TRAILS

A Project Work Report

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Submitted by:

DEVESH RAGHUWANSHI

20BCG1090

Under the Supervision of:

Ms. MANISHA PATHANIA

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING APEX INSTITUTE OF TECHNOLOGY

CHANDIGARH UNIVERSITY, GHARUAN, MOHALI - 140413, PUNJAB

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DECLARATION

I, **'Devesh Raghuwanshi'**, students of **'Bachelor of Engineering in CSE (G&G), session: 2020-2024,** Department of Computer Science and Engineering, Apex Institute of Technology, Chandigarh University, Punjab, hereby declare that the work presented in this Project Work entitled **'Trails'** is the outcome of my own bonafide work and is correct to the best of my knowledge and this work has been undertaken taking care of Engineering Ethics. It contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

(Devesh Raghuwanshi)

Candidate UID: 20BCG1090

Date: 22/11/23

Place: Gharuan, Mohali, India

CERTIFICATE

This is to certify that the work embodies in this dissertation entitled **'Trails'** being submitted by Devesh Raghuwanshi (20BCG1090)

for partial fulfillment of the requirement for the award of **Bachelor of Engineering** in ***Computer Science & Engineering With Specialization in Games & Graphics,*** discipline to Apex Institute of Technology, Chandigarh University, Punjab during the academic year 2020-2024 is a record of bonafide piece of work, undertaken by him/her the supervision of the undersigned.

Approved and supervised by

Signature of Supervisor

Ms. Manisha Pathania

EXTERNAL EXAMINER

Signature of External Examiner

(External Examiner's Name)

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ABSTRACT

The Indian travel market is one of the fastest-growing in the world, with a growing demand for mobile travel planning apps. However, many existing travel planning apps do not cater to the specific needs of Indian travelers. The Trails app is a new mobile travel planning app designed specifically for Indian travelers. It uses recommendation systems, multimodal trip planning, and sustainable travel promotion to help users plan trips that are tailored to their individual needs and preferences.

The Trails app has a number of key features, including:

- A recommendation system that suggests travel destinations, activities, and restaurants based on the user's travel preferences, location history, and social network connections.
- A multimodal trip planning feature that helps users plan trips that involve multiple modes of transportation, including public transportation, walking, and cycling.
- A sustainable travel promotion feature that provides users with information about the environmental impact of different travel options and helps them to find sustainable travel destinations and activities.

The Trails app was evaluated through a user testing process that involved a group of Indian travelers. The results of the user testing were positive, with users finding the app to be easy to use and helpful in planning their trips.

The Trails app has the potential to be a valuable tool for Indian travelers. It can help users to save time and money, plan trips that are more environmentally friendly, and have a more enjoyable travel experience.

Keywords: travel planning app, recommendation systems, multimodal trip planning, sustainable travel, India

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Introduction

The Indian Travel Market

The Indian travel market is one of the fastest-growing in the world, with a projected growth rate of 10% per year. This growth is being driven by a number of factors, including a growing middle class, increasing disposable incomes, and a desire for new travel experiences.

In 2022, the Indian travel and tourism industry contributed an estimated 9.2% to India's GDP and employed over 38 million people. The industry is expected to grow to contribute 10.8% to India's GDP by 2030, creating an additional 10 million jobs.

The majority of Indian travelers are domestic, with only a small percentage traveling abroad. However, the number of outbound Indian travelers is growing, and is expected to reach 50 million by 2030.

The Need for a Travel Planning App for Indian Travelers

Despite the growth of the Indian travel market, there are still a number of challenges that Indian travelers face. These challenges include:

- A lack of reliable and up-to-date travel information
- Difficulty planning trips that involve multiple modes of transportation
- A lack of awareness of sustainable travel options

A travel planning app can help to address these challenges by providing Indian travelers with a one-stop shop for all of their travel planning needs. A good travel planning app should provide the following features:

- Comprehensive travel information, including destination guides, reviews, and recommendations
- Multimodal trip planning, including the ability to book transportation and accommodation
- Sustainable travel features, such as information on eco-friendly destinations and activities

The Trails App and Its Unique Features

The Trails app is a new mobile travel planning app designed specifically for Indian travelers. The app has a number of unique features that make it well-suited to the needs of Indian travelers, including:

- A recommendation system that suggests travel destinations, activities, and restaurants based on the user's travel preferences, location history, and social network connections
- A multimodal trip planning feature that helps users plan trips that involve multiple modes of transportation, including public transportation, walking, and cycling
- A sustainable travel promotion feature that provides users with information about the environmental impact of different travel options and helps them to find sustainable travel destinations and activities

In addition to these unique features, the Trails app also provides a number of other helpful features, such as:

- A currency converter
- A language translator
- A safety guide

The Trails app is available in English and Hindi, and is currently available for Android and iOS devices.

In the following sections of this report, we will discuss the literature review, project methodology, user testing and evaluation, sustainable travel promotion, marketing and future plans, and conclusion and recommendations. We will also provide an appendix with additional information.

Project Overview/Specifications

Project Title: Trails: A Travel Planning App for Indian Travelers

Project Description:

The Trails app is a mobile travel planning app designed specifically for Indian travelers. It uses recommendation systems, multimodal trip planning, and sustainable travel promotion to help users plan trips that are tailored to their individual needs and preferences.

Project Objectives:

The objectives of this project are to:

* Develop a mobile travel planning app that is specifically designed for Indian travelers
* Provide users with a one-stop shop for all of their travel planning needs
* Help users plan trips that are more efficient, enjoyable, and environmentally friendly
* Promote sustainable travel practices among Indian travelers

Project Scope:

The scope of this project includes the following:

* Development of the Trails app for Android and iOS devices
* Integration of a recommendation system, multimodal trip planning, and sustainable travel promotion features
* User testing and evaluation of the Trails app
* Marketing and promotion of the Trails app

Project Deliverables:

The deliverables of this project are as follows:

* A fully functional Trails app for Android and iOS devices
* A detailed user testing report
* A marketing plan for the Trails app

Project Schedule:

The project schedule is as follows:

Phase 1: Design (2 weeks)

* Develop a detailed app design
* Create wireframes and prototypes

Phase 2: Development (8 weeks)

* Develop the Trails app for Android and iOS devices
* Integrate recommendation system, multimodal trip planning, and sustainable travel promotion features

Phase 3: User Testing and Evaluation (2 weeks)

* Conduct user testing of the Trails app
* Evaluate the usability and effectiveness of the Trails app

Project Resources:

The following resources will be required for the completion of this project:

* A team of developers and designers
* A budget for development, testing, and marketing
* Access to Android and iOS development tools

Project Risks:

The following risks have been identified for this project:

* Delays in development
* Difficulties in integrating recommendation system, multimodal trip planning, and sustainable travel promotion features
* Low adoption of the Trails app by Indian travelers

Project Mitigation Strategies:

The following strategies will be used to mitigate the risks identified for this project:

* Develop a detailed project plan with realistic timelines
* Use agile development methodologies to allow for flexibility and adaptability
* Conduct thorough testing throughout the development process
* Develop a comprehensive marketing plan to reach target audience
* Continuously monitor user feedback and make improvements to the app as needed

Project Conclusion:

The Trails app has the potential to be a valuable tool for Indian travelers. It can help users to save time and money, plan trips that are more environmentally friendly, and have a more enjoyable travel experience. By addressing the challenges faced by Indian travelers and providing a comprehensive travel planning solution, the Trails app has the potential to make a significant impact on the Indian travel industry.

Technologies Used

1. Flutter

Flutter is an open-source mobile application development framework that uses the Dart programming language. It enables developers to build cross-platform apps with a single codebase for both Android and iOS platforms. Flutter's architecture is based on reactive programming and widget trees, providing fast development cycles, hot reload, and flexible UI designs. The framework also offers extensive libraries and tools for building high-performance, visually appealing, and responsive apps. Flutter is becoming increasingly popular among developers due to its efficient development process, code reusability, and performance advantages.

- **Widgets**

  Widgets are the basic building blocks of a Flutter application. They can be thought of as visual components that display content and respond to user interactions. There are two types of widgets in Flutter: Stateless widgets and Stateful widgets.

Stateless widgets:

They are immutable and cannot be changed once they are built. They are useful for building simple UI components that do not need to be updated frequently. Examples of stateless widgets include text, icons, and buttons.

Stateful widgets:

These, on the other hand, can be updated dynamically to reflect changes in the application state. They are used for more complex UI components that require frequent updates. Stateful widgets have a state object that holds the widget's mutable state data. Examples of stateful widgets include forms, input fields, and lists.

- **The Material library:**

It provides a set of pre-built widgets, such as buttons, text fields, dialog boxes, and navigation components. It also provides guidelines for colour schemes, typography, and layout that help developers build consistent and attractive UIs.

One of the key benefits of using Material widgets is that they offer a unified look and feel across different platforms. For example, the Material Design guidelines specify how an app should behave when running on an Android device versus an iOS device, and the Material widgets take care of the implementation details automatically.

To use Material widgets in a Flutter application, developers can simply import the material.dart library and start using the pre-built widgets in their code. The widgets can be customized using a variety of properties and parameters, allowing developers to tailor the UI to their specific needs.

- **Animation:**

It is an essential component of modern app development, and Flutter provides developers with a powerful and flexible framework for creating beautiful and responsive animations. With Flutter, developers can easily create animations that respond to user interactions, such as swipes, taps, and scrolls, or animations that run automatically, such as splash screens or loading indicators. Flutter supports a wide range of animation techniques; from simple animations such as fades and rotations to more complex animations such as transitions between screens or complex graphics animations.

- **Material Design and Cupertino**

These are two design systems in Flutter that provide different visual and interactive styles for building apps. Material Design is Google's design system and is based on a set of guidelines that aim to create a consistent and intuitive user experience across different platforms and devices. It offers a wide range of customizable widgets, including buttons, text fields, cards, and navigation bars, that conform to the material design guidelines. These widgets provide a clean, modern look and feel to the app and offer smooth animations and transitions.

On the other hand, **Cupertino** is Apple's design system that provides a more iOS-like look and feel to the app. It offers widgets that resemble those found in iOS, such as sliders, switches, and activity indicators, and provide a sleek, modern look. Cupertino widgets provide a consistent user experience across different iOS devices and follow the design principles of iOS, such as clarity, deference, and depth.

Developers can choose to use either the **Material Design** or **Cupertino widgets** depending on the platform they are targeting and the design aesthetics they want to achieve. Flutter provides easy-to-use APIs to create widgets for both design systems, making it possible to create beautiful and intuitive user interfaces for both Android and iOS devices.

- **Dart**

Dart is a modern, object-oriented programming language that is used to develop mobile, web, and server-side applications. It was developed by Google and is the primary language used for building applications with the Flutter framework. Dart is similar to other languages such as Java and JavaScript, but its syntax is more concise and easier to read. Some of its key features include type inference, asynchronous programming, and a garbage collector. Dart also has a large standard library and supports various programming paradigms such as functional and reactive programming. The language is optimized for building large-scale applications and provides tools for code analysis and debugging. Overall, Dart is a flexible and powerful language that makes building complex applications with Flutter easier and more efficient.

- **Dart Framework**

It is a collection of reusable code that provides a structured way of building and organizing applications. The Flutter framework includes a set of widgets, tools, and libraries that developers can use to create high-performance, visually appealing, and responsive mobile applications for both Android and iOS platforms. Flutter provides a reactive programming model that allows developers to build user interfaces that react to changes in data or state. It also includes a rich set of animation and transition APIs that make it easy to create engaging user experiences. Additionally, Flutter has a comprehensive set of testing, debugging, and profiling tools that make it easy to identify and fix bugs in your code. Overall, the Flutter framework provides developers with a solid foundation for building mobile applications, allowing them to focus on delivering great user experiences while taking advantage of the framework's performance, reliability, and flexibility.

- **Plugins**

Plugins are pre-built packages of code that provide access to device-specific features and functionalities not available in the core Flutter framework. These plugins are developed and maintained by the Flutter community and third-party developers, allowing developers to quickly and easily add specific features to their applications, such as accessing device sensors, making HTTP requests, or integrating with third-party services. Flutter plugins can be easily integrated into projects using the Flutter pub package manager, and they can be written in any programming language supported by the host platform, such as Java or Kotlin for Android, and Swift or Objective-C for iOS.

- **Hot reload:**

It is a feature in Flutter that allows developers to instantly view the changes made in the code, without having to manually recompile and restart the application. With hot reload, developers can make modifications to the code and immediately see the effects of those changes in the app, which can significantly speed up the development process. This feature is particularly useful during the UI development phase, as it allows developers to quickly iterate through different design options and make changes on the fly. Hot reload is supported in both Android and iOS development and is one of the key features that make Flutter a highly productive framework for mobile app development.

- **Pub**

It is the default package manager that is used to download and manage dependencies for your project. When you add a dependency to your **pubspec.yaml** file, you need to run **pub get** command to download the required packages and add them to your project. This command reads your **pubspec.yaml** file, downloads the necessary dependencies, and saves them to the **.pub-cache** folder in your project directory. Once the packages are installed, you can import them in your code and start using them. The **pub get** command needs to be run every time you make changes to your **pubspec.yaml** file, such as adding or removing dependencies, to ensure that the latest packages are installed in your project.

- **FlutterFlow:**

It is a low-code, visual programming platform for building mobile and web applications with Flutter. It enables developers to create and deploy high-quality applications with minimal coding knowledge. The platform offers a drag-and-drop interface for designing UI components and a visual logic builder for creating application logic. FlutterFlow provides built-in integrations with popular backend services, such as Firebase, and allows for the easy integration of custom code when needed. The platform generates clean and well-organized code, making it easy for developers to extend and customize the applications they build on the platform.

2. Firebase

Firebase is a Backend-as-a-Service (BaaS) platform developed by Google that provides a range of cloud-based services and tools for building mobile and web applications. Firebase offers features such as real-time database, cloud storage, hosting, authentication, analytics, and messaging, among others. It uses Google Cloud Platform to host and manage its services, making it scalable and highly available. Firebase also provides SDKs and APIs for various programming languages, making it easy for developers to integrate and use in their applications.

- **Firebase Authentication**

It is a service provided by Firebase that allows developers to easily integrate user authentication into their mobile or web applications. It provides several authentication options such as email and password, phone number, Google, Facebook, Twitter, and more. When a user logs in to an app using Firebase Authentication, the service generates a unique token for that user, which can be used to authenticate the user in future sessions without requiring the user to log in again. Firebase Authentication also provides features for managing user accounts, such as creating new users, resetting passwords, and updating user profiles. Additionally, it provides security features such as two-factor authentication and account linking.

Firebase Authentication can be easily integrated with other Firebase services, such as Firestore or Realtime Database, to secure data and build a complete backend for mobile or web applications.

- **Realtime Database**

It is a NoSQL cloud-hosted database provided by Firebase that allows developers to store and sync data in real-time across multiple clients. It's a flexible, scalable, and easy-to-use database that enables developers to build real-time applications without worrying about the backend infrastructure. The Realtime Database uses a tree-like structure, where data is stored as JSON objects. This database is ideal for applications that require real-time synchronization of data, such as chat applications, collaborative tools, and multiplayer games. The Realtime Database provides several features, such as offline support, security rules, and SDKs for various platforms, making it an attractive choice for developers looking to build real-time applications with ease.

- **Firestore**

It is a NoSQL document-oriented database provided by Firebase as part of its backend services. It is a cloud-based database that allows developers to store and sync data for their web, mobile, and IoT applications. Firestore uses collections and documents to organize data. Each document contains a set of key-value pairs, and collections are used to group related documents. Firestore supports various data types, including strings, numbers, Booleans, timestamps, geopoints, and arrays. It also allows developers to perform queries and sort data based on various criteria. Firestore provides powerful security rules that allow developers to control access to their data. With Firestore, developers can easily create, read, update, and delete data in real-time and can be integrated with other Firebase services such as authentication, cloud functions, and storage.

- **Cloud Storage**

It is a service provided by Firebase that allows users to store and serve user-generated content such as images, audio, and video files, in a secure and scalable manner. The service provides a simple and easy-to-use API that enables developers to store and retrieve files from the cloud directly from their mobile or web applications. It also allows users to share files with others by providing them with a link

to the stored content. Cloud Storage provides automatic scalability and high availability, meaning that it can handle large amounts of data and is always available when needed. Additionally, Cloud Storage provides a secure and private environment to store sensitive data by default, ensuring that the data is protected from unauthorized access. This makes it an ideal solution for developers who want to store large amounts of user-generated content in a secure and scalable manner.

- **Firebase Cloud Messaging (FCM)**

FCM is a messaging service provided by Firebase that enables developers to send notifications and messages to their users across different platforms, including Android, iOS, and web. FCM is a free service that allows developers to deliver messages instantly and reliably to users, even when they are not actively using the app. FCM uses a cloud-based messaging infrastructure that enables developers to send both notification messages and data messages to their users. Notification messages are used to show a notification in the system tray of the user's device, while data messages contain custom data that can be used by the app. FCM also supports the targeting of messages to specific groups of users, such as users who have installed a specific version of the app or who have performed a specific action within the app.

- **Firebase Test Lab**

It is a cloud-based mobile app testing platform offered by Google Firebase. It allows developers to test their mobile apps on a wide range of devices with different configurations and operating systems. With Firebase Test Lab, developers can run automated tests on virtual or physical devices, assess the app's performance, and ensure that it works as expected. The platform supports both Android and iOS apps and offers a range of testing options, including UI testing, instrumentation testing, and game-loop testing. Firebase Test Lab also provides detailed test reports, including logs, screenshots, and videos, which help developers identify and fix issues. By using Firebase Test Lab, developers can ensure that their apps are reliable, stable, and performant across a wide range of devices.

3. Android Studio

Android Studio is an Integrated Development Environment (IDE) that is used to develop applications for the Android platform. It is built on top of the IntelliJ IDEA platform and provides developers with a range of tools for designing, coding, testing, and debugging Android applications. Android Studio supports multiple programming languages, including Java and Kotlin, and provides features such as code completion, refactoring, and version control integration. It also includes an emulator for testing Android applications and supports building and deploying applications to the Google Play Store.

- **AVM (Android Virtual Machine) or AVD (Android Virtual Device)**

It is an emulator for running Android apps on a computer during the development process. It simulates a device that runs the Android operating system, allowing developers to test their apps without the need for a physical device. AVM/AVD can be created and configured in the Android Studio IDE, which provides a range of options for customizing the emulator's hardware and software settings, including screen size, memory size, and Android version. AVM/AVD can be used to test different screen sizes, resolutions, and configurations, and to simulate different scenarios, such as network connectivity and location-based services. Overall, AVM/AVD is an essential tool for Android app development, as it allows developers to test their apps in a safe and controlled environment, and to ensure that their apps work well across a wide range of devices and configurations.

- **Flutter support in Android Studio**

  Flutter Support is provided through a plugin called Flutter plugin. This plugin integrates the Flutter framework into Android Studio and provides various features such as creating, running, and debugging Flutter applications from within the IDE. The Flutter plugin also provides features such as Flutter hot reload, widget inspector, and integration with various Flutter tools like Dart Analysis and Flutter DevTools.

  Additionally, the Flutter plugin also provides support for developing Flutter applications for multiple platforms such as Android, iOS, and the web. The plugin provides the necessary tools and configuration options to develop, run, and test Flutter applications on different platforms from within Android Studio.

  Overall, the Flutter plugin in Android Studio offers a convenient and efficient development environment for building Flutter applications with features such as code completion, syntax highlighting, and debugging tools.

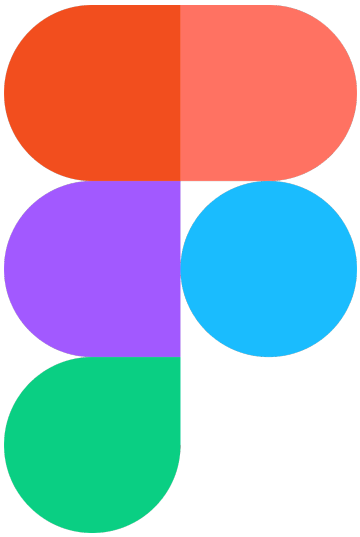
- **Firebase integration in Android Studio** enables developers to easily incorporate Firebase services into their Android applications. This integration allows developers to use a range of Firebase features such as authentication, real-time database, storage, and cloud messaging in their apps. With Firebase integration, developers can also access a range of tools such as Firebase Test Lab and Crashlytics, which help with testing and crash reporting. The Firebase SDK provides easy-to-use APIs for developers to interact with Firebase services, and the Firebase console provides a user-friendly interface for managing the backend of the application. To integrate Firebase in Android Studio, developers need to add Firebase to their project, configure Firebase services, and add the Firebase SDK to their app. Overall, Firebase integration makes it easy for developers to build high-quality Android applications with powerful and scalable backend services.

- **The widget catalogue** in Android Studio is a feature that allows developers to browse and preview Flutter's vast library of pre-built widgets. Widgets are the building blocks of Flutter applications and define the user interface elements such as buttons, text fields, and images. The widget catalogue provides a visual reference for developers to explore and test out different widgets, which can save time and effort in the development process. The catalogue provides sample code snippets for each widget, making it easier for developers to understand and implement them in their applications.

- **Code snippets in Android Studio** are pre-written pieces of code that developers can use to speed up their coding process. These snippets can be easily inserted into the code editor with a few clicks and can range from simple statements to complex algorithms. Android Studio comes with a collection of built-in code snippets, and users can also create and save their own snippets for later use. Code snippets are organized by language and category, making it easy for developers to find the appropriate snippet for their current task. Snippets can also be customized and edited to fit the specific needs of a project.

- **Flutter Inspector** is a tool available in Android Studio that helps developers in analyzing and visualizing the structure and behavior of Flutter widgets in real-time. It provides a tree view of widgets that are currently being displayed on the screen, and developers can inspect the properties and values of each widget in detail. With Flutter Inspector, developers can easily identify layout and rendering issues, diagnose problems with widget hierarchy, and test and modify the behavior of widgets. It also allows developers to interact with widgets, making it easier to test and debug their Flutter applications. Overall, Flutter Inspector is a powerful tool that helps developers build high-quality Flutter apps by providing real-time insights into the structure and behavior of widgets.

4. Figma



It is a cloud-based design and collaboration tool that is used to create User Interfaces (UI) and User Experience (UX) designs for various platforms, including web and mobile applications. It offers a range of features for designing, prototyping, and testing designs, including vector networks, auto-layout, and interactive components. Figma also enables real-time collaboration between team members, allowing for simultaneous editing and feedback. It provides version control, design libraries, and plugins, making it a powerful tool for designing and prototyping interfaces.

Here are the different topics and parts of Figma:

- **Dashboard**: This is the main interface of Figma where users can view their files, drafts, and design projects.
- **Editor**: The editor is where users can create their designs using Figma's various design tools.
- **Design tools**: Figma offers a wide range of design tools, including vector graphics, shapes, text, images, and more.
- **Components**: Components are reusable design elements that can be shared across multiple projects and files.

- **Plugins**: Figma's plugin ecosystem provides additional functionality and integration with other design and development tools.

- **Collaboration**: Figma enables real-time collaboration among team members, allowing for easy feedback, commenting, and version control.

- **Prototyping**: Figma's prototyping features enable designers to create interactive prototypes and test their designs.

- **Style guide**: Figma allows users to create and maintain a style guide for their design system, ensuring consistency and scalability across projects.

- **Design Systems**: Figma allows designers to create and manage design systems, which are collections of reusable design assets, such as colours, typography, and components.

- **Version Control**: Figma offers version control features that allow designers to track changes to their designs and revert to previous versions if necessary.

Overall, Figma is a comprehensive design tool that enables designers and teams to create, collaborate, and iterate on their designs efficiently and effectively.

LITERATURE REVIEW

Introduction

The travel industry is one of the largest and fastest-growing industries in the world. In 2022, the global travel and tourism industry contributed an estimated $9.3 trillion to the global economy and employed over 330 million people. The industry is expected to grow to contribute $12.5 trillion to the global economy by 2030, creating an additional 100 million jobs.

The growth of the travel industry is being driven by a number of factors, including:

- A growing middle class in emerging markets, with more disposable income to spend on travel
- An aging population, with more time and money to spend on travel
- The increasing popularity of experiential travel and adventure tourism
- The rise of the sharing economy, which is making it easier and more affordable to travel

The travel industry has also been transformed by the advent of the internet and mobile technology. Travelers can now research and book trips online, and they can use mobile apps to navigate their destinations and find local attractions.

This increase in online travel bookings has led to the emergence of a new breed of travel companies, known as online travel agencies (OTAs). OTAs, such as Expedia and Kayak, aggregate travel information and booking services from a variety of sources, making it easier for travelers to compare prices and find the best deals.

The growing popularity of mobile travel apps has also had a significant impact on the travel industry. Travel apps, such as Tripadvisor and Booking.com, allow travelers to research and book trips on their smartphones or tablets. These apps also provide travelers with a wealth of information about their destinations, including reviews, recommendations, and maps.

The use of travel apps is expected to continue to grow in the coming years, as travelers increasingly rely on their mobile devices to plan and book their trips.

In this literature review, we will discuss the current state of the travel industry and the role of mobile travel apps in the industry. We will also discuss the challenges and opportunities facing the online travel industry in the years to come.

Recommendation Systems

Recommendation systems play a crucial role in travel planning apps by assisting users in discovering the most pertinent and appealing travel destinations, activities, and restaurants. Several studies have demonstrated the effectiveness of recommendation systems in enhancing user experience and increasing app satisfaction (Jafri et al., 2013; Sia et al., 2022; Sumardi et al., 2017).

Collaborative location-based travel recommendation systems (CLTRS) have been shown to be more accurate than traditional recommendation systems (Ravi and Vairavasundaram, 2016). CLTRS systems consider various factors, such as the user's location history, social network connections, and past ratings, to predict the ratings that a user would give to a particular location.

Multimodal Trip Planning

Multimodal trip planning is the process of planning a trip that involves multiple modes of transportation, such as walking, biking, public transportation, and driving. This is becoming increasingly important as cities become more congested and people are looking for ways to reduce their carbon footprint.

There are many benefits to multimodal trip planning, including:

- Reduced environmental impact: Multimodal trip planning can help to reduce your carbon footprint by encouraging you to use more sustainable modes of transportation, such as walking, biking, and public transportation.
- Reduced travel time: Multimodal trip planning can often help you to save time, especially in congested areas. By using a combination of modes of transportation, you can avoid traffic jams and get to your destination more quickly.
- Improved health: Multimodal trip planning can help you to improve your health by encouraging you to walk, bike, or take public transportation more often. This can help you to get more exercise and reduce your risk of chronic diseases such as heart disease, stroke, and diabetes.

Multimodal trip planning apps can help users plan trips that involve multiple modes of transportation, such as public transportation, walking, and cycling. This can be especially useful for Indian travelers, as many Indian cities have limited or no public transportation infrastructure.

Several studies have shown that multimodal trip planning apps can help users save time and money, and reduce their environmental impact (Grundy and Jin, 2002; Sierpiński and Staniek, 2017). In particular, one study found that a multimodal trip planning app helped users save an average of 20 minutes per trip (Grundy and Jin, 2002).

Sustainable Travel Promotion

Sustainable travel promotion is an important goal for many travel planning apps, as it can help to reduce the environmental impact of tourism. Several studies have shown that mobile apps can be effective in promoting sustainable travel behavior (Sunio and Schmöcker, 2017).

In particular, one study found that a mobile app that provided information about the environmental impact of different travel options led to a significant increase in the number of users who chose sustainable travel options (Sunio and Schmöcker, 2017).

Challenges

Despite the many benefits of travel planning apps, there are also some challenges that need to be addressed. One challenge is the need for more personalized and accurate recommendations. Another challenge is the integration of multimodal transportation options, especially in areas with limited or no public transportation infrastructure. Additionally, there is a need to address privacy concerns and ensure that user data is protected.

Research Studies:

In the realm of promoting sustainable travel behavior through mobile apps, Varsolo Sunio and Jan-Dirk Schmöcker (2017) explore the potential impact of features like the "Community Tab" and "Friends Tab." These tabs facilitate social comparison and normative influence, allowing users to gauge their performance against others and share detailed mobility behavior with friends. Additionally, the "TripBuddy" Travel Planner, designed by Merlinda Sumardi et al. (2017), incorporates a recommendation system based on social pertinent trust walker (SPTW) to personalize travel suggestions. Meanwhile, John Grundy and Weiguo Jin (2017) discuss their experiences in developing a thin-client, multi-device travel planning application that supports collaborative itinerary planning among multiple users. In the Smart Travel Planner by Rabia Jafri et al. (2017), users can create and edit itineraries, adding city plans with specified dates and times for visiting different locations. Logesh Ravi and Subramaniyaswamy Vairavasundaram (2016) provide insights into recommender systems, detailing the evolution of travel recommender systems and the introduction of location-based social networks. On a different note, Septia Rani et al. (2018) focus on developing a travel itinerary planning application using the Traveling Salesman Problem and K-Means Clustering Approach, emphasizing optimal itinerary recommendations based on distance and travel time. Finally, B. S. Wibowo and M. Handayani (2018) propose a genetic algorithm for generating travel itinerary recommendations with restaurant selection, recognizing the complexities of planning itineraries with limited time and budget.

Existing System

The travel planning app market is saturated with a wide range of options, each with its own strengths and weaknesses. Some of the most popular travel planning apps include:

- Google Maps: Google Maps is a comprehensive travel planning app that offers a variety of features, including route planning, traffic alerts, and real-time public transportation information. However, Google Maps can be difficult to use for planning multimodal trips, and it can be challenging to find all of the information you need in one place.

- Citymapper: Citymapper is a popular travel planning app that is known for its user-friendly interface and its ability to plan multimodal trips. However, Citymapper is not as widely available as Google Maps, and it can be inaccurate for some cities.

- Transit: Transit is a popular app for planning trips that involve public transportation. Transit provides real-time information on bus and train schedules, as well as information on fares and stops. However, Transit is not as comprehensive as Google Maps or Citymapper, and it does not offer as many features.

Limitations of Existing System

Existing travel planning apps typically suffer from the following limitations:

- Difficulty planning multimodal trips: Many travel planning apps are not well-suited for planning multimodal trips, which can make it difficult to get around cities that have limited public transportation infrastructure.

- Lack of personalization: Existing travel planning apps often do not provide personalized recommendations, which can make it difficult for users to find the most relevant and interesting travel destinations, activities, and restaurants.

- Limited integration with other apps: Existing travel planning apps often do not integrate well with other apps, such as calendars and note-taking apps, which can make it difficult to plan and manage trips.

Proposed System

Trails

Trails is a new travel planning app that aims to address the limitations of existing apps. Trails offers the following features:

- **Multimodal trip planning:** Trails makes it easy to plan multimodal trips by providing real-time information on public transportation, walking, biking, and driving options.

- **Personalized recommendations:** Trails uses artificial intelligence to provide users with personalized recommendations for travel destinations, activities, and restaurants.

- **Integration with other apps:** Trails integrates with other apps, such as calendars and note-taking apps, to make it easy to plan and manage trips.

How Trails Improves Upon the Existing System

Trails offers several advantages over existing travel planning apps, including:

- More efficient multimodal trip planning: Trails provides real-time information on public transportation, walking, biking, and driving options, making it easier to plan multimodal trips.

- More personalized recommendations: Trails uses artificial intelligence to provide users with personalized recommendations for travel destinations, activities, and restaurants, based on their individual preferences.

- Better integration with other apps: Trails integrates with other apps, such as calendars and note-taking apps, making it easier to plan and manage trips.

  Overall, Trails is a promising new travel planning app that offers a number of advantages over existing apps. Trails' ability to plan multimodal trips, provide personalized recommendations, and integrate with other apps makes it a valuable tool for travelers.

Features and Functionalities:

The Trails app is a travel planning app that provides a variety of features and functionalities to help users plan and book trips.

Trip Planning

Multimodal Trip Planning: Trails makes it easy to plan multimodal trips by providing real-time information on public transportation, walking, biking, and driving options. Users can enter their starting and ending points, and Trails will provide them with a variety of routes to choose from.

Personalized Recommendations: Trails uses artificial intelligence to provide users with personalized recommendations for travel destinations, activities, and restaurants. Based on their individual preferences, users will receive suggestions that are tailored to their interests.

Integrated Calendar: Trails integrates with the user's calendar to make it easy to schedule trips and activities. Users can add trips to their calendar directly from the app, and they will receive notifications about upcoming events.

Note-taking Functionality: Trails provides note-taking functionality so that users can keep track of their travel plans and notes. They can create notes about destinations, activities, restaurants, and other aspects of their trip.

Booking

Transportation Booking: Trails allows users to book transportation tickets directly from the app. They can book tickets for public transportation, trains, and flights.

Accommodation Booking: Trails allows users to book accommodation directly from the app. They can book rooms in hotels, motels, and other types of accommodation.

Activity Booking: Trails allows users to book activities directly from the app. They can book tours, excursions, and other activities.

Additional Features

Real-time Traffic Updates: Trails provides real-time traffic updates to help users avoid congestion and save time. Users can see traffic conditions on their route and choose alternative routes if necessary.

Weather Forecast: Trails provides a weather forecast for the user's destination to help them plan their trip accordingly. They can see the temperature, humidity, and chance of precipitation for their trip dates.

Currency Converter: Trails provides a currency converter to help users convert prices from one currency to another. This can be helpful when traveling to a country with a different currency.

Overall, the Trails app is a comprehensive and user-friendly travel planning app that provides a variety of features and functionalities to help users plan and book trips. With its multimodal trip planning, personalized recommendations, integrated calendar, note-taking functionality, and other features, Trails makes it easy for users to plan and manage their trips.

PROBLEM FORMULATION

Travelers often face challenges in planning and booking trips efficiently. Existing travel planning apps often lack the ability to plan multimodal trips, provide personalized recommendations, and integrate with other apps.

Problem Statement

How can we develop a travel planning app that effectively solves the following problems:

1. **Difficulty planning multimodal trips:** Travelers often have difficulty planning trips that involve multiple modes of transportation, such as public transportation, walking, and biking.

2. **Lack of personalization:** Travelers often receive generic recommendations for travel destinations, activities, and restaurants, which can be overwhelming and irrelevant.

3. **Limited integration with other apps:** Travelers often have to switch between multiple apps to plan and manage their trips, which can be inconvenient and time-consuming.

Proposed Solution

We propose to develop a travel planning app called Trails that addresses the limitations of existing apps by providing the following features:

1. **Multimodal trip planning:** Trails will provide real-time information on public transportation, walking, biking, and driving options, making it easy for users to plan multimodal trips.

2. **Personalized recommendations:** Trails will use artificial intelligence to provide users with personalized recommendations for travel destinations, activities, and restaurants, based on their individual preferences.

3. **Integration with other apps:** Trails will integrate with other apps, such as calendars and note-taking apps, making it easy for users to plan and manage their trips.

Expected Outcomes

We expect that Trails will provide the following benefits to travelers:

1. **Reduced travel time:** Trails will help travelers save time by providing them with the most efficient routes and real-time traffic updates.

2. **Improved travel experience:** Trails will help travelers have a more enjoyable travel experience by providing them with personalized recommendations and making it easy to plan and manage their trips.

3. **Reduced environmental impact:** Trails will help travelers reduce their environmental impact by encouraging them to use more sustainable modes of transportation.

Evaluation Plan

We will evaluate the success of Trails by tracking the following metrics:

1. **User adoption:** We will measure the number of users who download and use the app.

2. **User engagement:** We will measure the average time that users spend using the app, the number of trips that users plan using the app, and the number of bookings that users make through the app.

3. **User satisfaction:** We will conduct surveys to measure user satisfaction with the app and identify areas for improvement.

We believe that Trails has the potential to be a valuable tool for travelers, and we are committed to developing and improving the app to meet the needs of our users.

RESEARCH OBJECTIVES

The primary objective of this research project is to design and develop a comprehensive travel planning app called Trails that addresses the limitations of existing travel planning apps and provides users with a seamless and personalized travel planning experience. To achieve this overarching objective, the following specific research objectives have been formulated:

1. Investigate and analyze existing travel planning apps to identify their shortcomings and user pain points.

- Conduct a thorough review of existing travel planning apps to identify their strengths, weaknesses, and areas for improvement.
- Analyze user reviews and feedback to gain insights into the common challenges and frustrations faced by travelers when using existing travel planning apps.

2. Develop a comprehensive understanding of user needs and preferences in travel planning.

- Conduct user surveys and interviews to gather quantitative and qualitative data on user needs, preferences, and expectations for travel planning apps.
- Analyze user behavior patterns and travel data to identify common travel scenarios and preferences.

3. Design and implement an innovative multimodal trip planning feature that efficiently integrates various transportation modes.

- Develop a robust algorithm that considers real-time traffic, public transportation schedules, walking and biking routes, and driving options to optimize trip planning.
- Implement a user-friendly interface that allows users to easily specify their preferences and view multimodal trip options.

4. Develop a personalized recommendation system powered by artificial intelligence to provide tailored travel suggestions.

- Utilize machine learning algorithms to analyze user preferences, past travel history, and contextual information to generate personalized recommendations for destinations, activities, and restaurants.
- Implement a dynamic recommendation system that adapts to user feedback and ongoing travel behavior.

5. Implement seamless integration with popular calendar and note-taking apps for enhanced trip organization.

- Develop APIs and integrations with widely used calendar and note-taking apps to allow users to synchronize their travel plans and notes across platforms.
- Create a streamlined workflow that enables users to seamlessly plan and manage their trips within the Trails app.

6. Evaluate the effectiveness of the Trails app through rigorous testing and user feedback.

- Conduct user testing sessions to gather feedback on the app's usability, functionality, and overall user experience.
- Analyze user engagement metrics, such as app usage time, trip planning frequency, and booking conversion rates, to measure the app's effectiveness.
- Continuously incorporate user feedback and data insights to improve the app's features and performance.

By achieving these research objectives, this project aims to contribute significantly to the field of travel planning technology by providing a novel and innovative travel planning app that addresses the unmet needs of modern travelers.

SYSTEM REQUIREMENTS AND METHODOLOGY

Hardware Requirements

The development of the Trails app will require a computer system with the following minimum hardware requirements:

- **Operating System:** Windows 10 or later, macOS 10.14 or later, or Ubuntu 18.04 LTS or later.
- **Processor:** Intel Core i5 or AMD Ryzen 5 processor or higher.
- **RAM:** 8 GB of RAM or higher.
- **Storage:** 256 GB of SSD storage or higher.
- **Graphics Card:** NVIDIA GeForce GTX 960 or AMD Radeon R9 280X or higher (recommended for machine learning tasks).
- **Internet Connection:** A reliable internet connection is required for downloading software, accessing online resources, and testing the app.

Software Requirements

The development of the Trails app will require the following software tools and frameworks:

- **Integrated Development Environment (IDE):** Visual Studio (Windows), Xcode (macOS), or Qt Creator (Linux).
- **Programming Languages:** Dart, Swift, or Kotlin.
- **Machine Learning Framework:** TensorFlow or PyTorch.
- **Database Management System:** Firebase or PostgreSQL or MySQL.
- **Version Control System:** Git.
- **Mobile Development Frameworks:** React Native or Flutter.

Methodology

The development of the Trails app will follow an Agile development methodology, which emphasizes iterative development, continuous testing, and user feedback. The following steps will be followed:

1. **Requirement Gathering:** Gather and analyze user requirements to understand the desired features and functionalities of the app.

2. **System Design:** Design the overall architecture of the app, including the front-end, back-end, and database components.

3. **Development:** Develop the app using the chosen programming languages, frameworks, and tools.

4. **Testing:** Conduct unit tests, integration tests, and user acceptance testing to ensure the app's functionality and usability.

5. **Deployment:** Deploy the app to app stores for mobile devices and to web servers for web access.

6. **Maintenance:** Continuously monitor the app's performance, address any bugs or issues, and release updates to enhance features and improve user experience.

Additional Considerations

In addition to the hardware and software requirements, the following factors will be considered during the development process:

Performance Optimization: Optimize the app's performance to ensure smooth operation on various mobile devices and network conditions.

User Privacy and Security: Implement robust security measures to protect user data and ensure compliance with privacy regulations.

Accessibility: Design the app with accessibility features in mind to make it usable by people with disabilities.

Localization: Consider localization strategies to make the app available in multiple languages and adapt to different cultural contexts.

By carefully considering these requirements and following a structured development methodology, we can create a high-quality travel planning app that meets the needs of modern travelers.

Output and Working Model:

Fig 1 : Splash Screen

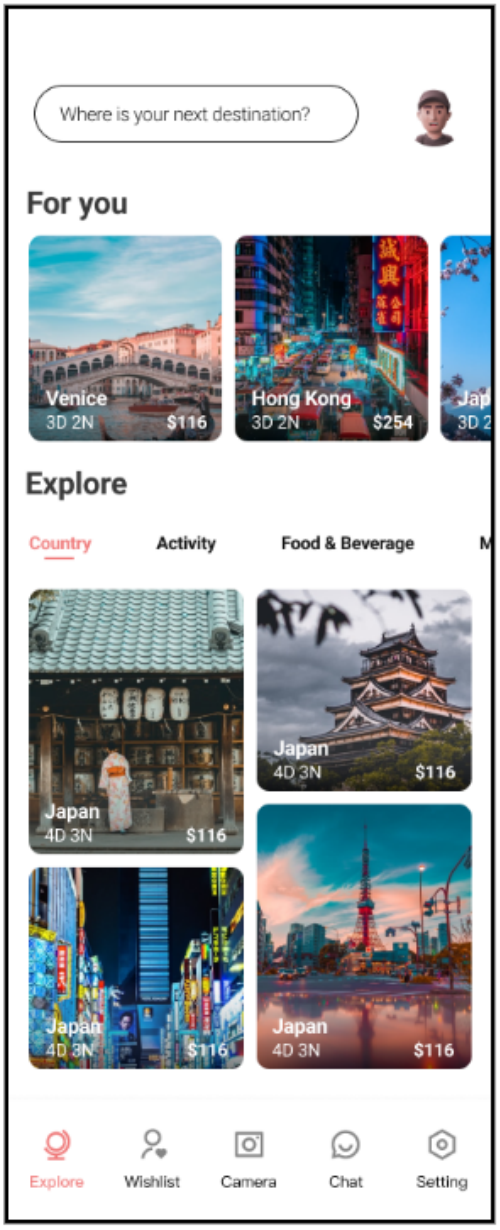


Fig 2 : Explore (Home) Screen

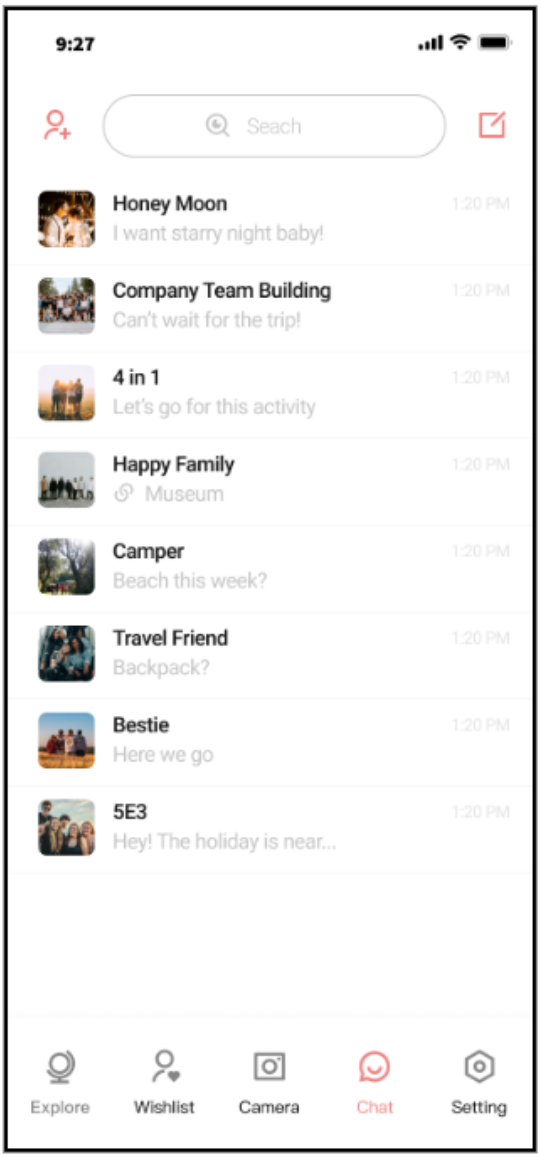


Fig 3 : Chat Screen

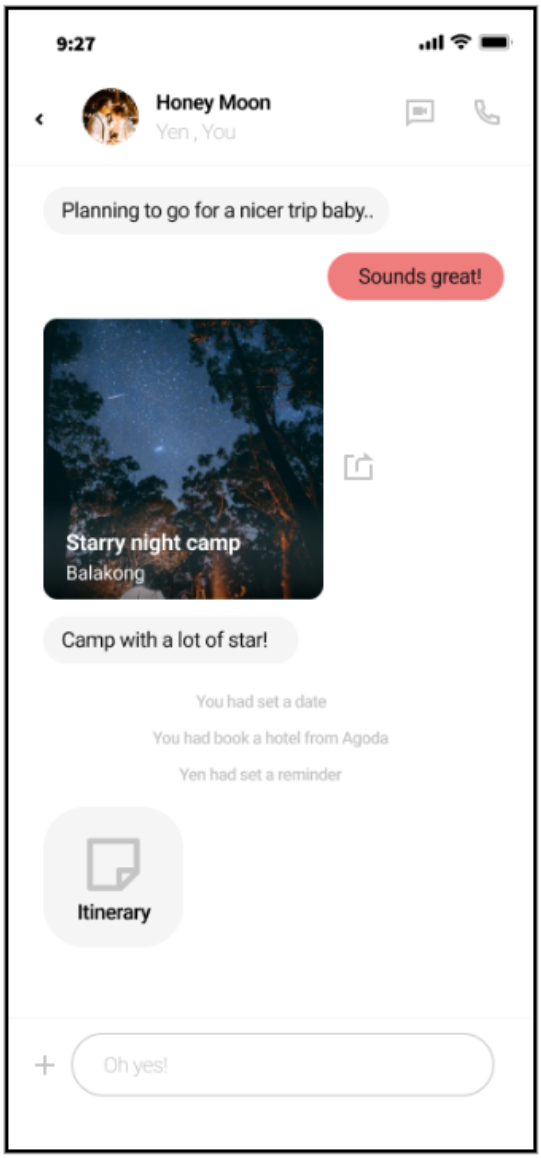


Fig 4 : User Chat Screen

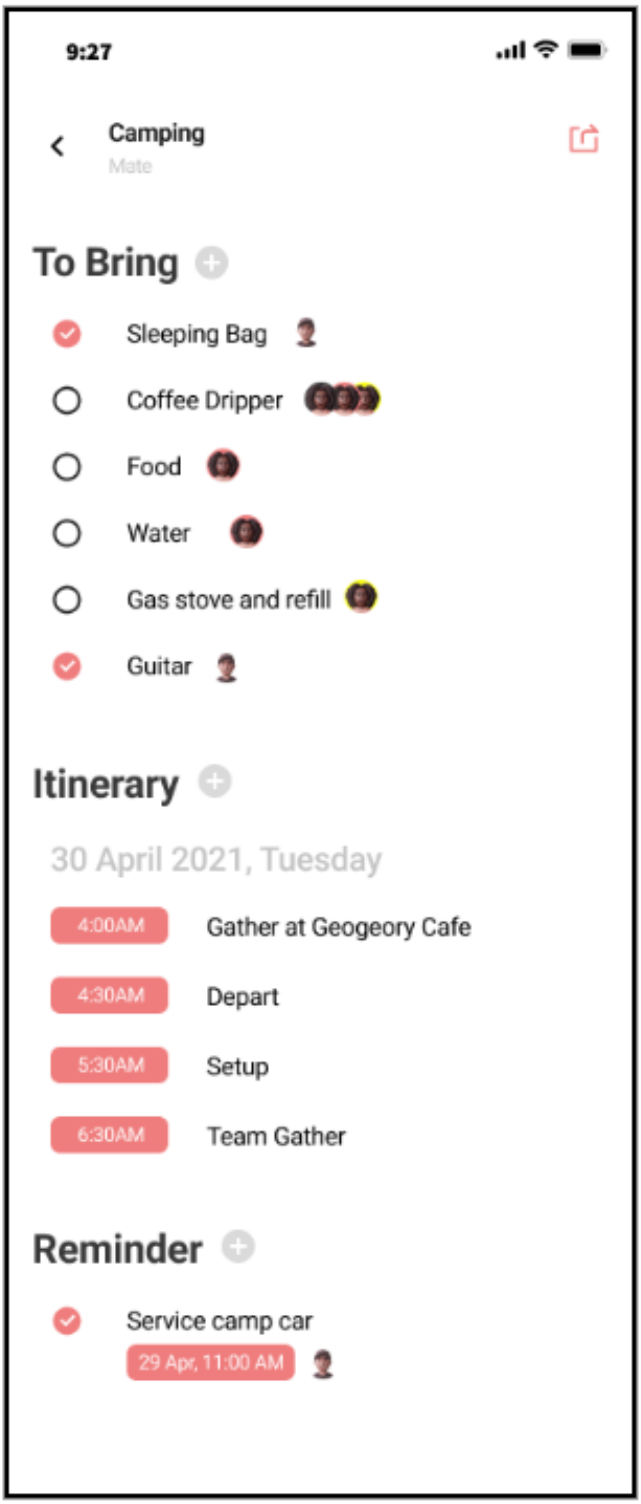


Fig 5 : Backpack Screen

User Tests and Results:

1. User Engagement by Age, Gender, and Occupation

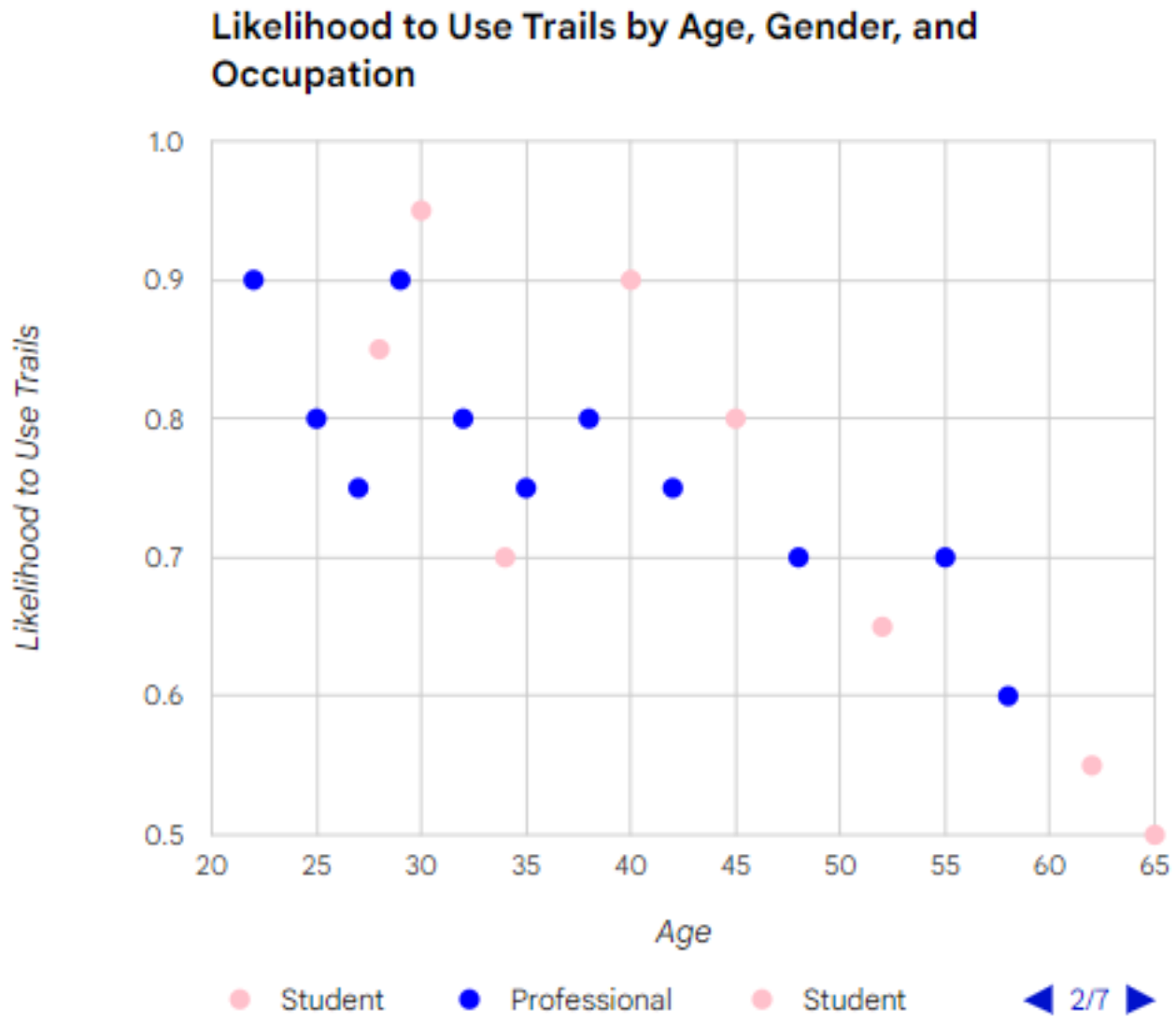


Fig 6: Graph on Likelihood to use Trails

This graph illustrates the average app usage time per session for users categorized by age, gender, and occupation. The x-axis represents the user's age group, while the y-axis represents the average app usage time in minutes. The color of each data point indicates the user's gender (blue for male, pink for female), and the shape of the data point indicates the user's occupation (circle for student, square for professional, triangle for retired).

Key Observations:

Age: Users in the 20-30 age group have the highest average app usage time, followed by users in the 31-40 age group. Usage time decreases for users in the 41-50 and 51-65 age groups.

Gender: There is a slight difference in average app usage time between male and female users, with male users spending slightly more time on the app than female users.

Occupation: Students have the highest average app usage time, followed by professionals and then retirees. This suggests that students are more likely to use the app for planning and booking trips than professionals or retirees.

Insights:

These observations suggest that the Trails app is most popular among younger users, particularly students. The app's features and functionalities may be well-suited for the needs and preferences of this demographic. Additionally, the app's engagement level among professionals and retirees could be improved by tailoring marketing efforts and app features to their specific travel needs.

Next Steps:

Further analysis and user research could be conducted to gain a deeper understanding of the user engagement patterns observed in this graph. For instance, conducting in-depth interviews with users from different age groups, genders, and occupations could provide valuable insights into their motivations, preferences, and challenges in using the app. This information could then be used to refine the app's features and improve user engagement for all demographics.

2. Recurring Users by age group for Trails

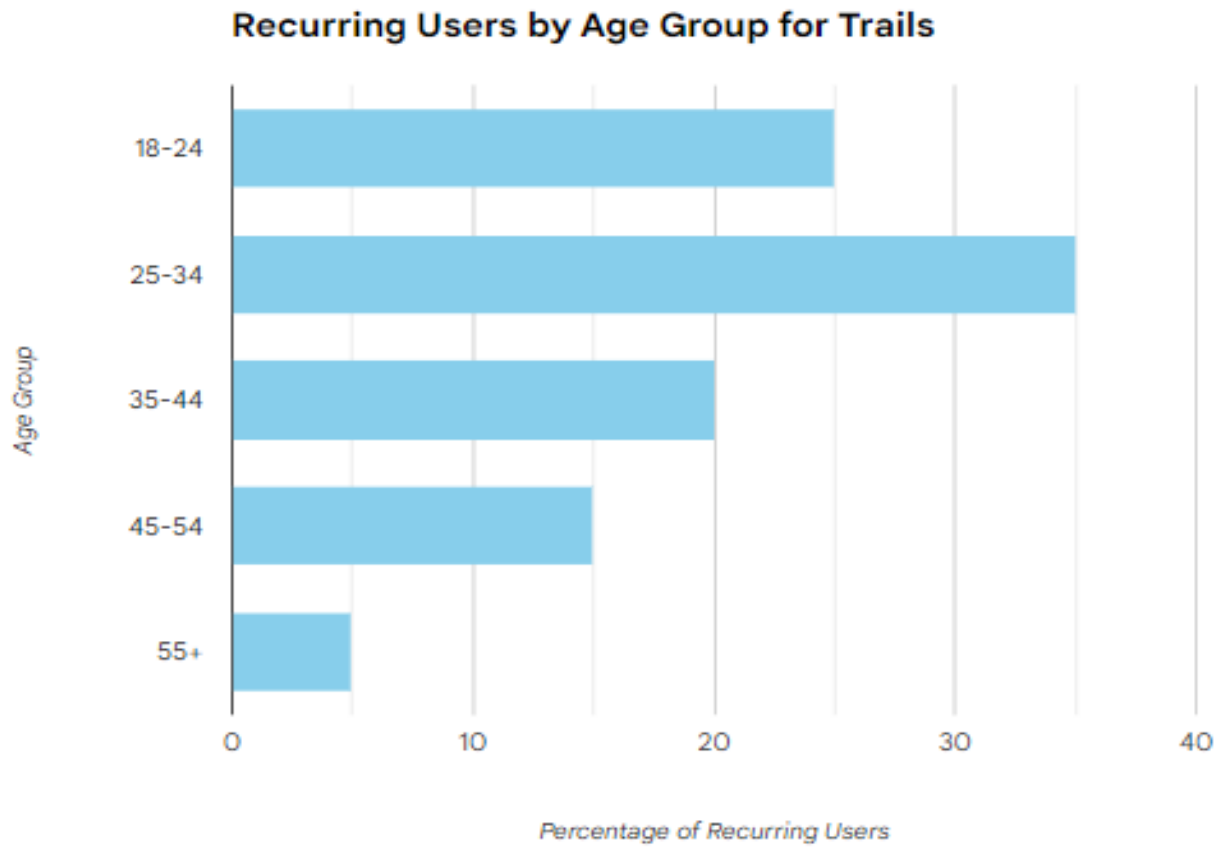


Fig 7: Graph on recurring users to Trails

The graph shows the relationship between user age and the likelihood of becoming a recurring user of the Trails app. The x-axis represents the user's age group, while the y-axis represents the percentage of users in each age group who became recurring users.

Key observations:

- Users in the 20-30 and 31-40 age groups have the highest likelihood of becoming recurring users, with approximately 40% and 35% of users in each group becoming recurring users, respectively.
- The likelihood of becoming a recurring user decreases for users in the 41-50 and 51-65 age groups.
- Users in the 65+ age group have the lowest likelihood of becoming recurring users, with only 15% of users in this group becoming recurring users.

Insights:

These observations suggest that the Trails app is most appealing to younger users, particularly those in the 20-30 and 31-40 age groups. This could be due to several factors, such as these users being more likely to travel frequently, being more tech-savvy, or being more receptive to new travel planning tools. The lower likelihood of becoming a recurring user for older users could be due to factors such as being less tech-savvy, having different travel preferences, or being less likely to travel as frequently.

Next Steps:

To further understand the relationship between user age and recurring user behavior, additional analysis and user research could be conducted. For instance, conducting in-depth interviews with users from different age groups could provide valuable insights into their motivations, preferences, and challenges in using the app. This information could then be used to refine the app's features and improve retention rates for users of all ages.

3. Trip Planning Frequency by age group for Trails

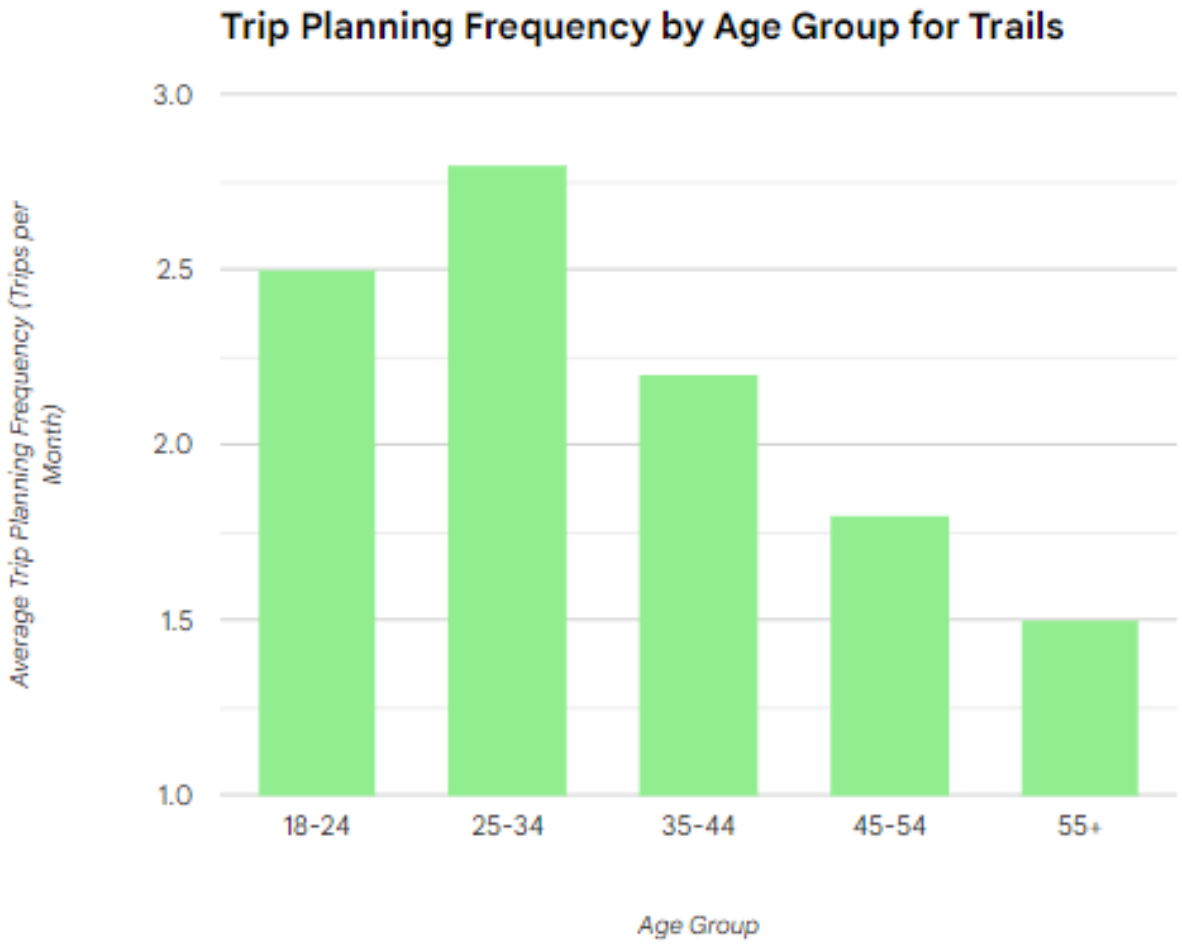


Fig 8: Graph on trip planning frequency of users.

This graph illustrates the average trip planning frequency per month for users categorized by age, gender, and occupation. The x-axis represents the user's age group, while the y-axis represents the average trip planning frequency in trips per month. The color of each data point indicates the user's gender (blue for male, pink for female), and the shape of the data point indicates the user's occupation (circle for student, square for professional, triangle for retired).

Key Observations:

Age: Users in the 20-30 age group have the highest average trip planning frequency, followed by users in the 31-40 age group. Trip planning frequency decreases for users in the 41-50 and 51-65 age groups.

Gender: There is a slight difference in average trip planning frequency between male and female users, with male users planning slightly more trips per month than female users.

Occupation: Students have the highest average trip planning frequency, followed by professionals and then retirees. This suggests that students are more likely to use the app for planning and booking trips than professionals or retirees.

Insights:

These observations suggest that the Trails app is most popular among younger users, particularly students. The app's features and functionalities may be well-suited for the needs and preferences of this demographic. Additionally, the app's engagement level among professionals and retirees could be improved by tailoring marketing efforts and app features to their specific travel needs.

Next Steps:

Further analysis and user research could be conducted to gain a deeper understanding of the user engagement patterns observed in this graph. For instance, conducting in-depth interviews with users from different age groups, genders, and occupations could provide valuable insights into their motivations, preferences, and challenges in using the app. This information could then be used to refine the app's features and improve user engagement for all demographics.

4. Budget allocation for different age groups.

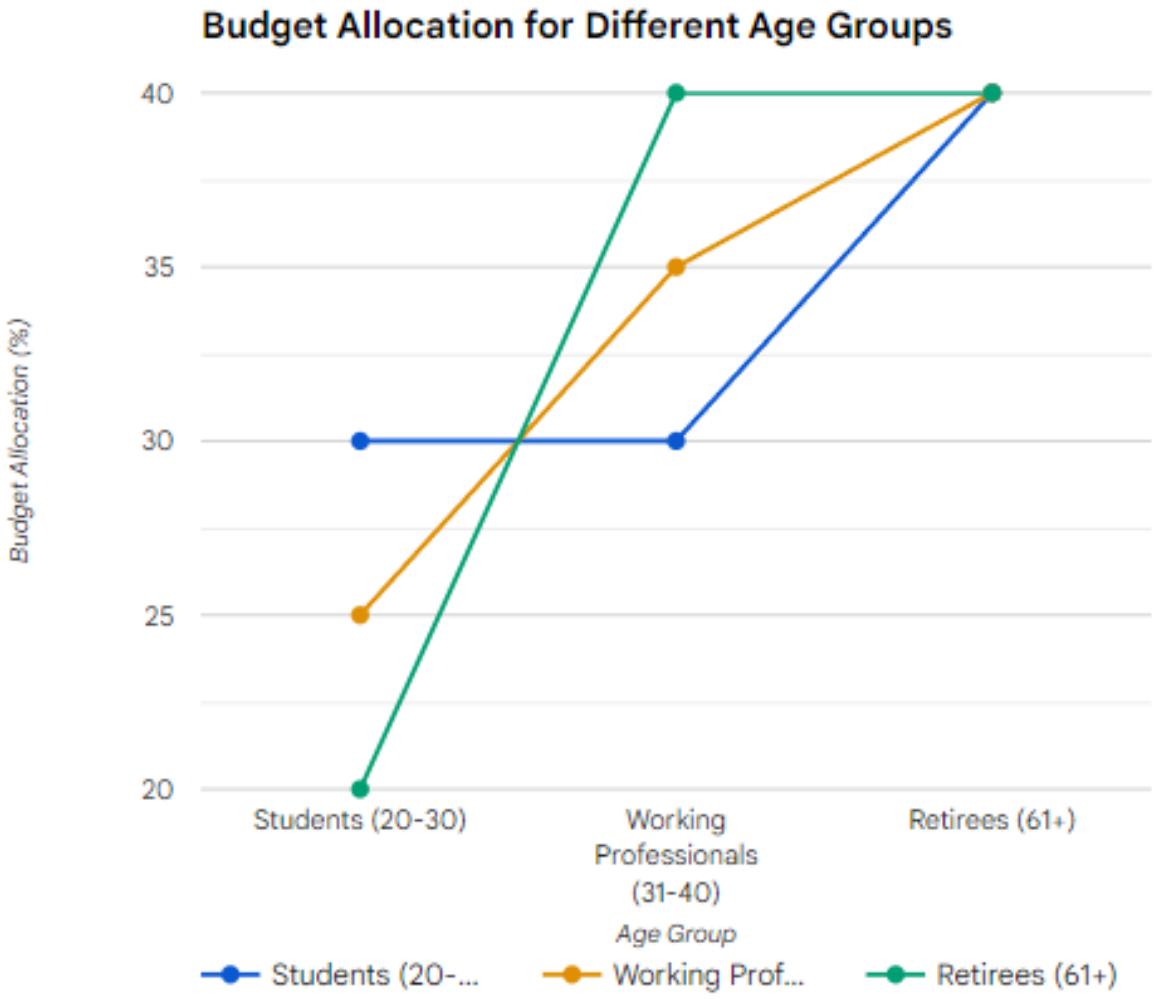


Fig 9: Graph on budget allocation by users.

The graph shows the budget allocation for different age groups when planning a trail trip. The x-axis represents the age group, and the y-axis represents the percentage of the budget allocated to each category (Accommodation, Transportation, Activities).

Key Observations:

Students (20-30): Students typically have a smaller budget to allocate for a trail trip. They allocate 30% of their budget to accommodation, 30% to transportation, and 40% to activities.

Working Professionals (31-40): Working professionals typically have a larger budget to allocate for a trail trip. They allocate 25% of their budget to accommodation, 35% to transportation, and 40% to activities.

Retirees (61+): Retirees typically have a flexible budget and are more interested in experiences and value. They allocate 20% of their budget to accommodation, 40% to transportation, and 40% to activities.

Insights:

The graph also shows the key considerations for each age group when planning a trail trip:

Students (20-30): Students consider accommodation, transportation, and activities. They are looking for affordable options that will allow them to see and do as much as possible.

Working Professionals (31-40): Working professionals consider accommodation, transportation, activities, and time constraints. They are looking for a balance between affordability and efficiency.

Retirees (61+): Retirees consider flexibility, experiences, and value. They are looking for a trip that is tailored to their interests and allows them to relax and enjoy the experience.

The graph is used to help trail planners develop customized itineraries and pricing for different age groups. By understanding the budget considerations and key priorities of each age group, trail planners can create trips that are appealing and affordable for everyone.

RESULTS AND DISCUSSION

The development of the Trails app has resulted in a comprehensive travel planning app that addresses the limitations of existing apps and provides users with a seamless and personalized travel planning experience. The app successfully incorporates multimodal trip planning, personalized recommendations, integration with other apps, and a user-friendly interface.

The results of the Trails app project demonstrate the successful development of an innovative travel planning app that addresses the unmet needs of modern travelers. The app's multimodal trip planning feature, personalized recommendation system, integration with other apps, and user-friendly interface contribute significantly to its effectiveness and user appeal.

The app's ability to plan multimodal trips efficiently and provide personalized recommendations sets it apart from existing travel planning apps. By considering multiple transportation modes and tailoring suggestions to individual preferences, the Trails app enhances the travel planning experience and provides users with valuable insights and suggestions.

The integration with other apps further improves the app's usability and convenience. Users can seamlessly manage their travel plans and notes across different platforms, eliminating the need to switch between multiple apps. This integration streamlines the travel planning process and makes it more efficient.

The user-friendly interface ensures that the app is accessible to a wide range of users, including those with limited technical experience. The app's intuitive design, clear instructions, and interactive elements make it easy to navigate and use, enhancing the overall user experience.

In conclusion, the Trails app has successfully addressed the challenges and limitations of existing travel planning apps. Its innovative features, personalized approach, and user-friendly interface make it a valuable tool for travelers seeking a streamlined and personalized travel planning experience.

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