PUSL2021 Computing Group Project

Project Report of Airline Reservation Management System

Submission Deadline: March 25th 2024

Module Leader: Mr. CMB Attanayake

Group A 95

	Student ID (Plymouth)	Name (as appeared on DLE)
1.	**10898536**	**Henaka Kumara**
2.	**10898502**	**Shakya Jayathilaka**
3.	**10908162**	**Horagala Piyumani**
4.	**10749144**	**Kaluthanthiri Patabandi**
5.	**10898438**	**Jayasundara Dasumi**
6.	**10898467**	**Tharushi Galappaththi**

Table of Contents

1. Introduction

The Airline Reservation System represents a comprehensive solution designed to streamline and modernize the flight booking process for both passengers and airline administrators. In today's fast-paced world, where air travel has become an integral part of global connectivity, the need for a robust and efficient reservation system is paramount. This system endeavors to address the complexities and challenges associated with airline ticketing while providing a seamless and user-friendly experience for all stakeholders involved.

1.1. Purpose and Objectives

The primary purpose of the Airline Reservation System is to revolutionize the way passengers book flights by offering a convenient, intuitive, and feature-rich platform. The system aims to simplify the booking process, enhance accessibility to flight information, and optimize resource utilization for airlines.

Key objectives of the project include:

1. **Enhanced User Experience:** The system seeks to provide passengers with a user-friendly interface that simplifies the flight search, reservation, and management process. By offering a seamless booking experience, it aims to increase customer satisfaction and loyalty.
2. **Efficient Resource Management:** For airlines, efficient resource management is crucial to optimizing operations and maximizing revenue. The system facilitates real-time inventory management, seat allocation, and pricing strategies to ensure optimal resource utilization and profitability.
3. **Comprehensive Administration Tools:** In addition to passenger-facing features, the system provides robust administration tools for airline staff. Administrators have access to functionalities such as flight management, airport management, and ticketing analytics, empowering them to make data-driven decisions and streamline operations.

4. **Scalability and Flexibility:** With scalability in mind, the system is designed to accommodate future growth and evolving business requirements. It offers flexibility in terms of customization, integration with third-party services, and support for multiple airlines and airports.

1.2. Scope and Limitations

The scope of the Airline Reservation System encompasses a wide range of features and functionalities aimed at addressing the diverse needs of passengers and airline administrators. These include.

1. **User Registration and Authentication**: Passengers can create accounts, manage profiles, and securely authenticate their identities to access booking services.
2. **Flight Search and Booking:** Passengers can search for flights based on various criteria such as origin, destination, date, and preferences. They can view detailed flight information, select preferred options, and complete the booking process seamlessly.
3. **Wallet Management:** The system allows passengers to manage their virtual wallets, enabling convenient payment options and loyalty rewards integration.
4. **Reservation Management:** Passengers can view, modify, or cancel existing reservations, providing flexibility and convenience in managing travel plans.
5. **Administration Functions:** Airline administrators have access to additional functionalities such as managing flights, airports, and viewing booking tickets. They can perform tasks related to inventory management, pricing strategies, and operational analytics.

2. Technologies Used

The Airline Reservation System leverages a sophisticated stack of technologies to deliver a robust, scalable, and efficient solution for airline ticketing and management. Each technology has been carefully selected to fulfill specific requirements and to ensure seamless integration across the system components.

2.1. Backend Technologies

a. Spring Boot

Spring Boot serves as the backbone of the backend architecture, providing a powerful and opinionated framework for building RESTful APIs. Key features and components of Spring Boot utilized in the project include:

- **Spring MVC:** For building web APIs and handling HTTP requests.
- **Spring Data JPA:** Simplifies data access layer by providing repository abstractions and ORM support.
- **Spring Security:** Offers comprehensive security features such as authentication, authorization, and role-based access control (RBAC).
- **Spring Boot Starter:** Provides pre-configured dependencies and auto-configuration, enabling rapid application development and deployment.

b. MySQL

MySQL Workbench is employed as the relational database management system (RDBMS) to store and manage structured data related to flights, reservations, users, and other entities. It offers robust performance, scalability, and reliability, making it an ideal choice for transactional applications like the Airline Reservation System.

2.2. Frontend Technologies

React.js

React.js powers the frontend of the Airline Reservation System, offering a declarative and component-based approach to building user interfaces. Key features and libraries of React.js utilized in the project include:

- **Functional Components:** Utilized for building reusable UI components with a clear separation of concerns.
- **React Hooks:** Used for managing state and side effects within functional components, enabling a more concise and readable codebase.
- **Redux:** Employed for global state management, facilitating predictable state updates and enabling complex interactions between components.
- **Axios:** Utilized for making HTTP requests to the backend API, handling asynchronous data fetching and updating.

2.3. Additional Technologies

a. Node.js

Node.js is utilized as the JavaScript runtime environment for the backend of the Airline Reservation System. Leveraging the event-driven, non-blocking I/O model of Node.js enables efficient handling of concurrent requests and ensures high scalability and performance. Key aspects of Node.js utilized in the project include.

- **Express.js:** A minimalist web framework for Node.js used to build the RESTful API endpoints of the system. Express.js simplifies routing, middleware integration, and request handling, facilitating rapid development and maintenance of backend services.

b. JDK (Java Development Kit)

The Java Development Kit (JDK) is essential for developing the backend components of the Airline Reservation System using Spring Boot. It provides the necessary tools and libraries for compiling, debugging, and running Java applications. The features and components of JDK utilized in the project include.

- **Java SE (Standard Edition):** Forms the foundation of Spring Boot applications, providing core libraries, APIs, and tools for Java development.
- **Java Compiler (javac):** Used to compile Java source code into bytecode executable on the Java Virtual Machine (JVM).
- **Java Virtual Machine (JVM):** Executes the compiled Java bytecode, providing platform independence and runtime optimizations.

c. npm (Node Package Manager)

npm serves as the package manager for the frontend development of the Airline Reservation System, facilitating dependency management, project scaffolding, and package installation. Key functionalities and utilities provided by npm include.

- **Package Installation:** Allows developers to install and manage frontend dependencies and libraries required for building the user interface of the system. Dependencies such as React.js, Redux, Axios, and Material-UI are managed through npm.
- **Script Execution:** Enables the execution of custom scripts defined in the project's package.json file, such as build scripts for bundling and minifying frontend assets, running development servers, and executing tests.
- **Version Management:** Provides versioning and semantic versioning (semver) support, allowing developers to specify compatible versions of dependencies and manage upgrades seamlessly.

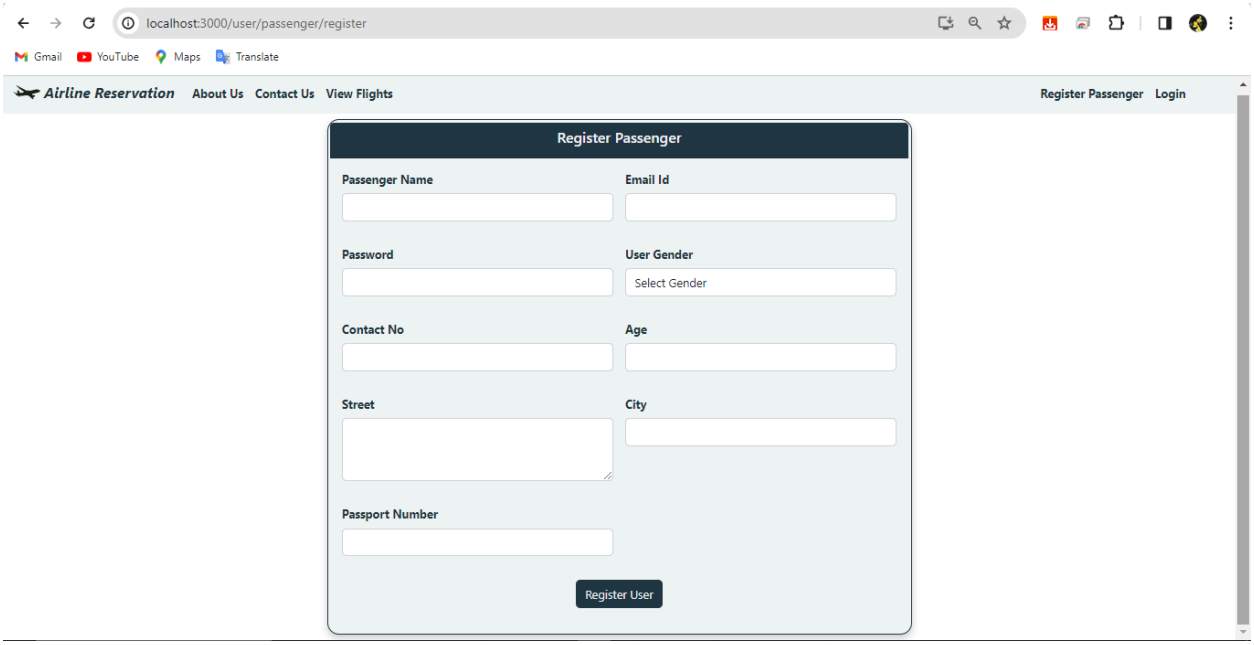
3. Features

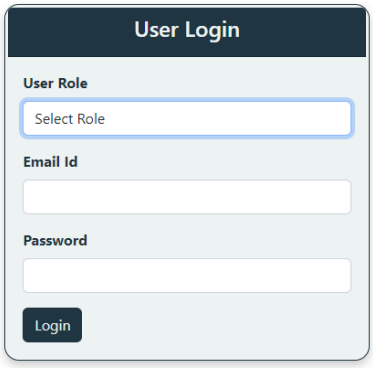
The Airline Reservation System offers a range of features tailored to meet the needs of both passengers and administrators. These features enhance the user experience, streamline operations, and provide comprehensive management capabilities.

3.1. For Passengers

User Registration and Authentication

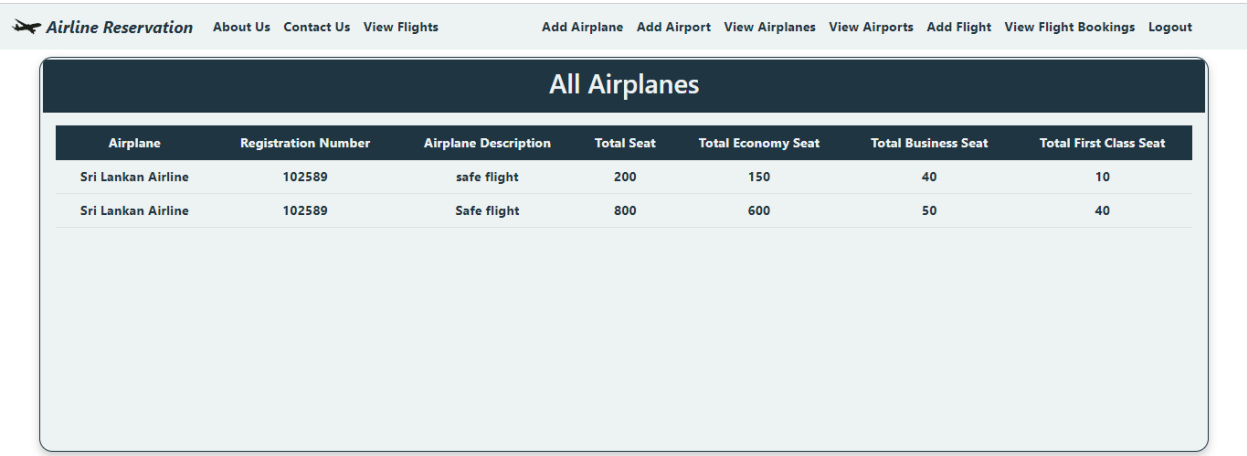
- Passengers can create accounts securely and authenticate their identities to access booking services.





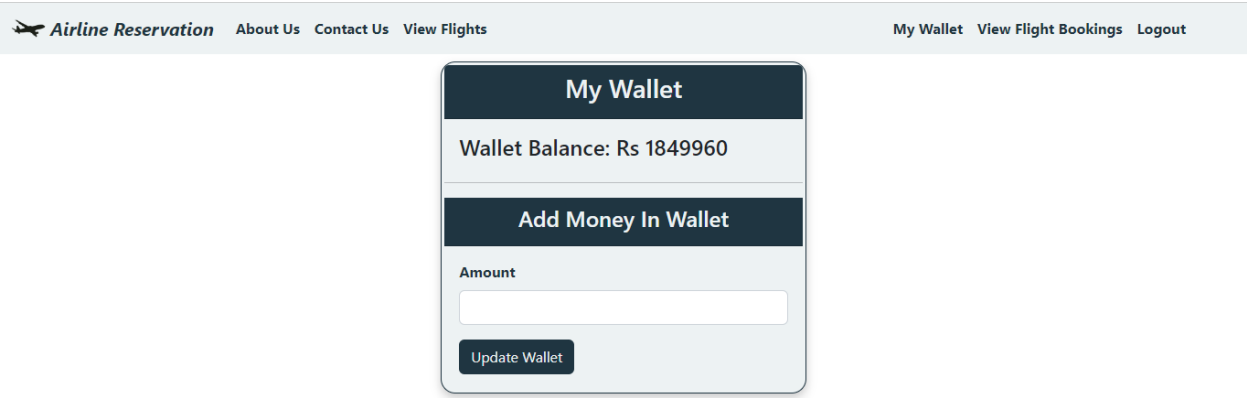
Flight Search and Booking

- Passengers can search for flights based on various criteria such as origin, destination, date, and preferences.
- They can view detailed flight information, select preferred options, and complete the booking process seamlessly.



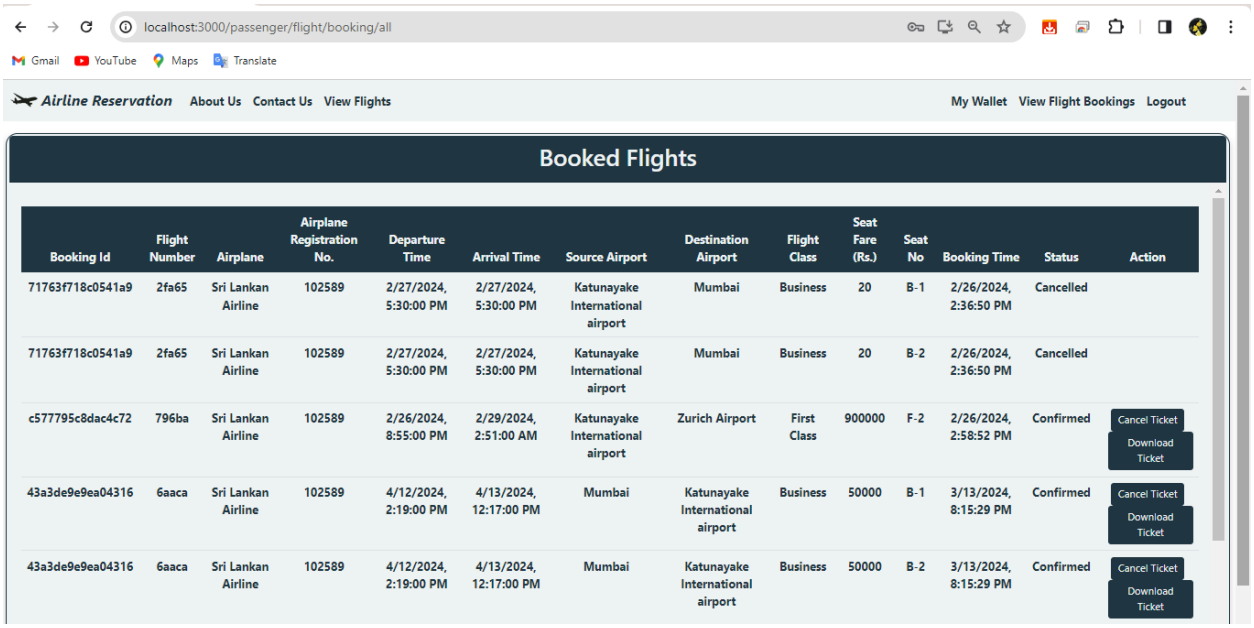
Wallet Management

- Passengers have the option to manage their virtual wallets, facilitating convenient payment methods and loyalty rewards integration.



Reservation Management

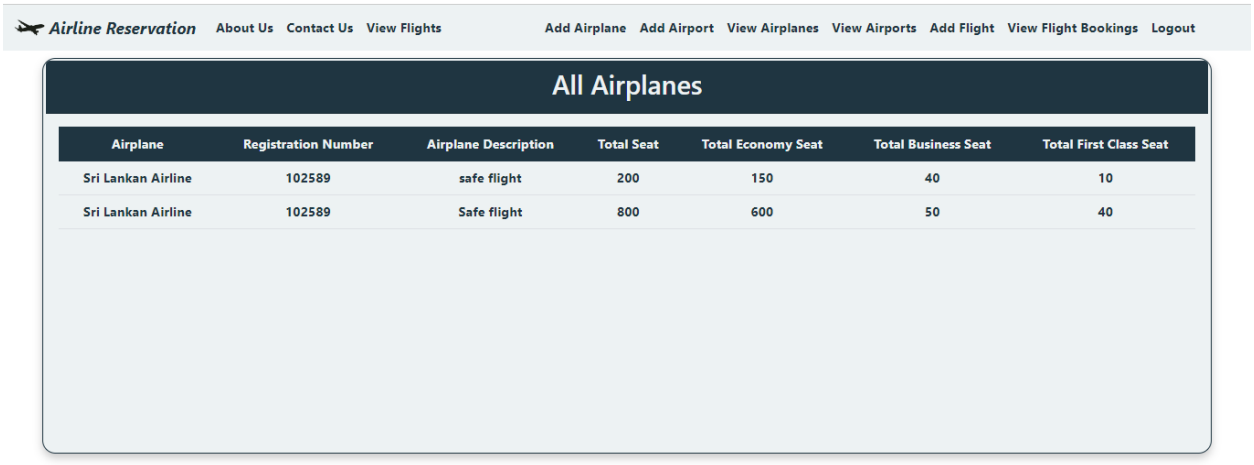
- Passengers can view, modify, or cancel existing reservations, providing flexibility and convenience in managing travel plans.



3.2. For Administrators

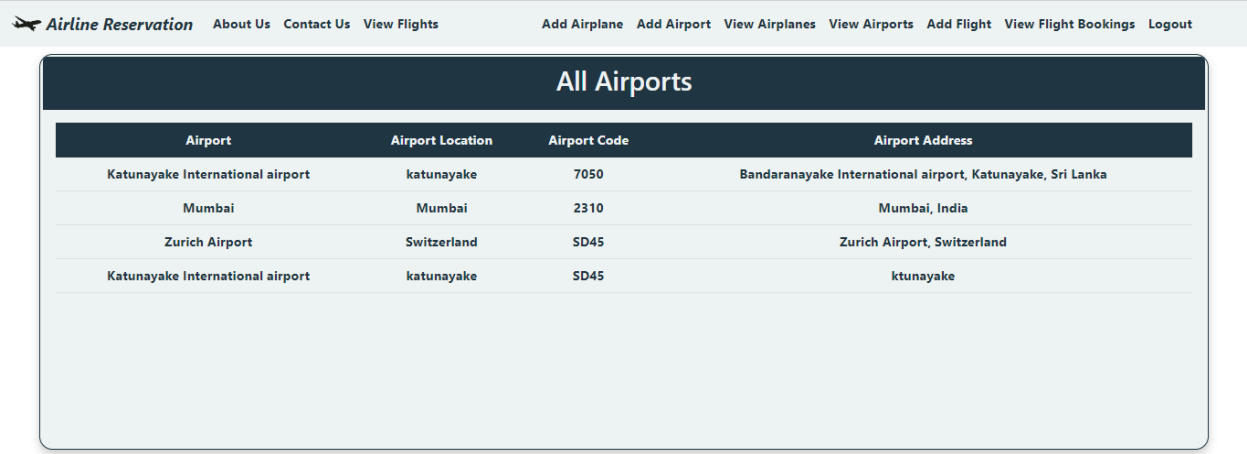
Flight Management

- Administrators have access to functionalities for managing flights, including adding new flights, updating schedules, and managing seat availability.
- They can also set pricing strategies, define fare rules, and configure discounts or promotions.



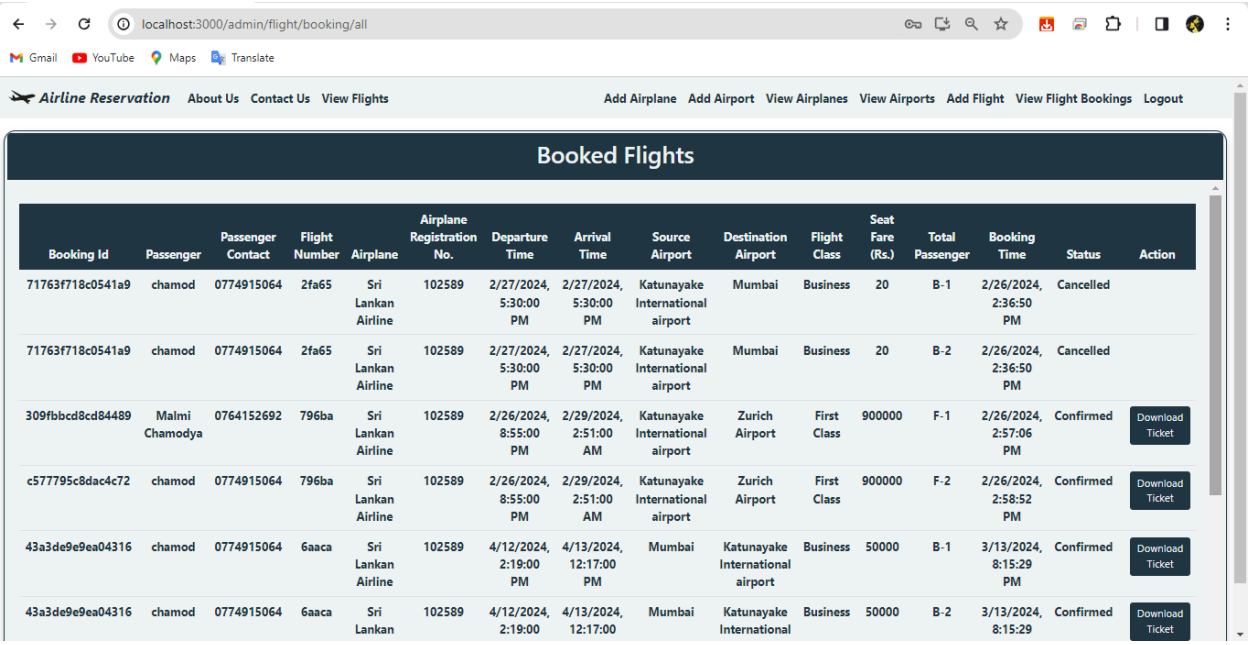
Airport Management

- Administrators can manage airport information, including adding new airports, updating location details, and configuring airport-specific rules or regulations.



Booking Ticket Management

- Administrators have the ability to view and manage booking tickets, including reviewing reservation details, processing refunds or cancellations, and generating reports on booking statistics.



4. Challenges Faced

The development of the Airline Reservation System was not without its challenges. Throughout the project lifecycle, several obstacles were encountered, requiring careful consideration and innovative solutions to overcome. These challenges encompassed various aspects of development, deployment, and maintenance,

1. Integration Challenges:

- Integrating frontend and backend components seamlessly posed challenges, particularly ensuring consistent data flow and synchronization between the two layers.
- Compatibility issues between different versions of libraries and frameworks required meticulous debugging and troubleshooting to ensure interoperability.

2. Security Concerns:

- Implementing robust authentication and authorization mechanisms to safeguard user data and prevent unauthorized access required careful planning and adherence to best practices.
- Addressing potential security vulnerabilities such as injection attacks, cross-site scripting (XSS), and data breaches demanded thorough code reviews and security audits.

3. Performance Optimization:

- Optimizing the performance of the system, particularly in handling concurrent user requests and processing large datasets, presented challenges.
- Techniques such as caching, lazy loading, and asynchronous processing were employed to enhance system responsiveness and scalability.

4. Error Handling and Debugging:

- Identifying and resolving errors and exceptions, both during development and in production environments, required comprehensive error handling and logging mechanisms.
- Debugging complex issues, including race conditions, memory leaks, and performance bottlenecks, demanded systematic troubleshooting and diagnostic tools.

5. Database Connectivity Issues:

- One notable challenge involved database connectivity issues, where the system failed to connect to the database due to incorrect database credentials.
- Resolving the issue required thorough investigation, and it was eventually discovered that the database password was incorrect due to a simple typo, highlighting the importance of meticulous configuration management and testing.

6. MySQL Server Stopping Unexpectedly:

- The MySQL server running on the developer's computer would intermittently stop unexpectedly, disrupting the development workflow.
- Investigating the root cause revealed that the MySQL service (mysql80) was abruptly stopping, leading to database connectivity issues and service downtime.
- Resolving this challenge involved troubleshooting the server logs, system resource utilization, and potential conflicts with other services or applications running on the computer.
- Eventually, a workaround was implemented to monitor and automatically restart the MySQL service upon failure, ensuring uninterrupted database access during development.
- This challenge underscored the importance of robust monitoring and fault-tolerant mechanisms to maintain system reliability and availability, especially in development environments.

5. Future Implementations

As the Airline Reservation System continues to evolve and adapt to meet the evolving needs of passengers and administrators, several strategic initiatives can further enhance the system's functionality, engagement, and competitiveness.

1. Payment Gateway Integration:

- Integration of additional payment gateways such as PayPal, Visa, and Mastercard into the user wallet functionality.
- These payment gateways will offer users greater flexibility and convenience in managing their finances and making secure transactions for flight bookings.

2. Enhanced Personalization Features:

- Implementation of a point system to incentivize and reward user loyalty based on their booking activities and engagement with the platform.
- Introducing a rewards program where passengers accrue points for every booking made, which can be redeemed for discounts, upgrades, or exclusive benefits.
- Selecting the most loyal passenger of the year based on accumulated points and awarding them a complimentary air ticket at the end of the year, encouraging repeat bookings and brand loyalty.

3. Mobile Application Development:

- Development of native mobile applications for iOS and Android platforms to complement the existing web-based interface.
- Mobile apps offer users on-the-go access to flight information, booking services, and real-time notifications, enhancing convenience and accessibility.

4. Advanced Search and Filtering Options:

- Expansion of search capabilities with advanced filtering options such as flexible date ranges, multi-city itineraries, and fare comparison tools.
- Incorporation of predictive search features and intelligent autocomplete to streamline the flight search process and improve user experience.

5. Accessibility and Localization:

- Enhancement of accessibility features to ensure compliance with accessibility standards and cater to users with diverse needs and preferences.
- Implementation of localization and internationalization features to support multiple languages, currencies, and regional preferences, expanding the system's global reach.

6. Continuous Performance Optimization:

- Continuous optimization of system performance and scalability to accommodate growing user demand and maintain responsiveness under high load conditions.
- Regular performance monitoring, profiling, and tuning of backend infrastructure and frontend components to minimize latency and improve user satisfaction.

6. Conclusion

To sum up, the flight ticket management system is an essential instrument for contemporary aviation operations, changing the way airlines handle reservations, expedite workflows, and improve passenger experiences. Numerous advantages that greatly affect income production, customer satisfaction, and operational efficiency are provided by this all-inclusive solution.

First off, the system reduces human labor and mistake by centralizing and automating reservation management, seat assignment, and ticket booking operations. Improved operational efficiency because of this automation enables airlines to use resources more wisely and maximize their revenue streams.

The flight ticket management system also improves the client experience by offering a smooth booking procedure, an easy-to-use interface, and customized features like online check-in and real-time flight updates. These characteristics support higher levels of customer satisfaction and loyalty, which are vital in a cutthroat industry.

Additionally, the system's data-driven insights give airlines the ability to examine market demand, booking trends, and passenger preferences, which enhances revenue management and strategic decision-making. Airlines can optimize revenue potential and adjust to fluctuating market conditions by utilizing dynamic pricing methods and seat optimization approaches combined.

The system also makes it easier for different departments to collaborate and communicate with one other, which promotes operational efficiency and transparency. Ensuring consistency and

accuracy in information communication through centralized data management facilitates workflow operations and enhances decision-making.

In addition, the flight ticket management system guarantees adherence to industry norms and guidelines, protecting the privacy and security of traveler data. While preserving operational integrity, this adherence to regulations increases passenger trust and confidence.

All things considered, the installation of a flight ticket management system gives airlines a competitive edge by allowing them to stand out in the competitive aviation market, provide outstanding customer care, and spur corporate expansion. The flight ticket management system will continue to be a vital component of contemporary airline operations, spurring innovation and superiority in service provision, as technology advances.

7. References

IEEE, n.d. IEEE (Institute of Electrical and Electronics Engineers) guide to software requirements specifications. [Online] Available at: https://www.computer.org/resources/software-requirements-specifications

Marichamy, L., n.d. Slide Share-SRS. [Online] Available at: https://www.slideshare.net/lavanyamarichamy/software-requirements-specification-108099965

target, T., n.d. Software requirement specification from internet.. [Online] Available at: https://www.techtarget.com/searchsoftwarequality/definition/software-requirements-specification

Unknown, n.d. Software Requirement Specifications. [Online] Available at: https://en.wikipedia.org/wiki/Software_requirements_specification