

## Design and Functional Testing of a QR Code-Based Attendance System Prototype in a Special Library for Improving Visitor Recording Efficiency

Davin Nugraha<sup>1</sup>, Aminudin<sup>2</sup>, Merryam Agustine<sup>3</sup>

<sup>1</sup> Perpustakaan & Sains Informasi, Universitas Widyatama Bandung

<sup>2</sup> Perpustakaan & Sains Informasi, Universitas Widyatama Bandung

<sup>3</sup> Perpustakaan & Sains Informasi, Universitas Widyatama Bandung

[davin.nugraha@widyatama.ac.id](mailto:davin.nugraha@widyatama.ac.id), [aminudin.mkom@widyatama.ac.id](mailto:aminudin.mkom@widyatama.ac.id),

[merryam.agustine@widyatama.ac.id](mailto:merryam.agustine@widyatama.ac.id)

DOI: 10.30742/tb.v10i2.5238

Received: 14 February 2026

Revised: 27 March 2026

Accepted: 26 April 2026

### ABSTRACT

**Purpose of the Research.** Recording visitor attendance is an essential aspect of library management, as it supports service evaluation and institutional reporting. However, visitor recording in many libraries is still conducted manually, leading to inefficiency, data inconsistency, and potential recording errors. This study aims to design and test a QR Code-based attendance system prototype to improve the efficiency of visitor recording in a special library context, which has received limited attention in previous studies. **Research Method.** This study employs a system development research approach focusing on system design and functional testing. Data were collected through conceptual observation of visitor recording workflows, documentation studies related to system requirements, and functional testing of the developed prototype. This study is limited to prototype development and does not involve full operational implementation. **Analysis Data.** Analysis data was conducted using a descriptive-analytical approach by examining the results of system testing and relating them to Information System theory and Efficiency theory. **Results.** The results indicate that the proposed QR Code-based attendance system is capable of recording visitor data in a structured and computerized manner. The system demonstrates potential improvements in recording efficiency, particularly in terms of processing speed, ease of data management, and consistency of visitor data. **Conclusions.** This study concludes that the QR Code-based attendance system prototype has the potential to serve as an alternative solution for improving visitor recording efficiency in special libraries. This study contributes by providing a prototype-based approach and highlighting its potential efficiency in a special library context. Future research is recommended to implement the system in real operational settings and evaluate its long-term effectiveness

**Keywords:** *Information Science; Special Library; Attendance System; QR Code; Visitor Recording*

## A. INTRODUCTION

The rapid development of information technology has brought significant changes across various sectors, including library management. Libraries are no longer viewed solely as repositories of information collections, but also as information service centers that require speed, accuracy, and efficiency in their operational processes (IFLA, 2015). One crucial aspect of library management is the recording of visitor attendance, which serves as a basis for service evaluation, managerial decision-making, and institutional reporting (Corral et al., 2017). In practice, visitor attendance recording in many libraries is still conducted manually through guest books or attendance forms. This method presents several limitations, such as time-consuming processes, susceptibility to recording errors, difficulties in data recap, and inefficiency in producing accurate and structured visitor data (Oyerinde et al., 2025). Moreover, manual recording increases the workload of librarians, particularly in libraries with high visitor intensity (Malgwi et al., 2025).

Along with the growing demand for service efficiency, information technology has increasingly been adopted to support library administrative processes. One technology that has been widely applied is the Quick Response (QR) Code. QR Code is a two-dimensional code capable of storing information and can be scanned quickly using digital devices. Its advantages in terms of speed, ease of use, and data accuracy have led to its application in various fields, including attendance and identification systems (Anggraeni et al., 2025; Narangamma & Shamila, 2025).

In the library context, the implementation of a QR Code-based attendance system has the potential to serve as an alternative solution for improving the efficiency of visitor recording. Through this system, visitors only need to scan a QR Code to record their attendance, enabling faster recording processes and digital data storage. This approach not only benefits visitors but also assists librarians in managing and processing visitor data in a more systematic manner (Sulthoni et al., 2025).

A special library context, as the focus of this research, requires an accurate and efficient visitor attendance recording system. However, conceptual analysis indicates that many special libraries still rely on conventional and non-integrated recording systems. Such conditions may result in inefficiencies in recording, data processing, and visitor report preparation. Therefore, a technological solution in the form of a QR Code-based visitor attendance system is required.

Previous studies have demonstrated that the application of QR Code-based attendance systems can improve efficiency and accuracy in attendance recording. Hendrawan et al. (2025) concluded that QR Code-based systems are able to replace manual methods that are slow and prone to errors. Similarly, Rahmawati et al. (2025) reported that QR Code implementation enhances time efficiency and minimizes data input errors through real-time recording. Nevertheless, most of these studies focus on formal educational environments, such as schools and universities. This condition shows that previous studies still have limitations, as the characteristics and operational needs of special libraries differ from those of formal

educational institutions, particularly in terms of visitor management and data recording processes.

On the other hand, Acevedo et al. (2026) emphasized the importance of utilizing information technology to improve the quality and efficiency of library services. In line with this, Aminudin & Abinowi (2025) demonstrated that web-based library applications are capable of supporting more structured data management and library services. Despite these findings, existing studies have not specifically addressed the implementation of QR Code-based attendance systems nor examined their potential efficiency in recording visitor attendance within special libraries. This condition indicates a research gap related to the integration of QR Code-based attendance systems and visitor recording in special library environments, as well as the assessment of their efficiency potential. Therefore, further investigation is required to explore how QR Code-based attendance systems can be adapted and evaluated within special library environments.

Based on the background and review of previous studies, this research aims to address the following issues: how a QR Code-based attendance system can be designed to support visitor attendance recording, how the results of system testing demonstrate its capability in supporting the recording process, and how the potential efficiency of visitor attendance recording can be identified based on system testing results. Accordingly, this study aims to design and test a QR Code-based attendance system as a structured and computerized solution for visitor recording, as well as to identify its potential efficiency based on the results of system testing. This study not only focuses on system development but also aims to provide an initial analytical assessment of its potential efficiency based on functional testing results.

This research adopts a system engineering approach by designing and testing a QR Code-based attendance system prototype. The theoretical foundation of this study is based on Information System theory proposed by Laudon & Laudon, (2018), which emphasizes input, process, and output components, as well as Efficiency theory proposed by Siagian (2015), which serves as the basis for analyzing the potential efficiency of visitor attendance recording. Data were collected through conceptual observation of visitor recording processes, documentation studies, and system testing. Data analysis was conducted using a descriptive-analytical approach by examining system testing results and relating them to the applied theories. Information System theory is used to explain how the system manages input, process, and output in visitor attendance recording, while Efficiency theory is applied to evaluate how the system potentially reduces time, effort, and recording errors compared to manual methods.

This study is based on the assumption that a QR Code-based attendance system can support visitor recording in a more structured and computerized manner compared to manual methods, and has the potential to improve recording efficiency in terms of processing speed, ease of data management, and reduction of recording errors. The findings of this research are expected to provide practical contributions in the form of a tested system prototype that may serve as a reference for special libraries in developing technology-based visitor attendance recording systems without requiring immediate full operational implementation.

This assumption forms the analytical basis for evaluating the system's functional performance and its potential contribution to improving library service efficiency. This study contributes by providing a practical prototype-based solution for visitor attendance recording and demonstrating its functional feasibility in a special library context.

## B. METHODS

This study employed a system development research approach with a focus on system design and functional testing. The approach was selected because the research aimed to produce a structured system prototype and evaluate its functional performance rather than to measure user behavior statistically. The development process followed common principles of software engineering, including requirement analysis, system design, implementation, and testing. The system development in this study adopts a prototyping model, which emphasizes iterative design, testing, and refinement of the system based on functional evaluation.

The research object was a QR Code-based visitor attendance system prototype designed for a special library context. The system was developed as a conceptual prototype without direct operational implementation in a real institution. Therefore, no human respondents were involved in this study. Instead, the research subjects consisted of test data, including visitor data and visit records, which were used to simulate real attendance scenarios within the system.

Data collection techniques were carried out through conceptual observation, documentation study, and system testing. Conceptual observation was conducted by examining common visitor attendance recording workflows applied in library services. Documentation study was used to design the system structure, including visitor data attributes, visit records, and system user roles. System design activities included the development of flowcharts, Entity Relationship Diagrams (ERD), and user interface/user experience (UI/UX) prototypes. Functional testing was then conducted on the developed system to ensure that each module operated according to the predefined design specifications. Functional testing in this study adopts a scenario-based approach equivalent to black-box testing, focusing on verifying whether each system function operates according to predefined requirements.

Data analysis was performed using a descriptive-analytical method. The analysis focused on examining the results of functional testing and evaluating the system's ability to support visitor attendance recording. The analysis emphasized indicators of potential efficiency, including process speed, ease of data management, and reduction of recording errors. The analytical results were interpreted by linking system performance to Information System theory and Efficiency theory.

To ensure validity, the system prototype was evaluated through functional testing based on predefined system requirements, and structured test scenarios, ensuring that each feature performed as intended. Reliability was addressed by testing system functions repeatedly using different test data scenarios to confirm

consistency of system performance across multiple testing conditions. This approach ensured that the results reflected the system’s functional capability and potential effectiveness in supporting visitor attendance recording in special libraries.

### C. RESULT AND DISCUSSION

The results of this study indicate that the QR Code–based visitor attendance system was successfully designed and tested in accordance with the research objectives. The initial stage of the study produced a system design developed based on the needs of recording library visitor visits, which include visitor identification, recording visit time, and storing visit data in a structured manner. The system design was developed by constructing a process flowchart that illustrates the visitor attendance mechanism, starting from QR Code scanning by visitors, system data validation, to the storage of visit data as shown in Figure 1.

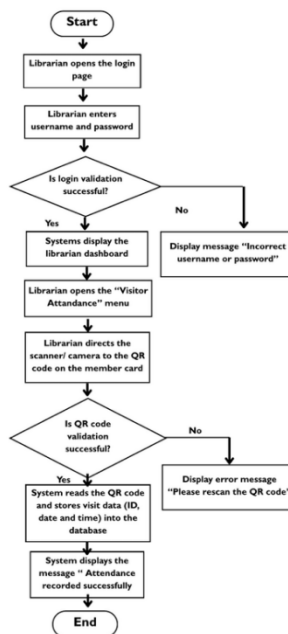


Figure 1. Flowchart of the QR Code–based Visitor Attendance System  
Source: Authors

The design of the system workflow and database structure demonstrates that the QR Code–based attendance system prototype was developed with integrated input, processing, and data storage processes. Each entity in the database has a specific role and is interconnected to support automated visitor visit recording, thereby minimizing data redundancy and potential recording errors. This indicates that the developed prototype focuses not only on the user interface but also on the logical and functional readiness of the system structure. In addition, the database structure design is represented through an Entity Relationship Diagram (ERD) that illustrates the relationships between visitor data, visit records, and system users as shown in Figure 2.

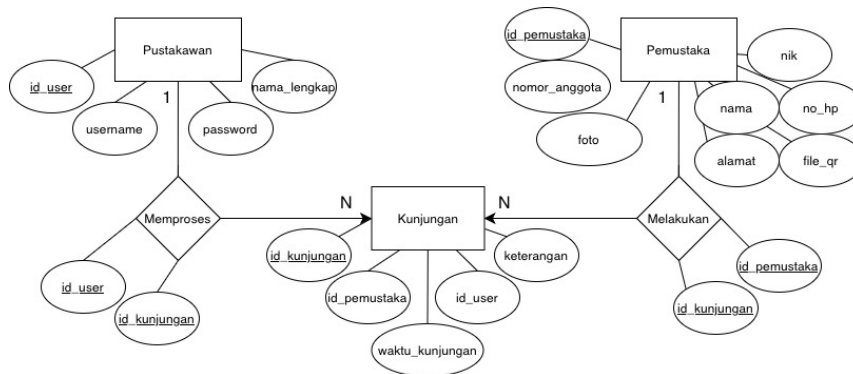


Figure 2. Entity Relationship Diagram of the Attendance System. Source: Authors

Based on the design results, the attendance system consists of several integrated main modules, including a visitor data management module, a module for generating and storing unique QR Codes for each visitor, a QR Code scanning module for recording visits, and a visit report presentation module. All modules were implemented in a web-based system designed to support computerized visitor attendance recording. Figure 3 illustrates the structure of the visitor table

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
<input type="checkbox"/>	1 id_pemustaka	int(11)			No	None		AUTO_INCREMENT	
<input type="checkbox"/>	2 nomor_anggota	varchar(30)	utf8mb4_general_ci		No	None			
<input type="checkbox"/>	3 nik_nis	varchar(20)	utf8mb4_general_ci		No	None			
<input type="checkbox"/>	4 nama	varchar(100)	utf8mb4_general_ci		No	None			
<input type="checkbox"/>	5 alamat	varchar(200)	utf8mb4_general_ci		No	None			
<input type="checkbox"/>	6 no_hp	varchar(20)	utf8mb4_general_ci		Yes	NULL			
<input type="checkbox"/>	7 file_qr	varchar(255)	utf8mb4_general_ci		Yes	NULL			
<input type="checkbox"/>	8 foto	varchar(255)	utf8mb4_general_ci		Yes	NULL			
<input type="checkbox"/>	9 status_aktif	tinyint(1)			No	1			

Figure 3. Database Table Structure for Visitor Data. Source: Authors

used to store visitor identity and attendance related data in the system. The web-based system design emphasizes ease of use and clarity of workflow for librarians. The system includes visitor data input pages, QR Code scanning pages, member data pages, and visit report and graph pages, allowing users to clearly understand the system usage flow. Figure 4 presents the dashboard interface that displays visitor attendance statistics and system summaries.

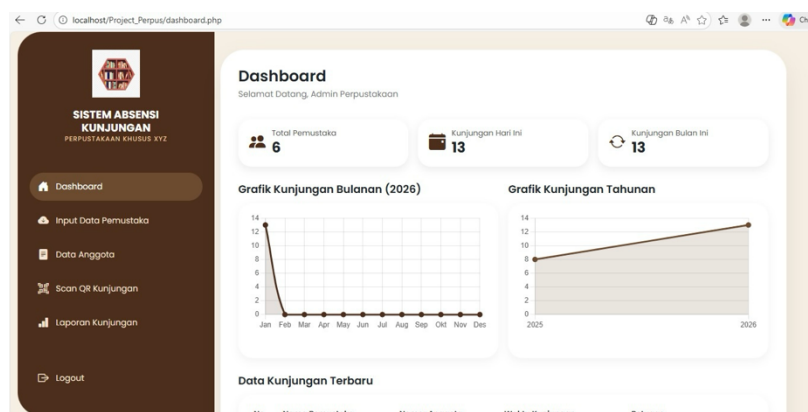


Figure 4. Attendance System Dashboard Interface. Source: Authors

The dashboard of the QR Code-based attendance system prototype functions as an information center that presents visual summaries of visitor visit data. In addition to displaying visit summaries, the dashboard is designed to present dynamic statistical information based on data stored in the visit database. The information displayed includes daily visits, monthly visits, and visit trends over specific periods, visualized in graphical form. These visualizations enable librarians to observe visitor visit patterns over time more easily and efficiently. Consequently, the dashboard serves not only as a visual display but also as a data-driven tool to support decision-making in special library services.

After the design stage was completed, the study produced a QR Code-based attendance system prototype that subsequently underwent functional testing. System testing was conducted to ensure that each module and core function operated in accordance with the predefined design. The testing process involved executing system functions based on usage scenarios, including librarian login, visitor data management, QR Code generation, QR Code scanning, and visit report presentation. Functional testing was performed on all major system modules to verify that each function worked as intended. A summary of the functional testing results is presented in Table I.

Table I. Functional Testing Results of the QR Code-based Attendance System. Source: Authors

NO	System Module	Test Scenario	Test Result	Description
1	User Login	Login using valid credentials	Successful	System displays the dashboard
2	Visitor Data Management	Add, Update, and Deactive Visitor Data	Successful	Data stored and managed properly
3	Visitor QR Code	Generate a unique QR Code	Successful	QR Code generated according to visitor data
4	QR Code Scanning	Scan a valid QR Code	Successful	Visit time recorded
5	QR Code Validation	Scan an invalid QR Code	Successful	System rejects attendance recording
6	Visit Recording	Store visit data	Successful	Visit data stored automatically
7	Visit Report	Filter visit data by date	Successful	Data displayed according to filter
8	Visit Statistics	Display visit statistics graph	Successful	Informative visit graph displayed
9	System Logout	Logout from the system	Successful	User session ended

The testing results indicate that the visitor data management module functioned properly, as evidenced by the system's ability to store, display, update, and deactivate visitor data according to system requirements. Each visitor record stored in the system was successfully linked to a unique QR Code generated automatically. In the QR Code scanning module, the system was able to read scanned QR Codes and process the corresponding visitor data. Each scanning process automatically recorded the visit time and stored it in the visit database.

The system was also able to reject attendance recording when an unrecognized QR Code was scanned or when the visitor data was not available in the database.

Testing of the visit report module shows that the system can display visitor visit data based on specific time ranges. The displayed data include visitor identity information and recorded visit times. In addition, the system is capable of presenting visit data in both tabular and graphical formats, facilitating data retrieval, recapitulation, and monitoring of visitor visits. During the testing process, no major functional errors were identified that could disrupt system operation, indicating that the QR Code-based attendance system prototype operates as designed.

Beyond functional performance, the testing results also demonstrate that the QR Code-based attendance system prototype exhibits adequate operational stability during the testing process. Each visit recording process produced consistent data between the information displayed in the system interface and the data stored in the database. This condition indicates that the system prototype is capable of maintaining data consistency throughout the testing phase.

Based on the system design and testing results, the study also identifies potential efficiency in visitor attendance recording. The identification of efficiency potential was conducted by observing system characteristics during testing and comparing them with conventional manual visitor recording processes. The results show that attendance recording through QR Code scanning follows a simpler process flow, consisting only of code scanning and automatic data storage, without requiring manual data entry.

Furthermore, the visit data recorded by the system are stored in a structured database, facilitating data management and retrieval processes. Visit reports can be generated directly without manual recapitulation, which has the potential to improve the efficiency of visit data management. From the perspective of reducing recording errors, the system records visit data based on previously stored visitor information, thereby minimizing errors caused by inconsistent or illegible manual data entry. Overall, the results indicate that the designed and tested QR Code-based attendance system has the potential to support more efficient visitor attendance recording, particularly in terms of recording speed, ease of data management, and consistency of visit data.

Despite the satisfactory functional performance of the QR Code-based attendance system prototype, this study has certain limitations. The testing was conducted on a limited scale and did not involve direct implementation of the system in daily library service operations. Therefore, the results of this study represent the potential performance of the system based on functional testing rather than actual long-term operational efficiency.

This discussion critically examines the findings of the study by interpreting the results of the design and functional testing of the QR Code-based attendance system prototype. The analysis focuses on how the system performance, as evidenced by the test results, addresses the problem of visitor attendance recording in special libraries. As this study is positioned at the prototype level, the discussion reflects the potential system performance based on functional testing rather than long-term operational implementation (Lorincz et al., 2026).

The results demonstrate that the QR Code–based attendance system is capable of supporting visitor attendance recording through an integrated mechanism involving data input, processing, and output. Visitor data and QR Code scanning results function as system inputs that are automatically processed through validation and time-stamping mechanisms, producing structured visit data and reports as outputs. This integration indicates that the system prototype aligns with the fundamental principles of information systems, particularly in terms of data flow consistency and system interoperability (Zebua et al., 2026). In line with Information System theory proposed by Laudon & Laudon (2018), the automation of input and processing stages has the potential to reduce manual intervention, which in turn may minimize operational errors and improve processing efficiency. This shows that the developed system not only functions technically but also reflects the application of efficiency principles in information system management. Functional testing results further strengthen this interpretation. All core system modules—including visitor data management, QR Code generation, QR Code scanning, and visit report presentation—operated according to the system design specifications. The consistency of system behavior across these modules suggests that the prototype has sufficient operational capability to support computerized visitor attendance recording in a structured manner. This finding indicates that the system is not merely conceptual but demonstrates practical feasibility at the functional level (Meliala et al., 2024).

From an efficiency perspective, the study findings reveal that the QR Code–based attendance system has the potential to simplify the visitor recording workflow. In a conventional manual attendance recording process, visitors are required to write their identity in a guest book, which involves multiple steps such as filling in personal data and verification by librarians. This process generally takes approximately 20–30 seconds per visitor. In contrast, the QR Code–based system reduces the process into a single scanning activity that takes approximately 5–7 seconds. This indicates a potential reduction in recording time of more than 70%, indicating a potential improvement in operational efficiency. These time estimations are based on a comparative analysis between conventional manual recording procedures and the simulated workflow of the QR Code–based system observed during functional test

In addition to time efficiency, the structured storage of visit data within the system database enables direct report generation without additional data processing steps. This capability has the potential to enhance the efficiency of data management and may support faster access to attendance information for monitoring and reporting purposes. From an operational perspective, this may reduce the administrative workload of librarians by eliminating repetitive manual recording and recapitulation tasks, allowing them to focus more on user services and information management activities.

Compared to manual attendance systems that rely on handwritten records, the QR Code–based system provides higher accuracy and data consistency, as all visitor data are automatically recorded and validated by the system. Furthermore, compared to other digital attendance systems that still require manual input, the QR Code approach minimizes user interaction, thereby reducing the risk of human

error. This comparative advantage indicates that the system offers both functional and practical benefits in supporting library operations.

The findings of this study are consistent with prior research that highlights the effectiveness of QR Code technology in improving attendance recording efficiency and accuracy (Hamuda & Firdaus, 2025; Hendrawan et al., 2025; Rahmawati et al., 2025). These studies indicate that QR Code-based systems can enhance recording speed and reduce input errors. However, unlike most previous studies that focus on educational institutions, this research applies QR Code-based attendance recording within the context of special libraries. This contextual difference suggests that the benefits of QR Code technology are adaptable across different institutional settings, including library environments with unique visitor management characteristics.

Despite these positive indications, the discussion must consider the limitations of the study. The system evaluation was conducted through functional testing in a controlled setting and did not involve direct implementation in daily library service operations. Consequently, the efficiency gains identified in this study represent potential efficiency based on simulated comparisons rather than empirically measured performance. Therefore, future research is needed to conduct empirical testing involving real users to measure actual time efficiency, error reduction, and user acceptance in real operational environments.

Overall, the discussion indicates that the QR Code-based attendance system prototype effectively addresses the research problem by demonstrating its capability to support structured, computerized visitor attendance recording and by showing potential efficiency improvements in attendance management. The integration of QR Code technology and automated data processing provides a practical framework for enhancing visitor attendance services in special libraries, while also contributing to the theoretical application of information system efficiency in a library context. From a practical perspective, the system can reduce librarian workload and simplify administrative processes. However, its implementation may depend on device availability and user familiarity with QR Code technology.

## **E. CONCLUSION**

This study concludes that the design of a Quick Response Code (QR Code)-based attendance system successfully produced a structured and computerized prototype for recording visitor attendance in special library contexts. The findings indicate that the proposed system is able to support automated attendance recording through QR Code scanning and systematic data storage, thereby addressing the research objective of developing an alternative digital solution for visitor attendance management. The study further demonstrates that the designed system has the potential to improve attendance recording efficiency, particularly in simplifying recording workflows, facilitating data management, and maintaining data consistency. In addition, this study contributes theoretically by demonstrating how Information System principles, particularly input-process-output

mechanisms, can be applied to support efficient visitor attendance recording in special library contexts.

Despite these positive findings, this research is limited to the design and functional testing stage of a system prototype. Therefore, future research is recommended to implement the system in real operational library environments to evaluate its long-term performance, user acceptance, and measurable efficiency outcomes by conducting empirical testing involving real users to measure time efficiency, error reduction, and user acceptance in actual library service environments. Further studies may also explore system integration with other library management systems and assess its scalability across different types of libraries to strengthen the practical contribution of QR Code-based attendance systems.

## REFERENCE

- Acevedo, C. G., Batuigas, E., & Bialen, D. (2026). Utilization of and satisfaction with library services: The case of a state university. *Pantao: International Journal of the Humanities and Social Sciences*. <https://doi.org/10.69651/PIJHSS0501824>
- Aminudin, & Abinowi, E. (2025). Development of a Web-Based Library Application at SMK Lugina Rancaek. *International Journal of Multidisciplinary Research and Analysis (IJMRA)*, 8, 356–363. <https://doi.org/10.47191/ijmra/v8-i01-45>
- Anggraeni, E. Y., Hartati, S., & Murwanto, D. (2025). QR Code-Based Information System Designed to Display Irrigation Unit Data. *Bit-Tech*, 7(3), 750–757. <https://doi.org/10.32877/bt.v7i3.2165>
- Corral, S., González, M., & Blasco, J. L. (2017). The role of academic libraries in research data management: A systematic literature review. *The Journal of Academic Librarianship*, 43(6), 527–536. <https://doi.org/10.1016/j.acalib.2017.07.005>
- Hamuda, H., & Firdaus, M. F. (2025). Aplikasi Sistem Absensi Digital Berbasis QR Code pada SMAN 16 Kabupaten Tangerang. *Jurnal Pengabdian Masyarakat - Teknologi Digital Indonesia*, 4(2), 149. <https://doi.org/10.26798/jpm.v4i2.1959>
- Hendrawan, J., Perwitasari, I. D., & Maulana, F. (2025). QR Code-Based Attendance Systems in Education: A Systematic Literature Review on Data Accuracy and Sustainable School Management. <https://doi.org/10.64803/cessmuds.v1i1.14>
- International Federation of Library Associations and Institutions. (2015). *IFLA Standards and guidelines for library services*. <https://www.ifla.org/publications/>
- Laudon, K. C., & Laudon, J. P. (2018). *Management Information Systems: Managing the Digital Firm* (15th ed.). Pearson Education.
- Lorincz, J., Barišić, K., & Vlahović, V. (2026). Usability Testing and the System Usability Scale Effectiveness Assessment on Different Sensing Devices of Prototype and Live Web System Counterpart. *Sensors*, 26(2), 679. <https://doi.org/10.3390/s26020679>
- Malgwi, P. G., Sadiq, H., & Ahmed, H. (2025). Automation and Digital Transformation in Nigerian University Libraries: A Thematic Analysis of Emerging Trends and Challenges. *Journal of Applied Information Science & Technology*, 18(2), 73–86. <https://doi.org/10.70118/jaist.202501802.7>

- Meliala, R. J., Anggraeni, A., Holik, W., Manik, J. S. R., Hakim, G. J. P., Mindara, G. P., & Wicaksono, A. (2024). Web-Based Financial Information System Testing of PT Perta Sakti Abadi Using the Black Box Testing Method. *International Journal of Computer Technology and Science*, 2(1), 58–66. <https://doi.org/10.62951/ijcts.v2i1.129>
- Narangamma, B. P. K., & Shamila, L. M. A. (2025). QR Code Based Attendance Management System. *International Journal of Research and Innovation in Social Science*. <https://doi.org/10.47772/IJRIS.2025.90400372>
- Oyerinde, E. I., Idepefo, F., Odo, F., Onamade, A. A., Adeoti, B., Adediran, O., Adelowo, O., Laminga, M., Isaac, M., & Akinyosoye, O. O. (2025). Design and Implementation of a Secure QR Code-Based Attendance Management System for Higher Education. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 11(5), 77–89. <https://doi.org/10.32628/cseit25111699>
- Rahmawati, E., Brawijaya, H., Andriansyah, D., & Mufida, E. (2025). Optimalisasi Presensi Sekolah Berbasis QR Code dengan Metode Rapid Application Development. In *Computer Science (CO-SCIENCE)* (Vol. 5, Number 2). <https://doi.org/10.31294/coscience.v5i2.8505>
- Siagian, S. P. (2015). *Manajemen Sumber Daya Manusia* (Revisi). Bumi Aksara.
- Sulthoni, M. H., Windarni, V. A., Atmaja, S. T., Istiqomah, D. A., & Puri, F. M. (2025). Design and Implementation of a QR Code-Based Attendance Application at SMA Negeri 1 Cangkringan. *Jurnal E-Komtek (Elektro-Komputer-Teknik)*, 9(1), 123–136. <https://doi.org/10.37339/e-komtek.v9i1.2392>
- Zebua, D. Y., Lase, E. D., Lahagu, D. K., Zandrato, J. F. C., & Zai, I. T. C. (2026). Integrasi Sistem Informasi Antar Unit Kampus Menggunakan Basis Data Terintegrasi. *Jurnal Komputer Teknologi Informasi Sistem Informasi (JUKTISI)*, 4(3), 2224–2230. <https://doi.org/10.62712/juktisi.v4i3.826>