



Novoy

IT 496: Graduation Project Report Product Release-2

Prepared by
Reema AlMansour, 442200477
Reema AlAngari, 442200134
Ghadeer AlMehaideb, 442200914
Dana Bin Salamah, 442200853

Supervised by
Dr. Lama AlZaben

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NOVOY

Reema AlMansour¹, Ghadeer AlMehaideb², Dana Bin Salamah³ and Reema AlAngari⁴

¹Information Technology Department, College of Computer and Information Sciences, King Saud University, Riyadh, Saudi Arabia; 442200477@student.ksu.edu.sa

²Information Technology Department, College of Computer and Information Sciences, King Saud University, Riyadh, Saudi Arabia; 442200914@student.ksu.edu.sa

³Information Technology Department, College of Computer and Information Sciences, King Saud University, Riyadh, Saudi Arabia; 442200853@student.ksu.edu.sa

⁴Information Technology Department, College of Computer and Information Sciences, King Saud University, Riyadh, Saudi Arabia; 442200134@student.ksu.edu.sa

Abstract (English):

Today, efficient trip planning remains a challenge due to the overwhelming number of options and lack of information. The Novoy app aims to revolutionize trip planning by providing organized itineraries tailored to users' preferences. Powered by the tf-idf algorithm, the app gives users full autonomy in arranging their trip yet makes it much easier with its features. Novoy will support travelers in scheduling their daily destinations in advance, commenting on each planned visit. It offers real-time information on places and suggests interesting sightseeing places. Users can also easily generate a to-do list for efficient travel planning, which can be shared with travel mates. Blogging and experience sharing are considered as distinguished features that the app provides.

Novoy was developed using the Scrum methodology, ensuring iterative development and timely delivery. The project was completed in five sprints, optimizing resource utilization. It is built using Flutter, providing cross-platform compatibility for users on different devices. Integration with Google Places and Google Maps APIs enhances location-based services.

During evaluation and user acceptance testing, participants expressed satisfaction with the app's performance. Users praised Novoy for its intuitive interface, personalized recommendations, and efficient itinerary creation. The app provides accurate information that elevates the user's satisfaction and trip planning experience.

Abstract (Arabic):

لا يزال التخطيط الفعال للرحلات يمثل تحدياً بسبب العدد الهائل من الخيارات وقلة المعلومات. يهدف تطبيق Novoy إلى إحداث ثورة في تخطيط الرحلات من خلال توفير مسارات منتظمة مصممة خصيصاً لفضوليات المستخدمين. يمنح التطبيق المدعوم بخوارزمية tf-idf للمستخدمين استقلالية كاملة في ترتيب رحلاتهم بسهولة بفضل ميزاته. يدعم Novoy المسافرين في الجدولة المسبقة لوجهاتهم اليومية، والتتعليق على كل زيارة مخطط لها. كما يقدم معلومات متزامنة للأماكن ويقترح أماكن مثيرة للاهتمام. ويمكن للمستخدمين إنشاء قائمة مهام بسهولة للتخطيط الفعال للسفر، والتي يمكن مشاركتها مع المرافقين في السفر. كما يعتبر التدوين ومشاركة الخبرات من الميزات المميزة التي يوفرها التطبيق.

تم تطوير Novoy باستخدام منهجية Scrum، مما يضمن التطوير التكراري والتسليم في وقت زمني. و تم تطوير المشروع في خمس جولات مما أدى الاستخدام الأمثل للموارد. كان التصميم باستخدام Flutter، الذي وفر توافقاً عبر الأنظمة الأساسية للمستخدمين على أجهزة مختلفة. يعمل بالتكامل مع أماكن Google وواجهات برمجة التطبيقات لخراطط Google على تحسين الخدمات المستندة إلى الموقع.

قمنا بتقدير وختبار قبول المستخدم، أعرب فيه المشاركون عن رضاه عن أداء التطبيق. وأشاروا بسهولة واجهة Novoy ، ووصيانته، وقدرته على إنشاء خط سير فعال للرحلة. يوفر التطبيق معلومات دقيقة تزيد من رضا المستخدم وتجربة التخطيط الأمثل للسفر.

Keywords: trip planning; personalized recommendations;travel;itinerary;tourism.

1. Introduction

Traveling is a fundamental pursuit of humanity driven by a curiosity for unexplored horizons, diverse cultures, and lasting memories. People embark on journeys for leisure, adventure, business, or education. The travel industry has many aspects which cater to the needs of those who travel from one side of the earth to another and between 2019 and 2021, the Saudi Arabian tourism sector experienced a significant increase of 16.02 million visitors, with the number of tourists rising from 47.81 million in 2019 to 63.83 million in 2021. [1]

Effective planning is a crucial part of traveling in order to manage budget, anticipate, make reservations, and seamlessly explore the area travelers are visiting. Yet, the process of trip planning was a complex challenge. The many choices and lack of information, especially for lesser-known destinations, have made planning overwhelming. This issue is universal and proves the significant need for efficient trip planning for cultural exchange, personal growth, and many other reasons.

By providing organized and structured planning, travelers will optimize their time and get the utmost of their journey. Building a thoughtfully designed itinerary in advance ensures visits to desired destinations, activities and more resulting in a fulfilling and memorable voyage. However, modern trip planning has become complex due to the numerous options available. This challenge affects both experienced and novice travelers, often leading to confusion.

Efficient trip planning is crucial on a global scale as it facilitates and supports the tourism sector which plays a significant role in economic growth. Our innovative trip planner aims to revolutionize this process. We proudly introduce the Novoy app as an ultimate travel companion that simplifies and enhances the trip planning experience, whether the traveler is a solo traveler or planning a group trip.

Novoy goes beyond providing basic functionalities. With its advanced AI technology, the app extracts relevant data from various sources to offer recommendations based on the user's trip destination. From the finest local restaurants to must-visit attractions, our AI-generated recommendations will ensure that travelers make the most of their trips.

In this project, we introduce our trip planner application. It presents its features, benefits, and objectives. By the end, you will have a comprehensive understanding of how our solution simplifies and enhances travel planning.

1.1 The Problem

A significant real-world problem in the field of tourism and travel is the overwhelming number of options and choices available to travelers when planning their trips, coupled with a lack of information and resources for lesser-known tourist destinations or those that have recently opened up for tourism.

The problem stems from the sheer volume of options that travelers encounter at every stage of trip planning, including accommodations, activities, and dining choices. This abundance of choices can become daunting and perplexing, leaving travelers struggling to make well-informed plans that align with their preferences.

Also, when it comes to lesser-known tourist destinations or those that have recently opened up to tourism. Travelers face a scarcity of dedicated information for these locales, making it challenging to find up-to-date recommendations and create their trip plans.

Furthermore, another issue that frequently arises when people travel as a group is the need to plan together and make collective decisions. Group travel often involves coordinating the schedules of multiple individuals, which can be a complex and time-consuming process.

In addition, there is a noticeable lack of apps that adequately address the challenges faced by travelers. While there are existing apps available for trip planning, they often have limitations that hinder their usefulness. One of the primary limitations is the overwhelming amount of user-generated content, which can make it difficult to find reliable information. This makes the process of planning a trip complex and time-consuming.

For example, let's consider a traveler planning a trip to Al Ula, a historically and culturally rich city in Saudi Arabia. As an emerging tourist destination, Al Ula may have limited comprehensive and up-to-date information available for travelers. The lack of resources can pose significant challenges for the traveler in planning their trip effectively. The planning process typically involves gathering information about various aspects of the trip, such as accommodation choices, activities, and dining options. However, due to the limited availability of comprehensive and up-to-date information about Al Ula, travelers may struggle to organize and plan the details regarding these aspects.

In our project, we aim to address the difficulties that travelers face in planning by introducing our solution in the next section.

1.2 The Solution

Our proposed solution for the overwhelming number of options and lack of information during travel planning is to develop a travel planning application that will help travelers create personalized travel plans. It will simplify the planning process for travelers, ensuring they explore destinations with confidence.

The benefits of our solution are diverse. Firstly, the travel planning application will significantly reduce the time and effort required for travelers to research and plan their trips. Eliminating the need to search through countless options and resources saves them valuable time and reduces planning-related stress.

Secondly, by considering the traveler's destination, the application can suggest accommodations, activities, places, and restaurants that match the user's trip destination. This would enhance the user experience, ensuring travelers have tailored plans and recommendations that align with their destinations.

Moreover, The application will integrate real-time data and updates to ensure that travelers have the most up-to-date information about their chosen destinations. This feature will be particularly advantageous for travelers interested in visiting lesser-known destinations. By providing comprehensive information on these locations, our solution will contribute to their promotion and growth in the tourism industry.

In conclusion, our solution will empower travelers to effortlessly create trip plans while ensuring the accuracy and reliability of the information. To achieve this, our application will integrate with external sources, leveraging data from reputable providers like Google API. By implementing user account functionalities, users can create accounts, log in, log out, and recover forgotten passwords, ensuring a seamless and secure experience. Our solution will also include a visually appealing trip representation, showcasing the sequence of events with dates, allowing users to create multiple plans and facilitating sharing and collaborative editing. Additionally, our integration of a recommender system will leverage the obtained data to offer recommendations, assisting users in making informed decisions. Overall, our travel planner application will revolutionize trip planning by simplifying the process, enhancing data accuracy, and providing valuable features for an exceptional user experience.

1.3 Product

1.3.1 Product Vision

For a traveler

Who needs to plan and discover a country they're visiting

The Novoy App is a travel planner app

That provides a collaborative planning feature and suggests places based on a traveler's destination.

Unlike the Tripwise and Tripsy Apps

Our product allows travelers to plan their trips, collaborate, and edit the trip plan to their liking, and discover new places with AI assistance

1.3.2 Objectives

1- Product (customer focus-value):

The main objective is to solve the problem of overwhelming trip planning. The app aims to benefit tourists worldwide in seamless trip planning

- Features of the app:
 - Ability to search for tourism attractions, hotels, restaurants, etc.
 - Integrated map of the places
 - AI recommender system
 - Option for users to create and share plans with friends and family
 - Editing capability for shared plans

2- Project (solution focus-plan):

To gather data about the applications of the market, we are going to search the domain of tourism. We will study the market scenery and learn more about competitor apps, such as TravelWise, TripIt, and Tripsy to predict demand and supply and help in building our application.

- Design considerations:
 - Create an appealing representation for displaying and sharing plans
 - Integrate API for interactive maps
 - Implement a Favorite List feature for saving preferred places
- AI model development:
 - Collect and analyze data
 - Train AI model to recommend places, restaurants, hotels, etc.
- Additional features:
 - Include a search engine for users to find and add places to their trip
 - Implement search filters
- User feedback:
 - Gather feedback from target users after the first release

- Use feedback to understand user needs
- Apply feedback to improve application

3- Learning (student focus):

Hopefully, throughout this project, we will learn something new, overcome challenges, and gain new expertise.

- Development tools:
 - Learn Flutter for application development
 - Utilize software tools like Jira, GitHub, and Slack
 - Use Visual Studio Code as the IDE
- Database system:
 - Implement a database system
- Data extraction:
 - Learn data import using APIs
- AI recommender system:
 - Gain knowledge in building an AI recommender system
- Skill development:
 - Develop problem-solving skills
 - Improve effective communication skills
 - Enhance teamwork skills

1.3.3 Scope

The scope of the Novoy app project involves the design, development, and deployment of a mobile application that assists users in planning their trips collaboratively and efficiently. The app will leverage AI technology to provide personalized travel suggestions and present these in a visually appealing and user-friendly manner. It will also have built-in capabilities for users to share their plans, manage their accounts, and interact with the app through various features.

The user should be able to do the following in:

User Account Management:

- Create an account.
- Recover forgotten passwords.
- Edit his/her information.
- Delete his/her account.

Navigation and Browsing:

- Understand and navigate through the app seamlessly.
- Browse through the app without signing in.
- Use the search engine.
- Filter searches.

Planning and Collaboration:

- Create multiple plans.
- Add places to the plan.
- Create a collaborative plan.

- Edit in a collaborative plan.
- Display the map.
- See the places displayed on the map.
- Share the plan with others by username or as PDF.
- Add a place to his/her favorites list.

Out of Scope:

- The user will not be able to directly book a restaurant, event, etc. on the app platform.
- The system will not support maps offline.
- The system will not have a budget calculator.
- The system will not be able to create a full plan using the AI recommender system.
- The system will not be available in any other language.

1.3.4 Hardware/Software Tools and Cost

Hardware Tools	
Name and Description	Cost
Laptop	3000 - Available
-	-
Software Tools	
Name and Description	Cost
GitHub	0
Figma	0
Flutter	0
Firebase	0
VS code	0
Jira software	0

Table 1: Hardware/Software Tools and Cost

1.4 Scrum Team

1.4.1 Skill Set Requirements

Technical Skill Required	What is the current level of the team (beginner-intermediate- advanced) for each skill? How will the gap be bridged? (if necessary) Learning plan
Flutter	Beginner, we are practicing more by completing Flutter code labs and tutorials
UX foundations	Advanced
Integration with external services/APIs	Intermediate
building recommender system	Intermediate, we will learn more by completing AI course

Table 2: Skill Set Requirements

1.4.1.1 Learning

To achieve the necessary learning to develop the Novoy app, we have taken the following steps:

1. Background Research:

Extensive research has been conducted to acquire domain knowledge. This includes studying topics such as travel planning methodologies, collaborative tools, AI technology, and mobile application development.

2. Development Tools and IDEs Exploration:

We searched for tools and IDEs such as Android Studio, Xcode, and Flutter and ensured they were suitable for building the Novoy app. Our team has also considered factors such as ease of use and compatibility of the tools and IDEs to choose the most suitable ones.

3. AI Technology Exploration:

Our team explored AI technology to understand its capabilities and potential applications in generating personalized travel recommendations. This involved studying recommender systems and machine learning algorithms to implement AI-driven features effectively.

4. Map Integration:

Exploration of map integration options to provide location-based information within the app. This includes understanding the utilization of APIs and SDKs provided by map service providers and ensuring seamless integration.

5. Collaborative Planning:

The team has researched and studied different approaches and tools for enabling collaborative planning among multiple users. This includes exploring real-time collaboration features, version control mechanisms, and user permission management to facilitate effective collaboration within the app.

6. Sharing and Security:

Extensive research has been undertaken on methods and technologies to enable users to share their travel plans in various formats, such as PDFs and links. Additionally, measures have been explored to implement password recovery functionality and account deletion options to enhance user convenience and security.

Current Stage of Learning:

At the current stage, the team has gained a solid understanding of the necessary domain knowledge and theoretical background required for the project. We have explored AI technology for personalized recommendations, map integration, collaborative planning methodologies, and sharing and security considerations. With this foundation, the team is now prepared to move forward with the implementation and development of the Novoy app.

1.4.2 Roles and Responsibilities

Scrum Team	
Product Owner: (name of the project supervisor)	Dr. Lama AlZaben
Developers: (list student names)	Reema AlMansour Reema AlAngari Ghadeer AlMehaideb Dana Bin Salamah
Scrum Master (SM): (name of the project supervisor)	Dr. Lama AlZaben
Stakeholders: (list names of project stakeholders, include customer names if any)	Travelers all over the world

Table 3: Roles and Responsibilities

2. Background

In this section, we focused on examining existing research, studies, books, and developments in the field of travel planning applications, AI driven recommender systems, and other technologies.

Tourism is a multifaceted activity that spans various economic, social, cultural, and environmental sectors [2]. The tourism industry is significant globally, contributing approximately 11% to the global gross domestic product (GDP) and employing 200 million people, with an estimated 700 million tourists worldwide [3].

The definition of tourism is broad and has evolved to encompass all forms of leisure travel, including recreational, leisure, and business purposes. Several people and organizations define travel and tourism; according to the World Trade Organization (W.T.O.), tourism is the movement of people away from their normal place of residence and work for a period of not less than 24 hours and not more than 1 year [4]. The United Nations World Tourism Organization (UNWTO) has also defined tourism as: “Activities of persons travelling to and staying in places outside their usual environment; not more than one consecutive year for leisure, business, and other purposes” [4]. Also, Walter Hunziker, which is the Swiss professor who founded the Tourism Research Institute, defined tourism as “the sum of the phenomena and relationships arising from the travel and stay of non-residents, in so far as it does not lead to permanent residence and is not connected to any earning activity” [4].

In the domain of travel and tourism, the process of travel planning plays a vital role in ensuring memorable and enjoyable experiences for individuals. A travel itinerary is a visual representation of a trip that includes information on locations, arrival and departure times, travel and accommodation details with a clear overview of the entire trip, including countries visited and durations of stays. It aims to simplify answering questions about travel logistics and facilitate collaborative information gathering and document creation [5]. Planning a trip involves a series of steps that can begin with selecting a destination based on personal preferences, budget, desired activities, and available time, and once a destination is chosen, the next step is to gather information about the location, including its attractions, cultural aspects, safety considerations, and available accommodations and transportation. This includes booking transportation, such as flights, trains, or cruises, as well as securing suitable accommodations, such as hotels, or resorts. Creating a well-structured travel plan is also a crucial aspect of travel planning, it outlines the schedule, activities, and attractions to be experienced during the trip. It helps travelers optimize their time, ensuring they cover significant destinations and make the most of their visit.

In recent years, technology has revolutionized the travel planning process. Information technology advancements have had a notable impact on the delivery of tourism services, enabling tourists to access information, make reservations, and plan trips more efficiently and cost-effectively compared to conventional methods [3]. Smart tourism is a recent term used to describe the growing reliance of tourism destinations, industries, and tourists [6].

Smart tourism refers to the utilization of information and communication technologies (ICT) in the travel and tourism industry to enhance the overall experience of tourists [7]. With the rapid growth of

the internet and mobile technologies, smart tourism has become a prevalent trend, revolutionizing the way people search for information, make reservations, and plan their trips [7]. The emergence of smart tourism technologies (STTs) has provided travelers with a plethora of channels and platforms to obtain accurate, comprehensive, and personalized information [7]. Websites have gained significant influence over travelers' purchasing decisions through the provision of consumer evaluations and performance scores for hotels and other travel services [7].

However, the abundance of online choices and information has created a new challenge for travelers, as it has become increasingly difficult to navigate through the vast amount of data available and identify the most relevant and trustworthy sources.

In Ref. [8], The workshop discussions highlighted several critical challenges that need to be addressed for the successful implementation of smart tourism. One key issue is the dependency on technology and the potential digital divide. Not all tourists may have the necessary devices or access to technology, resulting in unequal experiences at smart tourism destinations. Some destinations are trying to bridge this gap by making smartphones and mobile access widely available, but it raises questions about the inclusivity and options for tourists who prefer non-smart tourism experiences [8]. Another challenge is the complexity of the smart tourism infrastructure that also raises concerns about control and data privacy; data management, sharing, and privacy become significant issues and makes the tourist experience more challenging [8]. The Novoy app addresses this challenge by implementing robust security measures and privacy protocols. It also ensures user data privacy through encryption and secure storage, allowing users to enjoy the with confidence and control.

Furthermore, the assumption that smart tourism automatically enhances the tourist experience needs to be critically examined; cognitive overload and the constant need for interaction with information may create challenges for tourists who prefer a more effortless and authentic experience. Businesses will need to compete for the attention of smart tourists and find ways to deliver meaningful experiences while avoiding information overload [8]. The Novoy app aims to ease the user's experience by eliminating the challenge of cognitive overload and constant interaction with information, providing a more effortless and seamless planning experience.

In Ref. [9], the study examines mobile travel apps (MTA) and their smart features, with a focus on identifying the features that can increase user interest and address the challenges associated with their development. The study identifies the common functions of travel apps and eight key smart features, and then selects and evaluates 36 apps based on inclusion and exclusion criteria. The findings reveal the acceptance of smart technology in the tourism industry, with geolocation tracking services, travel itinerary generators, and real-time personalization and recommendation emerging as the major features. The practical implications of the findings are highlighted, guiding tourism organizations and app developers in offering smart features that enhance user engagement. The research fills a gap by examining MTA smart features from a developer-centric perspective and recommends integrating smart features for improved tourism services and market penetration in the tourism industry which supports the features suggested for the Novoy app.

The key concepts form the foundation of Smart Tourism research and have been extensively explored, such as privacy preservation, context awareness, recommender systems, social media, user experience, real-time, augmented reality, and more. Each concept contributes to enhancing the tourist

experience and improving the efficiency of tourism services [10]. In addition to the key concepts, several challenges have been identified in the field of Smart Tourism. These challenges include:

1. Personalization of content for users.
2. Identifying appropriate sources for data collection.
3. Extracting data implicitly or explicitly.
4. Utilizing technological infrastructures such as sensors, cloud computing, and WiFi.
5. Developing effective recommender systems.
6. Achieving location-based advertising through location tracking systems [10].

In the context of Smart Tourism, the interconnection and synchronization of technologies along with real-time data play crucial roles, forming a technological ecosystem rather than a standalone system [6,11]. The concept of "real-time" is frequently emphasized in the literature related to Smart Tourism. For instance, a significant tracking study highlighted in Ref. [12] records tourists' movements in real-time using mobile and GPS technology. An app is employed to transmit real-time location data and survey responses provided by tourists, capturing their experiences and preferences [12]. The rapid development of computer science and Internet techniques has led to the generation of massive-scale data in various formats, forming what is known as big data [13]. Big data has found applications in numerous fields, including tourism [13]. Leveraging big data is crucial for creating value in the smart tourism industry [8]. It has the potential to reshape competition, enhance the information-intensive nature of the sector, and offer several implications and benefits for tourism destinations and companies [14].

The utilization of big data in tourism research has brought significant advancements; it provides a better understanding of tourism demand, tourist behavior, and satisfaction, and reshapes the understanding of the hospitality industry [13]. The abundant data generated by tourists during their journeys can be utilized to create smart destinations and enable tourism firms to personalize their products and services, however, despite its potential, the practical implementation of data-driven value creation in tourism is still limited [14].

In Ref. [15], the studies highlighted that the exponential growth of user-generated content presents challenges in organizing and presenting the vast amount of data. Issues with inaccurate or missing spatiotemporal metadata pose challenges for data analysis. Preserving digital culture and navigating large online collections are also significant challenges [15].

However, the challenge of data acquisition in the tourism industry lies in the availability and accessibility of data. While there is a vast amount of data available, it is not accessible to everyone, which poses a challenge in obtaining comprehensive and inclusive information for purposes related to the development of the Novoy app.

Data plays a crucial role in machine learning, and data collection is becoming more critical [16]. In Ref. [16], the study highlights that insufficient training data can hinder the performance and effectiveness of machine learning models, particularly in new applications where abundant labeled data is not readily available. Traditional applications, such as machine translation or object detection,

benefit from massive amounts of accumulated training data, however, newer applications may have little or no training data available [16]. This highlights the pressing need for accurate and scalable data collection techniques, particularly in the era of big data [16]. The study in Ref. [16] emphasizes the importance of conducting a comprehensive survey of data collection, it notes three main methods for data collection: data acquisition, data labeling, and improvement of existing data or models.

Google API serves as a valuable source of data for the Novoy app; however, it is important to note that it may have limitations in terms of the availability of comprehensive data. The Google Places API is a service offered by Google that allows users to access comprehensive location data and imagery through HTTP requests. It provides accurate and up-to-date information about establishments, geographic locations, and points of interest, commonly referred to as "Places." Users can retrieve detailed place information, including addresses, contact information, ratings, reviews, and photos. The API enables users to create location-aware features, display targeted search results, enable autocomplete functionality, and incorporate high-quality photos into their applications. It is a valuable tool in the field of smart tourism as it allows for the development of location-based applications that provide users with valuable information and enhanced experiences. By leveraging the Google Places API, applications can offer rich location-based features, improve search functionality, and provide users with relevant and personalized recommendations based on their location and preferences [17].

The data obtained from Google Places address the challenges of access, coverage, and conceptual alignment, making them valuable resources for economic statisticians [17]. In the case of Google Places, the challenges are mitigated to a great extent and also allows seamless and stable access to a wealth of information about places worldwide as well as providing policies and notifications to ensure data stability [17].

Recommender systems have emerged as valuable tools in the travel and tourism domain. These systems have been successfully employed in various domains such as book recommendations, movie suggestions, and music recommendations [10]. In the context of travel and tourism, personalized recommendation systems aim to provide personalized recommendations for selecting destinations, tourist attractions, accommodations, restaurants, routes, and other aspects of travel planning. By tailoring recommendations to individual users, these systems aim to improve the discovery of relevant tourism services and attractions. E-tourism services encompass a wide range of functionalities, including destination selection, tourist attraction recommendations, accommodation suggestions, restaurant recommendations, and route planning [10].

Recommendation systems utilize various technologies, which can be broadly classified into two groups; the first group is content-based systems, which analyze the characteristics and properties of the recommended items, and the second group is collaborative filtering systems, which recommend items based on similarity measures between users and/or items [18]. We intend to use content-based recommender system in our app and ensure accurate and personalized recommendations.

In the NOVOY application we plan to implement the recommender system based on product similarity. Product Similarity (Item-Item Filtering) is a recommendation system technique that recommends items based on similarities between previous products that the user interacted with[19].

Several similarity measures can be used to calculate the similarity between two or more products, some of which are:

1. Minkowski Distance: a generalized distance measure that calculates the distance between two points based on the p-norm of the differences between their coordinates. It can be used for clustering and classification tasks [20].
2. Manhattan Distance: a distance measure that calculates the distance between two points by summing the absolute differences between their coordinates along each dimension. It is commonly used in machine learning for clustering, classification, and regression tasks[21].
3. Euclidean Distance: a distance measure that calculates the distance between two points in a straight line. It is commonly used in machine learning for clustering, classification, and regression tasks [22].
4. Cosine similarity: a measure of similarity that can be used to compare documents or, say, give a ranking of documents with respect to a given vector of query words. Let x and y be two vectors for comparison. Using the cosine measure as a $\text{sim}(x, y) = \frac{x \cdot y}{\|x\| \|y\|}$ [23].

We choose Cosine similarity as our similarity measure to use in a recommender system.

In conclusion, the background section highlights the significance of the tourism industry and the impact of information technology advancements on travel services. The review emphasizes the importance of recommendation systems in simplifying the search process and providing personalized recommendations for travel planning. It also discusses key concepts and challenges in the field of Smart Tourism, emphasizing the role of real-time data and technological ecosystems. The study on mobile travel apps (MTA) provides valuable insights into the features that enhance user engagement and acceptance of smart technology in the tourism industry.

Overall, the background supports the development of the Novoy app as it addresses the limitations of existing applications, and offers personalized recommendations, collaborative planning features, and seamless map integration, thereby providing users with an enhanced and user-friendly travel planning experience.

3. Literature Review

The rapid advancement of technology has significantly transformed various industries, including the travel and tourism sectors. With the rise of information and communication technologies, the concept of smart tourism has emerged, revolutionizing the way people plan and experience their trips. In this literature review, we delve into the existing developments in the field of travel planning applications, collaborative tools, AI-driven recommender systems, and map integration technologies. We will review five mobile applications; Tripwise, TripIt, TripAdvisor, Wanderlog, and Tripsy. We aim to identify the strengths and limitations of the Novoy app and provide recommendations for its improvement. The findings of this literature review will contribute to a better understanding of the current state of smart tourism and help us in our next step which is competitor product analysis.

TripIt:

<https://www.tripit.com/web> [24]. TripIt is an award-winning travel organizing app that keeps all your details in one place. Its premium service, TripIt Pro, provides additional features that keep travelers one step ahead with helpful reminders and alerts throughout their trip.

Features:

- **Nearby Places:** Easily find hospitals, clinics, and pharmacies near your location.
- **Documents:** Upload and store PDFs, photos, boarding passes, mobile QR codes, and other travel-related documents.
- **International Travel Tools:** TripIt Pro provides country-specific travel information such as embassy details, required vaccinations, and currency conversions.
- **Mobile Itinerary:** Access your travel plans across devices.
- **Airport Maps:** Access maps of airports and terminals to navigate easily.
- **Sharing:** Easily share your plans with colleagues, friends, or family.
- **Flight Ratings:** Provide feedback to help shape future in-flight experiences.
- **Collaborative Sharing:** Allows you to easily share your travel plans with others and collaborate on the itinerary.

User Interface Design:

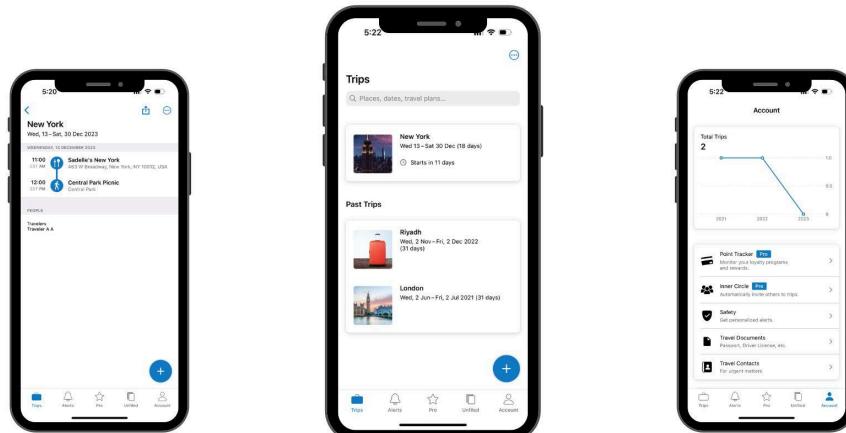


Figure.1 TripIt UI Design

TripAdvisor:

<https://www.tripadvisor.com> [25]. Tripadvisor brings people, passions, and places together. The aim of the app is to help make a better travel experience, from travel planning to booking, to taking a trip.

Features:

- **Traveler Reviews:** Access millions of reviews and ratings from fellow travelers to help you make informed decisions.
- **Destination Guides:** Explore comprehensive guides for various destinations, including popular attractions, things to do, local tips, and suggested itineraries.
- **Hotel Booking:** Find and book hotels directly through the app.
- **Flight Search:** Search for flights and compare prices from different airlines to find the best deals for your travel dates.
- **Personalized Recommendations:** Receive personalized travel recommendations based on your preferences and past searches.
- **Trip Planning Tools:** Use features like itinerary creation, saving favorite places, and organizing your travel plans to streamline your trip preparations.
- **Saved Lists:** Create and manage personalized lists of your favorite places.

User Interface Design:

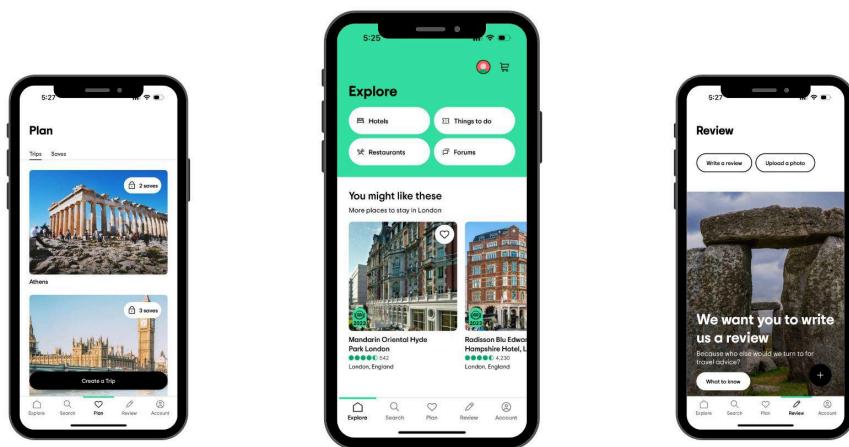


Figure.2 TripAdvisor UI Design

Wanderlog:

<https://wanderlog.com/> [26]. Wanderlog is a travel planner that is a good overall application. It works well for road trips and can do detailed planning. It also imports and organizes information and allows users to plan in a web browser or using a phone.

Features:

- **Itinerary Planner:** Organizes all your travel information, including flights, hotels, restaurants, and tours, in one place.
- **Hotel Booking:** Find and book hotels directly through the app, with options to filter by price, location, amenities, and guest ratings.
- **Collaborative Sharing:** Allows you to easily share your travel plans with others and collaborate on the itinerary.
- **Destination Guides:** Explore comprehensive guides for various destinations, including popular attractions, things to do, local tips, and suggested itineraries.
- **Personalized Recommendations:** Gives personalized travel recommendations based on your preferences and past searches.
- **Sharing:** Share plans with colleagues, friends, or family through text, email, or apps.

User Interface Design:

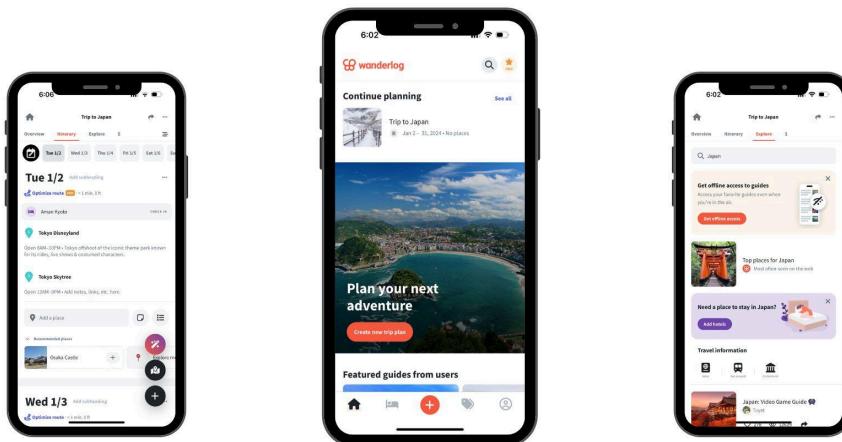


Figure.3 Wanderlog UI Design

Tripsy:

<https://tripsy.app/> [27]. Tripsy is a powerful app that helps people plan their trips with complete itineraries. With its latest update, Tripsy is getting new features that will make the process of organizing a trip even easier. This includes support for weather conditions, time zone changes, and a customizable dashboard.

Features:

- **Itinerary Planner:** Organizes all your travel information, including flights, hotels, restaurants, and tours, in one place.
- **10-day Weather Forecast:** Accesses the weather forecast for your destination.
- **Activities List:** Saves your activities, and Tripsy will automatically organize them by location, making it easier to travel to different countries or cities.
- **Map View:** Views all your saved places, itineraries, and routes on a map.
- **Share Trip:** Collaborates with guests by sharing your trip, allowing them to use PRO features for free.
- **Travel Document:** Stores and shares all your travel documents.
- **Automation:** Automatically imports reservations from over 700 providers, including Booking.com, Hotels.com, and major airlines.

User Interface Design:

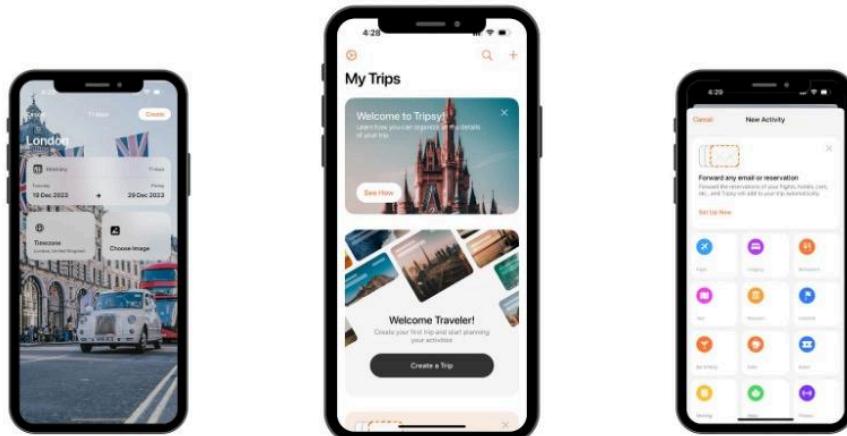


Figure.4 Tripsy UI Design

Tripwise:

<https://apps.apple.com.sa/app/tripwise-ai-travel-planner/id6446293038> [28]. Tripwise is an AI-powered travel planner and guide that simplifies the creation of personalized itineraries for 4853 cities worldwide.

Features:

- **Easy to use:** Select your destination city, travel dates, and interests, and let the app's AI technology handle the rest.
- **Optimized itineraries:** Tripwise groups sights by day and generates optimized routes to minimize walking, ensuring you make the most of your time.
- **Insider tips:** Get insider tips from locals and access travel guides for popular destinations.
- **Customization:** Customize your itinerary to your preferences, whether you want a detailed plan or prefer more flexibility.
- **Chatbot support:** The chatbot is available 24/7, ready to answer your queries and provide immediate support whenever you need it.

User Interface Design:



Figure.5 Tripwise UI Design

3.1 Competitive Product Analysis

Before building our product, we needed to research the market to learn about the strengths and weaknesses of existing similar products, and after a comprehensive literature review conducted for the Novoy app, we have gained valuable insights into the market.

After selecting the top-used apps in this field, we started comparing the features of each product to ours. Table 4 below describes some key features of the chosen applications in the literature review.

Features	Applications					
	TripIt	TripAdvisor	Wanderlog	Tripsy	Tripwise	Our App (Novoy)
Favorite List	✗	✓	✗	✗	✗	✓
Recommendation System	✗	✓	✓	✗	✓	✓
Trip Itinerary	✓	✓	✓	✓	✓	✓
Document Attachment	✓	✗	✗	✓	✗	✗
Explore Page	✗	✓	✓	✗	✗	✓
Collaborative Planning	✓	✓	✓	✗	✗	✓
Plan Sharing	✓	✓	✓	✓	✗	✓

Table 4: Competitive Product Analysis

Our findings have led to the following conclusions:

Among the listed travel planning applications, TripAdvisor and Novoy stand out as comprehensive travel itinerary apps that excel in generating detailed trip itineraries but do not handle document attachments. It also offers collaborative planning and plan-sharing capabilities, making it suitable for group travel. TripAdvisor is known for its extensive database of user-generated reviews and recommendations, making it a valuable resource for travelers seeking insights and suggestions from fellow users. Wanderlog and Tripsy are both travel planning apps that likely offer features similar to TripIt, such as trip itineraries and favorite lists. Tripwise is an AI-powered travel planner, and it fully generates a plan with days and times.

However, one limitation of Tripwise, Wanderlog, TripIt, and Tripsy is that they offer subscription plans to access some features. This can be a disadvantage for budget-conscious travelers or those who prefer not to commit to ongoing payments. Additionally, subscription plans may restrict access to certain features or content, limiting the full functionality of the app for users who opt for free or basic versions. This can hinder the overall user experience and limit the app's usefulness for those who choose not to subscribe. For example, Tripwire has a limit of 5 days to generate a plan, and Tripsy offers trip sharing and collaborating only for subscribers.

Based on the competitor analysis, the Novoy app is similar to TripAdvisor and both apps stand out among the listed travel planning applications. They excel in generating trip itineraries, offering collaborative planning and plan-sharing capabilities, and allowing users to use these features without the need for a subscription, making them suitable for all types of travelers.

4. System Design and Development

4.1 Methodology

4.1.1 Agile Approach

Novoy was created utilizing the agile software development methodology, which enables developers to deliver value to customers more efficiently and with fewer problems by continuously evaluating requirements, plans, learning, and outcomes. The development process is segmented into small, iterative phases known as sprints, with a total of five sprints completed.

4.1.2 Scrum Framework

In our approach, we embraced the Scrum framework, which places emphasis on teamwork, accountability, and iterative progress, ensuring that each team member contributes to a clearly defined objective. Within the software development Scrum framework, there are three distinct roles that play a crucial part:

- **Product Owner:** involves acting as a bridge between the development team and the customers. This individual is responsible for effectively communicating and aligning the expectations for the final product with all stakeholders involved.
- **Scrum Master:** often referred to as the project facilitator, plays a vital role in ensuring adherence to Scrum best practices. This individual serves as a leader and project manager, expert at fostering collaboration, resolving conflicts, and driving process improvement.
- **Development Team:** comprises members who collaborate to build and test incremental releases of the final product. These individuals possess a strong understanding of Scrum and Agile development practices, working collectively to deliver high-quality results.

The Scrum methodology promotes the philosophy of working with available resources and consistently evaluating the effectiveness of practices. Effective communication is a crucial aspect, facilitated through various meetings known as "events." The Scrum framework encompasses five key events, which are as follows:

1- Daily Scrum: is a brief, daily stand-up meeting held consistently at the same time and location. During these meetings, the team reflects on the progress made the previous day and collaboratively plans the tasks for the next 24 hours. It serves as an opportunity for team members to raise and address any challenges or obstacles that could potentially hinder the project's completion.

2- Sprint: represents a defined time period, typically around 30 days, within which the team must complete their work. As one Sprint concludes, a new one commences immediately thereafter.

3- Sprint Planning Meeting: active participation from all team members is encouraged to collectively establish the goals for the upcoming Sprint. The ultimate objective of this meeting is to ensure that at least one increment, which refers to a functional and usable piece of software, is delivered by the end of the Sprint.

4- Sprint Review: This is the time to show off the increment.

5- Sprint Retrospective: is a meeting conducted at the conclusion of a Sprint. It provides an opportunity for all team members to reflect on the Sprint process. The meeting may include team-building exercises and its primary objective is to foster a culture of continuous improvement.

Within Scrum product development, three artifacts are employed to track completed work and items that are still pending. These artifacts serve as valuable references during Sprint Planning Meetings. The Scrum framework encompasses the following artifacts:

- **Product Backlog:** represents the outstanding tasks and requirements yet to be completed. In a product backlog grooming session, the development team collaborates with the business owner to prioritize the backlog items. The product backlog may undergo further refinement and adjustments during a process known as backlog refinement.
- **Sprint Backlog:** is a compilation of tasks that must be accomplished prior to delivering the selected product backlog items. These tasks are organized into time-based user stories, creating a clear roadmap for the Sprint's objectives.
- **Product Increment:** represents the collective output achieved during a Sprint, encompassing both the completed product backlog items and any additional work accomplished from previous Sprints. It serves as a tangible demonstration of the progress made thus far in the development process.

4.1.3 Jira and GitHub

Tools we have used:

- **Jira:** an influential work management tool, equipped with Scrum boards that facilitated task distribution among team members, streamlined project organization and tracking, and served as a repository for the product backlog. Additionally, Jira enabled us to document all meetings with the supervisor, sprint reviews, and any submitted documents.¹²
- **GitHub:** is a hosting service for open-source repositories that supports seamless collaboration on code among team members. It enables the team to easily push and pull code changes, promoting efficient collaboration. Additionally, GitHub keeps track of the different modifications made by team members, ensuring transparency and version control.³

¹ Jira Project Link: <https://novoy.atlassian.net/jira/software/projects/SCRUM/boards/1/timeline>

² Confluence Link: <https://novoy.atlassian.net/l/cp/1ZxsdLgi>

³ GitHub Link: <https://github.com/Reemaalmansour/2023-GP1-19>

4.2 System Requirements

4.2.1 System Users

There are registered users, where the users can create, edit, share plans, add to favorites, and view the explore page. And the system's users are expected to be all travelers around the world, from teens to adults, with degrees ranging from high school to Ph.D., with experience and variation of technical backgrounds.

4.2.2 Requirements Elicitation and Analysis

We have searched in multiple similar systems, like TravelWise, TripIt, and Tripsy, to help us in requirements elicitation. Also, we have conducted some interviews, and a survey to aid us in choosing the requirements that our users are interested in and got a total of 40 responses in the survey and interviews with 3 target users shown in table 5 and table 6.

	Number	Percentage
Age		
Under 18	2	5%
18-24	27	67.5%
25-44	6	15%
45-64	5	12.5%
65 or over	0	0%
Gender		
Female	36	90%
Male	4	10%
Status		
Married	8	20%
Single	32	80%
Having Children		
Yes	7	17.5%
No	33	82.5%
Level of Education		
Less than High School	0	0%
High School	19	47.5%
Bachelor's' degree	19	47.5%
Postgraduate Degree	2	5%

Table 5: Form Demographic Table

	Number	Percentage
Age		
Under 18	0	0%
18-24	1	33.33%
25-44	2	66.67%
45-64	0	0%
65 or over	0	0%

Gender		
Female	3	100%
Male	0	0%
Status		
Married	0	0%
Single	3	100%
Having Children		
Yes	0	0%
No	3	100%
Level of Education		
Less than High School	0	0%
High School	0	0%
Bachelor's' degree	3	100%
Postgraduate Degree	0	0%

Table 6: Interviews Demographic Table

Results and Findings:

- From the online questionnaire, we have used google forms, and we send the survey through WhatsApp, and we've asked them 11 questions. How old are you? What is your gender? your current status? do you have children? the highest level of education you have completed? How many times did you travel in the last two years? What apps did you use to plan your trip? Do you travel? How do you plan your trips and daily activities? Which features would make you want to use our app? Do you have any features you would like to see in our app? and we have gathered 40 responses and we have found that 67.5% of them were from ages 18-24, 90% female, and 80% single. Also, 82.5% of them didn't have children, 47.5% of them were from high school, and the other 47.5% had completed bachelor's degrees (as shown in Table 5). Moreover, 77.5% of them said that they traveled from 1-5 times and only 17.5% have traveled 5-10, or over 10 times in the last two years (as shown in figure 6). Then, we asked them what apps they used to plan their trips, 82.5% of them said Google Maps which we expected because it is a universal web mapping platform, and 75% said other apps like Booking, and less than 30% chose TripAdvisor and other social media platforms like TikTok (as shown in figure 7). Furthermore, all of them said that they travel with family, and 7.5% said that they traveled alone, and 22.5% with colleagues and friends (as shown in figure 8). When we asked them how they plan their trips and daily activities, 62.5% said they planned on electronic notebooks which were expected because most people now prefer online and digital planning, 25% didn't plan in advance, and 10% used Pen and paper, and less than 3% used Notes app and WhatsApp groups which we think must be convenient to them to plan as a group and our application will benefit people in collaborative planning (as shown in figure 9).

We asked which features would make them want to use our app. We were happy to know that 60% said Collaborative Plan Editing, 77.5% said Favorites List, 40% said Integrated Map, 72.5% said AI-Generated Recommendations, and 62.5% said Travel Timeline (as shown in figure 10). Finally, we asked them if they had any features they would like to see in our app, we got some surprising answers that we believe would aid us in building our app, some of

them said that they would like to see trip budget features, recommendations based on the weather, a suitcase checklist, calendar with activity, reviews, reminders, and more (as shown in Appendix B).

Figures of the questionnaire:

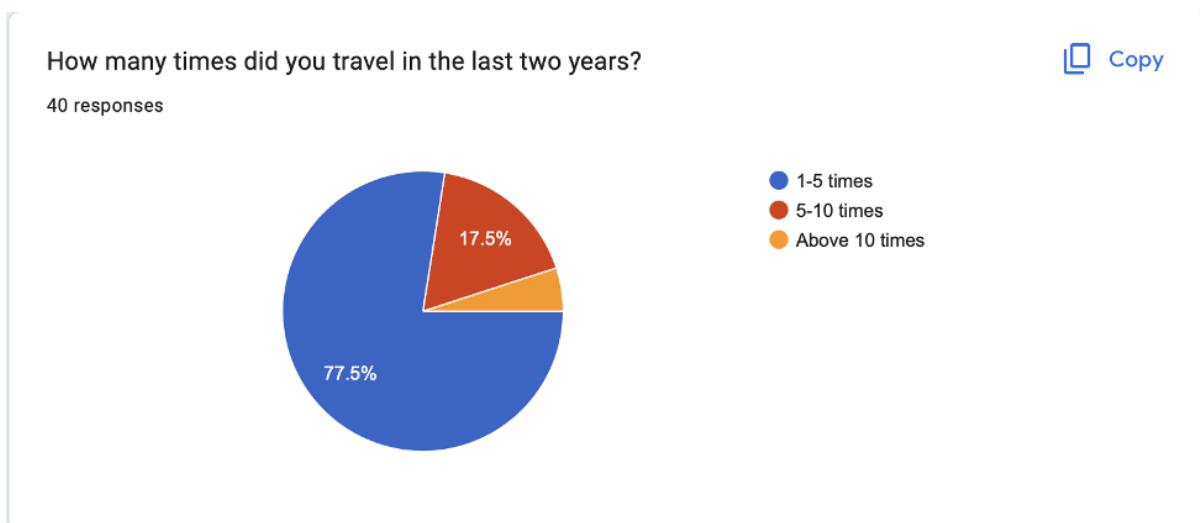


Figure.6 Questionnaire Question 1

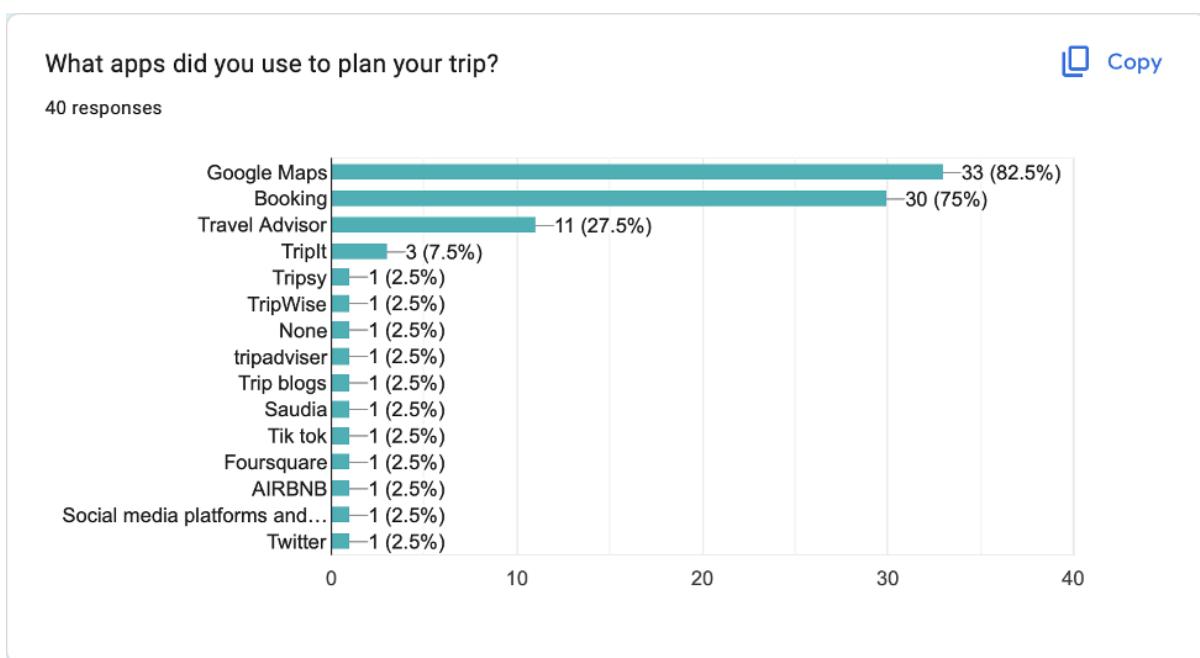


Figure.7 Questionnaire Question 2

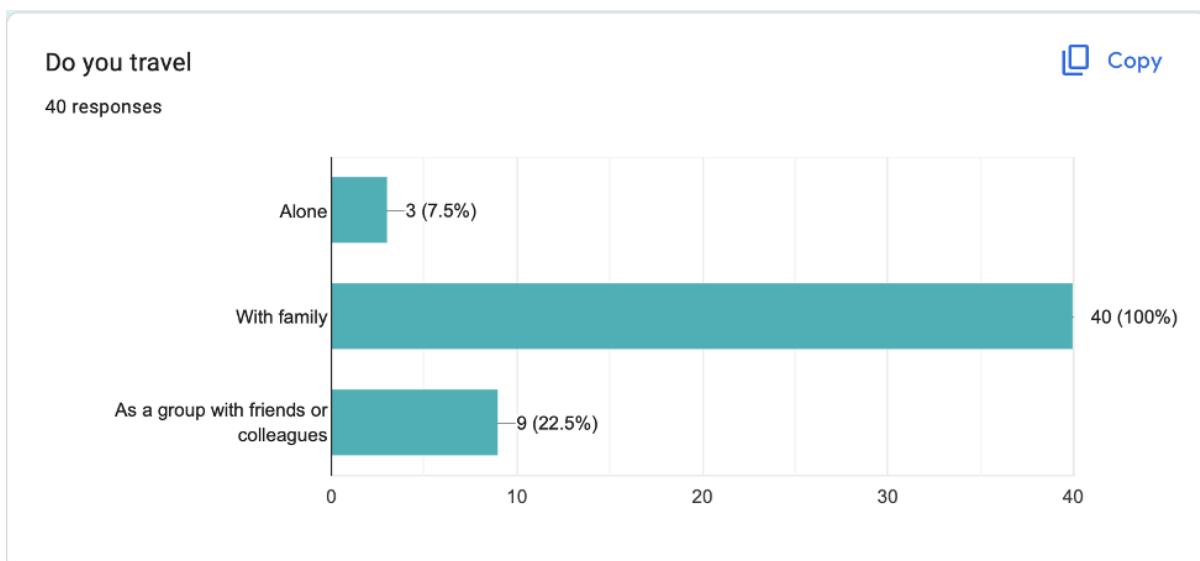


Figure.8 Questionnaire Question 3

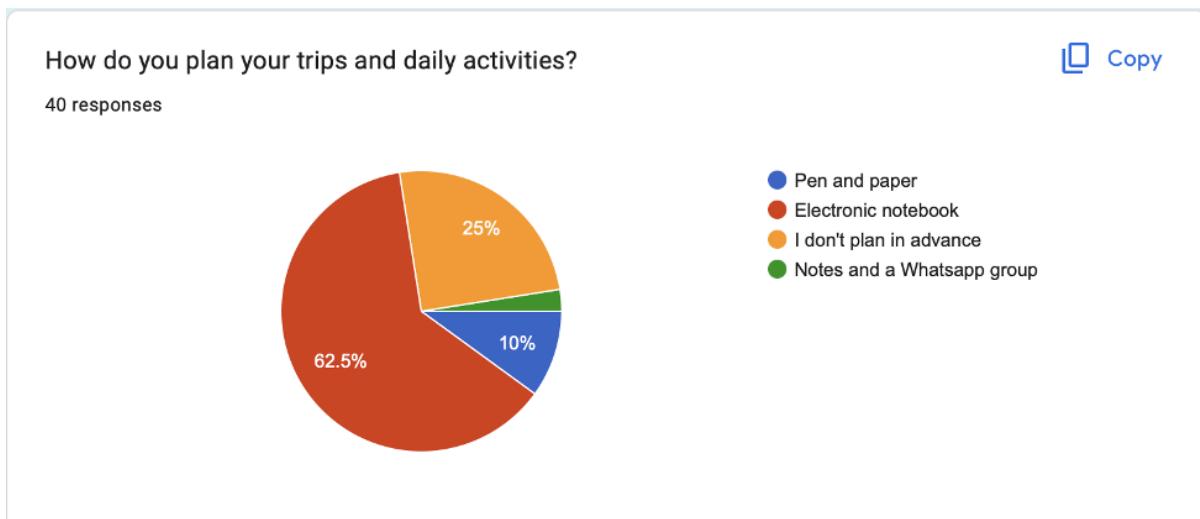


Figure.9 Questionnaire Question 4

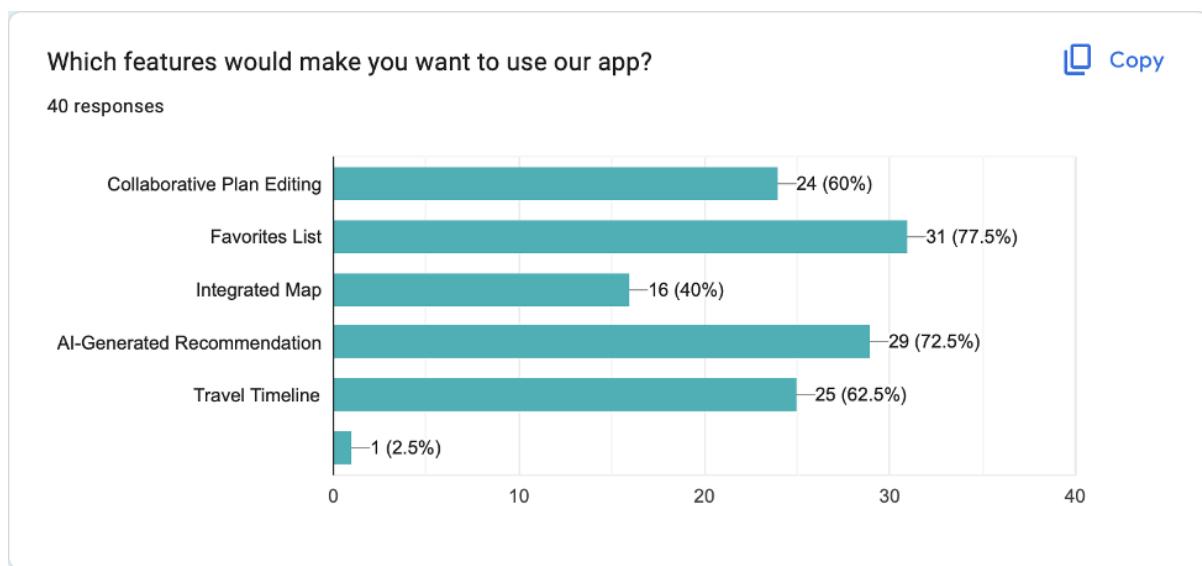


Figure.10 Questionnaire Question 5

From the interviews we did with 3 of our target users, the users we have recruited were family and friends, each interview was done face-to-face, and we asked them basic questions like: how old are you? What is your gender? your current status? do you have children? the highest level of education you have completed? (as shown in Table 6)

We asked them 10 questions: how often do you travel? Why do you travel? Do you think trip planning is important? How do you plan your trip? Have you ever found it overwhelming to plan for trips? Where do you get the information you need? What do you need to consider when planning for trips? What are your thoughts on a feature that enables you to do collaborative planning? Would you like AI recommendations when planning a trip? Why? Or why not? And what features would you like to see in a trip-planning application? And we found that all of them travel about 2-4 times a year, they travel to have fun and explore new experiences and cultures. All of them agreed that planning for trips is important for things such as booking hotels, flights, and other things. Two of them said that they plan their trips based on online research, which is what we think most people do, and one said that she plans based on her budget which is a thing most people consider when choosing their destination for trips. Moreover, all of them agreed that planning is overwhelming because of the amount of research they must go through, and we think our application would be sufficient because it will have information about destinations, and tourist attractions and they can immediately plan through the app. They said that they get their information mostly from websites, blogs, and other social media platforms such as TikTok. We asked what they needed to consider when planning, and they said things like important documents, transportation, budget, and their interests such as tourist attractions.

We were happy to hear that they all were thrilled with the idea of collaborative plan editing and they think it's going to be beneficial, and they would like to have AI recommendations which we think will give them a variety of options to choose from. Lastly, we asked them which features they would like to see in a trip planning app, and they said personalized recommendations, a timeline of the trip, booking options, maps, real-time information, and more.

In conclusion, from the answers we gathered from both interviews and the survey, we were happy that a lot of the answers we got to align with the features we're going to develop, and we think it's going to help us in building an application that our users would like to use when planning for their future trips.

4.2.3 User Interactions

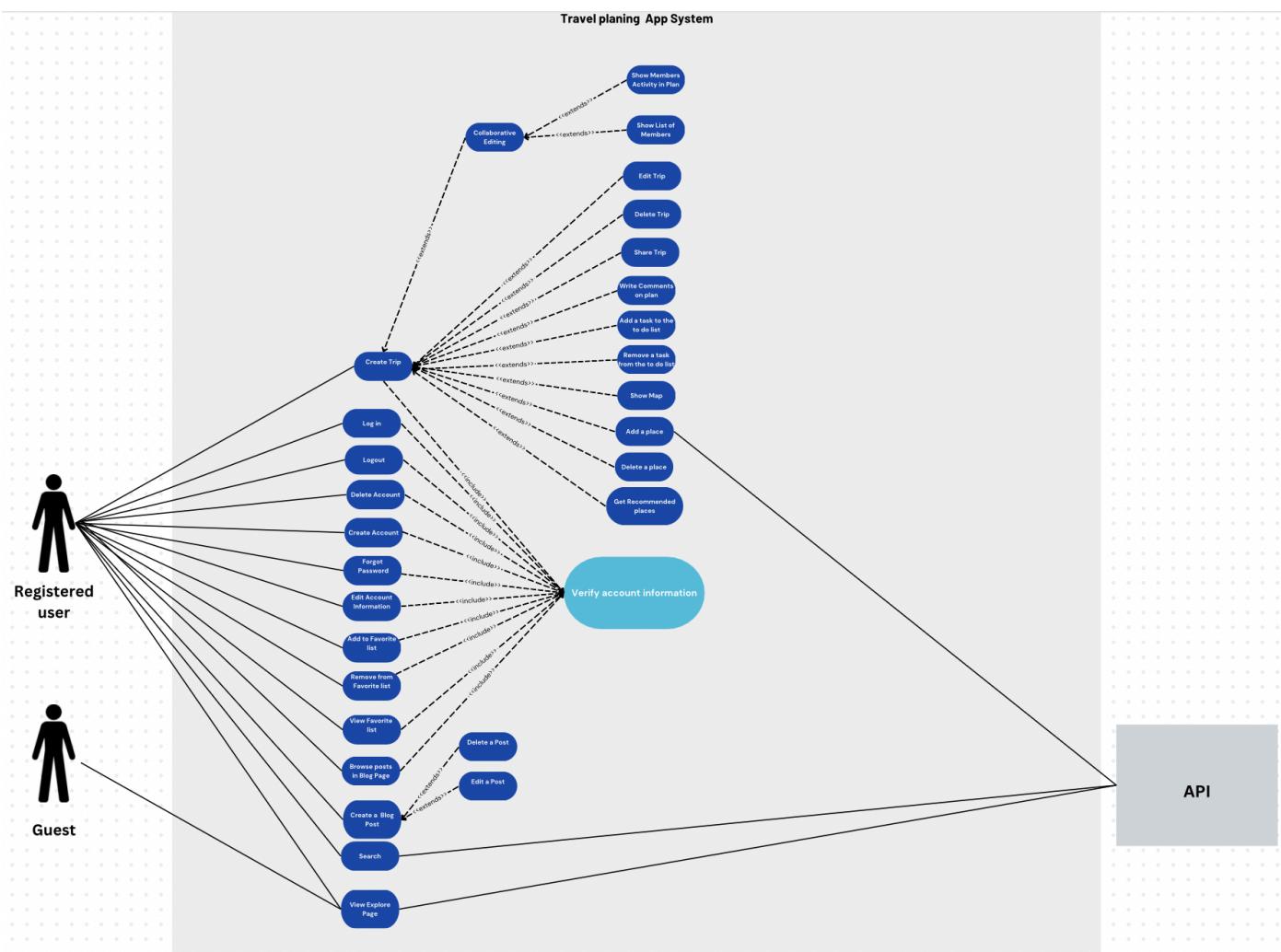
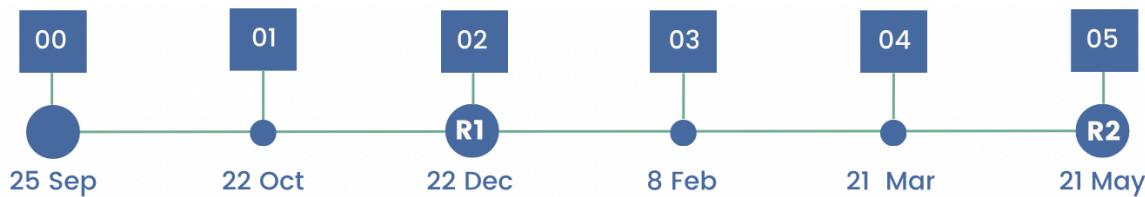


Figure 11: Use Case Diagram

4.2.4 Roadmap and Product Backlog

4.2.4.1 Roadmap

The project Roadmap, depicted in *Figure 12*, presents a structured arrangement of features and milestones divided into four distinct phases.



Sprint 0	Sprint 1	Sprint 2
<ol style="list-style-type: none"> 1. Logo: Branding 2. Requirements: Collection & Analysis 3. Language Learning: Skill Acquisition 4. Visuals: UI/UX Design 5. Infrastructure Setup: Environment Preparation 6. Team Roles: Assignment & Clarification 7. Timeline: Initial Planning 	<ol style="list-style-type: none"> 1. Create Account 2. Login 3. Logout 4. Forgot Password 5. Edit Information 6. Delete Account 7. Browse App 8. Create Trip 9. Add Place 10. Delete Place 11. Edit Trip 12. Delete Trip 13. Share Trip 14. Collaborative Editing 	<ol style="list-style-type: none"> 1. API Integration 2. Data Analysis 3. Seamless Import of Data for Planning 4. Add Favourites List 5. Delete from Favourites 6. Explore Page 7. Search
Sprint 3	Sprint 4	Sprint 5
<ol style="list-style-type: none"> 1. Integrated google Map 2. Search Filter 3. Show List of Members join in Trip 4. Show Members Activity in Trip 5. Make Interactive map 	<ol style="list-style-type: none"> 1. Discovery Section 2. Recent Places Section 3. AI Generated Recommender 	<ol style="list-style-type: none"> 1. Create a Blog Post 2. Delete a Post 3. Edit a Post 4. Comments on Trip 5. To do list 6. Recommendation Engine backend

Figure 12: NOVOY Roadmap

4.2.4.2 Product Backlog

ID	PBIs (User Stories)	Size	Type	Status	Acceptance Criteria
S1-1	As a user, I want to register by creating my own account, so that the system can remember my data.	2	Feature	Done	<ul style="list-style-type: none"> -If I enter a valid email, personal information and 8-digit password then click on the “Register” button, then the system should create a new account for me and redirect me to the login page. -If I enter an existing email during registration, the system should display an error message indicating that the email is used before.
S1-2	As a user, I want to login with my account information, so that I can access the application’s features and my data in a protected way.	2	Feature	Done	<ul style="list-style-type: none"> -If I fill in the email and password fields with my valid authentication information and click the “login” button, then the system logs me in. -If I enter incorrect account information, the system should display appropriate error messages indicating the issue.

s1-3	As a user, I want to logout from my account at any time, so that I can prevent others from accessing my information.	2	Feature	Done	<ul style="list-style-type: none"> -If I click on the “logout” button and confirm the action then I’m logged out from my account. -If I click on the “logout” button and cancel the action, I will not log out.
S1-4	As a user, I want the ability to reset my password if I forget it, so that I can regain access to my account.	3	Feature	Done	<ul style="list-style-type: none"> -If I click on the "Reset" button, then a new page should open with a field to enter my email account. -If I enter my registered email and click on the "Reset" button, then an email should be sent containing a password reset link. -If I enter the reset link that was sent to me, I will be able to enter a new password. -If I go back to the app and try to log in with my new password, I will log in successfully. -If I enter a non-existent email to reset my password, an error message should be displayed.
S1-5	As a user, I want to be able to edit my account information, so that I can keep my personal information up to date.	2	Feature	Done	<ul style="list-style-type: none"> -If I navigate to the profile page, then I should be able to see my current username, email, phone number, gender, and date of birth displayed. -If I edit my username, phone, gender, or date of birth and click on the “edit profile” button, then it should be reflected accurately in my profile and a message should appear indicating that the profile has been successfully edited. -If I try to edit the email field, then it should not be editable.

S1-6	As a user, I want the ability to delete my account, so that I can permanently remove my personal information from the app.	3	Feature	Done	<ul style="list-style-type: none"> -If I navigate to the profile page while I'm logged in, then I would be able to delete my account using the "delete account" button. -If I click on the "delete account" button and confirm the action, then my account will be deleted. -If I attempt to login after my account has been deleted, then I should receive an error message indicating that my account no longer exists. -If I click on the "delete account" button and cancel the action, then the confirmation message should disappear without initiating the account deletion.
S1-7	As a user, I want to browse through the app without signing in so that I can get a preview of the available features and content.	2	Feature	Done	<ul style="list-style-type: none"> -If I open the app without logging in, and click on the "skip" button, then I will access a limited set of features and content. -If I try to access a feature or content that requires logging in, such as a favourite page, trips page, profile page or adding places feature, then I should be prompted to sign in or create an account.

s1-8	As a user, I want to create a new trip plan by providing a name, destination, and dates, so that I can organize my trip details.	5	Feature	Done	<ul style="list-style-type: none"> -If I logged into my account, then there should be an option within the app to create a new trip. -If I select the option to create a new trip plan, then the app should provide an interface where I can input the name of the trip plan, destination, start date, and end date. -If I click on “create” button after filling the fields and there is non-empty field, then the app should create a new trip with the provided details. -If I click on “create” button and there is an empty field, then the app should provide an error message. -If the trip plan is created, then it should be visible and saved on the trips page, identified by its name. -If I open the trip plan after it is created, I will see the dates organized vertically with the destination name.
s1-9	As a user, I want to add a place to my trip plan, so that I can specify the places in each trip plan.	5	Feature	Done	<ul style="list-style-type: none"> -If I click on the “+” icon that appears beside each day in my trip plan, then I can add a place by typing its name on the search bar. -If start typing the place name, then the system should provide an autocomplete feature. -If select a place from the search bar, then the place should be added to the same day I selected. -If I want to add more places, then I can follow the same steps.

s1-10	As a user, I want to be able to delete a place within my trip plan so that I can remove unwanted places.	2	Feature	Done	<ul style="list-style-type: none"> -If I hold the place I want to delete and drag it to the left, then the place should be deleted from my trip plan.
s1-12	As a user, I want to be able to delete a trip plan, so that I can remove unnecessary or outdated trips.	2	Feature	Done	<ul style="list-style-type: none"> -If I'm in the trips page and I hold a specific trip and drag it to the left, then the trip should be deleted from my trips list.
s1-13	As a user, I want to share my trip plan as a PDF, so that I can share it with my friends and family.	3	Feature	Done	<ul style="list-style-type: none"> -If I open an existing trip, then I should have option to share my trip plan (share as pdf) -If I click on share as a pdf, then the system should provide a pdf format for my trip plan so I can share it.
s1-13	As a user, I want to share my trip plan by username, so that others can edit my trip plan.	3	Feature	Done	<ul style="list-style-type: none"> -If I open an existing trip, then I should have option to share my trip plan by username -If I click on share by username(email), then I can type the username(email) I want to share the trip with. -If I click on the share icon beside the email I typed, then the trip will be sent to the person I shared it with, appearing in their shared trips section. -If I click on share by username(email) and I type unregistered username(email), then the share icon will not appear.

s1-14	As a user, I want to access a trip plan to which I was invited, so that I can edit and collaborate with others.	5	Feature	Done	<ul style="list-style-type: none"> -If I join a shared trip plan, then I should be able to access and collaborate on the trip plan immediately. -If I wanted to add or delete a place in the shared trip plan, then I can do so, and the action should be reflected among all members of the group. -If I try to delete the trip, edit trip name, delete a destination, add destination, or edit destination, then I will be able to do these actions If I'm the trip owner only. -If I try to delete the trip, edit trip name, delete a destination, or edit destination while I'm not the trip owner, then I won't be able to do these actions. -If I want to share the trip by adding a user through their username(email) while I'm not the trip owner, then I won't be able to do these actions. -If I try to share the trip as a PDF while I'm not the trip owner, then I will be able to do this.
-------	---	---	---------	------	--

s2-4	As a user, I want the ability to add places to my favourites, so that I can easily access and reference them later.	2	Feature	Done	<ul style="list-style-type: none"> -If I open my favourite's page, then a search bar should display. -If start typing the place name, then the system should provide an autocomplete feature. -If I select a place from the search bar, then the place should be added to my favourites. -If I click on the “favourite button” that appears next to the places on my explore page, then the application should store the place in my favourite's list.
s2-5	As a user, I want to be able to delete a place within my favourites, so that I can remove unwanted places.	2	Feature	Done	<ul style="list-style-type: none"> -If I initiate the deletion of a place and there is at least one place in my favourites, then the system must display an unmistakable deletion option. -If I delete a place, then my favourites should be updated, and the deleted place should no longer be visible.

s2-6	As a user, I want to view an explore page, so that I can discover places.	3	Feature	Done	<ul style="list-style-type: none"> -If I navigate to the explore page, then I can see some places to discover, each with an image. -If I want to add a place to my favourites on the explore page, I can do so by clicking on the place itself.
s2-7	As a user, I want to be able to search for places, so that I can easily find specific places.	5	Feature	Done	<ul style="list-style-type: none"> -If the user accesses the application, then there should be a prominently displayed search bar on the “explore page” for entering search queries. -If I type a place name in the search engine, then the search results should promptly and accurately display places relevant to my query. -If I search for a place, then I can see some of the place details. -If no relevant places are found for the entered query, then the system should provide a clear and informative message indicating that no results were found.
s3-1	As a user, I want the app to display an interactive map that allows me to zoom in and out, so that I can explore locations more effectively.	5	Feature	Done	<ul style="list-style-type: none"> -If the user accesses the map feature in the existing trip plan, then the application should display an interactive map interface. -If the user zooms in on a specific location of the map, then the map should display more detailed information for that area. -If the user zooms out, then the map should gradually display a broader geographical area, allowing the user to explore larger regions.

S3-2	As a user, I want to filter search results based on filters (city, category), so that I can find specific information more efficiently.	5	Feature	Done	<ul style="list-style-type: none"> -If I want to further refine my search, then I should have the option to filter results based on categories or city. -If I apply multiple filters (city and category), then the application should provide results that meet all the selected filter criteria, ensuring that I find information that matches my specific requirements. -If I decide to change or remove a filter, then the application should allow me to easily modify my filter selections or clear them altogether, without the need to start a new search. -If I apply filters and initiate a search, then the search results should be displayed promptly, reflecting the selected filter criteria. -If there are no results that match the specified filters, then the application should provide a clear message indicating that no results were found, allowing me to adjust my filters accordingly. -If I successfully filter search results based on city and category, then I should find the information I'm looking for more efficiently.
S3-3	As a user, I want to see a list of participants to know who has joined the shared trip	3	Feature	Done	<ul style="list-style-type: none"> -if I click on number of members in the trip, then should show name and email of member. -if I add member in trip, then should change number in the interface with right number of members. -if I owner trip plan, then I can delete member by click name of member in list of members.
S3-4	As a user, I want to view members' activity within a trip, enabling me to track changes and contributions made by other members effectively	3	Feature	Done	<ul style="list-style-type: none"> - Users can access a section within the trip interface dedicated to displaying members' activities. - Activities such as additions, edits, and deletions made by trip members are logged and displayed.

S3-5	As a user, I want to see clear markers or icons on the map that represent the places in my trip plan, so that I can identify them easily	5	Feature	Done	If the user has created a trip plan and added places to it, then the application should display clear and distinct markers or icons on the map for each place within the trip plan.
S4-2	As a user, I want to view my recent places, so that I can easily revisit them.	3	Feature	Done	<ul style="list-style-type: none"> - When I access the application, then there should be an option to view my recent places. - Upon selecting the option to view recent places, I should see a list or grid display of the places I've recently visited, along with relevant details such as name, image, location. - If I click on a recent place, then I should be redirected to its details page.
S4-3	As a user, I want a list of places similar to those I have already chosen so that I can discover new destinations.	5	Feature	Done	<ul style="list-style-type: none"> - If the user has chosen places in trip, then generate a list of similar places. Display recommendations along with descriptions, images, and key details such as address and rating.
S5-1	As a user, I want a blog section, so that I can read and contribute articles.	3	Feature	Done	<ul style="list-style-type: none"> -The application includes a dedicated blog section accessible to users. - Users can read articles posted in the blog section. - Users can create and publish their own articles through a form provided in the blog section.
S5-1	As a user, I want to create a blog post, so I can share my thoughts and experiences.	3	Feature	Done	<ul style="list-style-type: none"> - Users can access a feature to create a new blog post. - The blog post creation form allows users to input content, including text, images, and formatting and location/places. - Upon submission, the blog post is published and visible to other users in the blog section.

S5-2	As a user, I want to delete a blog post, so I can manage my published content	3	Feature	Done	<ul style="list-style-type: none"> - Users have the option to delete their own blog posts from the blog section. - Upon confirmation, the selected blog post is permanently removed from the system.
S5-3	As a user, I want to edit a blog post, so I can update my content as needed	3	Feature	Done	<ul style="list-style-type: none"> - Users can access and modify their own blog posts from the blog section (images,title,location,text) , then Changes made to the blog post content are saved upon submission. - The updated blog post is reflected immediately in the blog section.
S5-4	As a user, I want to comment on a place at trip, so I can share my thoughts and feedback.	5	Feature	Done	<ul style="list-style-type: none"> - Users can access a comment section associated with each place on the trip. - Users can add comments to the place, providing their thoughts, feedback, and suggestions. - Comments are displayed chronologically below the place.
S5-5	As a user, I want a to-do list feature for each trip, so I can keep track of tasks and stay organized.	5	Feature	Done	<ul style="list-style-type: none"> - The application provides a to-do list feature accessible to users. - Users can add, delete tasks from the to-do list. - Completed tasks can be marked as done and shown who completes it. - The to-do list is visible and editable by the users in same trip

non-functional requirements					
s5	As a user, I want the system to be fast in response, not exceeding 10 seconds per request, so that I will not have to wait a long time. (Performance)	3	Feature	Done	If I send any request to the system, then it will respond fast and not exceed 10 seconds.
s5	As a user, I want the app's interfaces to be at least 85% user-friendly, so that I can accomplish my tasks without any confusion. (Usability)	3	Feature	Done	If the app's interfaces have intuitive labels and buttons, then I should be able to navigate and perform tasks without confusion.
s5	As a user, I want the system to be available at all times except 1 hour per week if needed, so that I can use it whenever I want. (Availability)	3	Feature	Done	If I access the app at any time, then I expect it to be consistently available for use.
s54	As a user, I want my personal information to be safeguarded, so that I can trust that my data is protected from unauthorized access. (Security)	3	Feature	Done	If I provide my personal information during registration, then the application should encrypt and securely store this information in its database

s5	As a user, I want to be able to access the system 99% of the time without any failure, so that I can depend on the system. (Reliability)	3	Feature	Done	If I attempt to access the system, then I should be able to access it without any failures in 99% of my attempts.
----	---	---	---------	------	---

Table 7: Product Backlog

4.3 System Design

4.3.1 Architectural Diagram

We have searched for the most appropriate architecture for our app and we have found that the best one is the client-server architectural pattern. It includes many benefits like scalability, centralized management, resource sharing, and security.

There are two components (as shown in figure 13), the client which is the frontend mobile application in the user's phone, and the server which contains the backend. The client contains the user's interactions with the app like the interface. while the server contains the APIs, recommender system, and the database.

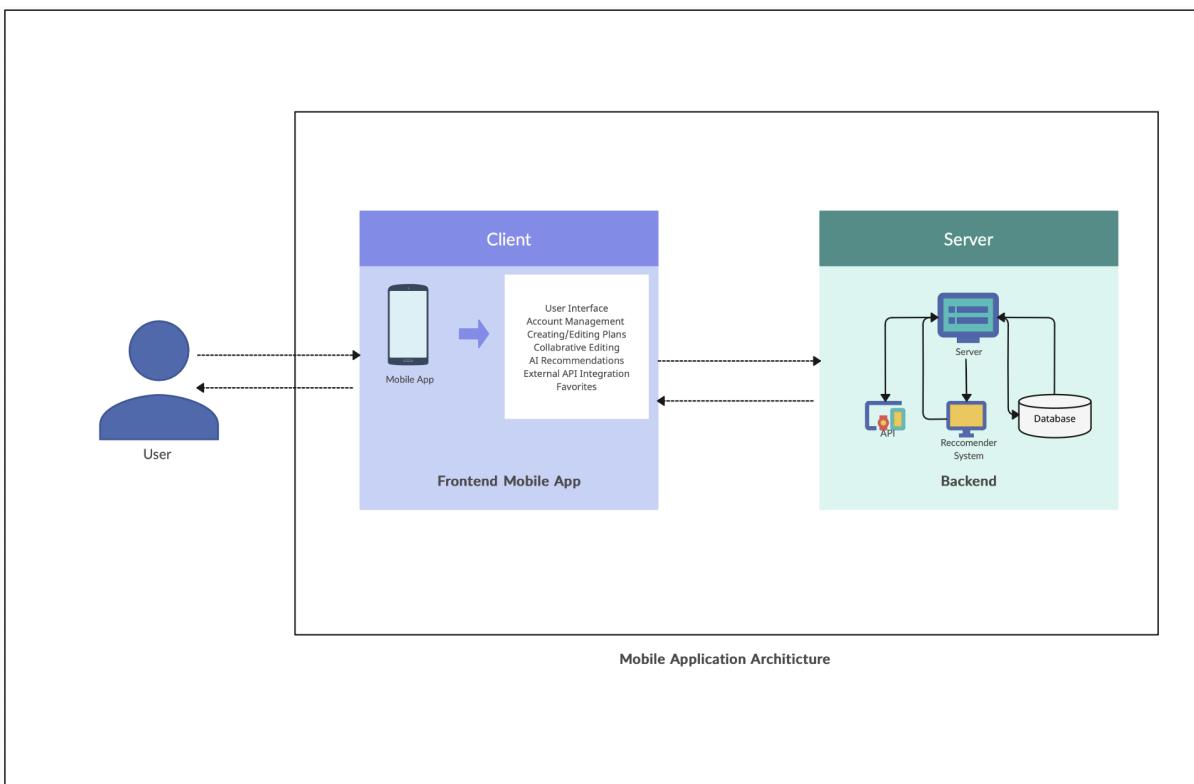


Figure.13 Architectural Diagram

4.3.2 Class Diagram

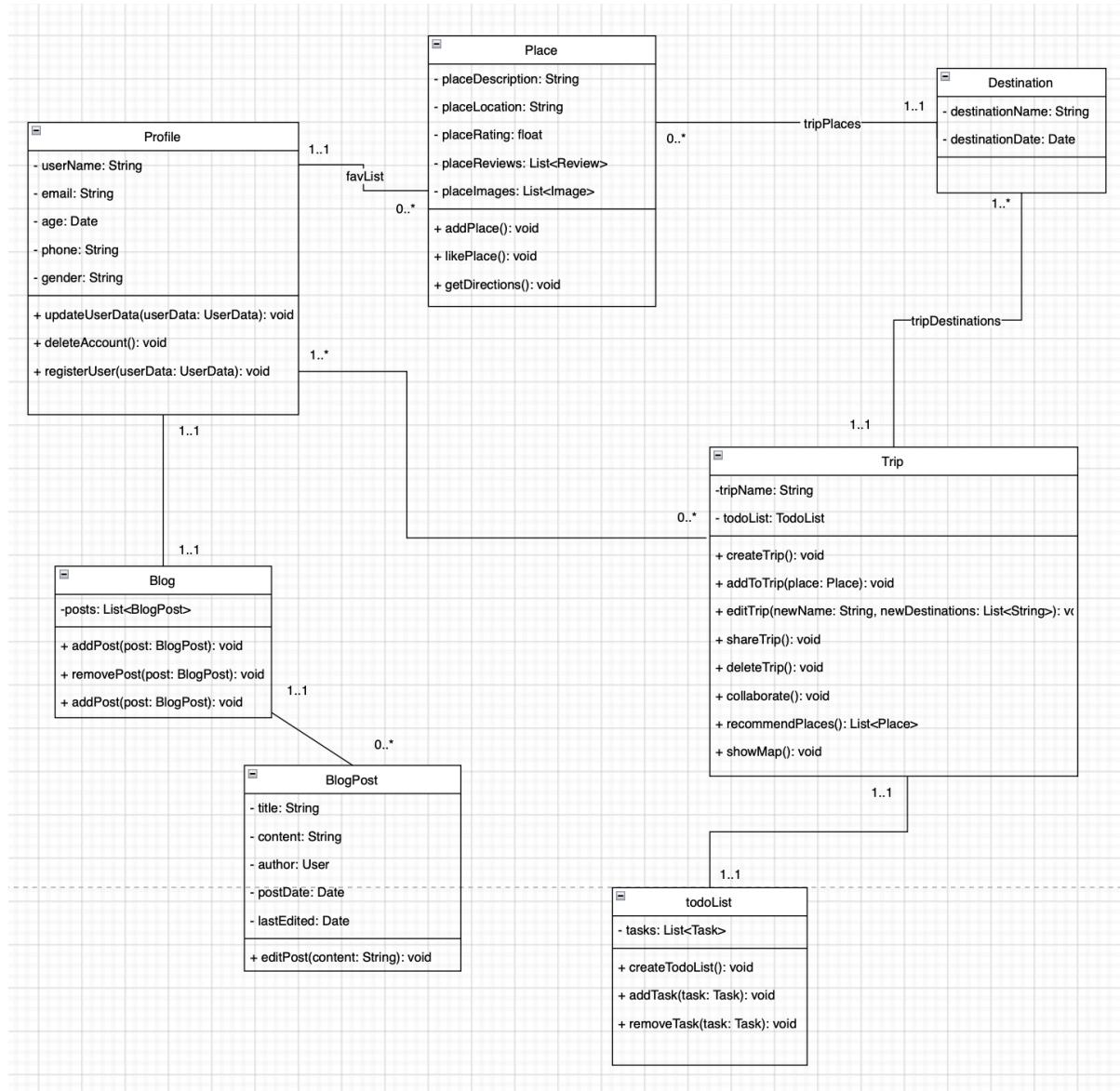


Figure.14 Class Diagram

4.3.3 Component Level Design

1- Create Trip Plan: The user navigates to the trips page and clicks on the "Create Plan" button. This triggers the display of a form where the user can enter trip plan details such as the trip name, destinations, start date, and end date. And validate Trip Plan Details: The code checks if any of the required fields are empty or if the start date is after the end date. If any validation errors occur, an error message is displayed. Otherwise, the trip plan is created with the provided details, added to the database, and a success message is displayed. The user is then redirected to the "Trips" page.

```
// Create Trip Plan
```

User navigates to the trips page

User clicks on the "Create Plan" button

// Enter Trip Plan Details

App displays a form to enter trip plan details:

- Input Trip Name in [Input field]
- Input Destinations in [Search field]
- Input Start Date in [Date picker input field]
- Input End Date in [Date picker input field]

// Validate Trip Plan Details

IF any required field is empty OR Start Date > End Date

THEN

Display error message: "Please fill in all fields correctly"

ELSE

// Create Trip Plan

Create a new trip plan with provided details

Add the trip plan to the database

Display success message: "Trip plan created successfully"

Redirect to the "Trips" page

END IF

2- Add New Destination: A form is displayed to allow the user to add new destinations to the trip plan. The user provides the destination name, start date, and end date. The code then validates the details, checking for empty fields. If the details are valid, the new destination is added to the trip plan object, the trip timeline is updated, and the updated trip plan object is saved to the database.

// Add New Destination

Display a form to add new destinations:

- Input Destination Name in [Search field]
- Input Start Date in [Date picker input field]
- Input End Date in [Date picker input field]

// Validate New Destination Details

IF Destination Name or Date is empty

THEN

Display error message: "Please provide all destination details"

ELSE

// Add New Destination

Add new destination to the trip plan object

Update trip timeline with new destination

Save updated trip plan object to the database

END IF

3- Add Place: The user clicks on the "Add Place" button to add a new place for the selected day. A form is displayed where the user can input the place name and description. The code validates the place name field and, if it's not empty, adds the new place to the selected day's places list. The updated trip plan object is then saved to the database.

// Add Place

User clicks on the "Add Place" button

Display a form to add a new place:

- Input Place Name in [Input field]

- Input Place Description in [Textarea]

// Validate Place Details

IF Place Name is empty

THEN

Display error message: "Please provide a place name"

ELSE

// Add Place

Add the new place to the selected day's places list

Save the updated trip plan object to the database

END IF

4.4 Data Design

4.4.1 Data Models

We have represented our data models in an ER diagram and a referencing approach non-relational schema[29].

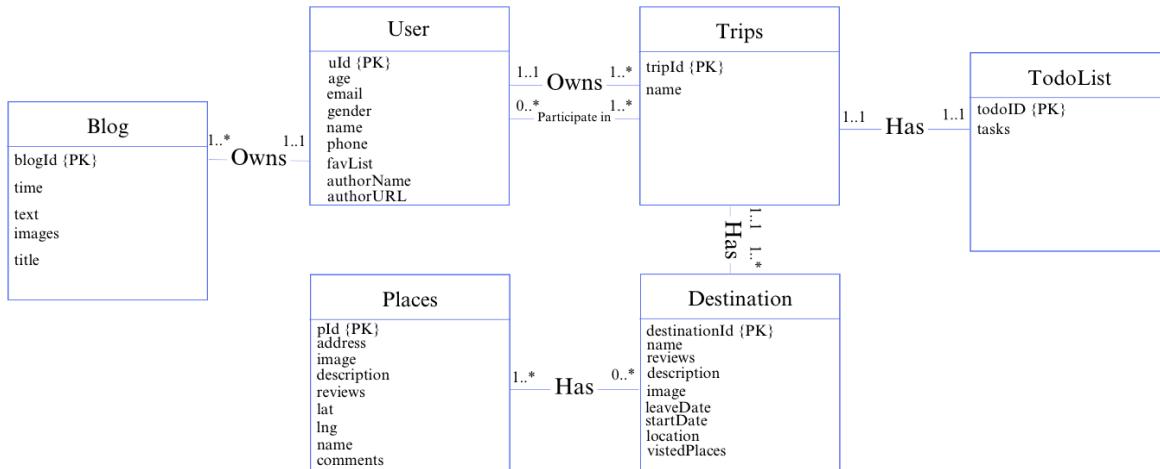


Figure.15 ER Diagram



Figure.16 Non-relational Schema

4.4.2 Data Collection and Preparation

Our application employs a TF IDF-based recommender system that relies on a rich dataset for effective operation. Initially, we obtained training data from the Google Places API, focusing solely on Riyadh City due to API constraints. However, to broaden the system's scope and ensure ongoing relevance, we later integrated a secondary database. This database continuously updates with user-generated location data, ensuring our recommender system stays aligned with users' evolving interests and delivers up-to-date recommendations.

Integration and Workflow involves two main components: Training Data (Excel) and Real-World Data (Firebase). The purpose of Training Data is to facilitate TF-IDF Model Training, utilizing data collected via the Google Places API to compute term frequencies and inverse document frequencies, serving as the foundation for the TF-IDF model. This static dataset is then utilized for model training, enabling the initial development and calibration of the TF-IDF model. On the other hand, Real-World Data obtained from user interactions is used post-model deployment. After employing the TF-IDF model, this data is employed in real-time applications. The dataset allows for dynamic updates and

improvements to the model based on real-world user behavior and feedback, ensuring the system remains responsive and aligned with user interests over time.

1- Collecting Training Data for the Recommender System

The purpose of collecting the recommender system's training data is to gather comprehensive information about places in Riyadh City, forming a foundational dataset for model training. To achieve this, we utilized the Google Places API, configuring it to retrieve data based on specific coordinates within Riyadh and focusing on various categories such as hotels, restaurants, cafes, and shopping centers. We collect around 3000 places . The collected data, comprising multiple items, was initially stored in Excel files, with each category having its own file. Key attributes included in the dataset are name, address, type, rating, and reviews in english and arabic . Subsequently, data preprocessing procedures were applied to ensure data quality, including validation, cleaning (such as duplicate removal and noise reduction), and transformation (such as normalization and aggregation)Normalization of Data:Ensuring consistency and compatibility across different datasets by normalizing numerical data such as coordinates (latitude and longitude).and Normalizing data retrieved from different API responses to a common format or structure for further analysis.Aggregation of Data:Creating a comprehensive dataset by aggregating data from multiple API responses or pages to contain all relevant information. Aggregating data at various levels of granularity (e.g., daily to monthly) to facilitate analysis and visualization.Combining data from different sources (e.g., various types of places) into a unified dataset for holistic analysis.

Our approach involved the use of Python libraries such as requests, openpyxl, and pandas, along with custom algorithms for deduplication and data validation. Overall, this method resulted in a comprehensive and structured dataset, ready for training our recommender system.

2- Setting Up and Populating the Post-Deployment Data Source for the Recommender System

aimsTo ensure that recommended places are current and not restricted to specific areas to construct and populate the data source for the Recommender System by leveraging user interactions and automatic logging within the application. Users engage with the app through queries, prompting data retrieval from the Google Places API, and subsequently viewing the presented data. Automatic logging captures places chosen by users, storing detailed information in a structured format within Firebase. Key attributes include timestamps, user IDs, descriptions, destination IDs, images, visit durations, reviews ,and geographical coordinates. Data preprocessing ensures completeness, correctness, and standardization of formats, supporting efficient storage, retrieval, and analysis for mapping, trip analysis, and user-specific queries. Key tools utilized include Firebase for real-time data storage, Firestore for scalability, and Firebase Admin SDK for server-side interactions, complemented by pandas for additional processing. Algorithms for real-time validation and data normalization further enhance data quality during user interactions.

The initial data collection using the Google Places API provides a comprehensive dataset for model training and initial analysis (stored in Excel). The ongoing data collection through Firebase ensures

the system remains dynamic and responsive, capturing real-world user interactions and preferences. Both methods are essential, with the Google Places API offering a robust dataset for training and Firebase enabling continuous, real-time data updates and personalized user experiences.

4.5 Interface Design

Application structure using a site map:

- 1) For pages that are accessible **before** logging in

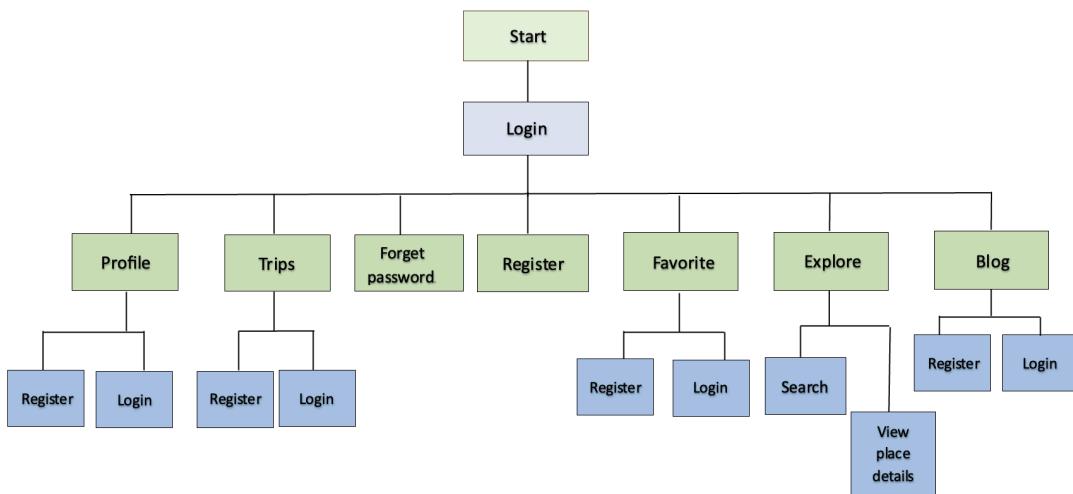
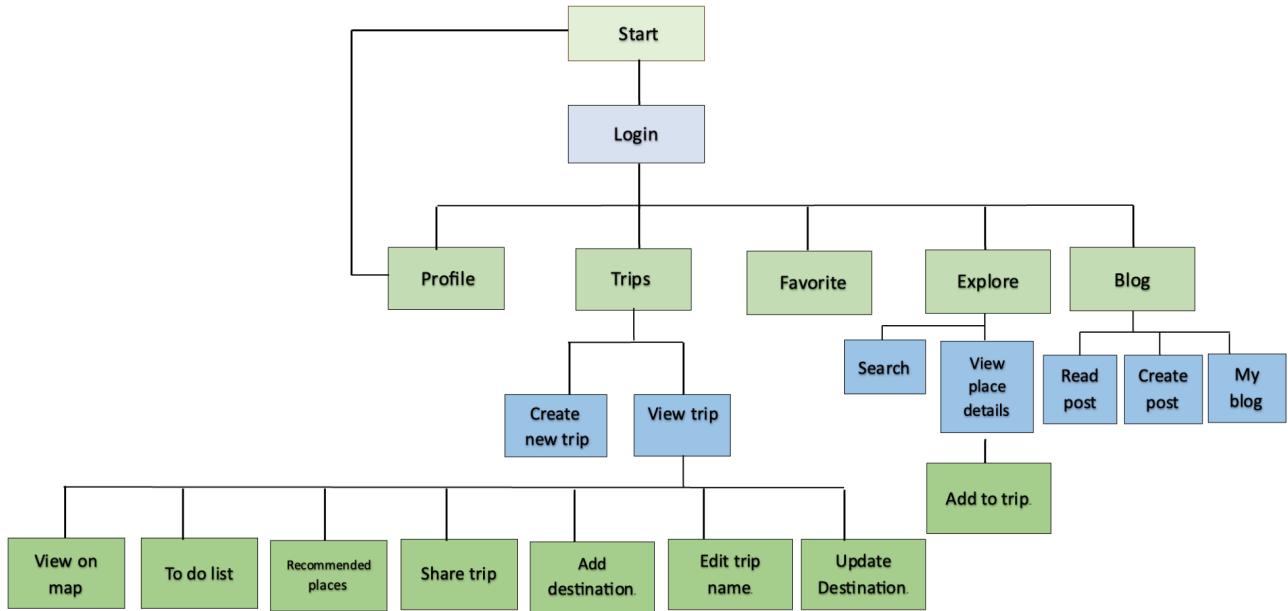


Figure.17 site map1

2) For pages that are accessible **after** logging in



Clarification:

- The line that goes back to the start page from the profile page is triggered when selecting the "delete account" or "logout" option.

Figure.18 site map2

UX guidelines:

1- Familiarity: The interface of our application follows common design conventions that users are familiar with. For example, the plus icon indicates adding a place to the plan, as shown in the figure below.

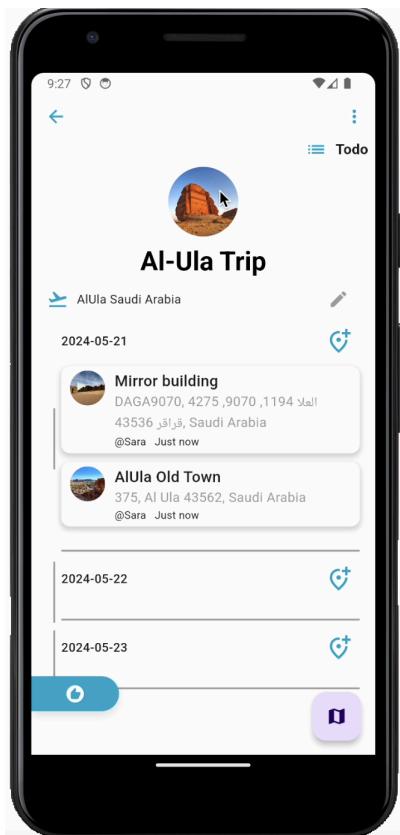


Figure.19 Familiarity Interface

2- Simplicity: The interface of our application is clean and straightforward, allowing users to navigate and interact with ease, while avoiding unnecessary elements that may cause confusion.

3- Feedback: Our application provides feedback to users after they interact with it. For example, when a user edits their profile, a message will appear, such as "Edit profile success," as shown in the figure below.

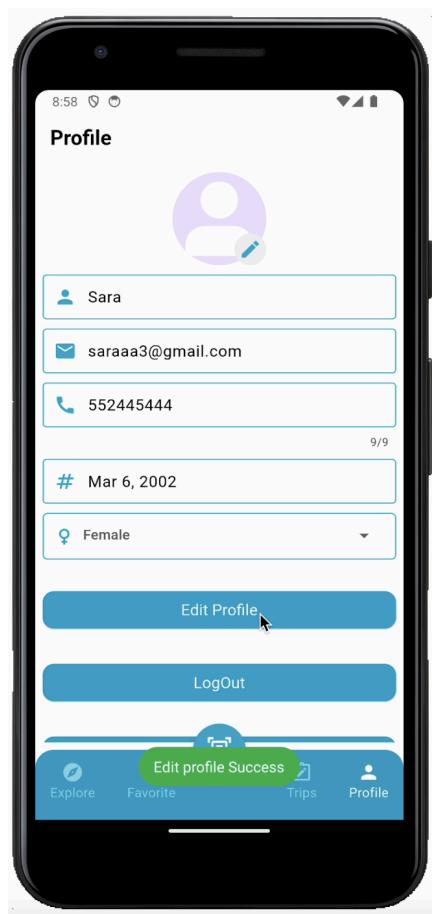


Figure.20 Feedback Interface

4- Error Prevention: We have made every effort to prevent errors from occurring in the first place. This involves actions such as displaying a confirmation message when the user tries to "delete a place", asking "Are you sure you want to remove the -place name-?" as shown in the figure below.

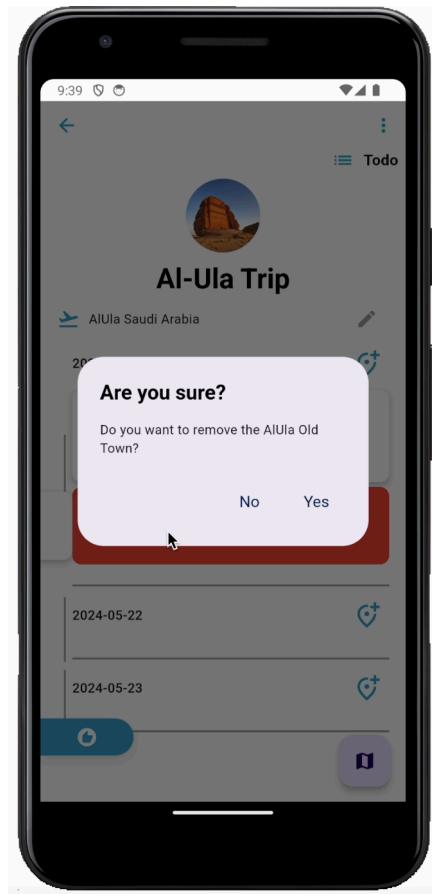


Figure.21 Error prevention Interface

5- Efficient Autocomplete: Our application implements an autocomplete feature that offers real-time suggestions as users type, enabling them to find what they're looking for quickly when using the search engine shown in the figure below.

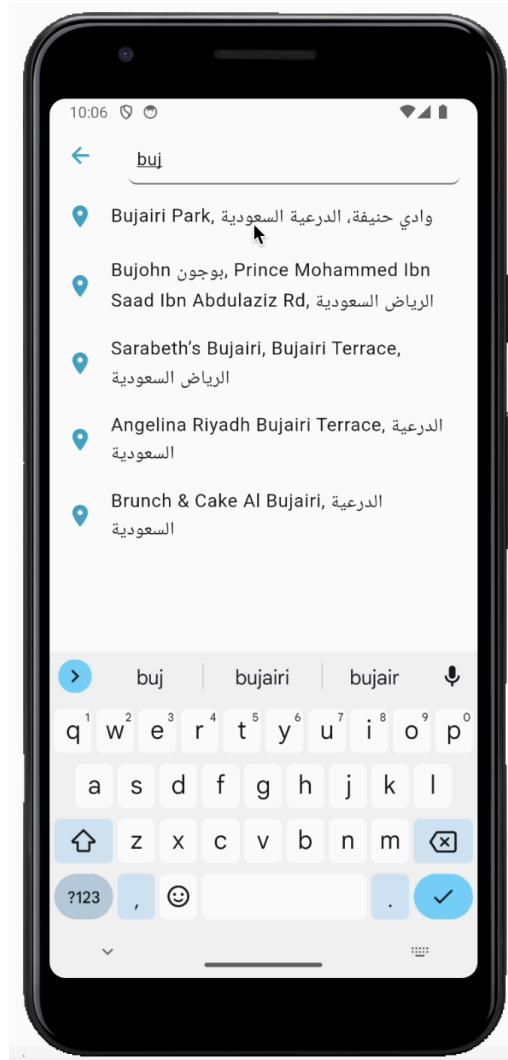


Figure.22 Efficient Autocomplete Interface

4.6 Implementation

4.6.1 API Integration

In the implementation of our Flutter app, several key aspects demand attention, each presenting unique challenges and considerations. Below, we elucidate the major components of our code, highlighting the key implementation steps, procedures, and configurations involved in connecting our system to Firebase as the primary API, as well as integrating third-party services such as Google Maps and Google Places.

```
static PlacesBloc get(context) => BlocProvider.of(context);

FutureOr<void> _onLoadPlace(
  LoadPlaces event,
  Emitter<PlacesState> emit,
) async {
  print("response.docs.isNotEmpty");
  log("response.docs.isNotEmpty");
  List<PlaceModel> places = [];
  emit(PlacesLoading());
  try {
    final response =
      await FirebaseFirestore.instance.collection('places').get();
    if (response.docs.isNotEmpty) {
      var data = response.docs;
      for (var item in data) {
        PlaceModel place = PlaceModel.fromJson(item.data());

        if (kUser != null && kUser!.favPlacesIds.contains(item.id)) {
          place.isFav = true;
        }
        places.add(place);
      }
    } else {
      emit(const PlacesError(message: "No places found"));
    }
  } catch (e) {
    emit(PlacesError(message: e.toString()));
  }
  allPlaces = places;
  emit(PlacesLoaded(places: allPlaces));
}
```

Figure.23 PlaceBloc Code

```

class PlaceModel extends Equatable {
    String? pId; // primary key
    String? name;
    String? address;
    String? description;
    String? image;
    List<String>? imageUrl;
    String? lat;
    String? lng;
    bool? isFav;

    PlaceModel({
        this.pId,
        required this.name,
        required this.address,
        required this.description,
        required this.image,
        required this.imageUrl,
        required this.lat,
        required this.lng,
        this.isFav = false,
    });

    factory PlaceModel.fromJson(Map<String, dynamic> json) {
        return PlaceModel(
            pId: json['pId'],
            name: json['name'],
            address: json['address'],
            description: json['description'],
            image: json['image'],
            imageUrl: json['imageUrl'] != null
                ? List<String>.from(json['imageUrl'])
                : <String>[], //json['imageUrl']
            lat: json['lat'],
            lng: json['lng'],
            isFav: json['isFav'],
        ); // PlaceModel
    }
}

```

Figure.24 PlaceModel Code

Major and Challenging Parts of the Code:

Firebase Integration:

Major Aspect: Firebase serves as the backbone API for our app, managing data storage, authentication, and real-time updates.

Challenges: Ensuring secure authentication, optimizing real-time data synchronization, and handling complex queries were pivotal challenges. Strategies such as Firebase security rules were implemented to address these concerns.

Google Maps Integration:

Major Aspect: Integration with Google Maps provides essential location-based services.

Challenges: Rendering dynamic maps, incorporating markers, and handling user interactions presented challenges. Implementing efficient algorithms to calculate routes and integrating custom markers were particularly intricate.

Google Places Integration:

Major Aspect: Leveraging Google Places enriches user experience by providing accurate and detailed location information.

Challenges: Retrieving and displaying place details dynamically, handling search queries, and managing the display of place suggestions in real-time posed challenges. Implementing an effective caching mechanism for frequently accessed places was crucial.

Key Implementation Steps and Procedures:

Firebase Configuration:

Step: Set up the Firebase project and configure necessary services such as Firestore for database and Firebase Authentication.

Procedure: Implement Firebase SDK in Flutter, configure authentication methods, and establish real-time listeners for dynamic data updates.

Google Maps Integration:

Step: Acquire API key from Google Cloud Console.

Procedure: Integrate the `google_maps_flutter` package, configure the API key, and implement necessary widgets for map rendering and user interaction.

Google Places Integration:

Step: Obtain the API key for Google Places.

Procedure: Integrate the google_places_flutter package, configure the API key, and implement functionalities for searching places, fetching details, and displaying suggestions.

Connection to Existing APIs and Third-Party Applications:

Firebase API:

Our app communicates seamlessly with Firebase for user authentication, data storage, and real-time updates. Secure connections are maintained through Firebase SDKs.

Google Maps API:

The integration with Google Maps API enables our app to render maps, calculate routes, and provide an interactive and visually appealing map interface.

Google Places API:

By leveraging the Google Places API, our app accesses a vast database of location information, enhancing the user experience with accurate and relevant place details.

In conclusion, our Flutter app's implementation intricately combines Firebase as the primary API with the integration of Google Maps and Google Places. The successful handling of authentication, real-time updates, and seamless interactions with external APIs contribute to the robust functionality of our application.

4.6.2 Recommendation System

The TFIDFProcess class encapsulates the entire recommender system pipeline.

- The **build_recommended_places** function is the main entry point, taking the recommended places data and the user's visited places data as input.
- The **clean_data** function removes any duplicate or missing data from the recommended places data.
- The **build_similarity** function creates the TF-IDF matrix for the recommended places data and the user's visited places data, and then calculates the cosine similarity between them.
- The **get_recommended** function uses the similarity scores to select the top 5 recommended places that the user has not yet visited.

```
class TFIDFProcess:
    def build_recommended_places(self, recommended_places, visited_places):
        df = self.clean_data(pd.DataFrame(recommended_places))
        user_df = pd.DataFrame(visited_places)
        data = self.build_similarity(df, user_df)
        recommended = self.get_recommended(df, data)
        return recommended

    def clean_data(self, df):
        df = df.drop_duplicates(keep="last")
        df = df.dropna(axis=0)
        df["Type"] = df["Type"].str.replace("_", " ")
        return df

    def build_similarity(self, df, user_df):
        # FS DataFrame => Recommended Places
        df["TextData"] = df["Type"] + " " + df["Reviews"]
        # User data => User selected trips
        user_df["TextData"] = user_df["Type"] + " " + user_df["Reviews"]
        # Create the TF-IDF vectorizer
        tfidf = TfidfVectorizer(stop_words="english", token_pattern=r"\b[a-zA-Z0-9]+\b")
        # Compute the TF-IDF matrix
        # This will use TF-IDF vectorizer to tfidf matrix
        tfidf_matrix = tfidf.fit_transform(df["TextData"])
        # This will use the same vocabulary and transform the user data based on tfidf_matrix learning
        tfidf_matrix_user = tfidf.transform(user_df["TextData"])
        data = dict()
        # i => one loop will loop for inner loop 1000 times
        for idx_user, user_row in enumerate(tfidf_matrix_user):
            sim_result = list()
            for idx, row in enumerate(tfidf_matrix):
                cosine_sim = cosine_similarity(row, user_row)
                sim_result.append({idx: cosine_sim[0, 0]})
            # Sort the sim_result to get the top similarity records
            sim_result = sorted(
                sim_result, key=lambda x: list(x.values())[0], reverse=True
            )
            # each place will have array with all recommended records => records will be dict type with key and value
            data[idx_user] = sim_result
        return data
```

Figure.25 TFIDFProcess Code

```

def get_recommended(self, df, data):
    unique_places = list()
    recommendations = list()
    places_indices = list()
    # user data
    for key, value in data.items():
        # loop sim places
        for item in value:
            # item dict
            for k, v in item.items():
                places_indices.append(k)

    recommended_places = df.iloc[places_indices].to_dict(orient="records")
    for recommend_place in recommended_places:
        if recommend_place["Name"] not in unique_places:
            unique_places.append(recommend_place["Name"])
            data = dict()
            data["Name"] = recommend_place["Name"]
            data["Address"] = recommend_place["Address"]
            data["Type"] = recommend_place["Type"].split(",")
            data["Rating"] = recommend_place["Rating"]
            # data["Description"] = recommend_place["Description"]
            data["Reviews"] = recommend_place["Reviews"].split(", ")
            data["Description"] = recommend_place["Description"]
            data["PriceLevel"] = recommend_place["PriceLevel"]
            data["VisitDate"] = recommend_place["VisitDate"]
            data["pId"] = recommend_place["pId"]
            data["lng"] = recommend_place["lng"]
            data["isFav"] = recommend_place["isFav"]
            data["lat"] = recommend_place["lat"]
            data["imageUrls"] = recommend_place["imageUrls"].split(", ")
            recommendations.append(data)
        if len(recommendations) >= 5:
            break
    return recommendations

```

Figure.26 TFIDFProcess Code Cont.

Implementation steps and procedures:

1. Data Cleaning: The **clean_data** function removes any duplicate or missing data from the recommended places data.
2. TF-IDF Matrix Creation: The **build_similarity** function creates the TF-IDF matrix for the recommended places data and the user's visited places data.
3. Cosine Similarity Calculation: The **build_similarity** function calculates the cosine similarity between the TF-IDF matrices of the recommended places data and the user's visited places data.
4. Recommended Places Selection: The **get_recommended** function uses the similarity scores to select the top 5 recommended places that the user has not yet visited.

5. System Evaluation

5.1 User Acceptance Testing

This section outlines the user acceptance testing (UAT) conducted to verify the software meets user needs. We defined the testing goals and scope, selected appropriate user testers, and set up a real-world testing environment. We analysed the results to determine if the app is ready for release or requires further improvements. The UAT ensured the software aligned with user requirements through direct user involvement in the testing process.

5.2 Demographics of Participants

We have chosen 20 participants to test our application and sent them a questionnaire on Google Forms after testing to evaluate their experience, and in the table below are their demographics.

	Number	Percentage
Age		
Under 18	2	10%
18-24	8	40%
25-44	7	35%
45-64	3	15%
65 or over	0	0%
Gender		
Female	12	60%
Male	8	40%
Level of Education		
Less than High School	0	0%
High School	2	10%
Bachelor's degree	12	60%
Postgraduate Degree	6	30%
Status		
Single	12	60%
Married	8	40%

Table 8: Demographics of Participants

5.3 Questionnaire

Results and Findings:

From the questionnaire we did after the testing on google forms we gathered the answers of 21 questions that we asked our users. First, we asked them if were they able to successfully register, log in, and log out without any difficulties and all of them said yes (as shown in Figure 27), we also asked them if they found the interfaces clear and simple to use and 85% strongly agreed and 15% agreed (as shown in figure 28). After that, we asked them if they found the search functionality effective in helping me find and view places of interest. 80% we were pleased to find that 80% strongly agreed and the rest also agreed (as shown in Figure 29). Then, we asked if their experience while creating a new trip plan was easy and successful and we were happy to find that 75% strongly agreed and 25%

agreed on that (as shown in Figure 30). We asked if they were satisfied with the ability to add a place to my trip plan and fortunately, they answered that they either agreed or strongly agreed (as shown in Figure 31). When we asked them if they found editing an existing trip plan, such as modifying the trip name, destination, and start or end dates, easy and successful. 70% of them said that they strongly agreed while the others agreed (as shown in figure 32). We asked them if sharing my trip plan with others was easy, we were glad to know that all of them agreed and strongly agreed (as shown in Figure 33). We asked if the process of editing shared trip plans was efficient. 70% strongly agreed while 30% agreed (as shown in figure 34).

Moreover, we asked them if they could easily view and write comments on trips and we were pleased to find that 70% strongly agreed and 30% agreed (as shown in Figure 35). We asked them if they found the map view for each trip visually appealing and informative and 85% strongly agreed on that while the others agreed (as shown in Figure 36). When we asked if they found the to-do list function efficient for organizing tasks on each trip we found that 75% of them strongly agreed while others agreed (as shown in Figure 37).

Furthermore, we asked them whether they found the recommendation system helpful in suggesting relevant places for your trip and we were thrilled to know that all of them said yes (as shown in Figure 38). We asked if they were able to conveniently add and remove places from your favorite list and we were happy to know that all of them said yes (as shown in figure 39). We also asked if they find the process of creating and publishing a blog post intuitive and user-friendly and 80% strongly agreed while 20% agreed (as shown in Figure 40). We asked if they easily found the explore page, favorite, blog, trips, and profile while navigating NOVOY and 80% strongly agreed while others agreed (as shown in figure 41). We wanted to know if they encountered any bugs or technical issues while using the NOVOY app and we were relieved to know no one had any issues (as shown in Figure 42). Finally, we asked if they could share their feedback on the experience using the Novoy app and mention any features they enjoyed, any challenges they encountered, and any additional comments or suggestions. We were happy to know that they enjoyed a lot of features such as trip planning and recommendations, and others expressed that they enjoyed all of the features (as shown in figures 43,44, and 45).

In conclusion, the user feedback gathered from the 21-question questionnaire on the Novoy app has been overwhelmingly positive. Users reported being able to easily complete core functionalities, found the interface clear and simple, and praised features like the recommendation system and visual appeal. No major technical issues were encountered, and the open-ended feedback further reinforced users' overall satisfaction with the app. The questionnaire results demonstrated that Novoy has successfully delivered a compelling and user-friendly travel planning solution.

Figures from the Questionnaire:



Figure.27 UAT Questionnaire Question 5

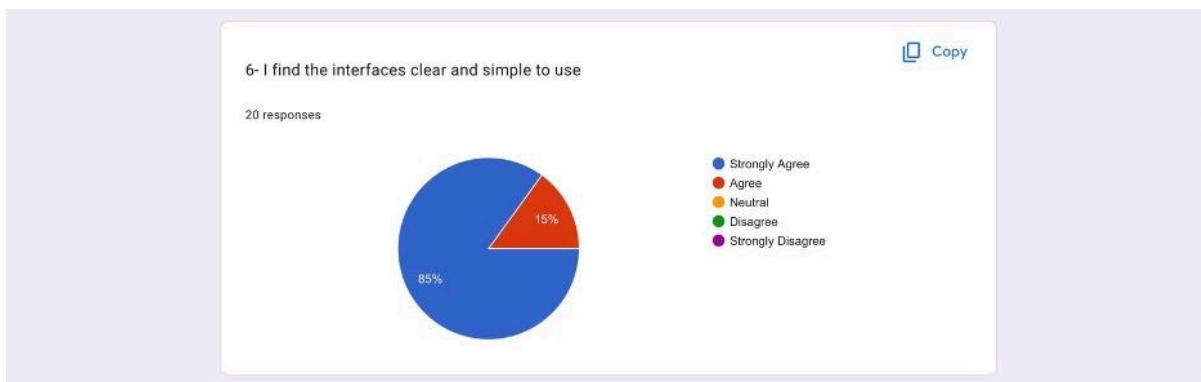


Figure.28 UAT Questionnaire Question 6

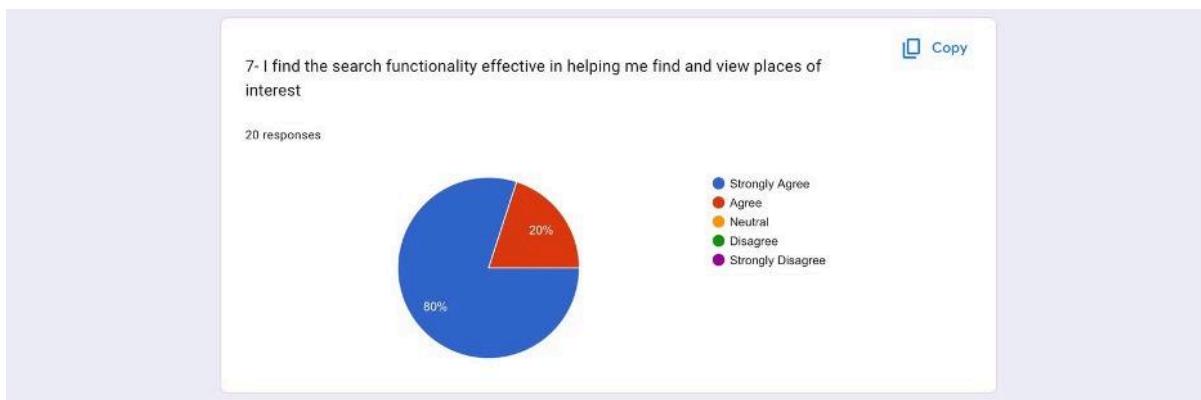


Figure.29 UAT Questionnaire Question 7



Figure.30 UAT Questionnaire Question 8

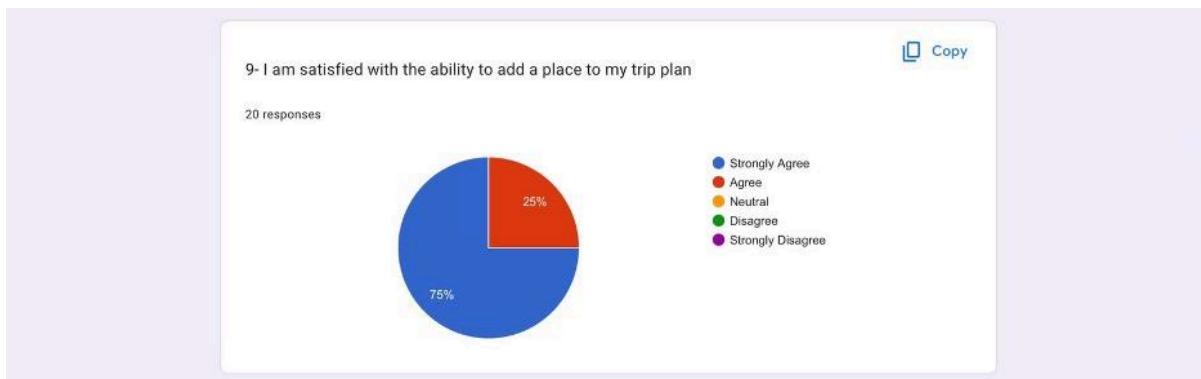


Figure.31 UAT Questionnaire Question 9

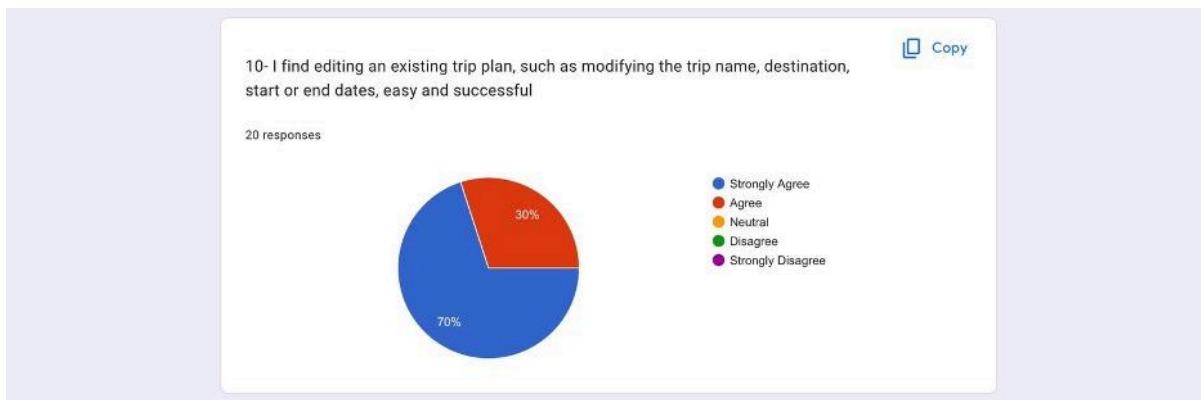


Figure.32 UAT Questionnaire Question 10

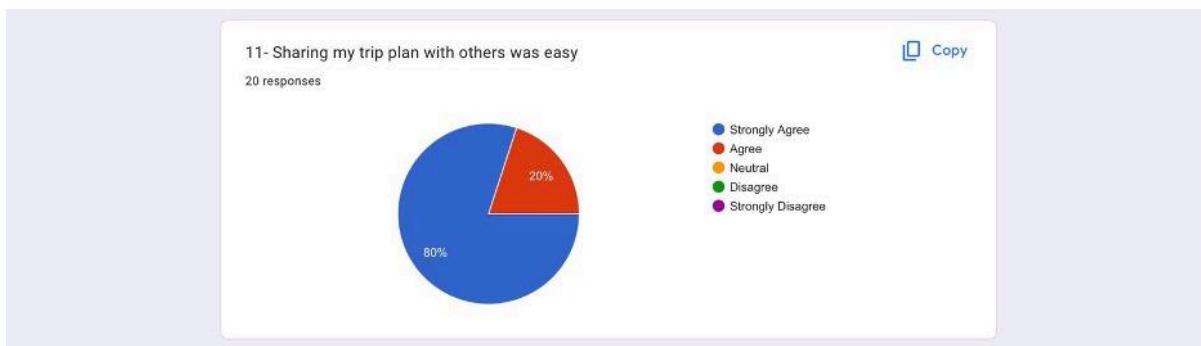


Figure.33 UAT Questionnaire Question 11

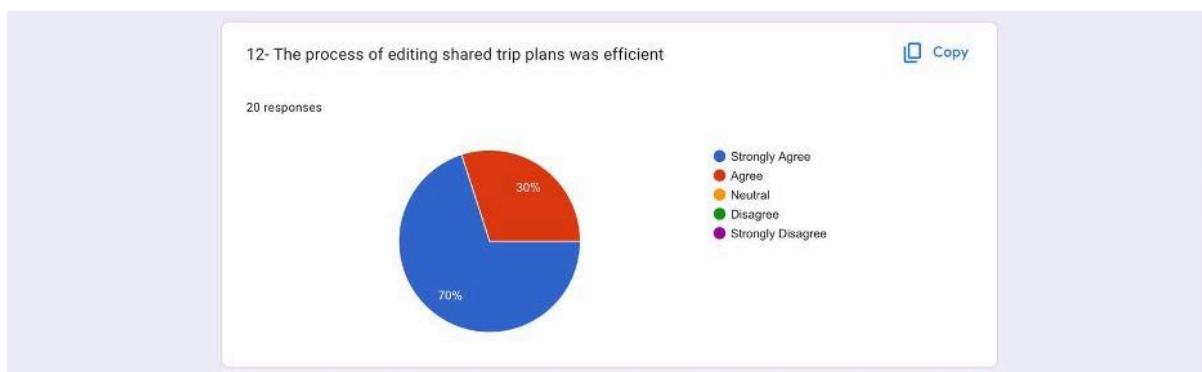


Figure.34 UAT Questionnaire Question 12

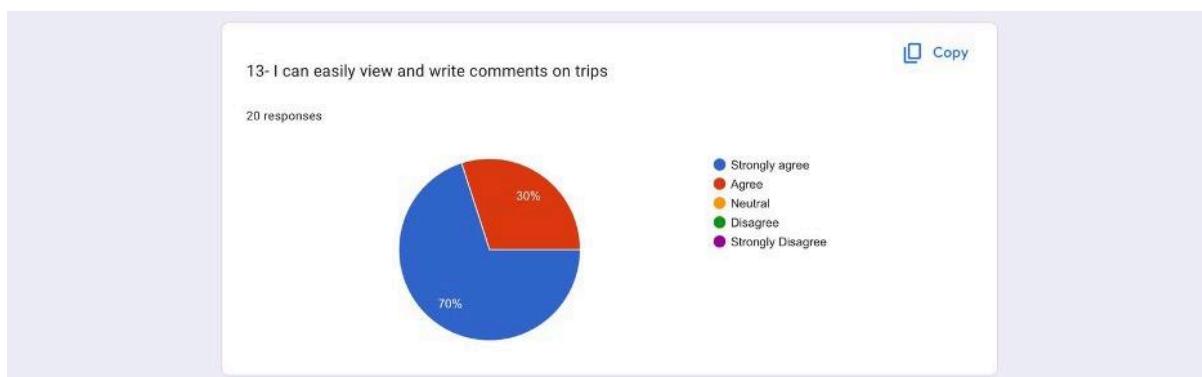


Figure.35 UAT Questionnaire Question 13

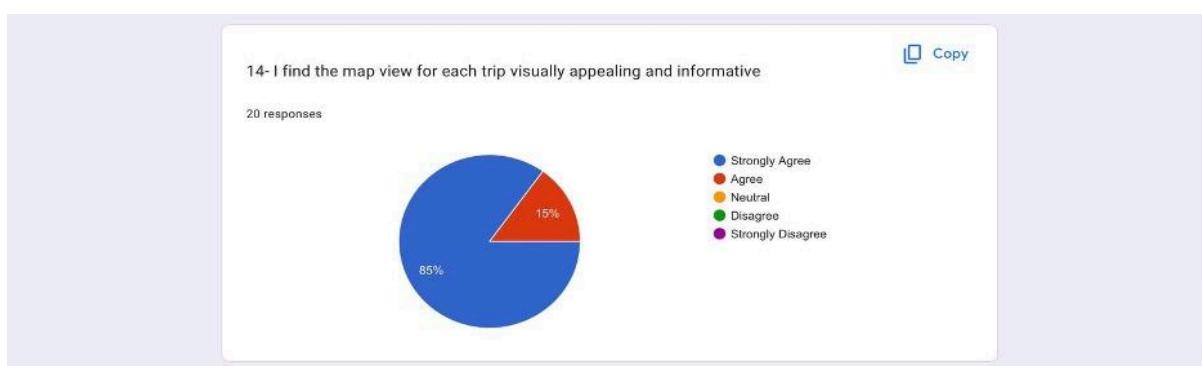


Figure.36 UAT Questionnaire Question 14

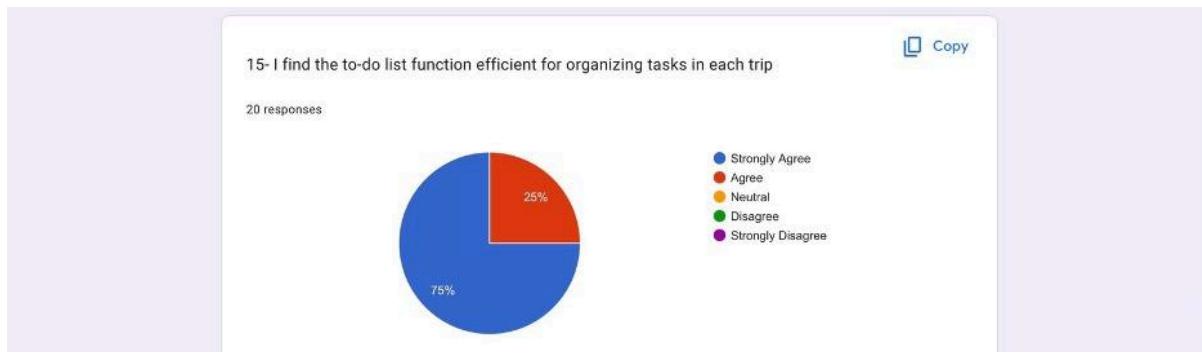


Figure.37 UAT Questionnaire Question 15

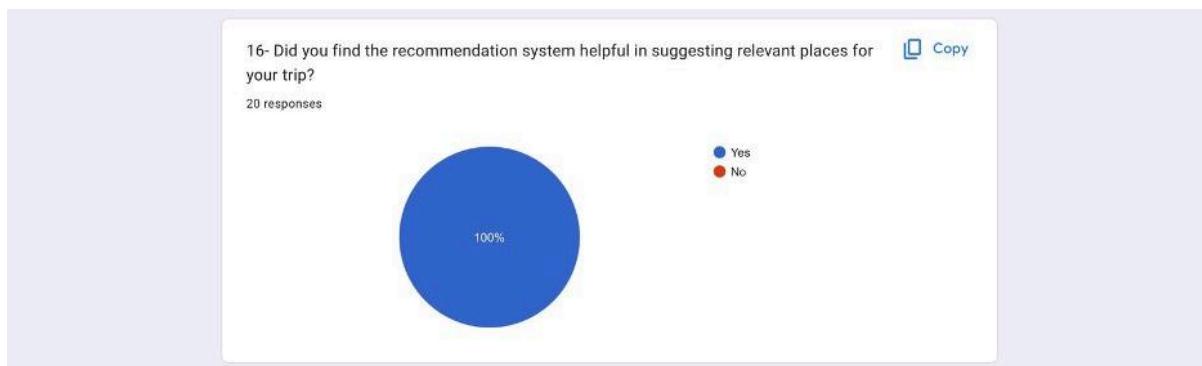


Figure.38 UAT Questionnaire Question 16

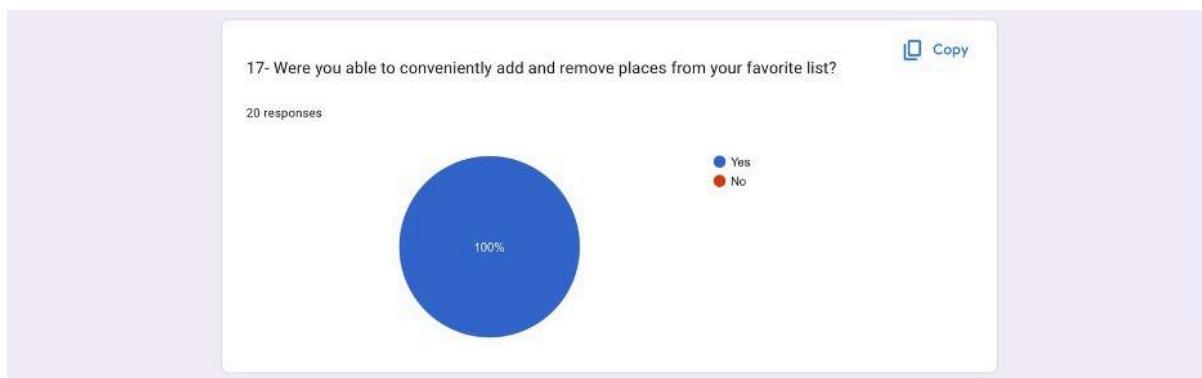


Figure.39 UAT Questionnaire Question 17

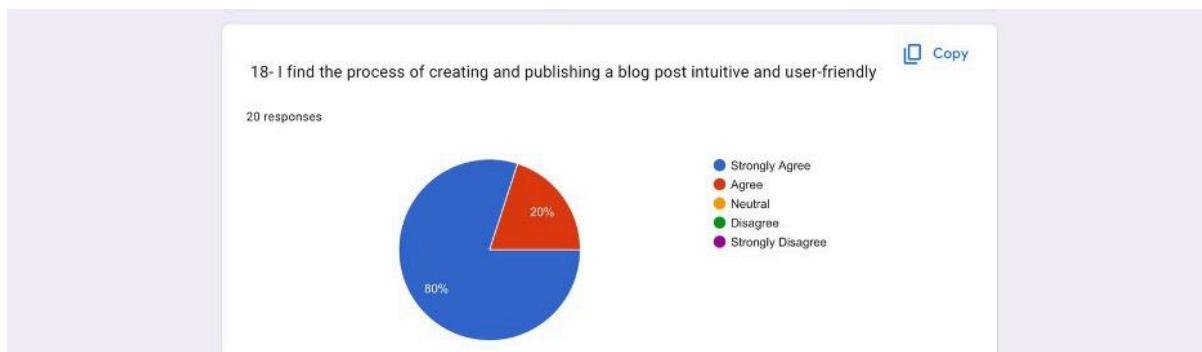


Figure.40 UAT Questionnaire Question 18

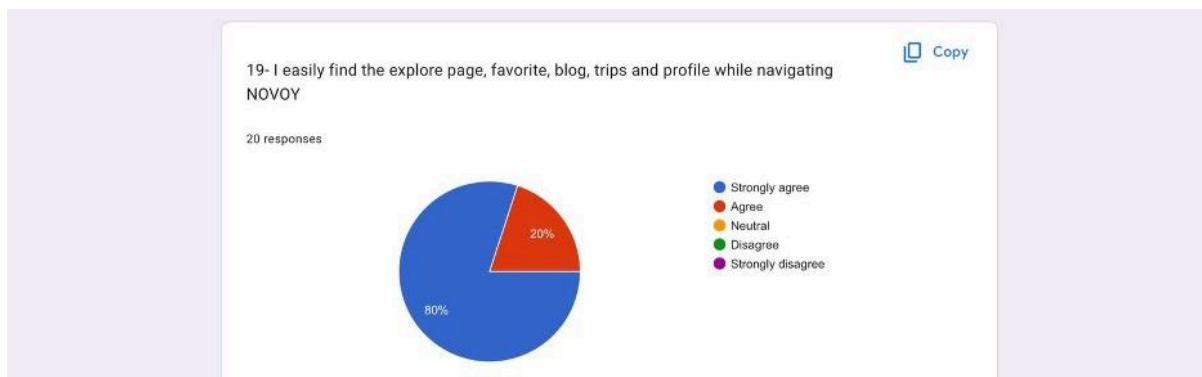


Figure.41 UAT Questionnaire Question 19

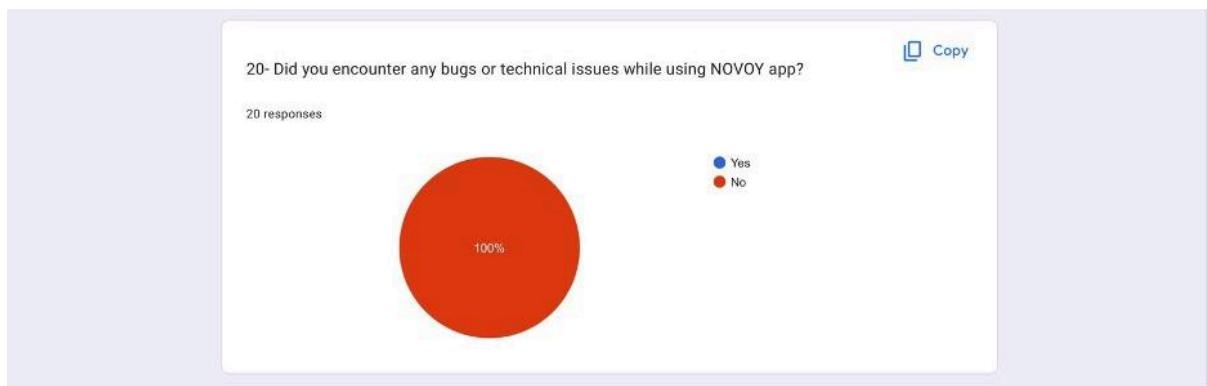


Figure.42 UAT Questionnaire Question 20

21- Please share your feedback on your experience using Novoy app.

Mention any features you enjoyed, any challenges you encountered, and share any additional comments or suggestions.

20 responses

I enjoyed all of the features especially the to do list feature

I really liked that the app provided recommendations

I enjoyed planning my trip on the application

I enjoyed all of the features provided by the novoy app

I like that I can share the trip with my friends

I liked the share feature

I enjoyed all features like the planning feature and todo list

I enjoyed all the features

I like the blog feature, todo list and planning a trip

Figure.43 UAT Questionnaire Question 21 #1

21- Please share your feedback on your experience using Novoy app.

Mention any features you enjoyed, any challenges you encountered, and share any additional comments or suggestions.

20 responses

I enjoyed that the app recommended places for me. Also, I enjoyed the process of planning the trip

I suggest adding Arabic language to the app

My experience using novoy has been fantastic! I didn't encourage any challenge

I particularly enjoyed the collaborative editing feature

The map for each trip was incredibly helpful in visualizing my plan

I really appreciate the option to view and create blog posts to document my adventures and trips

I'm impressed with the app's functionality, and I love that it's simple to use

It would be great to have integration with navigation app like google maps to provide directions between places on the map

Everything was good and I didn't encourage any challenges or bugs

Figure.44 UAT Questionnaire Question 21 #2

21- Please share your feedback on your experience using Novoy app.
Mention any features you enjoyed, any challenges you encountered, and share any additional comments or suggestions.

20 responses

It would be great to have integration with navigation app like google maps to provide directions between places on the map

Everything was good and I didn't encounter any challenges or bugs

Novoy was great, one of the features I enjoyed was the to do list, also the ability to add places to my favorite list was a nice touch

Great job on creating such a comprehensive app!!

Figure.45 UAT Questionnaire Question 21 #3

5.4 Quality Attributes (NFR testing)

User story	Quality Attribute	Measure	Results
As a user, I want the system to be fast in response, not exceeding 10 seconds per request, so I will not have to wait a long time.	Performance: Ability to meet timing requirements. When events occur, the system must respond quickly.	Latency: The time between the arrival of the stimulus and the system's response to it.[30]	<p>Novoy application was tested for its response time of 10 requests by 5 users. The average time it took for the application to process each request was 5 seconds, the minimum time was 2 seconds, and the maximum time was 7 seconds.</p> <p>We can calculate the latency using the following formula:</p> $\text{Latency} = (\text{total time for 10 requests}) / (\text{number of requests})$ $= (5 \text{ seconds} \times 10 \text{ requests}) / 10$ $= 5 \text{ seconds.}$ <p>So, the average time it took for the application to process each request was 5 seconds.</p>
As a user, I want the app's interfaces to be at least 85% user-friendly, so that I can accomplish my tasks without any confusion.	Usability: user's experience when interacting with products or systems.	Metric: Percentage of users who find the app's interfaces at least 85% user-friendly.	<p>The app's interfaces were evaluated based on their clear and user-friendly design using a scale of 1 to 5, with a score of 5 representing the highest level of clarity and user-friendliness.</p> <p>20 users were asked to evaluate the app's interfaces.</p> <p>90% gave it a score of 5 out of 5. 10% gave it a score of 4 out of 5.</p>

As a user, I want the system to be available at all times except 1 hour per week if needed, so that I can use it whenever I want.	Availability: Can the software carry out a task when needed?	Metric: Measured as (uptime) / (total time observed) [30]	We tested running the Novoy application for two weeks. Uptime = 336 hours (14 days x 24 hours per day) Total time = 336 hrs. Availability = $(331 / 336) \times 100\% = 98.5\%$
As a user, I want my personal information to be safeguarded, so that I can trust that my data is protected from unauthorized access.	Security: Ability to protect information from unauthorized access while providing service to authorized users.	Authentication: Can be measured by the rate of successful logins, by unauthorized users.	Three different users tried unauthorized access to the system by logging in 5 times each, but the system did not allow any of these 15 unauthorized logins.

Table 9: Quality Attributes (NFR Testing)

5.5 Discussion

The current version of the Novoy app has successfully met the users' requirements and specifications. Based on the results shown in Section 5, the results obtained from the system evaluation indicate that the Novoy application has good potential for further improvement. The overwhelmingly positive user feedback and successful delivery of core functionalities demonstrate that the app is on the right track in providing a compelling and user-friendly travel planning solution. However, there are areas that can be enhanced to take the user experience to an even higher level.

By addressing the response time optimization and refining the interface based on user feedback, we can work to provide a better and more polished user experience. Additionally, exploring ways to enhance the recommendation system and introducing new features based on user suggestions will help maintain the app's competitiveness and ensure continued user satisfaction.

Through the implementation of these enhancements and the ongoing process of testing, gathering feedback, and evaluating the system, the Novoy team aims to constantly improve the application and deliver an ever-better user experience. This commitment to continuous improvement will ensure that the Novoy app remains at the forefront of the travel planning market, meeting the evolving needs and expectations of its users.

6. Conclusions and Future Work

We are pleased to report that the latest version of Novoy has fulfilled the requirements and specifications set forth by our users. Based on the feedback we have received, our users found the purpose of the system to be evident and the system itself straightforward to use. We are excited to see that our efforts to create a user-friendly and efficient tutoring platform have paid off. Novoy presents a promising solution to the problems of trip planning and improving the travel process.

In conclusion, the Novoy app presents a comprehensive solution to the challenges faced by travelers in planning their trips. By addressing the overwhelming number of options and lack of information, Novoy simplifies and enhances the travel planning experience, providing users with personalized and tailored travel plans.

The development of the Novoy app has significant impact both locally and globally. Locally, it contributes to the growth and promotion of lesser-known tourist destinations by providing comprehensive and up-to-date information. This not only benefits travelers but also supports the tourism industry and economic growth in Saudi Arabia. Globally, Novoy empowers travelers from around the world to explore destinations with confidence, fostering cultural exchange and personal growth.

Throughout the software development journey, several problems and challenges were encountered. These included ensuring seamless integration of data from reputable sources such as Google API, optimizing performance, and addressing potential security concerns. However, through diligent efforts and collaboration, these obstacles were overcome, leading to the successful development of the features of the Novoy mobile application.

While Novoy offers a comprehensive range of features, it is important to acknowledge its limitations. The app relies on the availability and accuracy of external data sources, and therefore, any limitations or inaccuracies in these sources may affect the data provided. Additionally, the app's effectiveness may vary depending on the user's destination, as the availability of comprehensive information may differ for different locations.

The main contribution of the Novoy app lies in its ability to simplify and streamline the trip planning process. By facilitating collaboration and editing of travel plans, Novoy revolutionizes the way travelers plan their trips. The integration of a visually appealing trip representation and a recommender system further enhances the user experience and assists users in making informed decisions.

Looking ahead, future work will focus on further refining and expanding the capabilities of Novoy. One potential area is the expansion of the app's coverage to include more destinations and improve the availability and accuracy of information for lesser-known locations. Additionally, incorporating user feedback and continuously updating the app's features and recommendations will ensure its relevance and usefulness to travelers. Furthermore, exploring partnerships with local tourism authorities and businesses can enhance the app's capabilities and provide users with exclusive offers and experiences.

In conclusion, the Novoy app stands as a valuable tool for travelers, offering a user-friendly and efficient way to plan their trips. With its innovative features, recommendations, and integration of advanced technology, Novoy empowers travelers to explore the world with confidence, creating unforgettable experiences and fostering cultural exchange. As Novoy continues to evolve and adapt to user needs, it promises to play a pivotal role in transforming the travel planning experience.

7. Acknowledgements

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Lastly, we want to convey our profound gratitude and appreciation to our family and friends for their enduring love, support, and encouragement during this journey. Without their kindness and encouragement, our success would not have been possible

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9. Appendix

APPENDIX A: Interviews

Questions:

- 1- How often do you travel?
- 2- Why do you travel?
- 3- Do you think trip planning is important?
- 4- How do you plan your trip?
- 5- Have you ever found it overwhelming to plan for trips?
- 6- Where do you get the information you need?
- 7- What do you need to consider when planning for trips?
- 8- What are your thoughts on a feature that enables you to do collaborative planning?
- 9- Would you like AI recommendations when planning a trip? Why? Or why not?
- 10- What features would you like to see in a trip-planning application?

Interview 1:

1. How often do you travel?

I don't travel much, just a few times a year.

2. Why do you travel?

I travel to explore new places, experience different cultures, relax, and sometimes for work.

3. Do you think trip planning is important?

Yes, trip planning is important because it helps ensure a well-organized and enjoyable trip.

4. How do you plan your trip?

I research destinations online, read travel blogs and websites, and create an itinerary with attractions and accommodations.

5. Have you ever found it overwhelming to plan for trips?

Yes, sometimes trip planning can be overwhelming due to the amount of information and decisions to make.

6. Where do you get the information you need?

I get information from travel websites, blogs, social media, and recommendations from friends or family.

7. What do you consider when planning for trips?

I consider the purpose of the trip, budget, time of year, transportation, necessary documents, safety, and local customs.

8. What are your thoughts on a feature that enables you to do collaborative planning?

Collaborative planning is great for sharing ideas and coordinating preferences with travel companions.

9. Would you like AI recommendations for trip planning?

Yes, AI recommendations can be helpful for personalized suggestions, but I would still rely on my own judgment.

10. What features would you like in a trip-planning app?

User-friendly interface, booking options, maps, personalized recommendations, itinerary management, real-time information, budgeting tools, language translation, and offline accessibility.

Interview 2:

1. How often do you travel?

Two times a year.

2. Why do you travel?

To have fun.

3. Do you think trip planning is important?

Yes, especially for hotels and flights.

4. How do you plan your trip?

Based on the budget.

5. Have you ever found it overwhelming to plan for trips?

Yes, very much.

6. Where do you get the information you need?

From tiktok.

7. What do you need to consider when planning for trips?

Visa and transportation.

8. What are your thoughts on a feature that enables you to do collaborative planning?

Maybe an app to book everything like flights, hotels, visas, etc.

9. Would you like AI recommendations when planning a trip? Why? Or why not?

Yes, to help me while setting my plans.

10. What features would you like to see in a trip planning application?

AI recommendations based on my interests.

Interview 3:

1. How often do you travel?

On average, I travel around four times a year.

2. Why do you travel?

I travel for multiple reasons, one of them is that travel allows me to create lasting memories and experiences.

3. Do you think trip planning is important?

Sure, planning is really important to have a smooth trip.

4. How do you plan your trip?

I do deep research about the place after that I create an Itinerary based on my research.

5. Have you ever found it overwhelming to plan for trips?

Yes, especially in the research step. With so many travel resources available, it's easy to get overwhelmed.

6. Where do you get the information you need?

I gather information from various sources, such as travel websites, and social media platforms.

7. What do you need to consider when planning for trips?

For me, It's important to research and choose activities and attractions carefully to have a fantastic trip. Take into account my interests, what I like to do, and popular attractions.

8. What are your thoughts on a feature that enables you to do collaborative planning?

This feature would be highly beneficial! It could offer real-time updates, ensuring all participants are kept informed about the planning progress.

9. Would you like AI recommendations when planning a trip? Why? Or why not?

Yes, AI recommendations can provide a wider range of options, allowing me to explore alternatives I might not have considered initially.

10. What features would you like to see in a trip-planning application?

I would like to see a few key features. Firstly, recommendations and suggestions, as they help me discover places. Additionally, having a trip timeline feature would be essential for organizing my trip.

APPENDIX B: Questionnaire

Questions:

- How old are you?
- Under 18

- 18-24
 - 25-44
 - 45-64
 - 65 or over
- What is your gender?
- Female
 - Male
- Your current status
- Married
 - Single
- Do you have Children?
- Yes
 - No
- the highest level of education you have completed?
- Less than high school
 - High school
 - Bachelor's degree
 - Postgraduate degree
- How many times did you travel in the last two years?
- 1-5 times
 - 5-10 time
 - Above 10 times
- What apps did you use to plan your trip?
- Google Maps
 - Booking
 - Travel Advisor
 - TripIt
 - Tripsy
 - TripWise
 - None
 - Other
- Do you travel
- Alone
 - With family
 - As a group with friends or colleagues
- How do you plan your trips and daily activities?
- Pen and paper
 - Electronic notebook

- I don't plan in advance
- Other
- Which features would make you want to use our app?
- Collaborative Plan Editing
- Favorites List
- Integrated Map
- AI-Generated Recommendations
- Travel Timeline
- Other
- Do you have any features you would like to see in our app?

Do you have any features would you like to include in our app?

40 responses

No

no

فكرة حلوة يكون فيه اقتراح لاكتشاف وفعاليات أسوبيها خلال السفر، ممكن أدخل البدجت حقتي وهو يطلع لي الاقتراحات والتاييلين مبني عليها

no but this is a really fun idea, hope it comes to fruition!

.

I would love to have activities recommendations. It would be fantastic if the AI has access to weather forecast so that it recommends suitable activities according to the weather. Maybe add a trip budget feature as well to avoid overspending. Good luck!

Place capacity, is the place I am going to it now crowded or not

Search for places easily

Do you have any features would you like to include in our app?

40 responses

I think it is good idea if to add a brief about country culture and their traditional cuisine and locations of the restaurants they make it.

A suitcase check list that could be costumized

Calendar with the activity

Reminders on booking dates

No thanks

Highest rated places

See people's reviews. best of luck ❤️

Booking directly

-hotel recommendations -restaurants

Do you have any features would you like to include in our app?

40 responses

-hotel recommendations -restaurants
-must see areas -transportation

Nothing

Yes, weather forecasting

Include notification if the area is congusted

Providing most visited places by tourists

No

no

Virtual reality

User friendly interface

APPENDIX C: Links

- GitHub Link:

<https://github.com/Reemaalmansour/2023-GP1-19>

- Jira Project Link:

<https://novoy.atlassian.net/jira/software/projects/SCRUM/boards/1/timeline>

- Confluence Link:

<https://novoy.atlassian.net/l/cp/1ZxsdLgi>

APPENDIX D: Tools and Environments

- Flutter
- Visual Studio Code
- GitHub
- Jira
- Confluence

APPENDIX E: UAT Questionnaire

1- How old are you?

- Under 18
- 18-24
- 25-44
- 45-64
- 65 or over

2- What is your gender?

- Female
- Male

3- the highest level of education you have completed?

- Less than high school
- High school
- Bachelor's degree
- Postgraduate degree

4- Your current status

- Married
- Single

5- Were you able to successfully register, log in, and log out without any difficulties?

- Yes
- No

6- I find the interfaces clear and simple to use

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

- 7- I find the search functionality effective in helping me find and view places of interest
- Strongly agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
- 8- My experience while creating a new trip plan was easy and successful
- Strongly agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
- 9- I am satisfied with the ability to add a place to my trip plan
- Strongly agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
- 10- I find editing an existing trip plan, such as modifying the trip name, destination, start or end dates, easy and successful
- Strongly agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
- 11- Sharing my trip plan with others was easy
- Strongly agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
- 12- The process of editing shared trip plans was efficient
- Strongly agree
 - Agree
 - Neutral

- Disagree
 - Strongly Disagree
- 13- I can easily view and write comments on trips
- Strongly agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
- 14- I find the map view for each trip visually appealing and informative
- Strongly agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
- 15- I find the to-do list function efficient for organizing tasks in each trip
- Strongly agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
- 16- Did you find the recommendation system helpful in suggesting relevant places for your trip?
- Yes
 - No
- 17- Were you able to conveniently add and remove places from your favorite list?
- Yes
 - No
- 18- I find the process of creating and publishing a blog post intuitive and user-friendly
- Strongly agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
- 19- I easily find the explore page, favorite, blog, trips and profile while navigating Novoy
- Strongly agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree

- 20- Did you encounter any bugs or technical issues while using the Novoy app?
- Yes
 - No
- 21- Please share your feedback on your experience using the Novoy app. Mention any features you enjoyed, any challenges you encountered, and share any additional comments or suggestions.