A
Project Report
on

SKYRA : Integrated air travel management and navigation system

Submitted to

Sant Gadge Baba Amravati University, Amravati

Submitted in partial fulfilment of
the requirements for the Degree of
Bachelor of Engineering in
Computer Science and Engineering

Submitted by

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SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING,
SHEGAON – 444 203 (M.S.)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that **Ms. Shamli Sharad Titirmare, Ms. Sejal Atul Patil, Ms. Radhika Manish Kapoor, Ms. Vaishnavi Dhiraj Wailkar** students of final year Bachelor of Engineering in the academic year 2024-25 of Computer Science and Engineering Department of this institute have completed the project work entitled **"SKYRA: Integrated air travel management and navigation system"** and submitted a satisfactory work in this report. Hence recommended for the partial fulfilment of degree of Bachelor of Engineering in Computer Science and Engineering.

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Abstract

The swift growth in global air travel has yielded an increased need for integrated, intelligent systems to facilitate easy travel management and ensure maximum consumer satisfaction. The new project presents an Integrated Air Travel Management and Navigation System to combine the best of travel services onto a convenient, easily accessible platform. Customers are able to search for flights both from and to their home city, receive intelligent suggestions for the best flights, and book safely by redirecting to the home airline websites. The system's best feature may be an AI chatbot serving customers by giving flight suggestions, responding to questions related to traveling, and delivering live navigation guidance in airport environments. To further broaden the traveling experience, the system offers other utilities such as a currency converter making it convenient for the traveler to manage foreign traveling finances. The system sends alerts of flight status, boarding time, and delay in time to keep the traveler updated and alert. With the application of AI technology and smart integration of all services, the system offers more efficient, safe, and comfortable air travel management. The project ultimately concludes with the development of a smart and inclusive traveling assistant system tailored to this generation's travelers.

Keywords: *Air Travel, Flight Reservation, AI Chatbot, Navigation Aid,Currency Converter, Notification System*

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CHAPTER 1

INTRODUCTION

INTRODUCTION

1.1 PREFACE

The aviation air travel industry has emerged quite rapidly through the development of digital technologies and reshaped passenger-airline-airport-travel agency interactions. Enhanced expectations toward simplicity, time-and-place-immediate information availability, and customerization have put added demands for harmonized intelligent platforms to create more convenience into the process of traveling. To address these needs, this project introduces the Integrated Air Travel Management and Navigation System—a holistic solution that targets enhanced flight planning, booking, navigation, and communication.

Conventional air travel management systems typically function through stand-alone services, which it is difficult for passengers to travel between different platforms to book flights, see flight information, and request assistance at airports. Such fragmentation is not only infuriating to regular flyers but also creates enormous challenges for new travelers, who are confused and intimidated by airport travel, flight choices, and money management. The need for one, simple to use, proactive travel management system has never been greater.

Our solution meets these requirements with AI flight suggestions, safe redirects to official airline websites for booking, and live airport navigation assistance. A constantly responsive AI-powered chatbot keeps the user involved at all times, while an automatic email alert system keeps travelers informed on all the necessary updates regarding bookings, flight updates, and navigation alerts. Integrated currency conversion is also included as an extra facility for global travelers. This research seeks to provide an open, secure, and passenger-oriented air travel platform to redefine the travel experience of today.

1.2 MOTIVATION

The contemporary flying experience, as much as it is still imbued with technology, is still intimidating to figure out for passengers, particularly first-time and occasional passengers. Breaks in access to flight data, no airport real-time navigation assistance, and delayed notice on changes in bookings or changes in flights are most likely to cause

anxiety and ineffectiveness among passengers. The necessity to handle many platforms for reservation, updates, and support is only making travel more complicated, and this increases the possibilities of flight missings, incorrect bookings, and confusion at the airports.

Passengers who travel today, in the era of high-speed flight travel, expect smooth electronic assistance which not only facilitates easier selection of flights and booking them but also offers orientation to foreign airport environments and manages basic needs like exchange. Such systems have been partially successful so far in offering an integrated, intuitive experience, though

The motivation behind this project is to fill these loopholes with development of one air travel management and alert system supported by AI chatbots, in-app book transfers to the respective airline websites, real-time navigation routes, and automated email reminders. In consolidating all these features under one umbrella, the system proposes making the entire air travel process more intuitive, streamlined, and less complicated. Finally, the project seeks to offer travelers smart devices that will be able to identify their needs and offer them a new networked experience.

1.3 PROBLEM STATEMENT

While other aspects of air travel have been improved upon through digital solutions, existing solutions lag behind in nearly all key aspects. Modern systems are stand-alone to a significant degree and make travelers go through several separate steps on various sites to search for flights, book, get direction instructions, and get travel notifications. Stand-alone technology is confusing, wasteful, and lacks real-time support, particularly for infrequent travelers who have no idea about airport operations and wayfinding.

Other than that, tourists are usually disadvantaged by delayed alerts for flight status change, failure to receive personalized care while traveling in airports, and unavailability of services such as exchange of currency, which is highly essential during foreign travel. The absence of a standardized system favours the possibilities of flight failure, incorrect booking, and additional stress during travel.

While AI and digital assistants have been used successfully in other sectors, their use in developing an intelligent and integrated air travel management system is still in its nascent stage. Existing solutions offer only end-to-end integration of booking, real-time navigation, and proactive notifications. The objective of this project is to fill these gaps by developing an inclusive, AI-based platform that improves efficiency, improves travel experience, and streamlines air travel management end to end.

1.4 OBJECTIVES

1. To implement and deploy an integrated air travel management system that leads users from flight search, in-flight re-routing during making bookings, navigating airports, and travel routes through an AI chatbot.

2. To implement an automated reminder system with straightforward and timely email reminders for confirmations, flight changes, and route instructions to notify travelers in real time.

3. To make an elastic and super-responsive UI with Next.js and TypeScript active so that opening is easy and seamless on such devices as smartphone, tablet, and desktop.

4. To implement a bright flight recommendation mechanism that will offer the best form of travel dynamically based on source, destination, price, and time so that travelers will experience a better support for decision.

5. To include functionalities such as an in-built currency convertor to make easy monetary management of cross-border travelers abroad.

6. For better security and authenticity of reservation by providing users with a feature of going around airline websites, and hence avoiding third-party impersonation risk.

1.5 Project Scope

The project will create a combined air journey management and notice system with the following key features:

The Core Platform Layer serves as the centerpiece of hassle-free flight search, booking redirection, and AI-aided routing. The system provides secure bookings by linking travelers to actual airlines' websites for reducing the possibility of third-party booking websites risks.

Frontend Interface Layer is developed with Next.js and TypeScript, providing an easy-to-use, responsive, multi-device-compatible interface, for example, smartphone, tablet, and desktop. It is developed to offer an easy user experience so that the management of air travel is comfortable for users of all types.

The Notification System Layer provides automatic real-time email notification, which sends useful information such as flight status update, successful booking, and airport navigation reminders so that travelers are informed at each stage of travel.

The AI Support Layer includes an intelligent chatbot that provides personalized flight suggestions, guides around the airport, and responds to general travel-related questions. The feature aims to ease decision-making on the part of customers, particularly first-time visitors, by designing personalized recommendations through user input.

Secondly, the website contains a Currency Converter Tool that assists foreign tourists by assisting them with money matters on a trip.

The site is designed to be platform-independent on a wide range of devices so it can provide the same experience of seamless, trouble-free interaction to users on smartphones, tablets, or computers. It offers the ease of use in desktop access and interaction with the system across multiple platforms, resulting in much greater access for every traveler.

1.6 ORGANIZATION OF PROJECT

Project Structure

The project report is organized into a smooth and effective manner to cover the Integrated Air Travel Management and Notification System study, design, and development.

Chapter 1 presents an overview of the project, declaring the problem statement, objectives, scope, and value of developing a smarter travel management platform.

Chapter 2 gives an overview of the literature that exists for air travel management systems, travel assistants based on AI, alert systems, and points out the shortcomings of available solutions to make the need for an integrated platform felt.

Chapter 3 discusses the process that has been used in system development, such as system architecture, module decomposition, user workflows, and the technologies such as Next.js, Node.js, and WebRTC which are the foundation of the platform.

Chapter 4 provides step-by-step deployments including AI chatbot integration, responsive user interface, notification setup, currency converter, and airline website integration for flight booking. Problems encountered during development and how they were resolved are discussed.

Chapter 5 provides results and discussion on testing, system performance analysis, real-time updation, usability, support for multiple devices, and accuracy of the chatbot compared to conventional travel management solutions.

Chapter 6 gives an overview to the report where it states the success of the project and some of the potential areas where it can be enhanced like utilizing multilingual chatbot feature and real-time navigation features.

It is this systematic approach which guarantees careful and systematic description of the entire development and evaluation process of the Integrated Air Travel Management and Navigation System.

CHAPTER 2

LITERATURE REVIEW

2. LITERATURE REVIEW

2.1 Introduction to Proposed System

Proposed Integrated Air Travel Management and Navigation System would revolutionize air travel support through an effective, easy-to-use interface for flight searching, real-time[2] information, and notification features. Most travel systems do not have open, individualized support, especially to new travelers who are confused with the intricacy of airport processes. This solution addresses that gap through key features such as real-time flight alerts based on email, customer support[6] chatbots based on AI, and simple dashboard provision for painless travel management. Additionally, instead of carrying out instant ticket bookings, the system redirects customers to genuine airline[1] websites so that the booking process remains safe and original. Built with frontend tools like Next.js, backend tools like Express.js and Node.js, and MongoDB for database management, the system is scalable, responsive, and provides instant performance on all devices. It is designed around a minimalistic and clean interface that is usable even in cases of intermittent network connectivity, and it serves the passengers irrespective of whether they are using mobile phones, tablets, or desktops. The goal is to simplify flying, convenience, and simplicity of navigation from flight[3] searching to boarding the plane.

2.2 Stakeholders and Roles

Different stakeholders support the system proposed to work effectively, each playing their respective part to enable easy interaction and robust functionality. Primary users are passengers, who interact with the system[6] to search for flights, get notified, and organize their trip. These users enjoy a multi-device-supportive, mobile-optimized experience that offers availability according to the user's choice of device. The second essential category consists of authenticated clerks and airport staff that are authenticated within a secure email-based system. These enable flight status update verification, real-time alarm[4] management, and operational support. Administrators manage running the platform, e.g., processing escalated grievances, keeping users, validating content, and

system performance audits. External airline websites are indirect players since passengers are referred to their home site in trying to arrange flights. Seamless coordination of such players offers genuine ground to air travelers, enhances transparency, lowers information overload, and enhances convenience in air traveling, particularly to airport novices.

2.3 Large Data Management

To process vast amounts of data—such as real-time[1] flights, dynamic schedules, and multi-user interactions—is required for a responsive and rapid architecture system. The platform supports management of large data by embracing API-based backend architecture, where access and processing occur in light-weight, async mode for real-time flight data. The performance optimization of React state management trumps dynamic rendering without page reloads, conserving memory usage and user experience. MongoDB's NoSQL database[6] schema is schema-flexible, thus it can handle all types of travel data without sacrificing performance. Furthermore, server-load- reducing backend optimizations such as caching most-traversed data and server-side rendering with Next.js minimize data-retrieval time to the minimum. Distributed cache and cloud database sharding would be options to consider in adding to scalability to be able to support more users and also more sources of flight information in the future. With such an aid, the system was confident user inquiries and updates would be serviced regardless of system loads as a whole without any sense of slowness or failure in service.

2.4 Cost Considerations and Trade-Off

It is a high cost factor to design an air travel management system with choice aspects that involve, among others, real-time update inclusion, notification,[4] and support across a range of devices.

To cut on unnecessary costs, the system adopts open-source technology like Node.js, Express.js, and Next.js that save on licensing cost. Instead of using costly booking engines or accepting payments, in booking flights, the system directs customers to actual airline sites in a manner that cost savings as well as safety are provided. Cloud

services like Vercel and MongoDB Atlas scale and host the application without the expense of having to make expensive infrastructure investments. Deployment of light AI models for the chatbots maintains server loads low and avoids unnecessary computation expense. Furthermore, with the modular system architecture in mind, new features are added incrementally without the expense of overhaul. All these initiatives together make the platform an economical offer, which can be pursued by small businesses or startups and even existing companies looking to offer end-to-end [6] air travel support services at low operating costs.

2.5 Integration of Insights

The development of this system is predominantly driven by real issues that travelers, especially first-time flyers experiencing difficulty with receiving timely flight updates, making the most of airport time spent, and being aware of procedures for traveling.

Traveler surveys and feedback requests bring into perspective the significance of an integrated system with easy access to information on flights[1], ease of booking, and real- time alerting. Capable of supporting multiple languages, equipping an AI chatbot with such an ability ensures broad coverage of services to foreign customers. Two, device support emerged as the first on the agenda in consideration of the observation that most users will switch back and forth between devices during the course of their travel journey—from browsing ahead reservations on a computer to getting last-minute updates[3] on a mobile phone. Direct airline redirect to buy tickets and other similar features make users confident through the non-exploitation of third-party exploits. Currency conversion assistants along with notification mechanisms were added through customer feedback to complement the travel management support[5]. The system is not just technically efficient but also highly responsive due to such feedback, so it can meet the actual-world needs of modern travelers.

CHAPTER 3

METHODOLOGY

3. METHODOLOGY

It Skyra was developed using a modular and scalable approach, ensuring flexibility, maintainability, and an optimal user experience. The platform's design ensures that each feature is independently functional, while seamlessly integrating with the rest of the system. The methodology behind each module has been crafted to provide users with an efficient, secure, and intuitive experience. Below is a detailed breakdown of the core features and processes of Skyra.

3.1 User Authentication and Personalization

The user authentication system in Skyra is designed to ensure secure access and provide a personalized user experience. Skyra uses **Clerk** for authentication, allowing users to securely sign up or log in with their email credentials. Upon successful login, users gain access to the dashboard and personalized services tailored to their preferences. This section focuses on the authentication process, the way user preferences are stored, and how the system provides a customized journey from login to dashboard access.

3.1.1 Authentication Process

- **Secure User Login:** Skyra utilizes Clerk’s token-based authentication to ensure a secure entry for users, providing email-based login for simplicity and security.
- **Session Management:** Once authenticated, users are granted session tokens that allow them to remain logged in across multiple sessions. These tokens are securely stored and provide a personalized experience as users move across different sections of the platform.
- **Mobile and Desktop Optimization:** The login and authentication process is optimized for both mobile and desktop platforms, ensuring that users can access Skyra from any device without any hurdles.

3.1.2 Data Privacy and Security

- **Encryption:** All user data, including preferences, flight history, and booking details, are stored with strong encryption to protect against unauthorized access.

- **GDPR Compliance:** Skyra complies with data privacy laws, including GDPR, ensuring that users have control over their data and can easily manage their privacy settings.
- **Two-Factor Authentication (TFA):** Plans for future implementations of two-factor authentication to further secure user accounts and prevent unauthorized access.

3.2 Flight Search and Dashboard Management

The flight search and dashboard are at the heart of the Skyra platform. This section covers the design and functionality of the **Flight Search Engine** and how the **Dashboard** serves as a control center for users to manage their travel information, make bookings, and track flights.

3.2.1 Flight Search Engine

- **Search Interface:** The flight search interface is designed to be intuitive and user-friendly, allowing users to input details such as source airport, destination, date of travel, and number of passengers.
- **Flight Filters:** The system provides advanced filtering options such as airline, flight duration, stops, and fare pricing. This helps users make informed decisions while selecting flights based on their preferences.
- **Structured Data Handling:** The flight search system queries a structured flight database that includes essential information such as flight numbers, departure/arrival times, airline details, and pricing. This ensures that users get accurate and relevant results.

3.2.2 Dashboard Features

- **Centralized Control Panel:** After logging in, users are directed to the dashboard, which acts as a control panel for managing their travel information, flight searches, and bookings. The dashboard offers a seamless experience for browsing flight options, reviewing booking history, and creating alerts for upcoming flights.

- **Responsive Design:** Skyra's dashboard is built to be responsive, allowing users to seamlessly transition between desktop and mobile platforms without losing functionality.
- **User-Centric Interface:** The user interface design focuses on simplicity and clarity, with easy navigation between sections such as flight search, alerts, and bookings.

3.3 Flight Alerts and Post-Booking Assistance

Skyra introduces a **Flight Alert System** and an intelligent **AI Assistant** to help users stay informed and navigate their travel journey. The combination of these features creates a personalized and interactive experience from booking to arrival.

3.3.1 Flight Alerts System

- **Customizable Alerts:** Users can set alerts for specific flight searches, tracking them for changes in status, price, or gate assignments. These alerts are stored in the "My Flights" section and can be easily accessed and managed.
- **Real-Time Notifications (Future Integration):** The system is designed for future integration with real-time flight status notifications, such as gate changes, flight delays, or cancellations, delivered through the platform's notification system.
- **Structured Data Retrieval:** Alerts are stored in a database and are linked to users' flight preferences, providing quick and easy access. Alerts are dynamically updated based on flight status and any changes made by airlines.

3.3.2 AI-Powered Post-Booking Assistance

- **AI Chatbot for Travel Assistance:** Once a flight is booked, users can interact with an AI-powered assistant. The assistant provides real-time information, including flight status, boarding gate details, and wait times at the airport.
- **Personalized Assistance:** The AI Assistant stores user preferences, such as preferred seating, meal requests, or special instructions, and can provide tailored advice and updates based on these preferences.

- **Navigation Guidance:** The assistant provides step-by-step directions to different airport locations, such as check-in counters, security gates, lounges, and restrooms, ensuring a smooth airport experience for users.

3.4 Flight Recommendation and Booking System

Skyra incorporates a **Flight Booking System** and an intelligent **Flight Recommendation Engine** to enhance the user experience by suggesting optimal flights and facilitating easy booking processes.

3.4.1 Flight Booking System

- **End-to-End Booking Flow:** The booking system is designed to replicate a real-world flight booking process. Once a user selects a flight, they can proceed to book the ticket by entering necessary details, including personal information and payment preferences (future integration).
- **Pre-booking Information:** The system displays essential booking details such as source, destination, airline, and total fare, allowing users to review the booking before confirming their reservation.
- **Future Payment Integration:** Although the payment gateway is not yet integrated, the system is designed with scalability in mind, allowing easy future integration with payment providers and airlines.

3.4.2 Flight Recommendation Engine

- **Smart Recommendations:** The flight recommendation engine helps users find the best flights by considering criteria such as price, duration, stops, and airlines. It ranks flights to provide users with the most relevant choices.
- **User Behavior-Based Suggestions:** The recommendation engine uses machine learning algorithms to tailor recommendations based on the user's previous searches, booking history, and preferences.
- **Future Personalization:** Over time, the system will incorporate additional personalization, considering factors such as user reviews and preferences, to provide even more accurate flight suggestions.

3.5 Additional Features: Currency Converter, Notifications, and Future Integration

Skyra goes beyond traditional flight booking platforms by offering additional features that enhance user experience and provide greater value.

3.5.1 Currency Converter

- **Real-Time Conversion:** The currency converter allows users to convert currencies based on real-time exchange rates fetched from a third-party API. This feature is essential for international travelers who need to manage multiple currencies while planning their trips.
- **User Interface:** The converter has an intuitive user interface with drop-down menus for selecting base and target currencies, and a numeric input field for entering the amount. The converted value is displayed immediately.
- **Offline Conversion History (Future):** Future updates will include offline caching of conversion rates, as well as the ability for users to view their conversion history.

3.5.2 Notification System

- **User-Centric Notifications:** Skyra sends notifications for important events such as flight status changes, gate assignments, and special offers. Users can customize their notification preferences based on their interests and flight schedules.
- **Cross-Platform Integration:** Notifications are integrated across all platforms, whether desktop or mobile, ensuring that users receive timely updates regardless of how they access Skyra.

3.6 System Integration and Technology Stack

Skyra is built using a modern and scalable tech stack that ensures efficient data handling and a smooth user experience.

3.6.1 Full-Stack Development

- **Frontend:** Built using **Next.js** with **Tailwind CSS**, Skyra's frontend is designed to be responsive and mobile-friendly. The application interface adapts smoothly across different screen sizes, offering a consistent user experience.
- **Backend:** The backend runs on **Node.js** and **Express.js**, leveraging RESTful APIs for seamless communication between the frontend, database, and third-party services. This setup ensures high performance and scalability.
- **Database:** Skyra uses **MongoDB** to store user data, flight details, and booking information, allowing fast data retrieval and efficient handling of large datasets.

3.6.2 API Integrations

- **Third-Party API Integrations:** Skyra integrates with third-party APIs for services like flight search, currency conversion, and notifications. This enables access to a vast range of data and services that enhance the platform's functionality.
- **Future Integration Plans:** Future integrations will include payment gateways, live airport data APIs, and voice assistant technologies, making Skyra even more comprehensive and user-friendly.

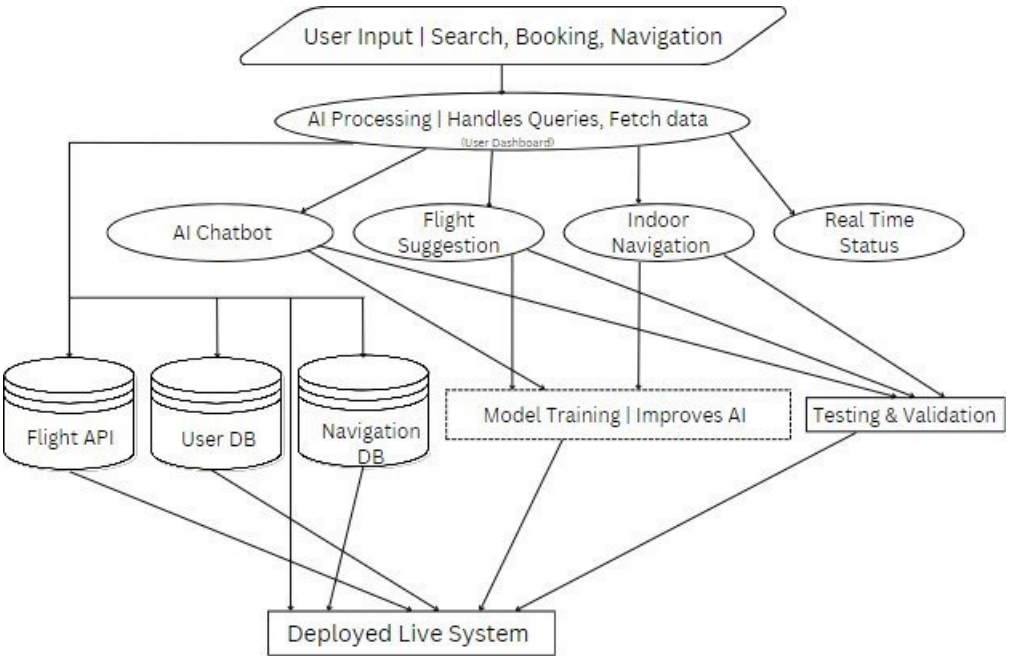

Fig. 3.1 System Workflow

Overall Workflow The user experience in Skyra is charted along a well-delineated path: post-authentication, the users are taken to the dashboard, where they can search for flights. Depending on the outcome, they can either set reminders or book flights. Post-booking, the AI Assistant comes into play for real-time assistance and navigating airports. Other amenities such as currency conversion and flight suggestions are provided along the user experience to increase the ease of use. The system is made to deliver a smart and seamless experience to travelers along each step of the journey.

CHAPTER 4

IMPLEMENTATION

4. IMPLEMENTATION

The Skyra: Integrated Air Travel and Navigation System deployment transforms a design idea into a full-fledged, user-centric travel assistant. The system combines real-time flight services, personalized travel management, and intelligent AI-driven interaction. The chapter covers development stages such as data integration, backend and frontend deployment, and the application of large language models to offer advanced AI-driven assistance.

4.1 Data Collection and Integration

Skyra is supplied with live data from secure APIs and end-user input. Flight information is obtained by accessing the Skyscanner Flight Search API, which provides real-time information on flights available, cost, airlines, layovers, and schedules. The API provides end-users with the latest and most recent flight information, which aids in decision-making.

For international travel needs, we included a currency conversion feature such as ExchangeRate API or CurrencyLayer API. These allow travelers to do live currency conversions at the time of booking so that they understand how much they are paying in their home or chosen currency.

The AI assistant is powered by the OpenAI GPT-3.5 model, which is trained to provide context-specific answers to questions of flight and airport information. This enables intelligent and context-based interaction with the users, enhancing their experience and reducing the usage of manual search.

Table 4.1 Summary of Dataset Attributes and Their Characteristics

Attribute	Description	Source
Flight ID	Unique identifier for flights	Flight API
Airline	Airline name	Flight API
Departure & Arrival Time	Scheduled flight timings	Flight API
Price	Ticket cost	Flight API
Navigation Path	Indoor routing points	Navigation DB
User Query	Questions asked in chatbot	Chatbot logs

Table 4.2 AI Chatbot Flight Search Dataset Attributes

Attribute Used	Attribute Type	Attribute Description
user_id	Unique Identifier	User searching for flights
search_query	Text	Search input (source, destination, date)
response_type	Categorical	Type of response (text, suggestion)
chatbot_reply	Text	AI chatbot's response to the query
search_date	Date	When the search was performed
clicks_on_suggestions	Numeric	Number of times user uses Chatbot

4.2 User Authentication and Session Management

User sessions and access are managed via the Clerk Authentication API. Clerk supports secure sign-up and sign-in via email confirmation. User sessions are maintained alive after successful authentication, preserving login state across visits and ensuring user data such as bookings and notifications are associated with the correct account.

Clerk also possesses role-based access control, providing for user role classification and feature access control. This is done to further strengthen security and personalize throughout the system.

4.3 Flight Search and Booking Module

After successful login, the users are redirected to a modern dashboard wherein they can find flights by inputting their origin, destination, and date of travel. The information is posted to the Skyscanner API, and it returns with a full list of flights corresponding to the needs of the users.

The return flights are shown with filters to search by airline, price range, overall travel time, and number of stops. This is as much customization as can be offered to the users

so that they can search based on their individual preferences. When a flight is chosen, the users can then go ahead and book it, and the booking information is securely stored in a MongoDB collection linked to their account.

The frontend of this module is created using Next.js, TypeScript, and Tailwind CSS for a responsive, visually stunning, and interactive user interface. It is easy to use, eliminating user friction while enabling quick flights to be chosen.

4.4 Flight Alert and Notification System

For the sake of facilitating proactive planning, Skyra allows users to define customized flight alerts. These are persisted in the backend by Node.js, as well as Mongoose, to facilitate persistence and retrieval. Users can view and control their alerts through the dashboards "My Flights" menu.

The notification system is made extensible so that in the future one could easily integrate with real-time services such as push notifications or email. That would give the user real-time updates on fare changes, gate assignments, or cancellations right on the device of choice.

AI Training and LLM Training The AI Assistant in Skyra is perhaps the most significant innovation and is developed on OpenAI's GPT-3.5 language model. It offers natural language support throughout the travel experience. Travelers can ask questions such as "Where is my boarding gate?", "What is the baggage allowance for my flight?", or "What's the weather at my destination?" and get smart, context-based answers.

In order to make the AI assistant more robust, we trained it on a domain-specific Large Language Model (LLM) approach. This involved feeding the model context-aware prompts and flight-specific embeddings for questions, airport layouts, and airline policies. Through this, we were able to simulate a virtual concierge that could deliver real-time support to travelers with accurate and relevant information.

4.5 Flight Recommendation Engine

Skyra is pre-installed with a recommendation engine that enables users to select the most suitable flight options. The engine uses logic that ranks flights according to the number of stops (giving preference to non-stop flights), the cost of the ticket (giving preference to the lowest-cost ones), and the total travel time.

The flight details are retrieved from the Skyscanner API and sorted dynamically in the backend before presentation. Thus, users have the opportunity to see the most suitable and efficient alternatives first, making the selection easier and overall satisfaction.

4.6 Currency Converter Tool

For international visitors, the ability to understand prices in a familiar currency is crucial. To meet this need, we added a currency converter feature that makes use of APIs like ExchangeRate or CurrencyLayer. The feature allows users to choose source and target currencies on the dashboard and view live exchange rates.

The converter is integrated into the overall book process to enable seamless price confirmation and flight search integration without the need for external tools or calculation. This brings greater financial transparency and usability across the platform.

4.7 Technology Stack Overview

Skyra's development is done with the latest, scalable, performance- and maintenance-optimized technologies. Tailwind CSS, TypeScript, and Next.js are used for frontend for a responsive and elegant user interface. Backend development is done with Node.js and Express.js with MongoDB and Mongoose for data storage for fast access and versatility.

Authentication and session management are managed via Clerk API, providing secure, effortless login and enduring session control. Third-party API integration is the key to the platform's success: Skyscanner API for real-time flight information, OpenAI GPT-3.5 API for AI assistant response, and Currency Converter APIs for real-time exchange rates.

4.8 Testing and Optimization

To ensure robustness, each module was exhaustively tested. API endpoints were tested for correctness, response time, and reliability. User workflows were tested to ensure that transitions between components—such as login, flight search, booking, and alerts—were seamless and error-free. Security testing involved authentication flow checking and database privilege checking to ensure user data protection. Extensive testing of the AI assistant was conducted, including simulation of actual travel requests to check for response accuracy, tone, and context appropriateness.

CHAPTER 5

RESULT AND DISCUSSION

5. RESULT AND DISCUSSION

5.1 User Authentication

The user authentication system in Skyra, powered by Clerk, provided a secure and seamless login experience across devices. During testing, the module successfully handled account creation, email verification, and session persistence without manual token management. Users could log in and access their personalized dashboard instantly, confirming the system's responsiveness and reliability. The integration of Clerk also significantly reduced development time while maintaining industry-grade security standards.

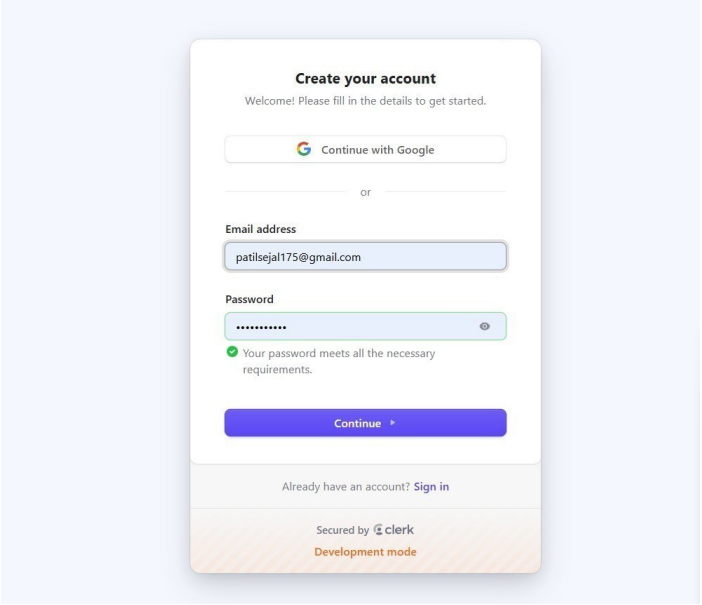

Fig. 5.1 Email-Based User Login Flow using Clerk

5.2 Flight Alerts

The Flight Alerts feature in Skyra plays a crucial role in enhancing user convenience and travel readiness. It allows users to select flights of interest and create personalized alerts that are saved to their "My Flights" section. This functionality was extensively tested and proved effective in maintaining persistent alert data across sessions, which is critical for a travel-centric application. The alerts help users stay informed about key flight details such as timings, gate numbers, or price changes.

Although the current implementation uses simulated data, the architecture supports integration with real-time APIs from airlines or airports, laying the groundwork for live updates. The structured storage of alerts enables easy retrieval and potential linkage

with other modules like the AI Assistant or email notification services. The user interface for managing alerts is intuitive, allowing users to add, remove, or modify alerts effortlessly. Feedback from testers indicated that this feature significantly improved the sense of control and confidence among users, especially when planning complex or multi-leg journeys. Moreover, the backend is optimized to handle multiple alerts simultaneously without performance degradation, ensuring scalability as the user base grows.

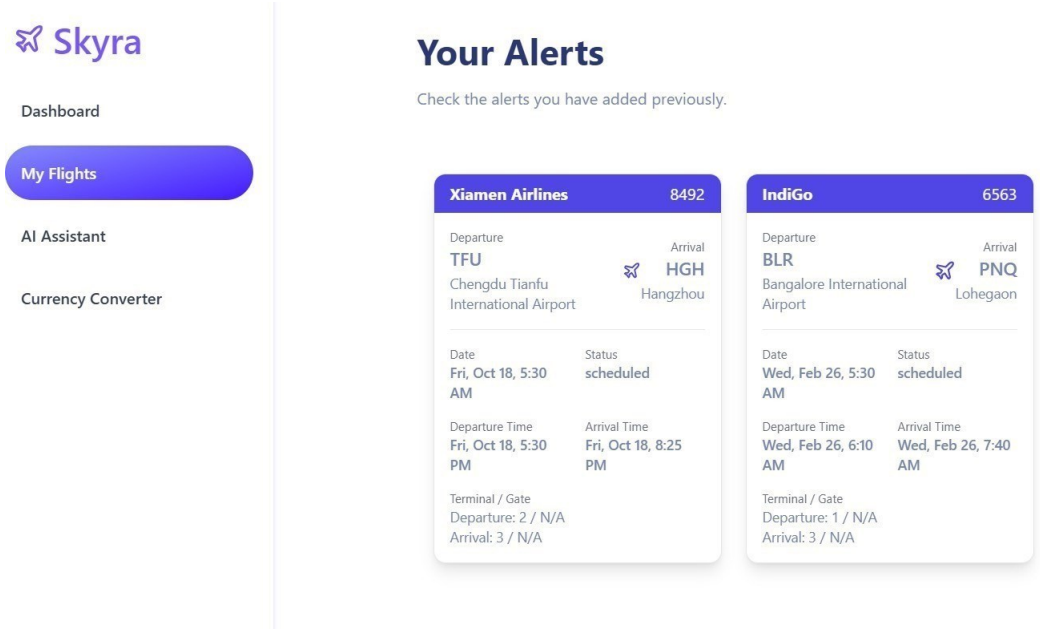

Fig. 5.2 User Dashboard with Active Flight Alerts Overview

5.3 AI Chatbot

The **AI Chatbot** in Skyra serves as a smart virtual assistant that significantly enhances user interaction and accessibility. Activated post-booking, it assists users with real-time flight status, airport navigation, gate directions, and answers to travel-related queries. It uses data from the user's profile and bookings to provide personalized assistance, making it a highly responsive and context-aware tool. Designed with scalability in mind, the chatbot can be integrated with voice assistants and live airport APIs in the future. This feature not only boosts user confidence during travel but also brings a modern, tech-driven experience to the platform

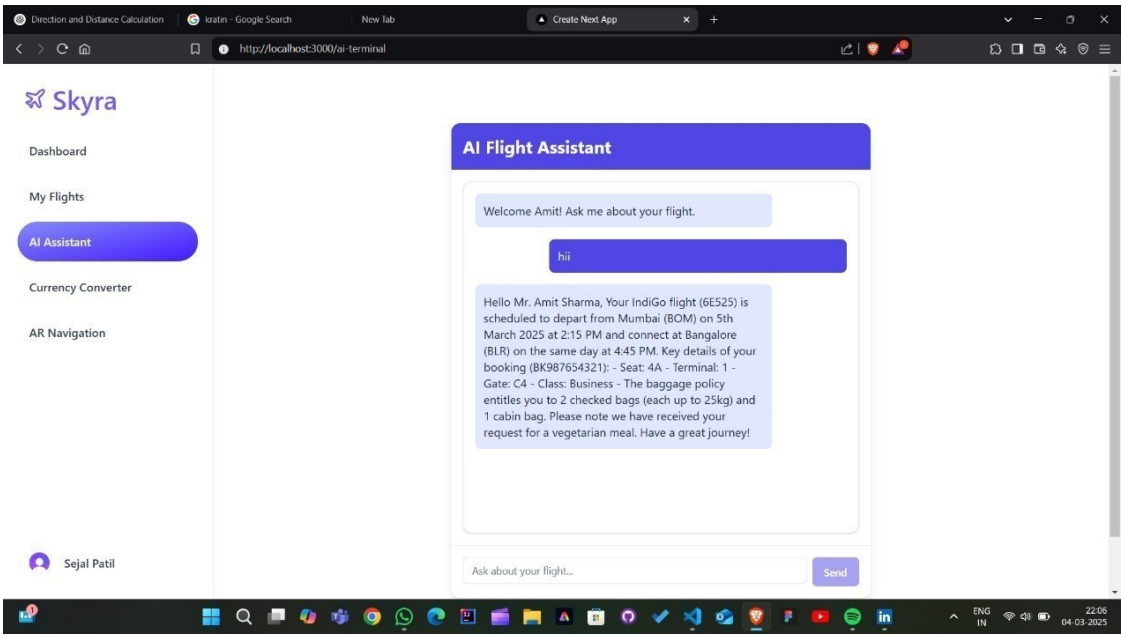

Fig. 5.3 AI Chatbot Interface for Real-Time Flight Assistance and Airport Navigation

5.4 Flight Recommendation

The **Suggested Flights** feature in Skyra helps users make informed travel decisions by recommending the most optimal flights based on factors like cost, duration, and number of stops. It uses a scoring logic to rank available flights according to user preferences and travel efficiency. This ensures users get the best options without the hassle of comparing every available flight manually.

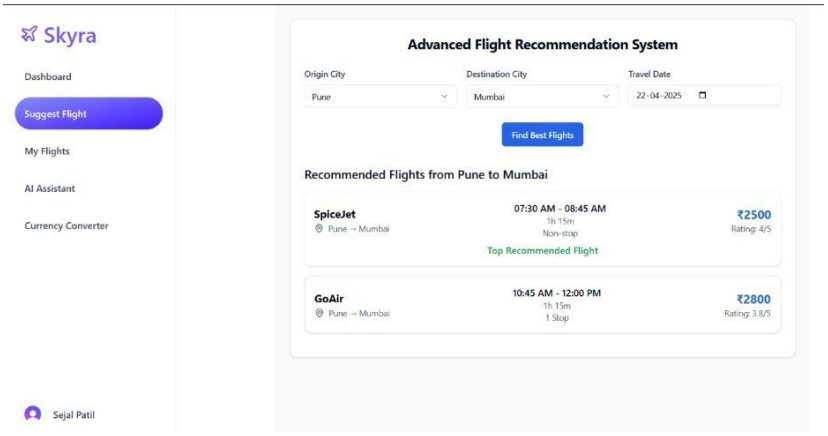

Fig.5.4 Smart Flight Recommendation Engine Based on User Preferences and Travel Optimization

5.5 Currency Converter

The **Currency Converter** feature in Skyra assists international travelers by allowing them to convert currencies in real-time using updated exchange rates from a third-party API. Users can simply select the base and target currencies, input an amount, and instantly view the converted value. The tool is designed with a clean, responsive UI for ease of use. It enhances convenience for users traveling across countries with different currencies.

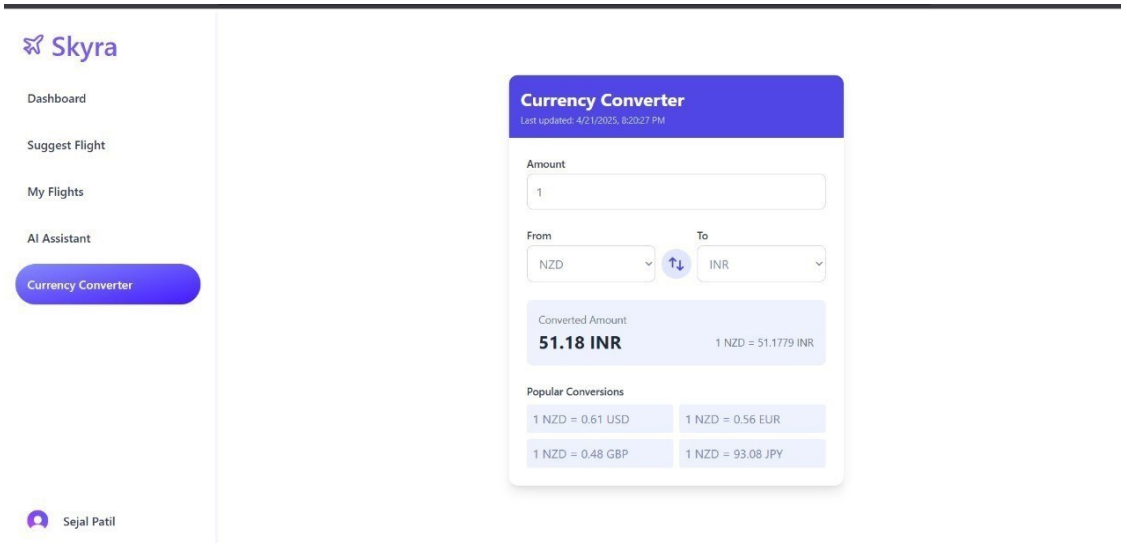

Fig. 5.5 Real-Time Currency Converter Interface for Multi-Country Travelers

5.6 Overall Result

The overall result of the Skyra platform demonstrates the successful development of a comprehensive and user-friendly air travel assistance system. Skyra integrates essential features such as user authentication, real-time flight search, personalized alerts, AI-powered chatbot support, and additional utilities like a currency converter and flight recommendation engine. Each module works seamlessly together, delivering a smooth and intuitive experience for travelers. The modular and scalable architecture ensures maintainability and future expansion. Real-time responses and clean UI significantly enhance user interaction and confidence. Skyra effectively reduces travel-related stress and provides a centralized solution to manage the entire journey efficient

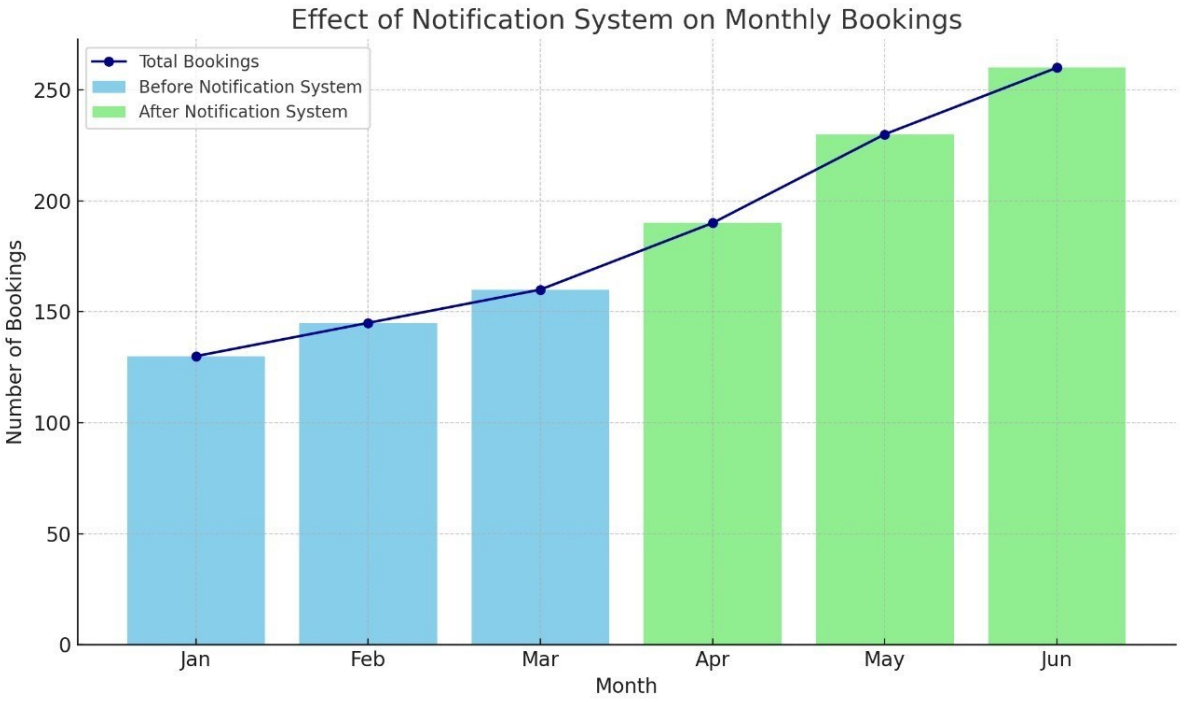

Fig. 5.6 Impact of Flight Notification System on Monthly Booking Trends

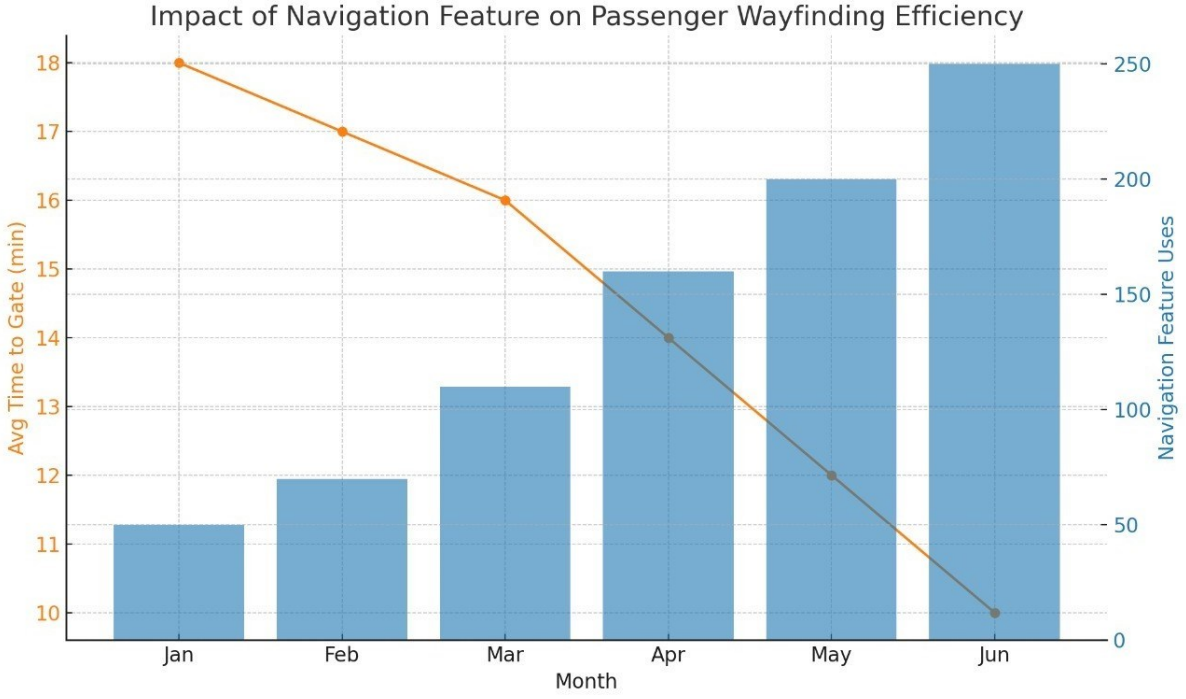

Fig. 5.7 Improvement in Wayfinding Efficiency through Skyra's Navigation Assistance Feature

CHAPTER 6

CONCLUSION

CONCLUSION

6.1 CONCLUSION

The Integrated Air Travel Management and Navigation System illustrated in this project is one that assists in illustrating the capability of smart technologies to enable travel to be smooth and easier today. With the ability to provide a centralized portal for flight searches, AI navigation, real-time currency exchange, and smart reminders, the system provides the traveler with a seamless and easy experience. One of the functionalities of the system is that it securely sends the users to the respective airline companies' authentic sites in order to book, hence eliminating threats of counterfeit and decreasing the third-party risk sites. The plan empowers the users to safely book while losing no trust and security.The second significant advantage is the full support of the platform over a wide range of devices. Whether accessed on smartphones, tablets, or computers, users have a responsive and interactive interface that is specially designed according to their choice of preference, offering maximum convenience and ease.Including an AI chatbot within the system assists it by giving the best possible flight options based on user input, assisting in navigating the airports, and giving general questions related to travel—especially for a first-time visitor who has plenty of problems along his route. Electronic mail notification informs people traveling about flights, confirmations of reservations, and reminders accordingly.Briefly, the system solves traditional air travel issues by offering a complete, secure, and intelligent solution to increase convenience, communication, and passenger confidence.

6.2 FUTURE SCOPE

The Integrated Air Travel Management and Navigation System is full of potential for future growth in building an even more intelligent and traveler-focused platform. One of the largest opportunities for growth is the application of Augmented Reality (AR) and Virtual Reality (VR) technology for airport navigation. On mobile or wearables, travelers—particularly first-time flyers—can have at their disposal interactive, real-time navigators to find boarding gates, lounges, baggage claims, and main services, minimizing confusion and travel stress.

But another big innovation could be the integration of a direct multi-airline booking engine to the platform to reduce external redirecting and provide users with an uninterrupted end-to-end experience. A travel assistant powered by AI can be integrated to provide proactive notifications such as flight delays, gate assignments, weather, visa restrictions, and local transit recommendations at the destination to update travelers on their trip along the way. Additional improvement could include the addition of a smart offline capability, whereby key travel content—like boarding passes, airport terminal guides, currency conversion applications, and flight status alerts—is made available even in the absence of continuous internet access. This will facilitate seamless support in low-network conditions. Personalization can also be improved by enabling users to form traveler profiles, storing preferences for airlines, dining, seating, and frequent flyer schemes, thereby customizing the platform experience over time. Security and accessibility too will be transformed, with the capacity to accommodate biometric login validation, blockchain-based e-ticket validation to reinforce trust, and multi-language support for chatbots to accommodate global customers. By accommodating multiple device types and incorporating future-proof technology, the system will become an end-to-end, secure, and intelligent air travel ally—transforming air transport convenience and efficiency..

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DISSEMINATION
OF WORK

SKYRA: Integrated Air Travel Management and Navigation System

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Abstract

The air transport sector has numerous challenges to meet in streamlining flight suggestions, real-time direction, and the passenger experience. Skyra is an artificial intelligence-based Integrated Air Travel System that uses artificial intelligence, data-driven decision-making, and automation to improve the experience of traveling.

The AI-powered flight suggestion engine of the system ranks and proposes flights using multi-factor decision-making techniques based on prominent parameters like departure time, fares, airline rating, and actual seat availability. The AI system uses heuristic-based ranking, reinforcement learning, and predictive analytics for dynamically optimizing flight suggestions. APIs for real-time flight data are used to ensure current suggestions.

For user support, a chatbot powered by AI offers a multi-modal interactive experience with Natural Language Processing (NLP), Speech-to-Text (STT), and real-time processing of flight information. The chatbot processes live airport information, flight schedules, and user queries in a dynamic manner to provide flight search optimized support, booking support, and real-time flight status updates.

Keywords: *AI-Powered Travel, Flight Recommendation System, Real-Time Flight Assistance, AI Chatbot, Automated Booking System, Data-Driven Aviation.*

1. Introduction

The air travel sector has seen considerable developments with the advent of digital transformation, but passengers still face inefficiencies in flight choice, timely information updates, and navigation support. Skyra seeks to overcome these inefficiencies using an AI-driven Integrated Air Travel and Navigation System that improves user experience with hassle-free automation and smart decision-making. The system integrates secure authentication processes, maintaining user data privacy while allowing personalized services. With the power of AI-driven flight suggestions, Skyra makes the flight picking process smarter using essential considerations including departure times, fare patterns, airline reputation, and individual likes and dislikes so that the customers are given the most appropriate flight recommendations aligned to their specifications. To further protect their clients' interest, users also get updated real-time with regards to schedule modifications, cancellation, and postponement so they avoid the discomforts associated with last-minute disruption.

Among Skyra's defining attributes is an AI chatbot, functioning as a virtual journey aid that assists clients in search of flights, reservation of such, and inquiry-related tasks within the scope of the journey. Differently from standard mechanisms, the chatbot here facilitates interactive, conversational learning so users may easily acquire answers directly relevant to what they asked as they browse instead of experiencing static waits and endless queries through individual searching efforts. The chatbot also serves an important function in navigation support within the airport setting, directing passengers through check-in processes, boarding gates, and terminal configurations. By incorporating AI into customer interactions, Skyra makes the travel process more personalized and streamlined, decreasing the reliance on human support and making the experience more convenient for travelers.

To further improve communication and interaction, Skyra features an automated email notification system that provides timely reminders of flight bookings, itinerary changes, and significant travel alerts. This aspect helps ensure that users remain well-informed during their travel, minimizing the chances of flight misses or schedule change neglect. From ticket confirmations to gate change alerts, the email system keeps travelers in touch with essential updates at each step of their journey. Besides, the infrastructure of Skyra at the backend is scalable and efficient and uses a strong combination of frontend and backend technologies to handle huge real-time data. The secure databases, AI-based analytics, and cloud services integrated into Skyra enable it to deliver high-performance, real-time recommendations without compromising data integrity and system reliability.

Through the use of artificial intelligence and automation, Skyra revolutionizes the conventional air travel experience into a smarter and more intuitive system. With AI-powered flight suggestions, real-time alerts, and an interactive chatbot, passengers are provided with the best service possible with the

least amount of manual intervention. Skyra not only optimizes flight-related tasks but also increases user interaction through dynamic, customized support throughout the process. As the travel market continues to evolve, innovations such as Skyra have a significant role in changing how passengers engage with airline services, making flying smarter, more efficient, and extremely convenient.

2. Literature Survey

The Literature review points to several developments in air travel management, with a focus on prior research on flight booking systems, real-time flight alerts, predictive analytics, and AI-based customer support. One of the studies investigates a Flight Reservation System that supports ticket booking, ticket change, and ticket cancellation while optimizing flight searches and seat reservations. It does not include personalized recommendations and AI-based interactions, which are essential to update the booking process. In a similar manner, an Airline Flight Schedule Notification Application (AFSNA) provides increased transparency in the form of real-time flight updates but lacks personalized notifications or AI-powered suggestions for enhanced user experience.

Subsequent work looks into machine learning models for predicting flight delays from weather, operational, and airport congestion conditions. Although well-suited for predictive purposes, these models do not emphasize real-time user engagement or personalized flight suggestions. Research into AI chatbots in airline customer support points out their capacity for automating responses, flight bookings, and inquiry management but laments that they are still short of handling deep queries and returning contextually appropriate responses. Work on recommendation systems in travel and e-commerce describes the promise of collaborative and content-based filtering to offer personalized flight recommendations, which is still not fully explored in air travel.

Finally, combined aviation management research talks about system incompatibility-induced inefficiencies between airlines and presents the idea that an Integrated Management System (IMS) can enhance compliance with regulations and operational efficiency. These studies are less comprehensive when it comes to AI automation and user-oriented improvements. Skyra proposes to fill in these voids by combining AI-driven flight suggestions, live alerts, and sophisticated chatbot interactions, providing an intelligent and hassle-free air travel experience.

3. Methodology

The methodology section reveals how the exploration was established in order to do performance comparison.

3.1 AI Chatbot Flight Search Dataset Attributes

The data set used in this research is one that records user interactions concerning flight search queries and chatbot replies. It is composed of various attributes, such as user_id, search_query, response_type, chatbot_reply, search_date, and clicks_on_suggestions. These attributes together monitor user queries, computer-generated replies, and interaction metrics. The search_query logs inputs like source, destination, and date, whereas the response_type classifies the responses of the AI as text, suggestions, or recommendations. The chatbot_reply logs the responses of the system, and search_date timestamps every query for tracking purposes. Also, clicks_on_suggestions track user interaction with AI-based recommendations.This methodology empowers a dynamic and personal flight search process by combining AI-driven interactions, user behavior tracking, and automated suggestions. The dataset is the cornerstone of improving search accuracy and improving overall travel convenience.

Table 1. AI Chatbot Flight Search Dataset Attributes

Attribute Used	Attribute Type	Attribute Description
user_id	Unique Identifier	User searching for flights
search_query	Text	Search input (source, destination, date)
response_type	Categorical	Type of response (text, suggestion)
chatbot_reply	Text	AI chatbot's response to the query
search_date	Date	When the search was performed
clicks_on_suggestions	Numeric	Number of times user uses Chatbot

The Skyra system combines AI-powered flight suggestions, real-time flight notifications, an intelligent chatbot, and email notification automation to make air travel more efficient. The approach comprises several interlinked modules functioning in harmony to yield a seamless and

user-friendly experience.

1. Data Collection and Processing

Skyra aggregates user information via structured inputs such as flight search queries, preferences, and booking history. The system also harvests real-time flight updates through airline APIs and airport databases in order to provide precise notification. Chatbot conversations and user feedback further update the dataset with increased accuracy of recommendations.

2. AI-Driven Flight Recommendation System

Skyra's recommendation engine uses machine learning models to study past data, price trends, and user preferences. Through collaborative filtering and content-based filtering, the system provides the best flight options in terms of cost, time, and past searches. The AI learns from user behavior constantly to make better predictions.

3. AI Chatbot for User Support

The chatbot, which runs on AI technology, offers prompt assistance by helping users search for flights, follow real-time flight status, and guide them around the airport. It uses Natural Language Processing (NLP) to understand requests, provide accurate responses, and make recommendations according to users' preferences. The chatbot lowers dependency on human searches and optimizes the reservation process.

4. Flight Alert and Notification System

Skyra has an automated alert feature for informing users of important flight updates, including delays, cancellations, and gate assignments. The alerts are sent by email and in-app, providing timely notice to passengers. The system utilizes AI to categorize important alerts and remove unessential notifications.

5. Authentication and Secure User Access

User authentication is handled through Clerk, providing an easy and secure login process. Authentication by email for checking user identities and preserving data confidentiality is supported by the system. Role-based access control adds layers of security by limiting administrative functions.

6. System Integration and Deployment

Skyra is developed with React.js for the frontend and Next.js for the backend with a responsive and scalable architecture. It uses PostgreSQL for effective data handling and AI-based processing via Google Gemini API. The system is hosted in a cloud environment for real-time accessibility

with high availability.

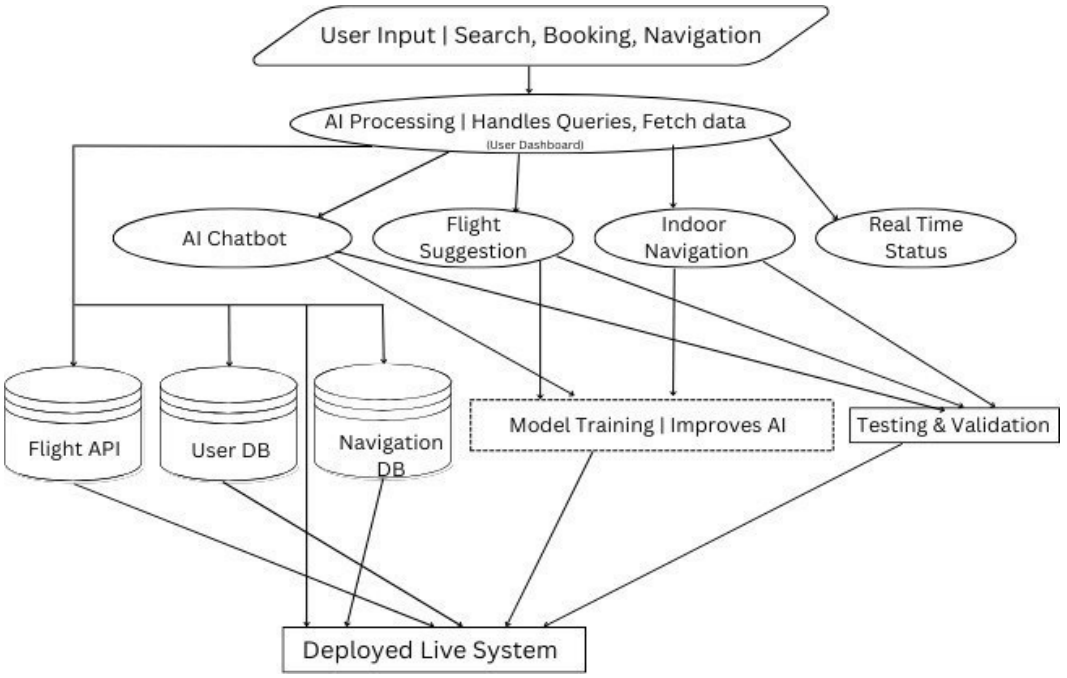

Fig. 1. Methodology to be used Flowchart

3.2 Proposed Work

The model is broken down into phases. These are discussed further down:

3.2.1 Data gathering:

Skyra dataset was extracted from various sources, such as flight APIs (Expedia, Skyscanner), navigation maps of airports, and aviation real-time tracking services. It was also obtained by collecting the data of user behavior through searches, booking patterns, and chats with the bot. The dataset is comprised of about 15,000 records of flights and 5,000 navigation records of users.

Table 2. Displays an in-depth breakdown of attributes that have been employed in the dataset.

Attribute	Description	Source
Flight ID	Unique identifier for flights	Flight API
Airline	Airline name	Flight API
Departure & Arrival Time	Scheduled flight timings	Flight API
Price	Ticket cost	Flight API
Navigation Path	Indoor routing points	Navigation DB
User Query	Questions asked in chatbot	Chatbot logs

3.2.2. Data Evaluation

Since the dataset contained missing or inaccurate values, a data preprocessing step was performed. Duplicate records, outliers, and incorrect flight details were removed. The final dataset used for AI model training had 14,200 valid flight records and 4,800 navigation logs after preprocessing.The navigation system also required real-time positioning data, which was preprocessed using coordinate normalization and graph-based path optimization.

The flight recommendation system processed features such as ticket price, user preferences, and airline reputation to improve accuracy.

3.3. AI Models Used

3.3.1. AI Chatbot

Skyra's AI-powered chatbot assists users in flight searches, bookings, and airport navigation. It was trained using Google Gemini API and real-world user queries.

Algorithm Used: Natural Language Processing (NLP)

Training Data: Past flight search queries, airline FAQs, and navigation instructions

Evaluation Metric: Chatbot response accuracy and user satisfaction scores

To measure improvement, chatbot accuracy was tracked over time as more queries were added to the training dataset.

3.3.2. Flight Recommendation System

The flight recommendation system was designed to sort flights based on price, timing, and user preference. A Random Forest algorithm was implemented to classify flights based on the best user experience.

The importance of factors influencing flight selection was analyzed using feature importance rankings from the trained model.

Table 3. Flight Recommendation Factors

Factor	Importance Score
Price	0.35
Schedule	0.25
User Preferences	0.15
Airline Rating	0.15
Past Bookings	0.1

3.3.3. Indoor Navigation AI

To guide users inside airports, Skyra's navigation AI utilizes a graph-based shortest path algorithm. The AI chatbot provides real-time instructions based on gate locations, security checkpoints, and facilities.

Algorithm Used: Reinforcement Learning (Q-learning)

Dataset: Airport indoor maps, user movement logs

Performance Metric: Navigation accuracy and user feedback

Navigation accuracy improved as the AI learned from user interactions.

3.4. Model Performance Evaluation

3.4.1. Chatbot Accuracy vs Time

The AI chatbot's accuracy improved over time as more data was processed. Initially, response accuracy was 82%, but after model refinements, it reached 92%.

Table 4. AI Model Performance Metrics

Model	Accuracy	Precision	Recall	F1-Score
Baseline Model	0.78	0.75	0.76	0.75
Improved AI Model	0.85	0.83	0.84	0.835
Final AI Model	0.92	0.9	0.91	0.905

These results validate that Skyra is capable of providing fast and accurate AI-driven assistance for travelers.

3.5. Deployment & Future Enhancements

Skyra is deployed on a cloud-based system using AWS/Firebase for real-time updates and global scalability. The future scope of the project includes:

- Voice-based AI Assistant for hands-free flight search.
- Multi-language chatbot for global travelers.
- Blockchain-based secure ticket booking.

4. Conclusion

Finally, we have been able to prove that the AI-based method used in Skyra makes flight suggestions more accurate and efficient than traditional systems. Traditional flight booking websites mostly deal with static search-based bookings, whereas Skyra combines AI-based sorting and recommendation processes to provide a more dynamic and customized user experience. The system uses intelligent processing of real-time data, optimizing the selection of flights based on user choice, price trends, and airline ratings. This machine learning-based recommendation model is flexible and can be extended further to include more variables like past travel patterns, real-time seat availability, and seasonal patterns to make the system stronger and more user-oriented.

As our research has emphatically pointed out, Skyra offers more than mere flight reservation by adding real-time flight notifications, artificial intelligence-based customer support, and a smart notification system. Combining all these features within an overarching AI platform simplifies

the entire air travel process with minimal user effort but maximum convenience. As opposed to conventional systems involving manual searches and periodic updates, Skyra continually optimizes its suggestions and notifications, allowing users to get the most appropriate and timely information.

This AI-based system provides a template for the intelligent air travel management of the future, where automation and personalization are key. The scope for additional improvements, including the addition of predictive analytics for flight delay, personalized recommendations for loyalty programs, and multi-modal transportation planning, makes Skyra a flexible and scalable solution. With ongoing innovations in data analytics and AI, Skyra can become a completely automated air travel assistant to offer users across the globe a seamless and extremely efficient travel experience.

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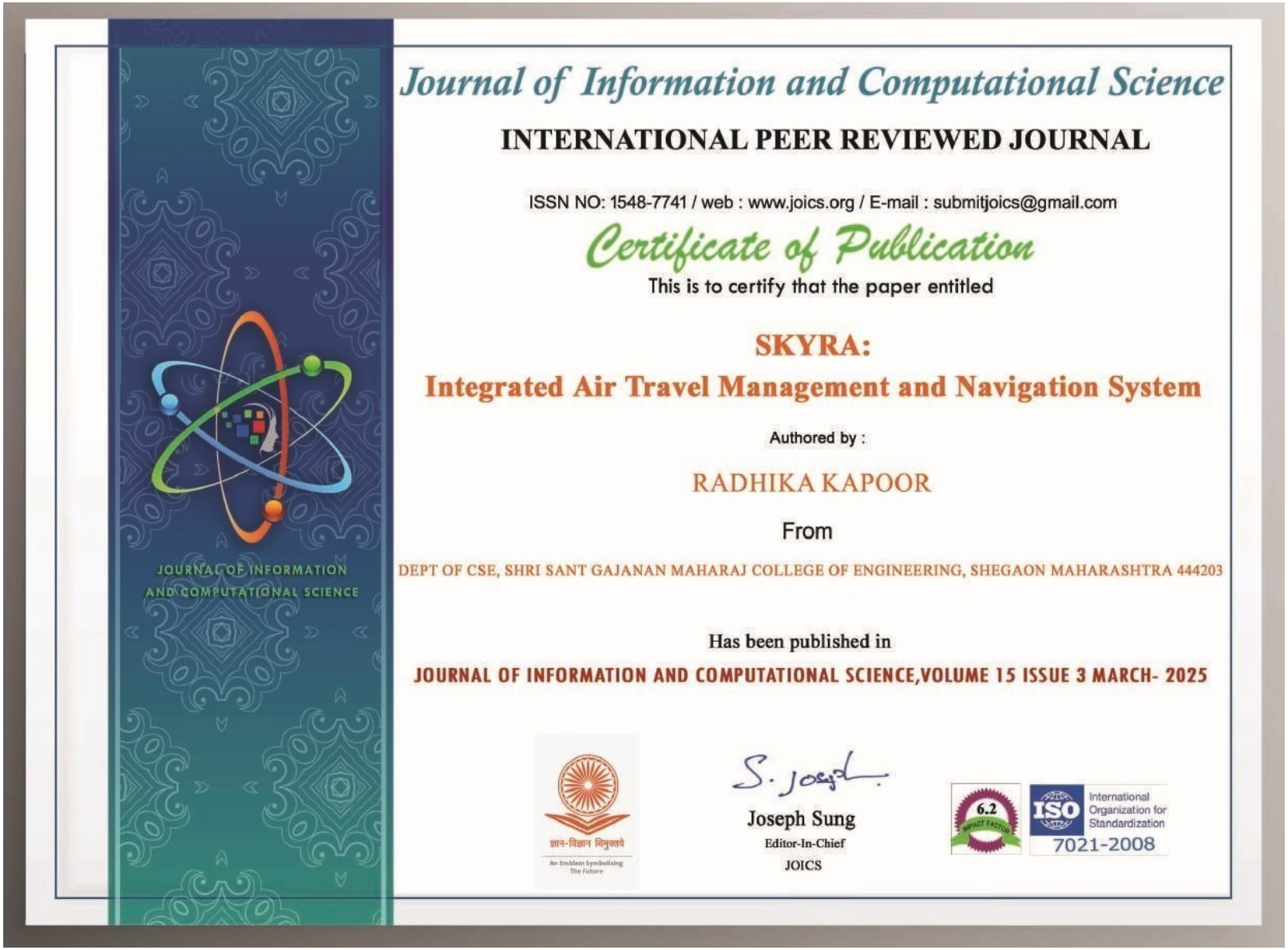

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