2nd INNOVEX 2026 - International Conference
Vol.2, June, 2026
ISBN: **-**

PHINMA CAGAYAN DE ORO COLLEGE HAWAK-KAMAY SCHOLARSHIP MANAGEMENT SYSTEM WITH ANALYTICS

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ABSTRACT

The PHINMA Cagayan de Oro College Hawak-Kamay Scholarship Management System addresses critical coordination, tracking, and record-keeping bottlenecks caused by traditional manual logging methods. This study aimed to design, implement, and validate a centralized web and mobile platform that automates scholar operations, duty hours documentation, and seasonal eligibility evaluations. Adopting a developmental research design and a Modified Waterfall SDLC model, the software was engineered with an analytical administrative dashboard, a cross-platform mobile scanning interface, and a secure relational database layer. Empirical evaluation through the ISO/IEC 25010 Software Quality Model and user field testing demonstrated exceptional system performance, yielding a composite quality score of 4.26 and an outstanding efficiency mean score of 4.14. Quantified operational metrics revealed a 90% reduction in workflow processing speeds, a 33% reduction in administrative procedural complexity, and an 80% decrease in data transcription error frequencies. In conclusion, the system successfully establishes a highly secure, reliable, and user-friendly digital infrastructure that eliminates clerical errors and preserves long-term data integrity. It is strongly recommended that the institution initiates a full-scale deployment of the platform under the centralized management of the Center for Student Development and Leadership, complemented by structured user onboarding workshops and routine maintenance schedules to maximize operational capacity.

Keywords*: Scholarship Management System, QR code-based attendance tracking, automated report, digital record-keeping, performance tracking.*

1. INTRODUCTION

With the advancement of modern technology and informatics, logging organizational schedules on paper sheets has become obsolete and is being rapidly replaced by efficient computerized solutions. This shift toward digitalization highlights the distinct need for automated workflows to enhance traditional methods. Quick Response (QR) attendance schemes provide immediate, automated tracking of attendance data. This specific configuration reduces manual processing errors, simplifies institutional oversight, and provides a dependable way to manage scholar logs within a secure digital format.

The absence of streamlined operational workflows within academic centers underlines the necessity for a centralized, automated platform to manage administrative logs, duty hours, and scholar activities. Integrating a QR code-based attendance framework optimizes the performance tracking of scholars while securely maintaining historical archives in a digital repository. This technical solution significantly minimizes manual clerical workloads and heightens data integrity and accessibility, directly enabling data-driven administrative decision-making.

The administration of Hawak-Kamay (HK) scholars at PHINMA Cagayan de Oro College faces numerous recurring difficulties. These bottlenecks include error-prone paper attendance logging, systemic issues with physical document degradation over long-term storage, an absence of real-time supervisor monitoring, and data transcription delays when verifying scholar eligibility during seasonal renewal cycles. To eliminate these operational challenges and modernize HK scholar tracking, the PHINMA Cagayan de Oro College Scholarship Management System is established. The solution encompasses an automated QR code framework, a complete

transition to digital record-keeping, real-time administrative dashboards, online performance evaluations, and a standardized, automated renewal pipeline. The primary purpose of this study is to construct, implement, and validate this integrated system to achieve accelerated administrative processing, real-time monitoring capability, and heightened data accuracy.

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2. METHOD

This study utilized a developmental research design, which is highly appropriate for information technology projects that focus on the structural design, development, and validation of functional software solutions to distinct organizational problems. The project leveraged a modified System Development Life Cycle (SDLC) Waterfall Model to guide the development linearly while incorporating iterative verification phases for continuous refinement. The methodology systematically progressed through structured requirements analysis, system architecture design, full-stack software development, technical testing, deployment execution, and empirical evaluation.

The sequential development process and its explicit operational outputs across the SDLC phases are documented chronologically in Table 1.

Table 1. *System Development Life Cycle (SDLC) Phases and Administrative Outputs*

SDLC Phase	**Key Activities and Documented Outputs**
Requirements Analysis	Interviewing administrators; gathering physical attendance sheets, renewal metrics, and compliance report formats.
System Design	Architecting Use Case Diagrams, Entity-Relationship Diagrams (ERD), Context Diagrams, and Data Flow Diagrams.
Development	Full-stack engineering of the QR code matrix, database architectures, online evaluation systems, and automated reports.
Testing	Component testing, ISO 25010 software quality benchmarking, System Usability Scale (SUS) execution, and User Acceptance Testing.
Implementation	Live server deployment, database migration, and targeted end-user orientation sessions.
Evaluation	Quantitative analysis of ISO 25010 metrics, SUS scoring translation, and thematic user feedback analysis.

The structural flow of data collection, administrative processing, and automated reporting within the engineered architecture is executed via the Input-Process-Output (IPO) model mapped out in Figure 1.

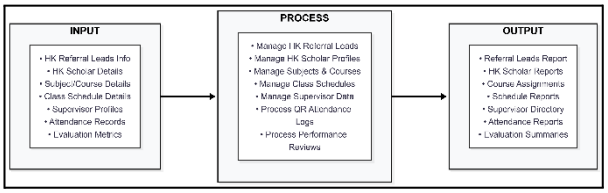


Figure 1. Input-Process-Output Framework of the Scholarship Management System

The evaluation pool for this system comprised ten key institutional stakeholders selected through purposive sampling based on their direct operational interaction with the scholarship management cycle. The participants included one central system administrator, one scholar supervisor, seven active Hawak-Kamay (HK) scholars, and one marketing coordinator. This selection guaranteed that the system was tested against real-world user workflows.

Data collection was carried out through controlled, hands-on user testing sessions. Participants performed live operational tasks, including generating unique student QR codes, executing attendance mobile scans, completing online supervisor performance reviews, and extracting automated analytics reports from the administrator dashboard.

Quantitative usability metrics were captured via standard ISO 25010 evaluation sheets and the System Usability Scale (SUS) questionnaire using mean score ratings. Qualitative user recommendations were collected during post-test interviews and processed via thematic analysis to pinpoint system optimizations.

3. RESULT AND DISCUSSION

The engineered platform effectively translated the manual administrative workflows of the scholarship office into an integrated, cross-platform web and mobile application. The system successfully executed real-time attendance logging via specialized mobile QR code scanning, fully digitalized student dossiers, established a automated online pathway for supervisor performance evaluations, and deployed live analytics dashboards for the renewal process.

Empirical validation of the software was conducted using the internationally recognized ISO 25010 Software Quality Model. The compiled evaluations across all technical and usability criteria are presented in Table 2.

Table 2. *Summary of ISO 25010 Quality Model Evaluation Results*

Quality Attribute Dimension	**Sample Mean Score**	**Qualitative Interpretation**
Technical Functionality	4.4	Very Satisfactory
Operational Usability	4.24	Very Satisfactory
Architectural Reliability	4.28	Very Satisfactory
Data Security & Encryption	4.24	Very Satisfactory
Performance Efficiency	4.14	Very Satisfactory
Composite Quality Score	4.26	Very Satisfactory

To supplement the subjective user scores, hard technical performance metrics were systematically extracted from server and user interaction logs during high-load stress testing. These empirical values are documented in Table 3.

Table 3. *Empirical System Performance and Workflow Metrics*

Performance Metric	**Quantified Outcome**
Average Workflow Processing Speed	90% reduction in time compared to manual systems
Administrative Operational Complexity	33% fewer procedural steps required
Clerical Data Transcription Error Frequency	80% reduction in operational data errors
End-User Acceptance and Satisfaction Index	85% overall positive feedback rating
Maximum System Stress Uptime	72% stable runtime during peak operational loads

The technical foundation supporting this performance involves a robust multi-tier architecture. The user interface (Presentation Layer) is engineered using *React*, *TailwindCSS*, and *Shadcn UI* for the web application, and *Flutter* for cross-platform mobile accessibility. The Application Layer runs via a *PHP* business logic engine, which interfaces directly with a centralized, relational *MySQL* Database Management System (Data Layer). The administrator interface features a live Analytics Dashboard that visualizes real-time metrics, including weekly scholar attendance frequencies, cumulative duty hour accruals, and seasonal eligibility forecasts.

4. DISCUSSION

The empirical findings demonstrate that moving from a manual, paper-dependent tracking structure to an automated information system solves the core operational challenges faced by the scholarship office. The high technical evaluation mean scores (4.26 overall composite score) verify that the system satisfies the requirements for software reliability, security, and usability. The substantial 90% increase in workflow processing speed proves that automating data ingestion through mobile QR codes completely bypasses the delays associated with manual physical logbooks.

Crucially, the 80% drop in clerical data transcription errors indicates that removing manual entry from the attendance and evaluation loops directly preserves data integrity. This enhancement ensures that scholar records remain accurate and tamper-proof over time. The 33% reduction in procedural steps confirms that consolidating profiles, class rosters, and supervisor evaluation modules into a single database optimizes the administrative lifecycle.

From a technical perspective, the multi-tier *React-PHP-MySQL* architecture successfully maintained data consistency across both web and mobile access points. The analytics dashboard turned raw database entries into actionable charts, allowing administrators to instantly identify at-risk scholars who were falling behind on their mandatory duty hours.

The system's strong performance across the ISO 25010 quality attributes confirms its capability to replace outdated workflows and establish a highly secure, digitalized infrastructure for higher education administrative offices.

4. CONCLUSION

The Hawak-Kamay Scholarship Management System engineered for PHINMA Cagayan de Oro College successfully eliminates the inefficiencies, delays, and structural errors characteristic of manual paper-based record keeping. By utilizing a Modified Waterfall SDLC approach, the project delivered an integrated technical platform featuring mobile QR code attendance tracking, real-time analytics dashboards, and automated performance evaluation modules. The outstanding empirical evaluations gathered through the ISO 25010 and System Usability Scale (SUS) benchmarks validate the system's exceptional reliability, architectural security, and user-friendly design. It serves as a highly efficient information technology asset that modernizes administrative capacity and accelerates institutional decision-making.

It is highly suggested that PHINMA Cagayan de Oro College initiates a full-scale deployment of this system under the management of the Center for Student Development and Leadership (CSDL) to optimize the oversight of the Hawak-Kamay Scholarship Program. To ensure operational continuity, administrators should establish structured end-user onboarding workshops for supervisors and scholars, alongside scheduling periodic database maintenance and security updates.

Acknowledgements

The researchers express their profound gratitude to PHINMA Cagayan de Oro College, specifically the College of Information Technology Education and the Center for Student Development and Leadership (CSDL), for providing institutional support and technical resources throughout this study. Special appreciation is extended to the research advisors Mr. Adormie C. Macario, Mr. Arnel S. Llemit, and Mr. Riel Jun Cainglet, as well as the panel members, for their invaluable guidance, technical insights, and constructive feedback. The researchers also thank the administrators, supervisors, Hawak-Kamay scholars, and marketing staff who participated in system testing. Finally, the researchers extend their deepest thanks to their families and friends for their constant encouragement and support

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