

Design of Web-Based Student Academic Information System

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Abstract

The management of student academic data often faces challenges due to the reliance on manual processes, which are susceptible to errors and inefficiencies. This study was conducted to design and implement a web-based academic information system aimed at improving the efficiency and accuracy of managing academic data in educational institutions. The development process employed the Rapid Application Development (RAD) methodology, chosen for its iterative and flexible approach, which allows for quick prototyping and feedback integration. Black box testing was used to ensure the system's functionality meets the required specifications and operates effectively under various conditions. User testing results showed that 80% of users rated the system as highly effective, citing its ease of use, real-time data access, and streamlined workflows. The remaining 20% rated the system as effective, highlighting its ability to improve overall academic data monitoring. The system enables students, teachers, and parents to access and monitor academic information efficiently, fostering better communication and decision-making. Furthermore, the findings underscore the system's ability to minimize data errors, enhance the quality of educational services, and contribute to the broader digital transformation of the education sector. This research demonstrates the feasibility and significant impact of implementing web-based solutions in modern educational settings, paving the way for further innovation and adoption of technology in education.

Keywords: Academic Information System; Web-Based Solution; Data Management Efficiency; Digital Transformation in Education; Rapid Application Development (RAD).

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Introduction

Education is one sector that needs the use of the latest technology to support the learning process and information management (Cholik, 2017; Setiyadi, 2023; Yusril, 2019). The technological transformation in education has enabled educational institutions to increase efficiency, speed, and accuracy in managing academic data (Ahyani & Dhuhani, 2024; Awaluddin et al., 2021; Noviyana & Nasution, 2024; Purba & Saragih, 2023; Susanti, 2013). In this case, a web-based information system is an effective solution to replace manual methods that tend to be time-consuming and risk losing important data (Fitriani et al., 2018; Puspitasari, 2016; Ula & Hasbi, 2021).

One of the main challenges faced by schools is managing student academic data, such as grades, absences, and progress reports (Hermansyah & Pauline, 2013; Kusmiati, 2021; Prasetya & Setiawan, 2019; Suryatman, 2020). Traditionally, this data processing is done manually using physical documents, which is not only time-consuming but also prone to errors and data loss. With the development of technology, web-based systems can provide more practical and efficient solutions (Muzakky et al., 2023; Sundari, 2024; Surachman et al., 2024; Wijaya et al., 2016).

In addition, the implementation of a web-based information system is also in line with the needs of modern schools to improve services to students, teachers, and parents. With this system, students can easily access their academic information, teachers can manage materials and assignments more effectively, and parents can monitor their children's development in real-time (Helmina et al., 2023; Lerekh et al., 2022; Ratulangi et al., 2021). This shows that technology has great potential in supporting the improvement of the quality of education (Achyadadia & others, 2016; Asviyati et al., 2023; Silahuddin, 2016). However, the implementation of this technology requires proper system design in order to optimally meet user needs. The use of approaches such as the Unified Modeling Language (UML) and intuitive interfaces are important elements in ensuring that the information system developed is not only effective but also easy to use by all parties.

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This research is in line with the research (Siregar.,2017) and (Damayanti & Sudaryanto., 2020). Previous studies have shown that the implementation of web-based information systems in educational environments can improve productivity and work efficiency. In addition, related studies also highlight the importance of comprehensive testing to ensure that the system runs according to the specifications that have been set. One effective testing method is black box testing, which allows the evaluation of system performance from the user's perspective.

The use of technology in education also plays a role in responding to the challenges of the digital era, where students and teachers are required to master technological skills (Fricitarani et al., 2023; Nadila, 2024; Saputra, 2020; Zebua, 2023). With a web-based information system, schools can create a more interactive, collaborative, and technology-based learning environment (Endar et al., 2017; Laugi, 2018; Patmanthara, 2018; Simpony et al., 2022). This not only supports the learning process but also prepares students to face future challenges.

This research was conducted to answer these needs by designing and implementing a web-based academic information system that can support the management of student academic data in schools. With this system, it is expected that academic data management will be more efficient, secure, and structured. With this background, this research aims to provide a real contribution to supporting digital transformation in the field of education, especially in the management of academic data. The system designed not only functions as an administrative tool but also as a medium to encourage innovation in the learning process. It is hoped that the results of this study can be a reference for other educational institutions that want to adopt similar technology to improve the quality of services and teaching and learning processes in the digital era.

Method

This research uses the Rapid Application Development (RAD) method, a software development approach with an iterative cycle that aims to accelerate the development process and increase efficiency without ignoring user needs (Hasanah & Untari, 2020; Ihsan et al., 2022; Noertjahyana, 2002; Parluka et al., 2023; Sari, 2021). The first stage is needs analysis, which is carried out through observation, interviews, and literature studies to identify the needs of principals, teachers, students, and guardians of students for academic information systems. Furthermore, the system design stage is carried out by designing a model using the Unified Modeling Language (UML), such as use case diagrams, activities, and classes, and creating an initial prototype as a description of the system's functions and interfaces for users (Bittner & Spence, 2003; Kurniawan, 2018; Lesmono, 2024; Maulana, 2022; Setiyani, 2021). The construction phase involves the development of a web-based system based on an approved prototype, including student data management features, grades, schedules, and assignments, with an intuitive interface. Finally, the testing and implementation phase is carried out using the black box testing method to ensure that the system functions according to specifications. After testing, the system is implemented in the school environment to support efficient academic data management.

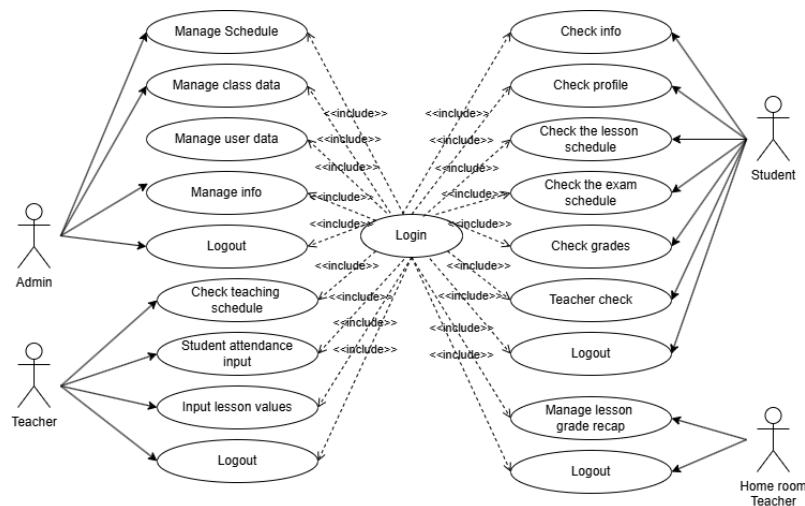


Figure 1. Use case diagram

Figure 1 is a use case diagram that illustrates the interaction between the academic information system and four main actors: Admin, Teacher, Student, and Homeroom Teacher. Admin has access to manage lesson schedules, class data, user data, and school information, while Teachers can check teaching schedules, input student attendance, and enter lesson grades. Students use the system to view school information, profiles, lesson schedules, exam schedules, and academic grades and can contact teachers if needed. Homeroom Teachers have a special function to manage lesson grade recaps. Each actor must go through the Login process as an initial step to access the designed system functions, with the <<include>> relationship showing the relationship between functions. This diagram reflects a structured system design to support comprehensive academic needs for all users.

Results and Discussion

Results

The design of the web-based academic information system was developed to accommodate four main user roles: admin, teacher, student, and homeroom teacher. Each role has specific access rights and functionalities tailored to their needs, ensuring optimal usability and relevance. Admins manage user accounts and system settings, teachers input academic data such as grades and attendance, students access their academic information, and homeroom teachers oversee and validate class-specific data.



Figure 2. User login page

In Figure 2, the user login page is the main display that appears after entering the application link. On this page, the user enters their email and password to enter the main menu.

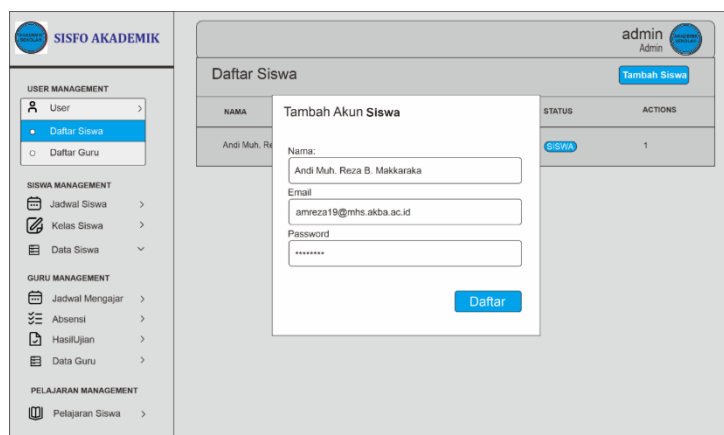


Figure 3. Add student account page

In Figure 3, the add student account page is a page for adding account data. This page is similar to the add teacher account page. By adding this account, users can access the system according to the input data.

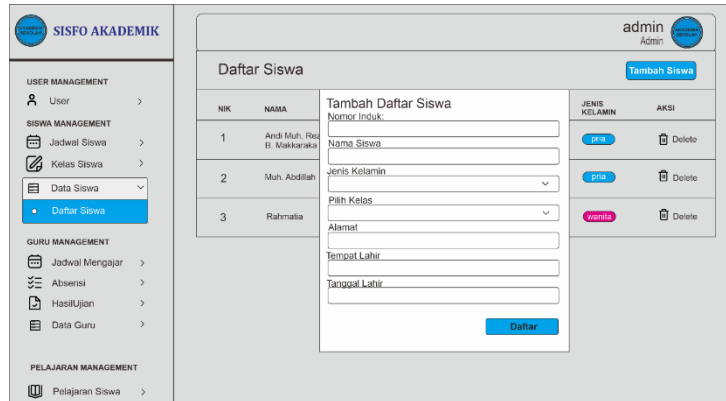


Figure 4. Add student data page

In Figure 4, the add student data page is a page for adding data in the form of student ID number, student name, gender, select class, birth address, and date of birth. This page is also similar to the add teacher data page, the data added is the student ID number, teacher name, gender, subject, address, and cellphone number.

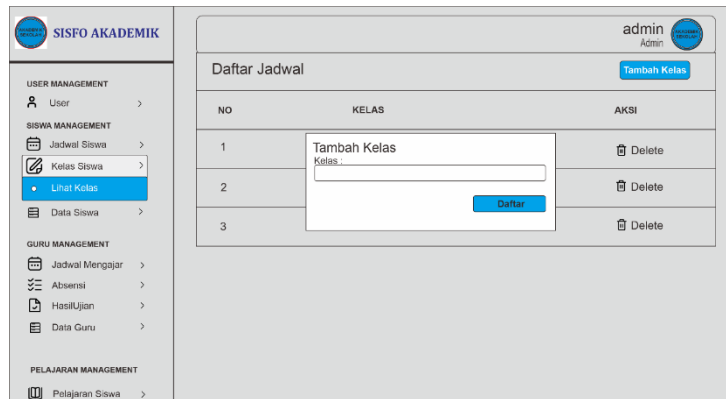


Figure 5. Add class page

Figure 5 illustrates the "Add Class" page, which allows users to add new classes to the system for monitoring and management purposes. The test results were obtained using the black-box testing method. Black-box testing is a technique used to assess software by evaluating its functionality based on inputs and outputs, without inspecting the internal structure or code (Dashti & Basin, 2020; Peled et al., 1999; Setiawan, 2021; Team, 2023; Wicaksono, 2022). The objective of this testing is to verify that the software operates according to its functional specifications and to identify any potential errors, including issues related to functionality, interface, or data validation.

Table 1. Blackbox test result data

Scenario	Results obtained	Information
Click login	Enter the admin page and display all information related to user data.	Succeed
Click on dashboard	The dashboard page appears	Succeed
Click on the student schedule	The student schedule page appears	Succeed
Click on teacher data	Teacher data is displayed	Succeed
Click on the exam schedule	List of exam schedule data	Succeed
Click on the exam results	The test result data is displayed	Succeed
Click on report card grades	Report card grades appear	Succeed
Click on attendance	Attendance appearance	Succeed

The results of the user testing show that 80% of users rated the system as highly effective, emphasizing its user-friendly interface, real-time data access, and efficient workflow management. These features played a significant role in the system's ability to meet user needs. The remaining 20% of users rated the system as effective, particularly appreciating its ability to enhance the accuracy and monitoring of academic information.

The positive feedback from users indicates that the system successfully facilitates access to critical academic data, such as schedules, grades, exam results, and attendance. These features promote better communication and decision-making among students, teachers, and parents. Moreover, the system's ability to reduce data errors and enhance the integrity of academic records improves the overall quality of educational services. In conclusion, the web-based academic information system has proven to be a reliable and effective tool for managing academic data. Its successful implementation contributes to the digital transformation of educational institutions, offering an efficient solution for enhancing both administrative efficiency and the quality of educational services.

Discussion

This study shows that the web-based academic information system designed in this research significantly enhances the efficiency and accuracy of managing student academic data. This finding aligns with the increasing demand for digital transformation in modern schools, where technology plays a central role in improving educational services. The system's ability to provide real-time access to academic data for students, teachers, and parents supports more effective monitoring of academic progress and facilitates better collaboration.

The use of the Rapid Application Development (RAD) methodology in the system's development, along with black box testing, ensures that the system not only meets functional specifications but is also user-friendly and accessible to all stakeholders. These findings contribute to the ongoing innovation in educational management by reducing the risk of data errors associated with manual methods and enhancing the efficiency of administrative processes. These results are consistent with previous studies by Siregar (2017) and Damayanti & Sudaryanto (2020), which found that the implementation of web-based systems can significantly increase productivity in educational environments.

However, it is important to note that the system currently lacks additional features, such as learning analytics or artificial intelligence integration, which could support personalized learning experiences. Further research is recommended to explore the development of these advanced features and to test the scalability of the system in a broader context. This could provide even greater benefits for educational institutions in the digital era, further enhancing the quality of education and administrative processes. In conclusion, the web-based academic information system has proven to be a reliable and effective tool for managing academic data, contributing to the digital transformation of educational institutions. Its successful implementation offers an efficient solution to improving both administrative efficiency and the overall quality of educational services.

Conclusions and Suggestions

Conclusions

This study demonstrates that the web-based academic information system significantly enhances the efficiency and effectiveness of managing student academic data. By providing real-time access to academic information, the system allows students and teachers to monitor academic progress more effectively. Transitioning from manual data management to a web-based approach minimizes the risk of errors and data loss, improving the overall accuracy and reliability of academic records. The well-structured system design, supported by use case diagrams and a systematic approach, ensures seamless accessibility for all users, including administrators, teachers, students, and homeroom teachers. Furthermore, the system fosters greater efficiency in administrative tasks and encourages innovation in teaching and learning processes, ultimately improving the quality of educational services.

Through rigorous black-box testing, the system has been confirmed to function according to specifications, enhancing user confidence in its reliability. These findings underscore the vital role of web-based systems in driving digital transformation in education, offering an effective solution for streamlining academic management and enhancing the quality of educational services.

Suggestions

The suggestions for developing web-based academic information system research are as follows:

1. Further research could focus on developing additional features, such as learning analytics integration, automated reporting, or user-to-user communication modules, to extend the system's functionality and meet more complex user needs;
2. Further research is needed to test the scalability of the system in larger educational environments or with a larger number of users;
3. Future research could explore the use of technologies such as artificial intelligence (AI) or machine learning to support personalization of learning and prediction of student performance so that systems can be more adaptive and proactive in supporting the educational process.

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