

An AI Integrated Online Hotel Management System

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Abstract

The rapid advancement in technology across all industries around the globe has paved the way for hospitality sector to reap benefits. Hotel management software has come an extended way in assisting hoteliers to amend the way their business functions. Hotel Management system includes many activities viz., maintaining hotel guest's records, booking, doing registrations, posting of bills and input room hotel rates, etc. Thus, handling the items manually creates great challenges because the process is tiresome and time consuming. This generates the need for automating the process. An efficient hotel management system not only ensures significant time savings across the whole business but also enhances the staff's productivity and contentment. The objective is to work towards the top goals of refining efficiency and increasing the guest experience. The main objective is to enhance customer experience and make businesses smarter besides automating the process of day-to-day activities of the hotel like searching rooms, booking rooms, booking tables, etc. Moreover, there are varied areas that need to be given serious attention in the hotel businesses for improved productivity and successful businesses. This varies from basic customer service, customize activities, more advanced troubleshooting and direct sales and direct mail processes which can be accomplished using AI Integration. To this end, this research presents AI incorporated Online Hotel Management System. This web application integrates AI driven chatbot and concierge, designed to deliver user friendly interface, allowing customers to ask questions and get almost instantaneous responses and ensures improved guests' experience. The application has been developed using front end and back-end tools PHP and MySQL respectively. It is realized that the developed system will ease down all hotel operations and streamline various tasks to a large extent.

Keywords: Online Hotel management, AI Integration, Online Hotel Reservation, chatbot, hotel operations

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INTRODUCTION

Hotel management is a branch of the hospitality business that entails managing a hotel's operations. The hospitality business is under pressure to separate itself from the competition as the number of travelers rises, and the travel industry undergoes significant changes [1]. The hotel industry's primary function is to promote the development of the hospitality industry. In many nations, hotels serve as a domestic extension. Hotel Management System manages an online hotel reservation system for business and leisure travelers throughout the world. Hotel Management system involves various activities like keeping record of hotel guests, booking, making registrations, and posting of bills, entering room hotel rates, using a luggage locker or a safety deposit box, guided tour service,

recreational and rehabilitative services, currency exchange etc. As a result, manually managing things is a significant difficulty because the procedure is laborious and time-consuming. As a result, it becomes necessary to use software to automate the procedure. Automation saves time, effort and money while also minimizing human error, thus allowing your company to focus on its core goals. Repetitive tasks can be completed faster. Automating processes ensure high quality results as each task is performed identically, without human error. Over the years, the use, and benefits of software in varied fields have been reported by many researchers. Sharma *et al.* has created an integrated fuzzy QFD software for effective decision making [2]; and Purohit and Sharma have presented Data mining driven forecasting tool for QFD practitioners [3, 4]. Customer needs' generation and prioritization through the software tool is demonstrated by Sharma and Khandait [5–7]. Literature survey on QFD and Software Engineering has been carried out by Sharma *et al.* [8].

A robust hotel management system saves time in almost every part of the business while also enhancing staff productivity and satisfaction. The purpose is to work towards the ultimate objectives of boosting efficiency and improving the client experience. The goal is to enhance customer experience and make businesses smarter besides automating the process of day-to-day activities of the hotel, like searching rooms, booking rooms, booking tables etc. Moreover, there are varied areas that need to be given serious attention in the hotel businesses for improved productivity and successful businesses. These include everything from fundamental customer support to personalization chores, advanced problem-solving, and sales processes and direct communications. This can be achieved using AI Integration.

As technology continues to grow at a breakneck pace across all industries, the hospitality industry has begun to employ embedded AI technology to provide a better client experience. AI is an additionally promising innovation to drastically develop and benefit the industry within the close future. It provides context centralized personalized services, chatbot, back-office automation and revenue accounting, post trip analysis, hotel staff assistance etc. Using AI technology, all services get enhanced or cost gets reduced. This study provides an AI-integrated Online Hotel Management System. To this end, this web application integrates AI driven chatbot and concierge, designed to deliver user friendly interface, allowing customers to ask questions and get almost instantaneous responses and ensure improved guests' experience. The application has been developed using front end and back-end tools PHP and MySQL respectively. It is realized that the developed system will ease down all hotel operations and streamlines various tasks to a large extent.

APPLICATIONS OF AI IN HOTEL MANAGEMENT

Context Sensitive Personalized Services

Personalization ensures that the guest has a positive experience, and that the client is satisfied. Data on client preferences, such as buying behavior, satisfaction levels, and likes/ dislikes, is decoded from personal/professional networks and several other sources to achieve personalization. However, gathering relevant data from a variety of separate systems and making useful inferences from it is the most difficult task here. To achieve this, AI can help in creating and refining hyper personalized campaign to increase revenue and customer retention.

Chatbot

Chatbots will scan keywords and respond with matching keywords from the learning database. The system will record, process, monitor, and learn every event that occurs around the guest, with the help of a digitally linked expert. Virtual assistant that communicates with guests and suggests services, offers, travel ideas, tips, and alternate plans.

Back-Office Automation and Revenue Accounting

RPA (Robotic Process Automation) is a fundamental tool in back-office automation that can perform work that would otherwise be performed by people. AI is capable of finding demand patterns, forecasting related prices, and even planning human resource requirements.

Post Trip Loyalty and Sentiment Analysis

Customers are drawn to hospitality businesses because of their loyalty program. Based on recommendation, hotels and service providers can create personalized smart videos and send them to guests. These could be about new offers, suggestions, or comparisons, among other things.

Hotel Staff Assistance

Concierge, Housekeeping, and Front-Desk employees all interact with customers on a personal level. AI can make real-time recommendations by tracking spending patterns and analyzing guest preferences [9].

RELATED WORK

The goal of the study, according to Priyadharshini and Joy, was to create an integrated Hotel Management System that could be used by both administrators and customers [10]. Customers will verify the availability of rooms at the preferred hotel when the admin informs them of the availability of rooms in various hotels. Customers can check to see if a specific hotel room is available. They can reserve available rooms ahead of time based on their requirements, making their stay more comfortable. Customers' reservation information is given to the Admin. Users should register and log in to the system. The administrator will have access to the reservation information as well as the regular income. The hotel department keeps track of seat availability and booking information in a database. This project protects both admin and user data. The administrator may be in charge of the hotel's several departments. The customer's check-in and check-out details are updated. Government entities that maintain track of all users registered in a specific state will benefit from this. The authorities can add hotel packages, room information, online booking, and room availability, among other things. Anyone who wishes to retrieve the information from the database or archives will be unable to do so; only authentication will be able to retrieve the right information from the files. This was developed using client-server application. According to Subramaniam and Lekha, the revolution of E-commerce industry boosts the immense growth and potential business opportunities of the online tourism market [11]. Emerging online travel booking operators have become a worldwide phenomenon, accounting for one-third of all global travel sales. Customers are enticed to shop online because of the best offers. Since the online agencies provide flexibility and accessibility, it is easy for tourists to search and buy travel products and services within a small fraction of time.

According to Delizo and Esguerra, the goal of this research was to build and develop an online reservation system that would be used for simulations by instructors and students at the College of International Hospitality Management [12]. Students will be able to experience a realistic scenario for jobs in hotel reservation and management, thanks to the system. The College of International Hospitality Management's Online Hotel Bookings System is a platform for faculty members to teach their students the fundamentals of hotel reservation. It also functions as a learning tool for students, as the system will teach them how to operate an online hotel reservation system, which is growing increasingly popular among hoteliers. Because faculty members can access the system and they will no longer acquire a similar system for the students, the College of International Hospitality Management uses an online hotel reservation system as a tool to improve services in the delivery of teaching. Each account had to have a username and password issued to it for security reasons. The creation of student and client accounts was managed and supervised by a system administrator.

According to Condino *et al.*, the mode of payment of the system is through credit card where 50% deposit is required for every reservation made [13]. Because the data is saved in a database, the system may be used to obtain information and present available rooms for reservations. Because it would feature a database where all information will be saved for security, the proposed system is similar to the Online Billing and Reservation System Waterville Island Resort. The planned system will also accept credit cards as a form of payment, and each reservation will require a 50% down payment. According to Adap *et al.*, the system contains two pages which are Administrator page and Customer page [14]. The Administrator page has full access to the system and will be able to alter all customer data for reservations made over the phone or walk-in customers, change the status of the

customers' reservations, and update the list of resort facilities. The administrator will also be able to generate reports containing information about the reservations made as well as the overall revenue received. Guesthouse online reservation system provides online room reservations, hotel information, and tourism information, according to Marco Polo [15]. The contact person's phone number and email address were clearly stated in the web system. Visitors can contact the contact person via phone or email if they have any questions. Guest suggestions are beneficial to the hotel's expansion. In any case, the internet system did not offer a real-time booking option. Guests must wait for confirmation within 24 h of making their reservation. To improve the current system, a system was created that allows guests to verify availability and receive quick confirmation of their booking. The goal of this function is to save time and money by eliminating email correspondence between guests and the reservation department. Reservation requests will no longer need to be processed, saving valuable reservation staff's time. Visitors can only see the photo for the bedroom, kitchen, and dining room, which was included in the web system. Visitors will be able to watch the entire room, from every angle, thanks to a more advanced function provided by the designed system. Marco Polo Guesthouse's present web system does not include housekeeping management. In addition to improving the operation of the created system, a 'Housekeeping' component was included to assist housekeepers with their everyday tasks.

Online Hotel Reservation Software (OHRS), according to Esparago, is a simple system that allows agents and hotels to make bookings online, allowing guests to reserve rooms directly via the internet once they have confirmed availability of rooms in accordance with the itinerary [16]. OHRS is a sophisticated and effective piece of software that is also very user-friendly. The OHRS gives you complete control and authority when reserving a hotel or motel room via the internet. This entails that one can accumulate all guest payments. In the Reservation System, enter your own room descriptions, amenities, pricing, and allocations. OHRS also allows you to confirm your reservation on the hotel's website in real time and complete the transaction without delay. Another research relating to the topic completed by Kian, as part of his bachelor's degree, similarly observed that Hotel Information Management Systems are growing more popular as the demand for additional hospitality service providers grows [17], hence any newly developed software must be able to meet all the services that the manager would require to provide for the ever increasing needs of the customers and this presents a lot of challenges for the Application developers in order to meet these needs. The Payroll Module, Room Maintenance Module, Food Ordering and Delivery Module, Housekeeping Scheduling Module, and E-Newsletter Subscription Module were all part of the system.

DESIGN AND IMPLEMENTATION

System Design Technologies

HTML, CSS, JavaScript, PHP, MySQL, and XAMPP are all used in the system's design. The database was designed using MySQL. Thereafter, the front-end (client-side) was designed to meet the users' needs using HTML5, CSS3, and JavaScript. The rationale for selecting these tools was to easily determine the content, appearance, and responsiveness of the webpage. The server-side (back-end) was designed using PHP to enhance the retrieval of data. The rationale being that the PHP code can be executed on all major platforms and can interact with numerous database languages including MySQL. XAMPP server was then activated, and SQL queries were written to interact with the database effectively.

System Architecture

A system architecture using only one single integrated model for the description of multiple views such as planning, requirement analysis, design, implementation, deployment, structure, behavior, input data and output data views, is a kind of system model as shown in Figure 1.

Use Case Diagram

A use case diagram is a graphic representation of how a user interacts with a technology. The administrators and customers are the users in this system (Figure 2).

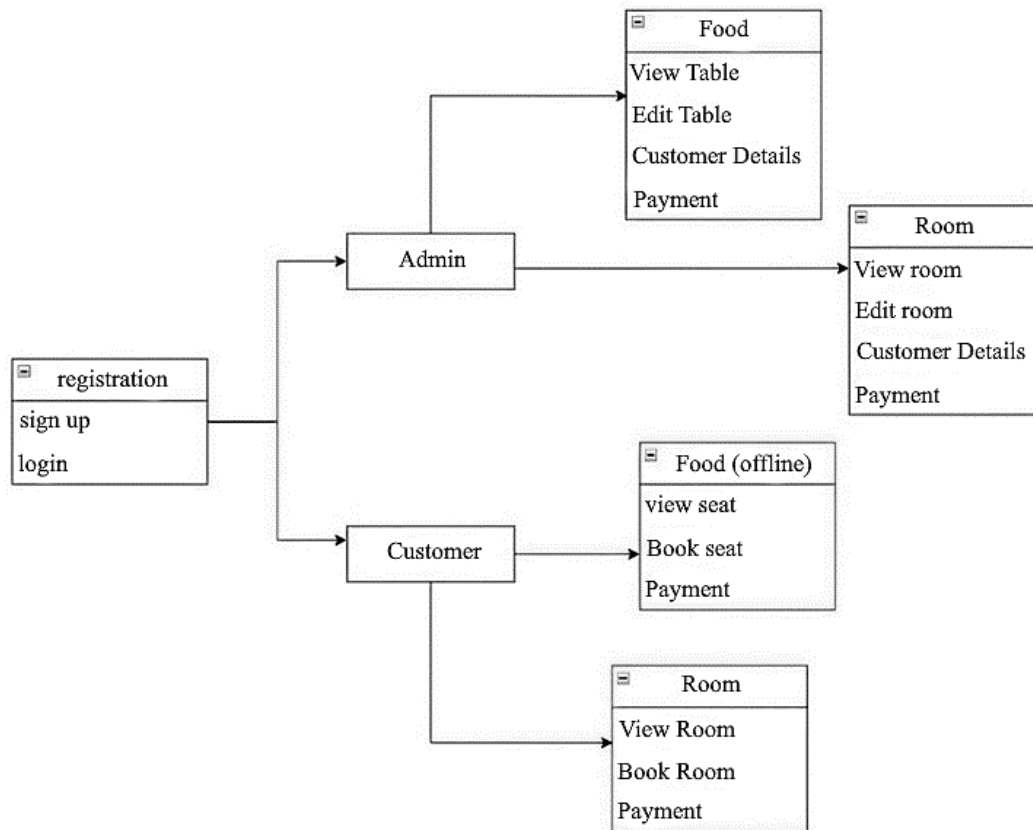


Figure 1. The architecture for the proposed system.

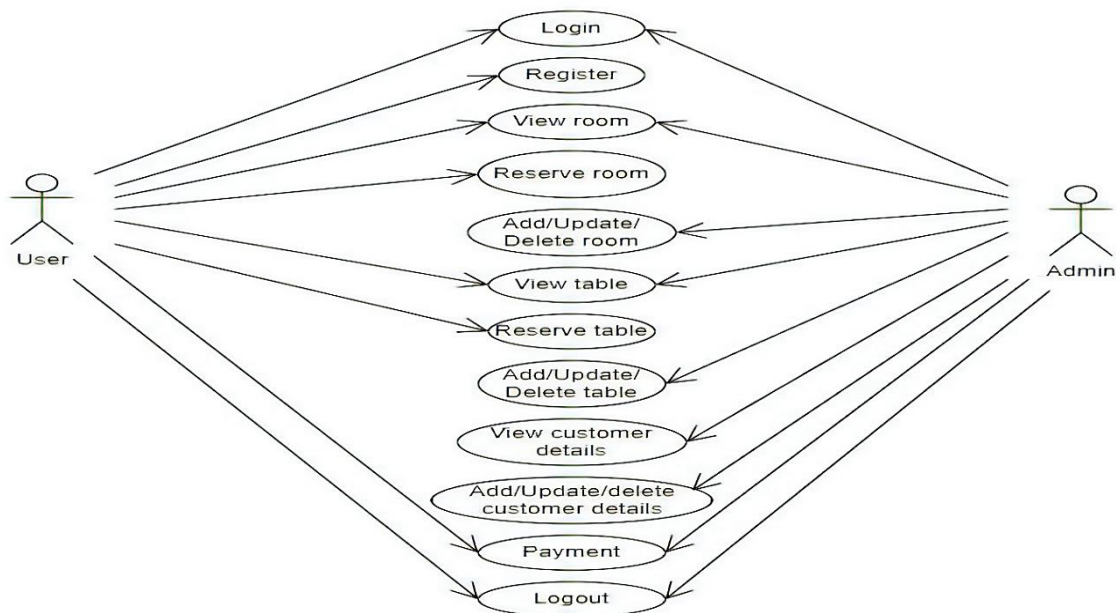


Figure 2. Use case diagram for the proposed system.

Activity Diagrams

A state chart, as shown in Figures 3–6. variation is an activity diagram, which is a graphical depiction of a set of executed procedural system actions. Activity diagrams describe parallel and conditional activities, use cases and system functions at a detailed level. Here we have program activity for user, admin, and reservation of rooms.

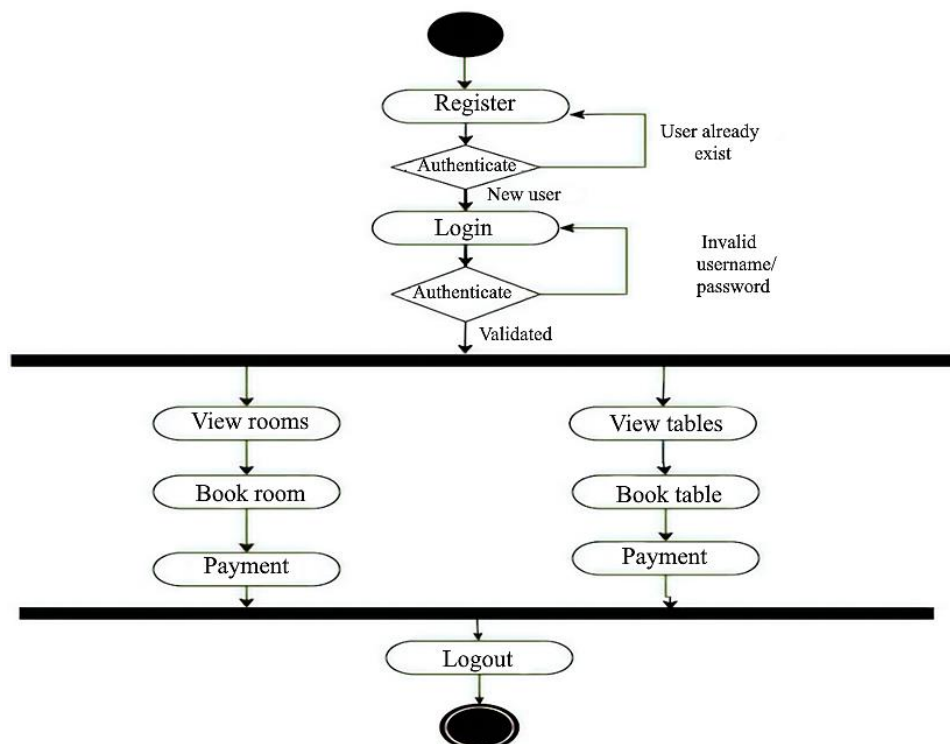


Figure 3. Program activity for user.

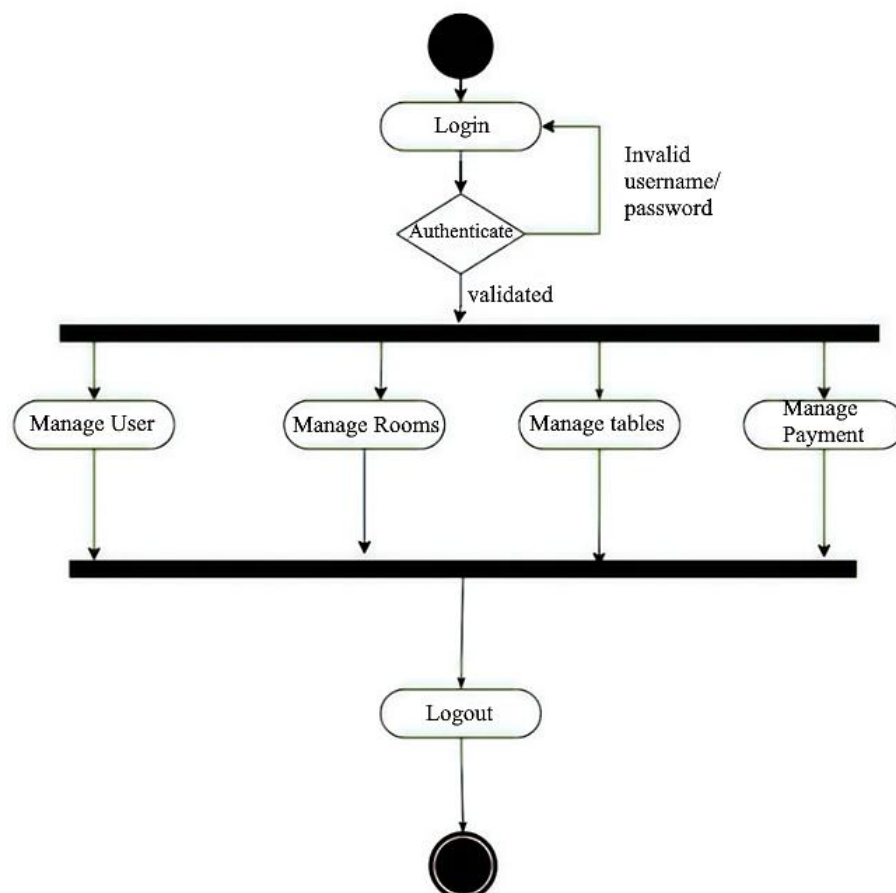


Figure 4. Program activity for admin.

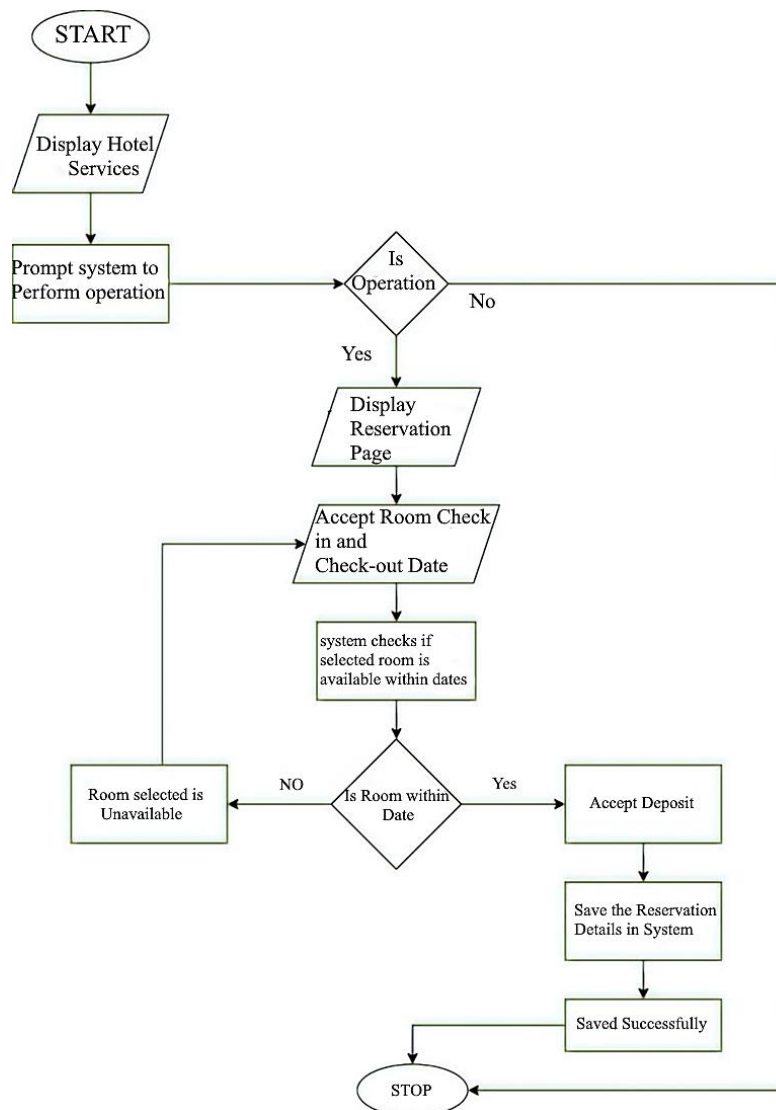


Figure 5. Program activity for reservation of rooms.

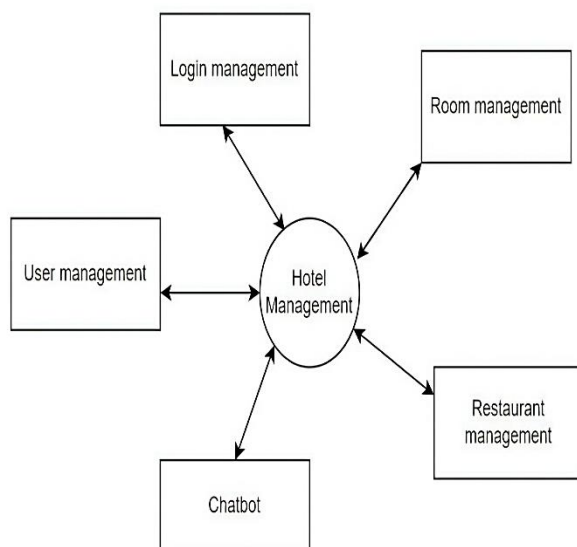


Figure 6. Data Flow diagram for hotel management system.

Database Design

The Tables 1–6 that are used in the proposed system are listed below:

Table 1. Login and registration.

Field	Datatype	Width	Constraint/Comment
FName	Varchar	20	
LName	Varchar	20	
Email	Varchar	30	Primary key
Password	Varchar	20	

Table 2. Field of Tables.

Field	Datatype	Width	Constraint/Comment
Name	varchar	20	
Email	varchar	20	Primary Key
Date	date		
Time	time		
People no	int		
Table num	int		

Table 3. Roombook.

Field	Datatype	Width	Constraint/Comment
Booking id	int		
Room ID	int		
Total room book	int		
Id	int		Primary Key

Table 4. User (admin).

Field	Datatype	Width	Constraint/Comment
ID	int		Primary Key
Username	Varchar	50	
Password	Varchar	50	

Table 5. Room.

Field	Datatype	Width	Constraint/Comment
Room ID	Int		Primary Key
Total room	Int		
Occupancy	int		
Size	varChar	30	
View	varchar	50	
Room name	varchar	50	
Descriptions	text		
Rate	double		
Imgpath	varchar	200	

Table 6. Booking.

Field	Datatype	Width	Constraint/Comment
Booking ID	int	200	Primary Key
Total adult	int	50	
Total child	int	50	
Check in date	Date		
Check out date	Date		
Spcl requirement	Text		
Payment status	Varchar	50	
Total amount	Double		
Deposit	Double		
Booking date	Timestamp		
First name	Varchar	50	
Last name	Varchar	50	

Field	Datatype	Width	Constraint/Comment
Email	Varchar	50	
Telephone no.	Varchar	20	
Add_line1	Varchar	100	
Add_line2	Varchar	100	
City	Varchar	30	
State	Varchar	30	
Postal code	Varchar	30	
Country	Varchar	30	

Implementation

User Interface

The implementation of the developed system is achieved by dividing the entire process into various modules and then coding them and validating the code. The developed application makes of total three modules (Figure 7).

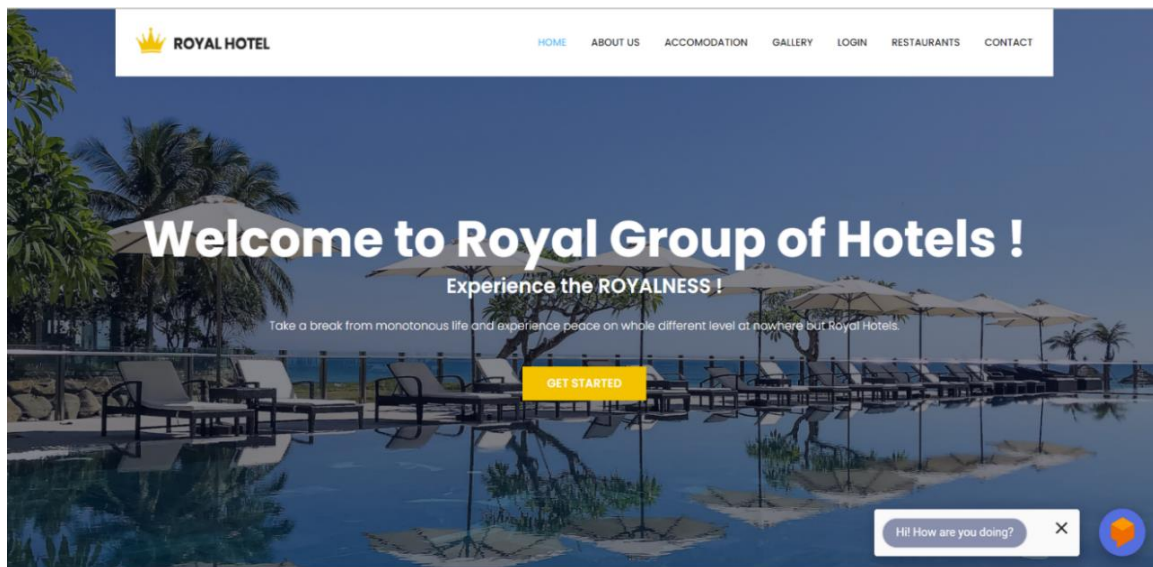


Figure 7. User interface (home page).

Registration Module

Signup

This signup page is for the new users who need to fill up the information as soon as they land on the website. It allows you to send a notification email to a specific email address when a new user signs up, as well as a confirmation email to existing users.

Algorithm

1. Get user Id (Name, password, mail, etc.).
2. If (id data validated in front).
3. Then send for backend validation.
4. Else.
5. Go back to 1.
6. If (backend validation OK).
7. Then user creation OK.
8. Else.
9. Operation failure.

Login

This option is for:

- Admin: Admin module allows system administrator to set up back-end of the system and perform basic system functions like add, update, and delete. And the website has been updated with the most recent version and features.
- User: Users can register, log in, and log out using the user module. Each user is assigned one or more roles.

Algorithm

1. Get (mail or username) and password.
2. In the event that (both match with the ones in the database) Then allow login.
3. Else.
4. Login failure.

Admin module

1. View customer details: In this section, the admin can monitor and check basic details of user.
2. View Rooms/tables: The admin can view rooms/tables which are available in the hotel at present.
3. Add rooms/tables: In this admin can add rooms and tables.
4. Update rooms/tables: When any customers leave the hotel, the room is updated as vacant by the admin on the website.
5. Delete rooms/tables: If any room or table is out of order by any issue so admin can delete from the page.

Algorithm for 1

1. Start.
2. If (login successful).
3. Display admin dashboard then select view record.
4. Retrieve customer details which is stored in database.
5. Else.
6. Login failure.
7. Return to step 1.
8. Stop.

Algorithm for 2

1. Start.
2. If (record==0).
3. Display message “room/table is empty”.
4. Else.
5. Retrieve current database record of rooms and tables.
6. Stop.

Algorithm for 3

1. Get new record (room type/table number, capacity, etc.).
2. If (record exists).
3. Display message “record already exists” and return to 1.
4. Else.
5. Successfully stored in database.

Algorithm for 4

1. Get old data (type, price, capacity, etc.).
2. If (record exists).
3. Enter new data and store it in database.
4. Else.
5. Display “record does not exist” return to 1.

Algorithm for 5

1. Enter the data which you want to delete.
2. System checks if it is present in the record and note the index.
3. If (data exists).
4. Then move all the components from index+1 to the left by one position and reduce the size by one.
5. Else.
6. Display “data not found” and return to 1.

Customer Module

1. View rooms/tables.
2. Book room.
3. Book table.
4. Payment.

Algorithm for 1

1. Start.
2. If (login successful).
3. Retrieve rooms/tables record.
4. Else.
5. Login failure return to 1.
6. Stop.

Algorithm for 2

1. If (login successful).
2. Display user landing page.
3. For a room reservation, enter the check-in and check-out dates.
4. The system determines whether the requested room is available within the specified dates.
5. Else.
6. Login failure return to 1.
7. If (room available).
8. Accept customer deposit based on capacity.
9. Save reservation information for the customer.
10. Else.
11. display “room not available” and go back to step 3.

Algorithm for 3

1. If (login successful).
2. Display user landing page and select table booking.
3. Enter dates for booking table.
4. System checks if selected table is available.
5. Else.
6. Login failure return to 1.
7. If (table available).
8. Enter details for booking and proceed.
9. Else.
10. Display “table not available” and go back to step 3.

Algorithm for 4

1. Start.
2. Order placed by client.
3. If (card valid).

4. Transaction complete.
5. At the end of the period, the cardholder receives a statement.
6. Else.
7. Display the notice "payment failed" and go back to step 1.
8. Stop.

Chatbot Implementation Module

We have used Dialog flow for implementation of Jarvis (chatbot) that simulates and processes human conversation, allowing people to communicate with digital devices as though they were talking to a real person. It will interact with user in two languages: English and Hindi.

Dialog flow is an artificial intelligence-powered tool for creating text-based conversational interfaces. It detects the goals of a conversation using Machine Learning models such as Natural Language Understanding. Intent detection in Dialog flow works like this: it first tries to understand the user utterance. Then, it will check the Dialog flow agent, which contains intents (or chat flows), based on the training phrases. The intent with the best match (highest confidence score), will return the answer, which could be a text response or a response from a system through a fulfillment.

Jarvis (English and Hindi)

Chatbot acts like user guide. A chatbot is a computer program that simulates and processes human communication, allowing people to communicate with digital gadgets as if they were talking to a real person. It will interact with user in two languages: English and Hindi as shown in Figures 8 and 9.

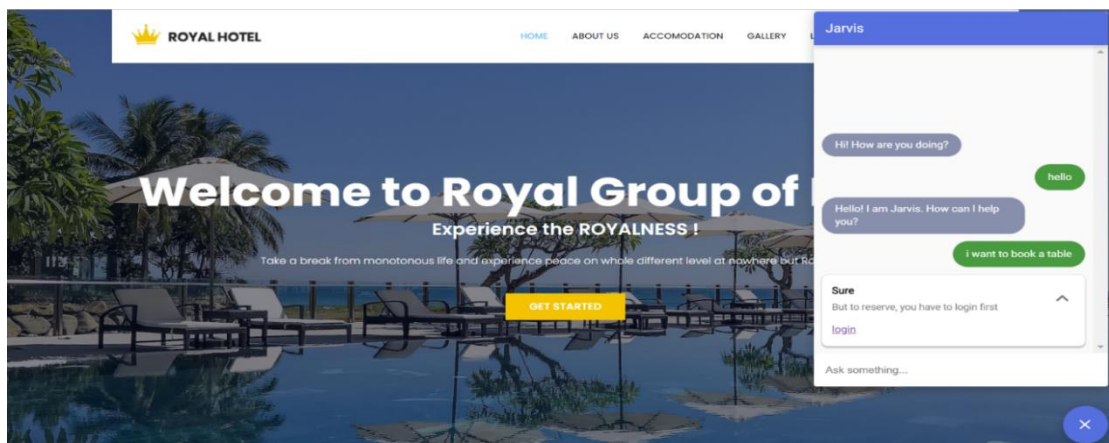


Figure 8. Jarvis (English).

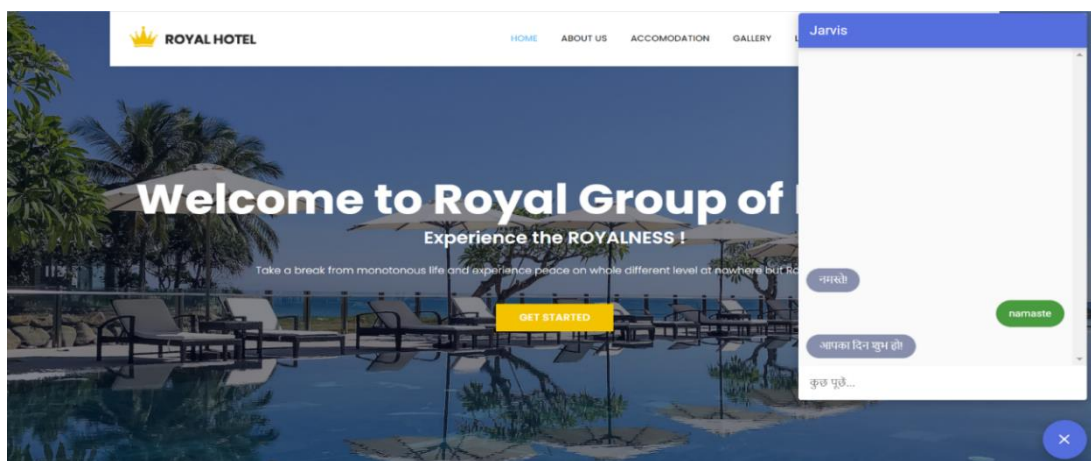


Figure 9. Jarvis (Hindi).

RESULTS AND DISCUSSION

The outcomes of the implementations are presented and discussed in this section. Two actors are involved in this study's application: Admin and Customer. To begin using the application, new users sign up to get registered in the system. Once successfully registered, login credentials, usually the username and password, are issued to the users which enable them to access the services available for them.

The connection of the user interface to the database ensures information centralization, unlike the paper-based approach that separates information into different storage thereby causing data inconsistency, replication, insecurity, and difficulty in updating information. Users are uniquely recognized and authenticated before being granted access to the system, ensuring data security. Furthermore, once the admin has successfully gained access into the system, the modules designed for the admin enables him to verify customer's payment to ascertain if it is legitimate.

The Home Page

The Hotel Management Information System's home page consists of three modules: registration, administration, and customers, as well as online restaurant reservations, as shown in Figures 10 and 11.

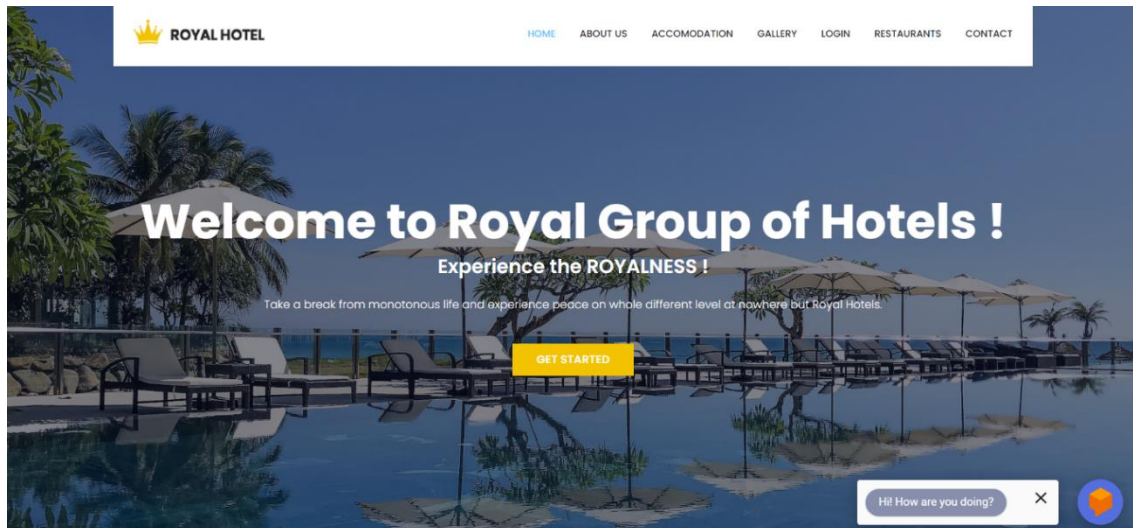


Figure 10. Home page.

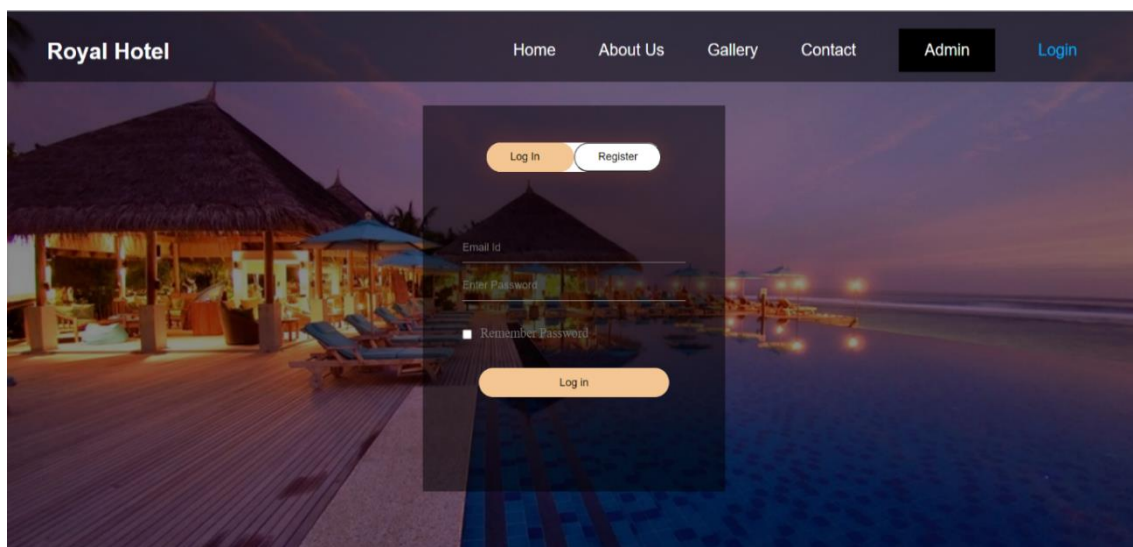


Figure 11. Login and Registration page.

The Login and Registration

A dialogue box appears on the login page, allowing the user to enter their User name and password. It also includes a login button and a checkbox for remembering the password. When the user enters a value, the input will be validated for either of the two required values, and if both are deemed correct validated, the application advances to the menu page, otherwise a message stating that the username and/or password are incorrect is displayed.

The registration page comprises of different fields and is for the new users who needs to fill up the information as soon as they land on the website. It allows you to send a notification email to a specific email address when a new user signs up, as well as a confirmation email to users who join up as shown in Figures 12 and 13.

Database Connectivity for Login

A database connection is a feature in computer science that allows client software to communicate with database server software, whether it is on the same machine or not. To send commands and receive responses, usually in the form of a result set, a connection is required. In data-centric programming, connections are an important concept.

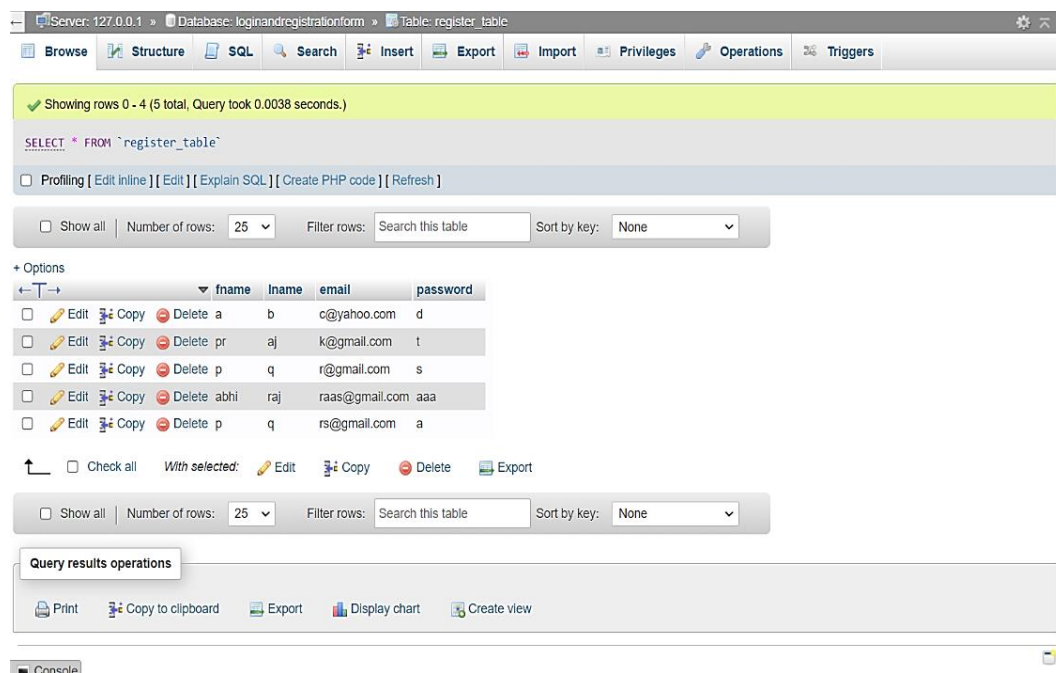


Figure 12. Database connectivity for login.

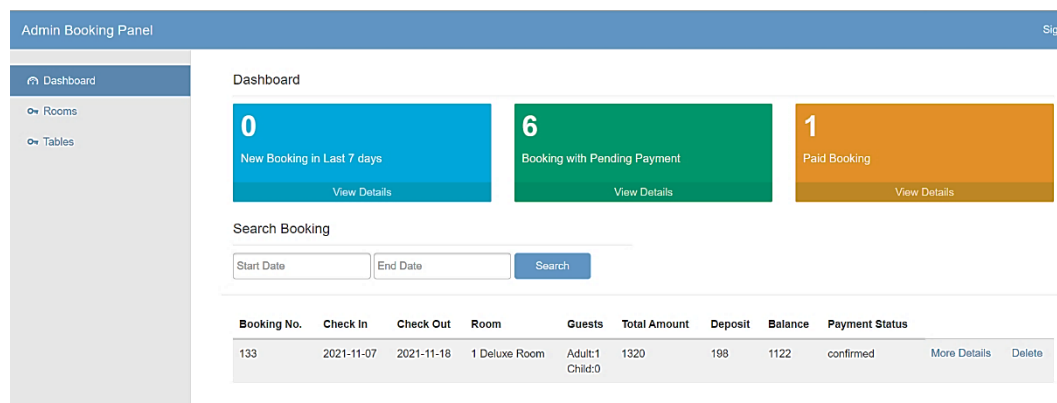


Figure 13. Admin dashboard.

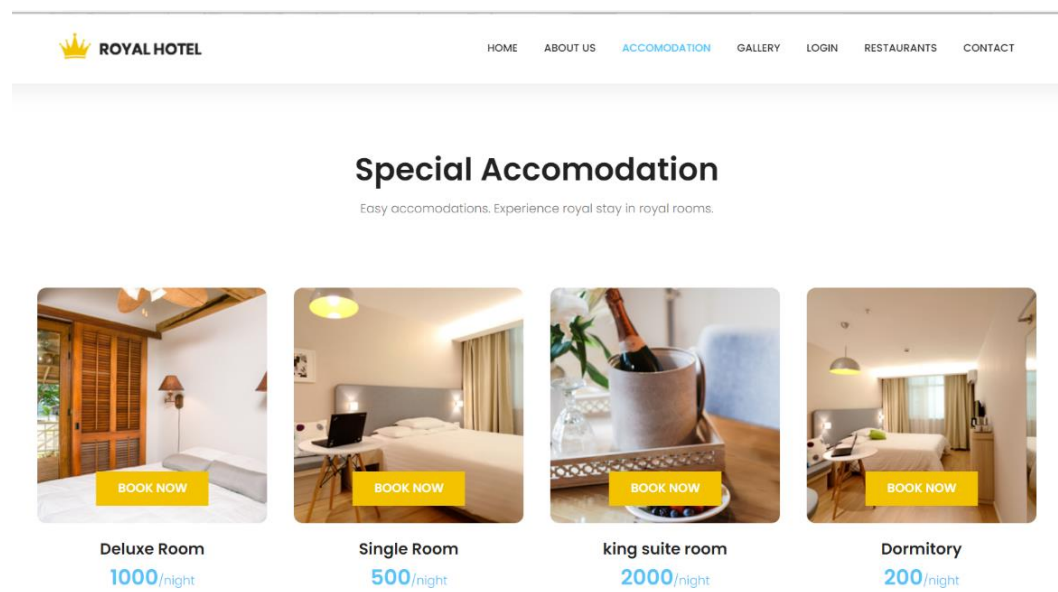


Figure 14. Accommodation.

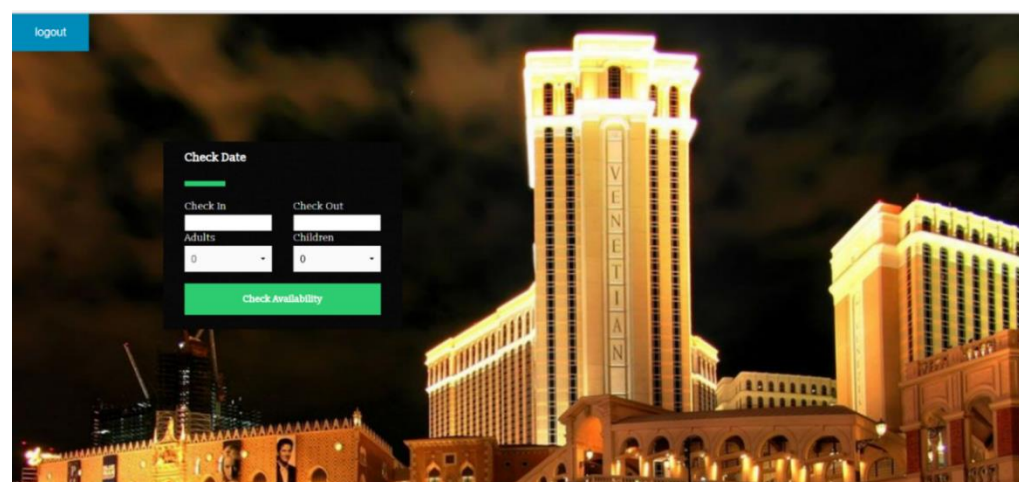


Figure 15. Reservation page.

Admin Dashboard

Admin module allows system administrator to set up back-end of the system and perform basic system functions like add, update, and delete. In addition, the website has been updated with the most recent version and features as shown in Figures 14 and 15.

Accommodation

In this we have included types of rooms available in the hotel that are: deluxe rooms, single rooms, king suite rooms and dormitories.

Room Allocation of Customers

Customers will be assigned to the room of their choice following the submission of their personal information as shown in Figure 16. The page requires the customer's name, which is selected from a dropdown menu, as well as the room, which is chosen from a list of available rooms in the dropdown menu. Administrators can also view, edit, and delete entries. The dropdown list only displays vacant rooms, and as each room is assigned to a specific client, the room status table is updated to occupied, thereby removing the room from the list of available rooms until it is manually updated to vacant status.

User information Data Connectivity

Users' information is saved in a database for room reservations as shown in Figure 17.

Customer Landing Page

In this page, we have included the 360° view of hotel for the better user experience. This is the landing page of customer, here they can book room and table according to their choice as shown in Figures 18 and 19.

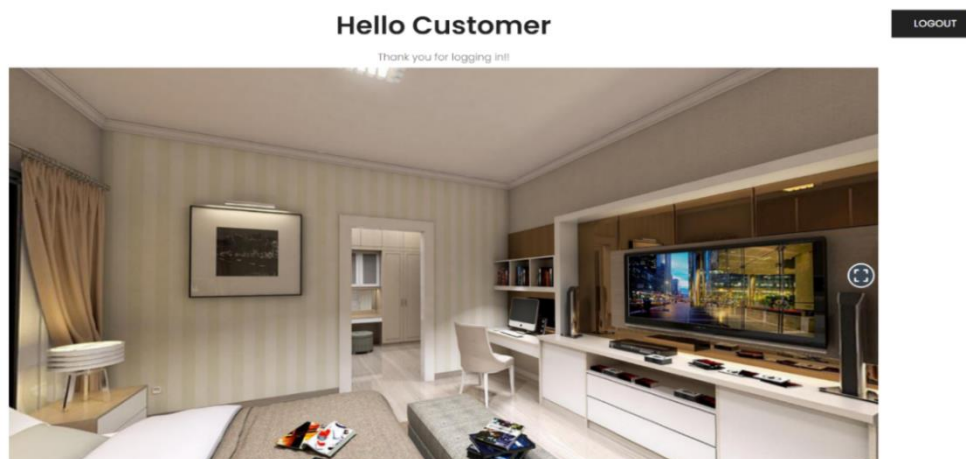


Figure 16. Customer landing page.

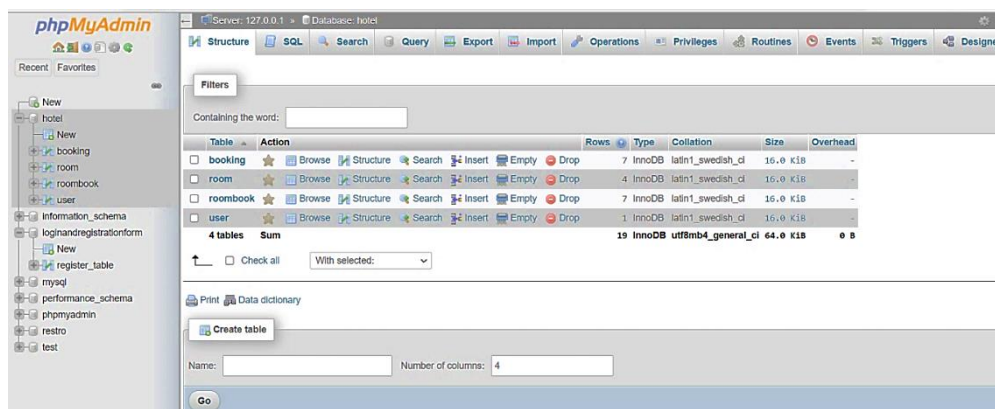


Figure 17. User information database connectivity.



Table



Room

Reserve Accommodation or Restaurant Table

Take a break from monotonous life and experience peace on whole different level at nowhere but Royal Hotels.

Experience the Royalness

Figure 18. Booking page.

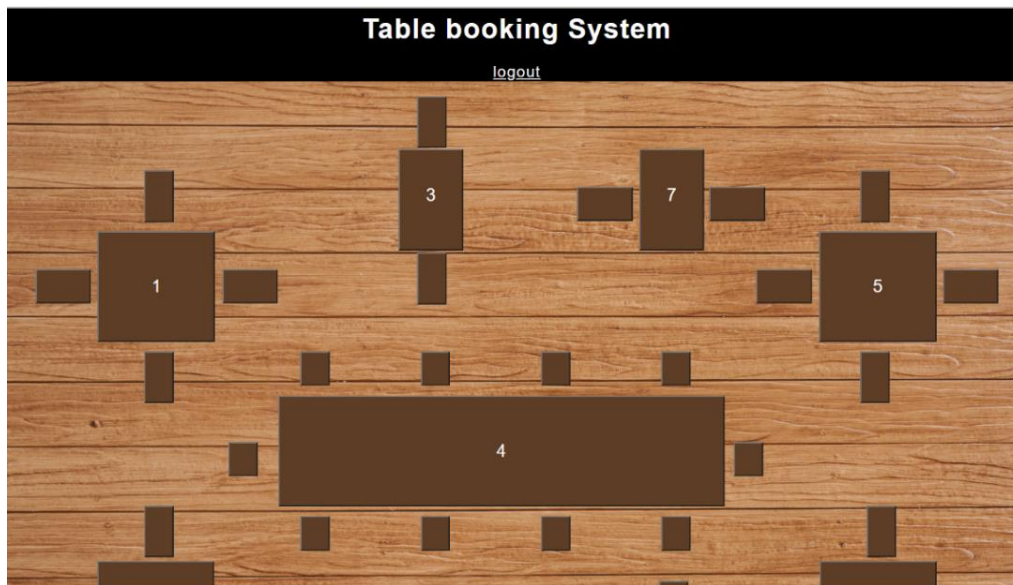


Figure 19. Seating arrangement table booking.

Restaurant database

Customer information for restaurant table reservations.

CONCLUSION

This research has presented an AI integrated online hotel management system that facilitates day to day activities of a hotel like searching rooms, booking rooms, booking tables etc. Moreover, in our research, the hotel bookings are made simple with many unique features so as to give customer a wonderful experience. An AI integrated online hotel management system is a website that makes booking an easy task along with a number of features that gives an enriching user experience. As a result, it fills the gap between hotel employees and customers. The online web application has the 360° view of the hotel for better experience. The web application makes use of chatbot and concierge, resulting in user friendly interface and experience. The research has also presented the various applications of AI in hotel management. The application has been developed using front end HTML, CSS and back-end tool PHP and MySQL. In summary, the result obtained from the implementation of the work and various benefits from the system is enough to entice all hotels, and these will go a long way towards improving the customer service quality. It is therefore suitable for all hotels where high performance of service is of prime importance.

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