



# Hotel Booking System – Technology Stack & Architecture



## Project Overview

A full-stack hotel booking platform featuring **AI-powered capabilities**, **real-time updates**, and **comprehensive user management**.

Designed for scalability, performance, and modern user experience.

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## Backend Technologies

### Spring Boot 3.x (Java 17)

- **Why:** Enterprise-grade framework with an excellent ecosystem
- **Benefits:** Auto-configuration, embedded server, production-ready features
- **Use Case:** RESTful API development, dependency injection, and security integration

### Spring Security + JWT

- **Why:** Industry-standard authentication and authorization
- **Benefits:** Stateless authentication and role-based access control
- **Implementation:**
  - JWT tokens for secure API access
  - Password encryption using BCrypt

### Spring Data JPA + Hibernate

- **Why:** Simplifies database operations using ORM
- **Benefits:** Automatic query generation, relationship mapping, transaction management
- **Models:** User, Hotel, Room, Booking, Payment, Review

### H2 Database (Development) + Multi-DB Support

- **Why:** In-memory database for rapid development and testing
- **Production Ready:** Supports MySQL, PostgreSQL, SQL Server migration
- **Benefits:** Zero setup, auto schema generation, easy initialization

### Maven

- **Why:** Reliable dependency management and build automation
  - **Benefits:** Standardized project structure, plugin ecosystem, lifecycle management
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## Frontend Technologies

### React 18

- **Why:** Component-based UI framework with modern hooks
- **Benefits:** Virtual DOM, reusable components, large ecosystem
- **Features:** Functional components, custom hooks, context API

### Redux Toolkit

- **Why:** Predictable and centralized state management
- **Benefits:** Time-travel debugging, middleware support
- **Implementation:** Manages auth, hotel, and booking state

### React Router

- **Why:** Enables client-side routing for a single-page app
- **Benefits:** Dynamic routing, protected routes, nested navigation
- **Features:** Role-based route protection

### Axios

- **Why:** HTTP client with interceptors and response transformation
- **Benefits:** Automatic JSON parsing, error handling, request cancellation
- **Implementation:** API service layer with authentication headers

### CSS3 + Modern Styling

- **Why:** Clean, responsive, and interactive design
- **Benefits:** Responsive layouts, animations, gradients
- **Features:** Flexbox, Grid, CSS variables, media queries

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## AI & Advanced Features

### Google Gemini AI Integration

- **Why:** Leverages NLP and AI for customer support
- **Benefits:** Context-aware, intelligent responses
- **Implementation:**
  - AI chatbot for customer queries
  - AI-generated emails

- Role-based AI responses (Customer/Admin)

### WebSocket Integration

- **Why:** Real-time communication between clients and server
- **Benefits:** Instant updates and live synchronization
- **Features:** Price updates, booking notifications, availability changes

### Email Service with AI Enhancement

- **Why:** Automated and personalized communication
- **Benefits:** AI-generated content with HTML templates
- **Implementation:** Booking confirmations, welcome emails, cancellations

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## Architecture Patterns

### RESTful API Design

- **Why:** Standardized, predictable, and stateless design
- **Benefits:** Uniform interface and scalability
- **Implementation:** CRUD operations with proper HTTP codes and JSON responses

### Repository Pattern

- **Why:** Separation of concerns between data and logic
- **Benefits:** Testability, maintainability, database independence
- **Implementation:** Custom JPA repositories

### DTO Pattern

- **Why:** Secure and efficient data transfer
- **Benefits:** Field filtering, validation, API versioning
- **Implementation:** Request/Response DTOs for each endpoint

### Service Layer Architecture

- **Why:** Separate business logic from controllers
- **Benefits:** Reusability, testability, single responsibility
- **Implementation:** UserService, BookingService, HotelService, PaymentService

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## Security Features

## JWT Authentication

- **Why:** Stateless and scalable authentication
- **Benefits:** No session storage, cross-domain compatibility
- **Implementation:** Role-based access control

## CORS Configuration

- **Why:** Enable secure frontend-backend communication
- **Benefits:** Controlled cross-origin access
- **Implementation:** Custom CORS policy per environment

## Password Encryption

- **Why:** Secure password handling with BCrypt
  - **Benefits:** Salt-based hashing, configurable strength
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## Development & Deployment

### Environment Configuration

- **Why:** Separate dev, test, and prod environments
- **Benefits:** Secure and flexible setup
- **Implementation:** application.yml, .env files, and profiles

### Data Initialization

- **Why:** Auto-load sample data for testing
- **Benefits:** Quick setup, demo-ready environment
- **Implementation:** DataInitializer with mock hotels, users, and bookings

### Multi-Database Support

- **Why:** Flexibility for deployment across platforms
  - **Benefits:** H2 (dev), MySQL/PostgreSQL/SQL Server (prod)
  - **Implementation:** Configurable JPA setup
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## Key Features Implemented

### User Management

- Registration/Login with JWT

- Role-based access (Customer/Admin)
- Profile management with avatars
- Secure password storage

### **Hotel & Room Management**

- Hotel search and filtering
- Real-time room availability
- Dynamic pricing
- Image management

### **Booking System**

- Real-time availability checks
- Secure payment integration
- Booking history and management
- AI-powered email confirmations

### **Admin Dashboard**

- Manage hotels, rooms, and users
- Monitor bookings and transactions
- Role-based administration

### **AI-Powered Features**

- Intelligent chatbot
- AI-generated emails
- Context-aware support

### **Real-Time Updates**

- WebSocket notifications
- Live price and booking updates
- Instant confirmations

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## **❏ Conclusion**

This technology stack delivers a **robust, scalable, and modern** hotel booking management solution — powered by **AI integration, real-time updates, and enterprise-level security**.

