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College of Computing and Information Technology

Software Engineering & Computer Science

GRADUATION PROJECT I

Travia

Submitted By:

Younis Mohamed Abdelrahman 211006892

Ahmed Ehab Elsayed 211014027

Abdelrahman Ibrahim Mahmoud 211002951

Mahmoud Gamal Mahmoud 211009758

Kareem Atef Abdelmaksoud 211014291

Abdulrahman Ramadan Bakry 212004117

Supervised By:

Dr. Fahima Maghraby

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DECLARATION

We affirm that this project, submitted to the Arab Academy for Science, Technology and Maritime Transport - College of Computing and Information Technology, is the result of our own independent effort and creativity. We have worked diligently to ensure that this work is entirely original and free from any infringement of copyright laws. Furthermore, any content or information drawn from external sources has been appropriately acknowledged and cited in the references section.

ABSTRACT

Our Project **TRAVIA**, is an intelligent travel planning and social networking application designed to provide a personalized travel experience for solo travelers. Upon logging in, users complete a brief survey that collects essential travel details only once; such as age, gender, and relationship status. Users then select their desired destination via an interactive map. The AI-powered travel planner offers two levels of customization: a Basic Planner (B) and an Advanced Planner (A). The Basic Planner allows users to set their budget, trip duration, and preferences for experiencing destinations as a tourist or local. The Advanced Planner builds on these with additional options like adventure vs. relaxation preferences, family-friendly recommendations, accommodation types, dining choices and also includes real-time events. Users can also access the integrated social media section, where they can view nearby travelers and their plans. The social media feed also features posts from suggested friends and other travelers, allowing users to discover updates, experiences, and recommendations from fellow explorers. When the app detects that the user has arrived at their chosen city, a map similar to Snapchat displays nearby users and highlights the percentage of similarity between their travel plans, encouraging connections with like-minded travelers. This combination of advanced planning tools and social interaction positions Travia as a comprehensive travel solution for modern explorers.

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Chapter One

1 INTRODUCTION

This chapter introduces TRAVIA, a travel planning and social networking application designed to enhance solo travel experiences. It discusses the project's objectives, scope, and problem statement, highlighting the challenges faced by modern travelers and the innovative solutions TRAVIA provides. Additionally, it outlines the intended audience, and the design and implementation constraints shaping the project's development.

OVERVIEW

Traveling solo can be an exciting yet challenging experience, as it often involves finding the right destinations, balancing budgets, and navigating unfamiliar places without companionship. These challenges highlight the need for an integrated solution that not only simplifies travel planning but also fosters connections among like-minded travelers. Addressing this gap, **TRAVIA** emerges as an innovative travel planning and social networking application specifically designed for solo adventurers. The platform combines advanced AI-driven customization with social interactivity to provide a holistic travel experience.

At its core, TRAVIA offers two levels of trip planning: the Basic Planner and the Advanced Planner. The Basic Planner caters to essential travel needs, such as setting budgets, determining trip duration, selecting transportation options, and tailoring experiences to suit preferences for exploring destinations as a tourist or a local. Building on this foundation, the Advanced Planner provides enhanced customization by incorporating user-specific preferences like adventure versus relaxation, family-friendly recommendations, accommodation styles, dining options, and real-time event suggestions. These features ensure that each traveler's itinerary aligns seamlessly with their unique needs and desires.

In addition to planning, TRAVIA integrates an innovative social media component that transforms solo travel into a connected experience. Travelers can interact with others through a dynamic feed featuring posts, updates, and recommendations from suggested friends and fellow explorers. Upon arriving at a chosen destination, TRAVIA's interactive map displays nearby travelers, highlights shared travel plans, and calculates compatibility percentages based on itinerary similarities. This fosters organic connections and enriches the solo travel experience by creating opportunities for meaningful interactions.

With its blend of intelligent planning tools and community engagement, TRAVIA redefines solo travel, offering a personalized and socially connected approach to exploring the world.

The platform positions itself as a comprehensive solution for modern explorers, empowering them to plan, connect, and experience travel in entirely new ways.

1.1 Purpose

The tourism sector is one of the primary focuses of any nation. Tourism offers job opportunities to locals as well as help nations gather foreign currency. During the past years, the demand for an integrated smart traveling solution has increased from governments, private institutions, and tourists alike. Smart traveling solutions have become popular over the years due to the availability of more reliable technologies, our project, **TRAVIA** aims to offer the best solution for companies, governments, and travelers through utilizing several technologies.

1.2 INTENDED AUDIENCE:

TRAVIA is designed for a wide range of travelers, including solo adventures, couples, families, groups of friends, avid travelers, and casual explorers. It simplifies travel planning by offering personalized itineraries, collaborative planning tools, real-time updates, and social networking features. By addressing diverse needs with advanced AI and real-time insights, the app ensures a seamless travel experience by providing a tailored and hassle-free experience for every user.

1.3 INTENDED USE:

The primary use of our system is to simplify various processes pertaining to traveling to ensure a smooth traveling experience for travelers.

1.4 OVERALL SCOPE:

Our aim is to create an integrated solution for regular people looking for a holiday, avid travelers alike, and people looking for like-minded individuals. Through this study, we are exploring the need for such a project and what the needs of the traveling industry are, as well as explore solutions to fulfill those needs. We aim to achieve this through the following:

- Analyze current market gaps in the travel planning and booking process.
- Evaluate existing travel solutions and their limitations.
- Identify specific user needs and preferences across different traveler segments.
- Assess technological capabilities.
- Explore potential features and functionalities that would address identified needs.

1.4.1 PROBLEM STATEMENT:

Travelers face challenges in creating personalized travel experiences due to fragmented solutions, limited customization, inadequate social connectivity, and a lack of real-time information integration. Current platforms operate in isolation, offering generic recommendations and failing to connect like-minded travelers or provide comprehensive, real-time destination insights. This inefficiency hinders effective planning and diminishes the overall travel experience.

1.4.2 OUR AIMS AND OBJECTIVES:

- Develop cross-platform mobile application
- Implement dual AI planning systems
- Create secure user authentication
- Establish real-time event tracking
- Build social networking features

1.5 Definitions

System/Product Description Travia is a comprehensive travel planning platform designed to cater to the needs of modern travelers. The system integrates advanced AI capabilities, social media features, and a user-friendly interface to help users plan personalized trips efficiently. It bridges the gap between travel planning and social connectivity by enabling users to generate detailed travel itineraries, interact with nearby travelers, and share experiences.

Features and Functionality

1. **Personalized Travel Planning:** The AI planner generates tailored travel plans based on user preferences, such as destination, budget, and travel duration.
2. **Social Media Integration:** Users can share their plans, view nearby travelers, and explore travel plan similarities to foster social interaction.
3. **Pricing Options:** Offers a free model with basic features, subscription plans for frequent travelers, and pay-per-use options for premium features.
4. **Support System:** Chatbot assistance for real-time guidance and issue resolution.

Challenges

1. **Data Privacy:** Protecting user data and ensuring secure transactions.
2. **System Scalability:** Ensuring the platform can handle increased user activity during peak travel seasons.
3. **User Retention:** Balancing free and paid features to retain users while generating revenue.

Risks and Mitigation

- **Risk:** Data breaches leading to user distrust.
Mitigation: Implement robust encryption and comply with GDPR and other privacy standards.
- **Risk:** High operational costs for AI and server infrastructure.
Mitigation: Optimize resource usage and explore scalable cloud-based solutions.
- **Risk:** Negative user feedback due to inaccurate AI plans.
Mitigation: Continuously improve AI algorithms through user feedback and testing.

1.6 Statistics

- The size of the global online travel market is predicted to reach \$1.2 trillion in 2027.
- 50% of travelers spend less than a week doing the research before departing on vacation.
- 87% of visitors desire to travel sustainably.
- The most lucrative online travel market is in Asia-Pacific.
- The average traveller makes 38 website visits before deciding and making a booking

References of the above are found at: [6]

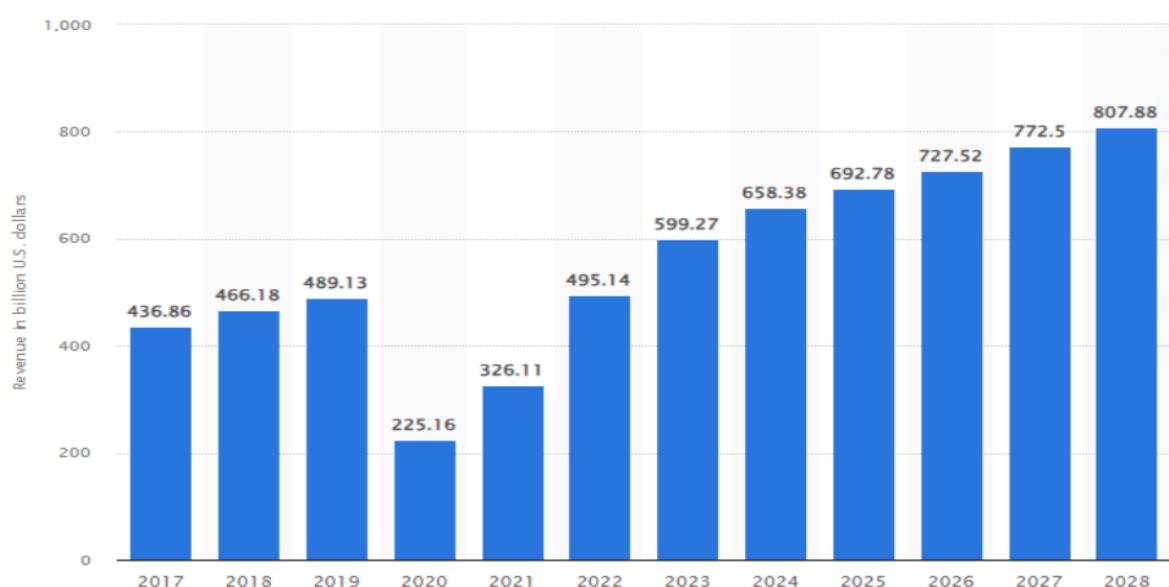


Figure 1 : Statistics 1

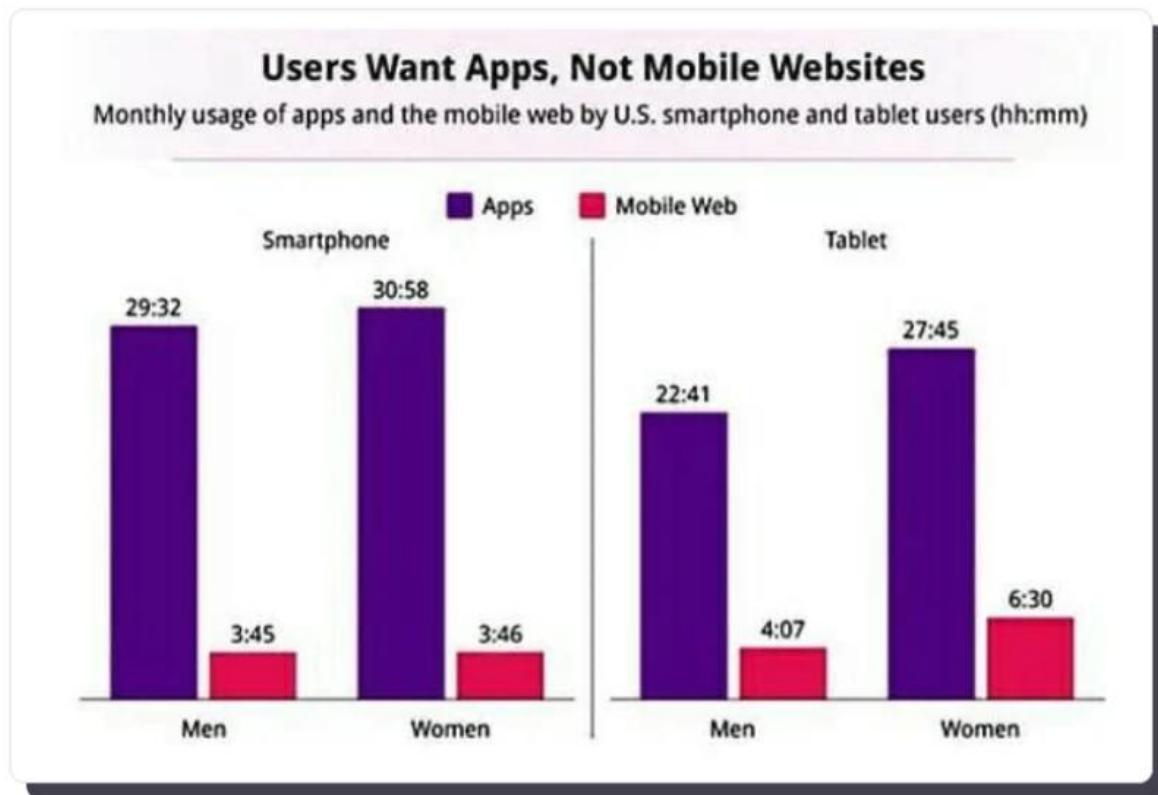


Figure 2 : Statistics 2

1.7 List of Standards

1. **ISO/IEC 27001:** Ensuring data security management throughout the platform.
2. **ISO 9241-210:** Following guidelines for user experience and usability.
3. **GDPR Compliance:** Protecting user data in accordance with international privacy laws.
4. **WCAG 2.1:** Ensuring accessibility for users with disabilities.
5. **IEEE 830-1998:** Adopting software requirements specification standards.

1.8 List of Realistic Constraints

Cost/Economics:

- Development and maintenance costs for AI modules, server infrastructure, and customer support systems.
- Revenue constraints due to reliance on free-tier users versus premium subscriptions.

Environmental Impact:

- Energy consumption of servers and AI processing, necessitating the use of energy-efficient data centers.

Ethics:

- Ensuring unbiased AI-generated plans that respect diverse user backgrounds and preferences.
- Transparent pricing and avoiding manipulative upselling tactics.

Social and Political Impact:

- Promoting cultural exchange and sustainable tourism practices.
- Avoiding political controversies by respecting regional travel restrictions.

Health and Safety:

- There are no Health and Safety measures in our app, we suggested giving alerts about places that are dangerous but this proved to be too difficult.

Sustainability:

- Encouraging eco-friendly travel options, such as public transport and sustainable accommodations.
- Minimizing carbon footprints by optimizing AI resource usage.

1.9 DESIGN AND IMPLEMENTATION CONSTRAINTS:

- **Technological Limitations:** AI algorithms and real-time data may face performance and accuracy challenges, especially on devices with varying capabilities.
- **Platform Compatibility:** Ensuring consistent functionality and design across iOS and Android platforms.
- **User Data Privacy and Security:** Protecting sensitive user data and ensuring compliance with privacy regulations (e.g., GDPR).
- **Real-Time Data Integration:** Reliance on third-party APIs for accurate, up-to-date event and location data.

- **Scalability:** Building a system that can handle increasing traffic and data loads as the user base grows.
- **User Interface and Experience:** Balancing advanced features with ease of use for all types of travelers.
- **Budget and Resources:** Developing within budget constraints, potentially limiting feature scope or AI depth in the initial release.

1.10 Software Components:

We will mainly mention the software tools that will be used for the project.

1.10.1 Software tools:

- Flask.
- Python.
- Google Colab
- FireBase
- Android Studio
- Dart
- Flutter

1.10.2 Libraries:

- Scikit-learn
- Pandas
- Numpy
- TensorFlow

1.11 LITERATURE REVIEW:

The evolution of smart tourism technologies (STTs) has fundamentally transformed the travel industry, creating new opportunities for enhanced tourist experiences and destination management.

In creating these smart tourism technologies and implementing our AI to better help our users, we researched multiple papers that will help us get a scientific background and better our understanding of travel planning.

Table 1 : Research Papers

Title, Author, and Publication Year.	Objective	Method	Result	Dataset	Limitations
Travel Itinerary Planner Using AI [1] Authors: Ankita Mudhale ¹ , Madhuri Shirmale ² , Vedant Kudalkar ³ , Rishikesh	The paper focuses on addressing the limitations of existing travel planning systems, including the lack of personalization, real-time data integration, and user-friendly interfaces. It aims to generate optimized travel itineraries by considering user preferences, real-time constraints, and contextual data like weather and travel duration.	System Architecture: User account management for profile-based planning. Integration of real-time data (e.g., weather, transportation) to dynamically adjust itineraries. AI models like NLP for understanding user inputs and generating tailored recommendations. Incorporates user preferences and constraints to generate unique travel plans.	The proposed system delivers: User-friendly interfaces for trip planning. Real-time itinerary adjustments based on contextual changes. High satisfaction due to the integration of user preferences and real-time data.	The system relies on various datasets, including destination attributes, transportation options, and real-time weather data. Data preprocessing steps ensure clean and standardized inputs for	Dependency on reliable real-time data sources, which could lead to inaccuracies in case of network failures. Algorithmic complexity might lead to higher

Motiray4, Sharique Ahmad5				machine learning models.	computational requirements.
Publication Year: 2020					
A Novel Mean-Shift Algorithm for Data Clustering Authors: Claude Cariou, Steven Le Moan, Kacem Chehdi Publication Year: 2022	The paper talks about the RMS algorithm and how it aims to improve clustering efficiency and accuracy by combining the strengths of MS and BMS. It is particularly suitable for identifying non-convex clusters and	The RMS algorithm employs a hybrid approach that incorporates kernel-based density estimation and nearest-neighbour techniques. Key aspects include: Kernel-based RMS: Adjusts bandwidth to optimize clustering. NN-based RMS: Uses the nearest neighbours to define clusters dynamically,	Experimental results show that RMS outperforms MS and BMS in terms of: Accuracy and purity of clustering. Computational efficiency due to fewer iterations. Robustness across diverse datasets, including high-dimensional ones.	The experiments used synthetic and real-world datasets with diverse configurations, such as overlapping, non-convex clusters, and varying dimensionality. Metrics included accuracy, kappa index, and	The document highlights some limitations: Scalability challenges with large datasets. Dependency on optimal parameter selection (e.g., bandwidth, number of neighbours). Relevance to TRAVIA:

	<p>handling datasets with varying densities.</p> <p>Relevance to TRAVIA: our project requires clustering techniques to group users and their preferences for personalized recommendations.</p> <p>RMS's ability to handle non-convex clusters aligns with the need to group travelers with diverse and overlapping preferences effectively.</p>	<p>adapting to local data density.</p> <p>Relevance to TRAVIA: The adaptability of RMS to local densities mirrors the clustering required for personalized recommendations in the social media section of TRAVIA.</p>	<p>Relevance to TRAVIA: High accuracy and robustness are essential for ensuring meaningful clustering of user preferences and travel plans.</p> <p>Faster convergence of RMS means reduced computational overhead, crucial for real-time applications in our app.</p>	<p>consistency violation ratio (CVR).</p> <p>Relevance to TRAVIA: Our dataset, encompassing user preferences, travel plans, and real-time events, is likely high-dimensional and diverse, similar to those tested in the study.</p> <p>Metrics like accuracy and purity can help evaluate the clustering models that we integrate into TRAVIA.</p>	<p>Parameter tuning for RMS (e.g., determining optimal K for nearest neighbours) must align with the app's dynamic clustering needs.</p>
Clustering And Deep Reinforcement Learning Based Multi-Period Portfolio Management Strategy [3] Authors: Zhengyong Jianga,b, Jeyan Thiayagalingam,	<p>The study aims to optimize portfolio management by clustering financial assets and applying reinforcement learning methods to generate trading actions and determine portfolio allocations.</p> <p>Relation to TRAVIA: The clustering-based approach can be adapted for categorizing destinations or user preferences (e.g., budget-friendly, adventure-focused, etc.) to refine personalized travel</p>	<p>Clustering: Used the DBSCAN method</p> <p>Reinforcement Learning:</p> <p>Relation to TRAVIA:</p> <p>Clustering: The DBSCAN clustering method can group destinations or events based on user preferences and environmental attributes, enabling nuanced recommendations.</p> <p>Reinforcement Learning: A3C and DDPG algorithms can be repurposed for itinerary planning.</p> <p>Metrics: Similar performance metrics, such as user satisfaction or alignment with preferences, can be used to validate TRAVIA's recommendations.</p>	<p>The integration of clustering with RL outperformed other strategies, achieving higher returns (151.29% cumulative portfolio wealth) and lower risk (Max Drawdown reduced from 0.148 to 0.089).</p> <p>Relation to Travia:</p> <p>The superior performance of clustering and RL in this study underscores their applicability in Travia. By clustering user preferences and applying RL to</p>	<p>The study used stock trading data from 800 stocks across the Shanghai Stock Exchange and NASDAQ, leveraging financial indicators for clustering and training RL models.</p> <p>Relation to TRAVIA: Instead of financial indicators, TRAVIA would use datasets comprising user demographics, destination attributes, and preferences. These datasets should include:</p> <ul style="list-style-type: none"> Budget constraints Real-time events User feedback <p>The structured approach to dataset pre-processing (e.g., dimensionality reduction) is directly transferable to TRAVIA for handling complex,</p>	<p>Dataset Size: Performance degraded with smaller datasets.</p> <p>Action Space: The vast action space posed challenges for DDPG in large datasets.</p> <p>Assumptions: Assumed perfect liquidity and zero impact costs, simplifying real-world conditions.</p> <p>Relation to TRAVIA: Dataset Size: Assembling comprehensive data on user behaviour, destinations, and events will be crucial for TRAVIA to achieve reliable</p>

Jionglong Su and Jinjun Liang e Publication Year: 2023	recommendations in TRAVIA. Reinforcement learning (RL) strategies align with the needs of dynamic itinerary adjustments in TRAVIA, addressing user feedback and real-time data such as events or location changes.		adaptively refine travel plans, Travia can ensure higher satisfaction rates. Metrics like Max Drawdown can inspire analogous measures (e.g., deviation from user preferences or budget overruns) for assessing travel plan quality.	multidimensional user data.	clustering and planning outcomes.
Trip Planner Using Generative AI Authors: K. Venkat Manideep, R. Atuliya, Vinayak Viswan, Durga Aakash Ganesh, Spoorti B. Reddy, Prof. Sahana Shetty Publication Year: 2024	To create a personalized trip planning application leveraging generative AI for itinerary generation. The paper introduces an AI-powered trip planner that aims to simplify trip planning by offering personalized recommendations and schedules. It leverages user preferences, historical data, and real-time updates to optimize travel experiences	Architecture: Integration of generative AI models for dynamic itinerary creation. Relevance to TRAVIA: NLP & Generative AI: Use fine-tuned language models for surveys and travel plan generation. Recommendation Systems: Suggest destinations and activities using collaborative and content-based filtering. K-Shortest Path: Optimize real-time mapping for efficient routes. Optimization Algorithms: Create personalized itineraries using constraint-based methods.	Achieved 85% accuracy in generating itineraries tailored to user preferences and budget constraints.	Travel-related APIs (e.g., Google Maps, Expedia) and datasets on user reviews, transportation, and accommodations.	Dependency on external APIs for real-time updates and challenges in balancing cost optimization with user personalization.
Tuning Reinforcement Learning Parameters for Cluster Selection to Enhance Evolutionary Algorithms	To optimize travel recommendations using AI by balancing exploration and	Reinforcement learning with dynamic cluster selection, parameter optimization using grid search, Gaussian distribution modeling for preference prediction. Example on TRAVIA: Cluster 1: Adventure-seekers.	Achieved 75.2% success rate in accurate cluster-based recommendations,	User preference clusters generated from travel APIs and historical travel behavior data.	High computational cost for tuning parameters; sensitivity to initial

Authors: Nathan Villavicencio and Michael N. Groves	exploitation in user clustering.	Cluster 2: Luxury-seekers. Cluster 3: Budget-friendly travelers. RL learns: Cluster 1 generates popular recommendations → Reward. Cluster 3 is overused → Penalize. Outcome: TRAVIA optimizes recommendations based on user feedback and data.	outperforming baseline methods by 41%.		clustering thresholds.
Publication Year: 2024					

1.11.1 Theoretical Foundation

The theoretical foundation of AI-driven travel planning systems is built upon several key concepts that emerge from the reviewed literature. Mudhale et al. [1] establish the fundamental framework for integrating AI into travel planning, emphasizing the importance of real-time data processing and personalized recommendation systems. The integration of clustering techniques, as demonstrated by Cariou et al. [2], provides the theoretical basis for grouping similar travel preferences and user behaviors. This is further enhanced by the application of reinforcement learning principles, which Jiang et al. [3] show can be effectively adapted from portfolio management to travel planning contexts.

1.11.2 Core Components

Modern AI-driven travel planning systems comprise several essential components that work in concert to deliver personalized experiences. The backbone of these systems includes user preference analysis, real-time data integration, and dynamic itinerary generation [1]. Manideep et al. [4] introduce generative AI as a crucial component for creating detailed, personalized travel plans, achieving an impressive 85% accuracy in matching user preferences. The clustering mechanisms, particularly the RMS algorithm [2], serve as vital components for grouping similar travel preferences and destinations, while reinforcement learning algorithms provide the adaptive decision-making capability necessary for real-time recommendations [3].

1.11.3 Impact on touristic experience

The literature reveals significant improvements in tourist experiences through AI-driven planning systems. Mudhale et al.'s [1] findings demonstrate enhanced user satisfaction through real-time itinerary adjustments and personalized recommendations. This is complemented by Villavicencio

and Groves' [5] research, which shows a 75.2% success rate in accurate cluster-based recommendations, significantly improving the match between traveler preferences and experiences. The integration of generative AI [4] further enhances the tourist experience by providing more nuanced and contextually appropriate recommendations.

1.11.4 Data driven decision method

The reviewed papers highlight sophisticated data-driven approaches to decision-making in travel planning. Jiang et al. [3] demonstrate how clustering combined with reinforcement learning can optimize decision-making processes, while Cariou et al. [2] show how advanced clustering algorithms can better handle the complexity of travel preference data. The RMS algorithm's ability to adapt to local data density proves particularly valuable for travel planning applications, where user preferences and destinations often form non-convex clusters.

1.11.5 Integration of technologies

Technology integration emerges as a critical factor in the success of AI-driven travel planning systems. Manideep et al. [4] showcase the effective integration of generative AI with traditional recommendation systems, while Mudhale et al. [1] demonstrate the successful combination of real-time data sources with AI planning algorithms. The integration of clustering techniques with reinforcement learning [3] represents a particularly promising approach, showing how different AI technologies can work together to provide more accurate and personalized recommendations.

1.11.6 Enhanced Personalization

Personalization capabilities have seen significant advancement through the application of AI technologies. Villavicencio and Groves [5] demonstrate how reinforcement learning can be tuned to optimize cluster selection for personalized recommendations. This is supported by Manideep et al.'s [4] work showing how generative AI can create highly personalized itineraries that account for individual preferences and constraints. The combination of clustering and reinforcement learning approaches [3] provides a robust framework for delivering increasingly personalized travel experiences.

1.11.7 Scalability and Performance Optimization

The literature addresses crucial aspects of scalability and performance optimization. Cariou et al.'s [2] RMS algorithm shows improved computational efficiency over traditional methods, while Jiang et al. [3] demonstrate how clustering can help manage large-scale data processing effectively. However, challenges remain, particularly in handling large datasets and optimizing real-time performance, as noted in several studies [1, 2, 3].

1.11.8 Future Directions and Challenges

The reviewed literature points to several emerging challenges and future directions in AI-driven travel planning. Key areas include improving real-time adaptation capabilities, enhancing the accuracy of preference matching, and developing more sophisticated social networking features. The integration of emerging technologies like generative AI [4] and advanced reinforcement learning techniques [5] suggests a trend toward more sophisticated and capable systems that can better serve users' evolving needs.

1.11.9 Security and Privacy Considerations

The implementation of AI-driven travel systems necessitates careful consideration of security and privacy aspects. The collection and processing of user data, especially in social networking features, requires robust security measures and privacy-preserving techniques to protect user information while maintaining system functionalities.

2 SYSTEM DESCRIPTION

TRAVIA is an essentially new System with several unique characteristics. **TRAVIA** consists primarily of a database as well as a mobile application serving as the interface.

2.1 Methodology

- **Gathering Data:**
Look at chapter 5 (system analysis)
- **Designing the mobile application:** We will design the mobile application using Figma, a mobile app prototyping tool, and ensure that the application meets key UI/UX design and HCI principles.
- **Developing the mobile application:** We will develop the mobile application using flutter as to ensure compatibility and optimization with both Android and IOS mobile phones.
- **Testing the mobile application:** We will test the mobile through different types of application testing, which include but not limited to, performance, usability, compatibility, and functional testing.
- **Integrating the system:** We will integrate all system components.
- **Testing the system as a whole:** We will test the system as a whole to ensure all components are interconnected together and working flawlessly. This is done through performance, usability, compatibility, functional, and interruption testing.

2.2 User Classes and Characteristics

Users of **TRAVIA** will be avid travelers and people looking for a holiday. We aim to help these people in their traveling through simplifying the processes related to traveling through our system.

Profiling the users:

- Avid Travelers
- People looking for a holiday

- People looking for like-minded individuals
- People who want to go for an outing

2.3 Assumptions and Dependencies

- **Accuracy:** We assume our system functions accurately; we should perform comprehensive testing as well as software verification and validation to verify our assumption.
- **Integration and stability:** We assume our system is well integrated and functioning in a synchronized and consistent manner, we will also need to verify this through testing.

2.4 Intended Technologies

2.4.1 Flutter

Description

Flutter is an open-source UI software development kit created by Google. It is used to develop cross platform applications from a single codebase for any web browser, Fuchsia, Android, iOS, Linux, macOS, and Windows.

Purpose

We will use Flutter to create the mobile application that will serve as an interface for our System.

2.4.2 Dart

Description

Dart is a programming language developed by Google. It can be used to develop web and mobile apps as well as server and desktop applications.

Purpose

We will use Dart with the flutter framework to create our mobile application.

2.4.3 Android Studio

Description

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development.

Purpose

We will use Android Studio as our IDE to implement our Flutter application.

2.4.4 Python

Description

Python is a high-level, general-purpose programming language that is dynamically typed.

Purpose

We will use Python to implement our AI model.

2.4.5 Spyder

Description

Spyder is an open-source cross-platform integrated development environment (IDE) for scientific programming in the Python language.

Purpose

We will use Spyder as our IDE to implement our AI model using Python.

2.4.6 Web Scraping

Description

Web scraping is a form of copying in which specific data is gathered and copied from the web, typically into a central local database or spreadsheet, for later retrieval or analysis.

Purpose

We will use web scraping to obtain data from various sources in order to display to the user. We are considering web scraping google maps data for the selected city.

2.4.7 Flask

Description

Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries.

Purpose

We will use Flask in order to establish a connection between our mobile application and the AI model.

2.4.8 Firebase

Description

Google Firebase is a set of cloud-based development tools that helps mobile app developers build, deploy and scale their apps.

Purpose

We will use Firebase for authentication for our mobile application.

2.4.9 Artificial Intelligence

Description

Artificial intelligence (AI) is a set of technologies that enable computers to perform a variety of advanced functions, including the ability to see, understand and translate spoken and written language, analyze data, make recommendations, and more.

Purpose

We will use AI to produce a plan for the user based on their preferences and selected options.

2.5 System Functional requirements

TRAVIA offers 7 basic functions:

- Registration
- Logging In
- Preferences Feature
- Destination Selection
- Basic AI Travel Planner
- Advanced AI Travel Planner
- Social Media Integration

2.6 Operating Environment

The interface component for **TRAVIA** will run as a mobile app with either IOS or Android and will be well suited for both platforms.

2.7 AI Technologies used:

This project integrates a range of advanced AI technologies and robust preprocessing techniques to create a seamless system for accurate, efficient, and personalized recommendations. By addressing the challenges inherent in raw and unstructured data, the system ensures that AI models

can function optimally and deliver actionable insights. The workflow can be divided into two key phases: **data preprocessing** and **AI-driven decision-making**

2.7.1 Data Preprocessing:

Before we dive into the AI techniques, it's essential to preprocess the data to make it suitable for the model. This step ensures that the data is clean, standardized, and encoded in a way that the algorithms can understand

2.7.1.1 Handling Missing Values:

Missing data can lead to inaccuracies in the model, so we employed the Simple Imputer class from the scikit-learn library. The imputer fills missing values based on predefined strategies, such as:

- Mean or Median Imputation for numerical features (e.g rating or price).
- Most Frequent or Constant Value Imputation for categorical features (e.g category).

2.7.1.2 Encoding Binary Features

Some features in the dataset had binary values (e.g., true or false for attributes like "Has Parking" or "Outdoor Seating"). To make these features usable by the model, we applied label encoding:

- true was encoded as 1, and false as 0.
- This simple transformation allowed these features to be represented numerically.

2.7.1.3 Encoding multi-Categorical Data fields

Problem Statement

- Our dataset contains a column named "**Category**", where each field includes multiple categories (e.g., "Adventure, Family, Luxury").
- If the "Category" column contained only a single category per field, we could have used **One-Hot Encoding** to transform the data.
- However, due to the presence of multiple categories in each field, **One-Hot Encoding** is not suitable.

Solution: Multilabel Binarizer

- To address this issue, we use **Multilabel Binarizer**, which is specifically designed for multi-category fields.
- Used to handle fields containing multiple categories or labels associated with each record.
- Ensures data is transformed into a machine-readable format for analysis and model training.

How It Works

- Converts multi-category data into binary vectors.
- Represents each unique category as a binary feature (column).
- Encodes the presence (1) or absence (0) of each category for a given record.
- Example: A "category" column with values like "Adventure, Family, Luxury" is split into separate binary columns for each category.
- Ideal for datasets with fields containing multiple labels, enabling structured and efficient preprocessing.

Benefits:

- Converts multi-category fields into a structured binary matrix for analysis.
- Enables machine learning models to process and utilize the data effectively.

Example:

- Input: "Adventure, Family, Luxury"
- Output:
 - Adventure: 1
 - Family: 1
 - Luxury: 1
 - All other categories: 0

2.7.2 Clustering for Business Grouping: Why Clustering?

1. **Reduces the Size of the Action Space**
 - Clustering reduces the number of potential choices by grouping similar options together.
 - By focusing on clusters rather than individual data points, the size of the action space becomes smaller, simplifying the decision-making process.
2. **Enhances Efficiency**

- By narrowing down options, clustering allows **Reinforcement Learning (RL)** algorithms to operate on a reduced and more focused set of alternatives.
 - This significantly speeds up the decision-making process, as the algorithm does not need to evaluate every individual data point but can concentrate on representative clusters.
- 3. Improves Personalization**
- Clusters naturally represent user preferences or behaviors.
 - For example, a cluster might represent users interested in "trendy restaurants for lunch" or "budget-friendly accommodations."
 - This improves the system's ability to deliver personalized recommendations or actions tailored to specific user needs.
- 4. Algorithm Recommendation: Mean Shift**
- After experimenting with multiple clustering algorithms (e.g., K-Means, DBSCAN), **Mean Shift** turned out to be the best choice for our use case.
 - It provided superior results in detecting clusters dynamically without requiring predefined parameters.

Steps of the Mean Shift Algorithm

- 1. Initialization**
 - Begin by placing a **kernel** (a window, circle, or sphere) around each data point in the dataset.
 - The kernel defines a region of influence for each data point, allowing the algorithm to focus on the local density of data points.
 - 2. Calculate the Mean**
 - For each kernel, calculate the mean (average) of all data points within its radius.
 - This mean represents the center of gravity of the data points within the kernel's range.
 - 3. Shift Towards Density**
 - Move the kernel center to the calculated mean.
 - This "shift" directs the kernel toward areas of higher density in the dataset.
 - 4. Repeat Until Convergence**
 - Repeat the process of calculating the mean and shifting the kernel center until the kernel's movement becomes insignificant or stabilizes.
 - Points whose kernels converge to the same position are grouped into the same cluster.
 - 5. Assign Clusters**
 - Once the kernel positions have stabilized, group data points based on their respective kernel centers.
 - Data points converging on the same kernel center are assigned to the same cluster.
-

Benefits of Mean Shift

- **No Predefined Clusters:** Unlike K-Means, Mean Shift does not require specifying the number of clusters beforehand.
- **Adaptability:** Automatically adapts to the dataset's density, making it ideal for complex or irregularly distributed data.
- **Improved Accuracy:** Produces more natural clusters by focusing on density, enhancing the quality of personalization and decision-making
- **Best Fit for Our Use Case:** After testing various clustering algorithms (e.g., K-Means, DBSCAN, Agglomerative Clustering), **Mean Shift** outperformed others in terms of accuracy, flexibility, and its ability to handle diverse and dynamic datasets. This made it the optimal choice for our project.

2.7.3 Reinforcement Learning for Personalized Recommendations:

Two Cluster Action Selection Methods

1) Dynamic Probability-Based Cluster Selection

- **Mechanism:**
 - Calculates the similarity between user preferences and the aggregate features of each cluster (e.g., using Euclidean distance or other distance metrics).
 - Multiplies this similarity score by the prior probability of selecting that cluster to account for its overall relevance.
 - Normalizes the resulting probabilities to ensure they sum to 1, making it easier to identify the most suitable cluster.
 - Selects the cluster with the highest probability as the final choice.
- **Limitations:**
 - **Lack of Sequential Awareness:**
 - This method does not consider the sequential nature of decision-making, where previous cluster selections can influence future actions.
 - It lacks adaptability in scenarios requiring a more dynamic approach.
 - **Struggles in Complex Environments:**
 - When the relationship between user preferences and clusters changes over time, this method may fail to capture these evolving dynamics effectively.
 - **Static Approach:**
 - The static calculation of probabilities does not adjust well to feedback received during the decision-making process.
- **Recommendation:**
 - Due to these limitations, **Dynamic Probability-Based Cluster Selection** is less effective for environments requiring dynamic, sequential decision-making.

- Instead, we recommend using **Proximal Policy Optimization (PPO)**, a reinforcement learning-based approach that provides better adaptability and precision in such scenarios.

2) Cluster Selection Using Reinforcement Learning (RL)

- **Mechanism:**
 - The RL agent selects a cluster based on the current state of the system and a predefined policy derived from precomputed clusters.
 - The agent evaluates the clusters by estimating their expected rewards, which represent how well they align with user preferences.
 - The cluster with the highest expected reward is chosen as the optimal action.
- **Reward Signal:**
 - Positive Reward:
 - If the selected cluster leads to high user satisfaction, the agent receives a positive reward.
 - For example, if a user enjoys a cluster characterized by a particular location or activity type, the agent prioritizes clusters with similar attributes in future selections.
 - Negative Reward:
 - If the selected cluster results in poor user satisfaction, the agent receives a negative reward.
 - The agent learns to avoid clusters with features that fail to meet user expectations in subsequent decisions.
- **Policy Update:**
 - The RL agent uses the reward signals to continuously update its policy.
 - Positive rewards increase the likelihood of selecting clusters with similar features, while negative rewards decrease the likelihood of choosing clusters associated with dissatisfaction.
 - This iterative learning process ensures the agent becomes more effective at matching user preferences over time.

3) PPO-Based Cluster Selection

- **Why PPO?**
 - **Dynamic Adaptability:** Unlike static methods like Dynamic Probability-Based Cluster Selection, PPO excels in adapting to evolving user preferences and dynamic environments.
 - **Sequential Decision-Making:** PPO effectively incorporates the sequential nature of decisions, allowing the agent to account for past actions and their outcomes when making future choices.
 - **Robustness:** PPO is known for its stability and efficiency in training reinforcement learning models, making it ideal for complex environments with changing relationships between user preferences and clusters.
- **Mechanism:**

- PPO uses a policy gradient approach to refine its decision-making process.
- The agent interacts with the environment and receives feedback (rewards) based on the outcomes of its actions.
- Positive feedback increases the probability of selecting the same or similar clusters in the future, while negative feedback decreases the probability.
- **Benefits of PPO in Cluster Selection:**
 - Allows the system to learn from user feedback in real-time.
 - Enhances personalization by continuously adapting to user preferences.
 - Improves efficiency by focusing on clusters with higher rewards, reducing the likelihood of poor choices.

Final Recommendation

While Dynamic Probability-Based Cluster Selection is a simpler and faster approach, its limitations in handling sequential decision-making and adapting to dynamic user preferences make it less suitable for complex environments. **PPO-Based Cluster Selection** provides a more robust, adaptable, and efficient method for selecting clusters that align with user needs, making it the preferred choice for advanced applications.

3 SYSTEM REQUIREMENTS

Functional requirements define what a product must do and what its features and functions are. Nonfunctional requirements, also known as quality attributes, describe the general properties of a system. In this section we will thoroughly specify both our functional and nonfunctional requirements in detail.

3.1 Functional Requirements

3.1.1 Registration

Description

The user registers for an account on TRAVIA.

Requirement(s)

The user creates an account through their phone number or E-mail. The user may also choose to create an account through their social media platform of choice.

3.1.2 Logging In

Description

The user logs in to their already registered **TRAVIA** account.

Requirement(s)

The user enters their credentials to log in to their already registered account. This may be through their mobile number, E-mail, or social media account.

3.1.3 Preferences Feature

Description

The user enters personal information so that the system could view preferred choices to them

Requirement(s)

The user enters some information about themselves that include:

- User Age

- User Sex
- User Relationship Status

3.1.4 Destination Selection

Description

User selects which location they want to learn more about to potentially choose that destination to travel to.

Requirement(s)

A map is displayed for the user to select their country and city of interest.

3.1.5 AI Travel Planner:

Table 2 : Basic Plan VS Advanced Plan

Basic AI Travel Planner	Advanced AI Travel Planner
<p>Description User chooses the basic AI travel planner to plan their trip.</p> <p>Requirement(s) The basic AI travel planner helps the user by comprising a plan that covers the following:</p> <ul style="list-style-type: none"> ● Budget ● Travel Days ● Act as a local/tourist ● Real-Time Events 	<p>Description User chooses the advanced AI travel planner to plan their trip.</p> <p>Requirement(s) The advanced AI travel planner helps the user by comprising a plan that covers the following:</p> <ul style="list-style-type: none"> ● Budget ● Travel Days ● Act as a local/tourist ● Real-Time Events ● Calm sites and locations ● Family friendly or non-family friendly locations ● Accommodations ● Cuisine

3.1.6 Social Media Integration

Description

After finalizing the trip, the user accesses the Social Media Section.

Requirement(s)

After the user has finalized the trip, they can view the following:

- View nearby people and their travel plans.
- Suggested posts from friends and other travelers.
- When the app detects that the user has arrived at their chosen city, a map is shown:
 - Displays people nearby.
 - Shows the percentage of similarity between the user's travel plans and those of others on the map.

3.2 External Interface Requirements

3.2.1 User Interfaces:

3.2.1.1 Login/Registration Interface:

- Simple, intuitive forms for account creation and login.
- Profile setup with fields for travel-related preferences.

3.2.1.2 AI Planner Interface:

- Dynamic interface for inputting preferences and viewing results.
- Toggle options for switching between Basic and Advanced planning modes.

3.2.1.3 Map Interface:

- Interactive map for destination selection with search and zoom features.
- Highlights suggested destinations and nearby users.

3.2.1.4 Social Networking Interface:

- Feed-style interface displaying updates, posts, and events.
- Real-time map showcasing nearby travelers.

3.2.2 Hardware Interfaces:

1. Compatible with smartphones and tablets.

2. Minimum specifications:
 - Android 8.0 and iOS 13 or later.
 - Internet connectivity (Wi-Fi or mobile data).

3.2.3 Software Interfaces:

1. Firebase for authentication and database management.
2. Google Maps API for mapping and real-time location data.
3. TensorFlow and Scikit-learn for AI functionalities.
4. Flutter and Dart for cross-platform development.

3.2.4 Communication Interfaces:

1. RESTful APIs for accessing third-party real-time data.
2. WebSocket or Firebase Realtime Database for instant updates.
3. HTTPS and TLS protocols for secure data transmission.

3.3 System Features

3.3.1 Performance Requirements:

1. AI itinerary recommendations should be generated within **2 seconds**.
2. Map interactions (e.g., loading destinations or nearby users) should complete within **1 second**.
3. Support for **10,000 concurrent users** with minimal latency.

3.3.2 Design Constraints:

1. **Cross-Platform Compatibility:**
 - Uniform experience across Android and iOS devices using Flutter.
2. **AI Efficiency:**
 - Optimized algorithms to work seamlessly on devices with varying computational power.
3. **Real-Time Updates:**
 - Dependence on third-party APIs may affect performance during downtimes or rate limits.
4. **Budget Constraints:**

- Development within allocated resources may limit the depth of features at initial release.

3.4 Nonfunctional Requirements

Table 3 : Non-Functional Requirements

Nonfunctional Requirements	
Performance	<ul style="list-style-type: none"> ✓ System Uptime: At least 99.9% availability. ✓ Response Time: All user actions should result in feedback within 2 seconds. ✓ Scalability: Designed to handle growing user traffic with efficient resource utilization.
Safety	<ul style="list-style-type: none"> ✓ Error Handling: <ul style="list-style-type: none"> • Graceful error messages for failed operations (e.g., network issues or API errors).

Security	<ul style="list-style-type: none"> ✓ User Authentication: <ul style="list-style-type: none"> ● Enforced password policies and optional two-factor authentication (2FA). ✓ Data Protection: <ul style="list-style-type: none"> ● Compliance with GDPR ● Other users can't access each other's data by assigning roles.
Usability	<ul style="list-style-type: none"> ✓ The platform should allow users to create a travel plan with a few number of clicks. ✓ The system should be accessible and intuitive for users with basic technical skills. ✓ The UI must be easy to understand and intuitive to users.
Reliability	<ul style="list-style-type: none"> ✓ High fault tolerance with mechanisms to recover from failures.
Accessibility	<ul style="list-style-type: none"> ✓ The system should be inclusive as to create a design suitable for colorblind through choosing neutral colors. Also use visuals to help people with dyslexia and/or low reading skills use the application.

4 MARKET AND BUSINESS ANALYSIS

This section explores the current state of the travel and tourism market, identifying trends, target audiences, and gaps that **TRAVIA** addresses. It also analyzes competitors, evaluates the app's strengths and opportunities, and outlines a sustainable business model and marketing strategy to position **TRAVIA** as a leading solution in personalized travel planning.

4.1 MARKET ANALYSIS:

4.1.1 Market Potential:

- The global travel industry is expected to reach \$1.1 trillion by 2026, with a 10% CAGR, driven by increasing demand for personalized travel experiences, real-time updates, and social connectivity. **TRAVIA**'s AI-driven planning tools and social features position it well to tap into this rapidly growing market by catering to various traveler segments, from solo adventurers to families.
- The estimated development cost for **TRAVIA** is \$50,000, with potential revenue from subscription models and partnerships. These figures may change as the app scales and attracts a larger user base, increasing its market share and profitability. However, marketing and operational costs are not included and will play a crucial role in the app's expansion.

4.1.2 Financial Plan

4.1.2.1 Fixed Costs for 1 Year:

1. App Development and Maintenance → \$50,000
2. Marketing and Advertising → \$60,000
3. Salaries (development, management, support staff) → \$120,000
4. Legal, Licensing, and Compliance Costs → \$10,000

Total Fixed Costs → \$240,000

4.1.2.2 Variable Costs for 1 Year (for 1,000 users):

1. Server and Cloud Storage → \$30,000
2. User Acquisition Costs (advertisements, promotions) → \$40,000

3. Customer Support and Service → \$15,000
Total Variable Costs → \$85,000

Total Costs for 1 Year (for 1,000 users) = Total Fixed Costs + Total Variable Costs = \$240,000 + \$85,000 = \$325,000

4.1.2.3 Revenue Generation:

Since TRAVIA doesn't use a subscription model, revenue could be generated through:

1. In-App Purchases (e.g., premium features or enhanced itineraries)
2. Advertising (partnerships with travel brands, hotels, airlines)
3. Affiliate Marketing (earnings from bookings made through the app)

Let's assume the following revenue:

- In-App Purchases: \$25,000
- Advertising Revenue: \$50,000
- Affiliate Marketing Revenue: \$30,000

Total Revenue for 1 Year = \$25,000 + \$50,000 + \$30,000 = \$105,000

4.1.2.4 Profit:

- Revenue for 1 Year = \$105,000
- Profit = Revenue – Total Costs = \$105,000 – \$325,000 = - \$220,000

4.1.2.5 Break-Even Point:

- Break-Even Point: When Profit = 0
- Break-Even Point Revenue = Total Cost = \$325,000
- Sales for Break-Even Point: Based on in-app purchases and advertising revenue, the break-even point would require significantly more in-app purchases, users, or larger partnerships.

4.2 BUSINESS ANALYSIS:

4.2.1 SWOT:

Table 4 : SWOT Analysis

Strengths	Weaknesses
<ul style="list-style-type: none">• Integration of multiple travel planning features in a single platform.• Advanced AI capabilities for personalized travel recommendations.• Social connectivity features enabling traveler networking.• Cross-platform accessibility through mobile devices.• Real-time information updates and event tracking.	<ul style="list-style-type: none">• Dependency on reliable internet connectivity.• Initial user base building challenges.• Resource limitations for comprehensive feature development.• Potential technical complexity in integrating multiple features.• Limited historical data for AI recommendations initially.
Opportunities	Threats
<ul style="list-style-type: none">• Growing demand for integrated travel solutions.• Rising trend in smart tourism technologies.• Increasing interest in social travel experiences.• Expansion into emerging markets.• Integration with existing travel services and platforms.	<ul style="list-style-type: none">• Strong competition from established travel platforms.• Privacy and security concerns.• Economic fluctuations affecting travel industry.• Regulatory changes in different regions.• Rapid technological changes requiring constant updates.

4.2.2 4P's:

Table 5 : 4P'S

<p>Product</p> <p>Travia is a travel planning application that offers personalized trip recommendations based on user preferences, destinations, and social interactions.</p> <p>Key Features:</p> <ul style="list-style-type: none"> ● User-friendly Interface: Simplifies the planning process with easy sign-up, login, and survey inputs. ● AI-driven Planning: Provides customized travel plans through basic and advanced planners. ● Social Media Integration: Connects travelers with others through posts, nearby traveler tracking, and travel plan similarity. ● Chat Bot Support: Guides users in decision-making and provides trip-related assistance. ● Data Security: Ensures the safety of personal and travel data stored in the system. 	<p>Place</p> <p>Travia operates as an online platform, accessible through:</p> <ul style="list-style-type: none"> ● Mobile App: Available on both iOS and Android for travelers on the go. <p>Target Audience:</p> <ul style="list-style-type: none"> ● Young professionals. ● Couples. ● solo travelers.
<p>Price</p> <p>The pricing strategy could follow:</p> <ul style="list-style-type: none"> ● Free Model: Basic features (e.g., basic planner, social media integration) are free. ● Advanced Subscription Plans: <ul style="list-style-type: none"> ○ Monthly/Annual: Access to advanced features for a recurring fee if the customer needs to travel several times. ○ Pay-Per-Use: Travelers can pay for specific features like premium AI-generated plans. ● Partnerships: Revenue generation through collaborations with hotels, airlines, and travel agencies. 	<p>Promotion</p> <p>Promotion strategies to increase awareness include:</p> <ul style="list-style-type: none"> ● Digital Marketing: <ul style="list-style-type: none"> ○ Social media campaigns showcasing features like AI-planned trips and travel similarities. ○ Influencer partnerships with travel bloggers and vloggers. ● Partnerships: <ul style="list-style-type: none"> ○ Collaborate with travel agencies, airlines, and hotels for co-marketing campaigns.

4.2.3 Marketing Strategy:

Our marketing strategy depends on the following:

- Number of app downloads and active users.
- Conversion rate from free to premium plan.
- Engagement rate on social media.
- Revenue growth from subscriptions and partnerships.

4.2.4 Business Model Canvas:

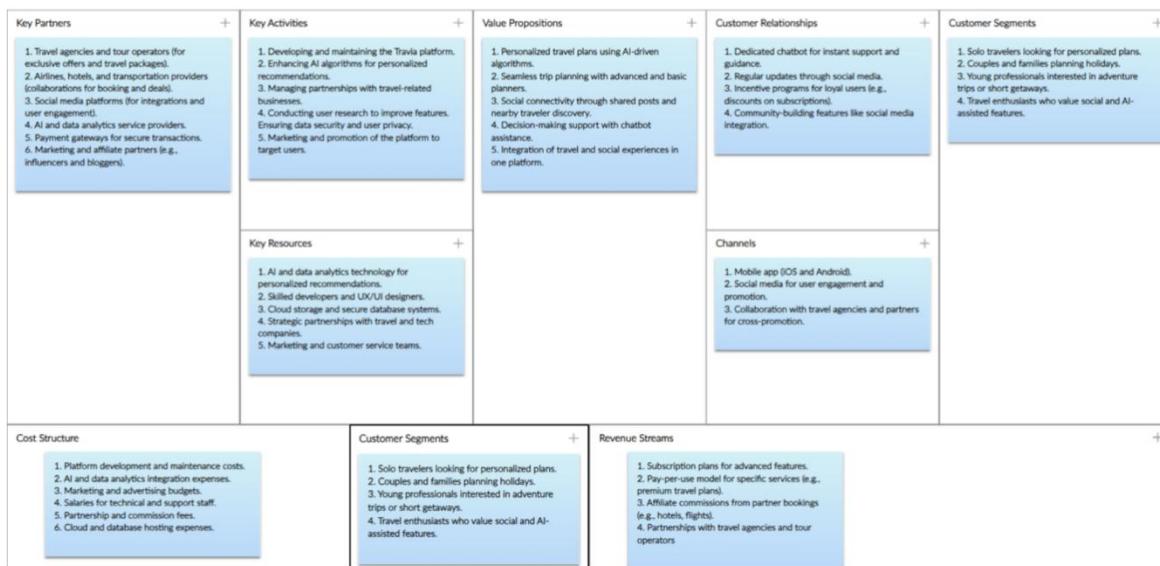


Figure 3 : Business Model Canvas

4.3 SURVEY:

We got 52 Responses from our survey, this will help us gain powerful insights on how people will preview the project.

Note that the sample chosen for this survey consist of mainly university students and people between the ages of 18-24 and approximately two thirds of them are of male gender.

What is your age group

52 responses

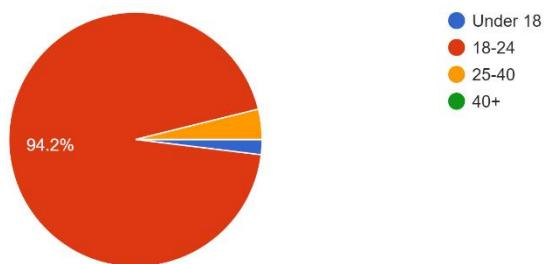


Figure 4 : Survey Question 1

Gender

52 responses

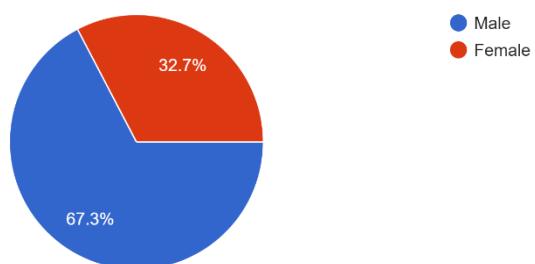


Figure 5 : Survey Question 2

The following figure shows the percentage of the sample's travelling habits.

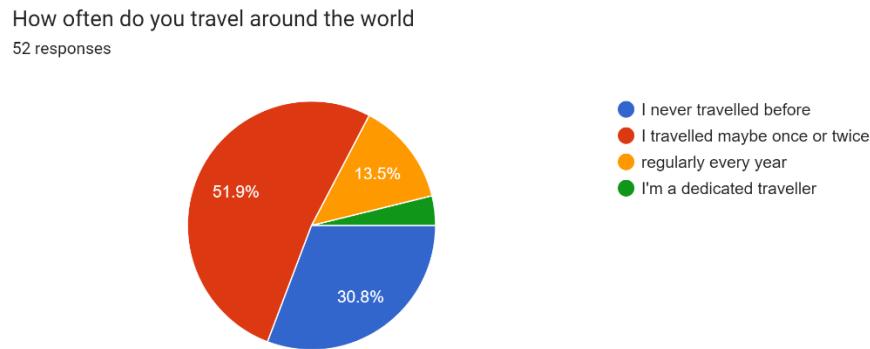


Figure 6 : Survey Question 3

Insights: We notice here that approx. 80% of the sample rarely travel or never do. This could hurt the popularity of our app among university students. One insight is university students and people of age 18-24 don't travel that much, possibly due to them being still young and unable to pay the costs of travelling. One last note that our app isn't tailored to travelers only, it could be used for outings in your own city.

The following two figures shows the percentage of the sample's way of finding recommendations and how successful are they:

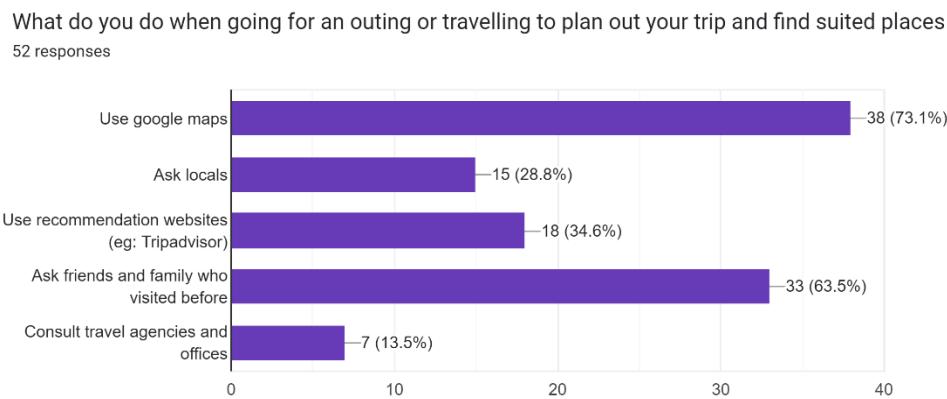


Figure 7 : Survey Question 4

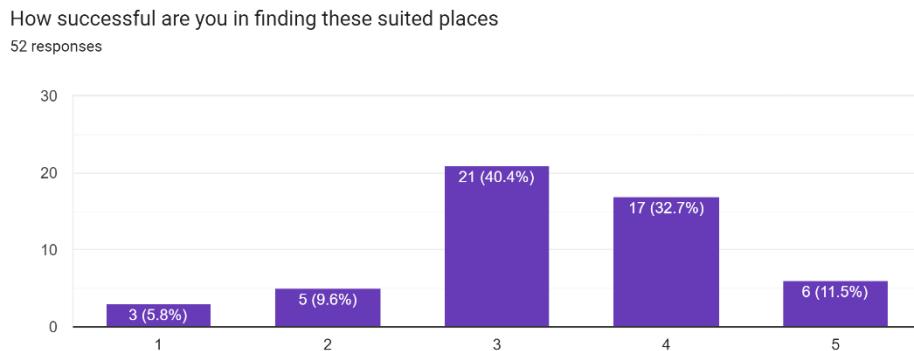


Figure 8 : Survey Question 5

Insights: The insight in the following is that people mainly use Google Maps and Ask relatives and friends for recommendations.

For the people that use Google Maps our app can vastly help ease the experience for them and find the best places possible.

And for the people who ask their friends or family that visited before, our app can help them find people who have experience in the city they want to visit.

Second figure shows an approximately normal curve of the sample finding the traditional methods for recommendations suited for them or not.

The following figure shows the percentage of sample's ability to find suited partners for their travels and outings.

If you were to travel solo or go for an outing, how hard is it to find friends that have the same preferences as you
52 responses

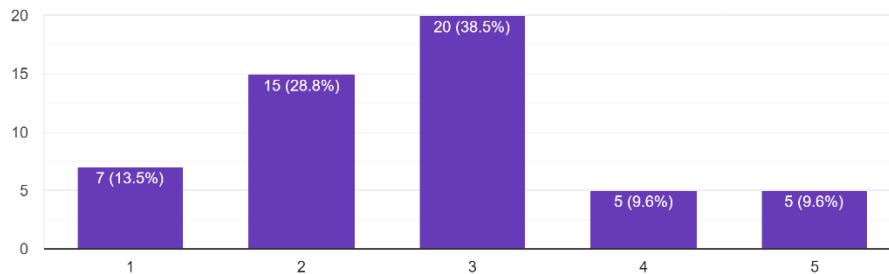


Figure 9 : Survey Question 6

Insights: Our app can help these people find their suited partner as most of the sample chose that they have a hard time of finding them.

The following figure shows a percentage of the sample's most important factors when planning a trip

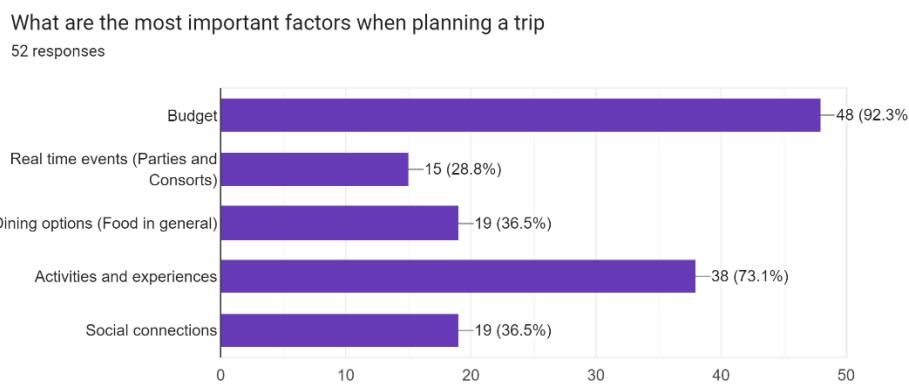


Figure 10 : Survey Question 7

Insights: This teaches us that most of the sample focus mainly on the budget and the activities are the most important factors that we need to consider.

The following figure shows us that the sample are comfortable with AI planning and managing their trip or outing.

How comfortable are you with AI planning your trip

52 responses

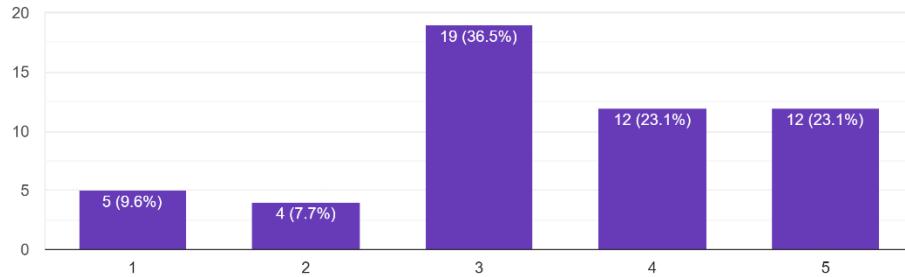


Figure 11 : Survey Question 8

Insights: The sample is mostly comfortable with AI planning their trip

The following figure shows us what are the biggest concerns of using our app.

What concerns, if any, do you have about using a travel-focused social networking app?

52 responses

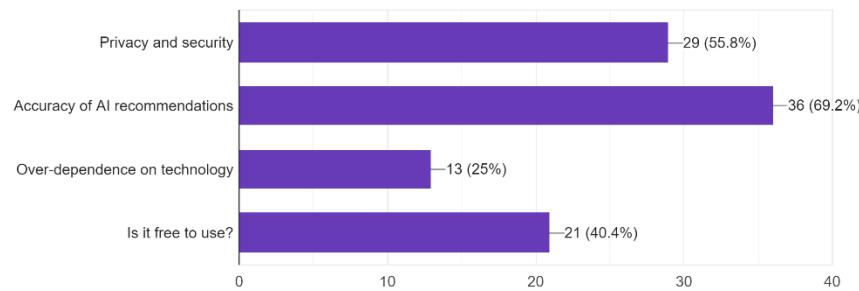


Figure 12 : Survey Question 9

Insights: this tells us that privacy, accuracy and pricing of the app are the most important factors.

4.4 Similar Projects

In this section, we will discuss the functionalities offered by the websites Tripplanner.ai, Wonderplan.ai, and Justasklayla.com as well as provide screenshots from within each website.



Figure 13 : Similar Projects

Figure 13 : From left to right: The logos of Tripplanner.ai, Wonderplan.ai, and Justasklayla.com

4.4.1 Tripplanner.ai

TripPlanner.ai is an AI-powered trip planning tool designed for creating detailed plans. It focuses on personalized travel suggestions and optimizing routes, but it does not offer social networking or real-time social engagement features.

TripPlanner.ai Strengths:

- Provides offline access through downloadable PDFs of itineraries.
- Focuses heavily on route optimization and detailed travel timelines.
- Includes robust AI recommendations for local cuisines and activities.

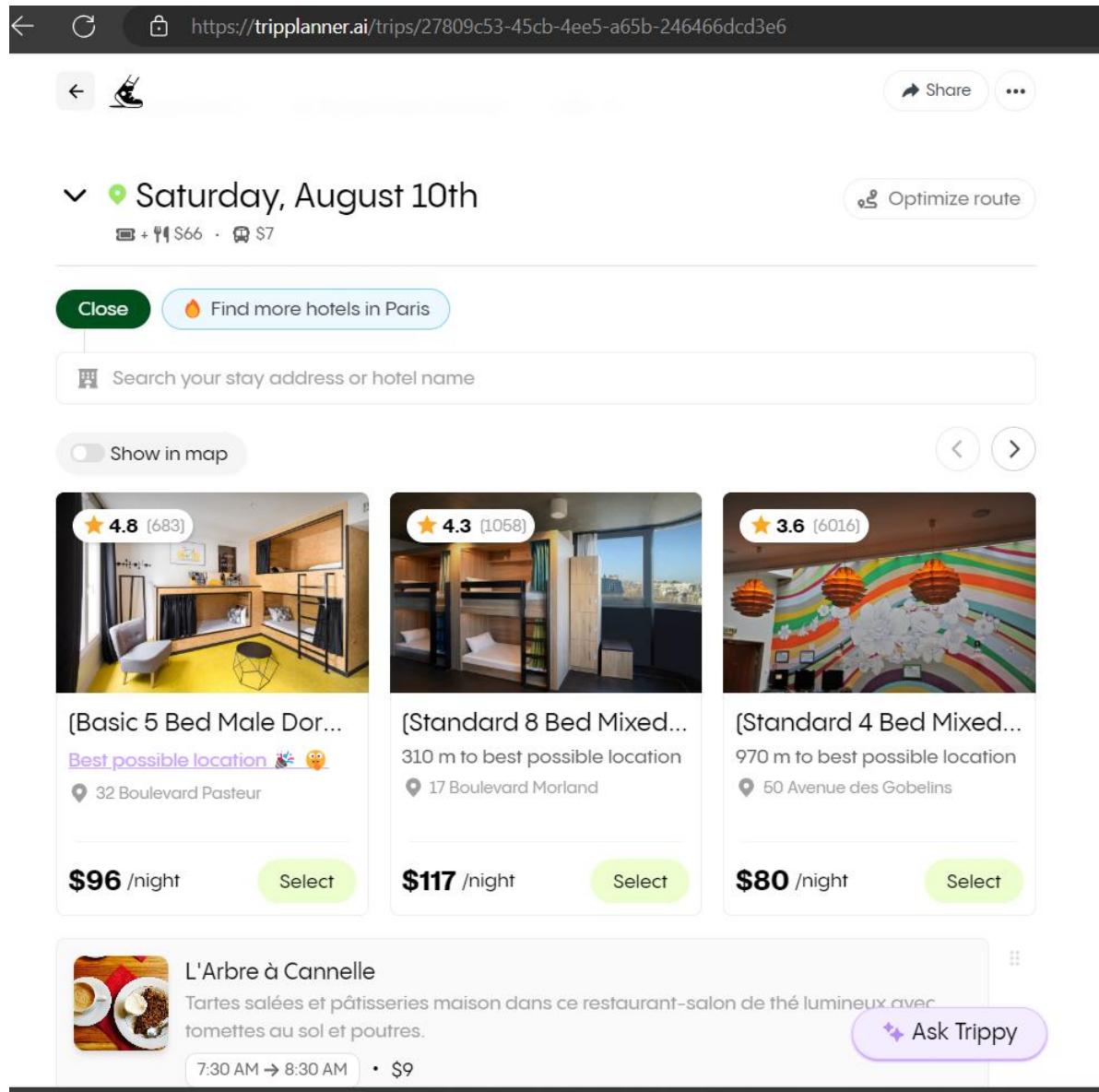


Figure 14: Snapshot from Inside Tripplanner.ai

4.4.2 Wonderplan.ai

Wonderplan.ai is a comprehensive AI-driven trip planner that focuses on customizable plans tailored to user's preferences. It provides downloadable travel plans for offline use and a seamless user interface.

Wonderplan.ai Strengths:

- Offers robust itinerary customization with AI-generated suggestions.
- Includes offline plan access via downloadable PDFs.
- Allows users to quickly adjust plans based on budget or preferences.

The screenshot shows a travel itinerary for 'Day 2' on 'Sun, 11 Aug'. At the top, there are icons for 'View Only' and sharing options. Below this, a button says 'Find a place to stay'. The itinerary items are numbered 5, 6, and 7. Item 5 is 'Santa Maria delle Grazie', described as a famous attraction for Leonardo da Vinci's 'The Last Supper' painting, with a duration of 120 min in Milan. Item 6 is 'Leonardo da Vinci Museum of Science and Technology', described as exploring Leonardo da Vinci's life and works, with a duration of 180 min in Milan. Item 7 is 'Pinacoteca di Brera', described as one of the most important art museums in Italy, with a collection of masterpieces from the 14th to the 20th century.

5

Santa Maria delle Grazie
Famous attraction for Leonardo da Vinci's 'The Last Supper' painting. Must-visit for art and history lovers.
120 min • Milan

6

Leonardo da Vinci Museum of Science and Technology
Explore the life and works of Leonardo da Vinci at this museum in Milan.
180 min • Milan

7

Pinacoteca di Brera
One of the most important art museums in Italy, with a collection of masterpieces from the 14th to the 20th century.

Figure 15 : Snapshot from Inside Wonderplan.ai

4.4.3 Justasklayla.com

Layla.ai is an interactive travel assistant leveraging AI chatbot technology for personalized trip planning. It simplifies the user experience with conversational planning but lacks comprehensive social or advanced customization features.

Layla.ai Strengths:

- Offers a highly interactive AI chatbot interface for quick and intuitive planning.

- Supports offline access with downloadable plans.
- Emphasizes ease of use and simplicity for users with basic travel needs.

Itinerary request

Hey, Layla here! Excited to help you with anything travel related. I can tell you where to go, what time of year to visit, what to do there...the list is endless. I'm on the edge of my seat, ask me anything.

build me an itinerary

Alright, let's get this party started! Do you have a specific destination in mind, or are you looking for some inspiration?

Beach destinations

Nice choice! Who doesn't love some sun, sand, and sea? How many days are you planning for this beach getaway?

Two weeks

Santorini looks amazing | More suggestions please | Love Bora Bora

give me the crime rate of every city

Itinerary

Day 1
Santorini

Day 2
Santorini

Day 3
Santorini

Discovering Akrotiri and Red Beach

Morning

Begin your second day with a visit to Akrotiri, an ancient Minoan city preserved under volcanic ash. Explore this fascinating archaeological site and learn about its history dating back to 1600 BC. For breakfast, stop by [The Good Heart](#) for some traditional Greek pastries and coffee before heading out.

Afternoon

After exploring Akrotiri, head to Red Beach nearby for some relaxation by the sea. The striking red cliffs create a unique backdrop against the turquoise waters. Spend some time swimming or sunbathing on this beautiful beach. For lunch, enjoy fresh seafood at [Taverna Glaros](#), located just steps away from Red Beach.

Evening

In the evening, return to Fira for more exploration. Visit [Santo Winery](#) where you can sample local wines while enjoying panoramic views of Santorini's vineyards and coastline. For dinner, savor authentic Greek dishes at [Naoussa Restaurant](#), known for its warm hospitality and delicious food.

Bedtime

Find amazing hotels in [Santorini](#).

For a balanced stay, [Andronis Boutique Hotel](#) choice offers a great mix of comfort and convenience. Those seeking an upscale experience can opt for the [Cellaria Estate Exclusive](#), featuring premium amenities and exceptional service. Budget-conscious visitors can find excellent value in a more affordable option like [Youth hostel Anna](#), providing basic comforts without breaking the bank.

Each type of accommodation ensures a pleasant stay, catering to different preferences and budgets.

Figure 16: Snapshots from Inside Justasklayla.com

Table 6 : Competitors Comparison

Competitors ➔ Features ↴	Tripplanner.ai	JustAskLayla	Wonerplan.ai	Travia
Social Media	✗	✗	✗	✓
Tailored Recommendations	(Limited options)	✓	✓	✓
Real Time Events	✗	✗	✗	✓
Interactive Map Selection	⚠️ (Basic map view)	✗	✗	✓
Basic Planning Options	✓	✓	✓	✓
Multi Language Support	✓	✓	✓	✗
Advanced Planning Options	⚠️ (Limited)	⚠️ (Limited)	⚠️ (Limited)	✓
Event Alert for users	✗	✗	✗	✓
Customizable Budget	✓	✓	✓	✓
Ai Suggestions	✓	✓	✓	✓
User friendly chatbot Interface	✗	✓	✓	✓
Cross platform compatibility	✓	✓	✓	✓
Offers accommodations and tickets	✓	✗	✓	✓
Offline access to plans for later	✓ (PDF Download)	✓ (Custom Download)	✓ (PDF Download)	✗
Similarity Matching for travellers	✗	✗	✗	✓

5 SYSTEM ANALYSIS AND DESIGN

This section focuses on the systematic analysis and design of the TRAVIA application. It presents use cases, diagrams, and prototypes that define the system's architecture and functionality. The chapter details how user requirements are translated into actionable designs, ensuring the system's effectiveness, scalability, and user-centric approach.

5.1 USE CASE

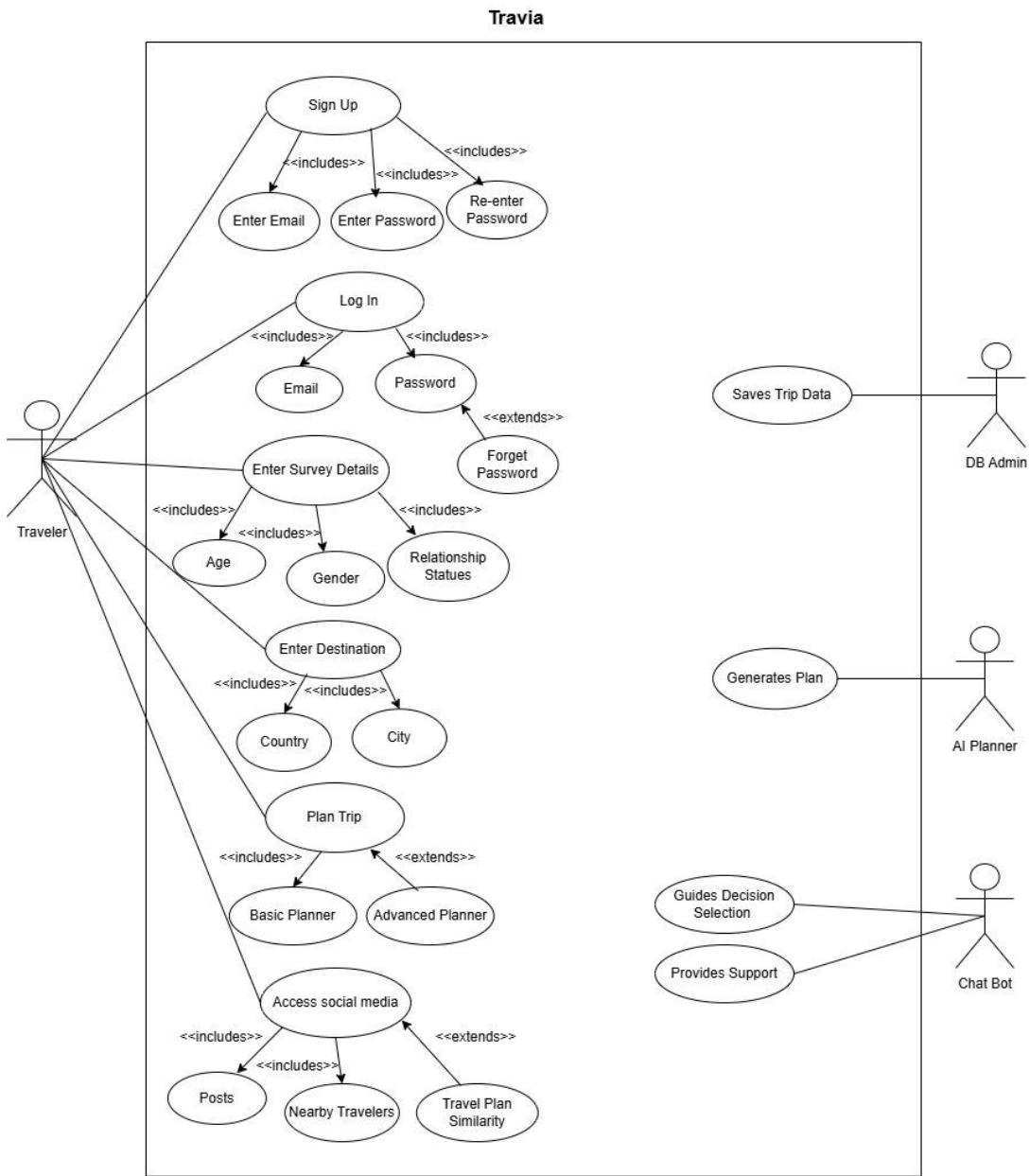


Figure 17 : Use Case Diagram

5.2 DETAILED USECASES:

Table 7 : Sign Up Use Case

Title	User Sign Up
Participating actor	Traveler
Precondition(s)	The Traveler must have access to the registration page.
Basic Flow of events	<p>1.The Traveler selects the "Sign Up" option.</p> <p>2.The system prompts the Traveler to enter their email and password.</p> <p>3.The system requests the Traveler to re-enter their password for confirmation.</p> <p>4.The system validates the email format and ensures the passwords match.</p> <p>5.The system creates a new user account and saves the data in the database.</p>
Alternative Flow	<p>If the email is already registered:</p> <p>The system informs the Traveler and suggests logging in or using "Forgot Password".</p>
Postcondition(s)	A new User Account is created successfully.
Exception(s)	<ul style="list-style-type: none"> -If the Traveler does not enter all required fields, the system displays an error. -If the email format is invalid, the

	system prompts the Traveler to correct it.
--	--

Table 8 : Login Use Case

Title	User Login
Participating actor	Traveler
Precondition(s)	The Traveler must have an existing account.
Basic Flow of events	<ul style="list-style-type: none"> -The Traveler selects the "Log In" option. -The system prompts for an email and password. -The system verifies the credentials with stored data. -The Traveler gains access to the system.
Alternative Flow	<p>If credentials are incorrect:</p> <p>The system informs the Traveler and provides the option to retry or reset their password.</p>
Postcondition(s)	The Traveler is logged into the system.
Exception(s):	If the Traveler enters an incorrect email or password multiple times, the account is temporarily locked.

Table 9 : Survey Details Use Case

Title	Enter Survey Details
Participating actor	-Traveler (Primary) -DB Admin (Support)
Precondition(s)	The Traveler must be logged in.
Basic Flow of events	<p>-The Traveler selects the "AI Planner" option.</p> <p>-The system prompts the Traveler to input age, gender, and relationship status.</p> <p>-The system validates the data and saves it to the database.</p>
Postcondition(s)	The survey details are stored successfully.
Exception(s):	If mandatory fields are left blank, the system prompts the Traveler to complete them.

Table 10 : Access Social Media Use Case

Title	Access Social Media
Participating actor	Traveler
Precondition(s)	The Traveler must be logged in.
Basic Flow of events	<p>-The Traveler Logs into the Application.</p> <p>-The system displays options for:</p> <ul style="list-style-type: none">● Viewing and creating posts.● Viewing nearby travelers on a map.● Viewing travel plans with similarity matches. <p>-The Traveler interacts with their chosen feature.</p>
Postcondition(s)	The Traveler successfully accesses social media features.
Exception(s):	If there are no nearby travelers or similar plans, the system informs the Traveler.

Table 11 : Save Trip Data Use Case

Title	Save Trip Data
Participating actor	-Traveler (Primary) -DB Admin (Support)
Precondition(s)	A trip plan must exist.
Basic Flow of events	-The Traveler finalizes their trip plan. -The system saves the trip data in the database via the DB Admin.
Postcondition(s)	The trip plan is saved and accessible for future use.
Exception(s):	If there's an issue with the database, the system informs the Traveler of the failure.

5.3 SEQUENCE DIAGRAM:

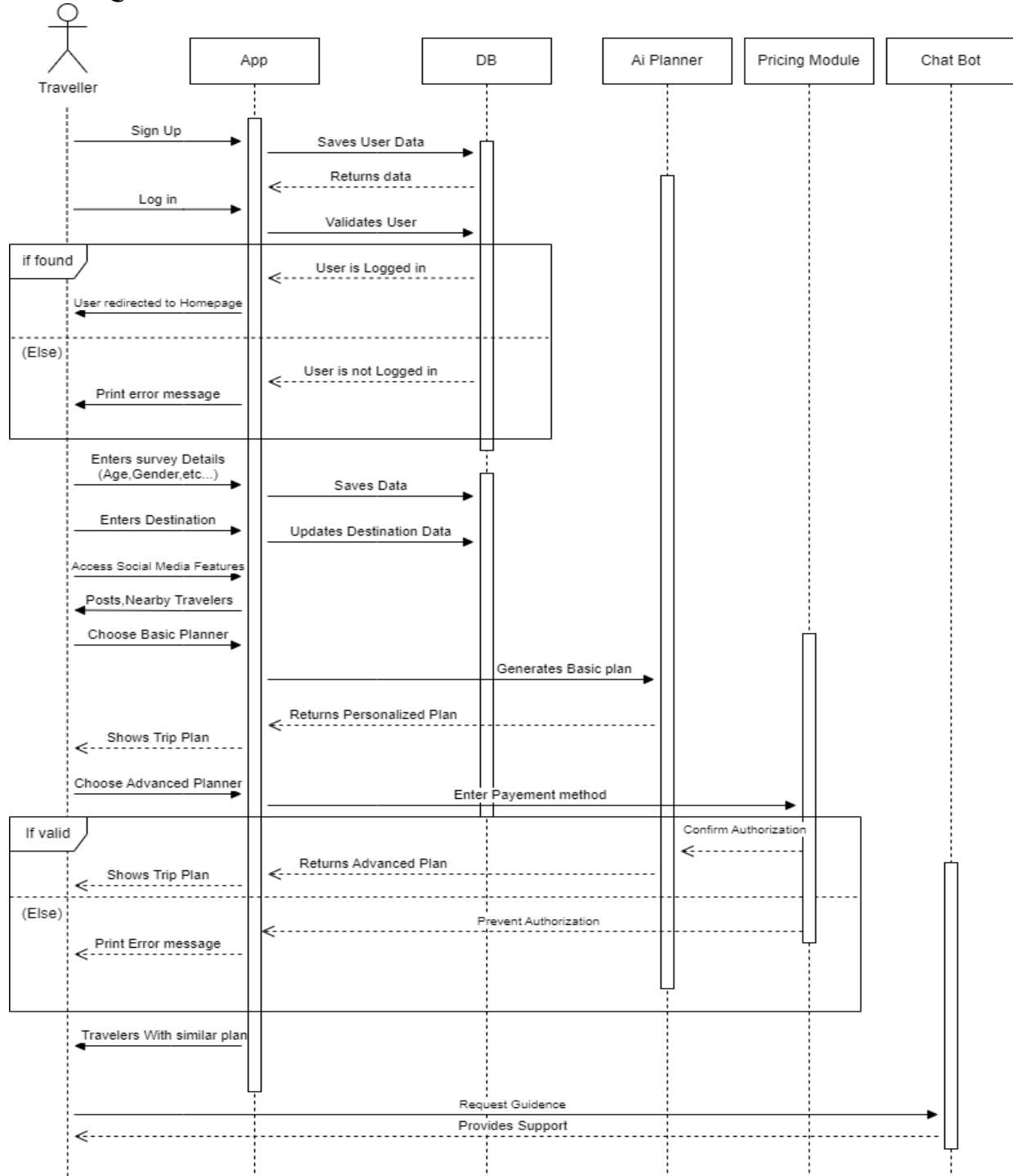


Figure 18 : Sequence Diagram

5.4 SURVEY SEQUENCE DIAGRAM:

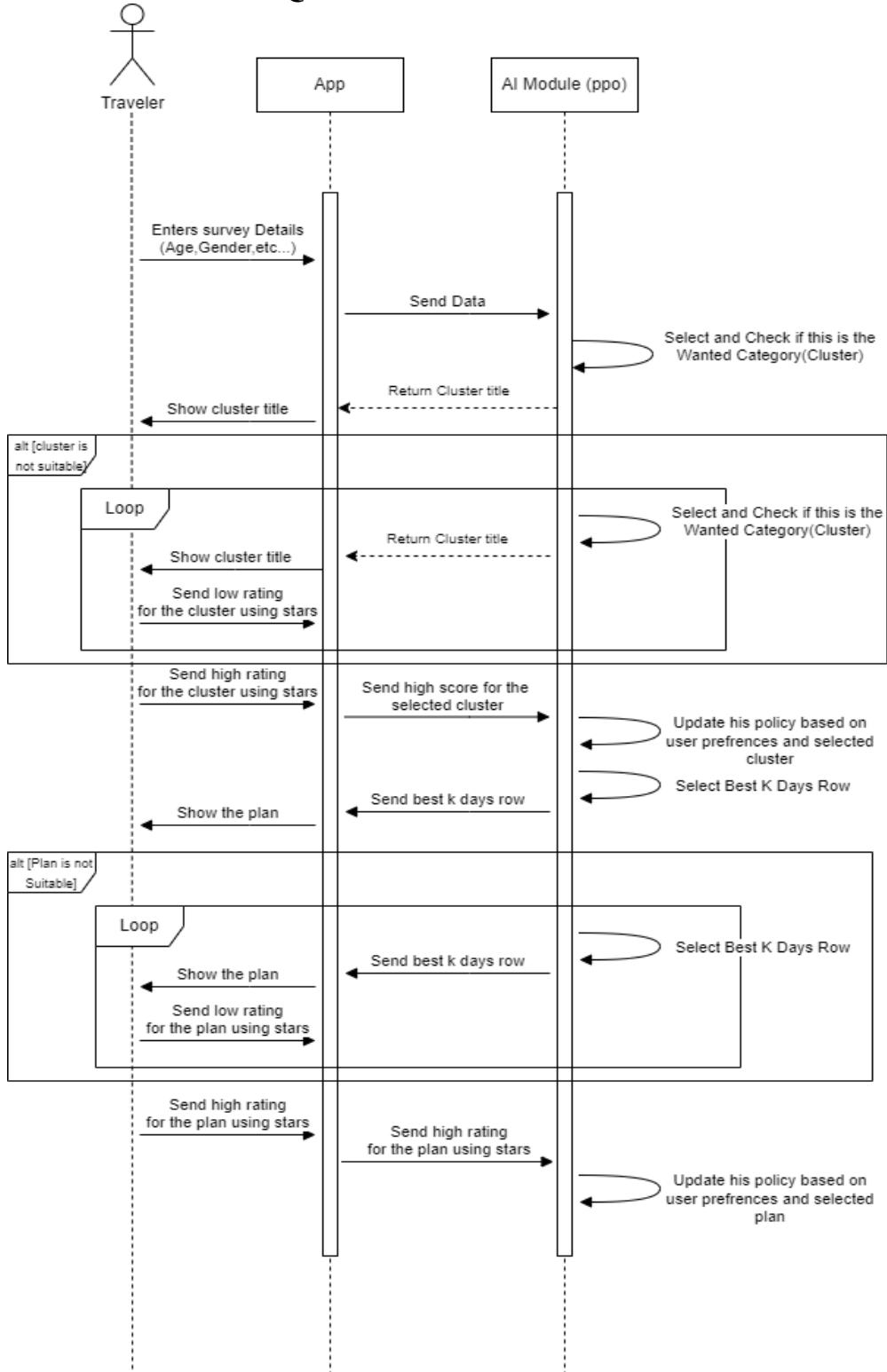


Figure 19 : Survey Sequence Diagram

5.5 CLASS DIAGRAM:

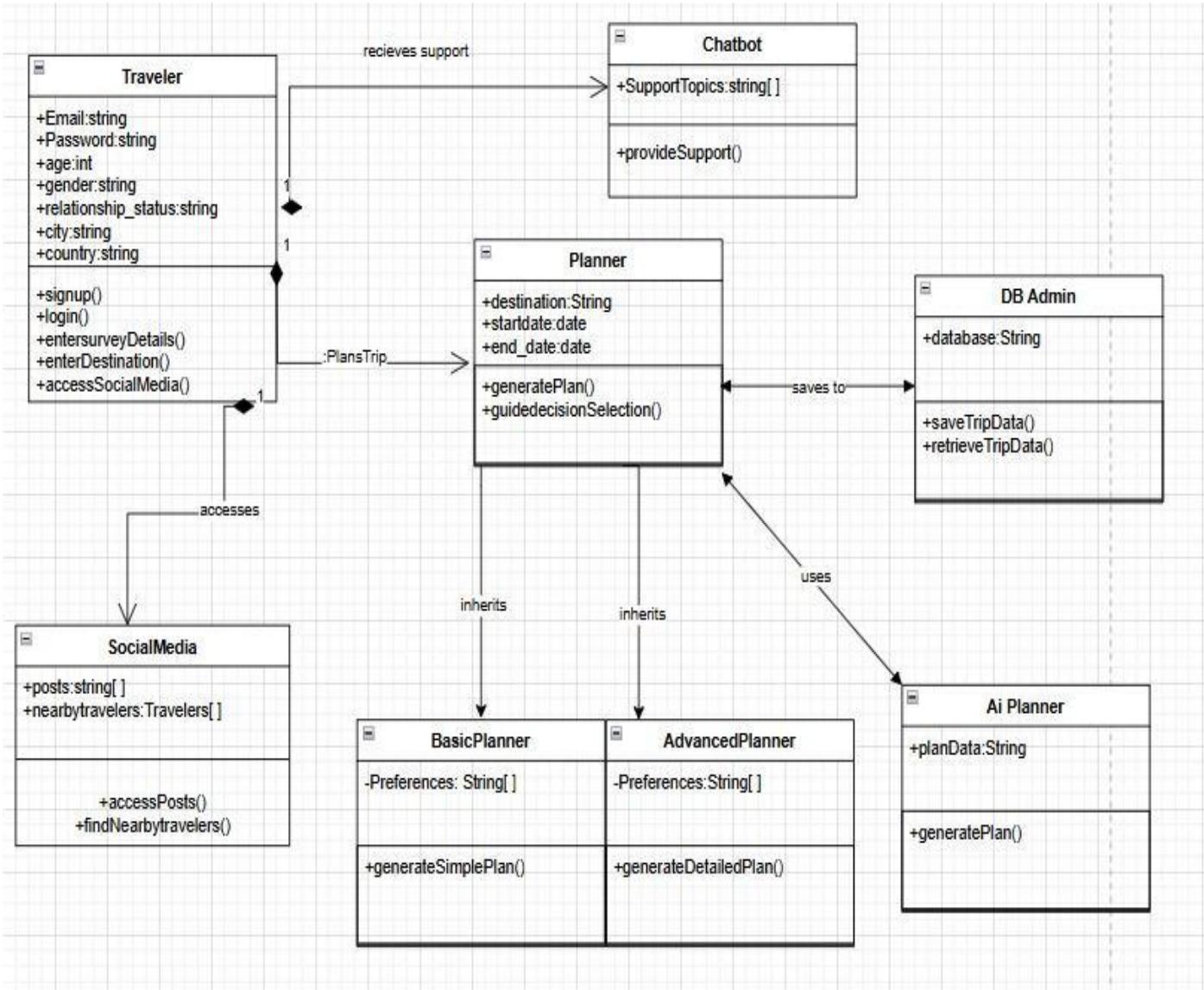


Figure 20 : Class Diagram

5.6 SYSTEM ARCHITECTURE DIAGRAM:

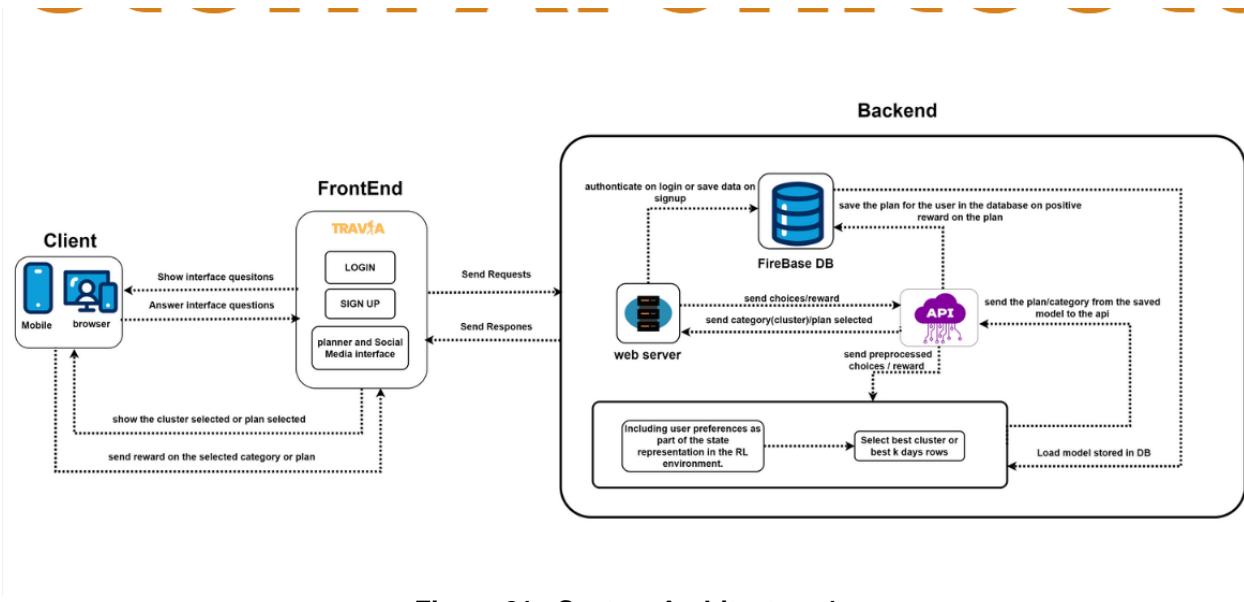


Figure 21 : System Architecture 1

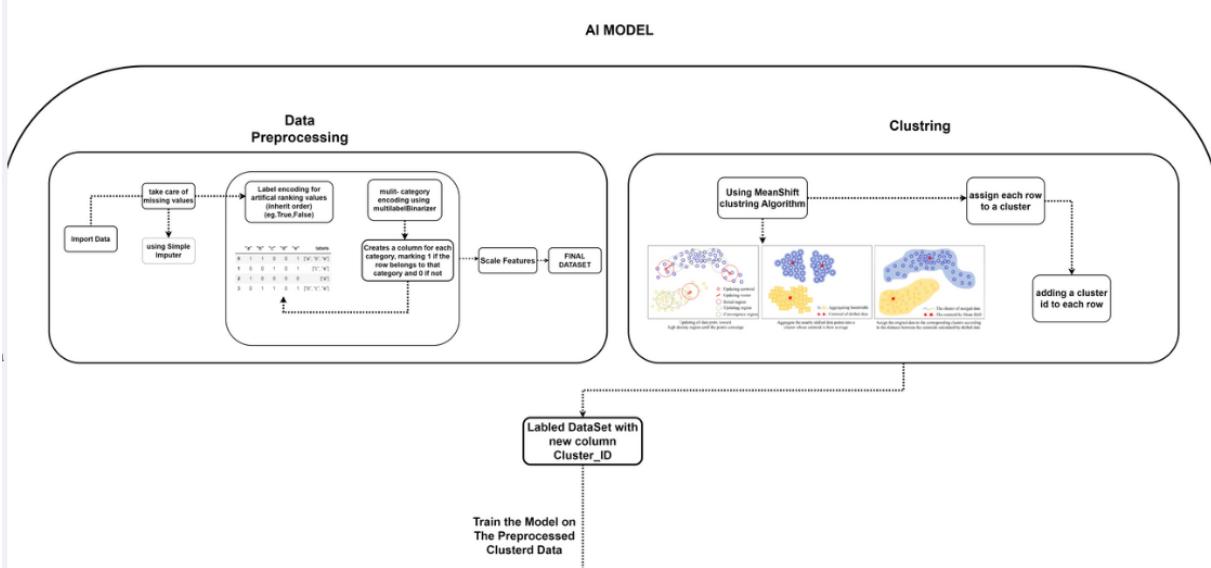


Figure 22 : System Architecture 2

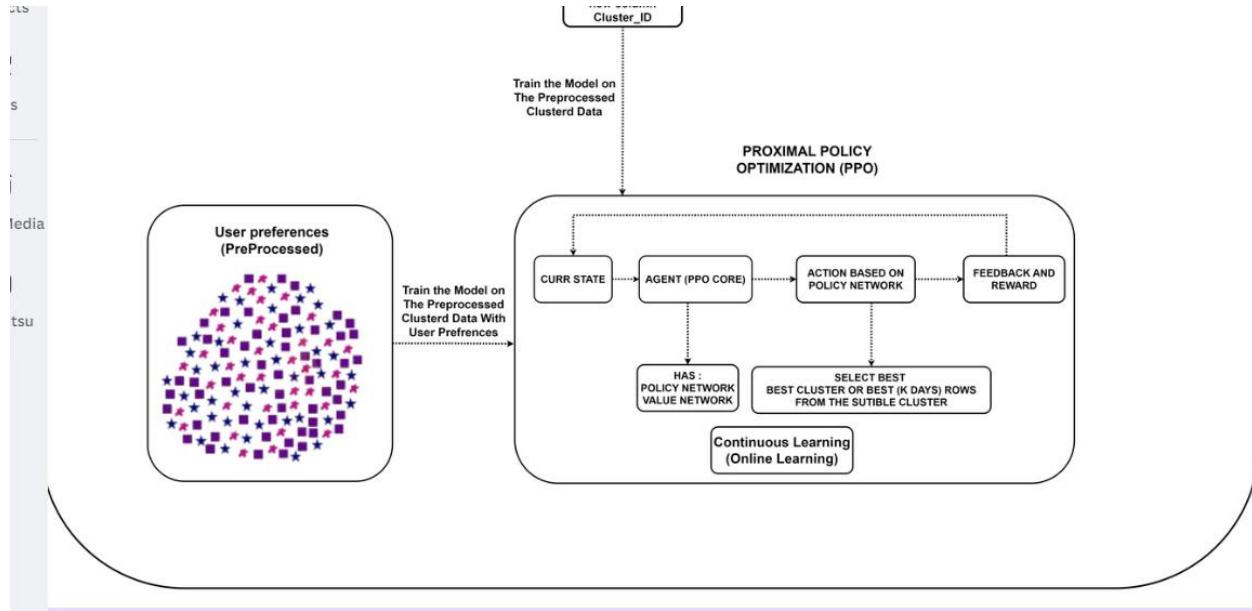


Figure 23 : System Architecture 3

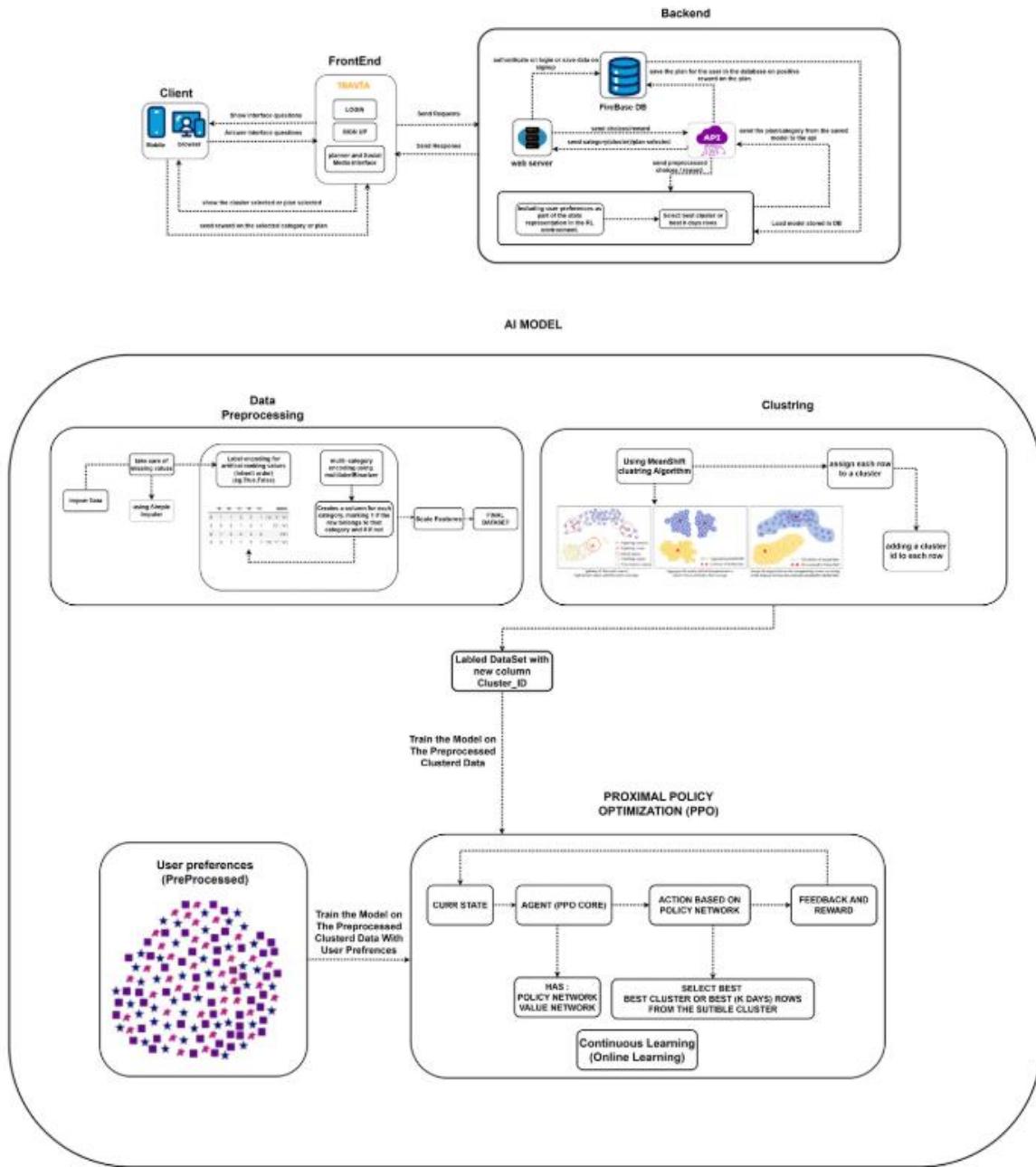


Figure 24 : System Architecture 4

5.7 SYSTEM PROTOTYPE

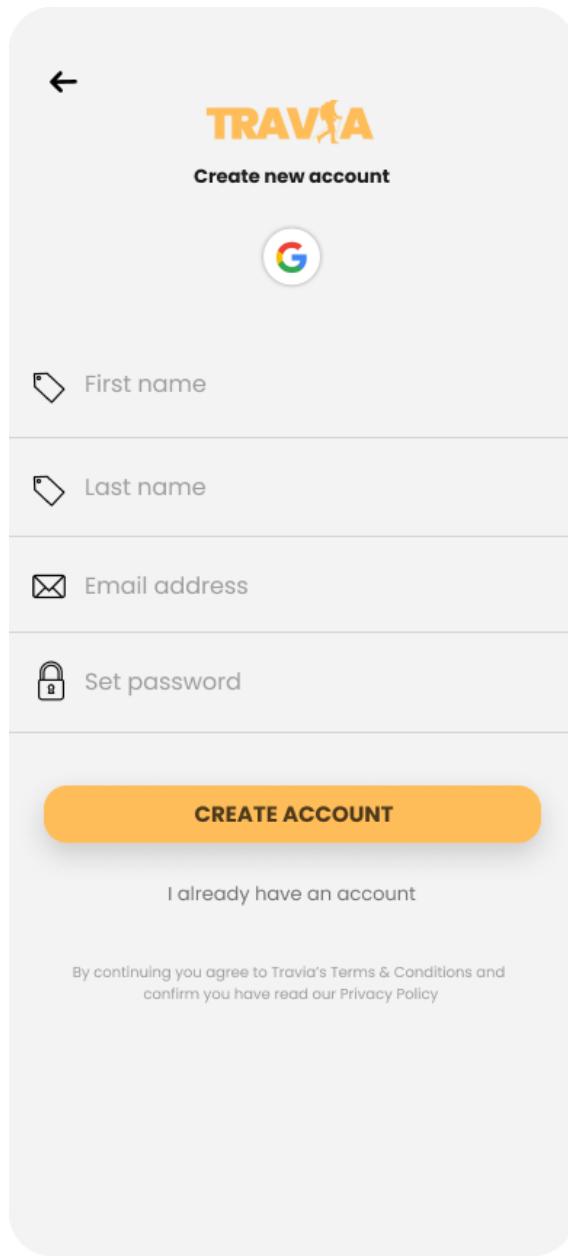


Figure 25 : Sign Up Prototype

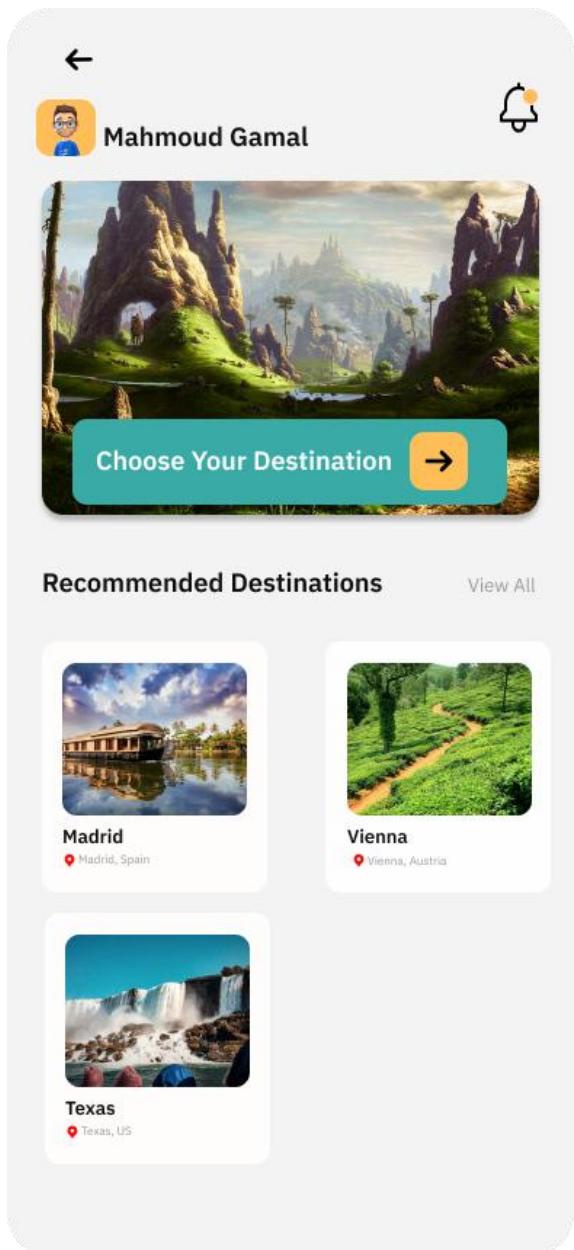


Figure 26 : Destination Prototype

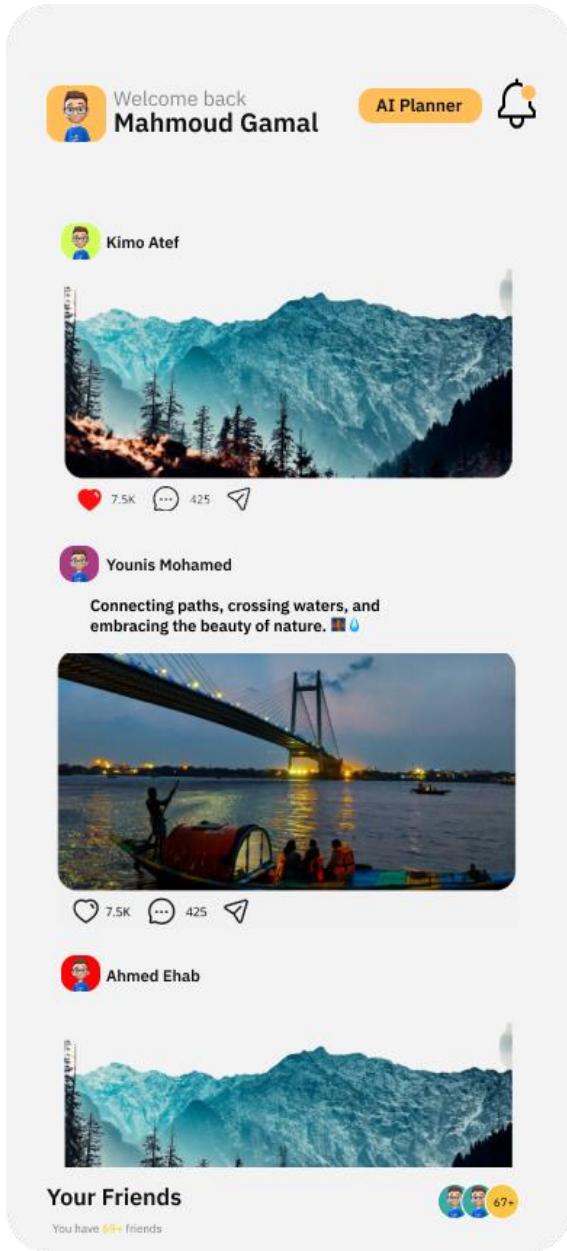


Figure 27 : Social Media Prototype

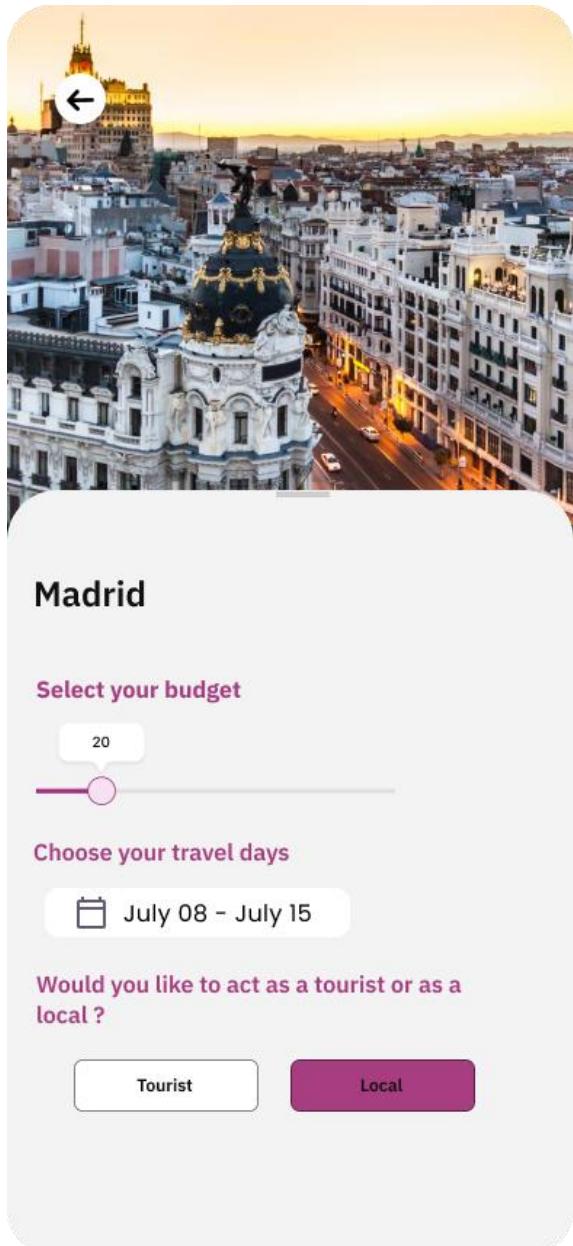


Figure 28 : Trip Details Prototype

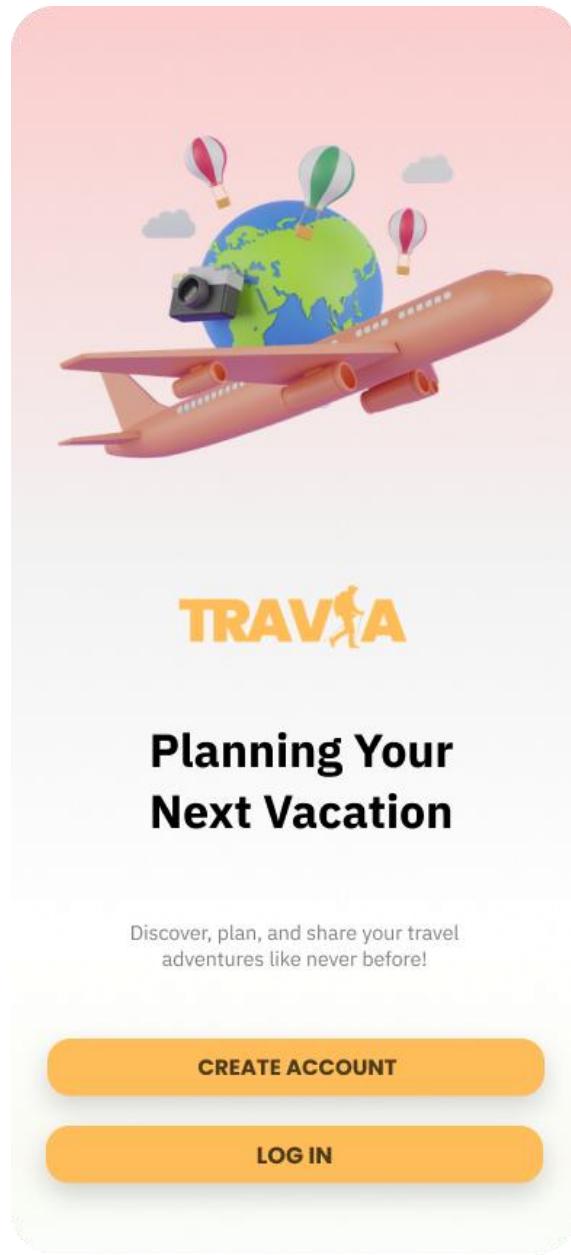


Figure 29 : Start Page Prototype

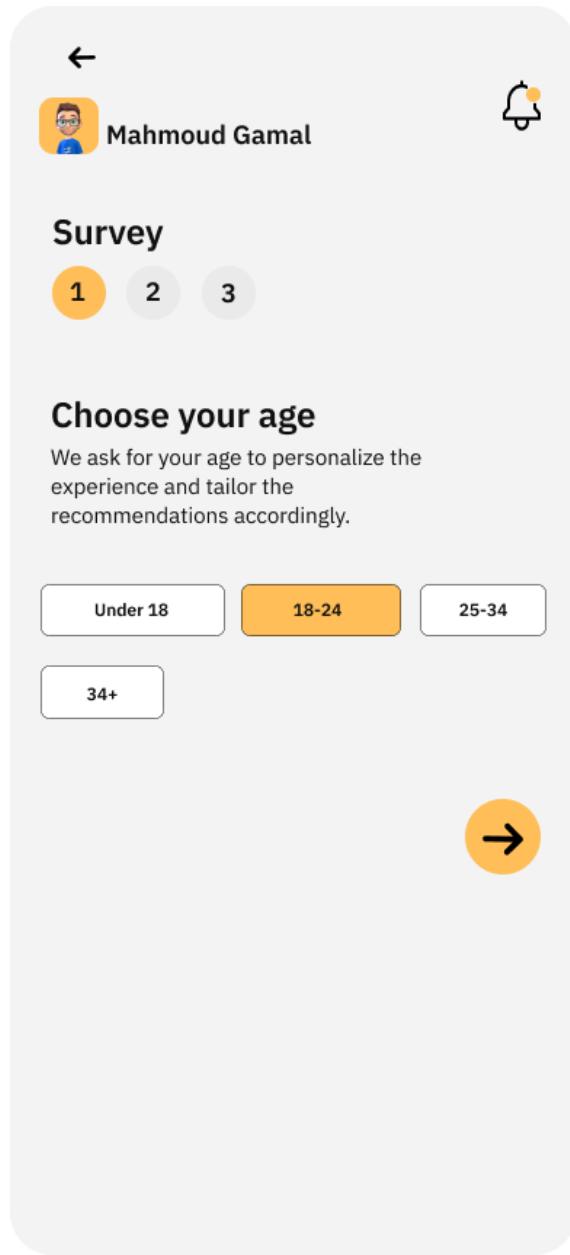


Figure 30 : Survey Prototype

6 SYSTEM ANALYSIS

Systems analysis is the process of studying a procedure or business to identify its goal and purposes and create systems and procedures that will efficiently achieve them. We will discuss and analyze different Apps and see how they differentiate from us.

6.1 Data Gathering

We will do analysis for the yelp dataset publicly available on the internet
Link: <https://www.yelp.com/dataset/documentation/main>

6.2 DATA ANALYSIS

The tool used for data analysis Python Jupyter, we will mention the charts used and the insights learned from the data.

As mentioned before our data has (85314 rows, 40 columns), we opted to take only a sample of 5000 rows to perform the data analysis on for time purposes.

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from scipy import stats

df = pd.read_csv("C:/Users/youni/Downloads/yelp_dataset/flattened_data.csv")

df.shape # The number of rows and columns of the dataset

(85314, 40)

# Since the number of rows is massive and we only need a sample of it to plot our charts and do analysis, we will take only the first 5 thousand rows.
df = df[0:5000]
df.shape

(5000, 40)
```

Figure 31 : Dataset

The following figure shows the top 10 categories

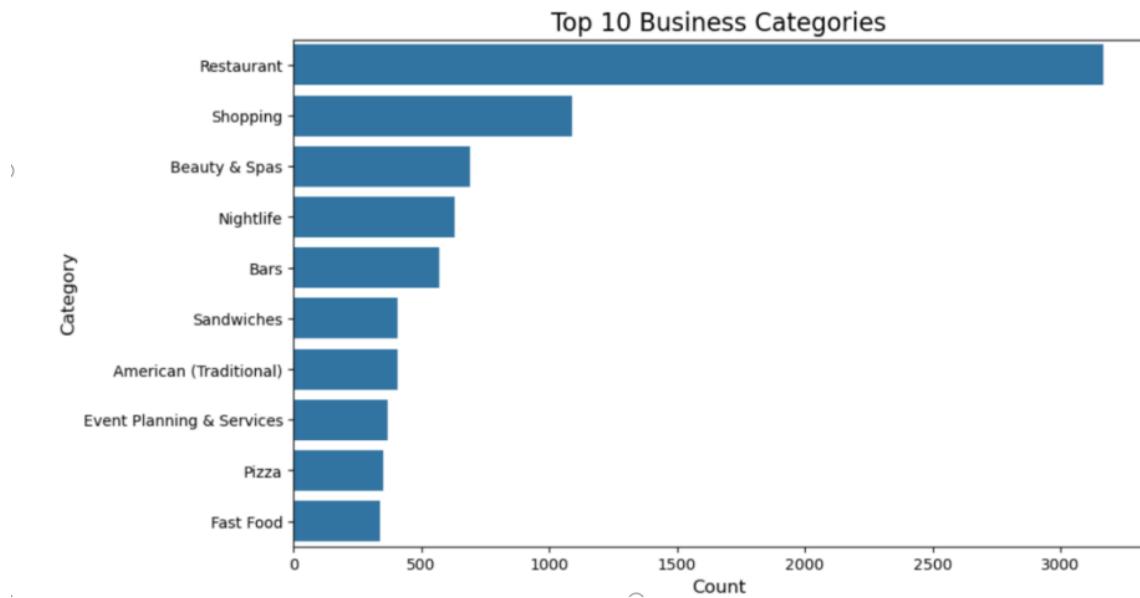


Figure 32 : Data Set Graph 1

Insights: We see that a majority of the data are restaurant businesses, many people consider restaurants are important places to visit for their trips so this aligns well with our findings.

The following two figures show Top businesses in various categories and in general in terms of rating and review counts as well:

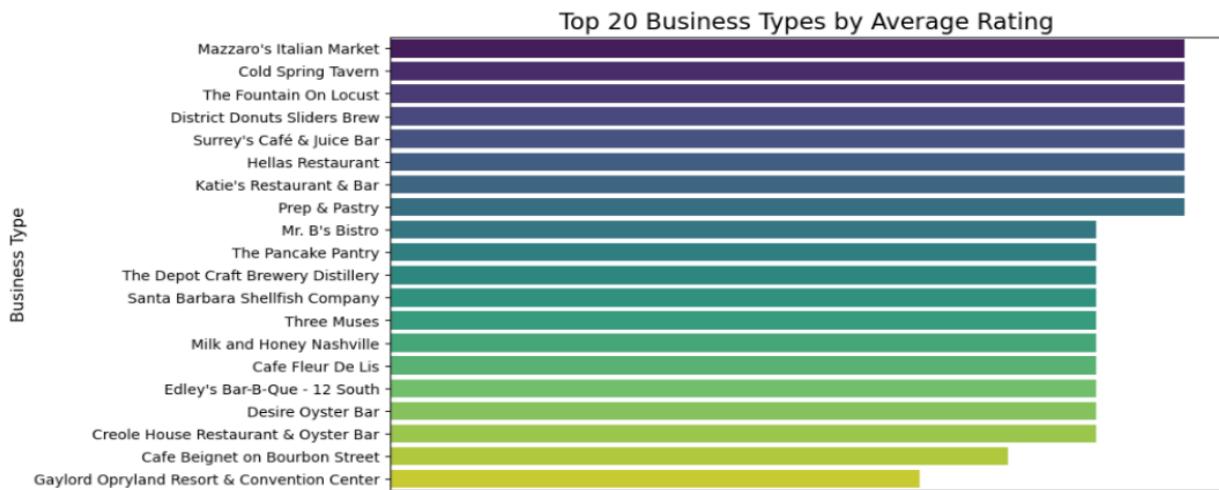


Figure 33 : Data Set Graph 2

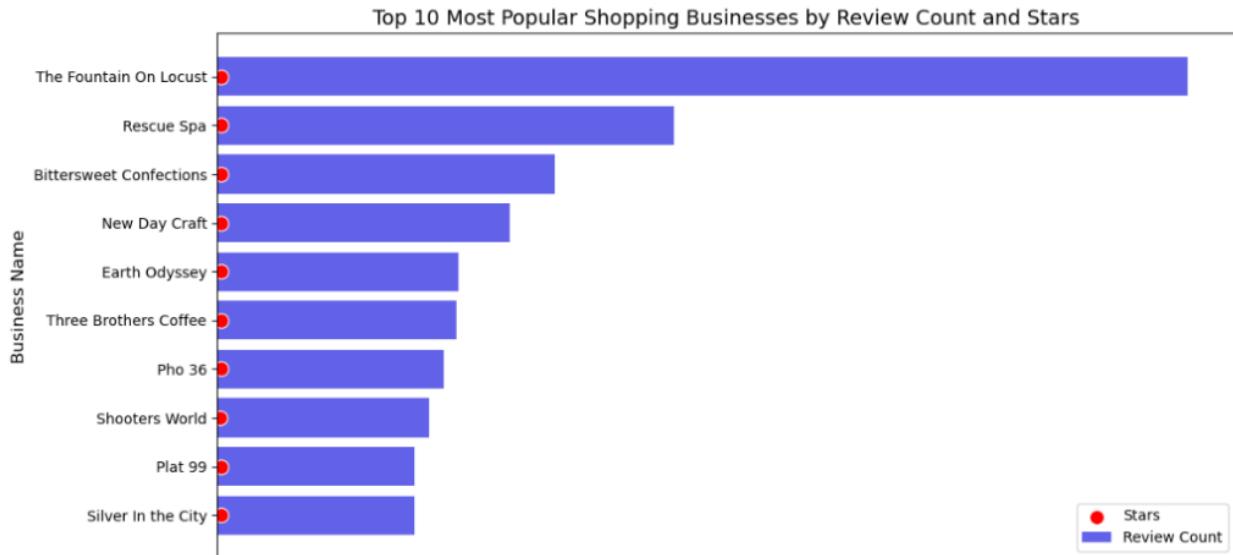


Figure 34 : Data Set Graph 3

Insights: This could help us find what are the most important businesses that our model could focus on, for example we could see places like “The fountain of locust”, “Creole House Restaurant” and others appear often in these top placements.

The following figure shows the distribution of ratings among businesses:

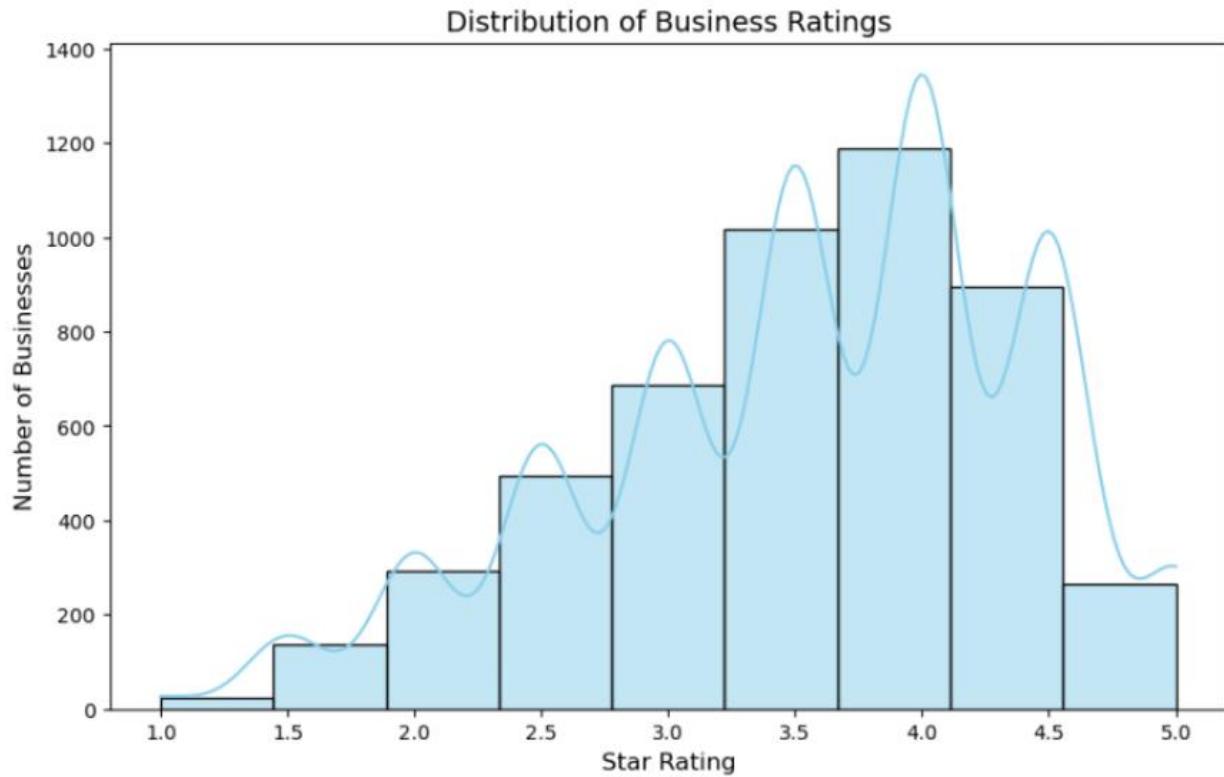


Figure 35 : Data Set Graph 4

Insights: The ratings follow a normal distribution where users often rate most businesses around the 4-star ratings.

The following figure will show the clustering of businesses according to price and ratings,

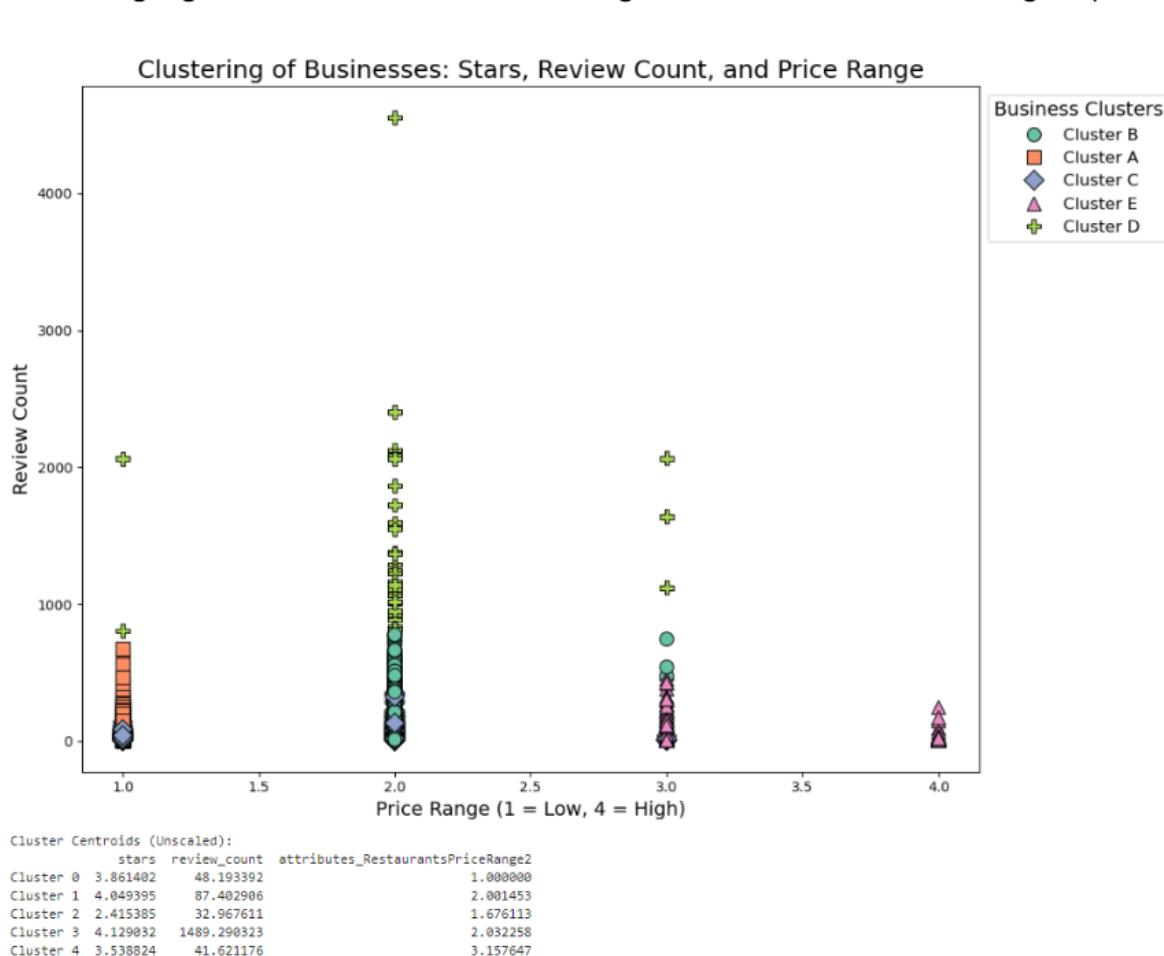


Figure 36 : Data Set Graph 5

Insights: This shows us businesses with a lower price (1,2) are more popular and get more reviews and more ratings.

A certain cluster however (Denoted with a triangle) has higher prices and little to no review counts.

The following figure will show a histogram with the distribution of review counts for all businesses:

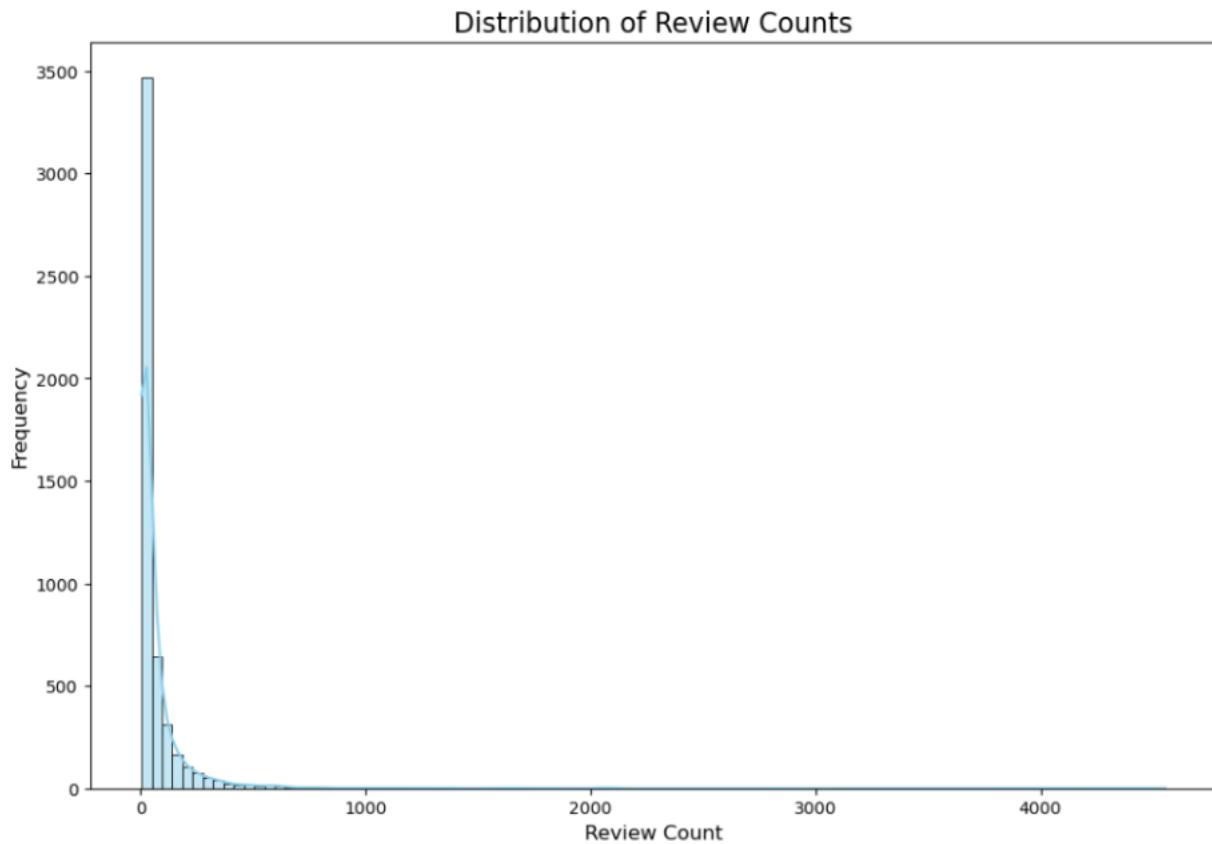


Figure 37 : Data Set Graph 6

Insights: This shows us that most businesses are not properly reviewed and businesses with higher popularity (review count) are rare.

The following figure shows the most important types of businesses (Touristic – casual – romantic etc.) and also another figure that shows us the most important types of meal preferences (Lunch – dessert – breakfast etc.)

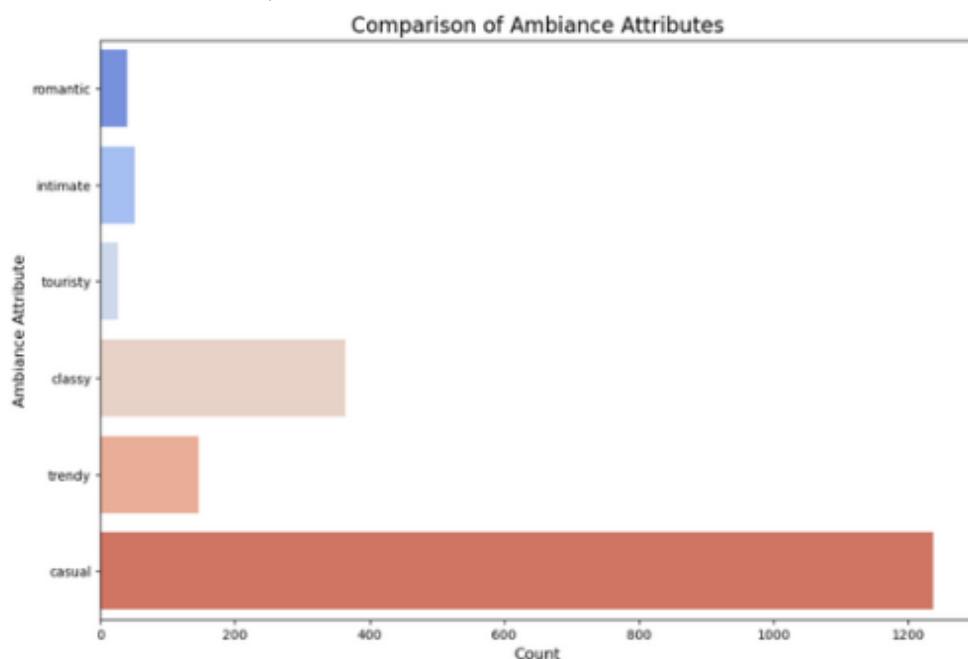


Figure 38 : Data Set Graph 7

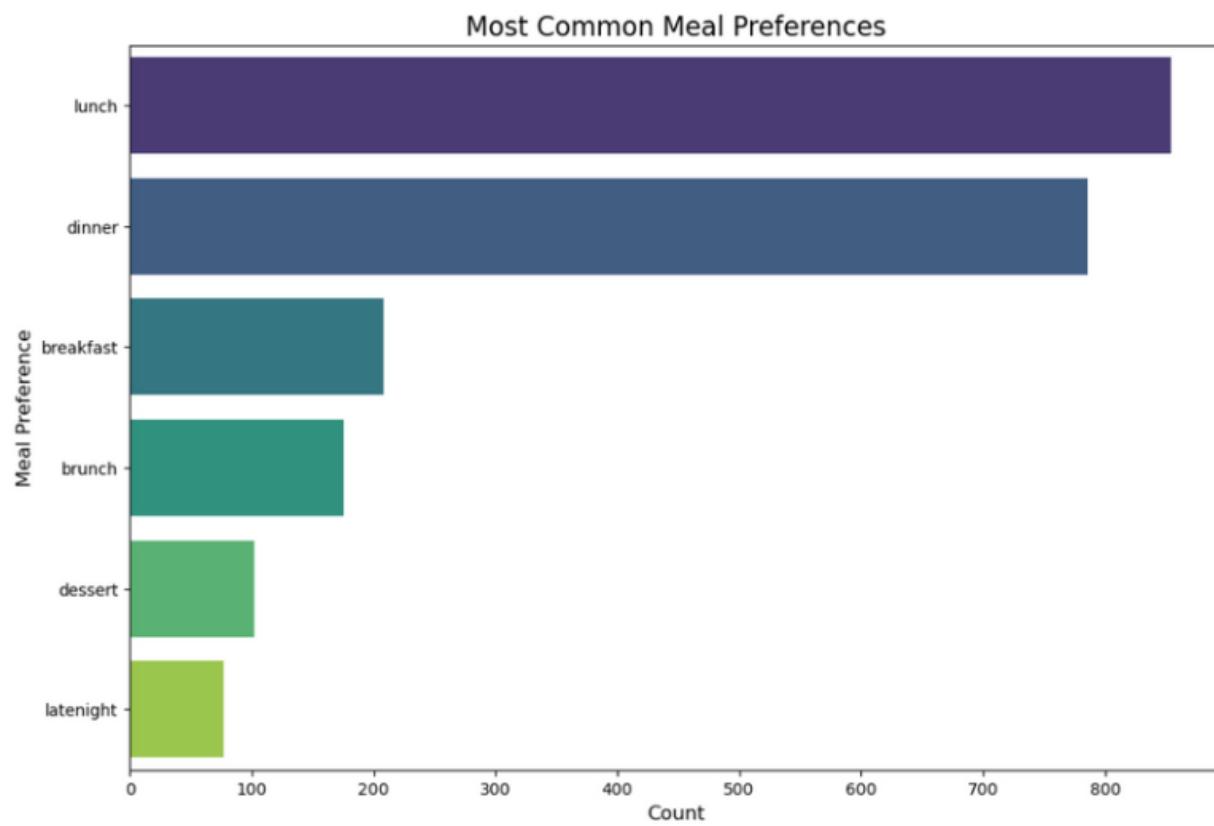


Figure 39 : Data Set Graph 8

Insights: We see that most restaurants serve lunch and dinner meals, and the most popular types of businesses are casual ones.

The following figure shows the heat map correlation between all the attributes:

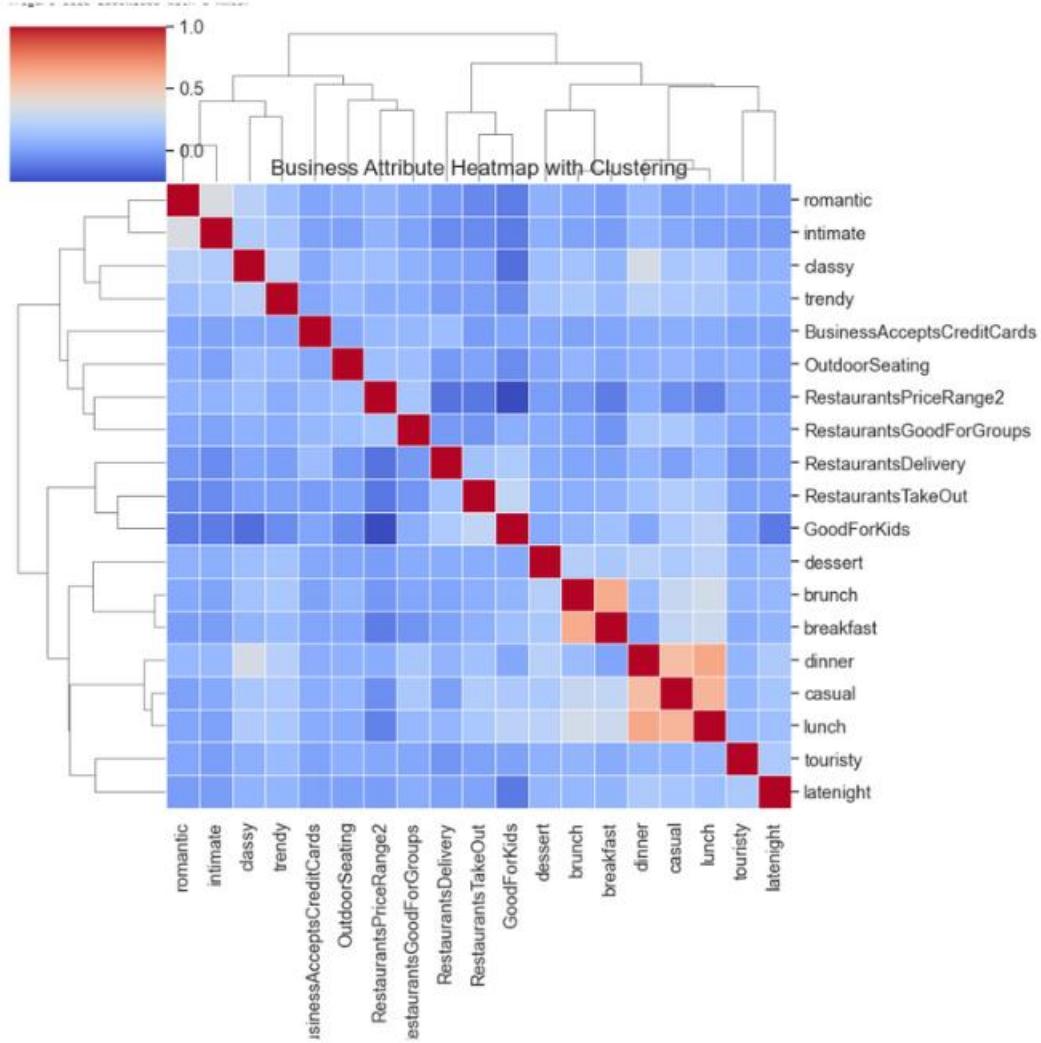


Figure 40 : Data Set Graph 9

Insights: The correlation map tells us some powerful insights on how each attribute correlates with other attributes, for example:

Most restaurants who serve breakfast also serve brunch as they have high correlation,

Most restaurants who classify themselves as “casual” serve lunch as well as dinner.

We see that columns like good for kids or restaurant take out have no effect on the pricing as they have little to no correlation.

The following figure shows a 3D scatter plot that shows each business ID, their rating and review counts:

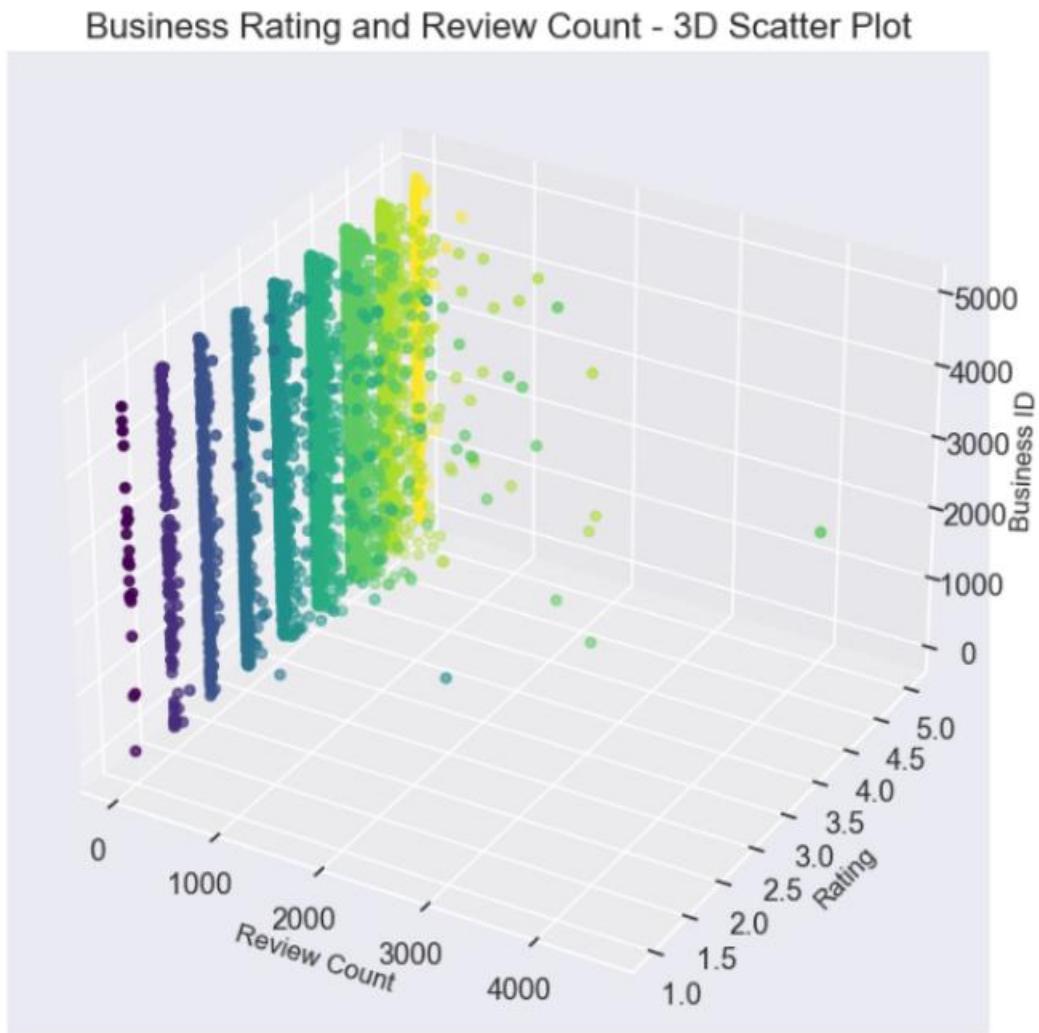


Figure 41 : Data Set Graph 10

Insight: most businesses fall under the category of high rating and low review count, as points with high review count are rare, but points where the rating is low is mid.

The following figure shows two box plots on how pricing affects ratings and review counts:

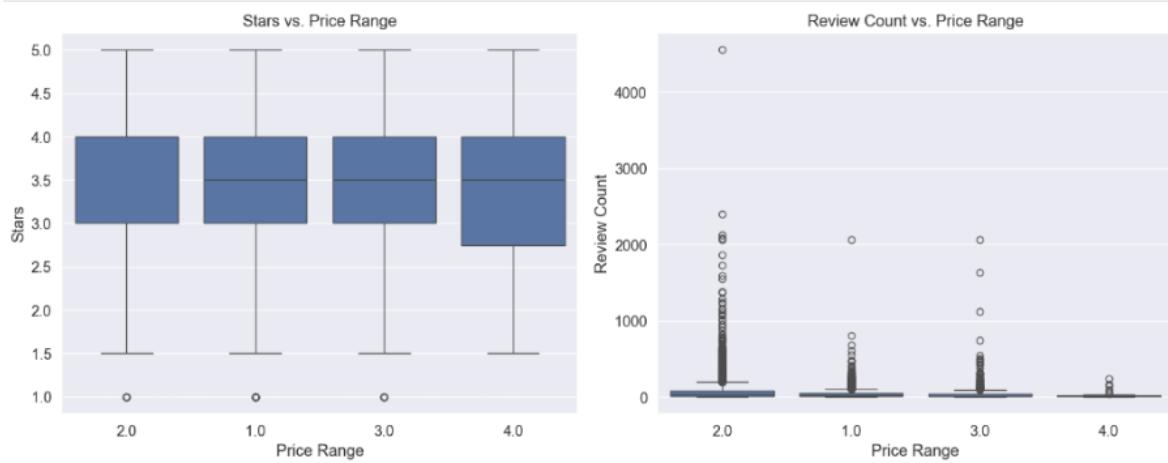


Figure 42 : Data Set Graph 11

Insights: We clearly see as the price goes down the reviews go up and, so the prices vastly affect the popularity of each business.

CONCLUSION

The TRAVIA project represents a significant step forward in addressing the evolving needs of modern solo travelers by seamlessly integrating advanced AI technologies and social connectivity into a user-friendly travel planning application. Throughout the development journey, we explored innovative approaches to tackle existing gaps in the travel industry, such as fragmented planning processes, limited customization, and lack of social engagement.

TRAVIA's dual AI planners, comprising the Basic and Advanced planning options, provide tailored solutions that accommodate diverse traveler preferences, budgets, and interests. By leveraging machine learning models, generative AI, and clustering techniques, the platform ensures personalized and efficient itinerary generation, dynamically adapting to real-time updates and user feedback. The integration of reinforcement learning for adaptive decision-making has enhanced the system's ability to refine recommendations continuously, ensuring alignment with user expectations.

The unique social media component elevates TRAVIA beyond traditional planning tools, fostering connections among travelers through shared itineraries, nearby traveler mapping, and compatibility metrics. This innovative feature transforms solo travel into a socially enriched experience, enabling users to form meaningful connections with like-minded explorers.

Extensive research and implementation of robust preprocessing techniques ensured the accuracy and efficiency of our AI models. We successfully navigated challenges related to data privacy, system scalability, and real-time performance by adhering to international standards and leveraging cloud-based technologies.

As we conclude this phase, TRAVIA stands as a comprehensive travel solution poised to redefine solo travel. It bridges the gap between travel planning and social networking, empowering users to plan, connect, and explore with ease. The insights gained during this project pave the way for future advancements, including enhanced personalization, improved real-time adaptation, and expansion into new markets. We are confident that TRAVIA will not only meet but exceed user expectations, offering an unparalleled travel experience for the modern explorer.

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