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EduConnect: A Comprehensive Review of a Decentralized Campus Networking and Academic Resource Management System

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Abstract: ***Traditional academic management systems often lack a unified platform that bridges the gap between student networking and administrative resource management. This paper reviews 'EduConnect', a full-stack MERN-based portal designed to streamline campus activities. The system integrates Role-Based Access Control (RBAC) to manage functionalities for Students, Teachers, and Admins. Key features include a skill-based student discovery engine, real-time collaboration via personal and group chats using Socket.io, and automated academic modules. Built using MongoDB, Express.js, React, and Node.js, EduConnect aims to foster a digital ecosystem that enhances peer-to-peer learning and administrative transparency.***
Index Terms: MERN Stack, RBAC, Campus Networking, Socket.io, Cloudinary, Academic Management, JWT Security, Peer-to-Peer Collaboration.

I. INTRODUCTION

In modern educational landscapes, information is often frag- mented across various social media groups and physical notice boards. Students frequently struggle to find peers with specific technical skill sets for collaboration, while teachers face challenges in organized assignment distribution. EduConnect addresses these issues by providing a centralized, secure, and intuitive platform starting with a descriptive landing page that introduces the project's vision before enforcing authentication.

II. PROBLEM STATEMENT AND MARKET GAP ANALYSIS

Most existing campus ERPs focus solely on administrative data like attendance and fees.

1) Networking Gap: There is no official way to find a teammate based on their "Internship" experience or specific technical skills.
2) Information Silos: Placement links and assignment PDFs are often lost in chaotic third-party messaging apps.
3) Accessibility: Students often lack easy access to timeta- bles of other branches, hindering inter-disciplinary learning.

III. SYSTEM ARCHITECTURE AND METHODOLOGY

The architecture follows a robust Model-View-Controller (MVC) pattern to ensure frontend and backend remain loosely coupled.

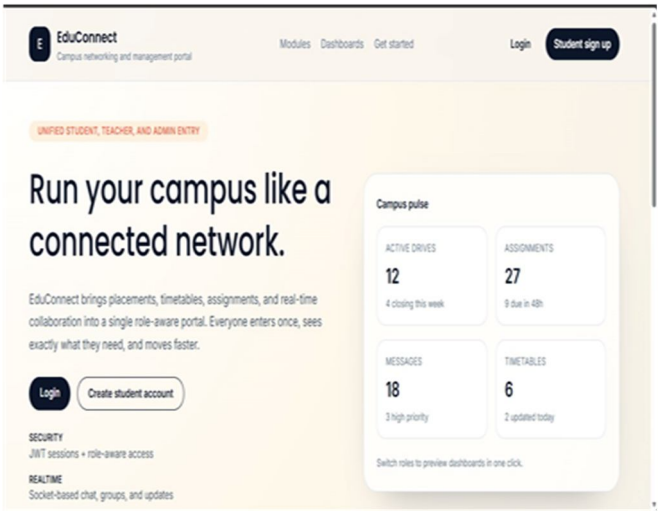


Fig. 1. EduConnect Landing Page illustrating the campus pulse and entry points.

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A. *Technology Stack*

The EduConnect ecosystem leverages a robust MERN- based stack:

1) Frontend: Developed using React.js and Tailwind CSS for a responsive user experience.
2) Backend: Node.js and Express.js handle business logic and API routing.
3) Database: MongoDB manages user profiles, chat logs, and academic records.
4) Storage: Cloudinary is integrated for asynchronous han- dling of profile photos and PDFs.

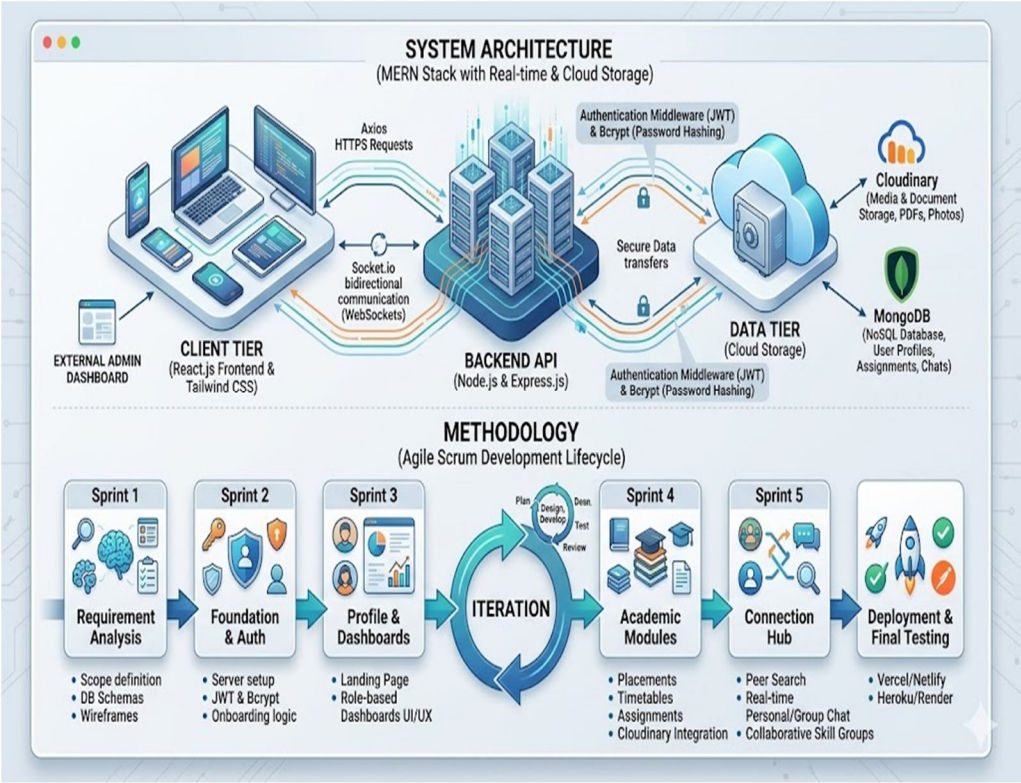


Fig. 2. EduConnect System Architecture and Agile Methodology workflow

B. *Authentication and RBAC*

EduConnect utilizes a secure gateway for different user roles. As seen in Fig. 3, the login system provides a unified entry point with a preview of campus activity.

1) Dual Entry Login: A unified login page with toggles for Students and Teachers.
2) Student Registration: Students can register manually and create profiles featuring photos, skills, and achievements.
3) Teacher Onboarding: Managed exclusively by the Ad- min to ensure academic integrity.

IV. DETAILED FUNCTIONAL MODULES

The primary workspace (Fig. 4) provides a snapshot of total assignments and notifications, centralizing the user's focus.

A. *The Connection Hub (The Social Core)*

1) Advanced Discovery: An indexed search engine (Fig. 5) allows for complex queries like "Find students with React.js skills".
2) Real-time Interaction: Integrated Socket.io facilitates instant personal messaging and interest-based study groups (Fig. 6).

B. *Academic Management (The Structured Core)*

1) Assignment Portal: Teachers upload assignments (Fig. 7) targeted at specific years and branches.
2) Submission Engine: A dedicated button allows students to upload work and view latest submissions.
3) Smart Timetable: A decentralized system allowing branch-wise schedule sharing (Fig. 8).

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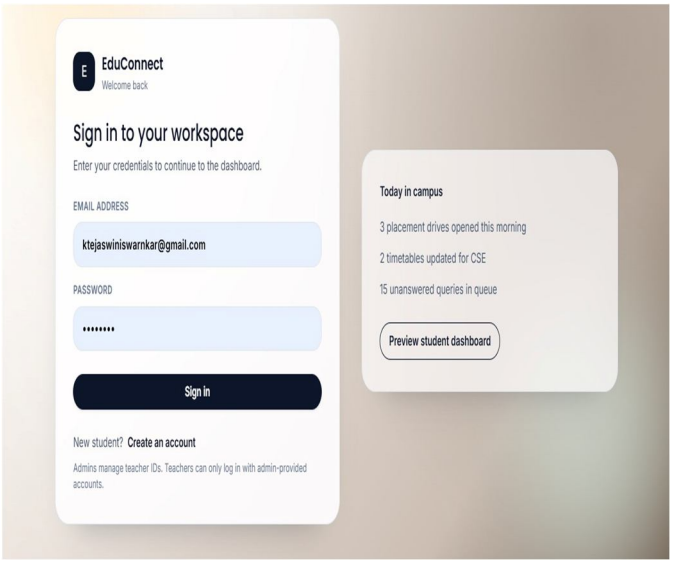


Fig. 3. Secure Login Interface with Role-based workspace entry.

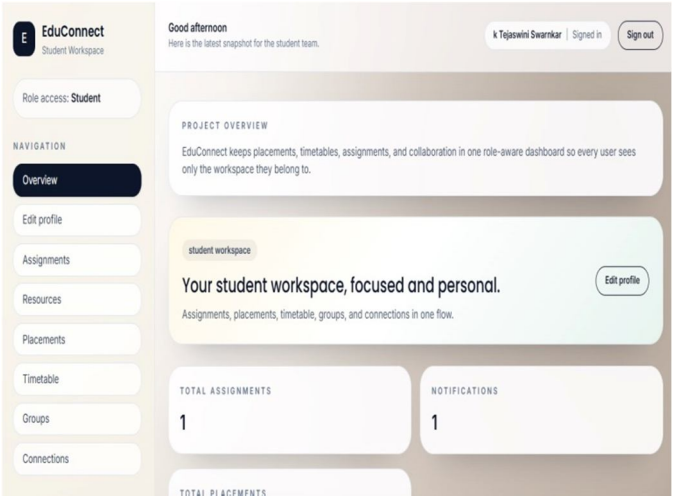


Fig. 4. Personalized Student Workspace Dashboard.

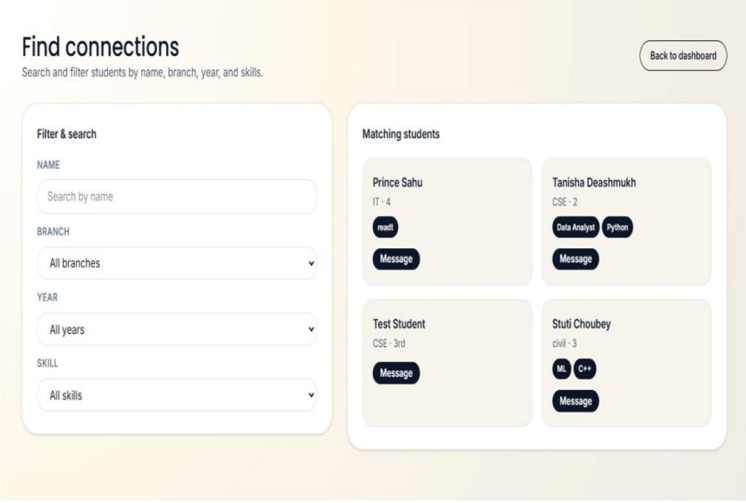


Fig. 5. Student Discovery Interface with skill-based filtering.

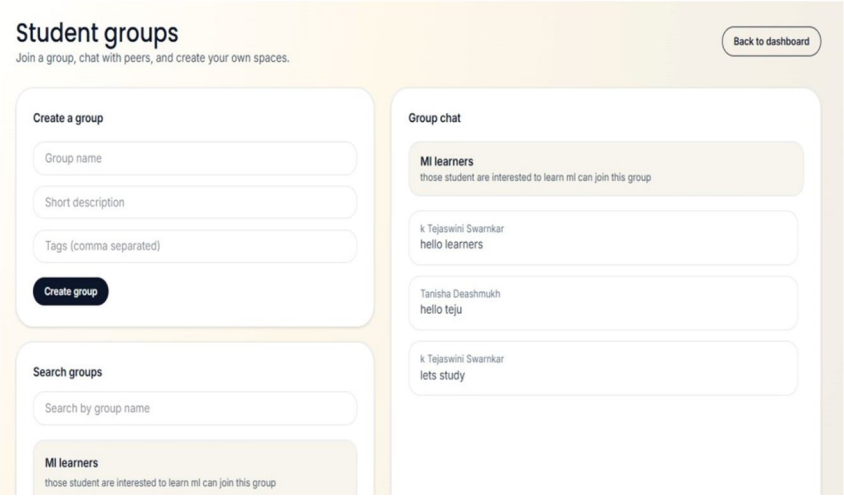


Fig. 6. Group Collaboration and Real-time Chat Hub.

4) Learning Library: A resource sharing module for ex- poring and uploading study materials (Fig. 9, 10).

V. TECHNICAL IMPLEMENTATION AND LOGIC

A. Database Modeling and Normalization

EduConnect utilizes MongoDB's indexing features on 'branch' and 'year' fields. The Profile model (Fig. 11) uses a referencing pattern to link skills and internships.

B. Real-Time Communication Layer

Using an event-driven model, the server listens for "send- message" events via Web Sockets. It broadcasts messages only to specific "Room IDs" assigned to personal or group chats.

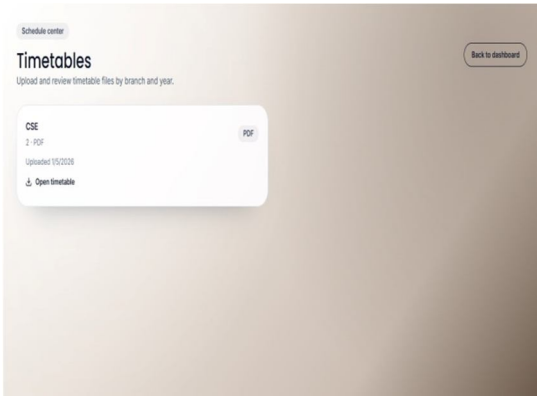


Fig. 7. Assignment Tracking and Submission Interface.

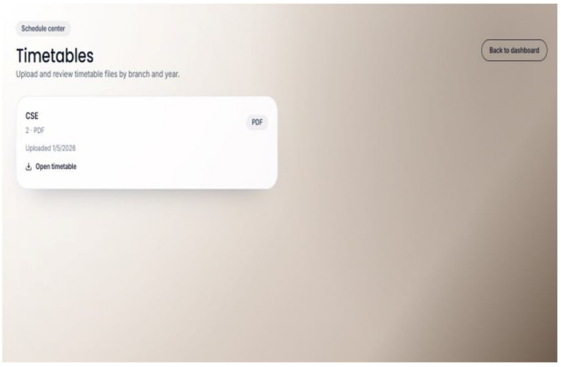


Fig. 8. Centralized Timetable and Schedule Center.

C. File Handling Strategy

By utilizing Cloud nary, the system avoids risks associated with local server storage. All files are treated as static assets, and the server only interacts with their secure URLs.

VI. EXTENDED COMPARATIVE ANALYSIS

VII. SECURITY AND DATA PRIVACY ARCHITECTURE

1) Stateless Authentication: Implements JSON Web To- kens (JWT) for secure session management.
2) Password Protection: Utilizes Bcrypt for salted hashing, ensuring passwords are never stored in plain text.
3) Authorization Middleware: Custom middleware verifies user roles before allowing access to sensitive features.

TABLE I
EDUCONNECT VS. TRADITIONAL SYSTEMS

Feature	Traditional ERP	Messaging (WhatsApp)	EduConnect Portal
Primary Focus	Admin tracking	Casual commu- nication	Networking
Networking	None	Unorganized	Skill-based
Onboarding	Manual entry	No verification	RBAC Hub
Retention	Hidden menus	Lost in chat	Branch Filter
Placement	Physical boards	Forwarded links	Real-time Hub
Collaboration	Non-existent	High clutter	Chat Groups

VIII. SOCIETAL AND EDUCATIONAL IMPACT

A. Educational Impact

1) Reduced Cognitive Load: By filtering assignments by year and branch, students no longer sift through irrelevant data.
2) Inter-disciplinary Awareness: Access to timetables across branches encourages students to attend guest lectures.
3) Academic Accountability: The submission engine creates a digital trail for tracking deadlines.

B. Societal Impact

1) Bridging the Gap: The discovery engine allows juniors to find mentors based on shared interests.
2) Digital Equality: The Placement Hub ensures every student receives company links simultaneously.

IX. CONCLUSION AND FUTURE IMPACT

EduConnect successfully integrates the requirements of academic management with student networking. It addresses communication challenges by providing a single source of truth for assignments and peer interaction.

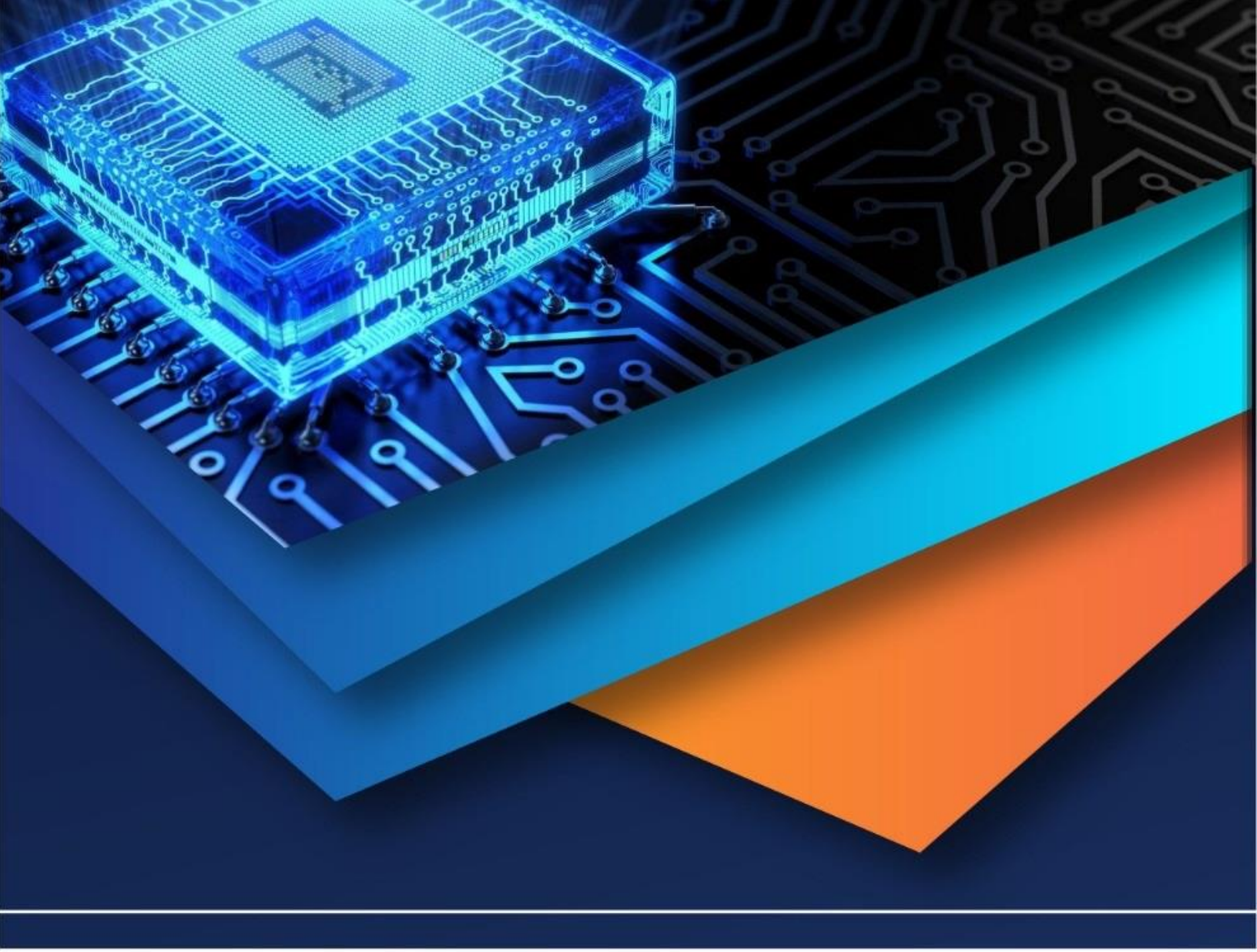
A. Future Work

1) AI Synergy: Future versions will include AI project matching.
2) Alumni Module: A dedicated module for verified alumni-student mentorship.
3) Scalability: Designed to be multi-tenant for use across multiple universities.

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