Green Journey: Integrated E-Bus Ticketing System For Eco-Conscious Transportation

Prof. Deepika G
Dr. Shantakumar B Patil
Chitta Talakal
Deeksha P
Hithyshi R Varada
Spoorthi J S
Dept. Of Computer Science
Sai Vidya Institute Of Technology
Bengaluru, India

Abstract –
The Green Journey: Integrated E-Bus Ticketing System for Eco-Conscious Transportation *is a Flask-based system that streamlines the process of booking bus tickets, offering an efficient and user-friendly experience for both passengers and administrators. Users can sign up, log in, and add funds to their digital wallets. Once the wallet is funded, users can select their travel route and input the number of passengers to calculate the total fare. After confirming the details, the payment is processed, and the amount is deducted from the user's wallet. Following successful payment, the system generates a QR code containing the booking details, ensuring a smooth and secure ticketing process.*
For administrators, the system provides a convenient method to validate ticket bookings by scanning the QR code. The scan allows them to quickly retrieve and verify the user's booking information, including travel route and payment status. This feature reduces administrative workload and ensures efficient validation during travel. The system not only improves user experience by simplifying ticket purchases and wallet management but also enhances security with QR code-based validation, making bus ticket booking and travel management faster and more reliable.

Keywords: *Flask based system, booking bus tickets, digital wallets, QR Code generation, payment processing, QR Code validation.*

Date of Submission: 01-03-2025   Date of Acceptance: 11-03-2025

I.   Introduction

The inclusion of a digital wallet simplifies the payment process, allowing users to add funds and pay for bookings without the hassle of external transactions. Selecting routes and passengers becomes a straightforward task, with automatic fare calculation enhancing the overall convenience of the system.

After successful payment, a unique QR code is generated, encapsulating all relevant booking details. This feature ensures secure storage of information and provides an efficient way to validate tickets during travel. Administrators benefit from the ability to scan QR codes and quickly verify booking authenticity, reducing their workload and minimizing errors.

The system's design emphasizes user-friendliness and security, making it an ideal solution for both urban and intercity bus services. It not only improves operational efficiency but also fosters trust among users by safeguarding their transactions and booking information.

By modernizing the ticketing process, this platform contributes to the digitization of public transport management. It aligns with the growing demand for automated solutions that cater to the fast-paced lifestyles of users, ensuring quick, reliable, and secure services. The *System* sets a new standard for public transportation, emphasizing convenience, safety, and innovation. It is a step toward enhancing the overall experience of bus travels, benefiting both travelers and service providers.

II.   Background Study

The **Green Journey: Integrated E-Bus Ticketing System for Eco-Conscious Transportation** offers

a streamlined approach to managing bus travel arrangements through a web-based platform built on Flask. This system bridges the gap between traditional ticketing processes and modern technological advancements by integrating digital wallets and QR code-based ticket validation. By addressing common challenges in bus ticketing, such as manual handling and inefficiency, the platform provides a seamless experience for both passengers and administrators.

With an intuitive interface, users can register, log in, and manage their accounts effortlessly.

The traditional bus ticketing system is fraught with inefficiencies, including long queues, manual fare calculations, and a lack of transparency in the booking process. These limitations often lead to customer dissatisfaction and operational bottlenecks. Payment methods such as cash transactions are prone to delays, errors, and potential security concerns. Additionally, ticket validation is time-consuming and lacks a standardized approach, increasing the risk of fraudulent entries.

Passengers face challenges in accessing reliable information regarding available routes, schedules, and ticket prices. The lack of a unified platform for managing bookings, payments, and ticket storage further complicates the process.

Administrators, on the other hand, struggle with managing large volumes of bookings, verifying ticket authenticity, and ensuring timely operations.

The absence of digital solutions also hinders the scalability of bus services. As public transport systems expand to accommodate growing populations, the limitations of traditional ticketing systems become more evident. These issues necessitate a modern solution that combines efficiency, security, and convenience for both users and service providers.

III.   Obectives

OBJECTIVE-1: Enhance Customer Convenience: Enable customers to book tickets and make payments online through a user-friendly interface, reducing the need to visit physical ticket counters and minimizing wait times.

OBJECTIVE-2: Improve Operational Efficiency: Automate the ticketing process by providing an efficient method for route selection, a centralized database, it also reducing manual errors and decreases the workload on staff.

OBJECTIVE-3: Ensure Security and Sustainability: Implement dynamic QR code-based e-tickets to prevent duplication and enhance security, while promoting eco-friendly practices by reducing the use of paper-based tickets.

IV.   Literature Review

"Smart E-Ticketing System for Public Transport Bus"(2024) This paper discusses a smart e-ticketing system using RFID, GPS, and GSM technologies, designed to replace traditional paper tickets and improve passenger experience.

"A Novel BIBO Automated Ticketing System Based on Blockchain Mobile Sensors for Public Transport Modes" (2024)
This study proposes a Be-in Be-out (BIBO) ticketing system integrated with blockchain and mobile sensors, enhancing security and preventing fraud in bus ticketing.

"The Future of Travel in Public Bus Service: How a Mobile Bus Ticketing System is Revolutionizing Public Travel" (2024)
The paper explores how mobile bus ticketing systems are transforming public transportation by offering more convenient, efficient, and cashless solutions for commuters.

"Modernizing Public Transit," Raj Patel, (2022):
This paper highlights the benefits of automated booking platforms, which focuses on improved efficiency and scalability.

"QR Code Validation in Transportation Systems," John Smith,(2019)
Explores QR code-based ticketing systems for public transport. It simplifies validation process and reduces fraud that may occur.

"Securing Digital Transactions," Robert Johnson, (2019) Addresses encryption techniques for securing payments Ensuring safety in transactions.

"Scalability of Public Transport Systems," Sarah Green, (2021)
Analyzes the scalability of digital ticketing platforms that can adjust to fluctuating user demands ensuring good performance.

V.   System Architecture

The **Green Journey: Integrated E-Bus Ticketing System for Eco-Conscious Transportation** architecture consists of three main layers: the user interface, application server, and database. The user interface, accessible via web browsers on mobile and desktop devices, allows customers to register, search for buses, select seats, and make online payments. The application server handles business logic, processes user requests, and integrates with a secure payment gateway to facilitate transactions. It also generates dynamic QR code- based e-tickets after successful bookings. The database layer stores and manages all relevant information, including user data, bus schedules, reservations, and payment records. An admin interface allows administrators to update schedules, manage bookings, and view reports, ensuring efficient system management.

Frontend:
The user interface serves as the interaction point for both passengers and administrators. It is designed to be intuitive, mobile-responsive, and user-friendly, enabling seamless navigation for tasks such as registration, route selection, and wallet management.

Backend:
The backend, powered by the Flask framework, manages all critical business logic. It handles user authentication, wallet operations, fare calculations, and booking management. Additionally, it oversees the generation and retrieval of QR codes for secure ticketing.

Database:
A MySQL database acts as the central repository, storing vital data, including user profiles, wallet balances, booking histories, and route details. Efficient indexing and query optimization ensure fast data retrieval and real-time updates.

QR-Scanner:
Administrators utilize a QR scanning tool to validate tickets quickly. This scanner integrates with the backend to fetch and verify the booking details encoded within the QR codes.
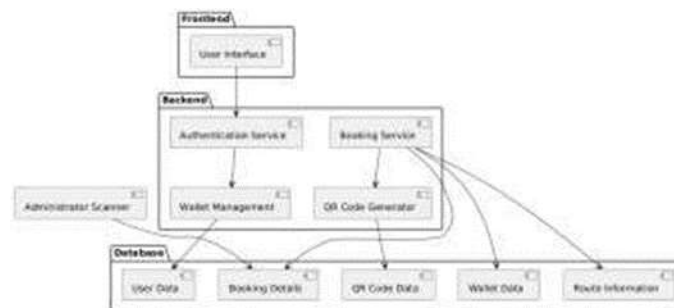
VI.   Implementation

Key Functionalities: The System provides several core features to address the challenges of traditional ticketing systems:

User Management:
➢Passengers can create and manage their accounts, enabling secure login/logout operations.
➢Separate administrator accounts provide enhanced control over ticket validation and system monitoring.

Wallet Integration:
➢Users can preload funds into a digital wallet, simplifying the payment process.
➢Real-time updates ensure that wallet balances reflect accurately after each transaction.

Route and Fare Selection:

➢ Passengers can browse available routes, choose their desired travel path, and input the number of passengers.
➢ The system dynamically calculates the total fare based on the selected route and number of passengers, ensuring transparency.

QR Code-Based Ticketing:
➢ Upon successful booking, the system generates a QR code containing essential booking details, such as the travel route, date, and payment status.
➢ Administrators use QR scanners to validate tickets efficiently, reducing manual intervention and errors.

VII. Workflow:

1. **Passenger Workflow**:
➢ Users register and log in to access the system. They can add funds to their digital wallets using integrated payment gateways.
➢ Passengers select their route and specify the number of passengers. The system calculates the fare, and upon confirmation, deducts the amount from the wallet.
➢ A QR code is generated and provided to the user as a digital ticket for travel.

2. **Administrator Workflow**:
➢ Administrators scan the QR codes during passenger boarding. The system retrieves and displays booking information, including payment status and route details, for verification.
➢ This process minimizes delays and ensures secure ticket validation.
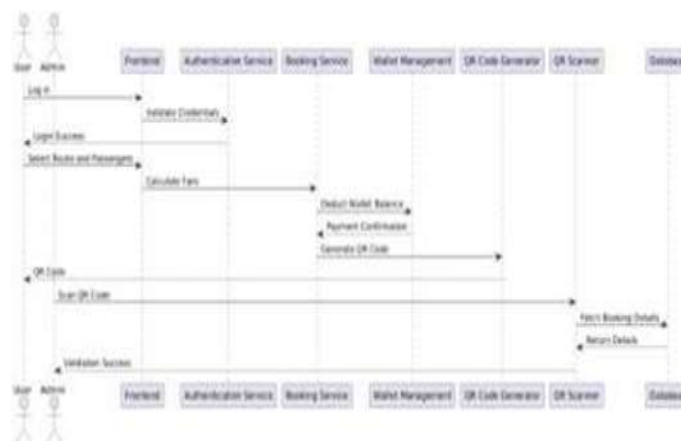
Sequence Diagram
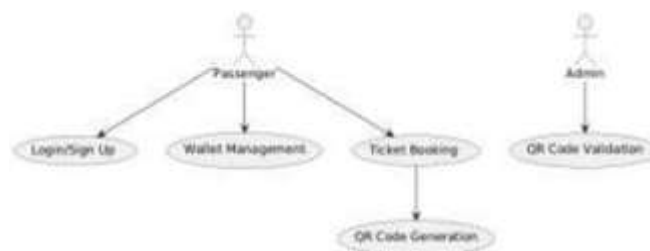
Use case diagram

VIII. Methodology:

This System leverages a robust combination of technologies and tools to provide a scalable, secure, and efficient platform**.**

1. **Database Connectivity**:
➢ **ODBC (Open Database Connectivity)**: Ensures platform-independent database interactions, facilitating easy upgrades and support for multiple database types.
➢ **JDBC (Java Database Connectivity)**: Manages backend operations, including user authentication and transaction handling, ensuring seamless data communication.

2. **Database Management**:

➢**MySQL**: Serves as the primary database, storing user credentials, booking details, and transaction histories. It supports complex queries and efficient indexing for high- performance data retrieval.

3. **Web and Mobile Technologies**:

➢**Servlets and JSP**: Facilitate the integration of dynamic web content and backend processing, enabling secure and interactive user interfaces.

➢**Android**: Provides mobile application support, allowing users to access functionalities like ticket booking and QR code scanning on the go.

4. **Development Tools**:

➢**SQLYog**: Used for database schema design and query testing during development.

➢**Flask**: Forms the backbone of the web application, handling routing, session management, and API integration.

5. **System Requirements**:

➢**Software**: Key tools include MySQL, Flask, Android Studio, and IDEs like Eclipse for application development.

➢**Hardware**: A robust server for hosting, secure storage systems, and client devices like PCs and smartphones ensure reliable performance.

This architecture ensures a user-friendly interface for passengers and administrators while maintaining scalability, performance, and data security.
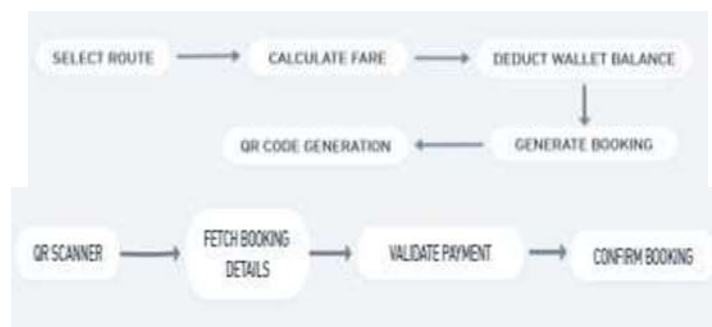
Data Flow Diagram

IX.   Security And Data Integrity:

1. **Data-Encryption**:

All sensitive information, including user credentials and wallet transactions, is encrypted to prevent unauthorized access and data breaches.

2. **Fraud-Prevention**:

The use of QR codes for ticket validation ensures that only genuine bookings are honoured. Administrators can quickly detect and reject duplicate or invalid tickets.

X.   Testing And Validation:

To ensure a reliable and robust system, multiple levels of testing were conducted:

1. **Unit Testing**: Verified individual components such as user authentication and fare calculations to ensure proper functionality.

2. **Integration Testing**: Examined the interaction between modules, such as payment processing and QR code generation, to identify any inconsistencies.

3. **System Testing**: Assessed the entire application under realistic conditions, validating end-to-end workflows from user registration to ticket validation.

XI. Results:

The implementation of the System has significantly improved the efficiency of ticketing operations.

Key benefits include:

➢**Enhanced User Accessibility**: Digital wallets simplify payment processes, eliminating the need for cash transactions.

➢**Efficient Ticket Validation**: QR code scanning reduces boarding times and minimizes human errors.

➢**Improved Operational Efficiency**: Automated fare calculations and real-time transaction updates streamline administrative tasks.

XII. Conclusion

The **Green Journey: Integrated E-Bus Ticketing System for Eco-Conscious Transportation** marks a transformative step in the digitalization of public transport ticketing by integrating modern technologies such as digital wallets and QR code-based ticket validation. This system addresses the critical inefficiencies inherent in traditional bus ticketing methods, including long queues, manual fare calculations, and the potential for fraud. By providing a secure, scalable, and user- centric platform, it simplifies the booking process for passengers and optimizes operational workflows for administrators.

The implementation of features like real-time fare calculations, digital payment options, and automated ticket generation ensures a hassle-free experience for users. Meanwhile, the administrative functions, such as QR code validation, significantly reduce workloads and eliminate manual errors, making the process both faster and more reliable. These advancements enhance user trust by safeguarding sensitive data and ensuring transparent transactions.

The system's design not only addresses current transportation challenges but also offers scalability, making it adaptable to handle increasing user loads, expanding bus networks, and future upgrades. Its compatibility across devices further supports accessibility for diverse user demographics, ensuring inclusivity and ease of use.

Moreover, the platform aligns with the broader goals of digital transformation in public transport systems by facilitating quicker, more secure, and paperless transactions, the system promotes sustainability, supporting efforts to reduce the environmental impact of traditional ticketing methods. Looking ahead, potential enhancements such as offline capabilities, integration with third-party payment gateways, and multilingual support can further enrich the system's functionality and expand its reach to underserved regions. These additions would make the platform more resilient, versatile, and aligned with evolving user expectations and technological trends.

In conclusion, the Bus Ticket Booking System sets a high standard for modern public transportation management, bridging the gap between passenger convenience and operational efficiency. It not only delivers immediate benefits but also establishes a scalable foundation for future advancements in automated ticketing and travel management solutions, paving the way for smarter, more connected transit systems globally.

References

[1]   S.M, S. Karthikh, D. V And S. S. J, "Cloud Based Town Bus Ticket Payment System Integrated With Mobile Application," 2023 2nd International Conference On Advancements In Electrical, Electronics, Communication, Computing And Automation (Icaeca), Coimbatore, India, 2023, Pp.1-6,Doi: 10.1109/Icaeca56562.2023.10200393.
        Keywords: {Automation; Smart Cities; Transportation; Conductors; Telecommunication Computing; Mobile Applications; Cashless Digitalization; Toll – Free Numbers; Seamless Ticketing Experience.}
[2]   T. Kavitha And G. Senbagavalli, "The Future Of Travel In Public Bus Service: How A Mobile Bus Ticketing System Is Revolutionizing The Public Travel," 2023 International Conference On Applied Intelligence And Sustainable Computing (Icaisc),Dharwad, India, 2023, Pp. 1-7, Doi:10.1109/Icaisc58445.2023.10200016.
        Keywords: {Transportation; Manuals; Mobile Bus Ticketing System; Public Bus Service; Bus Tracking And Ticketing; Online Bus Ticketing System; Public Transport Ticketing; Tracking System; Mobile Ticketing And Tracking }
[3]   S. Karthick And A. Velmurugan , "Android Suburban Railway Ticketing With Gps As Ticket Checker," In In Advanced Communication Control And Computing Technologies (Icaccct), 2012 Ieee International Conference, 2012