">Cordoba </option>
<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>
<option value="tiguan">Tiguan </option>
<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>
<option value="up">Up </option>
<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>
<option value="159">159 </option>
<option value="transit">Transit </option>
<option value="juke">Juke </option>
<option value="qashqai">Qashqai </option>
<option value="carisma">Carisma </option>
<option value="accord">Accord </option>
<option value="corolla">Corolla </option>
<option value="lanos">Lanos </option>
<option value="phaeton">Phaeton </option>
<option value="boxster">Boxster </option>
<option value="verso">Verso </option>
<option value="swift">Swift </option>
<option value="rav">Rav </option>
<option value="kuga">Kuga </option>
<option value="picanto">Picanto </option>
<option value="kalos">Kalos </option>
<option value="superb">Superb </option>
<option value="stilo">Stilo </option>
<option value="alhambra">Alhambra </option>
<option value="911">911 </option>
<option value="mx_reihe">Mx Reihe </option>
<option value="m_reihe">M Reihe </option>
<option value="roadster">Roadster </option>
<option value="ypsilon">Ypsilon </option>
<option value="cayenne">Cayenne </option>
<option value="galant">Galant </option>
<option value="justy">Justy </option>
<option value="90">90 </option>
<option value="sirion">Sirion </option>
<option value="crossfire">Crossfire </option>
<option value="6_reihe">6 Reihe </option>
<option value="agila">Agila </option>
<option value="duster">Duster </option>
<option value="cr_reihe">Cr Reihe </option>
<option value="v50">V50 </option>
<option value="discovery">Discovery </option>
<option value="c_reihe">C Reihe </option>
<option value="v_klasse">V Klasse </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>
    <option value="ducato">Ducato </option>
    <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="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>
<option value="6_reihe">6 Reihe </option>
<option value="legacy">Legacy </option>
<option value="pajero">Pajero </option>
<option value="auris">Auris </option>
<option value="niva">Niva </option>
<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>
<option value="serie_2">Serie 2 </option>
<option value="6er">6er </option>
<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 Brand
Name...</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>
```

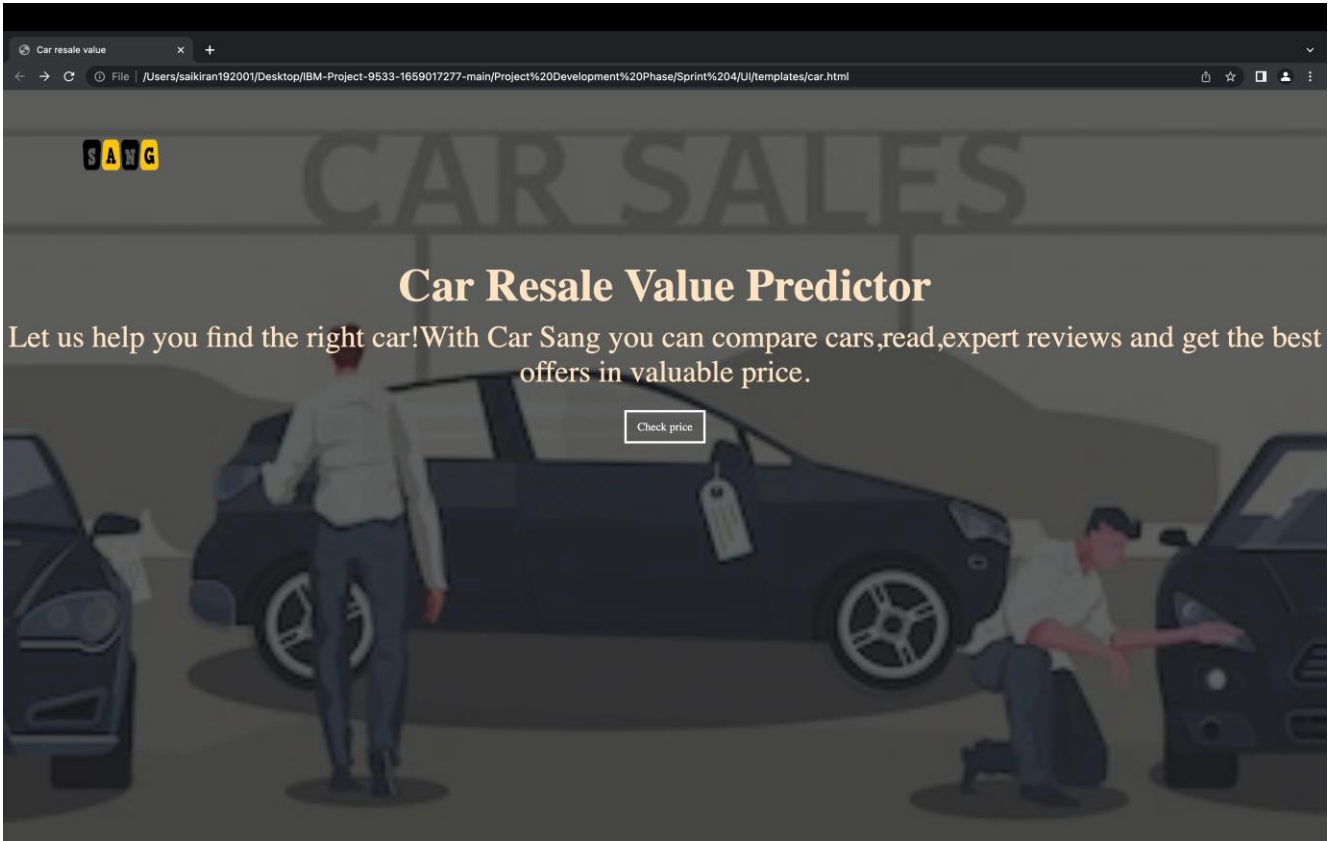
```
    </select>
    <br><br>
    </td>
    </tr>
    <tr>
    <td><label for="fuelType">Fuel Type
    :</label></td>
    <td>
    <select name="fuelType" id="brand">
    <option value="" disabled selected
hidden>Choose FuelType...</option>
    <option value="petrol"> Petrol </option>
    <option value="diesel"> 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>
```

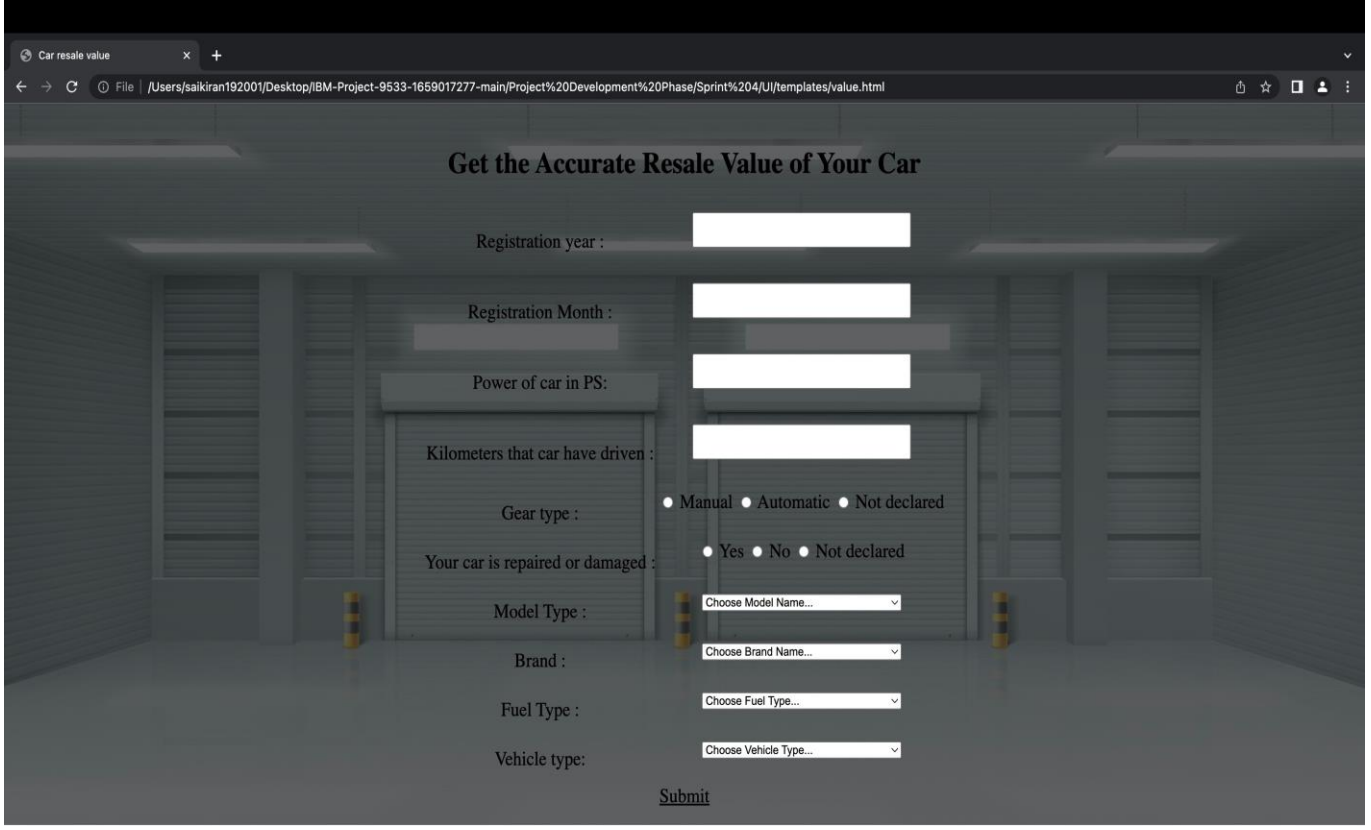
```
    <br>
    <br>
    </td>
    </tr>

    <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>
```

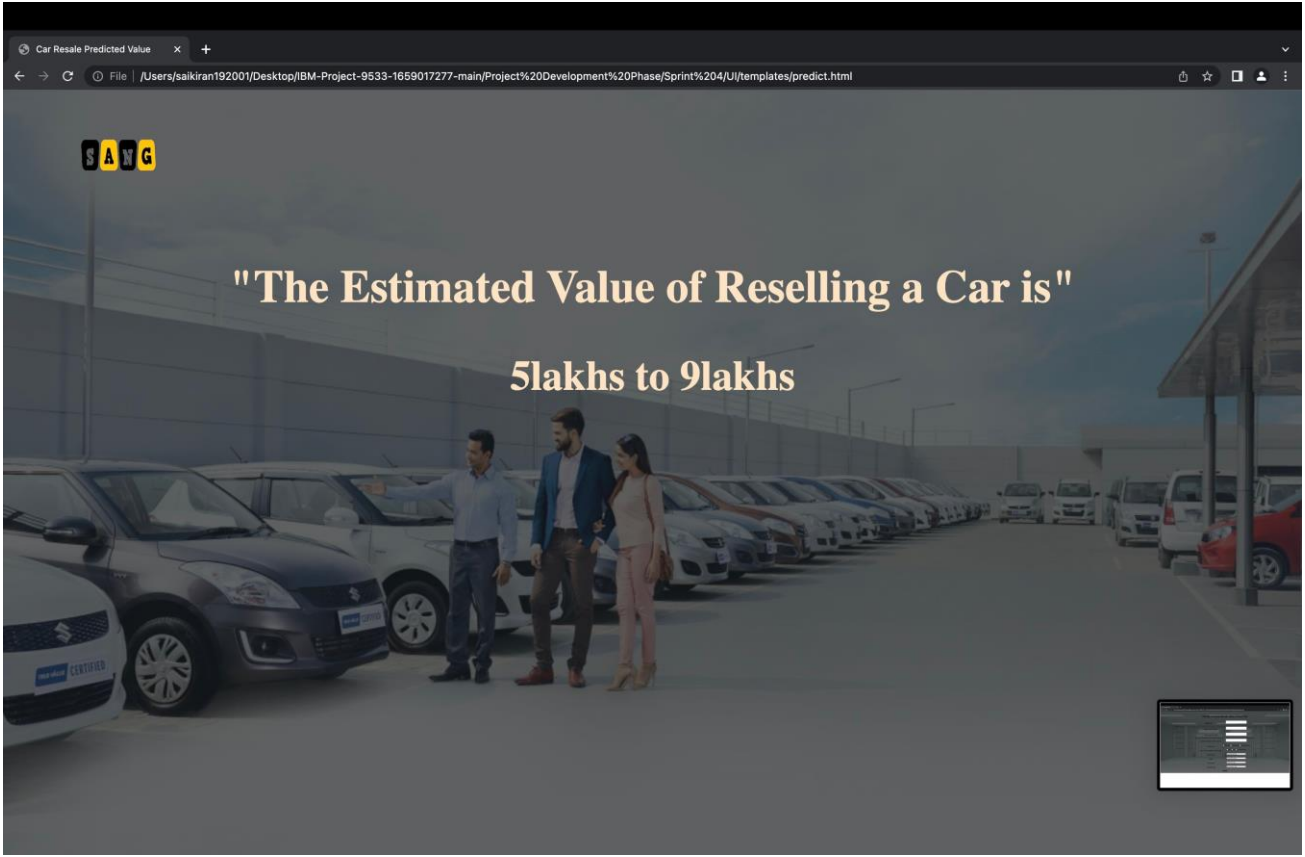
```
    </select>
    <br></br>
    </td></tr>
    </tbody>
    </table>
    <button><a href="predict.html"
    >Submit</a></button>
    </form>
  </section>
</body>
</html>
```

```
# 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)
```


Car resale value
File | /Users/saikiran192001/Desktop/IBM-Project-9533-1659017277-main/Project%20Development%20Phase/Sprint%204/UI/templates/car.html
SANG
CAR SALES
Car Resale Value Predictor
Let us help you find the right car!With Car Sang you can compare cars,read,expert reviews and get the best offers in valuable price.
Check price


Car resale value
File | /Users/saikiran192001/Desktop/IBM-Project-9533-1659017277-main/Project%20Development%20Phase/Sprint%204/UI/templates/value.html
Get the Accurate Resale Value of Your Car
Registration year :
Registration Month :
Power of car in PS:
Kilometers that car have driven :
Gear type :
Manual
Automatic
Not declared
Your car is repaired or damaged :
Yes
No
Not declared
Model Type :
Choose Model Name...
Brand :
Choose Brand Name...
Fuel Type :
Choose Fuel Type...
Vehicle type:
Choose Vehicle Type...
Submit


Car Resale Predicted Value
File
/Users/saikiran192001/Desktop/IBM-Project-9533-1659017277-main/Project%20Development%20Phase/Sprint%204/UI/templates/predict.html
SAWG
"The Estimated Value of Reselling a Car is"
5lakhs to 9lakhs

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.

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 process is 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 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 approximate prediction of the car resale value , our aim 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 the proposed approach.

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.

PROJECT GITHUB LINK

https://github.com/IBM-EPBL/IBM-Project-24667-1659947217