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Web-Based Attendance Information System At Diskominfosantik Bekasi District With Prototype Method

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ABSTRACT

Efficient and transparent attendance management remains a challenge in many government institutions due to the persistence of manual and semi-digital systems. This study aims to design and implement a web-based attendance information system at the Department of Communication, Informatics, Statistics, and Encryption (Diskominfosantik) of Bekasi Regency using the prototype development method. The system was developed iteratively with continuous user involvement to ensure alignment with organizational needs. Core features include role-based login authentication for administrators and employees, barcode scanning for attendance validation, GPS integration for verifying attendance location, digital leave requests, and real-time attendance data management and reporting. System testing was conducted using the black box method, applying various techniques such as all-pair testing, boundary value analysis, and state transition testing to validate functionality without accessing internal code. Additionally, system workflows were modeled using use case and class diagrams to illustrate interactions and data structures. This study introduces a novel approach by integrating both barcode and GPS-based attendance validation within a public sector setting, addressing the limitations found in earlier systems that lacked location verification or focused solely on the private or educational sector. The results show that the implemented system enhances recording accuracy, accelerates the data recap process, and supports accountability in attendance documentation, offering a relevant example of digital transformation in local government administration.

Keywords: Information System; Employee Attendance; Web-Based; Prototype; Black Box Testing.

INTRODUCTION

Employee attendance data serves as a fundamental basis for evaluating discipline, performance, and accountability in any institutional setting. In government agencies, the need for reliable and timely attendance records is closely linked to the quality of public service delivery and administrative transparency. However, many regional institutions, including the Communication, Informatics, Cryptography, and Statistics Agency (Diskominfosantik) of Bekasi Regency, still rely on conventional attendance systems, namely fingerprint scanners and manual data input. These methods are prone to inefficiencies such as delays in recording, human error, and lack of integration with other administrative systems, thereby hindering effective personnel management.

The growing emphasis on digital governance has pushed public institutions to adopt technology-based solutions to modernize their operations. Web-based information systems, in particular, offer substantial advantages in terms of scalability, real-time data access, centralized management, and compatibility with emerging technologies such as geolocation and QR/barcode validation. This technological shift is in line with global trends where government agencies are urged to transition from semi-manual processes to digital platforms that support transparency, accountability, and responsiveness. Rashid et al., (2022) highlight that integrating GPS and QR code technologies can significantly improve the integrity of attendance data, especially in public sector contexts where location verification is essential.

A number of previous studies have examined the development of attendance systems in various environments. proposed a web-based school attendance application capable of functioning both online and offline, thus supporting areas with limited connectivity. Putra, (2022) demonstrated how the use of an interactive prototype method in designing attendance systems improved data accuracy in local government offices. Mulia, (2020) introduced a web-based system for student attendance reporting in higher education institutions, emphasizing ease of use and interactive interfaces. Similarly, Juniawan et al., (2021) explored the application of mobile systems to monitor student grades and attendance, providing parents with real-time updates. These examples demonstrate the flexibility and adaptability of web-based systems in managing routine administrative tasks.

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Despite these contributions, the application of such technologies in local government institutions remains limited. Most existing systems are developed for educational institutions or private-sector use, with relatively few designed specifically to address the structural and operational dynamics of public agencies. Moreover, while many systems include barcode or QR code functionality, only a small number incorporate geolocation validation, which is crucial for verifying employee presence at designated locations. Almusallam et al., (2023) assert that location-aware systems are essential for enhancing trust and minimizing fraudulent reporting in civil service contexts, yet their implementation in Indonesian regional institutions has been underexplored.

This gap illustrates the urgent need for a system that not only digitizes attendance but also ensures its integrity through multi-layered verification. A comprehensive solution must accommodate the organizational hierarchy, user roles, and specific workflow of the public institution it serves. In the case of Diskominfosantik Bekasi, an agency tasked with leading digital transformation and managing sensitive public data, an integrated and secure attendance system is crucial. The current lack of automation and location validation features undermines operational effectiveness and limits the agency's capacity to align with national digital governance mandates.

To respond to these challenges, this study develops a web-based attendance information system specifically for the operational environment of Diskominfosantik Bekasi Regency. The system is designed to incorporate secure role-based authentication, barcode scanning for clock-in/clock-out validation, GPS-based location verification, and real-time attendance monitoring and reporting. By aligning with the agency's workflow and involving users in an iterative development process, the system aims to enhance the accuracy, efficiency, and accountability of attendance management in public administration.

LITERATURE REVIEW

The development of attendance information systems has gained significant attention in the context of digital transformation, particularly in efforts to modernize public sector administration. Web-based attendance systems are widely recognized for their ability to improve data recording efficiency, ensure accuracy, and provide transparency in reporting. Compared to manual or semi-digital systems, web-based platforms enable faster, more automated, and accessible attendance management processes.

Yulianto, (2021) designed a school attendance system that could operate both online and offline using the prototype method, which was particularly suitable for regions with limited internet infrastructure. Putra, (2022) applied a similar approach in a local government setting and found that interactive prototypes were more effective than rigid waterfall models in accommodating user needs. Both studies underline the importance of flexibility and iterative development in attendance system design.

In the private sector, Fridayanthie et al., (2021) built a web-based payroll system that was directly integrated with employee attendance data, resulting in reduced human error and improved operational efficiency. Mulia, (2020) developed a student attendance system for Padang State Polytechnic using a web interface and UML modeling, simplifying reporting and data storage. Juniawan et al., (2021) created an Android-based application that allowed parents to monitor student attendance and academic activities in real time, showing the usefulness of mobile access and user participation.

Meanwhile, Bimawan et al., (2024) emphasized user-centered design in developing a sports partner booking system, demonstrating that involving end users from early design stages improves system usability. Although not directly focused on attendance, this study supports the relevance of participatory design principles.

From a broader perspective, Rashid et al., (2022) proposed a secure web-based attendance system with GPS and QR code integration for enterprise use, proving that location-based validation enhances data authenticity. In a public sector context, Almusallam et al., (2023) argued for the need for location-aware attendance systems, although their model did not incorporate user role differentiation.

To provide a clearer comparison, Table 1 summarizes key prior research on web-based attendance systems, focusing on methods, features, and outcomes.

Table 1. Summary of Related Studies on Attendance Information Systems

Author(s)	Year	Method	Key Features	Key Findings
Yulianto	2021	Prototype	Web-based, offline-online mode	Suitable for limited connectivity; flexible implementation
Putra	2022	Prototype	Web-based, employee focus	Improved accuracy; responsive to user feedback

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Fridayanthie et al.	2021	Prototype	Attendance + payroll integration	Increased operational efficiency; minimized manual errors
Mulia	2020	Prototype	Web-based, academic focus	Simplified student attendance reporting
Juniawan et al.	2021	Prototype	Mobile app, parental monitoring	Real-time access to student data
Bimawan et al.	2024	Human Centered	UX-focused booking system	Emphasized user involvement in digital system design
Rashid et al.	2022	Design Study	GPS, QR code, web-based	Enhanced security and location-based validation
Almusallam et al.	2023	Case Study	Location-aware attendance system	Advocated GPS-based presence tracking in public institutions

Despite the variety of methods and applications reviewed, a noticeable research gap remains. Most studies focus either on education or private-sector contexts, while few explore the specific needs of local government institutions. Furthermore, while barcode or QR code scanning and GPS features have been used individually, and some systems incorporate flexible login mechanisms, no existing study in the public sector has combined barcode scanning, GPS-based location validation, and role-based authentication within a prototype development framework.

This study aims to fill that gap by developing a web-based attendance system tailored to the operational structure of Diskominfosantik Bekasi Regency. By integrating secure authentication, spatial validation, and user-specific access levels, the system is expected to support more accurate, accountable, and transparent attendance processes in the local government context.

METHOD

This study adopts the prototyping method as the primary approach in developing a web-based attendance information system for the Communication and Information Agency (Diskominfosantik) of Bekasi Regency. The prototyping method was selected due to its iterative and user-centered characteristics, which allow for rapid feedback loops and continuous improvement during development (Pressman, 2005). This approach ensures that the final system closely aligns with the operational needs and contextual requirements of the institution.

The development process followed a structured sequence, as illustrated in Figure 1, outlining stages from requirement analysis to system implementation.

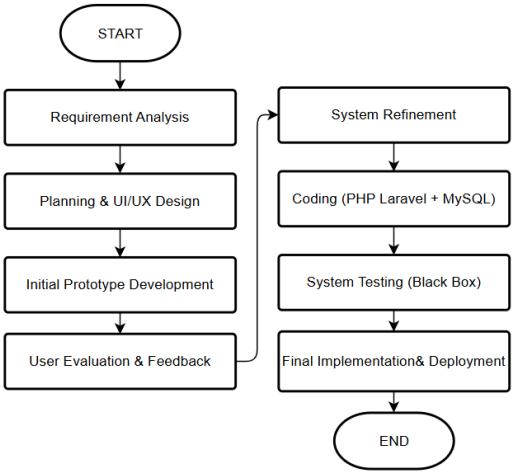

Fig. 1 Research Flow

The initial phase began with requirement analysis, where developers and stakeholders collaboratively identified essential features, access roles, and workflow specifications. This was followed by the planning and design stage, which focused on creating user interfaces, input-output structures, and technical flow mapping. A basic prototype was then built for user evaluation, and feedback was used to improve design and functionality iteratively.

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For implementation, the system was developed using the PHP programming language with the Laravel framework, and MySQL as the database system. Laravel was chosen for its modular structure, built-in security features, and support for MVC architecture, which enables faster and cleaner development of web-based applications (Pertiwi et al., 2023). MySQL was selected due to its robustness and widespread use in handling relational data (Arifin et al., 2022). While NoSQL alternatives like MongoDB offer schema flexibility and better read-write speed for unstructured data, studies show that MySQL performs more reliably in structured, rule-based datasets such as employee attendance (Makris et al., 2021).

To ensure functional quality, the system underwent black box testing, focusing on validating outputs based on input scenarios without examining internal code logic. This method is commonly used in system-level software verification to ensure user-oriented features function correctly (Sommerville, 2016). The key features tested include: Role-based login system (admin and employee access), Barcode-based attendance validation, GPS-based location verification, Attendance record status (present, late, leave), Data reporting and export.

Testing techniques such as equivalence partitioning, boundary value analysis, and state transition testing were applied to validate input ranges, condition changes, and role interactions. The use of black box testing ensures that all user-facing functionalities behave as expected under different scenarios. Full technical details of the test cases and results are provided in the appendix.

The final stage of development involved deployment in a real work environment within Diskominfosantik. This allowed live testing of the system by actual users under operational conditions to validate performance, usability, and compliance with institutional needs. Any final discrepancies were iteratively resolved before full adoption.

In summary, the combination of the prototyping method and structured functional testing supports the creation of a responsive, accurate, and secure web-based attendance information system tailored to the administrative context of a regional government institution.

RESULT

System Design

The development of the web-based attendance information system at Diskominfosantik Bekasi Regency is aligned with the problems identified in the introduction, particularly the reliance on manual attendance processes that are prone to delays, data loss, and lack of integration. By adopting a modular and role-based design, the system addresses these issues through centralized data management, secure login, real-time validation, and location-based verification features.

Use Case Diagram

A use case diagram is a type of diagram in Unified Modeling Language (UML) used to describe interactions between users (actors) and systems in the form of functional scenarios that represent system requirements (Amin, 2024). This diagram facilitates understanding of how users interact with the system and the main features available (Swasono & Prastowo, 2021).

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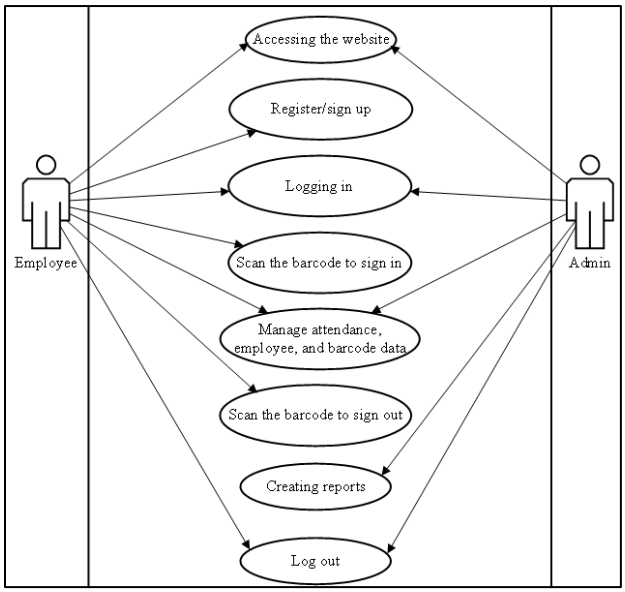

Fig. 2 Use Case Diagram

In this web-based attendance information system at the Bekasi Regency Communication and Information Agency, the use case diagram depicts two main actors, namely employees and administrators. Employees have access to basic functions such as accessing the website, registering, logging in, clocking in and out using barcode scanning, and logging out of the system. Meanwhile, administrators have additional roles, including managing attendance data, employee data, barcodes, and generating reports. Both can interact with the system via the web interface, but with different access rights. This use case demonstrates that the system is designed not only for the efficiency of the attendance process but also to provide ease in managing real-time and integrated attendance data.

Class Diagram

A class diagram is a visual representation of the structure of a system that shows the classes that make up the system, the attributes of each class, and the relationships between those classes (Kurniawan et al., 2020). This diagram illustrates the data model and operations performed on objects in the system. In this system, there are six main classes:

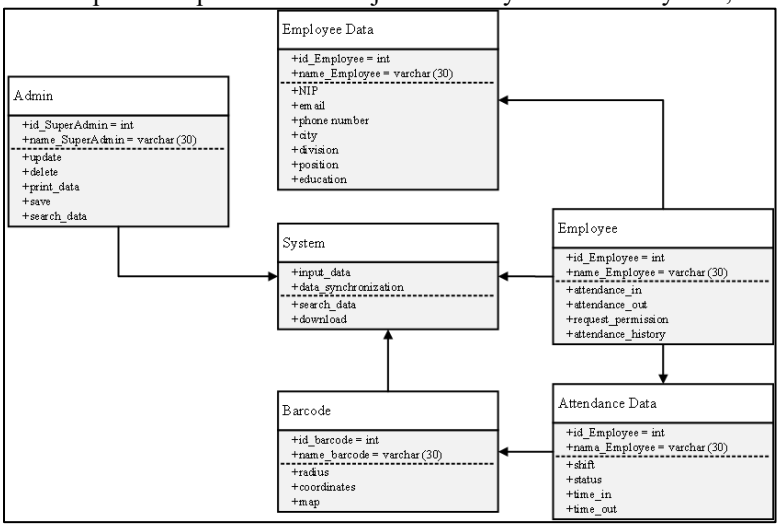

Fig. 3 Class Diagram

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1) Admin: This class represents system users with the highest access rights. Admin has the attributes id_SuperAdmin and nama_SuperAdmin, as well as main functions such as update, delete, print_data, save, and cari_data. Admin is responsible for managing all data in the attendance system.
2) Employee Data: This class contains detailed information about each employee, such as NIP, email, phone number, city, division, position, and education. This class is connected to the Employee class and serves as the central database for employees used in the attendance process.
3) Employee: This class contains employee identities with the attributes id_Employee and name_Employee. Employees have functions to perform attendance_check-in, attendance_check-out, request_leave, and access attendance_history.
4) Attendance Data: This class records attendance data for each employee with attributes such as shift, status, time_in, and time_out. The relationship between this class and the Employee class is associative, as each employee has their own attendance record.
5) Barcode: This class stores information about the barcode used for attendance verification. Its attributes include barcode_id, barcode_name, radius, coordinates, and map. The barcode is used as a tool for geographically validating attendance (e.g., office location).
6) System: This class is the central management and logic flow of the attendance application. It handles input_data, data_synchronization, search_data, and download information, which are closely related to barcode and attendance data.

This class diagram illustrates the structured and integrated relationships between classes. The Admin plays a central role in managing employee data, including updating, storing, and retrieving information. Employees are directly connected to their personal data and attendance records stored in the Attendance Data class. Barcodes are used as a means of attendance verification, working in conjunction with the Attendance Data class to record entry and exit times. All processes and data within the system are controlled by the System class, which handles data input, synchronization, search, and download. This diagram illustrates the logical structure of the system that supports attendance functionality efficiently and centrally.

System Interface Implementation

The web-based attendance system features a user-friendly interface to facilitate administrators and employees in recording attendance and managing data.

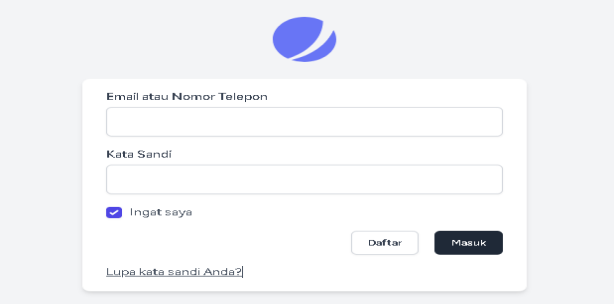

Fig. 4 Admin & Employee Login Screen

Users are required to log in with valid credentials. Administrators and employees have different access rights; administrators manage the system, while employees only take attendance.

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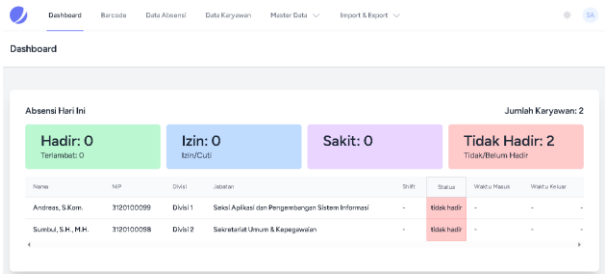

Fig. 5 Admin Dashboard

The dashboard displays the latest information such as date, time, and navigation menu to access key features. Admins can manage attendance, employee data, and reports.

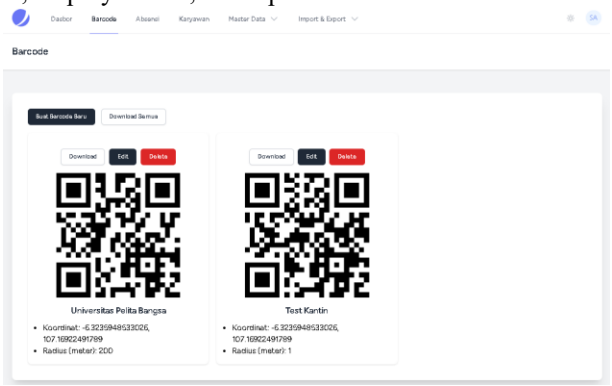

Fig. 6 Admin Barcode

The barcode feature is used to record employee attendance in real time, with location and time verification.

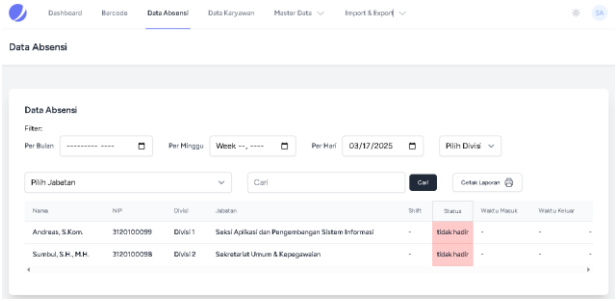

Fig. 7 Attendance Data

Admins can monitor daily and monthly attendance in detail through the attendance summary page.

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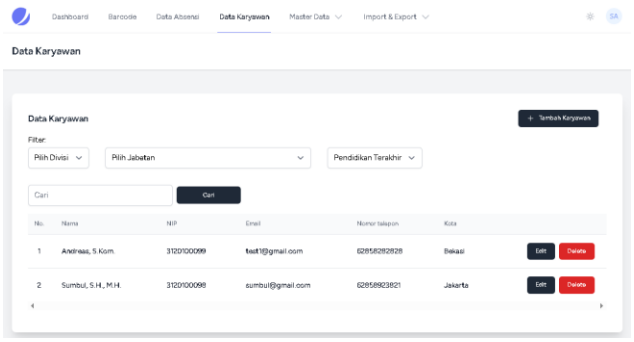

Fig. 8 Employee Data

This page displays complete employee data and has a filter feature based on division or position.

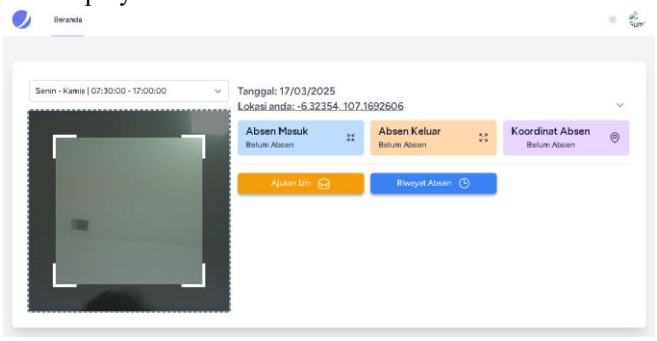

Fig. 9 Employee Attendance

Employees clock in by scanning a barcode and entering location and time data. This process is automatically verified by the system.

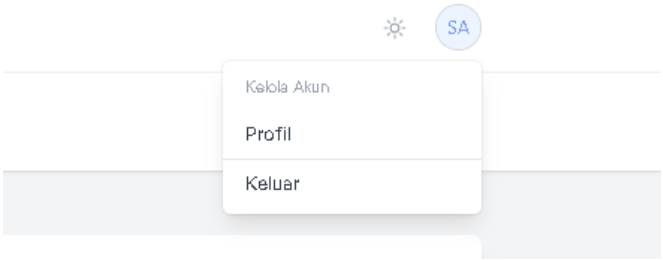

Fig. 10 Logout Admin & Employee

After completing their activities, users can safely log out of the system using the logout feature.

Black Box Testing

A total of 39 test scenarios were performed, consisting of 28 scenarios for admin features and 11 scenarios for employee features.

Table 1. Black Box

Role	Total Scenarios	Successful	Success Rate
Admin	28	28	100%
Employee	11	11	100%

All features, including authentication, barcode processing, location activation, data management, and report generation, functioned as intended under various input conditions.

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Analysis of Testing Results

While all test cases passed, the testing process revealed several points worth noting:

1) Location permission prompts on some browsers required additional manual confirmation, which could delay check-in processes if not properly guided.
2) Barcode scanning performance depended on lighting conditions and device camera quality, though not enough to cause test failure.
3) No functional errors or data inconsistencies were found, confirming that the system logic and role segregation were implemented correctly.

The successful test results suggest that the system is technically reliable, user-friendly, and adaptable to operational environments like Diskominfosantik. The integration of role-based access, barcode attendance, and GPS validation directly responds to the previously identified challenges, positioning the system as a practical solution for local government digital transformation.

DISCUSSIONS

The development and implementation of the web-based attendance information system at Diskominfosantik Bekasi has demonstrated clear improvements compared to the previously used fingerprint-based and manual attendance systems. The new system offers enhanced speed, accuracy, and flexibility in recording, validating, and reporting employee attendance. Unlike the old system, which was prone to data loss, input errors, and lacked integration with administrative reporting, the current system integrates barcode scanning, GPS-based location validation, and role-based user authentication, resulting in more secure and verifiable attendance data.

The success of the system, as indicated by 100% success in black box testing, confirms that the features operate in accordance with user expectations and functional requirements. This is consistent with the findings of Rashid et al., (2022), who emphasized that integrating GPS with QR code scanning significantly enhances the reliability of attendance systems. Furthermore, the use of structured class relationships and modular design, as visualized in the UML diagrams, aligns with best practices in system engineering Pressman, (2005), and supports long-term maintainability and scalability.

From a critical perspective, the system's effectiveness can be attributed to the prototyping development approach, which facilitated active user involvement at every stage. This approach ensured that design iterations directly addressed user needs, contrasting with traditional waterfall models that often fail to accommodate changing requirements (Putra, 2022). Moreover, the application of role-based access helped enforce data security and task separation, which is especially vital in government agencies that manage sensitive information.

Despite its strengths, several potential limitations must be acknowledged. For instance, barcode scanning relies on adequate lighting and device camera quality, which may affect performance on low-end devices. Similarly, GPS-based validation may face challenges in areas with weak signal reception, such as dense buildings or remote rural zones. These limitations were not reflected in the black box test results, but they represent operational risks in real-world deployment scenarios.

In comparison to previous systems explored by Yulianto, (2021) and Mulia, (2020), which focused on either offline functionality or education sector use, this system provides a more comprehensive solution by combining spatial validation and real-time web access tailored for public institutions. This integrated approach positions the system as a model for broader application across other local government agencies, especially those looking to modernize attendance tracking in alignment with national digital governance goals.

However, the replicability of the system in other institutions may depend on several contextual factors. These include the digital literacy of users, availability of supporting infrastructure (e.g., internet bandwidth, mobile device quality), and institutional readiness to shift from manual processes to digital workflows. In addition, consistent maintenance and training are necessary to ensure long-term adoption and system reliability.

In conclusion, the system does not only fulfill functional and technical expectations, but also offers a practical and scalable model for attendance management in the public sector. Its integration of barcode, GPS, and role-based access presents a distinctive value that has not been extensively implemented in previous systems. Future development should explore offline contingency modes, broader device compatibility, and integration with other administrative modules such as payroll or performance evaluation to increase its utility and adaptability.

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CONCLUSION

This study has developed a web-based attendance information system tailored to the operational context of the Communication and Information Agency (Diskominfosantik) of Bekasi Regency. The implementation of the prototyping method ensured that system development was iterative, user-oriented, and responsive to operational requirements in the public sector.

Based on testing and system validation, the application has demonstrated its ability to improve efficiency, transparency, and data accuracy in attendance management. The role-based structure and integration of barcode and location validation support administrative accountability and simplify attendance tracking in real time.

However, this research is not without limitations. The system was tested in a single-institution environment and has not yet been implemented across multiple agencies with varying administrative structures. In addition, the system currently operates independently and is not yet integrated with other modules such as payroll processing, performance evaluation, or HR analytics, which could further enhance its utility.

Future development should consider expanding the system's compatibility for multi-agency deployment, implementing offline capabilities for areas with limited connectivity, and integrating with payroll or e-governance systems. Enhancing mobile optimization and incorporating user feedback analytics may also support broader adoption and long-term sustainability.

In conclusion, this system serves as a promising model for digital attendance solutions in local government. With further development and integration, it has the potential to become a core component of broader digital transformation initiatives in the public sector.

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