

Requirements Analysis and Design of a Web-Based Academic Information System at Institut Teknologi dan Bisnis Muhammadiyah Bali

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ABSTRACT

The effective management of academic activities is a critical requirement for higher education institutions, particularly in the context of digital transformation (Bilqis et al., 2025) (Sufandi, 2022). Institut Teknologi dan Bisnis Muhammadiyah Bali currently manages its academic processes manually using fragmented physical and digital documents, resulting in inefficiencies, data inconsistencies, limited information accessibility, and insufficient support for managerial decision-making. This study aims to analyze system requirements and design a web-based academic information system as a foundational solution to these challenges (Siagian & Effiyaldi, 2018). A qualitative research approach was employed using a systems analysis and design methodology. Data were collected through observations of existing academic workflows, interviews with key stakeholders including academic administrators, lecturers, and management and document analysis of academic records and procedures (Ali et al., n.d.) (Rusdi & Kurniasih, 2020). The collected data were analyzed to identify functional and non-functional system requirements, which subsequently informed the system design stage. The results of the study include a comprehensive requirements analysis and a conceptual system design comprising functional models, process flows, data structures, role-based access control, and user interface designs tailored to different user roles. The proposed design demonstrates the potential to centralize academic data management, enhance transparency, improve workflow efficiency, and support data-driven academic governance. This research is limited to the requirements analysis and system design stages and does not include system implementation or empirical testing. Nevertheless, the study contributes both practically and academically by providing a structured reference for the development of a web-based academic information system and by enriching the body of knowledge on academic information system design for higher education institutions at an early stage of digital system adoption.

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1. INTRODUCTION

The advancement of information technology has encouraged higher education institutions to utilize information systems as a fundamental foundation for managing academic activities (Hendika & Siahaan, 2019) (Hikmawati & Julianto, 2023). Web-based academic information systems are regarded not only as administrative support tools but also as mechanisms for integrating academic processes that can enhance operational efficiency, data consistency, and the quality of educational services (Tumbade et al., Bilqis et al., 2025). In the context of modern higher education governance, the presence of an academic information system is a critical prerequisite for ensuring the availability of accurate, structured, and easily accessible information for all stakeholders (Putriyani et al., 2024) (Setiawan, 2023).

Nevertheless, the utilization of an academic information system has not yet become an integral part of academic management at Institut Teknologi dan Bisnis Muhammadiyah Bali. To date, the institution does not possess an integrated academic information system, resulting in academic activities being conducted

manually and in a document-based manner. Processes such as student data management, grade recording, course scheduling, and academic document archiving continue to rely on physical documents and separated digital files, without the support of a structured information system (Anjaya et al., 2025).

This condition indicates a mismatch between the increasing complexity of academic management demands and the continued use of conventional management mechanisms (Ramadhan et al., 2025). Dependence on manual processes leads to low operational efficiency, a higher likelihood of data entry errors, and difficulties in maintaining information consistency across organizational units. Furthermore, the lack of integrated academic document management complicates data retrieval and updating processes, particularly when academic reporting and managerial decision-making are required (Putra & Sutabri, 2024). These issues become increasingly critical as student numbers grow and academic activities intensify. In the absence of an academic information system, access to academic information cannot be provided in a centralized and real-time manner for students, lecturers, and administrative staff. Consequently, academic communication tends to be reactive and reliant on manual procedures, which may ultimately hinder improvements in academic service quality and institutional governance effectiveness (Gregorius Allan D.S.S, 2021) (Iskandar, n.d.). On the other hand, efforts to develop an academic information system without a comprehensive understanding of user requirements and academic business processes carry the risk of producing a system that does not align with institutional conditions (Ali et al., n.d.) (Hikmawati & Julianto, 2023). Previous studies have shown that failures in information system development are often caused by insufficient requirements analysis at the early design stage. Therefore, requirements analysis becomes an essential phase for bridging the gap between existing academic management conditions and the expected academic information system.

Based on this argumentation, the present study focuses on requirements analysis and the design of a web-based academic information system at Institut Teknologi dan Bisnis Muhammadiyah Bali. The study aims to identify user requirements and map existing academic processes, which are then translated into a structured and integrated system design. The system design is developed as a conceptual and technical foundation and does not include system implementation or testing stages, thereby explicitly limiting the study to the system planning phase. Accordingly, this research is expected to address the gap between manual academic management practices and the need for an integrated web-based academic information system. In addition to providing a practical contribution as an initial reference for academic information system development at Institut Teknologi dan Bisnis Muhammadiyah Bali, this study is also expected to contribute academically by enriching the literature on requirements analysis and academic information system design in higher education institutions at the early stages of digital transformation.

2. METHODS

2.1 Research Method and Data Collection

This study adopts a qualitative approach using an information systems engineering research method (systems analysis and design), with a focus on the stages of requirements analysis and the design of a web-based academic information system (Rusdi & Kurniasih, 2020). This approach is selected because the primary objective of the study is not to test hypotheses or to quantitatively measure system performance, but rather to gain an in-depth understanding of the existing academic management conditions and to formulate an academic information system design that aligns with institutional needs (Suheri et al., 2020). The object of this research is the academic management process at Institut Teknologi dan Bisnis Muhammadiyah Bali, which includes the management of student data, lecturer data, courses, class schedules, grade recording, and academic document management. The study examines academic workflows that are currently carried out manually and rely on non-integrated physical documents and digital files.

Data collection is conducted through observation of ongoing academic processes, interviews with relevant stakeholders, and document analysis of academic records used in operational activities (Tjahyanti & Sutama, 2024). Observation is carried out to obtain a direct understanding of academic process flows and the issues that arise in data management. Interviews are conducted with stakeholders directly involved in academic activities, such as academic administrative staff, lecturers, and management, in order to identify user requirements and expectations for the proposed academic information system. Document analysis is performed to understand data structures, document formats, and academic procedures that have been implemented to date. The requirements analysis stage involves identifying both functional and non-functional system requirements based on the collected data. Functional requirements represent the services and features needed to support academic processes, while non-functional requirements relate to system quality aspects, such as usability, data security, and web-based accessibility. The results of this requirements analysis serve as the basis for formulating specifications for an academic information system that meets the characteristics and needs of Institut Teknologi dan Bisnis Muhammadiyah Bali.

Based on the results of the requirements analysis, the subsequent stage involves the design of the web-based academic information system. System design is carried out by developing system models that represent actor relationships, academic process flows, and the required data structures. The design models are presented in the form of system design diagrams, such as user requirement diagrams, process flow diagrams, and data structure designs, which aim to provide a comprehensive overview of the proposed academic information system. This study is explicitly limited to the stages of requirements analysis and system design; therefore, system implementation, testing, and evaluation are not included within the scope of the research. Accordingly, the research outputs consist of conceptual and technical designs of the academic information system, which are expected to serve as an initial reference for the subsequent development and implementation of the academic information system at Institut Teknologi dan Bisnis Muhammadiyah Bali.

2.2 The Research Workflow

The research workflow consists of problem identification, literature review, observation, stakeholder interviews, data collection, data analysis, and the design of a web-based system. The final output of this study comprises the system requirements analysis document and the academic information system design. A more detailed illustration of the research workflow is presented in Figure 1.

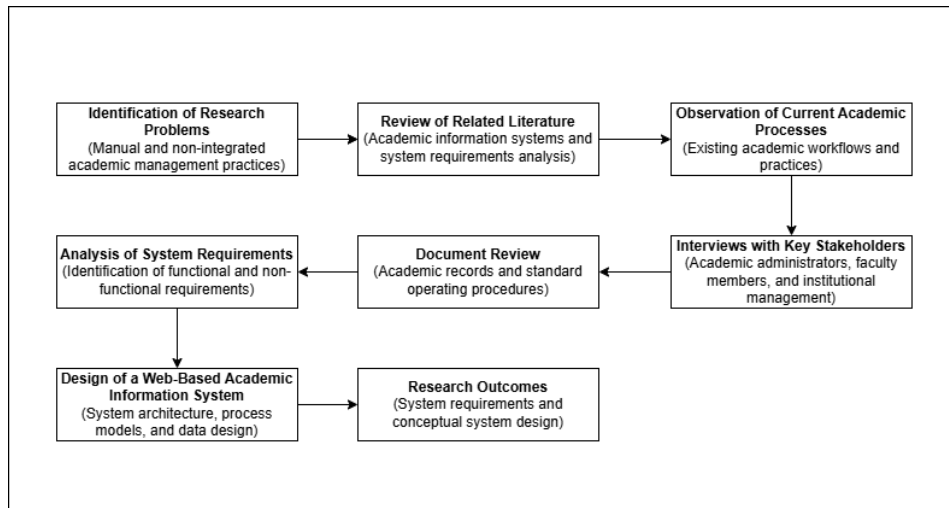


Figure 1. Research Workflow

The research process begins with the identification of problems in academic management that are still conducted manually and are not supported by an academic information system. This stage aims to understand the research context and the urgency of developing a web-based academic information system.

1. The next stage involves a literature review conducted to examine concepts related to academic information systems, system requirements analysis, and information system design approaches relevant to higher education institutions. The literature review serves as the theoretical foundation for determining the research approach and system design methodology.
2. Data collection is carried out through observation of existing academic processes, interviews with stakeholders, and document analysis of academic records and procedures. These three techniques are applied in an integrated manner to obtain a comprehensive understanding of the current academic management conditions and user system requirements.
3. The collected data are then analyzed to identify system requirements, including both functional and non-functional requirements. This requirements analysis stage constitutes the core of the study, as it provides the basis for formulating the specifications of the academic information system to be designed.
4. Based on the results of the requirements analysis, the design of a web-based academic information system is developed. This stage produces system models that describe academic process flows, relationships among actors, and the required data structures. The study is limited to the system design stage; therefore, system implementation and testing are not included within the research scope.

5. The final output of the study consists of requirements analysis documents and the academic information system design, which are expected to serve as an initial reference for the subsequent development of the academic information system.

3. RESULTS AND DISCUSSION

3.1 System Requirements Analysis

Table 1. System Requirements Analysis

No.	Title 1	Title 2
1	Academic data across organizational units are not integrated	Leads to data inconsistency, delays in information updates, and difficulties in synchronizing academic data between units.
2	Academic management still relies on manual documents and separated digital files	Increases the risk of data loss, recording errors, and duplication of academic documents.
3	Academic administrative processes require a long processing time	Reduces administrative staff efficiency and delays the delivery of academic services.
4	Limited access to academic information for lecturers and students	Hinders the effectiveness of teaching–learning processes and academic communication due to the lack of real-time information availability.
5	High potential for data input errors and duplication	Results in inaccurate academic data, which may affect the quality of academic reports and decision-making.
6	Difficulty in tracking and maintaining academic data history	Complicates the monitoring of students’ academic progress and the retrieval of supporting documents.
7	Academic data do not adequately support managerial decision-making	Limits management’s ability to conduct planning, evaluation, and data-driven academic policy formulation.
8	Low transparency of academic information	May lead to misunderstandings, delays in information dissemination, and reduced stakeholder trust.
9	Relatively high workload of academic administrative staff	Causes decreased productivity and increases the likelihood of errors due to work fatigue.
10	Limited institutional readiness for digital transformation	Hinders efforts to improve academic governance quality and adapt to advancements in information technology.

Based on the table presenting the results of stakeholder interview analysis at Institut Teknologi dan Bisnis Muhammadiyah Bali, it can be concluded that the primary issues in academic management stem from the absence of an integrated academic information system. Academic activities that are still conducted manually and rely on fragmented document-based processes result in low operational efficiency, a high potential for data recording errors, and difficulties in maintaining the consistency and accuracy of academic information. Furthermore, limited access to academic information for lecturers and students has caused academic processes and institutional communication to operate less optimally. Additional impacts are reflected in the increased workload of administrative staff and the limited availability of academic data to support managerial decision-making. Overall, these findings indicate an urgent need for a web-based academic information system capable of integrating data, enhancing information transparency, and supporting more effective and sustainable academic governance.

3.2 Scope of Information System Design

The scope of system design in this study is focused on the conceptual design of a web-based academic information system intended to support the centralized management of academic activities at Institut Teknologi dan Bisnis Muhammadiyah Bali. The system design encompasses user requirements modelling, academic process design, and data structure design that represent the core academic activities conducted

within the institution. In general, the proposed academic information system involves the main actors participating in academic processes, namely academic administrators, lecturers, students, and management, with roles and access rights tailored to their respective functions. To support these activities, the scope of the system design includes the following main modules.

1. An academic master data management module that includes student data, lecturer data, study programs, courses, class sections, and academic periods (semesters and academic years).
2. An academic process management module that covers the preparation and publication of course schedules, study plan management (if applicable), and the recording and management of academic grades by lecturers.
3. An academic information management module for students and lecturers that provides web-based access to course schedules, course information, and academic performance summaries.
4. An academic document management module designed to support the digital storage and structured archiving of academic documents.
5. An academic reporting module that provides report designs for management needs, such as student data summaries, grade recapitulations by course or class, and summaries of academic activities for specific periods.

In addition to functional aspects, the system design also considers non-functional requirements, which constitute an essential part of academic information system development. These non-functional requirements include system usability, academic data security and confidentiality, role-based access control, and web-based system accessibility.

This study is explicitly limited to the stages of requirements analysis and system design; therefore, the scope of the design does not include software implementation, integration with external systems, or system performance testing and evaluation. Consequently, the outputs produced within this system design scope consist of requirements analysis documents and system design artifacts that can serve as an initial reference for the subsequent development of a web-based academic information system.

3.3 Use Case Diagram



Figure 2. Use Case Diagram

The designed Use Case Diagram illustrates the interaction between users and the proposed web-based academic information system. The diagram is developed based on the results of user requirements analysis and represents the main system functionalities in supporting academic activity management at Institut Teknologi dan Bisnis Muhammadiyah Bali. The academic administrator acts as the primary actor responsible for overall academic data management. The administrator is granted access rights to manage academic master data, including student data, lecturer data, courses, class sections, and academic periods. In addition, the administrator is authorized to create and manage course schedules as well as to handle academic documents in digital form. This role is designed to ensure that academic data are stored in a centralized manner, remain consistent, and can be easily updated.

Lecturers interact with the system within the context of teaching and academic evaluation activities. Use cases related to lecturers include access to teaching schedules and the management of student academic grades. Lecturers are provided with facilities to input and update grades according to the courses they teach, enabling the assessment process to be conducted in a more systematic and well-documented manner.

Students act as system users who utilize academic information services. Student use cases include access to course schedules and other academic information, as well as the ability to view academic grade results. The design of these use cases aims to enhance the transparency of academic information and to provide convenience for students in obtaining information related to their academic activities. Management functions as an actor that utilizes the academic information system for monitoring and decision-making purposes. Use cases associated with management include access to concise and structured academic reports, such as student data summaries and academic performance reports by period. This role is designed to support data-driven evaluation and academic policy planning processes.

Overall, the Use Case Diagram demonstrates that the web-based academic information system is designed to accommodate users with different roles while remaining integrated within a single system. The diagram also emphasizes that this research is focused on the system design stage; therefore, the presented use cases represent a conceptual depiction of the proposed system's functionality and do not include implementation or testing aspects.

3.4 Entity Relationship Diagram (ERD)

The Entity Relationship Diagram represents the conceptual data model of the proposed Web-Based Academic Information System. The ERD is designed to support core academic processes, including academic data management, course delivery, enrolment, grading, scheduling, and reporting.

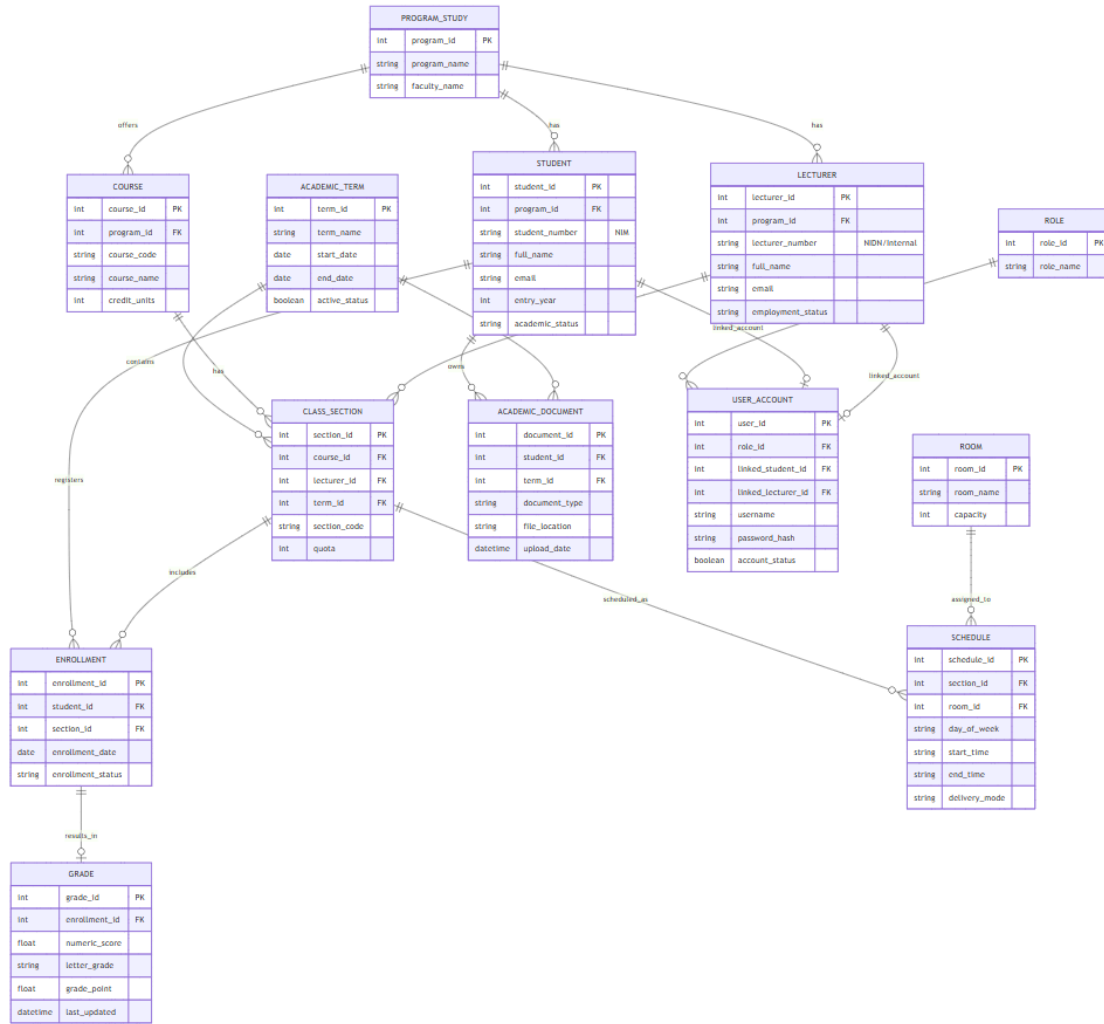


Figure 3. Entity Relationship Diagram (ERD)

The ERD models academic data management by separating master data entities from academic operational entities to ensure data consistency and scalability. The use of the ENROLLMENT entity enables the system to accurately record students’ course registrations across academic terms while preserving historical records. The GRADE entity is designed as a dependent entity of ENROLLMENT to accommodate incomplete or pending grading processes.

Scheduling information is modelled independently to allow flexibility in managing multiple sessions for a single course section. Supporting entities such as USER_ACCOUNT and ROLE enable role-based access control, which is essential for a web-based academic information system. Overall, this ERD provides a structured and extensible foundation for the future implementation of an integrated academic information system.

3.5 System Design

3.5.1 Landing Page UI

The dashboard interface presented in Figure 4 represents the role-based entry point of the proposed Academic Information System. This interface is designed to direct users to system functionalities according to their respective roles, namely Administrator, Lecturer, Student, and Management. Each role is clearly visualized through a dedicated card that provides a brief description of its main responsibilities, thereby enhancing usability and reducing cognitive load during system access.

The role selection dashboard adopts a clean and minimalist layout to ensure clarity and ease of navigation. By implementing a role-based access mechanism at the initial stage, the system enforces access control while improving user experience, as users are immediately guided to features relevant to their academic functions. This design supports efficiency, security, and scalability, which are essential characteristics of a web-based academic information system in a higher education environment.

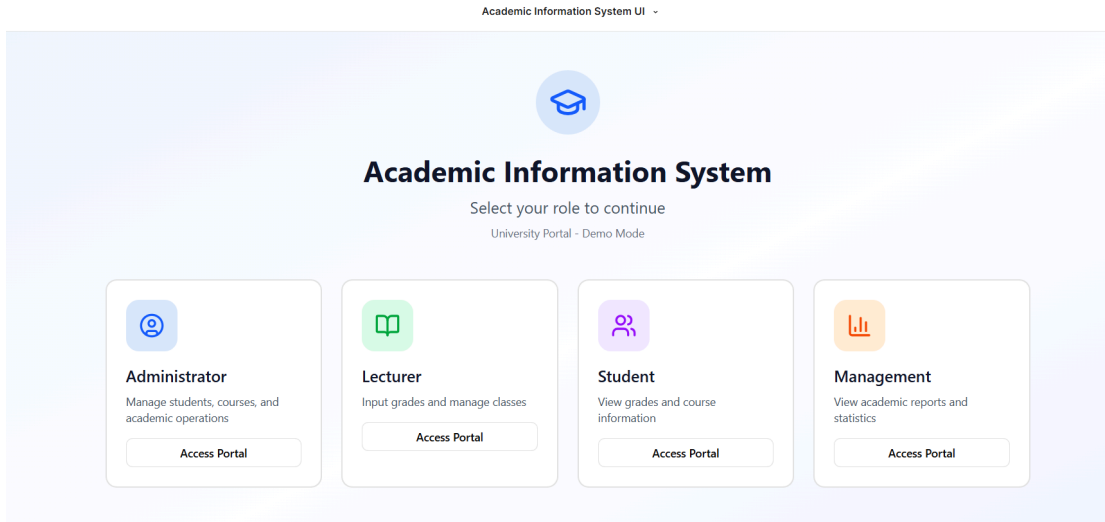


Figure 4. Landing Page

3.5.2 Administrator Dashboard UI

The administrator dashboard shown in Figure 5 illustrates the centralized control interface of the proposed Academic Information System. The dashboard provides a summary of key academic indicators, including the total number of students, lecturers, courses, and the currently active academic term. These key performance indicators are presented using visual summary cards to enable administrators to quickly assess the overall academic status of the institution.

In addition to high-level monitoring, the dashboard incorporates quick action features that allow administrators to perform essential academic management tasks, such as adding student records, creating new courses, and managing class schedules. A recent activity panel is also included to display the latest academic updates, supporting transparency and real-time monitoring of system operations. Overall, the dashboard is designed to enhance administrative efficiency, improve situational awareness, and support effective academic governance within a web-based academic information system.

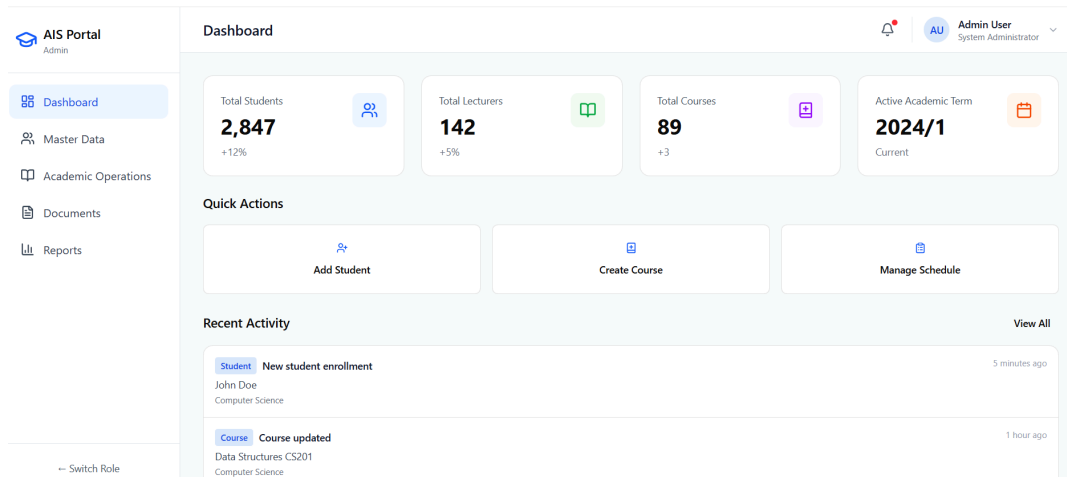


Figure 5. Administrator Dashboard

3.5.3 Lecturer Dashboard UI

The interface shown in Figure 6 represents the lecturer dashboard of the proposed Academic Information System. This dashboard provides lecturers with access to core academic functionalities, including inputting and managing student grades, viewing teaching schedules, and monitoring academic records related to their assigned courses.

Through this dashboard, lecturers can efficiently perform academic assessment activities by entering and updating student grades, reviewing class information, and ensuring the accuracy of academic data. The integration of grading, scheduling, and academic reporting features within a single interface is intended to

enhance workflow efficiency, data consistency, and transparency in academic management from the lecturer’s perspective.

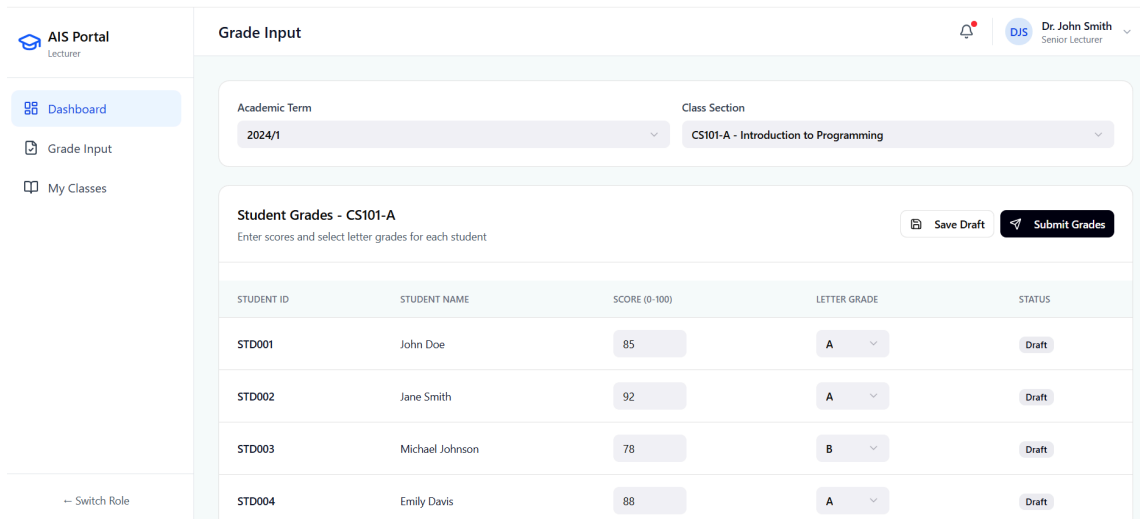


Figure 6. Lecturer Dashboard UI

3.5.4 Student Dashboard UI

The interface presented in Figure 7 represents the student dashboard of the proposed Academic Information System. This dashboard enables students to access their course schedules, review grades for enrolled courses, and view academic performance summaries, including transcript information.

By integrating scheduling, academic announcements, and grade information within a single interface, the student dashboard is designed to enhance information accessibility, transparency, and user convenience. This role-based interface supports students in monitoring their academic progress and managing their learning activities efficiently within a web-based academic information system.

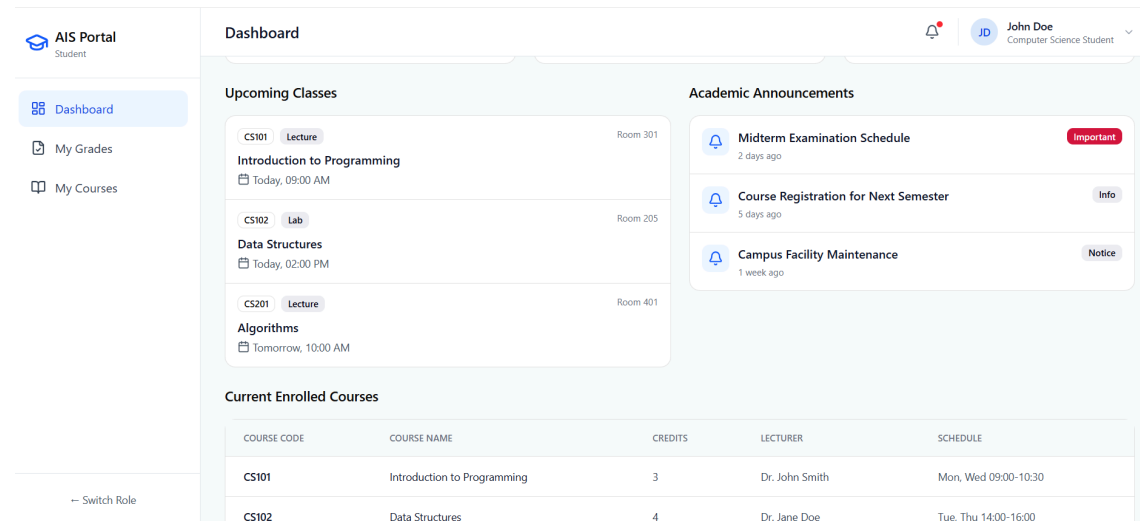


Figure 7. Student Dashboard UI

3.5.5 Management Dashboard UI

The interface shown in Figure 8 represents the management dashboard of the proposed Academic Information System, which is designed to support academic monitoring and decision-making at the institutional level. This dashboard provides an overview of key academic indicators, including total enrollment, active students, average grade point average (GPA), and overall pass rates for the selected academic term.

In addition to summary statistics, the dashboard presents academic performance reports by program, enabling management to evaluate student performance trends across different study programs. By consolidating academic reports into a centralized and visual interface, the management dashboard facilitates

efficient access to academic data, enhances transparency, and supports data-driven academic governance within a web-based academic information system.

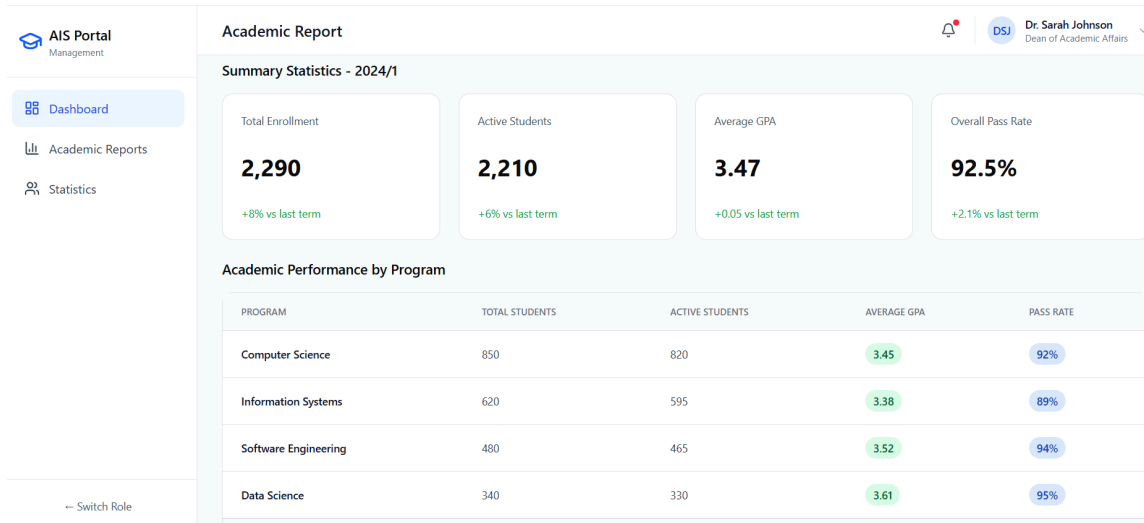


Figure 8. Dashboard Management User

4. CONCLUSIONS

This study aims to analyze system requirements and design a web-based academic information system as a solution to the academic management processes that are still conducted manually at Institut Teknologi dan Bisnis Muhammadiyah Bali. Based on the analysis of existing conditions, it can be concluded that the absence of an integrated academic information system has led to several critical issues, including low efficiency in academic processes, a high potential for data management errors, limited access to academic information, and inadequate data support for managerial decision-making.

The requirements analysis, conducted through observations, stakeholder interviews, and document analysis, indicates that Institut Teknologi dan Bisnis Muhammadiyah Bali requires a web-based academic information system capable of managing academic data in a centralized and structured manner. The primary system requirements include the management of student data, lecturer data, course information, class schedules, academic grades, and the provision of academic reports that can be accessed according to users' roles and authorities. These findings emphasize that the required system should function not only as an administrative tool but also as a platform for integrating academic processes and supporting institutional governance.

Based on the identified requirements, this study produces a proposed design for a web-based academic information system that includes functional design, process models, data structures, and role-based user interface design. The system design is developed to accommodate the needs of multiple stakeholders, namely academic administrators, lecturers, students, and management, while considering principles of usability, data consistency, and information security. This design is expected to serve as a conceptual and technical foundation for the future development and implementation of an academic information system.

This research is limited to the stages of requirements analysis and system design and does not include system implementation or empirical testing. Nevertheless, the results provide a practical contribution as an initial reference for Institut Teknologi dan Bisnis Muhammadiyah Bali in planning the digital transformation of its academic management. In addition, this study contributes academically by enriching the literature on requirements analysis and academic information system design in higher education institutions that are at an early stage of integrated system development.

Overall, the findings of this study confirm that comprehensive requirements analysis and structured system design are crucial steps in developing an academic information system that is relevant, effective, and sustainable. The results are expected to serve as a foundation for future research that includes the implementation, testing, and evaluation of the proposed web-based academic information system at Institut Teknologi dan Bisnis Muhammadiyah Bali.

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