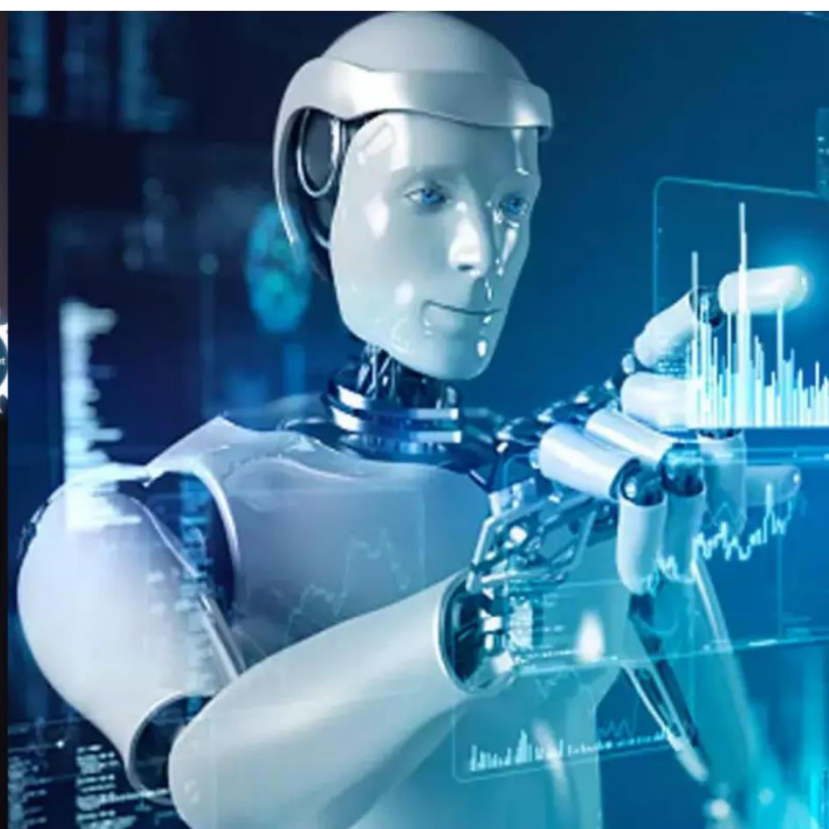




# International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

*(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)*



**Impact Factor: 9.935**

**Volume 15, Issue 10, October 2026**

# A Personalized Tourism Recommendation System Using Machine Learning Framework with 3D Visualization

Santhiya K, Santhiya K, Nivethitha R

U.G. Student, Department of Computer Engineering, K L N College of Engineering, Pottapalayam, Tamil Nadu, India

U.G. Student, Department of Computer Engineering, K L N College of Engineering, Pottapalayam, Tamil Nadu, India

Assistant Professor, Department of Computer Engineering, K L N College of Engineering, Pottapalayam,  
Tamil Nadu, India

**ABSTRACT:** Tourism has become an important part of modern life, and travelers increasingly depend on digital platforms to explore destinations and plan their trips. However, selecting suitable tourist attractions and obtaining relevant information can be difficult when available information is scattered across different platforms. This paper presents a **Personalized Tourism Recommendation System Using Machine Learning Framework with 3D Visualization**, designed to help users explore tourist destinations through an interactive web application. The system provides information about popular tourist attractions, supports travel planning through an AI-powered assistant, and allows users to view selected monuments using three-dimensional visualization. It also incorporates map-based location information to help users understand the geographical position of tourist destinations.

The proposed system combines a React-based frontend with a Flask backend to provide an interactive and user-friendly experience. It includes features such as destination exploration, personalized trip planning, landmark image analysis, map navigation, and saving favorite places. Three-dimensional visualization helps users understand the appearance and structure of selected monuments before visiting them, while the AI-powered assistant supports users in organizing their travel plans. By integrating destination information, interactive visualization, and travel assistance into a single platform, the system aims to make tourism exploration more convenient and engaging. The application provides a foundation for improving personalized tourism services through future enhancements to recommendation techniques and destination data coverage.

**KEYWORDS:** Personalized Tourism, Machine Learning, Recommendation System, 3D Visualization, Tourism Web Application, Landmark Recognition, Trip Planning.

## I. INTRODUCTION

Tourism is an important activity that supports cultural exchange, economic development, and the exploration of historical and natural attractions. With the growth of internet technology and mobile applications, travelers can access destination information, photographs, reviews, and navigation services online. However, planning a trip can still be time-consuming because users often need to visit different websites and applications to collect information about attractions, understand their locations, and organize their travel schedules. A unified tourism platform can help reduce this difficulty by bringing important travel-related features together in one place.

A tourism recommendation system aims to help users identify destinations that may suit their interests and travel requirements. Such a system can use information such as destination categories, user preferences, location details, and previous interactions to support the selection of tourist attractions. Machine learning techniques can be used in tourism applications to identify patterns in user preferences and improve recommendations when suitable data and a trained model are available. Personalization can make destination discovery more relevant than relying only on a general list of popular places.

The proposed project, titled “A Personalized Tourism Recommendation System Using Machine Learning Framework with 3D Visualization,” focuses on making tourism exploration more interactive and convenient. The application combines tourist destination information, AI-assisted trip planning, map-based navigation, landmark image analysis, and three-dimensional visualization. Users can explore selected attractions, obtain assistance in organizing their trips, view monument models, and save favorite destinations. These features are designed to provide a more connected experience for users who want to learn about places before visiting them.

Three-dimensional visualization is an important feature of the proposed system because it allows users to examine a digital representation of a monument from different viewpoints. Instead of depending entirely on ordinary photographs, users can interact with supported 3D models to gain a better understanding of a monument's visible structure. Map integration also helps users identify the geographical position of tourist attractions. By combining these capabilities in a web-based application, the project aims to support destination discovery and travel planning through an accessible interface.

## **II. EXISTING SYSTEM**

Existing tourism systems mainly provide general information about tourist destinations through websites, travel applications, and online guides. Users can search for popular places, view photographs, read descriptions, and access basic location details. However, these systems may provide limited personalization and often require users to switch between multiple platforms for destination information, route guidance, and travel planning. Some platforms offer recommendations based on user preferences, but they may not combine destination exploration, AI-assisted trip planning, and interactive 3D visualization in a single application. As a result, users may find it difficult to select suitable destinations and understand the appearance of monuments before visiting them. These limitations highlight the need for an integrated tourism recommendation system that offers personalized travel assistance, map-based navigation, and 3D visualization.

## **III. DRAWBACKS OF EXISTING SYSTEM**

The main disadvantages of the conventional approach are:

- Information scattered across platforms: Destination details, navigation, and travel planning may require separate applications.
  - Limited personalization: General destination lists may not adequately reflect each traveller's interests, budget, or available time.
  - Time-consuming planning: Users must compare different sources and organize their own itineraries.
  - Limited visual exploration: Ordinary photographs do not provide the same interactive viewing experience as a rotatable 3D model.
  - Repeated searching: Users may need to search separately for historical information, routes, and attractions.
  - Difficulty managing preferences: Users may have to save interesting destinations manually in different services.
  - Data limitations: Some services may not contain detailed information about smaller or less widely known attractions.
- These limitations motivate the development of a unified tourism platform that combines personalized planning with destination information and interactive visualization.

## **IV. PROPOSED SYSTEM**

The proposed system provides a common platform through which users can explore tourist destinations, access travel assistance, view monuments in three dimensions, and use map-based navigation. The application integrates destination discovery, personalized trip planning, landmark image analysis, user account management within a single web interface. After logging in, users can browse available tourist places, view destination information, explore associated 3D models, locate attractions on a map, and save their favourite destinations. The trip planner accepts details such as budget, travel duration, and interests to generate suggested itineraries using the configured planning logic and AI service.

The system follows a client-server architecture in which the React frontend, developed using Vite, manages the user interface, while the Flask backend processes application requests. MongoDB supports data storage where configured, and the Gemini AI service provides AI-assisted travel planning and chatbot responses.

**A. User Authentication Module**

The user authentication module allows users to register and log in to the application through the available account functionality. It verifies user credentials using the authentication process implemented in the system and provides access to features intended for authenticated users. This module supports account-related operations and helps manage access to user-specific features. It also works with the favourites functionality, allowing users to access saved destinations according to the application's storage and account management implementation. The authentication mechanism helps provide a more organized and user-oriented experience.

**B. Tourist Place Explorer Module**

The tourist place explorer module is the primary destination-discovery component of the application. It allows users to browse available tourist attractions and view information such as destination names, descriptions, historical backgrounds, images, and geographical locations where these details are available. When a user selects a destination, the application displays its associated information through the frontend. Users can also proceed to related features, such as viewing the monument's 3D representation, accessing map information, or saving the destination to their favourites. The usefulness of this module depends on the completeness and accuracy of the destination dataset included in the application.

**C. Personalized Recommendation and Trip Planner Module**

The personalized recommendation and trip planner module helps users organize their journeys according to their travel requirements. Users can provide information such as budget, travel duration, interests, and other supported preferences. The configured planning workflow processes these inputs and generates suggested itineraries based on the available destination information and planning logic. The Gemini AI service supports conversational travel assistance and can help generate itinerary suggestions in response to user queries. This feature makes travel planning more convenient by bringing destination suggestions and travel assistance together within the application. The quality of the generated plans depends on the user's inputs and the capabilities of the connected AI service.

The machine learning-based recommendation component aims to identify tourist destinations that are relevant to users' interests and travel requirements. Destination categories, user preferences, and available destination information can be considered when producing suitable suggestions. The objective is to make destination selection more relevant than relying only on a general list of tourist attractions. The recommendation approach must reflect the actual implementation of the application. If the current system uses predefined rules or Gemini AI rather than a separately trained machine learning model, this should be stated accurately, and the development of a trained and evaluated recommendation model can be identified as a future enhancement.

**D. 3D Visualization Module**

The 3D visualization module allows users to explore digital representations of selected tourist monuments through an interactive web interface. Three.js and React Three Fiber are used to render supported three-dimensional models within the application. When a user selects a monument, the associated model is displayed in a 3D scene with the required camera, lighting, and rendering settings. Users can rotate and zoom the model to examine its visible structure from different viewpoints. This feature provides a more interactive experience than static photographs and helps users become familiar with a monument before visiting it. The quality of the visualization depends on the accuracy, detail, and availability of the model assets. The feature is described as 3D visualization because the models are displayed digitally within the browser.

**E. Landmark Image Analysis Module**

The landmark image analysis module allows users to submit an image through the supported camera or file-upload functionality. The submitted image is processed by the analysis component configured in the application, and the resulting landmark-related information is presented to the user. Where a corresponding destination record is available, the result can be connected to additional information about the tourist attraction. The usefulness of this feature depends on the implemented image analysis method, the landmarks supported, and the quality of the submitted image. Images captured under poor lighting or from unusual angles may affect the analysis. Therefore, claims about landmark recognition accuracy should be made only after testing the implemented component with suitable images.

**F. Interactive Map and Navigation Module**

The interactive map and navigation module helps users identify the geographical locations of tourist attractions. Leaflet provides the interactive map interface, while OpenStreetMap supplies map data where integrated. The application uses

the selected destination's coordinates to display its location and may use the user's current location when permission is granted. The module helps users understand the geographical relationship between their location and a selected attraction and supports the route or navigation features available in the application. Its operation depends on valid coordinates, internet connectivity, browser location permissions, and the mapping or routing service configured in the system.

The overall system connects the frontend, backend, database, and external AI service to support these modules. The React frontend manages user interactions, while the Flask backend handles application requests and connects the relevant processing logic with the data services. MongoDB is used for document-based storage where configured, and Gemini AI supports the AI-assisted planning and chatbot functions. The favourites feature allows users to save destinations for future reference through the storage mechanism implemented in the application. By integrating these capabilities, the proposed system provides a common platform for tourism exploration, trip planning, and interactive monument visualization.

## **V. RESULTS AND DISCUSSIONS**

The current prototype integrates user login, tourist-place exploration, destination information, 3D visualization, map navigation, AI-assisted trip planning, landmark-related image analysis, and favourites management. These features are designed to support users throughout the tourism process, from discovering destinations to exploring monuments and planning their trips. By combining these functions in one web application, the system provides a common interface for accessing tourism-related information and services. Fig. 1. Illustrates User Authentication Page.

### **A. Tourist-Place Exploration**

The tourist-place explorer provides access to destinations included in the application's dataset. Users can select a location and view its available details, helping them learn about tourist attractions before planning a visit. The usefulness of this feature depends on the number, accuracy, and quality of the destination records currently available. Expanding the dataset with verified information about additional cities, local attractions, historical places, and regional specialties could improve destination coverage and make the application useful to a wider range of travellers. Fig. 2. represents Tourist Place Explorer.

### **B. Personalized Trip Planning**

The trip planner uses user-provided requirements to generate a suggested itinerary. It supports travel planning by considering the information supplied by users, such as their interests, budget, and trip duration, where these inputs are supported by the implementation. This approach is useful because travellers may have different preferences and travel requirements. However, the generated itinerary should be checked against the user's needs, and time-sensitive information such as prices and opening hours should be verified before travel. The current description does not establish a measured recommendation-accuracy score; therefore, recommendation performance should be evaluated before numerical results are reported. Fig. 3. represents Personalized Trip Planner.

### **C. 3D Visualization**

The 3D visualization module provides digital representations of selected monuments that users can inspect through the available interactive controls. This feature helps users explore the visible structure of a monument from different viewpoints before visiting the location. The overall experience depends on the quality and realism of the source models, loading time, and browser performance. Using detailed but optimized models and improving the responsiveness of the viewer could enhance the visualization experience and make the feature more effective for tourism exploration. Fig. 4. represents 3D Monument Visualization.

### **D. Landmark Analysis and Navigation**

The landmark image analysis module provides an image-input workflow for obtaining landmark-related information. Its effectiveness depends on the recognition method connected to the application, the landmarks supported, and the quality of the submitted images. Images captured under different lighting conditions or from unusual angles may affect the analysis. A labelled test dataset would be required to measure recognition accuracy and assess the reliability of the feature. Fig. 5. represents Landmark Image Analysis.

The map and navigation module connects destination selection with geographical information and the route guidance supported by the application. It helps users understand the location of tourist attractions and supports travel planning through map-based information. Its performance depends on valid geographical coordinates, location permissions,

internet connectivity, and the availability of the configured map or routing service. Further testing can help identify issues related to destination locations and route availability. Fig. 6. represents Interactive Map and Navigation.

## Discussion

The main contribution of the project is the integration of multiple tourism functions within a single interface. Users can discover destinations, inspect digital monument models, access geographical information, and obtain AI-assisted travel suggestions without treating each activity as a completely separate task. The combination of these features demonstrates the potential of integrating web technologies, AI services, mapping tools, and 3D visualization to support tourism exploration.

However, the current prototype has limitations, including restricted destination coverage and the need for systematic evaluation of the recommendation and landmark-analysis components. The usefulness of AI-generated itineraries also depends on the quality of the generated information, while the effectiveness of 3D visualization depends on the available models and their performance in the browser. Future testing should examine the correctness of destination details, the relevance of travel suggestions, successful 3D model loading, landmark recognition performance, route availability, and the persistence of saved favourites. Numerical performance results should be included only after the corresponding tests have been conducted.

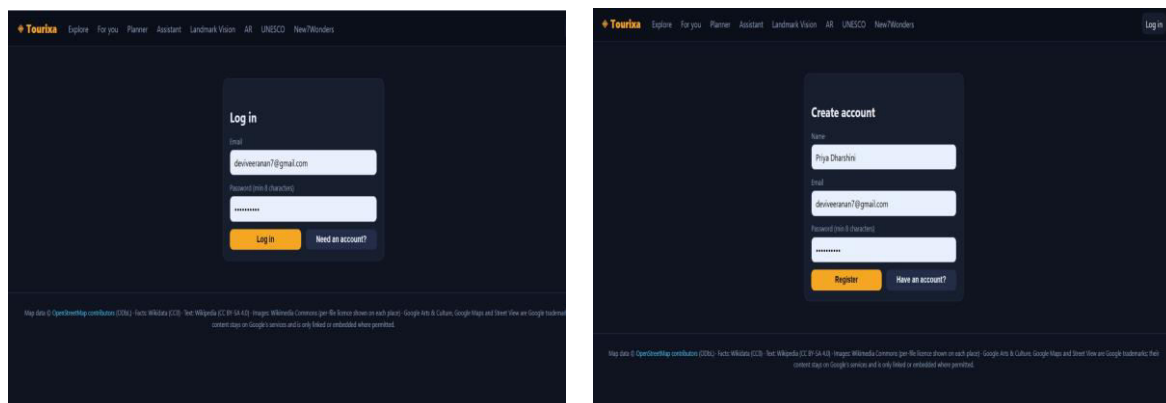


Fig. 1. User Authentication Page

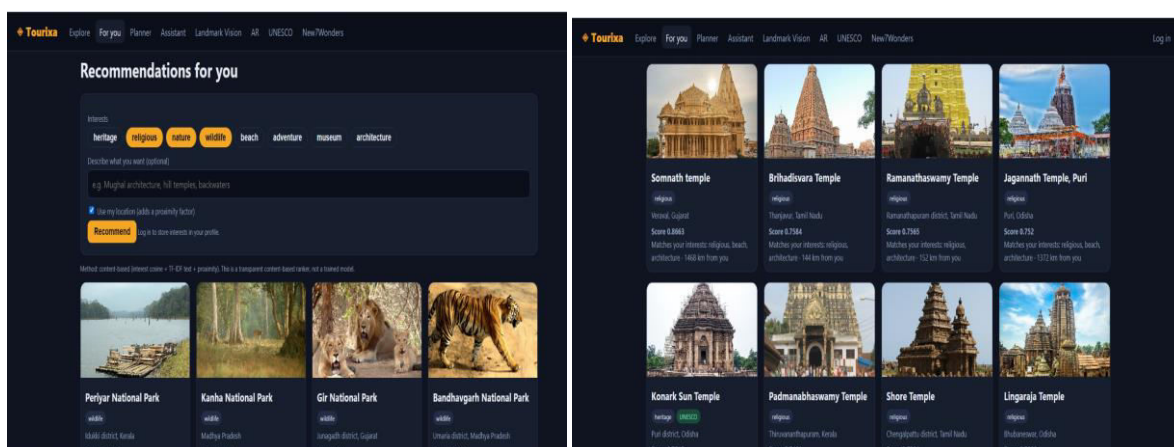


Fig. 2. Tourist Place Explorer

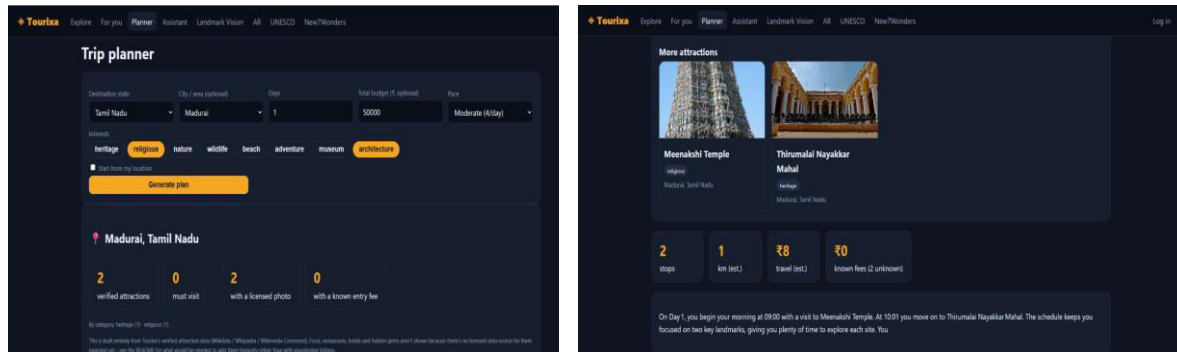


Fig. 3. Personalized Trip Planner

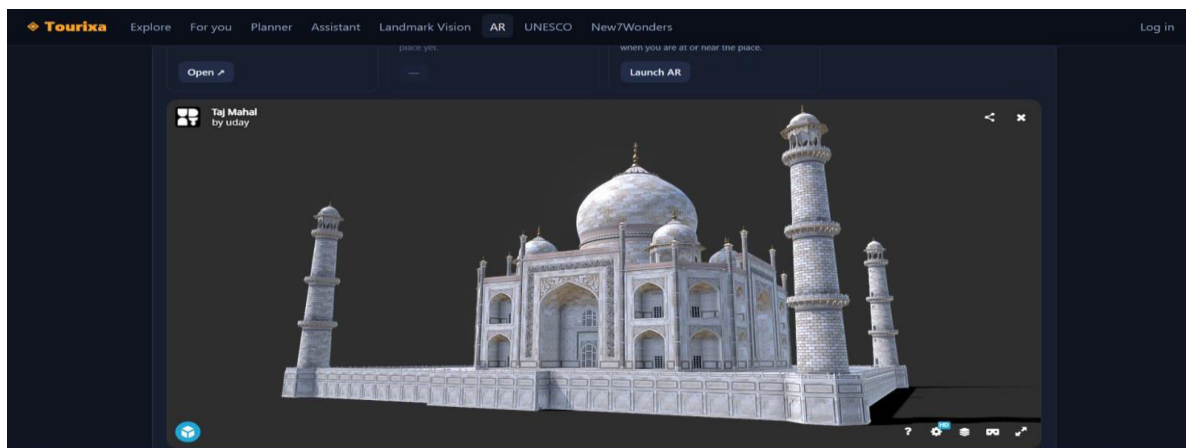


Fig. 4. 3D Monument Visualization

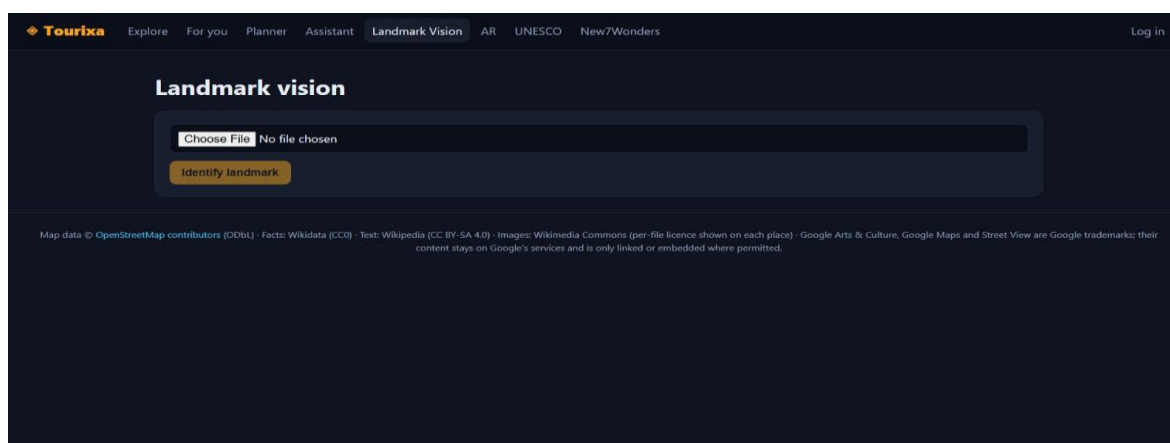


Fig. 5. Landmark Image Analysis

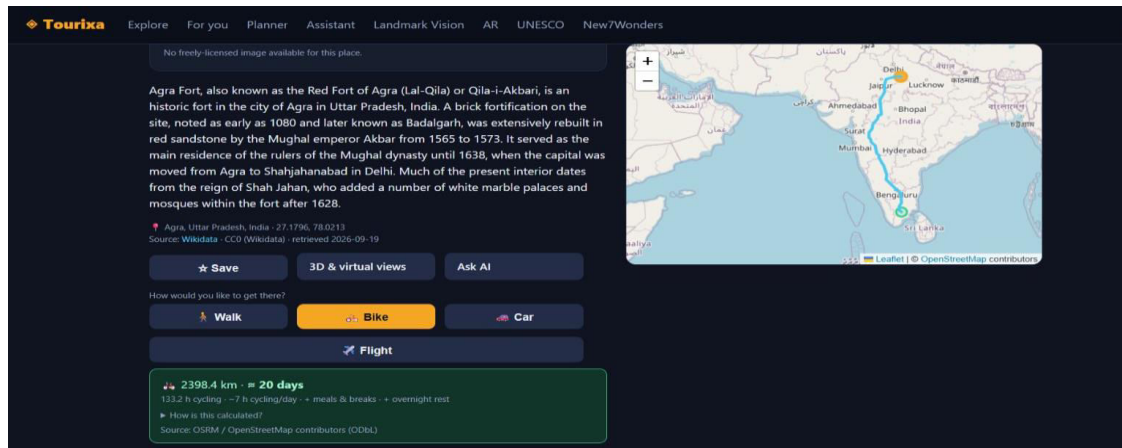


Fig. 6. Interactive Map and Navigation

## VI. CONCLUSION

The Personalized Tourism Recommendation System Using Machine Learning Framework with 3D Visualization provides an integrated platform for exploring tourist destinations and supporting travel planning. The system combines user authentication, tourist-place exploration, AI-assisted trip planning, three-dimensional monument visualization, landmark image analysis, map-based navigation, and favourites management within a single web application. These features help users access destination information, explore digital representations of selected monuments, and organize their travel plans more conveniently. The current prototype provides a foundation for developing more interactive and personalized tourism services. However, its effectiveness can be improved by expanding the destination database, enhancing recommendation techniques, improving landmark analysis, and adding more detailed 3D models. Future work can also include systematic testing to evaluate recommendation relevance, recognition performance, and overall usability. With these improvements, the system can be developed into a more comprehensive and user-friendly platform for tourism exploration and trip planning.

## REFERENCES

- [1] J. Borràs, A. Moreno, and A. Valls, "Intelligent tourism recommender systems: A survey," *Expert Systems with Applications*, vol. 41, no. 16, pp. 7370–7389, 2014.
  - [2] D. Gavalas, C. Konstantopoulos, K. Mastakas, and G. Pantziou, "Mobile recommender systems in tourism," *Journal of Network and Computer Applications*, vol. 39, pp. 319–333, 2014.
  - [3] F. Ricci, "Travel recommender systems," *IEEE Intelligent Systems*, vol. 17, no. 6, pp. 55–57, 2002.
  - [4] F. Ricci and H. Werthner, "Case base querying for travel planning recommendation," *Information Technology & Tourism*, vol. 4, no. 3–4, pp. 215–226, 2002.
  - [5] A. Garcia, O. Arbelaitz, M. T. Linaza, P. Vansteenwegen, and W. Souffriau, "Personalized tourist route generation," in *Enterprise Information Systems*, Springer, 2010.
  - [6] P. Vansteenwegen, W. Souffriau, G. Vanden Berghe, and D. Van Oudheusden, "The City Trip Planner: An expert system for tourists," *Expert Systems with Applications*, vol. 38, no. 6, pp. 6540–6546, 2011.
  - [7] H. Werthner and F. Ricci, "E-commerce and tourism," *Communications of the ACM*, vol. 47, no. 12, pp. 101–105, 2004.
  - [8] D. Buhalis and R. Law, "Progress in information technology and tourism management: 20 years on and 10 years after the Internet," *Tourism Management*, vol. 29, no. 4, pp. 609–623, 2008.
  - [9] Z. Xiang and U. Gretzel, "Role of social media in online travel information search," *Tourism Management*, vol. 31, no. 2, pp. 179–188, 2010.
  - [10] U. Gretzel, M. Sigala, Z. Xiang, and C. Koo, "Smart tourism: Foundations and developments," *Electronic Markets*, vol. 25, pp. 179–188, 2015.
- Machine Learning and Personalization

- [11] G. Adomavicius and A. Tuzhilin, "Toward the next generation of recommender systems: A survey of the state-of-the-art and possible extensions," *IEEE Transactions on Knowledge and Data Engineering*, vol. 17, no. 6, pp. 734–749, 2005.
- [12] F. Ricci, L. Rokach, and B. Shapira, Eds., *Recommender Systems Handbook*, 2nd ed. Springer, 2015.
- [13] R. Burke, "Hybrid recommender systems: Survey and experiments," *User Modeling and User-Adapted Interaction*, vol. 12, pp. 331–370, 2002.
- [14] P. Resnick, N. Iacovou, M. Suchak, P. Bergstrom, and J. Riedl, "GroupLens: An open architecture for collaborative filtering of netnews," in *Proceedings of the ACM Conference on Computer Supported Cooperative Work*, 1994, pp. 175–186.
- [15] B. Sarwar, G. Karypis, J. Konstan, and J. Riedl, "Item-based collaborative filtering recommendation algorithms," in *Proceedings of the 10th International Conference on World Wide Web*, 2001, pp. 285–295.
- [16] Y. Koren, R. Bell, and C. Volinsky, "Matrix factorization techniques for recommender systems," *Computer*, vol. 42, no. 8, pp. 30–37, 2009.
- [17] S. Rendle, C. Freudenthaler, Z. Gantner, and L. Schmidt-Thieme, "BPR: Bayesian personalized ranking from implicit feedback," in *Proceedings of the 25th Conference on Uncertainty in Artificial Intelligence*, 2009, pp. 452–461.
- [18] S. Zhang, L. Yao, A. Sun, and Y. Tay, "Deep learning based recommender system: A survey and new perspectives," *ACM Computing Surveys*, vol. 52, no. 1, article 5, 2019.
- [19] J. Bobadilla, F. Ortega, A. Hernando, and A. Gutiérrez, "Recommender systems survey," *Knowledge-Based Systems*, vol. 46, pp. 109–132, 2013.
- [20] G. Adomavicius, B. Mobasher, F. Ricci, and A. Tuzhilin, "Context-aware recommender systems," *AI Magazine*, vol. 32, no. 3, pp. 67–80, 2011.
- Location-Based Tourism and Navigation
- [21] J. H. Schiller and A. Voisard, Eds., *Location-Based Services*. Morgan Kaufmann, 2004.
- [22] A. K. Dey, "Understanding and using context," *Personal and Ubiquitous Computing*, vol. 5, pp. 4–7, 2001.
- [23] K. W. Church and B. Smyth, "Who, what, where & when: A new approach to mobile search," in *Proceedings of the 13th International Conference on Intelligent User Interfaces*, 2008, pp. 309–312.
- [24] D. Ashbrook and T. Starner, "Using GPS to learn significant locations and predict movement across multiple users," *Personal and Ubiquitous Computing*, vol. 7, pp. 275–286, 2003.
- [25] P. Vansteenwegen, W. Souffriau, and D. Van Oudheusden, "The orienteering problem: A survey," *European Journal of Operational Research*, vol. 209, no. 1, pp. 1–10, 2011.
- 3D Visualization and Cultural Heritage
- [26] F. Remondino and S. El-Hakim, "Image-based 3D modelling: A review," *The Photogrammetric Record*, vol. 21, no. 115, pp. 269–291, 2006.
- [27] M. Levoy et al., "The Digital Michelangelo Project: 3D scanning of large statues," in *Proceedings of SIGGRAPH*, 2000, pp. 131–144.
- [28] F. Remondino, "Heritage recording and 3D modeling with photogrammetry and 3D scanning," *Remote Sensing*, vol. 3, no. 6, pp. 1104–1138, 2011.
- [29] D. Koller, B. Frischer, and G. Humphreys, "Research challenges for digital archives of 3D cultural heritage models," *ACM Journal on Computing and Cultural Heritage*, vol. 2, no. 3, article 7, 2009.
- [30] P. Milgram and F. Kishino, "A taxonomy of mixed reality visual displays," *IEICE Transactions on Information and Systems*, vol. E77-D, no. 12, pp. 1321–1329, 1994.
- Image Recognition and Intelligent Visual Analysis
- [31] D. G. Lowe, "Distinctive image features from scale-invariant keypoints," *International Journal of Computer Vision*, vol. 60, pp. 91–110, 2004.
- [32] N. Snavely, S. M. Seitz, and R. Szeliski, "Photo tourism: Exploring photo collections in 3D," *ACM Transactions on Graphics*, vol. 25, no. 3, pp. 835–846, 2006.
- [33] A. Krizhevsky, I. Sutskever, and G. E. Hinton, "ImageNet classification with deep convolutional neural networks," in *Advances in Neural Information Processing Systems*, vol. 25, 2012.
- [34] K. He, X. Zhang, S. Ren, and J. Sun, "Deep residual learning for image recognition," in *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 2016, pp. 770–778.



INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details