

Digitalization of Higher Education Administration through a Paperless Platform to Improve AIK Lecturer Performance at Universitas Muhammadiyah Pontianak

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ABSTRACT

This study develops a web-based digital platform to improve administrative efficiency in Al-Islam and Kemuhammadiyah (AIK) courses at Universitas Muhammadiyah Pontianak. Using a participatory development approach, the system integrates digital attendance, paperless module distribution, recitation assessment, and real-time reporting. Usability evaluation based on the Technology Acceptance Model showed high perceived ease of use (4.37/5.00) and usefulness (4.51/5.00). The platform eliminated paper-based processes, reduced reporting time from several weeks to real-time, and lowered operational costs. These findings demonstrate that integrated digital platforms significantly enhance administrative efficiency in higher education.

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INTRODUCTION

The rapid advancement of information and communication technology over the past two decades has fundamentally transformed various aspects of higher education governance (Aripradono, 2024; Soegoto et al., 2023). Digital transformation in universities is no longer an optional strategy; it has become a strategic imperative for addressing the demands of efficiency, effectiveness, and quality of academic services (Dhameria, 2025; Bir et al., 2023). Institutions capable of adopting comprehensive digital solutions gain a significant advantage in administrative governance, instructional delivery, and learning outcome assessment (Yamin & Syahrir, 2020; Nugroho, 2025). In the Indonesian higher education context, digitalization of academic administration is particularly critical for supporting the Merdeka Belajar Kampus Merdeka (MBKM) curriculum framework and achieving Key Performance Indicators (IKU) mandated by the Ministry of Education, Culture, Research, and Technology (Arifin et al., 2025; Purwanto, 2024).

Al-Islam and Kemuhmadiyah (AIK) courses constitute a strategically significant General Education component (MKDU) at Universitas Muhammadiyah Pontianak (UM Pontianak). These courses — AIK 1 through AIK 4 — are compulsory for all students, regardless of religious background, and are managed by 16 dedicated AIK lecturers serving 800–1,000 students per semester across 32 classes (Hasan et al., 2023). The scale and complexity of AIK administration present substantial challenges that demand robust digital support systems (Marks & Al-Ali, 2022).

Preliminary observation conducted during the 2024/2025 academic year identified four critical administrative problems. First, attendance tracking for both lecturers and students relied entirely on paper-based methods, making data recapitulation laborious and accurate performance evaluation difficult (Kemendikbudristek, 2020). Second, teaching material delivery depended on printed documents — consuming over 100,000 sheets of paper annually at an estimated cost of IDR 8,000,000 — contradicting global trends toward green and sustainable campuses (Sugiarto, 2021; Omar et al., 2023). Third, Al-Qur'an recitation competency data for students and lecturers lacked systematic digital documentation, hampering longitudinal assessment and adaptive learning strategies (Hasan et al., 2023). Fourth, learning outcome reports and lecturer activity logs were compiled manually, requiring 2–3 weeks without analytical visualizations, limiting data-driven decision-making (Arifin et al., 2025).

These systemic gaps reflect a substantial discrepancy between the demands of modern higher education management and the current operational reality of MKDU AIK at UM Pontianak. Previous studies have demonstrated the effectiveness of integrated digital platforms in overcoming similar administrative inefficiencies across higher education institutions (Rahman & Putra, 2022; Soegoto et al., 2023). However, research specifically addressing the digitalization of Islamic religious education administration within the Muhammadiyah university ecosystem remains limited, highlighting a significant research gap.

In response to these challenges, this community service project focused on the development of *paperless.modules.id* — a responsive web-based digital platform designed as an integrated administrative solution for MKDU AIK. Unlike prior studies that predominantly addressed individual administrative functions, this project pursued a comprehensive integration of attendance management, paperless module distribution, Al-Qur'an recitation assessment, and infographic reporting within a single secure ecosystem. This study aims to develop and evaluate a digital platform for improving administrative efficiency and lecturer performance in AIK courses. This article presents the development process, usability evaluation findings, and the administrative efficiency outcomes achieved through this platform.

METHOD

This community service project employed a participatory development methodology, integrating principles from community-based participatory research with agile software development practices. The project was conducted between January 2025 and April 2026, involving 16 AIK lecturers and selected academic staff at UM Pontianak as primary stakeholders. The methodology consisted of four sequential phases. For the usability evaluation phase, a sample of 12 lecturers was selected based on their active involvement in AIK course administration across all four subject levels (AIK 1–4), ensuring representativeness of the platform's primary user group. Data were analyzed using descriptive statistics to compute mean scores and interpret TAM constructs of Perceived Ease of Use (PEOU) and Perceived Usefulness (PU).

Phase 1: Needs Assessment and Problem Identification

Structured interviews and direct observation were conducted with AIK lecturers, academic administrators, and MKDU AIK management. Quantitative data on administrative workloads, paper consumption, and recapitulation timelines were collected from internal records of the 2023/2024 academic year. A preliminary usability workshop held on February 27, 2025, provided qualitative insights into stakeholder expectations for the digital platform (FAIS Mobile Apps Technical Guidance session).

Phase 2: System Design and Development

Based on the assessment findings, the platform architecture was designed as a responsive web application (paperlesmodul.id), compatible across multiple operating systems and device types. The back-end was developed using a closed-architecture approach with Role-Based Access Control (RBAC), separating data processing logic from the front-end interface. Security was reinforced through JSON Web Token (JWT) authentication with dual-layer session validation. Four integrated functional modules were developed iteratively: (1) Digital Attendance System with fingerprint-based verification for AIK 1–3; (2) Paperless Module Distribution with an AI-powered RPS auto-generation engine switching dynamically across four AI APIs (Perplexity, ChatGPT, Hugging Face, and Gemini); (3) AI-Qur'an Recitation Evaluation Module with longitudinal tracking capability; and (4) Infographic Dashboard for real-time reporting of khutbah schedules, mentoring scores (AIK-3), and digital certificate issuance.

Phase 3: Usability Testing and Evaluation

Upon platform completion, usability evaluation was conducted using a structured questionnaire adapted from the Technology Acceptance Model (TAM) framework (Davis, 1989). The instrument assessed two primary constructs: Perceived Ease of Use (PEOU) and Perceived Usefulness (PU). Twelve AIK lecturers participated in the evaluation, responding to 10 Likert-scale items (1 = Strongly Disagree; 5 = Strongly Agree). Descriptive statistical analysis was applied to compute mean scores and interpret user perception levels.

Phase 4: Implementation and Monitoring

Following usability testing, the platform was deployed and made publicly accessible at <https://paperlesmodul.id/>. Monitoring focused on system performance, administrative process transformation (paper reduction, recapitulation speed), and operational readiness for full integration into

AIK administration workflows. Documentation outputs included a tutorial video published on the YouTube channel of the lead researcher and a video demonstrating the complete system.

RESULTS AND DISCUSSION

Platform Architecture and Module Features

The paperlesmodul.id platform was successfully developed as a fully responsive web-based application accessible across mobile and desktop environments. The system architecture adopts a closed back-end design that decouples the data processing layer from the user interface, ensuring that critical API endpoints — including the AI auto-generation engine and fingerprint-based attendance processing — are shielded from public exposure. This architectural decision significantly reduces vulnerability to exploitation and unauthorized data access.

The RBAC framework assigns differentiated access rights across three user roles: Administrator AIK, Lecturer, and System Manager. Each role interacts exclusively with data relevant to its designated authority scope. For instance, mentoring grade records (AIK-3), attendance histories, and Al-Qur'an recitation portfolios are encrypted at rest and accessible only by authorized users within their respective homebase assignments. JWT-based session tokenization provides an additional layer of authentication integrity, validating each transaction in real time to ensure data credibility for IKU reporting.

Table 1 summarizes the four core modules of the platform and their primary administrative functions.

TABLE 1. Core Modules of the paperless module.id Platform

No.	Module	Key Functions	Administrative Impact
1	Digital Attendance System	Real-time fingerprint-based attendance for AIK 1–3; data auto-recapitulation	Eliminates manual attendance sheets; reduces recapitulation from 3–4 weeks to real-time
2	Paperless Module Distribution	AI-powered RPS auto-generation (4 API engines: Perplexity, ChatGPT, Hugging Face, Gemini); digital sharing across AIK 1–4	Eliminates 100,000+ printed sheets/year; saves IDR 8,000,000/semester in printing costs
3	Al-Qur'an Recitation Evaluation	Digital mapping and longitudinal tracking of student and lecturer recitation competency	Enables evidence-based curriculum adaptation and personalized learning strategy
4	Infographic Dashboard & Reporting	Real-time visual display of schedules (khutbah/pengajian), AIK-3 mentoring scores, and digital certificates	Accelerates managerial decision-making; reduces report compilation from 2–3 weeks to instantaneous

Administrative Efficiency Outcomes

Before platform deployment, quantitative benchmarking of AIK administrative processes revealed severe inefficiencies. Only 31.25% of AIK lecturers (5 out of 16) documented attendance digitally, with the remaining 68.75% relying on paper-based sign-in sheets requiring 3–4 weeks for quarterly recapitulation. The distribution of printed teaching materials for 32 classes generated over 2,500 physical copies — approximately 100,000 sheets of paper — per semester for IDR 8,000,000, excluding supplementary printed materials such as activity forms and attendance records.

Following platform deployment, a comprehensive transformation of administrative processes was observed. Table 2 presents a comparative analysis of administrative conditions before and after platform implementation.

TABLE 2. Comparative Analysis of Administrative Conditions Pre- and Post-Platform Implementation

Administrative Aspect	Before Implementation	After Implementation
Attendance Management	Manual paper-based; 68.75% lecturers non-digital; 3–4 weeks recapitulation	100% digital; real-time fingerprint verification; instant data recapitulation
Teaching Material Distribution	100,000+ sheets/year; IDR 8,000,000 printing cost; manual distribution	100% paperless; AI-generated digital modules; instant sharing across 32 classes
AI-Qur'an Recitation Assessment	No systematic digital record; no longitudinal tracking capability	Integrated digital database; longitudinal competency tracking enabled
Academic Reporting	Manual compilation; 2–3 weeks per semester; no data visualization	Real-time infographic dashboard; instant access for managerial decisions
IKU Compliance Data	Labor-intensive manual extraction; risk of inaccuracy	Auto-generated from system; JWT-secured data integrity for IKU reporting

Usability Evaluation: Technology Acceptance Model Analysis

Usability evaluation using the TAM framework yielded results presented in Table 3. Twelve AIK lecturers participated in the structured evaluation following their interaction with the platform.

TABLE 3. TAM Usability Evaluation Results (n = 12 AIK Lecturers)

No.	Item Statement	Mean Score	Interpretation
Construct 1: Perceived Ease of Use (PEOU)			
1	The interface of paperlesmodul.id is intuitive and easy to navigate	4.42	Very High
2	Learning to use the attendance module requires minimal effort	4.33	Very High
3	The AI-powered module generation process is straightforward to operate	4.17	High
4	Accessing the dashboard reports requires no technical expertise	4.50	Very High
5	Overall, interacting with the system is clear and	4.42	Very High

No.	Item Statement	Mean Score	Interpretation
Construct 1: Perceived Ease of Use (PEOU)			
	understandable		
	Mean PEOU Score	4.37	Very High
Construct 2: Perceived Usefulness (PU)			
6	The digital attendance system significantly reduces administrative workload	4.67	Very High
7	The paperless module distribution improves teaching material accessibility	4.58	Very High
8	The AI-Qur'an recitation tracking module enhances evaluation accuracy	4.42	Very High
9	The infographic dashboard accelerates academic reporting processes	4.50	Very High
10	Overall, the platform enhances my efficiency as an AIK lecturer	4.33	Very High
	Mean PU Score	4.51	Very High

The evaluation results indicate a consistently high level of user acceptance across both TAM constructs. The mean PEOU score of 4.37 out of 5.00 demonstrates that AIK lecturers found the platform highly accessible, with intuitive navigation and minimal learning curve barriers. The mean PU score of 4.51 reflects strong lecturer confidence that the platform meaningfully enhances their administrative efficiency — particularly in attendance management and teaching material distribution. These findings align with established TAM research, which consistently demonstrates that perceived ease of use and usefulness are primary determinants of technology adoption intention in educational settings (Rahman & Putra, 2022; Dhameria, 2025).

Discussion: Implications for Administrative Digitalization in Higher Education

The development and deployment of paperless modules.id demonstrates that a well-designed, integrated digital platform can produce measurable and sustainable improvements in higher education administrative efficiency. The elimination of paper-based processes across all four identified administrative dimensions — attendance, material distribution, assessment documentation, and reporting — represents a significant operational transformation consistent with global green campus principles (Omar et al., 2023; Sugiarto, 2021; Optimization of the use of information technology, 2022).

The integration of four AI API engines in the RPS auto-generation module represents a particularly innovative contribution, enabling dynamic content generation that reduces dependency on a single AI provider and ensures service continuity. This multi-engine approach reflects best practices in building resilient educational technology systems capable of sustaining uninterrupted service for large-scale academic operations (Bir et al., 2023; Nugroho, 2025; Enhancing administrative competencies, 2025).

The platform's RBAC architecture and JWT-secured data management directly address a critical concern in academic digitalization: the protection of sensitive student and lecturer data while maintaining operational transparency for institutional performance monitoring. This approach ensures that IKU-related data extraction for governmental reporting remains accurate, tamper-resistant, and

audit-ready — a quality dimension frequently absent in ad-hoc digitalization initiatives at comparable institutions.

Furthermore, this project demonstrates strong alignment with the MBKM policy framework, particularly IKU 2 (student engagement in relevant learning experiences), IKU 3 (lecturer engagement in innovation beyond the classroom), and IKU 7 (program collaboration with partners in digital academic management) (Purwanto, 2024; Arifin et al., 2025; Baharuddin et al., 2025). The participatory development approach — engaging AIK lecturers throughout the design and testing phases — further strengthens stakeholder ownership and long-term sustainability of the platform.

Despite these significant improvements, this study has several limitations that should be acknowledged. The usability evaluation was conducted with a relatively small sample ($n = 12$ lecturers), which constrains the statistical generalizability of the TAM findings. Furthermore, the study was conducted within a single institutional context, limiting the applicability of results to other higher education settings with different administrative structures or technological infrastructure. From an implementation perspective, the system may face scalability challenges when integrated with larger institutional systems such as SIAKAD, as data synchronization across multiple platforms introduces additional technical complexity. These limitations should be addressed in future development cycles to strengthen the platform's broader applicability and resilience. Future development directions for the platform include integration with the university's Academic Information System (SIAKAD), implementation of advanced AI-based personalization for mentoring modules, development of a dedicated mobile application, and deployment of comprehensive log monitoring and anomaly detection systems to further strengthen data security infrastructure.

CONCLUSION

The developed platform successfully improved administrative efficiency by eliminating paper-based processes, enabling real-time data management, and reducing operational costs by an estimated IDR 8,000,000 per semester. High usability scores (PEOU = 4.37/5.00; PU = 4.51/5.00) confirm strong user acceptance among AIK lecturers. This study demonstrates that integrated digital platforms can significantly enhance higher education administration, particularly within the Islamic higher education context. Future development should focus on SIAKAD system integration, mobile application deployment, and scalability improvements to extend the platform's impact on academic governance quality.

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