



EduTrack: A Role-Based Student Academic Management System Using MERN Stack

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Abstract: EduTrack is a web-based application designed to manage the institutional data. In current time, every college and institution collects large number of data and storing that data manually can be hurdle and time consuming. A simple solution we present is EduTrack which is a MERN based web-application which allows users to manage institutional data efficiently. The System is build using MERN stack to meet the current trends in industry. The system includes role-based access control (RBAC) for their users to ensure secure access control. This system follows a modular database design where entities such as students, teachers, assignments, attendance, and marks are maintained in separate collections to ensure scalability and efficient data retrieval. It provides dedicated dashboard for each user role, enabling administrators to manage users, teachers to handle attendance, assignments, and marks, and students to view their academic records dynamically. EduTrack follows academic-year grouping, which allows teachers to assign tasks to an entire class without redundancy. The frontend is build using React with Tailwind CSS for a responsive and user-friendly interface. EduTrack practically demonstrates the implementation of full-stack development including RESTful APIs, role-based access control (RBAC), efficient data handling, authentication and authorization.

Index Terms - MERN Stack, RBAC, JWT, RESTful APIs, MongoDB, cookie-parser, Bcrypt, Student Management System, Web Application.

I. INTRODUCTION

Every institution stores large number of data and using traditional way manage this data can be difficult as well as time consuming. Manual way of data handling can cause data loss and data mismatch. We need a smart system that solves the problem for every institution. A system which can manage user data along with enable authorities to assign assignment, attendance and academic scores of students. This will save time and struggle which is seen in manual way. EduTrack provides a system that solve this problem via providing modular database with separate collections, allows teachers to assign attendance, assignments, academic score, admin to manage teacher's and student's data and students to access their data separately. Every role has their own dashboard for efficient working of the system.

II. LITERATURE SURVEY

Traditional system often uses manual processes or tools like spreadsheet where risk of error is high, lack data redundancy real-time access. Some web-based systems have been developed to address this issue but they lack scalability, role-based access control and proper data structure.

To overcome these limitations, we need a system that uses full-stack architecture and implement role-based authentication, modular database design, and responsive user interfaces. EduTrack is designed keeping these improvements in mind, providing a scalable, secure, and user-friendly solution.

III. PROPOSED SYSTEM

EduTrack is a web-based student academic management system build using MERN stack. Its agenda is to provide a centralized platform for managing academic activities efficiently using secure and role-based access. The system includes three primary user roles: administrator, teacher and student. Each role is provided with a dedicated dashboard and specific functionalities. Administrator can manage student and teacher records, teachers can handle assignment, academic scores, and attendance, and students can display their academic performance and updates.

A key feature of the system is the implementation of academic year grouping, which allows teachers to assign assignments to an entire class instead of individual students. The system also ensures data normalization by maintaining separate data collections such as attendance, mark, assignment, student, teacher, user. This proposed solution focuses scalability, ease to use, data handling, secure for modern educational institutions.

IV. System Architecture

EduTrack follows a three-tier architecture of full stack consisting of the frontend, backend, and database. The frontend is developed using React.js and provides an interactive user interface for all users. The backend is built using Node.js and Express.js, which handle backend logic, API handling, and request-response handling. Authentication is implemented using JSON Web Tokens (JWT), ensuring secure communication between the client and server. Middleware functions are used to verify tokens and enforce role-based access control. The database layer uses MongoDB with Mongoose for schema modelling. Data is stored in separate collections such as user, student, teacher, assignment, attendance, and mark. Relationships between entities are maintained using reference IDs, ensuring efficient data retrieval and scalability. The overall flow involves the frontend sending requests to the backend, which processes the logic, interacts with the database, and returns the required data to the user interface.

V. Modules

EduTrack includes admin, user, teacher, student, marks, assignment and attendance modules.

The admin module allows administrators to manage the system. It includes functionalities such as create, read, update, delete student and teacher records. The admin can also assign academic years and maintain overall system data.

The teacher module enables teachers to interact with students. Teachers can view students based on academic year, mark attendance, assign marks, and create assignments. Assignments are linked with a specific year, allowing automatic distribution to all students in that group.

The student module provides a personalized dashboard for students. After logging in, students can view their profile, attendance records, marks, and assignments. The data is dynamically fetched based on the logged-in user.

The attendance module allows teachers to record daily attendance for each student. Attendance data is stored separately, enabling efficient tracking and calculation of attendance percentages.

The marks module stores academic performance data. Teachers can assign marks based on subject and semester, and students can view their results in their dashboard.

The assignment module allows teachers to create assignments for a specific academic year. Students belonging to that year can view all assigned tasks, ensuring streamlined communication.

VI. Technologies Used

React.js: React.js is a JavaScript library used for building dynamic and interactive user interfaces. It follows a component-based architecture, allowing developers to create reusable UI elements. In EduTrack, React is used to build dashboards for admin, teacher, and student with real-time data updates. It improves performance through efficient rendering using the virtual DOM.

Node.js: Allows to create backend server. Node.js is a server-side JavaScript runtime environment that allows execution of JavaScript outside the browser. In EduTrack, Node.js is used to build the backend logic and handle API requests. It ensures fast and scalable server-side performance.

Express.js: Express.js is a framework for Node.js that simplifies server and API development. It provides routing, middleware support, and request handling features. In EduTrack, Express is used to create RESTful APIs for managing users, attendance, marks, and assignments.

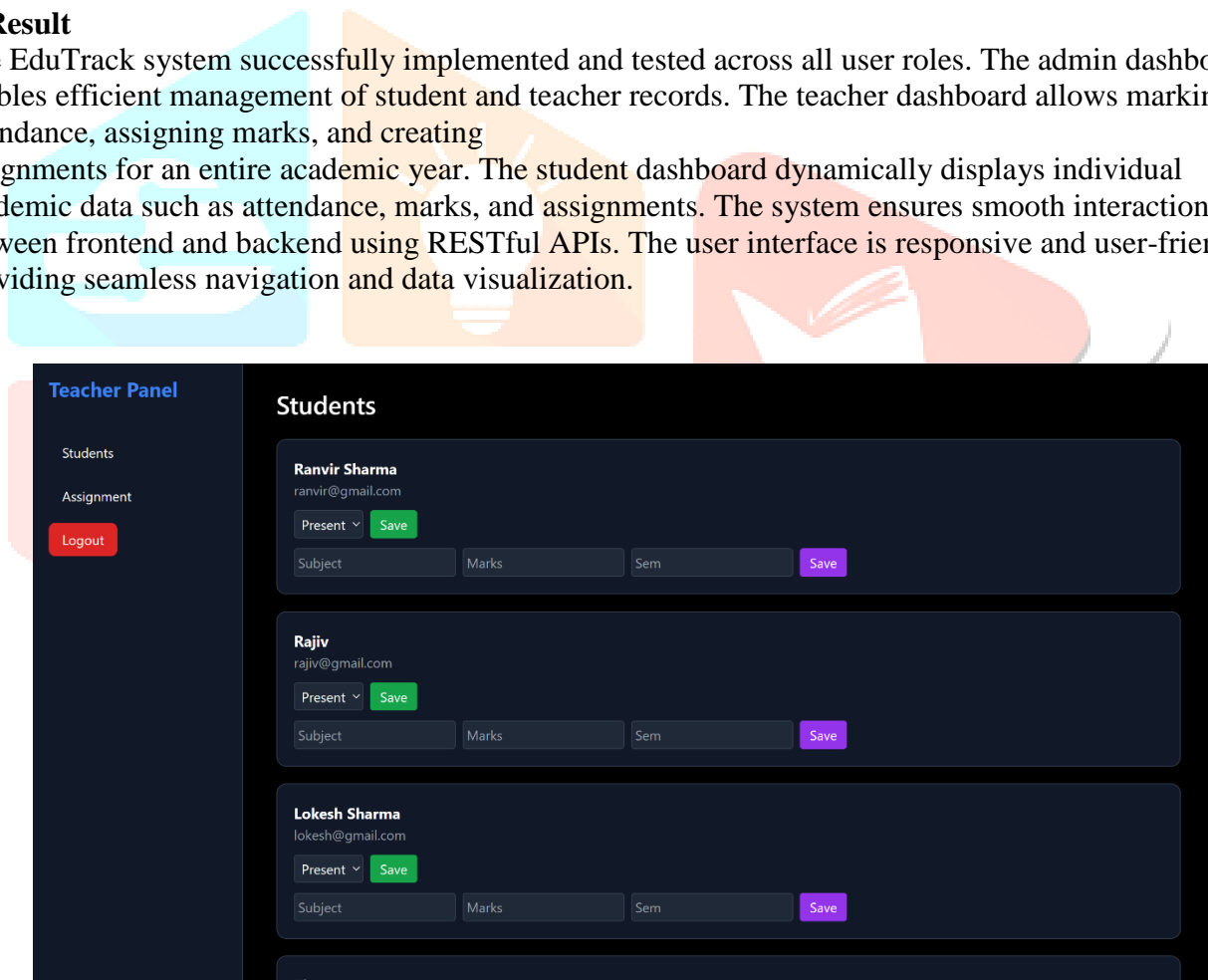
MongoDB: MongoDB is a NoSQL database that stores data in a flexible, JSON-like format called documents. It allows easy handling of large and unstructured data. In EduTrack, MongoDB is used to store user data, student records, assignments, attendance, and marks in separate collections.

Mongoose: Mongoose is an Object Data Modelling (ODM) library for MongoDB and Node.js. It provides a schema-based structure to model application data. In EduTrack, Mongoose is used to define schemas for different entities like student, teacher, and assignment.

Tailwind CSS – Tailwind CSS is a utility-first CSS framework used for designing responsive and modern user interfaces. In EduTrack, Tailwind is used to create consistent and visually appealing dashboards.

VII. Result

The EduTrack system successfully implemented and tested across all user roles. The admin dashboard enables efficient management of student and teacher records. The teacher dashboard allows marking attendance, assigning marks, and creating assignments for an entire academic year. The student dashboard dynamically displays individual academic data such as attendance, marks, and assignments. The system ensures smooth interaction between frontend and backend using RESTful APIs. The user interface is responsive and user-friendly, providing seamless navigation and data visualization.



Student Academic Management System

A web-based mini project designed to digitalize academic management in educational institutions. This system provides a secure and centralized platform for administrators, teachers, and students.

Built using the MERN stack, the application focuses on role-based authentication, structured data management, and easy access to academic records such as attendance and results.

Key Features:

- 1.RBAC Authentication
- 2.Secure Authentication using JWT and cookies
- 3.Built with MERN Stack
- 4.Student & Teacher Record Management
- 5.Attendance and Marks Tracking

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Welcome

Login to continue or register as admin

Login

Signin (Admin Only)

Admin Dashboard

Manage Students

Manage Teachers

Logout

Dashboard Overview

Total Students

6

Total Teachers

6

Logout

Profile

Email: rajiv@gmail.com
Department: cs
Contact: 123
Address: Nagpur

Quick Access

Attendance

Marks

Assignments

Info

Use quick access to view details

Attendance

Sem 8

78%

Marks Preview

Math - 85
C++ - 90
Communicational Skills - 17

Assignments Preview

Assignment 1
Assignment 2
Assignment 3

VIII. Future Scope

The system can be further enhanced by adding advanced features such as a mobile application for easier access, real-time notifications for assignments and updates, and online assignment submission functionality. Along with that AI techniques can be used to predict student performance and provide personalized recommendations.

IX. Conclusion

EduTrack has successfully demonstrates the implementation of a full-stack Student Academic Management System. The system provides a secure, scalable, and efficient platform for managing academic activities across different user roles. By integrating role-based authentication, modular database design, and responsive user interfaces, the system addresses key challenges faced in traditional academic management processes. Overall, the project highlights the practical application of MERN stack development

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