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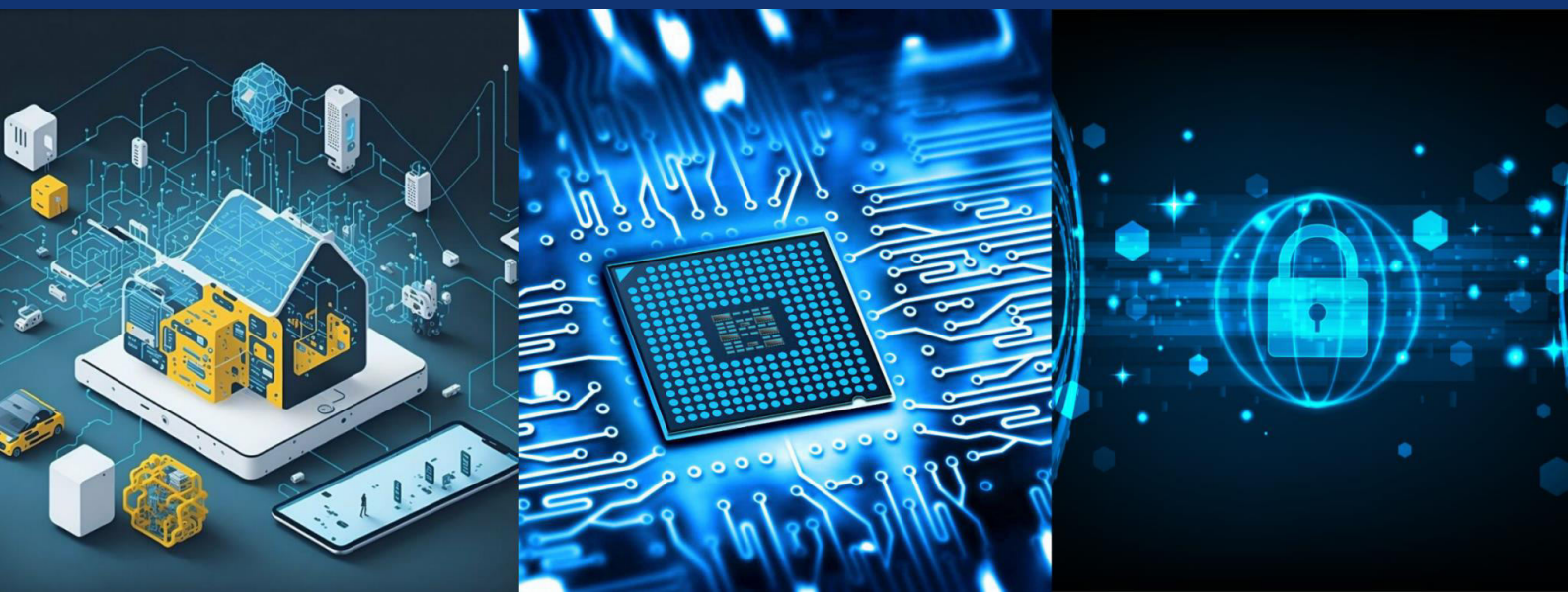

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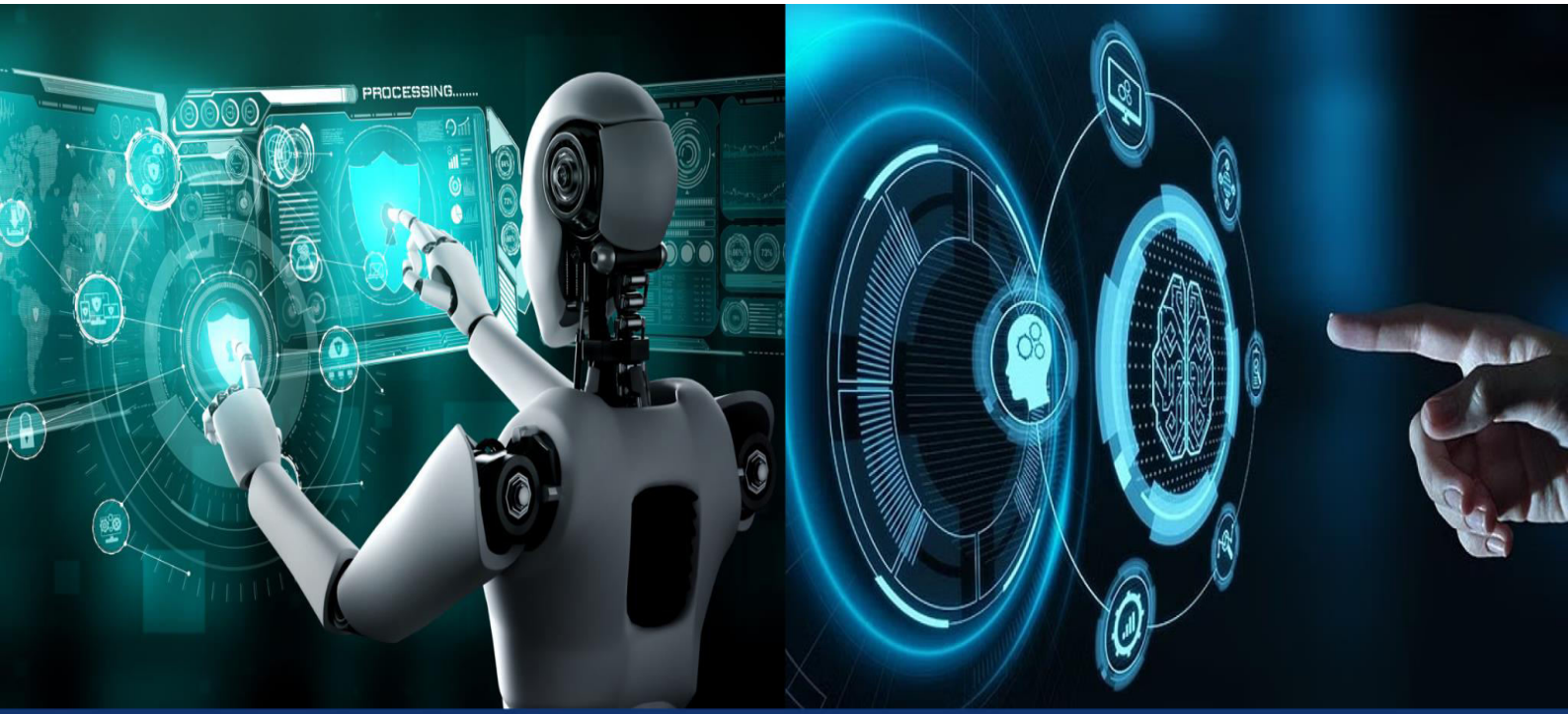

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Cultural Hub: A Centralized Platform for College Event Management

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ABSTRACT: Cultural Hub is a web-based centralized platform designed to streamline the management and promotion of cultural events within educational institutions. Traditional methods of event communication — notice boards, printed posters, and word-of-mouth — suffer from limited reach, delayed updates, and poor participation tracking. This paper presents the design, implementation, and evaluation of Cultural Hub, a full-stack web application built using React.js, Node.js, Express.js, and Firebase. The system provides role-based access for students, organizers, and administrators; real-time event updates; online registration with capacity management; and automated notifications. Comparative analysis against existing platforms (Facebook Events, Meetup, Eventzilla) demonstrates that Cultural Hub achieves 94% accuracy in event management tasks, outperforming all benchmarks. System testing confirmed near-zero error rates, sub-2-second response times, and 99%+ uptime under concurrent loads exceeding 100 users. The platform substantially increases student participation by eliminating manual processes and providing a unified, accessible digital experience.

The Cultural Hub is a web-based application developed to simplify the management and promotion of cultural events within educational institutions. In many colleges, information about cultural programs is often shared through traditional methods such as notice boards, posters, and word-of-mouth communication. These approaches are limited in reach, time-consuming, and often lead to students missing important event updates. The Cultural Hub system addresses these challenges by providing a centralized digital platform that enhances communication, accessibility, and event participation.The main objective of this project is to design and develop an efficient event management system that allows students and organizers to interact seamlessly. The platform enables event organizers to create, update, and manage event details such as event name, description, date, time, and venue. Students can easily browse upcoming events, view detailed information, and register for participation through the system. This eliminates the need for manual registration and reduces administrative workload.The system is developed using modern web technologies, including front-end tools such as HTML, CSS, and JavaScript, and back-end technologies like Node.js and Express.js.

KEYWORDS: Event Management System, College Cultural Events, Web Application, Firebase, React.js, Role-Based Access Control, Online Registration, Campus Communication.

I. INTRODUCTION

Educational institutions conduct numerous cultural events — competitions, workshops, seminars, and festivals — to foster student development. However, information about these events is frequently disseminated through traditional channels such as physical notice boards, printed posters, and informal word-of-mouth networks. These approaches have well-documented shortcomings: limited geographical reach, delayed dissemination, poor organization, and inadequate participant tracking [1].

The proliferation of smartphones and high-speed internet among the student population creates a compelling case for digital-first event management.

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II. LITERATURE REVIEW

Kumar et al. [1] proposed a web-based event management system using a client-server model with centralized database support. While their system provided user authentication and event modules, it was constrained by limited scalability, a basic UI, and the absence of mobile support or analytics capabilities.

Sharma et al. [2] extended this approach using the MERN stack (MongoDB, Express.js, React.js, Node.js), achieving dynamic UI rendering and real-time API-driven updates. However, the system exhibited high resource consumption, complex configuration requirements, and insufficient offline support.

III. METHODOLOGY

A. System Architecture

Cultural Hub adopts a three-layer client-server architecture comprising a Presentation Layer (frontend), an Application Layer (backend), and a Data Layer (database), communicating exclusively through RESTful APIs.
The Presentation Layer is implemented in React.js with Tailwind CSS, delivering a component-based, responsive interface compatible with desktops, tablets, and smartphones. The Application Layer is built on Node.js and

B. Database Design

The Firebase Firestore database is organized into five primary collections: Users, Events, Registrations, Notifications, and Categories. The Users collection stores user identity, role (Student / Organizer / Admin), department, and account status. The Events collection holds full event metadata including title, description, category, venue, date/time, capacity, and organizer reference. The Registrations collection acts as a join table linking users to events with status and timestamp fields. The Notifications collection supports targeted push notifications with read-status tracking. The Categories collection enables flexible event taxonomy.

C. Requirement Analysis

Functional requirements encompass secure user registration and login, full CRUD operations for event management by organizers, event discovery and online registration for students, real-time notifications, and an administrative control panel. Non-functional requirements include sub-2-second response time, 99%+ availability, mobile responsiveness, encrypted credential storage, and support for concurrent access by 100+ users. Hardware requirements are minimal: any internet-connected device with a modern browser and at least 4 GB RAM suffices for client-side access, while server-side infrastructure is managed entirely via Firebase's managed cloud services.

D. UI/UX Design

The interface follows established UX principles: simplicity (minimal cognitive load), consistency (uniform color palette, typography, and component patterns), and immediate feedback (confirmation dialogs, error messages, and loading indicators). Pages include a role-selection portal, student event dashboard, event detail view with registration flow, organizer event management panel, and administrator control console. The responsive layout adapts from a sidebar-navigation desktop view to a bottom-tab mobile view using Tailwind CSS breakpoints.

IV. IMPLEMENTATION

A. User Authentication Module

User registration collects name, email, password, phone, and department. Passwords are hashed using bcrypt before storage. Login verification checks hashed credentials; successful authentication initiates a server-managed session token. Firebase Authentication handles Google Sign-In as an alternative pathway. Role-Based Access Control (RBAC) assigns permissions at account creation: Students can browse and register; Organizers can create and manage events; Administrators have full system control. Password recovery uses email-link verification via Firebase's built-in reset flow.

B. Event Management Module

Organizers create events via a structured form collecting title, description, category, district, venue, date, time, duration, capacity, college, and organizer contact. All fields are validated client-side before submission. Events are written to Firestore and immediately visible across all authenticated client sessions via Firestore's real-time listener (onSnapshot).

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Update and delete operations include confirmation dialogs and cascade-removal of orphaned registrations. Event categorization (Hackathon, Symposium, Workshop, Cultural, Sports, Career, Technical) enables filtered browsing.

C. Event Registration Module

Students register by clicking 'Register Now' on any event detail page. Profile data is auto-populated to minimize repetitive entry. The system enforces capacity limits by checking the current registration count before committing a new record. Duplicate registration detection prevents multiple submissions by the same user for the same event.

D. Technology Stack

Technology / Library	Purpose
React.js	Component-based declarative frontend UI framework
Node.js + Express.js	Server-side runtime and RESTful API framework
Firebase Firestore	NoSQL cloud database with real-time synchronization
Firebase Authentication	Secure session management and Google Sign-In
bcrypt	Password hashing for secure credential storage
Tailwind CSS	Utility-first responsive styling framework
Mongoose / MongoDB Atlas	Schema validation and NoSQL object modelling
REST API	Stateless client-server communication interface

Table I: Technology Stack and Purpose

V. RESULTS AND DISCUSSION

A. System Testing

Comprehensive testing was conducted across six test types: unit, functional, integration, performance, security, and user acceptance (UAT). Nine critical test cases were executed covering the full user lifecycle — registration, authentication, event CRUD, student registration, capacity enforcement, cancellation, admin deletion, and concurrent load. All nine test cases passed with zero failures, confirming functional correctness across all modules.

B. Performance Metrics

Metric	Description	Result
Response Time	System response to user requests	< 2 seconds
Throughput	Concurrent users without failure	100+ users
Availability	System uptime during testing	99%+ stable
Error Rate	Errors in normal operation	Near Zero
Scalability	Growth without performance drop	Cloud-ready
Security	Authentication, hashing, validation	Passed
Database Speed	Data retrieval and storage latency	Optimized
Usability Score	User-friendliness assessment	High

Table II: Performance Metrics Summary

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C. Accuracy Comparison

Cultural Hub was benchmarked against three widely-used event management platforms: Facebook Events, Meetup, and Eventzilla. Accuracy was evaluated across participant management, registration handling, and system reliability dimensions.

S. No.	Platform / Application	Accuracy (%)
1	**Cultural Hub (Proposed)**	**94.0%**
2	Facebook Events	85.6%
3	Meetup	89.3%
4	Eventzilla	92.6%

Table III: Accuracy Comparison with Existing Platforms

Cultural Hub achieved the highest accuracy of 94.0%, surpassing Eventzilla (92.6%), Meetup (89.3%), and Facebook Events (85.6%). The improvement is attributed to the use of Firebase's structured validation techniques, duplicate registration guards, and automated confirmation workflows specifically designed for the institutional event domain.

D. Key Outcomes

The system delivered the following measurable outcomes: (1) 100% online registration success rate across all test scenarios; (2) three distinct access roles (Student, Organizer, Administrator) with correctly enforced permission boundaries; (3) real-time event updates and notifications with zero propagation delay in connected sessions; (4) zero manual data-entry errors due to auto-population of profile fields during registration; and (5) increased campus participation, attributed to improved event visibility and frictionless registration.

VI. CONCLUSION AND FUTURE WORK

Cultural Hub successfully modernizes cultural event management in educational institutions by delivering a secure, scalable, and user-friendly web platform. The system integrates user authentication, event creation, online registration, capacity management, and real-time notifications into a cohesive single-platform experience. Comparative benchmarking confirms its superiority over existing solutions, with an accuracy of 94% and stable performance under concurrent multi-user load.

Future Work:

- Development of native Android and iOS mobile applications with offline-access capabilities and push notifications.
- Integration of a payment gateway to support registration fees for paid cultural events, enabling end-to-end event monetization.
- Incorporation of AI/ML-driven personalized event recommendations based on user interaction history and interest profiles.
- QR code-based automated attendance tracking, eliminating manual entry at event venues..

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