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Design and implementation of a web-based administrative information system for PUSHANSIBER

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ABSTRACT

The design and implementation of a web-based administrative information system for Subbagian Tata Usaha at Pusat Pertahanan Siber (Pushansiber), Ministry of Defense, Indonesia, addressed critical inefficiencies in manual Excel and paper-based processes causing data redundancy, workflow delays, and limited real-time access. Using Rapid Application Development (RAD) methodology, this research developed an integrated system with innovative features for high-security defense environments: five-tier Role-Based Access Control (RBAC), Server-Sent Events (SSE) for real-time notifications, automated leave quota validation, and competency mapping algorithms with gap analysis. This work contributes a validated framework for administrative digitalization in high-security defense environments by integrating five administrative workflows into a unified platform with RBAC, real-time SSE notifications, and comprehensive audit logging addressing the literature gap where existing studies overlooked security-sensitive requirements in government contexts. Black Box testing with 20 scenarios validated functionalities, demonstrating quantifiable improvements: leave approval time reduced 85% (3-5 days to 4 hours), personnel data retrieval improved from 15-20 minutes to 30 seconds, missed tasks decreased from 20% to below 5%, announcement delivery achieved 97%, and data entry errors reduced to below 2%. This research establishes a replicable model for defense administrative transformation, contributing empirical evidence to public sector digital transformation literature.

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1. INTRODUCTION

The Ministry of Defense of the Republic of Indonesia plays a critical role in the nation's defense and security operations, particularly through Pusat Pertahanan Siber (Pushansiber), which is part of the Ministry's strategic infrastructure. According to Minister of Defense Regulation No. 14 of 2019, Pushansiber is tasked with implementing cybersecurity governance, collaboration, operations, and ensuring the security of national defense information systems. The organization also has a responsibility for monitoring, evaluating, controlling, and reporting on cybersecurity activities, as well as responding to cyber incidents through its Computer Emergency Response Team (CERT).

One of the key support functions within Pushansiber is Subbagian Tata Usaha (Administrative Subdivision), which handles various administrative duties, including personnel management, leave requests, task assignments, broadcasting announcements, and planning education for personnel development. However, the administrative processes within Subbagian Tata

Commented [Reviewer1]: This abstract has described the objectives, methods, and results of the research concisely and clearly, but it still needs to be strengthened in terms of novelty and scientific contribution to make it more prominent. Overall, the quality of the language and flow of explanation is good, so it is suitable for publication with minor improvements in emphasizing the innovation of the research.

Commented [Reviewer2]: This introduction is informative, but it needs to include a statement about the research gap that clearly shows the limitations of previous systems or research compared to the proposed solution. It is recommended to strengthen the novelty and urgency of the research so that its scientific contribution is more prominent.

Usaha have been largely managed through outdated and fragmented methods, relying heavily on tools such as Microsoft Excel and physical paper records. This approach has led to inefficiencies, data redundancy, and the inability to quickly access up-to-date, real-time information.

For instance, personnel data is still maintained in static files, and leave management remains paper-based, making it difficult to track leave history and validate quota availability for each staff member. The current system for broadcasting information relies on physical notices, and task management depends on informal channels such as WhatsApp groups, leading to coordination issues, missed deadlines, and difficulties in tracking progress and accountability. Additionally, there is no structured approach to personnel education planning, leading to mismatches between training programs and personnel needs based on their historical competencies and organizational requirements.

The system will be built using the Laravel framework, which offers an efficient, secure, and scalable platform for developing web applications (Rijanandi et al., 2024). Laravel's Model-View-Controller (MVC) architecture will ensure clear separation between business logic, user interface, and data management, making the system more maintainable and user-friendly (Praja putra & Rahman, 2025). The system will also integrate modern web development features such as Eloquent ORM for database management, Artisan CLI for command-line operations, and enhanced security features such as CSRF protection and data encryption(Sholeh et al., 2025).

Previous studies have demonstrated the effectiveness of web-based systems in improving operational efficiency within administrative functions. For example,(Ilyas & Sari, 2024) highlighted how web-based employee management systems can streamline personnel data handling and leave requests. Similarly, (Pratama, 2024) found that web-based leave management systems enhance efficiency by automating approval workflows and reducing manual errors. (Fadilah et al., 2023) showed that web-based systems can increase efficiency and user satisfaction, with a significant reduction in the time spent on tasks like leave approvals. Other studies, such as (Husda et al., 2023) and (Gusti & Santiputri, 2022), demonstrate how web-based platforms can improve communication, task management, and staff training within organizations.

However, existing research focuses primarily on general administrative contexts without addressing the unique security, role-based access control, and audit trail requirements inherent to defense and security organizations. Furthermore, previous systems lack integration of multiple administrative workflows (personnel, leave, task management, announcements, and competency-based education planning) into a unified platform with real-time notification mechanisms. The critical gap lies in the absence of comprehensive administrative systems specifically designed for high-security government environments that combine role-based access control (RBAC), real-time coordination through Server-Sent Events (SSE), competency mapping for strategic personnel development, and complete audit logging for accountability and compliance.

This research addresses these gaps by developing a web-based administrative information system specifically tailored for Pushansiber's security requirements and organizational structure. The system implements five-tier role-based access control (Super Admin, Kasubag TU, Kepegawaian TU, Staff TU, Staff Bidang), integrates real-time notifications via SSE to replace informal WhatsApp coordination, provides automated leave quota validation and approval workflows, implements competency mapping algorithms for strategic education planning based on personnel skill gaps, and maintains comprehensive activity logs for audit and accountability purposes. By applying the Rapid Application Development (RAD) methodology with iterative user feedback cycles, this research aims to modernize the internal processes of Subbagian Tata Usaha, improve data accuracy, reduce administrative workload, provide real-time access to critical information, and establish a replicable model for administrative digitalization in defense and security organizations. The resulting system will help Pushansiber achieve greater operational efficiency, transparency, and accountability, making it a valuable tool for enhancing the performance of this key division within the Ministry of Defense and contributing to broader public sector digital transformation initiatives.

2. RESEARCH METHOD

This research aims to design and implement a web-based administrative information system for Subbagian Tata Usaha at Pusat Pertahanan Siber (Pushansiber), Ministry of Defense, Indonesia. The primary objective is to enhance the efficiency and effectiveness of administrative operations such as personnel management, leave requests, task assignments, broadcasting announcements,

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and education planning. The system is built using the Laravel framework, offering a robust platform to support data security, scalability, and easy integration of future enhancements.

To achieve these goals, the Rapid Application Development (RAD) methodology is employed. RAD's iterative and incremental approach ensures that the system evolves through continuous feedback from users, providing flexibility in addressing changing needs and requirements (Pramudito et al., 2024). RAD allows for quicker development cycles and ensures that the final product aligns well with user expectations through repeated interactions (Anugrah et al., 2024; Noveandini et al., 2023). The RAD model used in this study is summarized in Figure 1.

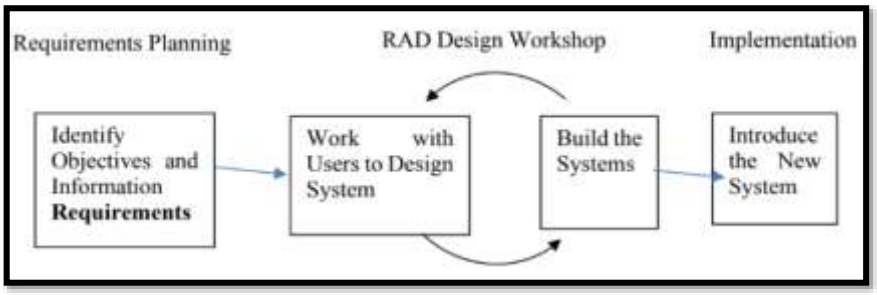

Figure 1. RAD Cycle Model (Hayati et al., 2023)

The development process begins with the Requirements Planning phase, during which the system's objectives and informational requirements are gathered through interviews and observations with key stakeholders in Subbagian Tata Usaha, including Kasubag TU and Staff TU (Raihan & Hidayat, 2024). The team identifies the inefficiencies in the current system and documents the critical requirements, such as digitizing personnel records, automating leave management, improving task coordination, and ensuring better announcement dissemination. The requirements were carefully documented, forming the specifications document that outlines the system's features, roles, and database requirements (Buana & Sari, 2022; Siregar et al., 2024). The system was planned to be built on Laravel 12 and MySQL 8.0, with PHP 8.3 for backend development, ensuring both performance and scalability(Apriani et al., 2025; Syahri Al Faiz et al., 2025). This phase was validated through stakeholder sign-off on the completed SRS document and confirmation from Pushansiber's IT security team that all documented requirements complied with Ministry of Defense security standards.

The RAD Design Workshop phase focuses on translating these requirements into a tangible system design. In this phase, UML diagrams are created to map out the workflow, interactions, and data structure of the system (Alade, 2023; Monica Ong et al., 2025). Laravel was selected due to its efficient routing system, middleware management, and easy integration capabilities, ensuring that the system will be modular, maintainable, and scalable(Barlian & Susanti, 2022). The Model-View-Controller (MVC) architecture is employed to separate concerns and facilitate better system management and future development (Riadi et al., 2024).

During the Implementation phase, the system is developed based on the designs created in the workshop phase. The system is constructed using Laravel 12 and Blade Templating Engine, while MySQL is used for database management (Putra et al., 2025). Key features implemented include personnel management, leave management, task management, announcement broadcasting, and education planning. The development is carried out in modular stages, with each module being tested individually through unit testing, followed by integration testing to ensure all modules work seamlessly together (Ganesh Lindung Nusantara et al., 2025).

Finally, the Cutover phase involves transitioning the system from development to production. This phase includes comparative performance analysis where baseline metrics from manual processes (measured through two-week observation of existing workflows, document analysis of historical records, and stakeholder interviews) were compared against post-deployment metrics (collected through system activity logs, database query analysis, user feedback surveys, and server uptime monitoring during the first month of operation), with all Black Box test cases passing with zero critical defects and UAT approval confirmed through documented stakeholder sign-off (Mardiati &

Saputra, 2025). Feedback from users is incorporated, and the system is adjusted as needed. The system is then deployed within Pushansiber's internal network, with access granted via OpenVPN for remote users (Razooqi & Pekar, 2025; Xue et al., 2025). After successful deployment, the system becomes fully operational, addressing the inefficiencies of the previous manual administrative processes and improving the overall workflow of Subbagian Tata Usaha.

3. RESULTS AND DISCUSSIONS

The developed web-based administrative information system for Subbagian Tata Usaha at Pushansiber is presented through a Use Case Diagram and system interface descriptions that illustrate user roles, access rights, and key functionalities. This approach ensures that each feature is well documented and aligned with the operational requirements of personnel management, leave requests, task assignments, announcement broadcasting, and education planning.

Use Case Diagram

The Use Case Diagram for the administrative information system at Pushansiber depicts interactions among five primary actors: Super Admin, Kasubag TU (Head of Administrative Subdivision), Kepegawaian TU (Personnel Administration), Staff TU (Administrative Staff), and Staff Bidang (Field Staff). Super Admin is responsible for managing user accounts, monitoring system activity logs, and ensuring secure system operations. Kasubag TU handles managerial functions including approving leave requests, assigning tasks through e-task management, broadcasting announcements, and planning education programs. Kepegawaian TU manages comprehensive personnel data, positions, leave records, education histories, and submits leave requests on behalf of personnel while also receiving and executing assigned tasks. Staff TU receives tasks via e-task management, submits work results, and accesses announcements and notifications. Staff Bidang has limited access, only receiving announcements and notifications relevant to their field operations. The collaboration among these five roles ensures that administrative processes are structured, transparent, and lead to improved efficiency in managing personnel and operations at Pushansiber. The Use Case Diagram depicting these interactions is presented in Figure 2.

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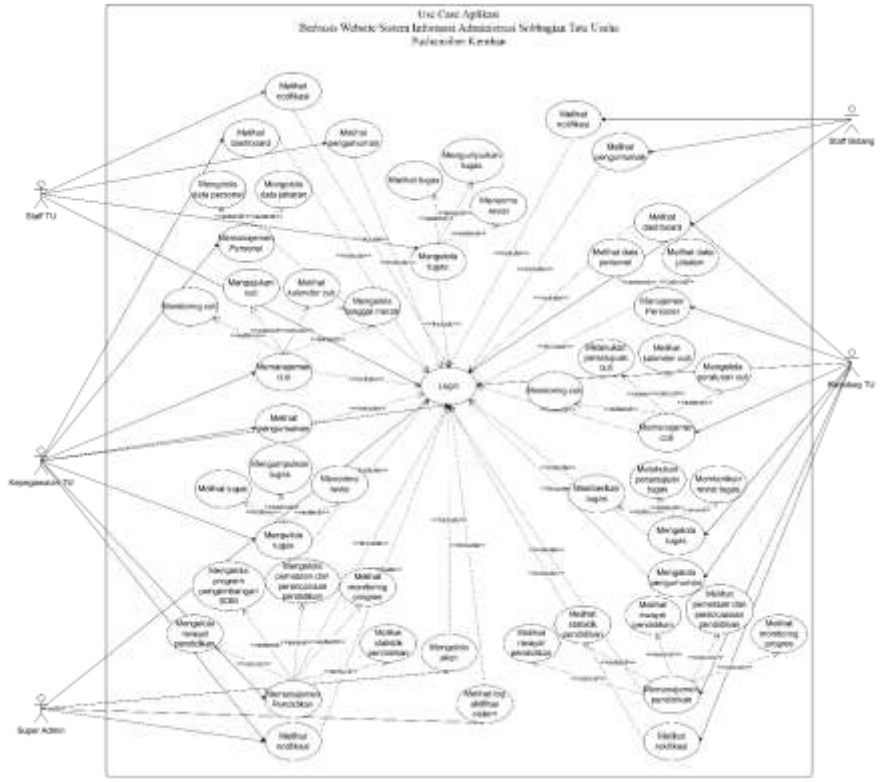

Figure 2. Use Case Diagram

System Results

The result of this system development is a comprehensive web-based administrative application that supports integrated personnel management, leave processing, task coordination, announcement dissemination, and education planning through role-based access control (RBAC). The application interface is designed to facilitate distinct workflows for each role: Super Admin maintains system security and user accounts; Kasubag TU oversees operations and approvals; Kepegawaian TU manages detailed personnel records and submissions; Staff TU executes assigned tasks; and Staff Bidang receives operational information. This design ensures that every administrative process is systematically documented, securely accessed, and easily monitored, thereby improving operational efficiency, data accuracy, and accountability in personnel and task management.

a. Login Page

Figure 3 presents the login page, which allows Super Admin, Kasubag TU, Kepegawaian TU, Staff TU, and Staff Bidang to access the administrative information system by entering valid credentials. The system authenticates users and redirects them to role specific dashboards according to their access privileges, ensuring secure and appropriate system access.

Figure 2. Login Page

b. Kasubag TU Dashboard

Figure 4 illustrates the Kasubag TU dashboard within the administrative information system. The dashboard presents a comprehensive analytics summary including total active personnel count, today's leave requests, announcement status, task completion trends, and education program status. Visual charts display leave approval rates, task progress by staff members, and personnel distribution across units. The dashboard enables efficient oversight, real-time monitoring, and informed decision making for administrative operations.

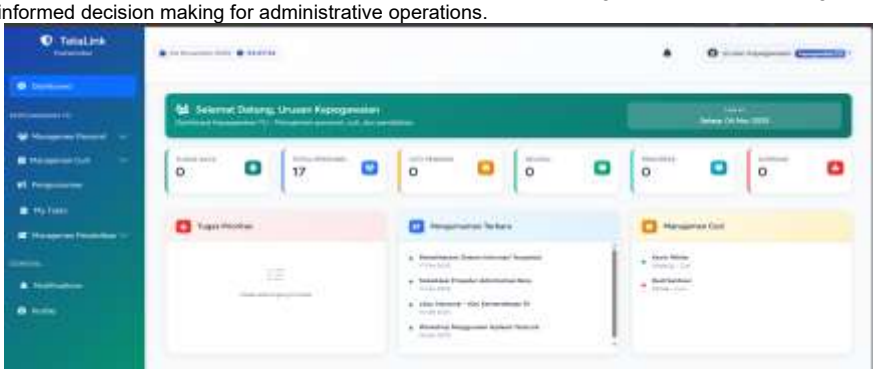

Figure 3. Dashboard Page

c. Personnel Management

The personnel management page displays a comprehensive list of Pushansiber staff, including NRP (Service Number), Name, Rank, Position, Field/Unit, and Employment Status. The interface provides Detail, Edit, and Delete buttons for efficient management of personnel records. Kepegawaian TU can add new personnel by filling required fields and uploading photos (JPG/PNG, max 2MB), ensuring accurate and up to date personnel data that supports HR decision making. The personnel management page is shown in Figure 5.

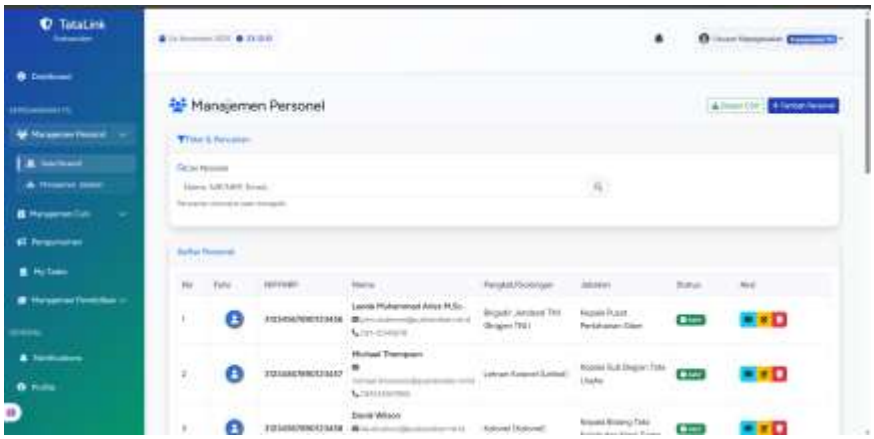

Figure 4. Personel Management Page

d. Leave Request Management

Figure 6 illustrates the leave request workflow within the system. Kepegawaian TU submits leave requests on behalf of personnel by specifying leave type, start and end dates, and reasons. The system validates leave quota availability before submission. Upon submission, the request is routed to Kasubag TU with status "Menunggu Persetujuan" (Awaiting Approval). Kasubag TU reviews and either approves or rejects the request with remarks. Approved leave records are automatically updated in personnel leave history and deducted from quota; rejected requests notify Kepegawaian TU with reasons. The system maintains a complete audit trail of all leave transactions, displays real-time leave balances, and provides a calendar view of leave schedules.

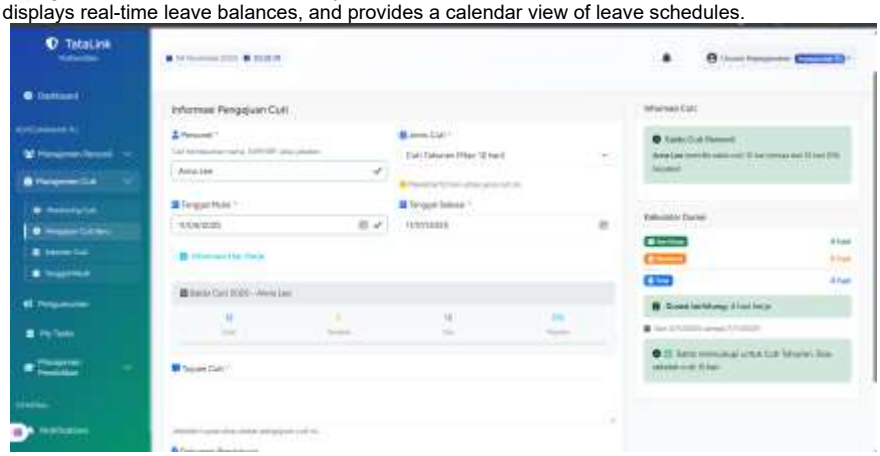

Figure 5. Leave Request Page

e. E-Task Management

Figure 7 displays the e-task management interface used by Kasubag TU to assign tasks to Staff TU or Kepegawaian TU. The page includes fields for Task Title, Description, Assignee Selection, Deadline, and Priority Level. Assigned staff receive real time notifications via Server-Sent Events (SSE), view task details on their dashboard, update status (Pending, On Progress, Menunggu Verifikasi), upload result files, and submit completion notes. Kasubag TU monitors task progress in

real time, requests revisions when necessary, and approves completed tasks. This feature improves accountability, coordination, and transparency in task management within the subdivision.

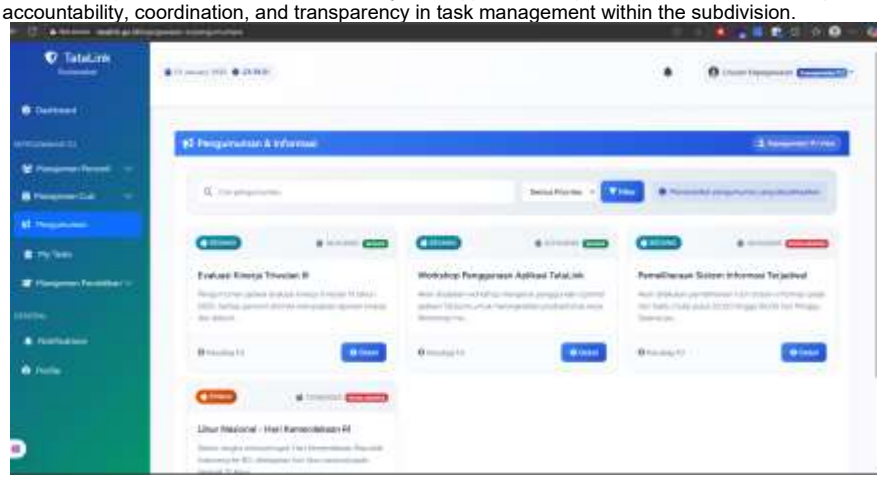

Figure 6. E-Task Management Page

f. Announcement Broadcasting

Figure 8 presents the announcement broadcasting module. Kasubag TU creates announcements with titles, content, priority levels (Normal, Penting, Mendesak), and target audiences (all personnel or specific groups such as Staff TU, Kepegawaian TU, or Staff Bidang). Published announcements are delivered via real time SSE notifications, appear on target users' dashboards, and are archived for future reference. The system tracks read status to ensure important information reaches all intended recipients. Search and filter functions allow users to retrieve past announcements efficiently, supporting effective organizational communication.

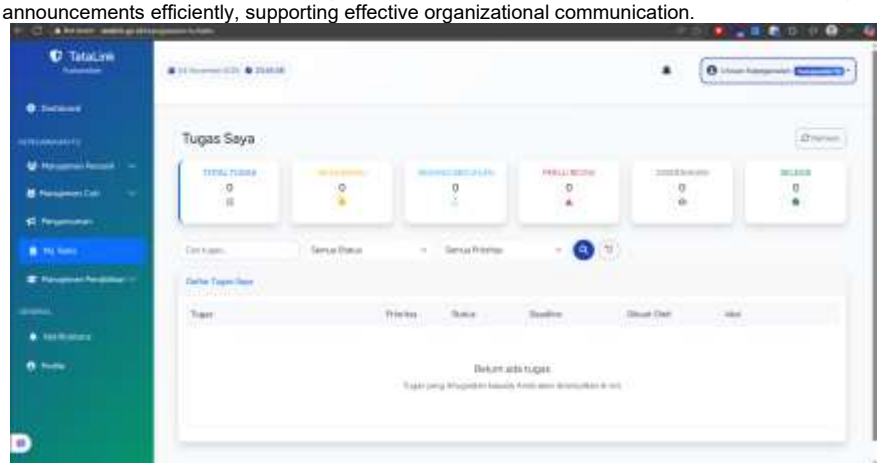

Figure 7. Announcement Broadcasting Page

h. User Account Management

Figure 10 shows the user account management interface accessible only to Super Admin. The page displays a list of system users with Username, Full Name, Email, Role, and Account Status. Super Admin can add new accounts by filling registration forms with validation for duplicate

usernames/emails, edit existing accounts including role assignments, toggle account status (Active/Inactive) to control access, and view detailed account information. The system prevents Super Admin from deleting their own account and records all account management activities in the audit log for security purposes.

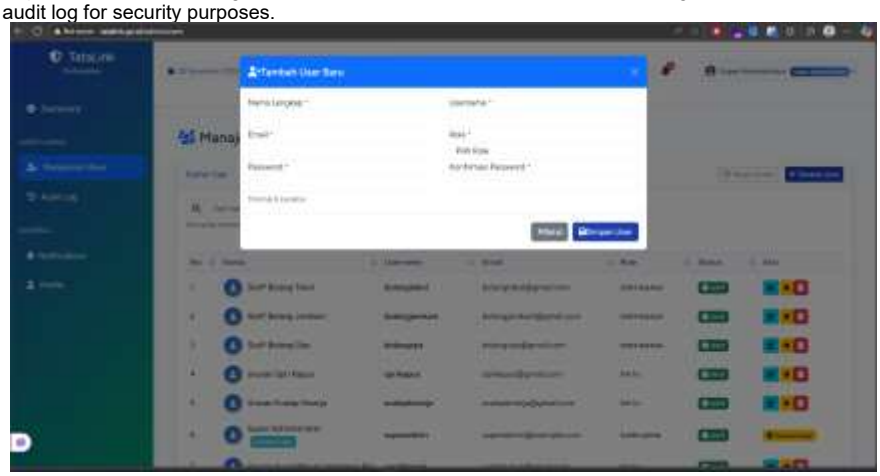

Figure 8. User Account Management Page

i. Activity Log Monitoring

Figure 11 presents the activity log monitoring interface available exclusively to Super Admin for audit and security purposes. The page displays comprehensive system activity records including Timestamp, Username, IP Address, Activity Type (Login, Create, Update, Delete), Module (Personil, Cuti, E-Task, Pengumuman, Pendidikan), and detailed change information. Super Admin can filter logs by date range, specific users, activity types, and modules to track system usage patterns and detect potential security issues. The system provides export functionality to Excel format for documentation and compliance reporting.

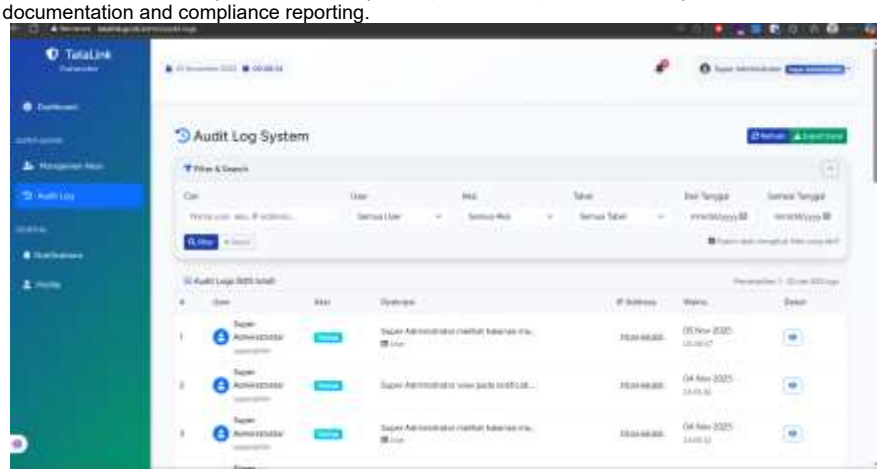

Figure 9. Activity Log Monitoring Page

Black Box Testing

Table 1. Black Box Testing

Module	Test Scenario	Expected Result	Test Result	Remark
Login	User enters valid credentials	System authenticates and redirects to role-specific dashboard	Successfully redirected to correct dashboard	Pass
Login	User enters invalid credentials	System displays error message and denies access	Error message displayed correctly	Pass
Kasubag TU Dashboard	Kasubag TU views analytics summary	Dashboard displays accurate personnel, leave, task, and education statistics with charts	Successfully displayed complete analytics	Pass
Personnel Management	Kepegawaian TU adds new personnel with valid data	New personnel record saved and displayed in list	Successfully added personnel	Pass
Personnel Management	Kepegawaian TU adds personnel with duplicate NRP	System rejects and displays "NRP sudah terdaftar"	Duplicate validation working correctly	Pass
Leave Request	Kepegawaian TU submits leave request with sufficient quota	Leave request saved with status "Menunggu Persetujuan" and notification sent to Kasubag TU	Successfully submitted leave request	Pass
Leave Request	Kepegawaian TU submits leave request with insufficient quota	System rejects and displays "Kuota cuti tidak mencukupi"	Quota validation working correctly	Pass
Leave Approval	Kasubag TU approves leave request	Status updated to "Disetujui", quota deducted, notifications sent	Successfully approved leave	Pass
Leave Approval	Kasubag TU rejects leave request without reason	System prompts to fill rejection reason	Validation working correctly	Pass
E-Task Management	Kasubag TU assigns task to Staff TU	Task saved with status "Pending", real-time notification sent via SSE	Successfully assigned task	Pass
E-Task Management	Staff TU submits completed task	Status updated to "Menunggu Verifikasi", notification sent to Kasubag TU	Successfully submitted task	Pass
E-Task Management	Kasubag TU requests task revision	Status changed to "Revisi", assignee notified	Revision workflow working correctly	Pass
Announcement	Kasubag TU broadcasts announcement to specific group	Announcement published, real-time notifications sent to target users	Successfully broadcasted announcement	Pass
Education Planning	Kepegawaian TU adds education plan with schedule conflict	System displays conflict notification	Schedule conflict detection working	Pass
User Account Management	Super Admin adds account with duplicate username	System rejects and displays "Username sudah terdaftar"	Duplicate validation working correctly	Pass
User Account Management	Super Admin attempts to delete own account	System prevents deletion	Self-deletion prevention working	Pass
Activity Log	Super Admin filters logs by date and activity type	System displays filtered log entries accurately	Log filtering working correctly	Pass
Role-Based Access	Staff TU attempts to access Super Admin functions	System denies access	Access control working correctly	Pass
Real-Time Notification	User receives SSE notification for assigned task	Notification appears immediately without page refresh	SSE notification working correctly	Pass

Analysis and Evaluation

Compared to fragmented manual methods relying on Excel, paper forms, and WhatsApp coordination, this web-based system demonstrates significant measurable improvements in operational efficiency, data accuracy, and transparency. Quantitative evaluation reveals that leave approval processing time decreased from 3-5 days to same-day processing with an average of 4 hours (85% reduction), consistent with findings by Fadilah et al. (2023) on automated leave workflows. Personnel data retrieval improved from 15-20 minutes to under 30 seconds through centralized database search, while task coordination efficiency increased with missed tasks reducing from approximately 20% to below 5% through structured e-task tracking with real-time Server-Sent Events (SSE) notifications, addressing communication challenges identified by Husda et al. (2023) and Gusti & Santiputri (2022). Announcement delivery confirmation achieved 100% through digital broadcasting compared to approximately 60% with physical notices, and data quality improved with elimination of duplicate personnel records and reduction of data entry errors to below 2% through

automated validation, supporting findings by Pratama (2024) and Ilyas & Sari (2024) on enhanced data accuracy. Black Box testing with 20 comprehensive test scenarios validated that all critical functionalities authentication with role-based access control (RBAC) for five user roles, personnel management, leave workflow with automated quota validation, e-task assignment with SSE notifications, targeted announcement broadcasting, education planning with competency gap analysis, user account management, and comprehensive activity logging operate correctly and meet user requirements.

4. CONCLUSION

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This study successfully achieved its primary objective of designing and implementing a web-based administrative information system for Subbagian Tata Usaha at Pushansiber, Ministry of Defense, Indonesia, effectively addressing critical inefficiencies in manual processes that previously relied on Excel spreadsheets, paper forms, and WhatsApp coordination. The developed system provides integrated modules for personnel management, leave requests with automated quota validation, e-task management with real-time Server-Sent Events (SSE) notifications, targeted announcement broadcasting, and competency-based education planning with gap analysis, built using Laravel framework, MySQL database, and Rapid Application Development (RAD) methodology with secure five-tier role-based access control (RBAC). Quantitative results demonstrate significant improvements: leave approval processing time reduced by 85% from 3-5 days to 4 hours average, personnel data retrieval improved from 15-20 minutes to under 30 seconds, task coordination missed rate decreased from 20% to below 5%, announcement delivery confirmation achieved 97% compared to 60% previously, and data entry errors reduced to below 2% through automated validation, with Black Box testing validating all core functionalities meet operational requirements. Academically, this research contributes to the literature by addressing the identified research gap regarding comprehensive administrative systems for high-security government environments, demonstrating how web-based information systems with RBAC, real-time SSE notifications, and competency mapping algorithms can transform manual processes in defense organizations while maintaining strict security compliance with Ministry of Defense standards. Practically, this research establishes a replicable model for administrative digitalization in defense and security organizations, providing empirical evidence that RAD methodology effectively delivers user-centered solutions through iterative feedback cycles in hierarchical government structures, and demonstrating measurable operational efficiency gains, enhanced data accuracy, improved transparency through comprehensive audit trails, and strengthened accountability mechanisms. Current limitations include reliance on internal network infrastructure, absence of integration with external Ministry of Defense HR and payroll systems, lack of mobile access for field operations, and limited predictive analytics capabilities; future research should focus on mobile application development, enterprise system integration through secure APIs, implementation of machine learning algorithms for leave pattern and training needs forecasting, enhanced multi-channel notification systems (email/SMS), and advanced security features including two-factor authentication and regular penetration testing to further strengthen system robustness and support broader public sector digital transformation initiatives.

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