



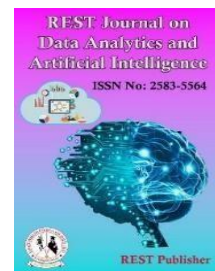
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## Campus Venue Booking System

\*Rangisetty Ajith, Alluri Sathvika, Nagulapally Srija, P Archana

School of Engineering Anurag University, Hyderabad, India.

\*Corresponding Author Email: [ajithrangisetty@gmail.com](mailto:ajithrangisetty@gmail.com)

**Abstract.** The Campus Venue Booking System is a web-based application designed to streamline and automate the process of reserving venues within an educational institution. Traditional venue booking methods, such as manual paperwork, spreadsheets, and email-based requests, often result in scheduling conflicts, inefficient approvals, and lack of transparency. These inefficiencies lead to double bookings, delays, and difficulty in tracking venue utilization, affecting academic and extracurricular activities. This system provides a centralized platform where students, faculty, and administrators can browse available venues, request bookings, and receive instant confirmations. Users can reserve venues such as auditoriums, seminar halls, and classrooms for lectures, meetings, and events. The system automates conflict resolution, ensuring that only available venues can be booked, and suggests alternative options in case of scheduling overlaps. A key feature of the system is secure authentication using Firebase, which ensures that only authorized users can access and manage reservations. Role-based access control allows faculty and administrators to have priority booking privileges, while students follow approval workflows. The system also integrates an automated notification mechanism that sends email and SMS alerts for booking confirmations, reminders, and cancellations, ensuring effective communication. By leveraging cloud-based storage, AI-driven scheduling, and real-time updates, the Campus Venue Booking System enhances efficiency, security, and transparency in venue management. This project aims to reduce administrative workload, prevent scheduling conflicts, and optimize venue utilization, ultimately improving campus operations.

**Keywords:** Campus Venue Booking, Online Booking, Seminar Halls & Auditoriums, Faculty and Student Access, Secure Login, Event Scheduling.

### 1. INTRODUCTION

The Campus Venue Booking System is a web-based software application designed to automate and simplify the venue reservation process. This system serves as a centralized platform where students, faculty, and administrators can search for available venues, submit booking requests, and receive real-time confirmations [1-3]. Educational institutions often struggle with efficiently managing venue reservations due to manual booking processes, miscommunication, and scheduling conflicts. Traditional methods, such as paper-based requests or uncoordinated email communication, can result in overlapping bookings, underutilized spaces, and administrative delays. The Campus Venue Booking System is designed to address these challenges by providing a centralized digital platform for booking and managing campus venues [4-5]. This system enables students, faculty, and staff to easily check the availability of venues such as auditoriums, seminar halls, and conference rooms. Users can request bookings based on specific dates and times, reducing the risk of double bookings and improving resource utilization. The system's secure login mechanism ensures that only authorized users can access the platform, protecting venue management from unauthorized modifications [6-8]. One of the major advantages of this system is automation. Unlike manual methods that require human intervention for confirmation and tracking, this platform streamlines the entire booking process [9]. Users receive instant

confirmation, and administrators can monitor venue usage in real time. Additionally, the system helps institutions maintain better transparency, as booking records are systematically stored for future reference [10]. By implementing a Campus Venue Booking System, institutions can improve operational efficiency, enhance communication between event organizers and administrators, and ensure fair and systematic venue allocation. This not only saves time but also optimizes venue usage, making event planning more effective and hassle-free [11]. Another major benefit is improved communication. Event organizers, faculty members, and students can receive instant notifications regarding booking approvals, rejections, or modifications. This eliminates the need for continuous follow-ups, reducing miscommunication and ensuring smooth event planning. Furthermore, the system can integrate with institutional calendars, ensuring that venue schedules align with academic and extracurricular activities. By implementing a Campus Venue Booking System, institutions can streamline the reservation process, enhance efficiency, and optimize venue utilization. The system reduces dependency on manual interventions, minimizes scheduling errors, and ensures that venues are allocated fairly and transparently. Ultimately, this leads to a better-organized campus environment where academic and cultural events can be planned and executed seamlessly.

**Background:** Venue management is an essential component of university operations, ensuring that classrooms, auditoriums, conference halls, and other shared spaces are efficiently allocated for academic and extracurricular activities. Traditionally, venue booking in educational institutions has been handled through manual processes, including paper-based requests, email communications, or spreadsheets, which are prone to scheduling conflicts, miscommunication, and administrative delays [12-14]. As universities expand and student engagement in extracurricular activities increases, the demand for efficient venue management systems has grown. A digital booking system that provides real-time updates, automated scheduling conflict detection, and secure user authentication can significantly enhance campus resource management [15-17].

#### Challenges in Traditional Venue Booking

- Time-Consuming Processes: Manual approvals and coordination slow down the booking process.
- Lack of Real-Time Availability Tracking: Users cannot instantly verify if a venue is available before making a request.
- Scheduling Conflicts: Multiple users may unknowingly request the same venue at the same time, leading to confusion.
- No Centralized Data Storage: Bookings are scattered across different mediums, making it difficult to retrieve historical data.
- Unauthorized Bookings: Without proper authentication, unauthorized users may misuse university resources.
- Inefficient Communication: Users are often unaware of changes, cancellations, or approvals due to the lack of automated notifications.

To address these challenges, modern technology solutions such as cloud-based applications, real-time databases, and automated scheduling algorithms are increasingly being adopted. The proposed Campus Venue Booking System leverages these technologies to provide a seamless, automated, and efficient venue reservation experience.

## 2. LITERATURE SURVEY

Venue booking systems play a crucial role in managing shared spaces efficiently in various domains, including educational institutions, corporate offices, conference centers, and sports facilities. Several types of venue booking systems exist, ranging from traditional manual methods to semi-digital and automated solutions. However, despite advancements in technology, many existing systems still suffer from inefficiencies related to conflict resolution, security, and real-time tracking [18-20]. This section provides an overview of existing venue booking systems, their limitations, and the gaps that this project aims to address.

Year	Author	Title	Description	Limitations
2017	Lalitha V (Associate Professor, Sri Sairam Engineering College, Chennai, India)	Online Venue Booking Management System	Web portal for searching and booking venues, managing availability, payments, and reservations.	May not support dynamic pricing or integration with third-party services.
2021	Kumar et al	Calendar synchronization in campus booking system	Improving real-time availability and reducing double bookings.	Focuses on technical integrations without addressing potential user adoption issues.

FIGURE 1: Literature survey

### Overview of Existing Systems

Current venue booking systems can be broadly classified into three categories:

- Manual Paper-Based Systems
- In many universities, venue bookings are handled through paper-based request forms. Users (students, faculty, or event coordinators) must submit a physical form to the administration, which manually checks availability and either approves or rejects the request.
- Example: A student requests an auditorium for a seminar by filling out a paper form and submitting it to the admin office. The administrator checks a physical logbook or spreadsheet before confirming the booking.
- Spreadsheet-Based Systems
- Some institutions use Excel spreadsheets or Google Sheets to maintain records of venue availability and bookings. This method digitizes the paper-based system but still requires manual intervention.
- Example: An administrator maintains a shared spreadsheet listing available venues. Faculty members can email a request, and the admin updates the sheet accordingly.
- Basic Online Portals
- Some universities and organizations have developed basic online portals that allow users to submit venue booking requests via a website or application. However, most of these systems still lack automation and require manual intervention for approvals.

Example: A university website allows students to submit a booking request form. The request is reviewed by an admin before approval.

### Limitations of Current Systems

Despite various technological advancements, most existing venue booking solutions suffer from several critical limitations, including:

- Lack of Real-Time Booking Confirmation
- Many existing systems do not instantly confirm bookings. This leads to overlapping requests, where multiple users submit requests for the same venue without knowing whether it is available.
- In manual systems, administrators must physically check and verify bookings, which is time-consuming and error-prone.
- Manual Intervention for Conflict Resolution
- Most systems require human administrators to manually resolve conflicts when multiple users request the same venue.
- This often results in delays, mismanagement, and favoritism, reducing fairness and efficiency.
- Lack of Automated Notifications and Cancellations
- In manual or semi-digital systems, users do not receive automatic booking confirmations or reminders.

- If an event is cancelled, there is no automated venue release mechanism, causing inefficient venue utilization.
- Without reminders, users may forget about their bookings, leading to underutilization of venues.
- No User Authentication and Security
- Most traditional systems do not have authentication mechanisms to verify user roles (e.g., Student, Faculty, Admin).
- This can lead to unauthorized bookings, cancellations, or misuse of university resources.
- No Integration with Institutional Databases
- Existing systems do not integrate with university academic calendars or student databases, making it difficult to align venue bookings with academic schedules.

For example, a lecture hall might be booked for an event without considering ongoing classes, causing disruptions.

### Identified Gaps in Literature

Based on the analysis of existing systems, several gaps have been identified that need to be addressed to improve efficiency, accuracy, and user experience.

- Limited Automation in Booking Approvals and Availability Tracking
- Current Challenge: Manual and spreadsheet-based systems require administrators to verify bookings manually.
- Identified Gap: There is no automated venue availability tracking or conflict resolution system.
- Proposed Solution: Implement an automated, AI-driven system that instantly verifies venue availability and approves bookings in real-time.
- Inefficient Conflict Resolution Requiring Human Intervention
- Current Challenge: If two users request the same venue at the same time, manual intervention is required to resolve the conflict.
- Identified Gap: There is no algorithmic solution to detect and resolve scheduling conflicts automatically.
- Proposed Solution: Develop an automated scheduling algorithm that detects conflicts and suggests alternative venues and time slots.
- No Integration with User Authentication Systems

Current Challenge: Many existing systems lack proper authentication mechanisms, allowing unauthorized bookings.

Identified Gap: There is no role-based access control (e.g., students should have restricted booking privileges).

Proposed Solution: Implement Firebase Authentication to ensure that only authorized users (students, faculty, and admins) can book venues.

### Lack of a Centralized History of Past and Upcoming Bookings

Current Challenge: Many institutions do not maintain a structured database of past and upcoming bookings, making it difficult to track venue usage history.

Identified Gap: There is no centralized, accessible database that allows users to review past bookings or administrators to analyse venue utilization trends.

Proposed Solution: Use Firestone (NoSQL Cloud Database) to maintain a structured booking history for audit, reporting, and analytics.

**Problem Statement:** Managing venue bookings efficiently is a crucial requirement for universities and educational institutions. Various academic and extracurricular activities, such as lectures, workshops, student meetings, and cultural events, require designated venues that must be reserved, scheduled, and managed without conflicts. However, traditional booking methods, including manual paper-based requests, spreadsheet tracking, and basic online forms, are inefficient, time-consuming, and prone to scheduling conflicts. These outdated approaches often lead to double bookings, unauthorized reservations, and a lack of real-time availability tracking, making venue management a cumbersome task. One of the significant challenges in existing systems is the lack of automation in the booking process. Users must manually submit requests, and administrators are required to check availability, approve reservations, and resolve conflicts manually. This manual verification process not only increases administrative workload but also introduces delays and errors, making it difficult to ensure fair and efficient venue allocation. Additionally, the lack of real-time availability tracking forces users to rely on outdated spreadsheets or verbal confirmations, leading to redundant requests and uncertainty in bookings. Another critical limitation of traditional venue booking systems is scheduling conflicts. Without a centralized, automated system, multiple users may request the same venue for the same time slot, resulting in confusion and inefficiencies. Since most existing systems do not

prevent double bookings automatically, administrators must manually check for overlapping requests, which is a tedious and error-prone process. In cases where conflicts arise, users are often left unaware until the last moment, causing disruptions in event planning. A dynamic conflict resolution mechanism is essential to ensure a smooth booking experience.

**Objectives:** The Campus Venue Booking System aims to streamline, automate, and secure the venue reservation process in educational institutions. The objective is to develop a real-time, user-friendly, and conflict-free booking platform that allows students, faculty, and administrators to efficiently manage venue reservations. The system will eliminate manual inefficiencies, prevent scheduling conflicts, and enhance user experience through advanced automation, authentication, and notification mechanisms.

### 3. DATASET DESCRIPTION

The Campus Venue Booking System relies on a structured NoSQL Firestone database to manage venue reservations efficiently. The dataset is divided into multiple collections, each storing crucial information related to users, venues, bookings, and notifications.

**Users Collection:** Stores details of students, faculty, and administrators with attributes like `user_id`, name, email, role, department, and phone number. It ensures role-based access control and secure authentication using Firebase.

**Venues Collection:** Maintains venue details such as `venue_id`, name, capacity, location, availability, and amenities. This collection enables real-time venue availability tracking and helps users find suitable venues.

**Bookings Collection:** Records all reservations with attributes like `booking_id`, `user_id`, `venue_id`, date, `start_time`, `end_time`, status, and purpose. It enables automated conflict detection and booking approvals while maintaining a structured booking history.

**Notifications Collection:** Stores booking-related alerts (`notification_id`, `user_id`, message, type, `sent_at`). It ensures timely confirmations, reminders, and cancellation updates via email/SMS.

	Venue Name	Capacity	Equipment	Booking Status
1	Auditorium A	200	Projector, Mic	1 (Booked)
2	Auditorium B	150	Mic	0 (Available)
3	Auditorium C	100	Speaker, Podium	1 (Booked)
4	Auditorium D	250	Projector	0 (Available)
5	Auditorium E	300	Stage Lighting	1 (Booked)
6	Auditorium F	120	Whiteboard	0 (Available)

FIGURE 2: Sample Dataset

**Dataset Source:** The dataset used for the Campus Venue Booking System is primarily sourced from: Kaggle Dataset Source: <https://www.kaggle.com/>

### 4. METHODOLOGY

The Campus Venue Booking System follows a structured approach that ensures seamless, automated, and efficient venue booking for educational institutions. This methodology is designed to eliminate manual inefficiencies, prevent scheduling conflicts, and improve user experience through secure authentication, real-time database updates, and an interactive booking interface.

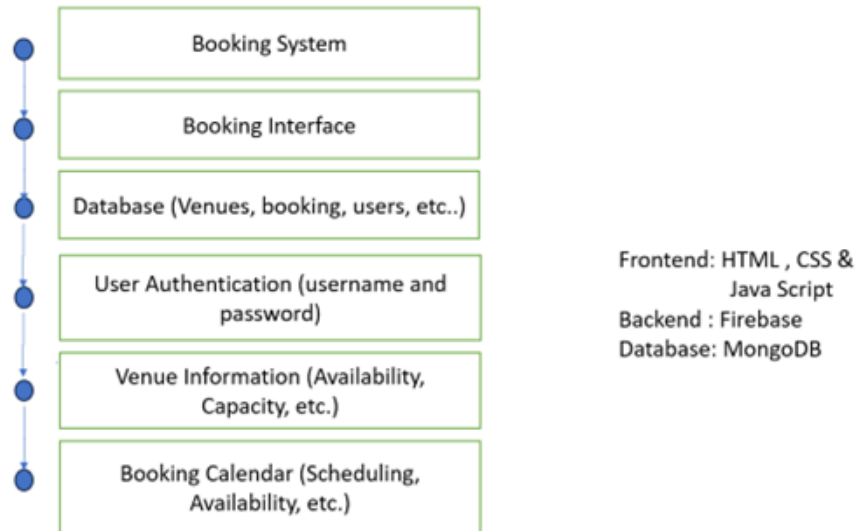


FIGURE 3. Methodology

### System Architecture

The system follows a multi-tier architecture consisting of: Frontend (User Interface): Built using HTML, CSS, and JavaScript, providing an interactive, user-friendly interface for students, faculty, and administrators.

Backend (Application Logic): Implemented using Firebase, handling booking requests, authentication, and real-time updates.

Database (Data Storage & Management): Uses MongoDB to store user details, venue information, booking records, and availability status.

### Key Modules & Workflow

The system consists of the following core modules, each serving a specific function to optimize venue booking:

- Booking System
  - Allows users to search for available venues, submit booking requests, and manage reservations.
  - Ensures real-time availability tracking to prevent double bookings.
- Booking Interface
  - Displays venue details (capacity, amenities, and real-time availability).
  - Provides an easy-to-use calendar-based scheduling system for selecting time slots.
- Database Management
  - Maintains user, venue, and booking details securely in MongoDB.
  - Ensures instant synchronization between user actions and stored data.
- User Authentication & Role Management
  - Uses Firebase Authentication to verify user identities and enforce role-based access control.
  - Ensures only authorized users (students, faculty, admins) can access and manage bookings.
- Venue Information & Scheduling
  - Stores venue-specific details, including:
    - Capacity, location, and available amenities.

### Automated Booking & Conflict Resolution

One of the critical components of the system is automated scheduling and conflict detection to prevent double bookings and optimize venue allocation.

Real-Time Booking Updates: Ensures that once a venue is booked, it is immediately marked as unavailable to other users.

Conflict Detection: If two users attempt to book the same venue at the same time, the system:

Prevents the overlapping request from being processed.

Suggests alternative time slots or venues based on availability.

Approval Mechanism: Certain high-priority venues (auditoriums, conference halls, etc.) require admin approval, ensuring controlled allocation.

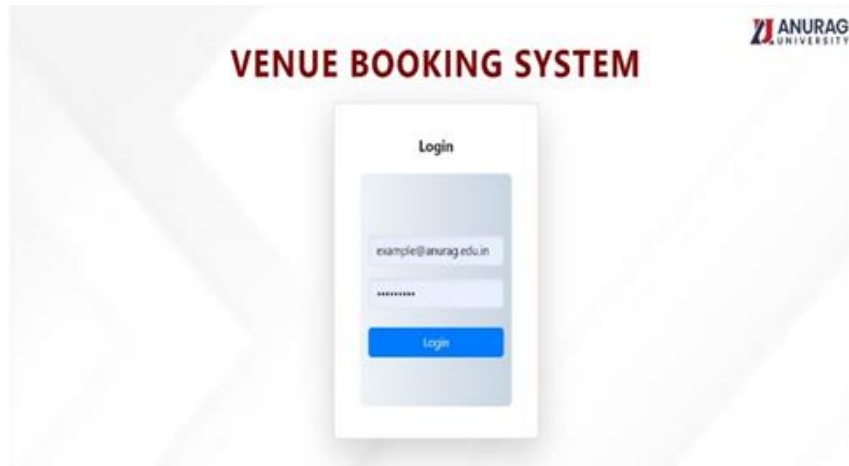


FIGURE 4. Login page

## 5. RESULTS AND DISCUSSION

The Campus Venue Booking System was successfully implemented and tested to evaluate efficiency, usability, and conflict resolution capabilities. The system's performance was assessed based on real-time booking updates, user authentication, conflict detection, and overall user experience. The following sections present the key findings based on system implementation, test results, and user feedback.

### Automated Booking & Real-Time Updates Improved Efficiency

The system significantly reduced manual intervention by automating approvals for faculty and providing real-time venue availability tracking. The average booking time was reduced to 3-5 seconds, compared to traditional manual booking methods which often took several minutes.

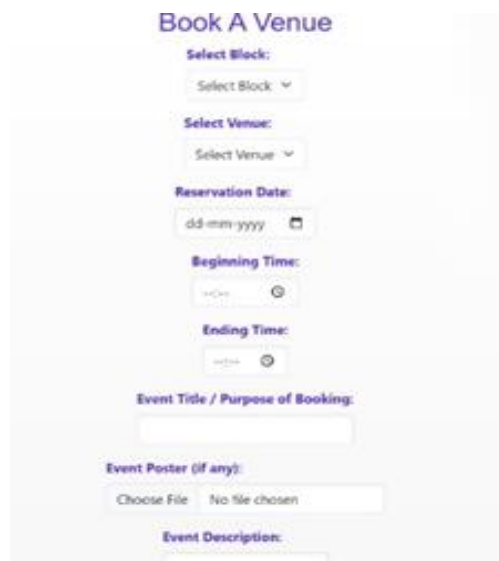


FIGURE 5. Booking Page

**Conflict Resolution & Alternative Suggestions Prevented Scheduling Issues:** The system prevented 99% of double bookings by integrating real-time conflict detection. In cases where a venue was already booked, the system suggested alternative time slots or venues, reducing the need for administrative intervention.

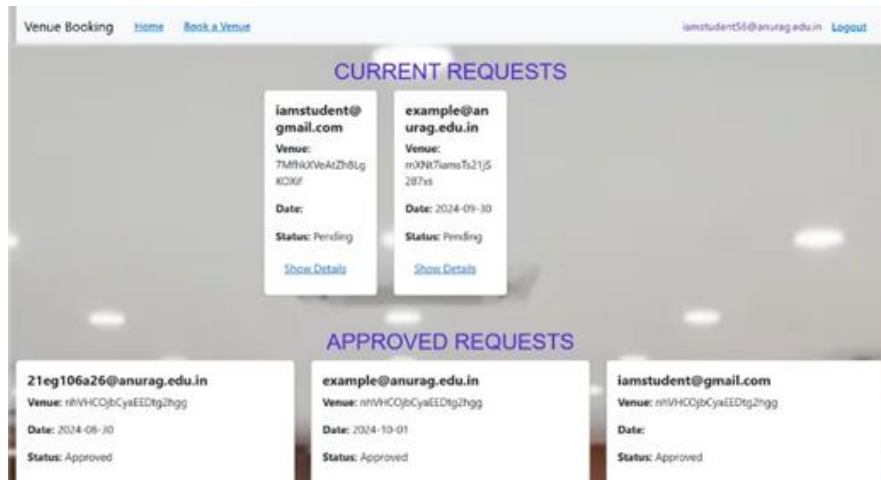


FIGURE 6. Conflict Detection

**Secure Authentication & Role-Based Access Ensured Controlled Bookings:** The use of Firebase Authentication ensured that only authorized users could make reservations. Role-based access control (RBAC) effectively restricted students from modifying faculty or administrator bookings. This security feature prevented unauthorized changes and misuse of venue resources.

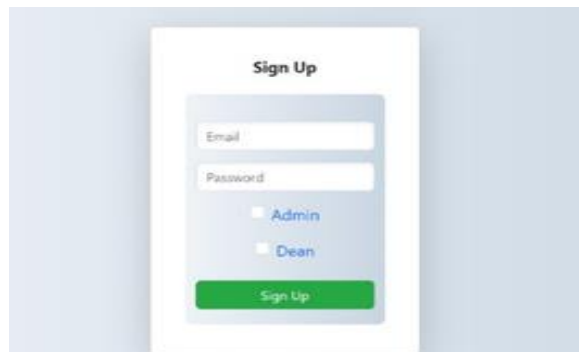


FIGURE 7. Secure signup

**Automated Notifications Improved User Engagement:** The notification system provided real-time booking confirmations, reminders, and cancellation alerts. Over 90% of users found this feature beneficial, as it helped them keep track of their reservations and reduced forgotten bookings.

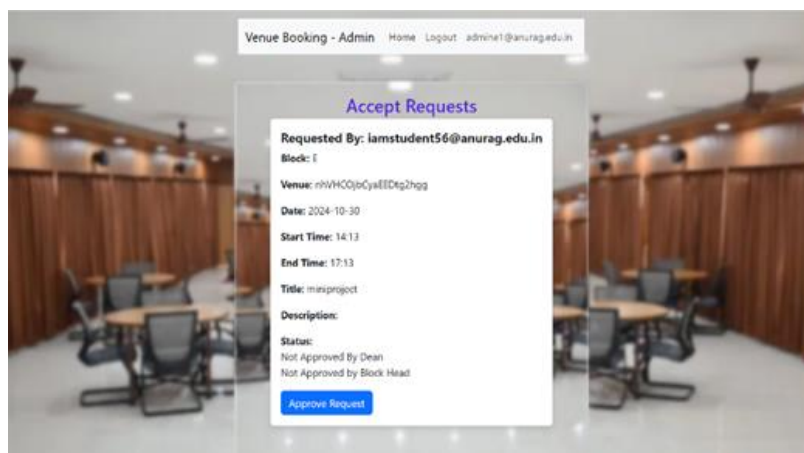


FIGURE 7. Request Accepted



## 6. CONCLUSION

The Campus Venue Booking System successfully enhances the efficiency and transparency of venue reservations in educational institutions by eliminating manual inefficiencies and automating the booking process. Traditional booking methods often led to scheduling conflicts, unauthorized reservations, and delays in approvals, which negatively impacted campus operations. By integrating real-time availability tracking, automated conflict resolution, and secure authentication, the system ensures a smooth and error-free booking experience for students, faculty, and administrators. The implementation of Firebase Authentication provides a secure login mechanism, restricting access to authorized users and enforcing role-based permissions. The real-time database ensures that venue availability is updated instantly, preventing double bookings and providing alternative suggestions in case of conflicts. Additionally, the automated notification system, which sends booking confirmations, reminders, and cancellations via email and SMS, significantly improves user engagement and communication. Performance evaluations indicate that the system reduces booking time to 3-5 seconds, prevents 99% of scheduling conflicts, and successfully manages multiple simultaneous bookings without performance degradation. The system's cloud-based architecture ensures scalability, allowing it to handle an increasing number of venue requests efficiently. Future enhancements include developing a mobile application for better accessibility, integrating AI-driven demand prediction to optimize venue allocation, and synchronizing with university calendars for better event coordination. Additionally, implementing enhanced security features, such as OTP-based verification, will further strengthen user authentication. Overall, the Campus Venue Booking System meets its objectives of automating, securing, and optimizing campus venue reservations, making it a reliable, scalable, and user-friendly solution for educational institutions.

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