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Automated Attendance System for Contract-Based Employees at Purwakarta Communication and Informatics Agency

Mutiara Andayani Komara[1)*], Asep Yusapra Salim[2)], Maulvi Firdaus[3)]
[1)3)]Sekolah Tinggi Teknologi Wastukancana, Indonesia, [2)]Universitas Kartamulia, Indonesia
[1)]mutiara@wastukancana.ac.id, [2)]asepyusaprasalim@univkartamulia.ac.id , [3)]maulvifirdaus02@gmail.com

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Abstract: Attendance is a crucial aspect of administrative management in both companies and institutions. The persistent challenges posed by manual attendance systems—data disorganization, compromised data control susceptible to fraud, and vulnerability to data loss—significantly impede effective administrative management across diverse organizational landscapes. Addressing these critical limitations, this research undertook the development of a comprehensive, web-based attendance information system specifically designed for the non-ASN staff at Agency Area Purwakarta called DISKOMINFO. Utilizing the PHP programming language and MySQL database for robust data management, the system's architecture adhered to the Waterfall model, ensuring a structured and systematic development lifecycle. Employing Unified Modeling Language (UML), the system integrates user-centric features, including streamlined online check-in/check-out, real-time attendance monitoring, and automated report generation, thereby simplifying attendance management for both staff and administrators. Rigorous evaluation, conducted through black box testing and the System Usability Scale, demonstrated substantial enhancements in attendance accuracy, a notable reduction in administrative overhead, and a marked improvement in overall operational efficiency. This study underscores the transformative potential of technological adoption in modernizing administrative processes within government organizations. By optimizing data integrity, mitigating fraudulent activities, and enhancing accountability, the developed system not only refines attendance management but also contributes to a more efficient, transparent, and accountable operational environment, showcasing the pivotal role of technology in advancing public sector administration.

Keywords: Attendance Information System, Waterfall Modell, Agency Area, Blackbox Testing, Scala Usability Scale.

INTRODUCTION

Attendance is a daily routine carried out by employees of an institution or company to verify their presence. (Agustini & Dewi, 2022) . Attendance is essential for all organizations, reflecting employee commitment and punctuality. Attendance records are vital for enforcing institutional disciplinary guidelines. (Mayamin & Usuluddin, 2023). In addition, attendance and attendance recap are critical activities in the employee payroll process. Recapitulation of attendance, calculated by the number of working days, requires supervision in recording attendance data and its recapitulation later. (Roosdianto et al., 2021). Consistent employee attendance is vital for organizational success, enhancing productivity by ensuring timely project completion and minimizing disruptions. It also strengthens teamwork and collaboration, guarantees reliable customer service, and fosters a positive company culture through accountability. (Jumady & Lilla, 2021). Despite technological advancements, numerous organizations still utilize manual attendance systems, which are prone to manipulation, time-consuming, and inefficient. This reliance on outdated methods hinders progress and exposes companies to risks associated with fraudulent activities and inaccurate data. (Febriandirza, 2020). Manual attendance systems often encounter problems such as wet, lost, damaged, or misplaced papers. (Budiasto et al., 2023). The manual attendance system has encountered several challenges, including inefficiency in terms of time and the attendance process, the use of hardcopy attendance reports, which hinders data retrieval, and the potential loss of attendance data. (Mulianto et

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al., 2020). Manual attendance systems are problematic due to their time-consuming nature, inaccurate data, lack of real-time information, limited analysis capabilities, and security risks. Consequently, governmental bodies in Gorontalo District transitioned to digital systems in 2019 to address the vulnerability of the previous signature-based method to fraud. (Manguleta et al., 2021). Recognized as a key indicator of achievement, modern attendance systems deliver superior performance compared to time-consuming and unreliable manual methods. The adoption of automated identification technologies is widespread, prompting extensive research and the creation of diverse applications. This review comprehensively examines attendance management systems, including their advantages, implementation strategies, and limitations, to understand their role in optimizing user presence tracking in diverse environments.(Ali et al., 2022)

The Communications and Informatics Office (DISKOMINFO), a local government agency responsible for the administration of governmental affairs in communication and informatics, cryptography, and statistics (BUPATI PURWAKARTA, 2021). DISKOMINFO currently uses manual attendance methods for non-ASN employees, leading to data recapitulation difficulties, increased data loss risks, and an inability to measure productivity impacts. Leadership's focus on Civil Servant attendance neglects the need for a comprehensive system to assess non-ASN work engagement, effectiveness, accountability, and productivity. This research proposes a web-based attendance application to address these issues, leveraging its accessibility and user familiarity. The development of this attendance system employs the Waterfall Model, a framework within the SDLC (Software Development Life Cycle). The Waterfall Model ensures that each phase of system development, from requirements analysis to maintenance, is conducted systematically. This methodology enables developers to achieve clear requirement definitions, structured system designs, controlled implementation processes, comprehensive system testing, and organized system maintenance. Essentially, the Waterfall Model ensures that the attendance system is built in a structured and controlled manner, resulting in a high-quality system that meets DISKOMINFO's specific needs. While numerous studies have explored attendance systems, a significant research gap exists concerning their implementation within the unique context of local government agencies, such as DISKOMINFO. These institutions are characterized by distinct bureaucratic structures, public information dissemination mandates, and specific organizational frameworks, factors often overlooked in previous research. Additionally, prior studies may not have adequately addressed the influence of organizational culture, regional government policies, and technological resource availability on attendance system effectiveness within this setting. Consequently, there is a pressing need for a reliable attendance system at DISKOMINFO to enhance staff performance, driven by increasing demands for public service transparency and accountability. The rapid advancement of information technology presents an opportunity to optimize attendance management efficiency; however, DISKOMINFO has yet to capitalize on these advancements fully. This system will be designed to accurately reflect employee contributions and align with DISKOMINFO's operational requirements. Ultimately, this study seeks to provide a model adaptable for other local government entities, thereby contributing to improved administrative efficiency, accountability, and non-ASN employee productivity.

LITERATURE REVIEW

As previously stated, this Attendance Information System was developed utilizing the Waterfall Model, a framework within the Software Development Life Cycle (SDLC). System modeling was conducted using Unified Modeling Language (UML), system development employed PHP, database management utilized MySQL, system testing was performed using Blackbox Testing, and the system's deployment phase incorporated usability testing through the System Usability Scale (SUS). Here is the explanation:

Attendance Information System

An Attendance Information System (AIS) is a software application or a combination of hardware and software designed to track, manage, and report on attendance. It's used in various settings like schools, universities, workplaces, and events to monitor the presence of individuals. (Mantik et al., 2021) The proposed attendance and information system offers significant advantages by being time-effective and reducing documentation efforts while also boasting the benefit of zero power consumption. This combination of efficiency, reduced administrative burden, and energy independence makes it a compelling solution for streamlining attendance management and information access. (Rjeib et al., 2018). Prior studies reinforce these findings, particularly research on the attendance information system at the Jeneponto District Office of the Ministry of Religious Affairs, which utilized PIECES analysis. This analysis validated the system's compliance with institutional SOPs, its provision of precise data, and its significant time-saving efficiencies. Moreover, the system was shown to generate attendance information that directly addressed organizational requirements, thereby enabling automated and accurate attendance summaries. (Nawi & Sahid, 2024)

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Waterfall Model

The Waterfall model, also known as the classic life cycle, is a systematic and sequential software development method. It involves a linear progression through distinct phases, much like water flowing sequentially down a waterfall. (Pressman, 2015). The Waterfall method was selected to guide the development of a website-based cooperative information system. The system aimed to streamline the creation of cooperation documents, expedite the retrieval of archived information, and facilitate the online monitoring of work plans. (Ramadan et al., 2023). Research findings confirmed the effectiveness of the developed system in achieving these objectives. It demonstrated improved efficiency in compiling documents, faster access to archived information, and enhanced control through the online monitoring of work plans. (Rahmadoni et al., 2022). Below is a picture of the waterfall method.

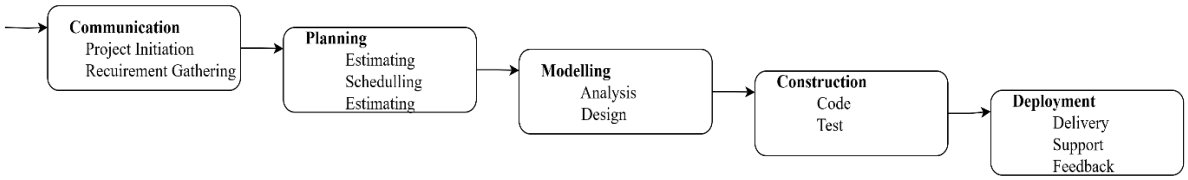

Fig. 1 The Waterfall Model (Pressman, 2015)

Figure 1 explains that The Waterfall Model, comprising communication, planning, modeling, construction, and deployment, structures system development. Communication initiates projects and gathers requirements, planning outlines tasks and schedules, modeling designs system architecture, construction involves coding and testing, and deployment focuses on implementation, maintenance, and feedback-driven development. This linear approach ensures a systematic progression, leading to a functional and adaptable software system.

Unified Modelling Language (UML)

A central goal of using UML diagrams is to facilitate effective communication and knowledge sharing about the system among the development team, and the clarity of their layout significantly impacts how easily they can be understood. (Bergström et al., 2022). UML consists of the Use Case Diagram, Activity Diagram, Sequence Diagram, and Class Diagram. Here is the explanation.

Use Case Diagram: A use case diagram is a type of UML (Unified Modeling Language) diagram that visually represents the interactions between users (actors) and a system to achieve specific goals. It provides a high-level overview of the system's functionality from the user's perspective. (Fauzan et al., 2021a). Activity Diagram: An activity diagram is a type of UML (Unified Modeling Language) diagram that visually represents the flow of control and activities within a system or process. It's essentially a flowchart that focuses on the sequence of actions and decisions involved in accomplishing a task or process. (Gedam & Meshram, 2023). Sequence Diagram: A sequence diagram is a type of UML (Unified Modeling Language) diagram that visually represents the interactions between different objects in a system over time. It focuses on the order in which messages are exchanged between objects to achieve a specific task or behavior. (Alvin et al., 2021). Class Diagram: A class diagram is a type of UML (Unified Modeling Language) diagram that visually represents the static structure of a system by showing its classes, their attributes, their methods, and the relationships between them. It's a fundamental tool in object-oriented design, providing a blueprint of the system's components and their connections. (Fauzan et al., 2021b)

PHP (Hypertext Preprocessor)

PHP is a server-side scripting language specifically designed for web development. This means PHP code is executed on the web server, and the results are sent to the user's browser in HTML format. PHP is highly flexible and can be used to create various types of web applications, ranging from simple websites to complex web platforms. PHP supports various databases, including MySQL. (*PHP: Hypertext Preprocessor*, n.d.)

MySQL

MySQL, a widely adopted open-source Relational Database Management System (RDBMS), facilitates the storage, management, and retrieval of interconnected data tables. Commonly utilized in conjunction with PHP for web application data management, such as user information, articles, or product inventories, its open-source nature ensures its accessibility and cost-free availability. (*MySQL :: Developer Zone*, n.d.)

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Blackbox Testing

Blackbox testing is used to test the functionality of each feature in the system. The tester treats the software as a "black box," focusing solely on the inputs and outputs to determine if the software behaves as expected. (Fathoni & Oktiawati, 2021) The following is the black box testing format, as shown in the table below.

Table 1. Blackbox Testing

No	Feature	Scenario Systems	Expecting Result	Result
…				

Scala Usability Scale (SUS)

The System Usability Scale (SUS) is a widely adopted evaluation method used to measure the usability of a product or system, particularly in user experience and interaction design. Developed by John Brooke in 1986, it employs a 10-item questionnaire with responses ranging from 'Strongly Agree' to 'Strongly Disagree,' enabling comparisons of usability across different products or systems. (Salim & Alijoyo, 2024). The following is a table of SUS test results. (Brooke, n.d.).

Table 2. SUS Testing

SUS Score	Grade	Adjective Ranking
>80.3	A	Excellent
68 – 80.3	B	Good
68	C	Okay
51-68	D	Poor
<51	E	Awful

Table 3. Guide SUS Testing

Respondent	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Jumlah	Skor Akhir
…												

METHOD

The Department of Communication and Information (DISKOMINFO) requires a website to facilitate the management of staff attendance activities, encompassing validation and reporting processes for staff, section heads, and sub-division heads. The development of this system necessitates the application of rigorous research methodologies to guide its construction. The research method is shown in Figure 2 below.

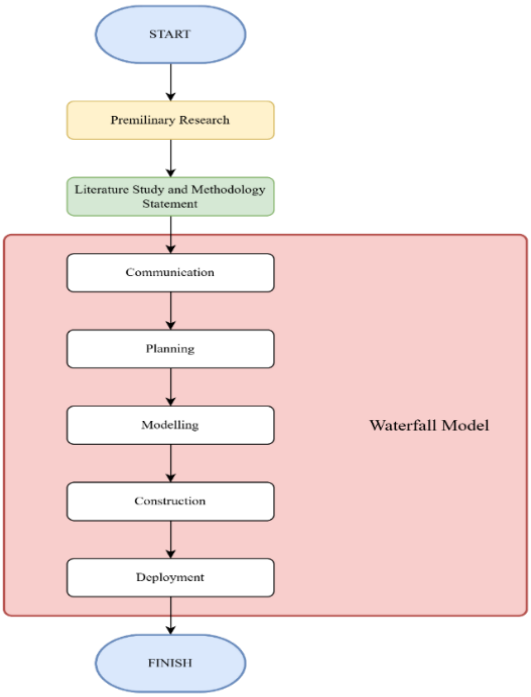

Fig. 2 Research Flowchart

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RESULT

The following are the research results based on the waterfall model in Figure 2, which are explained below.

Communication

Communication is carried out with staff, the head of section (KASI), and the head of sub-division (KASUBAG) of the DISKOMINFO service to follow up on system needs to comply with applicable work provisions and procedures. For identifying the problems, the current systems are shown in the Flow Map below in Figure 3.

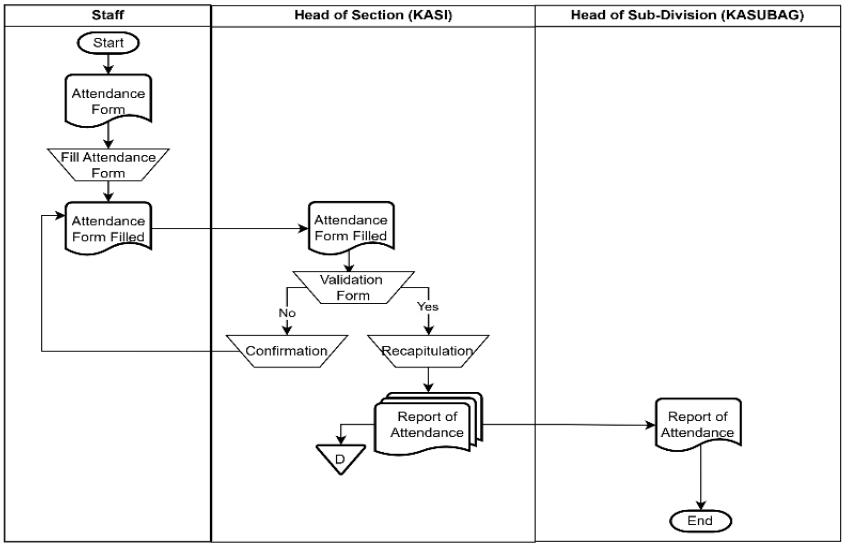

Fig. 3 Flowmap of Current System

Planning

The plan is made in the form of a Flowmap Planning System and a Gantt chart to track each step of the research implementation according to the planned deadline.

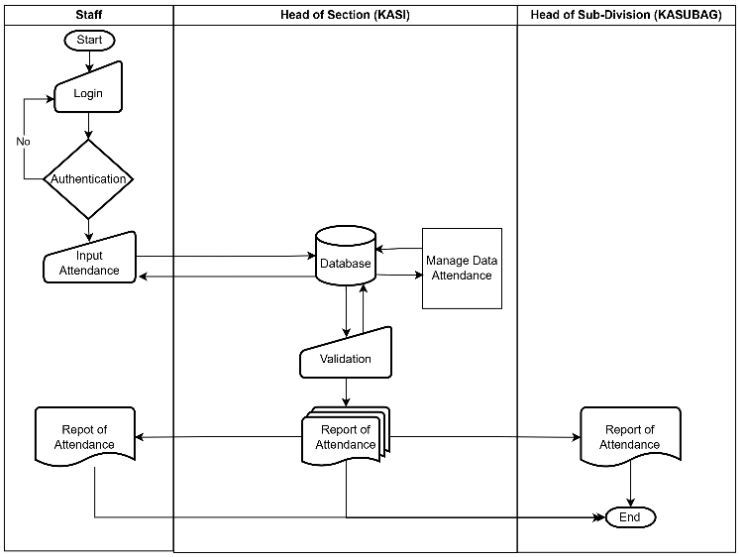

Fig. 4 Flowmap of Planned System

Modelling

Modeling is done using Unified Modeling Language (UML), which consists of a Use Case Diagram, Activity Diagram, Sequence Diagram, and Class Diagram.

1. Use Case Diagram: In Figure 4 below, there is a use case diagram on the attendance proposal system at the DISKOMINFO Purwakarta Regency. There are 3 users or so-called actors consisting of staff, the head

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of the section, and the head of the sub-division. Some of the use cases include: Login, Input Attendance, Validation, Manage Data Attendance, and View Data Attendance.

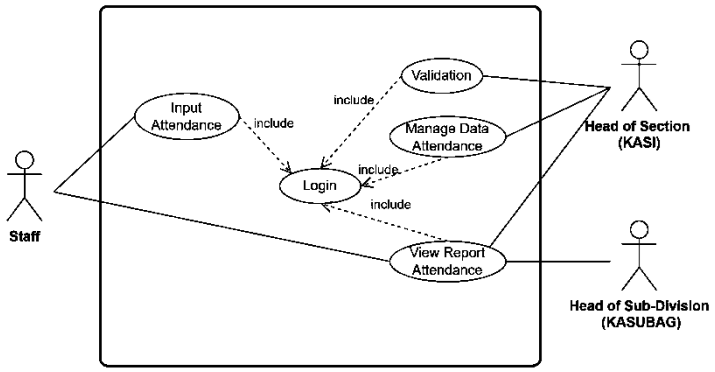

Fig. 5 Use Case Diagram

2. Activity Diagram: Activity diagrams are also very useful for visualizing business processes, software workflows, or operational procedures that depict the interactions between actors and the system in information system design. (Zaman et al., 2023). The uses of an activity diagram are for modeling software system workflows, business process analysis, operational procedure design, and use case documentation. [14]. Here are some activity diagrams that are depicted, including Activity Diagram Input Attendance, Validation, and View Report Attendance.

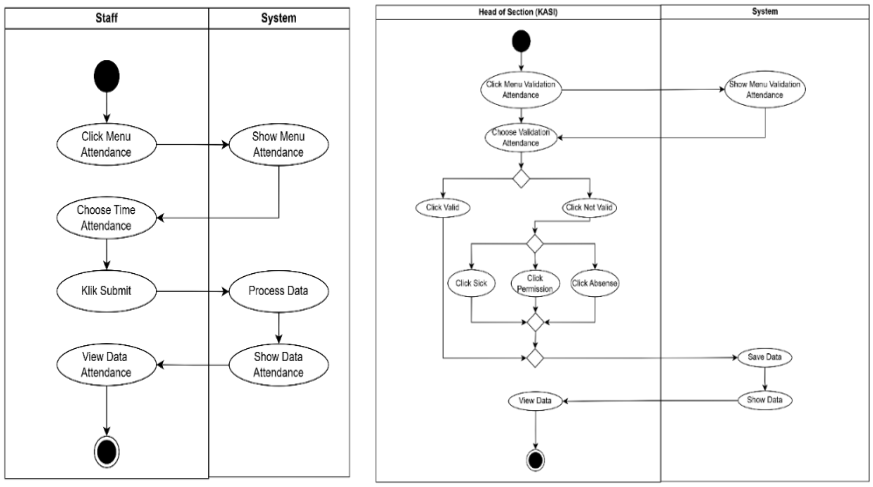

Fig. 6 Activity Diagram – Input Attendance and Validation

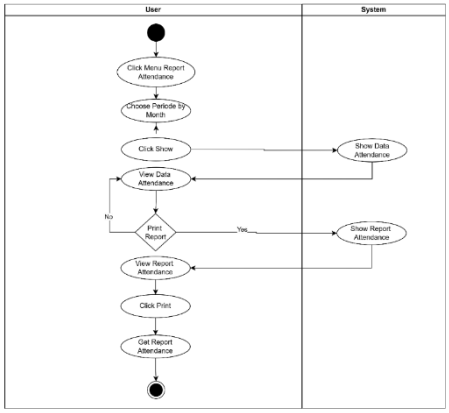

Fig. 7 Activity Diagram – View Report Attendance

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3. Sequence Diagram: Sequence diagrams bridge the gap between use cases and class diagrams by mapping use case actions to object class operations. Their user-friendly design and capacity to illustrate specific behavioral segments make them widely accepted, in contrast to the more intricate and exhaustive nature of state charts. (Al-Fedaghi, 2021). Here are some sequence diagrams that are depicted, including the Sequence Diagram Input Attendance, Validation, and View Report Attendance.

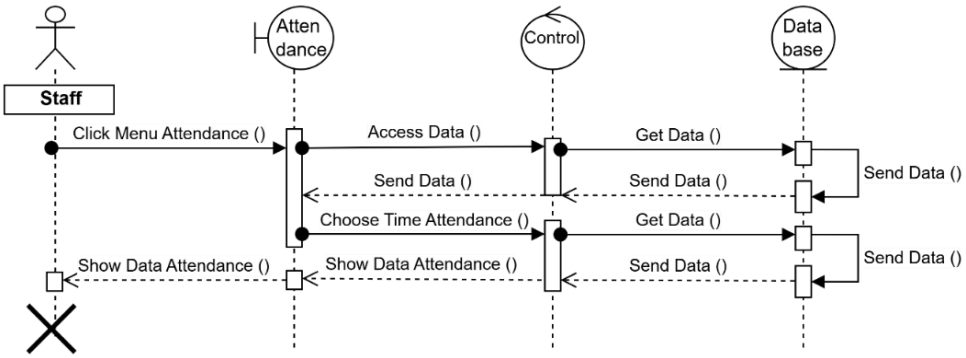

Fig. 8 Sequence Diagram - Input Attendance

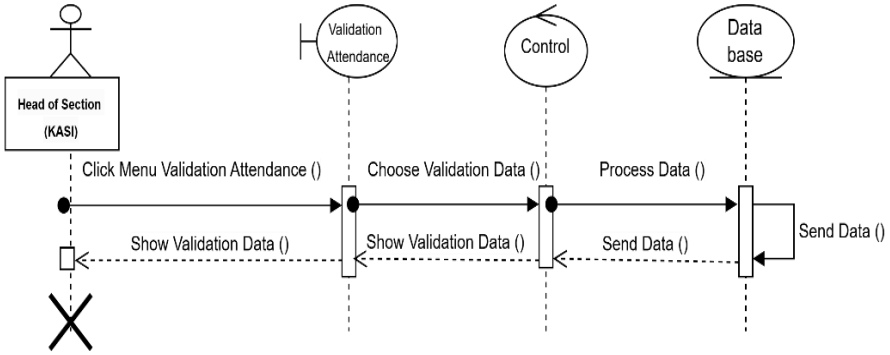

Fig. 10 Sequence Diagram Validation

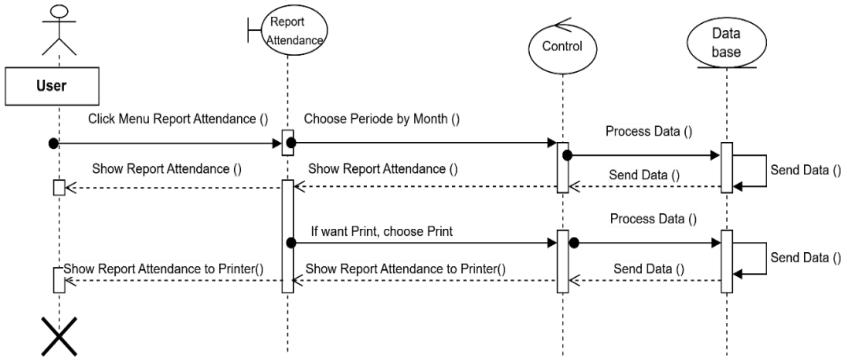

Fig. 11 Sequence Diagram View Report Attendance

4. Class Diagram: Class diagrams represent the organization of software by outlining its classes and how they relate to one another. (Fauzan et al., 2021b). Class diagrams are a type of structural model that visually represent the components of a system and how they interact. They utilize rectangular shapes for classes and linear connections to show relationships, often with arrows to specify the flow of those connections. (Bergström et al., 2022) Here is the class diagram modeled for the attendance system being built.

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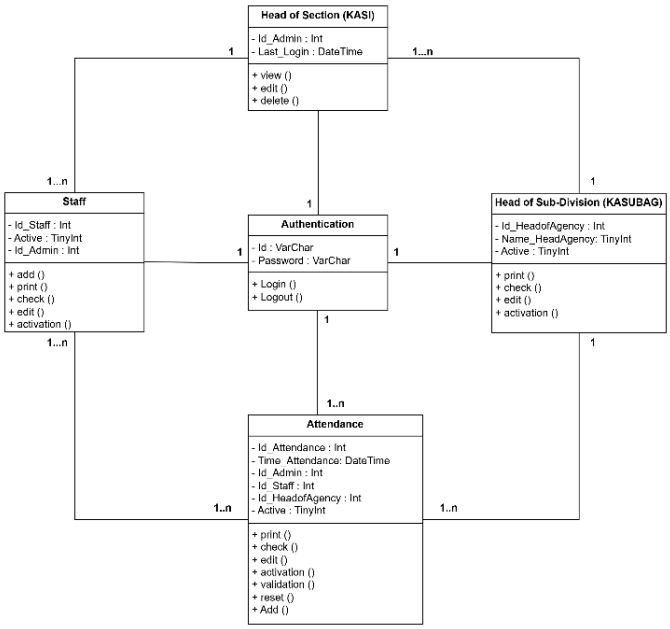

Fig. 12 Class Diagram

Construction

The software development process uses the PHP programming language and MySQL database, and testing is carried out using black box testing. Here are the user interface displays of the developed system. These include the Login, Attendance Input, Validation, Dashboard Admin (Head of Section), and View Report.

Fig. 13 Interface Login

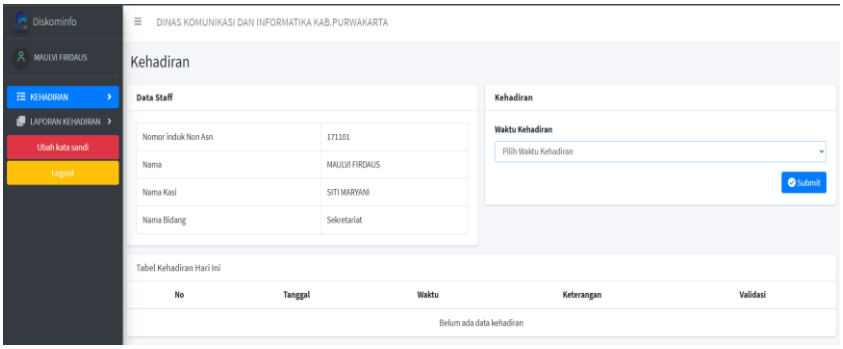

Fig. 14 Interface Input Attendance

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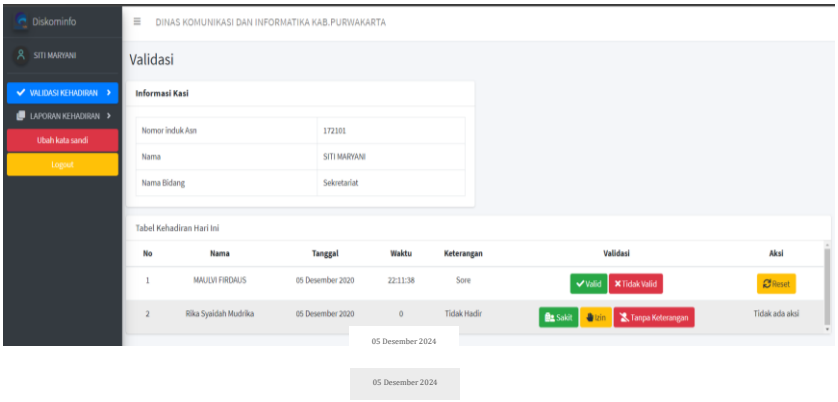

Fig. 15 Interface Validation

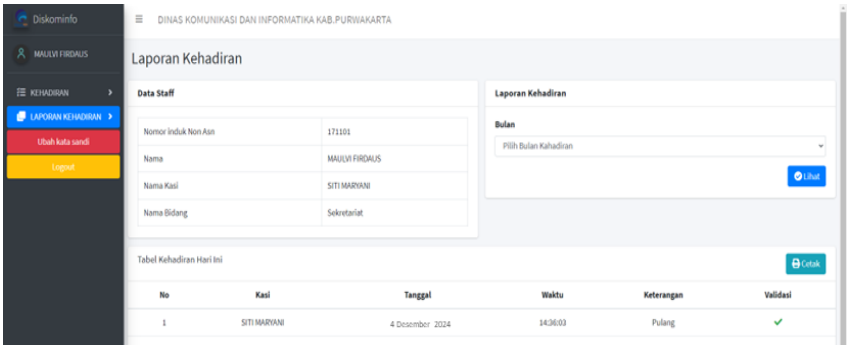

Fig. 20 Interface View Report Attendance

Blackbox testing is used to test the functionality of each feature in the system. The test results are shown below.

Table 4. Result of Blackbox Testing

No	Feature	Scenario Systems	Expecting Result	Result
1	Login	Input Username and Password, go to Dashboard	Input Username and Password, go to Dashboard	Success
2	Input Attendance	Input attendance and data saved in systems	Input attendance and data save in systems	Success
3	Validation Data Attendance	Click validation data and data saved in the systems	Click validation data and data saved in the systems	Success
4	Manage Data Attendance	Click manage data attendance and data saved in systems	Click manage data attendance and data saved in systems	Success
5	View Report Attendance	Click Report Attendance and show data attendance	Click Report Attendance and show data attendance	Success

Deployment

In this deployment process, the software is handed over to DISKOMINFO, and a reciprocal testing process is carried out regarding the system's effectiveness using the system usability scale (SUS).

Table 5. Question of SUS Testing

No	Questions	Range of Grade
1	I think that I would enjoy using this system frequently.	1-10
2	I feel this system is too complicated and unnecessary.	1-10
3	I found this system easy to use.	1-10
4	I think that I will need the help of a technical person to be able to use this system.	1-10
5	I feel the various functions in this system are well integrated.	1-10
6	I feel like there are too many inconsistencies in this system.	1-10
7	I imagine that most people will learn to use this system quickly.	1-10
8	I find this system very troublesome to use.	1-10
9	I feel very confident when using this system.	1-10

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No	Questions	Range of Grade
10	I think that I would enjoy using this system frequently.	1-10

Table 6. Result of SUS Testing

Respondent	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Jumlah	Skor Akhir
1	3	3	4	3	4	3	3	4	3	3	33	82,5
2	4	4	3	3	4	3	4	4	4	4	37	92,5
3	4	3	3	4	3	4	4	3	4	4	36	90
4	3	3	3	4	3	4	4	4	4	4	36	90
5	3	3	4	4	3	4	4	3	4	4	36	90
6	3	4	3	4	2	3	3	4	3	4	33	82,5
7	2	4	4	4	3	4	4	3	4	4	36	90
8	3	4	4	4	3	3	4	4	3	4	36	90
9	3	3	4	4	4	4	4	4	4	4	38	95
10	4	3	4	3	4	4	4	4	4	3	37	92,5
11	4	3	4	3	3	3	2	3	4	4	33	82,5
12	4	4	4	3	4	3	4	4	4	3	37	92,5
13	3	4	4	4	4	3	3	4	4	4	37	92,5
14	4	4	4	4	4	4	4	3	4	4	39	97,5
15	3	3	3	4	4	4	3	3	3	3	33	82,5
16	3	4	2	3	4	4	3	3	4	4	34	85
17	4	3	4	4	4	4	4	4	4	3	38	95
18	4	3	3	3	4	3	4	4	4	4	36	90
19	4	3	4	4	4	4	3	4	4	3	37	92,5
20	4	4	4	4	4	4	4	3	4	4	39	97,5
21	4	4	3	4	2	4	4	3	4	4	36	90
22	4	4	4	4	4	4	3	3	4	4	38	95
23	4	4	4	4	3	3	3	4	3	3	35	87,5
24	4	3	3	4	4	3	3	3	3	3	33	82,5
25	4	3	4	4	4	3	4	4	3	3	36	90
26	4	4	3	3	4	4	4	4	4	4	38	95
27	4	4	4	4	3	3	4	4	3	4	37	92,5
28	3	4	3	4	3	3	4	3	3	4	34	85
29	3	4	3	3	3	3	4	3	4	4	34	85
30	3	4	4	3	4	4	4	4	4	4	38	95
											Average	90

Based on the data presented in the aforementioned table, the final System Usability Scale (SUS) score is 84.5. This result indicates that the system achieves a grade of A, or "Excellent.".

DISCUSSIONS

While the system's performance demonstrates a high degree of effectiveness, it is imperative to conduct periodic analyses to evaluate the institution's readiness for the comprehensive implementation of attendance information systems. This evaluation should ensure optimal operational efficiency and address potential challenges. The presented data is structured to mirror the methodological sequence, revealing novel findings that contribute to the existing body of knowledge. These main findings, directly aligned with the study's purpose and methods, are further supported by supplementary data, clearly presented and appropriately analyzed. To ensure a robust discussion, the results are examined about the research questions posed in the introduction, addressing whether outcomes met expectations and comparing them to prior studies. Interpretations of the findings are provided and contextualized within the broader scientific landscape to highlight their significance and impact. A concise summary of key results is presented, elucidating their importance and offering alternative explanations where applicable. Furthermore, this discussion explores the strengths, weaknesses, and limitations of the study, alongside implications for future research. It is crucial to articulate how this research advances scientific understanding in the field, particularly in light of existing knowledge. Finally, the discussion concludes with generalized findings and recommendations for future research avenues, thereby ensuring a comprehensive and impactful analysis.

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CONCLUSION

This research culminates in the creation of an automated attendance system tailored for DISKOMINFO Purwakarta, providing functionalities for streamlined attendance input, rigorous validation, and automated report generation. The system's deployment is expected to significantly enhance data management for non-civil servant employees, potentially fostering a more motivated workforce. By facilitating adherence to applicable regulations and establishing effective work patterns, this system offers a practical tool for improving overall organizational efficiency. It is important to acknowledge that the generalizability of these findings may be influenced by the specific context of DISKOMINFO Purwakarta, and further research in diverse settings is recommended. Nonetheless, the system's capacity to optimize attendance management represents a significant advancement in administrative practices within this institution.

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*Mutiara Andayani Komara