ScoreSync

A MERN-Based Academic Management and Grade Transparency Platform

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***Abstract*—ScoreSync is a full-stack academic management platform designed to provide clearer grade visibility, encourage student engagement, and simplify routine course management through real-time reporting and intuitive dashboards. The system integrates course organization, analytics, and communication tools into a responsive web interface. Its features were developed around widely recognized principles such as clear data presentation, timely feedback, and responsible information handling. ScoreSync also offers a flexible foundation for future enhancements, including expanded reporting capabilities and predictive academic support tools. The platform aims to deliver a practical and accessible solution for both students and instructors.**

I. Introduction

Digital learning platforms frequently struggle to provide adequate transparency, timely feedback, and intuitive workflows [11]–[13]. These limitations can reduce student engagement and make it difficult for instructors to manage coursework efficiently [1], [4]. ScoreSync was developed to address these concerns by integrating grade tracking, course management tools, analytics dashboards, and communication features within a MERN-based architecture [8]–[10], [14]. Prior research highlights that clear information presentation and real-time updates significantly improve student trust, satisfaction, and academic performance [1], [4], while privacy-aware design remains essential for adoption in educational environments [2], [3], [5], [16]. Guided by these findings, ScoreSync aims to deliver reliable grade visibility, organized course content, and streamlined communication to support both students and instructors.

The team chose this project because nearly all university students rely on digital learning tools but often lack meaningful insight into their academic standing until late in the semester. Issues such as inconsistent grade updates, confusing dashboards, and fragmented communication are common across courses and majors, making the need for a clearer and more responsive system widely felt among peers. ScoreSync offers a practical response to these frustrations by providing real-time weighted grades, simplified course organization, and integrated scheduling and messaging features. These capabilities make the platform relevant and valuable not only for the project team, but for course peers and future students who seek a more transparent, organized, and engaging academic experience.

II. Project Details

A. System Architecture

ScoreSync is built with the MERN stack: MongoDB, Express.js, React.js, and Node.js [6]–[11], [14]. On the frontend, React.js supports component-based development and Tailwind CSS provides responsive styling. TanStack Query synchronizes server state and ensures data remains up to date. The backend exposes RESTful API endpoints through Express.js, while Node.js manages server logic and middleware tasks. MongoDB Atlas stores user accounts, courses, grades, analytics, and system data. Fig. 1 illustrates the overall architecture and associated data flow.

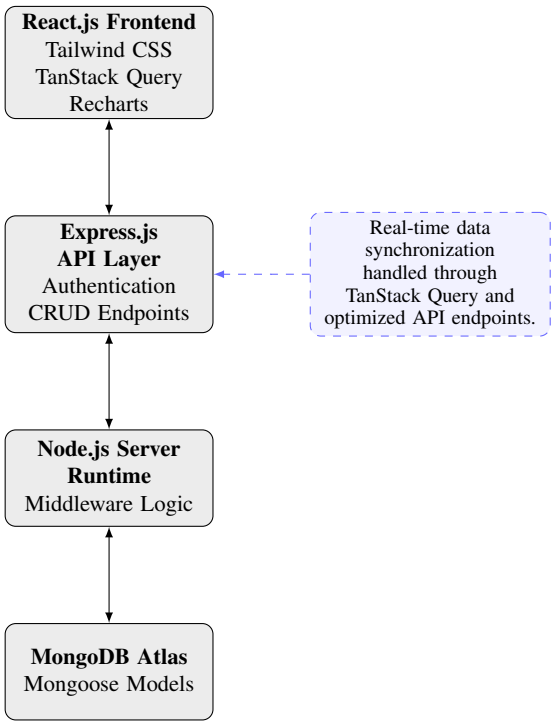

Fig. 1. Vertical MERN Stack architecture of ScoreSync

B. Database Schema

ScoreSync's data model is organized into collections for Users, Students, Teachers, Courses, Grades, and CalendarEvents. Relationships are normalized to support integrity,

transparency, and scalability [7], [15]. Fig. 2 shows the main relationships within the system.

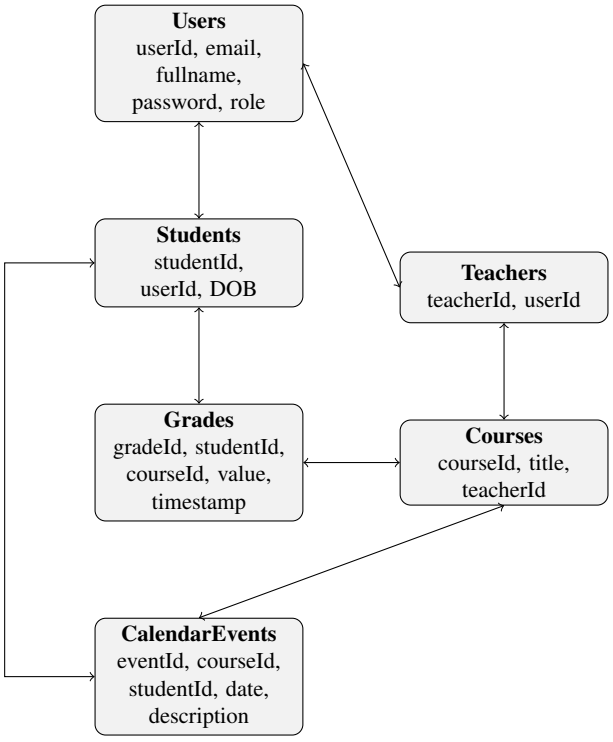

Fig. 2. Compact Database Schema Diagram for ScoreSync Collections and Relationships.

C. UI Wireframe

ScoreSync includes separate dashboards for students and administrators. Students can view grades, enrolled courses, calendar events, and messages. Administrators can manage courses, enter grades, view reports, and manage user access. Fig. 3 presents the wireframe layout.

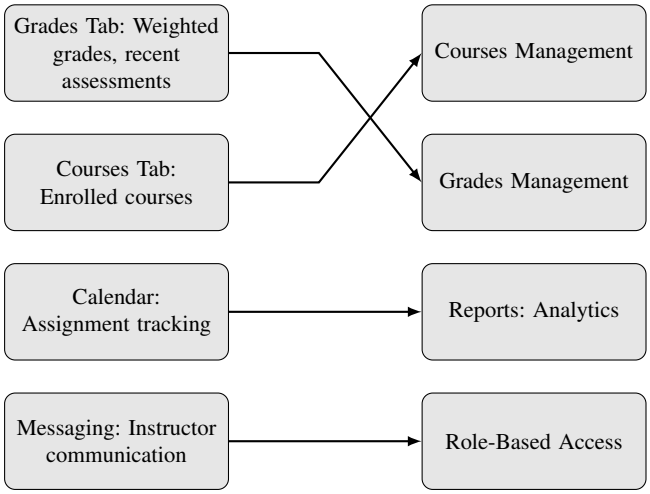

Fig. 3. Student and admin dashboard wireframe.

D. Methods

This project followed an applied, iterative development approach guided by the general research question of how transparency and clear data presentation influence student engagement.

1) Initial Planning and Research: The team conducted literature reviews, gathered requirements, organized tasks, and defined the architecture. Each member contributed research or planning based on their role.

2) Design and Architecture: The MERN stack was selected to support real-time updates and flexible schema requirements. React and TanStack Query supported dynamic front-end behavior, while Express and Node.js enabled modular backend development.

3) Development Sprints: Development tasks were organized into weekly sprints covering authentication, course management, grade entry, UI restructuring, messaging, and reporting.

4) Testing: Testing included manual UI review, backend API verification, weighted average validation, and multi-user synchronization tests.

E. Results

ScoreSync achieved full functionality across major modules, including course management, graded assessments, messaging, calendar events, and reporting.

1) Functional Outcomes: Testing demonstrated real-time grade updates, accurate weighted average calculations, working course detail pages, calendar synchronization, and stable reporting functionality.

2) User Experience Results: Students testing the platform reported improved clarity in grade interpretation, increased awareness of academic standing, and confidence in the accuracy of grade calculations.

3) System Stability: All major modules remained stable throughout development following initial debugging.

F. Discussion

The results support the idea that transparency and clear data presentation enhance student engagement. ScoreSync's architecture aligns with privacy and usability considerations highlighted in prior research. Limitations include small sample size and lack of long-term data.

G. Conclusion

ScoreSync addresses gaps in grade transparency and usability through a real-time, intuitive platform. The system demonstrates how structured data presentation and responsible handling can support student trust. Future improvements include predictive analytics, expanded reporting, and enhanced privacy tooling.

III. Group Responsibilities

A. Raya Boutany — Project Manager and Backend Support

- Researched authentication, UI tools, and database integration.
- Managed milestones, documentation, and GitHub task assignments.
- Developed the backend Grade model and routes, and resolved CORS issues.

B. Alyssa Darakdjian — Frontend Engineer

- Refactored the Calendar component for TypeScript support.
- Enhanced Grades page filtering, documentation clarity, and overall maintainability.
- Implemented the Add Grade functionality.

C. Jake Mansoor — Frontend Engineer

- Designed the UI and login page, and implemented coursework functionality.
- Updated the README, organized the repository structure, and refined overall styling.

D. Lucas Shahmurad — Database Engineer and Full-Stack Integrator

- Researched database connections and created MongoDB schemas.
- Developed the admin login system, course management features, and detailed course pages.
- Implemented weighted grade calculations and real-time student updates.

E. Mario Shakouri — Backend Engineer and System Architect

- Developed backend logic for the Messages and Reports pages.
- Built the backend for dashboard operations and connected grade-related functionalities.
- Implemented admin login, user authentication, and teacher database models.

IV. Current Status

All core modules are successfully implemented and performing reliably. Authentication, real-time database synchronization, and dashboard components remain stable across sessions. Students can seamlessly view enrolled courses, receive instant grade updates, track calendar events, and access messages. Instructors have full access to course creation and management tools, grade entry and modification, and detailed summary reports. Overall, ScoreSync supports complete end-to-end workflows for both user roles, providing a smooth and responsive experience throughout.

V. Next Steps

ScoreSync is fully functional and operating as intended, but several enhancements could further strengthen the platform:

- **UI refinements:** Small improvements to layout, accessibility, and mobile responsiveness would make the interface easier to use [12], [13].
- **Reporting and export tools:** Adding features such as PDF or CSV export would give instructors more ways to analyze student performance [13], [15].
- **Performance and scalability:** As usage increases, optimizing database queries, adding indexing, and running load tests will help ensure the system remains responsive [7], [14].
- **Predictive features:** Incorporating machine learning models could help identify students who may need additional support or recommend helpful resources, improving engagement and learning outcomes [4], [16].
- **Security and privacy updates:** Strengthening authentication, encrypting sensitive data, and aligning with regulations such as FERPA or GDPR would help maintain user trust. Routine audits and automated testing would support long-term reliability [2], [16].

VI. Generative AI Usage

ChatGPT was used to improve clarity in the written sections of this report and to assist with LaTeX formatting and figure layout (manuscript prepared on Overleaf [17]). All coding, design work, and documentation beyond wording support were completed by the team.

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