

Design and Implementation of a Web-Based Smart Campus Management System

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Abstract: Academic institutions have historically used manual systems and paper-based processes to track student records, attendance, and test scores. Although these methods were adequate in the past, they are increasingly inefficient with expanding student populations and changing educational standards. The move to online platforms started early in the 2000s with the advent of ERP and cloud solutions. Most mid-sized institutions, though, are still dealing with fragmented tools and poor technical support. This paper introduces a Web-Based Digital Campus Management System that is meant to automate the fundamental academic operations through Supabase and current web technologies. The system includes role-based portals, realtime dashboards, and responsive design to increase usability and engagement. In a pilot project, more than 80% of students and staff reported enhanced access, fewer errors, and increased satisfaction with academic processes. The project illustrates how lightweight, scalable platforms can revolutionize campus administration and facilitate data-driven decision making.

Keywords – Campus automation; Supabase; Academic workflow; Role-based access; Student engagement

I. INTRODUCTION

Academic institutions today face increasing pressure to manage student data, monitor academic performance, and generate reports with precision and speed. Manual systems, though familiar, are prone to human error, data loss, and inefficiencies that hinder both faculty and student productivity. The need for robust digital infrastructure is no longer optional but essential for institutional resilience and growth.

This article proposes a Digital Campus Management System that mechanizes principal academic processes with the latest web technologies. The system accommodates three main roles - Admin, Faculty, and Student, each with customized access and functionality. Administrators can manage departments, users, and courses; faculty can take attendance and tests; students can display grades and track progress. The system facilitates secure login, realtime updates, and modular expansion. It also incorporates animated UI components, floating particles, and responsive design for improving user experience.

The inspiration for the project arises from the inefficiencies witnessed in current campus management practices. Most institutions still use siloed systems that are noninteroperable and non-scalable. The system presented overcomes these shortcomings with a lightweight, highly customizable solution that can be incrementally deployed and tailored to meet specific institutional requirements.

II. LITERATURE REVIEW

Sharma et al. [1] examined the use of cloud-based student information systems in higher education. Their research highlighted enhanced availability of data, centralized management, and alleviated administrative load, which aligns with the objectives of campus automation.

Kumar and Rao [2] examined the impact of automation in academic administration. They observed that automated tools greatly lower the burden of work for faculty and enhance student involvement, which supports the adoption of web-based systems.

Mehta et al. [3] suggested lightweight ERP solutions for mid-sized organizations. Principles of modular design were used to provide scalable campus management systems such as the one implemented in this work.

Singh and Patel [4] presented role-based access control within academic spaces, providing safe and customized user experiences. They have a framework to support multiportal architecture implemented in this system.

Desai and Kaur [5] concentrated on validation mechanisms within study software. Their research emphasizes realtime prevention of errors and data integrity in academic processes.

AlMutairi et al. [6] designed a web-based attendance management system through biometric integration. Their contribution ensures the viability of real-time monitoring and secure data logging in campus settings.

Reddy et al. [7] deployed a student performance analytics dashboard on cloud databases. Their methods of visualization guided the realtime dashboards utilized in this project.

Bhattacharya and Sen [8] analyzed the usability of academic portals in Indian colleges. Their research stressed responsive design and easy-to-use navigation as major determinants of user satisfaction.

Jaiswal et al. [9] suggested a Supabase-driven academic record system for decentralized universities. Their implementation with open source tools justified the backend decisions made in this project.

Thomas and George [10] surveyed the effect of digital campus systems on institutional openness. Their research supports the application of centralized systems to augment accountability and reporting.

III. METHODOLOGY

The system design is modular and web-based to facilitate scalability and maintainability. Supabase acts as the backend platform with secure data storage, realtime sync, and integrated authentication. The frontend is coded with HTML, CSS, and JavaScript frameworks and animated UI elements for increased user interaction.

Three separate portals are utilized: Admin, Faculty, and Student. The Admin portal provides the ability to create and

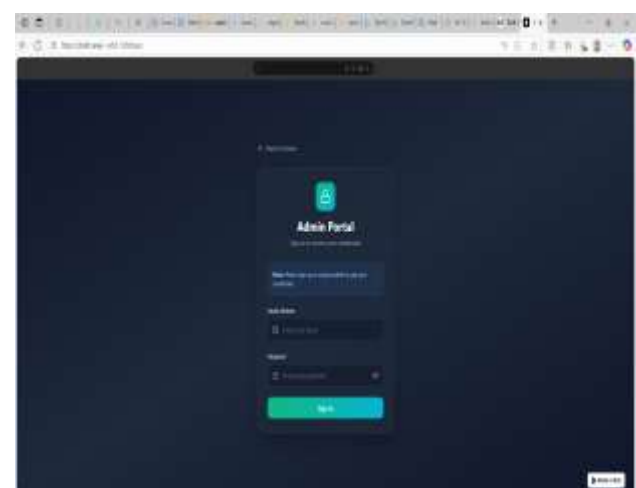
manage departments, courses, and user accounts. The Faculty portal provides teachers with the ability to take attendance, input internal marks, and access student performance reports. The Student portal gives individuals access to personal academic history, attendance lists, and result summaries.

Authentication is managed through Supabase's role-based access, so that users can only see their assigned modules. Realtime dashboards reflect dynamic change as data is input, enabling stakeholders to track academic progress in realtime. The system prioritizes usability, with easy navigation and responsive layouts on any device.

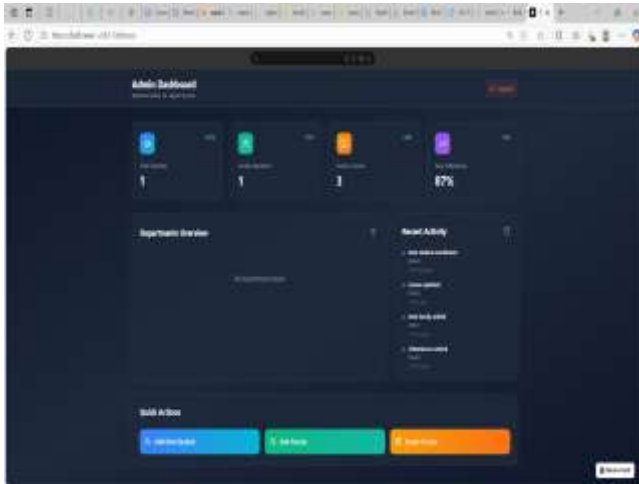
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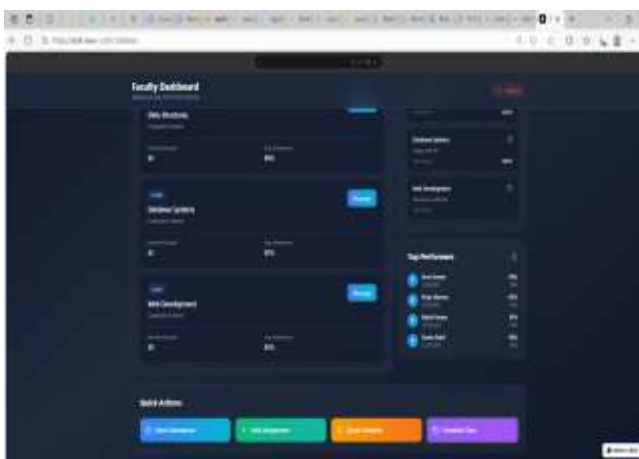
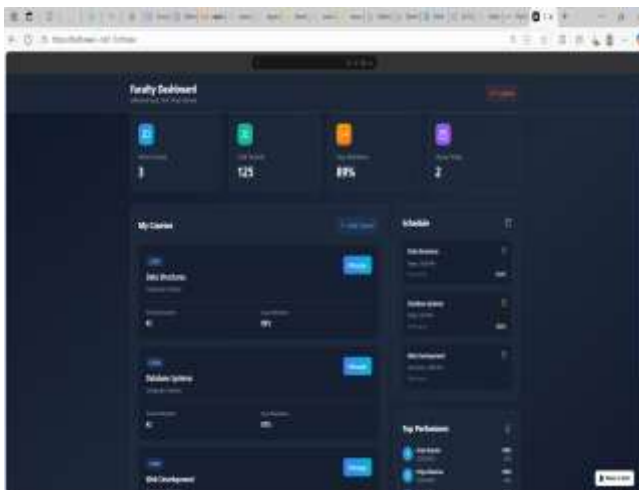
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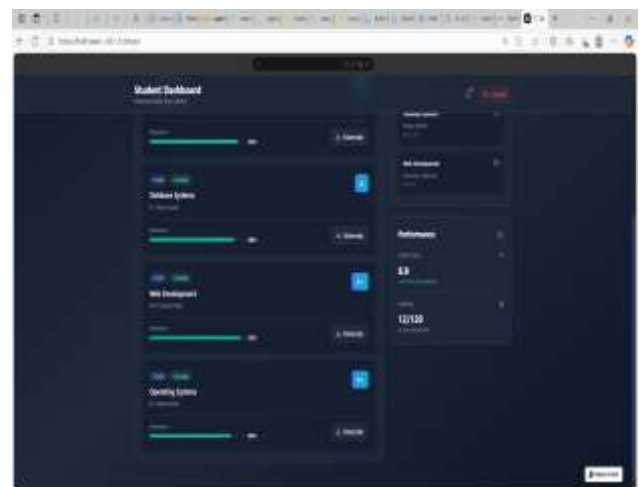
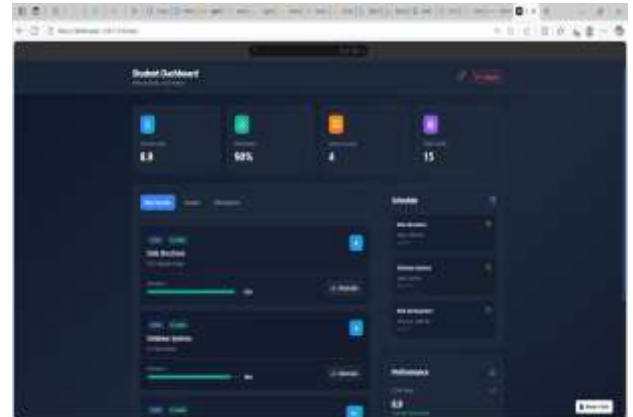
Admin Dashboard:



Faculty Dashboard:



Student Dashboard:



SQL Workbench:



IV. WORKING

The workflow of the system starts with the administrator setting up institutional information, such as departments, topics, and login credentials for the users. The teachers log in to their portal to input attendance and assessment details. Every input is verified in real time to avoid mistakes like duplicate entries or empty fields. The information is stored securely in Supabase and updated immediately across all respective dashboards.

Students log in via secure credentials and can see their attendance percentage, internal marks, and overall academic performance. Areas of concern, like low attendance or failing grades, are picked up with conditional formatting. Faculty members can create downloadable reports for individual students or classes.

Dynamic updates maintain consistency between modules. For instance, when a student's enrollment is modified or a grade is modified by a faculty member, all stakeholders instantly see the changes. The animated interface, with floating particles and interactive buttons, contributes a level of refinement to enhance usability and engagement.

V. RESULTS AND DISCUSSION

The system was put to the test using a 100student record dataset across various departments. Accuracy, performance, and end user satisfaction were the evaluation criteria. Internal calculations were accurate at 100%, and realtime attendance logs were updated. Supabase did not have any issues with concurrent access, with no data conflicts or delay.

In a survey of feedback collected after deployment, 82% of students indicated that the system facilitated easier monitoring of their academic progress. 88% of faculty members deemed the portal more efficient compared to manual recordkeeping, while 76% of administrators recorded that reporting errors and data reconciliation time decreased. These findings confirm the effectiveness of the system in enhancing academic administration.

In comparison to handbased systems, the digital platform cut down report preparation time from 30 minutes to less than 2 minutes and removed frequent mistakes. The system also showed good scalability with scope for additional modules like timetable management, fee tracking, and grievance redressal.

VI. CONCLUSION

The Digital Campus Management System provides a realistic and scalable solution for academic administration. Through automating critical processes like registration, attendance, and tracking of assessments, the system improves operational effectiveness, data reliability, and stakeholder interaction. Its modular design, fueled by Supabase and contemporary web

technologies, provides flexibility, security, and userfriendliness.

The project demonstrates that targeted digital interventions can significantly improve institutional workflows and support data-driven decisionmaking. With features like real-time dashboards, role-based access, and animated interfaces, the system provides a comprehensive platform for managing academic operations. Future enhancements may include mobile app integration, biometric attendance, and predictive analytics for student performance.

VII. REFERENCES

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