# E-Learning

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## 1 Introduction

originally before today's digital era, reservation systems were entirely manual, people had to make phone calls visit bus station or airports, go to the cinema or physically go to the university library to reserve a study room.people had to go to the booking location to reserve what they are asking,and this processs was full of drawbacks for example it was so unfair for people who lived far awy from the booking stations,for example if someone wanted to book a movie night cinema ticket he would have to go at day time to the cinema venue just to book the ticket before it rans out.similarly, a person needing to buy a bus ticket had to travel to the station, sometimes dealing with heavy traffic and long queues, only to find that their desired seat was unavailable. This was particularly challenging for individuals living in remote areas who had to travel significant distances just to make a reservation. additionally, hotels relied on receptionists keeping track of room availability in physical registers, which could easily lead to overbookings or errors in scheduling. Another major drawback of these traditional systems was their limited accessibility. Reservations could only be made during office hours, meaning that if someone wanted to book a ticket outside of working hours, they had no choice but to wait. This led to a lack of flexibility and often caused delays in travel or scheduling. Moreover, these manual processes were highly exposed to human errors. A simple mistake in writing down a date or misplacing a booking record could result in duplication of the reservation or conflictions, also it can result in losing a job of the one employee who made the mistake. this brings us to the introduction of the digital reservation systems with the development of internet in 1990 and the widespread use of mobile applications in early 2000s which changed all of these drawbacks in a significant way, it transformed the concept of the booking process from a exauhsting process to a process you can do from your home.this introduces the reservation systems which is a method used to allow the users and customers reserve services or book products,actually there are many different types of reservation system and is defined in several classes like travel(airlines and buses),hospitality(hotel room booking services),education(library room reservations),health care(doctor appointments),entertainment(cinema's ticket booking and concerts),etc , so now it is no longer required physical presence or making reservation phone calls.instead, customers now can reserve tickets, hotel rooms, or study spaces instantly from

their homes.this duplicate the manual type of booking that was used before,in addition it reduces the probability of human errors .and after the developing of the online booking systems many companies ,universities started integrating a online booking system.for example airlines started to integrate online ticket bookings,universities started developing online library room booking,and many other examples as mentined before,and in addition to that with the technology advancments there was the implementation of Ai,for example like cloud-based booking systems that allows integration with real-time updates,which introduces us to our project which is an online room booking website for university this project focuses on facilating the user interaction by implementing a user friendly design that simplifies the room reservation process,and by offering flexible room booking timings ,this system will provide students and faculty with an efficient way to reserve study rooms.The following section of this report will discuss the literature review on reservation systems.

# 2    Literature Review

Reservaion systems have been evolving throught the past few years,it is now classified one of the most improtant technologies that we have as it ensures the minimizations of conflicts and a smooth user experience The purpose of a literature review is to explore existing research and studies related to a specific topic. In this case, the evolution of reservation systems and the effectiveness of online booking platforms will be examined and we will highlight their advantages and disadvantages.This literature review will first explore the historical evolution of reservation systems, followed by an analysis of past studies on online booking platforms. The objective is to establish a strong platform for understanding the benefits and limitations of reservation technologies and how they apply to our university library room booking systems.

## 2.1    Early Manual Reservation Systems (Pre-1960s)

Originally, reservation systems were entirely manual , As People had to physically visit locations such as bus stations, hotels, theaters, or universities to book services. These manual methods were highly inefficient and not practical due to the following reasons:

time consuming: Customers had to wait in long queues for bookings or go through traffic jams. not realiable: as Mistakes in handwritten could lead to overbookings and lost records or duplicating the same reservation time. No real-time updates: If a booking was canceled, there was no immediate way to update the status.

for example:in hotels they relied on the receptionists to mantain the reservations, they where written in handwriting so if any updates or canceling in a booking was made it had a chance of not updating the reservation or if the reservation paper was lost, it will colapse the whole reservation system.

## 2.2 Computerized Reservation Systems (1960s – 1980s)

this was the first major change in the reservations technology, it was the development of computerized reservation systems (CRS). These systems were implemented in the airline industry to improve efficiency and reduce human errors. In 1964, American Airlines partnered with IBM to launch Sabre (Semi-Automated Business Research Environment), one of the world's first automated booking systems. it was in 1953 where the airline industry has seen a growth after the world war 2 and airlines were struggling to manage the link between airline and passenger reservations. This resulted in non realiability and that drove flights to be frequently over-or under-booked, passenger service issues, so american airlines realized that they were facing an issue in managing their reservations,so they needed a faster and reliable technology to develope a new intelligent booking system

it consisted of these following functions A database which holds all the records and all flights reservation data real time processing: data are frequently updated which leads to instant confirmation of the reservation and cancelling the bookings remote access:allows booking remotely

**Advanteges:**

- **before sabrine, making a reservation took almost up to 3 hours**

- **with subre this number was only reduced to a few minutes**

- **reduction of human errors**

**Disadvantages:**

- **it was very high in terms of costs**

- **limited access:as it was only in americanes airlines**

- **high system requirements:it was only working in large physical computers which is not very capable of anyone to have it**

## 2.3 Internet-Based Online Reservation Systems (1990s – Early 2000s)

The 1990s marked the rise of the internet, which revolutionized the booking process across various industries. people can now book tickets for cinemas ,reserve hotel rooms or any other services without any need to go to physical locations .Companies such as Expedia (1996) and Booking.com developed an online booking systems that allowed users to compare prices and make reservations. these following companies are the first major companies who started integrating their systems with online reservation systems

- **expedia airline company(1996):** One of the first online travel agencies who allowed online direct booking flights

- **booking.com hotel company(1996):** Started as a Netherlands-based hotel booking website

- **Hertz and Aviz car rentals company(1998):** Major car rental companies introduced online reservations.

- **IRCTC railways company(2002):** One of the first government-backed railway online booking systems.

- **Ticket master entertainment company(1998):** Allowed customers to book concert and event tickets online.

All of these companies above shared almost the same basics and functionality in there online booking systems which was

- **website interface:** where customers used to access their bookings and make reservations

- **real time availability:** websites was connected to a database to ensure live updates

- **online payments:** customers can pay online using credit cards or debit cards

,But all of this came with many disadvantages for sure and many challenges that they faced which was

- **slow internet speed:** As in 1990 dial-up internet connections made the websites load slowly

- **lack of secutrity:** lack of technology of encryption which made the customers really hesitate to access the website

- **limited trust in online payments:** this was a new sort of technology by that time which led to the fear of customers as they preferred cash or in-person transactions

Conclusion, The internet-based reservation systems of the 1990s–early 2000s led to the devolepment of the modern cloud-based and AI-driven booking platforms we use today, the challenges they faced back then led to many changes as they spend a lot of time thinking how to improve these systems to come up with of what we have no, and this what brings as to the next part.

## 2.4 Mobile and AI-Driven Reservation Systems (2010s – Present)

As internet-based booking systems became a main thing in the 2000s, the next major revolution in reservation technology came with the rise of mobile devices and artificial intelligence in the 2010s.These developments made the reservation systems more faster and more user friendly, easily allowing customers

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to book services instantly from their homes.Untill now mostly all of the online reservations was made using desktop computers,However, as smartphones became widely adopted, businesses realized the need for mobile-friendly booking systems. this happened By 2015,as more than 50 percent of online travel bookings were made via mobile devices, and By 2020 there over 70 percent of hotel reservations were completed on smartphones.,but why did that happen? why did the mobile bookings get so popular? The answer of that question is that Mobile reservation systems developed the booking systems by offering convenience, allowing users to make instant reservations from anywhere, coupled with 24/7 accessibility, enabling bookings at any time without relying on call centers or in-person visits; additionally, features like push notifications provided timely reminders for upcoming reservations, while faster transactions through mobile wallets and one-click payments streamlined the process, and google location services further enhanced the experience by suggesting nearby hotels, restaurants, or transportation options based on the user's location.This mobile apps had very good impacts on companies that we discussed before like Expedia,booking.com,etc was very thrilled by these developments as they used these technologies in their systems.

## 2.5   Ai impact on Travel  Transportation

Mobile apps now have reshaped the way people book flights and accommodations, Platforms such as Expedia, Booking.com, and Airbnb enable travelers to secure hotel rooms instantly, while airlines now offer mobile check-in and digital boarding passes as their systems are integrated with digital printers, reducing the reliance on paper tickets.Additionally, AI-driven pricing models adjust fares dynamically based on demand, ensuring cost efficiency for both companies and customers.Moreover, by integrating google location services it finds the best suitable and nearby location for the user

## 2.6   Ai impact on Education

Educational institutions has improved their booking systems to manage resources more effectively,Universities now have developed websites and systems that enables students to reserve study rooms and laboratory spaces in real time, preventing scheduling conflicts.  AI-based analytics can predict peak usage hours and suggest the best time slots for reservations, and it is integrated with databases so there is real time updates on the rooms and laboratories status of whether they are booked or not,and of course by enhancing the study part for student by creating technologies like automated exams feedback,and this can also reduce human errors

## 2.7   IRCTC ONLINE BOOKING(2023)

the IRCTC company stands for indian railway catering and tourism corporation, this company uses e-ticket technology which is a paperless electric ticket on

devices that is used for passengers to make reservations,typically most of the airlines now uses this technology,they wanted to measure the level of satisfaction of the passengers towards the online railway ticket booking through their application but they faced many limitations **Limitations:**

- **Internet Connectivity Issues:** their system faced unstable connectivity which let to failed transactions

- **Payment and Transaction Failures:** users claimed that there was a delay in transactions and failures

- **System Overload and Server Crashes:** the system struggled with highly crowded users

- **Poor User Interface:** some users found difficulty in navigating throuh the interface

- **Security issues:** the data handling technologies raised the customer's concerns

- **Limited Administrative Control:** no centralized adminstrators to manage bookings for customers

**How my system proposed improves that:**

- **using React.js ensures even if the internet connection is temporarily interrupted, the interface remains working and form data is retained, preventing session loss.and post gresql ensures that if a booking is submitted it is saved in the database even of connection was lost**

- **My university library room booking system does not involve payments which forbiddens the transaction failures entirely.**

- **Optimized API calls and efficient database indexing in PostgreSQL provides high performance system**

- **My university library booking system is built using React.js, ensuring high usability by improving the learnability and memorabality**

- **JWT (JSON Web Token) authentication is implemented to ensure that only verified users can access the system.**

- **The admin role has access to an admin dashboard in the university system that provides full control over bookings, users, and resources.**

To conclude,IRCTC booking system faced a lot of challenges and difficulties which still can be improved to ensure the optimum user experience with the system

## 2.8 International Journal of Modern Engineering and Management Research (IJMEMR) (March 2015)

This is a research paper that was published on March 2015,examines that a group of people attempted to develop online cinema ticket booking system,While this system successfully replaced manual ticket sales and provided a more usable and accessible online platform,it offered several good technologies,for example it was connected to SQL server which holds the system's database,and it was user friendly and easy to navigate in the interface,but unfortunately it also faced several technical and operational limitations. **Limitations:**

- **Uncustomized seat selection:** customers did not choose specific seats they had to go their and get help from the staff

- **Booking in the same day only:** the system only allowed the booking which is done in the same day of the movie, preventing customers to book a day,week earlier

- **Lack of Printing Functionality for Tickets:** system did not integrate with printing devices , which made it harder on customers by that time as they didn't have a hard copy of the ticket

- **No Role-Based Access for Admins:** Admins had limited control with managing the bookings and modifying it

- **lack of security:** Personal information and payment details were stored in unencrypted formats

- **System Lacked Mobile Optimization:** system was not designed to be working on mobile phones which limits the accessibility

**How my proposed system improves that:**

- **students can select available study rooms based on real-time availability, this is done with the aid of PostgreSQL**

- **Students can reserve room at any specific time from the upcoming 7 days**

- **The university booking system doesn't need any hard copy material,as the id of the student who made the reservation can be fetched from the database**

- **The proposed system has the admin role who can manage bookings and can cancel it,also he can manage users**

- **The system uses JWT authentication (JSON Web Token) for secure logins and data access control.**

- **The proposed system is Built using React.js, the university booking system support both desktop and mobile devices.**

To conclude , The Online Cinema Ticket Booking System (2015) was a significant step forward in online reservations world , but had many limitations and security issues that by these days these limitations can be improved to ensure the customer's satisfaction

# 3    Design Objectives

The design goal of this project is to implement an efficient and personalized booking system that serves the students needs in reserving study rooms seamlessly, while also make it easier for administrators to manage users and bookings clearly without any difficulty to interact with the system,by enhancing the usability by improving the learnability and memorability, ensuring that students can easily navigate through the interface and confirm the bookings they want to make in the room that has the features they prefer(for example a room that has white board and projector and a capacity of 5 students). Also a key goal of this proposed system is to eliminate human errors in room booking and scheduling ensuring that each student gets his personalized booking without interfering with other student's booking, unlike other booking systems that has double bookings issues or mismanagement by their admins or scheduling conflicts. This proposed system ensures the reliability as it automates room availability tracking with real time.Additionally has personalized features as it allows students to access their current booking and can have the ability to cancel them if they want with ease Another critical aspect of the system is improving the performance ,ensuring that the platform can handle a large number of users without lag or crashes. This is achieved by integrating the system with efficient database management using PostgreSQL, which optimizes query execution for faster data retrieval. This makes the system has the ability to handle a large amount of users without crashing or reduction on processing time. the system ensures quick response times, even during peak usage periods .Making the design learnable and user friendly was a main goal in developing this project and this can be achieved by using React.js for the frontend that enhances the response of the system, the system design ensures the consistency of the layout and color schemes to provide a smooth user experience. In addition Security and data protection are also central to the design of this project. The system incorporates JWT (JSON Web Token) authentication to ensure secure user logins, preventing unauthorized access and lowering the risk of hacks.

The main technical design objective is to build a fully functional E-Learning platform that fulfills all essential requirements of such platform. In order to achieve this target, the application's architecture follows the Model View Controller (MVC) design pattern. By applying this concept, each component could be developed on its own, enhancing the code maintainability. In addition to this main target, the architecture also aims to achieve the following targets:

- **Modularity**: Dividing the system into multiple components and services minimizes disruptions in future enhancements.

- **Role-Based Access Control (RBAC)**: Having different types of users assigned for specific roles and permissions defining the level of access for utilizing each feature. In the system there are three types of users, students, instructors and administrators.

- **RESTful API Design**: Implementing the RESTful API architecture in the platform facilitates the interaction between system components like the frontend and backend for example.

- **Secure Authentication**: The system utilizes the well known authentication technique, JSON Web Token (JWT) which grants sessions for each user and ensures controlled access.

- **Scalable Database Management**: PostgreSQL is used to manage the relational database and store all the relevant data. Using the relational database concept helps in maintaining the logical relationships between our system's entities.

## 3.1 System architecture

The online room booking system follows the Model-View-Controller (MVC) architectural pattern, which ensures clean code.The backend is built using Node.js with Express.js, while PostgreSQL is used as the relational database. The system follows a RESTful API approach, allowing seamless communication between the frontend and backend.
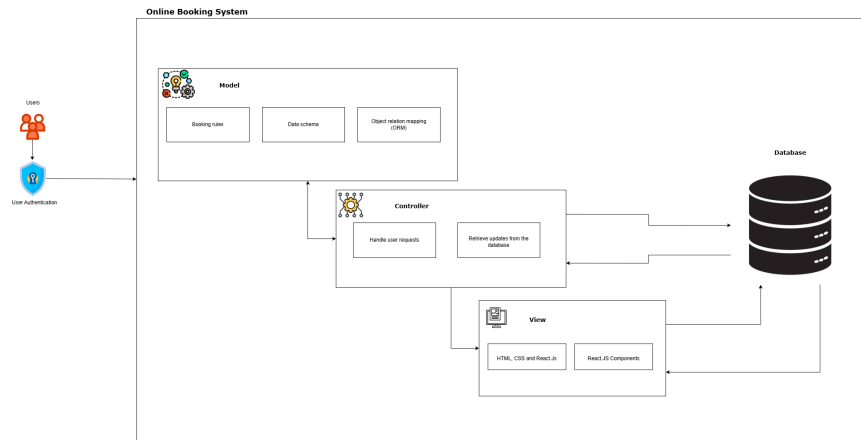


## 3.2 Model View Controller

The MVC pattern divides the application into three components: the Model, which handles data and business logic. The View, which manages user interface and the Controller, which acts as the middle-ware between the model and

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view. The following sections will provide a detailed explanation of how each component is implemented in this project.

### 3.2.1 Model component

The Model represents the platform's data structure and is responsible for interacting with the PostgreSQL database. It defines the schema for various entities such as Users, Courses and Quizzes. This ensures data integrity and relationships between them. Using an Object-Relational Mapping (ORM) like Sequelize, the Model layer abstracts raw SQL queries, making database interactions more efficient and structured. Additionally, the Model layer enforces business rules to ensure all the rules are implemented.
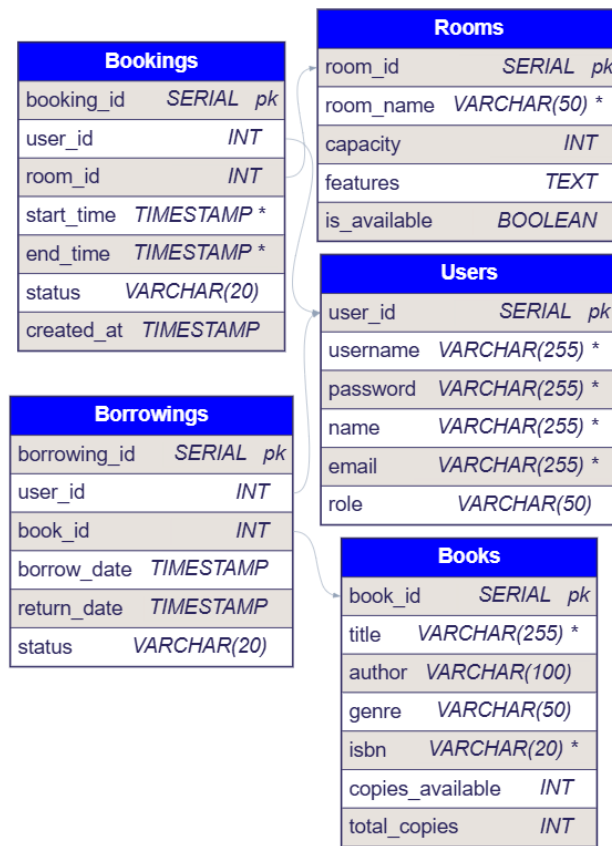
### 3.2.2 Controller component

The Controller acts as the connection between the model and the view. It handles incoming HTTP requests, processes the data, and redirects them to the necessary functions before interacting with the Model layer. Each request is routed through an appropriate controller, which then performs validation, authorization, and data manipulation. The Controller layer ensures secure and efficient data handling by implementing role-based access control (RBAC), preventing unauthorized users from accessing restricted features. Once a request is processed, the Controller returns a structured response to the client, either confirming a successful operation or providing error feedback.

### 3.2.3 View component

The View is responsible for rendering the user interface and displaying data fetched from the backend. The View layer consists of components that interact with the backend through RESTful API requests. It presents data such as available courses, upcoming deadlines, and quiz results to users. The View layer ensures a smooth user experience by rendering real-time updates, handling form submissions, and delivering relevant information based on user roles and permissions granted.

## 3.3 Database schema

The designed database schema ensures data integrity and the application of relational databases concepts. The ERD below illustrates the relationships between key entities in the database and a brief description for each entity:

**Bookings**

| | |
|---|---|
| booking_id | SERIAL pk |
| user_id | INT |
| room_id | INT |
| start_time | TIMESTAMP * |
| end_time | TIMESTAMP * |
| status | VARCHAR(20) |
| created_at | TIMESTAMP |

**Rooms**

| | |
|---|---|
| room_id | SERIAL pk |
| room_name | VARCHAR(50) * |
| capacity | INT |
| features | TEXT |
| is_available | BOOLEAN |

**Users**

| | |
|---|---|
| user_id | SERIAL pk |
| username | VARCHAR(255) * |
| password | VARCHAR(255) * |
| name | VARCHAR(255) * |
| email | VARCHAR(255) * |
| role | VARCHAR(50) |

**Borrowings**

| | |
|---|---|
| borrowing_id | SERIAL pk |
| user_id | INT |
| book_id | INT |
| borrow_date | TIMESTAMP |
| return_date | TIMESTAMP |
| status | VARCHAR(20) |

**Books**

| | |
|---|---|
| book_id | SERIAL pk |
| title | VARCHAR(255) * |
| author | VARCHAR(100) |
| genre | VARCHAR(50) |
| isbn | VARCHAR(20) * |
| copies_available | INT |
| total_copies | INT |

The university library room booking system is structured using a relational database model, where different tables store and manage data, for example like users, rooms, bookings, books, and borrowings. Each table is designed with data integrity and relationships,

- **Users:** Stores all information about the user. contains (user-id(primary key),username,password,name,email,role). It has one to many relation with the bookings table a user can make multiple bookings but the booking is only linked to one user,And it has one to many relation with the borrowings table,as a user can borrow multiple books,but each borrowing is linked to one user

- **rooms:** Stores informations about the study room that is available for booking. contains (room-id(primary key),room-name,capacity,features(noise cancelation,projector,etc),is-available).It has one to many relation with bookings table,as a room can have multiple bookings,but each booking is assigned to one room

- **Bookings:** Holds all study room reservations made by students.Contains (booking-id(primary key),user-id(foreign key),room-id(foreign key),start-time,end-time).It

has many-to-One with Users ,As multiple bookings can belong to one user,and has many-to-One relation with rooms,as multiple bookings can be made for the same room but at different times.

- **Books:** Stores library book details, tracking available copies and metadata.It contains (book-id(primary key),title, author,genre,isbn,copies-available,total copies).It has one-to-Many relation with borrowings table ,as a book can be borrowed multiple times, but each borrowing record refers to a single book.

- **Borrowings:** The Borrowings table tracks book loans by students.It contains(borrowing-id(primary key),user-id(foreign key),book-id(foreign key),borrow-date,return-date,sta has many-to-one relation with users table ,as a user can have multiple borrow records.

This database prevents overlapping in booking records by setting a unique constraint in the Bookings table, as each borrowing record has a borrowing-id. It also ensures data integrity, as foreign key constraints enforce referential integrity, ensuring that Bookings and Borrowings always reference valid Users, Rooms, and Books.

# 4    Design Milestones

The design process of the system consists of different milestones. The process was divide into the following phases:

- **Research and Technology Selection**: During this phase, a extensive research was done on the latest technologies and architectures in the web development field. After the research was conducted, Node.js and PostgreSQL were chosen as the core tools for developing this project. This was for many reasons such as the large number of online resources for both tools and the community support. Another reason was the vast majority of libraries and frameworks supported by Node.js. For example, it it offers multiple options for Object Relational Mapping (ORMs), such as Sequelize, TypeORM, and Prisma. By choosing these technologies, the project ensures utilizing the modern and efficient architecture.

- **Methodology**: There are several approaches of developing software like Agile, Kanban and Waterfall. Each technique has its own pros and cons. However, after weighing the options, the Agile methodology was chosen to be the technique implemented to develop the project. This methodology allows the project to be built feature by feature where every feature is tested before moving on to the next one.

- **Feature Development and Testing**: As stated above, each feature was designed, developed and tested on its own before integrating it to the application. For instance, new features were tested through their endpoints using Postman to ensure their proper functionality.

# 5  Design Options

Multiple technological choices were considered for each component of the system. The key choices were the backend framework, database management system, authentication mechanisms, and frontend framework.

## 5.1  Backend Framework

The choice of backend framework was critical to ensuring high performing code base. The main options compatible with Node.js were:

- **Express.js**
- **Nest.js**

**Decision:**Express.js was chosen due to its simplicity and ease of integration with other libraries.

## 5.2  Database Management System

The choice of backend framework was critical to ensuring high performing code base. The main options compatible with Node.js were:

- **PostgreSQL**
- **MySQL**
- **MongoDB**

**Decision:** First, there was a compentition between SQL and NoSQL database architecture, but after considering the systems's features and relations nature between entities like rooms, students and bookings, the decision was to go for an SQL database. Then the second choice between PostgreSQL and MySQL was to choose PostgreSQL due to the features which it supports such as views and stored procedures.

## 5.3  Authentication Mechanism

When developing an online library booking system, thinking about authentication and authorization is really important. There were a couple of authentication techniques considered such as:

- **JSON Web Token (JWT)**
- **OAuth 2.0**
- **Session-based authentication**

**Decision:** JWT was chosen due to its simplicity and how easily it integrates with Express.js and the RESTful APIs which the system was built on.

## 5.4 Frontend Framework

Choosing a Frontend Framework to showcase all backend functionalities are effectively represented. What adds to its importance is that in an E-Learning application, the user interface plays a vital role. It must be intuitive and easily accessible for all types of users, including students and administrators . The most popular options to integrate with Node.js are:

- **React.js**

- **Vue.js**

- **Angular**

**Decision:** React.js was selected as a reason for its seamlesss integration with Javascript. One of the advantages for example is that it makes use of JavaScript Extension, which is a particular syntax letting HTML quotes and HTML tag syntax to render particular subcomponents. Moreover, React.js is built on a component-based architecture which allows for building specific templates and reusing them elsewhere in the code.

# 6 Detailed Architectural Programme & Matrix

## 6.1 Features

The system incorporates a wide variety of features. Some features are role-related and some are accessible and for all types of users. These features serves the students needs in reserving study rooms seamlessly, while also make it easier for administrators to manage users and bookings clearly without any difficulty to interact with the system, and helping the administrators in their tasks. Additionaly, there are other types of general features such as fetching the user's current borrowing record and manage the bookings to help all users stay organized and on track.

### 6.1.1 Login and authentication

**Description:** The system implements a secure login mechanism using the JSON Web Tokens (JWT). Users must provide the system with the evidence, in this case the token, to be able to perform some user-restricted actions based on their assigned roles and permissions. This feature prevents unauthorized access and ensures that all types of users interact only with the features relevant to their roles.
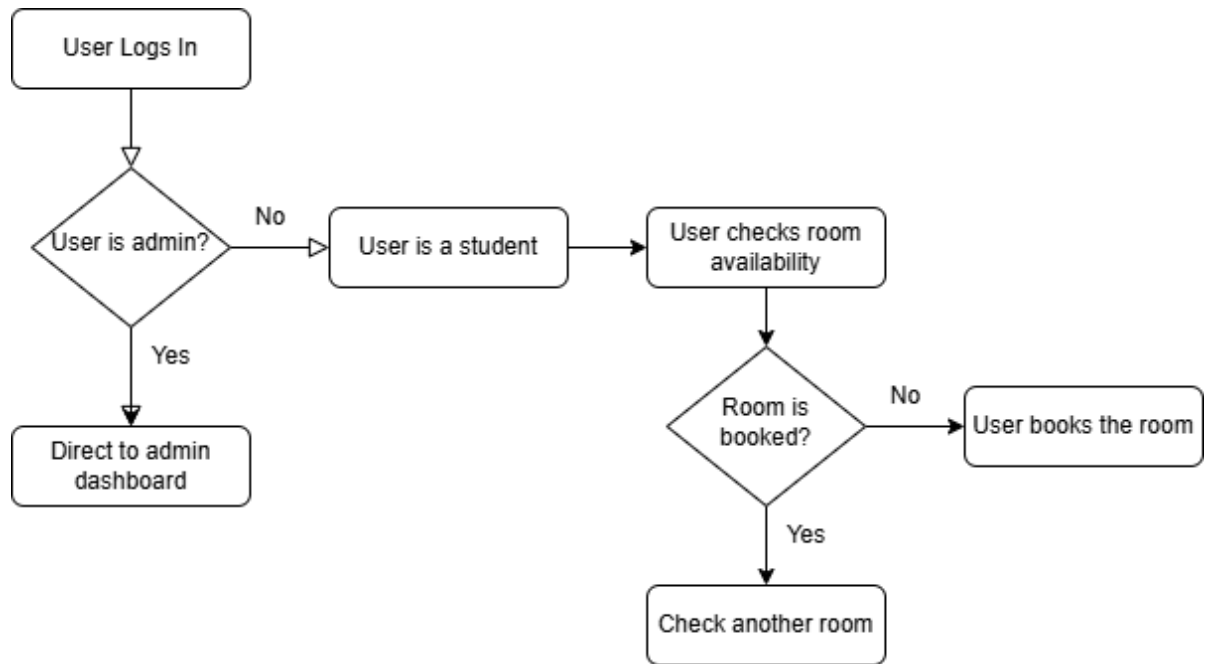
This flowchart for the university library room booking system begins with a login process. If the user is an admin, they are redirected to the admin dashboard, where they have access to several management functions. From this dashboard, the admin can manage users, add new books to the system, oversee and modify room bookings, and register new users.

If the user is a student, they are redirected to the student dashboard, where they can check the availability of study rooms. If a room is available, the booking is processed successfully, and the reservation is confirmed. However, if the selected room is not available at the desired time, the student is prompted to choose an alternative time slot or select a different room. This ensures that all reservations are handled efficiently and fairly, preventing scheduling conflicts and optimizing room usage within the university library.

## 6.2   Admin features

**Description:** Features that only users with the role admin can do.

- **Managing Users:** The admin has the ability to access and manage the list of students who are currently registered in the database. This is achieved by retrieving data from the Users table within the database, allowing the system to display an up-to-date list of all registered users. Through the admin dashboard, the admin can perform various user management functions, including blocking users, deleting accounts, or modifying user roles based on administrative needs. These features ensure that the system remains well-organized, secure, and accessible only to authorized users.

- **Managing Bookings:** The admin has the authority to view all current bookings.This is done by fetching the bookings table from the database. Including detailed information about which user made each reservation. This allows the admin to monitor and manage room allocations efficiently. Additionally, the admin has the ability to delete or modify any booking if necessary, ensuring that the reservation system remains organized, conflict-free, and accessible for all users. These administrative controls help maintain fair usage policies while preventing scheduling conflicts and ensuring optimal room utilization.

- **Adding books:**

### 6.2.1   Add course materials

**Description:** Instructors have the ability to upload the learning materials for the course smartly by providing the Google Drive links for the related material. This feature aims to save storage by not having to store the whole store large files directly in the system.

### 6.2.2   Assign TA

**Description:** Instructors can assign any number of TAs to specific courses and grants them the required roles such as exams grading, answering students' questions, updating deadlines and even adding learning material.

### 6.2.3   Add Exams

**Description:** Instructors are allowed to create and schedule exams within the system.

### 6.2.4   Auto exam correction

**Description:** In addition to the feature stated above, the instructor can supply the system with the model answer, allowing the system to auto correct and provide the instructor with the final grade and send it to the students.

### 6.2.5   Exam related material

**Description:** The system offers the feature to display a personalized feedback to the student at the end of each exam the recommended lectures and topics to revise based on their mistakes. This is done if the instructor chooses to link every question in the exam to its corresponding learning material.

### 6.2.6   Performance tracking

**Description:** Students have dashboards displayed on their registered courses' homepage to provide them an interactive overview throughout the course. These

dashboards get updated dynamically as students submits assignments or complete the learning material.

### 6.2.7   Register new users

**Description:**  Administrators have the authority to register new users and assign them to specific groups, instructors or students. They are also responsible to grant roles and permissions for each user.

### 6.2.8   Add course

**Description:** Administrators are able to add new courses to the system. Moreover, they are required to set the course prerequisites and define its description to be clear for instructors and students.

### 6.2.9   Manage users

**Description:** System admins are granted the permission to manage all types of users. This include updating their information, approving their requests, blocking inactive users and many other options.

### 6.2.10   Calendar

**Description:** The system displays a calendar all types of users to allow them to be up to date to the upcoming important dates.

### 6.2.11   Assignment submission

**Description:** The system offers an easy to reach submission functionality for all the assignments and exams.

### 6.2.12   Course enrollment

**Description:**  The system allows administrators to review all the students' enrollment requests and approve based on their credit points and prerequisites and other implemented business logic.

### 6.2.13   View materials

**Description:** Students who get enrolled in a course can have access to all of its visible materials like lectures, notes and videos. All of these are grouped in one interactive dashboard embedded in the course.

# 7   Future Enhancements

- **Personalized Grading:** The system should offer personalized grading and analytics for student's performance.

- **Discussion Forum:** The platform will be hosting a discussion forum where students can ask questions and discuss topics with the instructor and the instructor replies and gives feedback.

- **Artificial intelligence integration:**
  -Machine learning powered recommendation system which suggests materials based on the student's previous enrolled courses.
  -AI chatbot for support by providing instant answers for students' questions.

- **Setting goals:** Students will have daily or weekly goals which he creates and is showed in the student dashboard.

- **Enhanced Visuals:** Course materials will be including interactive simulations to enhance users' engagement.