



Design and Development of a Web-Based Information System for Monitoring Mandatory Employee Training Using Firebase: Case Study Peln Hospital

Wafi Hidayat Ahadi^{1*}, Rizal²

¹⁻² Institut Sosial dan Teknologi Widuri, Indonesia

email: 21412042@istekwiduri.ac.id¹

Article Info :

Received:
13-06-2026
Revised:
22-06-2026
Accepted:
27-06-2026

Abstract

Hospitals are required to ensure that medical and non-medical personnel maintain valid competencies through periodic mandatory training to support patient safety and accreditation compliance. PT RS PELNI still relied on manual documentation of employee training and certification records, making it difficult to monitor compliance status, identify certificates approaching expiration, and obtain centralized information for managerial decision-making. This study aimed to design and develop the Mandatory Training Monitoring Information System (SIMON), a web-based application for managing employee data, mandatory training categories, training histories, and real-time certification monitoring. The system was developed using a Research and Development (R&D) approach with the Waterfall software development model, while HTML5, CSS3, and vanilla JavaScript were employed for the front-end and Firebase Authentication together with Cloud Firestore served as the back-end infrastructure. Functional validation was conducted using Black Box Testing to evaluate the performance of all system modules. The results demonstrated that user authentication, employee management, training management, training history recording, and dashboard monitoring operated successfully according to predefined functional requirements. The implementation of Firebase enabled real-time data synchronization, allowing certificate status to be updated instantly without manual intervention. The proposed system improves administrative efficiency, supports timely monitoring of employee training compliance, and provides a scalable cloud-based solution for competency management in healthcare organizations.

Keywords: Cloud Firestore, Employee Competency, Firebase, Mandatory Training Monitoring, Web-Based Information System.



©2022 Authors.. This work is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License.
(<https://creativecommons.org/licenses/by-nc/4.0/>)

INTRODUCTION

The rapid digital transformation of healthcare systems has significantly reshaped how hospitals manage organizational processes, shifting from conventional administrative practices toward integrated information systems capable of supporting operational efficiency, regulatory compliance, and evidence-based decision-making. Hospitals are increasingly expected not only to provide high-quality clinical services but also to ensure that healthcare professionals continuously maintain valid competencies through mandatory training programs required by national accreditation and patient safety standards. Mandatory certifications, including Basic Trauma and Cardiac Life Support (BTCLS), Advanced Trauma Life Support (ATLS), intensive care training, and basic dialysis certification, require continuous monitoring because each credential is valid only for a limited period and must be renewed before expiration. Employee competency management has consequently become a strategic component of healthcare governance, where the availability of accurate and timely certification records directly influences institutional performance and patient safety. The increasing complexity of workforce management has accelerated the adoption of web-based information systems capable of integrating employee data, monitoring competency status, and supporting managerial decision-making through centralized digital platforms (Marcella & Hocky, 2025). Recent developments in intelligent information systems further demonstrate that digital monitoring platforms improve administrative efficiency while reducing operational risks associated with fragmented data management and manual documentation processes (Prayoga et al., 2025). These developments indicate that intelligent engineering solutions

have become an essential foundation for modern healthcare organizations seeking sustainable compliance with evolving regulatory requirements.

Despite these technological advancements, many hospitals continue to experience challenges in managing mandatory employee training because certification records are often maintained through physical documents or isolated spreadsheet files that limit data accessibility and organizational oversight. PT RS PELNI, one of the hospitals operating under Danantara Indonesia (IHC), faces similar responsibilities in ensuring that all medical and non-medical personnel maintain valid mandatory training certifications throughout their employment. The continued reliance on manual documentation creates difficulties in obtaining an aggregated overview of employee compliance status, while simultaneously increasing the likelihood of data duplication, document loss, delayed updates, and inaccuracies in identifying certificates approaching expiration. Such limitations may expose hospitals to operational risks because employees could perform professional duties with expired competency certifications, potentially affecting patient safety and institutional accreditation performance. Previous studies have consistently demonstrated that web-based information systems successfully improve administrative efficiency by replacing manual processes with centralized digital platforms capable of supporting organizational information management (Lua & Sulistyo, 2025). Similar findings have shown that web-based monitoring applications simplify administrative workflows, improve data accuracy, and strengthen coordination across organizational units, particularly in public service institutions requiring continuous information updates (Ali et al., 2026). Nevertheless, existing studies primarily emphasize general administrative functions rather than the specialized management of mandatory healthcare training and competency certification.

Recent advances in cloud computing have expanded the capabilities of web-based information systems through the integration of Backend-as-a-Service (BaaS) platforms, particularly Firebase, which enables real-time data synchronization, cloud-based storage, authentication services, and scalable application deployment without requiring dedicated server management. The adoption of Firebase has been reported to improve monitoring efficiency because information can be updated and synchronized instantly across multiple users and devices, allowing organizations to maintain consistent and current operational data (Ulfa et al., 2024). Numerous studies have confirmed the effectiveness of Firebase in supporting real-time monitoring applications across various domains, including Internet of Things systems, mobile applications, educational monitoring platforms, and smart information systems that require continuous data availability (Mesiah et al., 2021; Ibrahim et al., 2023; Jokanan et al., 2022). The platform has also demonstrated strong flexibility in supporting modern application development through integration with Flutter, FlutterFlow, Android applications, and cloud-based monitoring architectures that emphasize scalability and rapid system deployment (Alfahri & Widarma, 2025; Ilhamsyah & Fathurrahman, 2024; Pratama & Irianto, 2026). Although these studies collectively confirm the technical advantages of Firebase, they predominantly examine engineering applications, administrative monitoring, or IoT environments rather than employee competency management within healthcare institutions. Existing literature therefore provides limited empirical evidence regarding how Firebase can support continuous monitoring of mandatory training compliance in hospitals, particularly for certification validity management that directly influences organizational governance and patient safety. This conceptual and empirical gap suggests that further investigation is required to extend the application of cloud-based monitoring technologies into healthcare workforce competency management.

The identified limitations demonstrate that previous web-based monitoring systems have substantially improved administrative performance, yet inconsistencies remain regarding monitoring objectives, application contexts, and the integration of competency management within healthcare organizations. Research on web-based attendance systems has successfully digitalized employee attendance management, although its primary emphasis remains limited to attendance recording rather than monitoring mandatory certification validity throughout employees' professional careers (Lua & Sulistyo, 2025). Likewise, studies on referral monitoring information systems have confirmed the effectiveness of digital administrative transformation but have not addressed the continuous supervision of employee competency obligations required by healthcare accreditation standards (Ali et al., 2026). The scientific challenge therefore lies not merely in digitizing manual records but in developing an integrated monitoring framework capable of consolidating employee profiles, mandatory training categories, certification histories, and expiration status within a unified information system. Addressing

this challenge is increasingly important because competency data are dynamic, periodically updated, and closely associated with organizational compliance, workforce readiness, and patient safety outcomes. Firebase-based monitoring architectures offer considerable potential for fulfilling these requirements by enabling centralized storage, real-time synchronization, and efficient information accessibility suitable for continuous organizational monitoring (Purwanto, 2023; Putro et al., 2022). Even so, studies specifically integrating Firebase, web-based monitoring, and hospital employee competency management remain scarce, leaving an important research opportunity within the intelligent engineering and computing literature.

The urgency of this research extends beyond replacing manual documentation processes, as hospitals require intelligent monitoring systems capable of supporting proactive competency governance rather than reactive administrative recordkeeping. Failure to detect certificates approaching expiration may generate administrative sanctions, compromise accreditation readiness, and increase operational risks because healthcare personnel could continue performing professional responsibilities without valid competency credentials. Intelligent monitoring systems capable of delivering timely, centralized, and continuously updated information therefore represent an essential component of digital hospital governance in increasingly data-driven healthcare environments. From a software engineering perspective, the proposed system adopts the Waterfall development model because the functional requirements are clearly defined from the outset, allowing systematic progression through requirement analysis, system design, implementation, testing, and maintenance phases (Nur, 2019; Gunawan et al., 2020). Similar studies have demonstrated that the Waterfall model remains highly suitable for information systems with stable functional specifications because it facilitates quality control throughout every development stage while ensuring consistency between user requirements and technical implementation (Rahayu et al., 2024). The completed system is subsequently evaluated using Black Box Testing to verify that every functional component performs according to user requirements before operational deployment, following functional validation practices commonly adopted in contemporary web-based information system research (Ali et al., 2026). Within the broader landscape of intelligent engineering and computing, this study positions itself as an effort to integrate cloud-based architecture, structured software engineering methodology, and real-time monitoring capabilities into a specialized information system for mandatory employee training compliance in healthcare organizations.

This study aims to design and develop the Mandatory Employee Training Monitoring Information System (SIMON) as a web-based platform utilizing Firebase to support centralized management of employee competency records at PT RS PELNI. The proposed system is intended to integrate employee master data, mandatory training categories, training histories, and certification validity information within a single platform that can be accessed efficiently by authorized users. The implementation of a real-time monitoring dashboard is expected to provide hospital management with accurate and comprehensive information regarding employee training compliance, enabling more effective and timely managerial decision-making. Unlike previous studies that primarily addressed general administrative monitoring or engineering-oriented Firebase applications, this research specifically focuses on competency compliance management within healthcare organizations. The findings are expected to broaden the application of intelligent engineering and computing principles in the design of cloud-based monitoring systems for organizational competency management. Methodologically, the study contributes by integrating a structured software development process with functional system validation to produce a reliable and scalable web-based monitoring platform. Practically, the proposed system is expected to provide a reference model for healthcare institutions seeking to strengthen employee competency governance through intelligent, real-time, and sustainable digital monitoring.

RESEARCH METHODS

This study employed a Research and Development (R&D) approach to design and develop the Mandatory Employee Training Monitoring Information System (SIMON) for PT RS PELNI using the Waterfall software development model, as the system requirements were clearly identified through observations of the existing mandatory training management process. The development process consisted of five sequential phases, namely requirements analysis, system design, implementation, testing, and maintenance, allowing each stage to be completed before proceeding to the next

development phase (Nur, 2019). Functional and non-functional system requirements were collected through direct observation of the manual certification recording process and semi-structured interviews with relevant hospital personnel, and the resulting information was translated into business process models, database structures, and user interface designs. The application was implemented as a web-based information system using HTML5, CSS3, and vanilla JavaScript for the front-end, while Firebase Authentication was utilized for user authentication and Cloud Firestore served as the real-time database for storing employee profiles, mandatory training categories, training histories, and certificate validity information (Ulfa et al., 2024). The adoption of Firebase provided a cloud-based architecture capable of supporting centralized data management, real-time synchronization, and scalable system deployment without requiring dedicated database server administration (Alfahri & Widarma, 2025). The structured development process ensured that every functional module was implemented according to the predefined system specifications before being evaluated through software testing.

System validation was conducted using Black Box Testing to verify whether each functional component operated according to the predefined user requirements without examining the internal program structure. The testing scenarios covered all major system functions, including user authentication, employee data management, mandatory training management, training history recording, certificate validity monitoring, dashboard visualization, and real-time database synchronization. Each test case was evaluated based on the expected and actual system outputs, and a function was considered valid when the observed output matched the predefined functional specification. This functional validation approach has been widely adopted in contemporary web-based information system development to ensure software reliability before operational deployment (Ali et al., 2026). System performance was evaluated using functional success rate, calculated as the percentage of successfully executed test cases relative to the total number of test scenarios, while the consistency of real-time data synchronization between the web interface and Firebase database was also verified during testing (Purwanto, 2023). The validation results were subsequently analyzed descriptively to determine whether the developed system fulfilled the operational requirements for monitoring mandatory employee training and certification compliance at PT RS PELNI.

RESULTS AND DISCUSSION

System Design and User Interface

The development of the SIMON (Mandatory Employee Training Monitoring Information System) began with translating the functional requirements identified during the analysis phase into a web-based application architecture that supports centralized management of employee training records. The system was designed to address the limitations of the previous manual recording process by integrating employee data, mandatory training categories, training histories, and certificate validity information into a single digital platform accessible through standard web browsers. A modular architecture was adopted to ensure that each functional component could operate independently while maintaining seamless interaction through Firebase services as the cloud-based back-end infrastructure. This design enables hospital administrators to monitor employee compliance status without relying on dispersed spreadsheets or physical documents that are susceptible to duplication and data inconsistency. The implementation also emphasizes usability by providing an intuitive navigation structure that minimizes the learning curve for administrative personnel responsible for managing training records. Such an integrated design supports more efficient organizational governance by enabling timely access to updated information required for operational and accreditation purposes.

The authentication mechanism constitutes the first layer of the proposed information system because access to employee competency information must be restricted to authorized users. As illustrated in Figure 1, the SIMON login interface provides a simple authentication page requiring registered user credentials before granting access to the main system functions. The login module utilizes Firebase Authentication to verify user identity while securely managing authentication sessions through cloud-based services. This approach reduces the complexity of local authentication management while ensuring that unauthorized access to sensitive employee information can be effectively prevented. The minimalist interface design was intentionally adopted to improve usability by presenting only essential authentication components without unnecessary interface complexity. The implementation of cloud-based authentication also supports future scalability should additional user roles or organizational units be incorporated into the system.

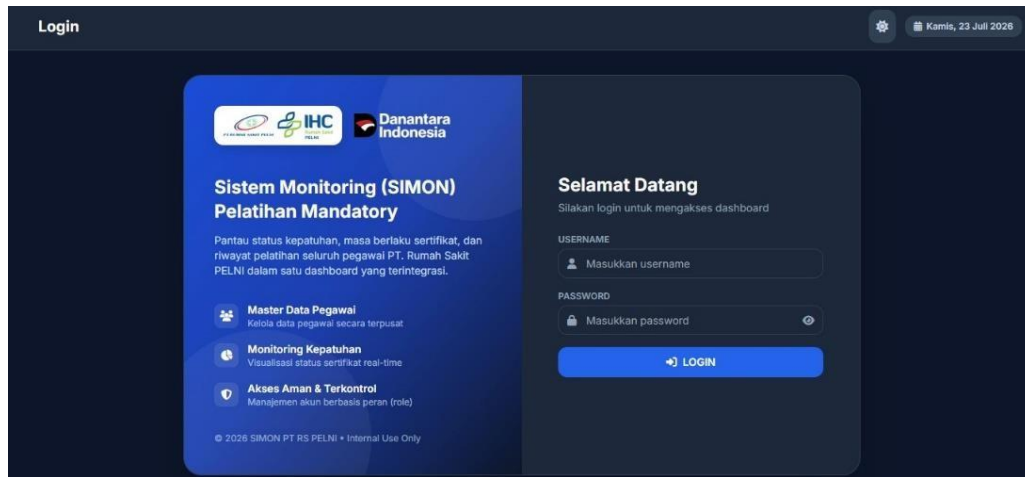


Figure 1. SIMON PT RS PELNI Login Page

After successful authentication, users are directed to the main dashboard, which functions as the central monitoring interface for employee mandatory training compliance. As presented in Figure 2, the dashboard summarizes important information regarding employee training records and certificate status, allowing administrators to obtain an overview of organizational compliance without manually reviewing individual documents. Information is organized through visual components that facilitate rapid identification of employees whose certifications remain active or require renewal. The centralized presentation of information significantly reduces the administrative workload associated with conventional monitoring practices because relevant data are immediately available within a single interface. Such visualization also improves managerial awareness by supporting faster identification of potential compliance risks before certificate expiration occurs. The dashboard therefore functions not only as an information display but also as a decision-support interface for workforce competency management.



Figure 2. SIMON System Dashboard

The dashboard was designed to integrate multiple functional modules into a unified monitoring environment that supports daily administrative activities. Users are able to navigate directly to employee records, mandatory training categories, training history, and certificate monitoring functions without leaving the primary interface. This navigation structure reduces operational complexity because all essential system modules remain interconnected through a centralized menu hierarchy. The implementation of Firebase Cloud Firestore enables every modification performed within individual modules to be reflected automatically across the dashboard, ensuring that displayed information always represents the latest available data. Such real-time synchronization is particularly important for competency management because certificate status continuously changes according to expiration

schedules. The combination of centralized navigation and cloud synchronization enhances both system responsiveness and organizational efficiency in managing mandatory employee training.

Table 1. Functional Features of the SIMON System

Module	Main Function
Login	User authentication and authorization
Dashboard	Monitoring employee certification status
Employee Data	Employee information management
Training Type	Mandatory training category management
Training History	Recording employee training activities

The functional architecture presented in Table 1 demonstrates that each module was developed to address a specific stage of the mandatory training management process while maintaining interoperability within the overall system. Authentication ensures secure access to organizational information, whereas the employee and training modules provide structured data management required for competency administration. The training history module records every completed training activity, enabling the system to maintain comprehensive documentation for each employee throughout the certification lifecycle. These interconnected modules collectively provide the information required to generate an accurate compliance overview within the dashboard. The modular design also simplifies future system maintenance because improvements to individual components can be implemented without affecting the entire application architecture. Such flexibility is advantageous for healthcare organizations whose administrative requirements continue to evolve alongside accreditation standards.

The overall implementation of the user interface demonstrates that SIMON successfully transforms fragmented manual administrative procedures into an integrated web-based monitoring environment capable of supporting healthcare competency management. The combination of secure authentication, centralized dashboard visualization, and interconnected functional modules establishes a digital workflow that is considerably more efficient than conventional document-based recording practices. From an engineering perspective, the system architecture emphasizes simplicity, accessibility, and maintainability while preserving the scalability required for future development. Compared with previous web-based administrative information systems, the proposed implementation extends monitoring capabilities by focusing specifically on mandatory employee training compliance rather than general administrative functions. The integration of cloud-based services further strengthens the ability of the system to provide accurate and continuously updated information required by hospital management. These implementation results establish the technical foundation for the mandatory training management modules discussed in the following section.

Mandatory Training Management Module

The mandatory training management module was developed as the core component of SIMON because it directly supports the administration and monitoring of employee competency records throughout their certification lifecycle. Unlike conventional recording methods that rely on multiple spreadsheets and physical documents, the proposed module centralizes all mandatory training information into a unified cloud-based database that can be accessed and updated through a web interface. Every training category is associated with standardized information, including the training name, validity period, and certificate expiration schedule, thereby providing a structured framework for competency management. The centralized architecture minimizes data redundancy while ensuring consistency across different operational units within the hospital. The implementation also facilitates efficient retrieval of historical records, enabling administrators to verify employee qualifications without manually searching archived documents. Such an integrated management approach strengthens organizational readiness in maintaining compliance with mandatory training requirements and accreditation standards.

The mandatory training categories available in the system are presented through a dedicated management interface designed to simplify administrative activities. As illustrated in Figure 3, the training type page enables administrators to create, modify, update, and remove mandatory training categories according to institutional requirements. Each training category is stored in Cloud Firestore

using a structured data model that supports efficient indexing and rapid information retrieval during daily operations. The interface applies a tabular layout that improves readability while reducing the possibility of input errors during data management activities. Search and filtering capabilities further assist administrators in locating specific training categories when the number of available programs increases over time. This implementation provides a standardized repository of mandatory training information that serves as the primary reference for all subsequent employee training records.

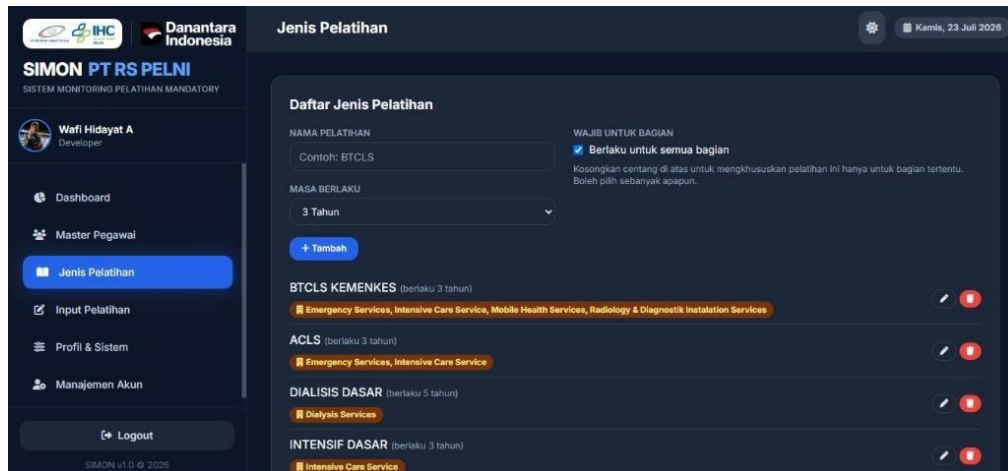


Figure 3. Mandatory Training Type Page

Following the establishment of standardized training categories, the system provides a dedicated module for recording employee participation in mandatory training programs. As presented in Figure 4, administrators are able to enter employee identification, training type, training completion date, certificate validity period, and additional supporting information through a structured input form. Every submitted record is automatically stored within Cloud Firestore, allowing the database to synchronize immediately with all connected interfaces without requiring manual refresh procedures. This real-time synchronization ensures that newly entered training information becomes instantly available for monitoring and reporting purposes. The structured data entry process also minimizes inconsistencies commonly found in manual documentation because each field follows predefined validation rules before submission. Consequently, the quality and completeness of competency records are significantly improved compared with traditional administrative practices.

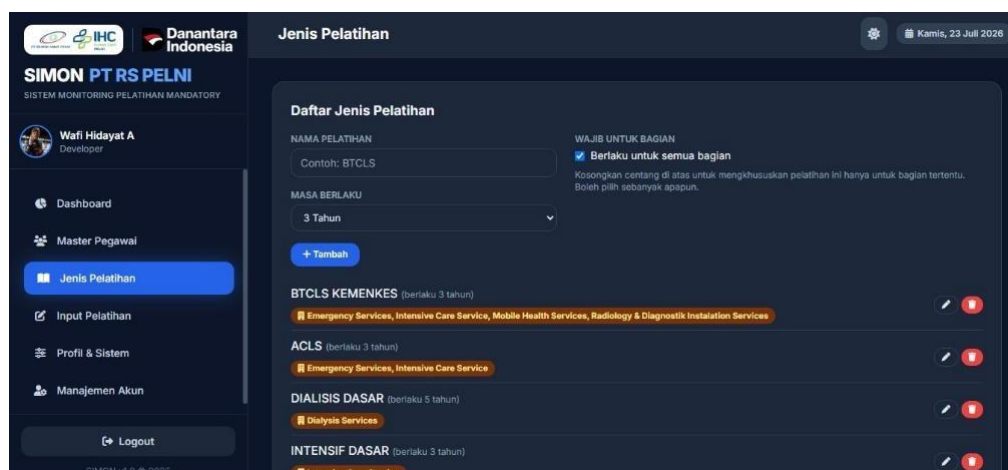


Figure 4. Training Input Page

The interaction between the training type module and the training input module establishes a complete digital workflow for competency management within the hospital. Administrators first define standardized mandatory training categories before assigning corresponding training records to individual employees, thereby ensuring consistency throughout the entire database. Each recorded

training activity is linked to employee information and certificate validity data, allowing the system to automatically determine the current status of each competency record. The integration of Firebase services enables every modification to be synchronized in real time, eliminating delays commonly encountered in conventional database management. This capability allows hospital management to obtain the latest information regarding employee training compliance whenever operational decisions are required. The seamless integration between data entry, storage, and monitoring significantly improves the reliability of mandatory training administration within the organization.

Table 2. Structure of Mandatory Training Data Stored in SIMON

Data Element	Description
Employee ID	Unique employee identification number
Employee Name	Registered employee name
Training Type	Mandatory training category
Training Date	Date of training completion
Expiration Date	Certificate validity period
Certificate Status	Active or Expired

The data structure presented in Table e demonstrates that the proposed system organizes mandatory training information using standardized attributes capable of supporting efficient monitoring and long-term data management. Each employee record is uniquely associated with a specific training category and corresponding certification period, enabling the system to continuously evaluate competency validity throughout the employment lifecycle. This structured database design facilitates future scalability because additional training categories or organizational units can be incorporated without requiring substantial modifications to the existing database architecture. From an information engineering perspective, the integration of standardized data structures with cloud-based storage enhances data consistency, accessibility, and maintainability across the entire monitoring system. Compared with fragmented manual documentation, the proposed module provides a considerably more reliable mechanism for managing mandatory employee training records while supporting faster administrative decision-making. The successful implementation of this module provides the operational foundation for evaluating system functionality and overall performance through the validation procedures discussed in the following section.

System Validation and Discussion

To evaluate the operational reliability of SIMON, functional testing was conducted after the implementation stage using the Black Box Testing method. This testing approach focuses on verifying whether every function of the system performs according to predefined user requirements without examining the internal source code. Test scenarios were prepared to represent the primary operational activities of hospital administrators, including user authentication, employee data management, mandatory training management, training history recording, and certificate monitoring. Each module was executed repeatedly using valid input data to ensure that all expected outputs were generated correctly during normal system operation. The evaluation emphasized functional correctness because the developed system is intended to support administrative processes where data accuracy and operational consistency are essential. The validation results provide evidence regarding the readiness of the developed information system before being utilized in the operational environment of PT RS PELNI.

Table 3. Black Box Testing Results

No	Skenario Pengujian	Hasil yang Diharapkan	Status
1	Login Menggunakan Akun Terdaftar	Pengguna berhasil masuk ke dashboard	Valid
2	Tambah Data Pegawai Baru	Data pegawai tersimpan pada database	Valid

3	Input Data Pelatihan Pegawai	Data pelatihan tersimpan & status ter-update	Valid
4	Menampilkan Data Pegawai Dengan Sertifikat Kadaluarsa	Sistem menampilkan notifikasi expired	Valid
5	Menampilkan Grafik Status Sertifikat	Grafik tampil sesuai data terbaru	Valid

The results presented in Table 3 indicate that all tested functional modules operated successfully according to their respective specifications. The authentication module correctly restricted access to registered users, while the employee management module successfully performed data creation, modification, retrieval, and deletion without generating functional errors. Similar results were observed in the mandatory training and training history modules, where every input process was successfully stored and displayed within the corresponding interface. The dashboard module also accurately presented updated employee certification information following every successful database transaction. These findings demonstrate that the implemented functions satisfy the operational requirements established during the system analysis phase. Overall, the Black Box Testing results confirm that SIMON possesses adequate functional reliability to support mandatory employee training management within the hospital environment.

Although functional validation confirms that every module operates correctly, the effectiveness of the proposed system is also reflected in its ability to maintain synchronized information throughout the entire application. The integration of Cloud Firestore enables newly added or modified training records to be propagated automatically across the system without requiring manual database synchronization. Consequently, administrators are able to monitor the latest certification status immediately after new training information has been recorded, thereby minimizing delays commonly encountered in manual administrative workflows. This real-time synchronization contributes to improved organizational responsiveness because decisions regarding employee competency can be made using current information rather than periodically updated records. The centralized cloud architecture also reduces the possibility of inconsistent information between different users accessing the system simultaneously. Such characteristics demonstrate that the developed information system provides not only functional correctness but also operational efficiency in supporting hospital competency management.

Table 4. Functional Evaluation Summary

System Module	Functional Status	Evaluation
Login Authentication	Successful	Passed
Employee Management	Successful	Passed
Training Type Management	Successful	Passed
Training History	Successful	Passed
Dashboard Monitoring	Successful	Passed

The functional evaluation summarized in Table 4 demonstrates that all major modules successfully satisfied the predefined functional requirements established during the system design stage. Each feature performed consistently according to its intended purpose, indicating that the integration between the front-end interface and the Firebase back-end infrastructure operated without functional discrepancies throughout the testing process. The successful execution of authentication, data management, monitoring, and dashboard modules confirms that the proposed system is capable of supporting mandatory employee training administration within the operational environment of PT RS PELNI. The implementation of a structured Waterfall development process also contributed to software reliability by ensuring that every development phase was completed and validated before progressing to the subsequent stage. From a software engineering perspective, these findings indicate that the developed information system possesses adequate functional stability for practical deployment in healthcare institutions. The successful validation further demonstrates that SIMON provides a dependable technological platform for supporting digital competency management and organizational compliance monitoring.

The overall findings indicate that the proposed system offers several improvements over conventional manual recording practices implemented in the hospital. By integrating employee information, mandatory training records, certificate validity, and monitoring functions within a centralized cloud-based platform, administrative activities become more efficient and less susceptible to recording errors or information redundancy. The real-time synchronization provided by Firebase enables every data modification to be reflected immediately across the application, allowing hospital administrators to monitor employee competency status without waiting for manual data consolidation. Such capabilities improve organizational responsiveness because certificates approaching expiration can be identified earlier, enabling timely planning for training renewal and reducing the risk of non-compliance with accreditation requirements. The modular system architecture also facilitates future expansion should additional mandatory training categories or organizational units need to be incorporated into the application. These results demonstrate that the proposed system not only fulfills its intended functional objectives but also provides practical value for strengthening digital governance of employee competency management within healthcare organizations.

CONCLUSION

This study successfully designed and developed the Mandatory Employee Training Monitoring Information System (SIMON) as a web-based application to support the management and monitoring of mandatory employee training at PT RS PELNI. The system was developed using HTML5, CSS3, vanilla JavaScript, and Firebase following the Waterfall software development model, which systematically guided the stages of requirements analysis, system design, implementation, testing, and maintenance. The resulting application effectively integrates employee master data, mandatory training categories, training histories, and certificate validity information into a centralized cloud-based platform. The implementation of Firebase enables real-time data synchronization, allowing updates to employee training records and certificate status to be reflected immediately across the system without manual intervention. Functional evaluation through Black Box Testing demonstrated that all major modules, including user authentication, employee management, training management, training history recording, and dashboard monitoring, operated according to the predefined functional requirements. These findings indicate that the proposed system provides a reliable and efficient digital solution for improving administrative processes associated with mandatory employee training management. The developed system therefore offers a practical approach for strengthening competency governance and supporting compliance with hospital accreditation requirements through centralized and real-time information management.

The implementation of SIMON also demonstrates the potential contribution of cloud-based information systems to intelligent engineering and computing applications within healthcare organizations. By replacing fragmented manual documentation with an integrated web-based monitoring platform, the system improves data accessibility, minimizes recording inconsistencies, and enables hospital administrators to identify certification expiration more efficiently. The centralized architecture supports more effective decision-making by providing accurate and continuously updated information regarding employee training compliance. The findings further suggest that integrating Firebase into healthcare information systems represents a feasible approach for developing scalable monitoring applications requiring real-time synchronization and cloud-based data management. Despite these positive outcomes, this study remains limited to functional system validation and has not evaluated security performance, scalability under large data volumes, or long-term operational usability in routine hospital environments. Future research is therefore recommended to incorporate automated notification services through email or WhatsApp, report export functionality for accreditation purposes, mobile application support, and comprehensive security and performance testing to further improve system reliability and practical implementation in large-scale healthcare institutions.

REFERENCES

- A'lam, M. B., & Sujono, S. (2026). Sistem Monitoring Kebakaran Dini Berbasis ESP8266 Menggunakan Sensor Api dan Firebase Realtime Database. *Journal Sains Student Research*, 4(1), 823-829. <https://doi.org/10.61722/jssr.v4i1.8624>

- Alfahri, D. A., & Widarma, A. (2025). Implementation of Flutter and Firebase in Developing a Mobile News Portal Application. *Bigint Computing Journal*, 3(1), 50-58. <https://doi.org/10.55537/bigint.v3i1.1086>
- Ali, A. S., Al-ikhsan, S. H., & Riana, F. (2026). Rancangan Bangun Sistem Informasi Dikaper Kota Bogor untuk Pengajuan aan Monitoring Rujukan Berbasis Web (Studi Kasus: Role Super Admin dan Admin). *JATI (Jurnal Mahasiswa Teknik Informatika)*, 10(1), 660-666. <https://doi.org/10.36040/jati.v10i1.16822>
- Anitha, P., Shekar, L., Padmavilochanan, A., & Sheshadri, S. (2024, September). ICT-Based Reporting and Monitoring for TVET: Effective Adoption Strategies. In *World Conference on Information Systems for Business Management* (pp. 537-549). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-96-1747-0_44
- Badderol, M. H., & Abdullah, N. A. (2025). Intruder Alert System with Firebase Cloud for Syndicate Store and Service. *Applied Information Technology And Computer Science*, 6(1), 382-400. <https://periodical.uthm.edu.my/index.php/aitcs/article/view/16443>
- Fauzi, R., & Minggu, D. (2024). Implementasi Sistem Monitoring ESP8266 Menggunakan Firebase: Telekomunikasi. *Jurnal Telkommil*, 5(1), 73-78. <https://doi.org/10.54317/kom.v5i1.451>
- Gunawan, S., Surniandari, A., & Rachmi, H. (2020). Penggunaan Metode Waterfall dalam Pengembangan Perangkat Lunak Kasir Event Multi UMKM. *Universitas Bina Sarana Informatika, Bogor*. <https://repository.bsi.ac.id/repo/27938/Penggunaan-Metode-Waterfall-Dalam-Pengembangan-Perangkat-Lunak-Kasir-Event-Multi-UMKM>
- Ibrahim, M. S. S., Faisol, A., & Prasetya, R. P. (2023). Rancang Bangun Aplikasi Controlling dan Monitoring Ruangan Jemuran Pintar Menggunakan Firebase pada Arduino dan Android. *JATI (Jurnal Mahasiswa Teknik Informatika)*, 7(1), 979-983. <https://doi.org/10.36040/jati.v7i1.6180>
- Ilhamsyah, M., & Fathurrahman, M. (2024). Rancang Bangun Aplikasi Android Mysmartfishfeeding Menggunakan Flutterflow dan Firebase Firestore. *Jurnal Informatika Dan Teknik Elektro Terapan*, 12(3S1). <https://doi.org/10.23960/jitet.v12i3S1.5269>
- Jokanan, J. W., Widodo, A., Kholis, N., & Rakhmawati, L. (2022). Rancang Bangun Alat Monitoring Daya Listrik Berbasis IoT Menggunakan Firebase dan Aplikasi. *Jurnal Teknik Elektro*, 11(1), 47-55. <https://doi.org/10.26740/jte.v11n1.p47-55>
- Liliana, L., Handani, F., Prijambodo, B., & Wariky, M. C. (2023). Development of a Target-Based Configurable Business-to-Business Model for Electronic Wholesale Information System in East Java. *CommIT Journal*, 17(1), 1-12. <https://doi.org/10.21512/commit.v17i1.8296>
- Lua, M. F., & Sulisty, W. Y. (2025). Rancang Bangun Sistem E-Absensi Web Menggunakan Laravel (Studi Kasus: RSUD Labuha). *Insect (Informatics and Security): Jurnal Teknik Informatika*, 11(2), 238-245. <https://doi.org/10.33506/insect.v11i2.4994>
- Marcella, F., & Hocky, A. (2025, June). Design of A Web-Based Employee Attendance Monitoring Information System. In *International Conference on ATLAS (Advanced Technologies, Learning Algorithms, and Systems)* (Vol. 1, No. 1, pp. 8-18). <https://www.ejournal.pelitaindonesia.ac.id/index.php/ATLAS/article/view/5150>
- Mesiah, L., Nurdin, A., & Suroso, S. (2021). Rancang Bangun Monitor Jarak Jauh Lampu Penerangan Menggunakan Teknologi Real Time Storage Firebase: Rancang Bangun Monitor Jarak Jauh Lampu Penerangan Menggunakan Teknologi Real Time Storage Firebase. *Jurnal Ecotipe (Electronic, Control, Telecommunication, Information, and Power Engineering)*, 8(2), 85-92. <https://doi.org/10.33019/jurnalecotipe.v8i2.2493>
- Nur, H. (2019). Penggunaan Metode Waterfall dalam Rancang Bangun Sistem Informasi Penjualan. *Generation Journal*, 3(1), 1-10. <https://doi.org/10.29407/gj.v3i1.12642>
- Pratama, R. A., & Irianto, K. D. (2026). Rancang Bangun Aplikasi Parkir Masjid Berbasis Android dan Firebase. *Technologia: Jurnal Ilmiah*, 17(1), 197-206. <https://doi.org/10.31602/tji.v17i1.21416>
- Prayoga, A. A., Hasanuddin, M., Khodijah, S., Rizki, C. A., & PA, D. (2025). Development of an Employee Performance Monitoring Information System Using a Web-Based Interactive Dashboard. *Journal of Computer Science Artificial Intelligence and Communications*, 2(2), 67-71. <https://doi.org/10.64803/jocsaic.v2i2.63>
- Purwanto, H. L. (2023). Penerapan Push Notification Pada Sistem Monitoring Belajar Berbasis Web Menggunakan Firebase Cloud Messaging. *Jaringan Sistem Informasi Robotik-JSR*, 7(1), 13-20. <https://doi.org/10.58486/jsr.v7i1.203>

- Putra, A., & Alda, M. (2025). Financial management information system design with business intelligence approach. *Journal of Dinda: Data Science, Information Technology, and Data Analytics*, 5(1), 122-127. <https://doi.org/10.20895/dinda.v5i1.1796>
- Putro, D. P., Gunawan, I., & Suryani, P. E. (2022). Software Push Notification Disposisi Persuratan Berbasis Website Menggunakan Firebase Cloud Messaging. *Journal of Information Technology Ampera*, 3(3), 370-381. <https://www.journal-computing.org/index.php/journal-ita/article/view/330>
- Rahayu, Y. S., Saputra, Y., & Irawan, D. (2024). Implementasi Metode Waterfall Pada Pengembangan Sistem Informasi Mobile E-Disarpus. *ZONasi: Jurnal Sistem Informasi*, 6(2), 523-534. <https://doi.org/10.31849/zn.v6i2.20538>
- Ulfa, S. M., Santoso, F., & Azize, N. (2024). Rancangan Bangun Sistem Informasi Monitoring Perjanjian Kerjasama Berbasis Website dengan Integrasi Firebase. *Jurnal Ilmiah Informatika*, 9(1), 15–29. <https://doi.org/10.35316/.v9i1.5208>
- Zaki, N. F., & Hermawan, A. (2025). Development of a Mobile Web Information System for Ordering and Managing Local Products. *bit-Tech*, 8(2), 2419-2429. <https://doi.org/10.32877/bt.v8i2.3263>