Building a Web and Mobile-Based Academic Information System for Optimizing Pesantren Management (Case Study: Pondok Pesantren Nurussalam Krapyak)

Muh Agna Khairul Aqila*, Sutarrman
Universitas Teknologi Yogyakarta, Indonesia
Email: agnakhairul50@gmail.co.id*, sutarman@uty.co.id

KEYWORDS	ABSTRACT
academic information systems, Islamic boarding schools, mobile applications, web-based systems.	This research aims to develop a web-based and mobile-based academic information system for Islamic boarding schools to enhance the efficiency, accuracy, and accessibility of academic data management. Traditional academic administration in many Islamic boarding schools is still conducted manually, often leading to data redundancy, limited access to information, and inefficiencies in administrative processes. To address these challenges, this study proposes an integrated system comprising a web-based dashboard for administrators and a mobile-based application for students, connected through an Application Programming Interface (API) to ensure real-time data synchronization across platforms. The system is developed using the Waterfall model, which includes systematic stages of requirements analysis, system design, implementation, and testing to ensure a structured and reliable development process. During the requirements analysis phase, user needs from administrators and students are identified to determine system functionalities. The design stage focuses on database structure, user interface, and API architecture. Implementation is carried out based on the approved design, followed by system testing using the Black Box Testing method to evaluate functionality without examining the internal code structure. The testing results indicate that all core features function as expected. The developed system effectively manages academic data, attendance records, class schedules, and announcements, thereby improving administrative efficiency and information transparency. Overall, this system supports the digital transformation of academic administration in Islamic boarding schools and provides a foundation for future system enhancements, such as financial management and Learning Management System (LMS) integration.

INTRODUCTION

Pesantren is one of the pillars of Islamic education in Indonesia, playing a strategic role in shaping students' character and equipping them with both religious and general knowledge. With the number of students continuing to increase, the management of academic data has become one of the crucial functions determining the sustainability and quality of educational services within these institutions (Atabik et al., 2024; Fatmawati et al., 2023; Taqwa & Raupu, 2022).

However, the academic data management systems in many Islamic boarding schools still rely on conventional or manual methods. Recording grades, attendance, lesson schedules, and announcements often involves physical documents that are vulnerable to recording errors, data loss, and lengthy recapitulation processes (Buss et al., 2021; J S et al., 2022; MATSUHIRA et al., 2023). As a result, administrative efficiency remains low, and the dissemination of important

information to students and their guardians is frequently delayed. This delay and lack of accountability can negatively affect the quality of managerial decision-making in Islamic boarding schools (Suryani & Putra, 2022) and the transparency of educational institutions (Shobri, 2024).

In facing the challenges of the digital era, the implementation of Sistem Informasi (SI), or information systems, has become a necessity for modern educational institutions (Ayu et al., 2021). Technology-based Sistem Informasi Akademik (SIA) offers solutions to overcome the limitations of manual data management. By implementing a web- and mobile-based SIA, the entire academic administration process can be conducted centrally, in an integrated manner, and accessed in real time by management, ustadz/ustadzah, and students. The use of mobile platforms provides convenient access to information for students, while web platforms offer administrators full control over data management (Widodo & Pratama, 2022).

Based on this background, this research focuses on developing an Islamic boarding school's academic information system using web technology built on Laravel and a mobile application developed with Flutter. The study aims to produce a functional and integrated SIA to support the digitization of academic management, attendance tracking, and the dissemination of announcements within the pesantren environment.

RESEARCH METHOD

This study adopts an applied research approach (Applied Research) with a focus on the Software Development Life Cycle (SDLC) for developing the Sistem Informasi Akademik (SIA) of the Islamic boarding school. The SDLC model applied is the Waterfall Model (Linear Sequential Model), chosen for its structured and sequential framework where validation at each phase serves as a prerequisite before progressing to the next stage (Amelia & Hidayat, 2021). The clarity provided by this model ensures strong support for system development projects with well-defined requirements established at the outset. The development of this SIA follows five main stages in accordance with the Waterfall Model cycle:

The first and most crucial stage aims to explicitly formulate all functional and non-functional requirements that must be fulfilled by the system. Data collection was conducted empirically through observation of manual academic administration workflows and in-depth interviews with key stakeholders in Islamic boarding schools. The primary output of this phase is the Software Requirements Specification (SKPL), which maps essential modules such as master data management, curriculum structure, grade recording, attendance authentication, and announcement dissemination mechanisms (Khaerudin et al., 2020).

System design is a conceptual phase in which the logical and physical architecture of the system is visualized (Ayu et al., 2021). This design process includes defining the distributed system topology, outlining interactions between the Web Admin Dashboard, Mobile Application, and Application Programming Interface (API), modeling data structures using Entity Relationship Diagrams (ERD) to ensure integrity and efficient centralized storage, and creating a user-friendly visual prototype (UI/UX) for both platforms.

The implementation phase transforms conceptual designs into executable source code using the latest technologies: the Laravel framework for backend and web administration (Hasan & Kurniawan, 2022; Rahman, 2021); Flutter and Dart for mobile applications (Pratama & Lestari, 2023; Saputra, 2022); and RESTful API as a bridge for real-time data communication

(Susanto, 2020; Wijoyo & Sari, 2021). This entire process is supported by the MySQL database management system to manage centralized data storage efficiently (Hartono & Susanti, 2023).

The final stage in this development cycle is system validation to ensure that the resulting software meets the functionality standards defined during the requirements analysis phase. The testing methodology applied is Black Box Testing, which focuses on verifying system functionality from the end user's perspective, ensuring that each feature and module—such as user authentication, data CRUD operations, and information display—operates accurately.

Although system development concludes at the testing phase, maintenance is identified as an essential stage in the software lifecycle. This phase includes post-implementation activities such as minor bug corrections, adaptations to evolving operational needs, and periodic updates to ensure that the system remains optimal and secure after official deployment.

RESULTS AND DISCUSSION

System Architecture and Technology Implementation

This academic information system is implemented using a distributed three-tier architecture, integrating the admin web dashboard and the student mobile application. Figure 1 illustrates this architecture, showing the role of the RESTful API built with Laravel as a bridge that controls all real-time data exchanges between the mobile client (developed using Flutter) and the MySQL database. This architecture is designed to ensure scalability and efficiency in data communication, enabling effective data management for administrators and fast, multiplatform access to information for students.
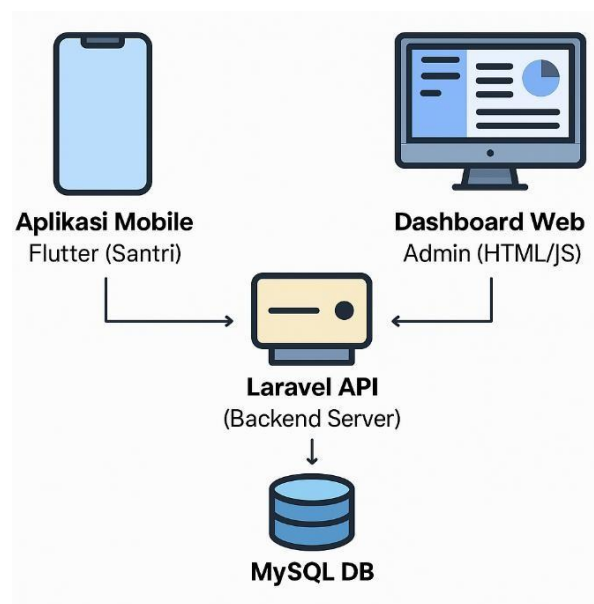

Figure 1 System architecture

Use Case Diagram

The functional design of the system is visualized using the Use Case Diagram. This diagram serves to model the main interactions between system actors—including Admins, Ustadz/Ustadzah, and Santri—with the various functional modules available. This modeling ensures that all system functionality needs, from master data management, value input, to

schedule access, have been accommodated and validated according to the functional needs set at the analysis stage.

Entity Relationship Diagram (ERD)

The structural aspects of the data are visualized through the Entity Relationship Diagram (ERD) (see Figure 5). This ERD describes the key data entities of the system, such as Students, Subjects, Grades, and Attendance, along with the relationships that exist between them. This structured database design is fundamental to ensuring data integrity, information consistency, and efficiency in centralized data storage and retrieval operations using MySQL.

User Interface (UI)

The system interface is designed with a focus on *user-friendly* aspects and clarity of information, especially in the *student mobile* application. Figure 2 presents an example of the main interface. The UI design uses intuitive navigation (such as *bottom navigation*) to make it easier for students to access important modules (Dashboard, Grades, Schedule, Attendance). The use of consistent color schemes and clean layouts aims to improve the user experience (UX) and ensure that access to academic information is quick and easy.
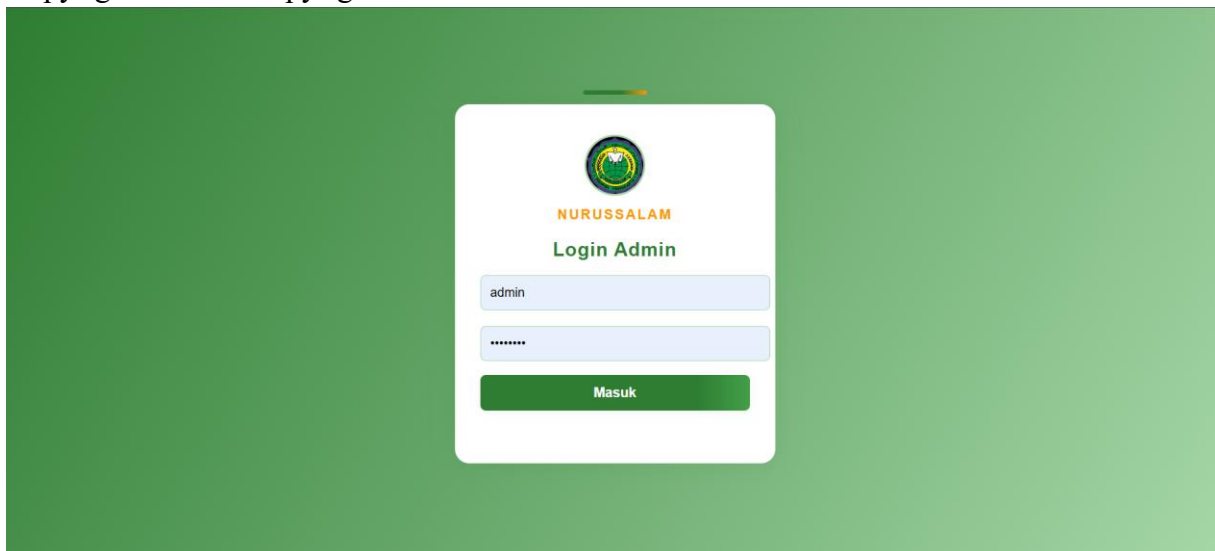
Figure 2. Admin login page

On this login page, the admin fills in the username and password, When the username and password are correct, they will be directed to the next page, namely the dashboard.
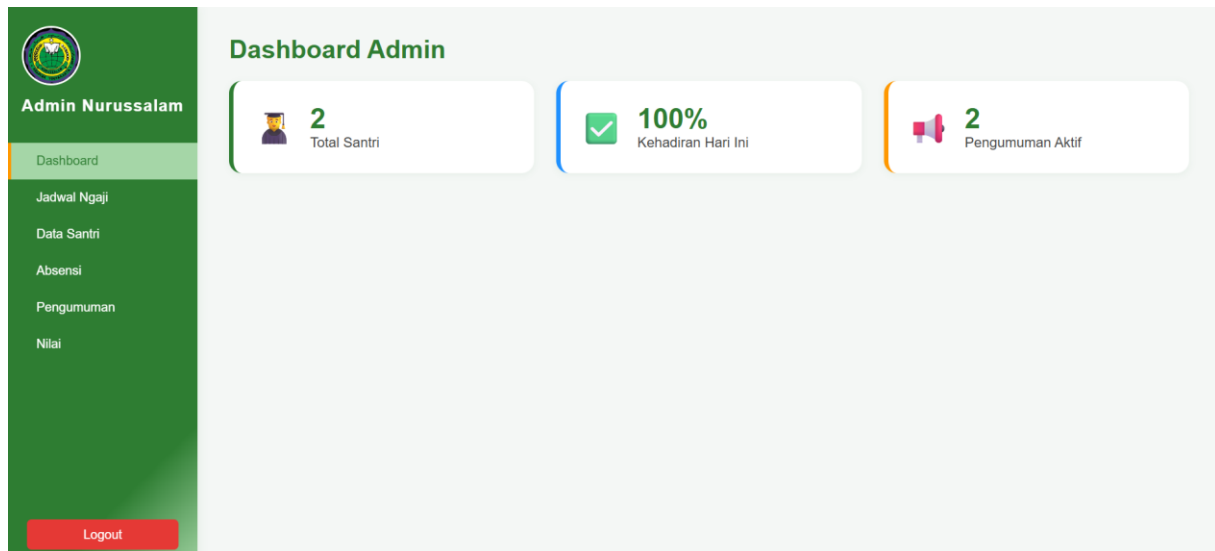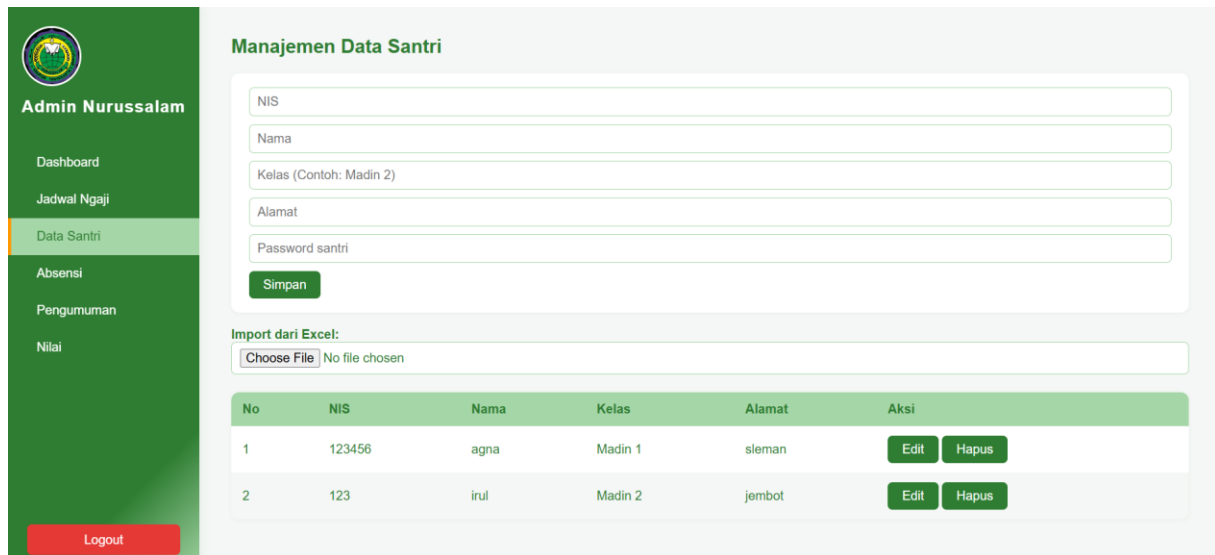
Figure 3. of the Admin Dashboard page

On the dashboard page, the admin can check the number of students, the attendance of students, and active announcements.

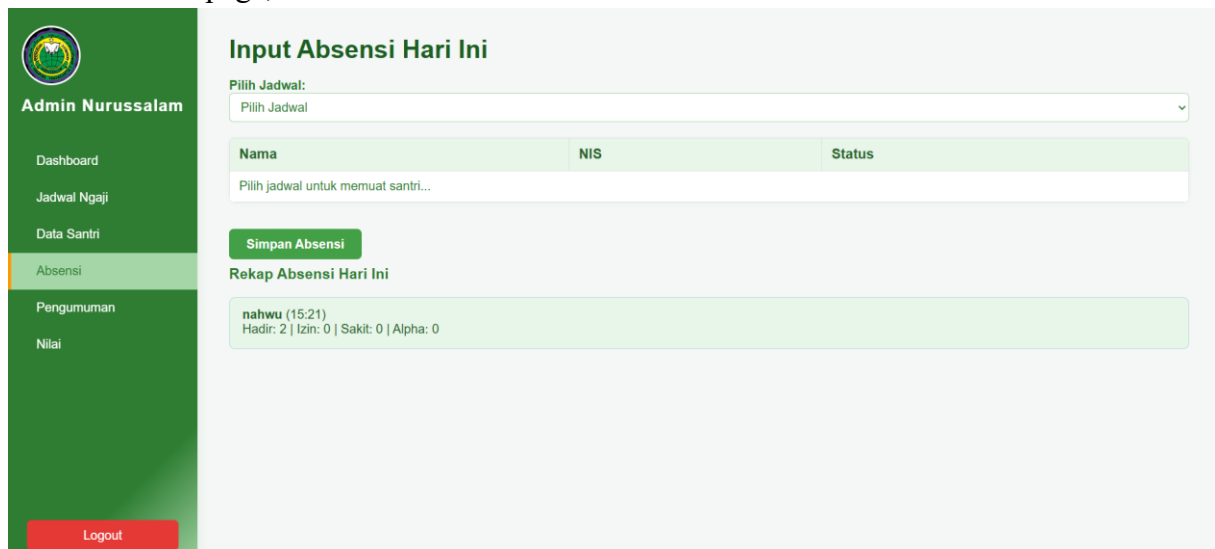**Figure 3.** of the Schedule of Administrators

In this section, the admin can add the schedule and can edit and delete it.

Figure 4. pages Admin student data

On this page, admins can add new student data and can delete edits
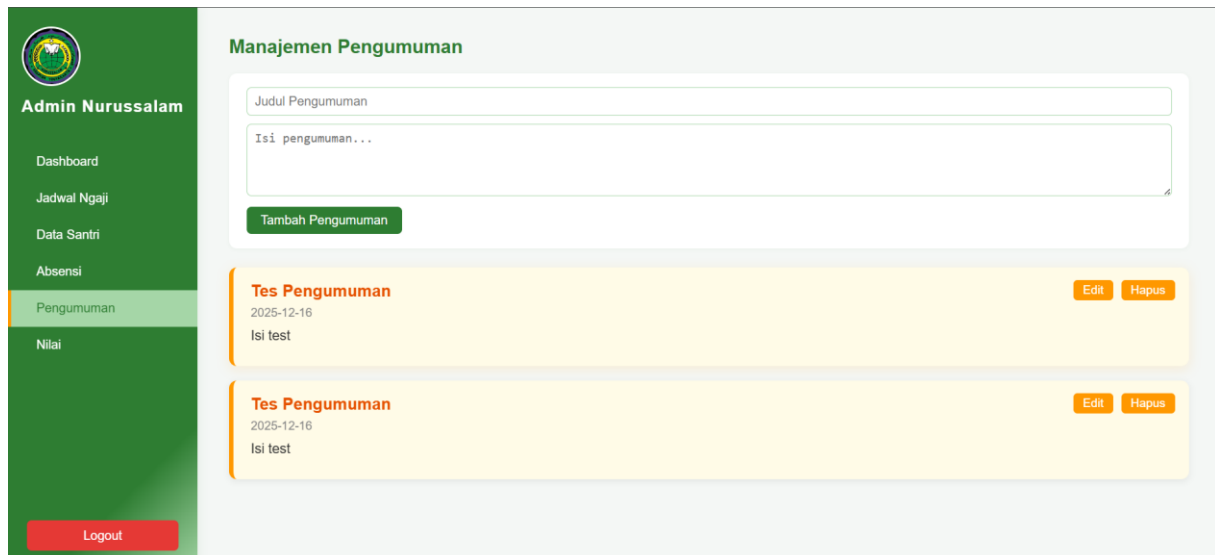
Figure 5. pages Admin Attendance

On the attendance page, the admin can add the attendance of students

Figure 6. Admin Announcement Page

On the announcement page, the admin can add announcements that are important for students and Islamic boarding schools

Figure 6. page Admin Values

On the value management page, the admin can also add the grades of the students UI Santri
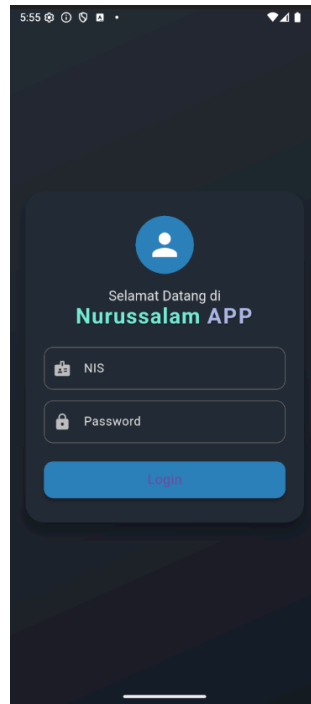
Figure 7. of the student login page

The login page on UI students is required to input the NIS and also the student's password to be able to log in after logging in will be directed to the dashboard page
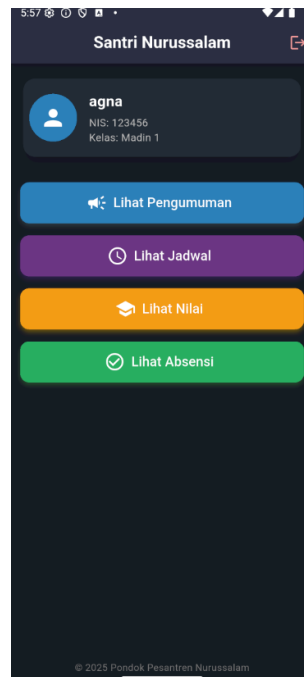

Figure 8. of the dashboard of the students

On the student dashboard there are several menus that can be accessed by students, it is hoped that it will make it easier for students to access information in the boarding school, there are announcements, schedules, grades, attendance
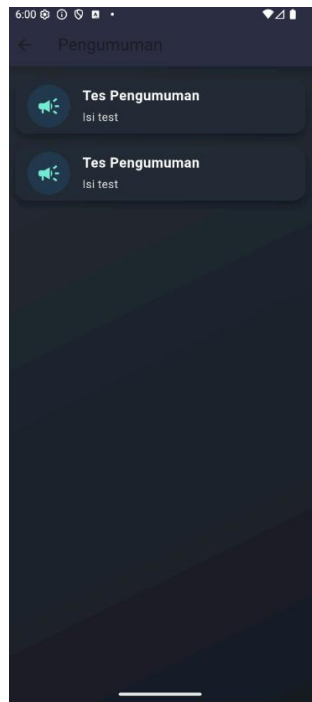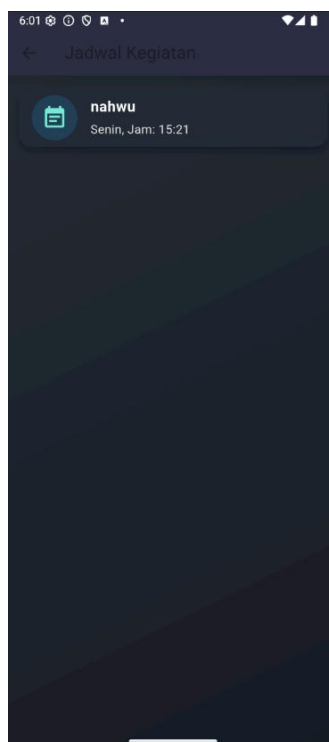
Figure 9. of the student announcement page

Figure 10. pages of the student's schedule
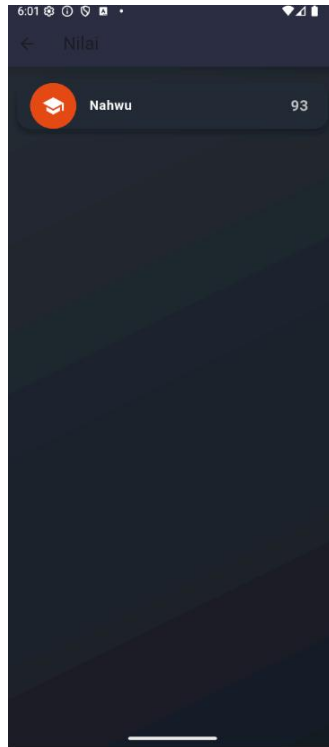
Figure 11. pages of student grades

Figure 12. pages of student attendance

System Testing and Results

Validation of system functionality is carried out through the Black Box Testing method. This test verifies the compatibility between the implemented functions and the documented requirements specifications. The focus of testing includes the authentication process, academic data management, and announcement delivery. The test results showed that all core functions of the system ran well and successfully met expectations, indicating that the system is

technically feasible to operate as a solution to digitize the academic administration of Islamic boarding schools. **Table 1** below presents a summary of the results of Black Box testing on some of the main functions of the system:

Table 1. Black box test

Yes	Testing Scenarios	Input Data	Expected Results	Test Results	Status
1	Login Admin And Santri Valid	Username and password are correct	System successfully logged in	Successful	Pass
2	Login Admin And Student Failed	Incorrect username and password	System rejects and displays error messages	Successful	Pass
3	Student data input	Student data	System successfully saved	Successful	Pass
4	Map value input and schedule	Maple values and times	System successfully saved	Successful	Pass
5	Add announcement	Contents of the announcement	System Successfully saved	Successful	Pass

CONCLUSION

Overall, the research on the development of the Islamic boarding school's academic information system was successfully completed through the implementation of the five-stage Waterfall Model, resulting in a functional web-based (Laravel) and mobile (Flutter) system. Based on a comprehensive design process—including Use Case Diagram, Flowchart, and Entity Relationship Diagram (ERD)—and the implementation of a three-tier architecture integrated through a RESTful API, the system has been proven effective in improving the efficiency of real-time management of academic data, schedules, and attendance. Validation of functionality using Black Box Testing confirmed that all core system functions operate effectively and are suitable for use as an administrative digitization solution. Therefore, this system makes a significant contribution to the modernization and digital transformation of pesantren management.

REFERENCES

Amelia, R., & Hidayat, R. (2021). The design of the academic information system uses the waterfall model. *Journal of Global Informatics, 12*(1), 1–10.

Atabik, Nurfuadi, Hidayat, I., Masruri, & Nur, S. (2024). Digitalization of educational quality management in higher education. *Revista de Gestão Social e Ambiental, 18*(7). https://doi.org/10.24857/rgsa.v18n7-133

Ayu, N., Ramadhani, S. N., & Syam, B. (2021). Basic concepts of information systems. *Journal of Management Information Systems and Technology, 3*(2), 1–8.

Buss, C., Rosa, D. de A., Metzner, F. S., & Junior, J. F. S. (2021). Academic data management: The application of data governance concepts to improve the processes of using information from the academic data management system. *Revista Ibero-Americana de Ciência da Informação, 14*(2). https://doi.org/10.26512/rici.v14.n2.2021.33872

Fatmawati, E., Suharto, B., Dahlan, M., Suhma, W. K., & Yudiawan, A. (2023). Challenges of educational management in the Islamic higher education sector based on pesantren. *Journal of Educational and Social Research, 13*(6). https://doi.org/10.36941/jesr-2023-0151

.

Hasan, M., & Kurniawan, D. (2022). Web application design using the Laravel framework. *Journal of Information Engineering, 11*(1), 1–10.

J. S., K., G., V., S. K., R., R., P., & S., G. (2022). TNAU post graduate students academic data management system: An overview. *Madras Agricultural Journal, 109*(Special). https://doi.org/10.29321/maj.10.000659

Khaerudin, A., Rosiyani, T., & Nugraha, A. (2020). Academic information system design using Unified Modeling Language (UML). *Journal of Information Technology and Computer Science (JTIK), 7*(2), 112–120.

Matsuhira, T., Kasahara, Y., Takata, Y., Hama, T., & Kaniyashiki, Y. (2023). Current status and future of Kanazawa University academic data management system. *Joho Chishiki Gakkaishi, 33*(2). https://doi.org/10.2964/jsik_2023_009

Pratama, I. A., & Lestari, Y. N. (2023). Development of Flutter-based mobile applications for information systems. *Journal of Information Technology, 15*(1), 1–10.

Rahman, F. (2021). Implementation of the Laravel framework in information systems development. *Journal of Informatics, 20*(2), 123–130.

Saputra, D. (2022). Building multiplatform applications with Flutter and Dart. *Scientific Journal of Information Technology, 18*(2), 110–120.

Shobri, M. (2024). The role of education management information systems in increasing transparency and accountability in Islamic educational institutions. *ACTION: Journal of Islamic Education Management, 2*(2), 78–88.

Suryani, A., & Putra, D. P. (2022). The role of information in managerial decision making. *Journal of Informatics Management, 4*(1), 1–9.

Susanto, B. (2020). API implementation in distributed information systems. *Journal of Information Systems, 15*(3), 200–208.

Taqwa, T., & Raupu, S. (2022). Website-based academic service development with ADDIE design in higher education. *Al-Ishlah: Jurnal Pendidikan, 14*(2). https://doi.org/10.35445/alishlah.v14i2.1323

Wibowo, A., & Ariyanto, E. (2021). Analysis of the information quality of academic information systems. *Journal of Information and Communication Technology, 12*(2), 112–120.

Widodo, A., & Pratama, R. A. (2022). Implementation of web-based academic information systems in vocational high schools. *Scientific Journal of Computer and Informatics (KOMPUTA), 11*(1), 56–65.

Wijoyo, A., & Sari, D. P. (2021). Designing RESTful APIs for mobile applications. *Journal of Computer Science and Informatics, 7*(1), 23–30.