



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

VASIPALLI NITHIN BHARATH REDDY (111719104171)

VENKATA SAHITH ANDEY (111719104177)

REKKALA GOWTHAM REDDY (111719104132)

POTTURI ROHIT VARMA (111719104122)

VEGESNA PAVAN VARMA (111719104175)

CONTENTS

1. INTRODUCTION

- 1.1 Project Overview
- 1.2 Purpose

2. LITERATURE SURVEY

- 2.1 Existing problem
- 2.2 References
- Problem Statement Definition

3. IDEATION & PROPOSED SOLUTION

- 3.1 Empathy Map Canvas
- 3.2 Ideation & Brainstorming
- 3.3 Proposed Solution
- 3.4 Problem Solution fit

4. REQUIREMENT ANALYSIS

- 4.1 Functional requirement
- 4.2 Non-Functional requirements

5. PROJECT DESIGN

- 5.1 Data Flow Diagrams
- 5.2 Solution & Technical Architecture
- 5.3 User Stories

6. PROJECT PLANNING & SCHEDULING

- 6.1 Sprint Planning & Estimation
- 6.2 Sprint Delivery Schedule
- 6.3 Reports from JIRA

7. CODING & SOLUTIONING

- 7.1 Feature 1
- 7.2 Feature 2
- 7.3 Database Schema(if Applicable)

8. TESTING

- 8.1 Test Cases
- 8.2 User Acceptance Testing

9. RESULTS

- Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURESCOPE

13. APPENDIX

1. INTRODUCTION

1.1 ProjectOverview

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 its 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 cars will increase. In many developed countries, it is common to lease a car rather than buying it outright. After the lease period is over, the buyer has the possibility to buy the car at its residual value, i.e. its expected resale value. Thus, it is of commercial interest to sellers/financers to be able to predict the salvage value 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.

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 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 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 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 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. More vehicles have been traded through this framework so this specific framework is all the more effectively oversaw.

LITERATURE REVIEWS

1. CAR RESALE VALUE PREDICTION USING MACHINE LEARNING BY

- **Prashant Gajera**
- **Akshay Gondaliya**
- **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.

1.LINEARREGRESSIONFORCARSALESPREDICTIONININDIANAUTOMOBILEINDUSTRYBY

- > **RohanKulkarni**
- > **AnujaBokhare**

SUPPORTVECTORREGRESSIONANALYSISFORPRICEPREDICTIONBYMarianaListiani

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 difficult. 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.

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.

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.

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 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:

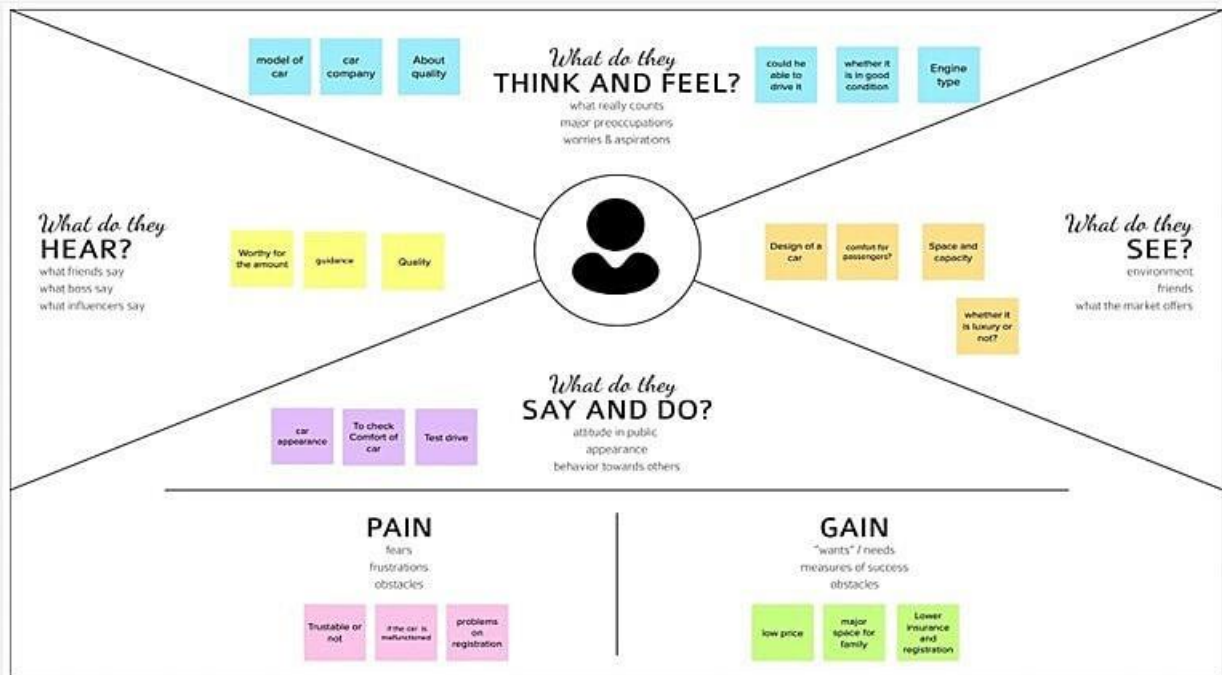
Empathy Map:- An empathy map is a collaborative visualization used to articulate what we know about a particular type of user.

Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1

Build empathy and keep your focus on the user by putting yourself in their shoes.



3.2 Ideation and Brainstorming



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](#) →



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



Key rules of brainstorming

To run a 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 don't need a sticky note and for the period, switch to whiteboard to start drawing!

NITHIN REDDY

1. Create a user profile for each user type.
2. Create a user journey map for each user type.
3. Create a user story for each user type.
4. Create a user persona for each user type.
5. Create a user avatar for each user type.

SAHITH ANGEY

1. Create a user profile for each user type.
2. Create a user journey map for each user type.
3. Create a user story for each user type.
4. Create a user persona for each user type.
5. Create a user avatar for each user type.

GOWTHAM REDDY

1. Create a user profile for each user type.
2. Create a user journey map for each user type.
3. Create a user story for each user type.
4. Create a user persona for each user type.
5. Create a user avatar for each user type.

RIVAN VARMA

1. Create a user profile for each user type.
2. Create a user journey map for each user type.
3. Create a user story for each user type.
4. Create a user persona for each user type.
5. Create a user avatar for each user type.

BOHET VARMA

1. Create a user profile for each user type.
2. Create a user journey map for each user type.
3. Create a user story for each user type.
4. Create a user persona for each user type.
5. Create a user avatar for each user type.

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 can break it up into smaller sub-groups.

⌚ 20 minutes

TIP

After brainstorming, try to write down the ideas to make it easier to find, organize, and categorize important ideas as themes within your mind.



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)	<p>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</p> <ol style="list-style-type: none">1. Fuel Type2. Manufacturing year3. Kilometers Driven4. Number of Previous Owners5. Maintenance Record
2.	Idea / Solution description	<p>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.</p> <p>Another goal of the project is to</p>

		<p>explore new methods to evaluate used cars prices and to compare their accuracies.</p>
--	--	--

3.	Novelty / Uniqueness	<p>As there are so many ongoing experiments that use statistical approaches and some traditional methods to focus on predicting item sales.</p> <p>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,</p>
----	----------------------	---

4.	Social Impact / Customer Satisfaction	<p>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 (R^2) 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.</p>
5.	Business Model (Revenue Model)	<p>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.</p>

6.	Scalability of the Solution	<p>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.</p> <p>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.</p> <p>Pair plots and scatter plots help visualize the outliers</p>
----	-----------------------------	--

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.
	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 like cars24 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 <ul style="list-style-type: none"> 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	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. Buying 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. 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		

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:

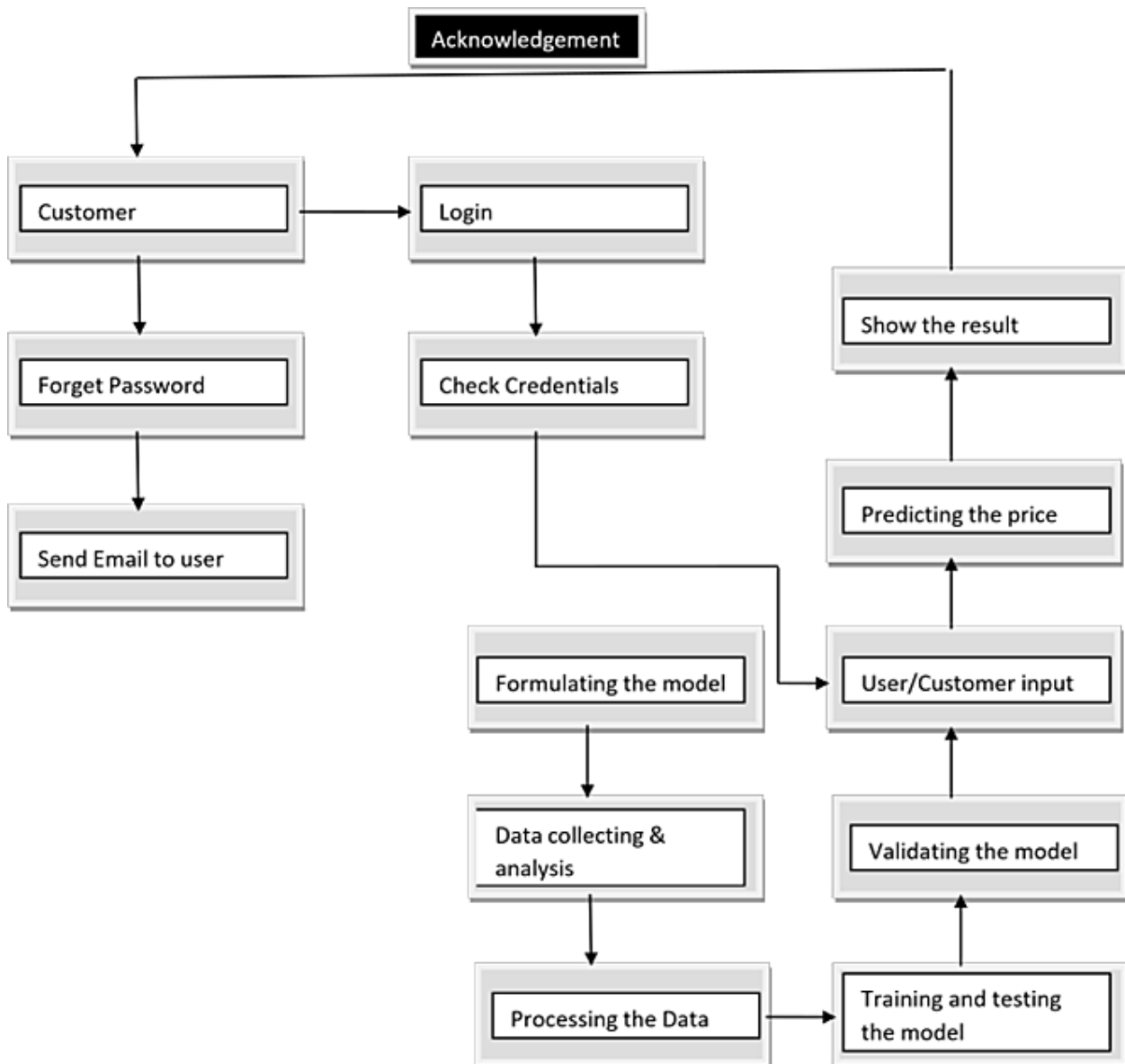
Following are the non-functional requirements of the proposed solution.

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

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 & gathering information 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, business model, social impact, scalability of solution, etc.	06 SEPTEMBER 2022.
Problem Solution Fit.	Prepare problem - solution fit document.	02 SEPTEMBER 2022.
Solution Architecture.	Prepare solution architecture document.	01 OCTOBER 2022.
Customer Journey.	Prepare the customer journey maps to understand the user interactions & experiences with the application.	14 OCTOBER 2022.
Data Flow Diagrams Draw the data flow.	Data Flow Diagrams, draw the data 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,

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points
Sprint-1	Dataset reading and Pre-processing	USN-1	Cleaning the dataset and splitting to dependent and independent variables	2
Sprint-2	Building the model	USN-2	Choosing the appropriate model for building and saving the model as pickle file	1
Sprint-3	Application building	USN-3	Using flask deploying the ML model	2
Sprint-4	Train the model in IBM	USN-4	Finally train the model on IBM cloud and deploy the application	2

Story points)

Product Backlog, Sprint Schedule, and Estimation

Use the below template to create product backlog and sprint schedule

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 (Planned End)
Sprint-1	15	5 Days	25 Oct 2022	29 Oct 2022	15
Sprint-2	15	5 Days	31 Oct 2022	05 Nov 2022	15
Sprint-3	15	5 Days	07 Nov 2022	12 Nov 2022	15
Sprint-4	15	5 Days	14 Nov 2022	19 Nov 2022	15

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)

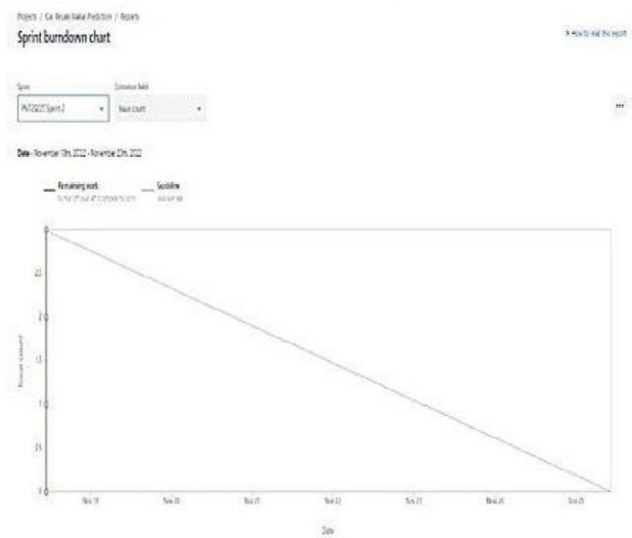
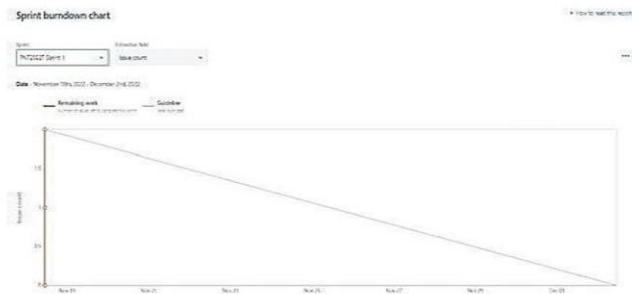
$$\text{Actual Velocity} = \text{Sprint Duration} / \text{Velocity} = 15/5 = 3$$

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.



Report from JIRA:
Burndown Chart:

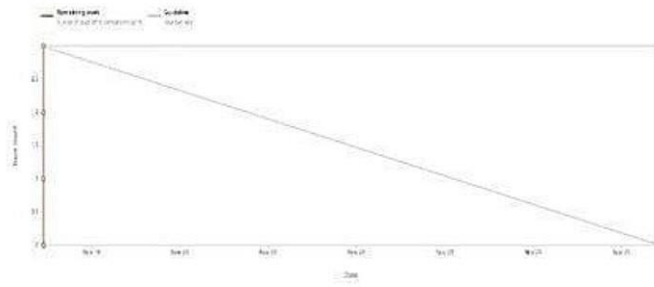


Sprint burndown chart

Project: [Project Name]

Sprint: SPRINT 1 (4 weeks)
 Sprint start: 2023-10-01

Date: November 1st 2023 - November 2nd 2023

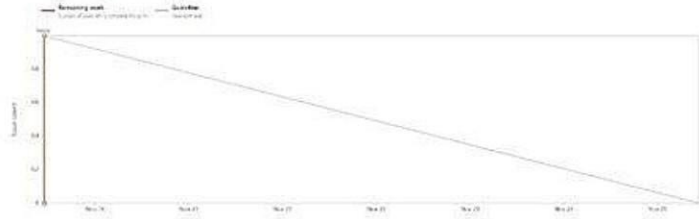


Sprint burndown chart

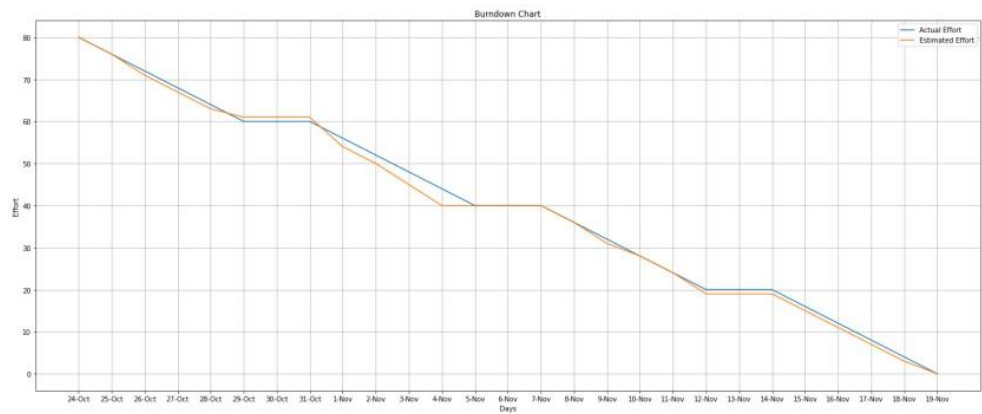
Project: [Project Name]

Sprint: SPRINT 2 (4 weeks)
 Sprint start: 2023-10-01

Date: November 1st 2023 - November 2nd 2023



6.4 Burndown Chart



6.5 Reports from JIRA

	OCT						NOV						NOV						NOV						NOV							
	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Sprints	CRVP Sprint 1						CRVP Sprint 2						CRVP Sprint 3						CRVP Sprint 4													
CRVP-1 Home Page																																
CRVP-2 Data Entry																																
CRVP-3 Car Resale Value Display																																
CRVP-4 Resale Value Prediction																																

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/fontawesome/4.7.0/css/font-awesome.min.css">
  </head>
  <body>
    <section class="header">
      <nav>
        <a href="/"></a>

      </nav>
      <div class="text-box">
        <h1>Car resale value Predictor</h1>
        <p>Best system to predict the amount of resale value based 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>
r>
    <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>
r>
    <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="/"></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>
      </select>
    </td>
  </tr>

```

<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> value="1_reihe">1 Reihe
        </option> value="avensis">Avensis
        </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>
    value="range_rover_evoque">Range Rover Evoque </
option>
    value="sanderro">Sanderro </option>
    value="note">Note </option>
    value="900">900 </option>
    value="147">147 </option>
    value="defender">Defender </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>
    value="i3">I3 </option> value="kappa">Kappa
    </option> value="serie_3">Serie 3 </option>
    value="48429">48429 </option>
    value="serie_1">Serie 1 </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> value="saab">Saab
    </option> value="chrysler">Chrysler </option>
    value="jaguar">Jaguar </option>
    value="daewoo">Daewoo </option> value="rover">Rover
    </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 Fuel
Type...</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
Vehicle Type...</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'))

@a
pp.r
out
e('/
')
def
ind
ex()
:#m
ain
pa
ge
return render_template('car.html')

@app.route('/pr
edict_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('geart
    ype') damage =
    request.args.get('dama
    ge') model =
    request.args.get('mode
    l') brand =
    request.args.get('brand
    ') fuel_type =
    request.args.get('fuelT
    ype') veh_type =
    request.args.get('vehic
    letype')

    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_labels', 'notRepairedDamage_labels',  
'model_labels','brand_labels', 'fuelType_labels', 'vehicletype_labels']], "values": X}]}
```

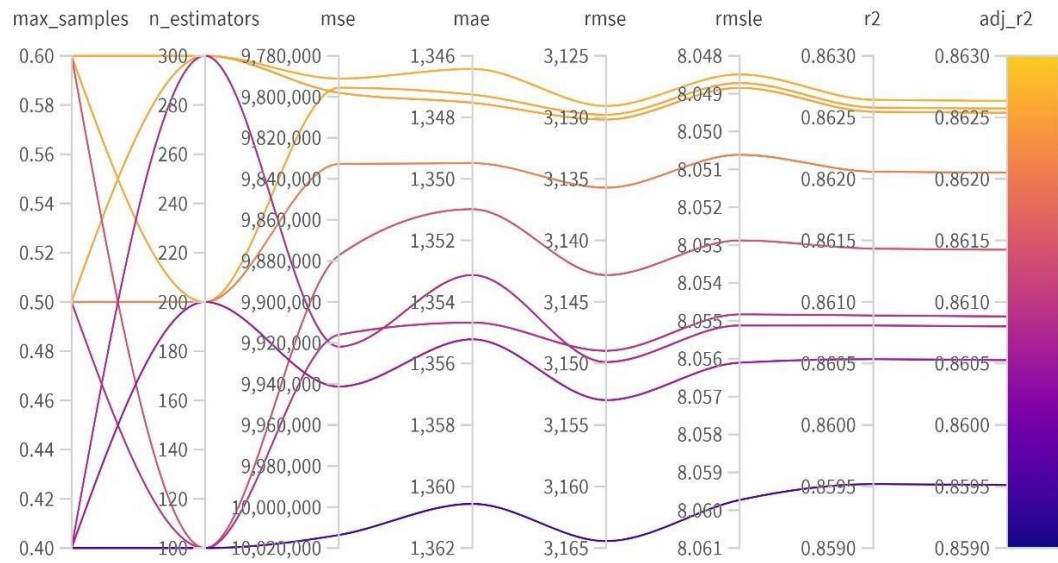
```
response_scoring = requests.post('https://us-  
south.ml.cloud.ibm.com/ml/v4/deployments/7f67cbcd-6222-413b-9901 -  
b2a72807ac82/predictions?version=2022-10-30', json=payload_scoring,  
headers={'Authorization': 'Bearer ' + ml_token}) predictions = response_scoring.json()  
print(response_scoring.json()) predict = predictions['predictions'][0]['values'][0][0]  
print("Final prediction :",predict)
```

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

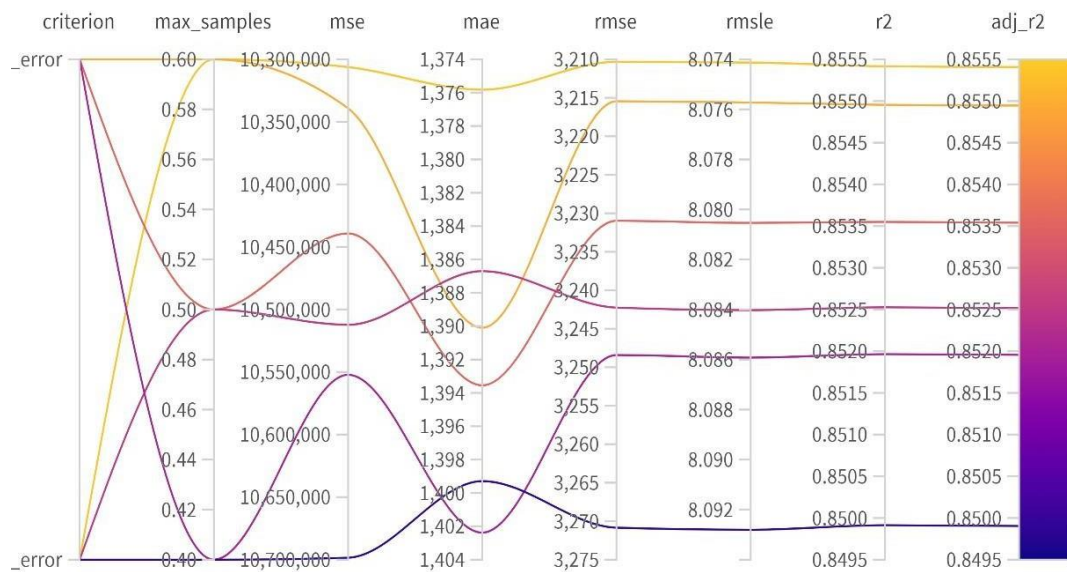
```
if __name__ == '__main__':  
    reg_model = load_model()#load the saved model  
    app.run(host='localhost', debug=True, threaded=False)
```

Output:

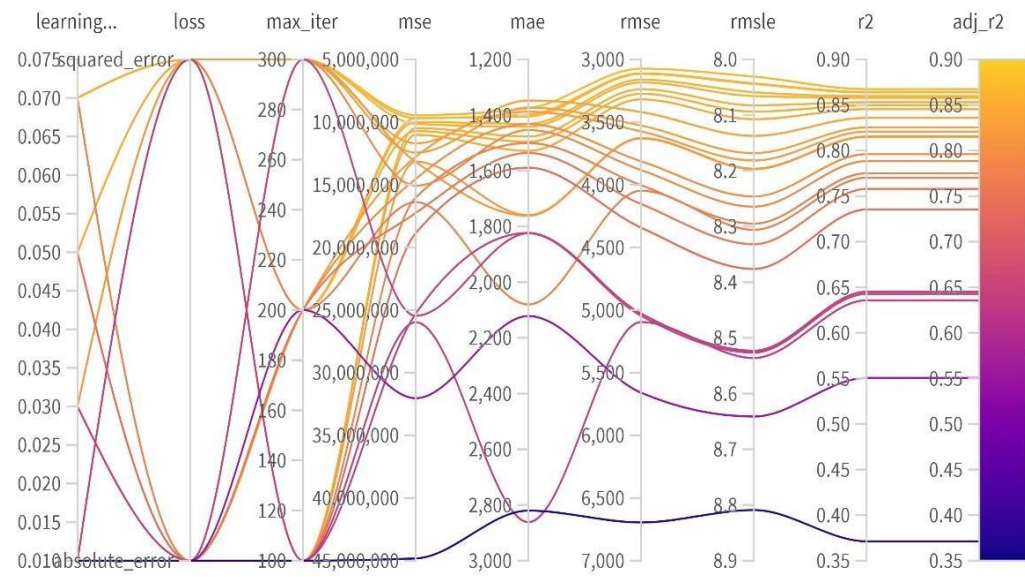
1) Bagging Regressor



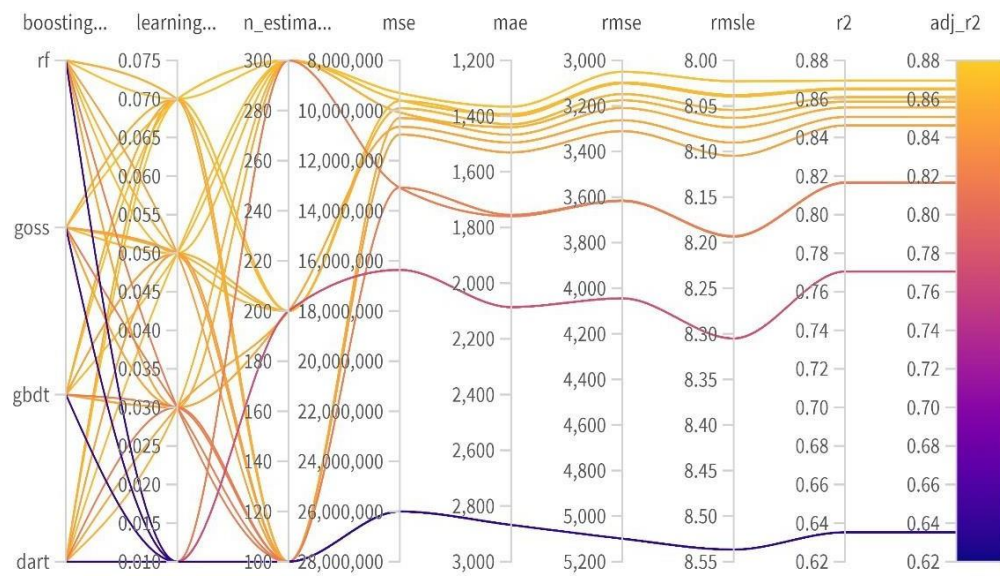
2) Extra Tree Regressor



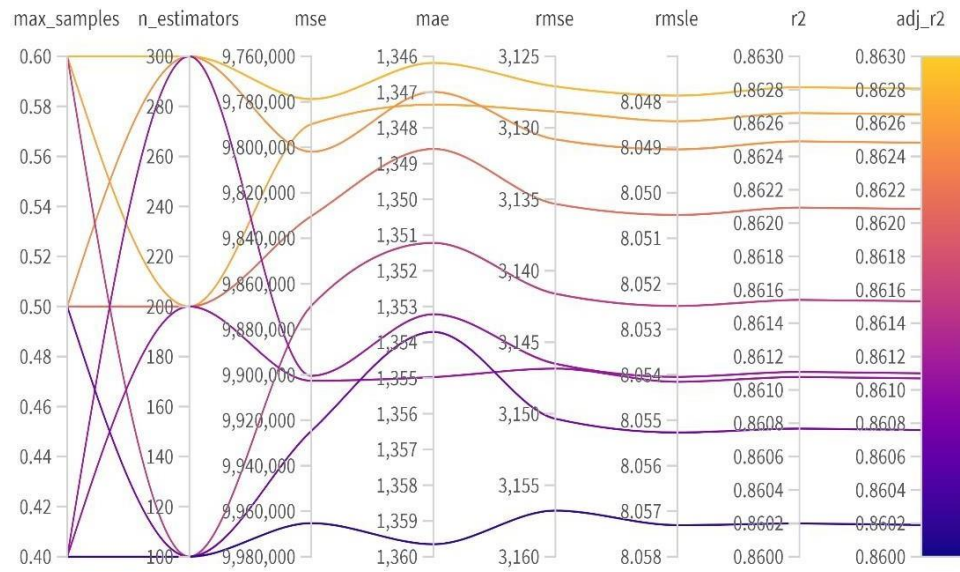
3) HOG Boosting Regressor



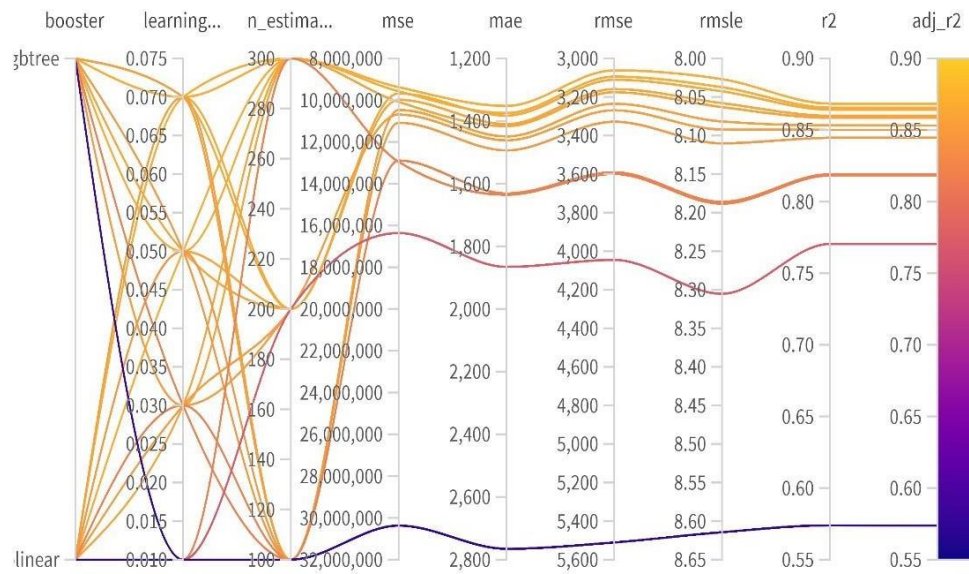
4) LGBM Regressor



5) Random Forest Regressor



6) XGB Regressor



8. TESTING

8.1 TEST CASES

Sprint-1

MODEL USED = RANDOM FOREST REGRESSION MODEL

MAE (MEAN ABSOLUTE ERROR) – 1655.53

```
from sklearn.metrics import mean_absolute_error  
  
print(mean_absolute_error(Y_test, y_pred))
```

1655.534681561534

MSE (MEAN SQUARED ERROR) –11832644.33

```
from sklearn.metrics import mean_squared_error  
  
print(mean_squared_error(Y_test, y_pred))
```

11832644.335139675

RMSE (ROOT MEAN SQUARED ERROR) –3439.86

```
from sklearn.metrics import mean_squared_error  
  
root_mean_squared_error = mean_squared_error(Y_test, y_pred, squared=False)  
print(root_mean_squared_error)
```

3439.861092419238

R2 SCORE – 0.82

```
from sklearn.metrics import r2_score  
  
print(r2_score(Y_test, y_pred))
```

0.8191322832483275

Sprint-2

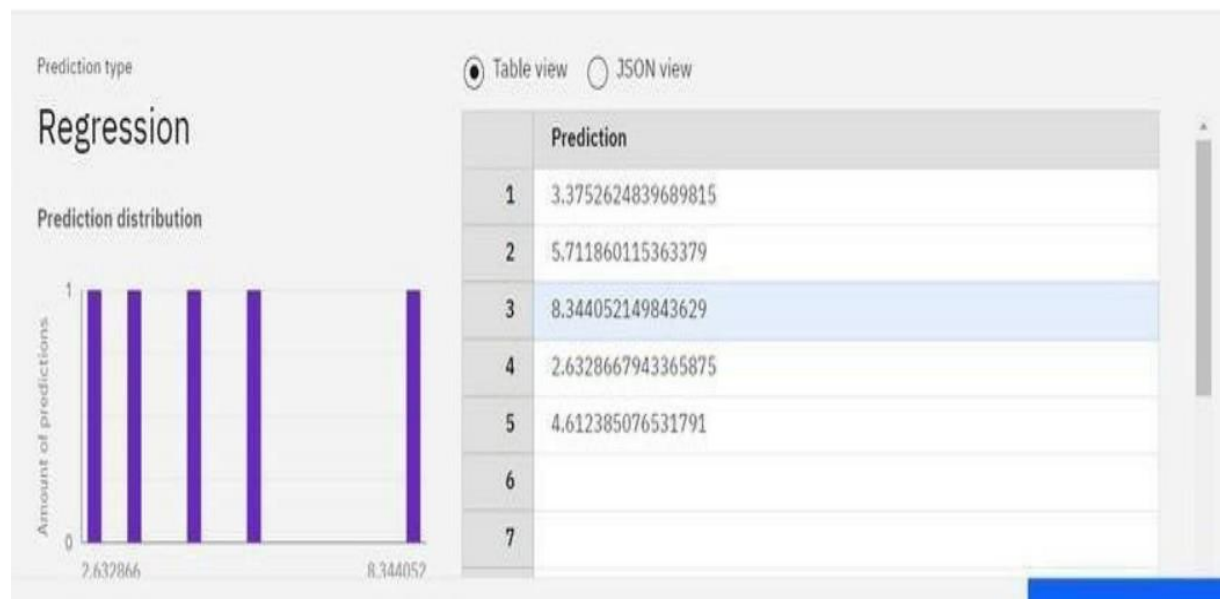
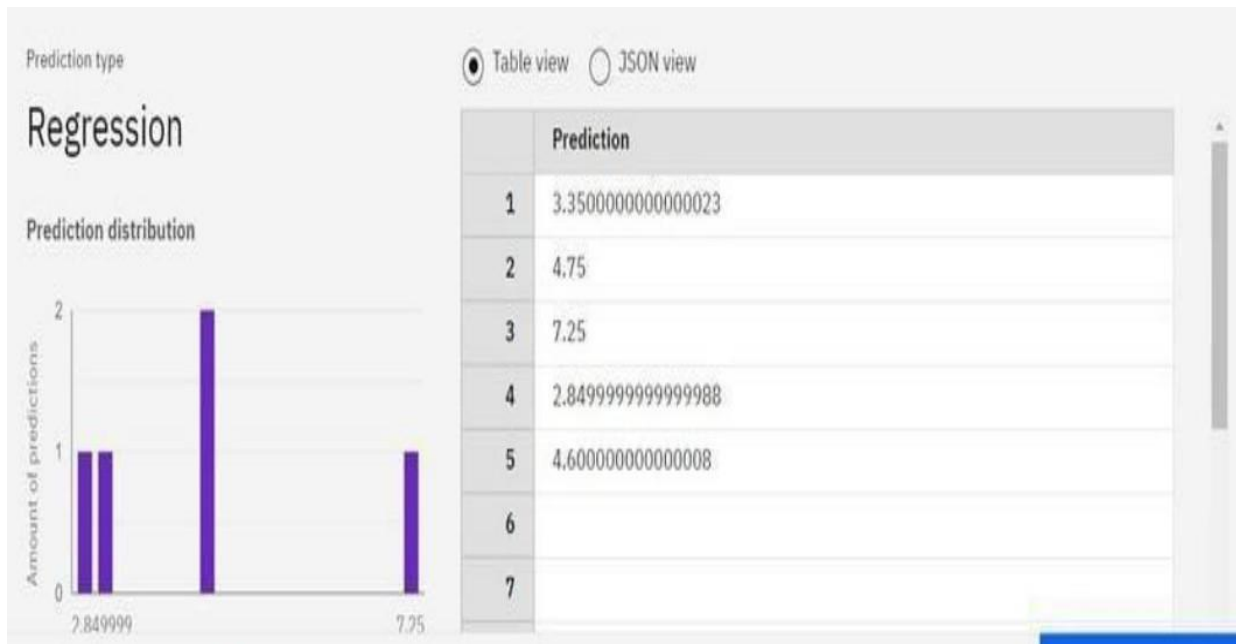
Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Executed By
Register_Page_01	UI	Landing Page	The Landing page must be responsive and the user must be redirected to register page since get started is clicked	1) Enter the URL, and go 2) Click get started	https://www.dreamcatcherweb.com/register.html#test	The page should load and once the user clicks get started this user must be redirected to register page.	Worked as expected	Pass	Ashish
Register_Page_02	UI	Register Page	The Register page must allow the user to register to the website	1) Enter the URL, and go 2) Click get started 3) Fill your credentials 4) Click register	https://www.dreamcatcherweb.com/register.html#test	The page should render form field boxes to fill name, email and password and the user should able to click on click register	Worked as expected	Pass	Dharmendra
Register_Page_03	Functional	Register Page	The Register page should register the user to backend service	1) Enter the URL, and go 2) Navigate to register page 3) Fill credentials and click register	https://www.dreamcatcherweb.com/register.html#test	The page should add a user to backend authentication service	Worked as expected	Pass	Dharmendra

Sprint-3

Test case ID	Feature Type	Component	Test Scenario's	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Executed By
Login_Page_01	UI	Login Page	The login page must load properly and be responsive	1) Visit the URL and go 2) Click get started button in the landing page 3) Navigate to the login tab	https://www.ck12.org/ask/ask-teacher-test/ https://www.ck12.org/ask/ask-teacher-test/	The user should be able to visit the login tab in the registration page	Worked as expected	Pass	Chakraborty
Login_Page_02	Functional	Login Page	Verify the user to login and continue to the application dashboard page when the user logs in first time	1) Visit the URL and go 2) Register by providing credentials 3) Navigate to login page 4) Fill credentials and login	https://www.ck12.org/ask/ask-teacher-test/ https://www.ck12.org/ask/ask-teacher-test/ https://www.ck12.org/ask/ask-teacher-test/	The user should receive a mail asking to confirm their registration and then should be able to login to the application dashboard	Worked as expected	Pass	Akash
Login_Page_03	UI	Dashboard Page	The dashboard page must load and provide options for making a new prediction, logging out and display cards of previous predictions	1) Visit the URL and go 2) Login using credentials 3) View your previous predictions	https://www.ck12.org/ask/ask-teacher-test/ https://www.ck12.org/ask/ask-teacher-test/ https://www.ck12.org/ask/ask-teacher-test/	The user should be navigated to the dashboard page and must be able to see buttons for viewing previous predictions, logging out and making new predictions	Worked as expected	Pass	Ganapathy

Sprint-4

[illegible]



User Acceptance Testing

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
HomePage_TC_001	UI	Home Page	Verify all the UI elements in Home page rendered properly		1.Enter URL and click go 2.Verify all the UI elements displayed or not.	-	All the UI elements rendered properly	Working as expected	Pass		N		Harish M.
HomePage_TC_002	Functional	Home Page	Verify the Data Entry page can be reachable.		1.Enter URL and click go 2.Verify all the UI elements displayed or not. 3.Press the Check Price button.	-	User should navigate to Data Entry Page	Working as expected	Pass		N		Rajesh T R.
DataEntryPage_TC_001	UI	Data Entry Page	Verify all the UI elements in Data Entry page rendered properly		1.Enter URL and click go 2.Verify all the UI elements displayed or not. 3.Press the Check Price button in the home page 4. Verify all the UI elements displayed or not.	-	All the UI elements rendered properly	Working as expected	Pass		N		Vengatesan D.
DataEntryPage_TC_002	Functional	Data Entry Page	Verify user is able to enter all values		1.Enter URL and click go 2.Verify all the UI elements displayed or not. 3.Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered	7012 12 22 Manual Yes Golf Volkswagen Petrol Coupe	User should be able to enter all values in data entry page	Working as expected	Pass		N		Sam Sundar Z.
DataEntryPage_TC_003	Functional	Data Entry Page	Verify the Output Display page can be reachable.		1.Enter URL and click go 2.Verify all the UI elements displayed or not. 3.Press the Check Price button in the home page 4. Verify all the UI elements displayed or not. 5. Verify if all values can be entered 6. Press the submit Button	-	User should navigate to Output Display Page	Working as expected	Pass		N		Rajesh T R.
OutputDisplayPage_TC_001	UI	Output Display Page	Verify all the UI elements in Output Display page rendered properly		1.Enter URL and click go 2.Verify all the UI elements displayed or not. 3.Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered 6. Press the submit Button 7. Verify all the UI elements displayed or not.	-	All the UI elements rendered properly	Working as expected	Pass		N		Harish M.
OutputDisplayPage_TC_002	Functional	Output Display Page	Verify user is able to get predicted result		1.Enter URL and click go 2.Verify all the UI elements displayed or not. 3.Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered 6. Press the submit Button 7. Verify all the UI elements displayed or not 8. Verify if the predicted value is displayed or not	-	Predicted Car Rental Value is displayed on the page	Working as expected	Pass		N		Vengatesan D.

Defect Analysis

This report shows the number of resolved or closed bugs at each severity level,and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	2	3	1	1	7
Duplicate	1	0	3	0	4
External	2	0	0	1	3
Fixed	2	2	1	2	7
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	2	2	1	5
Totals	7	7	9	6	29

Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Home Page	5	0	0	5
Data Entry Page	15	0	0	15
Output Page	4	0	0	4
Hyper Parameter Tuning	3	0	0	3
Final Model Building	2	0	0	2
Flask Application	10	0	0	10
Train Model on IBM	3	0	0	3
Final Report Output	4	0	0	4

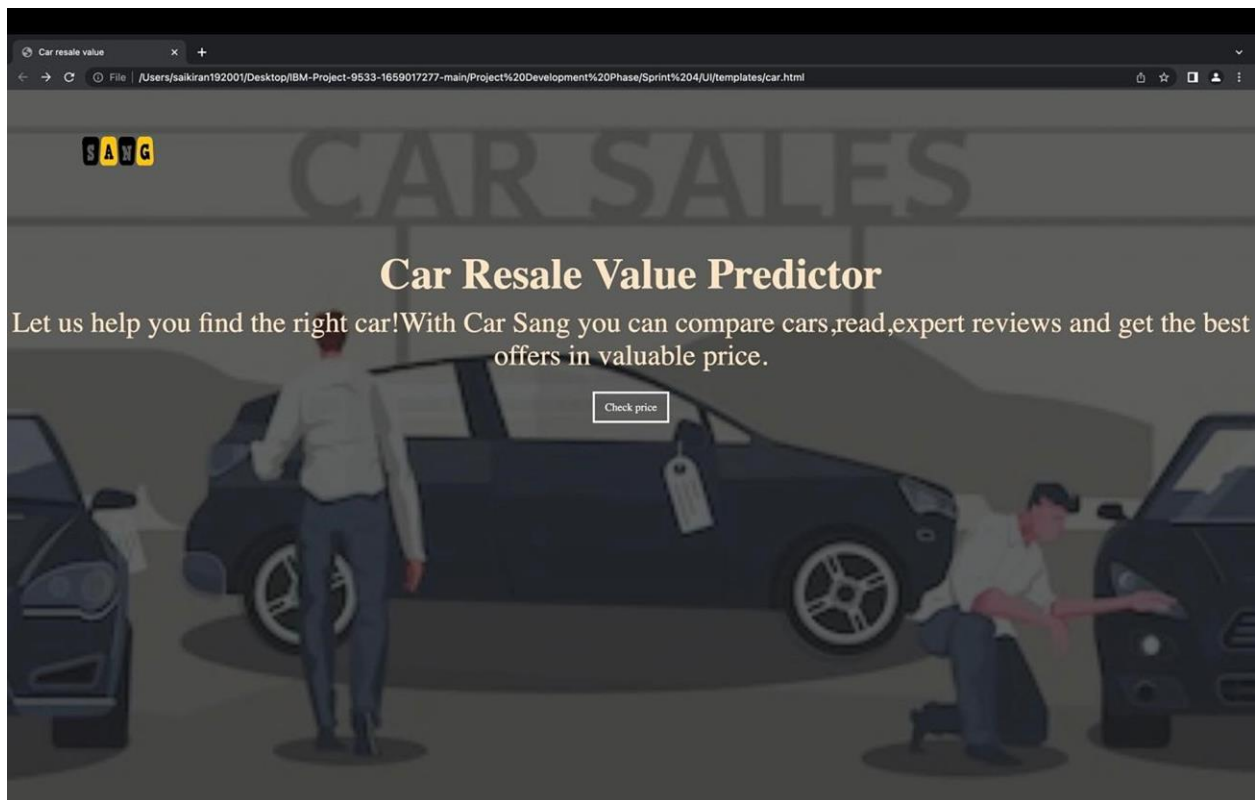
Project Development Phase
Model Performance Test

Date	10 November 2022
Team ID	PNT2022TMID15891
Project Name	Project – Car Resale Value
Maximum Marks	10 Marks

Model Performance Testing:

Project team shall fill the following information in model performance testing template.

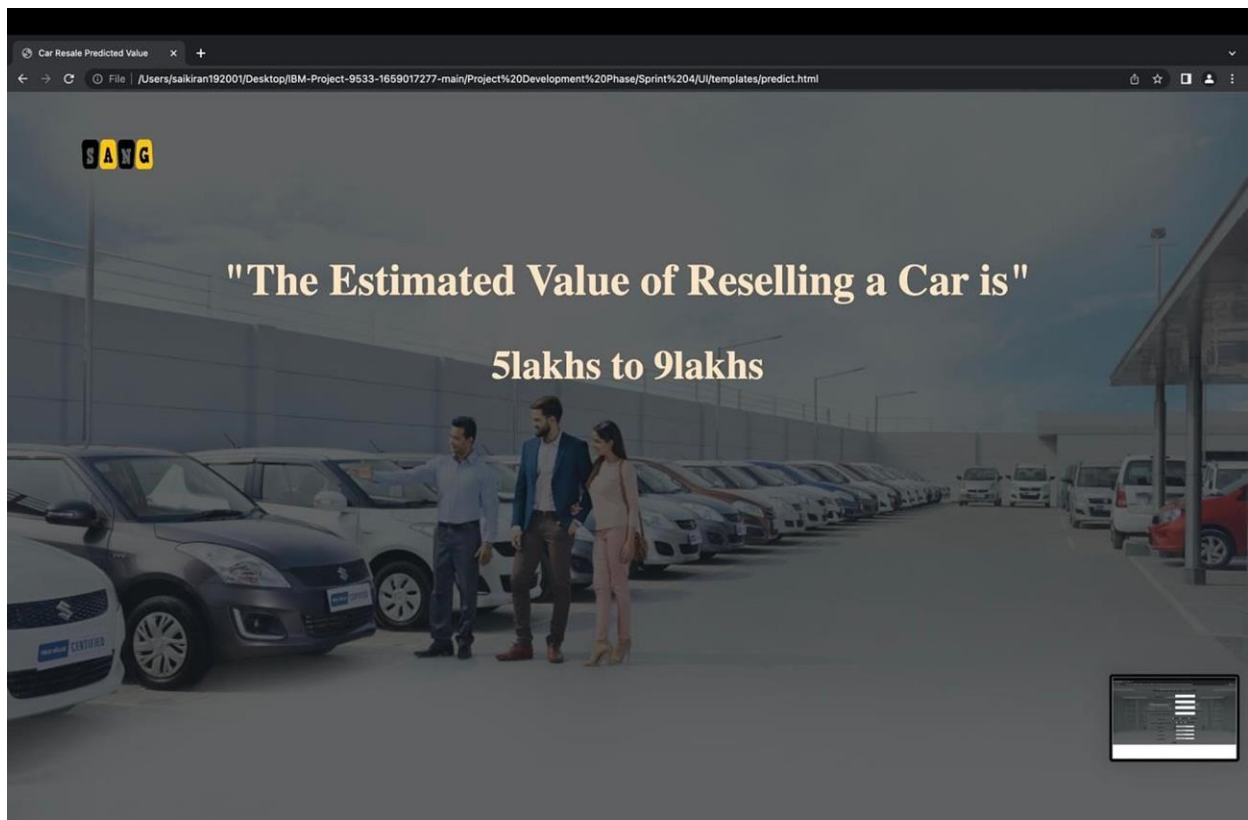
S.No.	Parameter	Values	Screenshot
1.	Metrics	Regression Model: LGBM Regressor MAE – 1327.55 MSE -9492244.28 RMSE -3080.95 RMSLE: 8.03 R2 score -0.8668 Adjusted R2 Score:0.8668	
2.	Tune the Model	Hyperparameter Tuning – 1) Learning Rate: [0.01, 0.03, 0.05, 0.07] 2) Boosting Type: ['gbdt','dart','goss','rf'] 3) Number of Estimators: [100,200,300] Validation Method - Grid Search Cross Validation Best Parameters: Learning Rate – 0.07 Boosting Type – ‘gbdt’ Number of Estimators - 300	



The screenshot shows a web browser window with the address bar displaying the file path: `File | /Users/saikiran192001/Desktop/IBM-Project-9533-1659017277-main/Project%20Development%20Phase/Sprint%204/UI/templates/value.html`. The page has a dark background with a stylized illustration of a car dealership. The main heading is 'Get the Accurate Resale Value of Your Car'. Below the heading, there is a form with the following fields and options:

- 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 :
- Brand :
- Fuel Type :
- Vehicle type:

A 'Submit' button is located at the bottom center of the form.



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 car parts.

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 DEMO LINK

<https://drive.google.com/file/d/1OeMI7gxGj5tbTaabAh-SqzbjiBweO1VA/view?usp=drivesdk>

PROJECT GITHUB LINK

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