

Implementation of a Secure Hotel Management System using Modern Web Technologies

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Abstract - The Hotel Management System is a web based application created to make hotel work easier. Many hotels still manages their hotel related operations in manual way. Which take more time due to manual work can cause booking errors, billing mistakes, duplicate records and management problems. To solve this issue, the proposed system provide secure centralized platform for different hotel operations. The proposed system provide a digital platform where hotel operations managed in single platform. The proposed system helps to handle booking, billing, reporting and customer feedback in single centralized dashboard. The proposed system developed using modern technologies. Modern technologies like React.js, TypeScript and Tailwind CSS. These technologies help to build responsive and user friendly system. The Node.js and Express.js are use as backend technologies. This technologies help to build communication between frontend and database. These backend technologies handle the server side response and request. The PostgreSQL with Prisma is used to manage and store important data securely on cloud. JWT authentication is implement to provide security to the system. This provide secure login and access control which helps to protect user information. PDFKit is used to generate billing report automatically. After the customer exits the system the report generated automatically. The system include important modules to build better system. Modules are Room Management, Booking Management, Employee Management, Billing, Report Generation and Feedback and Rating Management. The developed system helps to reduce manual work and increase revenue. The proposed system improves the booking accuracy and make hotel management fast and easier. This developed system is simple, responsive, attractive, user friendly and suitable for small and medium level hotels.

Index Terms—Hotel Management System, React.js, Node.js, PostgreSQL, Prisma ORM, Web Application, JWT Authentication, PDFKit.

I. INTRODUCTION

The Hotel industry is one of the fastest growing industry in the world. Hotels must be manage multiple operations such as booking, employee management, customer handling, billing, reporting etc. Traditional hotel management industry uses a mostly manual methods. The traditional hotels mostly depends on the paper records. Due to manual methods resulting in operational delays, data inconsistency, booking conflicts, and inefficient data management. Modern hotels required automated system which is capable for handling large amount of data

efficiently. Nowadays hotel management system have essential tools for improving hotel management system operations and customer service. The smart hotel management system is designed to automate hotel operations using modern and advance technologies. The system allows the administrators to manage rooms, bookings, billing, employees, customer and reports through the single platform. The modern hotel management system develop a centralized dashboard to manage all operations. The project includes the modules such as Room Management, Employee Management, Checkin and Check-out Management, Billing and Report Generation, Feedback Management.

These modules are helps to improve the overall efficiency of hotel operations. These all modules align on single centralized dashboard which helps owners to save time. The Employee management module is used to manage and store employee details such as name, address, roles , salary and staff records. The room management module helps to handle room availability, room type, room pricing and and housekeeping status. The Check-in and Check-out management handle the customer booking status, room allocation and customer entry and exit records management. The billing module helps to generate revenue, payment records in pdf format. The feedback module helps customer to give reviews and rating about the hotel and staff services. Dynamic pricing help to adjust room pricing on customers demand.

In traditional hotel management systems, rooms prices are fixed and do not change according to customer demand. To solve this problem our project introduces the dynamic pricing feature, which predict the demand using past booking history and automatically adjust the room prices according to customer demands. This feature of our system is helps the owners to increase revenue and optimize the room utilization. This is one of the best features of our system. We developed the system using modern technologies. The frontend is built using React with TypeScript and Tailwind CSS. These technologies are useful to create responsive and attractive user interface. The

main motive to use this technology as frontend is understand the interface easily by the non-technical person also. The backend is developed using Node.js and Express.js, which handle the server side operations. JWT authentication is implemented to provide secure login.

This feature allow known user to use system. This feature block the unauthorized user from accessing the system, it gives the warning message. Prisma ORM is used for database operations. PostgreSQL (Neon Database) is used as a cloud database system. PDFKit is used to generate report in PDF format. Our smart hotel management system provide separate dashboards for admin and customers. Customer can search rooms, make bookings, place food orders and submit feedback. Administrators can manage rooms, employees, bookings, billing records, reports and customer review through a centralized dashboard. The system reduce the paper work and minimize the human errors. Smart hotel management operations improve speed, accuracy and reliability. This project helps hotels manage their daily work in an easier way. It reduces the manual work and save the time of both customers and hotel staff. The system allows customers to book rooms, check room availability, and generate bills online. The System administrators to manage employees, rooms, bookings and reports from single platform. The dynamic pricing feature helps the hotel adjust the room prices according to customer demand. This feature helps to increase owner income and room utilization. We built a system simple, secure and user friendly. The modern technologies are used to built website responsive and attractive. The overall system provide a efficient solution for hotel management. The proposed system is designed especially for small and mediumsized hotels that need a cost-effective, smart, and easy-touse hotel management solution. In the future, the system can be further enhanced by integrating features such as online payment systems, mobile application support, advanced data analytics, and AI based recommendation services to improve customer experience and hotel management efficiency.

II. RELATED WORKS

Many hotel management system have been developed to improves the services and manage the different activities. Existing system mainly store the customer details, employee information, booking, billing and report manually. To store the all hotel important information existing system used a paper. These system helps to reduce manual work but they still lacked proper data management, accuracy, security and data efficiency.

Later online reservation system are introduced to make booking easier and faster. These system allows user to check room availability and book rooms online. However, these system mainly focused on only booking feature. They did not add complete hotel management operations such as customer management, employee management, billing, report generation and customer feedback.

The Web Application allows administrators to manage all hotel management operations through the web browser. The web application make a single platform where all hotel management operations are performed. Some system also add features like revenue generation and and report generation. Even, So many

system still face the difficulties like poor user interface design, security problems, data scalability and system maintenance.

The modern technologies such as Node.js, React.js, Express.js, PostgreSQL now used to build responsive, faster, user friendly interface and to make attractive application. JWT authentication are mainly used to provide security to the system. JWT Authentication gives the secure login system and access control.

III. LITERATURE SURVEY

The hospitality industry has experienced rapid digital transformation driven by advances in automation, web technologies and data management. As the demand for efficient and userfriendly hotel operations increases, researchers have proposed various frameworks and systems for hotel management that integrate information technology, online accessibility, and database-driven functionalities. This section reviews key studies and technological developments relevant to the design and implementation to modern hotel management systems. Early research focused on the automation of hotel operations through desktop-based applications Yang(2013) presented a model for automating hotel administrative tasks such as room booking, billing, and check-in/check-out using structured architectures. While effective for internal operations, such systems lacked scalability and remote accessibility which are essential for today's distributed business environments. With the evolution of the internet, researchers began exploring web-based HMS solutions to provided real-times access and centralized data control. Singh et al.(2023) emphasized that web-based applications enhance service delivery by integrating online booking ,customer record management and billing features. Their findings demonstrated that web systems improve accessibility and scalability, but raised challenges related to secure authentication and database synchronization across multiple users. Several studies adopted PHP and MySQL as backend technologie for developing lightweight hotel management platforms. Patel et al.(2022) created a PHP-MySQL HMS focusing on online reservations and billing management. Although it provided basic automation, it lacked modularity and responsive design, limiting usability on mobile and modern browsers. These limitations encouraged exploration of more flexible frameworks such as flask and Django. In recent years, pythonbased frameworks like flask have gained attention for building efficient and scalable web applications. Sharma et al.(2024) demonstrated the use of flask for managing inventory and user data with integrated MySQL databases. The study highlighted Flask's advantages, including rapid development, restful API support, and strong database integration, which make it weelsuited for real-time hotel management systems. Parallel studies have explored mobile-first and cloud integrated HMS architectures. Yadav et al.(2025) devloped a mobile application for hotel automation, enabling customeres to manage bookings, check-ins, and feedback through smartphones. Similarly, cloud-based HMS systems provide remote access and data synchronization across multiple properties. However, many of these implementations lack complete backend integration. Finally recent research has begun integrating data analytics and

machine learning to enhance decision-making in hospitality. Vargas-Calder et al.(2021) and Ramzan et al.(2019) used sentiment analysis and predictive models to assess customer satisfaction and recommend hotel services. such studies illustrate the growing importance of intelligent, data driven tools in improving guest experience and operational efficiency. From the reviewed literature, it is evident that most existing HMS solutions emphasize process automation or online accesibility, but few combine with both modern, light-weight web technologies. Moreover, there remains a gap in developing secure, scalable, and fully web based HMS solutions that provide seamless data management, responsive user-interface, and multi-role access. To address these gaps, this research proposes a Flask-based hotel management system that integrates frontend web technologie (HTML,CSS,Javascript) with a MySQL database to deliver a centralized, efficient, and secure platform for managing hotel operations.

IV. PROBLEM STATEMENT

To develop a Smart Hotel Management System integrated with Dynamic Pricing using modern web technologies and cloud database system for automating hotel operations and improving revenue management.

V. METHODOLOGY

A. System Architecture

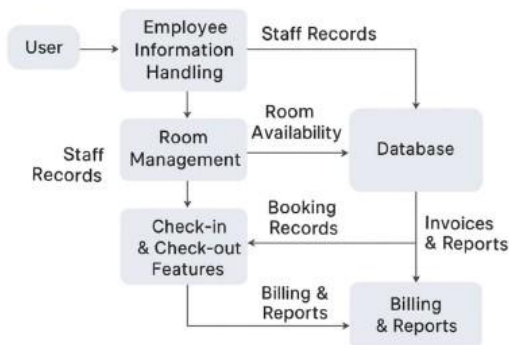


Fig. 1. System Architecture of Hotel Management System

The proposed hotel management system is built using a modern three layer architecture. This three layer architecture helps in managing hotel operations faster, securely and effectively. The system architecture is divided into three main parts:

Frontend Layer, Backend Layer and Database Layer. These three layers work together to perform different hotel management operations. Operations like room bookings, employee management, billing and report generation. The Frontend of the system is built using React with TypeScript and Tailwind CSS.

This layer provide a clean, responsive and user friendly interface. This layer provide attractive interface for both customer and administrator. The backend is developed using Node.js and Express.js. The backend helps to handle all server side operations. It build a communication between frontend and

the database. JWT authentication is implemented to provide security.

The database layer uses PostgreSQL along with Prisma ORM for store the hotel related data. It stores the important data such as employee records, room details, booking information, billing data and customer feedback. We developed the system using modern technologies. The frontend is built using React with TypeScript and Tailwind CSS. These technologies are useful to create responsive and attractive user interface.

The main motive to use this technology as frontend is understand the interface easily by the non-technical person also. The backend is developed using Node.js and Express.js, which handle the server side operations. JWT authentication is implemented to provide secure login. This feature allow known user to use system. This feature block the unauthorized user from accessing the system, it gives the warning message. Prisma ORM is used for database operations. PostgreSQL (Neon Database) is used as a cloud database system. PDFKit is used to generate report in PDF format. The proposed system is developed using modern web technologies. Software tools used to create secure, responsive and user friendly application. Different frontend, backend, database and tools are used for improve the system performance.

B. System Design Model

The Planning Phase: It would define the project objectives, requirements, and constraints related to student career prediction, anxiety detection. This would include determining the minimum level of accuracy and speed required for the career prediction, anxiety detection system and identifying the types of faces to be detected and the data to be used for training the system.

The Risk Analysis Phase: It would analyze potential risks associated with career prediction, anxiety detection such as algorithmic accuracy or constraints related to input data. Strategies would then be developed to mitigate or avoid these risks.

The Development Phase: It would create a prototype or a partial solution for anxiety detection, which could involve training a machine-learning prototype on a small set of datasets to evaluate accuracy and prediction. The evaluation of system would be evaluated, and areas for improvement are identified.

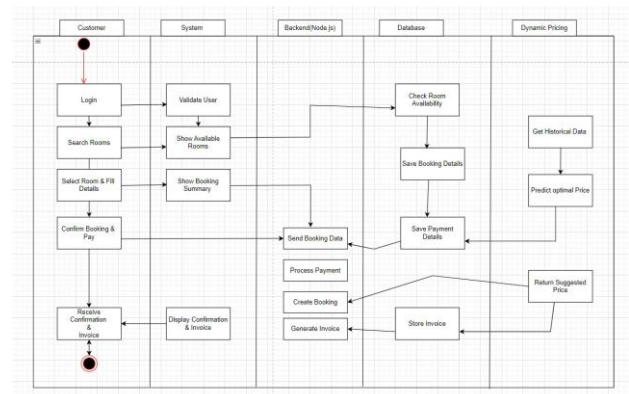


Fig. 2. System Design Flow Diagram

C. Development Module

The Frontend of the system is built using React with TypeScript and Tailwind CSS. This layer provide a clean, responsive and user friendly interface. This layer provide attractive interface for both customer and administrator. The backend is developed using Node.js and Express.js. The backend helps to handle all server side operations. It build a communication between frontend and the database. JWT authentication is implemented to provide security. The database layer uses PostgreSQL along with Prisma ORM for store the hotel related data. It stores the important data such as employee records, room details, booking information, billing data and customer feedback.

D. Technology Used

TABLE I
 TECHNOLOGIES USED

Category	Technology Used
Frontend	React.js, TypeScript, Tailwind CSS
Backend	Node.js, Express.js
Database	PostgreSQL (Neon), Prisma ORM
Authentication	JWT (JSON Web Token)
PDF Generation	PDFKit
Code Editor	Visual Studio Code
Operating System	Windows 10 or 11
Browser	Google Chrome
Runtime Environment	Node.js Runtime Environment

VI. FUTURE SCOPE

1. Online payment gateway integration.
2. Mobile application development.
3. AI based room recommendations system.
4. Multi hotel management support.
5. Multi language support for users.

VII. CONCLUSION

The proposed Hotel Management System successfully provides a digital solution for managing the hotel operations. The system automate important operations such as room management, employee management, room booking, checkin/check-out, billing, report generation and feedback. This system reduce the manual work. It helps to reduce booking errors and improves the overall management process of the hotel. The frontend developed using React.js, TypeScript and Tailwind CSS. This frontend technologies used to build user friendly interface. The backend developed using Node.js and Express.js handles system operations securely. JWT authentication improves system security by providing secure login and access control. The system also generate invoices and reports automatically using PDFkit. Which helps to improves billing management and reduce paperwork.

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