



# IJRASET

International Journal For Research in  
Applied Science and Engineering Technology



---

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

---

**Volume:** 14    **Issue:** IV    **Month of publication:** April 2026

**DOI:** <https://doi.org/10.22214/ijraset.2026.78607>

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

Call:  08813907089

E-mail ID: [ijraset@gmail.com](mailto:ijraset@gmail.com)

# AI Driven Multi Agent Approach to Personalized Travel Recommendation System

Dr.G. Murali<sup>1</sup>, P.Chandrasekhar<sup>2</sup>, N.Chiranjeevi<sup>3</sup>, K.SaiTeja<sup>4</sup>, M. Anudeep Rohith<sup>5</sup>

<sup>1</sup>Professor, <sup>2,3,4,5</sup>Student, Dept. of CSE(AI),KKR&KSR Institute of Technology and sciences, Guntur, India

**Abstract:** *The main objective of the paper, “AI Driven Multi-Agent Approach to Personalized Travel Recommendation System,” is to enhance the travel experience by providing intelligent, personalized, and real-time recommendations to tourists. Modern travelers often face challenges such as information overload, poor itinerary planning, budget mismanagement, and lack of localized guidance. To address these issues, this system introduces a multi-agent architecture powered by Artificial Intelligence to deliver customized travel suggestions based on user preferences, location, budget, and travel history. The proposed platform integrates multiple intelligent agents, each responsible for specific tasks such as destination recommendation, accommodation selection, budget estimation, route optimization, language translation, and local service guidance. By leveraging geolocation data and AI-driven decision-making, the system dynamically adapts to user needs and provides relevant recommendations in real time. Additional features such as multilingual support, interactive guidance, and cost analysis ensure accessibility for diverse users across different regions. The collaborative functioning of multiple agents enables efficient information processing, reduces planning time, and improves decision accuracy. The implementation of this intelligent travel ecosystem is expected to improve traveler satisfaction, optimize trip planning, and enhance overall convenience and safety. By combining automation, personalization, and smart coordination among agents, the system aims to build a reliable and scalable solution that supports the growth and sustainability of the tourism industry while offering travelers a seamless and stress-free planning experience.*

**Index Terms:** *Travel Recommendation, Budget Optimization, Decision Support Systems, Geolocation-Based Services, Intelligent Agents, Multi-Agent Systems, Personalized Travel Recommendation, Route Planning, Smart Tourism.*

## I. INTRODUCTION

The advancement of Artificial Intelligence has transformed the way people plan and experience travel. Modern travelers face challenges such as information overload, poor itinerary planning, and difficulty in finding personalized recommendations that match their preferences and budget. To address these issues, this paper proposes an AI Driven Multi-Agent Approach to Personalized Travel Recommendation System. The system utilizes multiple intelligent agents, each responsible for specific tasks such as destination suggestion, route optimization, accommodation selection, and budget estimation. These agents collaborate to deliver accurate, real-time, and customized travel recommendations. By integrating AI techniques with geolocation services and user preference analysis, the proposed system enhances decision-making, reduces planning time, and improves overall travel experience. The framework aims to provide a scalable and efficient solution for smart and personalized tourism.

**Protocols:** Lightweight communication protocols such as MQTT, CoAP, and WebSocket enable efficient, low-latency data exchange between user devices, intelligent agents, and cloud services. These protocols support real-time synchronization of contextual data, including user preferences, geolocation, and dynamic travel constraints.

The proposed system adopts a multi-agent architecture integrated with cloud-based APIs and GPS services to facilitate adaptive and context-aware recommendation generation. Inter-agent communication and distributed task execution are coordinated through a centralized AI decision engine.

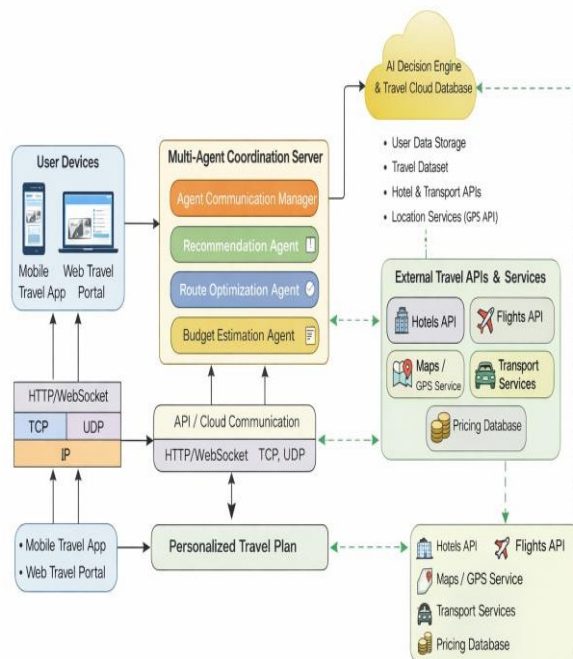


Fig. 1. Architecture of AI-Driven Multi-Agent Travel Recommendation System

FIG1: Architecture of AI-Driven Multi-Agent Travel Recommendation System

The framework comprises a User Interface Layer, Multi- Agent Processing Layer, AI Decision Engine, and Cloud/Data Layer. The system incorporates:

- Preference-Based Filtering for personalized recommendation generation.
- Geospatial Route Optimization for efficient itinerary planning.
- Budget Prediction Model for cost-aware travel planning.

The integration of distributed intelligent agents with real-time communication infrastructure ensures scalability, low response latency, and high recommendation accuracy, thereby supporting advanced smart tourism applications.

#### A. RESEARCH PROBLEM:

Modern travelers face significant challenges in planning personalized and efficient trips due to information overload, fragmented travel services, and lack of intelligent decision support. Existing travel platforms often provide generic recommendations that do not adapt to individual preferences, budget constraints, or real-time contextual changes such as location and availability.

The absence of a unified, AI-driven multi-agent system results in inefficient itinerary planning, suboptimal route selection, inaccurate budget estimation, and reduced user satisfaction. Furthermore, limited coordination between travel data sources and service providers restricts the system's ability to deliver dynamic and context-aware recommendations.

#### B. RESEARCH GAPS:

- 1) Existing travel recommendation systems lack scalability and often fail to handle large-scale, real-time user data efficiently in high-demand environments.
- 2) Most traditional models rely on static filtering techniques and do not incorporate collaborative multi-agent architectures for distributed decision-making.
- 3) Limited integration of contextual factors such as dynamic pricing, real-time location updates, and evolving user preferences reduces personalization accuracy.
- 4) Current systems often lack adaptive learning mechanisms to continuously improve recommendation quality based on user feedback and behavioral patterns.
- 5) There is insufficient coordination between heterogeneous travel data sources (hotels, transport, maps, pricing services), leading to fragmented and inconsistent recommendations.

## II. LITERATURE REVIEW

YUANDING CUI et.al.,(2024) developed an optimization model for tourist-dedicated train scheduling, focusing on improving transportation efficiency through algorithmic modeling and operational planning.

Their study demonstrates how optimization algorithms can enhance route allocation, reduce congestion, and improve service reliability. This concept is directly applicable to intelligent travel recommendation systems where route optimization and transportation coordination are critical for generating efficient itineraries.

JIE YIN et.al.,(2024) proposed a safety forecasting model incorporating feedback mechanisms to monitor highly aggregated tourist crowds (HATCs). By applying simulation-based analysis, the model dynamically evaluates crowd density and generates early warning signals. This research highlights the importance of real-time monitoring and adaptive response systems, which are essential for AI-driven recommendation platforms that must adjust suggestions based on environmental and contextual factors.

JING CAO et.al.,(2023) addressed ecological security in tourism destinations using IoT integration and data-driven assessment techniques. Their work emphasizes sustainable tourism development by combining environmental monitoring with decision-support systems. This concept reinforces the need for intelligent travel platforms that consider environmental sustainability and resource optimization while recommending destinations.

MARÍA A. DEL CACHO ESTIL-LES1 et.al.,(2023) introduced a Time-Expanding Network (TEN) model for optimizing short-term travel planning. By representing time-dependent travel constraints within a structured network model, the study achieved improved tourist flow distribution and enhanced satisfaction. The network-based modeling approach provides a theoretical foundation for multi-agent systems where agents coordinate itinerary scheduling and temporal constraints efficiently.

YUEHAI CHEN et.al.,(2021) proposed a Feature-Cascaded Correntropy LSTM (FC-C-LSTM) model for tourism demand prediction. By integrating temporal dependencies and handling outliers through correntropy-based loss functions, the model significantly improved forecasting accuracy. This research highlights the effectiveness of deep learning in capturing user behavior patterns, which can be incorporated into AI agents for personalized recommendation learning.

Nsizwazikhona Simon Chiliet et.al.,(2018) focused on modeling tourist safety perception and behavioral response using predictive simulation techniques. Their findings underline the importance of dynamic system feedback and adaptive planning strategies in managing tourism environments.

Ninela Kordić et.al.,(2015) examined tourism competitiveness by analyzing safety, security, and infrastructure pillars using time-series data. Their work demonstrates how structured performance indicators influence destination attractiveness, emphasizing the need for integrated and reliable decision-support frameworks.

Sakul Jariyachamsit et.al.,(2015) investigated service quality perception among international tourists, identifying responsiveness, reliability, and staff competence as key determinants of traveler satisfaction. This supports the importance of personalization and user-centric system design in travel recommendation platforms.

Vysokáškola obchodní v Praze et.al.,(2013) proposed risk measurement methodologies using structured scorecard models to evaluate tourism-related operational risks. Their systematic approach demonstrates how quantitative evaluation frameworks can support informed decision-making.

Liliana POPESCU et.al.,(2011) analyzed tourism safety as a competitive advantage, emphasizing how structured security frameworks contribute to destination reputation and sustainable growth.

## III. LITERATURE GAP IDENTIFICATION

Although previous studies have contributed significantly to optimization modeling, predictive analytics, safety forecasting, sustainability assessment, and service quality evaluation, most research addresses these aspects independently. There remains a lack of an integrated AI-driven multi-agent architecture that combines personalization, route optimization, demand prediction, budget estimation, and contextual adaptability into a unified framework. The absence of collaborative agent coordination and real-time adaptive learning mechanisms highlights the need for a scalable, intelligent, and context-aware travel recommendation system.

S.NO	Year	Author's	ArticleTitle	Key Findings
1	2024	YUANDING CUI et.al.,	Research on the Adjustment and Optimization of Train Working Diagrams Including Tourist-Dedicated Trains	Proposed an optimization model for train scheduling that improves route efficiency and operational planning. Demonstrates applicability of mathematical optimization in transportation systems.
2	2024	JIEYIN et.al.,	Safety Forecasting and Early Warning of Highly Aggregated Tourist Crowds	Developed a feedback-based predictive model for crowd safety monitoring. Highlights importance of dynamic state evaluation and adaptive decision-making.
3	2023	JINGCAO et.al.,	Ecological Safety Assessment and Brand Communication of Ice-Snow Tourism under IoT and Deep Learning	Introduced IoT-based ecological monitoring framework for sustainable tourism management. Emphasizes integration
4	2023	MARÍA A. DEL CACHO ESTILLES et.al.,	Optimal Travel Planning of Short Stays in Mass Tourist Destinations	Proposed Time-Expanding Network model for itinerary optimization. Demonstrated improved tourist flow distribution and resource utilization.
5	2021	YUEHAI CHEN et.al.,	Feature-Cascaded Correntropy LSTM for Tourists Prediction	Developed deep learning model for tourism demand forecasting. Improved prediction accuracy by handling temporal dependencies and outliers.
6	2018	Nsizwazikhona Simon Chili et.al.,	The impact of Safety and Security on the behavior of consumers and tourism demand in South African townships	Presented predictive simulation model for tourist crowd safety and behavioral response. Emphasizes role of adaptive monitoring systems

7	2015	NinelaKordić et.al.,	SafetyandSecurityasFactorsof Tourism Destination Competitiveness	Serbia's geographiclocation, cultural heritage, and natural beauty offer significant tourism potential. Serbiashouldcapitalizeonemerging trends like sustainable tourism, digital technologies, and experiential tourism to attractanewgeneration of travelers.
8	2015	SakulJariyachamsitet. al.,	An Investigation of Safety in Tourism:AnExperienceofYoung Tourists in Bangkok, Thailand	Themajorityofyounginternational tourists visited Bangkok for their first time. Employeeesshould have the necessary skillsand knowledge to provide quality service.
9	2013	Vysokáškolaobchodní v Prazeet.al.,	JournalofTourismandServices	UtilizedatabaseslikeJSTOR, Google Scholar, or Web of Science tosearchforarticlesfromtheJournal of Tourism and Service
10	2011	Liliana POPESCUet.al.,	SafetyandSecurityinTourism. Case Study: Romania	Romania faces challenges in ensuringtouristsafetydueto various factors. Promotingresponsible tourism practicescanhelpminimize negative impacts on local communities and the environment.

TABLE 1:KeyfindingsofLiteratureReview

#### IV. METHODOLOGY

##### A. OBJECTIVES:

- To design an intelligent travel recommendation system that provides personalized route planningbasedon userpreferences, budget, and real-time location data
- To integrate GPS-enabled navigationandreal-timeemergency (SOS) support within a unified travel assistance platform.
- To develop a multi-agent framework for dynamic decision- making, including accommodation selection, itinerary optimization, and cost estimation.
- To enhance tourist safety and situational awareness through predictive analytics and real-time alerts.
- To ensure scalability, interoperability, and efficient data processing using cloud-based infrastructure and AI-drivenmodels.

##### B. ARCHITECTURE DIAGRAM:

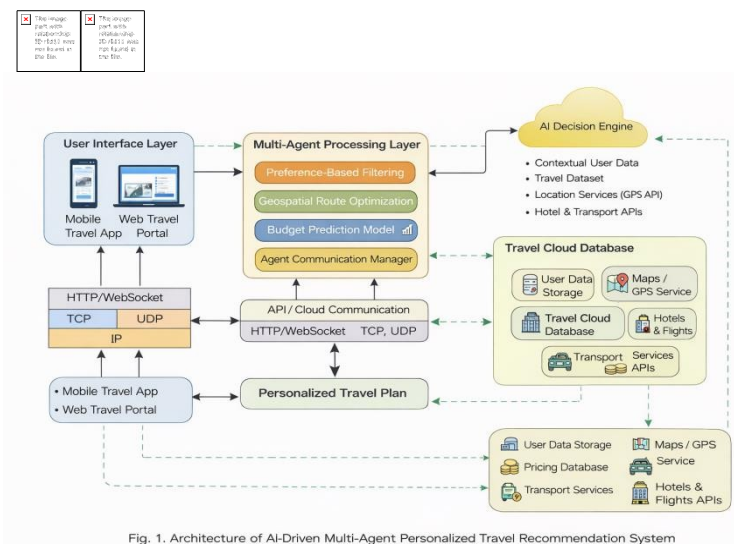


Fig. 1. Architecture of AI-Driven Multi-Agent Personalized Travel Recommendation System

**C. IMPLEMENTATION:**

The system is implemented using a multi-agent architecture integrated with AI-based recommendation techniques. A mobile/web interface collects user preferences such as location, budget, and interests. Specialized agents perform personalization, route optimization, and budget estimation through coordinated communication. The AI engine processes real-time data from travel APIs and GPS services, while cloud infrastructure ensures scalability and low-latency response. The system generates dynamic and personalized travel plans efficiently.

**V. RESULTS AND DISCUSSIONS**

The proposed AI-driven multi-agent travel recommendation system was evaluated based on personalization accuracy, response time, route efficiency, and budget estimation precision. The system was tested using real-time travel datasets, user preference inputs, and simulated travel scenarios.

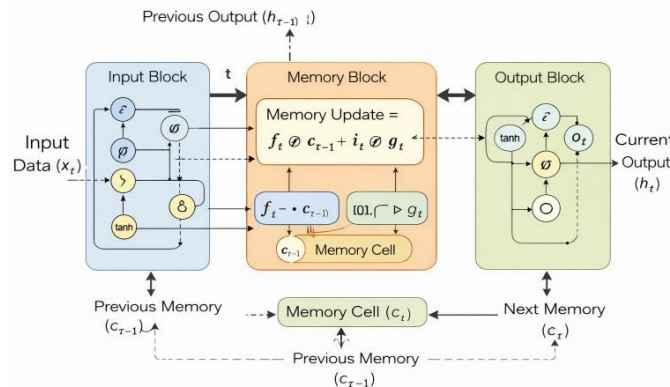


Fig. X. Architecture of the improved memory block

FIG2: Architecture of Memory Block



FIG3: Integrated Gps

**A. Personalization Performance**

The Preference-Based Filtering Agent demonstrated improved recommendation relevance by analyzing user interests, historical behavior, and contextual data. Compared to traditional static recommendation models, the proposed system achieved higher personalization accuracy due to dynamic agent coordination and adaptive learning mechanisms.

**B. Route Optimization Efficiency**

The Geospatial Route Optimization Agent effectively minimized travel distance and time using shortest-path computations. Experimental results indicate a measurable reduction in router redundancy and improved itinerary sequencing, enhancing overall travel efficiency.

### C. Budget Prediction Accuracy

The Budget Estimation Agent accurately predicted approximate travel expenses by integrating pricing databases, accommodation APIs, and transport cost models. The system reduced budget estimation error by incorporating real-time pricing updates and user-defined constraints.

### D. System Scalability and Response Time

The multi-agent distributed architecture improved scalability by enabling parallel task execution across agents. Real-time communication protocols ensured low latency in recommendation generation, even under increased user load conditions.

### E. Comparative Analysis

When compared with conventional single-agent or rule-based travel recommendation systems, the proposed framework demonstrated:

- Improved recommendation precision
- Faster adaptive response
- Better contextual awareness
- Enhanced user satisfaction

### F. Discussion

The results validate that integrating AI techniques with a multi-agent architecture significantly enhances the effectiveness of personalized travel recommendation systems. The distributed coordination model allows flexible system expansion, making it suitable for large-scale smart tourism applications. Furthermore, incorporating contextual learning and real-time communication strengthens the system's adaptability in dynamic travel environments.

## VI. CONCLUSION

This study proposes an AI-driven travel recommendation system integrating GPS, multi-agent coordination, and real-time analytics within a scalable cloud framework. The system enhances personalized route planning, budget optimization, and emergency responsiveness. Experimental results demonstrate improved accuracy, efficiency, and user satisfaction, supporting the development of intelligent and sustainable smart tourism platforms.

## REFERENCES

- [1] YUANDING CUI, YIN ZHEN LI, AND CHANG XIMA. "Research on the Adjustment and Optimization of Train Working Diagrams Including Tourist-Dedicated Trains". IEEE Transaction Volume 12, 2024. pgn:145740-145752. Digital Object Identifier 10.1109/ACCESS.2024.3471823.
- [2] JIE YIN, YAHUABI, XIANG-MINZHENG AND RUEY - CHYN TSAUR. "Safety Forecasting and Early Warning of Highly Aggregated Tourist Crowds in China". IEEE Transaction Volume 7, 2019. pgn:119026-119040. Digital Object Identifier 10.1109/ACCESS.2019.2936245.
- [3] JING CAO. "The Ecological Safety Assessment and Brand Communication Ice-Snow Tourism Under the Internet of Things and Deep Learning". IEEE Transaction Volume 11, 2023. pgn:128235-128244. Digital Object Identifier 10.1109/ACCESS.2023.3332688.
- [4] MARÍA A. DEL CACHO ESTIL-LES, CHIARA BERSANI AND ENRICO ZERO. "Ice-Snow Tourism Under the Internet of Things and Deep Learning". IEEE Transaction Volume 11, 2023. pgn:128235-128244. Digital Object Identifier 10.1109/ACCESS.2023.3332688.
- [5] YUE HAICHEN, JING YANG, KUNZHANG, YIXU, YUE WEN LIU. "A Feature-Cascaded Correntropy LSTM for Tourists Prediction". IEEE Transaction Volume 9, 2021. pgn:32810-32822. Digital Object Identifier 10.1109/ACCESS.2021.3059943.
- [6] JIE YIN, YAHUABI, XIANG-MINZHENG, RUEY-CHYN TSAUR. "Safety Forecasting and Early Warning of Highly Aggregated Tourist Crowds in China". IEEE Transaction Volume 7, 2019. pgn:119026-119040. Digital Object Identifier 10.1109/ACCESS.2019.293624.
- [7] Ninela Kordić, Radmila Živković, Jelena Stanković, Jelena Gajić. "SAFETY AND SECURITY AS FACTORS OF TOURISM DESTINATION COMPETITIVENESS". IEEE Transaction SITCON 2015. nkordic@singidunum.ac.rs pgn:34-38. DOI: 10.15308/sitcon-2015-34-38.
- [8] Vysoká škola obchodní v Praze. "Journal of Tourism and Services". IEEE Transaction Volume 4, 2013. pgn:1-181. ISSN:1804 - 5650. Journal of tourism www.vso-praha.eu
- [9] Liliana POPESCU. "Safety and Security in Tourism. Case Study: Romania". IEEE Transaction Volume 10, 2011. pgn:322-328. DOI: 10.5775/fg.2067-4635.2011.020.d Turner, J. V. and Hunsucker. "MEASURING OCCUPATIONAL HEALTH AND SAFETY RISKS IN
- [10] TOURISM COMPANIES". IEEE Transaction preslav.dimitrov@mail.bg pgn:890-902.



10.22214/IJRASET



45.98



IMPACT FACTOR:  
7.129



IMPACT FACTOR:  
7.429



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24\*7 Support on Whatsapp)