

360° Smart Personalization and Destination Based Artificial Intelligence Application

A destination predictive and recommending framework via predictive data modeling collaborative filtering on user profiles and social media generated data

Abstract

With the demands of tourism information technology increasing day by day to facilitate tourism industry. Every tourist tries to find some suggestions for next tour by using intelligent tour guide apps. There are multiple sources of information in the whole process to guide and facilitate the user through travel agencies, destination hotels and loyal and interested tourist which give feedback about the tour experience. Researchers are always present interesting and insightful rich ideas to predict the destinations, overall experience, and comprehensive recommendations. Authors proposed artificial intelligence models to predict and forecast the tourist destination using big data analysis. To help the online users to make better and effective decisions to enjoy the next tour first interact the users via smart applications. Collection of tourism preferences, past experiences, and demographic information to prepare the structured data from user side. The most reliable and accurate recommendations are based on data quality, diverse sources and continuously getting data from customers. In this article we propose a web based interactive platform to catch up tourism experience and future desires from passionate users and provide a dynamic and meaningful destination locations with compatible and mood-based recommendation.

Introduction

In the era of smart tourism global tourism organizations are investing to facilitate the customers to engage with tourism industry and make sure the best experience always remains. Billions of tourist travel across the globe in seasons and business trips to explore the world with specific goals. Mainly authors proposed the solutions to predict the numbers of visitors, forecasting the tourism trends, tour and route planning, restaurants and transport booking and recommendations of tourism experience based on past, current dynamic activities. With the advancement of social

apps online users are easily share their sentiment views, like attractive places and recommend tourist places to others to inspire or avoid. In this research we are going to conduct a practical implication of tourism by providing web interactive platform and find out the impactful dependent attributes on explicit recommendations.

With the rapid growth of tourism worldwide now travel and tourism agencies are using smart intelligence apps such as trip advisor to enhance the customer relationship management. The context of this article is based on what had happened in past by capturing tourist experience feedback on domestic tourist passionate and social media user generated data. What are the needs and desires to overcome the tourism avoiding by extracting the explicit factors?

Research Questions

In the era of artificial intelligence and cloud computing big data platforms researchers' proposals are increasing rapidly. As we presented a web-based platform to present destination predictions, recommendation and measure the key factors in tourism platform. In this research following are the research objectives which are concluded from related future work.

- What are the concrete factors of tourism satisfaction based on past tourism experience?
- How much helpful or satisfied with good destination recommendations?
- Why interested in tourism like mood, relax, enjoy or attachment?
- What are the core needs and desires of tourist during the travel and overall experience?
- What makes you to avoid or insist for tourism in available tourism services?
- What type of tourist moods, personality, and attachment factors?

Related work

In [1] author review the research attributes in hospitality analytics and found that major ones are big data analytics, social media consumers and customer relationship management.

The most work so far has done is predictive and forecasting modeling which predict the number of tourists in future on specific location in season and prediction of tourist destinations. In [2] author used DM-CRISP model to predict the tourist destination based on travel experience using social media tweets and comments. They determine the association between user interest and destination. They

performed social media analytics to predict the destinations on travel agencies data of multiple aspects like travel decisions, dairies, geolocated photos and hotel reviews. They build categorical data into major and subcategories of interest and applying decision tree classification and x-mean clustering to predict the destinations and getting 95% accuracy.

To predict the future demands via AI based on quality of unbiased and dynamic data which can collect from online search engines like google, Baidu and review platforms Ctrip and Qunar [3]. Authors proposed a tourism forecasting demands using multisource big data and compare with single source data to avoid biasness in forecasting. They calculate weekly rating of tourism on search engines which give by user. The temporal forecasting on 132 weeks data using ARIMA invariants, SNAIVE and ETS. They did comparison between datasets and models and found the improving forecasting attributes as well as the worth of search query, online reviews multiplatform data [3].

To improve the forecasting demands feature selection is also a challenging task in machine learning frameworks. In [4] authors collect and prepare search query data keywords for the forecasting of Beijing tourism as destination. They determine the destination demands and proposed a machine learning multiple type feature selection methods named as filter based, genetic algorithms, recursive and random forest selection models on search query data. A comparison is performed with ARMAX model by using Root mean squared error (RMSE), mean absolute error (MAE), mean absolute percentage error (MAPE), and improvement ratio.

In [5] proposed a ML based recommending framework that work with topic modeling through ANN, sentiment scores prediction using Latent Dirichlet

allocation (LDA) and support vector machine (SVM) on travel reviews data, location and weather data, and tourist best spot preferences and ratings data from blogs and history data to predict the most rated tourist spots. Their model recommends spot locations based on 1- History and ratings, 2- topics summarized from blogs data and sentiment on reviews data and got 94% accuracy to predict best locations using hybrid ML model.

A sentiment analysis to capture the users experience and feeling towards tourism is also a well-known technique. Authors proposed a text mining method to drive explicit recommendations on a yelp dataset on various industries and applied five ML algorithms to find out the positive and negative factors. They used Probit, binomial logistic and three other tree algorithms to classify the results under 67% accuracy. By using natural language processing to extract the parts of speech from uni and multi terms [6]. A context aware destination recommendation LSTM deep learning model used in [7] to predict the destination on user travel history, personal preferences, and destination services data. This proposed model recommends top destination recommendation using ratings, likes, shares, weather, users age data which collected from google, trip advisor, and visit JEJU sources and LSTM layers which take user travel history in layer-I which predict next visit, then combined these outputs with contextual based data layer to prepare best recommendations and got 97% accuracy.

In [8] measure the tourist happiness on onsite survey data of foreign tourists with multiple questions to on two factors one is smart tourism technology experience, and second is destination experience with four layers are tourist value seeking such as Wi-fi and assistance, and destination value such as cost and quality of tourism. Evaluate the tourist experience in terms of satisfaction and happiness based on tourism services and experiences.

In [9] authors present the souvenir shopping model to measure the shopping satisfaction with multiple factors such as display, value, loyalty with destination, collectability, functionality, and destination image and direct effect on loyalty of destination. In a business point of view cash flow in customer shopping duration is very valuable.

Methodology

The conceptual framework to understand the foundation of smart tourism application

based on four layered architecture. Our proposed model based on tourism experienced data as well future desires. First generate the data from online sources via social media posts, ratings, trends and, tourism agencies and smart tourism apps which contain personal, demographical, geographic, and social and economic attributes. The overall data first preprocess and prepare for machine learning modeling. By doing statistical analysis, exploring, and visualizing data trends show the existing correlations between the tourism feedback attributes. As the data is main concern to apply AI techniques and drive intelligent solutions. My proposed hybrid model consists of predictive, recommender and analytical model. In **fig-1** three layered architecture is shown which demonstrate the proposed research objectives and production of effective solution.

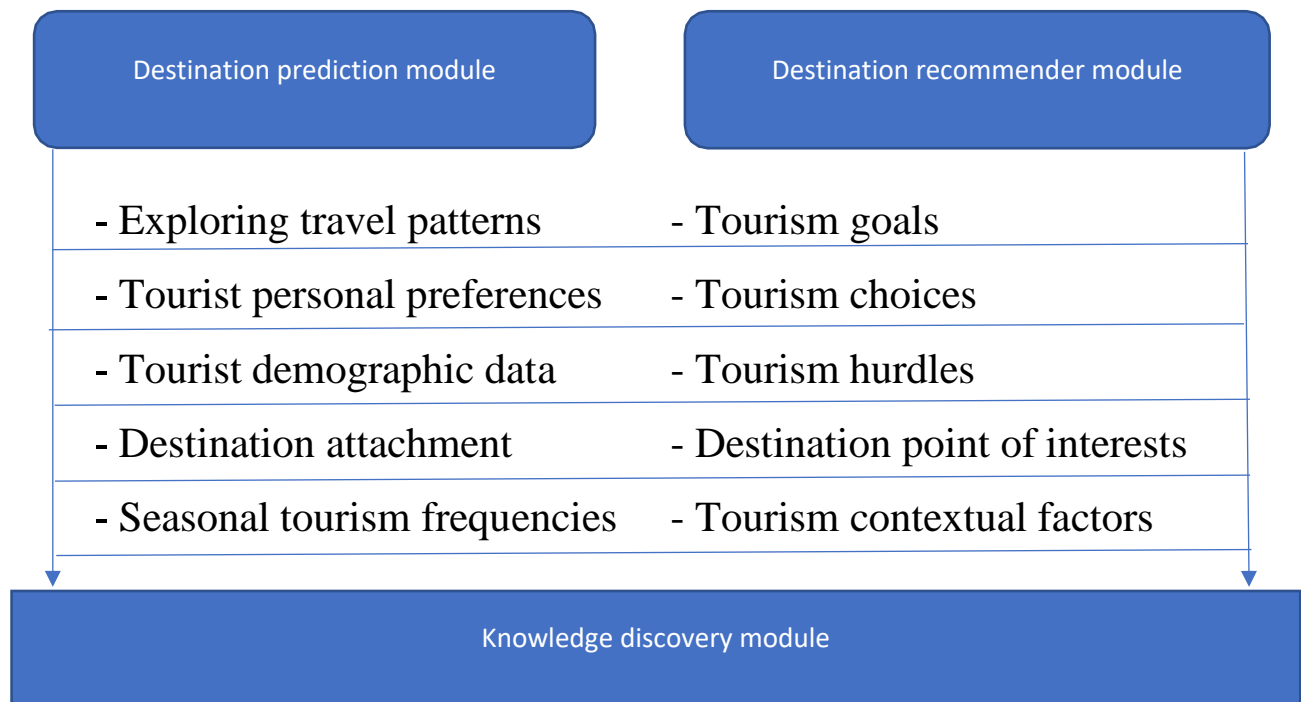


Fig: I Three layered conceptual framework to predict and recommend the tourist destination

As already describe the challenges of structured data collection. For example, how many are interested in specific location and passionate to go there every year. How much users are attached with tourism? Modeling the collected data from social media tourism posts likes, comments and personal profiles and preferences via

google form survey and categorized the collected data in following ways:

- Purely users' data like age, address, job/business, income, married and personality type.
- Tourism places, culture, weather, seasonal demands, major restaurant facilities, price trends and viewpoints.
- Travel mode, travel agency, travel services, security, and cost.
- Users interaction and experience from source to destination. Duration and frequency of tours, tour category, individual or friends and family tour, personal or booked transport, tour planner assistance, tour inspiration and selection of desirable places, meal, shopping, living, and riding.

A data modeling approach in **fig-II** to prepare and scrap insightful questions which fed into data and ML modeling and get hidden patterns in users generated data.

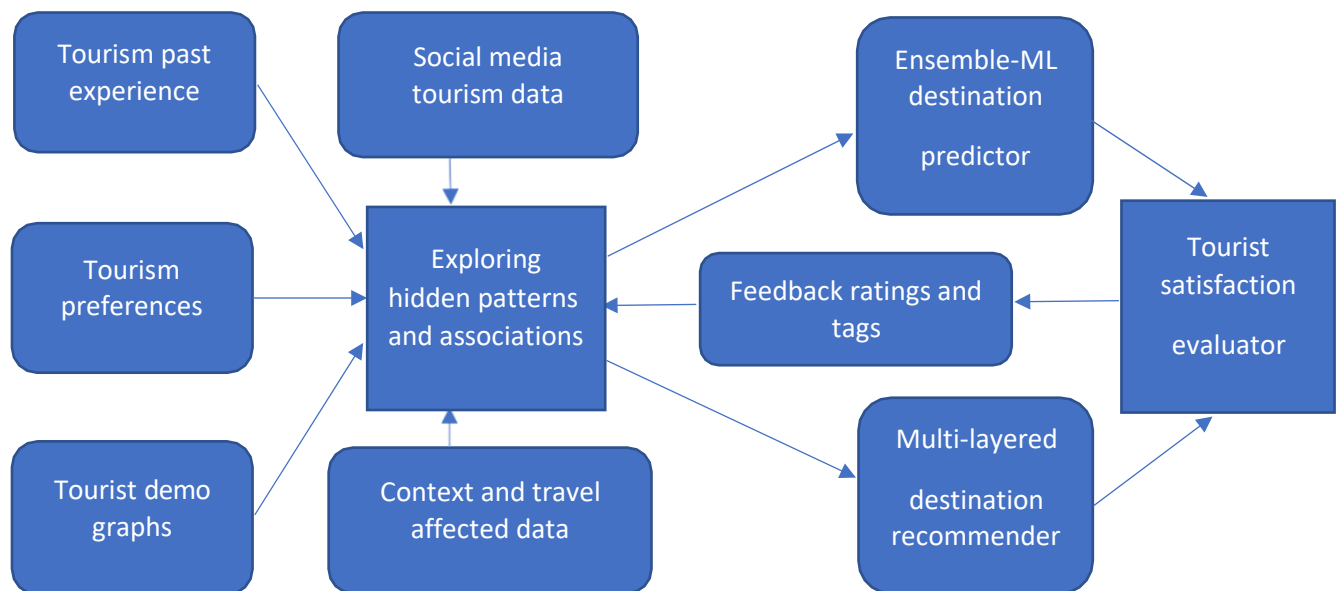


Fig: II EPD-SC data modeling and PRE-S model to predict and multi-recommendations

In **fig-II** a complete data modeling (**EPD-ST**) travel experience, tourism preferences and tourist demo graphs combined with social and contextual data. As the ML model based on quality and comprehensive amount of data which should be collected from diverse sources to find out the patterns and make the intelligent results. In **fig-II** (**PRE-S**) ensemble predictive and recommending model is presented. Above

attributed data can use to drive insightful next visit destination prediction and multitype recommendation. To address the research objectives following are the points to show the hybrid model sublayers:

- Prediction of tourist satisfaction using naïve baise, random forest, SVM and KNN algorithms.
- Recommendation of related destinations, personalization, and users to users' destinations via collaborative filtering and Apriori algorithms.
- Demographical clustering to diagnose and evaluate the user's interaction with tourism using K Mean, mean shifting and DBSCAN algorithms.
- Detailed descriptive analysis to find the attributes association and dependency by visualizing all factors using statistical analysis.

To implement these algos first categorize and structured the data. For tourist satisfaction prediction these are the dependent attributes. 1- Age, 2- Gender, 3- Job or business type, 4- Designation, 5- Income level, 6- Tour category (social), 7- Tour type (temporal), 8- Tour duration, 9- Security Score, 10- Travel Score (transport services), 11- Destination environment (weather and culture), 12- special activities (horse riding, racing, photos), 13- Tourism experience(living, meal and shopping). Satisfaction level is scaled as sentimental valued.

To collect the data from social media, user reviews from tourism apps and google form are the main challenges. Categories of tours as need or desire and then subcategories like educational trip, business trip, friends, and family trip etc. Similarly, emergency tour, vocational and special occasions. Individually tourism experience of restaurants or camping, local food or enjoying special foods and shopping local cloths or accessories.

For strong reliable engagement with tourist related suggestions should be available for tourism companies as well as travel agencies. To make solid recommendations separately handle tourist personal information, destination attributes and services and user feedback in terms of rating and comments. Mainly four types of recommendations are: 1- Most Popular: It provides mostly rated, visited with frequent seasonal and occasional destinations. 2- Related Destination: It suggest most featured related places like if user like mountains scenes then suggest similar places. Similarly, for weather, food, and culture. It filters the suggestions from overall data. 3- Personalized Wishlist: It recommend the destinations based on previous historical activities and selection. It only filters the data from user's data

bucket. 4- Friends Wishlist: It recommend the destinations from friends' destinations Wishlist. This is more interesting suggestions which calculate the personal attributes among friends. For example, if your age 25 to 30 and your friend's age is also in same range then system will recommend friends Wishlist destinations to you.

The third and fourth sub-modules are efficient analyzer to describe the past trends and diagnose the anomalies in the flow of user satisfaction as well as predictive destination results. The core objectives of these module are to demonstrate the hidden patterns in a following way:

- What type of tourist are facing travel issues?
- What are the most influential factors to avoid tourism?
- What are the most influential factors to inspire tourism?
- What are most rated and visited destinations?
- What are frequent times of tours across the country?
- What are the services which tourists need at destinations?
- Are the climate trends top preferences for you?
- How much you scared or feel insecure during tours?

By proposing a comprehensive solution, the above research goals are achieved by providing interactive and friendly web platform to measure the predicted and recommending tourist satisfaction and highlight the key factors by adopting user feedback on given results.

Benefits

The UNWTO (The World Tourism Organization of the United Nations) refers it as Tourism Sector which is made of several tourism focused industries that normally offer tourism characteristic products (and services). Taking this forward UNWTO defines 12 tourism industries that can be said to be serving the tourists in general. These industries are:

1. Accommodation for visitors
2. Food and beverage serving activities
3. Railway passenger transport
4. Road passenger transport
5. Water passenger transport


6. Air passenger transport
7. Transport equipment rental
8. Travel agencies and other reservation services activities
9. Cultural activities
10. Sports and recreational activities
11. Retail trade of country-specific tourism characteristic goods
12. Other country-specific tourism characteristic activities

The tourism industry encompasses many different travel areas, which allows the majority of a country's population to be employed. These employment places include hotels, car rental agencies, restaurants, tour companies, souvenir shops, and equipment shops, among others.

Profit earned from tourism can be reinvested into the country for better infrastructure, education, funding conservation efforts and creating more responsible ways of touring. Without tourism, many countries would not have the same level of access to education and infrastructure. Moreover, tourism allows hosts and visitors to share cultures and meet diverse groups of people. Through respectful interactions, a broader view of the world from both parties can be achieved. By reinvesting the money earned back into the country, tourism and its attractions can grow, creating a positive cycle for the country.





Figure 1: Flash screen of Application




Sign Up for free

By registering you can get
additional features


 Continue with Apple

 Continue with Apple


 Continue with Apple


Sign In


Figure 2: User Sign Up Form



Sign In

 Continue with Apple

 Continue with Apple

 Continue with Apple

Sign Up

Figure 3: User Sign In Form



Explore New Places

This application will help you find attractions,
tours or adventures in a new city



Figure 4: Main Screen of App

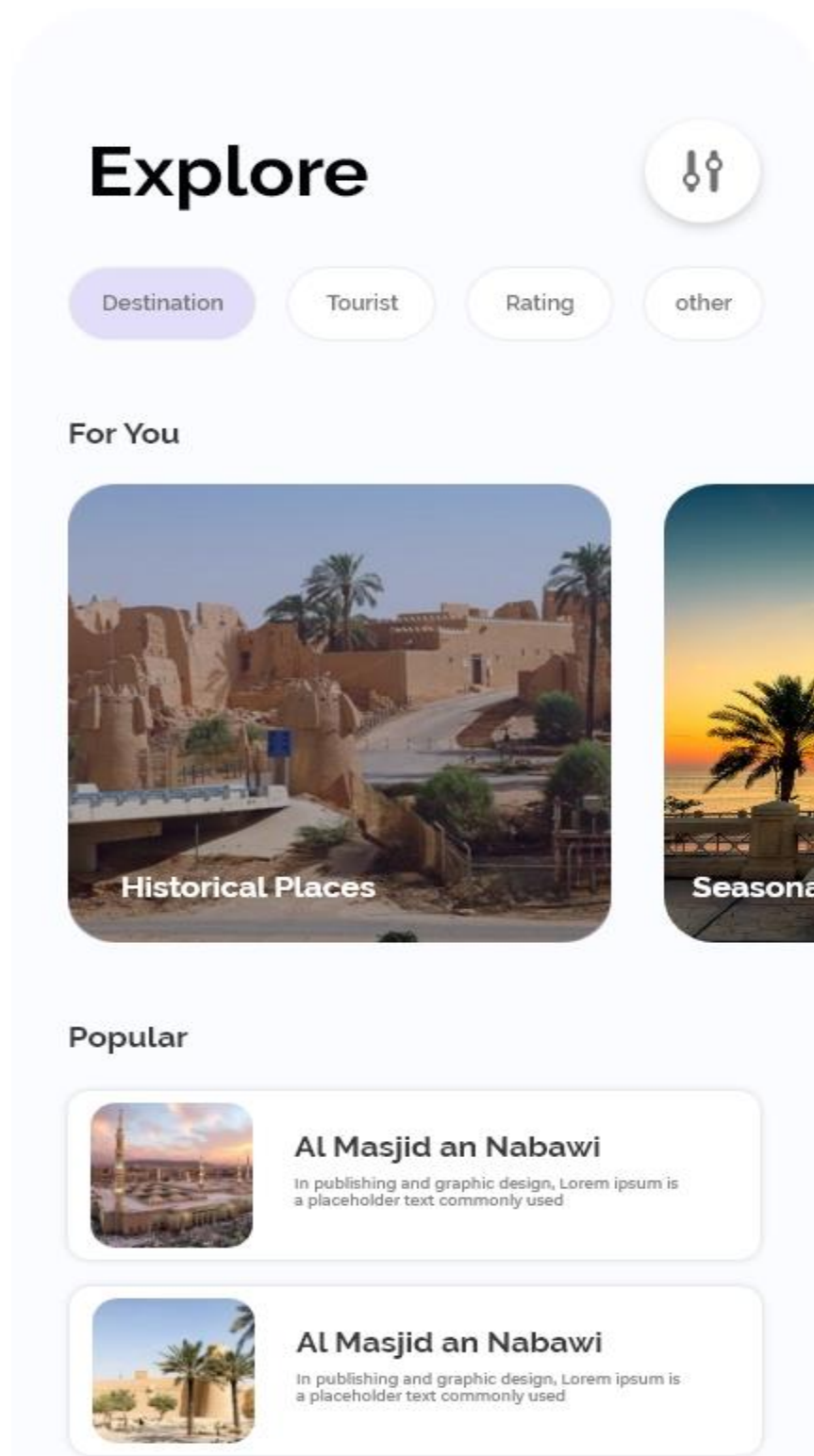


Figure 5: Explore Places

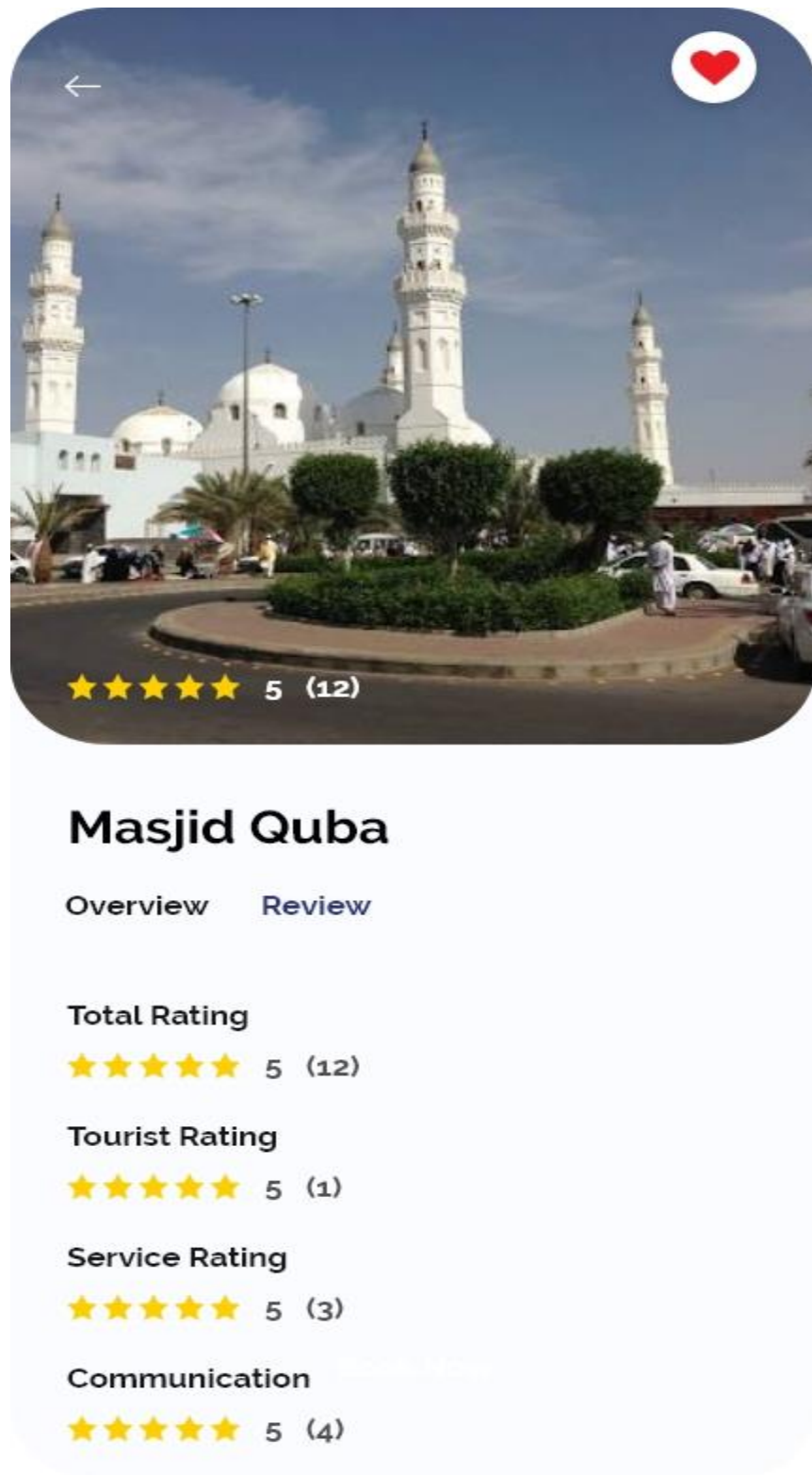


Figure 6: Review Report



Masjid Quba

[Overview](#) [Review](#)

Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularised in the 1960s with the release of Letraset sheets containing Lorem Ipsum passages, and more recently with desktop publishing software like Aldus PageMaker including versions of Lorem Ipsum.

[Book Now](#)

Figure 7: Booking Module for Visit

References

- 1- Rodrigues, J. P., Sousa, M. J., & Brochado, A. (2020). A systematic literature review on hospitality analytics. *International Journal of Business Intelligence Research (IJBIR)*, 11(2), 47-55.
- 2- Sohrabi, B., Vanani, I. R., Nasiri, N., & Rudd, A. G. (2020). A predictive model of tourist destinations based on tourists' comments and interests using text analytics. *Tourism Management Perspectives*, 35, 100710.
- 3- Li, H., Hu, M., & Li, G. (2020). Forecasting tourism demand with multisource big data. *Annals of Tourism Research*, 83, 102912. Machine Learning in Internet Search Query Selection for Tourism Forecasting
- 4- Shafqat, W., & Byun, Y. C. (2019). A recommendation mechanism for under-emphasized tourist spots using topic modeling and sentiment analysis. *Sustainability*, 12(1), 320.
- 5- Guerreiro, J., & Rita, P. (2020). How to predict explicit recommendations in online reviews using text mining and sentiment analysis. *Journal of Hospitality and Tourism Management*, 43, 269-272.
- 6- Shafqat, W., & Byun, Y. C. (2020). A Context-Aware Location Recommendation System for Tourists Using Hierarchical LSTM Model. *Sustainability*, 12(10), 4107.
- 7- Lee, H., Lee, J., Chung, N., & Koo, C. (2018). Tourists' happiness: are there smart tourism technology effects?. *Asia Pacific Journal of Tourism Research*, 23(5), 486-501.
- 8- Suhartanto, D. (2018). Tourist satisfaction with souvenir shopping: evidence from Indonesian domestic tourists. *Current Issues in Tourism*, 21(6), 663-679.
- 9- Chang, K. C. (2014). Examining the effect of tour guide performance, tourist trust, tourist satisfaction, and flow experience on tourists' shopping behavior. *Asia Pacific Journal of Tourism Research*, 19(2), 219-247.