RESTAURANT RECOMMENDATION SYSTEM

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1.INTRODUCTION

In today's fast-paced world, making informed decisions can be a challenge, especially when it comes to something as personal as dining out. With the abundance of restaurants available, choosing the right one to suit your preferences can be overwhelming. This is where a restaurant recommendation system comes into play.

1.1 PROJECT OVERVIEW

A restaurant recommendation system is a tool that utilizes machine learning algorithms to analyze user preferences and restaurant data to provide personalized suggestions. By considering factors such as user ratings, reviews, cuisine preferences, and location, these systems can effectively narrow down the vast array of options and present users with a selection of restaurants that are most likely to meet their individual needs and tastes.

At the heart of these systems lies a combination of collaborative filtering and content-based filtering techniques. Collaborative filtering algorithms draw upon the collective wisdom of users, analyzing their past behavior and interactions with restaurants to identify patterns and similarities. This approach allows the system to infer preferences based on the assumption that users with similar tastes will tend to agree on restaurant ratings.

Content-based filtering, on the other hand, focuses on the attributes of the restaurants themselves. By extracting information from restaurant descriptions, menus, and user-generated content, the system can create comprehensive profiles of each establishment. This enables the system to match restaurants with users based on shared characteristics, such as cuisine type, price range, and ambiance.

The culmination of these advanced techniques results in a restaurant recommendation system that goes beyond simply matching users to restaurants. It transforms the dining experience into a personalized journey, guiding users towards establishments that truly resonate with their preferences, and ensuring a satisfying and memorable dining experience.

1.2 PURPOSE

The primary purpose of a restaurant recommendation system is to enhance the dining experience by providing users with tailored suggestions that align with their specific

preferences. By eliminating the guesswork and reducing the time spent on research, these systems can help users make more informed decisions and increase their satisfaction with their dining choices. Additionally, restaurant recommendation systems can also serve as valuable marketing tools for restaurants, allowing them to target potential customers who are most likely to enjoy their offerings.

Benefits:

Restaurant recommendation systems offer a multitude of benefits to both users and restaurants. For users, these systems provide:

- Personalized recommendations based on individual preferences
- Reduced decision-making time and effort
- Increased satisfaction with dining experiences
- Exposure to new and interesting dining options

For restaurants, these systems offer:

- Increased visibility and exposure to potential customers
- Targeted marketing opportunities
- Improved customer satisfaction and loyalty
- Valuable insights into customer preferences and behavior

Applications:

Restaurant recommendation systems have a wide range of applications, including:

- Online restaurant review platforms
- Mobile food delivery apps
- Restaurant websites and social media pages
- Travel and tourism websites
- Personal assistant applications

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM

Restaurant Discovery Challenges

The restaurant industry has witnessed a surge in diversity, presenting consumers with an overwhelming array of dining options. Traditional methods of restaurant discovery, such as word-of-mouth recommendations or generic search engines, often fall short of providing personalized suggestions. Users frequently face difficulties in identifying restaurants that align with their specific preferences, resulting in a less-than-optimal dining experience.

Challenges:

- Information Overload: The abundance of restaurant options can lead to decision fatigue.
- Lack of Personalization: Existing systems may not adequately consider individual tastes and preferences.
- Inefficiency in Search: Users often spend significant time sifting through irrelevant recommendations.

2.2 REFERENCES

In addressing these challenges, several research efforts and technological solutions have been explored. Key references contributing to the understanding and evolution of restaurant recommendation systems include:

- R. Burke, A. Mobasher, C. Williams, and R. Bhaumik. "Towards More Conversational Recommendation Systems." Proceedings of the Eleventh ACM Conference on Hypertext and Hypermedia, 2000.
- https://towardsdatascience.com/recommendation-systems-models-and-evaluation-84944a84fb8e
- https://medium.com/analytics-vidhya/recommendation-system-content-based-part-1-8f5ac093127a
- https://www.leewayhertz.com/build-recommendation-system/

2.3 PROBLEM STATEMENT DEFINITION

The existing problem of inefficient restaurant discovery prompts the need for a sophisticated recommendation system that addresses the challenges faced by users. The primary goal is to develop a robust Restaurant Recommendation System that leverages advanced algorithms to offer personalized suggestions based on user preferences, thereby enhancing the overall dining experience.

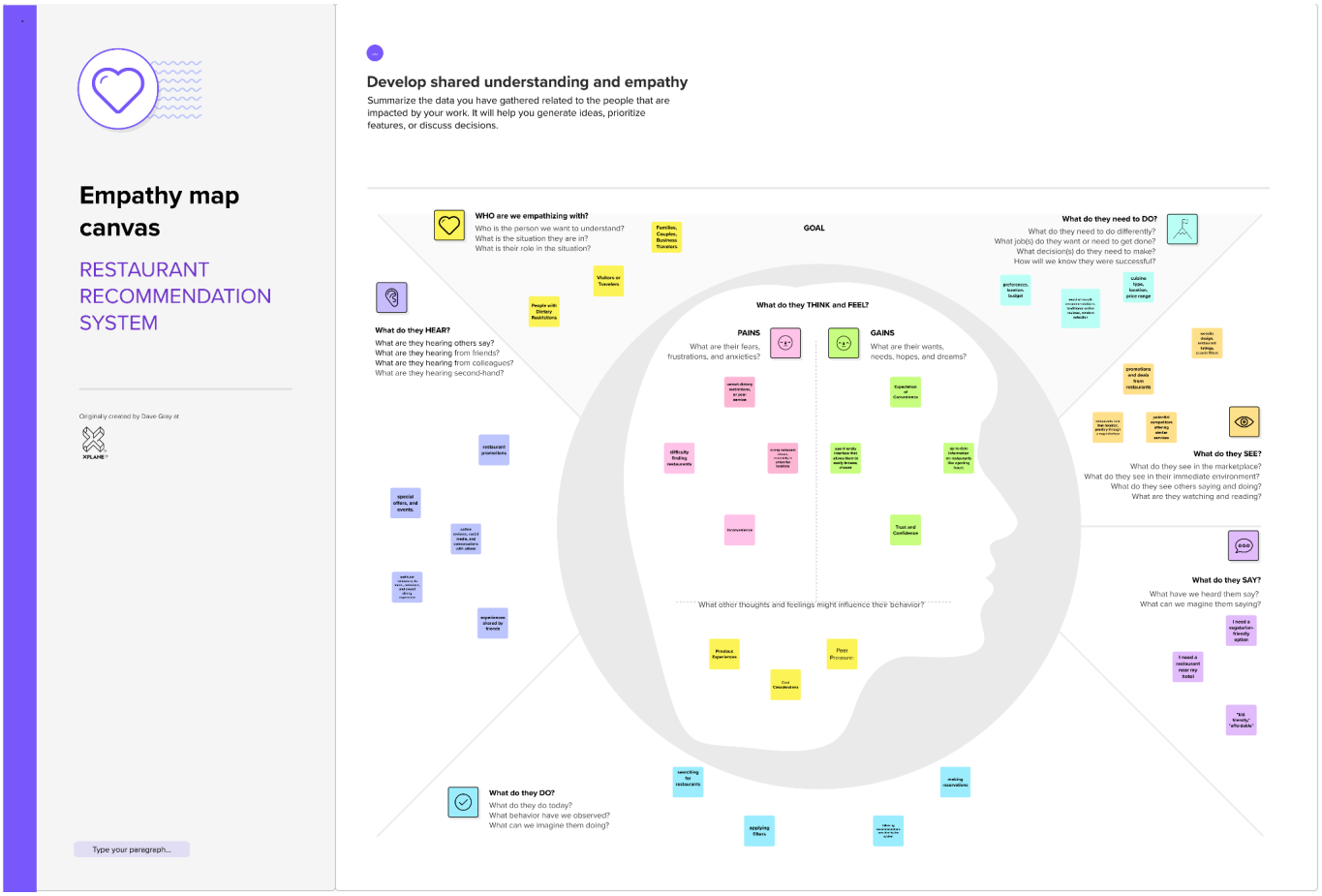
Scope of the Project:

The project will focus on implementing a content-based recommendation system, utilizing machine learning algorithms to analyze user preferences and restaurant features. External integrations with APIs for maps, reviews, and additional data sources will enhance the depth of recommendations.

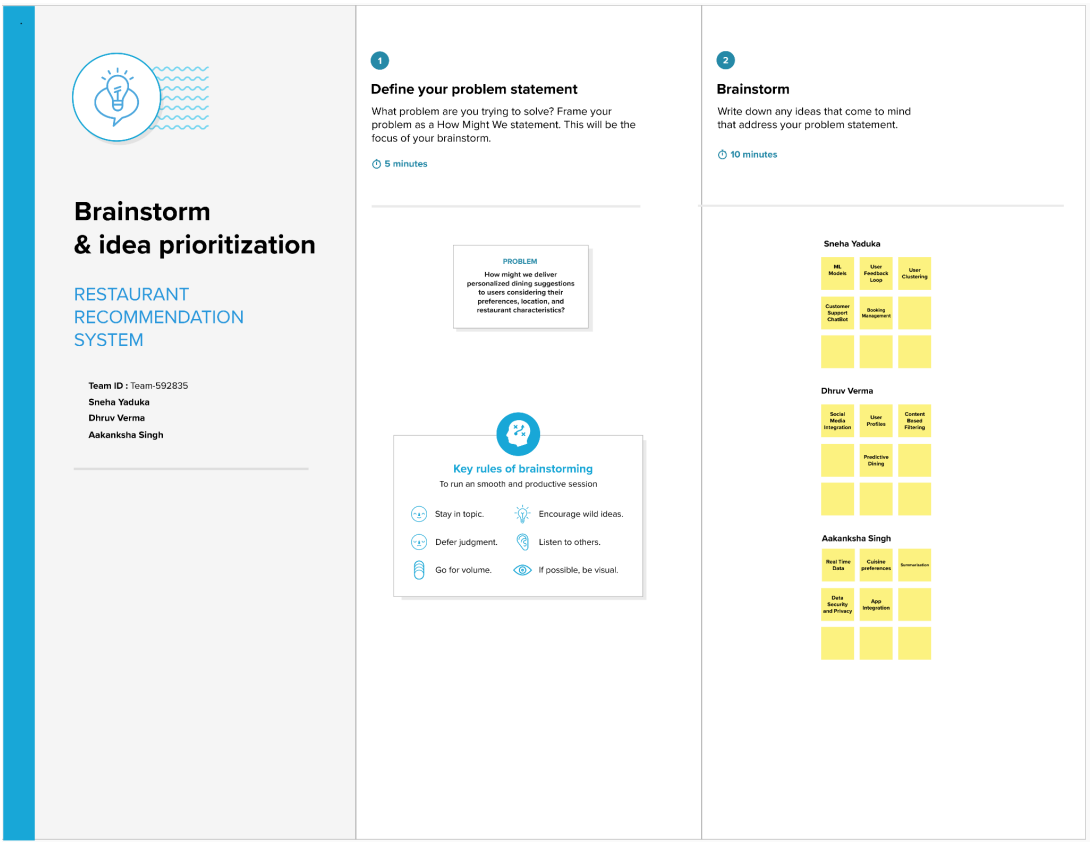
By defining the problem statement, the project aims to contribute to the evolution of restaurant recommendation systems, offering users a more personalized and efficient way to discover dining options.

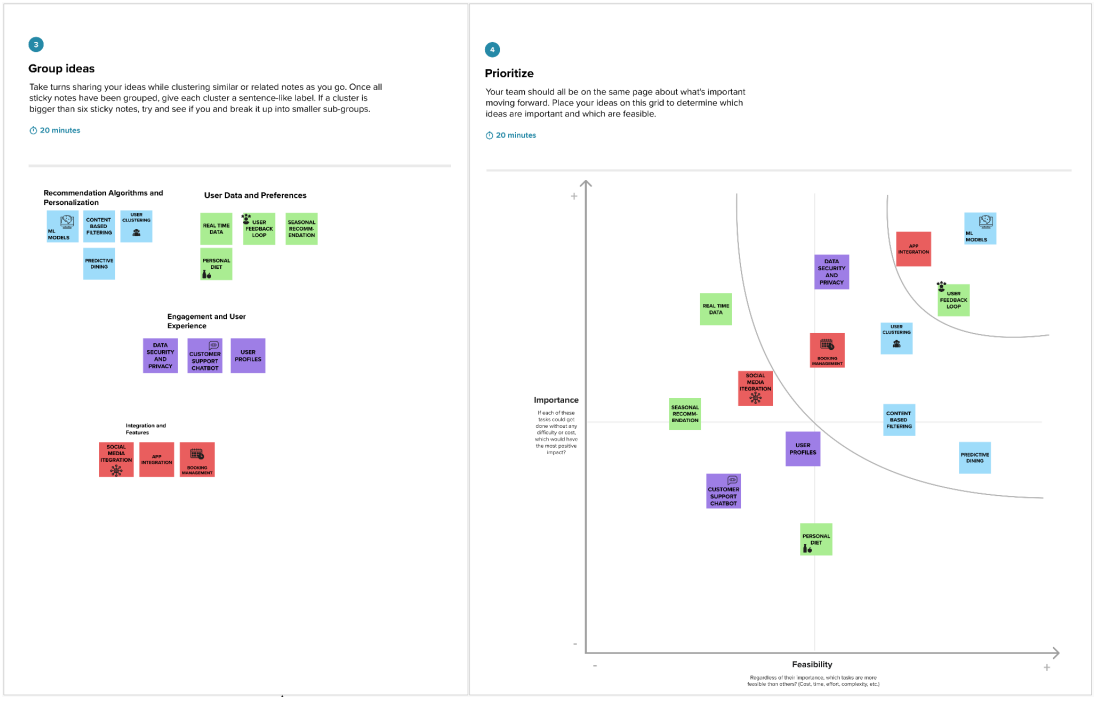
3.IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING





4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

- **User Profile:**
  Users can create and update their profiles.
  Preferences such as dietary restrictions and favorite cuisines should be stored.

- **Search and Recommendation Engine:**
  The system should allow users to search for restaurants based on various criteria (location, cuisine, price range, etc.).
  Implement recommendation algorithms to suggest restaurants based on user preferences and historical data.

- **Filtering and Sorting:**
  Users should be able to filter and sort search results (e.g., by rating, distance, popularity).

- **Integration with Maps:**
  Integrate with mapping services to provide location-based recommendations.
  Show maps with directions to selected restaurants.

4.2 NON-FUNCTIONAL REQUIREMENT

- **Performance:**
  The system should respond to user queries within a reasonable time frame.
  Support a scalable architecture to handle a growing user base.

- **Reliability:**
  The system should be available 24/7 with minimal downtime.
  Implement backup and recovery mechanisms to ensure data integrity.

- **Usability:**
  The user interface should be intuitive and easy to navigate.
  Support multiple devices (desktop, mobile) with a responsive design.

- **Scalability:**

The system should be able to handle a large number of users and restaurants as the user base grows.
Implement load balancing and resource scaling.

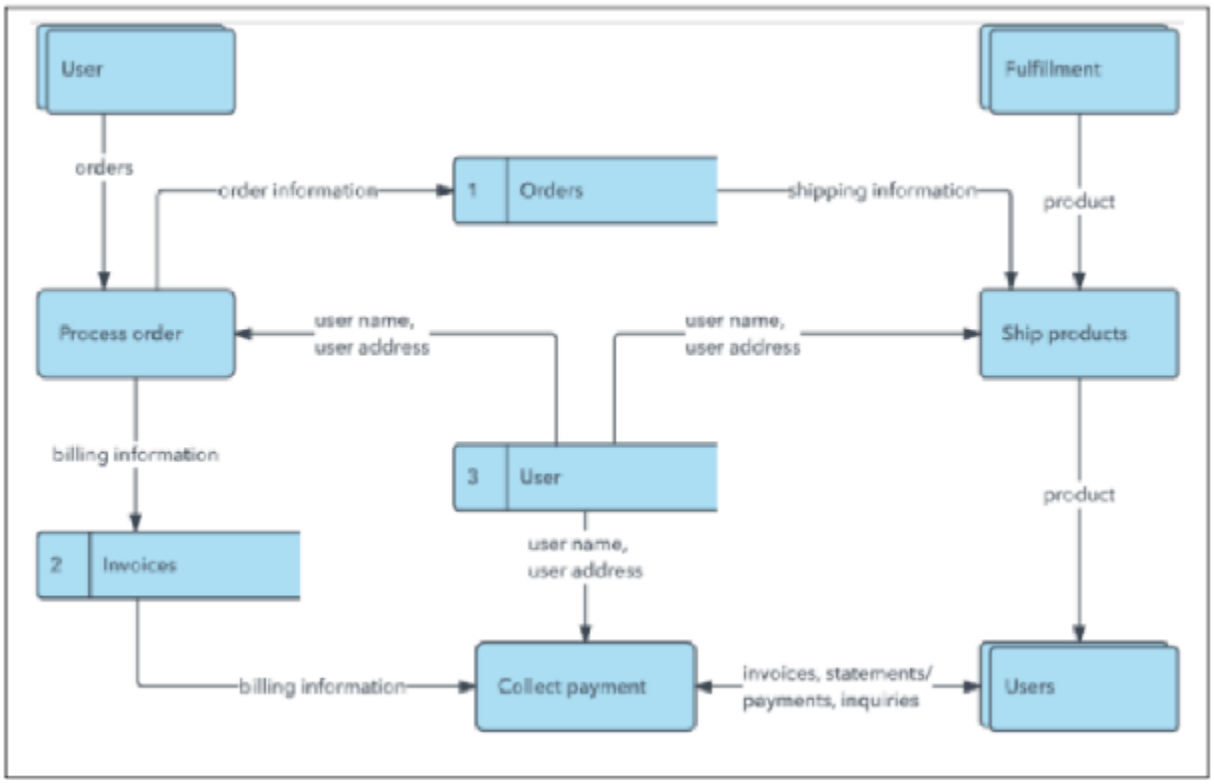
- **Compatibility:**
  Ensure compatibility with different browsers and operating systems.
  Support integration with popular social media platforms.

- **Maintainability:**
  The system should be easy to update and maintain.
  Implement logging and monitoring for error tracking and debugging.

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS AND USER STORIES

Data Flow Diagram:

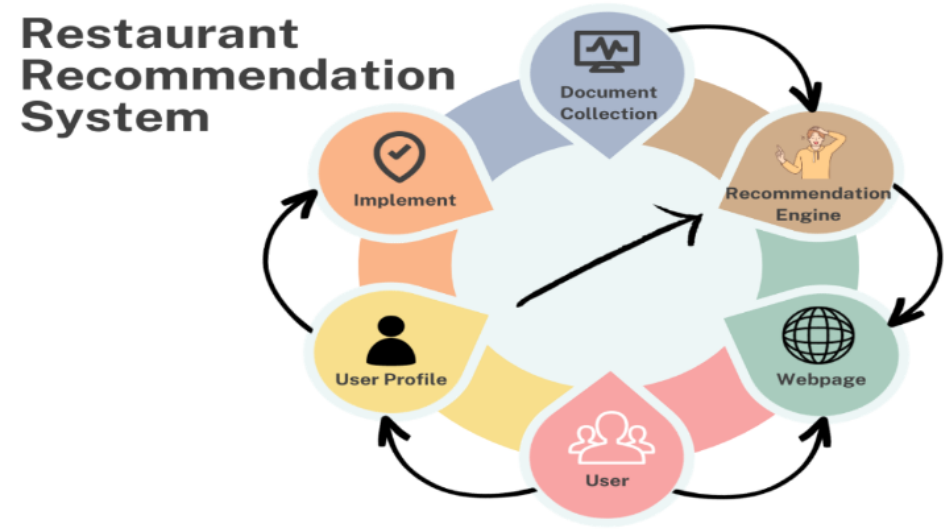


User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance Criteria	Priority	Release
Customer	Registration	USN-1	As a customer, I want to be able to create an account on the system by providing my name, email address, and password, so that I can access the system's features and functionality.	The system must allow the customer to create an account by providing their name, email address, and password.	High	Sprint 1
Customer	Login	USN-2	As a customer, I want to be able to log in to the application using my email and password.	The system must allow the customer to log in and access the dashboard	High	Sprint 1
Customer	Restaurant Recommendation	USN-3	As a customer, I want to be able to provide my preferences and dietary restrictions to the system, so that it can recommend restaurants that I am likely to enjoy.	The system must be able to rank the restaurant recommendations in order of relevance to the customer.	High	Sprint 2
Customer	Restaurant Recommendation	USN-4	As a customer, I want to be able to view the details of a restaurant recommendation, including its cuisine, price range, location, and reviews from other customers.	The system must be able to display the details of a restaurant recommendation, including its cuisine, price range, location, and reviews from other customers.	High	Sprint 2
Customer	Feedback	USN-5	As a customer, I want to be able to provide feedback on the restaurant recommendations that the system generates.	The system must allow the customer to provide feedback on the restaurant	Medium	Sprint 3
				recommendations that it generates.		
Restaurant Owner	Registration	USN-6	As a restaurant owner, I want to be able to create and manage my restaurant's profile in the system, including its name, address, cuisine, price range, and hours of operation.	The system must allow the restaurant owner to provide information about their restaurant's cuisine, price range, hours of operation, and other relevant details.	High	Sprint 1
Restaurant Owner	Restaurant Management	USN-7	As a restaurant owner, I want to be able to view customer reviews of my restaurant and respond to them.	The system must allow the restaurant owner to respond to customer reviews.	Medium	Sprint 3
Customer	Logout	USN-8	As a customer, I want to be able to log out of the system, so that I can protect my account and prevent others from accessing it.	When the customer logs out, the system must destroy their session and prevent them from accessing the system's features and functionality.	Medium	Sprint 4

5.2 SOLUTION ARCHITECTURE

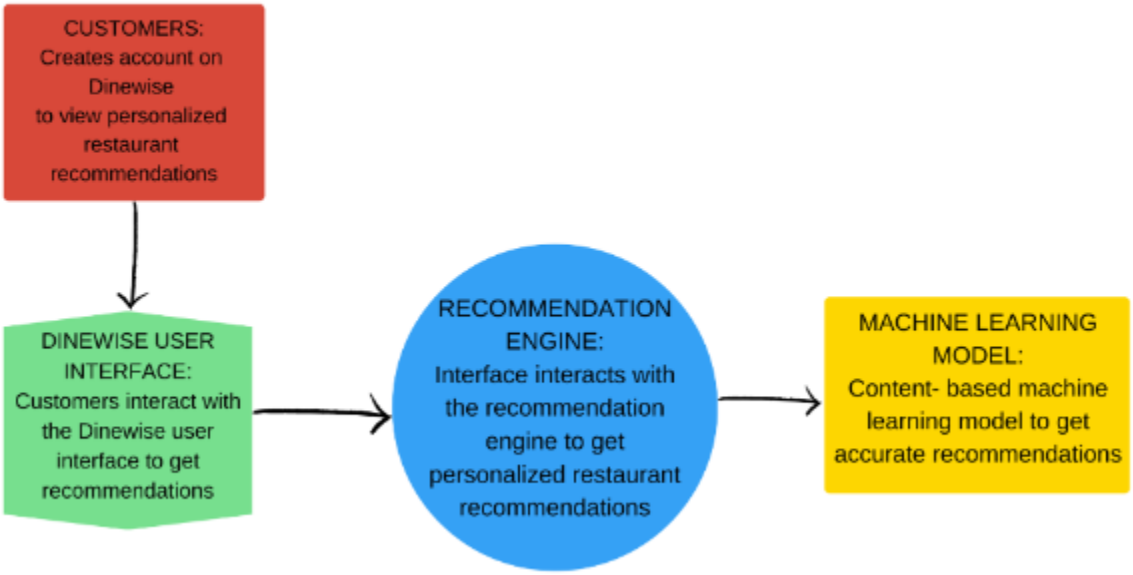
Solution Architecture Diagram:



6.PROJECT PLANNING & SCHEDULING

6.1 TECHNICAL ARCHITECTURE

Technical Architecture:



6.2 SPRINT PLANNING AND APPLICATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Project setup & Infrastructure	USN-1	Set up the development environment with the required tools and frameworks to start the restaurant recommendation project.	1	High	Sneha
Sprint-1	Data Collection	USN-2	Gather a diverse dataset of different restaurants across Bangalore	1	High	Sneha
Sprint-2	Data preprocessing	USN-3	Preprocess the collected dataset to remove the duplicate entries and to clean the text	2	High	Aakanksha
Sprint-2	Data visualization	USN-4	Visualize the dataset to find out the best features for model building and development.	2	High	Sneha
Sprint-3	Model building	USN-5	Explore and evaluate different recommendation models such as content-based filtering, collaborative filtering	3	High	Dhruv
Sprint-3	Training	USN-6	Train the selected model to make personalized recommendations	4	High	Dhruv

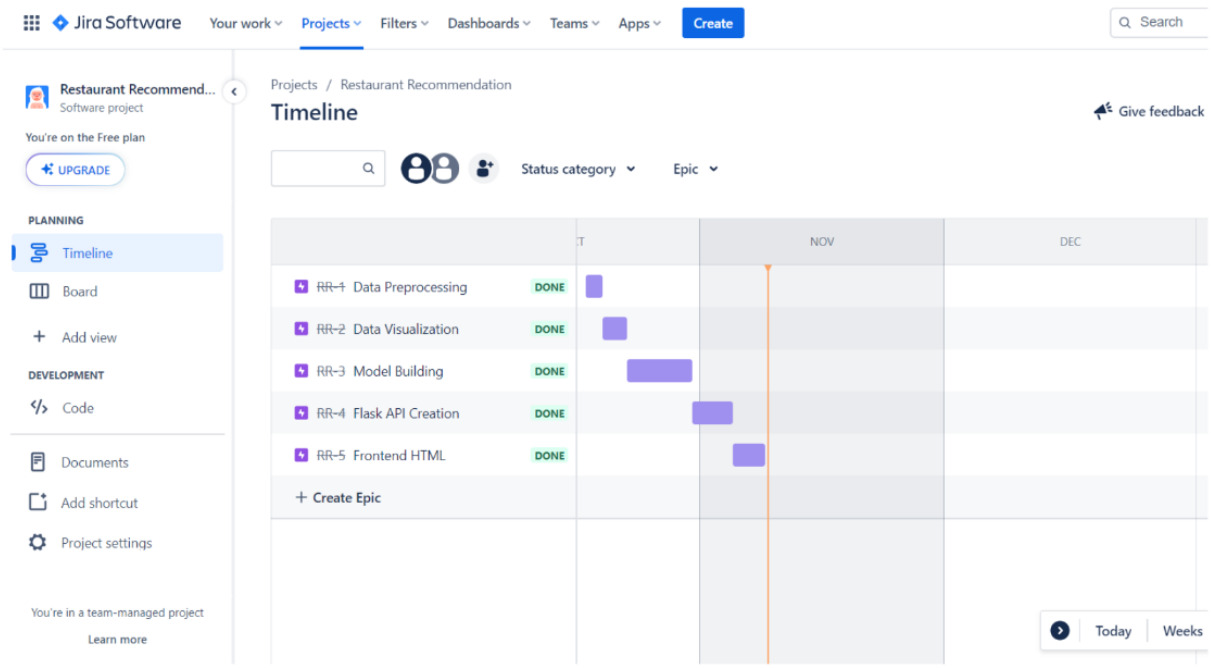
Sprint-4	Web Integration	USN-7 A user-friendly web interface is built for users to interact with and get personalized restaurant recommendations	5	medium	Aakanksha
Sprint-5	Model Deployment	USN-8 The trained model is deployed as an API or web service to make it accessible for users to get their restaurant recommendations	2	medium	Sneha

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	2	2 Days 18 Oct 2023 19 Oct 2023	18	9 Nov 2023
Sprint-2	4	2 Days 20 Oct 2023 22 Oct 2023		
Sprint-3	7	7 Days 23 Oct 2023 30 Oct 2023		
Sprint-4	5	5 Days 31 Oct 2023 4 Nov 2023		
Sprint-5	2	3 Days 5 Nov 2023 8 Nov 2023		

6.3 SPRINT DELIVERY SCHEDULE

Timeline



7. CODING & SOLUTIONING

7.1 FEATURE 1

Personalized Recommendations
This feature allows the recommendation engine to generate personalized restaurant recommendations for users with the help of content-based filtering. Content-based filtering algorithms analyze restaurant descriptions, menus, and reviews to extract features and match them with user preferences.

Code Snippets:

```
# Initialize HashingVectorizer
hash_vectorizer = HashingVectorizer(stop_words='english', n_features=2**10)  # Adjust n_features as needed

# Preprocessing: Handle missing data and convert 'cost' column to numerical values
if 'cost' in df.columns:
    df['cost'] = df['cost'].replace(',', '', regex=True).astype(float)

# Feature selection: Select the relevant columns for content-based filtering
features = ['name', 'location', 'rest_type', 'cuisines', 'dish_liked', 'rate', 'city']
df['content'] = df[features].apply(lambda x: ' '.join(x.dropna().astype(str)), axis=1)

# Transform using HashingVectorizer
hash_matrix = hash_vectorizer.transform(df['content'])

# Compute the cosine similarity matrix
cosine_sim = linear_kernel(hash_matrix, hash_matrix)
```

```
def recommend(user_input):
    # Transform user input using HashingVectorizer
    user_hash = hash_vectorizer.transform([user_input])

    # Compute the cosine similarity between user input and restaurants
    cosine_sim_user = linear_kernel(user_hash, hash_matrix).flatten()

    # Get indices of restaurants sorted by similarity
    restaurant_indices = cosine_sim_user.argsort()[::-1]

    # Exclude the first index (self) and take top recommendations
    top_recommendations = restaurant_indices[1:6]

    # Display the top recommendations with all parameters
    recommended_restaurants = df.iloc[top_recommendations]
    print("Top 5 Recommended Restaurants:")
    print(recommended_restaurants[['name', 'rate', 'location', 'rest_type', 'dish_liked', 'cuisines', 'cost']])

# Example usage:
user_input = input("Enter your preferences (name, rate, location, rest_type, dish_liked, cuisines, cost): ")
recommend(user_input)
```

7.2 FEATURE 2

Intuitive User Interface

This feature provides a user-friendly and intuitive interface that allows users to easily navigate the system, find the information they need, and make informed decisions about where to dine. The interface is designed with clear labels, consistent layouts, and intuitive navigation to enhance the user experience.

Code Snippets:

```
                <li>Log in</li>
                <li>Sign up</li>
            </ul>
        </div>
        <div class="head">

            <img class="logo" src="https://i.postimg.cc/26K5z2C0/image-removebg.png" alt="">
            <h3>Discover the best food & drinks in Bangalore</h3>
            <form id="searchForm">
            <div class="search">
                <div class="search-item">
                    <i class="fas fa-map-marker-alt"></i>
                    <p>Whitefield, Bangalore</p>
                </div>
                <div class="search-item">
                    <i class="fas fa-search"></i>
                    <input type="text" placeholder="Search for restaurant, cuisine, a dish or location">
                    <button type="button" onclick="submitForm()">Search</button>

                </div>
            </div>
            </form>
        </div>
        <div class="header-image">
            <img src="https://b.zmtcdn.com/web_assets/81f3ff974d82520780078ba1cfbd453a1583259680.png" alt="">
        </div>
    </header>
```

```
<!-- SECTION 3 -->
<section class="section-3">
    <div class="section-3-container">
        <div class="section-3-img">
            <img src="https://b.zmtcdn.com/data/o2_assets/a500ffc2ab483bc6a550aa635f4e55531648107832.png" alt="">
        </div>
        <div class="section-3-content">
            <h1>Get the DineWise App</h1>
            <p>
                Download the app from
            </p>
            <div class="section-3-download">
                <img src="https://b.zmtcdn.com/data/webuikit/23e930757c3df49840c482a8638bf5c31556001144.png" alt="">
                <img src="https://b.zmtcdn.com/data/webuikit/9f0c85a5e33adb783fa0aef667075f9e1556003622.png" alt="">
            </div>
        </div>
    </div>
</section>

<footer>
    <code>
        Made with ❤️ by SAD
    </code>
</footer>
<script>
```

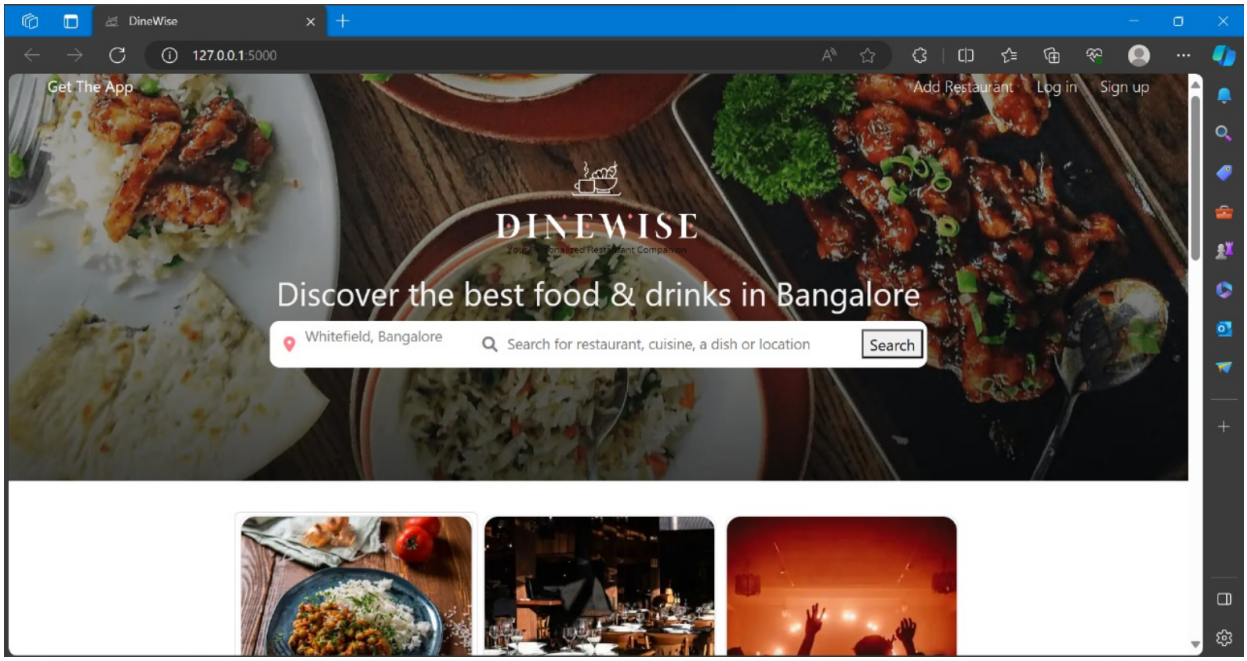
8.PERFORMANCE TESTING

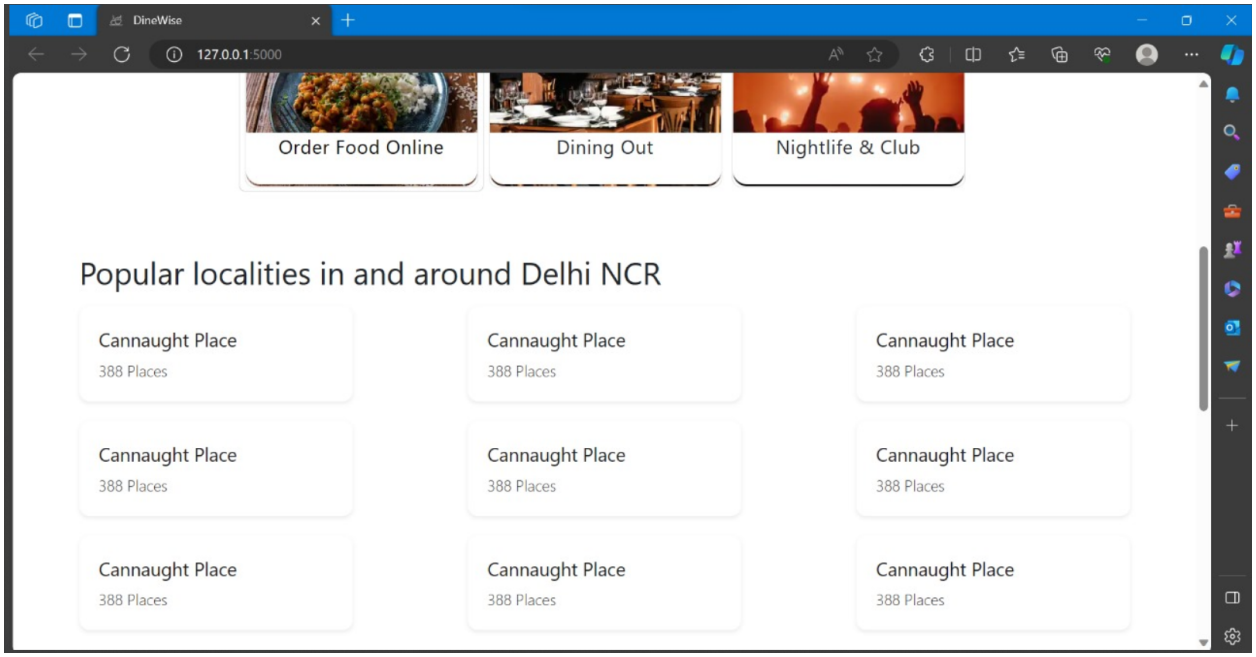
8.1 PERFORMANCE METRICS

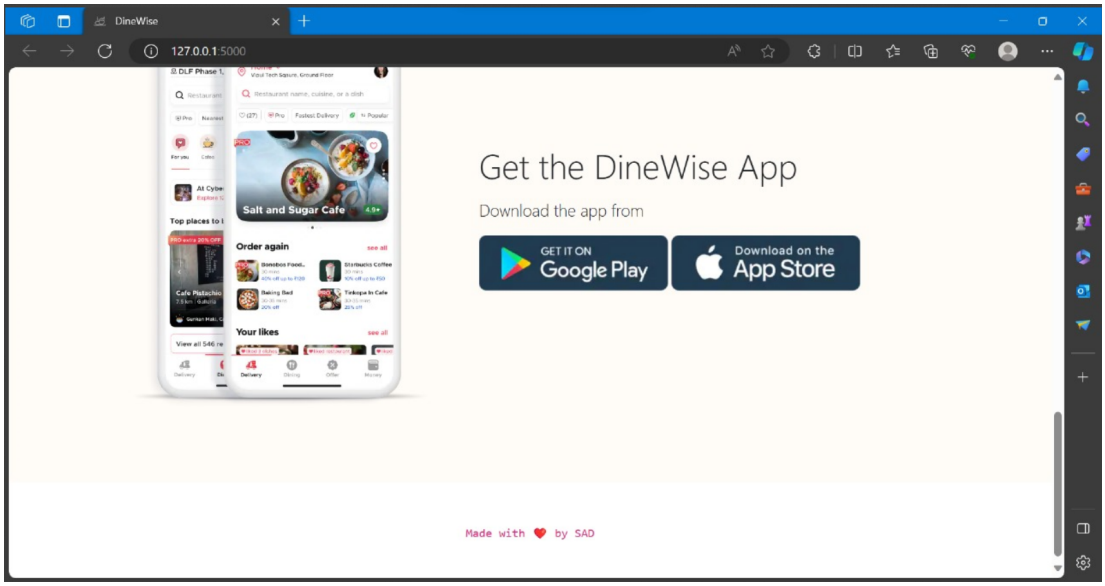
```
Average Precision: 0.20
Average Recall: 0.59
Average F1 Score: 0.29
```

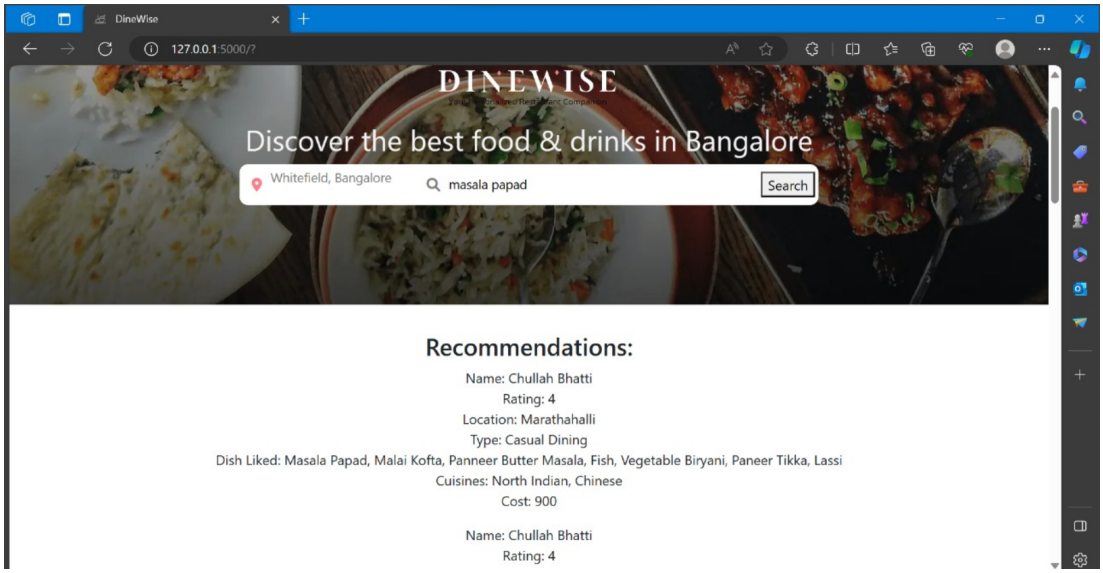
9.RESULTS

9.1 OUTPUT SCREENSHOTS









Recommendations:

Name: Chullah Bhatti
Rating: 4
Location: Marathahalli
Type: Casual Dining
Dish Liked: Masala Papad, Malai Kofta, Panneer Butter Masala, Fish, Vegetable Biryani, Paneer Tikka, Lassi
Cuisines: North Indian, Chinese
Cost: 900

Name: Chullah Bhatti
Rating: 4
Location: Marathahalli
Type: Casual Dining
Dish Liked: Masala Papad, Malai Kofta, Panneer Butter Masala, Fish, Vegetable Biryani, Paneer Tikka, Lassi
Cuisines: North Indian, Chinese
Cost: 900

Name: Delhi Restaurant
Rating: 3.6
Location: Whitefield
Type: Quick Bites
Dish Liked: Dal Makhani, Reshmi Kebab, Thali, Panneer Butter Masala, Naan, Rice, Masala Papad
Cuisines: North Indian, Mughlai, Chinese
Cost: 350

Name: Chullah Bhatti
Rating: 4
Location: Marathahalli
Type: Casual Dining
Dish Liked: Masala Papad, Malai Kofta, Panneer Butter Masala, Fish, Vegetable Biryani, Paneer Tikka, Lassi
Cuisines: North Indian, Chinese
Cost: 900

Name: Delhi Restaurant
Rating: 3.6
Location: Whitefield

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- **Personalization:**
  Users receive personalized recommendations based on their preferences, making the dining experience more enjoyable and tailored to individual tastes.
- **Time Efficiency:**
  Users can quickly find suitable restaurants without spending excessive time searching, enhancing user satisfaction and convenience.

- **Increased Engagement:**
  Regular updates and notifications about new restaurants or special offers can keep users engaged with the platform.

- **Enhanced Customer Experience:**
  Providing relevant suggestions improves the overall customer experience, leading to customer loyalty and repeat business.

- **Data-Driven Insights:**
  The system generates valuable insights into user preferences, helping restaurants optimize their menus, marketing strategies, and overall business operations.

- **Business Revenue:**
  Restaurants featured in recommendations may experience increased foot traffic and revenue, especially if the system promotes them effectively.

- **Community Building:**
  Users can share their experiences through reviews and ratings, contributing to a sense of community within the platform.

- **Social Integration:**
  Integrating with social media platforms allows users to share their restaurant choices and experiences with their social networks, providing free marketing for restaurants.

DISADVANTAGES:

- **Over-Reliance on Data:**
  Systems heavily depend on accurate user data, potentially leading to biased recommendations.

- **Limited Serendipity:**
  Content-based systems may lack the ability to introduce users to unexpected or novel dining experiences.

- **Influence of Fake or Biased Review:**
  Systems that incorporate user reviews may be susceptible to fake reviews or biased opinions.

- **Algorithmic Complexity:**
  Implementing sophisticated recommendation algorithms can be computationally intensive and can involve significant upfront and ongoing costs.

11. CONCLUSION

The Restaurant Recommendation System represents a significant step towards revolutionizing the way users discover and engage with dining options. Throughout the course of this project, the team has endeavored to address the existing challenges in restaurant discovery, aiming to provide a solution that goes beyond traditional search methods.

By leveraging machine learning algorithms, user data, and contextual information, the system effectively personalized recommendations, guiding users towards establishments that truly resonate with their tastes and expectations. The system's comprehensive set of functional and non-functional requirements ensures its effectiveness, reliability, and user-friendliness.

Throughout this project, our focus has been on addressing the challenges users face in discovering restaurants that align with their unique tastes. With the application of advanced content-based filtering algorithms, the system has become a virtual guide, navigating the expansive terrain of dining options and presenting users with recommendations tailored to their preferences.

As the system continues to evolve and incorporate new features, it is poised to play an increasingly significant role in the modern dining landscape. By continuously refining its algorithms, expanding its data sources, and integrating emerging technologies, the restaurant recommendation system will continue to revolutionize the way people discover, select, and enjoy dining experiences.

12. FUTURE SCOPE

The future scope of restaurant recommendation systems is vast and promising. As technology advances and user preferences evolve, these systems will continue to adapt and incorporate new features to enhance the dining experience. Here are some of the potential directions for future development:

- **Real-time Availability and Wait Times:** Integrating real-time data on restaurant availability and wait times can enable systems to provide accurate and timely recommendations, ensuring that users can avoid long waits and make informed decisions based on current conditions.

- **Social Recommendations and Collaborative Filtering:** Incorporating social connections and leveraging collaborative filtering techniques can allow systems to suggest restaurants based on the preferences and experiences of a user's friends or social network.

- **Knowledge base integration:** Integrating information from external sources, such as food blogs and culinary databases, to enrich restaurant profiles and provide contextually relevant recommendations.

- **Temporal preference analysis:** Understanding user dining preferences across different times of day and days of the week, providing contextually relevant recommendations based on the specific dining occasion.

- **Restaurant reservation integration:** Enabling seamless restaurant reservations within the recommendation system, providing a direct path from recommendation to dining experience.

- **Interactive and Immersive Experiences:** Augmented reality (AR) and virtual reality (VR) can be integrated to create immersive experiences, allowing users to virtually explore restaurants, visualize menus, and sample dishes before making a decision.

13. APPENDIX

References

- https://towardsdatascience.com/recommender-systems-and-hyper-parameter-tuning-25567b10e298
- https://www.analyticsvidhya.com/

Dataset: https://www.kaggle.com/datasets/himanshupoddar/zomato-bangalore-restaurants

GitHub Link
https://github.com/smartinternz02/SI-GuidedProject-600956-1697566749

Project Demo Link
https://drive.google.com/drive/folders/1Sf1atAwipiAuO2Uj1n5W6skY7TkYO-VH?usp=sharing