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A Web-Based Personnel Information System with Geolocation Using User-Centered Design: A Usability Evaluation with SUS

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Abstract
Digital transformation in public administration requires integrated and efficient personnel information systems. However, personnel management at the Ministry of Religious Affairs Office of Simalungun Regency remains semi-manual and fragmented, resulting in process inefficiencies, data inconsistencies, and limited information accessibility. This study seeks to develop and assess a web-based personnel information system by applying the User-Centered Design (UCD) approach to enhance service quality and optimize the user experience. The UCD method was applied iteratively through context analysis, user requirement specification, solution design, and usability evaluation. The developed system integrates geofencing-based attendance with real-time location monitoring, workflow-based leave management, and Key Performance Indicator (KPI)-based performance evaluation within a centralized platform. The usability assessment using the System Usability Scale (SUS) with 30 respondents yielded a mean score of 91.25 (Grade A), indicating excellent usability and high user acceptance. The findings further demonstrate that the integration of User-Centered Design (UCD) principles and geofencing technology contributes to improved attendance accuracy, administrative efficiency, information accessibility, and transparency in personnel management. The proposed system contributes to digital government transformation by providing an integrated and user-oriented solution for personnel administration in public sector organizations.

Keywords:
Personnel Information System; User-Centered Design; Geofencing Attendance; Digital Government Transformation; System Usability Scale.

1. INTRODUCTION

As digital innovation becomes increasingly embedded in organizational activities, government agencies are adapting their administrative systems to improve the management, coordination, and monitoring of personnel-related functions. The continuous evolution of digital technologies has accelerated administrative modernization within public institutions, leading to improvements in the planning, management, and oversight of human resource operations (Tangi et al., 2021). Furthermore, the digitalization of bureaucracy requires administrative services that are more efficient, accurate, transparent, and accountable as part of bureaucratic reform and efforts to improve public service quality (Ahn & Chen, 2022). In this context, personnel management becomes a strategic component as it encompasses employee data management, attendance tracking, leave administration, position management, and continuous performance evaluation (Safitri & Fajriah, 2023). However, processes that remain manual, fragmented, and non-integrated tend to result in data duplication, information inconsistencies, and delays in decision-making, ultimately affecting organizational effectiveness.

The Ministry of Religious Affairs Office of Simalungun Regency, as part of the public bureaucratic structure, is responsible for managing civil servants in religious and educational sectors. The demand for administrative order, data accuracy, and service transparency has increased alongside the growing complexity

of organizational tasks (Rahmawati et al., 2022). Based on observations and interviews, administrative processes are still dominated by physical archives and separate spreadsheets, leading to difficulties in data recapitulation, slower approval processes, and limited real-time attendance monitoring (Fadillah et al., 2024). Furthermore, the absence of an integrated performance evaluation system constrains data-driven decision-making. These conditions indicate a clear gap between the need for an integrated system and the existing conventional management practices.

The User-Centered Design (UCD) approach is adopted as it emphasizes users as the central focus in system development. This method actively involves users from the early stages of requirement identification to usability evaluation, ensuring that the resulting system aligns with operational needs. Prior studies have demonstrated that UCD enhances system acceptance and reduces the gap between design and real-world implementation (Retno & Samsudin, 2024).

Previous research further supports the relevance of this approach. Kristania (2021), published in the Indonesian Journal on Software Engineering, reported that implementing UCD in village administrative service systems improved efficiency and transparency (Kristania, 2021). Similarly, Cristivioni et al. (2025) reported in the JOINTECOMS Journal that a web-based personnel information system designed using the User-Centered Design (UCD) methodology achieved a System Usability Scale (SUS) score of 83.91 (Grade B), indicating a high degree of user satisfaction and acceptance. (Cristivioni et al., 2025). Nevertheless, these studies generally do not incorporate real-time geofencing-based attendance systems, which include location radius validation, continuous monitoring during working hours, and automated notifications, integrated with Key Performance Indicator (KPI)-based performance evaluation within a unified platform (Emalia et al., 2024).

Previous studies have demonstrated the effectiveness of the User-Centered Design (UCD) approach in improving system usability and user acceptance. (Kristania, 2021) reported that UCD improved efficiency and transparency in a village administrative service system, while (Cristivioni et al., 2025) developed a web-based personnel information system that achieved a System Usability Scale (SUS) score of 83.91 (Grade B). However, these studies primarily focused on administrative information management and usability evaluation. They did not integrate geofencing-based attendance with real-time location monitoring, attendance violation notifications, workflow-based leave management, and KPI-based performance evaluation within a single platform. Therefore, this study extends previous work by integrating these functionalities into a unified web-based personnel information system while applying the UCD approach to ensure alignment with user requirements and system usability.

Addressing this gap, this study develops an integrated web-based personnel information system. The attendance module utilizes geofencing technology to validate presence based on location and time while continuously monitoring employee positions during working hours. The system automatically generates notifications when employees move outside the designated area as a form of discipline control (Warman, 2025). Additionally, the system includes KPI-based performance evaluation, position management modules to support administrative decision-making, and a structured workflow-based leave management system (Dwayani et al., 2025). The development of the proposed system was carried out under the principles of User-Centered Design (UCD) to ensure that user requirements remained central to the design process. Therefore, this study undertook the development and evaluation of a geolocation-enabled web-based personnel information system, with its usability examined using the System Usability Scale (SUS).

From a normative perspective, civil servant management should also reflect values of trustworthiness, fairness, and transparency, as emphasized in the Qur'an (QS. An-Nisa: 58 and QS. Al-Baqarah: 282). These principles align with the concept of good governance, which prioritizes accountability, objectivity, and openness in human resource management (Siregar & Yahfizham, 2024). Therefore, the development of a web-based personnel information system supported by geofencing and a UCD approach represents a strategic solution for achieving modern, transparent, and sustainable personnel governance.

2. RESEARCH METHOD

In this study, a web-based personnel information system was developed by adopting the User-Centered Design (UCD) methodology. As an iterative methodology, UCD places strong emphasis on understanding user needs and characteristics while encouraging continuous user participation throughout the system development process. (Ali & Rohmanu, 2023). This approach was adopted to ensure that the system aligns with the organizational structure, bureaucratic work environment, and operational requirements of employees, managers, and administrators (Gobel & Puspa, 2023). Data were collected using a combination of direct observation and semi-structured interviews with 10 purposively selected participants, including employees, managers, and administrative staff. Selection criteria were based on their direct involvement in personnel administration, attendance handling, and managerial decision-making responsibilities. Data collection was conducted over four weeks. The collected data were analyzed descriptively and categorized into functional and non-functional requirements, which were subsequently translated into system features, including geofencing-based attendance, workflow-based leave management, centralized personnel data

management, KPI-based performance evaluation, and role-based access control. System usability was evaluated using the System Usability Scale (SUS) questionnaire administered to 30 respondents after implementation. The responses were analyzed using Brooke's scoring procedure to assess usability and user acceptance. The research process followed the UCD framework, comprising context analysis, requirement specification, solution design, and system evaluation, as illustrated in Figure 1.

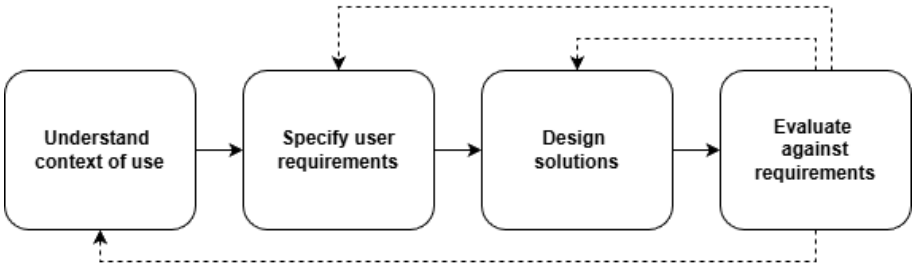

Figure 1. User Centered Design (UCD)

The UCD method consists of four main stages:

a. Understand Context of Use. This stage involved identifying the characteristics of system users, namely employees, managers, and administrators, as well as analyzing the personnel management environment within the Ministry of Religious Affairs Office of Simalungun Regency. Direct observations and interviews were conducted to understand existing workflows, attendance procedures, leave management processes, and performance evaluation practices (Samsudin & Dani, 2022).
b. Specify User Requirements. During this stage, data obtained from observations and interviews were analyzed to elicit user and organizational requirements. The identified requirements were categorized into functional and non-functional aspects, covering key areas such as attendance tracking, personnel data management, leave processing, performance evaluation, and role-based access control. (Fahriyah et al., 2024).
c. Design Solutions. Based on the identified requirements, system prototypes and interface designs were developed iteratively and refined through user feedback obtained during the design process. The proposed solution included geolocation-based attendance, workflow-based leave management, centralized personnel data management, KPI-based performance evaluation, and role-based access control to support different categories of users (Samsudin & Purba, 2023).
d. Evaluate Against Requirements. The developed system was evaluated to ensure that it met user requirements and usability standards. Usability assessment was performed using a System Usability Scale (SUS) questionnaire completed by 30 respondents, with the data subsequently evaluated through Brooke's SUS scoring method to determine both user acceptance and overall system usability performance (Haniyah & Samsudin, 2025).

3. RESULTS AND DISCUSSION

The implementation results of the User-Centered Design (UCD) method in this study were carried out iteratively through four main stages

3.1. Understand Context of Use

At the understand context of use stage, the identification of users, environment, and initial requirements of the personnel information system at the Ministry of Religious Affairs Office of Simalungun Regency was conducted, where employees act as primary users, while administrators and managers are responsible for data management, validation, and monitoring. Observations indicate that the current system remains semi-manual and fragmented, leading to delays, potential errors, and limited real-time access, while the attendance system does not yet support geofencing and continuous monitoring during working hours. These findings highlight the need for an integrated system designed to improve efficiency, ensure data accuracy, enhance transparency, and support effective attendance monitoring. The results of the system usage context identification are provided in Table 1.

Table 1. System Usage Context Identification

Component	Description
Primary Users	Employees responsible for managing and inputting personnel data
Supporting Users	Administrative staff and managers responsible for managing, validating, and monitoring data
Existing Conditions	Data management is still semi-manual and not integrated into a unified system
Problems	Delays in personnel data recapitulation, high potential for recording and processing errors, limited real-time information access, lack of centralized system integration, and low efficiency in personnel administration
Needs	An integrated web-based personnel information system that is real-time and accurate, supporting geofencing-based attendance with location monitoring during working hours and automatic notifications when employees move outside the designated radius, as well as improved accessibility and data management efficiency

3.2. Specify User Requirements

System requirements were identified through observations and interviews with employees and administrative staff at the Ministry of Religious Affairs Office of Simalungun Regency. The findings indicate the need for an integrated system capable of managing personnel data, providing real-time access, and supporting attendance, leave management, and reporting efficiently, complemented by location-based attendance validation and continuous monitoring during working hours. In addition, a simple and user-friendly interface is considered a primary requirement to enhance system usability and overall effectiveness.

Table 2. User Requirements Identification

Component	Description
Data Source	Observations and interviews with employees and administrative staff
Main Requirements	Integrated personnel data management, web-based system access, and real-time reporting
Additional Requirements	Simple, easy-to-understand, and user-friendly interface
Organizational Goals	To establish an accurate, efficient, transparent personnel system that supports decision-making

Based on the identified user requirements, each need was systematically translated into system solutions using the User-Centered Design (UCD) approach to ensure alignment with user expectations and to support the overall effectiveness of system usage.

Table 3. Mapping User Requirements to System Solutions

User Requirements	System Implementation
Integrated personnel data management	Development of a centralized database-based employee data management module
Web-based system access	System designed as a web-based application accessible across multiple devices
Real-time reporting	Provision of dashboards and automated real-time reporting features
User-friendly interface	Interface designed to be simple, consistent, and easy to use
Administrative processes (attendance, leave)	Implementation of geofencing-based attendance with location radius validation, continuous monitoring during working hours, automatic notifications, and workflow-based leave management

The requirement translation process was conducted iteratively with continuous user feedback, ensuring that all identified needs were accommodated as the foundation for system architecture design. The results improved efficiency, data accuracy, and user experience, confirming that the User-Centered Design (UCD) approach is effective in systematically and comprehensively identifying user requirements.

3.3. Design Solutions

Following the analysis of system requirements, an integrated web-based personnel information system was developed using the User-Centered Design (UCD) framework. The system provides functionalities for personnel data management, geolocation-based attendance via geofencing, leave administration, KPI-oriented performance evaluation, and role-based access control. To ensure improved usability and reduced cognitive workload, the interface design emphasizes simplicity, consistency, and intuitive interaction.

A three-tier architecture is implemented in the system, consisting of presentation, application, and database layers. The presentation layer supports user interaction through a responsive web interface, whereas

the application layer manages essential operations, including attendance verification, leave processing, personnel administration, KPI-based performance assessment, and notification management. The database layer manages personnel records, attendance logs, leave requests, performance data, and geolocation settings. Geofencing-based attendance is implemented through the HTML5 Geolocation API to verify attendance activities within predefined work areas. The overall system architecture is presented in Figure 2.

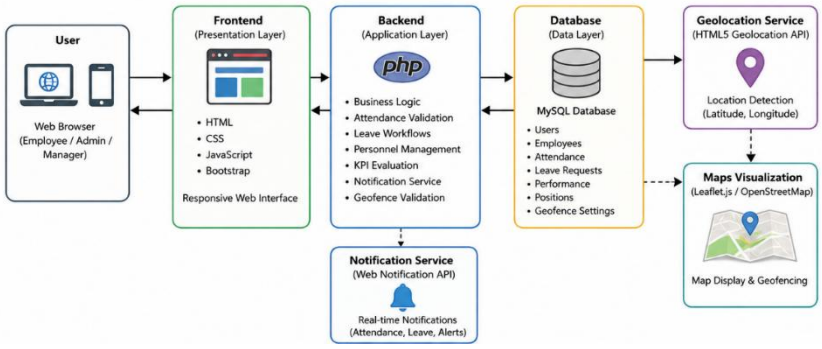

Figure 2. Three-Tier System Architecture

To support integrated personnel management, the system database was designed using a relational database model consisting of several core entities, including users, employees, attendance, leave_requests, performance, and positions. Relationships among these entities were established through primary key and foreign key associations to ensure data consistency and support system operations. The Entity Relationship Diagram (ERD) of the proposed system is presented in Figure 3.

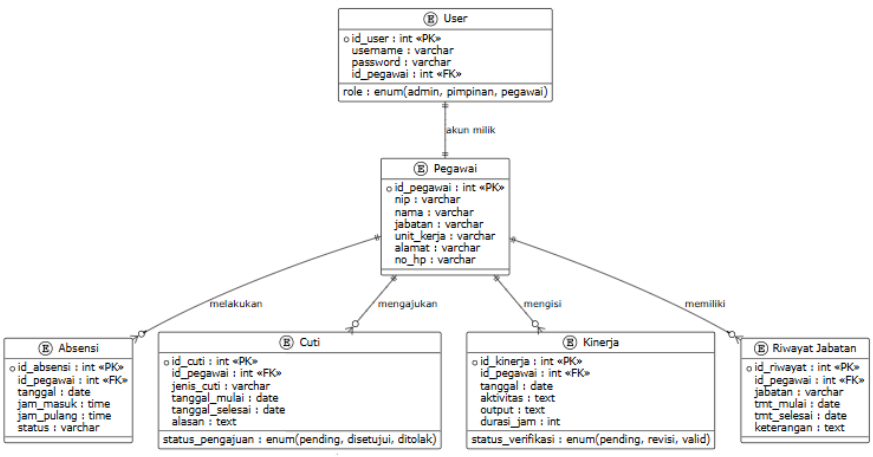

Figure 3. Entity Relationship Diagram (ERD)

The ERD illustrates the relationships among user authentication, employee records, attendance transactions, leave management, performance evaluations, and organizational positions that support personnel administration processes.

Table 4. System Architecture and Technology Stack

Component	Technology
Frontend	HTML, CSS, JavaScript, Bootstrap
Backend	PHP Native
Database	MySQL
Geolocation Service	HTML5 Geolocation API
Maps Visualization	Leaflet.js
Notification Service	Web Notification API
Web Server	Apache (XAMPP)

3.3.1. Main Page and Login Page

The main page serves as the initial interface of the system, providing general information and access to the personnel information system features. It displays the primary navigation menu to facilitate user understanding of system functionalities. The main page interface is presented in Figure 4.

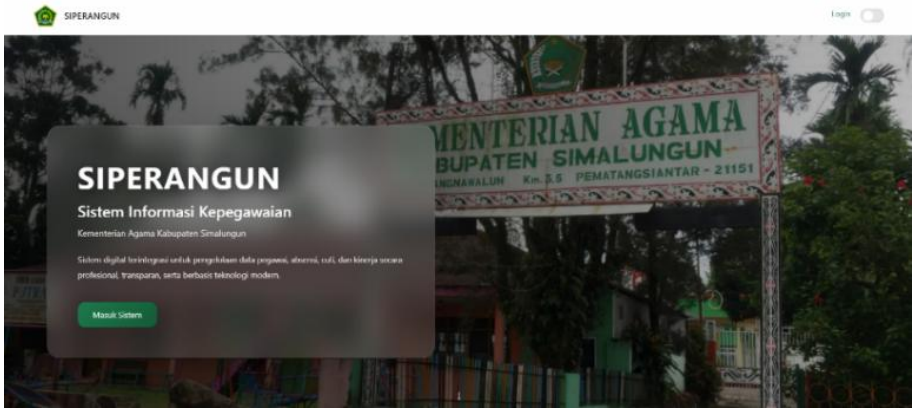

Figure 4. Main Page Interface

The login page functions as an authentication mechanism before users can access the system. Users enter their username and password, which are verified to determine access rights and direct them to the appropriate dashboard based on their roles, thereby ensuring the security of personnel data. The login page interface is presented in Figure 5.

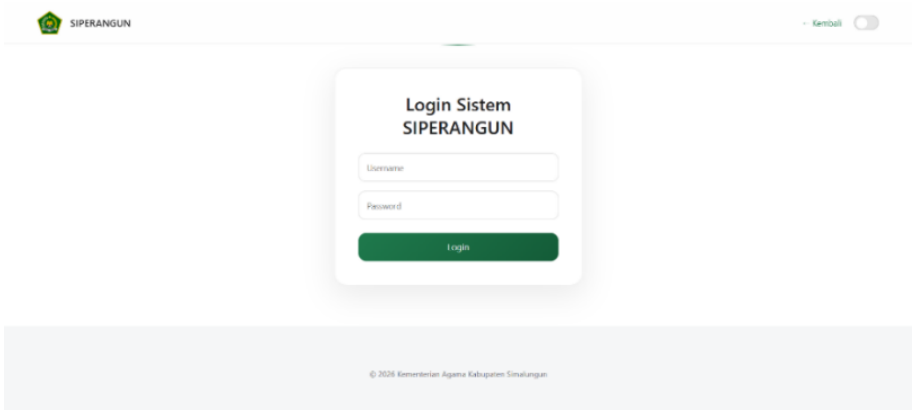

Figure 5. Login Page Interface

3.3.2. User Interface (Employee)

3.3.2.1. Employee Dashboard Page

The dashboard page presents a real-time summary of personnel information, including attendance data, total presence, and employee activities. This information provides a quick and accurate overview of the overall personnel condition. The dashboard interface is presented in Figure 6.

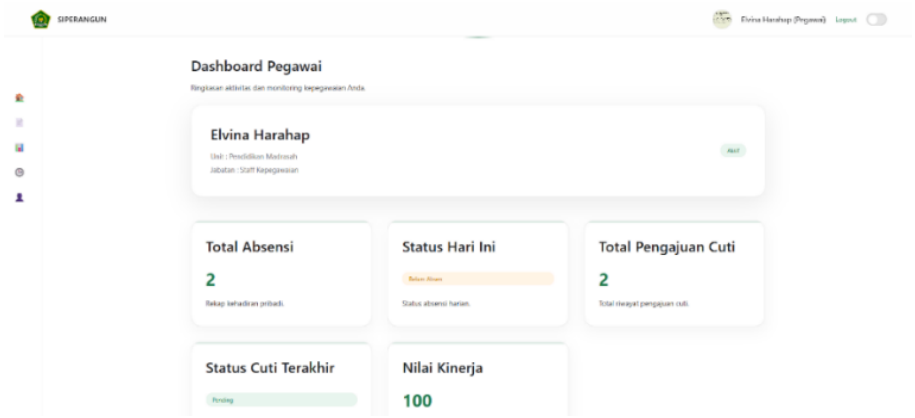

Figure 6. Employee Dashboard Page Interface

The employee data page is used to display comprehensive information related to personnel records stored in the system, including employee identity, position, and work unit. The interface of this page is presented in Figure 7.

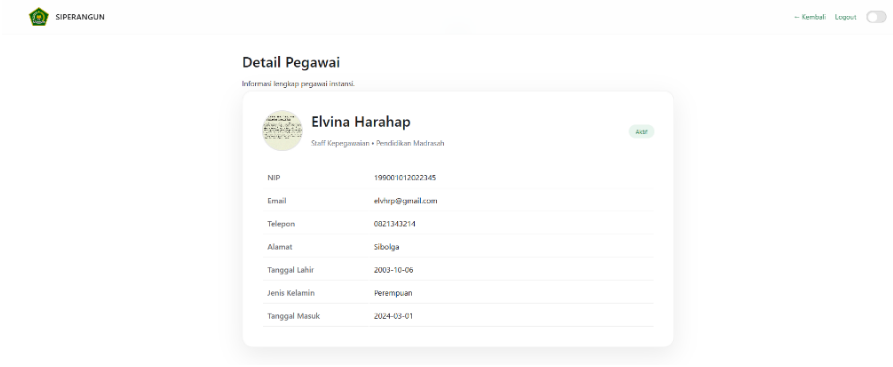

Figure 7. The Employee Data Page Interface

3.3.2.2. Attendance Page (Geolocation)

The attendance page is designed to record employee attendance digitally, allowing users to perform check-in and check-out activities, with timestamps automatically recorded by the system. This feature is integrated with geofencing technology to validate attendance based on a predefined work area radius. Employee locations are obtained through the browser geolocation service and compared with predefined office coordinates stored in the database. Attendance is validated only when the user is located within the specified geofence radius. During working hours, periodic location checks are performed to monitor employee presence and trigger notifications when violations are detected. Additionally, if an employee moves outside the designated geofence area, a real-time notification is automatically generated as an indicator of disciplinary violation.

The geofencing mechanism validates attendance by comparing the employee's current location, obtained through the HTML5 Geolocation API, with predefined office coordinates stored in the system database. Attendance is accepted only when the user is located within the configured geofence radius. The location information is visualized using Leaflet and OpenStreetMap to support real-time location verification and attendance monitoring. The attendance page interface is shown in Figure 8.

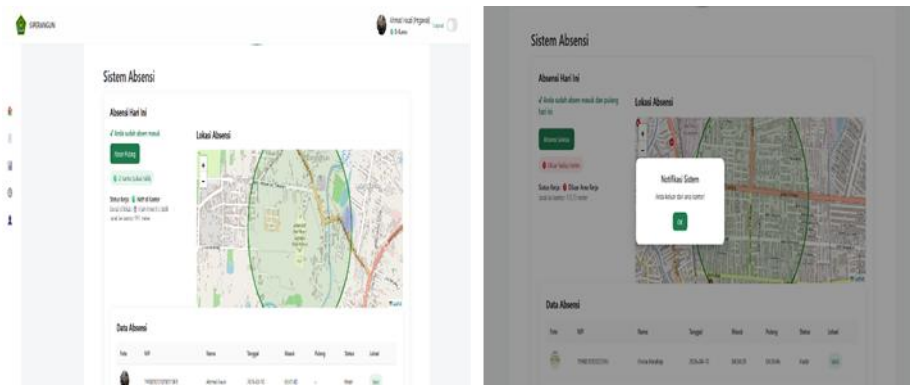

Figure 8. Attendance Page Interface

3.3.2.3. Attendance History Page

The attendance history page provides historical attendance data that can be used for monitoring and evaluation purposes, including date, time, and attendance status. The interface is presented in Figure 9.

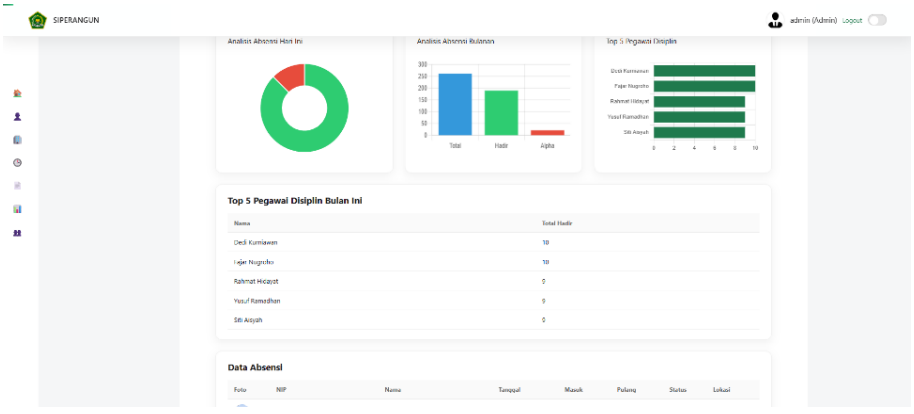

Figure 9. The Attendance History Page Interface

3.3.2.4. The Application and History Leave Page

The leave application page enables employees to submit leave requests by completing a form that includes leave type, date, and reason. Meanwhile, the leave history page displays a list of submitted leave requests along with their approval status. These interfaces are presented in Figures 10 and Figure 11.

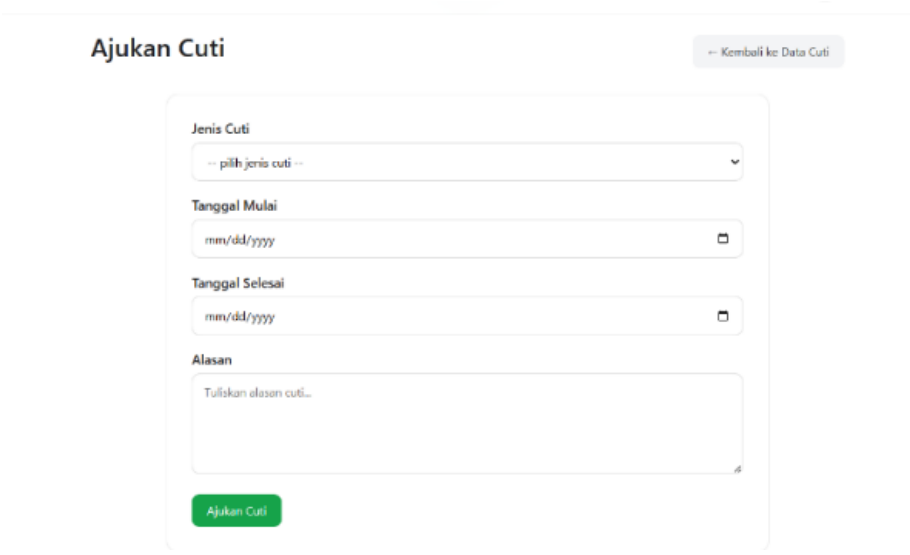

Figure 10. Leave Application Interface

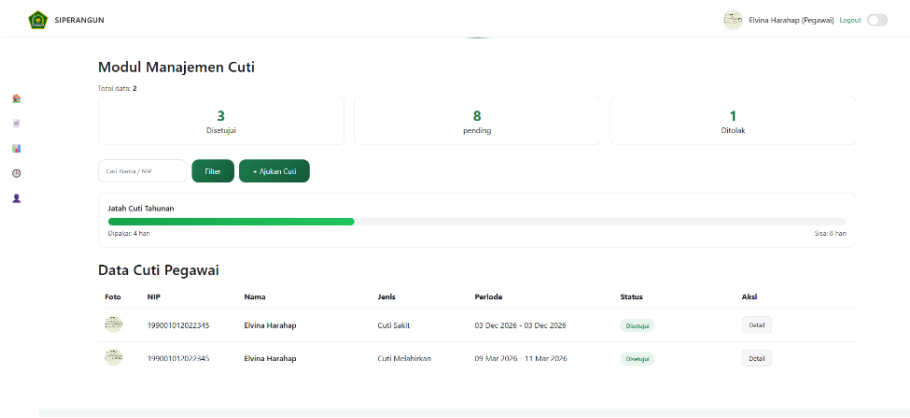

Figure 11. Employee Leave History Page Interface

3.3.2.5. Employee Performance Page (KPI)

The employee performance page displays performance evaluation results based on predefined Key Performance Indicators (KPI), including evaluation scores, performance categories, and assessment history. This feature enhances transparency and allows employees to monitor their performance outcomes as well as supports productivity improvement. The interface is presented in Figure 12.

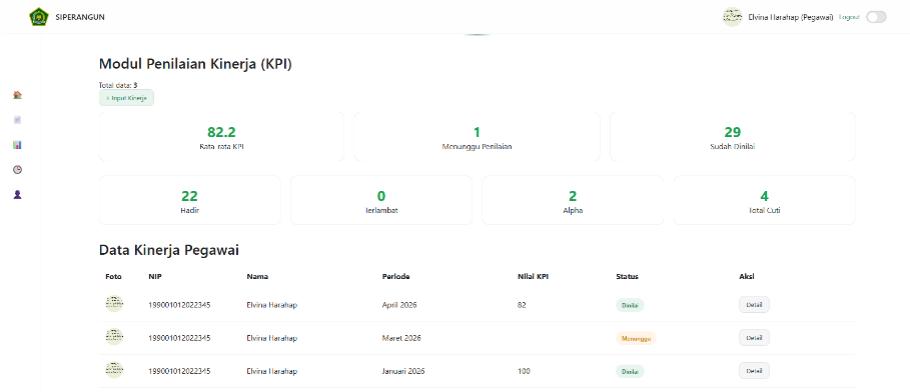

Figure 12. Employee Performance Page Interface

3.3.3. Admin and Manager Interface

3.3.3.1. Manager Dashboard Page

The manager dashboard page presents a summary of attendance data, employee information, and leave requests in the form of informative visualizations. This information supports monitoring, analysis, and timely decision-making. The interface is shown in Figure 13.

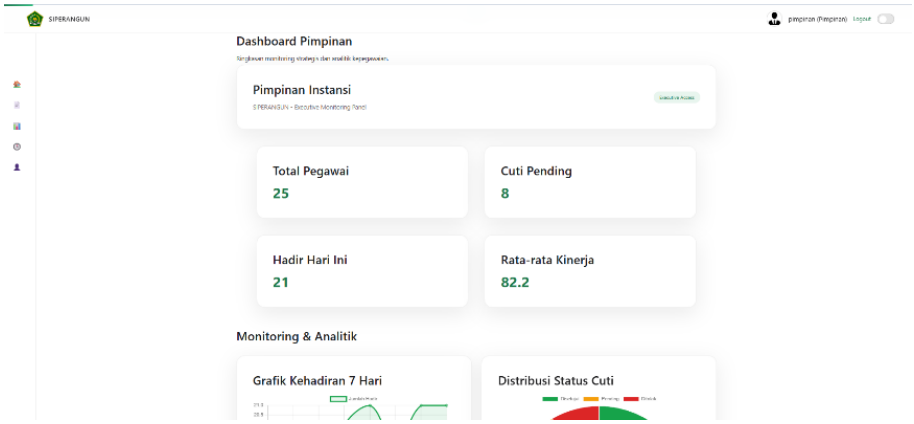

Figure 13. Manager Dashboard Page Interface

3.3.3.2. Employee Data Management Page

The employee data management page is used by administrators to add and update employee records, while managers can review personnel information. The managed data includes name, employee identification number, position, and work unit, ensuring structured and accurate data management. The interface is presented in Figures 14, 15, and 16.

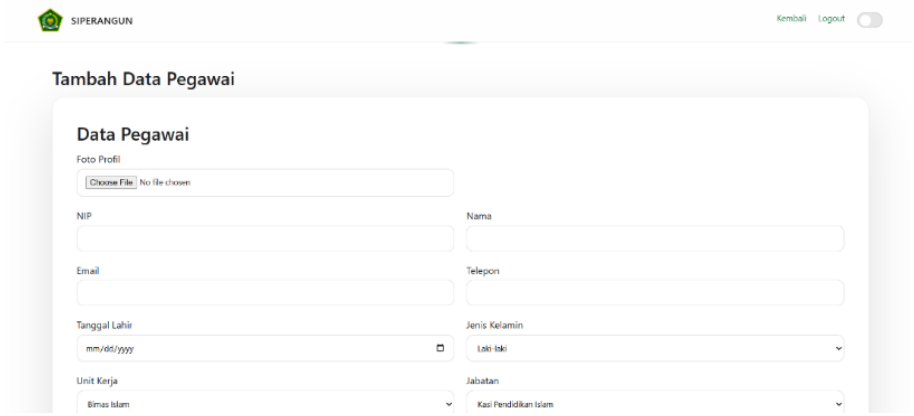

Figure 14. Add Employee Page Interface

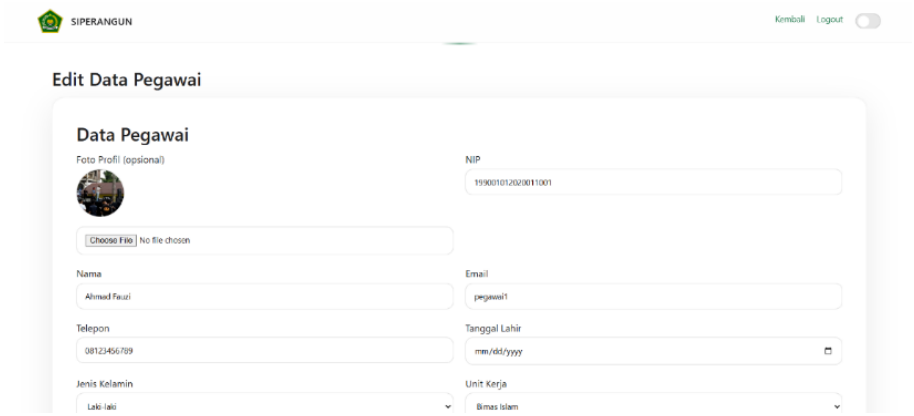

Figure 15. Update Employee Page Interface

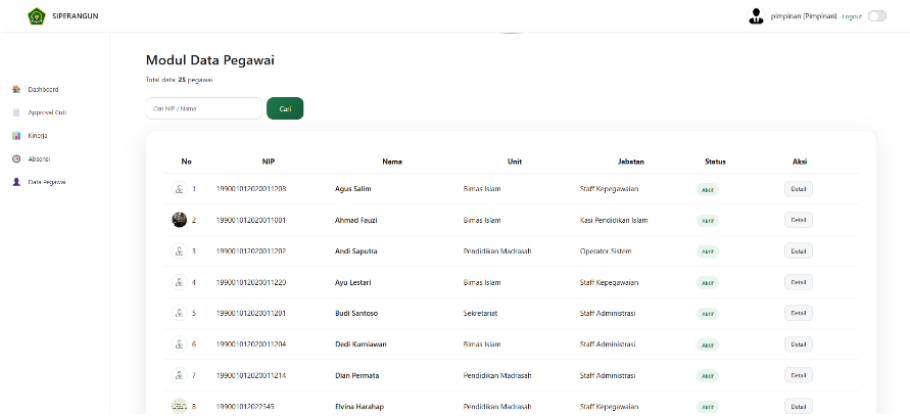

Figure 16. Employee Page Interface (Manager)

3.3.3.3. Leave Approval Page

The leave approval page is used by managers to verify employee leave requests, where decisions can be made in the form of approval or rejection based on applicable policies. The interface is presented in Figure 17.

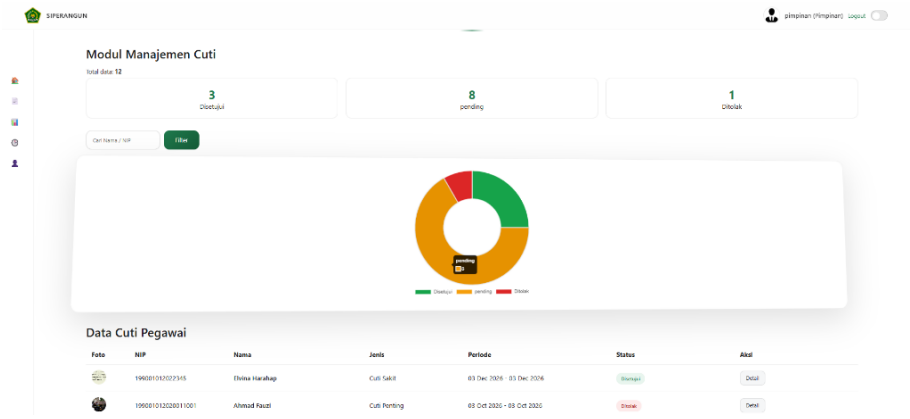

Figure 17. Leave Approval Page Interface

3.3.3.4. Performance Evaluation Page

The performance evaluation page is used to assess employee performance based on established KPI indicators. The evaluation results serve as a basis for managerial decision-making. The interface is presented in Figures 18, 19, and 20.

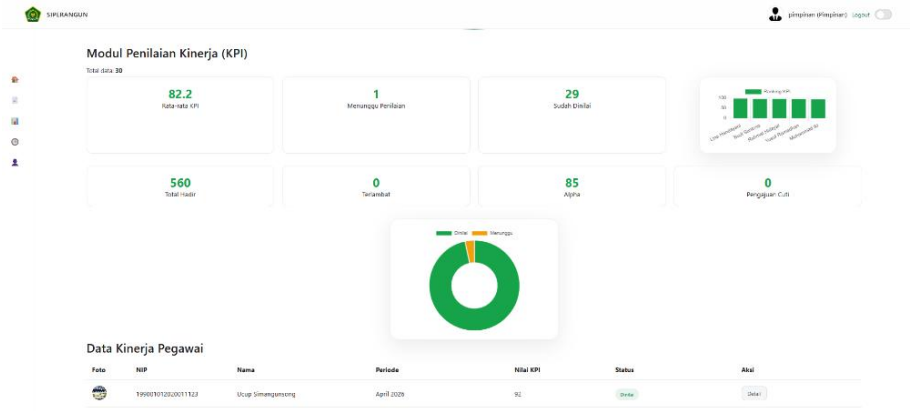

Figure 18. Employee Performance Evaluation Page

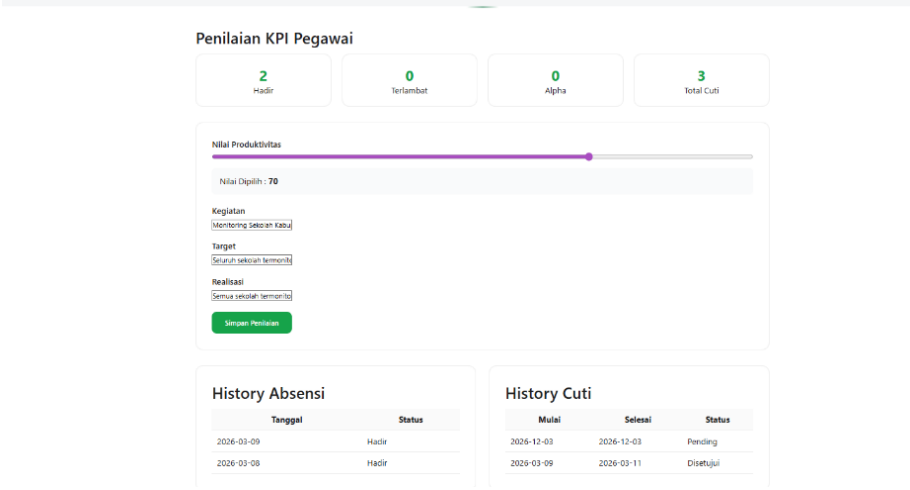

Figure 19. Employee Performance Evaluation Page Interface

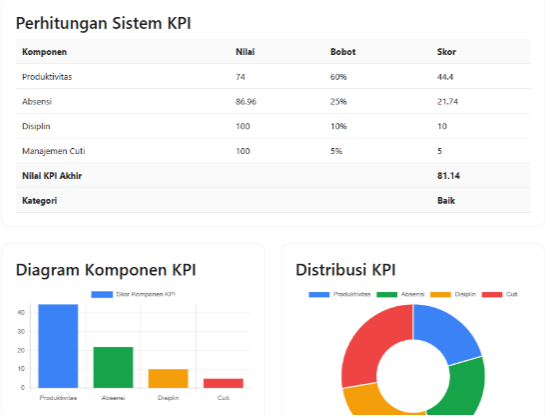

Figure 20. Employee Performance Evaluation Detail Page Interface

3.3.3.5. User Management Page

The user management page allows administrators to manage user data and access rights, including adding, updating, deleting users, and assigning roles. This feature supports access control and system security. The interface is presented in Figure 21.

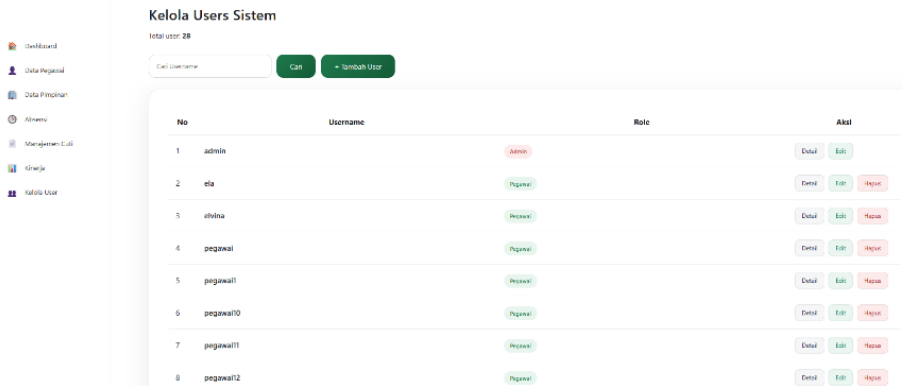

Figure 21. User Management Page Interface

3.4. Evaluate Design

The evaluation stage was conducted to ensure that the developed system operates optimally and aligns with user requirements, with a particular focus on usability aspects. The measurement process employed the System Usability Scale (SUS), introduced by John Brooke in 1986, which consists of 10 statements assessed using a five-point Likert scale (1–5). Data were collected online through Google Forms from 30 respondents and subsequently analyzed to obtain the usability score based on the SUS calculation formula proposed by Brooke (1986):

$$Score\ SUS = \left(\sum_{i=1}^{10} X_i\right)\ x\ 2{,}5$$

The scoring procedure is defined as follows:
- For odd-numbered items (1, 3, 5, 7, 9):
  Xi = (Score -1)
- For even-numbered items (2, 4, 6, 8, 10):
  Xi = (5- Score)

The adjusted scores are then summed and multiplied by 2.5 to obtain the final SUS score, which ranges from 0 to 100. This score is subsequently used to determine the system's feasibility level based on established usability rating categories.

Table 5. SUS score per-respondent

No	Respondent	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total Score	Score SUS (×2,5)
1	R1	4	4	4	4	4	4	4	4	4	4	40	100
2	R2	4	4	4	3	4	4	4	4	3	3	37	92.5
3	R3	3	3	3	4	3	3	3	3	4	4	33	82.5
4	R4	4	4	4	4	4	4	4	4	4	3	39	97.5
5	R5	3	4	4	4	3	3	3	3	3	4	34	85
6	R6	4	3	4	3	3	4	3	4	4	4	36	90
7	R7	4	4	4	4	4	3	4	4	4	4	39	97.5
8	R8	4	3	3	3	3	4	4	3	3	3	33	82.5
9	R9	4	4	4	4	4	3	4	4	4	3	38	95
10	R10	3	3	3	4	3	3	3	3	4	4	33	82.5
11	R11	4	4	4	4	4	4	4	4	3	4	39	97.5
12	R12	4	3	3	3	4	3	4	3	4	4	35	87.5
13	R13	3	3	4	3	3	3	4	4	3	4	34	85
14	R14	4	4	4	4	4	4	4	4	4	4	40	100
15	R15	4	3	4	3	3	3	3	3	4	4	34	85
16	R16	4	4	4	3	4	3	4	3	4	4	37	92.5
17	R17	3	3	4	4	3	3	4	4	4	4	36	90
18	R18	4	4	3	4	3	4	3	3	3	4	35	87.5
19	R19	4	4	3	3	4	4	3	4	4	3	36	90
20	R20	4	3	4	4	4	3	4	4	4	4	38	95
21	R21	4	4	4	3	4	4	4	4	4	4	39	97.5
22	R22	3	4	4	4	4	4	4	4	4	3	38	95
23	R23	3	3	3	3	4	4	4	3	4	4	35	87.5
24	R24	4	4	4	3	3	3	4	4	4	4	37	92.5
25	R25	4	3	4	3	4	3	3	3	4	4	35	87.5
26	R26	3	4	4	4	4	4	3	4	4	4	38	95
27	R27	4	4	4	3	4	3	4	4	3	3	36	90
28	R28	4	4	4	4	3	4	4	4	4	4	39	97.5
29	R29	3	3	3	4	3	3	3	3	3	4	32	80
30	R30	4	4	4	4	4	4	4	4	4	4	40	100
	Average												91.25

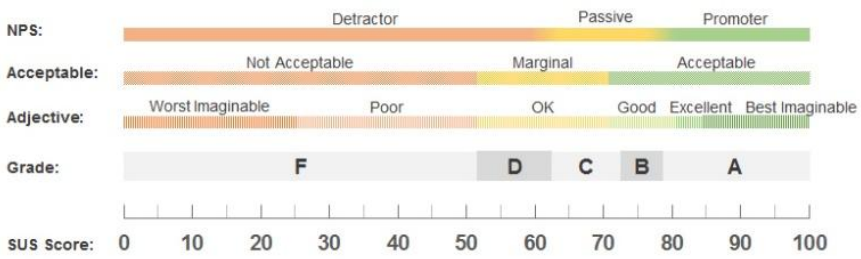

Figure 22. Score System Usability Scale (SUS)

The System Usability Scale (SUS) evaluation produced an average score of 91.25, indicating excellent usability and a high level of user acceptance. This score is higher than that reported by (Cristivioni et al.,

2025), who obtained a SUS score of 83.91 (Grade B). The result suggests that users perceived the system as easy to learn, efficient to use, and well aligned with personnel administration activities. The integration of attendance management, leave administration, personnel records, and KPI-based performance evaluation within a single platform contributed to a streamlined user experience and reduced operational complexity.

Based on feedback collected during the usability evaluation, respondents particularly appreciated the geolocation-based attendance feature, the centralized dashboard, and the accessibility of leave management services. These features simplified routine administrative tasks and improved information accessibility. Compared with previous studies, the higher SUS score may be attributed to the broader integration of personnel management functions, including attendance validation, leave workflows, performance evaluation, and real-time monitoring. Beyond usability, the system also supports more accurate attendance verification, centralized personnel data management, and data-driven decision-making, thereby contributing to efficiency, transparency, and accountability in government personnel administration.

4. CONCLUSION

This study produced a web-based personnel information system developed through the User-Centered Design (UCD) approach, placing user requirements at the center of the development process. The system incorporates a geofencing-based attendance feature to enhance attendance accuracy by validating employee locations in real time within a predefined work-area radius. In addition, continuous location tracking during working hours allows the system to automatically generate notifications whenever employees leave the designated work zone. In addition, the system provides workflow-based leave management and Key Performance Indicator (KPI)-based performance monitoring to support objective evaluation processes. These features enhance data management efficiency, information transparency, and accessibility for employees, administrators, and managers within a unified platform.

The System Usability Scale (SUS) evaluation generated a mean score of 91.25, categorized as Grade A (Excellent), indicating a high level of usability and strong user acceptance. Therefore, the proposed system is regarded as feasible for implementation as a digital personnel management solution intended to enhance effectiveness, accuracy, and service quality through geofencing and real-time location tracking as innovative tools for improving discipline and organizational governance.

This study is limited to its implementation within a single government institution and the evaluation of usability solely through the System Usability Scale (SUS). Therefore, the findings may not fully represent the performance and acceptance of the system in different organizational contexts. Future studies may involve multiple institutions and incorporate additional evaluation metrics, such as system performance, reliability, user satisfaction, and long-term operational impact. Future development is also directed toward mobile application integration and the utilization of data-driven analytics.

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