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(Review Article)

Design and development of hotel management system using spring boot application

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Abstract

This paper focuses on recognizing the rapid pace at which the hospitality industry is being run and the need for properly run operations in various hotels to enhance guest satisfaction. This project provides them with an enhanced solution, Hotel System that is developed based on the Spring Boot, React, and MySQL Integration for effectively operating and managing hotels and improving the service standards by catering to the guest's needs promptly. The system benefits from the technologies defined in the modern web to develop a coherent and effective way of management in hotels.

Manual booking and writing down records on paper are not efficient and prone to mistakes. The current system suggests a solution that is contemporary to the vices mentioned above and also improves the security and access to the documents. Some of the subsystems include reservation of the rooms, management of the guests, management and authentication The underlying objectives of the Hotel System are to transform the ways of hotel operations with the help of popular technologies, to provide guests with a higher level of satisfaction, and to improve the organizational and management effectiveness.

Keywords: Hotel Management System; Spring Boot Application; Database design; Reservation Management; Amazon S3 Integration

1. Introduction

Since the competition is increasing within the hotel industry, it become necessary to implement new information Technology solutions. Effective implementation of IT can easily expand the scope of the business, decrease expenses, and improve the choice-making methods. For instance, key hotels have adopted sophisticated revenue management systems that enhance the identification of customers and their spending abilities, to increase their revenue [1]-[6]. "Typical examples of successful use of IT by foreign hotels in the management platform is Marriott" [1].

Challenges in the current domestic hotel development include:

- The lack of clearly defined markets results in projects with the excessive engineering aspects and inadequate productization, leading to higher development costs and fewer research incentives.
- Uncodified rules of the manufacturing market lead to companies' solitary activities, making product integration difficult because of market segmentation.
- A heavy emphasis on the administrative methods of product promotion and the use of conventional networks for advertising and is not conducive to the formation of its own product features and quality control [1], [8].
- 4) Our observation is that low-cost foreign brands dominate the market due to which local developers are barred from having favorable and good selling rates [9].

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- A contemporary approach to these problems is to create an information system for hotel room management and its implementation in the Java programming language using client-server architecture. It is a complete system that will cover the booking of rooms, registration of guests, check-out procedures, and even inquiries of the guests and the rooms. It also creates easy expandability of the platform as well as its maintainability due to the use of modular programming. It creates easy expandability of the platform and its maintainability [10]-[11]. "As a part of the business strategy of an enterprise, the revenue management platform seeks for the consumption capacity and potential of each guest to increase the overall revenue through automatic identification of customers" [1].

2. System Design

At this stage, the system design entails developing a detailed plan of the system from the requirements gathered during the analysis stage. This includes defining the general framework of the total system, the functional units of the system, and the database.

2.1. System Architecture Design

The system uses a three-level hierarchy integrated into a client-server environment as described in Fig. 1. below.

- Presentation Layer: It is also responsible for handling the relations of the interface layer with the user. Each time the user engages the platform, the client application receives the input, does computation based on the business logic, and then presents the results. In this Client-server architecture, the users address the system by getting through the client application.
- Business layer: This level deals with the main business objectives and is involved in the processing of client requests. It authors presentation logic as needed and interacts with the database. The outcomes of these processes may be a picture shown to the user or a new record added to the stored database.
- Data Layer: This layer is usually concerned with the activities related to the database. A primary function it serves is moderating access towards the relational database system thus regulating fielding, storing, and administering of data.

2.2. System Function Design

Users, after signing in, get the main working window of the application, and their action depends on the defined roles and needs.

Module Descriptions: The Authentication User Management Module is another distinct feature which is examined as follows:

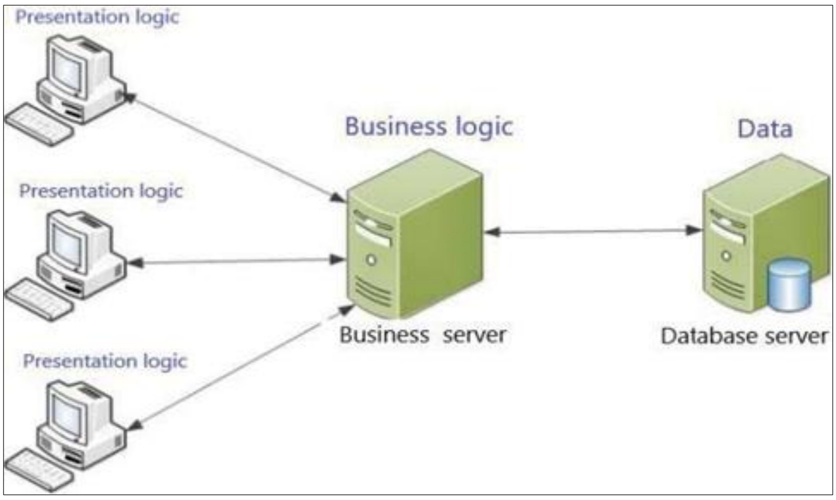

Figure 1 System architecture diagram

2.2.1. Authentication User Management Module

- Purpose: Control individuals who are allowed to create user accounts.

- Input: System’s personalized information (e.g., login credentials, user rights/privileges)
- Functions: Register new users, Authenticate users, Update user information, Delete user accounts
- Output: Users’ data and their authentication status.

2.2.2. Room Management Module

- Purpose: Manages all the rooms in the hotels.
- Input: Room details
- Functions: Add new rooms, Update room details, Delete room records, Retrieve room information.
- Output: Changes to the room inventory and information.

2.2.3. Booking Management Module

- Purpose: Administer the room bookings & reservations.
- Input: About customers such as their contact details and/or information about the rooms and/or dates of booking.
- Functions: Create new bookings, Update booking information, Cancel bookings, Retrieve booking details
- Output: Create record of the bookings and their corresponding status.

2.2.4. Customer Information Module

- Purpose: To manage customer profiles and captured data.
- Input: Personal details such as; credit card details, phone numbers etc.
- Functions: Creating new records of customers, Update customer information, Retrieve customer details
- Output: Controlled customer data and customer profile

2.2.5. Booking Lookup Module

- Purpose: It enable user or customer to search their booking details using the booking confirmation number.
- Input: User confirmation number.
- Functions: Booking confirmation number of the user will be accepted; Try to find records of the bookings matching the records given; To obtain and demonstrate the following information about a booking: the type of room, the dates of the reservation, and the payment status.
- Output: Booking details of the user.

2.2.6. Room Reservation Module

- Purpose: It involves the process that is used when reserving for the rooms.
- Input: The information on the reserves (for example customer name, and or type of room, dates).
- Functions: Create reservations, modify reservation details, Cancel reservations, Retrieve reservation information
- Output: Managed reservation records

2.2.7. Business Query Module

- Purpose: Expected to give queries and reports with business-related questions and findings.
- Input: Parameters such as the date when the analysis should occur and the type of customer to be included in the analysis.
- Functions: Retrieve check-out queries, Retrieve in-store guest queries
- Output: Query results

2.2.8. Security and Authentication Module

- Purpose: A prime responsibility to protect the system structure and manage users’ credentials.
- Input: Username and password, jwt tokens
- Functions: Authenticate users, Create and verify JSON Web Tokens, Implement security filters
- Output: Protect the identifiers of an authenticated session and a verified token

2.2.9. Exception Handling Module

- Purpose: Manage exceptions and errors when the application is being used.
- Input: Exception cases and the messages correlated to these cases

- Functions: Custom exception classes, Implement global exception handling
- Output: Message that contain error occurred in code.

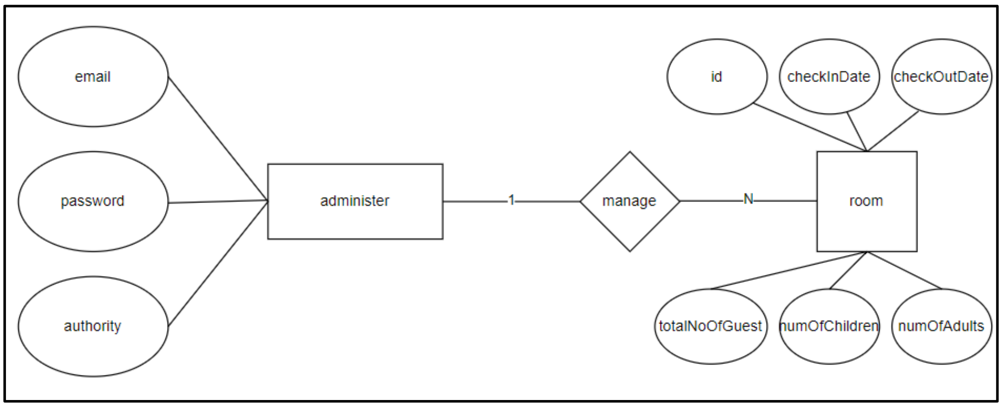

Figure 2 E-R diagrams

2.2.10. Booking Filtering Module

- Purpose: Allow the admin to select certain parameters by which guests and bookings should be sorted, for example, by type of rooms or by dates.
- Input: Hotel booking identification number and/ or any other searching parameters, such as the date of stay, and required type of rooms.
- Functions: Promote user input of filtering criteria, shows the bookings that meet some specified conditions; Reserve and display the filtered records of bookings and pertinent information such as the type of room to be booked, the dates, and customer information.
- Output: List of bookings that are filtered as per the mentioned criteria by the user.

2.3. Database Design

- Logical Structure Design: The logical structure design mainly includes the conversion of the conceptual structure design phase which is done in the form of an E-R diagram to a data model supported by the DBMS. Fig. 2. depicts the structural plan of the database for the administrators and the rooms details. In this framework, the key participants are administrators, rooms' types, room details, check-in details, reservations, check-out details, and anything related to them. All functions are centered on these entities and the relationship type between administrators and the rest constitutes many-to-one [1].
- Physical Structure Design: The physical database is a closer representation of the developed logical database, it contains detailed information on the physical organization of all the tables in the system database and the respective integrity constraints. The specific design of physical database depends on the specific database management system [1], [12]. Below are some of the data tables that were developed.

Some of the key data tables are

2.3.1. Booking Information Table

- Purpose: As shown in Table 1. it is used to store information about a given reservation.
- Attributes: Reservation ID, Check-In Date, Check-Out Date, Number of Adults, Number of Children, Total Number of Guests.

2.3.2. Room Information Table

- Purpose: As shown in Table 2. it is used to store information about the available rooms that could be let in a hotel.
- Attributes: Room ID, Room Type, Room Price, Room Photo URL, Room Description

2.3.3. User Information Table

- Purpose: As shown in Table 3. it is used to store a list of the users of the system.
- Attributes: User ID, Email, Name, Phone Number, Edison number such as the guest, the administrator.

In conclusion, the logical structure designs the conceptions about the relations and the entities of the system and the physical structure of the engages to ensure the looks of the designs are right and connective into the MySQL database so as to support their stability at the time they execute their purpose in the system.

Table 1 Booking Information Table

Name	**Type**	**Can empty**	**Meaning**
id	Long	no	Reservation ID.
checkInDate	Local Date	no	Check-In Date
checkOutDate	Local Date	no	Check-Out Date
numOfAdults	int	no	Number of Adults
numOfChildren	int	no	Number of Children
totalNumOfGuest	int	yes	Total Number of Guests

Table 2 Room Information Table

Name	**Type**	**Can empty**	**Meaning**
id	Long	no	Room ID
roomType	String	no	Room Type
roomPrice	Big Decimal	no	Room Price
roomPhotoUrl	String	no	Room Photo URL
roomDescription	String	yes	Room Description

Table 3 User Information Table

Name	**Type**	**Can empty**	**Meaning**
id	String	no	User ID
email	String	no	Email
name	String	no	Name
phoneNumber	String	no	Phone Number
role	String	yes	Role (e.g., guest, administrator)

3. System Implementation

In the case of extending the current Hotel Management System, after identifying these users and introducing the system architecture, the next place is to put the system into practice. Hence at this stage of the project, the major concern is to understand the needs with reference to the specification not only of the system but also of the logical and functional structure of the system as well as the technology to be utilized for the purpose. The implementation phase can be taken as a representation of all the above, this phase puts into real life the planned and analyzed system designs.

3.1. System Physical Structure:

In the physical context, the outermost layers of the Business Process Management System are; the login for users, the creation of rooms, the reservation aspect, the business question and answer section, the control of the customers, and the options for configuring the system. It contains check-out number, the guest's query, and a departing guest and a system setup module to enable the business of adding, deleting, or modifying room type, guest type, and operator type for the concerned business of the query Module., the above evaluation summary is correspondingly illustrated in the following evaluation frame.

3.2. Realization of Main Functions

System Login: Login interface helps the administrators to gain entry into the system. They select from the drop box the username, and then key in the password. The last piece of information declares that after three incorrect log-ins, the interface is left by a system. Moreover, an authorization obtained after successful login enables firms to perform other operations including billing, guest checkout, rooms bookings business inquiries, and customer control.

Room Reservation: This feature helps the guest to make advance bookings and hence, takes the room from the stock available and reserves the room status. Therefore, users can make new, or alter, or delete the existing reservations, and search the information using either the room number, or the name, or the guest.

Individual Check-in: On checking in, the administrators select an empty room; the particulars of the guests to be accommodated including the type of accommodation required, number of persons, and the length of stay are entered. The system locks the selected room and changes the status of the room to occupied and this is displayed in the main interface of the program.

3.3. Service Layer Implementation

To implement the functionalities, three RESTful service classes were created:

3.3.1. Booking Service Class

- saveBooking: Used in making a record of particulars related to the booking.
- findBookingByConfirmationCode: Enables one to get more information about the booking using the confirmation code.
- getAllBookings: Retrieves all the documents that exist in the specialization that concerns the entry and accommodation of customers.

3.3.2. Room Service Class

- addNewRoom: Helps to generate the input of the new room in the system.
- getAllRoomTypes: Retrieve all the possible room types that exist in the particular premise of the concerned establishment.
- getAllRooms: It summons all the rooms that have ever been developed in the system.
- getAvailableRoomsByDateAndType: A search that can be made specifically for rooms to let for a particular date and/or of a particular type.

3.3.3. User Service Class

- register: These actions include creating a new user account.
- login: Authenticates user login.
- getUserBookingHistory: Simply enables one to get history of the booking using the confirmation code.
- getMyInfo: Retrieves all the information that exists in the specialization about the customer

4. Conclusion

Innovating principles of software engineering put forward to the Hotel Management System offer an efficient and easily navigable interface for solving the problematic nature of management in the specific domain of hotels. In hiring Spring Boot as the backend, React JS as the frontend, and MySQL as the database system, the architecture is sufficiently flexible to meet the dynamic nature of today's hotels.

This way the employing of RESTful services in the system enables the concerns separation and enhances the maintainability of the system. Altogether, the classes known as Booking Service, Room Service, and User Service provide an adequate and effective tool for managing bookings or rooms and or information regarding the users. This made the development much easier in this case than the traditional approach and also would make it easier when extending the system through the new components meant with that in the future.

“This platform adopts the principle of software engineering and completes the design and implementation of hotel room management system by analyzing the market demand. The detailed design of each part ensures the complete implementation of the system”.

Key Achievements:

4.1. Enhanced User Experience

- The login and reservation interfaces are friendly, this improves the flow of communication between the administrators/guests and the system.
- This means that on the side of operation, the system is precise in regard to room booking, entry into the secrete as well as exit from the secrete.

4.2. Efficient Data Management

- MySQL plays the role of database of the system hence the proper and efficient storage and retrieving the data.

4.3. Scalability and Maintainability

- This is so because the combination of Spring Boot and React JS leads to the generation of a sustainable code. This is perhaps why plans have to be made with provisions for the future expansions as well as integration of new technologies.
- Thus, the contract based architecture of a RESTful system ensures its components are independent of one another hence easy to adapt to growing requirements.

4.4. Comprehensive Business Functionality

- Some of the functions include, among others, the following operations: bookings, accommodation checking in and checking out, and some questions about the structure organization and some clients.
- Such options as the possibility to custom configurations for the room types and other sorts of guests, as well as the similar view at the roles of the user are even more helpful in this particular case

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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