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Comparative Study on Web App Development

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Abstract

This research paper presents the development and evaluation of "MapMates," a web application designed to facilitate collaborative trip planning and synchronization among users. MapMates leverages Convex as a Backend as a Service (BaaS), Clerk for authentication, Leaflet for mapping, GeoJSON for data sharing, Next.js for frontend development, Nodemailer for email functionality, and Tailwind CSS with Mantine UI for the user interface. This paper details the design, implementation, and evaluation of MapMates, highlighting its features, user interface, and the results of user testing.

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1. Introduction

Planning group trips can be a challenging task, involving multiple individuals with varying preferences and schedules. MapMates was conceived as a solution to address these challenges by providing a collaborative platform that allows users to plan and synchronize their trips. The application aims to simplify the process of coordinating group travel while also employing advanced techniques like "Throttling Requests by Single-Flighting" to optimize its performance.

2. Methodology

2.1. Design

The design phase involved defining the core features of MapMates, including user registration, trip creation, itinerary planning, and synchronization. The application was designed with a user-friendly interface, making it accessible to both novice and experienced travelers. Tailwind CSS and Mantine UI were used to create a visually appealing and responsive design, while the "Throttling Requests by Single-Flighting" technique was implemented to efficiently manage server requests and enhance the application's responsiveness.

2.2. Implementation

MapMates was implemented using modern web development technologies, including Next.js for frontend development, Convex as a Backend as a Service (BaaS), and MongoDB for database storage. Real-time collaboration features were achieved using WebSocket technology to ensure seamless synchronization between users. The "Throttling Requests by Single-Flighting" for Presence technique was applied to regulate incoming requests, preventing server overload and optimizing the user experience.

3. Architecture

3.1. Presence

Presence, as we'll use the term here, is about surfacing activity in a UI about other users - surfacing their virtual presence. Some examples you've likely seen are the list of people "online" in Messenger, the "..." bubble in Messages when someone is composing a message to you, someone's cursor in a Google Doc, etc.
The value is a mix of utility and user experience. In a shared document, knowing where someone is typing can help you avoid typing over each other. The more subtle effects, however, tap into our social instincts. Seeing that other people are looking at the same document, seeing active engagement, gives a sense of aliveness. I feel more connected to collaborators than something like a Wiki. In a world where work is increasingly being done in private, I'll take all the presence I can get.

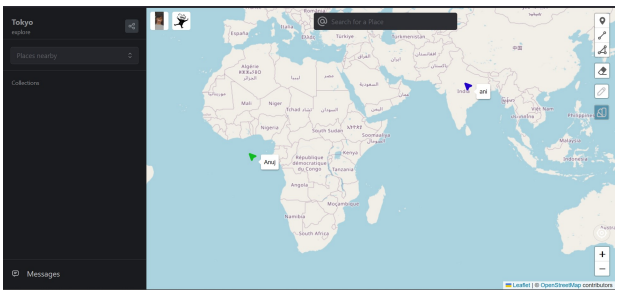


Figure 1. Presence

MapMates uses Convex to implement its presence feature, which allows users to see who else is online, where are they, and who is viewing the same map (**Figure 1**).

3.2. Throttling Requests by Single-Flighting

Throttling Requests by Single-Flighting is a technique used to prevent overloading a server by limiting the number of requests that can be made to it in a given period of time. It does this by grouping together similar requests and sending them to the server as a single request. This reduces the number of requests that the server has to process and improves the overall performance of the application.

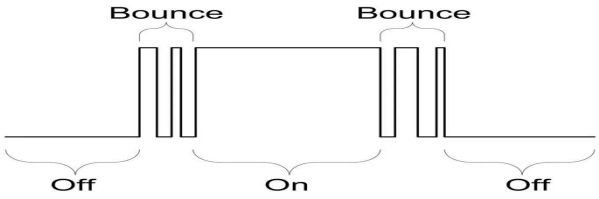


Figure 2. Single-flighting requests

4. Potential use cases

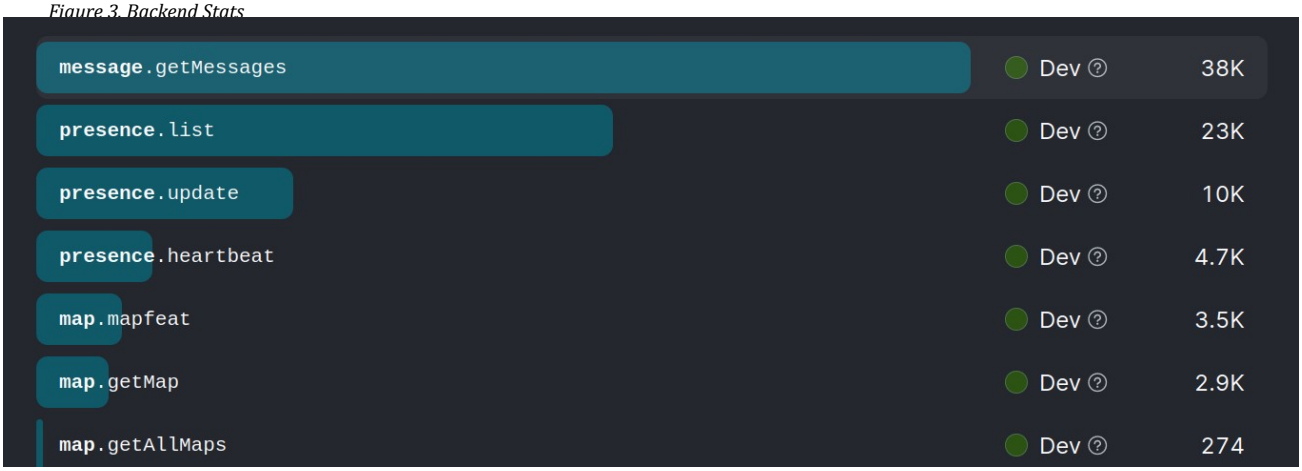
When conceptualizing this product, the primary use case that guided its development was centered around collaborative trip planning among friends. While existing tools like MyMaps offer valuable functionalities for this purpose, they primarily facilitate asynchronous collaboration, lacking the capability to provide real-time interaction. With MapMates, we sought to address this limitation by enabling users to seamlessly coordinate their travel plans, share insights, and make informed decisions in a real-time environment. This real-time collaboration greatly simplifies tasks such as recommending accommodations, dining establishments, hiking trails, and more.

The real-time collaboration features become especially advantageous in dynamic and rapidly changing scenarios, such as natural disasters. In such situations, MapMates can facilitate the swift aggregation of critical data from diverse sources, enabling effective coordination of rescue efforts and timely decision-making. Furthermore, the integration of real-time traffic and weather data or the capability for users to seamlessly incorporate their own APIs for collaborative data utilization can significantly enhance the tool's versatility.

5. Conclusion

MapMates, with its user-centric design, real-time synchronization capabilities, and integration with Convex, Clerk, Leaflet, GeoJSON, Next.js, Nodemailer, Tailwind CSS, and Mantine UI, offers a comprehensive solution for collaborative trip planning. The positive feedback from user testing, combined with the successful implementation of the "Throttling Requests by Single-Flighting" technique, underscores its potential for future development and expansion. This technique not only optimizes performance but also contributes to a seamless user experience.

Figure 3. Backend Stats



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