



# AI BNB: AI-BASED TRAVEL LISTING AND BOOKING PLATFORM

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**Abstract:** This paper presents AI BnB, an AI-powered travel and accommodation booking platform built using the MERN stack (MongoDB, Express.js, React.js, Node.js). The platform addresses the growing need for intelligent, personalized property discovery by integrating a machine learning-based recommendation system that analyses user preferences, search history, and behavioural patterns. The system enables users to search, filter, and book properties seamlessly, while hosts manage listings and administrators oversee the platform. Key features include role-based JWT authentication, AI-driven property recommendations, smart search filters, secure booking management, and an AI Concierge powered by the Gemini API for natural language hotel queries. The platform is designed for scalability, responsiveness, and data security, demonstrating how AI combined with modern web development can significantly improve user experience in the hospitality domain.

**Keywords:** AI Recommendation System, Travel Booking, MERN Stack, Machine Learning, Property Listing, JWT Authentication, Gemini API, MongoDB

## 1. INTRODUCTION

The travel and hospitality industry has witnessed a major shift toward digital accommodation platforms. However, most existing platforms lack advanced personalization and intelligent filtering. Users struggle to find stays that precisely match their budget, location, amenities, and rating preferences.

Research in collaborative filtering, content-based filtering, and hybrid recommendation models has shown that AI-powered personalization can significantly reduce decision time and increase booking conversions. AI BnB integrates these approaches within a full-stack web platform.

The system caters to three stakeholders — guests (search and book), hosts (list and manage properties), and administrators (system oversight). A Gemini AI Concierge enables natural language hotel queries, room comparisons, and chat-based booking, representing a novel integration of large language models in travel platforms.

This paper describes the design, architecture, and implementation of AI BnB, covering the recommendation engine, authentication, booking flow, and AI concierge, alongside real screenshots of the deployed system.

## 2. SCOPE

The scope covers an intelligent accommodation listing platform addressing property discovery, personalized recommendations, and seamless booking. The platform supports property listing by hosts, AI-driven search by guests, secure payment, and concierge-based conversational booking. The recommendation module analyses user behaviour and booking history to surface relevant properties in real time.

## 3. OBJECTIVES

The main objectives of this project are:

- [1] Smart Recommendations: Implement an AI engine analysing user preferences and behaviour to surface the most relevant properties.
- [2] Secure Authentication: Role-based JWT authentication for guests, hosts, and administrators.
- [3] Property Management: Hosts create, update, and manage listings with location, price, amenities, and images.
- [4] Smart Search & Filtering: Advanced filters by city, budget, rating, and amenities.
- [5] Booking System: Reliable booking with payment, confirmation, and history management.
- [6] AI Concierge: Gemini API-powered conversational assistant for hotel queries and chat-based booking.
- [7] Admin Control Panel: Full platform monitoring, user management, and listing control.



#### 4. LITERATURE REVIEW

[1] Recommendation systems using collaborative filtering and content-based filtering are widely applied in e-commerce and travel platforms. Hybrid models combining both techniques have demonstrated superior accuracy and user satisfaction.

[2] The MERN stack (MongoDB, Express.js, React.js, Node.js) has emerged as a scalable, JavaScript-based architecture for full-stack web applications, enabling seamless data flow between client and server.

[3] AI-driven search and booking platforms in the hospitality industry have shown improved booking conversion rates and reduced user search time through 30Ipersonalized recommendations and dynamic pricing.

[4] Large language models (LLMs) integrated into booking platforms as AI concierge services allow natural language property queries, significantly reducing friction in the property discovery process.

[5] JWT and Oauth 2.0 are established standards for stateless authentication in modern web applications, while role-based access control (RBAC) ensures appropriate access levels for different user types.

#### 5. PROPOSED METHODOLOGY

The AI BnB system employs a three-tier client-server architecture. MongoDB stores user profiles, property listings, booking records, and interaction logs. The application layer built with Node.js and Express.js exposes RESTful APIs for all platform functions. React.js provides a responsive, component-based UI.

The recommendation engine ranks properties by combining user preference signals (budget category, location history, past bookings) with property attributes (price, rating, amenities). The Gemini API is called asynchronously to process natural language concierge queries, returning contextually relevant hotel suggestions.

JWT middleware validates all protected API routes, with role-based guards differentiating guest, host, and admin access. bcryptjs is used for password hashing before storage.

#### 6. METHODOLOGY — AGILE MODEL

The project follows an Agile iterative development model with the following phases:

1. Requirements Gathering: Define functional and non-functional requirements for all three user roles.
2. System Design: Design database schema, API endpoints, UI wireframes, and security protocols.
3. Implementation: Develop React.js frontend, Node.js/Express.js backend, and configure MongoDB.
4. AI Integration: Integrate recommendation engine and Gemini AI Concierge; validate with sample data.
5. Testing: Unit, integration, and user acceptance testing across all modules.
6. Deployment: Cloud deployment with CI/CD pipeline for automated testing and releases.

#### 7. TECHNOLOGIES USED

1. React.js: Component-based frontend for a responsive, dynamic user interface.
2. Node.js & Express.js: Server runtime and API framework for RESTful backend services.
3. MongoDB: NoSQL document database for flexible storage of users, listings, and bookings.
4. JWT Authentication: Stateless, secure authentication with role-based access control.
5. Gemini API: Google's generative AI integrated as the AI Concierge for natural language queries.
6. bcryptjs: Password hashing library ensuring credentials are stored securely.
7. Cloud Deployment: AWS / Vercel / Render with Docker containers and CI/CD pipelines.

#### 8. SYSTEM DESIGN

##### 8.1 System Flow / Control Flow Diagram

Figure 1 shows the complete control flow of the AI BnB platform from user login through property search, AI recommendation, booking, and payment confirmation.



CONTROL FLOW DIAGRAM – AI BNB PLATFORM

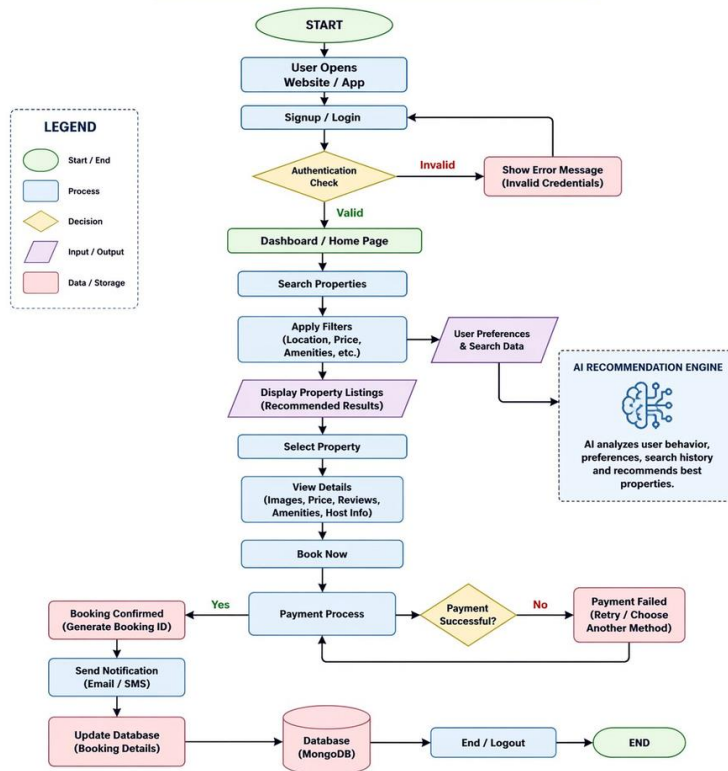


Figure 1: Control Flow Diagram – AI BnB Platform

8.2 Data Flow Diagram – Level 0

The Level 0 DFD (Figure 2) shows the high-level data flows between the three external entities (Guest, Host, Admin) and the AI BnB system, including property data, search queries, bookings, and management operations.

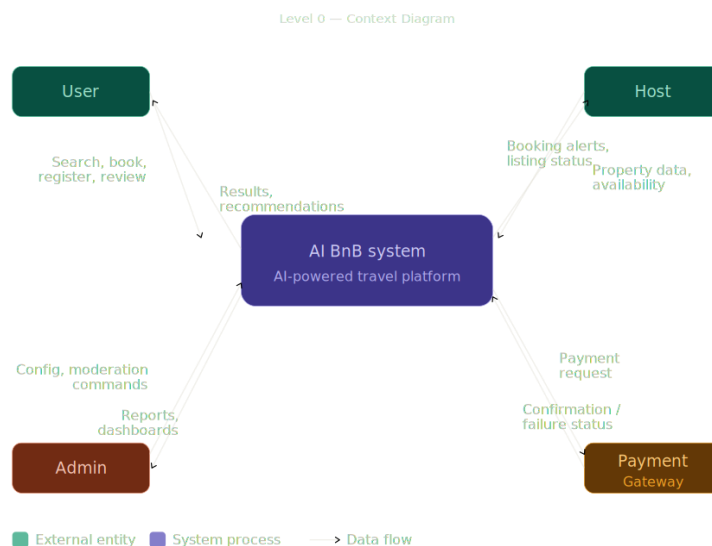


Figure 2: Data Flow Diagram – Level 0

8.3 Data Flow Diagram – Level 1

The Level 1 DFD (Figure 3) decomposes the system into its major processes: User Authentication, Property Management, AI Recommendation Engine, Booking & Payment, and AI Concierge, showing data flows between each process and the MongoDB data stores.

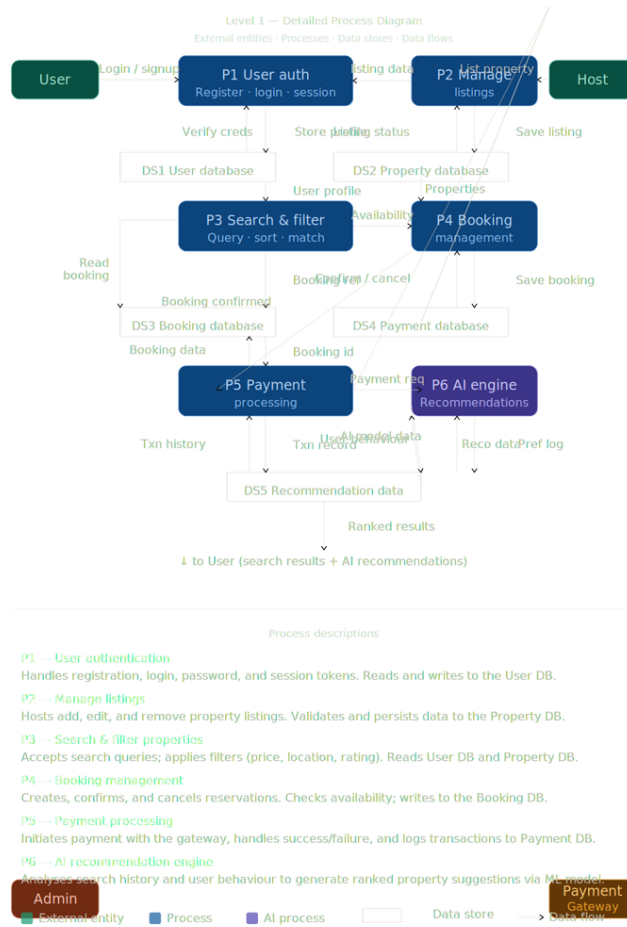


Figure 3: Data Flow Diagram – Level 1

## 9. IMPLEMENTATION & SCREENSHOTS

### 9.1 Home Screen & AI Recommendations

The home screen (Figure 4) features a full-width hero section with AI-powered search (city, budget, rating), quick-destination chips (Bangalore, Mumbai, Delhi, Gurgaon), and an AI Personal Recommendations section showing 'AI TOP PICK' properties. The Sanctuary Assistant sidebar generates live Gemini recommendations.

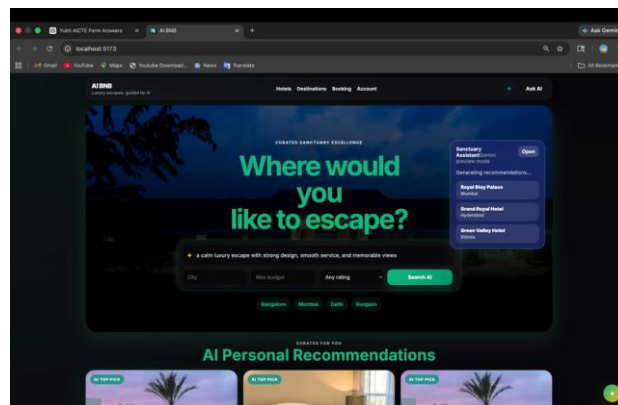


Figure 4: Home Screen – AI Search & Recommendations

### 9.2 AI Concierge

The AI Concierge (Figure 5), powered by Gemini API, presents as a chat panel. Users can use preset queries or type/speak custom ones. It supports room comparison, hotel summaries, and direct booking from chat.

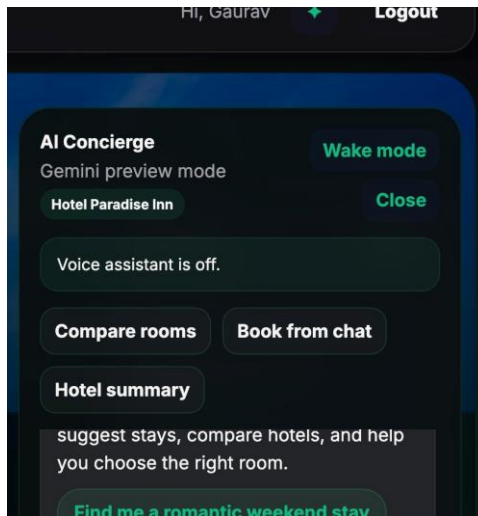


Figure 5: AI Concierge – Gemini Powered

9.3 User Profile Screen

The profile screen (Figure 6) displays the user's name, email, provider type, and budget preference. This preference data feeds directly into the recommendation engine to personalise property suggestions.

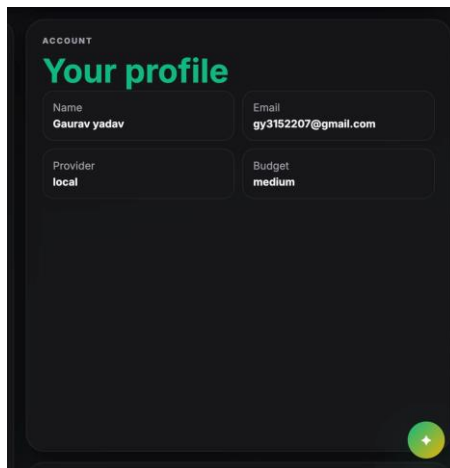


Figure 6: User Profile Screen

9.4 Booking / Dashboard Screen

The booking dashboard (Figure 7) presents the Effortless AI Booking Experience panel with live hotel catalog search, Gemini concierge integration, and the selected stay. The Concierge Snapshot shows real-time AI hotel summaries alongside the user profile.

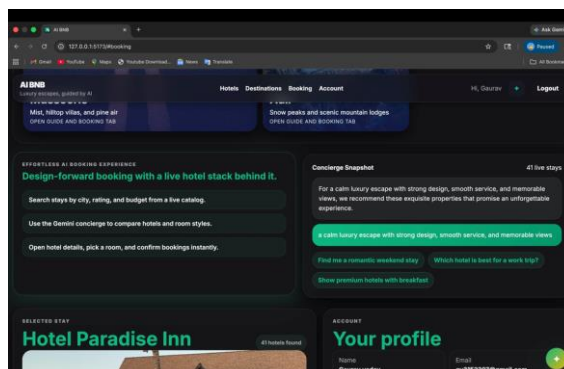


Figure 7: Booking Dashboard with AI Concierge Snapshot



### 9.5 Destination Page

Each destination (Figure 8) has a dedicated page with a full-width hero, destination description, live stats (Hotels: 2, Rooms: 18, Starting: Rs. 2799), trip snapshot, and 'View stays' / 'Ask concierge' CTAs.

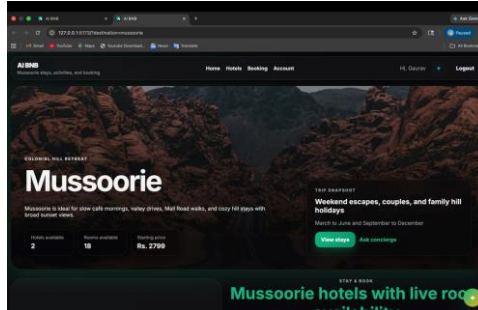


Figure 8: Mussoorie Destination Page

### 9.6 Hotel Listing Screen

The listing screen (Figure 9) shows destination experiences (Mall Road Walk, Gun Hill Ropeway, etc.) alongside live hotel cards — AI BnB Cloudline Mussoorie (Rs. 3399/night) and AI BnB Pineglass Residences (Rs. 2799/night) — with room availability and 'Book now' CTA.

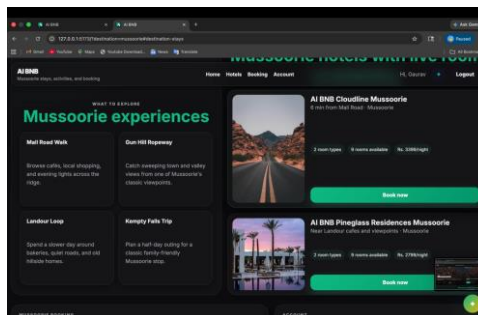


Figure 9: Hotel Listing with Experiences

## 10. SYSTEM FLOW

Upon opening the platform, unauthenticated users are redirected to the signup/login screen. After JWT authentication, users land on the home dashboard. They can search using filters or the AI search bar; the recommendation engine returns ranked results. Users select a property, view details (images, price, amenities, host info), and proceed to booking. Payment confirmation generates a Booking ID and sends an email/SMS notification. MongoDB is updated with booking details. The AI Concierge is available throughout for natural language hotel queries.

## 11. RESULT

The AI BnB platform was successfully developed and tested as a full-stack MERN web application. The AI recommendation engine correctly ranks and returns the top 5 properties based on user preferences and price signals. The JWT authentication system accurately enforces role-based access for guests, hosts, and admins. The Gemini AI Concierge interprets natural language queries and returns contextually relevant hotel suggestions in real time. The booking flow operates reliably with atomic MongoDB updates. The platform renders responsively across desktop, tablet, and mobile viewpoints.

## 12. CONCLUSION

This paper presented AI BnB, an AI-powered travel listing and booking platform combining the MERN stack with machine learning recommendations and a Gemini-powered AI Concierge. The platform successfully addresses core challenges in online accommodation booking — lack of personalization, complex search, and poor discoverability — through intelligent, data-driven features.



The integration of JWT authentication, role-based access, a recommendation engine, and conversational AI demonstrates the practical viability of combining modern web technologies with generative AI for superior hospitality UX. Future work will include collaborative filtering models, real payment gateway integration (Razorpay/Stripe), mobile app support, and sentiment analysis of guest reviews for dynamic property scoring.

## REFERENCES

- [1]. S. Dey and D. Shukla, "Analytical study on use of AI techniques in tourism sector for smarter customer experience management," 2020 International Conference on Computer Science, Engineering and Applications (ICCSEA), Gunupur, India, 2020, pp. 1–5, doi: 10.1109/ICCSEA49143.2020.9132925.
- [2]. Buhalis, D., & Sinarta, Y. (2019). Real-time co-creation and newness service: lessons from tourism and hospitality. *Journal of Travel & Tourism Marketing*, 36(5), 563–582. doi:10.1080/10548408.2019.1592059
- [3]. Q. Li, J. Chen and W. Vanhaverbeke, "uBid100: A New Model of Hotel Booking in the Age of AI," 2018 IEEE International Symposium on Innovation and Entrepreneurship (TEMS-ISIE), Beijing, China, 2018, pp. 1–6, doi: 10.1109/TEMS-ISIE.2018.8478600.
- [4]. Cheng, Y., & Jiang, H. (2020). How Do AI-driven Chatbots Impact User Experience? Examining Gratifications, Perceived Privacy Risk, Satisfaction, Loyalty, and Continued Use. *Journal of Broadcasting & Electronic Media*, 64(4), 592–614. doi:10.1080/08838151.2020.1834296
- [5]. Law, R., Chan, I. C. C., & Wang, L. (2018). A comprehensive review of mobile technology use in hospitality and tourism. *Journal of Hospitality Marketing & Management*, 27(6), 626–648. doi:10.1080/19368623.2018.1423251
- [6]. Žemila M. Reasons and Consequences of Overtourism in Contemporary Cities—Knowledge Gaps and Future Research. *Sustainability*. 2020; 12(5): 1729. doi: 10.3390/su12051729
- [7]. Shafiee MM, Shafiee MM, Shams H, et al. ICT capacities in creating sustainable urban tourism and its effects on resident quality of life. In: *Proceedings of the 7th International Conference on e-Commerce in Developing Countries: with focus on e-Security*. 2013, doi: 10.1109/ecdc.2013.6556745
- [8]. Kumar, V., Rajan, B., Venkatesan, R., & Lecinski, J. (2019). Understanding the Role of Artificial Intelligence in Personalized Engagement Marketing. *California Management Review*, 61(4), 135–155. doi:10.1177/0008125619859317
- [9]. Gerritsma R. Overcrowded Amsterdam: striving for a balance between trade, tolerance and tourism. In: *Overtourism: excesses, discontents and measures in travel and tourism*. Wallingford UK: CAB International; 2019. pp. 125–147. doi: 10.1079/9781786399823.0125
- [10]. Libai, B., Bart, Y., Gensler, S., Hofacker, C. F., Kaplan, A., Kötterheinrich, K., & Kroll, E. B. (2020). Brave New World? On AI and the Management of Customer Relationships. *Journal of Interactive Marketing*, 51(1), 44–56. doi: 10.1016/j.intmar.2020.04.002
- [11]. Blasiak A, Khong J, Kee T. CURATE.AI: Optimizing Personalized Medicine with Artificial Intelligence. *SLAS TECHNOLOGY: Translating Life Sciences Innovation*. 2020;25(2):95–105. doi:10.1177/2472630319890316
- [12]. Chi, O. H., Denton, G., & Gursoy, D. (2020). Artificially intelligent device use in service delivery: a systematic review, synthesis, and research agenda. *Journal of Hospitality Marketing & Management*, 29(7), 757–786. doi:10.1080/19368623.2020.1721394
- [13]. Lin, H., Chi, O. H., & Gursoy, D. (2019). Antecedents of customers' acceptance of artificially intelligent robotic device use in hospitality services. *Journal of Hospitality Marketing & Management*, 29(5), 530–549. doi:10.1080/19368623.2020.1685053
- [14]. Ehret, M., & Wirtz, J. (2016). Unlocking value from machines: business models and the industrial internet of things. *Journal of Marketing Management*, 33(1–2), 111–130. doi:10.1080/0267257X.2016.1248041
- [15]. Li, R. Y. C., & Liew, A. W. C. (2015). An interactive user interface prototype design for enhancing onsite museum and art gallery experience through digital technology. *Museum Management and Curatorship*, 30(3), 208–229. doi:10.1080/09647775.2015.1042509
- [16]. Shilina, M. (2017). My Data: framing a new vision in the current data ecosystem. *Russian Journal of Communication*, 9(3), 308–309. doi:10.1080/19409419.2017.137680