

A Digital Solution for Student Internship: Tracking and Enhancing Student's Experience

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ABSTRACT

This research presents the design and implementation of an electronic logbook system developed to improve the Students Industrial Work Experience Scheme (SIWES) process in tertiary institutions. The traditional paper-based SIWES logbook has faced persistent issues such as loss of records, poor supervision, and delayed evaluation. This study introduces a web-based system that digitizes the logging, monitoring, and assessment of students' industrial training activities. The system was implemented using HTML, CSS, PHP, and MySQL to provide an accessible, efficient, and secure platform for students, supervisors, and administrators. It enables students to record daily or weekly tasks online, supervisors to evaluate remotely, and administrators to manage placements and generate reports. The developed system significantly reduces paperwork, improves supervision efficiency, ensures reliable data storage, and promotes accountability. The results demonstrate that the electronic logbook system enhances transparency, accessibility, and performance monitoring within the SIWES framework.

Keywords: Electronic; Placements; Logbook; Industrial; Training; Supervision; Web-based System; Accountability; Tertiary.

1. Introduction

Accurate and consistent documentation has long been a cornerstone of scientific and technical disciplines, enabling researchers, engineers, and students to record experimental activities, innovations, and findings for verification, knowledge transfer, and intellectual property protection. Traditionally, this documentation has taken the form of paper-based logbooks used to record dates, methodologies, results, and observations. These records have historically served as vital references that ensure accountability, reproducibility, and ownership of innovation Altini et al. (2010). Over time, however, advances in information and communication technology (ICT) have transformed record-keeping practices across the globe. The digital revolution has redefined documentation processes, making them more efficient, reliable, and accessible. According to Wavetracks (2010), the methods and habits surrounding logbook use have undergone significant change over the past two decades as electronic systems have replaced manual ones in research, education, and industry. Digital logbooks now offer advantages such as real-time accessibility, data security, automated reporting, and seamless collaboration among multiple users. In Nigeria, ICT integration in tertiary education has increasingly become a strategic tool for improving teaching, learning, and administrative processes. A prominent example is the Students Industrial Work Experience Scheme (SIWES), a program established to bridge the gap between classroom theory and practical industrial exposure. Administered by the Industrial Training Fund (ITF), SIWES provides students with opportunities to apply theoretical knowledge in real-world work environments related to their field of study. During the program, students are required to maintain a logbook documenting their daily or weekly industrial activities, which serves as a key assessment tool for both industrial and academic supervisors.

Despite its importance, the existing paper-based logbook system used in most Nigerian universities presents numerous limitations. Physical logbooks are prone to loss, damage, and deterioration over time. Supervisors often

face difficulties accessing or reviewing them promptly, particularly when students are placed in remote industrial locations. Moreover, errors in manual data entry, illegible handwriting, and incomplete records compromise the quality and reliability of information collected. These limitations hinder effective supervision, delay evaluations, and reduce the overall efficiency of the SIWES program. The emergence of web-based technologies provides a viable and sustainable alternative to the traditional manual system. Electronic logbooks offer centralized and secure platforms that allow students, supervisors, and administrators to interact and share information seamlessly. Using modern web technologies such as HTML, CSS, PHP, and MySQL, students can log their activities online, supervisors can monitor progress remotely, and administrators can generate reports automatically. The implementation of such systems promotes transparency, ensures data integrity, and supports Nigeria's national policy on e-learning and digital transformation in education. Furthermore, the global shift toward electronic record management aligns with sustainability and environmental conservation objectives by reducing paper use and minimizing administrative workload. For educational institutions, electronic systems not only simplify data storage and retrieval but also facilitate faster communication and evaluation processes. By automating documentation, supervision, and reporting, institutions can achieve greater efficiency and accountability within academic-industry partnerships. The proposed electronic logbook system is particularly relevant to the Nigerian educational context. It addresses several recurring issues faced by students and supervisors during SIWES, including delayed communication, missing records, and inefficient assessment procedures. Through the adoption of this digital platform, students can record their industrial training experiences more conveniently, supervisors can verify and evaluate progress remotely, and institutions can maintain accurate, centralized records for future reference. The main aim of this study is to design and implement an Electronic Logbook System for the Students Industrial Work Experience Scheme (SIWES) that enhances efficiency, accessibility, and transparency in documentation and supervision. The system is designed to bridge the communication gap between students and supervisors, enable real-time monitoring of industrial activities, and provide an integrated digital space for all stakeholders.

1.1. Objectives

Specifically, the system objectives are:

- (i) Review and analyze the existing manual system.
- (ii) Develop a user-friendly platform for recording student work entries electronically.
- (iii) Facilitate communication between students and supervisors.
- (iv) Enhance student learning experiences through a centralized information interface.

The significance of this study lies in its potential to contribute to the ongoing digital transformation of the Nigerian educational sector. By replacing paper-based logbooks with an electronic system, institutions can achieve improved data accuracy, reduced administrative burden, and enhanced assessment processes. The system also contributes to sustainability by reducing paper consumption and aligns with global best practices in digital education management. Moreover, it offers students practical exposure to ICT applications relevant to their academic and professional development, reinforcing the objectives of the SIWES program. The scope of this work is focused on

the design and implementation of an electronic logbook system for Students Industrial Work Experience Scheme (SIWES) at Nigeria. The proposed system includes distinct interfaces for different categories of users—students, industrial supervisors, school-based supervisors, administrators, and the Industrial Training Fund (ITF). Each interface provides functionalities tailored to the user’s role, ensuring secure access, data validation, and efficient information flow.

Although the study demonstrates the potential of electronic logbooks for improving SIWES documentation and supervision, it is limited by certain constraints. These include the exclusion of advanced functionalities such as automated week counters and extensive search capabilities. Additionally, integration with external ITF databases may not be fully realized due to policy restrictions. Nonetheless, the developed system serves as a functional prototype that can be expanded or adapted for broader institutional adoption in Nigeria and beyond. In summary, this study underscores the need for digital transformation in the management of the Students Industrial Work Experience Scheme. The proposed electronic logbook system aims to modernize the supervision and assessment process, enhance communication between students and supervisors, and strengthen the overall quality of industrial training programs in Nigerian tertiary institutions.

2. Review of Related Literature

In recent years, there has been a consistent growth of interest in Information and Communication Technology (ICT) and the consequent demographic changes in society. Most sectors of the economy have been influenced by technological advancement, particularly through improved access to information. The twenty-first-century workforce has experienced significant transformation in working patterns due to digitalization. One sector that has been profoundly affected by ICT growth is the education sector, with notable changes in research patterns, academic collaboration, social interaction, information dissemination, and examination procedures. Numerous software applications have been developed to enhance learning and academic management. Within the university community, the logbook remains a commonly used and required tool, especially for industrial training documentation. In many developed countries, traditional paper-based logbooks have transitioned to electronic logbooks (e-logbooks). For instance, the Alcatraz (Alto Campo Torus) experiment at the Massachusetts Institute of Technology (MIT) has utilized an e-logbook since 1991 Bärnlund, (2008).

Electronic logbooks facilitate multiple simultaneous access, efficient searchability, and functionality that traditional logbooks cannot support. They are essential for maintaining accurate and secure records across diverse and distributed users. According to Wavetrax (2014), the ship’s log originated from a small wooden board, or “chip log,” which was weighted and thrown overboard to measure a ship’s speed by tracking the line length released within a set time. The recorded measurements were written in a book—hence the term logbook. In the fifteenth century, Portuguese mariners recorded navigational data during exploratory voyages, marking the earliest systematic use of logbooks (National Maritime Museum Royal Observatory, 2014). These records provided accountability to ship owners, traders, and navigators. By the seventeenth century, logbooks became standardized as official documents for maritime operations, with the British Admiralty introducing uniform record-keeping instructions by 1731. Over time, logbooks evolved beyond maritime use to serve multiple domains, including

aviation, healthcare, engineering, and education. An electronic logbook is a computer-based system for recording operational states, events, or conditions in complex environments such as aircraft, nuclear plants, particle accelerators, or educational institutions Wikipedia, (2014).

Most e-logbooks adopt a client-server architecture, where a central database is accessed via web browsers or dedicated client applications. The advantages of electronic logbooks include remote accessibility, data durability, centralized storage, and improved analytical capabilities. Bärlund (2008) conducted a usability study of the CERN Control Centre (CCC) e-logbook. The application supports entry, editing, and retrieval of log data for physics experiments. Special features include fault linking, automated shift intensity recording, and a built-in screen capture tool.

The e-logbook comprises two interfaces:

- **Java Client:** Used locally by operators for real-time editing and data entry.
- **Web Interface:** Used for remote viewing, searching, and editing of entries.

The adoption of e-logbooks in education, especially in medical and technical training, has increased substantially. Herman and Ushma (2013) reported that Western countries have integrated e-logbooks into handheld devices since 2000. With the advent of smartphones, medical trainees now log procedures, patient data, and training milestones through mobile apps. In India, electronic logbooks are recommended for over 236 medical colleges offering postgraduate anesthesiology training. These digital tools enable data entry at the point of care and synchronization via wireless or 3G networks, thus enhancing accuracy and supervision (Herman & Ushma, 2013). In Nigeria, however, smartphone penetration remains limited. Only 25% of the country's 105 million mobile subscribers use smartphones, while 59% use basic phones (TNS Report, 2012). Despite this, the potential for e-logbook adoption remains strong due to declining device costs and increasing ICT literacy. Olubodun (2012) proposed using social media platforms such as blogs and Twitter as digital logbooks for industrial training supervision. His model, the BT Logbook, transforms student experiences into open-source digital records, bridging the gap between school knowledge and industrial practice. Evolutionary computation is being used to improve software as claimed by Ugah et al. (2025).

2.1. Case Studies of Electronic Logbooks

- **iGaslog** (Herman & Ushma, 2013): is a successful e-logbook used by trainees in the United Kingdom. It offers intuitive dropdown menus, automatic field population, CSV exports, and email integration. However, its high cost and Apple-only compatibility pose limitations.
- **LOGIT** (Nigel, 2013): is an Australian vehicle e-logbook designed for GPS-based journey recording. It streamlines fleet management, provides monthly journey summaries, and tracks vehicle locations for efficiency.
- **SHEEL (Secure and Harmonized European Fishery Logbook):** Research and Innovation, (2006) was developed to standardize fish catch recording across EU countries. Initially paper-based, it now allows real-time data entry at sea to support fisheries monitoring and research.

The ALICE Electronic Logbook: the ALICE (A Large Ion Collider Experiment) e-logbook at CERN is a LAMP-based application (Linux, Apache, MySQL, PHP) used by over 600 users in 30 countries IOP science Journal of Physics (2002). Originally designed as a statistical repository, it evolved into a complete information management system for experiment data and system conditions. Challenges include cost, smartphone dependence, limited cross-platform compatibility, data security, and report generation inconsistencies. Nevertheless, the benefits such as efficient data access, improved data integrity, and enhanced research supervision far outweigh these issues.

3. Methodology and System Analysis

The Agile-MVC Hybrid methodology was chosen after carefully considering project needs, constraints, and long-term goals. In developing the SIWES Management System, the flexibility of Agile allowed for adjusting to changing requirements, without disrupting progress. Laravel’s MVC structure supports clean, organized code and faster development, while React’s component-based design encourages reusability and smooth integration through Inertia.js. A database-first approach ensures the system’s scalability and data integrity, meeting educational standards for reliability and traceability. Overall, this hybrid approach provided a balance between adaptability and structure, resulting in a maintainable, efficient, and user-focused system that meets design expectations.

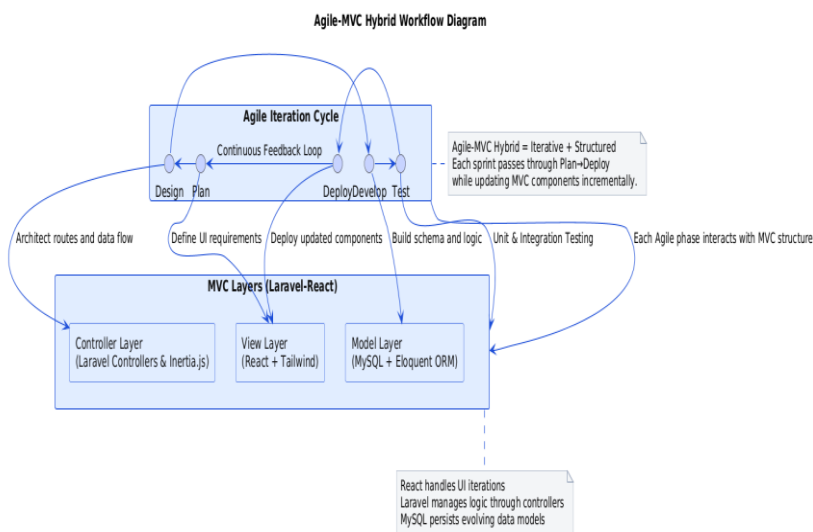


Figure 1. Agile-MVC Hybrid Workflow for the student internship tracking system

4. System Analysis

The system analysis section provides a comprehensive evaluation of both the existing and proposed approaches to managing the Students’ Industrial Work Experience Scheme (SIWES) in Nigerian higher institutions. The current system remains largely manual and paper-based, a legacy of the scheme’s inception in 1973 by the Industrial Training Fund (ITF). Students are required to maintain physical logbooks documenting their daily or weekly industrial activities, which are validated by industry supervisors and later reviewed by academic supervisors during monitoring visits. At the end of the training, students compile detailed technical reports and submit evaluation forms, such as the ITF Form 8, for final assessment. Although this traditional method promotes simplicity and accessibility—especially in areas with limited internet connectivity it presents serious limitations in terms of data loss, inefficiency, inconsistency, and administrative burden.

The existing system, while low-cost and user-friendly, is characterized by delays in data processing, vulnerability to physical damage, and lack of real-time monitoring. Errors arising from manual data entry and inconsistent record-keeping often compromise grading accuracy and transparency. Additionally, physical storage of reports and logbooks consumes institutional resources and makes long-term data retrieval difficult. These challenges have led to growing calls for a digital transformation of SIWES management to enhance operational efficiency, accountability, and scalability.

In response to these challenges, the proposed Digital SIWES Management System, developed using Laravel (backend) and React (frontend) technologies, introduces an automated, secure, and centralized platform that digitizes all major SIWES processes. The system employs Role-Based Access Control (RBAC) to ensure that users—students, supervisors, administrators, and organizations—have clearly defined permissions. It enables students to submit digital logs and reports, supervisors to evaluate performance online, and administrators to oversee placements and generate automated reports. Real-time feedback, communication tools, and built-in analytics further enhance transparency and collaboration among stakeholders.

Moreover, the system’s Progressive Web Application (PWA) design ensures compatibility across both desktop and mobile devices, increasing accessibility even in low-infrastructure environments. Security is reinforced through data encryption, password hashing, and automated backup routines that comply with data protection standards. Automation reduces administrative workload by up to 80%, streamlines report generation, and ensures grading consistency across departments. Overall, the new system provides a robust, scalable, and cost-effective digital solution that replaces the inefficiencies of the traditional paper-based process, ultimately modernizing SIWES operations and improving the quality and reliability of experiential learning management in Nigerian institutions.

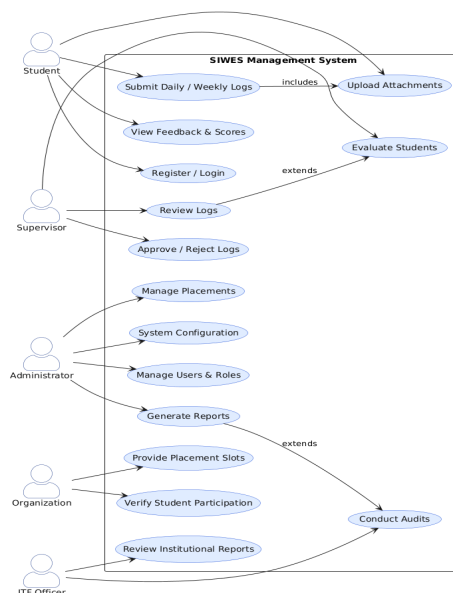


Figure 2. Proposed student internship tracking system Management System

5. System Architecture

The system uses a Three-Tier Architecture to promote modularity, scalability, and maintainability. The Presentation Layer, built with React and Tailwind CSS, provides a responsive and user-friendly interface, while

Inertia.js ensures smooth page transitions without full reloads. The Application Layer, powered by Laravel, manages business logic through controllers, service classes, and background jobs for tasks like report generation. The Data Layer, based on MySQL and Eloquent ORM, securely stores and organizes data, with caching improving performance for frequent queries. This structured, n-tier setup keeps components loosely connected, allowing the system to scale easily and evolve with future needs.

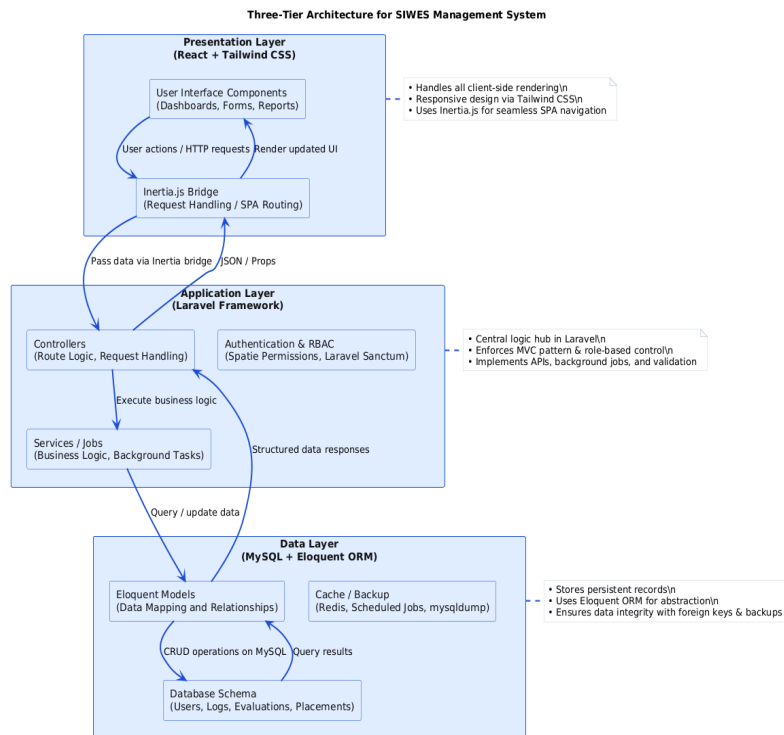


Figure 3. Three Tier Architecture for student internship tracking system

6. System design and implementation

The design of the SIWES Management System emphasizes ease of use, strong security, and future growth. Each interface is tailored to the user’s role, ensuring a simple experience for students and advanced tools for administrators. Data security is maintained through encryption and authentication to prevent unauthorized access. The database structure is built to scale efficiently, with support for optimized reporting that includes clear visualizations like bar charts. Additionally, the system’s mobile-friendly layout, developed with Tailwind CSS, ensures full accessibility across devices and complies with WCAG 2.1 standards for inclusive design.

6.1. Program module design

The system is organized into well-defined modules that ensure maintainability, scalability, and clarity. The Authentication Module uses Laravel Breeze for login and registration, enhanced with Spatie permissions for role-based access and Sanctum for secure API token management. The User Management Module provides CRUD operations, advanced search through Eloquent scopes, and bulk actions for administrative efficiency. The Log Management Module automates workflows using Laravel Jobs and enums to manage log states such as pending, approved, or rejected. The Evaluation and Reporting Modules handle score calculations, notifications, and data exports through structured services and factories. Finally, the Placement Module applies query-based matching

logic and workflow automation via state machines. All modules adhere to SOLID principles, ensuring clean architecture and easy testing.

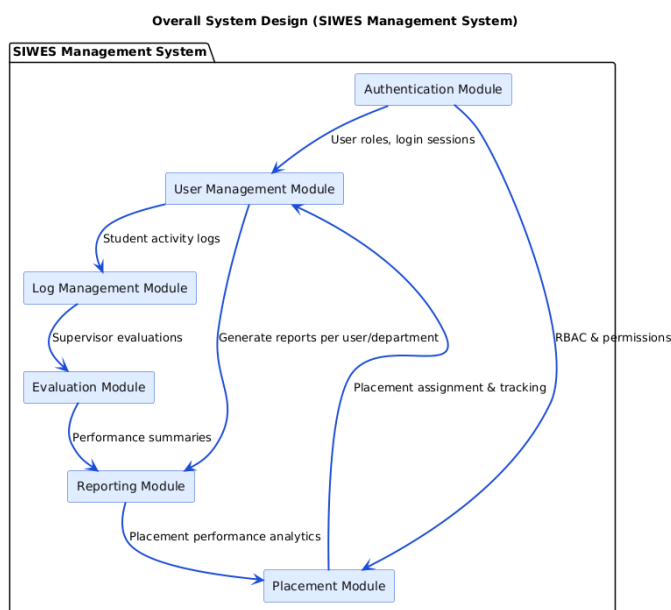


Figure 4. Overall System Design for the student internship tracking system

6.2. Database design

The Entity-Relationship (ER) Diagram for the SIWES Management System establishes a well-structured, normalized database model optimized for integrity and performance. At its core, the users table manages all system actors; students, supervisors, and administrators linked through a role_id for access control. The log entries table records daily or weekly submissions, tied to users via a foreign key and supporting attachments, statuses, and timestamps.

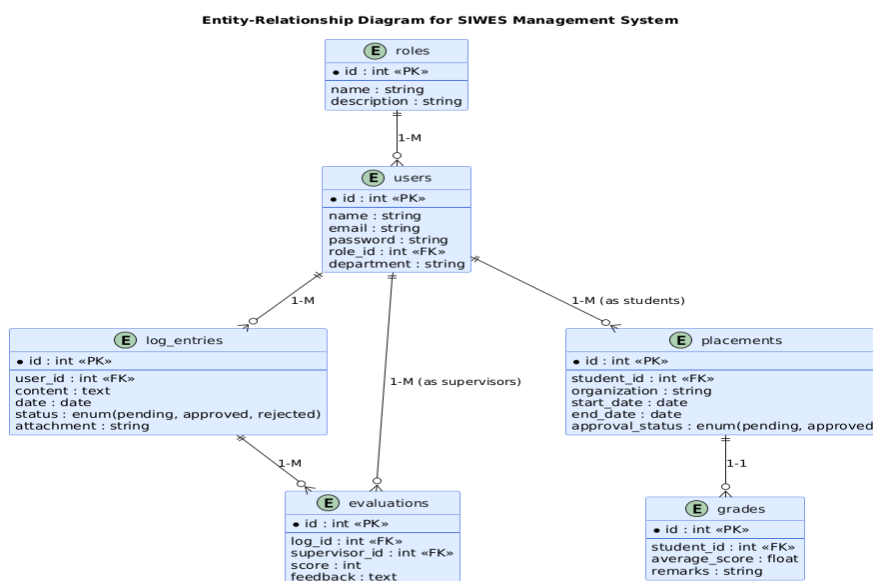


Figure 5. Entity-Relationship Diagram for student internship tracking system

The evaluations table connects to both logs and supervisors, storing detailed JSON-based scoring and textual feedback. Similarly, placements link students to organizations, tracking internship duration, approval state, and host

details. Additional tables like grades derive performance metrics, while roles and permission pivots enforce access management. Indexes on foreign keys and composite keys (e.g., user_id + date) improve query performance, with cascading deletes ensuring referential integrity. The database adheres to Third Normal Form (3NF).

6.3. Input Implementation

The input implementation of the system emphasizes strict validation and data integrity across both the frontend and backend components. On the backend, Laravel's Form Request Validation is employed to enforce comprehensive validation logic, ensuring that input fields such as log entries, registration details, and evaluation forms meet predefined structural and content requirements before processing. These validation rules check parameters such as data type, minimum and maximum length, and input format to prevent invalid submissions.

The frontend mirrors these backend rules using synchronized validation schemas, providing real-time user feedback to minimize submission errors. This dual validation mechanism ensures consistency and enhances user experience. File uploads, including reports and attachments, are managed securely through Laravel's Storage System, which employs queued processing for efficiency and scalability. Additionally, rich text editors are integrated into the input interface to allow structured, interactive, and sanitized content entry, maintaining both usability and system security. This implementation guarantees data quality, prevents redundancy, and strengthens the overall reliability of system inputs.

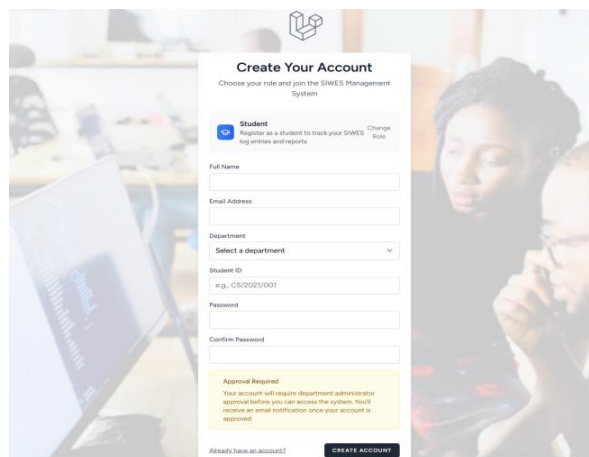


Figure 6. Input Implementation for the student internship tracking system

6.4. Output Implementation

The output implementation focuses on generating structured, exportable, and filterable data reports that facilitate informed decision-making, performance evaluation, and record-keeping. The system supports dynamic CSV exports, optimized to handle large datasets efficiently with proper encoding and descriptive headers for clarity. For formal reporting, PDF generation is implemented using styled views that incorporate institutional branding elements, tables, and graphical summaries such as charts to enhance readability and professional presentation.

Users can apply advanced filtering mechanisms based on parameters such as department, session, student status, or date range, ensuring that data retrieval is both precise and relevant. These customizable reporting features allow administrators and supervisors to easily access accurate information for auditing, performance assessment, and

academic evaluation. By providing flexible and well-structured outputs, the system enhances transparency, accountability, and institutional data management.

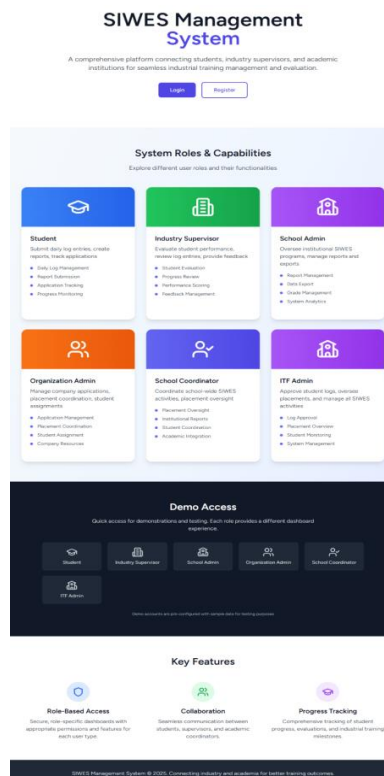


Figure 7. Output Implementation of the student internship tracking system

6.5. Program Module Implementation

The program module integrates controllers, middleware, and service classes to ensure smooth operation and role-based functionality throughout the system. Controllers manage core application logic such as record creation, updates, and data retrieval, while background jobs (e.g., notifications and automated evaluations) are dispatched asynchronously to enhance system performance. Middleware is employed to enforce authentication, authorization, and access control, ensuring that only permitted users can perform specific actions, thus preserving data security and integrity.

Furthermore, service classes encapsulate specialized business logic—such as automated student–organization matching based on departmental alignment or industry type—thereby promoting modularity and code reusability. This layered architecture separates concerns between different modules, enhancing maintainability, scalability, and adherence to clean architectural principles. As a result, the system remains flexible for future updates or feature expansion.

6.6. Database Implementation

The database implementation leverages Laravel’s migration, seeding, and Eloquent ORM features to achieve structural consistency, scalability, and efficient data manipulation. Database migrations define well-structured schemas for all entities, establishing foreign key constraints, indexes, and relationships that enforce referential integrity. This ensures that all data interactions remain consistent across the application lifecycle.

Database seeding is utilized to populate sample datasets, including test users, log entries, and evaluation records, which facilitate performance testing and development validation. The Eloquent ORM provides an abstraction layer for interacting with the database through expressive, human-readable syntax. Complex relationships, such as retrieving all logs associated with a particular student or evaluation, are efficiently handled using Eloquent’s relationship methods. Overall, this implementation ensures a normalized, secure, and easily maintainable database structure that supports the system’s dynamic workflows and real-time operations.

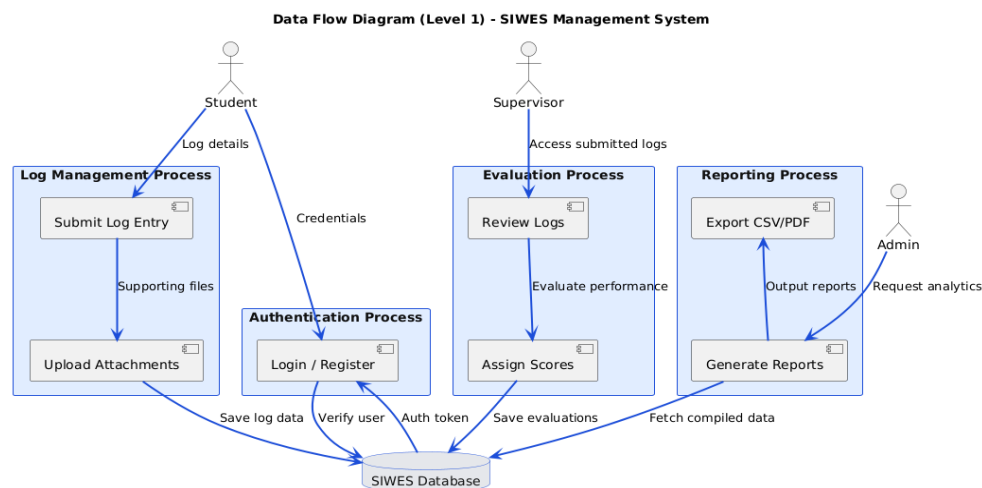


Figure 8. Data Flow diagram (Level 1) - SIWES management system

7. System testing, evaluation and deployment

System Testing

Test plan

Testing was conducted in multiple phases to ensure the system’s reliability, performance, and security. Unit testing employed PHP Unit to isolate core functions such as score calculations within the Evaluation Service, achieving over 80% coverage to confirm logic accuracy. Integration testing validated API interactions using Postman, ensuring smooth data flow across modules like log creation and approval, with mock databases used for consistency. System testing involved full end-to-end simulations in a staging environment, following the student workflow from registration to report export, confirming functional cohesion. Security evaluations included OWASP ZAP scans and manual penetration tests to confirm resilience against SQL injection and XSS vulnerabilities.

Test data

Currently, unit testing is being conducted to ensure that each system component functions correctly and independently. This involves verifying modules such as authentication, log management, evaluations, and placements using PHP Unit, with test cases designed to validate expected outputs and error handling. In the future, comprehensive testing will be performed using anonymized datasets aligned with GDPR standards. The planned test environment will include 50 users across five roles, 100 log entries with varied statuses and attachments, 25 organizations, 30 evaluations with scores between 60 and 100, and 20 placements covering the 2024–2025 period.

Functional testing is expected to achieve complete success, with authentication and RBAC controls working flawlessly.

System Conversion

The system conversion will follow a phased migration strategy to ensure data integrity and minimal disruption. In Phase 1, existing legacy data both digital (Excel files) and paper-based records will be exported using Python pandas scripts, with Optical Character Recognition (OCR) applied to scanned documents for digitization. Phase 2 focuses on data normalization, where Extract-Transform-Load (ETL) processes will map legacy columns to the new schema and remove duplicates using structured SQL queries. Phase 3 involves controlled data import in batches through Laravel’s database transactions to guarantee atomicity and prevent partial data corruption. Phase 4 validates the migration with checksum verification and query-based cross-checks to ensure accuracy and completeness. To safeguard data throughout the process, daily backups will be maintained using MySQL dump, with offsite replication to AWS S3 for redundancy. The entire conversion will be automated and repeatable through custom Laravel Artisan commands, ensuring a smooth transition to the new SIWES Management System.

Table 1. Test Data

| Data Type | Quantity | Purpose | Validation Target |
|---------------|----------|--|-----------------------------------|
| Users | 50 | Test authentication and RBAC roles. | Correct login and role access. |
| Log Entries | 100 | Test log creation and approval process. | Accurate timestamps and content. |
| Organizations | 25 | Test placement and data linking. | Unique, valid organization names. |
| Evaluations | 30 | Test scoring and report generation. | Correct computation of results. |
| Placements | 20 | Test mapping between students & companies. | Proper foreign key relationships. |

8. Conclusion

Based on the findings and the successful implementation of the developed system, it can be concluded that the Electronic Logbook System effectively replaces the traditional paper logbook by providing a more efficient, secure, and accessible digital platform for documenting students’ industrial experiences. The system successfully performs its core functions, including daily log entry, supervisor evaluation, and report generation, while offering additional features that enhance collaboration and transparency between students, Technology. This research demonstrates that the digital transformation of industrial training documentation is both feasible and beneficial within the Nigerian higher education context. By leveraging web technologies and database-driven architecture, the system ensures improved data management, real-time monitoring, and easier retrieval of training records, thereby contributing to the overall quality of the SIWES program.

9. Future Suggestions

The development of any software is not a one-time affair, the reason being that challenges are bound to occur as humans evolves. Efficient result can only be obtained if the logbook is used efficiently and also upgraded when the need arises therefore it is necessary therefore to make recommendations that will guide computer user as well as the administrators.

1. It is recommended that the system be adopted since it will save cost and boost the learning experience of interns.
2. The system may be upgraded to suit other needs of the university community, especially as it regards internship.
3. The ITF should adapt the electronic method since ITF forms pass from hand to hand before getting to the officials.
4. Students and supervisors should be encouraged to use the logbook regularly so that records are kept up to date and reports are more accurate at the end of the training period.
5. Users should be allowed to share their experiences and suggestions so that the system can be improved from time to time to meet their needs.

Declarations

Source of Funding

This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Competing Interests Statement

The authors declare no competing financial, professional, or personal interests.

Consent for publication

The authors declare that they consented to the publication of this study.

Authors' contributions

All the authors took part in literature review, analysis and manuscript writing equally.

Availability of data and materials

Supplementary information is available from the authors upon reasonable request.

Ethical Approval

Not applicable for this study.

Informed Consent

Not applicable for this study.

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