

Development and Evaluation of Pakistan Explorer: A Recommender Web Platform for Navigating Pakistani Culture

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Abstract

The study seeks to bridge the gap in existing cultural exploration resources by offering a personalized, technology-driven understanding of Pakistan's diverse cultural heritage, which answers the significant void in tailored cultural exploration, particularly for Pakistani heritage. This project not only showcases the rich traditions, cuisine, and arts of Pakistan but also addresses the lack of tailored cultural information available for this region. The platform's advanced recommendation algorithms promote personalized user experiences, thus fostering cross-cultural understanding and appreciation. The backbone of this platform is a hybrid-recommendation system which combines both content-based filtering with collaborative-filtering through the innovative use of the 'Surprise' library's Singular Value Decomposition (SVD) algorithm, a method not typically applied in cultural context platforms. Additionally, the system integrates real-time data processing for dynamic content updates, including weather and local events, which are crucial for real-time travel and cultural recommendations. The platform has demonstrated a capability to offer personalized and dynamic cultural insights, substantially improving user engagement and satisfaction. The application of the SVD algorithm in a new domain—cultural recommendations—is a novel adaptation, showing promising results in enhancing the relevancy of content delivered to users. For future scalability, transitioning from embedded data within the Flask app to a more robust database system, such as SQL or NoSQL, is recommended. This would facilitate easier data management and richer feature implementation. The research could also benefit from focusing on integrating more AI-driven capabilities, such as natural language processing (NLP) to parse and categorize user reviews and feedback, which could further refine and personalize recommendations. The innovative use of SVD in cultural context platforms presents a new avenue for academic exploration and can be expanded to other cultural recommendation systems.

Keywords: Pakistan, Cultural Exploration, Recommendation System, Singular Value Decomposition (SVD), Flask, Content Based Filtering



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 Sana Fatima is a committed master's student of Information Technology at Adamson University. She was acknowledged for her fantastic aptitude in programming languages and database control. As a woman student in a field often dominated via guys, she sticks out for her innovative hassle-solving abilities and her capability to bridge technical understanding with practical programs. Her academic journey is marked with the aid of a passion for technology and a commitment to contributing to the sector through studies and collaboration. Address correspondence to Fatima Sana, College of Science, Adamson University, 900 San Marcelino Street, Ermita, Manila, Philippines. Email: sana.fatima@adamson.edu.ph; sanafatima.ds@gmail.com.

INTRODUCTION

The digital exploration of culture typically relies on generalized algorithms that fail to capture the unique nuances of specific heritages. "Pakistan Explorer" addresses this gap by introducing a tailored web platform dedicated to

the rich diversity of Pakistani culture. Unlike existing tools, this platform integrates a hybrid-recommendation system that uses both content-based and collaborative-filtering. This system is fine-tuned to the cultural context, making use of the 'Surprise' library's SVD algorithm in ways that have not been previously applied in the domain of cultural recommendations.

This innovative technological approach allows "Pakistan Explorer" to offer not just general cultural insights but deeply personalized and contextually relevant experiences that adjust in real time. The inclusion of real-time data processing for updating weather conditions and local events further enhances the platform's

utility, providing a comprehensive and dynamic tool for cultural exploration.

Through its advanced algorithms and user-focused design, "Pakistan Explorer" exemplifies how technology can bridge cultural divides and promote understanding. It is a pioneering example of applying advanced computational techniques to cultural content, offering a new model for how such platforms can operate effectively and sensitively in a diverse world.

By providing a platform that not only recommends but educates about local customs, "Pakistan Explorer" fills a crucial void. It caters to various users—from tourists and students to researchers and business professionals—each looking to enrich their understanding and appreciation of Pakistani culture. Through targeted recommendations and interactive content, the platform serves as a bridge between diverse cultures, promoting a broader dialogue on cultural appreciation and mutual respect.

This project is essential because it helps people understand and appreciate Pakistani culture better. By using a user-friendly website that tailor recommendations to each person's interests, "Pakistan Explorer" makes exploring traditions and customs more personal. This will not only teach users about Pakistani culture but also promotes respect and appreciation for cultural diversity.

Statement of the Problem. The study aimed to specifically develop a web platform for navigating Pakistani culture. Specifically, the study seeks to elicit answers to the following questions:

1. How can "Pakistan Explorer" give users an access to detailed information about Pakistan's most popular cities, including their unique attractions, cultural landmarks, food, and others?
2. How can users create tailored travel plans that suit the user's needs and preferences?
3. Would there be a forum wherein users can connect to a community of fellow travelers

and locals to share experiences, tips, and recommendations?

4. Is there any other information that a user can view per city upon using the web application?

LITERATURES

Web 2.0 and its services, such as social networks, have significantly influenced various businesses, including e-commerce. As a result, we face a new generation of e-commerce called Social Commerce. On the other hand, in the tourism industry, a variety of services and products are provided. The dramatic rise in the number of options in travel packages, hotels, tourist attractions, etc. put users in a difficult situation to find what they need. For a reason, tourism recommender systems have been considered by researchers and businesses as a solution (Esmaeili, Mardani, Golpayegani & Madar, 2020). With the development of the Internet, technology, and means of communication, the production of tourist data has multiplied at all levels (hotels, restaurants, transport, heritage, tourist events, activities, etc.), especially with the development of Online Travel Agency (OTA). However, the list of possibilities offered to tourists by these Web search engines (or even specialized tourist sites) can be overwhelming and relevant results are usually drowned in informational "noise", which prevents, or at least slows down the selection process. To assist tourists in trip planning and help them to find the information they are looking for, many recommender systems have been developed. (Fararni, Nafis, Aghoutane, Yahyaouy, Riffi & Sabri, 2021). Numerous numbers of tourism attractions along with a huge amount of information about them on web and social platforms have made the decision-making process for selecting and visiting them complicated. In this regard, the tourism recommendation systems have become interesting for tourists, but challenging for designers because they should be able to provide personalized services (Abbasi-Moud, Vahdat-Nejad & Sadri, 2020). Travel and Tourism is an important business domain that can leverage the power of recommender systems in various stages starting from trip

planning to execution. Internet has a huge volume of information on tourism/leisure spots and activities. It is a really challenging task for travelers to read through all such information in order to plan their trip/leisure time. A travel recommender can help in this scenario by supporting the decision-making process in the areas like choice of destinations, selection of attractions, finalization of routes, mode of transport, identification of appropriate accommodations and restaurants, etc. Modern recommender systems can add the personalization aspects like learned user preferences from past user traits to arrive at recommendations. It can also recommend traits observed in other travelers who belong to similar demographic groups of the user in consideration. A simple contextualization may include proposing options to traveler based on the forecasted weather at the locations in consideration on any proposed period (Renjith, Sreekumar, & Jathavedan, 2019).

Tourism is one of the most noticeable elements of international trade in the non-commodity sector of the economy. According to the World Tourism Organization, it is the third-largest export category in the world export, being the top export product for most developed countries. Tourism is one of the industries having the highest multiplier effect on the economy. Investments in the tourism industry form the added value in transport, trade and services, construction and production of building materials, and other types of economic activity. An important socio-economic effect of tourism development on the population involved in the creation and provision of services is the growth of employment and incomes, and the formation of entrepreneurial culture. The tourism industry has undergone dramatic changes since various forms of information and communication technologies (ICT) began to penetrate the society, industry, and markets. Modern world trends in the tourism industry are related to the modernization and development of user interfaces along with the digitalization of promotion tools; creating communities in social media and services having information and educational content; integration of domestic tourism products into communication

(navigation and cartographic) services, and voice assistants; promotion of tourism products using strategies based on technologies for studying and predicting consumer preferences, etc. (Gamidullaeva, Finogeev, Kataev & Bulysheva, 2023).

Cultural Heritage (CH) domain is rapidly moving from traditional heritage sites into smart cultural heritage environment through various technologies. As one of the important technologies in the smart space, Recommender Systems (RSs) have been widely utilized to personalized services and matching visitors' goals and behaviors. Whereas cultural difference is often considered a barrier to technology transfer or adoption. However, few studies focus on how the cultural factor influences recommendation despite cultural difference largely affects user preferences in the RSs. Furthermore, existing researches have mainly analyzed evaluation results of their recommendation to reveal cultural differences, rather than utilizing the cross-cultural factors into RSs (Hong, An, Akerkar, Camacho & Jung, 2019). Recommendation Systems help users select appropriate products or services from a wide range of choices. Thus, It solves the problem of information overload up to a remarkable extent. Specifically, it is highly applicable in certain industries that sell the product online or provide the services online. Recommendation Systems are very relevant in such a domain because they can grow their business by putting it in the practice. In this review article, we offer an overview of the Recommendation Systems and their variations and extension (Patel, Pate & Chauhan, 2023).

METHODOLOGY

To rigorously assess the functionality, performance, and effectiveness of "Pakistan Explorer," the researchers established several metrics:

User Interaction Observations. Monitoring how users interact with various components of the platform during real-time use, focusing on navigational ease and the relevance of the content provided.

Performance Metrics. The following are the established metrics to measure the performance of the web platform:

Load Time. Measuring the response time from the server to user actions to ensure a smooth experience.

Accuracy of Recommendations. Evaluating the precision and recall of the recommendation algorithms through user feedback and predefined test cases.

Effectiveness Evaluation

User Satisfaction. Employing a Likert Scale to measure user satisfaction across several dimensions such as usability, content relevance, and overall experience. For the detailed numerical range and corresponding verbal interpretations of the scale, please refer to Table 1 below.

Table 1
Likert Scale

Scale	Description
5 = 4.50 to 5.00	Strongly Agree
4 = 3.50 to 4.49	Agree
3 = 2.50 to 3.49	Neither agree nor disagree
2 = 1.50 to 2.49	Disagree
1 = 1.00 to 1.49	Strongly disagree

Cultural Impact Assessment. Qualitative assessments via user surveys and reviews to determine the platform's role in enhancing cultural understanding and appreciation.

Qualitative and Quantitative Methods. The qualitative research involved conversational methods such as user reviews and groups to acquire some new insights into everyone's unique user experiences. This was complemented by quantitative methods using the Likert scale to systematically measure user responses to functionality and content.

System Architecture

Front-end. Developed using HTML, CSS, and JavaScript which aims to create an intuitive and

comfortable and as well as responsive user interface.

Back-end. Python with Flask was employed as the server-side language to manage the application's logic, user requests, and data responses.

Database. We used a lightweight database that is embedded inside the flask route, with plans to migrate to a more scalable solution like MySQL or PostgreSQL in the future.

Algorithm Integration

Content-Based Filtering. This method analyzes item descriptions to recommend items like what a user has liked in the past. It was primarily used for personalizing cultural site recommendations.

Collaborative Filtering. Implemented using the 'Surprise' library's SVD algorithm, this approach predicts user preferences based on similar user interactions, enhancing the recommendation system's accuracy.

Real-time Data Processing. Integrates APIs for live updates on weather and local events, ensuring that the recommendations are contextually relevant to current conditions.

System Evaluation

RESULTS

This section shows the results of the system, and how it answers the mentioned problem statements.



Figure 1
Sign in Page

Upon visiting “Pakistan Explorer”, users are prompted with a simple sign in screen where they can use their accounts to log in or sign up if they do not have an account yet.



Figure 2
Landing Page

After logging in, users will be prompted to the landing page in which they can click either one of the three cards or refer to the navigation bar in order to access the following pages.

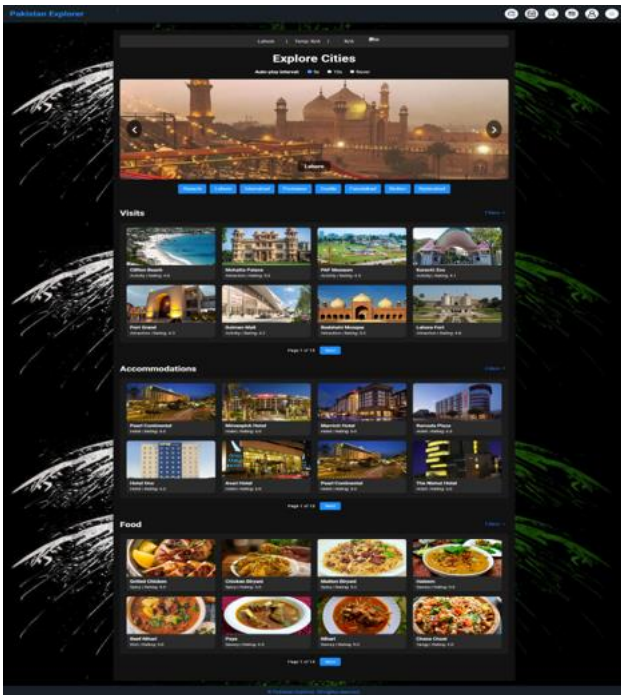


Figure 3
Explore Page

Upon clicking either the ‘Explore Cities’ card or the button on the navigation bar, users are redirected to explore cities page where they can see detailed information about Pakistan’s cities. This feature answers problem statement 1.

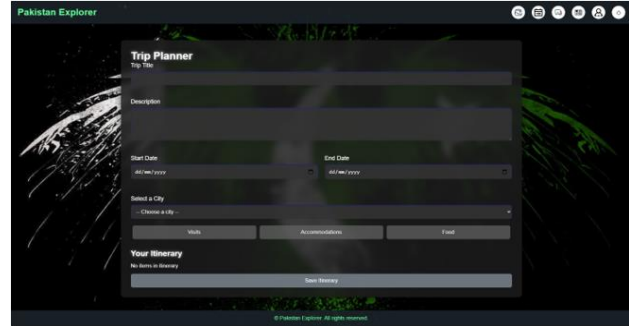


Figure 4
Planner Page

This is the page where users get redirected to when they click on the ‘Plan your trip’ card on the landing page or via the navigation bar, in this section, users can create their own travel plans by seeing different places to visit, different accommodations, food, and transportation modes. This feature answers problem statement 2.

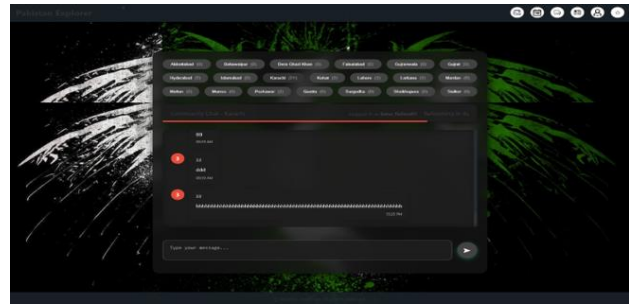


Figure 5
Community Page

This is where users are able to chat and connect with their fellow travelers or locals and are separated by rooms depending on the city they are based on. This feature answers problem statement 3.

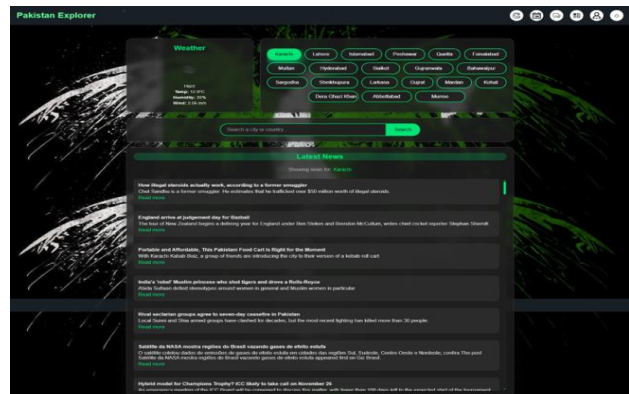


Figure 6
News and Weather Page

This is where the users can access the latest news and real time weather updates to ensure that they're well prepared and informed about their travel destinations. This feature answers problem statement 4.

User Survey Results. The Webpage is working within the expected functionality. Users are able to manually navigate through cities which are shown as city cards, with added real-time temperature and weather updates per city card. Then, restaurants are shown within the city chosen, then the meals offered in that restaurant. On the last page, users can access the recommendation system. In the recommendation system, they can choose what their preferences are and based on the preferences chosen; the recommendation system will recommend one or a few more restaurants which is then clickable by the user to allow them to navigate to the restaurant.

To reiterate, the webpage delivers a seamless user experience designed for exploring culinary options alongside real-time weather conditions. Here's a breakdown of the key functionalities:

1. **City Exploration.** Users can browse through various cities presented as interactive "city cards." Each card displays the city name alongside real-time weather data, including temperature and other relevant weather conditions. This allows users to quickly assess weather conditions at their chosen destination.
2. **Restaurant Discovery.** Upon selecting a city, users are presented with a list of restaurants within that location. This provides a focused overview of dining options specific to the chosen city.
3. **Menu Exploration.** Each restaurant listing likely offers the ability to delve deeper and explore the specific menu items available. This allows users to get a clear understanding of the cuisine offered before committing to a particular restaurant.
4. **Recommendation System.** The final page empowers users to leverage the power of

the recommendation system. Here, users can specify their dining preferences, potentially including factors like cuisine type, price range, dietary restrictions, or desired ambience. Based on these preferences, the system dynamically recommends one or more restaurants that best suit the user's needs. These recommendations are presented as clickable links, allowing users to seamlessly navigate to the restaurant's detailed information page or even its online ordering platform (if available).

Overall, the webpage streamlines the process of finding restaurants, taking into account both weather conditions and user preferences. This creates a user-friendly and efficient experience for anyone seeking a delicious and enjoyable dining experience.

DISCUSSION

"Pakistan Explorer's" system architecture emphasizes its efficiency and user-friendly design. The front-end user interface, developed with HTML, CSS, and JavaScript, prioritizes seamless user experiences. This choice of technologies allows for a visually appealing and responsive interface, crucial for engaging users.

On the backend, Python with Flask is chosen for its ability to handle user requests and manage the application's logic effectively. Flask's lightweight and modular design make it well-suited for web development, especially in the context of adding routes to other webpages. Flask, while utilizing Javascript has the capability to handle user requests and be responsible for the application's logic. This flexibility enables easy expansion and modification of the platform as needed.

Additionally, the use of a reliable dataset for storing and retrieving data ensures that the platform can provide accurate and up-to-date information to users. This aspect is crucial for the success of a recommendation system, as it relies heavily on the quality of the data it processes. It is currently embedded within the

flask routes, ensuring that the data is easily accessed by the webpages.

This capstone project focuses to create a Web-Based Application System helping users to understand different cultures, discover delicious local cuisines, and stay weather-aware during your adventures in Pakistan. It was designed to make users' travel experience richer and more connected.

However, every superhero has its limits. "Pakistan Explorer" primarily focuses on culture, food, and weather. Hence, it might not cover every single detail of a user's trip. Its effectiveness also depends on the availability and accuracy of information. So, while it's a fantastic travel sidekick, it's not an all-knowing guide. It shines in specific areas, ensuring users gets the most out of their travel within those boundaries.

"Pakistan Explorer" is a comprehensive travel companion tailored for explorers in Pakistan. Additionally, it keeps travelers' weather-aware, ensuring a seamless and well-prepared journey. With an interactive and user-friendly interface, "Pakistan Explorer" aims to enhance the overall travel experience, making it more immersive and enjoyable. The app's effectiveness relies on the availability and accuracy of information, which can vary. It excels in certain areas but may not cover every minute detail. "Pakistan Explorer" is a valuable companion for specific dimensions of your journey but should be complemented with other resources for a comprehensive travel plan. It's your go-to guide for cultural and culinary adventures, but for the complete travel picture, a combination of tools is recommended.

Conclusion. "Pakistan Explorer" has successfully achieved its primary goal of showcasing the richness of Pakistani culture through technology. The platform provides a user-friendly interface, allowing users to effectively and easily navigate through cities, restaurants, and meals, while also providing real-time weather updates. The combination of content-based filtering and the SVD algorithm has proven effective in providing personalized

recommendations to users based on their preferences. "Pakistan Explorer" contributes to the broader dialogue on global cultural appreciation by promoting cross-cultural understanding through technology. Recommendations for future improvements include optimizing the database using SQL or NoSQL databases, implementing features for user ratings and reviews, expanding the dataset with more information about each Pakistani city, developing a mobile application version, and incorporating collaborative filtering techniques and contextual information. The success of "Pakistan Explorer" demonstrates the potential of technology in promoting cultural exploration and appreciation, opening avenues for future research in enhancing recommendation systems, incorporating contextual information, and improving user engagement in cultural exploration platforms, particularly in the tourism industry.

Recommendations. Consider optimizing the database using SQL or NoSQL databases, implementing features for user ratings and reviews, expanding the dataset with more information about each Pakistani city, developing a mobile application version, and incorporating collaborative filtering techniques and contextual information. The success of "Pakistan Explorer" demonstrates the potential of technology in promoting cultural exploration and appreciation, opening avenues for future research in enhancing recommendation systems, incorporating contextual information, and improving user engagement in cultural exploration platforms, particularly in the tourism industry.

Implications. The success of "Pakistan Explorer" highlights the potential of technology in promoting cultural exploration and appreciation. It suggests that similar platforms focusing on other cultures could be developed to foster cross-cultural understanding. Imagine mobile apps dedicated to specific regions, countries, or even indigenous communities. These apps could provide immersive experiences through augmented reality, virtual tours, and interactive storytelling. This could bridge geographical divides and break down

cultural barriers, encouraging appreciation for diverse traditions and perspectives.

Beyond cultural exploration, the success of “Pakistan Explorer’s” recommender system offers exciting possibilities for the tourism industry. Personalized recommendations can significantly enhance the travel experience by tailoring suggestions to individual interests, travel styles, and budgets. This can streamline trip planning, ensure visitors discover hidden gems, and avoid tourist traps. Furthermore, the app’s success suggests opportunities for future research in recommender systems. By incorporating contextual information like weather, travel restrictions, and current events, recommendations can become even more dynamic and user centric.

Additionally, research on improving user engagement in cultural exploration platforms is crucial. Gamification elements, interactive quizzes, and social media integration could all contribute to a more engaging and enriching user experience. The possibilities for leveraging technology to promote cultural understanding and enhance travel experiences are vast, and the success of “Pakistan Explorer” serves as a springboard for further innovation.

Acknowledgement. This project proposal has been completed with the help of numerous people. It might not be possible to mention everyone, but I extremely admire their assistance.

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Funding. This study did not receive funding from any institution. This independent funding status underscores the researcher’s commitment to conducting the study without any external influence. Ensuring the integrity and impartiality of the research findings is paramount. By foregoing external funding, the researcher avoids any potential bias that could be introduced by funders with specific agendas. This independent approach strengthens the credibility and trustworthiness of the research.

Declarations. The following are the essential declarations of the author:

1. **Conflict of Interest.** The researcher declares no conflict of interest in this study. Once again, the researcher affirms that no conflict-of-interest is present in this research/study. This declaration ensures that the research is conducted impartially and without bias. Disclosing any potential conflicts that could influence the study’s outcomes is crucial for maintaining transparency and ethical research practices. By acknowledging and managing any potential conflicts, the researcher demonstrates a commitment to conducting objective and unbiased research.
2. **Informed Consent.** Informed consent was to be obtained from all participants involved in this study, even though it may not seem initially applicable. Participants were provided with detailed information about the study’s purpose, procedures, potential risks and benefits, and their rights as participants, even if those rights were primarily related to data privacy. They were given the opportunity to ask questions and clarify any concerns before providing their consent to participate.

The informed consent process, even in contexts where data collection is minimal, ensures that participants are fully informed about the study and voluntarily agree to participate. This fosters trust and ethical conduct in the research process.

3. Ethics Approval. Ethics approval was not applicable for this study as the “Pakistan Explorer” app does not store or retrieve any data from its users. This ensures that there are no ethical concerns related to the handling of participant data, as no data collection involving human participants is involved during the study/projects. However, it’s now important to note that even in studies without data collection, ethical considerations may still exist, such as ensuring the app does not mislead users or cause any harm through inaccurate information. The decision to forego formal ethics approval should be carefully considered and documented.

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