

Track My Bus: Real-Time Bus Tracking Web

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Abstract—Urban bus transportation often faces issues such as uncertain schedules, lack of real-time updates, and inefficient communication. This paper presents “Track My Bus: Real-Time Bus Tracking Web Application,” a web-based solution to improve transport reliability and user experience. The system enables passengers to track live bus locations, view estimated arrival times, and book seats digitally, while drivers can manage routes and share real-time location data. The application is developed using HTML, CSS, JavaScript, and Firebase, integrating GPS-based geolocation and real-time database services. A responsive, mobile-first design ensures accessibility across devices. The proposed system reduces waiting time, enhances transparency, and improves operational efficiency. It offers a scalable and cost-effective approach toward intelligent transportation and smart urban mobility solutions.

Index Terms—Real-Time Passenger Information (RTPI), GPS-Based Bus Tracking, Firebase (Realtime Database & Authentication), Web Application (HTML, CSS, JavaScript), Progressive Web App (PWA), User Experience (UX) in Transport Apps || Google Maps API Integration || Intelligent Transportation System (ITS) ||, || Real-Time Data Synchronization || Security & Web Protection (OWASP) || Accessibility (WCAG Standards) || Urban Mobility Systems,

I. INTRODUCTION

Public transportation is widely used but often suffers from issues such as unpredictable bus arrival times, lack of real-time information, and inefficient communication between passengers and operators. These limitations reduce reliability and create inconvenience for daily commuters.

The proposed project, “Track My Bus: Real-Time Bus Tracking Web Application,” aims to address these challenges by providing a smart, web-based solution for live bus tracking and digital management. The system enables passengers to view real-time bus locations, estimate arrival times, and book seats

online, while drivers can manage routes and share live location data.

The application is developed using HTML5, CSS3, JavaScript, and Firebase, integrating geolocation APIs for real-time tracking and cloud-based data synchronization. Its responsive, mobile-first design ensures accessibility across multiple devices.[2]

This system improves transparency, reduces waiting time, and enhances operational efficiency, contributing to smarter and more reliable urban transportation. It also provides a scalable foundation for future advancements in intelligent transport systems.

II. LITERATURE REVIEW

Recent studies in intelligent transportation systems highlight the importance of real-time passenger information (RTPI) in improving public transport reliability and user satisfaction. Research by Watkins et al. and Brakewood et al. shows that access to live bus tracking and accurate arrival predictions significantly reduces perceived waiting time and increases commuter confidence.[4]

Existing solutions such as mobile transit applications provide location-based services, but many lack integration with driver-side management and real-time data synchronization. Traditional systems also rely on complex infrastructure, making them costly and less scalable.

With advancements in cloud computing and web technologies, platforms like Firebase and geolocation APIs have enabled the development of cost-effective, real-time tracking systems. Recent studies also emphasize user-centric design and mobile accessibility as key factors for successful adoption.

However, there remains a gap in developing integrated platforms that serve both passengers and drivers efficiently. The proposed system addresses this gap by

combining real-time tracking, booking, and route management into a unified web-based solution.

III. PROBLEM STATEMENT

Urban bus transportation systems face major challenges due to the absence of real-time tracking and effective communication between passengers and service providers. Commuters often experience uncertainty in bus arrival times, leading to long waiting periods and inconvenience. Additionally, the lack of a centralized digital platform makes route information, seat availability, and booking processes inefficient and unreliable.

From the operator’s perspective, manual route management and absence of data-driven tools result in poor planning and reduced operational efficiency. The overall system remains fragmented, with no integrated solution to connect passengers and drivers.

Therefore, there is a need to develop a smart, web-based system that provides real-time bus tracking, accurate arrival information, and digital management features to improve reliability, transparency, and user experience in public transportation.

IV. OBJECTIVES

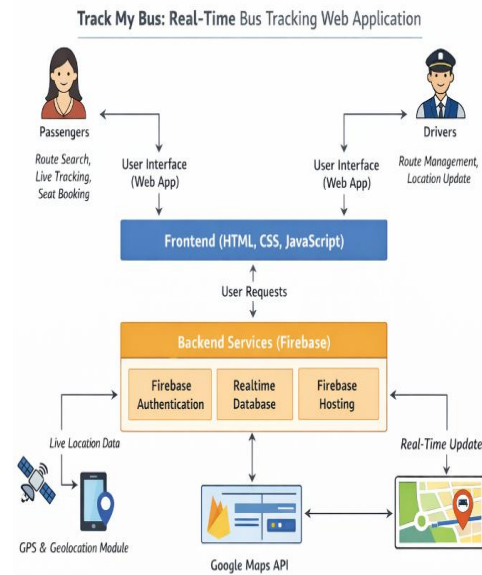
The main objective of the proposed system is to develop a smart and efficient web-based platform for real-time bus tracking and management. The specific objectives are as follows:

- To design and implement a real-time bus tracking system using GPS and geolocation APIs to provide accurate bus location and ETA to passengers
- To develop a user-friendly web application that allows passengers to search routes, track buses, and perform digital seat booking.
- To create a driver interface for route management, live location sharing, and operational control.
- To integrate cloud-based backend services (Firebase) for real-time data synchronization and secure user authentication.
- To ensure responsive and mobile-first design for accessibility across multiple devices.
- To enhance transparency, reduce waiting time, and improve overall efficiency of public transportation systems.

- To provide a scalable and cost-effective solution with future scope for advanced features like AI-based optimization and digital payments.

V. SYSTEM DESCRIPTION

The proposed system, “Track My Bus: Real-Time Bus Tracking Web Application,” is a web-based platform designed to provide real-time tracking and digital management of bus services. The system follows a client–server architecture, where the frontend is developed using HTML5, CSS3, and JavaScript, and the backend is supported by Firebase services.



The application consists of two main modules: Passenger Module and Driver Module. The passenger module allows users to search routes, track live bus locations, view ETA, and book seats, while the driver module enables route management and real-time location updates using GPS.

The system utilizes geolocation APIs and Firebase Realtime Database for continuous data synchronization, ensuring accurate live tracking. Firebase Authentication provides secure access for both users.

Designed with a responsive, mobile-first approach, the application ensures accessibility across devices. By integrating real-time tracking, booking, and cloud-based services, the system offers a scalable, efficient, and user-friendly solution for modern public transportation.

VI. METHODOLOGY

The proposed system follows an iterative and modular development approach to ensure efficient implementation and reliable performance.

Initially, the system is designed with a client-server architecture, where the frontend is developed using HTML, CSS, and JavaScript, and the backend is managed using Firebase services. A dual-user system is implemented to support both passengers and drivers with separate functionalities.

In the first phase, user authentication and interface design are developed, enabling secure login and smooth navigation. In the second phase, core features such as route management, real-time tracking, and booking system are implemented.

Real-time tracking is achieved using geolocation APIs, where the driver's GPS location is continuously captured and stored in the Firebase Realtime Database. This data is then synchronized and displayed to passengers instantly. The booking system ensures seat availability and updates data dynamically.

The system is tested through unit and integration testing to ensure accuracy, reliability, and performance. Finally, the application is deployed using Firebase Hosting, providing a scalable and accessible solution.

Flowchart of Application Development Methodology



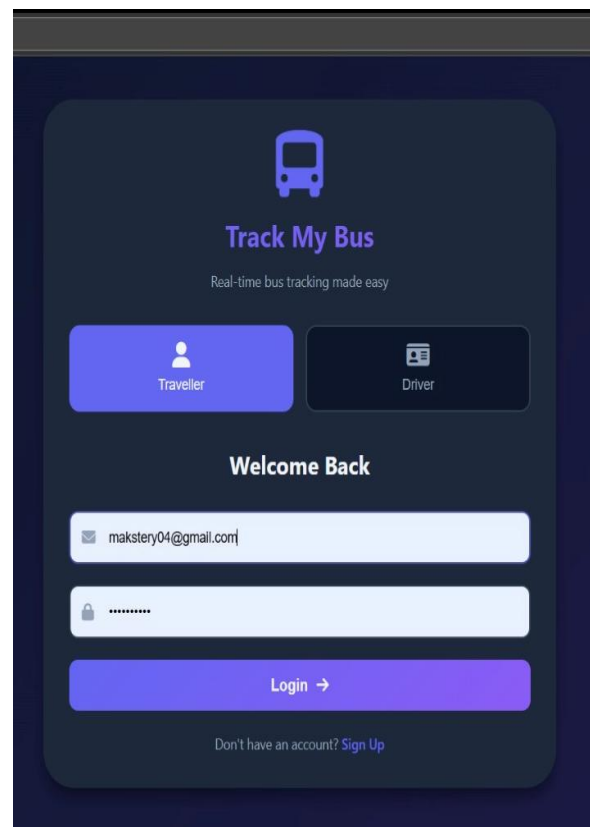
VII. EXPERIMENTAL RESULTS

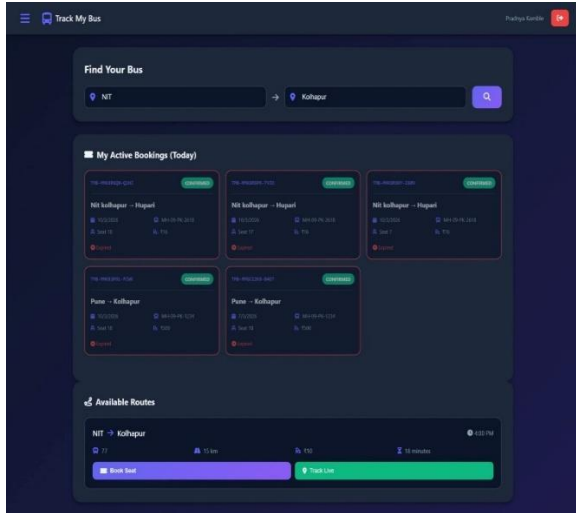
The proposed system was successfully implemented and tested under different scenarios to evaluate its performance and reliability. The real-time tracking feature accurately displayed bus locations with minimal delay, ensuring effective synchronization between driver and passenger modules.

The booking system was tested for multiple users, and it efficiently handled seat reservations with instant updates in the database. The system showed stable performance during continuous data updates using Firebase Realtime Database.

User interface testing confirmed smooth navigation and responsiveness across various devices, including mobile and desktop platforms. Authentication mechanisms ensured secure access for both passengers and drivers.

Overall, the system demonstrated improved accuracy, reduced waiting time, and enhanced user experience. The results validate that the proposed solution is efficient, scalable, and suitable for real-world public transportation applications.

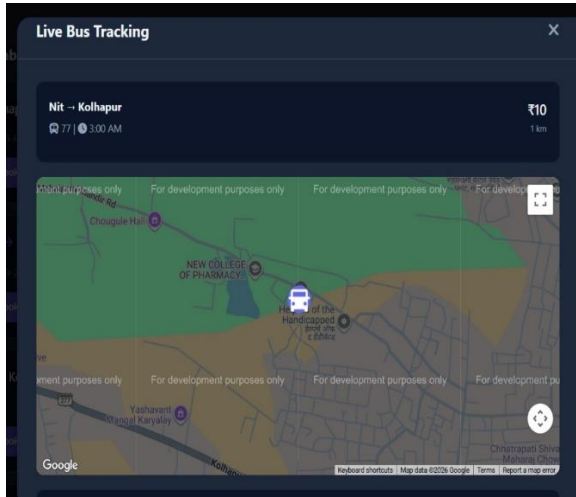




IX. FUTURE SCOPE

- Advanced features such as AI-based route optimization and traffic prediction can improve efficiency and reduce travel time.
- Integration with IoT devices and smart sensors can enhance tracking accuracy and data collection.
- implementing push notifications for bus arrival alerts and delays can improve user convenience.
- expanded to support multi-modal transportation (bus, metro, etc.), contributing to smart city initiatives)

X. CONCLUSION



The proposed system, “Track My Bus: Real-Time Bus Tracking Web Application,” successfully addresses key challenges in public transportation by providing real-time tracking, accurate arrival information, and digital booking facilities. The integration of GPS, geolocation APIs, and Firebase ensures efficient data synchronization and reliable system performance. The application improves transparency, reduces passenger waiting time, and enhances overall operational efficiency. Its responsive, user-friendly design makes it accessible across multiple devices, ensuring ease of use for both passengers and drivers. Overall, the system demonstrates a scalable, cost-effective, and practical solution for modernizing public transport. It also lays a strong foundation for future enhancements, contributing toward the development of intelligent and smart urban mobility systems.

VIII. LIMITATIONS

The system depends on internet connectivity, and performance may degrade in low or unstable network conditions. Real-time tracking accuracy is limited by GPS precision, which may vary in dense urban or indoor areas. The application currently supports web-based access only and does not include a dedicated mobile app. Payment integration is not implemented, limiting the booking system to basic functionality. The system is tested on a limited scale and may require further optimization for large-scale deployment. Continuous use of GPS may lead to increased battery consumption on driver devices.

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