Development of a Web-Based Accreditation System for Study Program Management using the Waterfall Model

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INFORMATION	ABSTRACT
	At Universitas Islam Makassar, study program accreditation is still managed manually. This slows down the process, increases the workload, and makes errors more likely. This research introduces a web-based accreditation system designed to simplify document submission, verification, and assessment. The system was developed using the Waterfall model, moving through requirement analysis, design, implementation, testing, and maintenance. Three user roles were defined: administrator, head of study program, and assessor, each with tailored access and features. Functions include structured document uploads, real-time accreditation tracking, and role-based dashboards. The system was tested using black-box testing, and all key features worked as intended. Results show the system improves process speed, reduces manual work, and helps stakeholders manage accreditation more efficiently. Further features like video uploads and automated notifications are planned for future updates.

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1. INTRODUCTION

Accreditation is a critical process for higher education institutions. It ensures that study programs meet the standards required by national accreditation bodies [1]. In Indonesia, this process is usually overseen by BAN-PT or LAM, and involves the preparation and verification of many supporting documents [2]. Despite its importance, the accreditation workflow at Universitas Islam Makassar remains predominantly manual. Supporting documents are collected in varied formats PDFs, spreadsheets, scanned images, URLs-often stored across multiple devices or shared informally through email, messaging applications, or ad-hoc communication channels. This fragmented approach complicates document retrieval, version control, and traceability. Moreover, the absence of a centralized monitoring mechanism makes it difficult for accreditation teams to track the completeness and verification status of evidence files. As a result, the process becomes administratively burdensome, prone to delays, vulnerable to human error, and challenging to audit during internal reviews or external assessments. These challenges highlight the need for a more structured, transparent, and integrated accreditation management system capable of improving efficiency while reducing dependency on repetitive manual tasks [3].

Several studies have explored the use of information systems to streamline accreditation. For example, developed a simulation-based web system to evaluate program readiness [4], while used user-centered design to build a monitoring app that scored high in usability [5]. Beyond these examples, other researchers have highlighted the importance of digital accreditation tools in strengthening institutional data governance [6]. These systems helped automate processes but were often general-purpose and not tailored to specific needs of Islamic-based institutions like Universitas Islam Makassar.

This research addresses that gap by developing a dedicated web-based accreditation system that reflects both technical requirements and organizational workflows. The system was built using Laravel, a modern PHP framework, and follows the Waterfall development model[7]. It defines specific roles for admin, program heads, and assessors-each with features relevant to their responsibilities.

The purpose of this system is not merely to digitize existing accreditation procedures, but to enhance efficiency, transparency, and traceability[8]. Compared to manual workflows, the platform centralizes documentation, supports real-time progress monitoring, and minimizes repetitive communication and manual file handling.

This paper contributes a practical, role-based accreditation platform designed for a mid-sized Islamic university. It demonstrates how a structured digital system can improve document organization, accelerate verification processes, and strengthen institutional readiness for external accreditation assessments.

2. METHOD

This study employed a development-based methodology utilizing the Waterfall model, a structured and sequential software development approach commonly applied in information system engineering [9]. The model was selected due to its suitability for projects requiring clear documentation, well-defined stages, and stable system requirements-conditions that align with the accreditation workflow at Universitas Islam Makassar, particularly within the Informatics Engineering study program.

The development process consisted of five major phases [10]: (1) requirements analysis, which involved identifying functional and non-functional system needs; (2) system design, where architectural components, data structures, and user interfaces were specified; (3) implementation, involving the coding and development of system modules; (4) testing, conducted to validate functionality and ensure system reliability; and (5) maintenance, focused on system refinement and addressing issues identified during deployment.
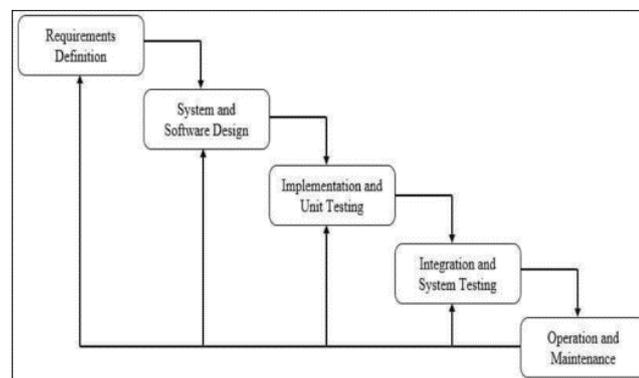

Figure 1. Waterfall model

2.1. Requirement analysis

The requirements analysis phase involved a series of structured interviews and on-site observations with accreditation team members, program heads, and administrative staff [11]. These qualitative elicitation techniques were employed to examine existing accreditation workflows, identify data management practices, determine the types of documents handled, and locate key operational bottlenecks within the process [12]. The analysis identified several critical functional requirements, including clearly defined user role segregation, structured mechanisms for uploading and managing accreditation documents, and real-time monitoring of progress. In addition, key non-functional requirements emerged, such as system usability, cross-browser compatibility, and adherence to institutional data security standards.

2.2. System design

The system was designed using a modular architectural approach to ensure scalability, maintainability, and a clear separation of concerns across system components. The core entities of the system include Users, Roles, Documents, Programs, and Accreditation Records. Use case diagrams, activity diagrams, and an Entity

Relationship Diagram (ERD) were created to represent how users interact with the system and how data is organized [13].
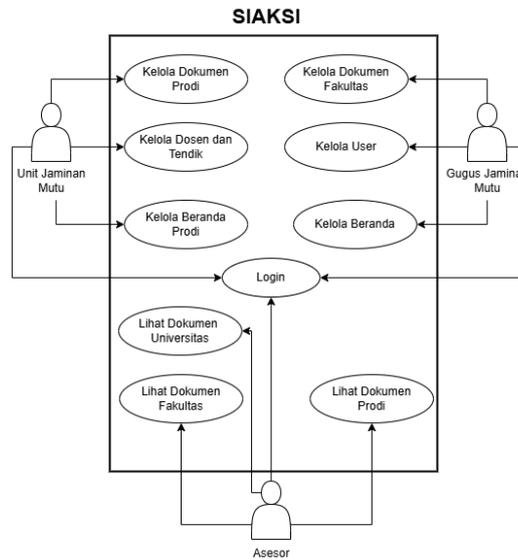

Figure 2. Use case diagram

Figure 2 illustrates the primary interactions between system users and the accreditation platform. Three user roles are depicted: primary user roles Administrator (GJM), Program Head (UJM), and Assessor—and the system's core functionalities. Administrators manage user accounts, accreditation categories, and institutional documents. Program heads upload, organize, and verify accreditation documents related to their study program. Assessors review the submitted evidence and provide evaluations based on the documentation available. This use case model clarifies the role-based access structure of the system and supports the development of a workflow aligned with institutional accreditation procedures.
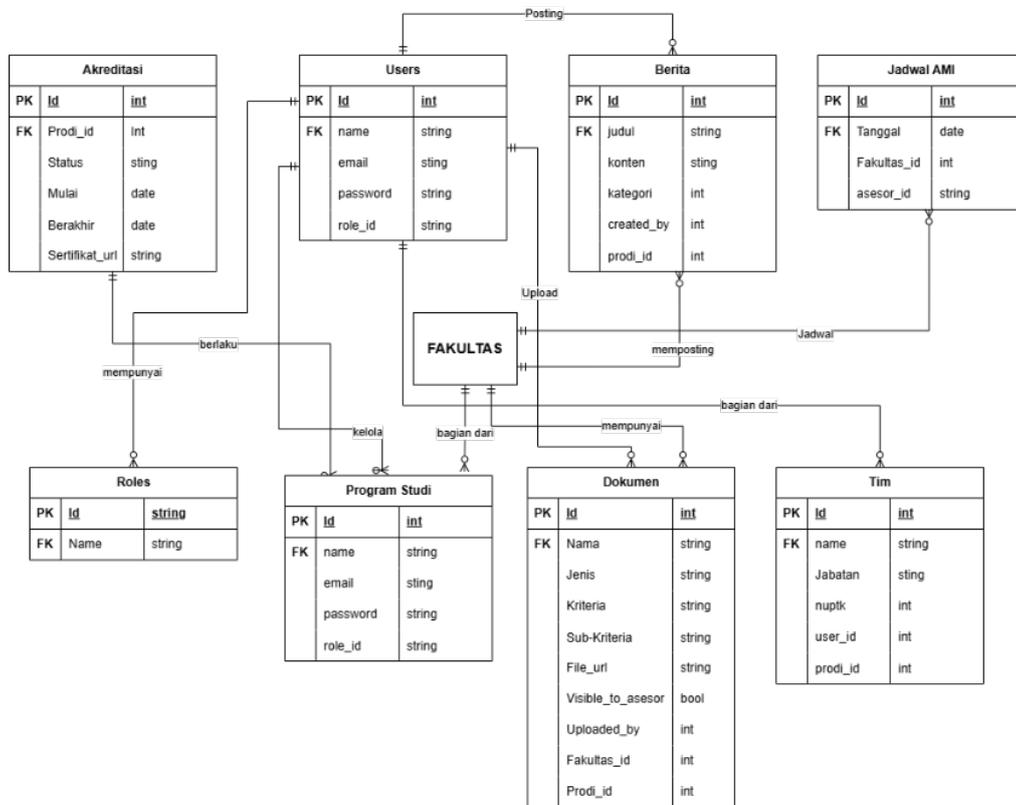

Figure 3. Entity relationship diagram (ERD)

Furthermore, the Entity Relationship Diagram (ERD) outlines the relationships between key database entities, including Users, Roles, Documents, Programs, and Accreditation Records. The ERD highlights the

foreign key dependencies that define how data is linked and stored within the system, ensuring data integrity and supporting efficient retrieval processes [14][15]. This database structure establishes the foundation for stable, consistent, and secure data handling within the accreditation platform.

2.3. Implementation

The system was developed using Laravel for the backend [16] and Blade templating engine for the frontend [17]. The development used MySQL as the relational database[18], and Bootstrap to ensure a mobile-friendly layout [19]. The implemented system incorporates several major functional components:

First, a login and role-based access control module ensures that administrators, program heads, and assessors interact with the system according to their designated permissions. Second, a document management interface enables users to upload, organize, and review accreditation files in a structured format. Third, a verification workflow facilitates the progression of documents from initial submission to assessment, allowing assessors to evaluate uploaded files efficiently. Finally, a dashboard provides real-time accreditation progress visualization through color-coded status indicators, enabling stakeholders to monitor the completion level of each accreditation component at a glance.

2.4. System testing

The system underwent black-box testing to evaluate the correctness of its functional components and to ensure that all user-facing features performed according to predefined requirements [20]. Testing procedures focused on validating expected inputs and outputs for each user role-administrator (GJM), program head (UJM), and assessor-particularly for core activities such as login authentication, document submission, verification, assessment access, and profile management. Additional attention was given to usability and error-handling behavior to verify that the system responded appropriately to both valid and invalid user inputs. A summary of the black-box testing results is presented in Table 1. All test cases produced successful outcomes, indicating that the system operated reliably across all major functionalities.

Table 1. Summary of black-box testing results

No	Feature	User	Test Description	Result
1	Login	All Users	Enter valid credentials	Success
2	Login (invalid input)	All roles	Enter wrong email or password	Success
3	Upload Document (GJM)	GJM	Upload PDF, Excel, or URL	Success
4	Upload Document (UJM)	UJM	Upload PDF, Excel, or URL	Success
5	Verify Document	GJM	Verify selected document	Success
6	Assessor Dashboard View	Assesor	Log in and access assessor dashboard	Success
7	Search Document	GJM, UJM	Search document by keyword	Success
8	Edit Profile	All Users	Change Email, Name and Password	Success

2.5. Deployment and maintenance

The system was deployed on a local university server for initial trials. During this stage, usability feedback was collected and minor bugs were resolved. Maintenance is currently focused on support and monitoring. Planned future improvements include:

- PDF report export
- Email notifications for deadline reminders
- Logging system for all user actions

3.   RESULTS AND DISCUSSION

This section presents the main outcomes of the system implementation and evaluates how the developed accreditation system enhances workflow efficiency at Universitas Islam Makassar. The analysis integrates results from functional testing, performance evaluation, user feedback, and comparative review of previous studies[21][22]. His section presents the main outcomes of the system implementation and discusses how it improves the accreditation workflow at Universitas Islam Makassar.

3.1. System output and functionality

The system was tested using functional black-box testing. All primary features performed as expected, including login, document upload, verification, search, and role-based dashboard display. Table 2 summarizes the test results across user roles. Users could upload accreditation documents by category, verify and track their status, and view progress in real-time. The system successfully handled various file types (PDF, Excel, URLs) and supported three main roles: admin (GJM), program head (UJM), and assessor. Table 2 shows a functional testing result.

Table 2. Functional Testing Results

Feature	Role	Success Rate	Error Rate	Notes
Login Authentication	All Users	100%	0%	Valid/invalid credential checks
Documents Upload	Admin	100%	0%	PDF, XLSX, Image and URL format supported
Data Verification	Admin	100%	0%	Editable with timestamp logs
Accreditation Review	Assessor	100%	0%	Read-only access maintained
Dashboard Visualisation	Assessor	100%	0%	Real-time updates confirmed

Users reported that the interface was intuitive and required minimal training. The dashboard displayed a clear breakdown of document statuses pending, verified, and rejected-making it easier to coordinate tasks within the accreditation team. Login access was also restricted properly, showing only the appropriate features based on user roles.

3.2. Performance and process efficiency

System performance evaluations show that the platform operated stably, with an average response time ranging between 0.6 and 1.2 seconds. Compared to the manual procedure, data input and verification time decreased by 56%, indicating a substantial improvement in operational efficiency. Stress testing with 30 concurrent users confirmed backend stability, and no data loss occurred during trials. These results highlight the system's capacity to handle moderate institutional loads and support continuous accreditation activities without performance degradation.

3.3. User feedback and usability

User feedback was collected via a short questionnaire and interviews with 6 participants (1 GJM, 3 UJM and 2 assessors in act). Figure 4 shows the distribution of satisfaction levels
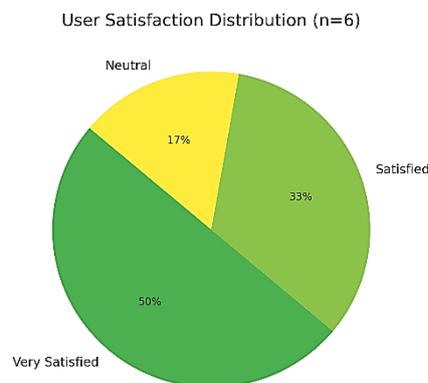

Figure 4. distribution of satisfaction levels

- Ease of use: 87% rated the interface as intuitive and easy to navigate.
- System usefulness: 100% agreed that the system simplifies the accreditation process.
- Recommended improvements: Participants requested auto-notification features and mobile responsiveness.

Feedback shows high user acceptance and indicates potential areas for future enhancement. Overall, the feedback reflects a high level of user acceptance while also identifying practical areas for future system enhancement.

3.4. Comparison with previous studies

Compared to systems studied in this research offers greater relevance to accreditation processes based on LAM standards. Table 3 below summarizes the key distinctions:

Table 3. Comparison with Previous Studies

Criteria	Previous System	This Study
Accreditation model	Generic or not tailored to LAM standards	Tailored to LAM Teknik and Infokom
User access roles	Typically limited (Admin & User only)	Three roles: Admin, Program Head, Assessor
Real-time dashboard	Often unavailable or basic visualization	Fully implemented real-time progress view
Testing scope	Rarely detailed	Full black-box testing on five core features
Usability feedback	Not collected or not discussed	Survey and short interviews conducted

The study contributes not only a technical solution but a validated approach based on actual institutional needs.

4. CONCLUSION

This study successfully developed and evaluated a web-based accreditation information system designed to support more efficient and structured accreditation management at Universitas Islam Makassar. The system, implemented using the Waterfall development model, incorporates essential features such as role-based authentication, digital document submission, verification and assessment workflows, and real-time progress visualization. Functional testing demonstrated full operational reliability with a 100% success rate and no recorded errors, while performance evaluations showed stable system response times ranging from 0.6 to 1.2 seconds. Compared with existing manual procedures, the system reduced processing time by 56%, and user feedback indicated a high level of satisfaction, with 87% of respondents rating the interface and workflow positively.

Despite these promising results, several limitations should be acknowledged. The usability evaluation involved a relatively small sample of six respondents, and the system was tested within a single institutional context, potentially limiting the generalizability of the findings. Broader participation and multi-institutional trials would strengthen the validity and applicability of future evaluations. Future development should consider integrating the system with the institutional academic information system through API connections to minimize data redundancy and streamline user workflows. Additional enhancements—such as automated deadline notifications, improved mobile responsiveness, and expanded reporting capabilities—would further increase system utility. Moreover, adopting the system in other faculties or institutions with similar accreditation requirements could provide valuable insight into scalability and adaptability across diverse organizational settings. Overall, this study demonstrates that a well-structured digital accreditation system can substantially improve efficiency, accuracy, and transparency in accreditation processes, offering a practical model for higher education institutions seeking to transition from manual to fully digital accreditation management workflows.

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