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.2026.79457

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

TripSync: AI-Powered Social Travel Companion Platform

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Abstract: ***The TripSync application is a social media platform with a focus on travel that aims to create a seamless experience with features such as content sharing, real-time location discovery, and collaborative expense management. The application is built on a novel concept of a social network for travelers, which is quite different from the regular travel planning applications available in the market. The application provides features such as geo-tagging of posts, discovery of users through an interactive map, the formation of travel groups, and a debt minimization engine. The application is built on a modern technology stack with React/Next.js as the frontend framework and Supabase as the backend infrastructure. This paper aims to discuss the design rationale, system architecture, and features of the TripSync application and how the concept of a social network with real-time geospatial and financial features addresses the gap in the available travel applications in the market.***

Keywords: travel social platform, location-based services, real-time collaboration, group travel management, interactive map, geo-tagged content, social networking, expense splitting.

I. INTRODUCTION

The rise of smartphones and pervasive mobile connectivity has revolutionized the way in which travel is planned, undertaken, and shared. Social media platforms like Instagram and TikTok have facilitated the sharing of experiences during a journey in the form of multimedia content, whereas Google Maps and TripAdvisor aid in the planning of the destinations. However, the platforms are used in isolation. The sharing of content, discovery, coordination, and management of finances are done using different platforms, which is a cognitive burden on the travelers who have to switch between the platforms during the course of the journey.

This fragmentation creates a notable void in the travel technology landscape. For group travelers, their problems are exacerbated by the need to simultaneously share travel experiences, coordinate with their companions, and share financial responsibilities. Although existing apps such as Splitwise address the financial aspect of shared expenses, and social media platforms do not offer real-time geospatial discovery of other travelers or group management, the need to address all of these factors in a single solution led to the development of TripSync.

It is suggested that a location-based social network named TripSync would be developed with the aim of integrating three essential aspects of travel into a unified platform. Firstly, it would feature a content-sharing layer through which users would be enabled to share geo-tagged images and videos. Secondly, it would feature an interactive map layer through which users would be enabled to locate other travelers and shared content in real-time, thus facilitating the spontaneous discovery of popular locations, hidden gems, and other travelers nearby. Thirdly, it would feature a structured expense-splitting system within a travel group, with the aim of minimizing the number of financial settlements between group members.

From a technical perspective, TripSync is constructed using a state-of-the-art technology stack. The front end is constructed using React with Next.js, which provides server-side rendering and routing for better performance. The user interface is styled using Tailwind CSS with animations provided using Framer Motion. Authentication is handled using Auth0, which provides OAuth 2.0 compliant authentication. The back end is constructed using Supabase, which provides a PostgreSQL database, real-time subscription APIs, and object storage. Geospatial functionality is achieved using the Google Maps Platform.

The rest of the paper is organized as follows. In Section II, related work is discussed. In Section III, the system architecture is described. In Section IV, the results and their discussion are provided. Finally, in Section V, the conclusion is drawn.

II. RELATED WORK

A lot of different types of work, like social media platforms, location-based services, collaborative travel tools, and expense management systems, went into the design of TripSync.

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A. Social Media and Geo-Tagged Content Sharing

Instagram and Snapchat are two examples of platforms that have set the standard for sharing user-generated visual content. Instagram added location tagging to posts, which lets people connect pictures and short videos to specific places on a map. Snapchat took this idea further with its Snap Map feature, which shows user-generated content on an interactive map in almost real time. These platforms are great for sharing content, but they weren't made with travellers in mind and don't have any tools for managing money or coordinating groups. TripSync builds on the geo-tagged content model, but it makes the feed and discovery experience more travel-friendly.

B. Location-Based Services and Traveler Discovery

Foursquare and the app that came from it, Swarm, was the first app to let people check in at a location and find other users nearby. Studies on location-based social networks (LBSNs) have shown that being close to someone is a big reason why people interact with each other and find content useful [1]. With its Places API, Directions API, and Maps JavaScript SDK, Google Maps Platform has made it easier for developers to add geospatial features to their apps. TripSync uses the Google Maps Platform to run its features for finding nearby posts and showing travellers on a map in real time.

C. Group Travel Coordination Platforms

A few platforms have tried to help with coordinating group travel. Polarsteps lets people keep track of and share their travel routes, and TripIt combines travel plans from email confirmations. But these tools are mostly for managing your own itinerary and don't have any real-time social interaction or peer discovery features. Bidwell et al.'s research shows that group travellers need tools that help them coordinate both in real time and asynchronously [2]. TripSync fills this gap by combining temporary travel groups with built-in messaging and shared expense tracking.

D. Expense Splitting and Financial Coordination

The most popular app for managing shared expenses among groups is Splitwise. It came up with the idea of debt simplification, which uses graph-based algorithms to cut down on the number of transactions needed to pay off all of a group's debts. Research on collaborative consumption indicates that friction in financial coordination constitutes a principal source of conflict in group travel [3]. TripSync has a debt-minimization expense system built right into travel groups, so you don't need a separate app.

E. Real-Time Backend Architectures

Because of its WebSocket-based listeners, Firebase became a popular choice for apps that need to work in real time. But because it was proprietary and didn't support complex relational queries well, developers looked for other options. Supabase is an open-source alternative that is built on PostgreSQL. It has row-level security, real-time subscriptions through WebSockets, RESTful APIs, and built-in object storage [4]. Supabase supports full relational data modelling, which is important for TripSync's connected data entities.

F. Authentication and Identity Management

Auth0 is an identity-as-a-service platform implementing OAuth 2.0 and OpenID Connect standards, supporting federated login through providers such as Google and GitHub. Research consistently identifies delegated authentication as superior to custom credential management in terms of security and maintenance overhead [5]. TripSync adopts Auth0 to offload authentication complexity while supporting both social login and email-based registration.

III. SYSTEM ARCHITECTURE

TripSync follows a three-tier client-server architecture comprising a frontend presentation layer, a backend data and logic layer, and a third-party services layer. The overall design prioritizes real-time responsiveness, scalability, and modularity, ensuring that each component can be developed, tested, and scaled independently.

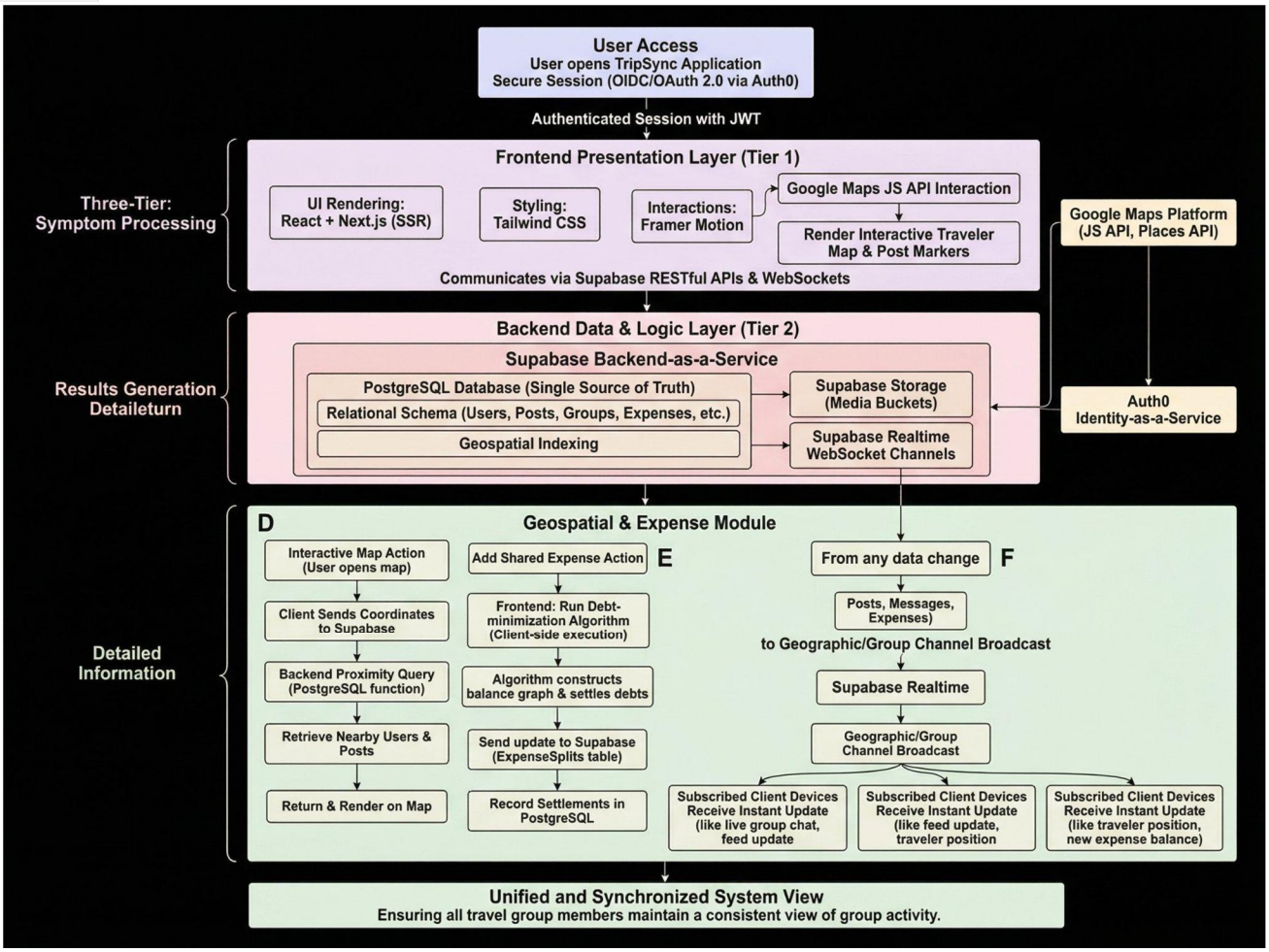


Fig. 1. TripSync Three-Tier System Architecture Diagram

A. Frontend Layer

The frontend of TripSync is developed using React in conjunction with Next.js, a production-grade framework that extends React with server-side rendering (SSR), static site generation (SSG), and file-based routing. SSR is particularly beneficial for TripSync's public-facing content pages, such as location-based post feeds, as it improves initial page load performance. The user interface is styled using Tailwind CSS, a utility-first CSS framework that enables rapid and consistent UI development. Animations and micro-interactions are implemented using Framer Motion. The frontend communicates with the backend exclusively through Supabase's auto-generated RESTful APIs and real-time WebSocket subscriptions, eliminating the need for a custom API server.

B. Authentication Layer

Authentication in TripSync is handled by Auth0, an identity-as-a-service provider implementing the OAuth 2.0 and OpenID Connect protocols. Upon successful authentication, Auth0 issues a JSON Web Token (JWT) to the client, which is included in the Authorization header of all requests to Supabase. Supabase's row-level security (RLS) policies validate the JWT on the server side, ensuring that users can only access and modify data they are authorized to interact with. TripSync supports Google OAuth and email-password based login through Auth0.

C. Backend Layer

The backend infrastructure of TripSync is built entirely on Supabase, an open-source backend-as-a-service platform powered by PostgreSQL. The primary entities in the database schema include Users, Posts, Locations, Groups, GroupMembers, Messages, Expenses, and ExpenseSplits. Relationships between these entities are enforced through foreign key constraints, and indexes are applied on frequently queried columns to optimize query performance.

Supabase Realtime enables TripSync to push live updates to connected clients through WebSocket channels. This powers the live group chat feature, instant feed updates when nearby users publish new posts, and dynamic rendering of traveler positions on the interactive map. Supabase Storage manages all user-generated media including photographs and short videos, organized into access-controlled buckets.

D. Geospatial Layer

Location-based functionality in TripSync is implemented through a combination of the Google Maps Platform and PostgreSQL's native geospatial capabilities. The Google Maps JavaScript API is embedded in the frontend to render the interactive traveler map and display post markers. When a user opens the map view, the client transmits the user's current geographic coordinates to Supabase, which executes a proximity query using PostgreSQL's geospatial functions to retrieve nearby users and posts within a configurable radius.

E. Expense Management Module

The expense splitting module is implemented as a logical layer within the Supabase database and frontend application. When a group member adds a shared expense, the system records the total amount, the payer, and the list of participants with their share proportions in the ExpenseSplits table. The debt-minimization algorithm is executed on the frontend by constructing a net balance graph among group members, where each node represents a user and each directed edge represents a net amount owed. The algorithm iteratively settles the largest outstanding debt against the largest outstanding credit, minimizing the total number of required transactions.

F. Data Flow

A typical user interaction in TripSync follows this data flow. The user authenticates via Auth0 and receives a JWT. The frontend uses the JWT to establish an authenticated session with Supabase. When the user publishes a post, the media file is uploaded to Supabase Storage and the post metadata including caption, location coordinates, and media URL is inserted into the Posts table. Supabase Realtime broadcasts the new post event to all subscribed clients in the relevant geographic channel, and the post appears on nearby users' feeds and map in real time.

IV. RESULTS AND DISCUSSION

This section presents the results obtained from the implementation of TripSync, demonstrating the core features of the platform through interface walkthroughs and functional validation. The system was successfully developed and deployed as a fully functional web and mobile-compatible application using the technology stack described in Section III.

A. User Authentication and Onboarding

The authentication flow implemented via Auth0 was validated for both Google OAuth and email-password login methods. Upon successful login, users are redirected to their personalized home feed without any perceptible delay. The onboarding screen prompts new users to set a display name, profile photo, and home location. The interface is clean and minimal, following standard social application onboarding conventions to reduce friction for first-time users.

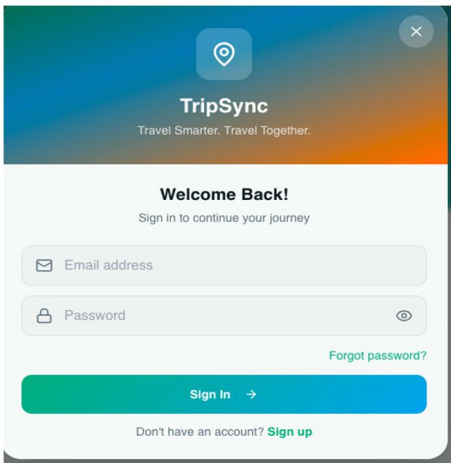


Fig. 2. TripSync Login and Sign-Up Screen

B. Geo-Tagged Post Creation and Feed

Users can create posts by capturing or uploading a photograph or short video, adding a caption, and confirming their current location. The location is automatically populated using the browser's Geolocation API and displayed as a human-readable place name retrieved from the Google Places API. The home feed displays posts from followed users as well as nearby travelers, sorted by a combination of recency and geographic proximity. The feed updates in real time as new posts are published by nearby users without requiring a manual page refresh.

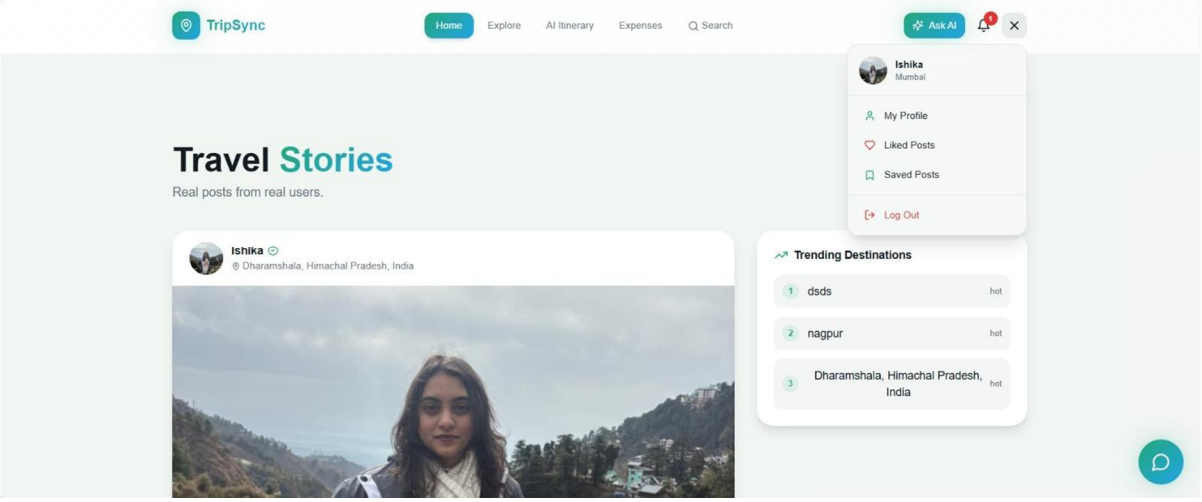


Fig. 3. TripSync Home Feed Displaying Geo-Tagged Travel Stories

C. Interactive Traveler Map

The interactive map is one of the most distinctive features of TripSync. Rendered using the Google Maps JavaScript API, the map displays real-time markers representing nearby travelers and their most recent posts. Each marker is tappable and expands into a post preview card showing the user's profile photo, post thumbnail, caption, and distance from the viewer. During testing, the map accurately rendered nearby user positions with marker updates reflecting database changes within approximately one to two seconds of publication.

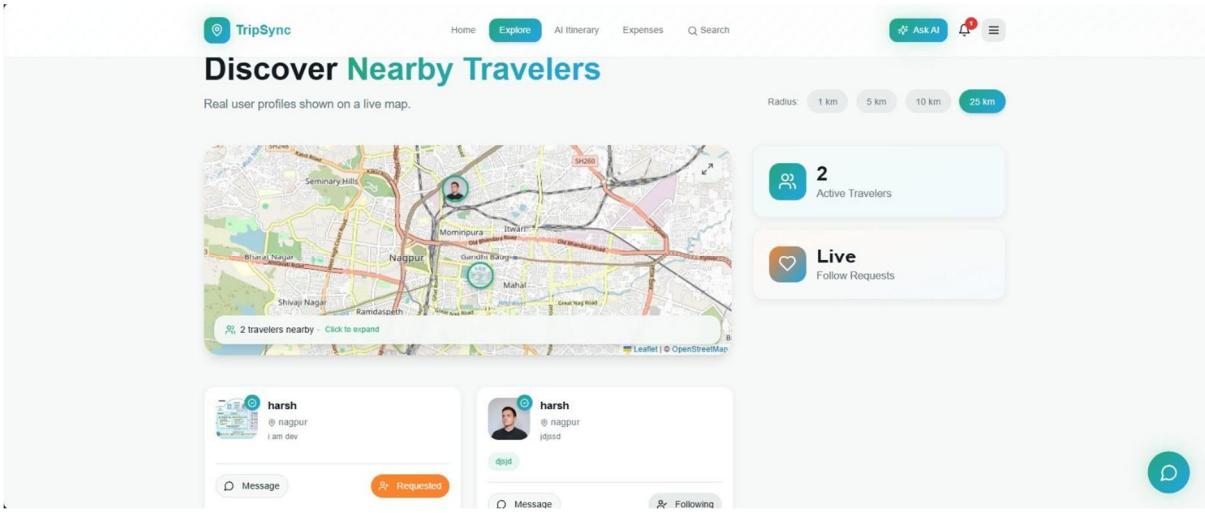


Fig. 4. Discover Nearby Travelers on Live Interactive Map

D. Travel Groups and Real-Time Messaging

Users can create or join travel groups, which serve as collaborative spaces for coordinating trips. Each group has a dedicated chat interface powered by Supabase Realtime, where messages are broadcast to all group members instantly upon sending. The group interface also displays the current location of active members on a shared mini-map, providing situational awareness during group travel. During functional testing, messages were delivered to all connected group members with negligible latency.

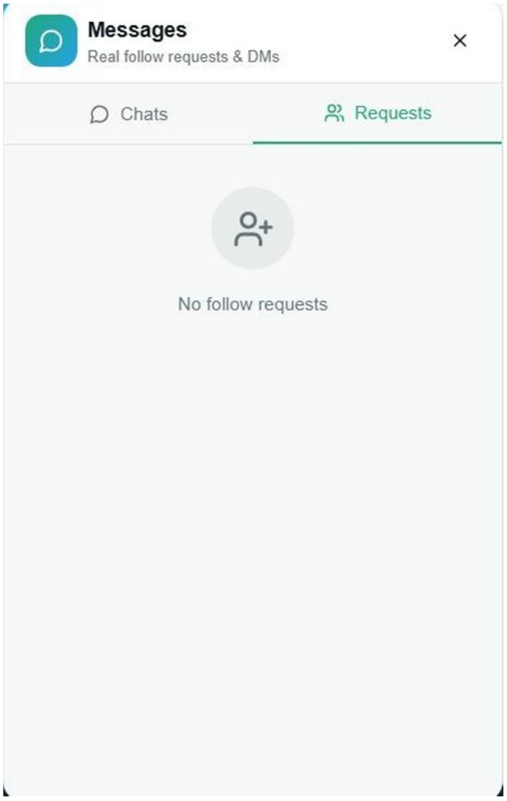


Fig. 5. Real-Time Messaging and Follow Requests Interface

E. Expense Splitting and Debt Minimization

The expense management module was tested with multiple simulated group travel scenarios involving varying numbers of participants and expense distributions. The debt-minimization algorithm consistently reduced the number of required settlement transactions compared to naive pairwise settlement. For example, in a group of five members with ten shared expenses, the algorithm reduced the number of settlements from a potential maximum of ten transactions to as few as four, demonstrating effective graph-based debt simplification. All expense updates were reflected in real time across all group members' devices.

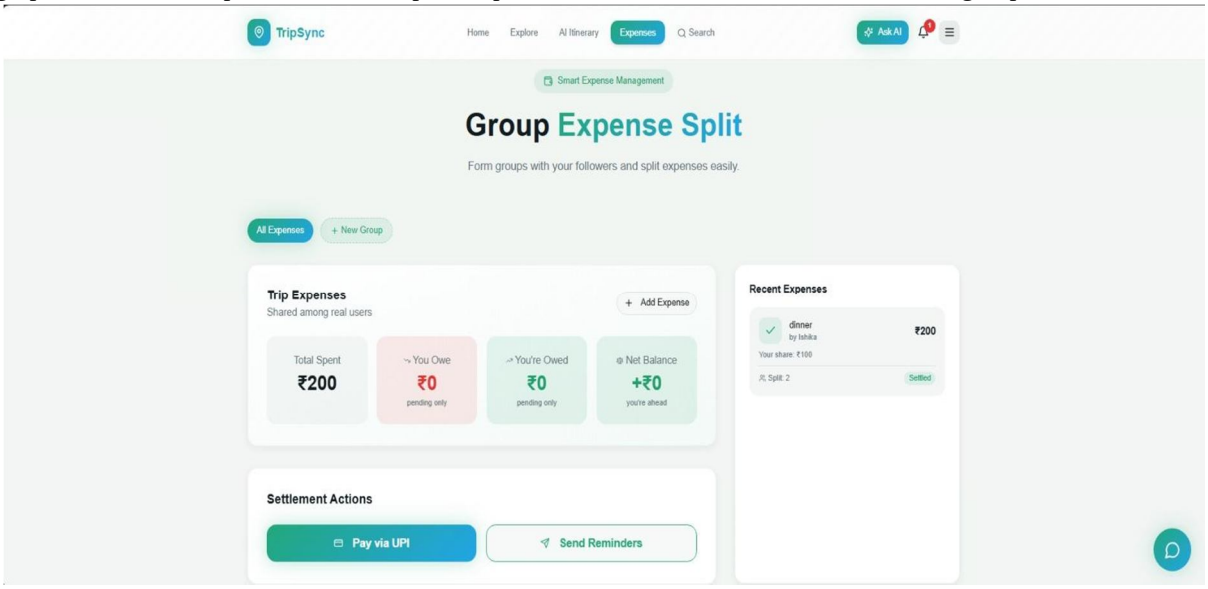


Fig. 6. Group Expense Split and Settlement Dashboard

F. User Profile and AI Itinerary Generator

TripSync additionally provides a personalized user profile page displaying travel statistics, follower counts, interests, and travel personality tags. The platform also features an AI-powered Smart Itinerary Generator that accepts a destination, trip duration, budget, and interest preferences to produce a day-by-day personalized travel plan complete with cost estimates. This feature further differentiates TripSync from conventional social platforms by adding intelligent travel planning capabilities within the same unified application.

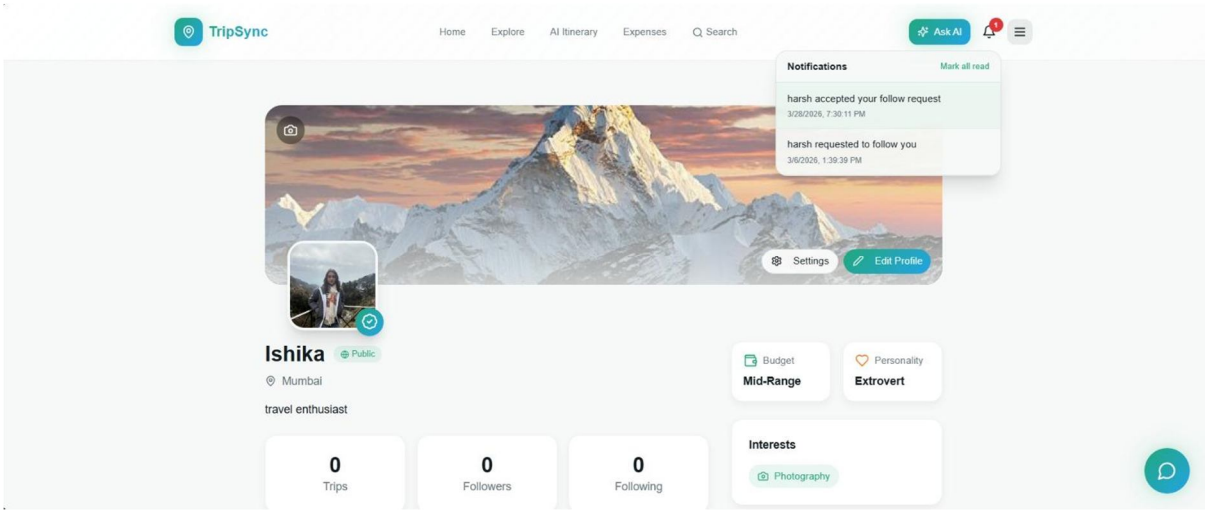


Fig. 7. User Profile Page with Travel Statistics and Notifications

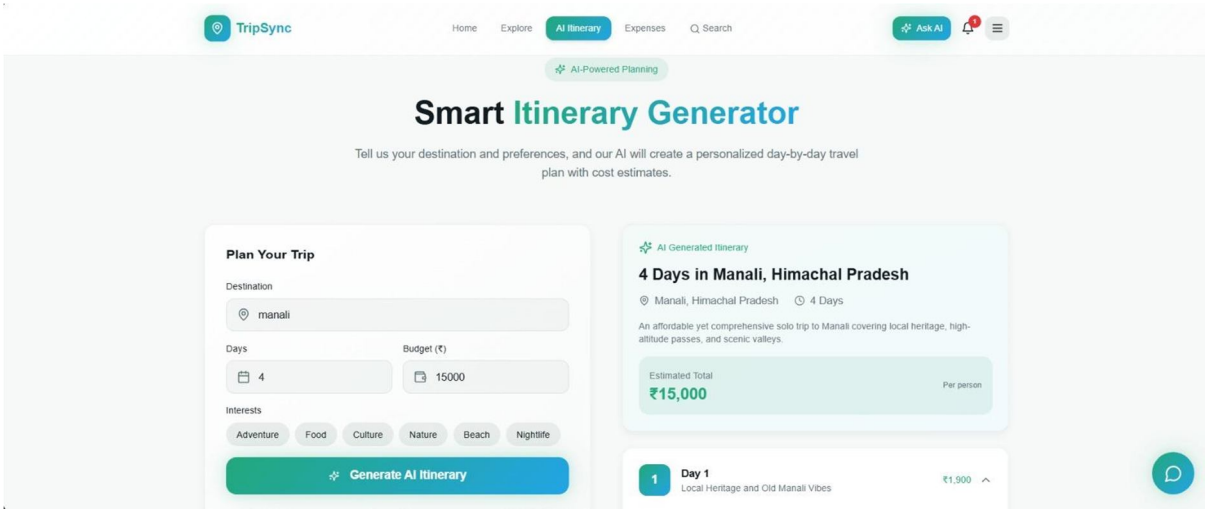


Fig. 8. AI-Powered Smart Itinerary Generator

G. Discussion

The results demonstrate that TripSync successfully integrates social content sharing, real-time geospatial discovery, and collaborative expense management into a unified platform. The use of Supabase as the sole backend infrastructure proved effective, with its combination of PostgreSQL, real-time subscriptions, and integrated storage eliminating the need for multiple third-party services. Auth0 provided a robust and low-maintenance authentication layer, and the Google Maps Platform delivered reliable geospatial functionality.

However, certain limitations were observed during development and testing. The real-time map feature's accuracy is dependent on the frequency at which client devices report their location, meaning users who have not recently opened the app may appear at stale positions. Additionally, the debt-minimization algorithm is currently executed on the frontend, which may introduce inconsistencies in multi-device scenarios where two users simultaneously modify group expenses. Migrating this logic to a Supabase Edge Function in future iterations would ensure atomicity and consistency.

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V. CONCLUSION

This paper presented TripSync, a location-aware travel social platform designed to unify three core aspects of group travel — content sharing, real-time traveler discovery, and collaborative expense management — into a single cohesive application. The motivation for TripSync stems from the fragmented nature of existing travel tools, which force users to switch between multiple applications to accomplish tasks that are inherently interconnected during a trip.

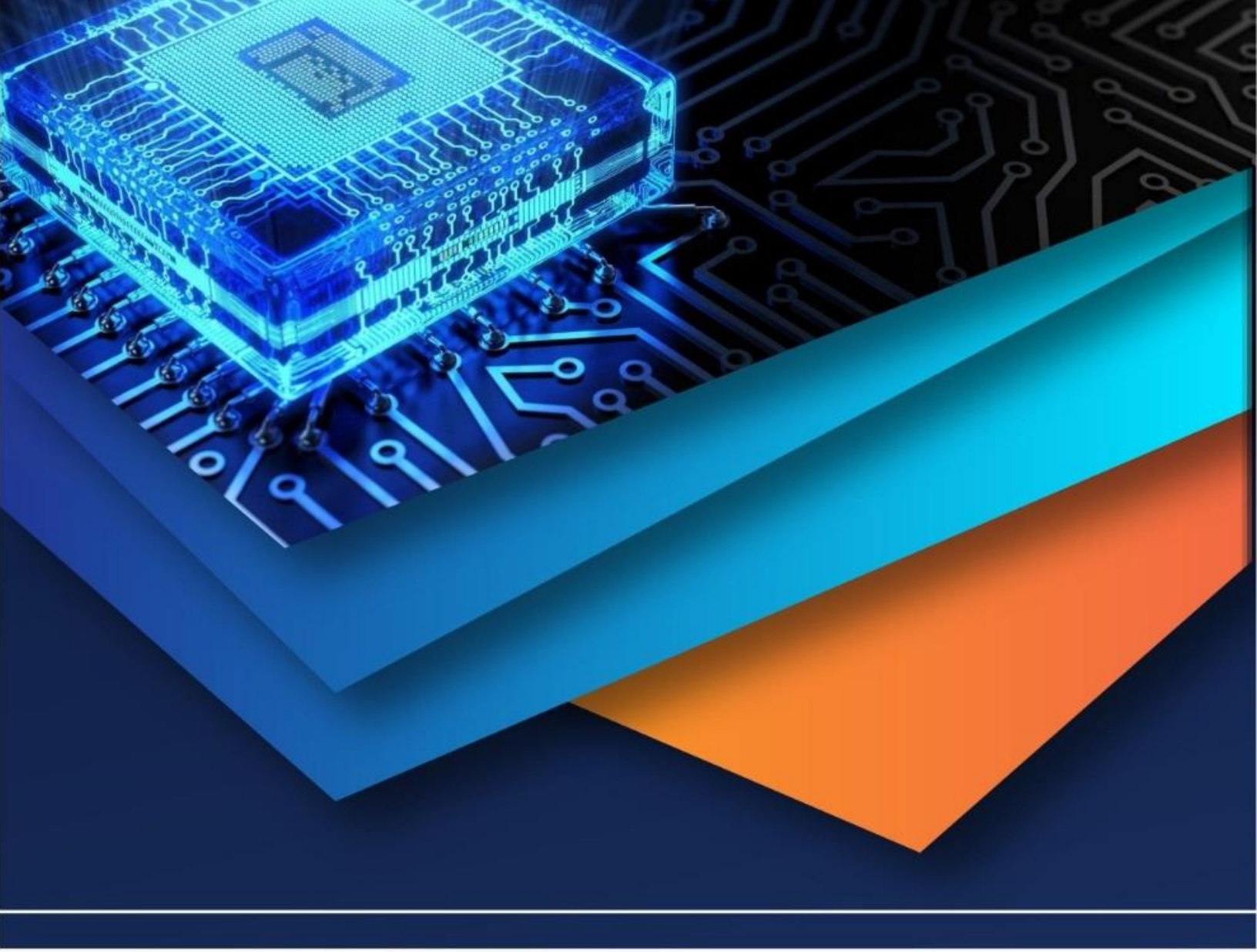
The key contributions of this work are as follows. First, TripSync introduces a location-driven social feed that surfaces travel content based on geographic proximity, making content discovery contextually relevant to the user's current location. Second, the interactive real-time map enables spontaneous discovery of nearby travelers and popular spots, a feature absent from existing travel and social platforms. Third, the embedded expense splitting module with debt minimization eliminates the need for a separate financial coordination tool within group travel contexts. Fourth, the AI-powered itinerary generator adds intelligent trip planning capabilities within the same unified platform.

Future work will focus on several directions. Migrating the expense calculation logic to Supabase Edge Functions will improve consistency and security. Expanding the AI itinerary generator with richer personalization based on past travel history represents a significant opportunity. Support for offline mode, push notifications, and a native mobile application built with React Native are also planned to improve accessibility and reach.

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