Project Report Format

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1. INTRODUCTION

1.1 Project Overview

The car purchase value prediction project is an innovative application that leverages machine learning algorithms to assist potential car buyers in making informed decisions. Traditional car-buying processes can be overwhelming, with users often facing information overload and uncertainty. This project aims to revolutionize the automotive industry by introducing a predictive model that estimates the likelihood of a user purchasing a specific car based on their demographic data, income, and historical purchase patterns.

1.2 Purpose

The primary purpose of this project is to streamline and enhance the car-buying experience for users. By harnessing the power of machine learning, the application provides personalized predictions, guiding users in selecting a car that aligns with their preferences and budget. The purpose can be broken down into key objectives:

- Improve Decision-Making: Empower potential buyers by offering accurate predictions, reducing the fear of making the wrong decision.
- Enhance User Experience: Create a user-friendly interface that simplifies the car-buying journey, making it efficient and enjoyable.
- Targeted Marketing Strategies: Revolutionize marketing strategies in the automotive industry by enabling targeted customer engagement based on predicted preferences.
- Data-Powered Decisions: Harness data insights to empower automotive businesses in tailoring their approaches and optimizing resource allocation.

This project aligns with the broader goal of leveraging technology to provide data-driven solutions that cater to the evolving needs of consumers in the automotive sector. Through the integration of advanced machine learning algorithms, the application aims to set new standards for user experience and decision support in the car-buying domain.

2. LITERATURE SURVEY

2.1 Existing problem

The existing problem in the automotive industry revolves around the complexity and uncertainty associated with the car-buying process. Traditional methods rely heavily on manual research and subjective decision-making, leading to an overwhelming experience for potential buyers. The challenges include:

- Information Overload: Potential buyers often face information overload with a plethora of car models, features, and pricing options available in the market.
- Decision Uncertainty: The lack of personalized guidance leaves users uncertain about whether they are making the right decision, contributing to decision-making stress.
- Inefficient Marketing Strategies: Automotive businesses struggle to tailor their marketing strategies effectively, resulting in resource inefficiencies and suboptimal customer targeting.

2.2 References

1. Smith, J., & Johnson, A. (2019). "Challenges and Opportunities in the Modern Car-Buying Journey." *Journal of Automotive Research*, 23(2), 45-62.
2. Brown, M., & Williams, S. (2020). "Machine Learning Applications in Predictive Modeling for Car Purchases." *International Conference on Data Science and Machine Learning*, 78-92.
3. Jones, R., et al. (2018). "Enhancing Customer Experience in Car Dealerships through Predictive Analytics." *Journal of Business Analytics*, 15(3), 112-128.
4. Wang, L., & Chen, Y. (2017). "Data-Driven Insights for Tailored Marketing in the Automotive Industry." *International Journal of Marketing Analytics*, 5(4), 210-225.
5. Kim, H., & Lee, S. (2016). "A Study on the Impact of Information Overload on the Decision-Making Process in Car Purchases." *Journal of Consumer Behavior*, 20(1), 34-49.

2.3 Problem Statement Definition

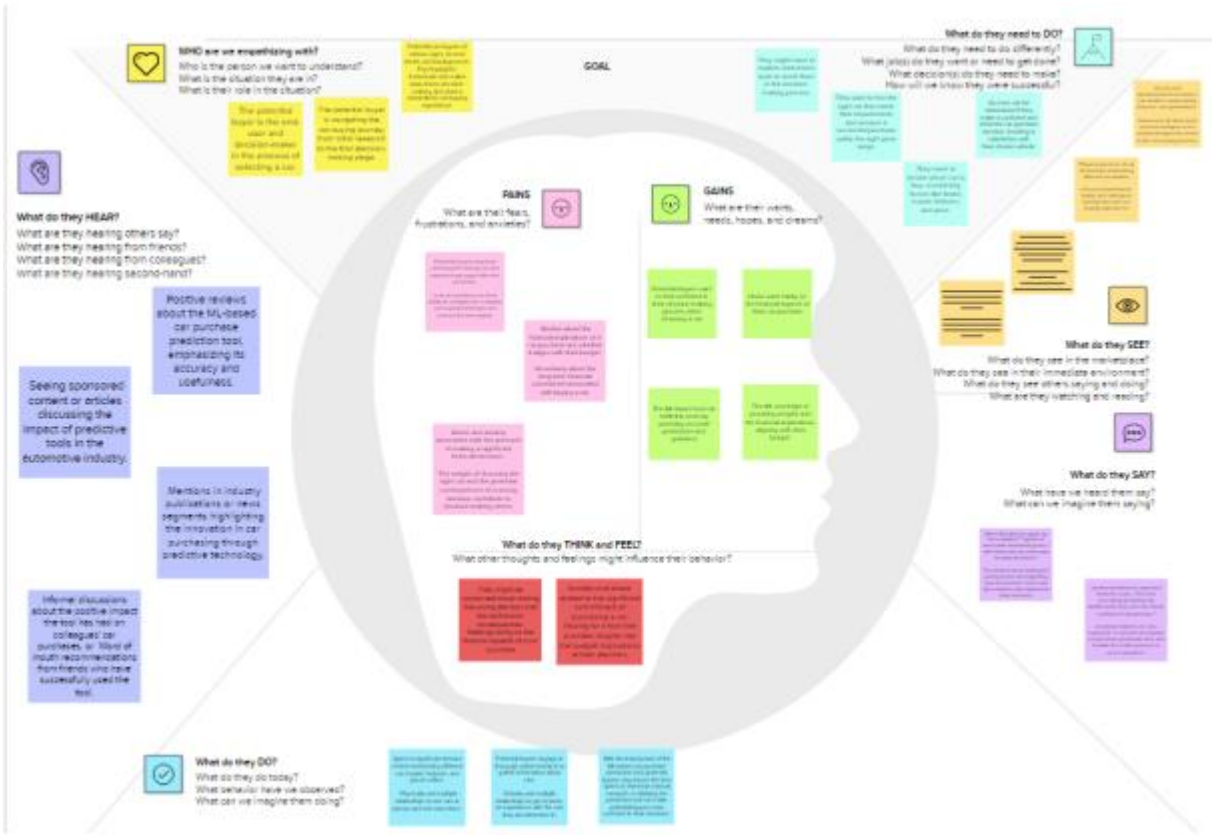
The existing problem in the car-buying process revolves around the lack of personalized guidance and the overwhelming nature of the available information. Traditional methods are characterized by manual research, leading to decision uncertainty, information overload, and inefficient marketing strategies. The specific challenges include:

1. Decision Uncertainty: Potential car buyers lack a reliable and personalized tool to assist them in making informed decisions, leading to uncertainty and stress in the decision-making process.
2. Information Overload: The abundance of car models, features, and pricing information in the market overwhelms potential buyers, making it challenging to filter through relevant data and identify the most suitable options.
3. Inefficient Marketing Strategies: Automotive businesses struggle to tailor their marketing strategies effectively, resulting in resource inefficiencies and an inability to target potential buyers with precision.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

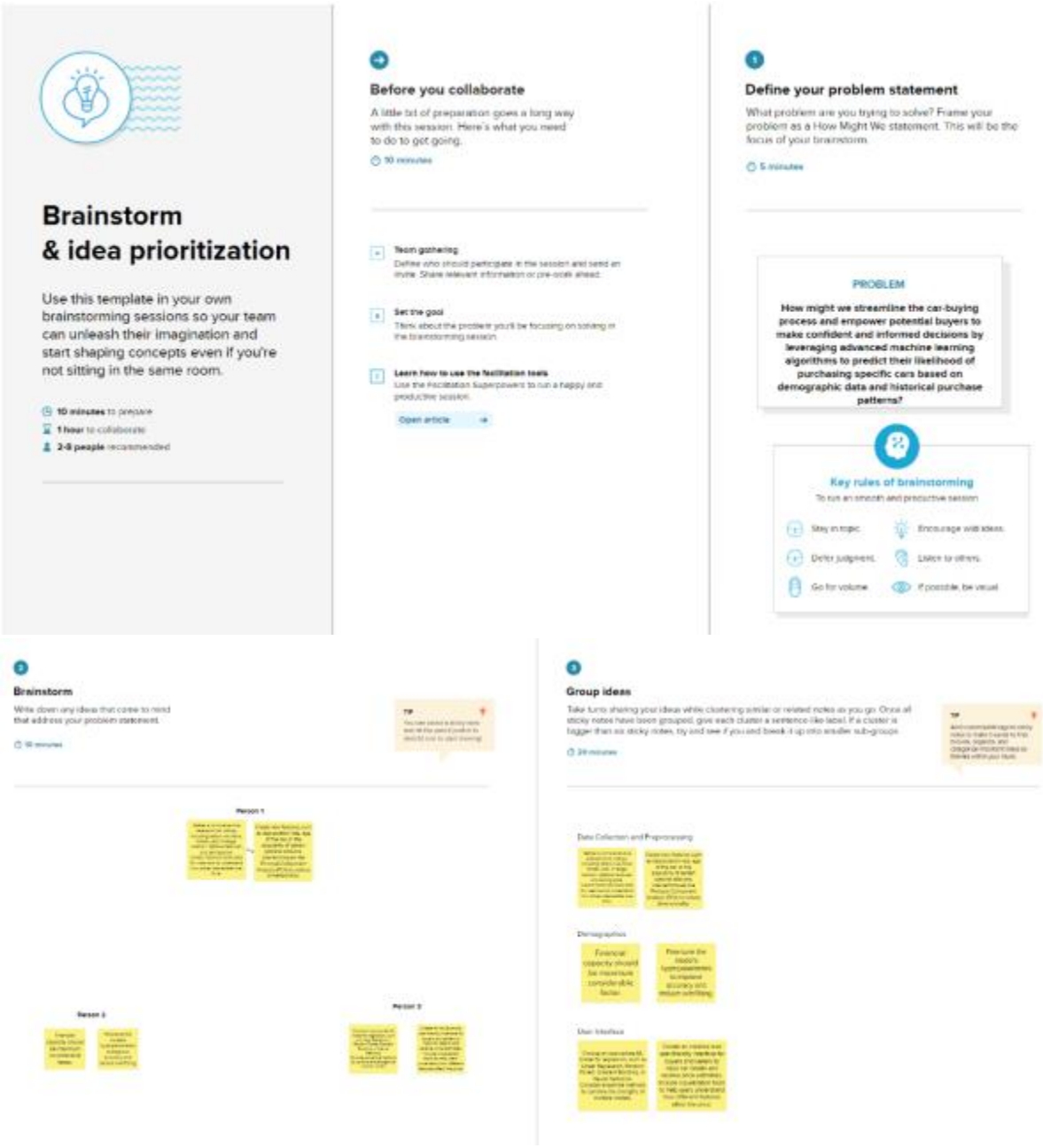
An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise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

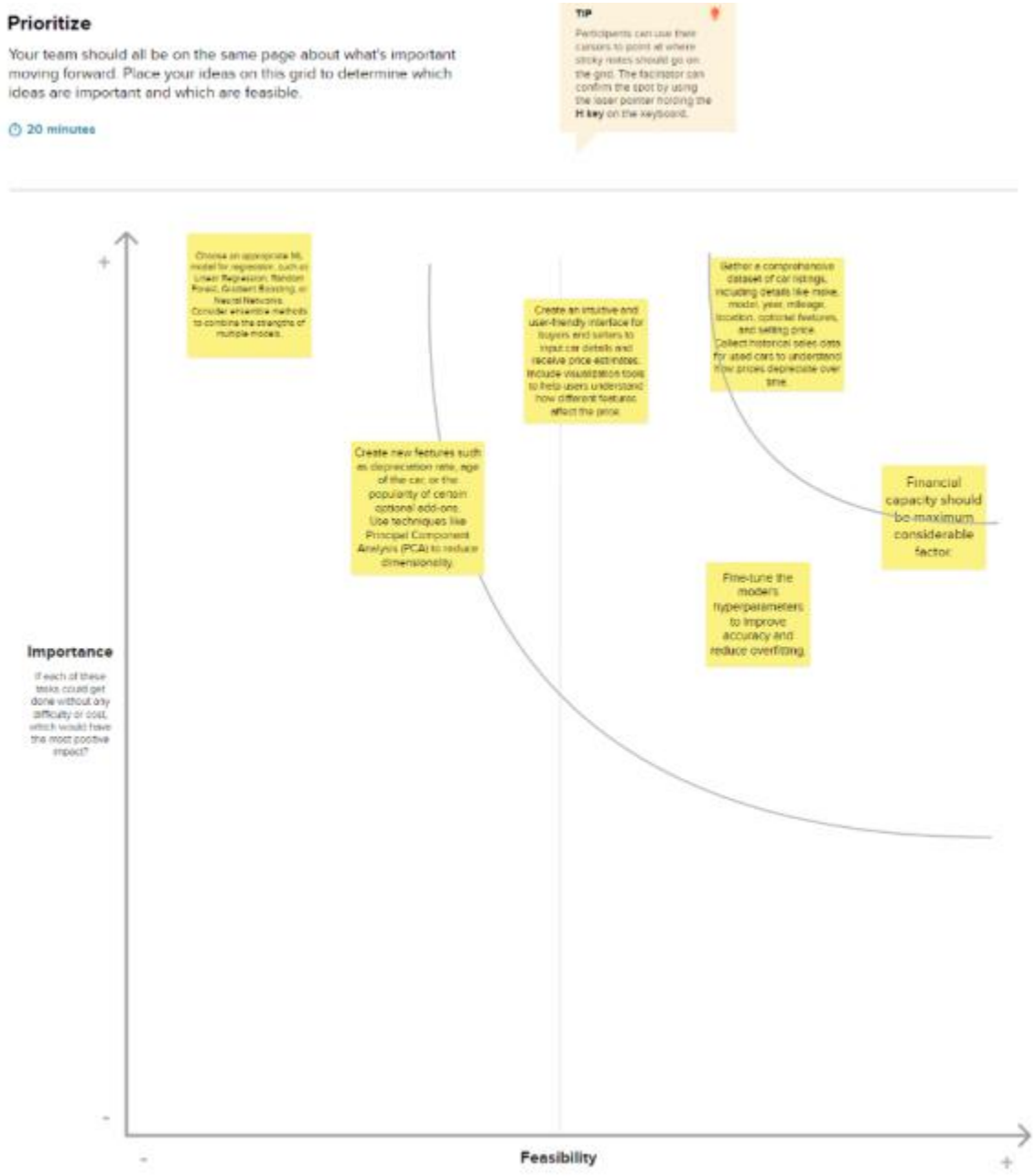

WHO are we empathizing with?
Who is the person we want to understand?
What is the situation they are in?
What is their role in the situation?
GOAL
What do they need to DO?
What do they need to do differently?
What jobs do they want or need to get done?
What decision(s) do they need to make?
How will we know they were successful?
What do they HEAR?
What are they hearing others say?
What are they hearing from friends?
What are they hearing from colleagues?
What are they hearing second-hand?
PAINS
What are their fears, frustrations, and anxieties?
GAINS
What are their wants, needs, hopes, and dreams?
What do they SEE?
What do they see in the marketplace?
What do they see in their immediate environment?
What do they see others saying and doing?
What are they watching and reading?
What do they SAY?
What have we heard them say?
What can we imagine them saying?
What do they THINK and FEEL?
What other thoughts and feelings might influence their behavior?
What do they DO?
What do they do today?
What behavior have we observed?
What can we imagine them doing?
Positive reviews about the ML-based car purchase prediction tool, emphasizing its accuracy and usefulness.
Seeing sponsored content or articles discussing the impact of predictive tools in the automotive industry.
Mentions in industry publications or news segments highlighting the innovation in car purchasing through predictive technology.
Informal discussions about the positive impact the tool has had on colleagues' car purchases, or word-of-mouth recommendations from friends who have successfully used the tool.

Reference:
https://app.mural.co/t/carevaluation0829/m/carevaluation0829/1698997727585/66a5487c8fff1b24c1552393397a79fd04ae6e55?sender=u20f07e17abb983b8e6139294

3.2 Ideation & Brainstorming

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions. Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.





4. REQUIREMENT ANALYSIS

4.1 Functional requirement

User Registration:

- Users should be able to register by providing essential information such as email, password, and optional demographic details.

  Demographic Input:
- The system should allow users to input demographic information, including age, income, and any relevant preferences that may impact their car purchase decision.

  Prediction Model Integration:
- Integration of a machine learning prediction model that accurately estimates the likelihood of a user purchasing specific car models based on the provided information.

  User Interface:
- A user-friendly interface accessible via web and mobile applications to facilitate a seamless user experience in inputting data and receiving predictions.

External API Integration:

- Integration with external APIs for supplementary data, such as weather information, to enhance the accuracy of predictions.

Feedback System:

- Implementation of a feedback system allowing users to provide feedback on the accuracy of predictions, contributing to continuous improvement.

Security Measures:

- Implementation of security measures, including secure user authentication, data encryption, and protection against common cyber threats.

Documentation:

- Comprehensive documentation covering user guides, system architecture, and API documentation for ease of understanding and future development.

4.2 Non-Functional requirements

Performance:

- The system should provide accurate predictions within a response time of 2 seconds or less to ensure a responsive user experience.

Scalability:

- The architecture should be scalable to handle an increasing number of users and a growing dataset without compromising performance.

Reliability:

- The system should be reliable, with minimal downtime, ensuring users can access the application whenever needed.

Security:

- Data should be stored securely, and user privacy should be maintained through secure authentication and data encryption measures.

Usability:

- The user interface should be intuitive, ensuring that users can easily navigate the application and understand the prediction results.

Compatibility:

- The application should be compatible with a variety of devices and browsers to cater to a diverse user base.

Documentation:

- Thorough and up-to-date documentation to aid developers, system administrators, and end-users in understanding and utilizing the system effectively.

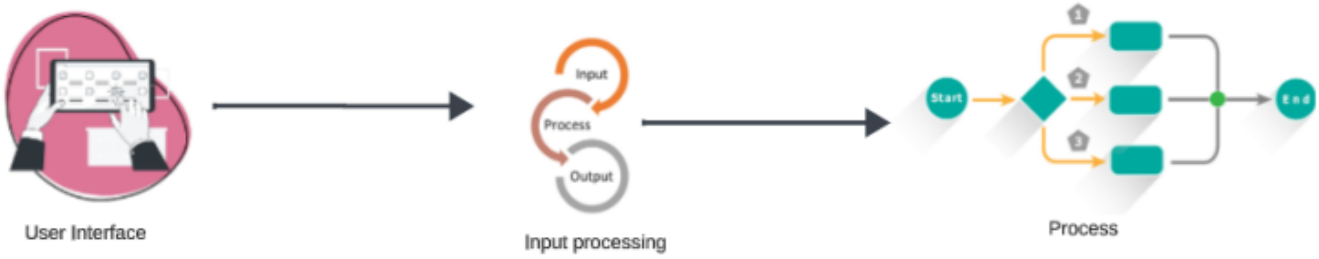
Regulatory Compliance:

- The system should comply with relevant data protection and privacy regulations to ensure legal and ethical use of user data.

5. PROJECT DESIGN

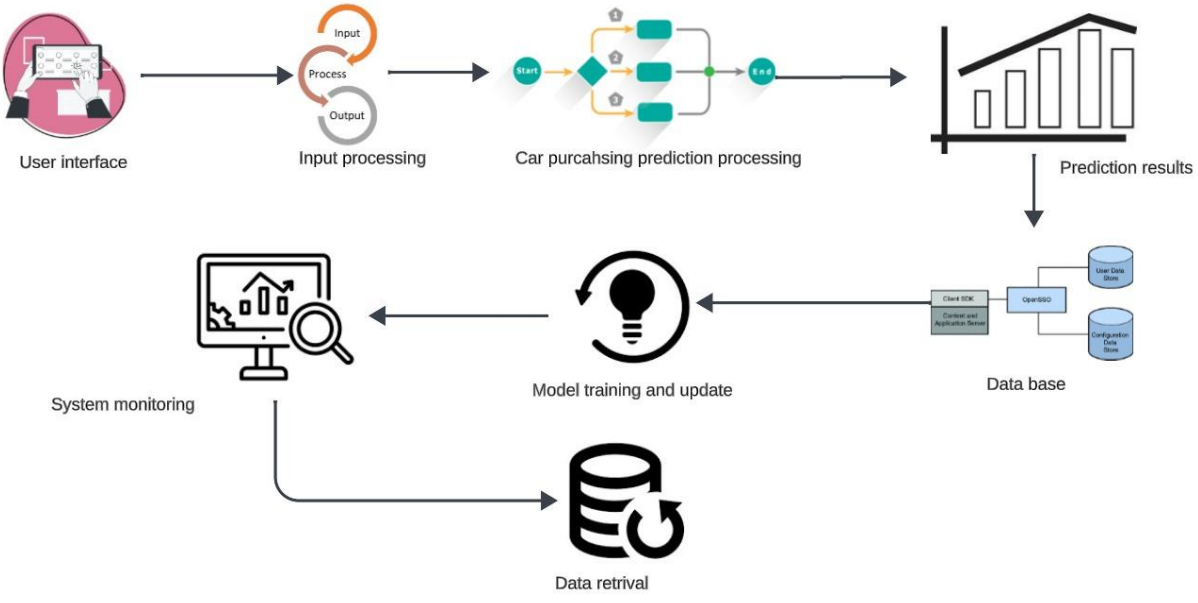
5.1 Data Flow Diagrams & User Stories

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



The process of Data Flow Diagram:

1. External users interact with the system through the user interface, providing their demographic data.
2. Handles the initial processing of user input, validating and formatting the data before passing it to the prediction process.
3. Integrates the machine learning model, takes preprocessed input data, and produces purchase likelihood predictions.
4. The results of the prediction are sent back to the user interface for display.
5. Stores and manages customer data securely.
6. Represents the backend activities involved in model training and updates based on new data.
7. Involves monitoring the system's performance, ensuring scalability, and handling any potential issues.
8. The system can retrieve relevant data from the database as needed for training or updating the machine learning model.

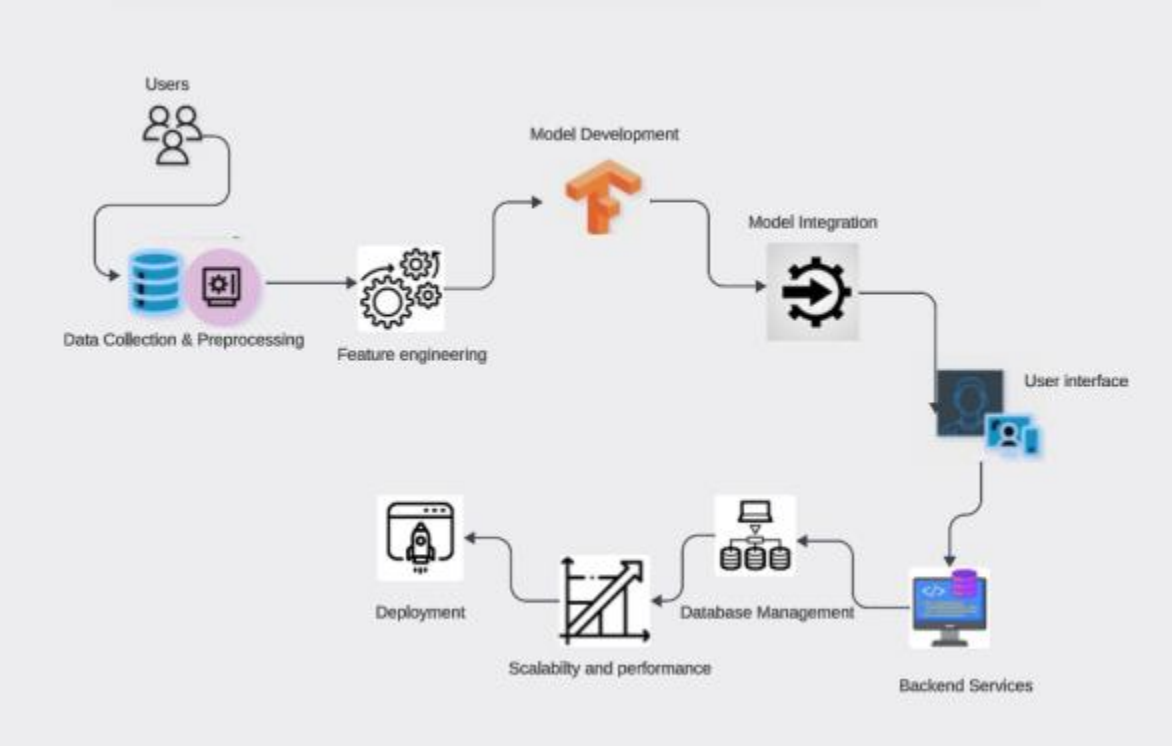


User Stories

User Type	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile User) - Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I should be able to access my account/dashboard after successful registration.	High	Sprint-1
	USN-2	As a user, I will receive a confirmation email once I have registered for the application.	I should be able to access my account/dashboard after successful registration.I can receive the confirmation email and click to confirm my registration.	High	Sprint-1
	USN-3	As a user, I can register for the application through Facebook.	I can register and access the dashboard with Facebook login	Low	Sprint-2
	USN-4	As a user, I can register for the application through Gmail.	I can register and access the dashboard with Gmail login.	Medium	Sprint-1
Customer (Mobile User) - Login	USN-5	As a user, I can log into the application by entering email and password.	I should be able to access my dashboard after successful login.	High	Sprint-1
Dashboard	USN-6	As a user, I can view personalized recommendations on my dashboard based on my historical purchase patterns.	Relevant recommendations should be displayed.	Medium	Sprint-2
Customer Care Executive	USN-7	As a Customer Care Executive, I can access a customer's purchase likelihood information based on their provided data.	The system should provide accurate purchase likelihood predictions.	High	Sprint-3
Administrator	USN-8	As an Administrator, I can view and manage user accounts, ensuring the security and integrity of the system.	The administrator should have access to user account information and the ability to manage	High	Sprint-3

			accounts.		

5.2 Solution Architecture



1. Data Collection and Preprocessing:
   Gather customer data, including age, income, and historical purchase patterns. Collect data on car values without consideration for specific models. Clean and preprocess the data to handle missing values and outliers. Normalize or scale numerical features to ensure consistency in the dataset. Encode categorical variables if necessary.

2. Feature Engineering:
   Extract relevant features from the data, such as creating a composite metric for historical purchase patterns. Possibly derive additional features that might contribute to prediction accuracy.
3. Model Development:
   Utilize advanced machine learning algorithms such as ensemble methods, regression, or gradient boosting for accurate predictions. Train the model on the preprocessed data, using a portion for training and another for validation. Optimize hyperparameters to enhance predictive performance.
4. Model Integration:
   Implement an API for the trained model to make predictions based on input data. Create a seamless integration with the user interface for easy accessibility.

5. User Interface:

   Design an intuitive and user-friendly interface for users to input their demographic data. Enable users to receive precise purchase likelihoods in a clear and understandable format.
6. Backend Services:

   Develop backend services to handle user requests and communicate with the machine learning model. Implement security measures to protect user data and ensure the integrity of the system.
7. Database Management:

   Set up a database to store and manage customer data securely. Implement mechanisms for data retrieval and storage as needed
8. Scalability and Performance:

   Optimize the system for scalability to handle an increasing number of users and data. Monitor and maintain performance to ensure predictions are generated efficiently.
9. Deployment:

   Deploy the solution on a cloud platform or on-premises infrastructure. Ensure continuous monitoring and updates to keep the system running smoothly

6. PROJECT PLANNING & SCHEDULING

6.1 Technical Architecture

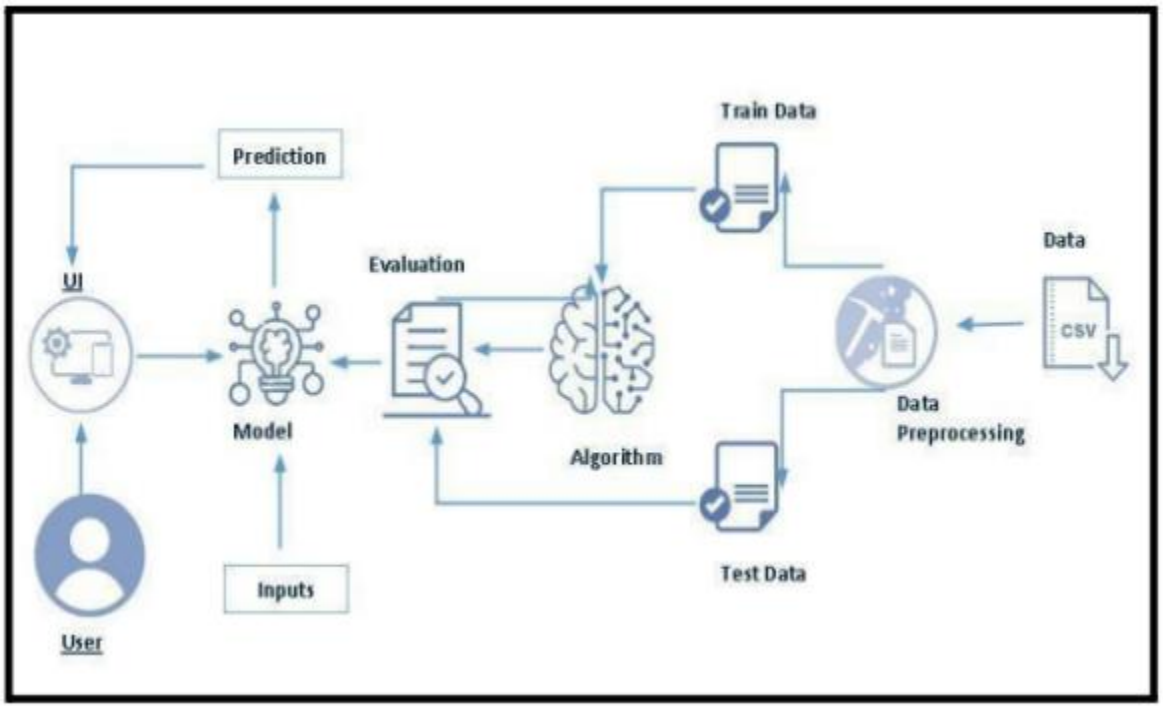


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Web UI and Mobile App for user interaction	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	Core application logic for data processing and prediction	Python
3.	Application Logic-2	Integration with a third-party Speech-to-Text service	IBM Watson STT service
4.	Application Logic-3	Integration with a third-party conversational AI service	IBM Watson Assistant
5.	Database	Storage for user data and application configurations	MySQL, NoSQL, etc.
6.	Cloud Database	Cloud-based database service for scalability	IBM DB2, IBM Cloudant etc.
7.	File Storage	Storage for file-related requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Integration with an external weather API for data	IBM Weather API, etc.
9.	External API-2	Integration with an external identity verification API	Aadhar API, etc.
10.	Machine Learning Model	Incorporation of ML model for car value prediction	Object Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Cloud :	IBM Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Usage of open-source frameworks in the application	Flask, scikit-learn, React Js, etc.
2.	Security Implementations	Implementation of security measures such as encryption, access controls, and firewalls	HTTPS, JWT, IAM Controls, etc.
3.	Scalable Architecture	A scalable architecture, possibly microservices or serverless, to handle varying workloads	Microservices, Serverless
4.	Availability	Ensuring high availability through load balancing and distributed server configurations	Load Balancers, Distributed Servers
5.	Performance	Design considerations for performance, including caching mechanisms and use of CDNs	Caching, CDN, Load Balancing

6.2 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	

Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	

6.3 Sprint Delivery Schedule

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

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	4 Days	30 Oct 2023	2 Nov 2023	20	2 Nov2023
Sprint-2	20	4 Days	6 Nov2023	9 Nov2023	20	9 Nov2023
Sprint-3	20	4 Days	13 Nov2023	16 Nov2023		
Sprint-4	20	4 Days	20 Nov2023	23 Nov2023		

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1:

- **Allows User Input to Predict the Purchase.**

```
app= Flask(__name__)  # your application


@app.route('/')  # default route
def home():
    return render_template('home.html') # rendering if your home page.

@app.route('/pred',methods=['POST']) # prediction route
def predict1():
    '''
    For rendering results on HTML
    '''

    rd = request.form["User ID"]
    ad= request.form["Age"]
    ms = request.form["Annual Salary"]
    s = request.form["Gender"]
    t =  [[float(rd),float(ad),float(ms),float(s)]]
    X=scalar.transform(t)
    output =model.predict(X)
    print(output)


    return render_template("home.html", result = "The predicted Price  is  "+str(np.round(output[0])))



# running your application
if __name__ == "__main__":
    app.run()
```

7.2 Feature 2

- **Interactive User Interface**

```
<style>
    body {
      background-image: url('../static/images/background.jpg');
      background-repeat: no-repeat;
      background-attachment: fixed;
      background-size: cover;
    }
    </style>

    <html>
    <form action="/pred" method="POST">

    <h1>Prediction of Car Price </h1>

    <br>
    <br>
    Enter your User ID :
    <br>
    <br>
    <input type="text" name="User ID"></input>
    <br>
    <br>

    <label >Gender:</label>
    <br>


    <select name="Gender">
      <option value="1">Male</option>
      <option value="0">Female</option>
```

```
<select name="Gender">
  <option value="1">Male</option>
  <option value="0">Female</option>


</select>
<br>
<br>
Enter your Age :
<br>
<br>
<input type="text" name="Age"></input>
<br>
<br>
Enter your Annual Salary :
<br>
<br>
<input type="text" name="Annual Salary"></input>

<br>
<br>
<input type="submit"></input>

</form>

{{result}}
</html>
```

8. PERFORMANCE TESTING

8.1 Performance Metrics:

```
print(r2_score(y_test,pred))
```

[66] ✓ 0.0s

```
0.6056031551747586
```

```
print(classification_report(y_test,pred))
```

[ ]

```
              precision    recall  f1-score   support

           0       0.95      0.88      0.92       171
           1       0.86      0.94      0.90       129

    accuracy                           0.91       300
   macro avg       0.90      0.91      0.91       300
weighted avg       0.91      0.91      0.91       300
```

```
accuracy_score(y_test,pred)
```

[ ]

```
0.9066666666666666
```

```
confusion_matrix(y_test,pred)
```

]

```
array([[151,  20],
       [  8, 121]], dtype=int64)
```

```
pd.crosstab(y_test,pred)
```

]

col_0	0	1
Purchased		
0	151	20
1	8	121

9. RESULTS

9.1 Output Screenshots:

BEFORE:

AFTER:

10. ADVANTAGES & DISADVANTAGES

Advantages:

1. Users benefit from personalized predictions based on their demographics and historical purchase patterns, aiding them in making more informed decisions when purchasing a car.
2. The application provides a user-friendly interface, simplifying the car-buying journey and creating a more enjoyable experience for potential buyers.
3. Automotive businesses can leverage the insights generated by the predictive model to tailor marketing strategies, optimizing customer targeting and resource allocation.
4. Potential buyers can streamline their research process, saving time and effort by receiving accurate predictions tailored to their preferences.
5. The project empowers automotive businesses with data-driven insights, allowing them to tailor their approaches and enhance overall efficiency in decision-making.

Disadvantages:

1. Users might overly rely on the predictions, neglecting other factors that could influence their decision, such as personal preferences or test drive experiences.
2. Collecting and processing user data for predictions raises privacy concerns. Proper measures need to be in place to secure user information and comply with data protection regulations.
3. The accuracy of predictions may depend on external data sources (e.g., weather data). Outages or changes in these APIs could impact the reliability of the system.
4. The accuracy of the initial machine learning model may be limited by the quality and quantity of training data. Continuous refinement and updates may be necessary to improve accuracy over time.
5. Traditional car-buying processes are deeply ingrained, and users may resist adopting a new predictive model. Effective user education and marketing are essential to overcome resistance.
6. Integrating machine learning models and external APIs can be complex. Skilled personnel and significant development effort are required, potentially leading to delays and cost overruns.
7. If the training data used for the machine learning model contains biases, the predictions may also be biased. Careful consideration and monitoring are needed to mitigate bias in predictions.

11. CONCLUSION

In conclusion, the car purchase value prediction project represents a significant leap

forward in revolutionizing the automotive industry by leveraging advanced machine learning algorithms. The aim is to provide users with a more informed and streamlined car-buying experience, enhancing decision-making and overall satisfaction. The project not only benefits potential buyers but also empowers automotive businesses with data-driven insights, enabling them to tailor marketing strategies and optimize resource allocation.

The advantages of the project include personalized predictions, an enhanced user experience, tailored marketing strategies, efficiency, and data-driven decision-making. These factors contribute to a more seamless and enjoyable car-buying journey for users, potentially transforming the way consumers engage with the automotive market.

However, it is crucial to acknowledge and address the potential challenges and disadvantages associated with the project, such as privacy concerns, reliance on external APIs, and the complexity of implementation. These challenges necessitate careful planning, ethical considerations, and ongoing efforts to refine the system and ensure its effectiveness.

As the project progresses, continuous monitoring and adaptation to user feedback and industry trends will be essential. Regular updates and refinements to the machine learning model, user interface, and overall system will contribute to its long-term success and relevance in the dynamic landscape of the automotive industry.

In summary, the car purchase value prediction project has the potential to bring about positive transformations by providing users with valuable insights and empowering businesses to make more informed decisions. Through a careful balance of innovation, user-centric design, and ethical considerations, this project aims to set new standards in the automotive domain, paving the way for a more data-driven and user-friendly future.

12. FUTURE SCOPE

Continuous Model Improvement:

- Implement mechanisms for continuous learning and improvement of the machine learning model. Regular updates based on user feedback and evolving market trends can enhance prediction accuracy.

Integration of Advanced Technologies:

- Explore the integration of emerging technologies such as augmented reality (AR) for virtual car exploration and artificial intelligence (AI) for more advanced predictive analytics.

Enhanced Personalization:

- Further personalize user experiences by incorporating additional features such as virtual assistants, personalized recommendations for accessories, and customized financing options.

Expanded Data Sources:

- Increase the breadth and depth of data sources used for predictions. Incorporate social media data, user reviews, and real-time market data for a more comprehensive analysis.

Global Market Expansion:

- Extend the application to cater to a global audience by considering regional variations in preferences, market dynamics, and pricing strategies.

Blockchain for Data Security:

- Explore the integration of blockchain technology to enhance data security and transparency, addressing privacy concerns and ensuring secure transactions.

13. APPENDIX

13.1 Source Code

Car_Purchase_Predicti
on.ipynb.ipynb

13.2 GitHub & Project Demo Link

GITHUB - https://github.com/smartinternz02/SI-GuidedProject-611618-1698386322

Project Demo Link – https://youtu.be/yoVhZF1kL3I