PUSL3190 Computing Individual Project

Project Interim Report

<Flight Ease Integrated Passenger & Cargo Booking System>

Supervisor: <Ms. Hirushi Dilpriya>

Name: <Yonhewa Y Silva >

Plymouth Index Number: <10898669 >

Degree Program: <BSc (Hons) Software Engineering >

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Introduction

In today's fast-paced and highly competitive aviation industry, airlines must constantly find new ways to improve efficiency and maximize revenue while maintaining a high level of customer satisfaction. One of the biggest challenges faced by Sri Lankan Airlines is the inefficient management of passenger seat allocation and cargo space utilization. These two crucial aspects of airline operations are often handled separately, leading to lost revenue opportunities and operational inefficiencies. To address these issues, FlightEase has been developed as a comprehensive, web-based solution designed specifically for Sri Lankan Airlines. This system seamlessly integrates passenger and cargo booking processes, ensuring better coordination, increased transparency, and optimized resource utilization.

FlightEase offers an improved passenger seat booking system that allows travelers to select their seats in real time while incorporating a dynamic pricing model. In traditional airline booking systems, all seats within the same class are typically priced equally, even though passengers tend to prefer window and aisle seats over middle seats. This imbalance leads to situations where highly desirable seats are booked quickly, while middle seats remain unoccupied until the last moment, reducing the airline's ability to maximize revenue. FlightEase solves this problem by introducing a smart pricing strategy high-demand seats are priced slightly higher, while middle seats are offered at a lower rate or bundled with additional perks, such as extra baggage allowance or increased legroom. This approach not only makes seat allocation more balanced and efficient, but also provides passengers with greater flexibility and choice, leading to a smoother and more transparent booking experience.

In addition to enhancing passenger bookings, FlightEase significantly improves cargo space management. Traditionally, airlines struggle to fully utilize their available cargo capacity, especially on flights with lower passenger occupancy. Since cargo and passenger booking systems often operate independently, there is a lack of real-time coordination, preventing airlines from dynamically adjusting cargo space allocation based on passenger load. This often results in flights departing with unused cargo space, representing a missed opportunity for additional revenue. FlightEase addresses this issue by offering a real-time cargo booking system, allowing freight companies and other clients to view live cargo space availability and make instant bookings based on current capacity.

A key feature of the FlightEase cargo management system is the digital handling of Acceptance Declaration Forms (ADF). The ADF is a critical document in cargo operations, required for cargo acceptance and compliance. However, the manual submission process currently used often leads to delays, miscommunication, and increased administrative work for both airline staff and freight clients. With FlightEase, the ADF process is automated and digitized, making it easier for clients to submit the required documents online. This reduces paperwork, speeds up cargo processing, and enhances transparency in the freight booking workflow. Additionally, the system includes a real-time cargo tracking feature, allowing clients to monitor their shipments throughout the journey, ensuring greater reliability and customer satisfaction.

One of the most powerful aspects of FlightEase is its integrated approach to managing both passenger and cargo operations. Unlike conventional airline systems, where these two processes function separately, FlightEase provides a unified platform that allows Sri Lankan Airlines to dynamically adjust resource allocation based on real-time demand. For instance, during peak travel seasons when passenger numbers are high, the system prioritizes seat bookings to accommodate more travelers. Conversely, during off-peak periods when passenger demand is lower, the system automatically reallocates available space for cargo, ensuring that every flight is optimized for maximum profitability. This level of flexibility and

intelligent resource management was not possible with previous systems, making FlightEase a game-changing solution for Sri Lankan Airlines.

By implementing FlightEase, Sri Lankan Airlines will benefit from a more efficient, transparent, and revenue-driven booking system. The platform is designed to enhance customer satisfaction by providing passengers with better booking options and more pricing flexibility, while simultaneously improving cargo operations through real-time tracking and streamlined document handling. Ultimately, FlightEase enables the airline to fully capitalize on its available resources, reducing inefficiencies and boosting overall profitability. With this innovative system in place, Sri Lankan Airlines can stay ahead in an industry that demands constant adaptation and optimization, ensuring long-term success and a superior experience for both passengers and cargo clients.

Problem Statement

Sri Lankan Airlines is currently facing several challenges in optimizing both its passenger seat booking process and cargo management operations. One of the key issues in the passenger segment is the imbalance in seat occupancy due to customer preferences for specific seats, such as window and aisle seats, while middle seats remain largely unpopular. This creates inefficiencies in revenue generation, as high-demand seats get booked quickly, while less desirable seats remain vacant for extended periods. Since all seats within the same class are typically offered at a fixed price, this leads to a situation where the airline cannot fully capitalize on its seating capacity, especially during peak travel times. The lack of a dynamic pricing model further contributes to this problem, as passengers have no incentive to book middle seats earlier. As a result, flight occupancy becomes uneven, leading to missed revenue opportunities and an overall less efficient use of available resources.

In addition to seat allocation inefficiencies, Sri Lankan Airlines also encounters significant issues in cargo management. A major problem is the underutilization of available cargo space, especially on flights that have lower-than-expected passenger bookings. Due to the absence of an integrated system that manages both passenger and cargo operations simultaneously, the airline struggles to dynamically adjust cargo capacity based on real-time demand. This lack of coordination between the two booking processes often leads to missed opportunities, where flights depart with unused cargo space that could have otherwise generated additional revenue.

Another critical challenge in cargo operations is the manual and inefficient handling of Acceptance Declaration Forms (ADF), which are essential documents required for cargo acceptance and compliance. Freight companies and clients often face difficulties in submitting ADFs efficiently, leading to delays in cargo processing and overall dissatisfaction with the booking experience. Without a structured, digitized system for ADF handling, both airline staff and clients experience unnecessary administrative burdens, slowing down cargo operations and reducing transparency in the process.

To address these pressing issues, this project proposes two key solutions:

1. An Enhanced Passenger Seat Booking System – A system designed to improve seat allocation efficiency by addressing passenger seat preferences and implementing a dynamic pricing model.

This will help balance seat occupancy, optimize revenue per flight, and ensure better resource utilization.

2. A Cargo Management System with Digital ADF Handling – A platform that allows freight clients to submit Acceptance Declaration Forms (ADF) electronically, enabling smoother cargo processing and improved coordination between the airline and cargo operators. This will enhance transparency, reduce delays, and create a more streamlined cargo booking experience.

By implementing these solutions, Sri Lankan Airlines can significantly improve its operational efficiency, increase revenue generation from both passenger and cargo operations, and enhance overall customer satisfaction for both travelers and freight clients.

Project Objectives

The FlightEase system is designed with two primary features that serve as the core foundation of the project. These two key components focus on improving passenger seat allocation and cargo space management, ensuring a streamlined and efficient booking experience for both travelers and freight clients.

1. Passenger Seat Booking System with Real-Time Selection and Pricing

- Introduce a real-time seat selection feature, allowing passengers to view and choose available seats instantly.
- Implement a basic demo pricing model that differentiates high-demand seats (window and aisle) from middle seats, encouraging a more balanced distribution of seat occupancy.
- Provide passengers with a transparent and user-friendly booking experience, reducing last-minute seat allocation issues.

2. Cargo Management System with Digital Acceptance Declaration Form (ADF)

- Develop a cargo booking system that enables clients (freight companies or individuals) to reserve cargo space with better efficiency.
- Integrate a digital Acceptance Declaration Form (ADF), simplifying the submission and verification process for cargo shipments, reducing paperwork, and improving communication between freight clients and airline staff.
- Ensure better cargo space utilization by providing real-time visibility into available capacity, minimizing waste, and increasing operational efficiency.

These two core features serve as the anchors of FlightEase, forming the foundation of the project's development and ensuring Sri Lankan Airlines can optimize both passenger and cargo operations in a simplified and effective manner.

System Analysis

Facts Gathering Techniques

To develop FlightEase as an effective solution for passenger seat allocation and cargo space management, various fact-gathering techniques were employed. These methods provided valuable insights into existing challenges and helped shape the system's features.

1. Interviews with Industry Experts

- Conducted structured interviews with airline professionals, including a Cargo Duty Manager at Sri Lankan Airlines, to gain firsthand knowledge of operational challenges.
- Gathered insights on cargo space underutilization, passenger booking inefficiencies, and challenges in processing Acceptance Declaration Forms (ADF).

2. Observational Research

- Analyzed existing Sri Lankan Airlines booking processes to identify gaps in real-time seat selection and cargo space allocation.
- Observed passenger booking behavior to understand why certain seats, such as middle seats, remain unbooked longer than others.

3. Review of Existing Systems and Literature

- Compared current airline booking platforms to identify missing functionalities and areas for improvement in FlightEase.
- Researched dynamic pricing models, airline revenue management strategies, and cargo logistics best practices to refine the system's approach.

4. Data Analysis from Historical Records

- Examined past flight booking and cargo data to detect patterns in passenger seat preferences and cargo load fluctuations.
- Assessed how often cargo space is left unused, leading to missed revenue opportunities.

By utilizing these fact-gathering techniques, FlightEase was designed to address the real-world inefficiencies faced by Sri Lankan Airlines, ensuring better seat and cargo utilization, improved customer experience, and optimized revenue generation.

Existing System

1. Existing Airline Booking Systems in Sri Lanka

1.1. SriLankan Airlines

SriLankan Airlines, the national carrier of Sri Lanka, operates a passenger and cargo booking system through its official website. The system allows passengers to:

- Search for flights based on departure and destination.
- Select seats (but without dynamic pricing for preferred seats).
- Manage bookings (modify or cancel reservations).
- Check-in online for convenience.

For cargo operations, SriLankan Airlines provides:

- Online cargo booking, where freight operators can request space.
- Cargo tracking system, allowing users to monitor shipments in real-time.
- Manual submission of Acceptance Declaration Forms (ADF), causing delays in cargo processing.

Strengths: Simple interface, flight booking and check-in available online.
Weaknesses: No dynamic seat pricing, lack of integration between passenger and cargo bookings, and manual cargo documentation.

1.2. FitsAir

FitsAir, Sri Lanka's first privately owned international airline, provides an online ticket booking system but with limited features. The system allows:

- Basic seat selection during booking.
- Baggage pre-purchase options.
- Flight status tracking.

Cargo operations are handled through direct inquiries, and there is no automated cargo booking system available online.

Strengths: Affordable ticketing, simple user experience.
Weaknesses: No cargo booking system, lacks real-time seat selection updates, does not offer dynamic pricing.

2. International Airlines with Similar Booking Systems

2.1. Qatar Airways

Qatar Airways offers a fully integrated booking system for both passengers and cargo, making it one of the most advanced airline platforms.

✓ Passenger Booking Features:

- Dynamic Pricing: Seat prices adjust based on demand (e.g., window and aisle seats cost more than middle seats).
- Interactive Seat Selection: Users can view a real-time seating map to choose available seats.
- Flight Upgrades & Add-ons: Passengers can upgrade to business class, add extra baggage, or select meal preferences.

✓ Cargo Management System:

- Online Cargo Booking: Freight companies can book cargo space through a dedicated portal.
- Automated ADF Processing: Cargo documentation, including Acceptance Declaration Forms, is handled digitally.
- Cargo Tracking System: Real-time tracking is available, providing transparency for freight operators.

Strengths: Fully automated and real-time seat and cargo booking.
Weaknesses: High cost of premium seat selections.

2.2. Emirates Airlines

Emirates offers one of the most sophisticated airline management systems with a strong focus on real-time updates and passenger convenience.

✓ Passenger Booking Features:

- Dynamic Pricing: Preferred seats have variable pricing.
- Loyalty Program Integration: Users can redeem points for upgrades and seat selection.
- AI-Powered Recommendations: The system suggests flights, seats, and add-ons based on user history.

✓ Cargo Management System:

- Dedicated Cargo Booking Portal : Emirates SkyCargo allows businesses to book cargo online.
- Live Cargo Availability Check: Freight operators can view available space before booking.
- Automated Documentation: All required cargo forms, including ADF, are handled digitally.

Strengths: Highly automated and customer-friendly.
Weaknesses: Premium features are expensive, and last-minute bookings can be costly.

2.3. Singapore Airlines

Singapore Airlines has one of the most seamless booking platforms with advanced passenger and cargo management systems.

✓ Passenger Booking Features:

- AI-based seat selection recommendations based on passenger preferences.
- Dynamic pricing and flexible fare options.
- In-flight service customization during booking.

✓ Cargo Management System:

- Real-time cargo booking and tracking.
- Instant cargo space adjustments based on passenger flight capacity.
- ADF submission and processing through an automated portal.

Strengths: Seamless user experience, integrated real-time systems.
Weaknesses: Premium services are expensive.

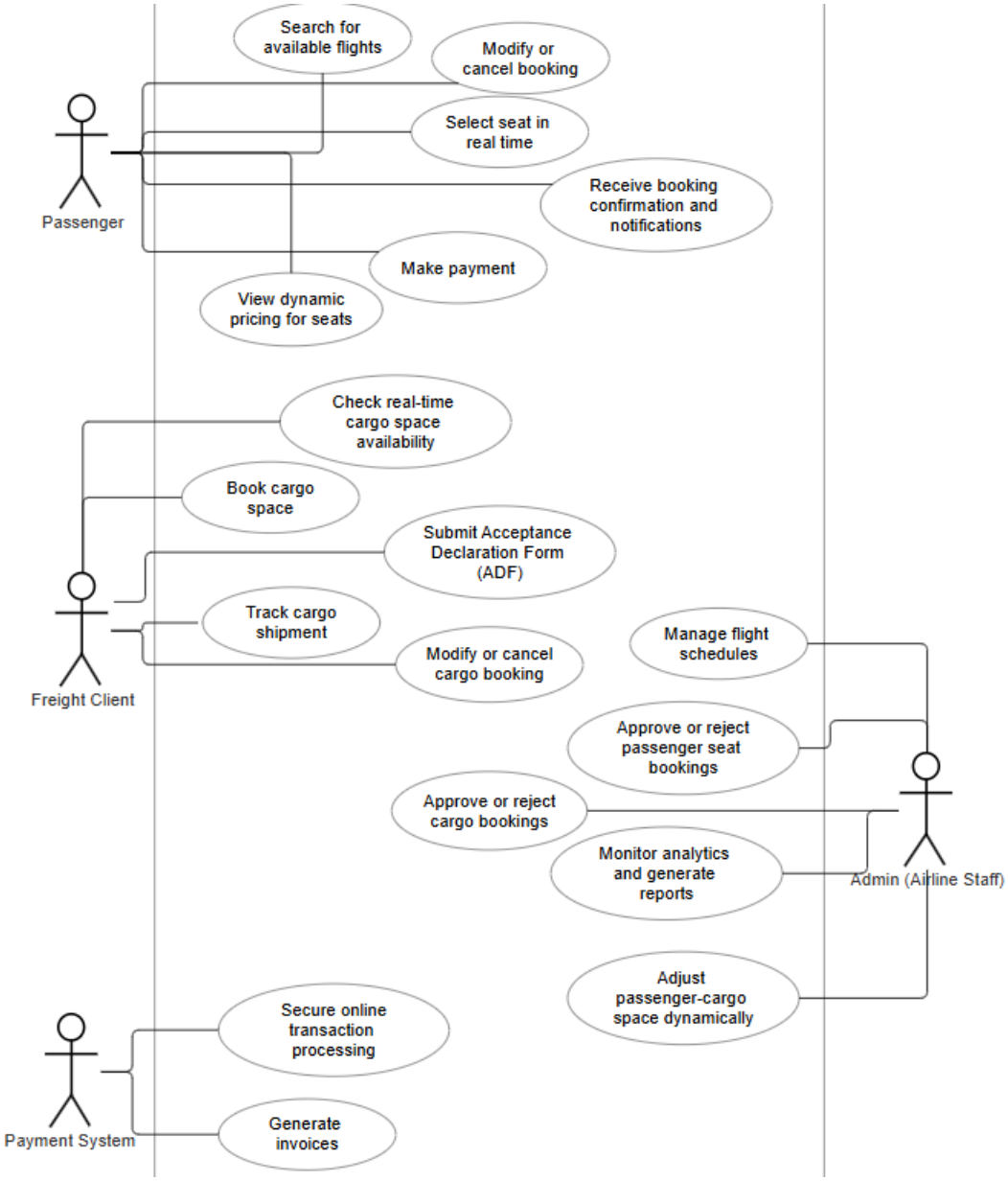
4. Key Takeaways for FlightEase Development

- Need for Integration: Unlike most Sri Lankan airline systems, FlightEase will combine passenger and cargo bookings into a single platform.
- Automated Cargo Documentation: Inspired by Qatar Airways and Emirates, FlightEase will support digital ADF processing for efficiency.
- Dynamic Pricing Model: FlightEase will introduce basic dynamic pricing to balance seat demand and optimize revenue.
- Real-Time Updates: FlightEase will offer real-time seat selection and cargo space visibility to improve user experience.

Conclusion

While Sri Lankan Airlines and FitsAir provide basic booking systems, they lack real-time seat adjustments, dynamic pricing, and automated cargo handling. International airlines like Qatar Airways, Emirates, and Singapore Airlines have highly advanced integrated systems, but they come with high costs. FlightEase aims to bridge this gap by offering a cost-effective, integrated solution tailored specifically for Sri Lankan Airlines, bringing automation, efficiency, and transparency to both passenger and cargo management.

Use case diagram



Drawbacks of the Existing System

The current passenger booking and cargo management systems used by Sri Lankan Airlines and similar airlines have several inefficiencies that limit revenue generation and operational effectiveness. These shortcomings impact both passenger satisfaction and cargo space utilization, leading to underutilized resources and lost revenue opportunities. Below are the key drawbacks of the existing system:

1. Lack of Integration Between Passenger and Cargo Booking Systems

One of the biggest challenges in the current system is that passenger seat reservations and cargo bookings are managed separately. These systems operate in isolation, preventing the airline from dynamically adjusting seat availability or cargo space based on real-time demand.

Example: If a flight has low passenger occupancy, available space could be allocated for additional cargo. However, since the two systems are not connected, this adjustment rarely happens, leading to wasted cargo capacity.

2. No Real-Time Seat and Cargo Availability Updates

The existing system does not provide real-time visibility into available seats and cargo space. This creates delays in booking and prevents passengers and freight companies from making quick and informed decisions.

For Passengers:

- Limited ability to see up-to-the-minute seat availability.
- No clear visibility into which seats are likely to be booked faster.

For Cargo Clients:

- No live updates on remaining cargo space, leading to missed booking opportunities.
- Freight companies must rely on direct communication with airline staff, slowing down the booking process.

3. No Dynamic Pricing Model for Passenger Seats

In the existing system, all seats within the same class (Economy, Business, etc.) are priced equally, regardless of passenger preferences. This results in:

Seat Imbalance:

- High-demand seats (window & aisle) are booked quickly.
- Middle seats remain unoccupied until the last minute.
- This uneven distribution negatively impacts seat utilization and profitability.

Missed Revenue Opportunities:

- Airlines fail to capitalize on passenger preferences because prices remain fixed.
- A dynamic pricing model (where high-demand seats cost more and middle seats cost less) could encourage earlier and balanced seat bookings.

4. Inefficient Cargo Documentation Process (Manual ADF Submission)

Cargo clients must manually fill out the Acceptance Declaration Form (ADF), which increases processing time and administrative workload. Since the ADF process is not digitized, it leads to:

Delays in Cargo Acceptance:

- Clients must physically submit documents, causing unnecessary wait times.

- Airline staff must manually verify and approve documents, slowing down operations.

Higher Risk of Errors:

- Manual data entry increases the chance of mistakes and discrepancies.
- Errors can lead to shipment rejections or delayed cargo processing, affecting customer satisfaction.

5. Poor Seat Utilization and Last-Minute Adjustments

Without a smart allocation system, the existing setup fails to optimize available seats efficiently.

Key Issues:

- Middle seats remain unbooked until the last minute.
- The system does not offer discounts or incentives to encourage passengers to book them earlier.
- Last-minute adjustments are difficult, meaning airlines cannot effectively redistribute seat and cargo capacity in response to demand.

6. Limited Transparency in Cargo Space Booking

Freight companies struggle to access real-time information about cargo availability, which affects their ability to plan shipments efficiently.

Current Issues:

- Cargo space availability is not updated instantly.
- Freight operators must contact airline staff manually to confirm bookings.
- This leads to overbooked or underutilized cargo capacity, reducing operational efficiency.

7. No Automated Resource Allocation Based on Demand

Since passenger and cargo systems are not integrated, the airline cannot adjust its resource allocation dynamically.

Missed Opportunities:

- Peak travel seasons: The system cannot prioritize passenger seating over cargo when demand is high.
- Off-peak seasons: Flights often depart with empty seats and unused cargo space, leading to lost revenue.
- No AI-driven system to optimize space allocation based on real-time conditions.

Conclusion

The current system used by Sri Lankan Airlines and similar carriers is outdated and inefficient, leading to:

- Underutilized passenger seat capacity.
- Missed cargo revenue opportunities.
- Delays and errors in manual documentation processing (ADF).
- Lack of real-time integration, reducing overall operational flexibility.

By implementing an integrated solution like FlightEase, the airline can enhance efficiency, maximize revenue, and improve customer satisfaction for both passengers and freight clients.

Requirements Specification

This chapter details the essential functional, non-functional, hardware, and software requirements necessary for the development and successful implementation of FlightEase. These requirements ensure that the system effectively enhances passenger seat booking and cargo space management, leading to greater operational efficiency and improved revenue generation.

Functional Requirements

The functional requirements outline the specific features and capabilities that FlightEase must provide to support passenger reservations and cargo bookings efficiently.

1. Passenger Seat Booking System

- Real-time seat selection, allowing passengers to view and choose available seats instantly.
- A booking and payment system that enables users to confirm reservations and complete transactions securely.
- The ability for passengers to modify or cancel their bookings under airline policies.
- Automated notifications that send booking confirmations, flight reminders, and status updates via email or SMS.

2. Cargo Management System

- A real-time cargo availability tracking system to provide freight companies with up-to-date space availability.
- A digital submission process for Acceptance Declaration Forms (ADF) to streamline documentation and reduce administrative burdens.
- A cargo booking system that allows clients to reserve, modify, or cancel bookings based on availability.
- A cargo tracking system that provides real-time shipment status updates.
- An invoicing and payment system for secure transaction processing.

3. Admin & System Management

- A flight schedule management feature that enables admins to add, modify, or cancel flights.
- The ability to approve or reject passenger and cargo bookings, ensuring efficient capacity utilization.
- A system that dynamically balances seat availability and cargo space based on demand fluctuations.
- Reporting and analytics tools to generate data-driven insights on seat utilization, cargo efficiency, and revenue performance.

Non-Functional Requirements

The non-functional requirements define the overall quality, security, and performance standards for the system, ensuring a smooth and reliable experience for all users.

1. Performance & Scalability

- The system should provide real-time updates for seat and cargo availability to prevent overbooking.
- All operations, including booking and payment transactions, should be processed within three seconds for optimal user experience.
- The infrastructure must be scalable to accommodate increased user traffic during peak booking periods.

2. Security & Data Protection

- A secure payment gateway should be implemented to ensure encrypted and safe financial transactions.
- Role-based authentication should be enforced to restrict system access for passengers, freight clients, and admins.
- User data should be encrypted to prevent cyber threats and unauthorized access.
- Automated daily backups should be maintained to protect against data loss.

3. Usability & User Experience

- The system should have an intuitive and user-friendly interface that simplifies the booking process for passengers and freight clients.
- A responsive design should be implemented to ensure compatibility with desktop and mobile devices.
- Multilingual support should be available to accommodate international travelers and cargo clients.
- The system should adhere to accessibility standards to support users with disabilities.

4. System Availability & Reliability

- The system should maintain 99.9% uptime, ensuring round-the-clock availability.
- A robust error-handling mechanism should be in place to log issues and alert system administrators when troubleshooting is needed.
- Cloud-based backup solutions should be used to prevent data loss and support disaster recovery operations.

Hardware / Software Requirements

Software requirements define the technical infrastructure needed for the system's development, deployment, and maintenance.

Category	Technology Used
Front-End	HTML, CSS, JavaScript (React.js)
Back-End	Node.js
Database	Mongo DB

Conclusion

The requirements specification outlined in this chapter ensures that FlightEase is designed to provide a seamless booking experience for passengers and freight clients while maintaining high standards of performance, security, and efficiency. The system leverages modern technologies and cloud-based infrastructure to enhance airline operations and maximize revenue generation.

Feasibility Study

A feasibility study is essential to assess whether FlightEase can be successfully developed and implemented within Sri Lankan Airlines. This chapter evaluates the operational, technical, and financial feasibility of the project to ensure that the proposed solution is both practical and sustainable.

Operational Feasibility

Operational feasibility determines whether the FlightEase system can effectively integrate with existing airline operations and improve overall efficiency. This assessment examines the system's impact on passenger bookings, cargo management, and airline staff workflows.

Passenger & Cargo Booking Efficiency

The current system lacks real-time updates and integration between passenger and cargo bookings, leading to underutilized resources and missed revenue opportunities. Implementing FlightEase will

introduce real-time seat selection, automated ADF processing, and improved cargo space management, creating a more seamless and efficient booking process.

Improved Customer Satisfaction

By incorporating real-time seat selection, automated notifications, and a structured pricing model, the system enhances the passenger booking experience. Freight companies will benefit from an optimized cargo booking process, allowing them to reserve space efficiently without unnecessary delays.

Reduced Workload for Airline Staff

Currently, airline staff manually process seat allocations, cargo bookings, and ADF documentation, which is time-consuming and prone to errors. FlightEase automates these processes, significantly reducing manual effort, improving workflow efficiency, and minimizing human error.

Competitive Advantage

Many international airlines, including Qatar Airways and Emirates, already utilize automated booking and cargo management systems. Implementing FlightEase will help Sri Lankan Airlines modernize its operations, allowing it to remain competitive and improve overall profitability.

Conclusion

The FlightEase system is operationally feasible as it significantly enhances the airline's booking system, reduces administrative workload, improves customer experience, and maximizes revenue generation.

Technical Feasibility

Technical feasibility examines whether the required technology, infrastructure, and expertise are available to successfully develop and implement FlightEase.

Availability of Technology

With advancements in web development, cloud computing, and real-time data processing, the system can be developed using:

- Front-End: JavaScript frameworks such as React.js .
- Back-End: Node.js (Express for efficient server-side operations.
- Database: Mongo DB for managing passenger and cargo booking data.

Outline Budget

The development of FlightEase does not require any significant financial investment, as all necessary resources have been sourced online at no cost. The project utilizes open-source technologies, free cloud-based tools, and publicly available development frameworks, eliminating the need for additional funding.

Software Development Costs

Since the system is built using open-source programming languages and frameworks, there are no expenses related to software licensing or proprietary tools. Development tools such as React.js, Node.js, and PostgreSQL are freely available, making it possible to create the platform without incurring costs.

Infrastructure & Hosting Costs

The project does not require dedicated cloud hosting or paid database services, as free-tier cloud environments and local hosting solutions are being utilized for testing and deployment. Additionally, version control and collaboration tools like GitHub are available for free, reducing infrastructure-related expenses.

Operational & Maintenance Costs

Since the system is being developed as part of an academic project, there are no operational or maintenance costs associated with ongoing support, software updates, or employee training. The system's functionality is demonstrated through a prototype, eliminating the need for a dedicated team to manage post-deployment activities.

Miscellaneous Costs

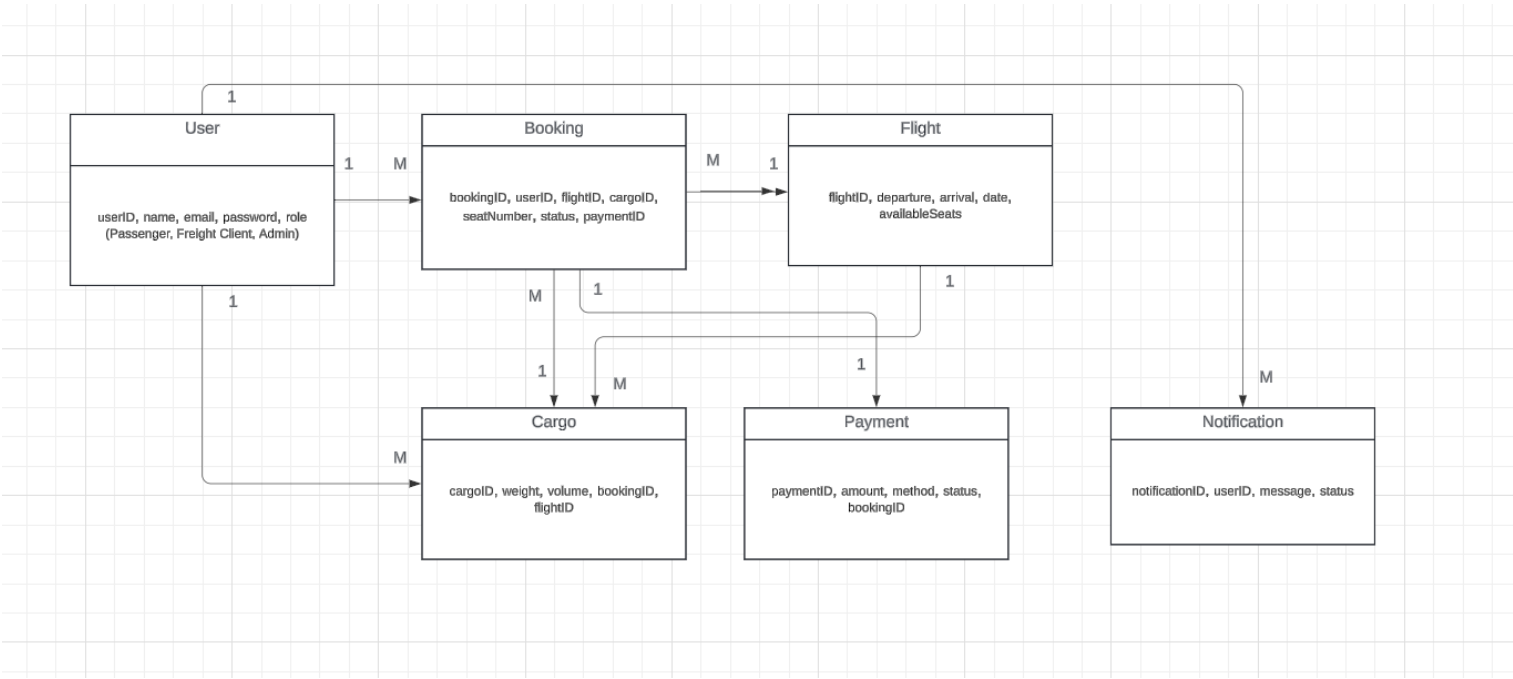
There are no additional expenses for marketing, domain registration, or licensing, as the project is not being deployed in a commercial environment. The entire development process relies on freely available educational materials, documentation, and online resources, further reducing the need for external funding.

Conclusion

The FlightEase system is financially feasible, as all required components are being sourced at no cost. The project is developed using free online tools, open-source technologies, and cloud-based solutions, ensuring a cost-effective yet fully functional prototype without any financial burden.

System Architecture

Class Diagram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Flight
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Cargo
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Notification
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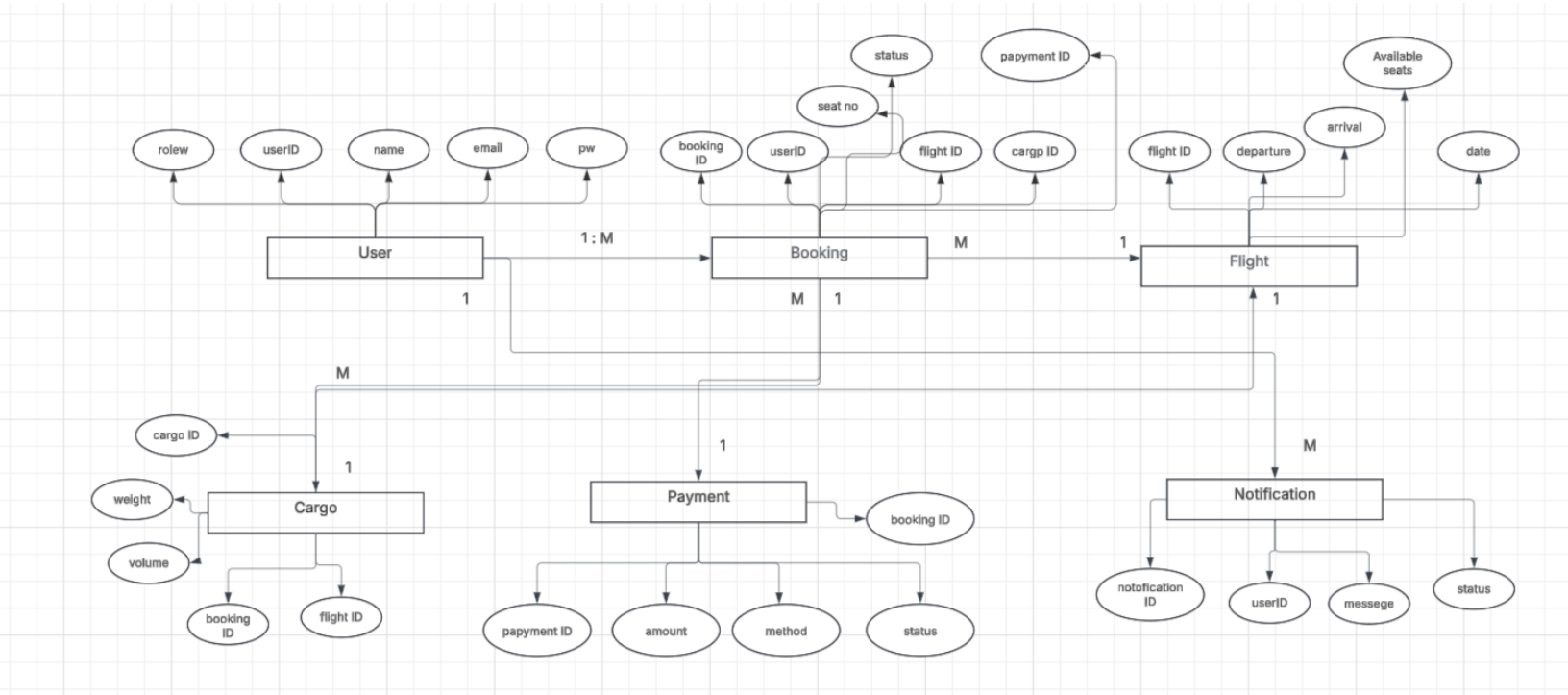
ER Diagram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status
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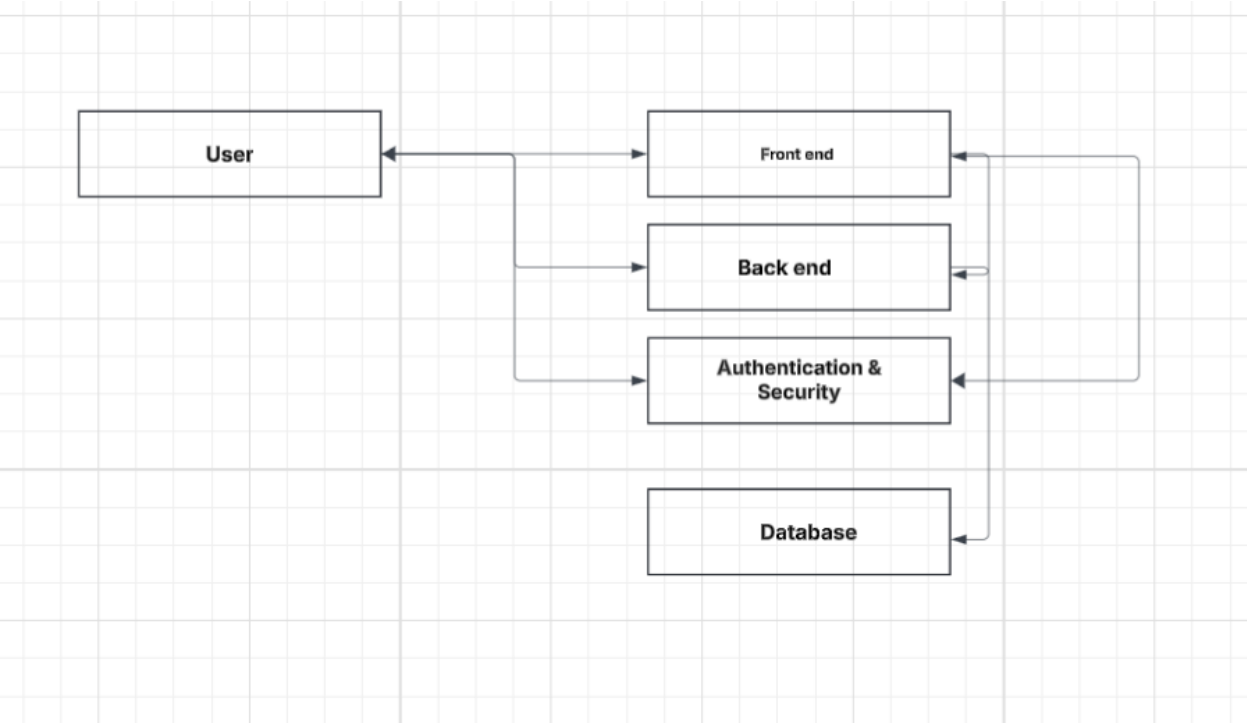
High-level Architectural Diagram



Development Tools and Technologies

The success of FlightEase depends on utilizing the right development methodologies, programming languages, tools, third-party components, and algorithms to ensure smooth operation, scalability, and efficiency. This chapter provides an overview of the technologies and techniques used to develop the system.

Development Methodology

To ensure an organized and efficient development process, FlightEase follows the Agile methodology, which allows for flexibility, continuous improvements, and adaptability throughout the project lifecycle.

Why Agile?

- The project is developed in iterative cycles, enabling regular testing and refinements.
- Feedback can be incorporated at different stages, ensuring the system aligns with user requirements.
- Issues can be identified and resolved early in development, reducing unexpected delays.

- Agile allows for incremental feature releases, ensuring that each functionality is fully tested before proceeding to the next phase.

By following Agile, the development process remains dynamic, structured, and highly efficient, ensuring the final product meets all expectations.

Programming Languages and Tools

Front-End Development

For a responsive and user-friendly interface, the following technologies are used:

- HTML5 & CSS3: For structuring and designing web pages.
- JavaScript (React.js): A modern front-end framework that provides a fast and interactive user experience.

Back-End Development

The back-end is responsible for managing the system's logic, user authentication, and data processing. The technologies used include:

- Node.js with Express.js: A high-performance and scalable framework for handling server-side requests.

Database Management

The system requires a flexible and scalable database solution to manage passenger bookings, cargo reservations, and other operational data. The chosen database technology is:

- MongoDB: A NoSQL database that allows for fast and efficient data retrieval, making it ideal for handling dynamic airline data.

Third-Party Components and Libraries

To enhance functionality and streamline development, several third-party libraries are integrated into FlightEase:

Front-End Libraries

- Bootstrap & Tailwind CSS: Ensure a responsive and visually appealing UI.
- React Router: Manages smooth navigation between different system pages.

Back-End Libraries

- Express.js: A fast and lightweight framework for managing API requests.
- Mongoose: Simplifies MongoDB operations and enhances data structuring.

Database & Security Libraries

- JWT (JSON Web Tokens): Ensures secure user authentication.
- Bcrypt.js: Encrypts passwords for enhanced security.

By incorporating these third-party tools, FlightEase ensures optimized performance, enhanced security, and improved user experience.

Algorithms

Real-Time Seat Allocation Algorithm

- Ensures instant seat availability updates to prevent overbooking.
- Allocates available seats dynamically based on booking trends.

Conclusion

The use of Agile methodology, modern programming languages, cloud-based technologies, and efficient algorithms ensures that FlightEase is developed as a high-performance, scalable, and user-friendly airline booking system. These technologies work together to create a seamless experience for passengers, freight clients, and airline staff, making airline operations more efficient and profitable.

Overview of the Interim Report

This interim report provides a detailed insight into the development of FlightEase, an advanced web-based system designed to streamline passenger seat allocation and cargo space management for SriLankan Airlines. The report outlines the challenges faced by airlines in optimizing seat bookings and cargo utilization and presents FlightEase as an innovative solution to address these inefficiencies. Through a combination of real-time data processing and dynamic pricing models, the system ensures better resource management while enhancing the overall customer experience.

The report covers various aspects of the project, including the existing systems in the aviation industry, their limitations, and how FlightEase offers an improved alternative. It also details the methodologies used for fact-gathering, system requirements, feasibility analysis, and the technologies implemented in the development process. Additionally, system architecture diagrams such as the Use Case Diagram, ER Diagram, and High-Level Architectural Diagram illustrate how different system components interact to achieve the intended functionality.

Summary of the Report

In summary, this report serves as a comprehensive document outlining the core functionalities and objectives of FlightEase. It begins by introducing the system, emphasizing the need for a unified passenger and cargo booking solution, and providing an in-depth review of existing platforms. The document then progresses into technical specifications, discussing functional and non-functional requirements, hardware and software needs, and the architectural framework supporting the system.

Moreover, the feasibility study highlights the operational and technical viability of the project, ensuring that it is both practical and sustainable. The development tools and technologies section provides insights into the programming languages, frameworks, and databases utilized in building the system. The final section of this report offers a structured discussion on the project's progress, the methodologies employed, and the anticipated impact of FlightEase on airline operations.

This interim report lays the foundation for the final phase of development, focusing on refining system functionalities, testing, and implementation. Moving forward, the project will emphasize system optimization, security enhancements, and user experience improvements to ensure a seamless and efficient booking process for both passengers and freight companies.

Challenges Faced

During the development of FlightEase, several challenges emerged that required adjustments and problem-solving to ensure the system's success. While there were numerous obstacles, a few significant ones are highlighted below:

- Code Integration Issues – One of the primary challenges encountered was that the coded modules were not properly connecting to the emulator, which led to difficulties in testing and debugging certain features. This required extensive troubleshooting and modifications to establish a seamless connection.
- Backend Architecture Adjustments – Initially, the chosen backend framework did not align perfectly with the project’s needs. After realizing this, a decision was made to revise the backend structure and implement a more suitable technology stack that better supports system requirements and scalability.
- Database Optimization – Managing real-time seat availability and cargo space allocation required an efficient database structure. However, the initial database design faced performance issues with handling dynamic updates. This led to modifications in database indexing and query optimizations to improve efficiency.

Future Plans / Upcoming Work

There are several ongoing developments within the FlightEase project. However, some aspects are still uncertain regarding their completion within the current timeline. Due to these uncertainties, I plan to provide a detailed update on these pending features and enhancements in the final report.

The focus will be on refining system functionalities, addressing any remaining technical challenges, and optimizing performance to ensure seamless user experience. Any additional improvements or modifications made during the final stages of development will be thoroughly documented and presented in the final project report.

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