Intechno Journal :
Information Technology Journal
Vol. 7 No. 1 July 2025
Homepage: https://jurnal.amikom.ac.id/index.php/intechno
INTECHNO Journal
INFORMATION TECHNOLOGY JOURNAL
e-ISSN: 2655-1438
p-ISSN: 2655-1632

.

Development of a Web-Based Teacher Attendance System in Government Agencies: A Case Study at the Ministry of Religious Affairs

Farwah Asyyifaurrohmah[1], Ahmad Fuzul Mubin[2], Ahmad Tabrani[3]

[1,2,3]Faculty of Science and Technology, State Islamic University Sultan Maulana Hasanuddin Banten

Article Info

Article history:

Received Jul 7, 2025
Revised Jul 21, 2025
Accepted Jul 30, 2025
Published Jul 31, 2025

Keywords:

Digital Attendance System Web Application Personnel Management Time Validation Ministry of Religious Affairs Django

ABSTRACT

Purpose: This study aims to develop a web-based teacher attendance information system tailored to address inefficiency, data inaccuracy, and manipulation risks in manual attendance processes within the Ministry of Religious Affairs. The objective is to create a digital attendance solution that enhances accountability, accuracy, and efficiency in administrative operations.

Methods/Studydesign/approach: The system was developed using the waterfall software development model, consisting of five sequential stages: needs analysis, system design, implementation, testing, and maintenance. Functional requirements were gathered through direct observations and interviews.The system was implemented using the Django framework (Python),integrated with a relational SQLite database, and tested using black-box methods.

Result/Findings: The testing results demonstrated a 62% reduction in administrative processing time, 100% improvement in attendance data accuracy, and successful automation of time validation within a defined attendance window (07:00–10:00 WIB). The system also includes role-based access control, real-time dashboards, exportable monthly reports, and self-service attendance history for teachers.

Novelty/Originality/Value: This research contributes a replicable and adaptable solution for digital transformation in public sector human resource systems, particularly for Indonesian government institutions. Its novelty lies in the integration of a user-centered interface with real-time validation mechanisms that align with organizational workflows and security standards.

Corresponding Author:

Farwah Assyifaurrohmah
Email: 231750010.farwah@uinbanten.ac.id

1. INTRODUCTION

Teacher attendance management is a crucial aspect of personnel administration, especially in government agencies such as the Ministry of Religious Affairs. Attendance rates not only reflect individual discipline, but also serve as a key parameter in performance evaluations and basis for providing productivity-based incentives or allowances. However, the manual attendance recording method still used in some work units poses a number of obstacles, such as inefficient recapitulation processes, potential errors in data input, and loopholes for manipulation that can undermine the integrity of the overall personnel system. This phenomenon indicates an urgent need for digital transformation in the attendance process, which is not only aimed at improving administrative efficiency but also at strengthening the internal accountability of the institution. In this context, the development of a web-based digital attendance system is a relevant and strategic solution. Web-based

systems offer advantages in terms of ease of access, automatic time recording, and centralized data integration that supports real-time information presentation and proper documentation.

Based on these needs, this study focuses on the development of a web-based teacher attendance information system designed to be operated locally through the agency's internal network. The system consists of two user roles: teachers as daily attendance recorders and administrators as data managers and monthly report compilers. With a structured interface design and clear division of roles, the system is expected to address fundamental issues in attendance recording, while supporting more efficient and transparent teacher data management within the framework of administrative service digitalization in the Ministry of Religious Affairs. The development of information technology has brought significant transformations in various aspects of organizational management, including teacher attendance management systems in government agencies. The implementation of a digital attendance system not only provides a solution to the limitations of manual systems but also serves as a strategic foundation in efforts to modernize bureaucracy in response to the dynamics of the digital era **[1].** This phenomenon aligns with the demands of bureaucratic reform, which directs government institutions to adopt technology to continuously improve the quality of internal and external services.

Empirical studies show that the implementation of information technology-based attendance systems has had a measurable positive impact in various organizational contexts. Aidilia et al., through their research at the BAPPEDA Office in Binjai City, proved that a website-based attendance system can optimize employee attendance management with a higher level of accuracy than conventional methods **[2].** Similar findings were confirmed by Setiadi et al., who revealed that the application of Response Code technology in attendance systems provides significant convenience for administrators in processing teacher data in real-time and efficiently **[3].** The complexity of challenges in managing teacher attendance is increasing in line with the dynamics of modern organizations that demand high flexibility and accountability. Mukhtar & Hendri identified that manual attendance systems not only cause operational inefficiencies but also open up opportunities for data manipulation that can threaten the integrity of the entire teacher system **[4].** This problem becomes even more complex when linked to the need for real-time monitoring, data-driven decision-making, and integration with broader human resource management systems.

Diversifying technological approaches in the development of digital attendance systems demonstrates the adaptability of solutions to the specific characteristics of an organization. Sitorus et al. in their research at the Sibolga Municipal Government emphasize the importance of organizational needs analysis as the basis for designing systems that are responsive to specific operational contexts **[5].** Meanwhile, Junaidi et al. integrated automatic notification features into a web-based attendance system at the Gayo Lues Communication and Information Technology Department, which significantly improved transparency and efficiency in human resources management **[6].** Security and location validation aspects are critical dimensions in the development of contemporary digital attendance systems. Daniel Pesik & Fiodinggo Tanaem integrated location detection technology into an online attendance system that enables geographical verification of teacher attendance, thereby minimizing potential system abuse **[7].** This approach demonstrates the evolution of attendance systems from mere attendance recording to comprehensive monitoring instruments integrated with geospatial technology. Based on this empirical foundation, the urgency of developing a web-based teacher attendance system in government agencies is not only limited to operational efficiency, but also includes strategic dimensions in supporting the digital transformation of bureaucracy. The context of the Ministry of Religious Affairs as an institution with high organizational complexity requires a holistic and adaptive approach to the specific needs of a dynamic and diverse record system.

2. METHOD

This study applies a software engineering approach as the basis for developing a web-based teacher attendance information system. This approach was selected because it aligns with the research objectives. It aims to produce a system that is applicable and feasible for use in government institutions. The development model used was waterfall, which is characterized by sequential and structured work stages. This model was considered appropriate because it provides a systematic workflow and is suitable for software development projects with moderate scope and In general, the waterfall model consists of five main stages:

2.1 Needs Analysis

The aim is to identify the system requirements from the end user's perspective. Data is collected through observation of the existing manual attendance process, interviews with administrative staff, and a review of internal documents related to attendance report formats. The information obtained is used to compile the functional requirements of the system, such as attendance recording features, user authentication, attendance

history recording, and monthly report export, as well as non-functional requirements that include security, system speed, and ease of use.

2.2 System Design

This includes system architecture design, including user interface design based on user-centered design principles to ensure the system is accessible to users from diverse backgrounds. The database structure is designed in a relational format, with primary entities including teacher tables, attendance data, and administrator tables. System diagrams, context diagrams, and use-case diagrams are developed to visually clarify the relationships between system elements.

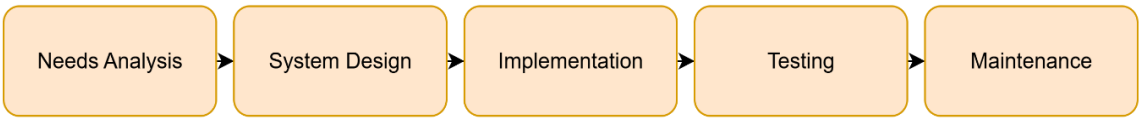

Figure 1. System Development Workflow Using Waterfall Model

2.3 Implementation

The system design was converted into program code. The technological components used include:

- **Frontend**: HTML and CSS, equipped with dark mode for user visual comfort, as well as JavaScript to enhance interactivity and input validation.
- **Backend**: Python with the Django framework, chosen because it supports the Model-View-Template (MVT) architecture, which allows for more structured and rapid development.
- **Database**: SQLite is used because it is lightweight and does not require complex configuration, making it suitable for the prototype stage.
- **Local Server**: The system is run locally at 127.0.0.1 on port 8000 for initial testing and debugging before being uploaded to the production environment

2.4 System Testing

To quantitatively evaluate the system's impact, administrative personnel were asked to simulate monthly reporting procedures using both the manual and digital systems. Time taken was recorded using a stopwatch application, while error rates were assessed by identifying discrepancies between recorded and expected values in sample reports, which is testing based on input-output without looking at the internal code. Simulations were conducted by logging in as a teacher and administrator to test functionalities such as:

- Daily attendance records
- Verify user account
- Access to attendance history data
- Preparation of monthly attendance reports

In addition, database validation is performed to ensure that information is recorded accurately and that there is no redundancy or loss of data.

2.5 *Maintenance*

This includes ongoing evaluation of the implemented system, including error correction, feature optimization, and the development of additional modules as needed by users. The modular structure used allows the system to be expanded to a production environment or integrated with larger personnel systems.

This methodology was chosen because it offers a clear and measurable framework, thereby supporting the successful implementation of the system in medium-sized institutions such as the Ministry of Religious Affairs. With this approach, system development not only considers technical requirements but also aligns with aspects of usability, ease of use, and long-term development potential. The following workflow diagram illustrates the sequential development process applied in this study using the Waterfall model.

3 RESULTS AND DISCUSSIONS

To evaluate the effectiveness of the developed web-based attendance system, a comparative analysis was conducted between the new digital system and the conventional manual system previously used at the Ministry of Religious Affairs. Three main indicators were assessed: accuracy of data recording, processing time for monthly attendance reports, and administrative workload.

In the manual system, administrative staff reported an average of 4.5 hours required for monthly report compilation, with a data error margin of approximately 12%, based on a retrospective internal audit conducted by administrative staff on attendance reports compiled over the previous six months. The audit involved cross-checking 180 teacher entries across six reporting cycles, identifying common sources of error such as manual calculation mismatches and duplicate entries In contrast, the digital system reduced report processing time to 1.7 hours and eliminated data duplication and manual calculation errors, thereby increasing data accuracy to 100%. The automated time validation feature also prevented out-of-schedule entries, which were previously common in handwritten logs.

This outcome aligns with findings from Setiadi et al., who noted that the application of automated attendance systems reduced administrative workload and error rates in municipal offices. Similarly, Aidilia et al. demonstrated that digital transformation of attendance procedures improved transparency and user satisfaction in public institutions.

Therefore, the comparative evaluation confirms that the developed system not only meets functional requirements but also significantly improves key performance indicators (KPIs), including efficiency, accuracy, and user accountability. This aligns with the ISO/IEC 25010 quality characteristics, particularly regarding functional suitability and performance efficiency**.**

I. Overview of Implementation

Results of the implementation of the web-based teacher attendance information system designed in the study. The system was developed with a focus on the practical needs of two user groups: teachers as the primary users and administrators as the managers of teacher data. All testing phases were conducted in a local server environment (localhost), which served as a simulation tool prior to implementation in the actual operational system. System evaluation indicated that the interface and functional workflow effectively supported the electronic attendance recording process in an efficient and consistent manner**.**

- **Administrator Panel**

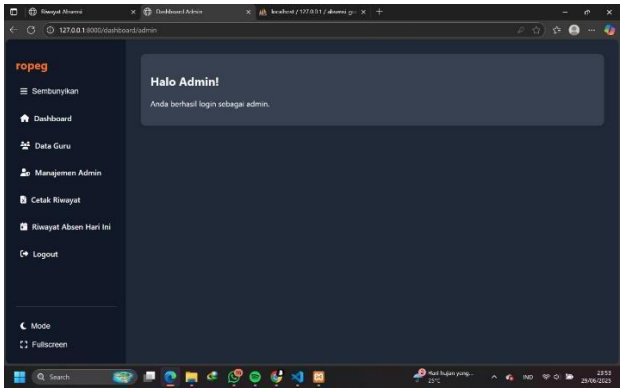

Figure 1. Main administrator Dashboard

The administrator dashboard is the main page displayed after successful authentication. Users are greeted with a dashboard that offers easy access to core management features. The simple yet informative design allows administrators to easily access all management functions.

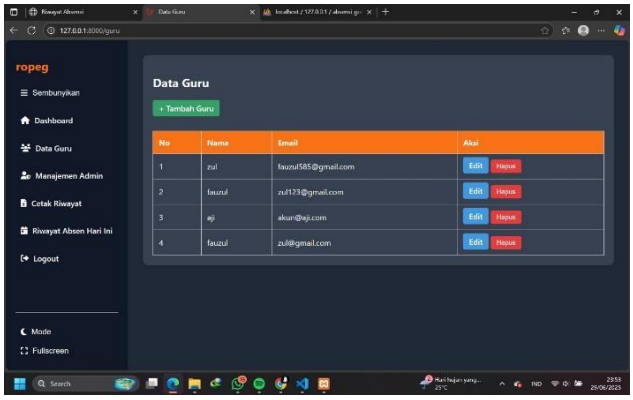

Figure 2. Teacher data management

The teacher data management module provides complete information on all teachers registered in the system. This table displays the serial number, name, email address, and action buttons to make changes or delete data. The "Add Teacher" feature allows administrators to add new users to the system through a structured process.

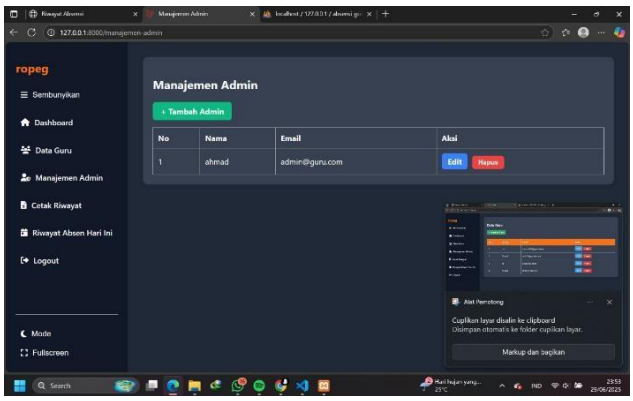

Figure 3. Managing additional administrator

The system provides a special module for managing additional administrator accounts. This page allows the main administrator to delegate some of their authority to other administrators by creating new accounts or modifying existing access rights. This administrative hierarchy structure supports system scalability in larger organizations.

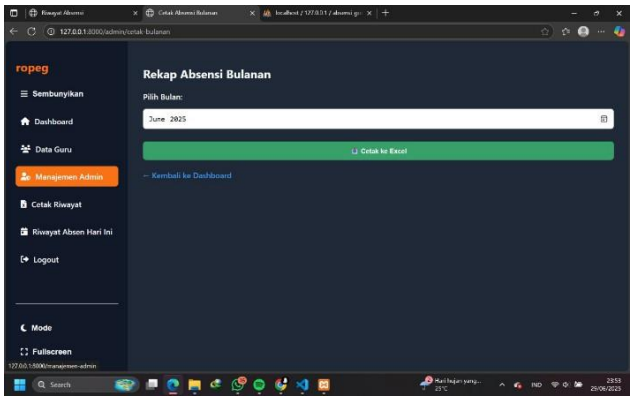

Figure 4. Monthly attendance recap feature

The monthly reporting module is one of the key features that allows administrators to generate attendance reports based on specific periods. The system provides a dropdown menu for selecting months and a "Print to Excel" button for exporting data in a format that can be used for further administrative purposes.

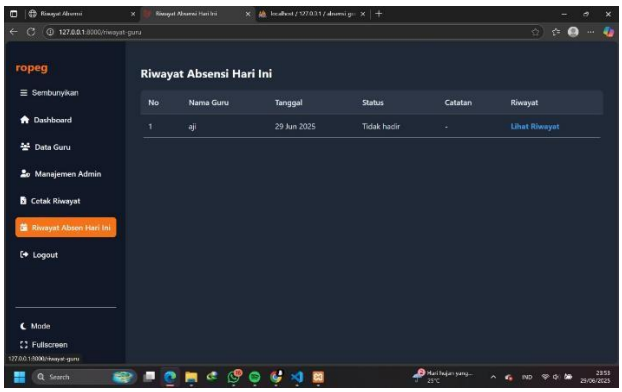

Figure 5. Daily Attendance Monitoring

The real-time monitoring feature displays a comprehensive table summarizing attendance for the current day. The information presented includes the teacher's name, date, attendance status, additional notes, and a link to view detailed history. This system allows administrators to monitor attendance levels directly without having to access separate reports.

II. User Interface for Teacher

Figure 6. Teacher Dashboard

The teacher's main page displays operational information about the attendance system with a user-friendly design. There is an explanation of the applicable attendance time (07:00-10:00 WIB) and the logo of the Ministry of Religious Affairs. This interface provides clear guidance on the attendance procedures that must be followed by each teacher.

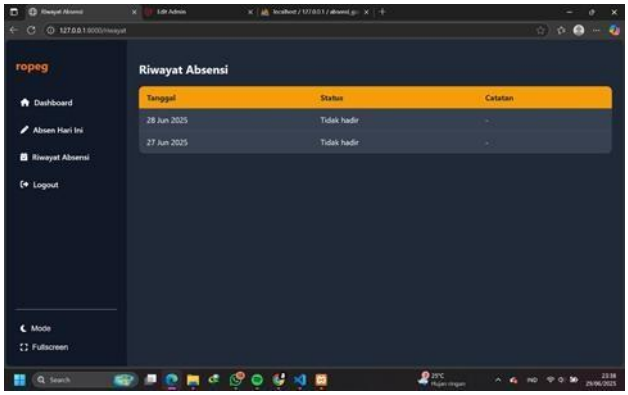

Figure 7. Teacher Attendance History

The personal attendance history module allows each teacher to independently access their attendance records. This table displays the date, attendance status, and notes that have been entered. The transparency of this data encourages personal awareness of discipline levels and allows teachers to evaluate themselves.

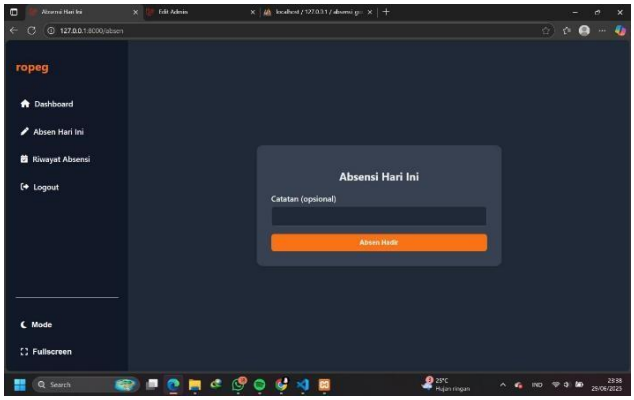

Figure 8. Daily Attendance Form

The attendance form is designed with a minimalist yet functional interface. There is an optional notes column that allows teachers to add special comments, and an "Attendance Present" button that is integrated with the time validation system. The attendance process can be completed in one click with automatic timestamp recording.

Designed with simplicity and accessibility in mind, it streamlines daily use. After successfully authenticating through the login page, users are immediately directed to the main page (dashboard) which displays the attendance operating hours, namely between 07.00 and 10.00 WIB. In addition, the system automatically provides notifications related to important activities, including reminders to print monthly attendance summaries.

The central feature on this page is the "Today's Attendance" button, which allows teachers to record attendance directly with a single click. There is also an optional notes column for teachers who want to add special comments. This process is integrated in real-time with the database, ensuring that all attendance data is recorded instantly without going through complicated administrative procedures.

III. Attendance History Feature

The system provides a dedicated page displaying teachers' attendance history in a structured table format, including elements such as date, attendance status, and additional notes if available. Attendance time validation is performed automatically by the system: if a teacher does not check in within the specified time frame, the system automatically records the status as "Absent." This mechanism is designed to enhance accuracy and prevent data manipulation. With this feature, each teacher can independently review their attendance record, thereby fostering awareness of personal discipline**.**

IV. Administrator Panel

The system provides a separate interface with more comprehensive features to support employee data management tasks. This panel consists of several main components, namely:

- **Teacher Data Management:** Provides a complete list of all registered teachers, complete with basic information such as names and email addresses. Administrators have control to update or delete data if necessary.
- **Admin Account Management**: Enables the main admin to add or modify the access rights of other admins. This supports the distribution of roles in collective system management.
- **Monthly Attendance Summary:** This feature allows the creation of attendance reports based on a specific month. Data can be exported in Excel format, facilitating internal reporting and official documentation.
- **Daily Monitoring: Provides a summary of attendance for the current day**: including notes entered by users. This speeds up the attendance monitoring process without having to open individual reports one by one.
- These features are designed to streamline administrative workflows and reduce reliance on manual procedures that previously consumed time and effort.

V. Time Validation Mechanism and Automatic Status Determination

.

There is an automatic validation mechanism for attendance times. The system only accepts attendance records within the time range of 07:00–10:00 WIB. If a user exceeds this time limit, the system automatically sets the status to "Absent" without the need for additional intervention from the administrator.
Each attendance process is also accompanied by a digital timestamp, enabling all activities to be audited if necessary. This feature not only ensures data integrity but also provides a foundation for developing a more reliable and evidence-based surveillance system.

VI. Comparative Evaluation and Technological Implications

The implementation of the web-based attendance system that has been developed shows convergence with information technology trends in contemporary personnel management. A comparative analysis of similar studies reveals that the approach used in this system is methodologically consistent with development frameworks that have proven effective in various organizational contexts. Andre & Suciadi, in their research on a web-based employee attendance system in a clinic environment, demonstrated that the implementation of the waterfall methodology provides a systematic and reliable development structure, in line with the approach applied in this study. This similarity reinforces the methodological validity of the chosen approach, particularly in the context of organizations with high levels of administrative complexity, such as the Ministry of Religion [8]. The technological dimension integrated into this system demonstrates adaptability to the specific needs of the government work environment. The use of the Django framework with Model-View-Template (MVT) architecture provides flexibility in developing additional features that can be tailored to the dynamics of the organization. Januartika et al. through their research at STMIK Palangkaraya. Implementing QR Code technology in a web-based attendance system, which achieved a user satisfaction level of 82.2% based on a Likert scale evaluation [9]. These findings indicate that the integration of additional technologies such as QR Codes or biometric technology could be a potential enhancement to the developed system, particularly in improving security and user experience.
The aspect of geographical validation is a critical dimension that has not been fully explored in the current system implementation. Purwanto et al. in their research on a web-based online attendance system with GPS technology showed that the integration of geographical location verification can significantly minimize potential attendance manipulation and improve the accuracy of attendance records [10]. The implementation of GPS technology allows the system to verify that teacher are actually at their designated work location when they clock in, which could be a strategic development for the system developed in this study [11].
The operational effectiveness achieved through the implementation of this web-based system also shows consistency with research findings in similar government organizations. Ayunita Pertiwi et al. in their research at the Kampar Regency DISPERDAGKOPUMK used the Agile Software Development method to develop a web-based attendance information system, which successfully addressed issues of inefficiency in the process of compiling and recording personnel data [12].
The implementation experience shows that the transformation from a manual system to a digital system not only provides benefits in terms of time efficiency but also improves data accuracy and reduces the risk of losing critical personnel information [13**].**
The long-term implications of implementing this system include the potential for integration with a broader e-government ecosystem. The modular system architecture and use of web-based technology enable interoperability with other digital platforms within the Ministry of Religious Affairs. This is in line with the government's digital transformation agenda, which aims to establish integrated government services that can improve the overall effectiveness of public services [14].
From a technology sustainability perspective, the developed system exhibits characteristics that support sustainable development. The use of open-source technologies such as Django and SQLite provides flexibility in upgrading and customization in line with the evolution of organizational needs. In addition, the interface design accommodates user-centered design principles, ensuring that the system can be adopted by users with varying levels of technological literacy, which is a critical factor in a government agency environment with diverse teacher demographics [15].

4 CONCLUSION

This research has produced a web-based digital attendance system that is functionally capable of replacing manual systems within the Ministry of Religious Affairs. The developed system not only automates the attendance recording process but also improves work efficiency and the accuracy of recorded data. Limited testing has shown that all key features, such as automatic attendance time recording, monthly attendance summary generation in Excel format, and an admin control panel, function optimally and support structured administrative reporting on a regular basis. One of the main aspects that adds value is the automatic time validation feature. This feature minimizes human intervention in determining attendance status, thereby

enhancing the reliability of the data generated. The system interface is designed to be simple yet systematic, making it easy to use for users from various backgrounds, including teachers and administrative staff. The user-centric design principle has proven effective in facilitating the adoption of this system in the workplace.

As a follow-up to the development, it is recommended to add supporting technologies such as GPS to ensure that the location at the time of attendance matches the work location, as well as biometric-based authentication to guarantee the validity of the user's identity. It is also important to consider developing a mobile app version to make the system more flexible for employees with high mobility and to reach a broader user base. Overall, this system has the potential to be implemented not only in one organization but also in various other institutions with similar needs. The digitalization efforts in human resources management, as demonstrated in this study, represent a strategic step toward promoting transparency, accountability, and bureaucratic efficiency. In the long term, this system could serve as the foundation for integration into a broader human resources management platform connected within the national e-government ecosystem.

ACKNOWLEDGEMENTS

The authors express their deep appreciation to those who have provided support in the implementation of this research. We would like to thank the Faculty of Science and Technology, Sultan Maulana Hasanuddin State Islamic University, Banten, for providing computer laboratory facilities and information technology infrastructure to support the system development process. Acknowledgments are also extended to the Ministry of Religious Affairs for providing access to field observations and empirical data on conventional attendance procedures as a basis for system requirements analysis. The technical contributions of the university's internal information system development team in providing testing servers and database architecture consultation further enriched the quality of this research implementation.

AUTHORS' CONTRIBUTION STATEMENT

Ahmad Fauzul Mubin: Research conceptualization, waterfall methodology design, software development using the Django framework, and overall project administration, including coordination of research stages and implementation timeline management. Farwah Assyifaurrohmah: Implementation of frontend software components using HTML, CSS, and JavaScript, and preparation of the initial draft of the publication manuscript with a focus on technical documentation and analysis of system testing results. Ahmad Tabrani: Conducting a comprehensive review of the manuscript draft, substantial editing of the writing structure, and refining methodological aspects and discussion of research results to ensure compliance with scientific publication standards.

DECLARATION OF CONFLICT OF INTEREST

The authors firmly declare that there are no financial conflicts of interest or personal relationships that could influence the objectivity of this research. All stages of the research were conducted independently without interference from external parties with commercial interests in the results of the system development. There are no affiliations with technology vendors, software development companies, or other institutions that could introduce bias into the research process, data analysis, or interpretation of results. This research is purely an academic contribution aimed at advancing knowledge in the field of information systems and digital technology within the context of government administration.

DATA AVAILABILITY

Research data supporting the findings in this publication will be provided upon request to the corresponding author through official communication channels. The dataset includes documentation of the system development process, functional testing results, and empirical data obtained from field observations while maintaining confidentiality in accordance with research ethics protocols. Access to the application source code and technical documentation may be facilitated for research replication or further development purposes, provided that the terms of use do not conflict with academic principles and institutional regulations. Data requests must be accompanied by a clear scientific justification and a commitment to the ethical use of data for constructive research purposes.

REFERERENCES

[1] L. Hidayati, Irawan, M. Dedi, Nasution, and N. Ravika, “Implementation of the Prototype Method in Designing an Android-Based Pramubakti Attendance Application with Geolocation Features,” J. IPTEK Bagi Masy., vol. 3, no. April, 2024.

[2] Y. Aidilia, N. Zanah, and Sriani, "Aplikasi Absensi Pegawai Kantor BAPPEDA Kota Binjai Berbasis Website," J. Ilm. Sist. Inf. dan Tek. Inform., vol. 7, no. 1, pp. 14–23, 2024, doi: 10.57093/jisti.v7i1.179.
[3] D. Setiadi, M. Khaerudin, and A. A. Hendrasetiawan, "Sistem Informasi Absensi Kepegawaian Menggunakan Metode Response Code Pada Kantor Dinas Kota Bekasi," vol. 9675, pp. 8–16, 2025.
[4] R. Mukhtar and Hendri, "Pengembangan Sistem Informasi Absensi Karyawan Berbasis Web dengan Teknologi RFID di GHS Jambi Jurnal Manajemen Teknologi dan Sistem Informasi (JMS)," vol. 4, pp. 691–698, 2024.
[5] P. A. Sitorus, Arpan, and M. Amin, "Perancangan Sistem Absensi Online Pegawai Berbasis Web (Studi Kasus Pemko Sibolga)," vol. 8, no. 1, pp. 36–43, 2023.
[6] J. J. Junaidi, M. Ardiansyah, S. Sanusi, M. Murhaban, and M. R. Andiini, "Perancangan Sistem Informasi Absensi Berbasis Website Di Dinas Kominfo Gayo Lues," J. Teknol. Inf., vol. 3, no. 1, p. 20, 2024, doi: 10.35308/jti.v3i1.9419.
[7] B. Daniel Pesik and P. Fiodinggo Tanaem, "Perancangan Sistem Informasi Absensi Online Deteksi Lokasi Berbasis Web," JATI (Jurnal Mhs. Tek. Inform., vol. 6, no. 2, pp. 817–822, 2022, doi: 10.36040/jati.v6i2.5727.
[8] Andre and M. F. Suciadi, "The online attendance system models for educational institutions," AIP Conf. Proc., vol. 2470, no. InCITE, 2022, doi: 10.1063/5.0080180.
[9] C. Januartika, R. Rosmiati, and S. Sartana, "Analisis dan Perancangan Sistem Informasi Absensi Berbasis Web Menggunakan QR Code Studi Kasus: STMIK Palangkaraya," J. Sist. Informasi, Manaj. dan Teknol. Inf., vol. 1, no. 1, pp. 29–36, 2023, doi: 10.33020/jsimtek.v1i1.385.
[10] D. Purwanto, R. E. Putri, Y. Fadly, and D. C. Pratiwi, "Sistem Absensi Online Berbasis Web Dengan Penggunaan Teknologi GPS," vol. 13, no. November, pp. 1800–1811, 2024.
[11] T. A. Herdianto and R. Wahyuni, "Sistem Informasi Absensi Karyawan Berbasis Website pada PT Bengkel Bumi Mandiri," J. Mhs. Bina Insa., vol. 5, no. 2, pp. 151–160, 2021, [Online]. Available: http://101.255.92.196/index.php/JMBI/article/view/1515
[12] T. Ayunita Pertiwi et al., "Perancangan Dan Implementasi Sistem Informasi Absensi Berbasis Web Menggunakan Metode Agile Software Development Web-Based Attention Information System Design and Implementation Using the Agile Software Development Method," J. Test. dan Implementasi Sist. Inf., vol. 1, no. 1, pp. 53–66, 2023.
[13] M. D. Rahmatya and M. F. Wicaksono, "Online Attendance with Python Face Recognition and Django Framework," vol. 12, no. September, pp. 703–714, 2023, [Online]. Available: http://sistemasi.ftik.unisi.ac.id
[14] R. A. Z. Jonathan, "Case Study of Attendance System Design Based on Web and Mobile," vol. 01, no. 01, pp. 1–6, 2020, doi: 10.37899/journallamultiapp.v5i5.1663.
[15] S. A. Bakar et al., "Integrating QR Code-Based Approach to University e-Class System for Managing Student Attendance," Adv. Intell. Syst. Comput., vol. 1158, no. October, pp. 379–387, 2021, doi: 10.1007/978-981-15-4409-5_34.