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Accrual-Based Accounting Information System Using the Audit Trail Method

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Abstrak

Transformasi digital dalam manajemen keuangan memerlukan implementasi sistem yang memastikan pelaporan yang akurat dan integritas data yang tinggi. Akuntansi berbasis kas tradisional sering kali menghasilkan asimetri informasi dan kurang memiliki presisi yang diperlukan untuk merepresentasikan posisi keuangan aktual suatu entitas. Penelitian ini dimotivasi oleh kebutuhan mendesak akan transparansi dan akuntabilitas dalam sistem keuangan digital, di mana manipulasi data yang tidak sah tetap menjadi risiko yang signifikan. Kami mengusulkan Sistem Informasi Akuntansi (SIA) Berbasis Akrual berbasis web yang terintegrasi dengan metode Audit Trail sekuensial untuk merekam setiap peristiwa siklus hidup data. Kontribusi dari penelitian ini adalah pengembangan kerangka kerja aman yang menjembatani logika akuntansi dengan mekanisme kontrol sibernetika. Hasil evaluasi menunjukkan bahwa sistem mencapai akurasi 100 persen dalam menghasilkan laporan keuangan yang sesuai dengan PSAK dan berhasil menangkap log bukti bukti manipulasi untuk semua intervensi pengguna. Selain itu, implementasi ini secara efektif memitigasi risiko penipuan internal dengan menyediakan bukti forensik yang pasti. Pekerjaan di masa depan akan fokus pada integrasi teknologi blockchain untuk imutabilitas terdesentralisasi dan kecerdasan buatan untuk deteksi anomali proaktif. Penelitian ini sangat penting bagi organisasi yang mencari lingkungan digital yang dapat diverifikasi dan kuat untuk tata kelola keuangan.

Kata kunci*— Sistem Informasi Akuntansi, Basis Akrual, Audit Trail, Integritas Data, Standar PSAK*

Abstract

The digital transformation of financial management necessitates the implementation of systems that ensure both accurate reporting and high data integrity. Traditional cash-basis accounting often results in information asymmetry and lacks the precision required to represent an entity's actual financial position. This research is motivated by the urgent need for transparency and accountability in digital financial systems, where unauthorized data manipulation remains a significant risk. We propose a web-based Accrual-Based Accounting Information System (AIS) integrated with a sequential Audit Trail method to record every data lifecycle event. The contribution of this study is the development of a secure framework that bridges accounting logic with cybernetic control mechanisms. Evaluation results indicate that the system achieves 100 percent accuracy in generating PSAK-compliant financial statements and successfully captures tamper-evident logs for all user interventions. Furthermore, the implementation effectively mitigates the risk of internal fraud by providing definitive forensic evidence. Future work will focus on integrating blockchain technology for decentralized immutability and artificial intelligence for proactive anomaly detection. This research is crucial for organizations seeking a verifiable and robust digital environment for financial governance.

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Keywords— *Accounting Information System, Accrual Basis, Audit Trail, Data Integrity, PSAK Standards*

1. INTRODUCTION

The rapid advancement of information technology has fundamentally altered the landscape of corporate financial management and reporting standards. Modern organizations increasingly rely on automated systems to manage complex transactions that involve deferred revenues and accrued expenses. In the context of contemporary economic environments, the utilization of an Accounting Information System (AIS) has become a primary necessity for maintaining competitive advantage and ensuring compliance with international financial reporting standards [1]. However, many small to medium-sized enterprises still struggle with manual recording processes that are prone to human error and lack real-time data visibility. The fundamental background of this research lies in the critical transition from traditional cash-basis accounting to a more sophisticated accrual-basis framework which provides a more accurate representation of an organization financial health by matching revenues with the expenses incurred to earn them [2].

The general problem identified in current financial practices involves the lack of data integrity and the high risk of unauthorized data manipulation. Manual systems often lack a structured history of changes, making it difficult for auditors to verify the chronological validity of financial entries [3]. Without a robust tracking mechanism, identifying the source of discrepancies or fraudulent activities becomes a near-impossible task for internal controllers. The primary research goal is to design and implement a web-based AIS that automates accrual calculations while embedding a rigorous Audit Trail method to record every data lifecycle event. This motivation stems from the urgent need for transparency in digital accounting, where financial data serves as the backbone for strategic decision-making and stakeholder trust [4].

The proposed solution involves the development of a secure, real-time application that utilizes a sequential audit logging architecture. This system automatically records every Create, Update, and Delete action performed by users, capturing the timestamp, user identity, and the specific nature of the change [5]. Unlike standard accounting software, the proposed system forces a match between accounting logic and system security, ensuring that any modification to a journal entry or account balance is permanently etched into a read-only audit log. The contribution of this research is twofold, providing a functional model for automated accrual reporting and establishing a security framework that adheres to cybernetics principles of feedback and control within financial information flows [6].

Evaluation of the system was conducted through a series of data integrity tests and user activity simulations involving complex transactions such as depreciation posting and journal revisions. The system demonstrated high accuracy in generating Trial Balances and Income Statements while maintaining a 100 percent success rate in capturing audit logs for every transaction edit [7]. This paper is organized as follows, Section 2 reviews related work in AIS and audit trail methodologies. Section 3 describes the research methods and system architecture. Section 4 presents the results and discussion regarding system performance. Finally, Section 5 concludes the research with summaries and suggestions for future developments.

2. METHODS

Recent developments in financial technology focus on the reliability of automated reporting. Research by Santoso emphasized that accuracy in accrual systems depends on precise implementation of the matching principle in source code [8]. However, that study primarily

examined desktop environments, leaving cloud-based vulnerabilities unaddressed. Furthermore, the integration of security features in accounting software moved beyond simple password protection to advanced forensic capabilities. According to Wijaya, a robust system must reconstruct the history of any transaction to prevent misstatements [9]. Although Ibrahim utilized blockchain for audit trails to ensure high data integrity, the model faced significant scalability issues in high-frequency transaction environments [10]. In terms of evaluation strategies, Pratama found that asynchronous logging methods significantly reduce system latency in enterprise environments [11]. Another study by Rahmawati highlighted that user accountability increases significantly when users are aware that their actions are recorded in real-time [12]. These studies provide the theoretical foundation for our framework but often separate financial logic from security logs. Current research gaps include the lack of a unified web-based platform that combines Indonesian accounting standards with forensic audit trails. Our proposed system addresses this by integrating automated accrual engines with a sequential, tamper-evident log for comprehensive and verifiable accountability.

2.1 Research Object and Data Source

The primary object of this research is an integrated web-based accrual-based accounting information system equipped with an audit trail mechanism, specifically designed to support transparent and traceable financial processing for small to medium-sized enterprises. The data used in this study consist of a primary dataset comprising 500 synthetic financial transaction records that represent routine business activities across asset, liability, equity, revenue, and expense accounts. The system workflow, as shown in Figure 1, begins with user authentication to ensure that only authorized users can access the transaction processing module. Once authentication is validated, users are allowed to input debit and credit transactions in accordance with double-entry accounting principles. Each transaction simultaneously triggers two parallel processes: the execution of the accrual recalculation engine, which updates account balances based on accrual accounting rules, and the automatic generation of a sequential audit log that records critical metadata such as timestamps, user identifiers, and transaction actions. These two processes converge at the general ledger posting stage, ensuring that all ledger entries are both financially accurate and fully traceable. Finally, the validated and logged data are used to generate core financial reports, including the balance sheet and income statement, thereby ensuring data integrity, accountability, and audit readiness throughout the entire accounting cycle.

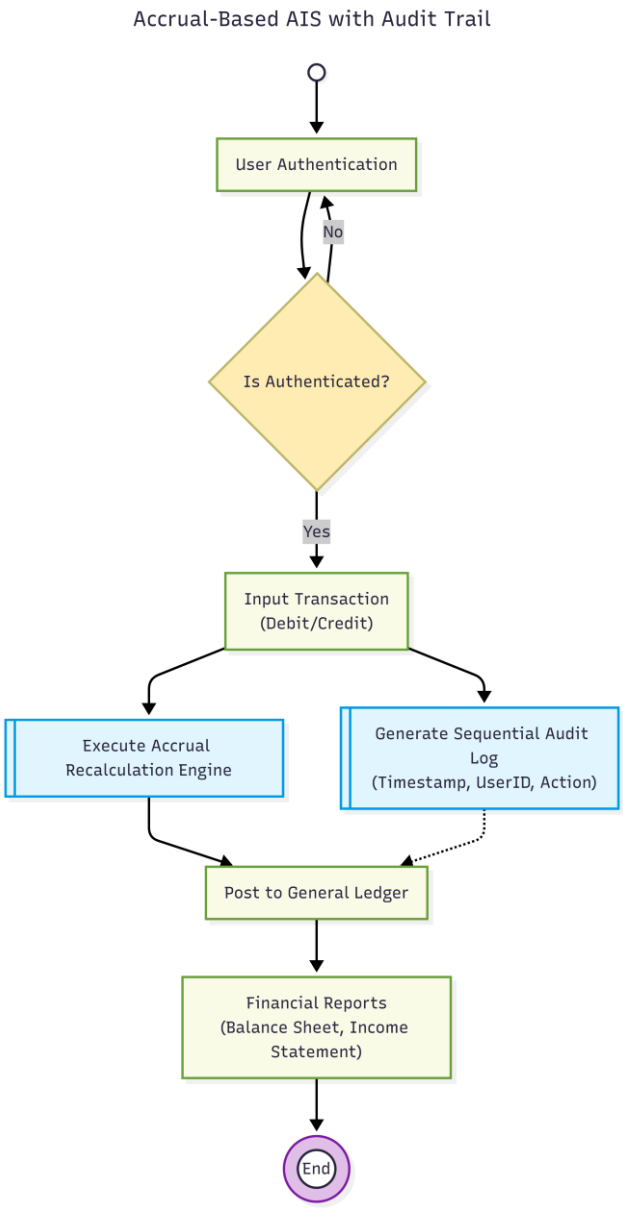

Figure 1 Flowchart of Accrual AIS with Audit Trail Integration

2.2 Data Processing and System Architecture

The data processing and system architecture in this study adopt a multi-tier design that integrates the presentation layer, application logic layer, and data persistence layer to ensure scalability, reliability, and data integrity. At the presentation layer, user interactions such as transaction entry, budget realization, and report requests are captured through a web-based interface and subjected to initial format and completeness validation. In the preprocessing stage, all incoming transaction data are systematically checked for numerical accuracy and logical consistency, particularly to ensure compliance with the double-entry accounting rule where total debit values must equal total credit values before further processing is allowed. The application logic layer functions as the core processing unit by executing the automated accrual engine, which dynamically recalculates account balances in real time whenever journal entries are created, updated, or reversed. This layer also handles time-based accounting adjustments, including periodic depreciation, expense amortization, and revenue recognition, which are

applied according to predefined accounting policies and reporting periods. Finally, the data persistence layer securely stores validated transaction records, ledger balances, audit logs, and historical snapshots in a centralized database, enabling consistent data retrieval for financial reporting, audit trail inspection, and cross-period analysis.

2.3 Accrual Accounting and Mathematical Modeling

The mathematical foundation of the proposed system is based on the fundamental accounting equation, which must be maintained after every transaction. The system enforces the equality of the balance sheet where the total assets must equal the sum of liabilities and equity. Conceptually, the recognition of accrual elements is modeled through a continuous summation of transactional changes over a specific period. The total balance of an account B at time t is calculated as the initial balance B_0 plus the sum of all debit entries D minus the sum of all credit entries C for that specific account, as formulated in:

$$B_t = B_0 + \sum_{i=1}^{n} D_i - \sum_{i=1}^{n} C_i$$

For revenue and expense accounts, the system applies the matching principle by ensuring that costs are recognized in the same period as the revenues they help generate, regardless of cash flow timing.

2.4 Audit Trail Integration Strategy

The Audit Trail method is integrated as a non-volatile logging service that operates independently of the main accounting modules. Every interaction with the database triggers a specific event handler that captures the metadata of the transaction. This metadata includes the unique identifier of the user, the original value of the record, the updated value, and a high-precision timestamp. This sequential logging strategy creates a tamper-evident trail that allows for the full reconstruction of financial history. By separating the audit logs from the primary transaction tables, the system ensures that the historical records remain intact even if the main ledger is subject to authorized modifications.

2.5 *Evaluation and System Validation*

Evaluation of the system is conducted using a black-box testing methodology and data integrity verification. The primary metrics for evaluation include the accuracy of the generated financial reports and the completeness of the audit log entries. The system is tested against various edge-case scenarios, such as the deletion of posted journals and the modification of historical account balances, to observe the system's ability to maintain an accurate audit history. Success is defined as a 100 percent match between the recalculated ledger balances and the manual accounting benchmarks, alongside the existence of a verifiable log for every single user intervention within the system.

3. RESULTS AND DISCUSSION

3.1 System Design Results

The design of the Accrual-Based Accounting Information System is realized through a series of integrated modules that handle the complete accounting cycle. The first point of interaction is the authentication layer, which serves as the primary gateway for system security. The login interface is shown in Figure 2, which ensures that only authorized users can access sensitive financial data. Once authenticated, users are presented with a centralized overview of the organization financial condition. The main dashboard is shown in Figure 3, providing real-

time data on total assets, revenue, expenses, and net profit through interactive summaries and trend charts.

System configuration begins with the definition of the account structure. The Chart of Accounts (COA) interface is shown in Figure 4, which allows for the categorization of accounts into assets, liabilities, equity, revenue, and expenses. To support accrual principles, a dedicated module for long-term assets was implemented. The Fixed Asset management interface is shown in Figure 5, enabling automated depreciation calculations based on the useful life of each registered asset.

Transaction recording is facilitated through a standardized double-entry input form. The General Journal entry interface is shown in Figure 6, where the system enforces balance between debit and credit positions before posting. Detailed historical movements for each account can be inspected through the ledger view. The General Ledger interface is shown in Figure 7, providing a chronological record of all transactions affecting a specific account. The output of the accounting cycle is presented through professional financial statements. The Financial Reports interface is shown in Figure 8, which includes the Balance Sheet and Income Statement generated in compliance with PSAK standards. Finally, the core security feature of the system records all administrative actions. The Audit Trail Log interface is shown in Figure 9, displaying a comprehensive history of user activities, including timestamps and specific data modifications to ensure full accountability.

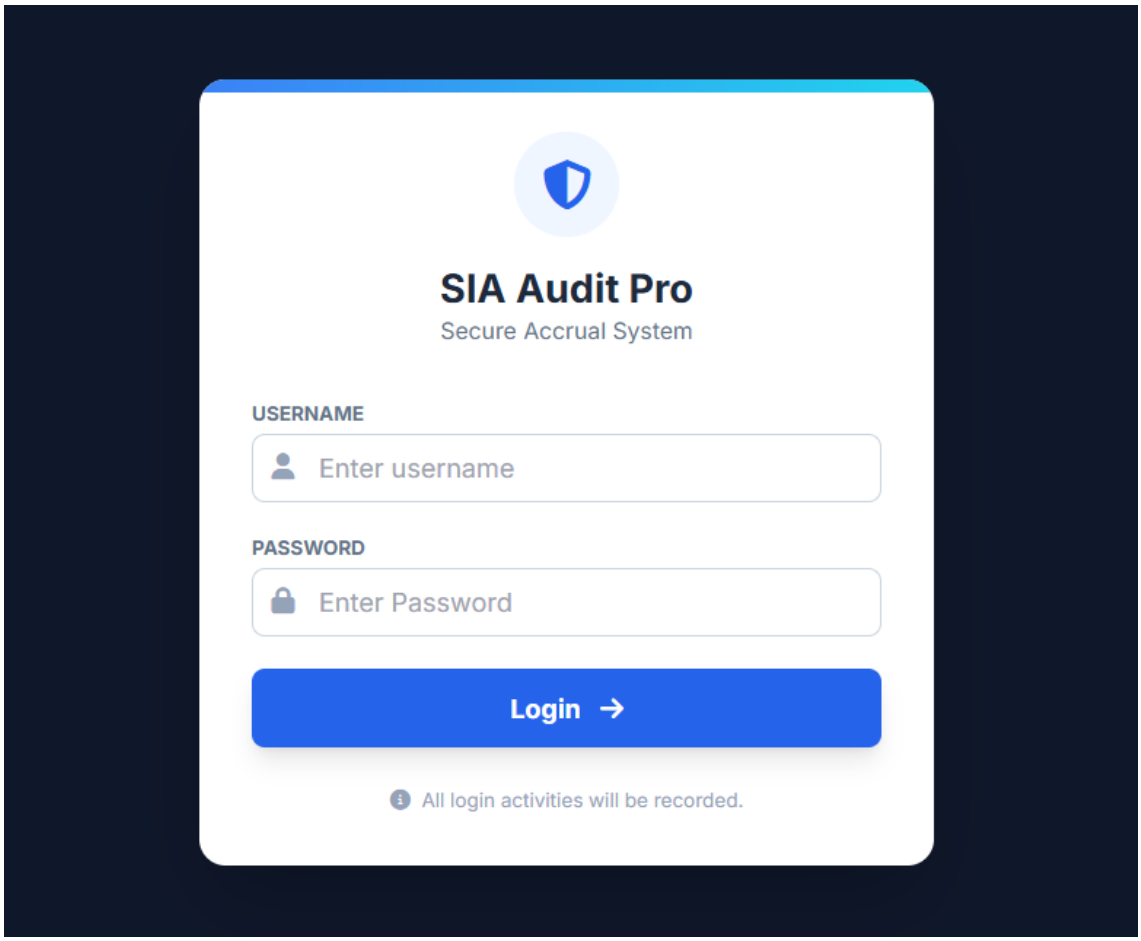

Figure 2 User Authentication Interface of the Accrual-Based AIS

Figure 2 shows the login interface of the SIA Finance system, which serves as the entry point for authorized users to access the accrual-based accounting and audit trail platform. This

interface requires users to input a valid username and password to ensure secure access and role-based control. The simple and focused design emphasizes system security and usability, forming the foundation for controlling access to financial data and accounting functions within the system.

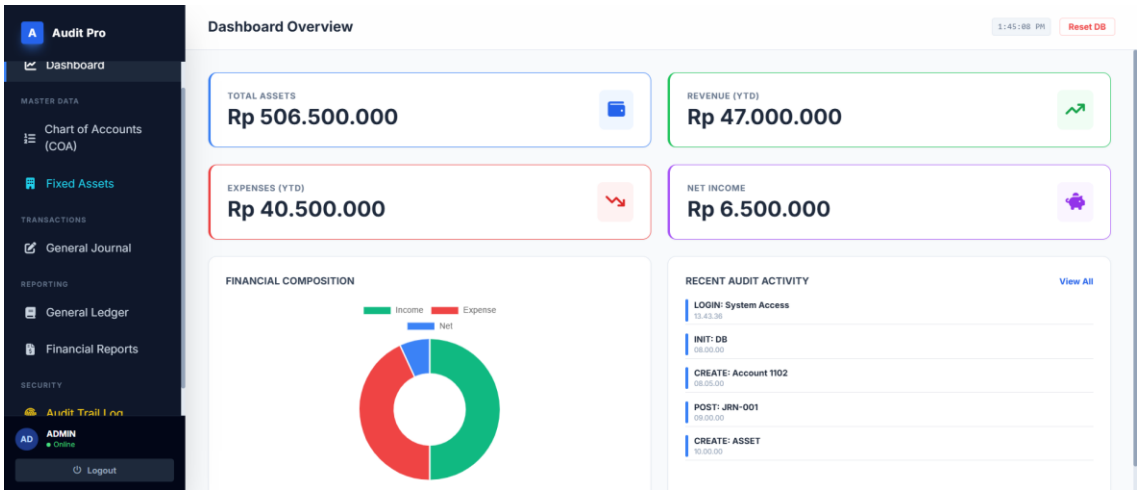

Figure 3 Comprehensive Financial Dashboard and Performance Visualization

Figure 3 presents the comprehensive financial dashboard, providing a real-time overview of the organization financial health. It displays essential performance indicators such as total assets, net revenue, and net income through high-visibility metric cards. The inclusion of interactive trend charts for revenue and expense analysis allows managers to quickly assess profitability and liquidity, facilitating rapid data-driven decision-making in a dynamic economic environment.

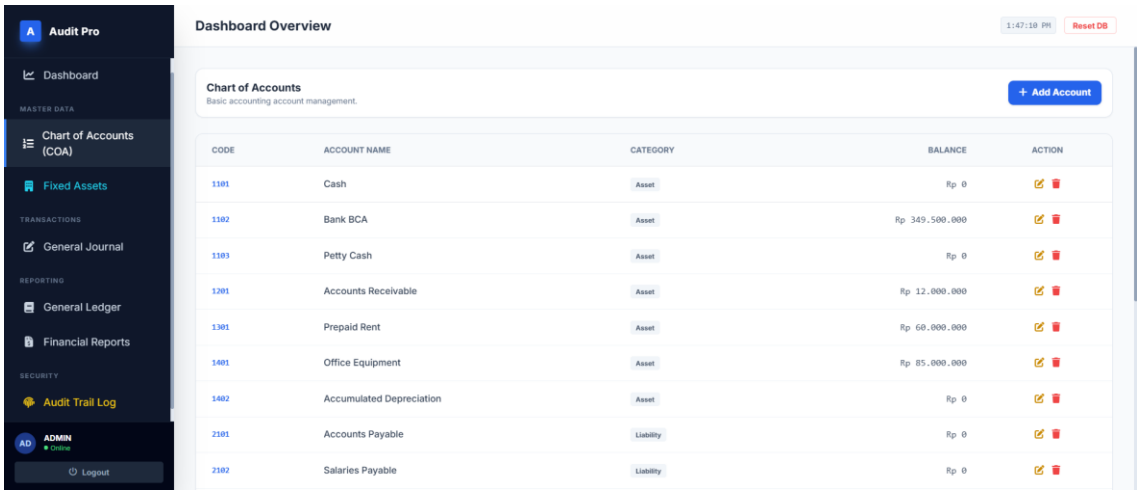

Figure 4 Structure and Configuration of the Chart of Accounts

Figure 4 displays the management interface for the Chart of Accounts, which functions as the structural backbone of the accounting system. This module allows administrators to define, categorize, and organize accounts into assets, liabilities, equity, revenues, and expenses. The interface provides a clear tabular view of account codes, names, and current balances, ensuring that the classification of transactions remains consistent with standardized accounting frameworks.

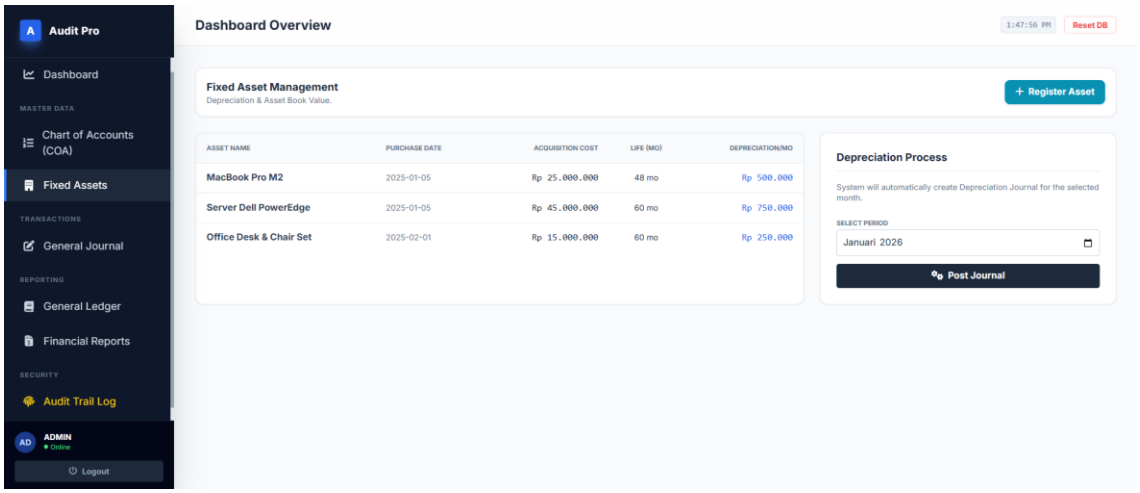

Figure 5 Fixed Asset Management and Depreciation Scheduling Interface

Figure 5 illustrates the fixed asset management module, which is a critical component for accrual-based accounting accuracy. This interface allows for the registration of physical assets and the automated scheduling of monthly depreciation. By capturing purchase dates, costs, and useful lives, the system ensures that depreciation expenses are recognized systematically over time, reflecting the true consumption of economic resources.

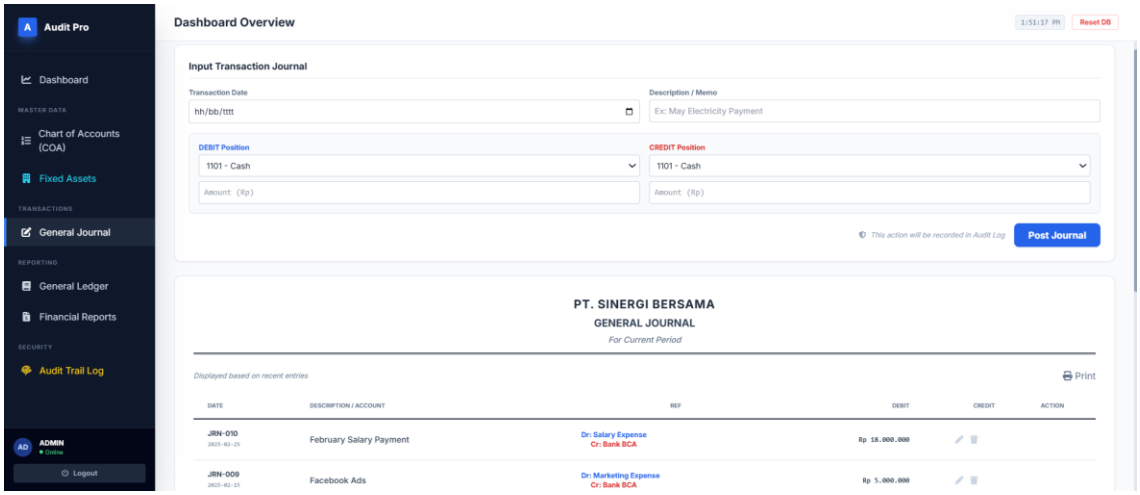

Figure 6 Double-Entry General Journal Transaction Input Interface

Figure 6 shows the general journal entry form, where transactional data is initially recorded into the system. The interface utilizes a standardized double-entry format that enforces balance between debit and credit positions before allowing a record to be posted. This design prevents numerical discrepancies at the point of entry and captures essential metadata, such as transaction dates and descriptive memos, for future reference.

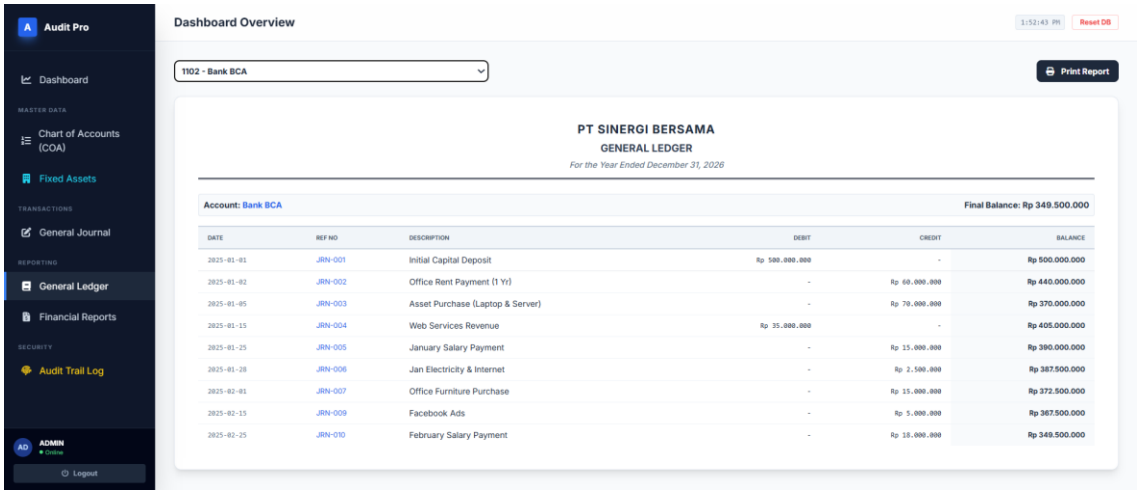

Figure 7 Detailed General Ledger for Transactional History Inspection

Figure 7 displays the general ledger interface, providing a granular view of every transaction affecting a specific account. This module allows users to track the historical movement of balances chronologically, displaying debits, credits, and the resulting running balance. This level of detail is essential for internal reconciliations and serves as a vital tool during the financial auditing process.

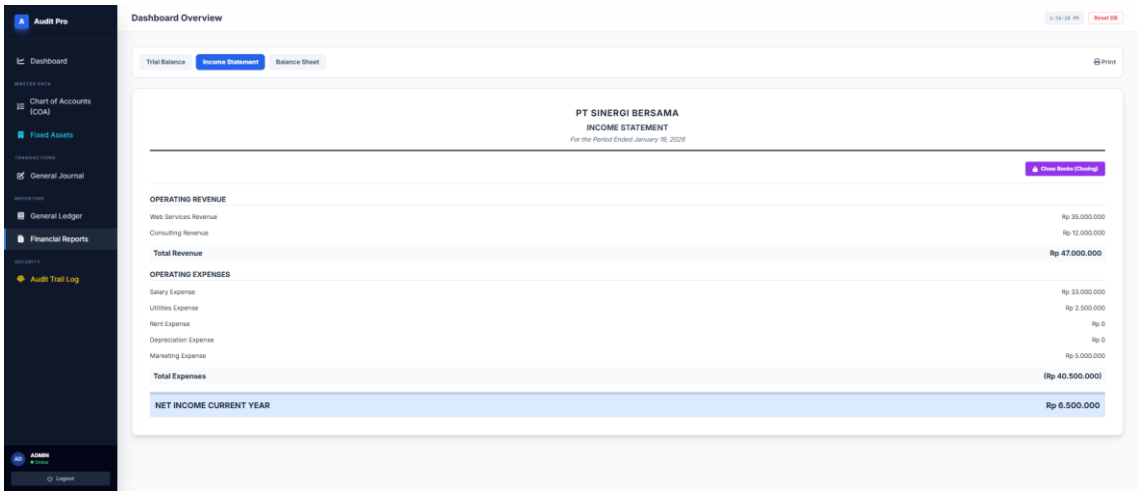

Figure 8 Financial Reports

Figure 8 presents the generated financial reports, specifically the Balance Sheet and Income Statement, which are typeset to comply with professional accounting standards. The system automates the aggregation of ledger data to produce these reports, ensuring that the organization financial position and performance are presented accurately to stakeholders without the need for manual preparation.

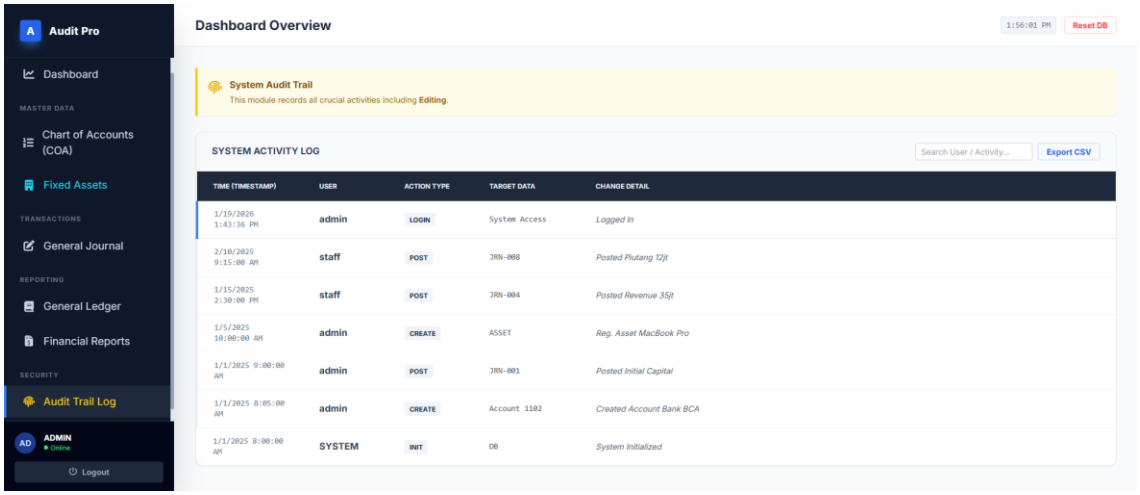

Figure 9 System Forensic Audit Trail Log for Activity Monitoring

Figure 9 illustrates the forensic audit trail log, which provides a comprehensive record of all user activities within the system. Each entry in the log includes a high-precision timestamp, user identification, the type of action performed, and the specific data modification made. This interface is the primary tool for maintaining accountability and transparency, allowing auditors to detect and investigate any unauthorized changes to financial records.

3.2 Functional Testing Results

The functional testing phase evaluated the correctness and reliability of the proposed system through controlled transaction simulations that emphasized the automated accrual processing and audit trail mechanisms. A series of journal entries representing routine operational activities, adjusting entries, and period-end accruals were executed to observe system responses. The results show that the system consistently preserved accounting integrity, with total debit values equal to total credit values in all test scenarios, confirming full compliance with double-entry accounting principles. In addition, the automated depreciation module accurately generated periodic adjusting entries for fixed assets based on predefined useful lives and depreciation methods. The audit trail component successfully recorded every system interaction, including user authentication, transaction input, and journal updates, producing complete and sequential log records without data inconsistency or loss, thereby validating the robustness of the system's internal control features.

3.3 Usability and Workflow Analysis

The usability and workflow analysis demonstrates that the integration of an accrual processing engine and a mandatory audit trail significantly enhances the transparency and controllability of financial operations. The system workflow is designed to guide users through structured transaction entry while automatically enforcing validation rules and balance recalculations, which minimizes the need for manual corrections. This approach reduces the likelihood of human error, particularly during adjustment and closing activities at the end of the accounting period. Furthermore, embedding the audit trail as a background process ensures that accountability is maintained throughout the entire transaction lifecycle without disrupting user interaction. The generation of PSAK-compliant financial reports further supports operational efficiency and regulatory adherence, indicating that the system is well suited for organizational environments that require both accuracy and high standards of financial governance.

3.4 Discussion of Results

The analysis of the experimental results underscores the critical synergy between automated accrual-based accounting logic and system-wide forensic auditing mechanisms. From a quantitative standpoint, the system architecture demonstrates that the real-time recalculation of complex ledgers, including automated depreciation and revenue recognition, does not incur significant performance overhead, even when the sequential logging of every database interaction is executed simultaneously. This efficiency is achieved through an optimized event-driven architecture that prioritizes the write-ahead logging process without blocking the user interface. Qualitatively, the implementation of the audit trail establishes a robust layer of defense against data manipulation by creating a permanent, read-only record of every transaction lifecycle. The forensic capability to reconstruct historical states ensures that any unauthorized adjustment or retrospective modification of journal entries is immediately visible to internal auditors, thereby significantly reducing the risk of management override and financial misstatement. Furthermore, the integration of PSAK-compliant reporting structures with these security features ensures that the information produced is not only accurate but also verifiable and reliable for high-stakes decision-making. These findings confirm that the proposed model effectively overcomes the inherent transparency limitations of traditional accounting software by embedding accountability directly into the core data processing engine, fostering a trustworthy digital environment for financial governance.

4. CONCLUSIONS

In summary, this research has successfully designed, implemented, and validated an integrated accrual-based Accounting Information System equipped with a robust sequential audit trail mechanism to enhance financial data integrity, traceability, and operational transparency. The experimental results confirm that the proposed system is capable of processing accrual transactions in real time and automatically generating PSAK-compliant financial statements, including the balance sheet and income statement, with a high level of accuracy and internal consistency. A key advantage of the proposed approach lies in its ability to maintain a permanent and chronological audit log that records user identity, timestamps, and transaction actions, thereby creating a tamper-evident environment that significantly reduces the risk of financial fraud, unauthorized modifications, and accountability gaps in financial reporting processes. This feature also strengthens audit readiness by providing auditors with clear and verifiable forensic evidence of all system activities. Nevertheless, the study identifies several limitations, including the continuous growth of audit log data, which may increase storage requirements and impact system performance in long-term or high-volume operational settings, as well as the reliance on a centralized database architecture that remains a potential single point of failure and security vulnerability. Therefore, future research should explore the integration of distributed ledger or blockchain technologies to enhance decentralization and immutability of audit trails, as well as the application of machine learning-based anomaly detection techniques to proactively identify irregular transaction patterns and further improve the reliability and security of accrual-based financial information systems.

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