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ONETAP: A Unified Multi-Domain Ticket Reservation System

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Abstract

Current ticket booking platforms operate in separate domains such as movies, concerts, buses, and flights, causing users to switch between multiple applications. This paper presents OneTap, a unified web-based reservation system that integrates real-time APIs across all these services. Built using React, Node.js, and Firebase, the system offers real-time availability, instant seat synchronization, and centralized booking management. Experimental results show improved booking efficiency, seamless user experience, and reliable system performance.

Keywords

Ticket Reservation, API Integration, Firebase, Cloud Synchronization, Web Application, Real-Time Systems, Multi-Domain Booking

I. INTRODUCTION

Online ticket reservation systems have significantly transformed travel and entertainment planning. However, most existing applications operate in isolated domains—separate apps for bus bookings, flight reservations, movie tickets, or concert passes. This siloed structure creates inconvenience, forces users to switch between platforms, and results in inefficient workflows. The OneTap Ticket Reservation System is designed to overcome these limitations by providing a unified interface that consolidates all booking categories.

OneTap integrates real-time external APIs to fetch accurate schedules, pricing, and seat availability for flights, buses, concerts, and movies. The system employs a modern technology stack, including React, Node.js, Express, and Firebase Firestore, to ensure responsive performance, secure data handling, and instant synchronization. This paper presents the design, architecture, implementation, and performance evaluation of OneTap, highlighting its potential as a scalable multi-domain booking platform.

II. SYSTEM OVERVIEW

OneTap is constructed using a modular architecture that separates the frontend, backend, and database layers. The frontend is built using React and Tailwind CSS, offering a responsive and intuitive user interface. Backend operations are implemented using Node.js and Express.js, which handle API aggregation, authentication, and booking workflows. Firebase Firestore acts as the real-time database storing user data, booking records, and seat availability.

The system integrates several third-party APIs: AviationStack for flight schedules, OpenRouteService for bus routes, SeatGeek for concert listings, and TMDB for movie details. These APIs enable dynamic data retrieval and accurate availability updates. Additionally, an administrative dashboard provides insights into bookings, revenue, and category-wise performance using real-time analytics.

III. METHODOLOGY

The system follows a modular and event-driven development methodology. The frontend communicates with backend services through RESTful API endpoints. The backend processes requests, performs input validation, interacts with external APIs, and updates Firestore. Real-time seat management is achieved using Firestore’s onSnapshot listeners, ensuring live updates for all connected clients and eliminating double bookings.

State management on the frontend is handled using TanStack Query, which provides intelligent caching, background refetching, and optimized data synchronization. Role-based access control differentiates between administrators and regular users. The design emphasizes scalability, low latency, and secure communication between modules.

IV. SYSTEM MODULES

A. User Management Module

Manages authentication using Firebase Authentication, handles registration, login, and profile management, and stores user metadata in Firestore.

B. Booking Modules (Bus, Flight, Concert, Movie)

Each module integrates a specific external API to fetch real-time schedules, prices, seat layouts, and availability. Bookings are confirmed and stored in Firestore.

C. Real-Time Seat Selection Module

Implements Firestore's real-time listeners to track booked seats and update seat maps instantly for all connected clients.

D. Database Management Module

Firestore is used to maintain centralized booking records, user profiles, and real-time seat data with fast and secure retrieval.

E. Admin Dashboard Module

Displays analytics such as total bookings, revenue, category performance, and enabling add/delete operations for listings.

V. RESULTS AND DISCUSSION

The system was tested across multiple booking categories and was found to deliver fast search results, accurate seat availability, and seamless multi-domain integration. Real-time synchronization significantly minimized booking conflicts and improved user experience. The admin dashboard updated analytics every five seconds, providing near-instant insights into platform performance. Experiments confirmed the system's scalability and low-latency performance during simultaneous user access.

VI. FUTURE SCOPE

Future enhancements include the integration of secure payment gateways, expansion to mobile platforms using React Native, and implementation of AI-based recommendations. Additional features such as multilingual support, push notifications, and advanced data analytics can further improve usability and platform reach.

VII. CONCLUSION

OneTap successfully addresses the fragmentation in existing ticket booking systems by unifying multiple booking categories into a single, seamless platform. Through API-driven architecture, real-time database synchronization, and a user-centric design, the system enhances both convenience and operational efficiency. Its scalable architecture and robust features position OneTap as a strong foundation for future enhancements and adoption in real-world booking ecosystems.

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