

Polibatam Training and Certification Information System

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Abstract- The management of employee training and certification data at Politeknik Negeri Batam (Polibatam) is currently handled manually and decentrally, complicating the administration and reporting processes. This research aims to develop a web-based Training & Certification Information System (SITS) to manage data in a centralized and integrated manner. The system was developed using the Waterfall method, encompassing requirement analysis, design, implementation, and testing phases. The result of this research is a web application that facilitates submission processes, multi-level approval workflows according to the organizational structure, and automated reporting. Based on testing, the system is proven to accelerate administrative processes, making data management more efficient, transparent, and well-documented to support the digitalization of internal campus services.

Keywords: Information System; Training; Certification; Employee; Polibatam

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1. Introduction

As a vocational education institution, Politeknik Negeri Batam (Polibatam) is required to possess competent human resources capable of developing in accordance with institutional needs and industrial advancements. To support this competency enhancement, every employee including staff, lecturers, unit heads, and the Human Resources (Kepegawaian) department needs to participate periodically in various self-development activities such as training, workshops, industrial internships, and certifications. With a total of more than 400 active employees, the management of human resource development at Polibatam is massive in scale, averaging 30 to 50 submissions for training and certification activities each year. However, based on observations and interviews conducted with the Human Resources department on September 19, 2025, the current management process of these tracking records still relies entirely on conventional, paper-based methods. Information regarding employee training and certification is scattered across physical archive folders and is not integrated into a single centralized database.

This conventional condition directly impacts the length of the bureaucratic approval workflow. The process from submission to the final validation of a single activity document takes an average of 3 to 5 working days or more. This delay is caused by the sequential handover of physical files from desk to desk, where the validation and approval processes still heavily rely on the wet signatures of authorized officials. On the other hand, the lack of transparency regarding submission status makes it difficult for employees to independently

monitor the progress of their applications or track their competency development records. Besides hindering mobility,

this dependence on physical documents triggers significant material waste, such as the continuous use of paper, printing ink, and archive folders.

The impact of the absence of an integrated system also places a significant operational burden on Human Resources staff. The staff must perform dual or repetitive tasks, namely reading physical approval files and then manually re-entering that data into a spreadsheet (Excel) recap format. This method is highly susceptible to human error, increases the risk of physical documents getting lost or misplaced between units, and causes difficulties for the institution when rapid data retrieval is needed for campus accreditation or annual competency evaluations.

Comprehensively, the root causes of these delays and governance inefficiencies can be mapped into four main factors. From the human factor (man), there is a dual workload on Human Resources staff due to manual recaps and employee difficulties in tracking submission status. From the procedural factor (method), the handover of physical folders is still done sequentially, and its validation absolutely depends on wet signatures. From the technological factor (machine), the lack of a centralized database causes training records to be scattered and difficult to locate. Finally, from the material factor (material), the use of this physical system results in the waste of paper, ink, and archive folders, while also increasing the risk of documents being lost or misplaced between units.

2. Research Methods

A. Product development stages

This project utilizes the Waterfall software development method. According to Valacich & George (2021), Waterfall is a linear model that divides the development process into sequential phases, requiring each phase to be fully completed before proceeding to the next. This systematic approach was selected because the Training & Certification Information System (SITS) Polibatam has clearly defined requirements, well-identified business processes, and necessitates robust documentation to support formal administrative management from the outset. This phase has five stages, as illustrated below.

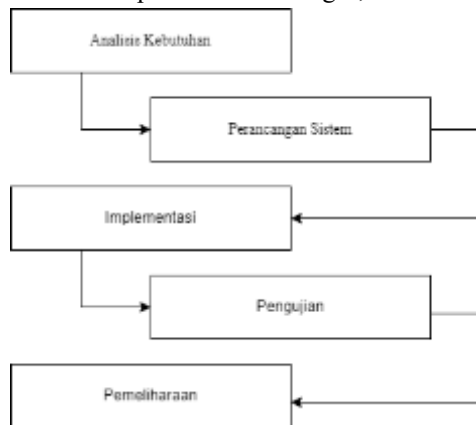


Figure 1. Product development stages

B. The Course of Research

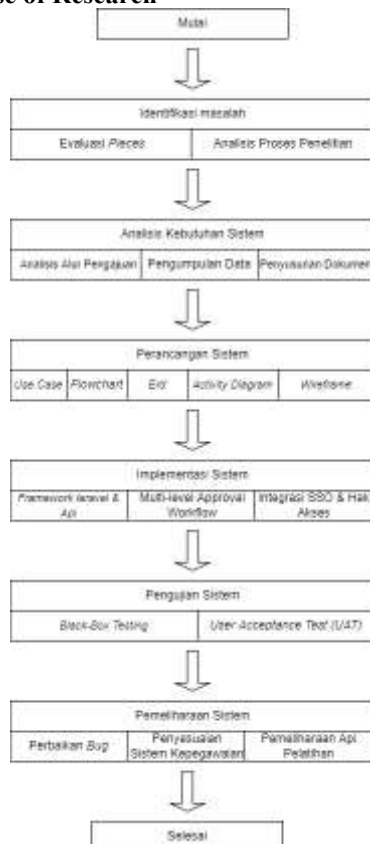


Figure 2. The Course of Research

This image explains the research flow, starting from problem identification to system maintenance.

C. Pieces Method

Advanced information system development requires evaluating both application features and their operational impact on organizational governance. This study utilizes the PIECES method, a widely recognized and highly structured framework (Adha et al., 2025) for identifying institutional problems, opportunities, and development directives. Its reliability in training information systems is proven; Hidayat & Utomo (2023) highlight its effectiveness in formulating system feasibility and user satisfaction during the transition from manual to digital records. By applying this framework, functional requirements are systematically measured to ensure the architecture and solutions proposed for SITS effectively resolve technical and administrative field challenges.

Stages of PIECES Analysis for System Requirements

1. **Performance:** Evaluates how well the system operates, primarily measured by throughput (task volume over time) and response time.
2. **Information:** Assesses data quality, ensuring the system provides accurate, relevant, and timely information to support management decision-making.
3. **Economics:** Involves cost-benefit analysis to determine if the proposed system reduces operational expenses, minimizes waste, and adds value to the institution.
4. **Control:** Focuses on system security and data protection mechanisms to prevent unauthorized access, data loss, and technical failures through proper access rights management.
5. **Efficiency:** Evaluates resource utilization (time, human effort, and technology), aiming to eliminate redundant or excessive manual tasks.
6. **Service:** Measures end-user satisfaction based on system usability, reliability, adaptability to changing needs, and operational support quality.

D. Functional Requirements

Table I. Functional Requirements

No	Kebutuhan Fungsional
FR-01	The system provides user authentication (login) based on role assignments (Employee, Unit Head, Admin, and Human Resources).
FR-02	The system provides a logout feature to securely end user sessions.
FR-03	Employees can submit training requests online through the system.
FR-04	Employees can upload data of completed training.
FR-05	Employees can upload their acquired certificates.
FR-06	Employees can upload proof of training reports and obtained certificates.
FR-07	Unit Heads can verify employee training requests.
FR-08	Admins can create and complete training details for requests approved by the Unit Head.
FR-09	Human Resources can provide final validation by approving or rejecting employee training and certification requests.
FR-10	Unit Heads can evaluate employee training requests.
FR-11	Admins can generate and export (via Excel) the recapitulation data of employee training and certificates.

E. Non-functional needs

Table II. Non-functional needs

No	Parameter	Kebutuhan Non-Fungsional
NFR-01	<i>Security</i>	The system must implement security mechanisms through the integration of the campus Single Sign-On (SSO) authentication and role-based authorization. All competency history data and submission documents must be protected from unauthorized access.
NFR-02	<i>Usability</i>	The system must feature a consistent, responsive, and user-friendly user interface, ensuring that the submission and approval workflows can be easily understood by all users, from employees to the Human Resources Department, without requiring intensive training.
NFR-03	<i>Performance</i>	The system must provide fast and optimal response times when processing submission workflows, uploading documents, and exporting training data recapitulation reports without any lag that disrupts operations.
NFR-04	<i>Availability/Accessibility</i>	This web-based system must be consistently available and smoothly accessible via standard browsers (such as Chrome, Edge, Firefox), whether accessed through the campus internal network (intranet) or external internet networks.
NFR-05	<i>Data Integrity</i>	The system must maintain the

		integrity, consistency, and centralization of the database. Submission data, training history, and certification files must not be lost, duplicated, or unlawfully altered during the multi-tier approval process.
NFR-06	<i>Scalability</i>	The system architecture (based on the Laravel framework) must be designed to be scalable and expandable to accommodate surges in employee history data or the addition of new feature modules in the future without degrading existing system performance.

F. Flowchart diagram

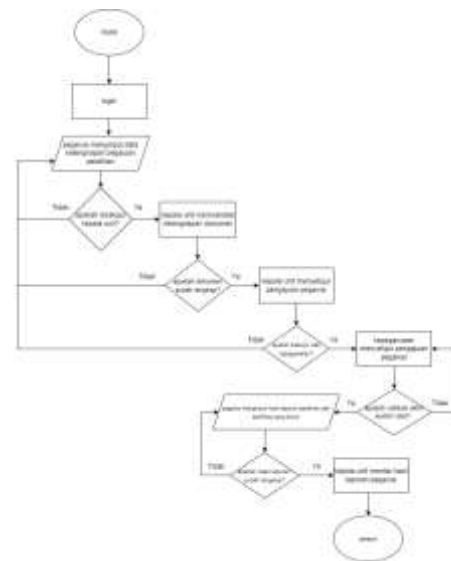


Figure 3. Flowchart diagram

Based on the flowchart, the workflow begins with the Employee logging in and submitting the required training data. The process then reaches the first decision node: "Is it approved by the Unit Head?". If rejected (No), the submission is returned to the employee for revision. If approved (Yes), the Unit Head validates the document completeness. At the next decision node, "Are the documents complete?", any incomplete submissions (No) are routed back to the initial data input stage.

Once the documents are verified as complete (Yes), the Unit Head formally approves the request and forwards it to Human Resources (HR). At the "Is it approved by HR?" node, unverified requests (No) are sent back to the initial data input stage. If verified (Yes), HR approves the submission, leading to the final

decision node: "Is the final validation valid?". If invalid (No), the request reverts to HR for further review.

Upon successful final validation (Yes), the workflow enters the post-training phase, where the Employee uploads their training report and certificate. The system evaluates this at the "Is the report complete?" node. Incomplete reports (No) are returned to the employee for correction. Once the report is fully validated (Yes), the Unit Head evaluates the employee's training results, marking the completion of the system workflow.

G. Use case diagram

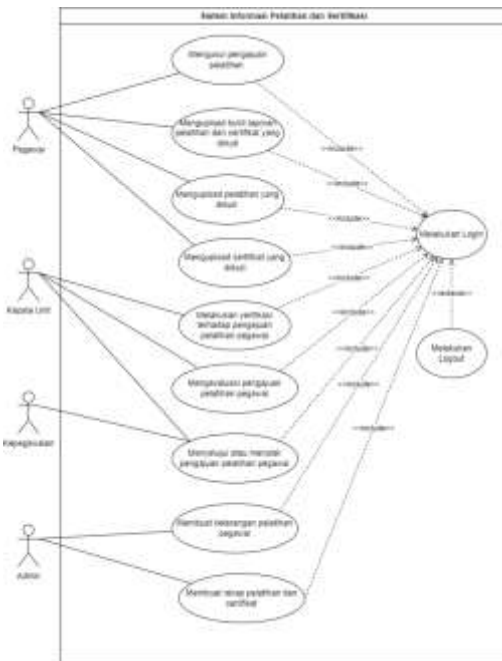


Figure 4. Use case diagram

The Use Case Diagram illustrates the interactions between users and the Training and Certification Information System (SITS). The system involves four actors, each with distinct role-based access rights and responsibilities:

1. Employee: Acts as the proposer who logs in to submit training or certification requests, uploads supporting documents, and monitors the submission status.
2. Unit Head: Verifies and evaluates submissions within their unit. They have the authority to approve or reject requests based on unit needs and policies.
3. Admin: Manages training and certification data, generates data recapitulations, and inputs relevant training details.
4. Human Resources (HR): Executes the final approval or rejection of the submissions and ensures all records are officially documented in the system.

All system activities require a login authentication process to enforce role-specific functions. This diagram provides a foundational overview of user-system interactions prior to further design and implementation stages.

H. ER diagram

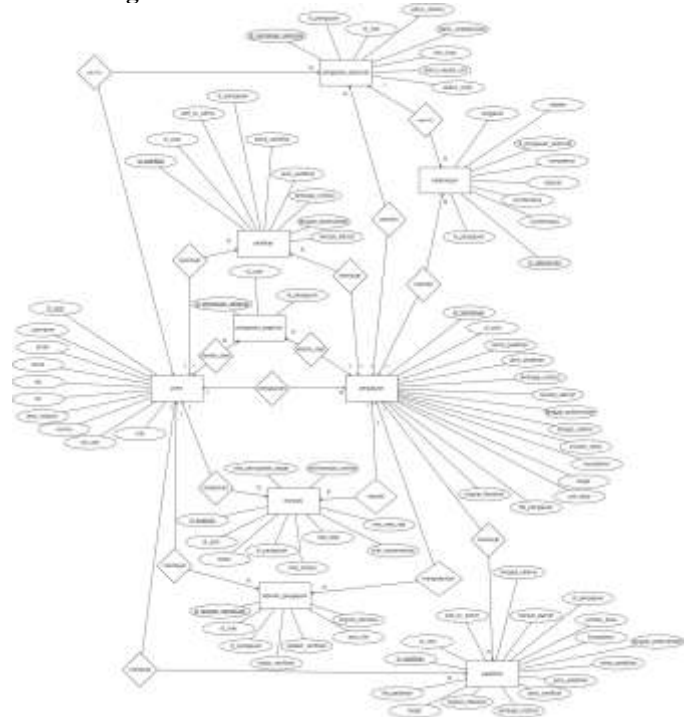


Figure 5. ER diagram

The figure above illustrates the Entity Relationship Diagram (ERD) modeling the relational database structure of SITS Polibatam. The core users entity represents the system's transactional actors (Employee, Unit Head, Admin, and Human Resources).

The pengajuan (submission) entity serves as the operational hub for employee requests, linking directly to pengajuan_approval to facilitate a systematic multi-level approval workflow from Unit Heads to HR. Once fully approved, submissions connect to derivative entities such as pelatihan (training), sertifikat (certificate), and keterangan (details) for centralized documentation.

Furthermore, post-activity obligations are managed via the laporan_pengajuan (submission report) entity for execution accountability, and the evaluasi (evaluation) entity for assessing achievements and future development recommendations. Overall, this ERD demonstrates robust data interconnections, ensuring a fully integrated and highly secure lifecycle for training and certification governance.

3. Result and Discussion

A. Implementation Environment Description

The SITS system implementation process is carried out in a local development environment before being deployed on production servers.

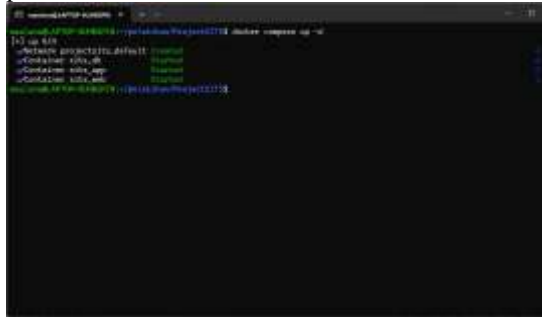


Figure 6. Server and database environment (containerization)



Figure 7. Programming languages and frameworks

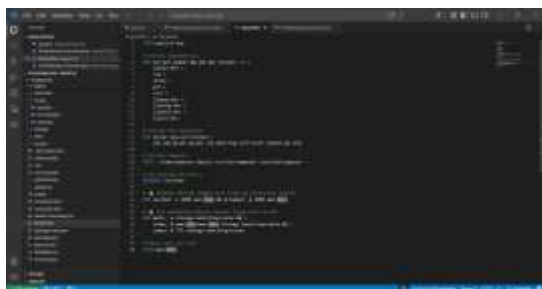


Figure 8. Dependency management



Figure 9. Installation, configuration, and deployment

B. User Interface Implementation

This section presents the implementation results of the SITS application user interface (UI) that has been designed responsively and web-based. The appearance and flow of the system usage are arranged based on the Functional Requirements (FR) fulfillment scenarios that have been defined in the design stage.



Figure 10. Login page implementation



Figure 11. Implementation of the main dashboard and logout feature



Figure 12. Implementation of training submission feature



Figure 13. Implementation of training upload feature



Figure 14. Implementation of certificate upload feature



Figure 15. Implementation of report document upload feature



Figure 16. Implementation of submission verification feature (role: unit head)



Figure 17. Implementation of the technical information completeness feature (role: admin)



Figure 18. Implementation of final validation feature (role: human resource)



Figure 19. Implementation of post-training evaluation feature (role: unit head)



Figure 20. Implementation of data recap and export features (role: admin)

C. Implementation Results Based on PIECES Analysis

Table III. Implementation Results Based on PIECES Analysis

NO	Aspek PIECES	Hasil Implementasi Sistem (SITS)
1	P - <i>Performance</i>	The physical approval workflow is successfully

		digitized, enabling instant and real-time verification without manual document handovers.
2	I - <i>Information</i>	A centralized database (MySQL) systematically provides comprehensive employee training and certificate histories on the dashboard.
3	E - <i>Economics</i>	Paperless administration is achieved through digital document uploads (PDF/Images), significantly reducing paper, ink, and folder waste.
4	C - <i>Control</i>	Data security is ensured via institutional Single Sign-On (SSO) integration, with approval actions permanently logged to prevent forgery.
5	E - <i>Efficiency</i>	Repetitive HR workloads are eliminated. The system automates data recapitulation, allowing direct report generation via the Export to Excel feature.
6	S - <i>Service</i>	An interactive dashboard allows employees to independently track their submission progress, ensuring a transparent and user-friendly experience.

D. User Acceptance Test (UAT) Results

The final functional evaluation of the Polibatam Training and Certification Information System was conducted using the User Acceptance Test (UAT) method. This test ensures that all designed Functional Requirements (FR) operate correctly and meet users' operational needs. The UAT was conducted on July 16-17, 2026, in a local environment involving three respondents representing each system role:

1. Sri Rahayu (Employee)
2. Lina Dwi Wahyuni (Unit Head)
3. Ratna Juwita (Human Resources)

Quantitative data processing is based on UAT recapitulation sheets manually filled by the respondents. The pass and fail percentages are calculated using standard software engineering formulas:

1. $\text{Pass Rate} = (\text{Total Passed Features} / \text{Total Tested Features}) \times 100\%$
2. $\text{Fail Rate} = (\text{Total Failed Features} / \text{Total Tested Features}) \times 100\%$

Based on the execution of 11 main system features by the three respondents, the quantitative UAT recapitulation is presented in Table 4:

Table IV. Quantitative Recapitulation of UAT Results

Respondent	Total Tested	(Pass)	(Fail)	(Pass Rate)	(Fail Rate)
Ibu Sri Rahayu	11	11	0	100%	0%
Ibu Lina Dwi Wahyuni	11	11	0	100%	0%
Ibu Ratna Juwita	11	11	0	100%	0%
Total		33	0	100%	0%

To provide data transparency regarding the tested functionalities, Table 33 presents a brief description of the actual results obtained during the UAT process:

Table V. Actual Results of UAT Features (UAT_FR_01 - UAT_FR_11)

ID UAT	Nama Fitur / Modul	Hasil Aktual	Status
UAT_FR_01	Multi-Role Authentication	System successfully logs in according to the assigned role	Pass
UAT_FR_02	System Logout	System successfully logs out and terminates the session	Pass
UAT_FR_03	Training Submission	System successfully creates a training submission	Pass

4. Conclusion and Recommendation

A. Conclusion

Based on the design, implementation, and testing of the Polibatam Training & Certification Information System (SITS) outlined in Chapter IV, the following conclusions directly address the research objectives:

1. Paperless Submission Digitalization: SITS successfully facilitates online activity submissions, history tracking, and proof document uploads (certificates and reports). This effectively eliminates manual physical document workflows and accelerates bureaucratic processes.
2. Automated Multi-Level Approval: A structured, role-based approval workflow was successfully implemented. Bureaucracy is sequentially automated from the Employee level to the Unit Head (verification and evaluation), Admin (technical details), and Human Resources (final decision), resulting in a faster, transparent, and well-documented process.
3. Secure and Consistent Centralized Data Management: Employee competency data is centralized using a relational database deployed within a containerized environment (Docker). This ensures that training and certification data is neatly stored, safely isolated from data loss risks, and easily reportable via the Excel export feature.
4. Validation of Operational Requirements: Testing

UAT_FR_04	Upload Training	System successfully creates/uploads training data	Pass
UAT_FR_05	Upload Certificate Document	System successfully creates/uploads certificate data	Pass
UAT_FR_06	Upload Report & Certificate	System successfully uploads the report and certificate files	Pass
UAT_FR_07	Unit Head Verification	System successfully processes verification by the Unit Head	Pass
UAT_FR_08	Create Training Details	System successfully adds training details	Pass
UAT_FR_09	HR Verification	System successfully processes verification by Human Resources	Pass
UAT_FR_10	Unit Head Evaluation	System successfully submits and records Unit Head evaluation	Pass
UAT_FR_11	Recap & Excel Export (OSDM)	System successfully generates the Excel export	Pass

results, including the User Acceptance Test (UAT), confirm that all application features and workflows operate validly. Institutional Single Sign-On (SSO) integration and data completeness instruments have proven to meet the operational standards of human resource governance at Politeknik Negeri Batam.

Key Development Finding:

During the system design and testing process, implementing a Model-View-Controller (MVC) architecture combined with a container-based server infrastructure (Docker) proved crucial for maintaining system stability. This technology ensures the SITS application can transition from a local development environment to a production server without software compatibility issues.

B. Recommendations

Based on the implementation results and research limitations, the following recommendations are proposed for future SITS development:

1. Training Management Module Development: Currently, the system only accommodates submission workflows and document recapitulation. Future development should include internal training operational features, such as activity scheduling, speaker data management, and centralized training material distribution.
2. Native Mobile Interface Development: To enhance user accessibility and flexibility, the current web system should be expanded into native mobile applications

- (Android and iOS). This will simplify the process for employees, particularly for uploading reports or scanning certificates directly via smartphone cameras.
3. Enhanced Data Exports and Executive Dashboard: The current data recapitulation focuses on Excel format. Future research should add PDF report generation. Additionally, an interactive visual executive dashboard would greatly assist leadership in monitoring real-time employee competency improvement statistics.
 4. Cross-System Institutional Integration: SITS should be integrated via Application Programming Interface (API) with Polibatam's Human Resource Management Information System. This integration will enable the automatic synchronization of employee competency portfolios and training histories, eliminating redundant data entry across different platforms.

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