A Secured Knowledge Management System to enhance the User Experience in Engineering Education

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Abstract: With the increasing complexity of institute management systems, there is a growing need for an integrated digital solution that streamlines academic, administrative, and extracurricular activities. The system is a unified institute management application designed to simplify processes for students, faculty, and administrators. The platform offers academic tools such as course registration, attendance tracking, and examination applications, along with administrative features like fee payment and digital certificate requests. Additionally, it enhances student engagement through event management, resource management, and knowledge sharing forums. It also provides data driven dashboards and analytics, enabling users to track progress and institutional efficiency. This paper explores the functional architecture, key features, and impact of the system, highlighting its role in improving efficiency and user experience in higher education. Future enhancements and the potential of such systems in digitalizing institutes are also discussed.

Keywords: Institute management system, digital integration, academic tools, administrative efficiency, student engagement, event management, knowledge sharing, data analytics, higher education, Insightify, digital transformation.

1. Introduction

In the rapidly evolving landscape of higher education, institutes are facing increasing challenges in managing academic, administrative, and extracurricular activities efficiently. Traditional methods of institute management often involve fragmented systems that require students, faculty, and administrators to navigate multiple platforms for different tasks. This lack of integration leads to inefficiencies, miscommunication, and delays in critical processes such as course registration, attendance tracking, fee payments, and event management.

To address these challenges, Insightify is designed as an all-in-one institute management application that serves as a centralized digital platform for students, faculty, heads of departments (HODs), and administrators. By integrating multiple features into a single application, Insightify streamlines essential institute functions such as academic management, attendance tracking, course registration, faculty-student interactions and knowledge sharing.

2. Literature Review

The development of institute management systems has been a topic of extensive research in recent years. Various studies have proposed and evaluated different models, frameworks, and implementations that aim to enhance the efficiency of academic institutions.

2.1 Knowledge Management in Higher Education Institutions

Research highlights the role of knowledge management (KM) in universities, emphasizing the importance of structured KM systems for academic and administrative efficiency. It discusses the impact of KM frameworks on improving decision-making, student engagement, and faculty collaboration.

2.2 Impact of Digital Platforms on University Administration

This study examines the implementation of digital university management systems that integrate academic, financial, and administrative services into a unified platform. It compares traditional systems with modern cloud-based solutions and evaluates their scalability and security.

2.3 A Framework for University Knowledge Management System

A proposed framework highlights the importance of integrating KM strategies with university management platforms. The study suggests using AI-driven recommendation systems to enhance personalized learning experiences and streamline administrative processes.

2.4 Technology-Driven University Management Systems

This research focuses on the technological advancements in university management, emphasizing cloud computing, AI, and big data analytics. The study discusses the implementation of web-based platforms that facilitate course registration, examination management, and student performance tracking.

2.5 Student-Centric Digital Transformation in Higher Education

The paper explores how digital transformation impacts student experiences in higher education. It discusses the role of mobile applications and dashboards in providing realtime academic insights, attendance tracking, and performance analytics.

3. Methodology

3.1 Introduction to Methodology

The efficient management of academic and administrative processes is a significant challenge in modern institutes. Institutions require an integrated, scalable, and secure system to streamline student services, faculty interactions, and administrative operations. This research paper presents a comprehensive university management system designed to centralize various academic, financial, and extracurricular activities into a single digital platform.

This section outlines the methodology employed in the design, development, and evaluation of the system. The methodology ensures a structured approach that aligns with user requirements while optimizing system performance, security, and scalability. The research integrates both theoretical frameworks and practical implementations, offering a holistic understanding of the architectural, functional, and usability aspects of this system. To achieve these objectives, the methodology is structured into several key components:

- Requirement Analysis to identify the essential features based on user needs.
- System Architecture Design to establish a scalable and modular structure.
- Data Collection and Processing methods to handle user information securely and efficiently.
- Development and Optimization Techniques for ensuring high performance and usability.
- Testing and Evaluation Strategies to validate functionality and user experience.

- Deployment Planning and Maintenance to ensure long-term sustainability and updates.

4. System Design and Model

The system design follows a modular and scalable approach to accommodate the diverse functionalities required by students, faculty, and administrators.

4.1 Overview

The system follows a three-tier architecture:

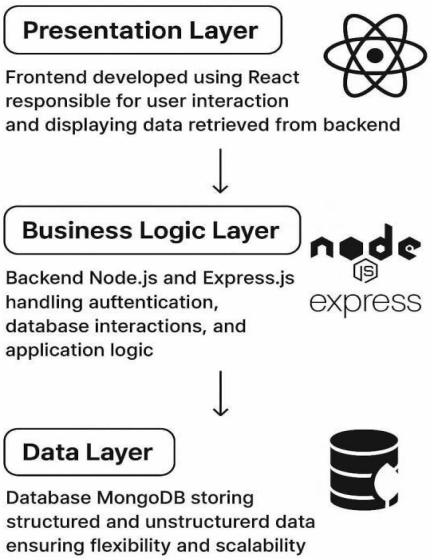

Figure 1. System Design

4.2 Proposed Solution: System Overview

The system is designed to be an all-in-one application offering distinct features for students, faculty, and administrators. The system integrates various modules to ensure smooth management of academic and administrative processes. The primary components include:

- Student Dashboard: Provides access to course registration, attendance tracking, examination applications, result viewing, timetable management, fee payments, and hostel facilities.
- Faculty Dashboard: Facilitates course allocation, attendance marking, grading, result generation, and scheduling of classes.
- Admin Dashboard: Oversees digital applications, meeting bookings, certificate issuance, and centralized academic records

4.3 System Architecture

The architecture is built on the MERN stack, comprising React.js for the frontend, Node.js with Express.js for the backend, and MongoDB as the database. Users interact with the system through a responsive React interface, which communicates with backend APIs to perform actions like login, data submission, and content retrieval. The backend handles logic, user authentication via JWT/OAuth, and role-based access control. MongoDB stores all academic and administrative data, including user profiles, timetables, and attendance. Cloud deployment ensures scalability, while monitoring and testing tools like Postman and Prometheus maintain system reliability. This architecture enables secure, modular, and efficient data flow across all components.

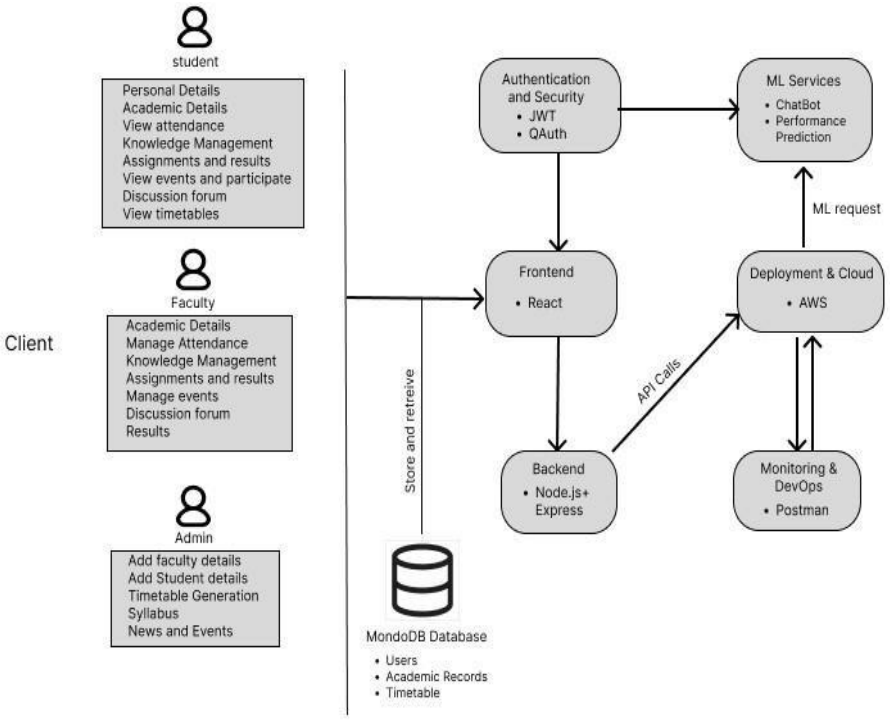

Figure 2. System Architecture

4.4 Features and Functionalities

4.4.1 Student Functionalities

The Student module of this system includes the following feactures:

- Academic functions: Course registration, timetable viewing, examination applications.
- Administrative functions: Fee payments, certificate applications, leave requests.
- Canteen and hostel services: Online food ordering, seat reservations, hostel applications.
- Community engagement: Event registrations, discussion forums, knowledge sharing.

4.4.2 Faculty Features

The faculty module of this system includes the following features:

- Course management: Viewing and managing assigned courses.
- Assessment management: Attendance, internal evaluations, result generation.
- Administrative tasks: Leave applications, meeting bookings, student guidance.
- Community engagement: Event management, knowledge sharing, discussion forums.

5. Results

Table 1. *Results*

Previous systems	Hurdles overcame	System enhancement
Manual course registration	Time delays, errors	Online academic process
Paper-based attendance	Lack of tracking	Digital attendance and results

No unified student portal	Scattered systems	Centralized dashboard
Manual search for free resource availability	Scheduling issues	Convenient and proper resource usage
Limited communication	Low engagement	Forums and event management
Offline fee/certificate process	Manual delays	Online payments and applications
No KMS or academic resources	Limited knowledge sharing	Integrated Knowledge Management System (KMS)
No doubt resolution platform	Student queries went unanswered	Doubt-raising and discussion forum

Figure 3. Results

6. Benefits and Impact

- Efficiency: Automates manual processes, reducing administrative workload.
- Transparency: Improves information flow between students, faculty, and administration.
- Accessibility: Enables remote management of academic functions.
- Engagement: Encourages knowledge sharing and collaboration through discussion forums.

7. Conclusion

The system is composed to revolutionize institute management by integrating all essential academic, administrative, and extracurricular functionalities into a single platform. By

leveraging modern technology, the system enhances efficiency, reduces administrative overhead, and fosters a collaborative learning environment.

With AI-driven analytics and real-time data processing, institutes can optimize course scheduling, monitor student performance, and facilitate personalized learning. The automation of administrative tasks, such as fee management and event coordination, will help institutions allocate resources more effectively and improve operational efficiency.

References

D.-G. J. Dei and T. B. van der Walt, ”Knowledge Management Practices in Universities: The Role of Communities of Practice,” *International Journal of Knowledge Management, vol. 12, no. 4, pp. 1–14, 2016*. DOI: 10.4018/IJKM.2016100101.

Mouna Ben Chouikha Zouari, Salem Ben Dhaou Dakhli, "A Multi-Faceted Analysis of Knowledge Management Systems*", Procedia Computer Science*, *2018*,

K. Iskandar, M. I. Jambak, R. Kosala, and H. Prabowo, ”Current Issue on Knowledge Management System for Future Research: A Systematic Literature Review,” *Procedia Computer Science, vol. 116, pp. 68–80, 2017*. DOI:10.1016/j.procs.2017.10.011.

Ahmed, Professor & Sutton, Michael. (2017). Gamification, serious games, simulations, and immersive learning environments in knowledge management initiatives. *World Journal of Science, Technology and Sustainable Development.* 14. 78-83.10.1108/WJSTSD-02-2017-0005.

Kudozia, R. , Kudozia, C. and Owusu-Donkor, D. (2023) Knowledge Management Infrastructure in Organisational Knowledge Management Processes—A Case of Aquantuo LLC. *Open Journal of Business and Management, 11, 1248-1270*. doi: 10.4236/ojbm.2023.113070

T. Gao, Y. Chai, and Y. Liu, ”A Review of Knowledge Management about Theoretical Conception and Designing Approaches,” *International Journal of Crowd Science, vol. 2, no. 1, pp.42–52,2018*. DOI: 10.1108/IJCS-08-2017-0023.