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EDUMATRIX: An AI-Integrated Academic Content Management and Doubt-Solving Portal

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Abstract: *EduMatriX is a web-based academic management platform that combines attendance tracking, assignment submission, subject content, discussion forums and department analytics under one roof with role-based dashboards for Students, Faculty and the Head of Department (HOD). Nova AI, a doubt-solving assistant based on large language models, is at its core, along with an AI lesson planner and an AI quiz generator that takes repetitive academic groundwork off a faculty member's plate. Built on Next.js, TypeScript and Supabase, the system automates the record-keeping and communication tasks most colleges still manage by hand, while giving each user group the analytics and tools relevant to their role*

Keywords: *EduMatriX*

I. INTRODUCTION

In academic institutions, daily activities such as attendance, tracking assignments and communicating with students still heavily depend on registers, spreadsheets and split messaging apps. These manual routines take up faculty time, lead to errors and make it difficult for a department to have a clear, real-time view into how its students and courses are performing. Current learning management tools typically solve only one piece of the puzzle at a time, forcing institutions to stitch together several disconnected applications.

The work proposes EduMatriX, a single AI-integrated web platform that unifies these academic activities.It offers Students, Faculty and the Head of Department with separate purpose-built dashboards such that each user only interacts with relevant information and tools. Beyond routine record-keeping, EduMatriX embeds artificial intelligence directly into everyday academic work: Nova AI answers a student's subject-related questions instantly using course material as context, the AI Lesson Planner helps faculty draft structured lesson outlines and the AI Quiz Generator produces topic-based quizzes automatically.

II. METHODOLOGY

EduMatriX is designed around a role-based workflow that guides the user from authentication through AI-assisted academic support. The whole process can be broken down into the following phases: user authentication and role validation, data collection from students and faculty, AI-based doubt resolution, AI-assisted content generation, attendance and assignment tracking, and analytics reporting.

A. Authentication and role management for the user.

All users log in using Supabase Authentication and are assigned one of three roles – Student, Faculty or HOD – and directed to the relevant dashboard. All new accounts are put in a pending state until they are approved by the HOD . RLS policies are applied such that a user can only read or modify data belonging to their role and account.

B. Data Collection.

The platform gathers academic data from two sources: faculty members upload subject materials, assignments, timetables and announcements, and students submit assignments, post discussion queries and ask academic questions via

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Nova AI. This data is stored in a structured Supabase (PostgreSQL) schema on users, subjects, materials, assignments, submissions, attendance and notifications.

C. AI-Driven Doubt Resolution.

When a student asks a question in Nova AI, the system will optionally pull up to ten related materials for that subject from Supabase and add them to a context block. This context and the student's question are fed into Groq's chat-completion endpoint (model: llama-3.3-70b-versatile) which produces an organised, numbered explanation and a brief summary.

D. Lesson Planning and Quiz Development using AI.

Faculty can request a lesson plan on a topic, or a quiz of a specified length, to be generated by AI. Both features call the Gemini/Groq APIs, parse the returned JSON (stripping any Markdown fencing), and fall back to a safe default structure if the AI response is malformed—so a temporary AI failure never blocks the faculty member's workflow.

E. Attendance, Assignment and Communication Monitoring.

Faculty have the ability to take attendance and set due dates for assignments right from their dashboard. Assignments are automatically time stamped and flagged if they are late. Faculty or HOD announcements create notification rows for all relevant students so communication is centralised and not spread across chat apps.

F. Analytics and Reporting.

The system brings together attendance percentages, assignment completion, quiz scores, and engagement metrics into role-specific dashboards – providing students with a personalised progress view, faculty with a class-level view and the HOD with a department-wide analytics view.

III. MODELING AND ANALYSIS

EduMatriX is based on Model-View-Controller (MVC) pattern on top of a modular, cloud-native architecture. The View is a dashboard component built with React/Next.js for Students, Faculty and the HOD. The Controller layer consists of Next.js API routes (e.g. /api/chat, /api/generate-quiz) and Server Actions that authenticate each request, call the appropriate AI service and interact with the database. The Model is the Supabase PostgreSQL schema – comprising users, subjects, materials, assignments, submissions, attendance, notifications and logs – which is accessed via the Supabase client with Row Level Security applied on all tables.

The frontend, which is deployed on Vercel's edge network, communicates with backend services through REST APIs, and Groq and Google Gemini power the AI inference for Nova AI, lesson planning and quiz generation. This separation of presentation, application-logic and data layers allows the system to be easily extensible: new academic modules can be added without disturbing existing dashboards or database schema.

Sl. No	Material / Tools	Purpose / Usage
1	Windows / Linux / macOS	Operating System for running and developing Applications
2	Next.js (React.js), TypeScript	Frontend framework used to build role-based dashbords & pages
3	Tailwind CSS	Styling framework for consistent responsive UI
4	Supabase (PostgreSQL)	Cloud database for tracking users, subjects, materials, assignments and attendance
5	Supabase Auth	Enables secure login, session management and role-based access control

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6	Groq API / Google Gemini API	Powers Nova AI doubt solving AI quiz generation AI lesson planning

IV. SNAPSHOTS

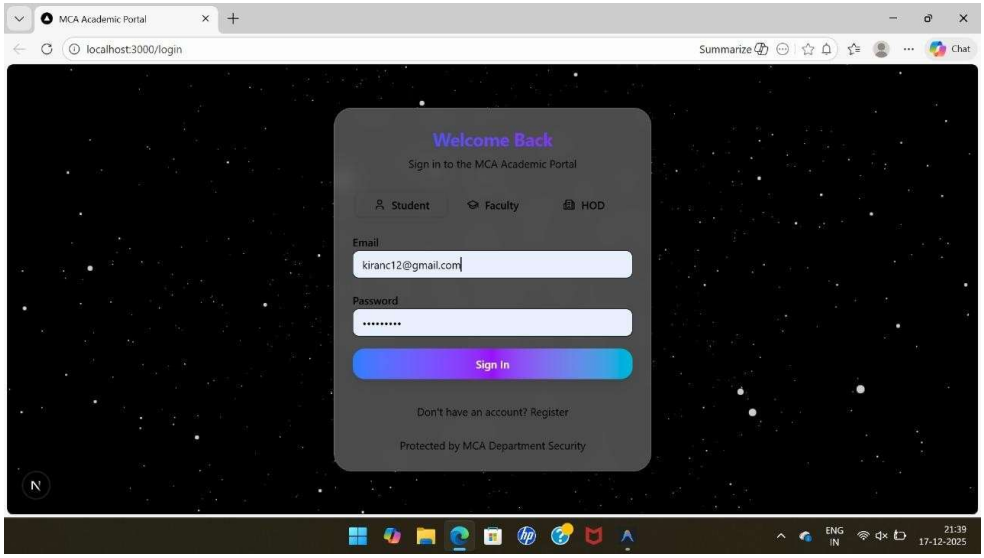

Fig 4.1 Login Page with Role Selection

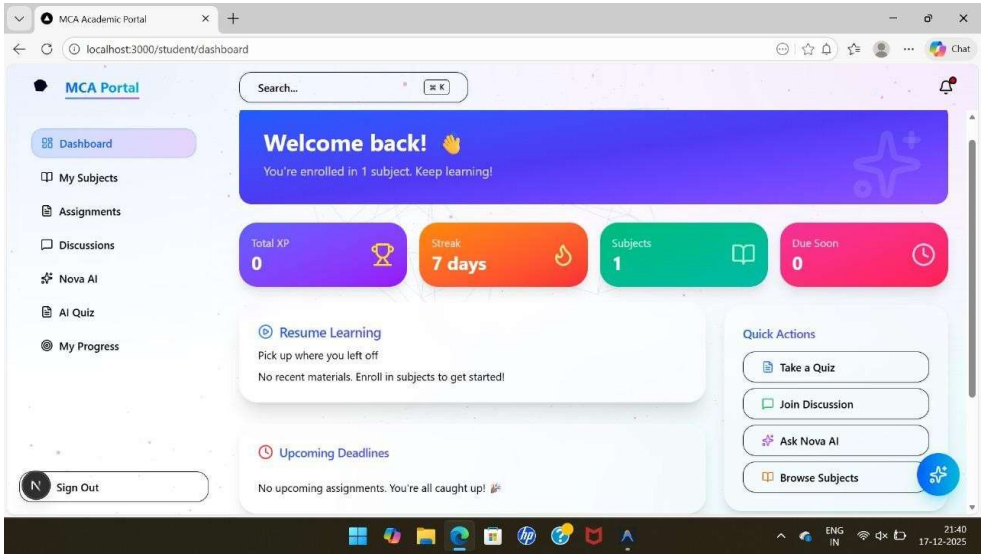

Fig 4.2 Home Page

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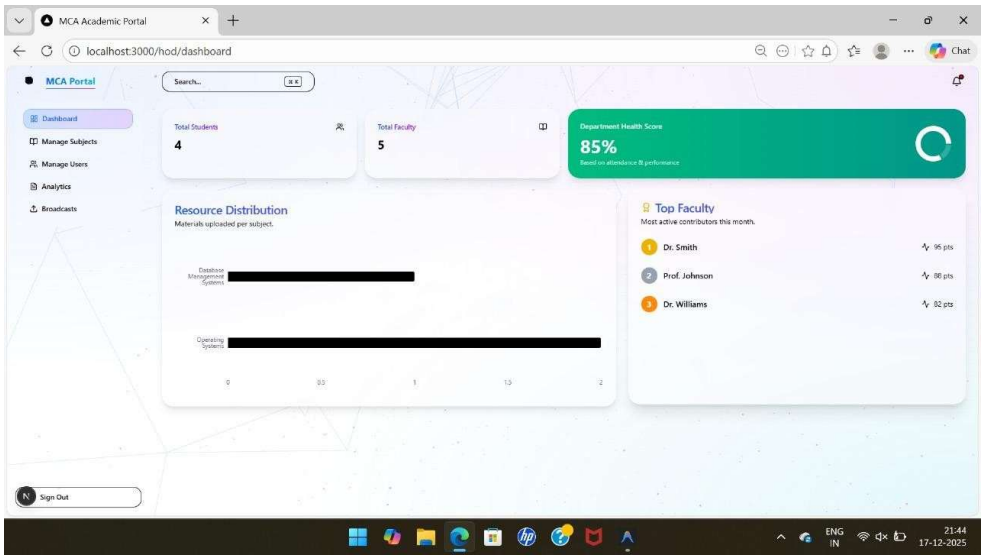

Fig 4.3 Role-Based Dashboard

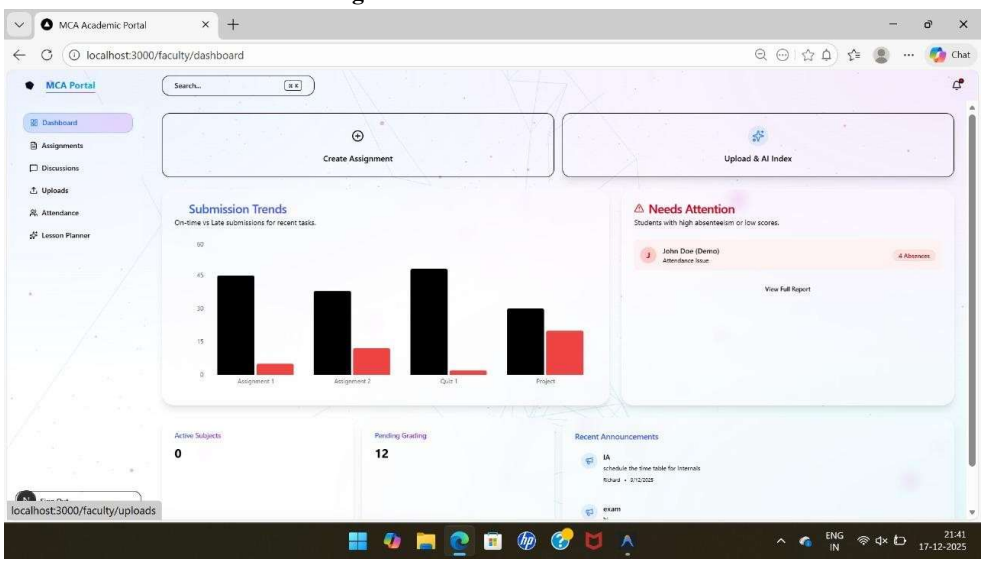

Fig 4.4 Assignment Submission Analytics

V. RESULTS AND DISCUSSIONS.

EduMatriX was built with Next.js, TypeScript, Tailwind CSS and Supabase and hosted on Vercel. It uses Groq and Gemini for AI services. The system was tested in phases, including unit testing of individual functions, integration testing across the Next.js application and Supabase, and extensive end-to-end testing of student, faculty and HOD workflows.

A. Security and Role-Based Access.

Supabase Row Level Security did its job and prevented every attempt to read or modify data outside a user's own role, regardless of what the client-side interface showed, confirming access control is enforced at the database level and not just in the UI.

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B. Web Application Development 1.

The application has different dashboards for Students, Faculty and the HOD. Students can check attendance, submit assignments, view subject material, take AI generated quizzes and ask questions via Nova AI. Faculty can upload material, assign assignments, take attendance and generate lesson plans. HOD can approve accounts, track attendance and performance across the department and check analytics.

C. Reliability of AI Features

The AI Quiz Generator and the AI Lesson Planner were tested with well-formed and deliberately malformed AI responses. In all instances where the AI output was not parseable as expected, the system reverted to a safe fallback rather than failing outright. Response times for the AI endpoints were within an acceptable range for interactive classroom use.

VI. CONCLUSION

EduMatriX combines attendance management, assignment tracking, subject content, communication and AI-supported academic assistance in a single role-based platform for Students, Faculty and the Head of Department. “The system embeds Nova AI, an AI Lesson Planner and an AI Quiz Generator directly into daily academic workflows, reducing the repetitive manual work faculty otherwise spend on doubt-clearing, lesson preparation and quiz creation, while giving students instant, contextual academic support.

The project was successfully implemented using Next.js, TypeScript, Tailwind CSS, Supabase and large-language-model APIs. Testing confirmed that role-based access control, attendance and assignment tracking, and the AI-driven features behave reliably under normal and adversarial conditions. Future work includes extending EduMatriX with an online examination module, a parent portal, fee and library management, native mobile apps and predictive analytics for early identification of at-risk students, bringing the platform closer to a complete educational ERP solution.

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