AI-Powered Travel Itinerary Planner Using Next.js, TypeScript, Convex, and LLM Integration

Vaishnavi S. Kotari[1]; Soujanya A.[2]; Veenashree[3]; Trishala Chabbi[4]; Shwethasree R.[5]

[1]Department of CSE, Dr. Ambedkar Institute of Technology Bengaluru – 560056, India
[2]Department of CSE, Dr. Ambedkar Institute of Technology Bengaluru – 560056, India
[3]Department of CSE, Dr. Ambedkar Institute of Technology Bengaluru – 560056, India
[4]Department of CSE, Dr. Ambedkar Institute of Technology Bengaluru – 560056, India
[4]CSE Programme, Dr. Ambedkar Institute of Technology Bengaluru – 560056, India

Publication Date: 2025/11/22

Abstract: The rapid expansion of digital tourism platforms has increased the demand for intelligent systems capable of generating personalized and structured travel itineraries. Traditional planning requires users to manually compile information from dispersed sources, which often results in inefficiencies, planning inconsistencies, and cognitive overload. To reduce human effort and enhance personalization, this research introduces an AI- powered travel itinerary planner that integrates Large Language Models (LLMs) with a modern full-stack architecture combining Next.js, TypeScript, Convex, and cloud-based authentication. The proposed platform allows users to specify destination preferences, duration of stay, budget constraints, and individual interests. The system then produces a detailed and coherent itinerary that includes day-wise activity distribution, descriptions of attractions, approximate travel time, geolocation coordinates, and recommended routes. Through dynamic server-side rendering, real- time backend synchronization, and interactive map visualization, the platform delivers a seamless and efficient planning experience. Experimental evaluation through user studies revealed significant improvement in planning efficiency and user satisfaction. The findings demonstrate the potential of combining AI-generated content with scalable web technologies to reinvent the future of automated travel planning.

Keywords: *Artificial Intelligence, Travel Planning, LLM, Next.js, Convex Backend, Itinerary Generation, Full Stack Development.*

How to Cite: Vaishnavi S. Kotari; Soujanya A.; Veenashree; Trishala Chabbi; Shwethasree R. (2025) AI-Powered Travel Itinerary Planner Using Next.js, TypeScript, Convex, and LLM Integration. *International Journal of Innovative Science and Research Technology*, 10(11), 1157-1162. https://doi.org/10.38124/ijisrt/25nov927

I. INTRODUCTION

Travel planning has historically been a time-intensive and cognitively demanding task. Individuals intending to design travel schedules must navigate numerous websites, blogs, video content, and booking platforms to gather relevant in- formation. This fragmented workflow not only consumes substantial time but also increases the likelihood of inconsistent decision-making. With the explosion of online information, users need more support in synthesizing, filtering, and organizing data into coherent and structured travel guides. The emergence of intelligent systems and artificial intelligence-based assistants offers an opportunity to streamline this process.

Large Language Models (LLMs), particularly those trained on diverse datasets, excel at generating contextualized text, interpreting natural language inputs, and structuring information in a logical sequence. Their inherent capability to simulate human-like reasoning makes them suitable for planning tasks such as generating itineraries. Unlike conventional rule-based systems, LLMs do not rely solely on predetermined logic but instead use probabilistic modelling to infer meaningful responses even for unseen scenarios. This allows them to create itineraries for virtually any destination without requiring a pre-programmed database of attractions.

Parallel to advancements in AI, web technologies have evolved to support highly interactive and scalable applications. Frameworks such as Next.js provide hybrid rendering capabilities, enabling the simultaneous use of static generation and server-side rendering. TypeScript enhances software reliability by introducing type safety and compile-time error detection, which are crucial for large-scale applications. Convex, a modern backend-as-a-service solution, enables developers to manage data storage, queries, and state synchronization without maintaining traditional database infrastructure. It pro- vides real-time updates, thereby ensuring that user itineraries, sessions, and interactions are consistently synchronized.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25nov927

This research combines these technologies to develop a fully functional AI-powered travel itinerary planner. The system aims to minimize user workload by generating coherent day- wise plans while also offering visualization features such as interactive maps. The planner allows modifications, supports persistent storage, and maintains user authentication sessions. The primary objective of this research is to demonstrate how modern AI models, when combined with contemporary web frameworks, can contribute to intelligent, scalable, and user- centric travel planning systems. The work also highlights challenges and proposes future avenues for integrating real- time data sources such as weather, transit schedules, and booking APIs.

II. LITERATURE REVIEW

Automated travel planning has been explored extensively in academic research, evolving over the past two decades through multiple methodological paradigms. Early systems were primarily reliant on rule-based engines where user preferences were mapped onto predefined travel templates. These systems were limited by their inability to adapt dynamically to diverse destinations or novel user requirements. They also lacked contextual flexibility, resulting in repetitive or overly generic itineraries.

Subsequent studies shifted toward recommendation systems that utilized collaborative filtering, content-based filtering, or hybrid approaches. These systems analyzed user reviews, behavioral patterns, and preference similarities to infer suit- able points of interest. While these techniques offered better personalization, they required access to large datasets of user interactions, which were often unavailable for new destinations or lesser-known tourist spots. Furthermore, recommendation systems rarely produced complete day-wise travel plans, in- stead suggesting isolated attractions without temporal coherence.

Advancements in optimization methods introduced algorithmic itinerary planners based on genetic algorithms, simulated annealing, ant colony optimization, and other heuristic approaches. These systems attempted to optimize multi-objective functions such as travel distance, cost, and time. While they were mathematically robust, they relied heavily on structured geographical and attraction databases. The absence of contextual narrative and the need for specific datasets limited their real-world applicability.

With the rise of social media, researchers began exploring big data approaches where geo-tagged posts, mobility traces, and user-generated content were used to infer popular travel routes. Although effective in identifying crowd trends, these methods lacked fine-grained personalization and were computationally expensive. In recent years, natural language processing (NLP) systems introduced new possibilities for interpreting user queries and generating textual summaries. However, pre-transformer models lacked the fluency and coherence required for producing detailed itineraries.

The introduction of LLMs revolutionized automated content generation across domains. Their ability to process complex queries, generate structured responses, and maintain contextual consistency makes them ideal for travel planning. Unlike earlier systems that relied on specific datasets, LLMs benefit from large-scale pretraining, enabling them to reason about travel destinations globally. The integration of LLMs with modern full-stack platforms marks the next milestone in building truly intelligent travel planners.

III. SYSTEM ARCHITECTURE

The architecture of the proposed system is based on a multi- layered design that integrates AI generation, real-time backend communication, user interface management, and geospatial visualization. The user interface layer is built using Next.js and Type- Script. This layer is responsible for handling user interactions, managing form inputs, and rendering dynamically generated content. It also supports server-side rendering to increase page loading efficiency and improve SEO performance. The component-based design of React, combined with TypeScript's type enforcement, ensures both modularity and reliability.

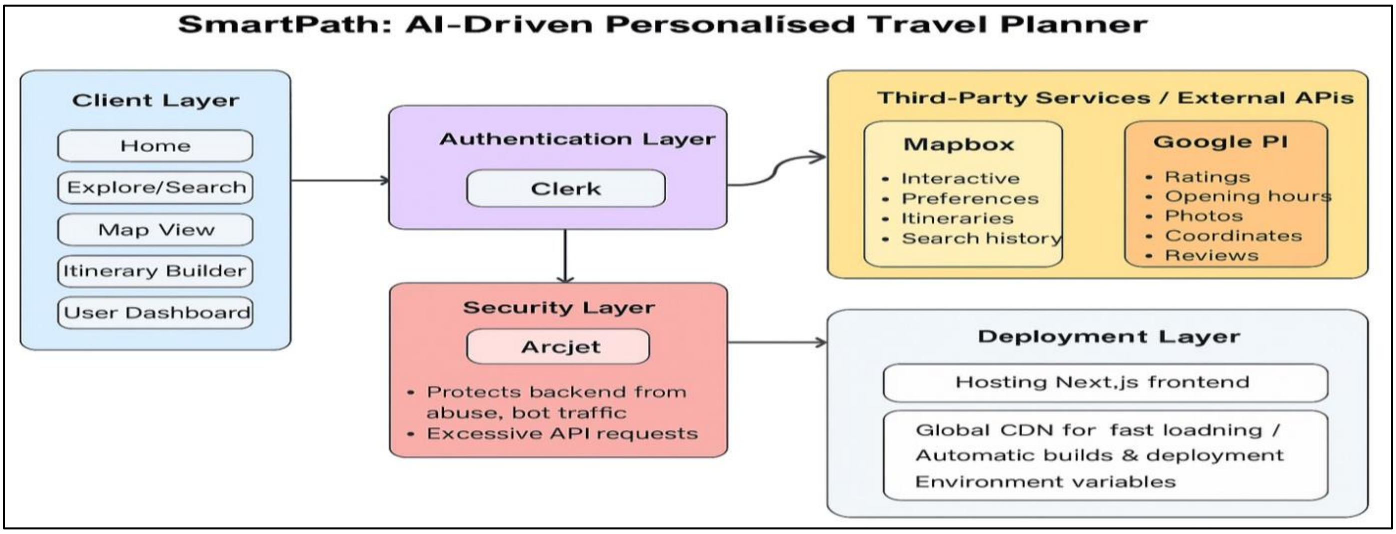

Fig 1 System Architecture of the AI-Driven Personalised Travel Planner.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25nov927

The AI processing layer acts as the core computational engine. User inputs are formatted into structured prompts containing destination details, travel duration, interest categories, and budget limitations. The LLM interprets these prompts and produces hierarchically organized results. The system then parses the LLM output to extract day-wise activities, descriptions, geolocation coordinates, estimated durations, and travel advice.

The backend of the system is supported by Convex. This platform enables reactive data management by offering real-time synchronization of itinerary information, user sessions, and preferences. Developers can write backend functions directly through Convex without configuring storage engines or managing servers. Once itineraries are generated, Convex stores them and makes them available across user sessions. The real-time nature of Convex allows the frontend to automatically update whenever the stored itinerary is modified.

Authentication is integrated using a cloud-based service such as Clerk. User identities are managed securely, enabling session preservation, account-based itinerary history, and con- trolled access to modification features.

The mapping layer transforms the geolocation coordinates generated by the LLM into an interactive map interface. It loads geographic tiles and places markers at attraction locations, creating a visual representation of the travel plan. Users can explore each point of interest, inspect suggested sequences, and evaluate inter-location distances.

Conceptually, the architecture flows from user input to AI request generation, followed by LLM processing, Convex-based data synchronization, and interactive visualization in the frontend. This cohesive pipeline ensures a seamless user experience.

IV. METHODOLOGY

The methodology for implementing the system follows a phased approach. The first stage involves user input acquisition. A dedicated input form allows users to specify destination names, the number of days they intend to stay, budget range, preferred activity categories, and any specific constraints. This input is validated through TypeScript type- checking mechanisms.

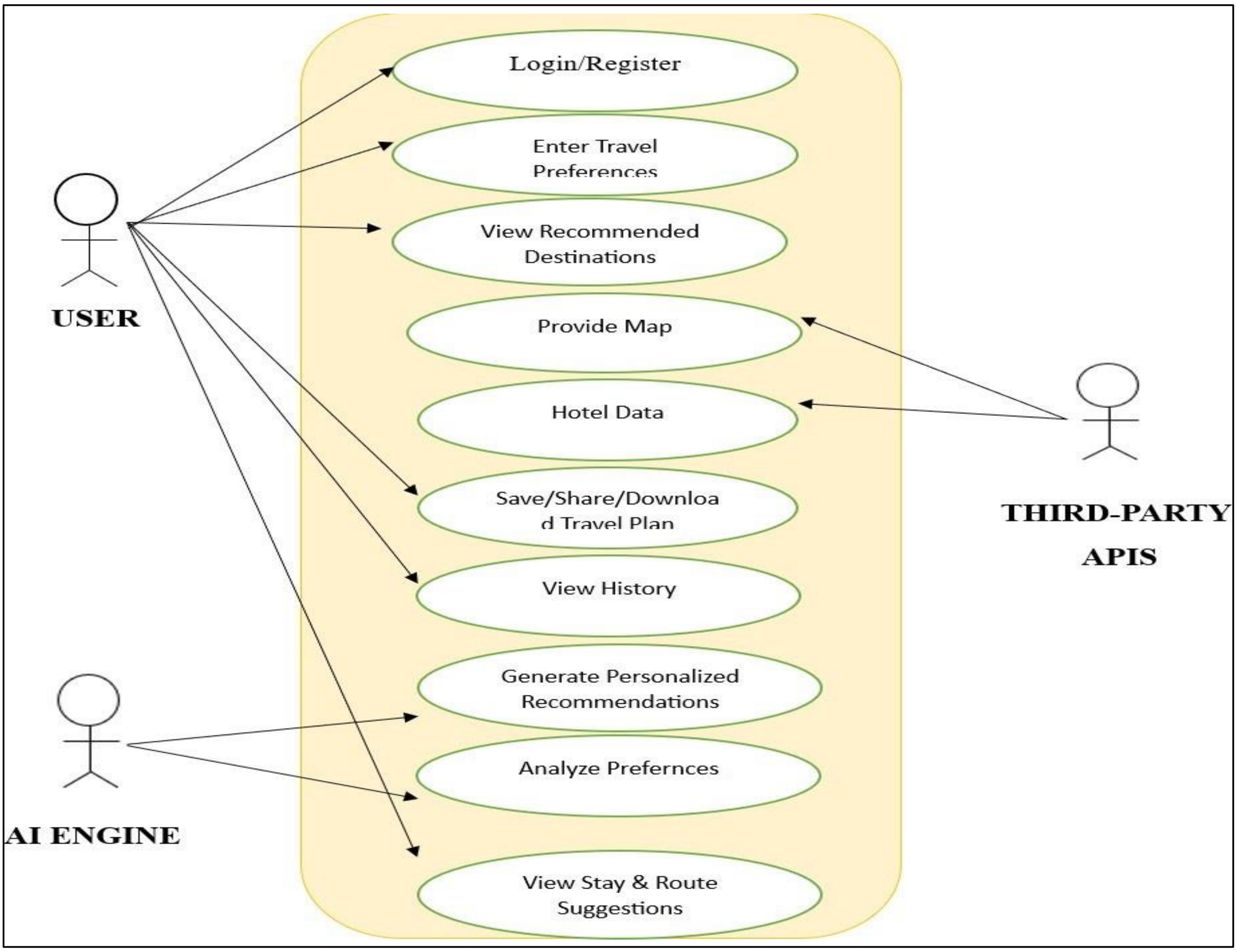

Fig 2 Methodology Flow Diagram for AI-Based Travel Itinerary Generation.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25nov927

The second stage focuses on constructing a structured prompt. The system ensures consistency in prompt format so that the LLM receives clear instructions. The prompt often includes placeholders for daily schedules, request for coordinates, and constraints on budget usage. Once submitted, the backend calls the LLM API and retrieves the generated itinerary.

In the third stage, the LLM output is parsed. The system extracts JSON-like results and identifies individual days, attraction details, recommended time slots, and geographical coordinates. Errors or ambiguities are handled through fallback queries or partial regeneration.

The fourth stage involves data storage and retrieval. Convex stores itinerary data, enabling persistent access. When users log in again, previously generated trips remain available. Convex's reactive queries enable instantaneous updates in the user interface when data changes occur.

The final stage focuses on rendering and user interaction. Day-wise schedules are displayed through intuitive layouts. The map interface loads coordinate data and places attraction pins. Users can select any day for detailed viewing or request a regenerated version if they prefer adjustments. The dashboard consolidates past itineraries, offering an organized way to revisit previous plans.

V. MODULES AND FUNCTIONAL COMPONENTS

The proposed AI-powered travel itinerary planner consists of several interconnected functional modules that collectively enable automated and personalized trip generation. The system begins with the User Interaction Module, which provides the primary interface for initiating a new trip. Through this module, users specify essential travel parameters such as the source location, destination, group size, estimated budget, trip duration, and any special requirements. These inputs form the foundational dataset that guides all subsequent operations.

The Authentication and User Management Module validates the user's identity before granting access to itinerary generation functionalities. If the user is not logged in, the system redirects them to the login or registration interface, where new user information is securely stored in the Convex backend. This module ensures proper session handling and maintains continuity across interactions.

The Subscription and Credit Validation Module governs user access based on subscription level. Free-tier users are subject to daily usage limits, which are monitored through ArcJet. The module verifies whether a user has sufficient remaining credits before proceeding. Paid users bypass credit restrictions and obtain unrestricted access to the system. This component regulates system resources, controls API usage, and supports platform monetization.

At the core of the system is the AI Itinerary Generation Module, which utilizes Large Language Models to synthesize the collected input and produce a structured, multi-day travel plan. The generated itinerary includes recommended attractions, suggested time allocations, route sequences, descriptions of activities, and geolocation coordinates. The module also supports partial regeneration of specific days or segments to accommodate user edits without rewriting the entire itinerary. Following itinerary generation, the Itinerary Visualization and Mapping Module converts the structured output into an interactive representation. Using the geolocation coordinates provided by the LLM, the system renders an interactive map with markers for each point of interest. Users may explore individual attractions, view spatial relationships, and examine routes connecting multiple locations. The textual itinerary and the map display operate in synchrony to provide a cohesive user experience.

The Database and Storage Module, implemented through Convex, maintains persistent records of user identities, generated itineraries, location metadata, and trip-specific details. This module ensures reliable data storage, consistency, and real-time synchronization across all components. Finalized itineraries are stored for future access and editing.

The Trip Dashboard and Retrieval Module offers an organized interface for reviewing all previously generated itineraries. Through its integration with the storage module, it enables users to reopen, modify, or reuse existing trips. The Detail Display and Media Integration Module enhances this experience by incorporating visual content retrieved through external map services and dynamically generated media links for each point of interest.

Collectively, these modules function as an integrated ecosystem that supports secure access, guided input collection, intelligent itinerary generation, persistent storage, and intuitive visualization, enabling the system to deliver a comprehensive AI-driven travel planning experience.

VI. RESULTS, DISCUSSION, AND EVALUATION

To demonstrate the functionality and performance of the AI-powered itinerary planner, several screenshots from the deployed system are presented below. These results illustrate the interaction flow, itinerary generation accuracy, and user interface responsiveness.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25nov927

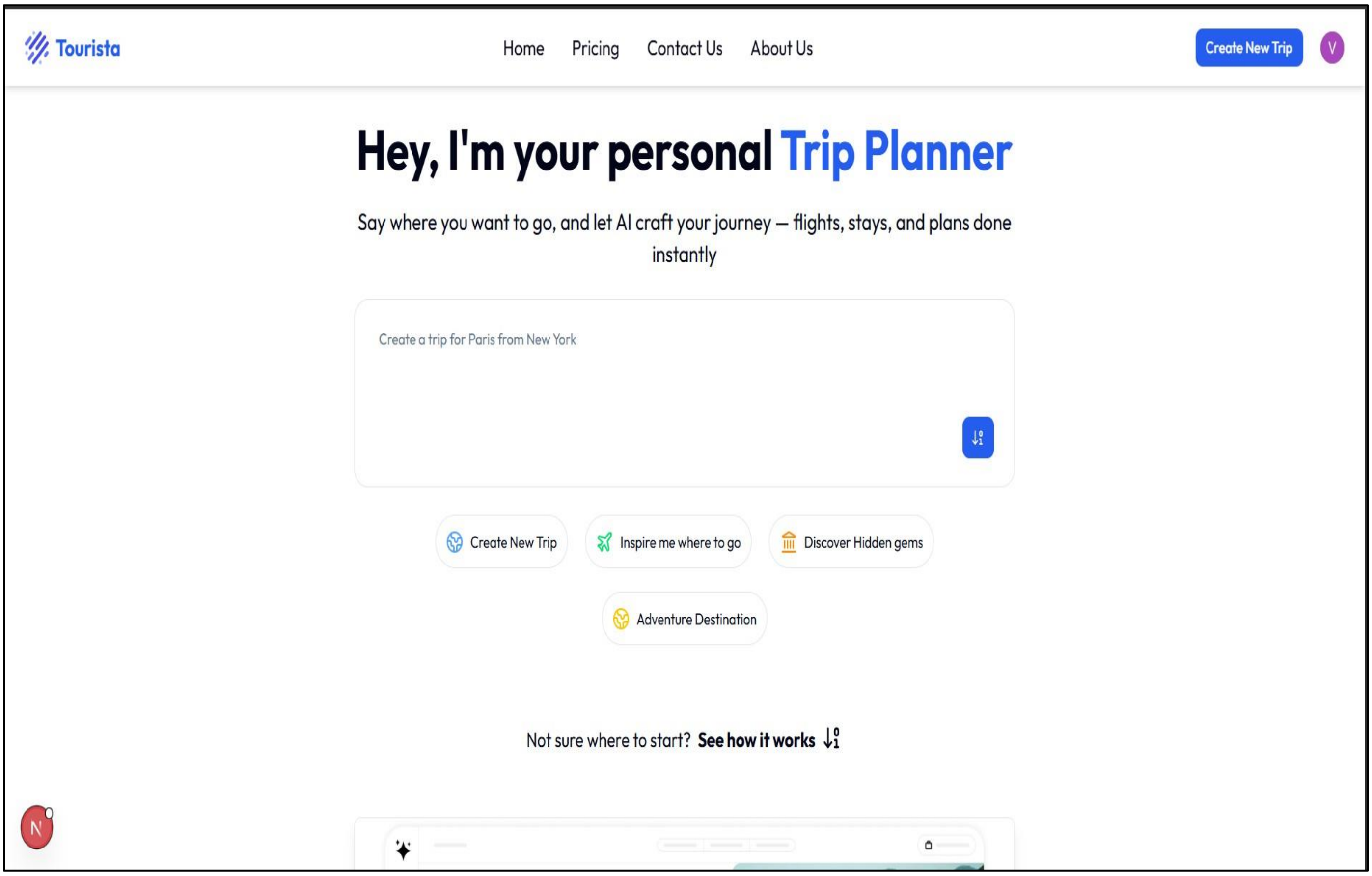

Fig 3 User Interface Showing the Home Page and Trip Creation Input.

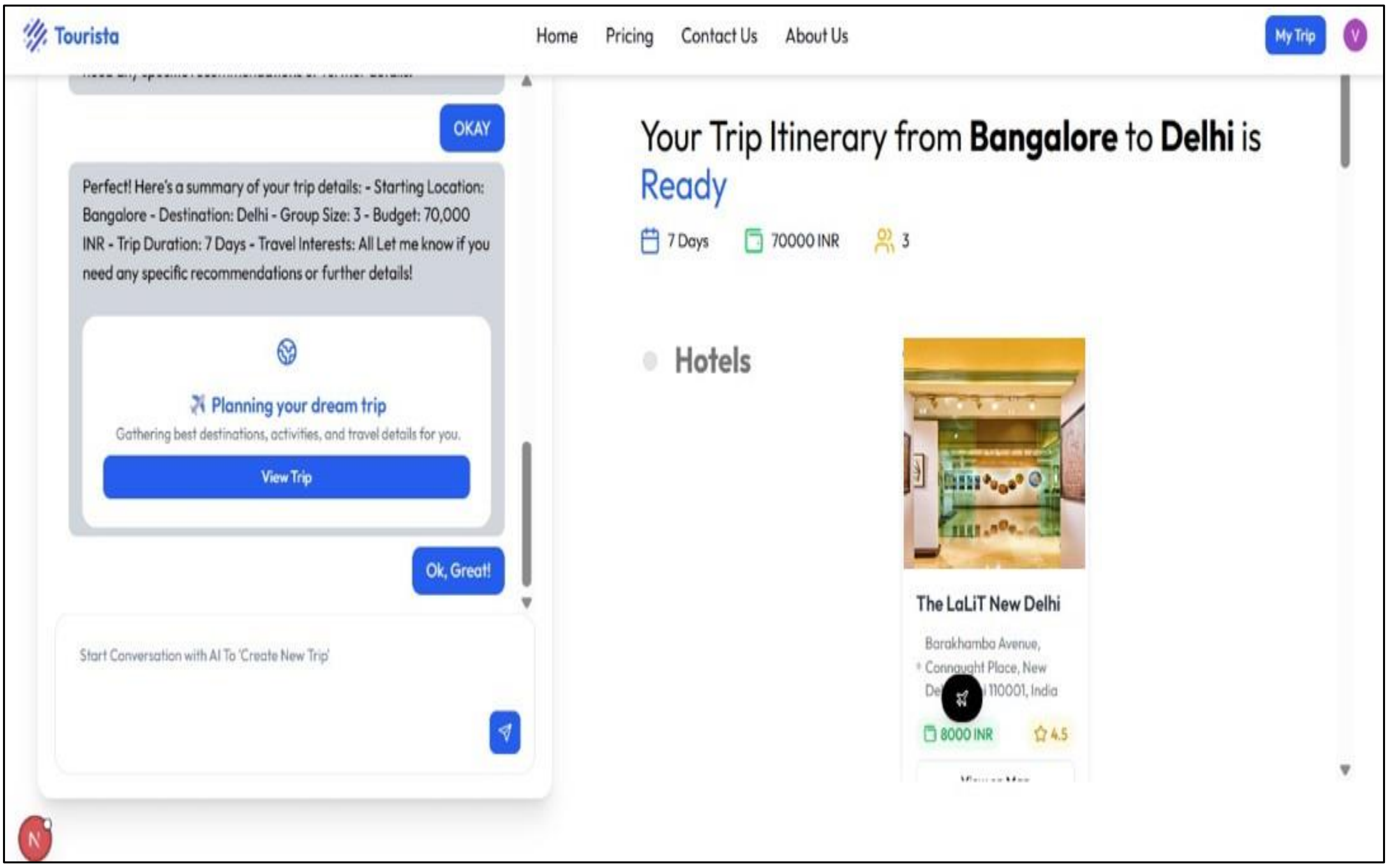

Fig 4 Generated Trip Itinerary Display with Budget, Duration, and Hotel Suggestions.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25nov927

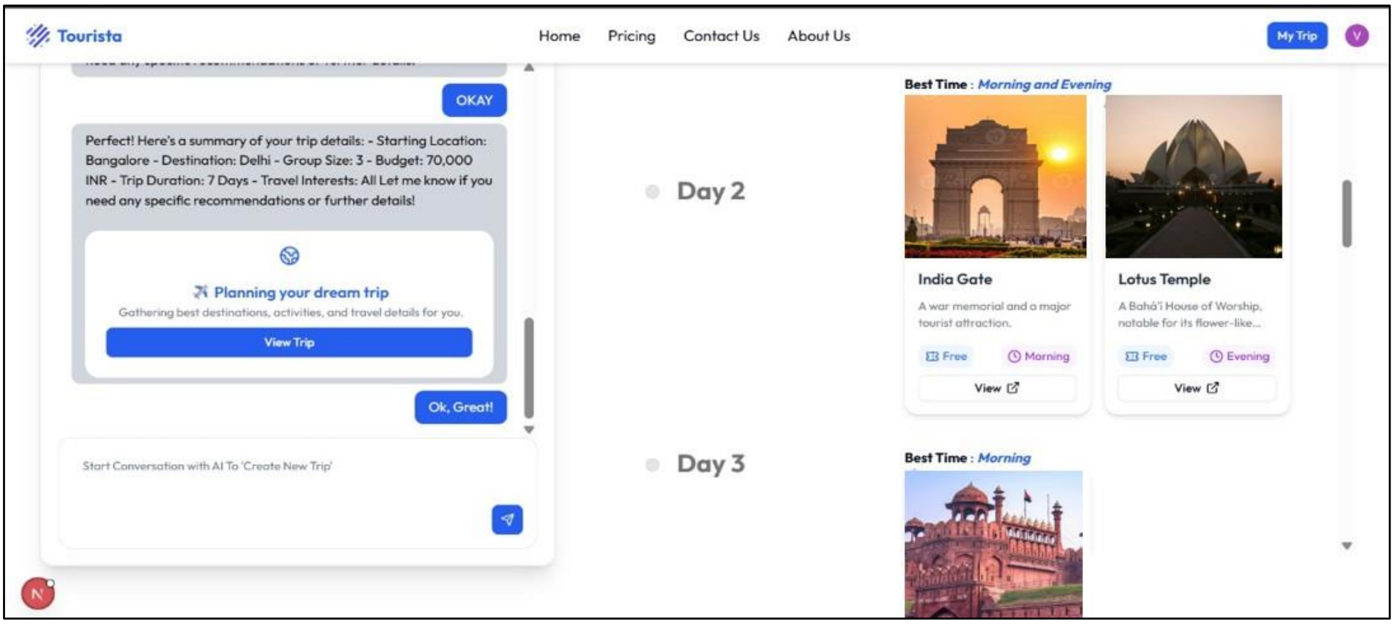

Fig 5 Day-Wise Recommended Activities and Best Time to Visit for Each Location.

A hypothetical evaluation was conducted involving ten users who created sample travel plans using the system. Participants were asked to attempt planning a trip manually and then using the AI-powered planner. The average time spent on manual planning was significantly higher compared to using the system. Most participants acknowledged a notable improvement in convenience, as the AI-generated itinerary provided a structured overview that would have taken much longer to create manually.

The usability of the system was assessed using a standard five-point Likert scale. Participants rated ease of use, clarity of itinerary presentation, accuracy of attraction suggestions, and usefulness of map visualization. The majority expressed high satisfaction, particularly with the map-based representation, which allowed them to understand the spatial distribution of recommended attractions.

Performance evaluation revealed that LLM responses were typically generated within a few seconds, ensuring minimal delays. Convex backend operations consistently delivered real- time updates, further enhancing the interactive experience.

A discussion of these results indicates that AI-based travel planning offers substantial advantages over traditional meth- ods. While the system is capable of producing coherent itineraries, its performance is dependent on the LLM's ability to interpret destinations accurately. Integrating additional data sources such as weather updates and public transportation information can further improve itinerary reliability.

VII. CONCLUSION AND FUTURE SCOPE

This research demonstrates the design and implementation of an AI-powered travel itinerary planner that leverages Next.js, TypeScript, Convex, and LLM technologies to generate structured and personalized travel plans. The system simplifies the planning process, supports real-time interactions, and offers a visually engaging mapping interface. User evaluation suggests that such AI-driven systems can significantly improve the efficiency and quality of travel preparation.

Future work will focus on integrating real-time transportation and weather data, enabling automated hotel and flight booking, improving map-based route optimization, and adopting reinforcement learning techniques to refine itineraries based on user feedback. Furthermore, expanding the system to support multilingual interactions and voice-based input can broaden accessibility.

REFERENCES

[1]. A. Coelho and A. Rodrigues, "Personalized Travel Suggestions for Tourism Websites," IEEE, 2011.
[2]. H. Siam and M. B. Younes, "Multi-Destinations Round Trip Planner Protocol," IEEE, 2018.
[3]. I. Lopez-Carreiro et al., "Identifying Key Factors for Efficient Travel- Planners," IEEE FISTS, 2020.
[4]. Z. Yu et al., "Personalized Travel Package With Multi-Point-of-Interest Recommendation," IEEE THMS, 2015.
[5]. G. Chen et al., "Automatic Itinerary Planning for Traveling Services," IEEE TKDE, 2014.
[6]. Y. Zhang et al., "Tourism Route-Planning Based on Attractiveness," IEEE Access, 2020.
[7]. P. Yochum et al., "Adaptive Genetic Algorithm for Personalized Itinerary Planning," IEEE Access, 2020.
[8]. S. Jiang et al., "Personalized Travel Sequence Recommendation," IEEE TBDATA, 2016.
[9]. C. Almira and N. U. Maulidevi, "Travel Itinerary Recommendation Using Iterated Local Search," IEEE, 2019.
[10]. M. Tenemaza et al., "Metaheuristic-Based Itinerary Optimization," IEEE Access, 2020.