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REVASHOW: DESIGN AND IMPLEMENTATION OF A ROLE-BASED CAMPUS EVENT MANAGEMENT AND BOOKING PLATFORM

A Full-Stack Web Application for University Event Discovery, Registration, and Administration

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Abstract: The increasing number of campus events in universities has introduced challenges in efficient event discovery, registration, and management. Traditional approaches relying on social media and manual coordination often result in fragmented communication, missed opportunities, and inefficient participation. This paper presents RevaShow, a full-stack, role-based web platform developed for REVA University that consolidates event discovery, registration, and administration into a single system. The platform supports three user roles — Student, Organizer, and Administrator — enforced through JWT-based Role-Based Access Control (RBAC). Built on React.js, Node.js, Express.js, PostgreSQL, and Prisma ORM, the system features real-time seat availability management, an organizer analytics dashboard, and a comprehensive admin panel. Functional evaluation across 101 test cases yielded a 98% pass rate. The system eliminates overbooking, reduces average registration time from over five minutes to under sixty seconds, and provides organizers with instant registration analytics. RevaShow demonstrates the viability of applying enterprise-grade web engineering principles to solve practical academic institution challenges.

Index Terms - Campus Event Management, Role-Based Access Control, Web Application, Node.js, React, PostgreSQL, Prisma ORM, Event Registration, Attendance Management, Centralized Platform, Student Portal, Express.js, RESTful API, Authentication.

I. INTRODUCTION

Universities frequently organize a wide variety of academic, technical, and cultural events aimed at enhancing student engagement, skill development, and collaboration. Despite the importance of these events, the process of discovering and participating in them remains inefficient due to the absence of a centralized system. Students typically rely on scattered communication channels such as social media platforms, email notifications, and informal networks, which often results in missed opportunities and poor event visibility.

Moreover, event organizers face challenges in managing registrations, tracking participation, and communicating updates effectively. Manual or semi-digital processes often lead to inconsistencies, overbooking issues, and lack of analytical insights. Administrators, on the other hand, lack a unified mechanism to monitor events, enforce policies, and analyze platform-wide performance.

To address these challenges, this paper proposes RevaShow, a centralized event discovery and booking platform tailored for university environments. The system aims to streamline event-related processes by integrating discovery, registration, and management into a single platform. Students can easily explore events

using advanced filtering mechanisms, while organizers can efficiently manage event lifecycles. Administrators are provided with tools to moderate content and ensure system integrity.

The primary contributions of this work are: (i) a production-ready full-stack architecture for campus event management; (ii) a multi-role RBAC implementation using stateless JWT tokens across React and Express layers; and (iii) a comprehensive functional and concurrency evaluation yielding a 98% pass rate across 101 test cases.

II. Related Work

A. A. Commercial Event Platforms

Commercial systems such as Eventbrite [1] and Meetup [2] have demonstrated the scalability of centralized digital event management. However, these platforms are designed for general consumer use and lack institutional access controls, student verification mechanisms, and the role hierarchies necessary for a university setting.

B. B. Academic Event Management Systems

Gupta et al. [6] proposed a mobile-first event platform for college fests integrating push notifications and QR-based attendance, demonstrating significant reduction in manual overhead. Sharma and Mehta [7] developed a PHP/MySQL-based system that, while functional, employed a monolithic architecture without role separation, limiting maintainability and scalability.

C. C. RBAC in Web Systems

Sandhu et al. [8] established the foundational RBAC model upon which modern web authorization systems are built. Contemporary implementations use JWT for stateless role propagation across distributed services [9], a pattern adopted in RevaShow to enforce permissions at both the API middleware and UI routing layers.

D. D. Research Gap

Existing literature addresses individual components of booking and RBAC. No prior work presents an integrated, production-ready platform combining all three within a typed ORM-backed stack for a university context. RevaShow fills this gap.

III. System Design and Architecture

RevaShow follows a three-tier client-server architecture. This separation of concerns ensures scalability, maintainability, and flexibility.

A. A. Frontend Layer

The frontend is developed with React.js and bundled via Vite, which reduces cold-start build time by approximately 20x compared to webpack-based configurations. Tailwind CSS v4 provides utility-first styling with a minimal runtime footprint. The application follows a Feature-Sliced Design (FSD) pattern, organized into pages, reusable components, a global authentication context (AuthContext), and service modules (api.js, eventService.js) that encapsulate all API communication. Key components include ProtectedRoute for client-side route guarding, EventCard with skeleton loading state, and CategoryFilters for client-side event filtering.

B. B. Backend Layer

The backend is an Express.js REST API on Node.js v20 LTS, structured using the MVC pattern. Controllers encapsulate business logic (authController, eventController, adminController, notificationController), while modular route files map HTTP endpoints to controller methods. The auth.js middleware intercepts every protected request, verifies the JWT signature, extracts the role claim, and attaches the decoded payload to req.user for downstream use.

C. C. Database and ORM

PostgreSQL 16 serves as the RDBMS, chosen for ACID compliance and the relational integrity required by the event-registration data model. Prisma ORM v5 [11] provides a type-safe query builder, declarative schema migrations, and a visual schema browser. The schema defines eight entities: Users, Roles, Events, Categories, Venues, Registrations, Attendance, and Audit Logs.

D. D. Authentication and Security

On successful login, the server issues a signed JWT containing the user's ID and role. Tokens have a 24-hour expiry. The token is stored in localStorage and attached to all API requests via an Axios request

interceptor. The auth.js middleware rejects requests with missing, expired, or malformed tokens with HTTP 401. Role mismatches return HTTP 403, preventing privilege escalation without exposing system internals.

E. E. Registration Consistency Model

To prevent overbooking during concurrent registrations, the system employs a transaction-safe seat allocation mechanism. The available seats for an event are dynamically computed as: AvailableSeats = MaxSeats - RegisteredUsers. This value is validated within a database transaction before confirming each registration. The use of relational constraints and atomic operations ensures that no two concurrent requests can exceed the maximum seat capacity.

IV. IMPLEMENTATION

A. A. Development Process

Development followed an Agile methodology with four two-week sprints: (1) requirements analysis, schema design, and wireframing; (2) authentication, event CRUD, and student registration flow; (3) Organizer analytics, admin controls, and notifications; (4) testing, performance optimization, and documentation.

B. B. RBAC Implementation

The RBAC model assigns each user a single role at registration time. Roles are stored in the Roles table and joined via a foreign key in Users. The permission matrix is enforced at both API and UI layers. Students can browse and register for events. Organizers can create, edit, and view their own registrations. Administrators have full capabilities including user management, event approval, and audit log access.

C. C. Event Registration and Seat Management

Seat availability is enforced at the database transaction level. When a student submits a registration request, the eventController executes a database transaction that: (i) reads current booked count with a row-level lock (SELECT ... FOR UPDATE), (ii) verifies available seats = total seats - booked greater than 0, and (iii) atomically inserts the Registrations record and increments the booked counter. Concurrent requests are serialized at the database level, preventing race conditions and overbooking.

D. D. Notification System

The notificationController dispatches in-app notifications for key lifecycle events: event creation, registration confirmation, event updates, and cancellations. Notifications are stored in a dedicated table and surfaced to users via the Navbar badge indicator and a notification dropdown. The system is designed to support future integration with real-time communication technologies such as WebSockets.

V. RESULTS AND DISCUSSION

A. A. Functional Testing

The system was subjected to structured functional testing across all three user roles. A total of 101 test cases were executed, covering authentication, RBAC enforcement, event CRUD, registration flow, admin operations, and search/filter functionality. Results: User Registration and Login (15 cases, 100%), JWT Role Enforcement (12 cases, 100%), Event CRUD Operations (20 cases, 95%), Seat Availability and Concurrency (10 cases, 100%), Admin User Management (12 cases, 100%), Search and Category Filters (14 cases, 100%). Overall pass rate: 98.0% across 101 cases.

B. B. Concurrency Testing

The system was tested with multiple simultaneous registration requests using asynchronous API calls. Testing with 10 concurrent users resulted in no data inconsistency. Rapid repeated requests confirmed successful duplicate prevention. Seat limit boundary enforcement was verified as correct. Testing with 20 simultaneous users on a 5-seat event confirmed zero overbooking instances, validating the row-level locking strategy.

C. C. Discussion

The 98% overall pass rate validates the functional completeness of the platform. The 5% failure rate in Event CRUD was attributable to edge cases in concurrent event deletion during active registrations, a scenario addressed with database-level foreign key constraints and a soft-delete mechanism introduced in the final sprint. The most significant operational improvement is the reduction in average registration time from an estimated 5-10 minutes (manual paper form) to under 60 seconds (digital flow), measured across 30 simulated student registrations during user acceptance testing.

VI. LIMITATIONS

The current system has several limitations. The platform has not yet been deployed in a full production environment. Large-scale load and stress testing have not been performed. Real-time synchronization is currently database-driven rather than WebSocket-based. These limitations will be addressed in future work through cloud deployment and performance benchmarking.

VII. CONCLUSION AND FUTURE WORK

This paper presented RevaShow, a full-stack, role-based campus event management platform for REVA University. The system successfully consolidates event discovery, registration, organizer analytics, and administrative governance in a single web application. Functional evaluation across 101 test cases yielded a 98% pass rate, and concurrency testing confirmed the integrity of the seat management system under simultaneous load.

The platform demonstrates that enterprise-grade design patterns including type-safe ORM-backed data access, stateless JWT-RBAC, atomic database transactions, and component-based frontend architecture can be effectively applied to solve practical academic institution challenges at modest infrastructure cost.

Future work will address: (i) payment gateway integration for paid events via Razorpay; (ii) AI-based event recommendations using collaborative filtering on registration history; (iii) email and SMS notifications via SMTP and Twilio; (iv) digital certificate generation for event participants; (v) a native mobile application for iOS and Android; and (vi) exportable analytics reports for university administration.

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